Conco West Inc

Cal State License #353199
DIR# 10000001168
PO Box 1360
Manteca, CA 95336
(209) 239-2110
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CENTERPOINT STORM PUMP STATION

Installation, Operation, and Maintenance Manual

Prepared for:

City of Manteca

1001 W. Center St.
Manteca, CA 95337
Tel. (209) 456-8400

Prepared by:

Conco-West, Inc.

PO Box 1360
Manteca, CA 95336
Tel. (209) 239-2110
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Centerpoint Storm Pump Station
Installation, Operation, & Maintenance Manual
City of Manteca

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Centerpoint Storm Pump Station
Installation, Operation, & Maintenance Manual
City of Manteca

AS-BUILT DRAWINGS

General Contractor:

Conco-West, Inc.

PO Box 1360
Manteca, CA 95336
Tel. (209) 239 -2110
Fax (209) 239-2384

Install new SonTek Flow sensor in this vicinity.

1" PVC routed through (E) 42" pipe

Existing Pump Control Panel

Install new 1" between (E) pullbox and SSJID discharge vent pipe.

WP JBox mounted on 30" vent pipe. GRS conduit for above grade only.

Spare 2" from (E) Control Panel to (E) N9 pullbox.

Existing (E) pullboxes Power / Control

New 1" Sch 40 PVC to SSJID outfall vent pipe.

Rosemount Mag Meter

LT Flex to JBox

1" To (E) pullbox

1" PVC through 42" to flow sensor. Conduit anchored at 3' intervals to pipe wall.

Stone Road

PRIVATE ROAD

STORM DRAIN BASIN ~ SITE PLAN

STORM DRAIN PUMP STATION ~ SITE PLAN

NOTES:

1. ELECTRIC CONTROL PANEL METER SERVICE SIZE AND LOCATION TO BE SPECIFIED BY P.G. & E. CO. PRIOR TO CONSTRUCTION.
2. PROVIDE ALUMINUM OR HOT-DIPPED GALVANIZED GRATING CAPABLE OF SUPPORTING A LIVE LOAD OF 100 LBS./FT.2. GRATES TO COVER ALL EXPOSED AREAS. INDIVIDUAL GRATE SECTIONS TO BE A MAX. 24" IN WIDTH: SHALL BE LONGITUDINALLY PARALLEL TO THE PARTITION WALL; SHALL BE ANCHORED WITH REMOVABLE CLIPS; SHALL BE BOUNDED BY A FRAME AT ALL EDGES; AND SHALL BE SPLIT ON THE CENTRAL BEAM.

NOTE:
SEE ATTACHED CITY OF MANTECA PUMP STATION DETAIL SHEET FOR CONSTRUCTION DETAILS

STILLING WELL CONNECTION LATERAL RG LOCATION

NOT TO SCALE

NOTE: HARD WIRE LEVEL SENSOR FROM CONNECTION TO NEW PUMP. DIRECT BURIAL WIRE PER MANUFACTURES RECOMMENDATION.

SECTION

1 S.S.J.I.D. OUTFALL CONNECTION
STA: 225+80.56 SCALE: N.T.S.

PLAN VIEW

S.S.J.I.D., its employees and agents are not responsible for verification of the elevations and dimensions indicated on plans nor any errors or omissions that may be present. Approval is subject to the data shown which appears to be in conformity with S.S.J.I.D. requirements for protection of District Facilities.
So Conditionally Approved

DATE

811 Know what's below. Call before you dig. 811 / 800-227-2600

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STORM DRAIN PUMP STATION & OUTFALL

CENTERPOINT INTERMODAL CENTER
PHASE 1 ON-SITE IMPROVEMENTS
MANTECA, CALIFORNIA

REVISIONS			
NO.	DESCRIPTIONS	DATE	APPROVED

MCR ENGINEERING
www.mcreng.com
MCR ENGINEERING, INC.
1242 DUPONT COURT
MANTECA, CA 95336
TEL: (209) 239 - 6229
FAX: (209) 239 - 8839

JOB NO. 10-063
DATE 09/28/2012 09:15
SCALE AS SHOWN
DR. BY SLS
CK. BY JDE
FILE: z:\2010\10-063\dwg\tmp\17_Basin.dwg

REGISTERED PROFESSIONAL ENGINEER TONY B. MARSHALL No. C51015 EXP. 9-30-13 CIVIL STATE OF CALIFORNIA

SHEET NUMBER 17 OF 23

Centerpoint Storm Pump Station
Installation, Operation, & Maintenance Manual
City of Manteca

FIELD INSTRUMENTATION O&M MANUAL

Manufacturer Representative:

Primex

859 Cotting Ct. Suite G
Vacaville, CA 95688
Tel. (707) 449-0341
Fax (707) 449-8860

General Contractor:

Conco-West, Inc.

PO Box 1360
Manteca, CA 95336
Tel. (209) 239 -2110
Fax (209) 239-2384

City of Manteca

CenterPoint Center SWPS Instruments

Field Instrumentation O&M Manual

(Contract Specification N/A)

Owner: City of Manteca
Contractor: Conco-West Inc.

PRIMEX Project No.:	**7003628**
PRIMEX Submittal No.:	**401**
PRIMEX Revision No.:	**4.0**
Submittal Date:	**9/26/2017**
Prepared By:	**M. Waqar Ahmed**

859 Cotting Court, Suite G, Vacaville, CA 95688 | 707.449.0341 ph | 707.449.8860 fax | www.PRIMEXcontrols.com

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2.	Electromagnetic Flowmeter
3.	Submersible Level Transducer
4.	SonTek Flow Display
5.	Panel Modifications

PRIMEX Warranty

Project Name: 7003628 Manteca Centerpoint Center SWPS Instruments

Effective Date: 9/25/17

PRIMEX hereby agrees to warranty the Work provided by PRIMEX for the above-referenced project as follows:

WARRANTY PERIOD

PRIMEX warrants the Work for a period of: twelve months from the date of substantial completion as defined in the General Conditions of the Contract, which is referenced as the Effective Date of Warranty above.

WARRANTY COVERAGE

PRIMEX warrants that all materials and equipment furnished under the Contract, including those provided by sub-suppliers and other vendors, are of good quality and are new components. PRIMEX further warrants that the Work is complete, fully functional, and that it shall be free from defects for the warranty period specified above.

CORRECTION OF DEFECTIVE WORK

PRIMEX hereby agrees that if within the warranty period any such equipment or work is defective, it will be promptly repaired or replaced by PRIMEX.

LIMITS OF CONTRACTOR LIABILITY

PRIMEX shall not be held responsible for correcting defects due to factors beyond the control of PRIMEX.

PRIMEX shall NOT be liable for:

1. Any equipment or Work, which has been subjected to misuse, neglect, or accident that was not the cause of the PRIMEX.
2. Any equipment or Work, which has been altered, tampered with, or upon which corrective work has been done thereon without PRIMEX' written consent (except that which may be necessitated by PRIMEX' lack of

corrective action in accordance with the above requirements for correcting defective work).

3. Any equipment which has been operated or maintained in a manner, which deviates from the maintenance, schedules, specifications, and parameters set for in PRIMEX' Operation Manual for such equipment which was provided to Owner under this Contract.
4. Normal wear and tear under normal usage for the subject equipment.

OTHER WARRANTIES AND EXCLUSIONS

This warranty is exclusive and in lieu of all other guarantees and warranties of quality, whether written or oral. The provisions of other warranties, including supplier's usual warranties, terms of sale, and the like, shall not be substituted for the warranty defined herein, except where such warranty or guarantee provides coverage beyond the requirements defined herein.

EXECUTION

Signed this 26 day of September, 2017.

PRIMEX

Leigh G. Taylor — 9/26/17

Signature of Authorized Agent — Date

Leigh Taylor

Printed Name

TAB 1

PRIMEX	Primex 859 Cotting Court # G Vacaville, CA 95688 707-449-0341 Phone 707-449-8860 FAX	Project: Mantec, CA	Project No. 7003628
		Centerpoint Center SWPS	Submittal No. 101
			Date: XX/XX/XXXX
		Content: Instrumentation	Author: SCA
			Electronic Filename:
		Section: XXXXX	Master BOM 7003628

BILL OF MATERIALS

Item #	Description	Manufacturer / Model	Part No.	Tag No.	Qty
1	Son-Tek-IQ Pipe	Xylem	SON-IQXP		1
2	SonTek-IQ Flow Display	Xylem	SON-FD-ANA		1
3	Communications Cable (36-0012-040)	Xylem	36-0012-060		1
4	Submersible Level Transmitter, KPSI SERIES 710 RANGE: 0-20 FT. W/O LIGHTNING PROTECTION ANEROID BELLOWS MOISTURE PROTECTION 50 FT. CABLE	Measurement Specialties	710S14A0A008.670000.000C1050A		1
5	Magnetic Flow Meter, 10", Polyurethane liner, 316SS bullet nose self cleaning electrodes, 304SS body, CS 150# ANSI flanged end connections, (2) 316SS grounding rings, IP68 submergence rated with 100 feet of integral potted cable, 0.5% accuracy, remote 8712E transmitter with 110VAC input power, NEMA 4X, wall mount, LCD display with operator interface, 4-20 ma output, HART, pulse output, local rate meter and totalizer	Rosemount	8750WDEW1A1FPSB100CA1M4G1R10		1

TAB 2

Product Data Sheet
March 2016
00813-0300-4750, Rev BA

Rosemount™ 8750W Magnetic Flowmeter System

for Utility, Water, and Wastewater Applications

- Best in class value with performance, reliability, and diagnostics suited for monitoring applications
- Reliable all welded coil housing and lightweight sensor design rated to IP68
- Process Diagnostics and SMART™ Meter Verification to provide better insight to the process and meter's health
- Available with drinking water certifications

EMERSON™
Process Management

Product selection guide

The Rosemount 8750W Magnetic Flowmeter sensor is available in a flanged style and transmitter is available in remote and integral transmitter configurations to ensure compatibility with all utility, water, and wastewater applications.

- For transmitter details, see Table 1 and Table 11.
- For sensor styles and details, see Table 2 and Table 12.
- For available lining materials, see Table 12.
- For available electrode materials and electrode types, see Table 14.
- For process reference (grounding) options, see Table 15 and Table 16.

For guidance on selecting materials, refer to the Magnetic Flowmeter Material Selection Guide located on Rosemount.com (document number 00816-0100-3033). For more information regarding the available product offering see the ordering information, Table 7 through Table 14.

Table 1. Transmitter Selections

Transmitter	General characteristics
Field mount	• Integral and remote mount configurations available • HART®/analog and pulse outputs available • Advanced Diagnostics available • Optical switch local operator interface (optional) • Two discrete channels (optional)
Wall mount	• Remote mount configuration • HART/analog and pulse outputs available • Advanced Diagnostics available • Easy to use local operator interface with dedicated configuration buttons (optional)

Table 2. Sensor Selection

Sensor	General characteristics
Flanged	• Flanged process connections • Welded coil housing • 1/2-in. (15 mm) to 48-in. (1200 mm) • Standard, reference, and bullet-nose electrodes available

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Magmeter Diagnostics

Rosemount diagnostics reduce cost and improve output by enabling new practices

Rosemount Magnetic Flowmeters provide device diagnostics that detect and warn of abnormal situations throughout the life of the meter - from installation to maintenance and meter verification. With Rosemount Magnetic Flowmeter Diagnostics enabled, plant availability and throughput can be improved, and costs through simplified installation, maintenance and troubleshooting can be reduced.

Table 3. Magnetic Flowmeter Diagnostics

Diagnostic name	Diagnostic category	Product capability
Basic diagnostics		
Tunable empty pipe	Process	Standard
Electronics temperature	Maintenance	Standard
Coil fault	Maintenance	Standard
Transmitter fault	Maintenance	Standard
Reverse flow	Process	Standard
Coil current(1)	Maintenance	Standard
Electrode saturation(1)	Process/Maintenance	Standard
Advanced diagnostics		
High process noise	Process	Suite 1 (DA1)
Grounding and wiring fault	Installation	Suite 1 (DA1)
Coated electrode detection(1)	Process	Suite 1 (DA1)
Commanded SMART Meter Verification	Meter Health	Suite 2 (DA2)
Continuous SMART Meter Verification(1)	Meter Health	Suite 2 (DA2)
4–20 mA1 Loop Verification	Installation	Suite 2 (DA2)

1. Only available with field mount transmitter.

Options for accessing diagnostics

Rosemount Magmeter Diagnostics can be accessed through the Local Operator Interface (LOI), a Field Communicator, AMS™ Suite: Intelligent Device Manager, and ProLink™. Contact your local Emerson™ Process Management representative to activate diagnostics or for diagnostic availability on existing transmitters.

Access diagnostics through the LOI for quicker installation, maintenance, and meter verification

Rosemount Magnetic Flowmeter Diagnostics are available through the LOI to simplify maintenance.

Access diagnostics through ProLink III(1)

Simplify maintenance and troubleshooting practices by utilizing ProLink III to access diagnostics and troubleshooting information, log variable data, run SMART Meter Verification, and print verification reports.

Access diagnostics through AMS Intelligent Device Manager for the ultimate value

The value of the diagnostics increases significantly when AMS Intelligent Device Manager is used. AMS Intelligent Device Manager provides a simplified screen flow and procedures for how to respond to the diagnostic messages.

1. *Available with Prolink III v3.0 or later.*

Magnetic Flowmeter Sizing

Selecting the appropriate sensor size is an important step when considering a magnetic flowmeter. The physical properties of the process fluid, as well as the fluid velocity should be considered. It may be necessary to select a flow sensor that is larger or smaller than the adjacent piping to ensure the fluid velocity is in the recommended flow range for the application.

- Application guidelines and velocity ranges are provided in Table 4.
- A table to convert from volumetric flow to velocity is shown in Table 5. Two examples of these calculations are show below.
- Minimum and maximum flow rates based on line size are shown in Table 6.
- Operation outside these guidelines may also give acceptable performance.

Table 4. Sizing Guidelines

Application	Velocity range (ft/s)	Velocity range (m/s)
Normal service	0–39	0–12
Preferred service	2–20	0.6–6.1

To convert flow rate to velocity, use the appropriate factor listed in Table 5 and the following equation:

$$\text{Velocity} = \frac{\text{Flow Rate}}{\text{Factor}}$$

Example:

English units

Magmeter Size: 4-in. (factor from Table 5 = 39.679)
Normal Flow Rate: 300 GPM

$$\text{Velocity} = \frac{300 \text{ (gpm)}}{39.679}$$

Velocity = 7.56 ft/s

SI units

Magmeter Size: 100 mm (factor from Table 5 = 492.78)
Normal Flow Rate: 800 L/min

$$\text{Velocity} = \frac{800 \text{ (L/min)}}{492.78}$$

Velocity = 1.62 m/s

Table 5. Line Size vs. Conversion Factor

Nominal line size Inches (mm)	Gallons per minute factor	Liters per minute factor
1/2 (15)	0.947	11.762
1 (25)	2.694	33.455
1 1/2 (40)	6.345	78.806
2 (50)	10.459	129.89
2 1/2 (65)	14.923	185.33
3 (80)	23.042	286.17
4 (100)	39.679	492.78
5 (125)	62.356	774.42
6 (150)	90.048	1,118.3
8 (200)	155.93	1,936.5
10 (250)	245.78	3,052.4
12 (300)	352.51	4,378.0
14 (350)	421.70	5,237.3
16 (400)	550.80	6,840.6
18 (450)	697.19	8,658.6
20 (500)	866.51	10,761
24 (600)	1,253.2	15,564
30 (750)	2006.0	24,913
36 (900)	2,935.0	36,451
40 (1000)	3,652.1	45,357
42 (1050)	4,115.1	51,107
48 (1200)	5,407.6	67,159

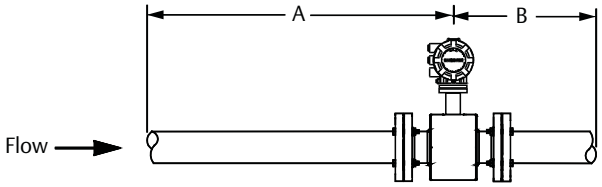
Table 6. Line Size vs. Velocity/Rate

Nominal line size in inches (mm)	Minimum/maximum flow rate							
	Gallons per minute				Liters per minute			
	at 0.04 ft/s (low-flow cutoff)	at 1 ft/s (min range setting)	at 3 ft/s	at 39.37 ft/s (max range setting)	at 0.012 m/s (low-flow cutoff)	at 0.3 m/s (min range setting)	at 1 m/s	at 12 m/s (max range setting)
1/2 (15)	0.038	0.947	2.841	37.287	0.141	3.529	11.76	141.15
1 (25)	0.108	2.694	8.081	106.05	0.401	10.04	33.45	401.46
1 1/2 (40)	0.254	6.345	19.04	249.82	0.946	23.64	78.81	945.67
2 (50)	0.418	10.459	31.38	411.77	1.559	38.97	129.89	1,558.7
2 1/2 (65)	0.597	14.923	44.77	587.51	2.224	55.60	185.33	2,224.0
3 (80)	0.922	23.042	69.13	907.17	3.434	85.85	286.17	3,434.0
4 (100)	1.587	39.679	119.04	1,562.2	5.913	147.84	492.78	5,913.4
5 (125)	2.494	62.356	187.07	2,454.9	9.293	232.33	774.42	9,293.0
6 (150)	3.602	90.048	270.14	3,545.2	13.42	335.50	1,118.3	13,420
8 (200)	6.237	155.93	467.79	6,138.9	23.24	580.96	1,936.5	23,238
10 (250)	9.831	245.78	737.34	9,676.3	36.63	915.73	3,052.4	36,629
12 (300)	14.10	352.51	1,057.5	13,878	52.54	1,313.4	4,378.0	52,535
14 (350)	16.87	421.71	1,265.1	16,603	62.85	1,571.2	5,237.3	62,848
16 (400)	22.03	550.80	1,652.4	21,685	82.09	2,052.2	6,840.6	82,087
18 (450)	27.89	697.19	2,091.6	27,448	103.90	2,597.6	8,658.6	103,903
20 (500)	34.66	866.51	2,599.5	34,114	129.14	3,228.4	10,761	129,137
24 (600)	50.13	1,253.2	3,759.6	49,339	186.77	4,669.2	15,564	186,769
30 (750)	80.24	2,006.0	6,018.0	78,976	298.96	7,474.0	24,913	298,959
36 (900)	117.40	2,935.0	8,805.1	115,553	437.42	10,935	36,451	437,416
40 (1000)	146.09	3,652.1	10,956	143,785	544.29	13,607	45,357	544,286
42 (1050)	164.60	4,115.1	12,345	162,011	613.28	15,332	51,107	613,278
48 (1200)	216.30	5,407.6	16,223	212,898	805.91	20,148	67,159	805,908

Upstream/downstream piping length

To ensure specification accuracy over widely varying process conditions, install the sensor with a minimum of five straight pipe diameters upstream and two straight pipe diameters downstream from the electrode plane. See Figure 1.

Figure 1. Upstream and Downstream Straight Pipe Diameters



A. Five pipe diameters
B. Two pipe diameters

Installations with reduced upstream and downstream straight runs are possible. In reduced straight run installations, the meter may not meet absolute accuracy specifications. Reported flow rates will still be highly repeatable.

Sensor grounding

A reliable ground path is required between the sensor and the process fluid. Optional grounding rings, and a process reference electrode are available with sensors to ensure proper grounding. See Table 15 and Table 16.

Ordering Information

Rosemount 8750W Magnetic Flowmeter Platform

The Rosemount 8750W Magnetic Flowmeter is available in a flanged sensor design. The sensors are fabricated from stainless and carbon steel and welded to provide a sealed coil housing that protects against moisture or other contaminants. Sizes range from 1/2-in. (15 mm) to 48-in. (1200 mm). The field mount transmitter has a die cast aluminum housing for excellent reliability. The wall mount transmitter features an easy to use operator interface. Both transmitter styles are available with advanced diagnostics to provide the best insight into the process and the meter's health.

Table 7. Rosemount 8750W Ordering Information

★ The starred offerings represent the most common options, and should be selected for best delivery.

Model	Product description	
8750W	Magnetic Flowmeter System (utility, water, and wastewater)	
Sensor design revision		
D	Revision "D"	
Transmitter class		
E(1)	Revision 3 electronics	★
M	Revision 4 electronics	★
0	Spare sensor, no transmitter	
Transmitter mount		
T	Integral field mount	★
R	Remote field mount	★
W	Remote wall mount	★
Transmitter power		
1	AC power supply (90–250 VAC, 50–60 Hz)	★
2	DC power supply (12–42 VDC)	★
0	Spare sensor, no transmitter	
Transmitter outputs		
A	4–20mA; Digital HART; Scalable Pulse	★
0	Spare sensor, no transmitter	
Conduit entries		
Integral mount qty (2), remote mount qty (4)		
1	1/2–14 NPT	★
2	M20	★
Integral mount qty (3), remote mount qty (5)		
4	1/2–14 NPT, additional entry	★
5(2)	M20, additional entry	★
0	Spare sensor, integral mount only, no transmitter	

Table 7. Rosemount 8750W Ordering Information

★ The starred offerings represent the most common options, and should be selected for best delivery.

Sensor style		
F	Flanged	★
0	Spare transmitter, no sensor	
Lining material		
T[3]	PTFE	★
P[4]	Polyurethane	★
N[5]	Neoprene	★
0	Spare transmitter, no sensor	
Electrode material		
S	316L stainless steel	★
H	Nickel alloy 276 (UNS N10276)	★
0	Spare transmitter, no sensor	
Electrode type		
A	2 Measurement electrodes - standard	★
B	2 Measurement electrodes- bulletnose	★
E[6]	2 Measurement plus 1 reference electrode - standard	★
F[6]	2 Measurement plus 1 reference electrode - bulletnose	★
0	Spare transmitter, no sensor	

Table 7. Rosemount 8750W Ordering Information

★ The starred offerings represent the most common options, and should be selected for best delivery.

• = Available
– = Unavailable

Line size		PTFE code T	Polyurethane code P	Neoprene code N
005	1/2-in. (15 mm)	•	–	–
010	1-in. (25 mm)	•	•	•
015	1 1/2-in (40 mm)	•	•	•
020	2-in. (50 mm)	•	•	•
025	2 1/2-in. (65 mm)	•	–	•
030	3-in. (80 mm)	•	•	•
040	4-in. (100 mm)	•	•	•
050	5-in. (125 mm)	•	–	•
060	6-in. (150 mm)	•	•	•
080	8-in. (200 mm)	•	•	•
100	10-in. (250 mm)	•	•	•
120	12-in. (300 mm)	•	•	•
140	14-in. (350 mm)	•	•	•
160	16-in. (400 mm)	•	•	•
180	18-in. (450 mm)	•	•	•
200	20-in. (500 mm)	•	•	•
240	24-in. (600 mm)	•	•	•
300	30-in. (750 mm)	•	•	•
360	36-in. (900 mm)	•	•	•
400	40-in. (1000 mm)	–	–	•
420	42-in. (1050 mm)	–	•	•
480	48-in. (1200 mm)	–	–	•
000	Spare transmitter, no sensor	–	–	–
Flange type and material[7]				
C	Slip-on, raised-face, carbon steel			★
S	Slip-on, raised-face, 304/304L SST			★
F	Slip-on, flat-face, carbon steel			
G	Slip-on, flat-face, 304/304L SST			
0	Spare transmitter, no sensor			

Table 7. Rosemount 8750W Ordering Information

★ **The starred offerings represent the most common options, and should be selected for best delivery.**

Flange rating[7]		
A1	ASME B16.5, Class 150	Refer to Table 8 for flange availability.
A3	ASME B16.5, Class 300	
AD	AWWA C207 Class D (line size 30-in. and above)	
AE	AWWA C207 Class E (line size 30-in. and above)	
AF	AWWA C207 Class F (line size 30-in. and above)	
DD	EN1092-1, PN10	
DE	EN1092-1, PN16	
DF	EN 1092-1, PN25	
DH	EN 1092-1, PN40	
GD	GB/T9119, PN10	
GE	GB/T9119, PN16	
GH	GB/T9119, PN40	
JP	JIS B2220, 10K	
JR	JIS B2220, 20K	
KU	AS4087, PN16	
KW	AS4087, PN21	
KY	AS4087, PN35	
TK	AS2129, Table D	
TL	AS2129, Table E	
00	Spare transmitter, no sensor	

Options **(must be included in the model number if selected - not required)**

Safety approvals		
Ordinary Location[8]	No code required	★
Factory Mutual (FM)		
Z5	FM Non-Incendive, Class I Div 2 for Non-Flammable Fluids; DIP	★
CSA		
Z6	CSA, Class I Div 2 for Non-Flammable Fluids; DIP	★
ATEX		
Z1	ATEX Non-Sparking and Dust for Non Flammable Fluids	★
ND	ATEX Dust	★
IECEx		
Z7	IECEx Non-Sparking and Dust for Non-Flammable Fluids	★
NF	IECEx Dust	★
NEPSI		
Z3	NEPSI Non-Sparking and Dust for Non-Flammable Fluids	★

Table 7. Rosemount 8750W Ordering Information

★ The starred offerings represent the most common options, and should be selected for best delivery.

Advanced Diagnostics Suite		
DA1	Process diagnostics HPN, grounding/wiring, electrode coating	★
DA2	SMART Meter verification	★
Discrete input/output		
AX[9]	Two discrete channels (DI/DO 1, DO 2)	★
Display options		
M4	Local operator interface	★
M5	LCD display only	★
Optional ground rings		
G1	316L stainless steel (Qty 2)	★
G2	Nickel alloy C-276; UNS N10276 (Qty 2)	
G5	316L stainless Steel (Qty 1)	★
G6	Nickel alloy C-276; UNS N10276 (Qty 1)	
Certifications		
PD	European Pressure Equipment Directive Certification (PED, per 97/23/EC)	
CR	Canadian Registration Number (CRN) Certification	
BD	ASME B31.3 Process Piping Standard	
DW[10]	NSF Drinking Water Certification	
Other options		
C1	Custom configuration (CDS required)	
D1	High accuracy calibration (base ref accuracy 0.25% of rate)	
B6	316 SST 4-bolt kit for 2 inch pipe mount	
P05[11]	5-Point verification	
P10[12]	10-Point verification	
Submergence protection		
R05	Potted junction box with 50 feet of combo cable/cable gland	
R10	Potted junction box with 100 feet of combo cable/cable gland	
R15	Potted junction box with 150 feet of combo cable/cable gland	
R20	Potted junction box with 200 feet of combo cable/cable gland	
R25	Potted junction box with 250 feet of combo cable/cable gland	
R30	Potted junction box with 300 feet of combo cable/cable gland	
Special paint		
V1	Coal tar paint (submersible/direct burial)	

Table 7. Rosemount 8750W Ordering Information

★ The starred offerings represent the most common options, and should be selected for best delivery.

Quality certificates		
Q4	Calibration certificate per ISO 10474 3.1B/EN 10204 3.1	
Q8	Material traceability per ISO 10474 3.1B/EN 10204 3.1	
Quick Start Guide (QSG) language options (default is English)		
YA	Danish	★
YB	Hungarian	★
YC	Czech	★
YD	Dutch	★
YE	Bulgarian	★
YF	French	★
YG	German	★
YH	Finnish	★
YI	Italian	★
YJ	Japanese	★
YL	Polish	★
YM	Chinese (Mandarin)	★
YN	Norwegian	★
YP	Portuguese	★
YR	Russian	★
YS	Spanish	★
YW	Swedish	★
Typical model number: 8750WDMT1A1FPSA010CA1DA2		

1. Wall mount transmitter only.
2. Not available with the wall mount transmitter.
3. Available in 1/2- to 36-in. (15 mm to 900 mm) line sizes.
4. Available in line sizes 1- to 36-, and 42-in. (25 mm to 900 mm, and 1050 mm) line sizes.
5. Available in line sizes 1- to 48-in. (25 mm to 1200 mm) line sizes.
6. Not available in 1/2-in. (15mm).
7. Refer to Table 8 for flange offering.
8. FM marked, CSA marked, CE marked, EAC marked and C-tick marked.
9. Requires Conduit Entry code 4 or 5 with field mount transmitter.
10. NSF drinking water certification is available with the PTFE liner in line sizes 0.5- to 36-in (15 mm to 900 mm) and the polyurethane liner in line sizes 3- to 36-, and 42-in. (80 mm to 900 mm, and 1050 mm).
11. Available for 1/2- to 24-in (15 mm to 600 mm) at velocities 1, 3, 5, 7, 10 ft/s; 30-in. (700 mm) at velocities 1, 3, 5, 7, 9.5 ft/s; 36-in. (900 mm) at velocities 1, 2, 3, 5, 6.5 ft/s; 40- to 48-in. (1000 mm to 1200 mm).
12. Available for 1/2- to 24-in. (15 mm to 600 mm) at velocities 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 ft/s; 30- to 48-in. (700 mm to 1200 mm) not available.

Table 8. Flowmeter Availability – Line Size vs. Flange Type and Rating

• = Available
– = Not applicable

Flange rating	Flange type	005	010	015	020	025	030	040	050	060	080	100	120	140	160	180	200	240	300	360	400	420	480
A1	ASME 150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	–	–	–	–
A3	ASME 300	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	–	–	–	–
AD	AWWA Class D	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	•	•	•	•	•
AE	AWWA Class E	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	•	•	•	•	•
AF	AWWA Class F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	•	•	–	–	–
DD	EN 1092-1 PN10	–	–	–	–	–	–	–	–	–	•	•	•	•	•	•	•	•	–	•	•	–	•
DE	EN 1092-1 PN16	–	–	–	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	•	•	–	–
DF	EN 1092-1 PN 25	–	–	–	–	–	–	–	–	–	•	•	•	•	•	•	•	•	–	–	–	–	–
DH	EN 1092-1 PN 40	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	–	–	–	–
GD	GB/T PN10	–	–	–	–	–	–	–	–	–	•	•	•	•	•	•	•	•	–	•	•	–	–
GE	GB/T PN16	–	–	–	–	–	–	•	•	•	•	•	•	•	•	•	•	•	–	•	•	–	–
GH	GB/T PN40	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	–	–	–	–
JP	JIS B2220 10k	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	–	–	–	–
JR	JIS B2220 20k	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	–	–	–	–
KU	AS4087 PN16	–	–	–	•	•	•	•	•	•	–	•	•	•	•	•	•	•	•	•	•	–	–
KW	AS4087 PN21	–	–	–	•	•	•	•	•	•	–	•	•	•	•	•	•	•	•	•	•	–	–
KY	AS4087 PN35	–	–	–	•	•	•	•	•	•	–	•	•	•	•	•	•	•	•	•	–	–	–
TK	AS2129 TABLE D	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	•
TL	AS2129 TABLE E	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	•

Ordering procedure

To order, select the desired sensor and/or transmitter by specifying model codes from the ordering table.

For remote transmitter applications, note the cable specification requirements.

Standard configuration

Unless the Configuration Data Sheet is completed, the transmitter will be shipped as follows:

Engineering units	ft/sec
4 mA	0
20 mA	30
Sensor size	3-in.
Empty pipe	On
Sensor calibration number	1000005010000000

Integrally Mounted Rosemount 8750W Transmitters are factory configured with the paired sensor size and appropriate calibration number.

Custom configuration (Option Code C1)

If Option Code C1 is ordered, the Configuration Data Sheet (CDS) must be submitted at the time of order.

Standard tagging

Instrument tags for the transmitter and sensors are as follows:

- 316SST laser etched label, permanently attached
- Main label - Tag name:

  1 line 21characters
- Additional 316SST 'wire-on' tag available:

  5 lines, 17 characters per line (6mm height)

Cable requirements for remote transmitters

Remote mount transmitter installations will require equal lengths of interconnecting cables for the coil drive (1, 2, 3) and the electrode cable (17, 18, 19).

The interconnecting cables can be either individual component cables or a combination coil drive and electrode cable. Review hazardous area approval requirements.

When ordering remote cables be sure to review the installation requirements for proper cable selection. Integrally mounted transmitters are factory wired and do not require additional interconnecting cables.

Component cable lengths should be limited to less than 500 feet (150 m). Consult factory for length between 500–1000 feet (150–300 m).

For installations using the combination coil drive and electrode cable, lengths should be limited to less than 330 feet (100 m).

Cables kits are available as individual component cables or as a combination coil/electrode. Remote cables can be ordered direct from Emerson Process Management using the kit numbers shown in Table 9 and Table 10. Equivalent Alpha cable part numbers are also provided as an alternative. To order cable, specify length as quantity desired. Equal length of component cable is required.

Example:

25 feet = Qty (25) 08732-0065-0001

Table 9. Component Cable Kits

Cable kit number	Description	Individual cable	Alpha p/n
Standard temperature (-20 °C to 75 °C)			
08732-0065-0001 (feet)	Kit, component cables, std temp. (includes coil + electrode)	Coil Electrode	518243 518245
08732-0065-0002 (meters)	Kit, component cables, std temp. (includes coil + electrode)	Coil Electrode	518243 518245
08732-0065-0003 (feet)	Kit, component cables, std temp. (includes coil + I. S. electrode)	Coil Intrinsically safe blue electrode	518243 518245
08732-0065-0004 (meters)	Kit, component cables, std temp. (includes coil + I. S. electrode)	Coil Intrinsically safe blue electrode	518243 518245
Extended temperature (-50 °C to 12 5 °C)			
08732-0065-1001 (feet)	Kit, component cables, ext temp. (includes coil + electrode)	Coil Electrode	840310 518189
08732-0065-1002 (meters)	Kit, component cables, ext temp. (includes coil + electrode)	Coil Electrode	840310 518189
08732-0065-1003 (feet)	Kit, component cables, ext temp. (includes coil + I. S. electrode)	Coil Intrinsically safe blue electrode	840310 518189
08732-0065-1004 (meters)	Kit, component cables, ext temp. (includes coil + I. S. electrode)	Coil Intrinsically safe blue electrode	840310 518189

Table 10. Combination Cable Kits

Coil and electrode cable (-20 °C to 80 °C)	
Cable kit number	**Description**
08732-0065-2001 (feet)	Kit, combination cable, standard
08732-0065-2002 (meters)	
08732-0065-3001 (feet)	Kit, combination cable, submersible (80 °C dry/60 °C wet)(33-ft. continuous)
08732-0065-3002 (meters)	

Specifications

The tables below outline some of the basic performance, physical, and functional specifications of the Rosemount 8750W Magnetic Flowmeter. Table 11 provides an overview of the Rosemount 8750W Transmitters available. Table 12 provides an overview of the Rosemount 8750W Sensors available.

Table 11. Transmitter Specifications

Transmitter	Style	Mount	Base accuracy	Power supply	User interface	Communication protocol	Diagnostics	Detailed specifications	Ordering information
	Field mount	Integral or Remote	0.5% Standard 0.25% High Accuracy Option	Global AC or DC	4 Optical Switch LOI Display only	HART	Basic, DA1, DA2	Page 17	Page 7
	Wall mount[1][2]	Remote	0.5% Standard 0.25% High Accuracy Option	Global AC or DC	Dedicated 15-Button LOI	HART	Basic, DA1, DA2	Page 21	Page 7

1. Electrode coating diagnostic is not available with the wall mount transmitter.
2. Continuous Smart Meter verification is not available with the wall mount transmitter.

Table 12. Sensor Specifications

Sensor	Style	Base accuracy	Line sizes	Design features	Detailed specifications	Ordering information
	Flanged	0.5% Standard 0.25% High Accuracy Option	1/2- to 48-in. (15 mm to 1200 mm)	Standard design	Page 25	Page 7

Table 13. Lining Material Selection

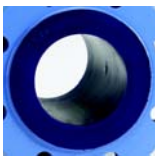
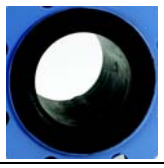
Liner material	General characteristics
PTFE	• Chemical resistance • Excellent high temperature capabilities • -20 to 248 °F (-29 to 120 °C)
Polyurethane 	• Limited chemical resistance • Excellent abrasion resistance for slurries with small and medium particles • 0 to 140 °F (-18 to 60 °C)
Neoprene 	• Very good abrasion resistance for small and medium particles • Better chemical resistance than polyurethane • Typically applied in applications containing chemicals and sea water • 0 to 176 °F (-18 to 80 °C)

Table 14. Electrode Material Selection

Electrode material	General characteristics
316L Stainless Steel	• Good corrosion resistance • Good abrasion resistance • Not recommended for sulfuric or hydrochloric acids
Nickel Alloy 276 (UNS N10276)	• Better corrosion resistance • High strength • Good in slurry applications • Effective in oxidizing fluids
Electrode type	**General characteristics**
Standard Measurement	• Lowest cost • Good for most applications
Measurement + Reference Electrode (Also see Table 15 and Table 16 for grounding options and installation	• Low cost grounding option especially for large line sizes • Minimum conductivity of 100 microSiemens/cm • Not recommended for electrolytic or galvanic corrosion applications
Bulletnose	• Extended head protrudes into the flow stream for self-cleaning • Best option for coating processes

Table 15. Process Reference Option

Grounding options	General characteristics
No grounding options (grounding straps)	• Acceptable for conductive unlined pipe • Grounding straps provided at no cost
Reference electrode	• Same material as measurement electrodes • Sufficient grounding option when process fluid conductivity is greater than 100 microSiemens/cm • Not recommended in electrolysis applications, galvanic corrosion applications, or applications where the electrodes may coat.
Grounding ring/rings	• Low conductivity process fluids • Cathodic or electrolysis applications that may have stray currents in or around the process • Variety of materials for process fluid compatibility

Table 16. Process Reference Installation

Type of pipe	Grounding straps	Grounding rings	Reference electrode	Lining protectors
Conductive unlined pipe	Acceptable	Not required	Not required	Not required
Conductive line pipe	Not acceptable	Acceptable	Acceptable	Acceptable
Non-conductive pipe	Not acceptable	Acceptable	Not acceptable	Acceptable

Rosemount 8750W Field Mount Transmitter Specifications

Functional specifications

Transmitter coil drive current

500 mA

Flow rate range

Capable of processing signals from fluids that are traveling between 0.04 and 39 ft/s (0.01 to 12 m/s) for both forward and reverse flow in all sensor sizes. Full scale continuously adjustable between –39 and 39 ft/s (–12 to 12 m/s).

Conductivity limits

Process liquid must have a conductivity of 5 microSiemens/cm (5 micromhos/cm) or greater.

Power supply

90 - 250 VAC, 50/60 Hz or 12 - 42 VDC

Line power fuses

90-250 VAC systems

1A, 250V, $I^2t \geq 1.5\ A^2s$ Rating, Fast Acting

Bussman AGC-1, Littelfuse 31201.5HXP

12-42 VDC systems

3 Amp, 250V, $I^2t \geq 14\ A^2s$ Rating, Fast Acting

Bel Fuse 3AG 3-R, Littelfuse 312003P, Schurter 0034.5135

Power consumption

15 W maximum - DC

40 VA maximum - AC

Switch-on current

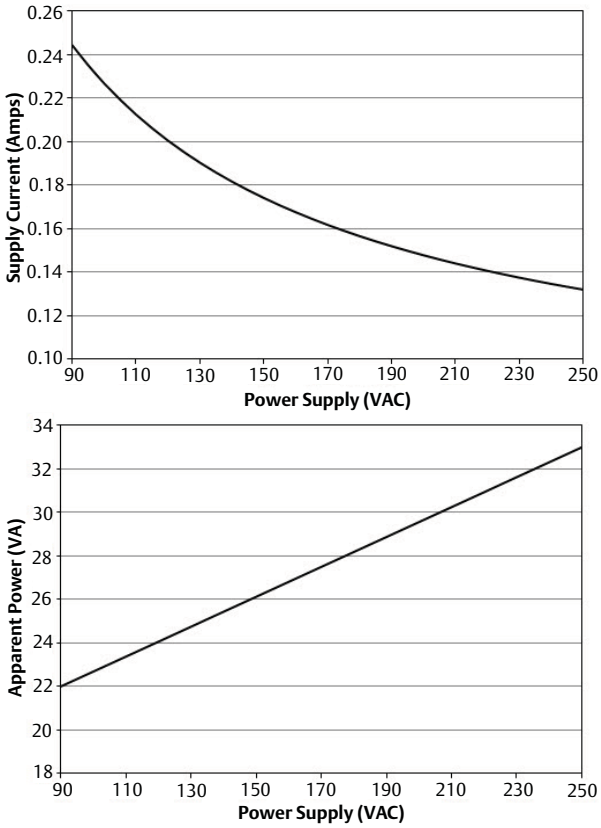
AC: Maximum 35.7 A (< 5 ms) at 250 VAC

DC: Maximum 42 A (< 5 ms) at 42 VDC

AC power supply requirements

Units powered by 90 - 250 VAC have the following power requirements.

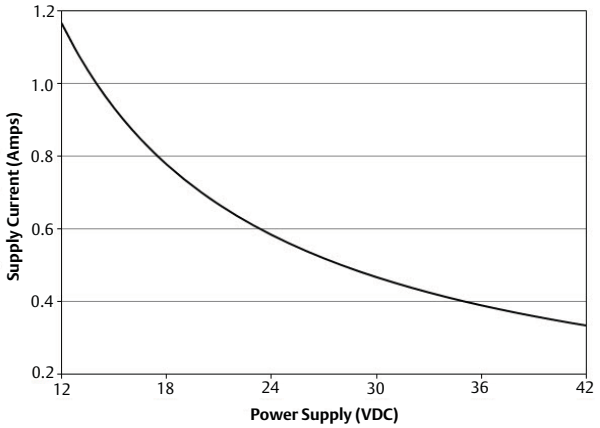
Figure 2. Field Mount Transmitter AC Power Requirements



DC supply current requirements

Units powered by 12 VDC power supply may draw up to 1.2 A of current steady state.

Figure 3. Field Mount Transmitter DC Power Requirements



Ambient temperature limits

Operating

–40 to 140 °F (–40 to 60 °C) without local operator interface

–4 to 140 °F (–20 to 60 °C) with local operator interface

The Local Operator Interface (LOI) will not display at temperatures below -20 °C

Storage

–40 to 185 °F (–40 to 85 °C) without local operator interface

–22 to 176 °F (–30 to 80 °C) with local operator interface

Humidity limits

0–95% RH to 140 °F (60 °C)

Altitude

2000 meters maximum

Enclosure rating

Type 4X, IEC 60529, IP66 (transmitter)

Transient protection rating

Built in transient protection that conforms to:

IEC 61000-4-4 for burst currents

IEC 61000-4-5 for surge currents

Turn-on time

Five minutes to rated accuracy from power up

Five seconds from power interruption

Start-up time

50 ms from zero flow

Low flow cut-off

Adjustable between 0.01 and 38.37 ft/s (0.003 and 11.7 m/s). Below selected value, output is driven to the zero flow rate signal level.

Overrange capability

Signal output will remain linear until 110% of upper range value or 44 ft/s (13 m/s). The signal output will remain constant above these values. Out of range message displayed on LOI and the Field Communicator.

Damping

Adjustable between 0 and 256 seconds.

Advanced diagnostics capabilities

Basic
Self test
Transmitter faults
Analog output test
Pulse output test
Tunable empty pipe
Reverse flow
Coil circuit fault
Electronics temperature
Coil current
Electrode saturation

Process diagnostics (DA1)
Ground/wiring fault
High process noise
Electrode coating diagnostic

SMART Meter Verification (DA2)

SMART Meter Verification (continuous or on-demand)
4–20 mA loop verification

Output signals

Analog output adjustment

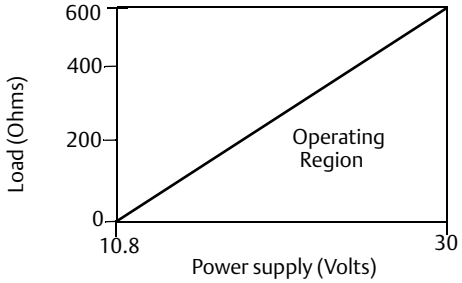
4–20 mA, switch-selectable as internally or externally powered.

Analog loop load limitations

Internally powered 24 VDC max, 500 Ω max loop resistance. Externally powered 10.8–30 VDC max.

Loop resistance is determined by the voltage level of the external power supply at the transmitter terminals:

Figure 4. Analog Loop Load Limitations



R_{max} = 31.25 (V_{ps} – 10.8)
V_{ps} = Power supply voltage (Volts)
R_{max} = Maximum loop resistance (Ohms)

The analog output is automatically scaled to provide 4 mA at lower range value and 20 mA at upper range value. Full scale continuously adjustable between -39 and 39 ft/s (-12 to 12 m/sec), 1 ft/s (0.3 m/s) minimum span.

HART Communications is a digital flow signal. The digital signal is superimposed on the 4–20 mA signal and is available for the control system interface. A minimum of 250 Ω loop resistance is required for HART Communications.

Scalable pulse frequency adjustment

0-10,000 Hz, switch-selectable as internally or externally powered. Pulse value can be set to equal desired volume in selected engineering units. Pulse width adjustable from 0.1 to 650 ms.

Internally powered: Outputs up to 12 VDC

Externally powered: Input 5 - 28 VDC

Output testing

Analog output test

Transmitter may be commanded to supply a specified current between 3.5 and 23 mA.

Pulse output test

Transmitter may be commanded to supply a specified frequency between 1 and 10,000 Hz.

Optional discrete output function (AX option)

Externally powered at 5 - 28 VDC, 240 mA max, solid state switch closure to indicate either:

Reverse flow
Activates switch closure output when reverse flow is detected.

Zero flow
Activates switch closure output when flow goes to 0 ft/s or below low flow cutoff.

Empty pipe
Activates switch closure output when an empty pipe condition is detected.

Transmitter faults
Activates switch closure output when a transmitter fault is detected.

Flow limit 1, Flow limit 2
Activates switch closure output when the transmitter measures a flow rate that meets the conditions established for this alert. There are two independent flow limit alerts that can be configured as discrete outputs.

Totalizer limit
Activates switch closure output when the transmitter measures a total flow that meets the conditions established for this alert.

Diagnostic status
Activates switch closure output when the transmitter detects a condition that meets the configured criteria of this output.

Optional discrete input function (AX option)

Externally powered at 5–28 VDC, 1.4–20 mA to activate switch closure to indicate either:

Net total reset
Resets the net totalizer value to zero.

Positive zero return (PZR)
Forces outputs of the transmitter to zero flow.

Security lockout

Security lockout switch on the electronics board can be set to deactivate all LOI and HART-based communicator functions to protect configuration variables from unwanted or accidental change.

LOI lockout

The display can be manually locked to prevent unintentional configuration changes. The display lock can be activated through a HART Communication Device, or by holding the UP arrow for 3 seconds and then following the on-screen instructions. When the display lock is activated, a lock symbol will appear in the lower right hand corner of the display. To deactivate the display lock, hold the UP arrow for three seconds and follow the on-screen instructions.

Display auto lock can be configured from the LOI with the following settings: OFF, 1 Minute, or 10 Minutes.

Sensor compensation

Rosemount sensors are calibrated in a flow lab at the factory and are assigned a calibration number. The calibration number must be entered into the transmitter, enabling interchangeability of sensors without calculations or a compromise in standard accuracy.

8750W Transmitters and other manufacturers' sensors can be calibrated at known process conditions or at the Rosemount NIST-Traceable Flow Facility. Transmitters calibrated on site require a two-step procedure to match a known flow rate. This procedure can be found in the operations manual.

Performance specifications

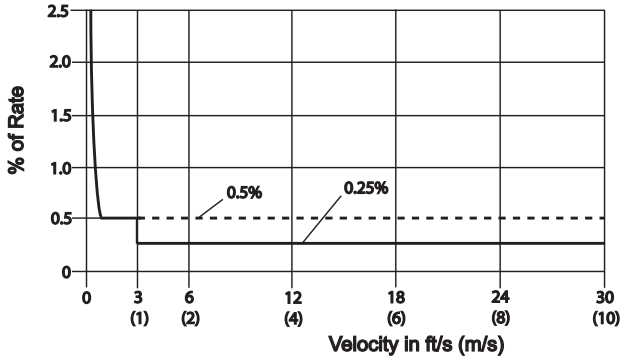
System specifications are given using the frequency output and with the unit at reference conditions.

Accuracy

Includes the combined effects of linearity, hysteresis, and repeatability.

Standard system accuracy is +/-0.5% of rate from 1 to 39 ft/s (0.3 to 12 m/s). Accuracy is +/-0.005 ft/s (0.0015 m/s) from the low flow cutoff to 1 ft/s (0.3 m/s).

Optional high accuracy is +/-0.25% of rate from 3 to 39 ft/s (1 to 12 m/s).



Analog output effects

Analog output has the same accuracy as frequency output plus an additional ±4 µA at room temperature.

Repeatability

±0.1% of reading

Response time (analog output)

20 ms max response time to step change in input.

Stability

±0.25% of rate over six months

Ambient temperature effect

±0.25% change over operating temperature range

Physical specifications

Materials of construction

Standard housing

Low copper aluminum

Type 4X and IEC 60529 IP66

Paint

Polyurethane coat (1.3 to 5 mils thick)

Cover gasket

Buna-N

Electrical connections

Conduit entries: 1/2-in. NPT standard. (optional third connection available).

Terminal block screws: 6-32 (No. 6) suitable for up to 14 AWG wire.

Safety grounding screws: external stainless assembly, M5; internal 8-32 (No. 8)

Vibration rating

2G per IEC 61298

Dimensions

See Figure 9.

Weight

Approximately seven lbs. (3.2 kg).

Add one pound (0.5 kg) for display option code M4 or M5.

Rosemount 8750W Wall Mount Transmitter Specifications

Functional specifications

Transmitter coil drive current

500 mA

Flow rate range

Capable of processing signals from fluids that are traveling between 0.04 and 39 ft/s (0.01 to 12 m/s) for both forward and reverse flow in all sensor sizes. Full scale continuously adjustable between –39 and 39 ft/s (–12 to 12 m/s).

Conductivity limits

Process liquid must have a conductivity of 5 microSiemens/cm (5 micromhos/cm) or greater.

Power supply

90 - 250 VAC, 50/60 Hz or 12 - 42 VDC

Line power fuses

90-250 VAC systems

2 Amp, Fast Acting, Bussman AGC-2

12-42VDC systems

3 Amp, Fast Acting, Bussman AGC-3

Power consumption

15 W maximum - DC

40 VA maximum - AC

Switch-on current

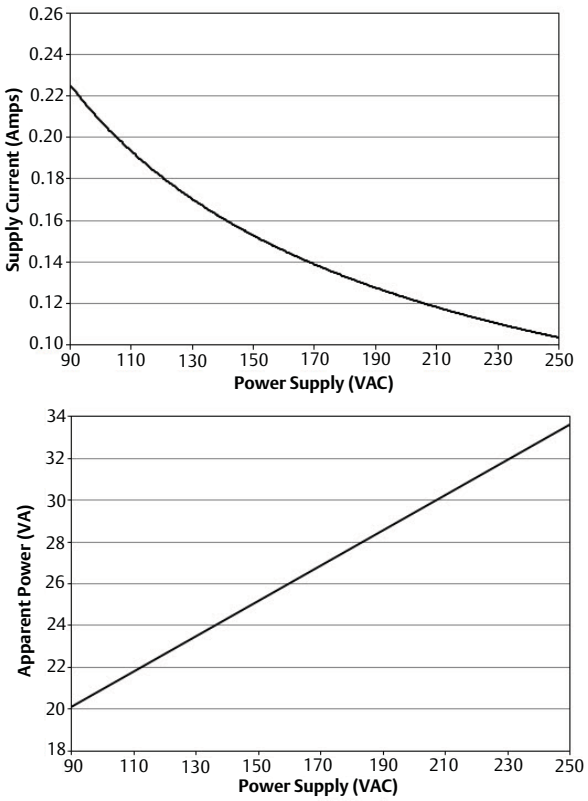
AC: Maximum 35.7 A (< 5 ms) at 250 VAC

DC: Maximum 42 A (< 5 ms) at 4 2VDC

AC power supply requirements

Units powered by 90 - 250 VAC have the following power requirements.

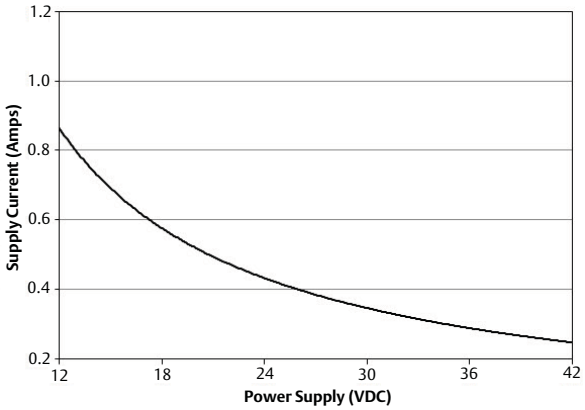
Figure 5. Wall Mount Transmitter AC Power Requirements



DC supply current requirements

Units powered by 12V DC power supply may draw up to 1.2A of current steady state.

Figure 6. Wall Mount Transmitter DC Power Requirements



Ambient temperature limits

Operating

–40 to 165 °F (–40 to 74 °C) without local operator interface

–20 to 140 °F (–29 to 60 °C) with local operator interface

The Local Operator Interface (LOI) will not display at temperatures below -20 °C

Storage

–40 to 176 °F (–40 to 80 °C) with and without local operator interface

Humidity limits

0–95% RH to 120 °F (49 °C), decrease linearly to 10% RH at 130 °F (54 °C)

Altitude

2000 meters maximum

Enclosure rating

Type 4X, IEC 60529, IP66 (transmitter)

Transient protection rating

Built in transient protection that conforms to:

- IEC 61000-4-4 for burst currents.
- IEC 61000-4-5 for surge currents.

Turn-on time

Five minutes to rated accuracy from power up.

Five seconds from power interruption.

Start-up time

50 ms from zero flow

Low flow cut-off

Adjustable between 0.01 and 38.37 ft/s (0.003 and 11.7 m/s). Below selected value, output is driven to the zero flow rate signal level.

Overrange capability

Signal output will remain linear until 110% of upper range value or 44 ft/s (13 m/s). The signal output will remain constant above these values. Out of range message displayed on LOI and the field communicator.

Damping

Adjustable between zero and 256 seconds.

Advanced diagnostics capabilities

Basic
Self test
Transmitter faults
Analog output test
Pulse output test
Tunable empty pipe
Reverse flow
Coil circuit fault
Electronics temperature

Process diagnostics (DA1)
Ground/wiring fault
High process noise

SMART Meter Verification (DA2)

SMART Meter Verification (on-demand)
4–20 mA loop verification

Output signals

Analog output adjustment

4–20 mA, switch-selectable as internally or externally powered.

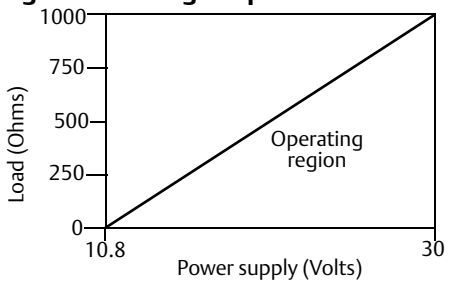
Analog loop load limitations

Internally powered 24 VDC max, 500 Ω max loop resistance.

Externally powered 10.8–30 VDC max.

Loop resistance is determined by the voltage level of the external power supply at the transmitter terminals:

Figure 7. Analog Loop Load Limitations



R_{max} = 52.08 (V_{ps} – 10.8)
V_{ps} = Power Supply Voltage (Volts)
R_{max} = Maximum loop resistance (Ohms)

The analog output is automatically scaled to provide 4mA at lower range value and 20 mA at upper range value. Full scale continuously adjustable between -39 and 39 ft/s (-12 to 12 m/sec), 1 ft/s (0.3 m/s) minimum span.

HART Communications is a digital flow signal. The digital signal is superimposed on the 4–20mA signal and is available for the control system interface. A minimum of 250 Ω loop resistance is required for HART communications.

Scalable pulse frequency adjustment

0-10,000 Hz
Pulse value can be set to equal desired volume in selected engineering units. Pulse width adjustable from 1.5 to 500 ms. Below 1.5 msec pulse width automatically switches to 50% duty cycle.

Externally powered: Input 5 – 24 VDC

Output testing

Analog output test

Transmitter may be commanded to supply a specified current between 3.5 and 23 mA.

Pulse output test

Transmitter may be commanded to supply a specified frequency between one and 10,000 Hz.

Optional discrete output function (AX option)

Externally powered at 5–28 VDC, 240 mA max, solid state switch closure to indicate either:

Reverse flow
Activates switch closure output when reverse flow is detected.

Zero flow
Activates switch closure output when flow goes to 0 ft/s or below low flow cutoff.

Empty pipe
Activates switch closure output when an empty pipe condition is detected.

Transmitter faults
Activates switch closure output when a transmitter fault is detected.

Flow limit 1, Flow limit 2
Activates switch closure output when the transmitter measures a flow rate that meets the conditions established for this alert. There are two independent flow limit alerts that can be configured as discrete outputs.

Totalizer limit
Activates switch closure output when the transmitter measures a total flow that meets the conditions established for this alert.

Diagnostic status
Activates switch closure output when the transmitter detects a condition that meets the configured criteria of this output.

Optional discrete input function (AX option)

Externally powered at 5– 28 VDC, 1.4–20 mA to activate switch closure to indicate either:

Net total reset
Resets the net totalizer value to zero.

Positive zero return (PZR)
Forces outputs of the transmitter to zero flow.

Security lockout

Security lockout switch on the electronics board can be set to protect configuration variables from unwanted or accidental changes.

Sensor compensation

Rosemount Sensors are calibrated in a flow lab at the factory and are assigned a calibration number. The calibration number must be entered into the transmitter, enabling interchangeability of sensors without calculations or a compromise in standard accuracy.

Rosemount 8750W Transmitters and other manufacturers' sensors can be calibrated at known process conditions or at the Rosemount NIST-Traceable Flow Facility. Transmitters calibrated on site require a two-step procedure to match a known flow rate. This procedure can be found in the operations manual.

Performance specifications

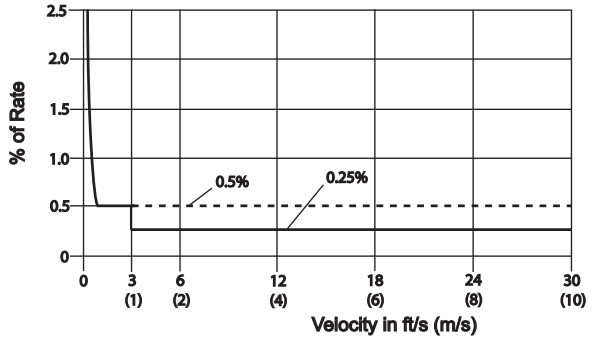
System specifications are given using the frequency output and with the unit at reference conditions.

Accuracy

Includes the combined effects of linearity, hysteresis, and repeatability.

Standard system accuracy is +/-0.5% of rate from 1 to 39 ft/s (0.3 to 12 m/s). Accuracy is +/-0.005 ft/s (0.0015 m/s) from the low flow cutoff to 1 ft/s (0.3 m/s).

Optional high accuracy is +/-0.25% of rate from 3 to 39 ft/s (1 to 12 m/s).



Analog output effects

Analog output has the same accuracy as frequency output plus an additional 0.05% of span.

Repeatability

±0.1% of reading.

Response time (analog output)

50 ms max response time to step change in input.

Stability

±0.25% of rate over six months.

Ambient temperature effect

±0.25% change over operating temperature range.

Physical specifications

Materials of construction

Standard housing

Low copper aluminum

Type 4X and IEC 60529 IP66

Paint

Polyurethane coat (1.3 to 5 mils thick)

Cover gasket

Silicone rubber

Electrical connections

Four 1/2-in. NPT standard

Terminal block screws: 6-32 (No. 6) suitable for up to 14 AWG wire.

Vibration rating

2G per IEC 770 (1984)

Dimensions

See Figure 11.

Weight

Approximately nine lbs. (4.0 kg).

Add one pound (0.5 kg) for display option code M4 or M5.

Rosemount 8750W Sensor Specifications

Functional specifications

Service

Utility, water, and wastewater fluids

Line sizes

1/2– to 48-in. (15 mm to 1200 mm)

Sensor coil resistance

9 - 17 Ω

Interchangeability

Rosemount 8750W Sensors are interchangeable with Rosemount 8750W Transmitters. System accuracy is maintained regardless of line size or optional features. Each sensor nameplate has a sixteen-digit calibration number that can be entered into a transmitter through the Local Operator Interface (LOI) or the Field Communicator.

Upper range limit

39.37 ft/s (12 m/s)

Process temperature limits

PTFE lining
–20 to 248 °F (–29 to 120 °C)

Polyurethane lining
0 to 140 °F (–18 to 60 °C)

Neoprene lining
0 to 176 °F (–18 to 80 °C)

Ambient temperature limits

–20 to 140 °F (–29 to 60 °C)

Pressure limits

See Table 17, Table 18 and Table 19

Vacuum limits

PTFE lining
Full vacuum to 248 °F (120 °C) through 4-in. (100 mm) line sizes. Consult factory for vacuum applications with line sizes of 6-in. (150 mm) or larger.

All other standard sensor lining materials
Full vacuum to maximum material temperature limits for all available line sizes.

Submergence protection IP68

The remote mount Rosemount 8750W Sensor is rated IP68. IP68 rating requires the transmitter be remote mount. Installer must use IP68 approved cable glands, conduit connections, and/or conduit plugs.

For more details on proper installation techniques for IP68, reference Rosemount Technical Note 00840-0100-4750 available on EmersonProcess.com/Rosemount.

Conductivity limits

Process liquid must have a minimum conductivity of 5 microSiemens/cm (5 micromhos/cm) or greater.

Table 17. Sensor Temperature vs. Pressure Limits for ASME B16.5 Class Flanges (1/2- to 24-in. Line Sizes)(1)

Flange material	Flange rating	Pressure		
		@ -20 to 100 °F (-29 to 38 °C)	@ 200 °F (93 °C)	@ 300 °F (149 °C)
Carbon steel	Class 150	285 psi	260 psi	230 psi
	Class 300	740 psi	675 psi	655 psi
304 stainless steel	Class 150	275 psi	235 psi	205 psi
	Class 300	720 psi	600 psi	530 psi

1. Liner temperature limits must also be considered.

Table 18. Sensor Temperature vs. Pressure Limits for AS2129 Table D and E Flanges (4- to 24-in. Line Sizes)(1)

Flange material	Flange rating	Pressure		
		@ -29 to 50 °C (-20 to 122 °F)	@ 100 °C (212 °F)	@ 150 °C (302 °F)
Carbon steel	D	101.6 psi	101.6 psi	101.6 psi
	E	203.1 psi	203.1 psi	203.1 psi

1. Liner temperature limits must also be considered.

Table 19. Sensor Temperature Vs. Pressure Limits for EN 1092-1 Flanges (15 mm to 600 mm Line Sizes)(1)

Flange material	Flange rating	Pressure		
		@ -29 to 50 °C (-20 to 122 °F)	@ 100 °C (212 °F)	@ 150 °C (302 °F)
Carbon steel	PN 10	10 bar	10 bar	9.7 bar
	PN 16	16 bar	16 bar	15.6 bar
	PN 25	25 bar	25 bar	24.4 bar
	PN 40	40 bar	40 bar	39.1 bar
304 stainless steel	PN 10	9.1 bar	7.5 bar	6.8 bar
	PN 16	14.7 bar	12.1 bar	11.0 bar
	PN 25	23 bar	18.9 bar	17.2 bar
	PN 40	36.8 bar	30.3 bar	27.5 bar

1. Liner temperature limits must also be considered.

Table 20. Temperature vs. Pressure Limits for GB/T 9119 Flanges(1)

Flange material	Flange rating	Pressure (Mpa)		
		≤ 20 °C	@ 100 °C (212 °F)	@ 150°C (302 °F)
Carbon steel Group3E0	PN 10	1.00	0.92	0.88
	PN 16	1.60	1.48	1.40
	PN 40	4.00	3.71	3.52
304 SST Group11E0	PN 10	1.00	0.90	0.81
	PN 16	1.60	1.45	1.31
	PN 40	4.00	3.63	3.27

1. Liner temperature limits must also be considered.

Table 21. Temperature vs. Pressure Limits for JIS B2220 Flanges[1]

Flange material	Flange rating	Pressure (Mpa)	
		≤ 50 °C (122 °F)	@ 120 °C (248 °F)
Carbon steel	10K	1.4	1.4
304 stainless steel (15 mm to 65 mm)	10K	1.4	1.4
304 stainless steel (≤ 80 mm)	10K	1.4	1.0

1. Liner temperature limits must also be considered.

Physical specifications

Non-wetted materials

Sensor pipe

Type 304/304L SST

Flanges

Carbon steel, Type 304/304L SST

Coil housing

Rolled carbon steel

Paint

Polyurethane coat (1.3 to 5 mils thick)

Process wetted materials

Lining

PTFE, Polyurethane, Neoprene

Electrodes

316L SST, Nickel Alloy 276 (UNS N10276)

Flat-faced flanges

Flat-faced flanges are manufactured with full-face liners. Available in Neoprene only.

Process connections

ASME B16.5

Class 150: 1/2- to 24-in. (15 mm to 600 mm)

Class 300: 1/2- to 24-in. (15 mm to 600 mm)

AWWA C207

Class D: 30- and 48-in. (750 mm to 1200 mm)

Class E: 30- to 48-in. (750 mm to 1200 mm)

Class F: 30- and 36-in. (750 mm to 900 mm)

EN 1092-1

PN10: 8- to 24-, 36-, 40-, 48-in. (200 mm to 600 mm, 900 mm,1000 mm, 1200 mm)

PN16: 2- to 24-, 36-, 40- (50 mm to 600 mm, 900 mm, 1000 mm)

PN 25: 8- to 24-in. (200 mm to 600 mm)

PN40: 1/2- to 24-in. (15 mm to 600 mm)

AS2129

Table D and E: 1/2- to 40-, 48-in. (15 mm to 1000 mm, 1200 mm)

AS4087

PN16, PN21: 2- to 40-, 48-in. (8-in. excluded) (50 mm to 1000 mm, 1200 mm)

PN35: 2- in 36-in. (8-in. excluded)(50 mm to 900 mm)

GB/T9119

PN10: 8- and 24-, 36-, 40-, 48-in. (200 mm to 600 mm, 900 mm, 1000 mm, 1200 mm)

PN16: 4- and 24-, 36-, 40-in. (100 mm to 600 mm, 900 mm, 1000 mm)

PN40: 1/2- to 24-in. (15 mm to 600 mm)

JIS B2220

10K, 20K: 1/2- to 24-in. (15 mm to 600 mm)

Electrical connections

Conduit entries: 1/2-in. NPT standard

Terminal block screws: 6–32 (No. 6) suitable for up to 14 AWG wire

Safety grounding screws: external stainless assembly, M5; internal 8-32 (No. 8)

Process reference electrode (optional)

A process reference electrode can be installed similarly to the measurement electrodes through the sensor lining. It will be made of the same material as the measurement electrodes.

Grounding rings (optional)

Grounding rings can be installed between the flange and the sensor face on both ends of the sensor. They have an I.D. slightly smaller than the sensor I.D. and an external tab to attach ground wiring. Grounding rings are available in 316L SST and Nickel Alloy 276 (UNS N10276). See Figure 16.

Dimensions

See Figure 16.

Weight

See Table 31.

Product Certifications

Table 22. Rosemount 8750W Magnetic Flowmeter Platform

Option code	8750W Magnetic Flowmeter platform rating	Region	Agency	Certification number
-	Ordinary Locations[1]	USA, Canada EU, CU[2]	FM or CSA and EAC	3030548(FM) or 70030489(CSA)
Z1	ATEX Non-Sparking and Dust for Non-Flammable Fluids	EU	DEKRA	15ATEX0003 X
ND	ATEX Dust	EU	DEKRA	15ATEX0003 X
Z2	InMetro Non-Sparking and Dust for Non-Flammable Fluids	Brazil	PENDING[3]	PENDING
Z3	NEPSI Non-Sparking and Dust for Non-Flammable Fluids	China	NEPSI	GYJ15.1228X
Z5	DIP (Dust-Ignitionproof) Class II and III, Div 1. Non-Incendive, Class I Div 2 for Non-Flammable Fluids	USA	FM	3030548
Z6	CSA, Class I Div 2 for Non-Flammable Fluids; DIP, NI	USA and Canada	CSA	70030489
Z7	IECEx Non-Sparking and Dust for Non-Flammable Fluids	Global	DEKRA	IECEx DEK 15.0001X
NF	IECEx Dust	Global	DEKRA	IECEx DEK 15.0001X
Z9	KTL Non-Sparking and Dust for Non-Flammable Fluids	Korea	KTL[3]	PENDING

1. Complies with only the local country Product safety, electromagnetic, pressure and other applicable regulations. Cannot be used in a classified or zoned hazardous location environment.
2. Customs union (Russia, Belarus and Kazakhstan).
3. Planned submittal or in process with agency.

Table 23. Approval Markings and Logos

Symbol[1]	Marking or symbol name	Region	Meaning of marking or symbol
CE	CE	European Union	Compliance with all applicable European Union Directives.
Ex	ATEX	European Union	Compliance with equipment and protective systems intended for use in potentially explosive atmospheres directive (ATEX) (94/9/EC).
N96	C-tick	Australia	Compliance with Australian applicable electromagnetic compatibility standards.
FM APPROVED	FM Approved	United States	Compliance with the applicable ANSI standards.
C SP® US	CSA	US = United States C = Canada	Indicates that the product was tested and has met the applicable certification requirements for the noted countries.
EAC	Eurasian Conformity (EAC)	Eurasian Customs Union (Russia, Belarus and Kazakhstan)	Compliance with all of the applicable technical regulations of the EAC customs union.
Segurança INMETRO DEKRA OCP 0089	INMETRO	Brazil	Compliance with all of the applicable technical regulations of Brazil.
Ex NEPSI	NEPSI	China	Compliance with all of the applicable technical regulations of China.
KCs	KTL	Korea	Compliance with all of the applicable technical regulations of Korea.

1. Ordinary Location labels will be marked with CE, C-tick, FM, CSA and EAC logos.

European Directive Information

A copy of the EC Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EC Declaration of Conformity can be found at EmersonProcess.com/Rosemount.

Electro Magnetic Compatibility (EMC) (2004/108/EC) and (2014/30/EU)

EN 61326-1: 2013

Low Voltage Directive (LVD) (2006/95/EC) and (2014/35/EU)

EN 61010-1: 2010

Ingress protection rating for dust and water;

Degree of protection, per EN-IEC 60079-0 and EN-IEC 60529: IP66[1]

Degree of protection, per EN-IEC 60079-0 and EN-IEC 60529: IP66, IP68 (10m, 48h)[2]

Degree of protection, per EN-IEC 60079-0 and ISO 20653: IP69K[3]

1. *The Transmitter is rated IP66 when integral or remote mounted, it is not IP68 nor IP69K rated.*
2. *The IP68 rating only applies to the flowtube and the remote junction box when the transmitter is remotely mounted. The IP68 rating is only valid at a depth of 10 meters for 48 hours.*
3. *The IP69K rating only applies to the flowtube and the remote junction box when the transmitter is remotely mounted. The temperature K = 80 °C.*

European Pressure Equipment Directive (PED) (97/23/EC) and (2014/68/EU)

PED Certification requires the “PD” option code.

CE marked models that are ordered without the “PD” option will be marked “Not Complaint to (97/23/EC and 2014/68/EU)”

Mandatory CE-marking with notified body number 0575 or 2460, for all flowtubes is located on the flowmeter label.

Category I assessed for conformity per module A procedures.

Categories II - III assessed for conformity per module H procedures.

QS Certificate of Assessment

EC No. 4741-2014-CE-HOU-DNV: Module H Conformity Assessment

Rosemount 8750W Flanged Flowtubes

Line size 40 mm to 600 mm (1 1/2-in to 24-in)

EN 1092-1 flanges and ASME B16.5 class 150 and ASME B16.5 Class 300 flanges.

Also available in ASME B16.5 Class 600 flanges in limited line sizes.

All other Rosemount Flanged Flowtubes - line sizes of 25 mm (1-in.) and less: Sound Engineering Practice (SEP).

Flowtubes that are SEP are outside the scope of PED and cannot be marked for compliance with PED.

Certifications

Factory Mutual (FM)

Ordinary Location Certification for FM Approvals

As standard, the transmitter and flowtube have been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM Approvals, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Rosemount 8750W Magnetic Flowtube and Transmitter

Z5 All Flowtubes and Integral or Remote Mount Transmitters (Transmitter mount codes T or R)
Non-Incendive for Class I, Division 2, Groups ABCD: T4
Dust-Ignition Proof for Class II/III, Division 1, Groups EFG: T5 -29 °C ≤ T_a ≤ 60 °C
Enclosure Type 4X, IP66/68 (IP68 flowtube only with Remote mount transmitter)
Install per drawing 8750W-1052.

Special Condition for Safe Use (X):

1. Flowtube to be used only in a non-flammable process.

Rosemount 8750W Magnetic Flowtube and Transmitter

Z5 All Flowtubes and Wall Mount Transmitter (Transmitter mount code W)
Non-Incendive for Class I, Division 2, Groups ABCD: T4
Dust-Ignition Proof for Class II/III, Division 1, Groups EFG: T4-29 °C ≤ T_a ≤ 40 °C
Enclosure Type 4X, IP66/68 (IP68 flowtube only)
Install per drawing 8750W-1052.

Special Condition for Safe Use (X):

1. Flowtube to be used only in a non-flammable process.

CSA

Ordinary Location Certification for FM Approvals

As standard, the transmitter and flowtube have been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM Approvals, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Rosemount 8750W Magnetic Flowtube and Transmitter

Z6 Non-Incendive for Class I, Division 2, Groups ABCD: T4
Dust-Ignition Proof for Class II/III, Division 1, Groups EFG: T4 -29°C ≤ T_a ≤ 60 °C (Transmitter mount codes T or R)
-29 °C ≤ T_a ≤ 40 °C (Transmitter mount code W)
Enclosure Type 4X, IP66/68/69K(1)
Install per drawing 8750W-1052.

Special Condition for Safe Use (X):

1. Flowtube to be used only in a non-flammable process.

1. *The Transmitter is rated IP66 when integral or remote mounted, it is not IP68 nor IP69K rated. The IP68 rating only applies to the flowtube and the remote junction box when the transmitter is remotely mounted. The IP68 rating is only valid at a depth of 10 meters for 48 hours. The IP69K rating only applies to the flowtube and the remote junction box when the transmitter is remotely mounted. The temperature K = 80 °C.*

Figure 8. Rosemount 8750W Declaration of Conformity

EMERSON. Process Management

ROSEMOUNT

CE

EC Declaration of Conformity

No: RFD 1098 Rev. G

We,

Emerson Process Management
Rosemount Flow
12001 Technology Drive
Eden Prairie, MN 55344
USA

declare under our sole responsibility that the product(s),

Rosemount Model 8750W Magnetic Flowmeters

to which this declaration relates, is in conformity with the provisions of the European Community Directives, including the latest amendments, as shown in the attached schedule.

Assumption of conformity is based on the application of harmonized or applicable technical standards and, when applicable or required, a European Community notified body certification, as shown in the attached schedule.

(signature)

22 February 2016	**Mark Fleigle**
(date of issue)	(name - printed)

Vice President Technology and New Products

(function name - printed)

F FILE ID: 8750W CE Marking Page 1 of 3 RFD1098.docx

EMERSON. Process Management

ROSEMOUNT

CE

Schedule

EC Declaration of Conformity RFD 1098 Rev. G

LVD Directive (2006/95/EC) and (2014/35/EU) as of 20 April 2016

All Models: EN 61010-1: 2010

EMC Directive (2004/108/EC) and (2014/30/EU) as of 20 April 2016

All Models: EN 61326-1: 2013

PED Directive (97/23/EC) and (2014/68/EU) as of 19 July 2016

Model 8750W Magnetic Flowtube with Option "PD", in Line Sizes 1.5" – 24"

Equipment without the 'PD' option is NOT PED compliant and cannot be used in the EEA without further assessment unless the installation is exempt under Article 1, paragraph 3 of the PED Directive (97/23/EC) or (2014/68/EU)

QS Certificate of Assessment - EC No. 4741-2014-CE-HOU-DNV
Module H Conformity Assessment
ASME B31.3: 2010

Model 8750W in Line Sizes 0.5" – 1.0"
Sound Engineering Practice
ASME B31.3: 2010

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EMERSON. Process Management

ROSEMOUNT

CE

Schedule

EC Declaration of Conformity RFD 1098 Rev. G

ATEX Directive (94/9/EC) and (2014/34/EU) as of 20 April 2016

Model 8750W Magnetic Flow Transmitter and Flow Tubes

CERTIFICATE: DEKRA 15ATEX0003 X
Equipment Marking Summary:

II 3 G	Ex nA [ic] IIC T4 Gc
II 3 G	Ex nA ic IIC T5...T4 Gc
II 3 D	Ex tc IIIC T 80°C...T 130°C Dc

EN 60079-0: 2012 +A11:2013
EN 60079-15: 2010
EN 60079-11: 2012
EN 60079-31: 2014

PED Notified Body

DNV GL [Notified Body Number: 0575]
Veritasveien 1, N-1322
Hovik, Norway

Or

DNV Nemko Presafe AS [Notified Body number: 2460]
P.O. Box 73, Blindern
0314 Oslo, Norway

FILE ID: 8750W CE Marking Page 3 of 3 RFD1098.docx

IEC EC and ATEX Approval Information

Equipment markings[1]

Type Examination Certificate

(ATEX)DEKRA 15ATEX0003 X

Certificate of Conformity (IECEx)

IECEx DEK 15.0001X

Required documentation

8750W-2052 Installation Drawing Model 8750W ATEX/IECEx Hazardous (Ex) Locations

Referenced documentation

- 00825-0300-4750.pdf, Quick Start Guide
- 00809-0300-4750.pdf, Reference Manual
- 8750W-AP01, Approvals Document
- 8750W-1504 Installation Drawing, Rosemount 8750W Transmitter Wiring

The Required and Referenced Documents listed above address the following items:

a. Instructions for safety i.e.
   - Putting into service
   - Use
   - Assembling and dismantling
   - Maintenance, overhaul and repair
   - Installation
   - Adjustment

b. Where necessary, training instructions

c. Details which allow a decision to be made as to whether the equipment can be used safely in the intended area under the expected operating conditions.

d. Electrical parameters, maximum surface temperatures and other limit values.
   - Electrical - See document 8750W-2052

Rosemount 8750W Flow Transmitter	
Power input	90–250 VAC, 0.45 A, 40 VA 12–42 VDC, 1.2 A, 15 W
Pulsed circuit	Internally powered (Active): outputs up to 12 VDC, 12.1 mA, 73 mW Externally powered (Passive): input up to 28 VDC, 100 mA, 1 W
4–20 mA output circuit	Internally Powered (Active): outputs up to 25 mA, 24 VDC, 600 mW Externally Powered (Passive): input up to 25 mA, 30 VDC, 750 mW
Modbus®	Internally Powered (Active): outputs up to 100 mA, 3.3 VDC, 100 mW
Um	250 V
Coil excitation output	500 mA, 40 V_{max}, 9 W_{max}
Rosemount 8750W Flowtube[1]	
Coil excitation input	500 mA, 40 V_{max}, 20 W_{max}
Electrode	5 V,200 uA,1 mW

1. Provided by the transmitter.

Special Conditions for Safe Use (X):

1. When “Special Paint Systems” are applied, instructions for safe use regarding potential electrostatic charging hazard have to be followed.
2. Terminals 1,2,3,4, for data communication, cannot withstand the 500 V isolation test between signal and ground, due to integral transient protection. This must be taken into account upon installation.
3. Conduit entries must be installed to maintain the enclosure ingress rating of IP66 (Transmitter and Flow Tube), IP68 or IP69K (Flow Tube) as applicable.
4. The flow tube and transmitter are not allowed to be thermally insulated.

e. Where necessary, the essential characteristics of tools which may be fitted to the equipment
   - No proprietary tools required.

1. See section VI in the tables on the following pages.

f. List of the standards, including the issue date, with which the equipment is declared to comply:

- ATEX - EN 60079-0:2012 + A11:2013,
  EN 60079-11:2012,
  EN 60079-15:2010,
  EN 60079-31:2014
- IECEx - IEC 60079-0:2011,
  IEC 60079-11:2011,
  IEC 60079-15:2010,
  IEC 60079-31: 2013

g. Supply wire requirements;

- Use 10 - 18 AWG wire rated for the proper temperature of the application. For wire 10 - 14 AWG use lugs or other appropriate connectors. For connections in ambient temperatures above 122 °F (50 °C), use a wire rated for 194 °F (90 °C).

h. Contact address:
Rosemount Inc.
12001 Technology Drive
Eden Prairie,
MN 55344
United States of America

Table 24. Nomenclature Magnetic Flow Meter System Model 8750W and Electrical Data

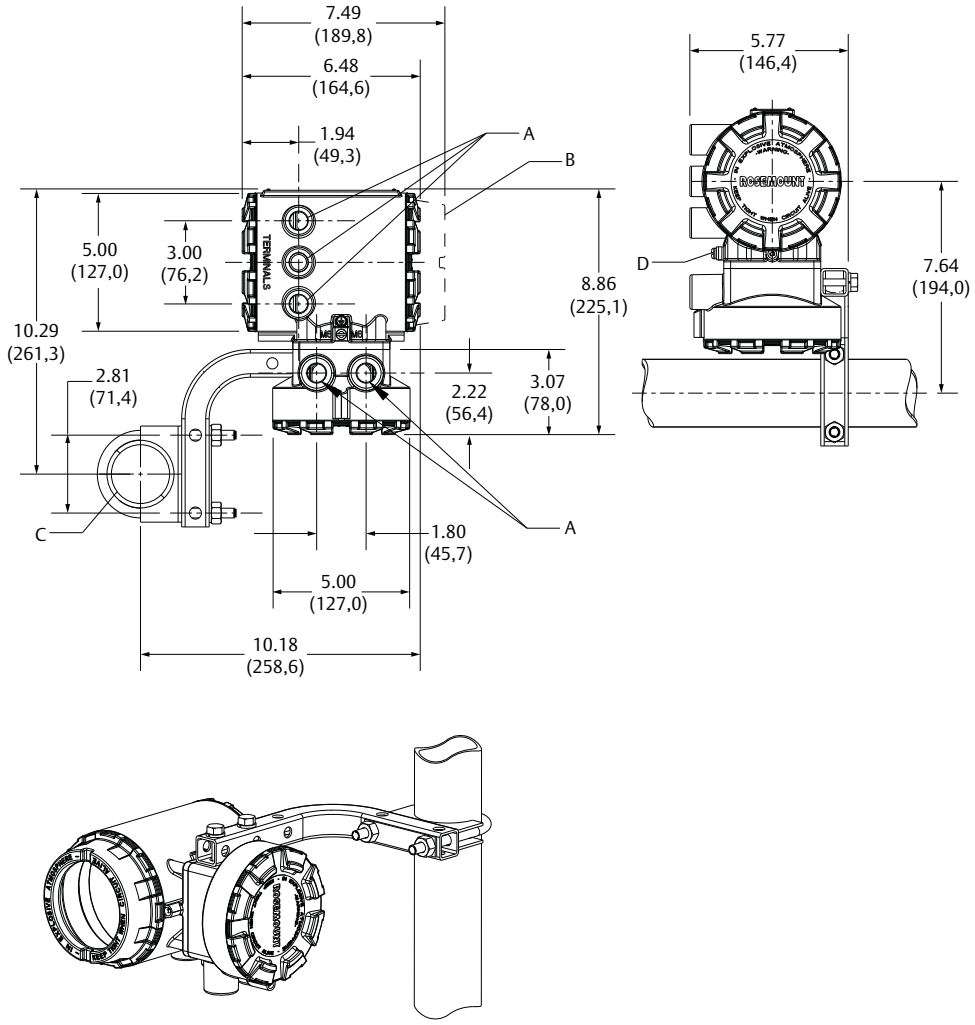
8750W	...	R	1	A	2	...	F	005	...	Z1	...	M4	...	AX	...	V1	...	RH50
I		II	III	IV	V		VI	VII		VIII		IX		X		XI		IX

Designation	Explanation	Value	Explanation
I	Model	8750W	Flow Meter System Model 8750W
II	Transmitter mount	R T	Remote mount Integral mount
III	Transmitter power supply	1 2	AC (90–250 Vac, 50/60 Hz), not for Ex nA DC (12–42 Vdc)
IV	Transmitter outputs	A M 0	4–20 mA with digital HART Protocol & scalable pulse output Modbus RS-485 Spare flow tube, no transmitter
V	Conduit entries	1 or 4 2 or 5	½–14 NPT female CM20, M20 female
VI	Electrode type	A, B, E, F 0	Seal of electrodes comply with IEC 61010-1. Spare transmitter, no flow tube
VII	Line size	005 to 480 000	1/2-in. NPS (15 mm) to 48-in. NPS (1200 mm) Spare transmitter, no flow tube
VIII	Safety approvals	Z1 ATEX	Ⓔx II 3 GEx nA [ic] IIC T4 Gc(1) Ⓔx II 3 GEx nA ic IIC T5...T4 Gc(2) Ⓔx II 3 DEx tc IIIC T80 °C...T130 °C Dc(3)
		Z7 IECEx	Ex nA [ic] IIC T4 Gc(1) Ex nA ic IIC T5...T4 Gc(2) Ex tc IIIC T80 °C...T130 °C Dc (3)
		ND ATEX	Ⓔx II 3 DEx tc IIIC T80 °C...T130 °C Dc(3)
		NF IECEx	Ex tc IIIC T80 °C...T130 °C Dc(3)
IX	Transmitter display	M4 M5	LOI Display
X	Transmitter discrete input/output	AX	Two discrete channels (DI/DO 1, DO 2)
XI	Specials paint	Vx	Special paint systems (4)
XII	Remote cable option	RTxx(5) RHxx(5)	Standard temperature component Extended temperature component

1. Model Rosemount 8750W Transmitter DC Power Supply only.
2. Model Rosemount 8750W Flow Tube only.
3. Model Rosemount 8750W Transmitter AC and DC Power Supply and Model Rosemount 8750W Flow Tube.
4. Subject to special conditions for safe use.
5. Length = xx x10-ft, max. 500-ft.

Dimensional Drawings

Figure 9. Rosemount 8750W Field Mount Transmitter



A. 1/2-in.–14 NPT or M20 conduit entry
B. LOI cover
C. 2-in. pipe bracket
D. Ground lug

Figure 10. Rosemount 8750W Integral Field Mount Transmitter

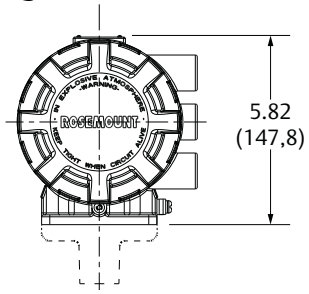
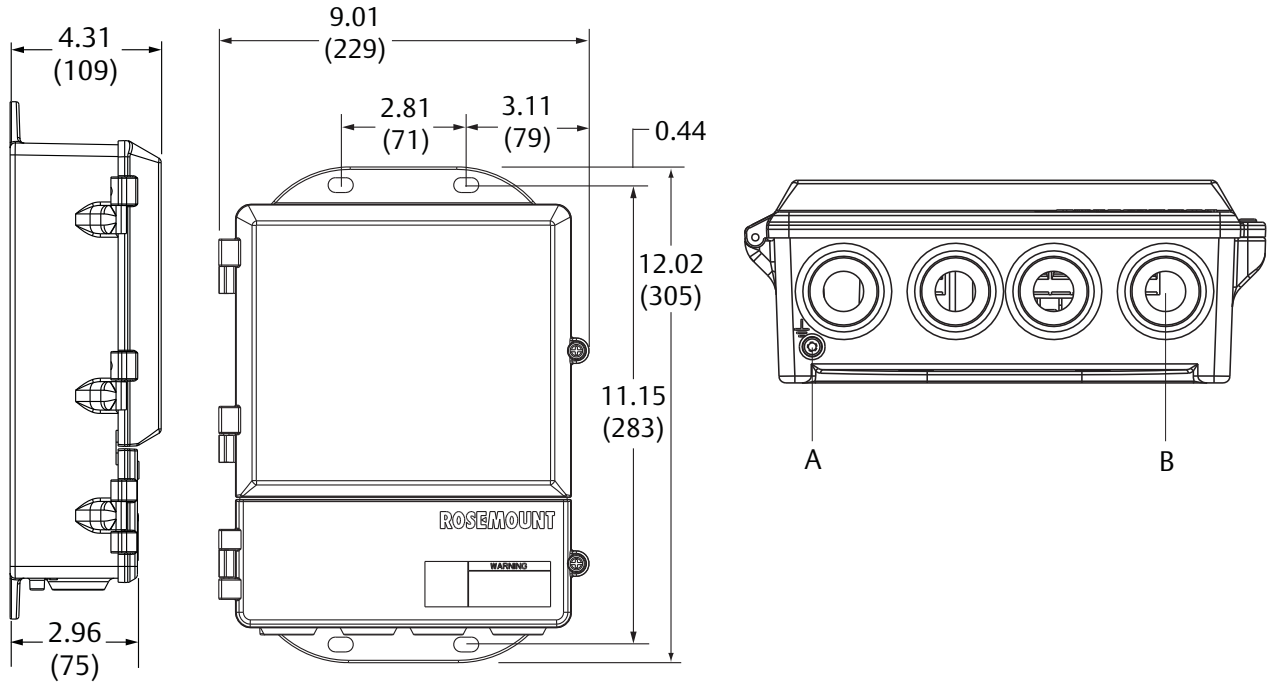


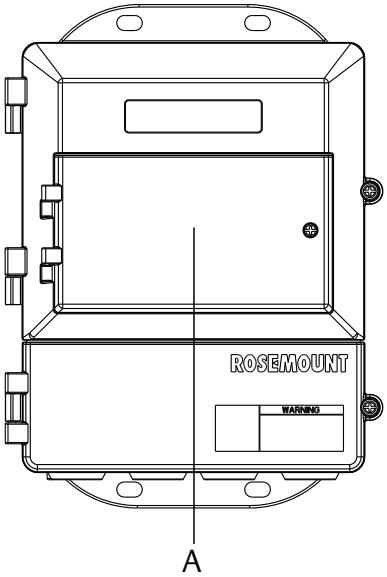
Figure 11. Rosemount 8750W Wall Mount Transmitter with Standard Cover



A. Ground lug
B. 1/2-in.–14 NPT conduit connection (four places)

Dimensions in inches (millimeters).

Figure 12. Rosemount 8750W Wall Mount Transmitter with LOI Cover



A. LOI keypad cover

Figure 13. Rosemount 8750W Raised Face Flanged Sensor 1/2-in to 2.5-in. (15 mm to 65 mm)

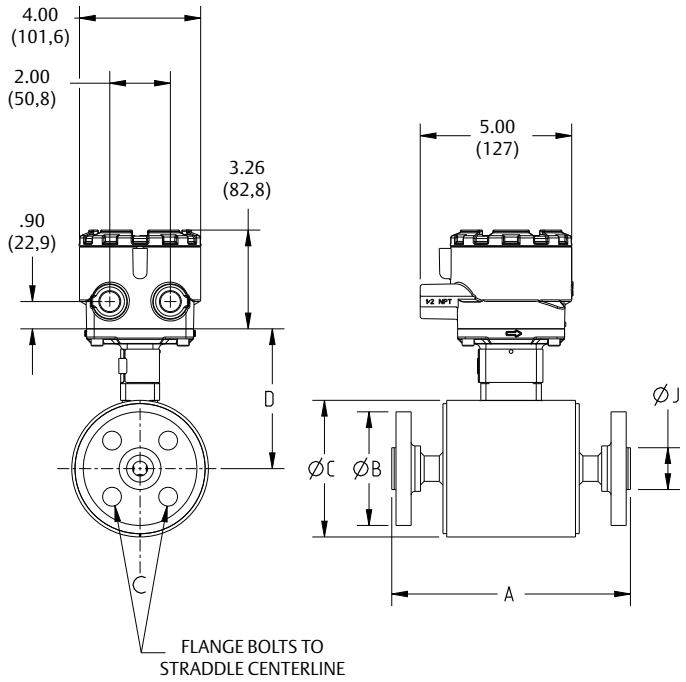


Table 24. Rosemount 8750W Raised Face Flanged Sensor 1/2- to 2 1/2-in. (15 mm to 65 mm) Dimensions

Size, description	Overall length			FLANGE Ø DIM "B"	Body Ø DIM "C"	DIM "D"	Liner Ø on face DIM "J"	Flow tube weight (lbs./ kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly					
0.5-in. (15 mm) ASME - 150, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	3.50 (89)	4.50 (114)	4.41 (112)	1.38 (35)	9 (4)
0.5-in. (15 mm) ASME - 300, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	3.74 (95)	4.50 (114)	4.41 (112)	1.38 (35)	10 (5)
0.5-in. (15 mm) EN 1092-1 - PN40, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	3.74 (95)	4.50 (114)	4.41 (112)	1.77 (45)	10 (5)
0.5-in. (15 mm) AS 2129 Table D, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	3.74 (95)	4.50 (114)	4.41 (112)	1.85 (47)	8 (4)
0.5-in. (15 mm) AS 2129 Table E, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	3.74 (95)	4.50 (114)	4.41 (112)	1.85 (47)	8 (4)
0.5-in. (15 mm) JIS B2220 - 10K, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	3.74 (95)	4.50 (114)	4.41 (112)	1.77 (45)	10 (5)
0.5-in. (15 mm) JIS B2220 - 20K, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	3.74 (95)	4.50 (114)	4.41 (112)	1.77 (45)	10 (5)
0.5-in. (15 mm) GB/T9119 PN40, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	3.74 (95)	4.50 (114)	4.41 (112)	1.77 (45)	10 (5)
1-in. (25 mm) ASME - 150, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	4.25 (108)	4.50 (114)	4.41 (112)	2.00 (51)	11 (5)
1-in. (25 mm) ASME - 300, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	4.88 (124)	4.50 (114)	4.41 (112)	2.00 (51)	14 (6)
1-in. (25 mm) EN 1092-1 - PN40, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	4.53 (115)	4.50 (114)	4.41 (112)	2.68 (68)	14 (6)
1-in. (25 mm) AS 2129 Table D, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	4.53 (115)	4.50 (114)	4.41 (112)	2.56 (65)	10 (5)
1-in. (25 mm) AS 2129 Table E, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	4.53 (115)	4.50 (114)	4.41 (112)	2.48 (63)	10 (5)
1 -in. (25 mm) JIS B2220 - 10K, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	4.92 (125)	4.50 (114)	4.41 (112)	2.64 (67)	13 (6)
1-in. (25 mm) JIS B2220 - 20K, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	4.92 (125)	4.50 (114)	4.41 (112)	2.64 (67)	14 (6)
1-in. (25 mm) GB/T9119 PN40, SO/RF	7.88 (200)	7.88 (200)	7.88 (200)	4.53 (115)	4.50 (114)	4.41 (112)	2.68 (68)	14 (6)
1.5-in (40 mm) ASME - 150, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	5.00 (127)	5.21 (132)	4.82 (122)	2.88 (73)	15 (7)
1.5-in. (40 mm) ASME - 300, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	6.12 (155)	5.21 (132)	4.82 (122)	2.88 (73)	21 (9)
1.5-in. (40 mm) EN 1092-1 - PN40, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	5.91 (150)	5.21 (132)	4.82 (122)	3.46 (88)	19 (9)

Table 24. Rosemount 8750W Raised Face Flanged Sensor 1/2- to 2 1/2-in. (15 mm to 65 mm) Dimensions

Size, Description	Overall length			FLANGE Ø DIM "B"	Body Ø DIM "C"	DIM "D"	Liner Ø on Face DIM "J"	Flow Tube weight (lbs./ kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly					
1.5-in. (40 mm) AS 2129 Table D, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	5.31 (135)	5.21 (132)	4.82 (122)	3.07 (78)	12 (6)
1.5-in. (40 mm) AS 2129 Table E, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	5.31 (135)	5.21 (132)	4.82 (122)	3.07 (78)	13 (6)
1.5-in. (40 mm) JIS B2220 - 10K, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	5.51 (140)	5.21 (132)	4.82 (122)	3.19 (81)	16 (7)
1.5-in. (40 mm) JIS B2220 - 20K, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	5.51 (140)	5.21 (132)	4.82 (122)	3.19 (81)	17 (8)
1.5-in. (40 mm) GB/T9119 PN40, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	5.91 (150)	5.21 (132)	4.82 (122)	3.46 (88)	19 (9)
2-in. (50 mm) ASME - 150, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	6.00 (152)	5.21 (132)	4.82 (122)	3.62 (92)	20 (9)
2-in. (50 mm) ASME - 300, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	6.50 (165)	5.21 (132)	4.82 (122)	3.62 (92)	23 (11)
2-in. (50 mm) EN 1092-1 - PN40, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	6.50 (165)	5.21 (132)	4.82 (122)	4.02 (102)	24 (11)
2-in. (50 mm) AS 2129 Table D, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	5.91 (150)	5.21 (132)	4.82 (122)	3.54 (90)	14 (6)
2-in. (50 mm) AS 2129 Table E, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	5.91 (150)	5.21 (132)	4.82 (122)	3.54 (90)	15 (7)
2-in. (50 mm) JIS B2220 - 10K, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	6.10 (155)	5.21 (132)	4.82 (122)	3.78 (96)	18 (8)
2-in. (50 mm) JIS B2220 - 20K, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	6.10 (155)	5.21 (132)	4.82 (122)	3.78 (96)	19 (9)
2-in. (50 mm) AS 4087 PN16, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	5.91 (150)	5.21 (132)	4.82 (122)	3.54 (90)	16 (7)
2-in. (50 mm) AS 4087 PN21, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	6.50 (165)	5.21 (132)	4.82 (122)	4.06 (103)	34 (16)
2-in. (50 mm) AS 4087 PN35, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	6.50 (165)	5.21 (132)	4.82 (122)	4.06 (103)	96 (44)
2-in. (50 mm) GB/T9119 PN40, SO/RF	7.87 (200)	7.80 (198)	7.87 (200)	6.50 (165)	5.21 (132)	4.82 (122)	4.02 (102)	23 (11)
2.5-in. (65 mm) ASME - 150, SO/RF	7.82 (199)	7.76 (197)	N/A	7.00 (178)	6.31 (160)	5.37 (136)	4.12 (105)	27 (12)
2.5-in. (65 mm) ASME - 300, SO/RF	7.82 (199)	7.76 (197)	N/A	7.50 (191)	6.31 (160)	5.37 (136)	4.12 (105)	32 (15)
2.5-in. (65 mm) EN 1092-1 - PN16, SO/RF	7.82 (199)	7.76 (197)	N/A	7.28 (185)	6.31 (160)	5.37 (136)	4.80 (122)	27 (12)
2.5-in. (65 mm) EN 1092-1 - PN40, SO/RF	7.82 (199)	7.76 (197)	N/A	7.28 (185)	6.31 (160)	5.37 (136)	4.80 (122)	31 (14)
2.5-in. (65 mm) AS 2129 Table D, SO/RF	7.82 (199)	7.76 (197)	N/A	6.50 (165)	6.31 (160)	5.37 (136)	4.06 (103)	17 (8)
2.5-in. (65 mm) AS 2129 Table E, SO/RF	7.82 (199)	7.76 (197)	N/A	6.50 (165)	6.31 (160)	5.37 (136)	4.06 (103)	19 (9)
2.5-in. (65 mm) JIS B2220 - 10K, SO/RF	7.82 (199)	7.76 (197)	N/A	6.89 (175)	6.31 (160)	5.37 (136)	4.57 (116)	25 (11)
2.5-in. (65 mm) JIS B2220 - 20K, SO/RF	7.82 (199)	7.76 (197)	N/A	6.89 (175)	6.31 (160)	5.37 (136)	4.57 (116)	26 (12)
2.5-in. (65 mm) AS 4087 PN16, SO/RF	7.82 (199)	7.76 (197)	N/A	6.50 (165)	6.31 (160)	5.37 (136)	4.06 (103)	18 (8)
2.5-in. (65 mm) AS 4087 PN21, SO/RF	7.82 (199)	7.76 (197)	N/A	7.28 (185)	6.31 (160)	5.37 (136)	4.80 (122)	24 (11)
2.5-in. (65 mm) AS 4087 PN35, SO/RF	7.82 (199)	7.76 (197)	N/A	7.28 (185)	6.31 (160)	5.37 (136)	4.80 (122)	27 (12)
2.5-in. (65 mm) GB/T9119 PN40, SO/RF	7.82 (199)	7.76 (197)	N/A	7.28 (185)	6.31 (160)	5.37 (136)	4.80 (122)	31 (14)

Figure 14. Rosemount 8750W Raised Face Flanged Sensor 3-in to 48-in. (75 mm to 1200 mm)

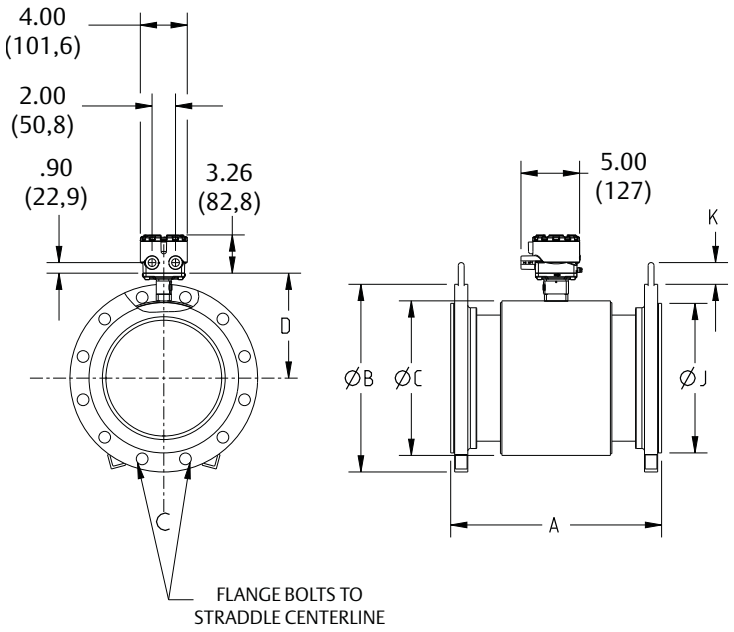


Table 25. Rosemount 8750W Raised Face Flanged Sensor 3- to 6-in. (75 mm to 150 mm) Dimensions

Size, description	Overall length			FLANGE Ø DIM "B"	Body ∅ DIM "C"	DIM "D"	Liner ∅ on face DIM "J"	Lift ring height DIM "K"	Flow tube weight (lbs./kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly						
3-in. (80 mm) ASME - 150, SO/RF	7.87 (200)	7.75 (197)	7.87 (200)	7.50 (191)	7.21 (183)	5.82 (148)	5.00 (127)	1.70 (43)	34 (15)
3-in. (80 mm) ASME - 300, SO/RF	8.63 (219)	8.51 (216)	8.63 (219)	8.25 (210)	7.21 (183)	5.82 (148)	5.00 (127)	1.70 (43)	43 (19)
3-in. (80 mm) EN 1092-1 -PN40, SO/RF	7.87 (200)	7.75 (197)	7.87 (200)	7.87 (200)	7.21 (183)	5.82 (148)	5.43 (138)	1.70 (43)	38 (17)
3-in. (80 mm) AS 2129 Table D, SO/RF	7.87 (200)	7.75 (197)	7.87 (200)	7.28 (185)	7.21 (183)	5.82 (148)	4.80 (122)	1.70 (43)	24 (11)
3-in. (80 mm) AS 2129 Table E, SO/RF	7.87 (200)	7.75 (197)	7.87 (200)	7.28 (185)	7.21 (183)	5.82 (148)	4.80 (122)	1.70 (43)	25 (11)
3-in. (80 mm) JIS - 10K, SO/RF	7.87 (200)	7.75 (197)	7.87 (200)	7.28 (185)	7.21 (183)	5.82 (148)	4.96 (126)	1.70 (43)	28 (13)
3-in. (80 mm) JIS - 20K, SO/RF	7.87 (200)	7.75 (197)	7.87 (200)	7.87 (200)	7.21 (183)	5.82 (148)	5.20 (132)	1.70 (43)	34 (16)
3-in. (80 mm) AS 4087 PN16, SO/RF	7.87 (200)	7.75 (197)	7.87 (200)	7.28 (185)	7.21 (183)	5.82 (148)	4.80 (122)	1.70 (43)	20 (9)
3-in. (80 mm) AS 4087 PN21, SO/RF	7.87 (200)	7.75 (197)	7.87 (200)	8.07 (205)	7.21 (183)	5.82 (148)	5.55 (141)	1.70 (43)	56 (25)
3-in. (80 mm) AS 4087 PN35, SO/RF	7.87 (200)	7.75 (197)	7.87 (200)	8.07 (205)	7.21 (183)	5.82 (148)	5.55 (141)	1.70 (43)	109 (49)
3-in. (80 mm) GB/T9119 PN40, SO/RF	7.87 (200)	7.75 (197)	7.87 (200)	7.87 (200)	7.21 (183)	5.82 (148)	5.43 (138)	1.70 (43)	37 (17)
4-in. (100 mm) ASME - 150, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	9.00 (229)	7.91 (201)	6.17 (157)	6.19 (157)	1.70 (43)	45 (20)
4-in. (100 mm) ASME - 300, SO/RF	10.88 (276)	10.73 (273)	10.88 (276)	10.00 (254)	7.91 (201)	6.17 (157)	6.19 (157)	1.70 (43)	65 (29)
4-in. (100 mm) EN 1092-1 - PN16, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	8.66 (220)	7.91 (201)	6.17 (157)	6.22 (159)	1.70 (43)	41 (19)
4-in. (100 mm) EN 1092-1 - PN40, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	9.25 (235)	7.91 (201)	6.17 (157)	6.38 (162)	1.70 (43)	49 (22)
4-in. (100 mm) AS 2129 Table D, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	8.46 (215)	7.91 (201)	6.17 (157)	6.06 (154)	1.70 (43)	31 (14)
4-in. (100 mm) AS 2129 Table E, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	8.46 (215)	7.91 (201)	6.17 (157)	6.06 (154)	1.70 (43)	33 (15)
4-in. (100 mm) JIS - 10K, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	8.27 (210)	7.91 (201)	6.17 (157)	5.95 (151)	1.70 (43)	35 (16)
4-in. (100 mm) JIS - 20K, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	8.86 (225)	7.91 (201)	6.17 (157)	6.30 (160)	1.70 (43)	44 (20)
4-in. (100 mm) AS 4087 PN16, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	8.46 (215)	7.91 (201)	6.17 (157)	6.06 (154)	1.70 (43)	28 (13)

Table 25. Rosemount 8750W Raised Face Flanged Sensor 3- to 6-in. (75 mm to 150 mm) Dimensions

Size, description	Overall length			FLANGE Ø DIM "B"	Body ∅ DIM "C"	DIM "D"	Liner ∅ on face DIM "J"	Lift ring height DIM "K"	Flow tube weight (lbs./kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly						
4-in. (100 mm) AS 4087 PN21, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	9.05 (230)	7.91 (201)	6.17 (157)	6.57 (167)	1.70 (43)	68 (31)
4-in. (100 mm) AS 4087 PN35, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	9.05 (230)	7.91 (201)	6.17 (157)	6.57 (167)	1.70 (43)	119 (54)
4-in. (100 mm) GB/T9119 PN16, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	8.66 (220)	7.91 (201)	6.17 (157)	6.22 (158)	1.70 (43)	41 (19)
4-in. (100 mm) GB/T9119 PN40, SO/RF	9.84 (250)	9.69 (246)	9.84 (250)	9.25 (235)	7.91 (201)	6.17 (157)	6.38 (162)	1.70 (43)	49 (22)
5-in. (125 mm) ASME - 150, SO/RF	9.79 (249)	9.71 (247)	N/A	10.00 (254)	9.61 (244)	7.02 (178)	7.31 (186)	1.70 (43)	54 (24)
5-in. (125 mm) ASME - 300,SO/RF	10.94 (278)	10.86 (276)	N/A	11.00 (279)	9.61 (244)	7.02 (178)	7.31 (186)	1.70 (43)	89 (40)
5-in. (125 mm) EN 1092-1 - PN16, SO/RF	9.79 (249)	9.50 (241)	N/A	9.84 (250)	9.61 (244)	7.02 (178)	7.40 (188)	1.70 (43)	55 (25)
5-in. (125 mm) EN 1092-1 - PN40, SO/RF	9.79 (249)	9.71 (247)	N/A	10.63 (270)	9.61 (244)	7.02 (178)	7.40 (188)	1.70 (43)	65 (29)
5-in. (125 mm) AS 2129 Table D, SO/RF	9.79 (249)	9.71 (247)	N/A	10.04 (255)	9.61 (244)	7.02 (178)	7.32 (186)	1.70 (43)	43 (20)
5-in. (125 mm) AS 2129 Table E, SO/RF	9.79 (249)	9.71 (247)	N/A	10.04 (255)	9.61 (244)	7.02 (178)	7.31 (186)	1.70 (43)	44 (20)
5-in. (125 mm) JIS - 10K, SO/RF	9.79 (249)	9.71 (247)	N/A	9.84 (250)	9.61 (244)	7.02 (178)	7.17 (182)	1.70 (43)	49 (22)
5-in. (125 mm) JIS - 20K, SO/RF	9.79 (249)	9.71 (247)	N/A	10.63 (270)	9.61 (244)	7.02 (178)	7.68 (195)	1.70 (43)	64 (29)
5-in. (125 mm) GB/T9119 PN16, SO/RF	9.79 (249)	9.50 (241)	N/A	9.84 (250)	9.61 (244)	7.02 (178)	7.40 (188)	1.70 (43)	51 (23)
5-in. (125 mm) GB/T9119 PN40, SO/RF	9.79 (249)	9.71 (247)	N/A	10.63 (270)	9.61 (244)	7.02 (178)	7.40 (188)	1.70 (43)	60 (27)
6-in. (150 mm) ASME - 150, SO/RF	11.81 (300)	11.61 (295)	11.73 (298)	11.00 (279)	9.98 (253)	7.30 (185)	8.50 (216)	1.70 (43)	68 (31)
6-in. (150 mm) ASME - 300, SO/RF	13.06 (302)	12.88 (327)	13.00 (330)	12.50 (318)	9.98 (253)	7.30 (185)	8.50 (216)	1.70 (43)	117 (53)
6-in. (150 mm) EN 1092-1 - PN16, SO/RF	11.81 (300)	11.61 (295)	11.73 (298)	11.22 (285)	9.98 (253)	7.30 (185)	8.35 (212)	1.70 (43)	67 (31)
6-in. (150 mm) EN 1092-1 - PN40, SO/RF	13.06 (332)	12.88 (327)	13.00 (330)	11.81 (300)	9.98 (253)	7.30 (185)	8.58 (218)	1.70 (43)	95 (43)
6-in. (150 mm) AS 2129 Table D, SO/RF	11.81 (300)	11.61 (295)	11.73 (298)	11.02 (280)	9.98 (253)	7.30 (185)	8.31 (211)	1.70 (43)	52 (24)
6-in. (150 mm) AS 2129 Table E, SO/RF	11.81 (300)	11.61 (295)	11.73 (298)	11.02 (280)	9.98 (253)	7.30 (185)	8.15 (207)	1.70 (43)	57 (26)
6-in. (150 mm) JIS - 10K, SO/RF	11.81 (300)	11.61 (295)	11.73 (298)	11.02 (280)	9.98 (253)	7.30 (185)	8.35 (212)	1.70 (43)	64 (29)
6-in. (150 mm) JIS - 20K, SO/RF	11.81 (300)	11.61 (295)	11.73 (298)	12.01 (305)	9.98 (253)	7.30 (185)	9.06 (230)	1.70 (43)	82 (37)
6-in. (150 mm) AS 4087 PN16,SO/RF	11.81 (300)	11.61 (295)	11.73 (298)	11.02 (280)	9.98 (253)	7.30 (185)	8.31 (211)	1.70 (43)	46 (21)
6-in. (150 mm) AS 4087 PN21,SO/RF	11.81 (300)	11.61 (295)	11.73 (298)	12.01 (305)	9.98 (253)	7.30 (185)	9.13 (232)	1.70 (43)	98 (45)
6-in. (150 mm) AS 4087 PN35, SO/RF	11.81 (300)	11.61 (295)	11.73 (298)	12.01 (305)	9.98 (253)	7.30 (185)	9.13 (232)	1.70 (43)	186 (84)
6-in. (150 mm) GB/T9119 PN16, SO/RF	11.81 (300)	11.61 (295)	11.73 (298)	11.22 (285)	9.98 (253)	7.30 (185)	8.35 (212)	1.70 (43)	64 (29)
6-in. (150 mm) GB/T9119 PN40, SO/RF	13.06 (332)	12.88 (327)	13.00 (330)	11.81 (300)	9.98 (253)	7.30 (185)	8.58 (218)	1.70 (43)	94 (43)

Table 26. Rosemount 8750W Raised Face Flanged Sensor 8- to 12-in. (200 mm to 300 mm) Dimensions

Size, description	Overall length			FLANGE Ø DIM "B"	Body ∅ DIM "C"	DIM "D"	Liner ∅ on face DIM "J"	Lift ring height DIM "K"	Flow tube weight (lbs./kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly						
8-in. (200 mm) ASME - 150, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	13.50 (343)	11.92 (303)	8.27 (210)	10.62 (270)	1.70 (43)	105 (48)
8-in. (200 mm) ASME - 300,SO/RF	15.60 (396)	15.42 (392)	15.54 (395)	15.00 (381)	11.92 (303)	8.27 (210)	10.62 (270)	1.70 (43)	183 (83)
8-in. (200 mm) EN 1092-1 - PN10, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	13.39 (340)	11.92 (303)	8.27 (210)	10.55 (268)	1.70 (43)	97 (44)
8-in. (200 mm) EN 1092-1 - PN16, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	13.39 (340)	11.92 (303)	8.27 (210)	10.55 (268)	1.70 (43)	96 (43)
8-in. (200 mm) EN 1092-1 - PN25, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	14.17 (360)	11.92 (303)	8.27 (210)	10.94 (278)	1.70 (43)	120 (54)
8-in. (200 mm) EN 1092-1 - PN40, SO/RF	15.60 (396)	15.42 (392)	15.54 (395)	14.76 (375)	11.92 (303)	8.27 (210)	11.22 (285)	1.70 (43)	158 (72)
8-in. (200 mm) AS 2129 Table D, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	13.19 (335)	11.92 (303)	8.27 (210)	10.55 (268)	1.70 (43)	77 (35)
8-in. (200 mm) AS 2129 Table E, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	13.19 (335)	11.92 (303)	8.27 (210)	10.39 (264)	1.70 (43)	86 (39)

Table 26. Rosemount 8750W Raised Face Flanged Sensor 8- to 12-in. (200 mm to 300 mm) Dimensions

Size, description	Overall length			FLANGE Ø DIM "B"	Body ∅ DIM "C"	DIM "D"	Liner ∅ on face DIM "J"	Lift ring height DIM "K"	Flow tube weight (lbs./kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly						
8-in. (200 mm) JIS - 10K, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	12.99 (330)	11.92 (303)	8.27 (210)	10.32 (262)	1.70 (43)	81 (37)
8-in. (200 mm) JIS - 20K, SO/RF	15.60 (396)	15.42 (392)	15.54 (395)	13.78 (350)	11.92 (303)	8.27 (210)	10.83 (275)	1.70 (43)	134 (61)
8-in. (200 mm) AS 4087 PN16, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	13.19 (335)	11.92 (303)	8.27 (210)	10.55 (268)	1.70 (43)	73 (32)
8-in. (200 mm) AS 4087 PN21, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	14.57 (370)	11.92 (303)	8.27 (210)	11.65 (296)	1.70 (43)	136 (62)
8-in. (200 mm) AS 4087 PN35, SO/RF	15.60 (396)	15.42 (392)	15.54 (395)	14.57 (370)	11.92 (303)	8.27 (210)	10.24 (260)	1.70 (43)	241 (109)
8-in. (200 mm) GB/T9119 PN10, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	13.39 (340)	11.92 (303)	8.27 (210)	10.55 (268)	1.70 (43)	96 (43)
8-in. (200 mm) GB/T9119 PN16, SO/RF	13.78 (350)	13.53 (344)	13.65 (347)	13.39 (340)	11.92 (303)	8.27 (210)	10.55 (268)	1.70 (43)	95 (43)
8-in. (200 mm) GB/T9119 PN40, SO/RF	15.60 (396)	15.42 (392)	15.54 (395)	14.76 (375)	11.92 (303)	8.27 (210)	11.22 (285)	1.70 (43)	154 (70)
10-in. (250 mm) ASME - 150, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	16.00 (406)	13.12 (333)	8.91 (226)	12.75 (324)	2.00 (51)	138 (63)
10-in. (250 mm) ASME - 300,SO/RF	17.88 (454)	17.61 (447)	17.73 (450)	17.50 (445)	13.12 (333)	8.91 (226)	12.75 (324)	2.00 (51)	247 (112)
10-in. (250 mm) EN 1092-1 - PN10, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	15.55 (395)	13.12 (333)	8.91 (226)	12.60 (320)	2.00 (51)	122 (55)
10-in. (250 mm) EN 1092-1 - PN16, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	15.94 (405)	13.12 (333)	8.91 (226)	12.60 (320)	2.00 (51)	126 (57)
10-in. (250 mm) EN 1092-1 - PN25, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	16.73 (425)	13.12 (333)	8.91 (226)	13.19 (335)	2.00 (51)	158 (72)
10-in. (250 mm) EN 1092-1 - PN40, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	17.72 (450)	13.12 (333)	8.91 (226)	13.58 (345)	2.00 (51)	221 (100)
10-in. (250 mm) AS 2129 Table D, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	15.94 (405)	13.12 (333)	8.91 (226)	12.91 (328)	2.00 (51)	112 (51)
10-in. (250 mm) AS 2129 Table E, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	15.94 (405)	13.12 (333)	8.91 (226)	12.91 (328)	2.00 (51)	127 (57)
10-in. (250 mm) JIS B2220 - 10K, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	15.75 (430)	13.12 (333)	8.91 (226)	12.76 (324)	2.00 (51)	118 (53)
10-in. (250 mm) AS 4087 PN16, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	15.94 (405)	13.12 (333)	8.91 (226)	12.91 (328)	2.00 (51)	168 (76)
10-in. (250 mm) AS 4087 PN21, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	16.93 (395)	13.12 (333)	8.91 (226)	13.74 (349)	2.00 (51)	258 (117)
10-in. (250) AS 4087 PN35, SO/RF	17.88 (454)	17.61 (447)	17.73 (450)	16.93 (395)	13.12 (333)	8.91 (226)	12.24 (311)	2.00 (51)	333 (151)
10-in. (250 mm) GB/T 9119 PN10, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	15.55 (395)	13.12 (333)	8.91 (226)	12.60 (320)	2.00 (51)	105 (48)
10-in. (250 mm) GB/T 9119 PN16, SO/RF	17.98 (457)	17.61 (447)	17.73 (450)	15.94 (405)	13.12 (333)	8.91 (226)	12.60 (320)	2.00 (51)	117 (53)
10-in. (250 mm) GB/T 9119 PN40, SO/RF	17.88 (454)	17.61 (447)	17.73 (450)	17.72 (450)	13.12 (333)	8.91 (226)	13.58 (345)	2.00 (51)	213 (97)
12-in. (300 mm) ASME - 150, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	19.00 (483)	15.12 (384)	9.91 (252)	15.00 (381)	2.00 (51)	238 (108)
12-in. (300 mm) ASME - 300,SO/RF	19.92 (506)	19.58 (497)	19.70 (500)	20.50 (521)	15.12 (384)	9.91 (252)	15.00 (381)	2.00 (51)	346 (157)
12-in. (300 mm) EN 1092-1 - PN10, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	17.52 (445)	15.12 (384)	9.91 (252)	14.57 (370)	2.00 (51)	187 (85)
12-in. (300 mm) EN 1092-1 - PN16, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	18.11 (460)	15.12 (384)	9.91 (252)	14.88 (378)	2.00 (51)	198 (90)
12-in. (300 mm) EN 1092-1 - PN25, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	19.09 (485)	15.12 (384)	9.91 (252)	15.55 (395)	2.00 (51)	243 (110)
12-in. (300 mm) EN 1092-1 - PN40, SO/RF	19.92 (506)	19.58 (497)	19.70 (500)	20.28 (515)	15.12 (384)	9.91 (252)	16.14 (410)	2.00 (51)	340 (154)
12-in. (300 mm) AS 2129 Table D, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	17.91 (455)	15.12 (384)	9.91 (252)	14.88 (378)	2.00 (51)	185 (84)
12-in. (300 mm) AS 2129 Table E, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	17.91 (455)	15.12 (384)	9.91 (252)	14.72 (374)	2.00 (51)	197 (89)
12-in. (300 mm) JIS B2220 - 10K, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	17.52 (445)	15.12 (384)	9.91 (252)	14.49 (368)	2.00 (51)	178 (81)
12-in. (300 mm) AS 4087 PN16, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	17.91 (455)	15.12 (384)	9.91 (252)	14.88 (378)	2.00 (51)	264 (120)
12-in. (300 mm) AS 4087 PN21, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	19.29 (490)	15.12 (384)	9.91 (252)	15.98 (406)	2.00 (51)	361 (164)
12-in. (300 mm) AS 4087 PN35, SO/RF	19.92 (506)	19.58 (497)	19.70 (500)	19.29 (490)	15.12 (384)	9.91 (252)	14.25 (362)	2.00 (51)	452 (205)
12-in. (300 mm) GB/T 9119 PN10, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	17.52 (445)	15.12 (384)	9.91 (252)	14.57 (370)	2.00 (51)	185 (84)
12-in. (300 mm) GB/T 9119 PN16, SO/RF	19.91 (506)	19.58 (497)	19.70 (500)	18.11 (460)	15.12 (384)	9.91 (252)	14.88 (378)	2.00 (51)	204 (92)
12-in. (300 mm) GB/T 9119 PN40, SO/RF	19.92 (506)	19.58 (497)	19.70 (500)	20.28 (515)	15.12 (384)	9.91 (252)	16.14 (410)	2.00 (51)	343 (156)

Table 27. Rosemount 8750W Raised Face Flanged Sensor 14- to 18-in. (350 mm to 450 mm) Dimensions

Size, description	Overall length			FLANGE Ø DIM "B"	Body ∅ DIM "C"	DIM "D"	Liner ∅ on face DIM "J"	Lift ring height DIM "K"	Flow tube weight (lbs./kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly						
14-in. (350 mm) ASME - 150,SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	21.00 (533)	16.38 (416)	10.54 (268)	16.25 (413)	2.00 (51)	251 (114)
14-in. (350 mm) ASME - 300, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	23.00 (584)	16.38 (416)	10.54 (268)	16.25 (413)	2.00 (51)	453 (205)
14-in. (350 mm) EN 1092-1 - PN10, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	19.88 (505)	16.38 (416)	10.54 (268)	16.93 (430)	2.00 (51)	198 (90)
14-in. (350 mm) EN 1092-1 - PN16, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	20.47 (520)	16.38 (416)	10.54 (268)	17.24 (438)	2.00 (51)	221 (100)
14-in. (350 mm) EN 1092-1 - PN25, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	21.85 (555)	16.38 (416)	10.54 (268)	17.72 (450)	2.00 (51)	297 (135)
14-in. (350 mm) EN 1092-1 - PN40, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	22.83 (580)	16.38 (416)	10.54 (268)	18.31 (465)	2.00 (51)	404 (183)
14-in. (350 mm) AS 2129 Table D, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	20.67 (525)	16.38 (416)	10.54 (268)	17.24 (438)	2.00 (51)	181 (82)
14-in. (350 mm) AS 2129 Table E, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	20.67 (525)	16.38 (416)	10.54 (268)	17.24 (438)	2.00 (51)	207 (94)
14-in. (350 mm) JIS B2220 - 10K, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	19.29 (490)	16.38 (416)	10.54 (268)	16.26 (413)	2.00 (51)	170 (77)
14-in. (350 mm) AS 4087 PN16,SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	20.67 (525)	16.38 (416)	10.54 (268)	17.24 (438)	2.00 (51)	367 (167)
14 -in. (350 mm) AS 4087 PN21, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	21.65 (550)	16.38 (416)	10.54 (268)	18.07 (459)	2.00 (51)	409 (186)
14-in. (350 mm) AS 4087 PN35, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	21.65 (550)	16.38 (416)	10.54 (268)	16.50 (419)	2.00 (51)	622 (282)
14-in. (350 mm) GB/T 9119 PN10, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	19.88 (505)	16.38 (416)	10.54 (268)	16.93 (430)	2.00 (51)	192 (87)
14-in. (350 mm) GB/T 9119 PN16, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	20.47 (520)	16.38 (416)	10.54 (268)	17.24 (438)	2.00 (51)	219 (99)
14-in. (350 mm) GB/T 9119 PN40, SO/RF	21.75 (553)	21.55 (547)	21.67 (550)	22.83 (580)	16.38 (416)	10.54 (268)	18.31 (465)	2.00 (51)	421 (191)
16-in. (400 mm) ASME - 150, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	23.50 (597)	18.40 (467)	11.55 (293)	18.50 (470)	3.13 (80)	346 (157)
16-in. (400 mm) ASME - 300,SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	25.50 (648)	18.40 (467)	11.55 (293)	18.50 (470)	3.13 (80)	632 (287)
16-in. (400 mm) EN 1092-1 - PN10, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	22.24 (565)	18.40 (467)	11.55 (293)	18.98 (482)	3.13 (80)	272 (123)
16-in. (400 mm) EN 1092-1 - PN16, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	22.83 (580)	18.40 (467)	11.55 (293)	19.28 (490)	3.13 (80)	306 (139)
16-in. (400 mm) EN 1092-1 - PN25, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	24.41 (620)	18.40 (467)	11.55 (293)	19.88 (505)	3.13 (80)	498 (226)
16-in. (400 mm) EN 1092-1 - PN40, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	25.98 (660)	18.40 (467)	11.55 (293)	21.06 (535)	3.13 (80)	606 (275)
16-in. (400 mm) AS 2129 Table D, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	22.83 (580)	18.40 (467)	11.55 (293)	19.25 (489)	3.13 (80)	243 (110)
16-in. (400 mm) AS 2129 Table E, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	22.83 (580)	18.40 (467)	11.55 (293)	19.25 (489)	3.13 (80)	287 (130)
16-in. (400 mm) JIS B2220 - 10K, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	22.05 (560)	18.40 (467)	11.55 (293)	18.70 (475)	3.13 (80)	250 (114)
16-in. (400 mm) AS 4087 PN16, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	22.83 (580)	18.40 (467)	11.55 (293)	19.25 (489)	3.13 (80)	458 (208)
16-in. (400 mm) AS 4087 PN21,SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	24.02 (610)	18.40 (467)	11.55 (293)	20.31 (516)	3.13 (80)	603 (273)
16-in. (400 mm) AS 4087 PN35, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	24.02 (610)	18.40 (467)	11.55 (293)	19.02 (483)	3.13 (80)	804 (364)
16-in. (400 mm) GB/T 9119 PN10, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	22.24 (565)	18.40 (467)	11.55 (293)	18.98 (482)	3.13 (80)	241 (109)
16-in. (400 mm) GB/T 9119 PN16, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	22.83 (580)	18.40 (467)	11.55 (293)	19.28 (490)	3.13 (80)	303 (137)
16-in. (400 mm) GB/T 9119 PN40, SO/RF	23.71 (602)	23.51 (597)	23.63 (600)	25.98 (660)	18.40 (467)	11.55 (293)	21.06 (535)	3.13 (80)	636 (289)
18-in. (450) ASME - 150, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	25.00 (635)	20.42 (519)	12.57 (319)	21.00 (533)	3.13 (80)	440 (200)
18-in. (450 mm) ASME - 300, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	28.00 (711)	20.42 (519)	12.57 (319)	21.00 (533)	3.13 (80)	849 (385)
18-in. (450 mm) EN 1092-1 - PN10, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	24.21 (615)	20.42 (519)	12.57 (319)	20.94 (532)	3.13 (80)	370 (168)
18-in. (450 mm) EN 1092-1 - PN16, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	25.20 (640)	20.42 (519)	12.57 (319)	21.65 (550)	3.13 (80)	423 (192)
18-in. (450 mm) EN 1092-1 - PN25, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	26.38 (670)	20.42 (519)	12.57 (319)	21.85 (555)	3.13 (80)	686 (312)
18-in. (450 mm) EN 1092-1 - PN40, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	26.97 (685)	20.42 (519)	12.57 (319)	22.05 (560)	3.13 (80)	759 (345)
18-in. (450 mm) AS 2129 Table D, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	25.20 (640)	20.42 (519)	12.57 (319)	20.94 (532)	3.13 (80)	345(156)
18-in. (450 mm) AS 2129 Table E, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	25.20 (640)	20.42 (519)	12.57 (319)	21.73 (552)	3.13 (80)	403 (183)
18-in. (450 mm) JIS B2220 - 10K, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	24.41 (620)	20.42 (519)	12.57 (319)	20.87 (530)	3.13 (80)	362 (164)
18-in. (450 mm) JIS B2220 - 20K, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	26.58 (675)	20.42 (519)	12.57 (319)	22.05 (560)	3.13 (80)	693 (314)

Table 27. Rosemount 8750W Raised Face Flanged Sensor 14- to 18-in. (350 mm to 450 mm) Dimensions

Size, description	Overall length			FLANGE Ø DIM "B"	Body ∅ DIM "C"	DIM "D"	Liner ∅ on face DIM "J"	Lift ring height DIM "K"	Flow tube weight (lbs./kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly						
18-in. (450 mm) AS 4087 PN16, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	25.20 (640)	20.42 (519)	12.57 (319)	21.73 (552)	3.13 (80)	312 (141)
18-in. (450 mm) AS 4087 PN21, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	26.58 (675)	20.42 (519)	12.57 (319)	22.48 (571)	3.13 (80)	442 (200)
18-in. (450 mm) AS 4087 PN35, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	26.58 (675)	20.42 (519)	12.57 (319)	20.98 (533)	3.13 (80)	859 (390)
18-in. (450 mm) GB/T9119 PN10, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	24.41 (620)	20.42 (519)	12.57 (319)	20.94 (532)	3.13 (80)	370 (168)
18-in. (450 mm) GB/T9119 PN16, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	25.20 (640)	20.42 (519)	12.57 (319)	21.65 (550)	3.13 (80)	423 (192)
18-in. (450 mm) GB/T9119 PN40, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	26.97 (685)	20.42 (519)	12.57 (319)	22.05 (560)	3.13 (80)	782 (355)

Table 28. Rosemount 8750W Raised Face Flanged Sensor 20- to 36-in. (500 mm to 900 mm) Dimensions

Size, description	Overall length			FLANGE Ø DIM "B"	Body ∅ DIM "C"	DIM "D"	Liner ∅ on face DIM "J"	Lift ring height DIM "K"	Flow tube weight (lbs./kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly						
20-in. (500 mm) ASME - 150, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	27.50 (699)	22.44 (570)	13.58 (345)	23.00 (584)	3.13 (80)	544 (247)
20-in. (500 mm) ASME - 300, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	30.50 (775)	22.44 (570)	13.58 (345)	23.00 (584)	3.13 (80)	1027 (466)
20-in. (500 mm) EN 1092-1 - PN10, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	26.38 (670)	22.44 (570)	13.58 (345)	23.03 (585)	3.13 (80)	448 (204)
20-in. (500 mm) EN 1092-1 - PN16, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	28.15 (715)	22.44 (570)	13.58 (345)	24.02 (610)	3.13 (80)	542 (212)
20-in. (500 mm) EN 1092-1 - PN25, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	28.74 (730)	22.44 (570)	13.58 (345)	24.21 (615)	3.13 (80)	832 (378)
20-in. (500 mm) EN 1092-1 - PN40, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	29.72 (755)	22.44 (570)	13.58 (345)	24.21 (615)	3.13 (80)	913 (414)
20-in. (500 mm) AS 2129 Table D, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	27.76 (705)	22.44 (570)	13.58 (345)	23.98 (609)	3.13 (80)	446 (203)
20-in. (500 mm) AS 2129 Table E, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	27.76 (705)	22.44 (570)	13.58 (345)	23.98 (609)	3.13 (80)	503 (228)
20-in. (500 mm) JIS B2220 - 10K, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	26.58 (675)	22.44 (570)	13.58 (345)	23.03 (585)	3.13 (80)	428 (195)
20-in. (500 mm) JIS B2220 - 20K, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	28.74 (730)	22.44 (570)	13.58 (345)	24.21 (615)	3.13 (80)	819 (372)
20-in. (500 mm) AS 4087 PN16, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	27.76 (705)	22.44 (570)	13.58 (345)	23.98 (609)	3.13 (80)	428 (195)
20-in. (500 mm) AS 4087 PN21, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	28.94 (735)	22.44 (570)	13.58 (345)	24.96 (634)	3.13 (80)	602 (274)
20-in. (500 mm) AS 4087 PN35,SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	28.94 (735)	22.44 (570)	13.58 (345)	23.50 (587)	3.13 (80)	974 (442)
20-in. (500 mm) GB/T9119 PN10, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	26.38 (670)	22.44 (570)	13.58 (345)	23.03 (585)	3.13 (80)	445 (202)
20-in. (500 mm) GB/T9119 PN16, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	28.15 (715)	22.44 (570)	13.58 (345)	24.02 (610)	3.13 (80)	555 (252)
20-in. (500 mm) GB/T9119 PN40, SO/RF	23.46 (596)	23.51 (597)	23.38 (594)	29.72 (755)	22.44 (570)	13.58 (345)	24.21 (615)	3.13 (80)	978 (444)
24-in. (600 mm) ASME - 150, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	32.00 (813)	26.50 (673)	15.61 (396)	27.25 (692)	3.13 (80)	634 (287)
24-in. (600 mm) ASME - 300, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	36.00 (914)	26.50 (673)	15.61 (396)	27.25 (692)	3.13 (80)	1335 (606)
24-in. (600 mm) EN 1092-1 - PN10, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	30.71 (780)	26.50 (673)	15.61 (396)	26.97 (685)	3.13 (80)	466 (211)
24-in. (600 mm) EN 1092-1 - PN16, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	33.07 (840)	26.50 (673)	15.61 (396)	28.54 (725)	3.13 (80)	665 (302)
24-in. (600 mm) EN 1092-1 - PN25, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	33.27 (845)	26.50 (673)	15.61 (396)	28.35 (720)	3.13 (80)	938 (426)
24-in. (600 mm) EN 1092-1 - PN40, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	35.04 (890)	26.50 (673)	15.61 (396)	28.94 (735)	3.13 (80)	1207 (528)
24-in. (600 mm) AS 2129 Table D, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	32.48 (825)	26.50 (673)	15.61 (396)	28.35 (720)	3.13 (80)	501 (227)
24-in. (600 mm) AS 2129 Table E, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	32.48 (825)	26.50 (673)	15.61 (396)	28.23 (717)	3.13 (80)	625 (283)
24-in. (600 mm) JIS B2220 - 10K, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	31.30 (795)	26.50 (673)	15.61 (396)	27.17 (690)	3.13 (80)	451 (204)
24-in. (600 mm) AS 4087 PN16, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	32.48 (825)	26.50 (673)	15.61 (396)	28.35 (720)	3.13 (80)	1133 (514)
24-in. (600 mm) AS 4087 PN21,SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	33.47 (850)	26.50 (673)	15.61 (396)	29.09 (739)	3.13 (80)	1605 (728)
24-in. (600 mm) AS 4087 PN35, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	33.47 (850)	26.50 (673)	15.61 (396)	27.52 (699)	3.13 (80)	1777 (806)
24-in. (600 mm) GB/T 9119 PN10, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	30.71 (780)	26.50 (673)	15.61 (396)	26.97 (685)	3.13 (80)	486 (221)

Table 28. Rosemount 8750W Raised Face Flanged Sensor 20- to 36-in. (500 mm to 900 mm) Dimensions

Size, description	Overall length			FLANGE Ø DIM "B"	Body ∅ DIM "C"	DIM "D"	Liner ∅ on face DIM "J"	Lift ring height DIM "K"	Flow tube weight (lbs./kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly						
24-in. (600 mm) GB/T 9119 PN16, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	33.07 (840)	26.50 (673)	15.61 (396)	28.54 (725)	3.13 (80)	669 (304)
24-in. (600 mm) GB/T 9119 PN40, SO/RF	23.46 (596)	23.51 (597)	23.63 (600)	35.04 (890)	26.50 (673)	15.61 (396)	28.94 (735)	3.13 (80)	1282 (581)
30-in. (750 mm) AS 2129 Table D, SO/RF	29.34 (745)	29.39 (747)	29.26 (743)	39.17 (995)	33.00 (838)	16.38 (416)	34.96 (888)	3.13 (80)	929 (421)
30-in. (750 mm) AS 2129 Table E, SO/RF	29.34 (745)	29.39 (747)	29.26 (743)	39.17 (995)	33.00 (838)	16.38 (416)	33.75 (857)	3.13 (80)	1059 (480)
30-in. (750 mm) AS 4087 PN16, SO/RF	29.34 (745)	29.39 (747)	29.26 (743)	39.17 (995)	33.00 (838)	16.38 (416)	34.96 (888)	3.13 (80)	975 (442)
30-in. (750 mm) AS 4087 PN21, SO/RF	29.34 (745)	29.39 (747)	29.26 (743)	39.96 (1015)	33.00 (838)	16.38 (416)	33.35 (898)	3.13 (80)	948 (430)
30-in. (750 mm) AS 4087 PN35, SO/RF	29.34 (745)	29.39 (747)	29.26 (743)	39.96 (1015)	33.00 (838)	16.38 (416)	33.35 (898)	3.13 (80)	2096 (950)
30-in. (750 mm) JIS B2220 - 10K, SO/RF	29.34 (745)	29.39 (747)	29.26 (743)	38.19 (970)	33.00 (838)	16.38 (416)	33.66 (855)	3.13 (80)	862 (392)
36-in. (900 mm) AS 2129 Table D, SO/RF	35.25 (895)	35.30 (897)	35.17 (893)	46.26 (1175)	39.00 (991)	21.86 (555)	41.34 (1050)	3.13 (80)	1396 (633)
36-in. (900 mm) AS 2129 Table E, SO/RF	35.25 (895)	35.30 (897)	35.17 (893)	46.26 (1175)	39.00 (991)	21.86 (555)	41.34 (1050)	3.13 (80)	1648 (747)
36-in. (900 mm) AS 4087 PN16, SO/RF	35.25 (895)	35.30 (897)	35.17 (893)	46.26 (1175)	39.00 (991)	21.86 (555)	41.34 (1050)	3.13 (80)	1574 (714)
36-in. (900 mm) AS 4087 PN21,SO/RF	35.25 (895)	35.30 (897)	35.17 (893)	46.26 (1175)	39.00 (991)	21.86 (555)	41.73 (1060)	3.13 (80)	2197 (997)
36-in. (900 mm) AS 4087 PN35, SO/RF	35.25 (895)	35.30 (897)	35.17 (893)	46.65 (1185)	39.00 (991)	21.86 (555)	40.55 (1030)	3.13 (80)	3133 (1421)
36-in. (900 mm) GB/T9119 PN10, SO/RF	35.25 (895)	35.30 (897)	35.17 (893)	43.9 (1115)	39.00 (991)	21.86 (555)	39.57 (1005)	3.13 (80)	1209 (549)
36-in. (900 mm) GB/T9119 PN16, SO/RF	35.25 (895)	35.30 (897)	35.17 (893)	44.29 (1125)	39.00 (991)	21.86 (555)	39.37 (1000)	3.13 (80)	1429 (649)
36-in. (900 mm) EN 1092-1 - PN10, SO/RF	35.25 (895)	35.30 (897)	35.17 (893)	43.90 (1120)	39.00 (991)	21.86 (555)	39.57 (1005)	3.13 (80)	1364 (619)
36-in. (900 mm) EN 1092-1 - PN16, SO/RF	35.25 (895)	35.30 (897)	35.17 (893)	44.29 (1125)	39.00 (991)	21.86 (555)	39.37 (1000)	3.13 (80)	1719 (780)
36-in. (900 mm) JIS B2220 - 10K, SO/RF	35.25 (895)	35.30 (897)	35.17 (893)	44.09 (1120)	39.00 (991)	21.86 (555)	39.57 (1005)	3.13 (80)	1194 (543)

Table 29. Rosemount 8750W Raised Face Flanged Sensor 40-in. and 48-in. (1000 mm and 1200 mm) Dimensions

Size, description	Length			FLANGE Ø DIM "B"	Body ∅ DIM "C"	DIM "D"	Liner ∅ on face DIM "J"	Lift ring height DIM "K"	Flow tube weight (lbs./kg)
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly						
40-in. (1000 mm) EN 1092-1 - PN10, SO/RF	N/A	39.40 (1001)	NA	48.43 (1230)	47.27 (1201)	25.86 (657)	43.70 (1110)	3.38 86)	1444 (655)
40-in. (1000 mm) EN 1092-1 - PN16, SO/RF	N/A	39.40 (1001)	NA	49.41 (1255)	47.27 (1201)	25.86 (657)	43.90 (1115)	3.38 86)	1559 (707)
40-in. (1000 mm) AS 2129 Table D, SO/RF	N/A	39.40 (1001)	NA	49.41 (1255)	47.27 (1201)	25.86 (657)	44.61 (1133)	3.38 86)	1494 (678)
40-in. (1000 mm) AS 2129 Table E, SO/RF	N/A	39.40 (1001)	NA	49.41 (1255)	47.27 (1201)	25.86 (657)	44.49 (1130)	3.38 86)	1806 (819)
40-in. (1000 mm) AS 4087 PN16, SO/RF	N/A	39.40 (1001)	NA	49.41 (1255)	47.27 (1201)	25.86 (657)	44.61 (1133)	3.38 86)	2175 (987)
40-in. (1000 mm) AS 4087 PN21, SO/RF	N/A	39.40 (1001)	NA	50.20 (1275)	47.27 (1201)	25.86 (657)	45.24 (149)	3.38 86)	2464 (1118)
40-in. (1000 mm) GB/T9119 PN10, SO/RF	N/A	39.40 (1001)	NA	48.43 (1230)	47.27 (1201)	25.86 (657)	43.70 (1110)	3.38 86)	1576 (715)
40-in. (1000 mm) GB/T9119 PN16, SO/RF	N/A	39.40 (1001)	NA	49.41 (1255)	47.27 (1201)	25.86 (657)	43.90 (1115)	3.38 86)	1735 (787)
48-in. (1200 mm) EN 1092-1 - PN10, SO/RF	N/A	47.20 (1199)	NA	57.28 (1455)	55.27 (1404)	29.86 (758)	52.36 (1330)	3.38 86)	1949 (884)
48-in. (1200 mm) AS 2129 Table D, SO/RF	N/A	47.20 (1199)	NA	58.66 (1490)	55.27 (1404)	29.86 (758)	53.86 (1368)	3.38 86)	2068 (938)
48-in. (1200 mm) AS 2129 Table E,SO/RF	N/A	47.20 (1199)	NA	58.66 (1490)	55.27 (1404)	29.86 (758)	53.74 (1365)	3.38 86)	2680 (1216)
48-in. (1200) AS 4087 PN16, SO/RF	N/A	47.20 (1199)	NA	58.66 (1490)	55.27 (1404)	29.86 (758)	53.86 (1368)	3.38 86)	2703 (1226)
48-in. (1200 mm) AS 4087 PN21,SO/RF	N/A	47.20 (1199)	NA	60.24 (1530)	55.27 (1404)	29.86 (758)	54.53 (1385)	3.38 86)	3152 (1430)
48-in. (1200 mm) GB/T9119 PN10, SO/RF	N/A	47.20 (1199)	NA	57.28 (1455)	55.27 (1404)	29.86 (758)	52.36 (1330)	3.38 86)	2081 (944)
48-in. (1200 mm) GB/T9119 PN16, SO/RF	N/A	47.20 (1199)	NA	58.46 (1485)	55.27 (1404)	29.86 (758)	52.36 (1330)	3.38 86)	2832 (1284)

Figure 15. Rosemount 8750W Flat Face Sensor 30- to 48-in. (750 mm to 1200 mm)

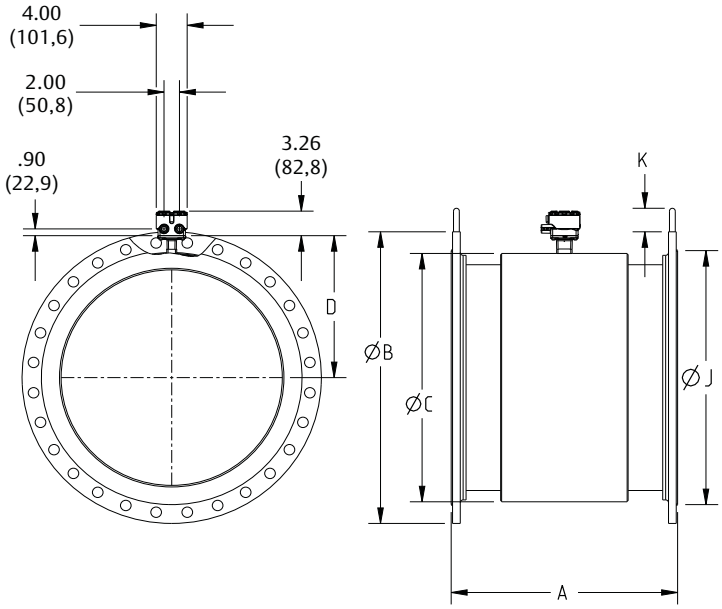
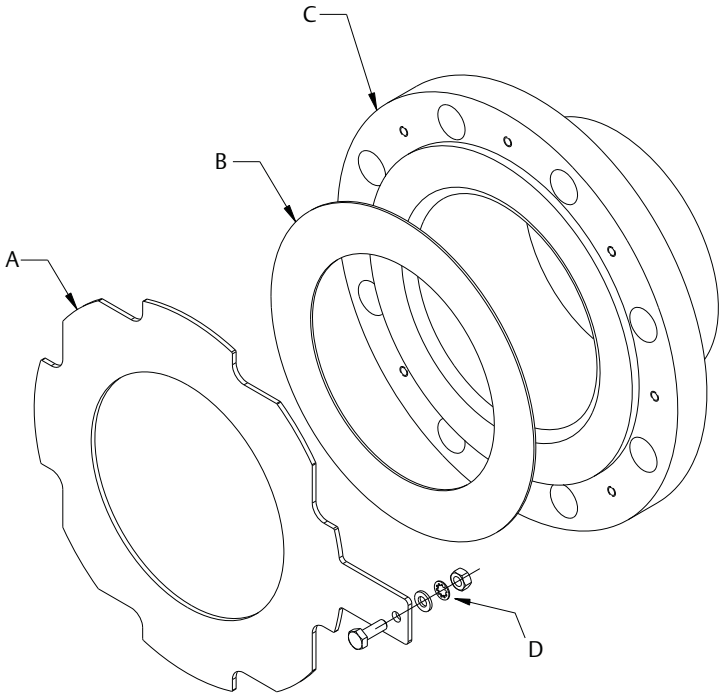


Table 30. Rosemount 8750W Flat Face Sensor 30- to 48-in. (750 mm to 1200 mm) Dimensions

Size, description	Length			FLANGE Ø DIM "B"	Body Ø DIM "C"	DIM "D"	Liner Ø on Face			Lift ring height DIM "K"	Flow tube weight (lbs./ kg
	DIM "A" PTFE	DIM "A" Neoprene	DIM "A" Poly				DIM "J" PTFE	DIM "J" Neoprene	DIM "J" Poly		
30-in. (750 mm) AWWA CLASS D, SO/FF	29.34 (745)	29.39 (747)	29.26 (743)	38.75 (984)	33.00 (838)	16.38 (416)	33.75 (857)	38.75 (984)	33.75 (857)	3.13 (80)	789 (358)
30-in. (750 mm) AWWA CLASS E, SO/FF	29.34 (745)	29.39 (747)	29.26 (743)	38.75 (984)	33.00 (838)	16.38 (416)	33.75 (857)	38.75 (984)	33.75 (857)	3.13 (80)	1205 (548)
30-in. (750 mm) AWWA CLASS F, SO/FF	29.34 (745)	29.39 (747)	29.26 (743)	43.00 (1092)	33.00 (838)	16.38 (416)	33.75 (857)	43.0 (1092)	33.75 (857)	3.13 (80)	1795 (816)
36-in. (900) AWWA C207 CLASS D, SO/FF	35.25 (825)	35.3 (897)	35.17 (893)	46.00 (1168)	39.00 (991)	21.86 (555)	40.25 (1022)	40.25 (1022)	40.25 (1022)	3.13 (80)	1148 (521)
36-in. (900 mm) AWWA C207 CLASS E, SO/FF	35.25 (825)	35.30 (897)	35.17 (893)	46.00 (1168)	39.00 (991)	21.86 (555)	40.25 (1022)	46.00 (1168)	40.25 (1022)	3.13 (80)	1911 (867)
36-in. (900 mm) AWWA C207CLASS F, SO/FF	35.25 (825)	35.30 (897)	35.17 (893)	50.00 (1270)	39.00 (991)	21.86 (555)	40.25 (1022)	50.00 (1270)	40.25 (1022)	3.13 (80)	2651 (1202)
40-in. (1000 mm) AWWA CLASS D, SO/FF	N/A	39.40 (1001)	N/A	50.75 (1289)	47.27 (1201)	25.86 (657)	N/A	50.75 (1289)	N/A	3.38 (86)	1435 (651)
40-in. (1000 mm) AWWA CLASS E, SO/FF	N/A	39.40 (1001)	N/A	50.75 (1289)	47.27 (1201)	25.86 (657)	N/A	50.75 (1289)	N/A	3.38 (86)	2464 (1118)
42-in. (1050 mm) AWWA CLASS D, SO/FF	N/A	42.00 (1067)	N/A	53.00 (1346)	49.27 (1251)	26.86 (682)	N/A	53.00 (1346)	N/A	3.38 (86)	1550 (703)
42-in. (1050 mm) AWWA CLASS E, SO/FF	N/A	42.00 (1067)	N/A	53.00 (1346)	49.27 (1251)	26.86 (682)	N/A	53.00 (1346)	N/A	3.38 (86)	2400 (1089)
48-in. (1200 mm) AWWA CLASS D, SO/FF	N/A	47.2 (1199)	N/A	59.50 (1511)	55.27 (1404)	29.86 (758)	N/A	59.50 (1511)	N/A	3.38 (86)	1892 (848)

Figure 16. Rosemount 8750W Flanged Sensor 1/2- to 48-in. (DN 15 mm to 1200 mm) Grounding Rings



A. Grounding ring
B. Customer supplied gasket
C. Flowtube
D. Grounding strap hardware

Table 31. Rosemount 8750W Flanged Sensor 1/2- to 48-in. (15 mm to 1200 mm) Grounding Ring Dimensions

Line size	Single grounding ring thickness		Double grounding ring thickness	
	MIN	MAX	MIN	MAX
0.5-in. (15 mm)	0.059 (1,5)	N/A	0.12 (3)	N/A
1-in. (25 mm)	0.059 (1,5)	N/A	0.12 (3)	N/A
1.5-in. (40 mm)	0.059 (1,5)	N/A	0.12 (3)	N/A
2-in. (50 mm)	0.059 (1,5)	N/A	0.12 (3)	N/A
2.5-in. (65 mm)	0.059 (1,5)	N/A	0.12 (3)	N/A
3-in. (80 mm)	0.059 (1,5)	N/A	0.12 (3)	N/A
4-in. (100 mm)	0.059 (1,5)	N/A	0.12 (3)	N/A
5-in. (125 mm)	0.059 (1,5)	0.12 (3)	0.12 (3)	0.24 (6,1)
6-in. (150 mm)	0.059 (1,5)	N/A	0.12 (3)	N/A
8-in. (200 mm)	0.059 (1,5)	N/A	0.12 (3)	N/A
10-in. (250 mm)	0.059 (1,5)	N/A	0.12 (3)	N/A
12-in. (300 mm)	0.059 (1,5)	0.12 (3)	0.12 (3)	0.24 (6,1)
14-in. (350 mm)	0.12 (3)	0.25 (6,4)	0.24 (6,1)	0.5 (12,7)
16-in. (400 mm)	0.12 (3)	0.25 (6,4)	0.24 (6,1)	0.5 (12,7)
18-in. (450 mm)	0.12 (3)	0.25 (6,4)	0.24 (6,1)	0.5 (12,7)
20-in. (500 mm)	0.12 (3)	0.25 (6,4)	0.24 (6,1)	0.5 (12,7)

Table 31. Rosemount 8750W Flanged Sensor 1/2- to 48-in. (15 mm to 1200 mm) Grounding Ring Dimensions

Line size	Single grounding ring thickness		Double grounding ring thickness	
24-in. (600 mm)	0.187 (4,7)	0.25 (6,4)	0.374 (9.5)	0.5 (12,7)
30-in. (750 mm)	0.187 (4,7)	0.25 (6,4)	0.374 (9.5)	0.5 (12,7)
36-in. (900 mm)	0.187 (4,7)	0.25 (6,4)	0.374 (9.5)	0.5 (12,7)
40-in. (1000 mm)	0.25 (6,4)	N/A	0.5 (12,7)	N/A
42-in. (1050 mm)	0.25 (6,4)	N/A	0.5 (12,7)	N/A
48-in. (1200 mm)	0.25 (6,4)	N/A	0.5 (12,7)	N/A

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Reference Manual
00809-0300-4750, Rev CA
March 2016

Rosemount™ 8750W Magnetic Flowmeter Platform

for Utility, Water, and Wastewater Applications

EMERSON™
Process Management

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Rosemount™ 8750W Magnetic Flowmeter Platform

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

⚠WARNING

Failure to follow these installation guidelines could result in death or serious injury.

- Installation and servicing instructions are for use by qualified personnel only. Do not perform any servicing other than that contained in the operating instructions, unless qualified.
- Verify the installation is done safely and is consistent with the operating environment.
- Ensure the device certification and installation techniques are suitable for the installation environment.
- Explosion hazard. Do not disconnect equipment when a flammable or combustible atmosphere is present.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing circuits.
- Do not connect a Rosemount 8750W Transmitter to a non-Rosemount sensor that is located in an explosive atmosphere.
- Follow national, local, and plant standards to properly earth ground the transmitter and sensor. The earth ground must be separate from the process reference ground.
- Rosemount Magnetic Flowmeters ordered with non-standard paint options or non-metallic labels may be subject to electrostatic discharge. To avoid electrostatic charge build-up, do not rub the flowmeter with a dry cloth or clean with solvents.

Explosions could result in death or serious injury.

- Verify the operating atmosphere of the sensor and transmitter is consistent with the appropriate hazardous locations certifications.
- Do not remove transmitter cover in explosive atmospheres when the circuit is alive.
- Before connecting a HART®-based communicator in an explosive atmosphere, make sure instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

Failure to follow safe installation and servicing guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.
- Do not perform any service other than those contained in this manual unless qualified.
- Process leaks could result in death or serious injury.

High voltage that may be present on leads could cause electrical shock.

- Avoid contact with leads and terminals.

⚠ CAUTION

The products described in this document are NOT designed for nuclear-qualified applications. Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on Rosemount nuclear-qualified products, contact your local Emerson™ Process Management Sales Representative.

Section 1 Introduction

1.1 System description

The Rosemount™ 8750W Magnetic Flowmeter System consists of a sensor and a transmitter. The sensor is installed in-line with the process piping; the transmitter can be remotely mounted or integrally mounted to the sensor.

Figure 1-1. Field Mount Transmitter

Integral **Remote**

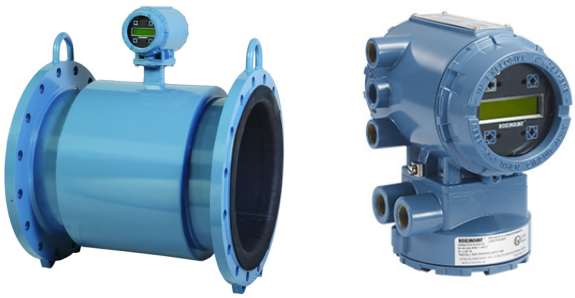
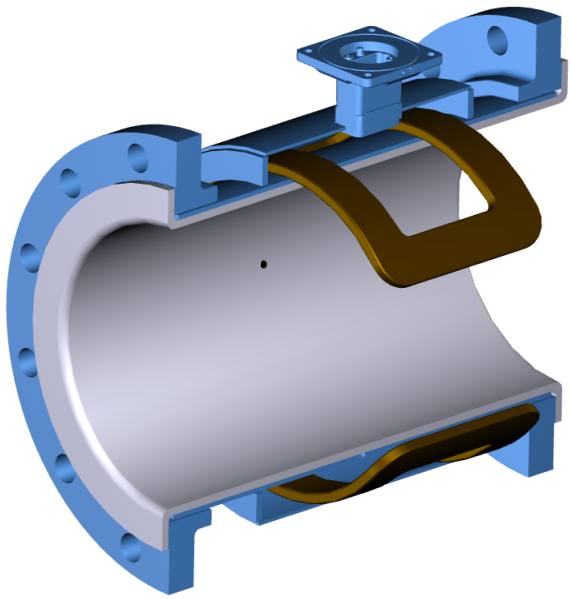


Figure 1-2. Wall Mount Transmitter

Remote

Figure 1-3. Flanged Sensor

Figure 1-4. Rosemount 8750W Cross Section



The flow sensor contains two magnetic coils located on opposite sides of the sensor. Two electrodes, located perpendicular to the coils and opposite each other, make contact with the liquid. The transmitter energizes the coils and creates a magnetic field. A conductive liquid moving through the magnetic field generates an induced voltage at the electrodes. This voltage is proportional to the flow velocity. The transmitter converts the voltage detected by the electrodes into a flow reading.

1.2 Product recycling/disposal

Recycling of equipment and packaging should be taken into consideration and disposed of in accordance with local and national legislation/regulations.

Section 2 Quick Installation and Start-Up

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Safety messages . . . . . page 3
Transmitter symbols . . . . . page 4
Pre-installation . . . . . page 5
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Handling and lifting . . . . . page 10
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Sensor location . . . . . page 12
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Process reference connection . . . . . page 17
Wiring the transmitter . . . . . page 19
Field mount transmitter cover jam screw . . . . . page 32
Basic configuration . . . . . page 32

2.1 Introduction

This section covers the steps required to physically install the magnetic flowmeter. Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Refer to the following safety messages before performing any operation in this section.

2.2 Safety messages

This section provides basic installation guidelines for the Rosemount™ 8750W Magnetic Flowmeter System. For comprehensive instructions for detailed configuration, diagnostics, maintenance, service, installation, or troubleshooting refer to the appropriate sections in this manual. The manual and quick start guide are also available electronically on EmersonProcess.com/Rosemount.

⚠WARNING

Failure to follow these installation guidelines could result in death or serious injury.

- Installation and servicing instructions are for use by qualified personnel only. Do not perform any servicing other than that contained in the operating instructions, unless qualified.
- Verify the installation is done safely and is consistent with the operating environment.
- Ensure the device certification and installation techniques are suitable for the installation environment.
- Explosion hazard. Do not disconnect equipment when a flammable or combustible atmosphere is present.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing circuits.
- Do not connect a Rosemount 8750W Transmitter to a non-Rosemount sensor that is located in an explosive atmosphere.
- Follow national, local, and plant standards to properly earth ground the transmitter and sensor. The earth ground must be separate from the process reference ground.
- Rosemount Magnetic Flowmeters ordered with non-standard paint options or non-metallic labels may be subject to electrostatic discharge. To avoid electrostatic charge build-up, do not rub the flowmeter with a dry cloth or clean with solvents.

NOTICE

- The sensor liner is vulnerable to handling damage. Never place anything through the sensor for the purpose of lifting or gaining leverage. Liner damage may render the sensor inoperable.
- Metallic or spiral-wound gaskets should not be used as they will damage the liner face of the sensor.
- Correct flange bolt tightening is crucial for proper sensor operation and life. All bolts must be tightened in the proper sequence to the specified torque specifications. Failure to observe these instructions could result in severe damage to the sensor lining and possible sensor replacement.
- In cases where high voltage/high current are present near the meter installation, ensure that proper protection methods are followed to prevent stray voltage / current from passing through the meter. Failure to adequately protect the meter could result in damage to the transmitter and lead to meter failure.
- Completely remove all electrical connections from both sensor and transmitter prior to welding on the pipe. For maximum protection of the sensor, consider removing it from the pipeline.

2.3 Transmitter symbols

Caution symbol — check product documentation for details ⚠

Protective conductor (grounding) terminal ⏚

2.4 Pre-installation

Before installing the Rosemount 8750W, there are several pre-installation steps that should be completed to make the installation process easier:

- Identify the options and configurations that apply to your application
- Set the hardware switches if necessary
- Consider mechanical, electrical, and environmental requirements

2.5 Installation procedures

2.5.1 Transmitter installation

Installation of the Rosemount Magnetic Flowmeter Transmitter includes both detailed mechanical and electrical installation procedures.

2.5.2 Identify options and configurations

The typical installation of the Rosemount 8750W Transmitter includes a device power connection, a 4–20 mA output connection, and sensor coil and electrode connections. Other applications may require one or more of the following configurations or options:

- Pulse Output
- Discrete Output
- Discrete Input
- HART® Multidrop Configuration

Hardware switches

The Rosemount 8750W electronics stack is equipped with user-selectable hardware switches. These switches set the Alarm mode, Internal/external analog power, Internal/external pulse power, and Transmitter security. The standard configuration for these switches when shipped from the factory are as follows:

Standard switch configuration	
Alarm Mode	High
Internal/External Analog Power	Internal
Internal/External Pulse Power(1)	External
Transmitter Security	Off

1. Only available with the Field Mount Transmitter.

In most cases, it will not be necessary to change the setting of the hardware switches. If the switch settings need to be changed, follow the steps outlined in the Rosemount 8750W Reference Manual (see "Changing hardware switch settings" on page 38).

Note
To prevent switch damage, use a non-metallic tool to move switch positions.

Be sure to identify any additional options and configurations that apply to the installation. Keep a list of these options for consideration during the installation and configuration procedures.

2.5.3 Mechanical considerations

The mounting site for the Rosemount 8750W should provide enough room for secure mounting, easy access to conduit entries, full opening of the transmitter covers, and easy readability of the LOI screen if equipped.

For remote mount transmitter installations, a mounting bracket is provided for use on a 2-in. pipe or a flat surface (see Figure 2-1 for field mount and Figure 2-3 for wall mount).

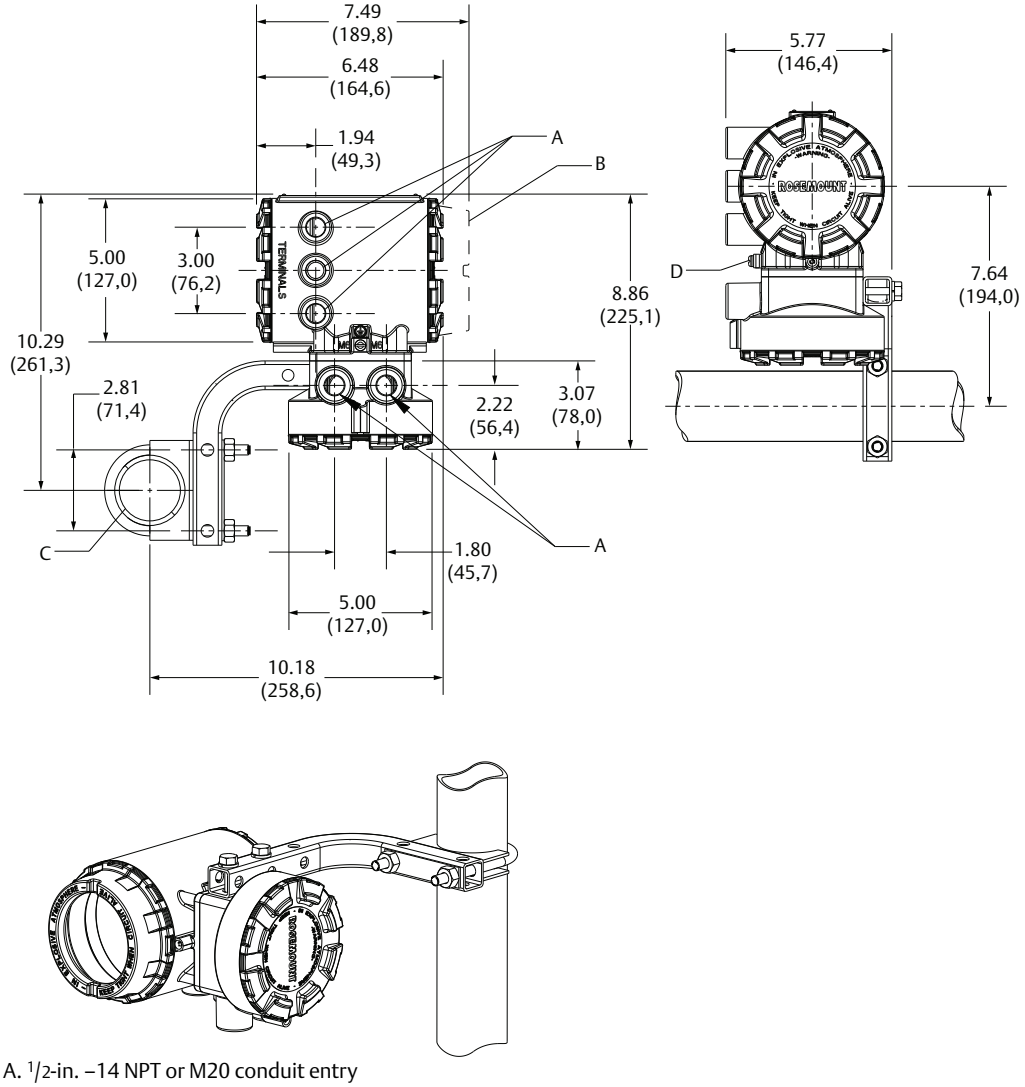
Note
If the transmitter is mounted separately from the sensor, it may not be subject to limitations that might apply to the sensor.

Rotate integral mount transmitter housing or remote junction box

The transmitter housing can be rotated on the sensor in 90° increments by removing the four mounting screws on the bottom of the housing. Sensor lead wires should be disconnected from the electronics before rotating the housing. Do not rotate the housing more than 180° in any one direction. Prior to tightening, be sure the mating surfaces are clean, the O-ring is seated in the groove, and there is no gap between the housing and the sensor.

Dimensional drawings

Figure 2-1. Rosemount 8750W Remote Field Mount Transmitter



A. 1/2-in. –14 NPT or M20 conduit entry
B. LOI cover
C. 2-in. pipe bracket
D. Ground lug
Dimensions are in inches (millimeters).

Figure 2-2. Rosemount 8750W Integral Field Mount Transmitter

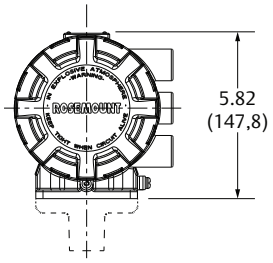
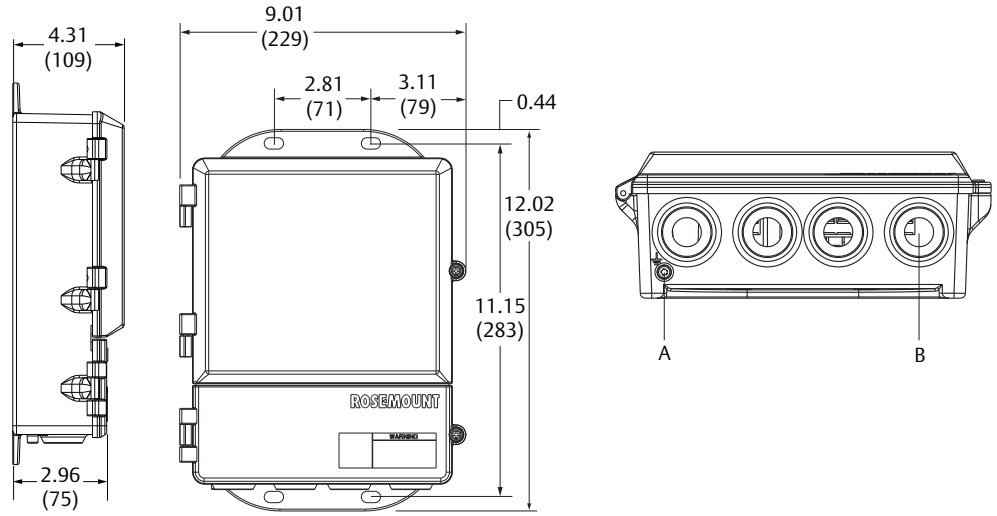
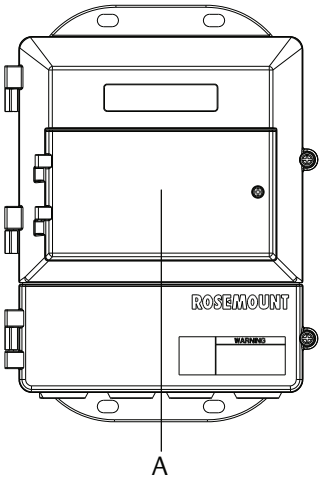


Figure 2-3. Rosemount 8750W Wall Mount Transmitter with Standard Cover



A. Ground lug
B. 1/2-in. –14 NPT conduit connection (4 places)
Dimensions in inches (millimeters).

Figure 2-4. Rosemount 8750W Wall Mount Transmitter with LOI Cover



A. LOI keypad cover

Note
Default conduit entries are 1/2-in. NPT. If an alternate thread connection is required, thread adapters must be used.

2.5.4 Electrical considerations

Before making any electrical connections to the Rosemount 8750W, consider national, local and plant electrical installation requirements. Be sure to have the proper power supply, conduit, and other accessories necessary to comply with these standards.

Both remotely and integrally mounted transmitters require external power so there must be access to a suitable power source.

Table 2-1. Electrical Data

Field mount transmitter	
Power input	90–250 VAC, 0.45 A, 40 VA 12 –42 VDC, 1.2 A, 15 W
Pulsed circuit	Internally powered (Active): Outputs up to 12 VDC, 12.1 mA, 73 mW Externally powered (Passive): Input up to 28 VDC, 100 mA, 1 W
4—20 mA output circuit	Internally Powered (Active): Outputs up to 25 mA, 24 VDC, 600 mW Externally Powered (Passive): Input up to 25 mA, 30 VDC, 750 mW
Coil excitation output	500 mA, 40 V max, 9 W max
Wall mount transmitter	
Power input	90–250 VAC, 0.28 A, 40 VA 12 – 42 VDC, 1 A, 15 W
Pulsed circuit	Externally powered (Passive): 5–24 VDC, up to 2 W
4—20mA output circuit	Internally Powered (Active): Outputs up to 25 mA, 30 VDC Externally Powered (Passive): Input up to 25 mA, 10–30 VDC
Coil excitation output	500 mA, 40 V max, 9 W max
Sensor[1]	
Coil excitation input	500 mA, 40 V max, 20 W max
Electrode circuit	5 V, 200 uA, 1 mW

1. Provided by the transmitter.

2.5.5 Environmental considerations

To ensure maximum transmitter life, avoid extreme temperatures and excessive vibration. Typical problem areas include the following:

- High-vibration lines with integrally mounted transmitters
- Tropical/desert installations in direct sunlight
- Outdoor installations in arctic climates

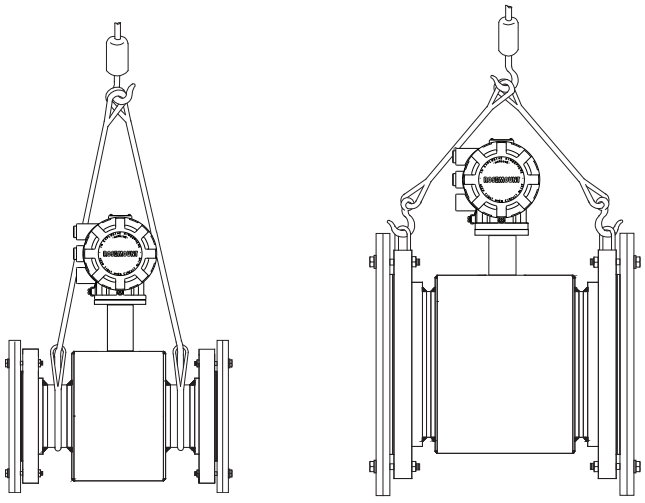
Remote mounted transmitters may be installed in the control room to protect the electronics from the harsh environment and to provide easy access for configuration or service.

2.6 Handling and lifting

- Handle all parts carefully to prevent damage. Whenever possible, transport the system to the installation site in the original shipping container.
- PTFE-lined sensors are shipped with end covers that protect it from both mechanical damage and normal unrestrained distortion. Remove the end covers just before installation.
- Keep the shipping plugs in the conduit connections until you are ready to connect and seal them.
- The sensor should be supported by the pipeline. Pipe supports are recommended on both the inlet and outlet sides of the sensor pipeline. There should be no additional support attached to the sensor.
- Additional safety recommendations for mechanical handling:
  - Use proper PPE (Personal Protection Equipment should include safety glasses and steel toed shoes).
  - Do not drop the device from any height.
- Do not lift the meter by holding the electronics housing or junction box.The sensor liner is vulnerable to handling damage. Never place anything through the sensor for the purpose of lifting or gaining leverage. Liner damage can render the sensor useless.
- If provided, use the lifting lugs on each flange to handle the Magnetic Flowmeter when it is transported and lowered into place at the installation site. If lifting lugs are not provided, the Magnetic Flowmeter must be supported with a lifting sling on each side of the housing.
  - Flanged sensors 3-in. through 48-in. come with lifting lugs.

Figure 2-5. Support for Handling and Lifting

Without lifting lugs **With lifting lugs**

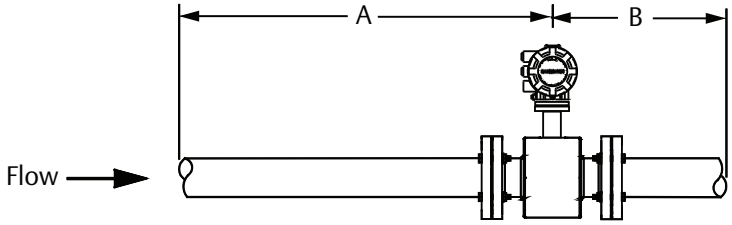


2.7 Mounting

2.7.1 Upstream/downstream piping

To ensure specified accuracy over widely varying process conditions, install the sensor with a minimum of five straight pipe diameters upstream and two pipe diameters downstream from the electrode plane (see Figure 2-6).

Figure 2-6. Upstream and Downstream Straight Pipe Diameters



A. five pipe diameters
B. two pipe diameters

Installations with reduced upstream and downstream straight runs are possible. In reduced straight run installations, the meter may not meet absolute accuracy specifications. Reported flow rates will still be highly repeatable.

2.7.2 Flow direction

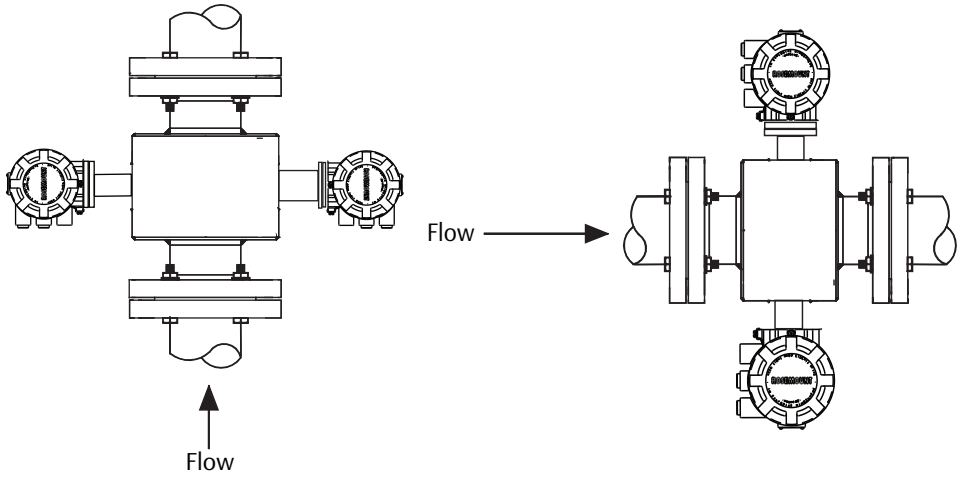
The sensor should be mounted so that the arrow points in the direction of flow. See Figure 2-7.

Figure 2-7. Flow Direction Arrow

2.8 Sensor location

The sensor should be installed in a location that ensures it remains full during operation. Vertical installation with upward process fluid flow keeps the cross-sectional area full, regardless of flow rate. Horizontal installation should be restricted to low piping sections that are normally full.

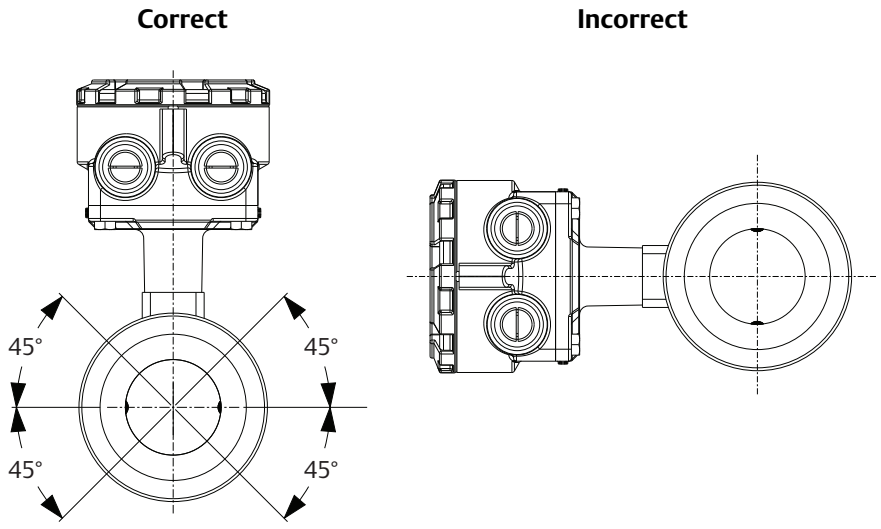
Figure 2-8. Sensor Orientation



2.8.1 Electrode orientation

The electrodes in the sensor are properly oriented when the two measurement electrodes are in the 3 and 9 o'clock positions or within 45° from the horizontal, as shown on the left in Figure 2-9. Avoid any mounting orientation that positions the top of the sensor at 90° from the vertical position as shown on the right in Figure 2-9.

Figure 2-9. Mounting Position



2.9 Sensor installation

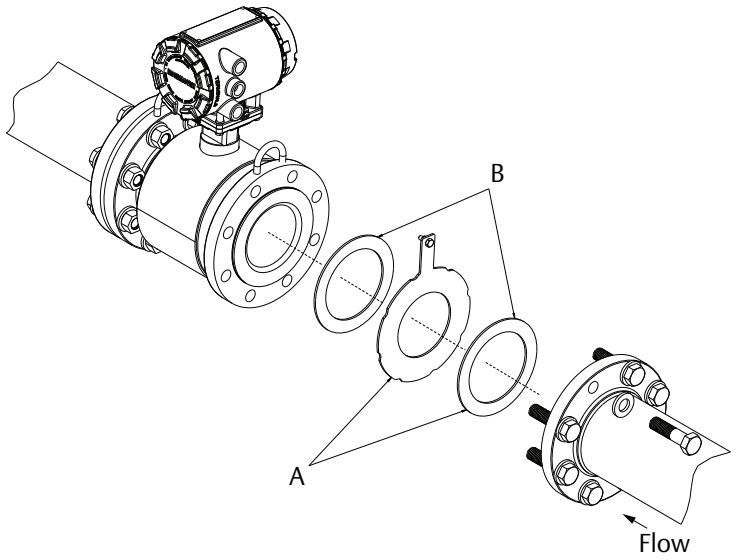
2.9.1 Flanged sensors

Gaskets

The sensor requires a gasket at each process connection. The gasket material must be compatible with the process fluid and operating conditions. Gaskets are required on each side of a grounding ring (see Figure 2-10). All other applications (including sensors with lining protectors or a grounding electrode) require only one gasket on each process connection.

Note
Metallic or spiral-wound gaskets should not be used as they will damage the liner face of the sensor.

Figure 2-10. Flanged Gasket Placement



A. Grounding ring and gasket (optional)
B. Customer-supplied gasket

2.9.2 Flange bolts

Note
Do not bolt one side at a time. Tighten both sides simultaneously. Example:

1. Snug upstream
2. Snug downstream
3. Tighten upstream
4. Tighten downstream

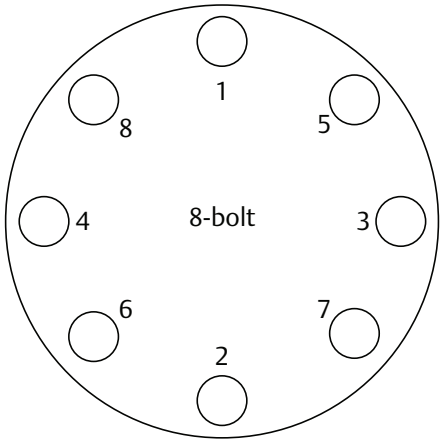
Do not snug and tighten the upstream side and then snug and tighten the downstream side. Failure to alternate between the upstream and downstream flanges when tightening bolts may result in liner damage.

Suggested torque values by sensor line size and liner type are listed in Table 2-3 for ASME B16.5 flanges and Table 2-4 for EN flanges. Consult the factory if the flange rating of the sensor is not listed. Tighten flange bolts on the upstream side of the sensor in the incremental sequence shown in Figure 2-11 to 20 percentof the suggested torque values. Repeat the process on the downstream side of the sensor. For sensors with more or less flange bolts, tighten the bolts in a similar crosswise sequence. Repeat this entire tightening sequence at 40, 60, 80, and 100% of the suggested torque values.

If leakage occurs at the suggested torque values, the bolts can be tightened in additional 10% increments until the joint stops leaking, or until the measured torque value reaches the maximum torque value of the bolts. Practical consideration for the integrity of the liner often leads the user to distinct torque values to stop leakage due to the unique combinations of flanges, bolts, gaskets, and sensor liner material.

Check for leaks at the flanges after tightening the bolts. Failure to use the correct tightening methods can result in severe damage. While under pressure, sensor materials may deform over time and require a second tightening 24 hours after the initial installation.

Figure 2-11. Flange Bolt Torquing Sequence



Prior to installation, identify the lining material of the flow sensor to ensure the suggested torque values are applied.

Table 2-2. Lining Material

Fluoropolymer liners	Other liners
T - PTFE	P - Polyurethane N - Neoprene

Table 2-3. Flange Bolt Torque and Load Specifications (ASME)

Size code	Line size	Fluoropolymer liners		Resilient liners	
		Class 150 (pound-feet)	Class 300 (pound-feet)	Class 150 (pound-feet)	Class 300 (pound-feet)
005	0.5-in. (15 mm)	8	8	N/A	N/A
010	1-in. (25 mm)	8	12	N/A	N/A
015	1.5-in. (40 mm)	13	25	7	18
020	2-in. (50 mm)	19	17	14	11
025	2.5-in. (65 mm)	22	24	17	16
030	3-in. (80 mm)	34	35	23	23
040	4-in. (100 mm)	26	50	17	32
050	5-in. (125 mm)	36	60	25	35
060	6-in. (150 mm)	45	50	30	37
080	8-in. (200 mm)	60	82	42	55
100	10-in. (250 mm)	55	80	40	70
120	12-in. (300 mm)	65	125	55	105
140	14-in. (350 mm)	85	110	70	95
160	16-in. (400 mm)	85	160	65	140
180	18-in. (450 mm)	120	170	95	150
200	20-in. (500 mm)	110	175	90	150
240	24-in. (600 mm)	165	280	140	250

Table 2-4. Flange Bolt Torque and Load Specifications (EN 1092-1)

Size code	Line size	Fluoropolymer liners			
		PN10 (Newton-meter)	PN 16 V (Newton-meter)	PN 25 (Newton-meter)	PN 40 (Newton-meter)
005	0.5-in. (15 mm)	N/A	N/A	N/A	10
010	1-in. (25 mm)	N/A	N/A	N/A	20
015	1.5-in. (40 mm)	N/A	N/A	N/A	50
020	2-in. (50 mm)	N/A	N/A	N/A	60
025	2.5-in. (65 mm)	N/A	N/A	N/A	50
030	3-in. (80 mm)	N/A	N/A	N/A	50
040	4-in. (100 mm)	N/A	50	N/A	70
050	5-in. (125 mm)	N/A	70	N/A	100
060	6-in. (150mm)	N/A	90	N/A	130
080	8-in. (200 mm)	130	90	130	170

Table 2-4. Flange Bolt Torque and Load Specifications (EN 1092-1)

Size code	Line size	Fluoropolymer liners			
		PN10 (Newton-meter)	PN 16 V (Newton-meter)	PN 25 (Newton-meter)	PN 40 (Newton-meter)
100	10-in. (250 mm)	100	130	190	250
120	12-in. (300 mm)	120	170	190	270
140	14-in. (350 mm)	160	220	320	410
160	16-in. (400 mm)	220	280	410	610
180	18-in. (450 mm)	190	340	330	420
200	20-in. (500 mm)	230	380	440	520
240	24-in. (600 mm)	290	570	590	850
010	1-in. (25 mm)	N/A	N/A	N/A	20
015	1.5-in. (40 mm)	N/A	N/A	N/A	30
020	2-in. (50 mm)	N/A	N/A	N/A	40
025	2.5-in. (65 mm)	N/A	N/A	N/A	35
030	3-in. (80 mm)	N/A	N/A	N/A	30
040	4-in. (100 mm)	N/A	40	N/A	50
050	5-in. (125 mm)	N/A	50	N/A	70
060	6-in. (150 mm)	N/A	60	N/A	90
080	8-in. (200 mm)	90	60	90	110
100	10-in. (250 mm)	70	80	130	170
120	12-in. (300 mm)	80	110	130	180
140	14-in. (350 mm)	110	150	210	280
160	16-in. (400 mm)	150	190	280	410
180	18-in. (450 mm)	130	230	220	280
200	20-in. (500 mm)	150	260	300	350
240	24-in. (600 mm)	200	380	390	560

Table 2-5. Flange Bolt Torque and Load Specifications Larger Line Sizes (AWWA C207)

Size code	Line size	Fluoropolymer liners		
		Class D (pound-feet)	Class E (pound-feet)	Class F (pound-feet)
300	30-in. (750 mm)	195	195	195
360	36-in. (900 mm)	280	280	280
		Resilient liners		
300	30-in. (750 mm)	165	165	165
360	36-in. (900 mm)	245	245	245
400	40-in. (1000 mm)	757	757	N/A
420	42-in. (1050 mm)	839	839	N/A
480	48-in. (1200 mm)	872	872	N/A

Table 2-6. Flange Bolt Torque and Load Specifications Larger Line Sizes (EN 1092-1)

Size code	Line size	Fluoropolymer liners		
		PN6 (Newton-meter)	PN10 (Newton-meter)	PN16 (Newton-meter)
360	36-in. (900 mm)	N/A	264	264
		Resilient liners		
360	36-in. (900 mm)	N/A	264	264
400	40-in. (1000 mm)	208	413	478
480	48-in. (1200 mm)	375	622	N/A

2.10 Process reference connection

Figure 2-13 through Figure 2-16 illustrate process reference connections only. Earth safety ground is also required as part of the installation but is not shown in the figures. Follow national, local, and plant electrical codes for safety ground.

Use Table 2-7 to determine which process reference option to follow for proper installation.

Table 2-7. Process Reference Installation

Process reference options				
Type of pipe	**Grounding straps**	**Grounding rings**	**Reference electrode**	**Lining protectors**
Conductive unlined pipe	See Figure 2-12	See Figure 2-13(1)	See Figure 2-15(1)	See Figure 2-15(1)
Conductive lined pipe	Insufficient grounding	See Figure 2-13	See Figure 2-12	See Figure 2-15
Non-conductive pipe	Insufficient grounding	See Figure 2-14	Not recommended	See Figure 2-15

1. Grounding ring, reference electrode, and lining protectors are not required for process reference. Grounding straps per Figure 2-12 are sufficient.

Note

For line sizes 10-in. and larger, the ground strap may come attached to the sensor body near the flange. See Figure 2-16.

Figure 2-12. Grounding Straps in Conductive Unlined Pipe or Reference Electrode in Lined Pipe

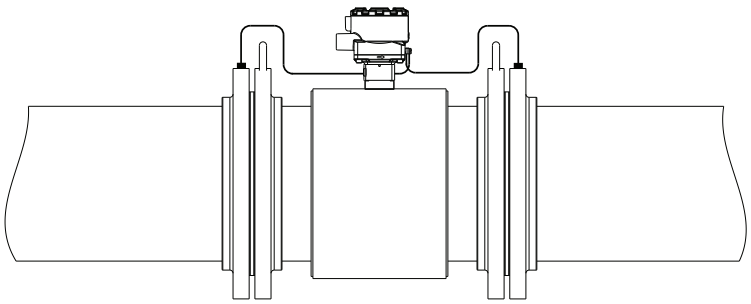
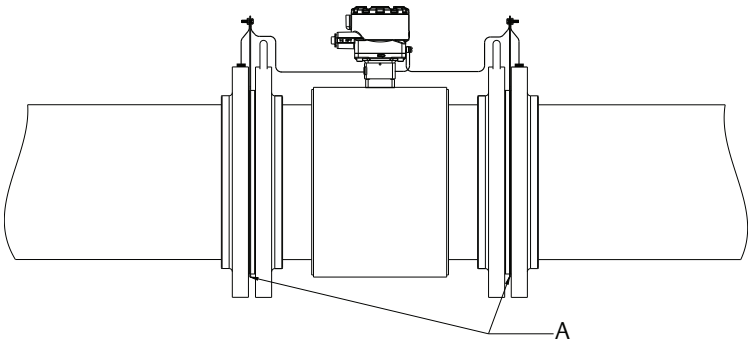
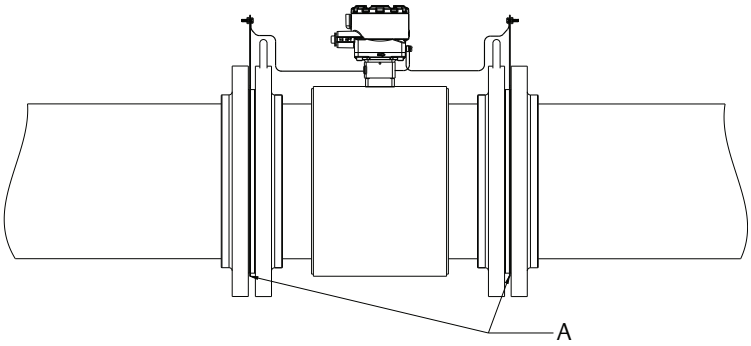


Figure 2-13. Grounding with Grounding Rings in Conductive Pipe



A. Grounding rings

Figure 2-14. Grounding with Grounding Rings in Non-Conductive Pipe



A. Grounding rings

Figure 2-15. Grounding with Reference Electrode in Conductive Unlined Pipe

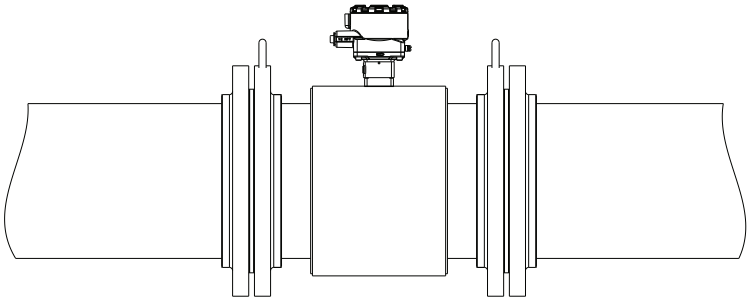
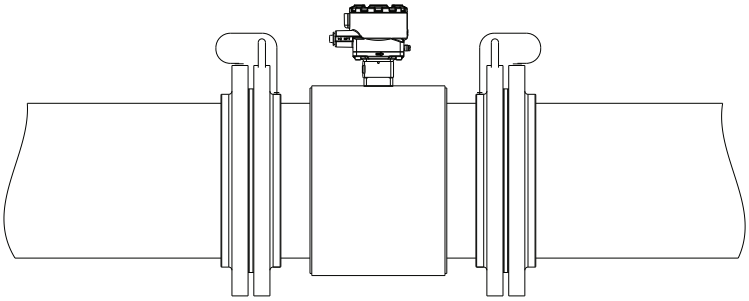


Figure 2-16. Grounding for Line Sizes 10-in. and Larger



2.11 Wiring the transmitter

This wiring section covers the wiring between the transmitter and sensor, the 4—20 mA output, and supplying power to the transmitter. Follow the conduit information, cable requirements, and disconnect requirements in the sections below.

For sensor wiring diagrams, see Electrical Drawing 8750W-1504 in Appendix C: Wiring Diagrams.

For information on connecting to another manufacturer's sensor, refer to Appendix D: Implementing a Universal Transmitter.

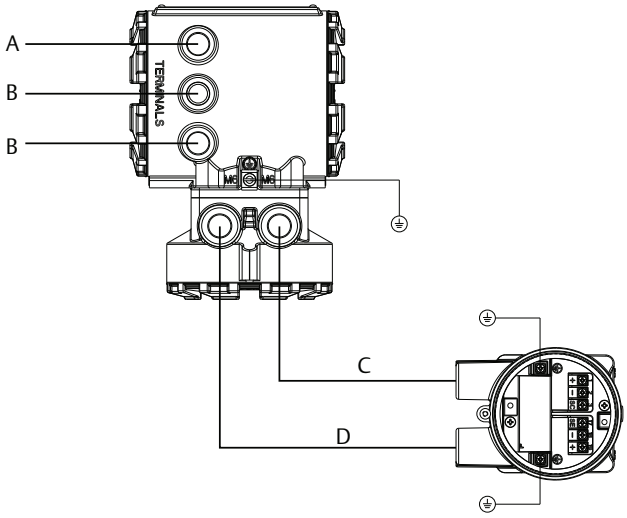
2.11.1 Conduit entries and connections

The standard conduit entries for the transmitter and sensor are 1/2-in. NPT. Thread adapters are provided for units ordered with M20 conduit entries. Conduit connections should be made in accordance with national, local, and plant electrical codes. Unused conduit entries should be sealed with the appropriate certified plugs. The flow sensor is rated IP68. For sensor installations requiring IP68 protection, the cable grands, conduit, and conduit plugs must be rated for IP68. The plastic shipping plugs do not provide ingress protection.

2.11.2 Conduit requirements

- For installations with an intrinsically safe electrode circuit, a separate conduit for the coil cable and the electrode cable may be required. See drawing 08732-2062.
- Electrode cables should not be run together and should not be in the same cable tray with power cables.
- Output cables should not be run together with power cables.
- Select conduit size appropriate to feed cables through to the flowmeter.

Figure 2-17. Best Practice Conduit Preparation



A. Power
B. Output
C. Coil
D. Electrode

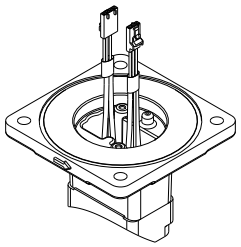
2.11.3 Connecting sensor to transmitter

Integral mount transmitters

Integral mount transmitters ordered with a sensor will be shipped assembled and wired at the factory using an interconnecting cable. (See Figure 2-18). Use only the interconnecting cable provided by Emerson Process Management.

For replacement transmitters use the existing interconnecting cable from the original assembly. Replacement cables are available.

Figure 2-18. Interconnecting Cables



Remote mount transmitters

Cables kits are available as individual component cables or as a combination coil/electrode cable. Remote cables can be ordered direct from Emerson Process Management using the kit numbers shown in Table 2-8 and Table 2-9. Equivalent Alpha cable part numbers are also provided as an alternative. To order cable, specify length as quantity desired. Equal length of component cables is required.

Example: 25 feet = Qty (25) 08732-0065-0001

Table 2-8. Component Cable Kits

Standard temperature (-20 °C to 75 °C)			
Cable kit number	**Description**	**Individual cable**	**Alpha p/n**
08732-0065-0001 (feet)	Kit, Component cables, Std temp. (includes Coil + Electrode)	Coil Electrode	518243 518245
08732-0065-0002 (meters)	Kit, Component cables, Std temp. (includes Coil + Electrode)	Coil Electrode	518243 518245
08732-0065-0003 (feet)	Kit, Component cables, Std temp. (includes Coil + I.S. Electrode)	Coil Intrinsically Safe Blue Electrode	518243 518245
08732-0065-0004 (meters)	Kit, Component cables, Std temp. (includes Coil + I.S. Electrode)	Coil Intrinsically Safe Blue Electrode	518243 518245
Extended temperature (-50 °C to 125 °C)			
Cable kit number	**Description**	**Individual cable**	**Alpha p/n**
08732-0065-1001 (feet)	Kit, Component cables, Ext temp. (includes Coil + Electrode)	Coil Electrode	840310 518189
08732-0065-1002 (meters)	Kit, Component cables, Ext temp. (includes Coil + Electrode)	Coil Electrode	840310 518189
08732-0065-1003 (feet)	Kit, Component cables, Ext temp. (includes Coil + I. S. Electrode)	Coil Intrinsically Safe Blue Electrode	840310 518189
08732-0065-1004 (meters)	Kit, Component cables, Ext temp. (includes Coil + I. S. Electrode)	Coil Intrinsically Safe Blue Electrode	840310 518189

Table 2-9. Combination Cable Kits

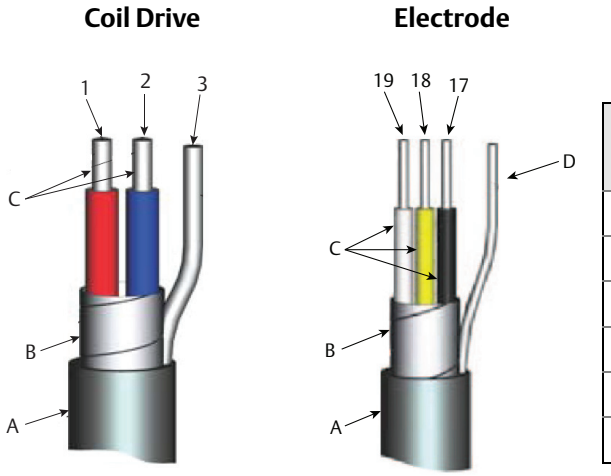
Coil/Electrode cable (-20 °C to 80 °C)	
Cable kit number	**Description**
08732-0065-2001 (feet)	Kit, Combination cable, Standard
08732-0065-2002 (meters)	
08732-0065-3001 (feet)	Kit, Combination cable, Submersible (80 °C dry/60 °C Wet)(33 ft. continuous)
08732-0065-3002 (meters)	

Cable requirements

Shielded twisted pairs or triads must be used. For installations using the individual coil drive and electrode cable, see Figure 2-19. Cable lengths should be limited to less than 500 ft. (152 m). Consult factory for length between 500 to 1000 ft. (152 to 304 m). Equal length cable is required for each.

For installations using the combination coil drive/electrode cable, see Figure 2-20. Combination cable lengths should be limited to less than 330 feet (100 m).

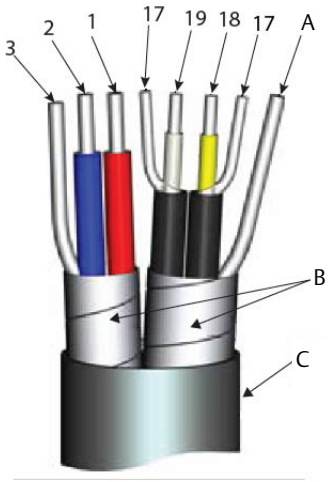
Figure 2-19. Individual Component Cables



Cable number	Color
1	Red
2	Blue
3	Drain
17	Black
18	Yellow
19	White

A. Outer jacket
B. Overlapping foil shield
C. Twisted stranded insulated conductors

Figure 2-20. Combination Coil/Electrode Cable



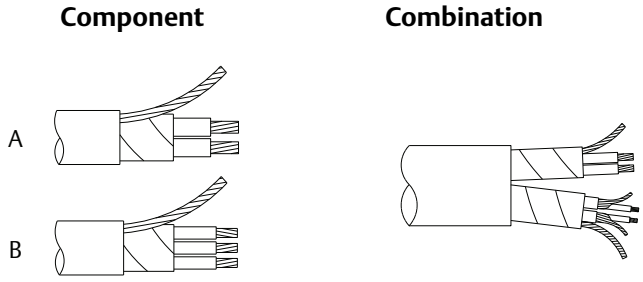
Cable number	Color
1	Red
2	Blue
3	Drain
17	Reference
18	Yellow
19	White

A. Electrode shield-drain
B. Overlapping foil shield
C. Outer jacket

Cable preparation

When preparing all wire connections, remove only the insulation required to fit the wire completely under the terminal connection. Prepare the ends of the coil drive and electrode cables as shown in Figure 2-21. Limit the unshielded wire length to less than one inch on both the coil drive and electrode cables. Any length of unsheathed conductor should be insulated. Excessive removal of insulation may result in an unwanted electrical short to the transmitter housing or other wire connections. Excessive unshielded lead length, or failure to connect cable shields properly, may expose the unit to electrical noise, resulting in an unstable meter reading.

Figure 2-21. Cable Ends



A. Coil
B. Electrode

⚠ WARNING

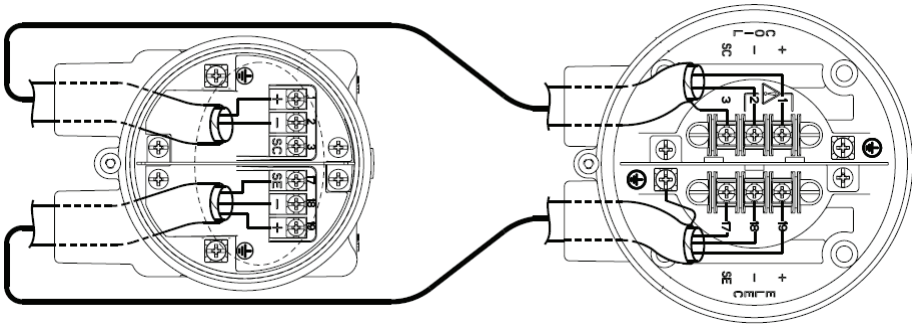
Shock Hazard

Potential shock hazard across remote junction box terminals 1 and 2 (40V).

Explosion Hazard

Electrodes exposed to process. Use only compatible transmitter and approved installation practices.

Figure 2-22. Remote Junction Box Views



A

A. Sensor

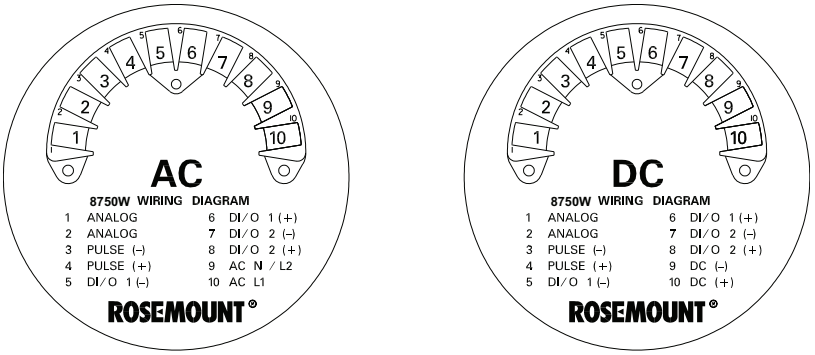
For complete sensor wiring diagrams, reference installation drawings in Appendix C: Wiring Diagrams.

2.11.4 Transmitter terminal block connections

Field mount transmitter

Remove the back cover of the transmitter to access the terminal block. See Figure 2-23 for terminal identification. To connect pulse output and/or discrete input/output consult the comprehensive product manual. Installations with intrinsically safe outputs should reference the hazardous location installation drawings in Appendix B: Product Certifications.

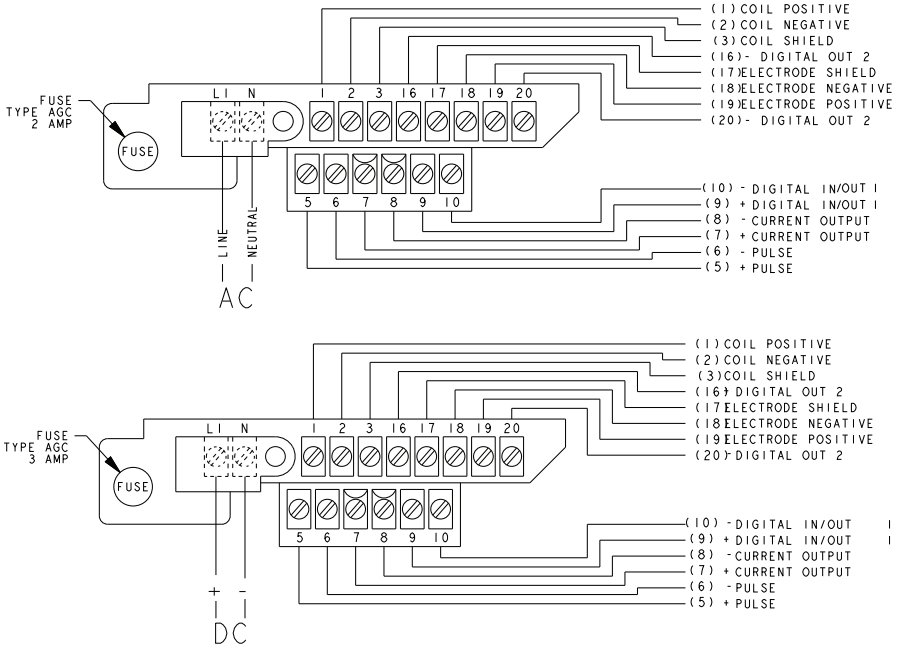
Figure 2-23. Field Mount Transmitter Terminal Block Connections



Wall mount transmitter

Open the lower cover of the transmitter to access the terminal block. See Figure 2-24 for terminal identification or inside the cover for wiring terminal identification. To connect the pulse output and or discrete input/output, see "Connect pulse output" on page 40 or "DI/O 1 control" on page 95.

Figure 2-24. Wall Mount Transmitter Terminal Block Connections



2.11.5 Analog output

Field mount transmitter

The analog output signal is a 4—20 mA current loop. The loop can be powered internally or externally via a hardware switch located on the front of the electronics stack. The switch is set to internal power when shipped from the factory. For units with a display, the LOI must be removed to change switch position.

For HART communication a minimum loop resistance of 250 ohms is required. It is recommended to use individually shielded twisted pair cable. The minimum conductor size is 0.51 mm diameter (number 24 AWG) for cable runs less than 5,000 ft. (1,500 m) and 0.81 mm diameter (number 20 AWG) for longer distances.

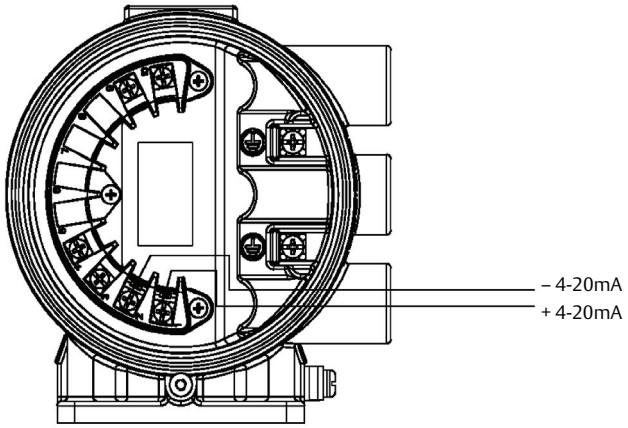
Internal power

The 4—20 mA analog signal is a 24 VDC active output.

Maximum allowable loop resistance is 500 ohms.

Wire terminal 1 (+) and terminal 2 (-). See Figure 2-25.

Figure 2-25. Field Mount Transmitter Analog Wiring - Internal Power



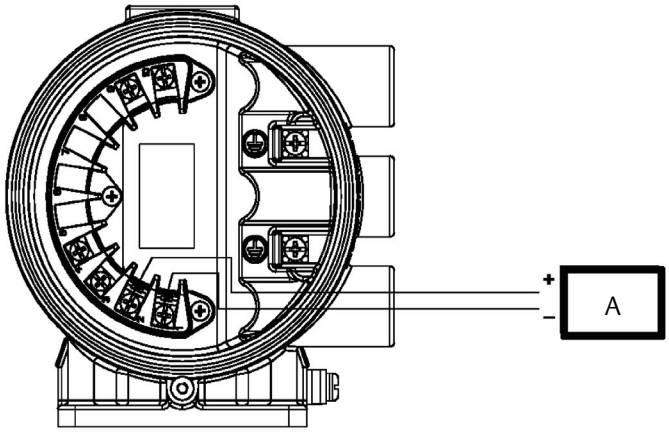
Note
Terminal polarity for the analog output is reversed between internally and externally powered.

External power

The 4—20mA analog signal is passive and must be powered from an external power source. Power at the transmitter terminals must be 10.8 — 30 VDC.

Wire terminal 1 (-) and terminal 2 (+). See Figure 2-26.

Figure 2-26. Field Mount Transmitter Analog Wiring - External Power

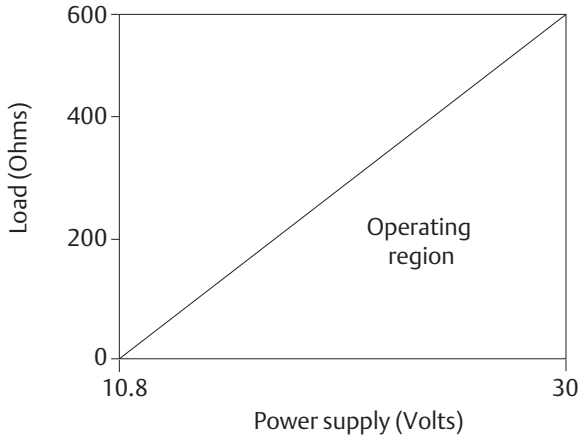


A. Power supply

Analog loop load limitations

Maximum loop resistance is determined by the voltage level of the external power supply, as described in Figure 2-27.

Figure 2-27. Field Mount Transmitter Analog Loop Load Limitations



$R_{max} = 31.25 (V_{ps} — 10.8)$
V_{ps} = Power supply voltage (Volts)
R_{max} = Maximum loop resistance (Ohms)

Wall mount transmitter

The analog output signal is a 4—20mA current loop. The loop can be powered internally or externally via a hardware switch. The switch is set to internal power when shipped from the factory.

For HART Communication a minimum resistance of 250 ohms is required. It is recommended to use individually shielded twisted pair cable. The minimum conductor size is 0.51 mm diameter (number 24 AWG) for cable runs less than 5,000 ft. (1,500 m) and 0.81 mm diameter (number 20 AWG) for longer distances.

Internal power

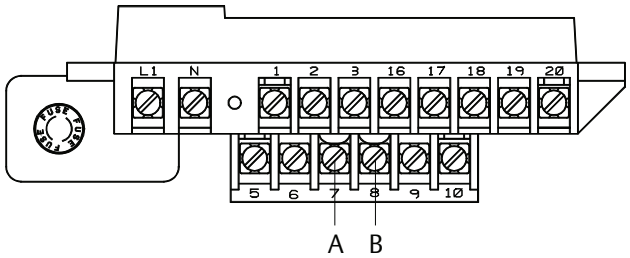
The 4—20mA analog signal is a 24 VDC active output.

Maximum allowable loop resistance is 500 ohms.

External power

The 4—20 mA analog signal is powered from an external power source. HART multidrop installations require a 10—30 VDC external analog power source.

Figure 2-28. Wall Mount Transmitter Analog Wiring

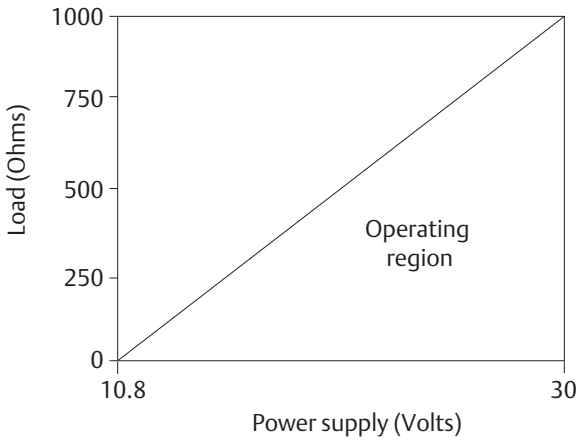


A. +4–20 mA
B. -4–20 mA

Analog loop load limitations

Maximum loop resistance is determined by the voltage level of the external power supply, as described in Figure 2-29.

Figure 2-29. Wall Mount Transmitter Analog Loop Load Limitations

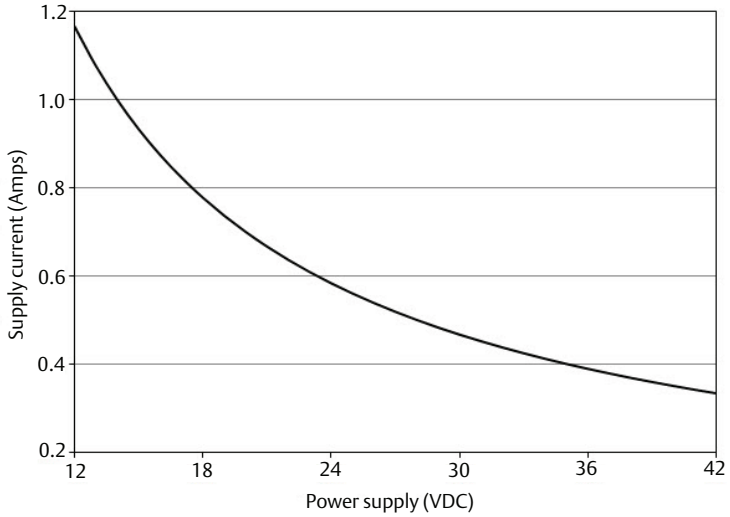


$R_{max} = 52.08 (V_{ps} – 10.8)$
V_{ps} = Power supply voltage (Volts)
R_{max} = Maximum loop resistance (Ohms)

2.11.6 Powering the transmitter

The transmitter is available in two models. The AC powered transmitter is designed to be powered by 90—250 VAC (50/60 Hz). The DC powered transmitter is designed to be powered by 12—42 VDC. Before connecting power to the transmitter, be sure to have the proper power supply, conduit, and other accessories. Wire the transmitter according to national, local, and plant electrical requirements for the supply voltage. See Figure 2-30 through Figure 2-33.

Figure 2-30. Field Mount Transmitter DC Power Requirements



Peak inrush is 42 A at 42 VDC supply, lasting approximately 1 ms
Inrush for other supply voltages can be estimated with:
Inrush (Amps) = Supply (Volts)/1.0

Figure 2-31. Wall Mount Transmitter DC Power Requirements

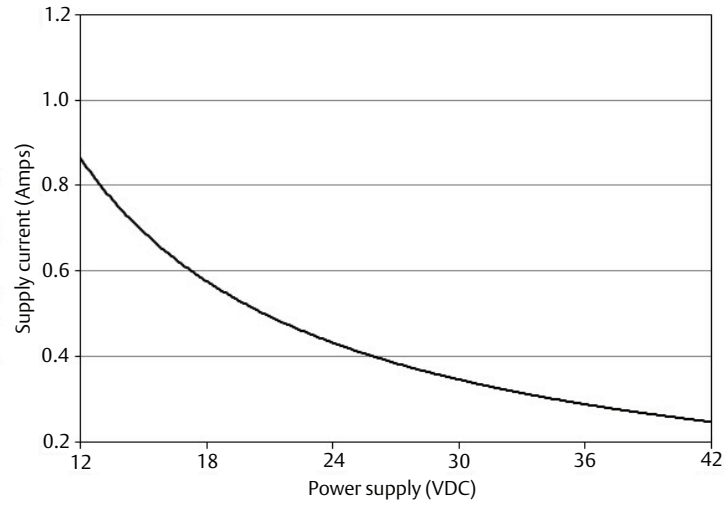
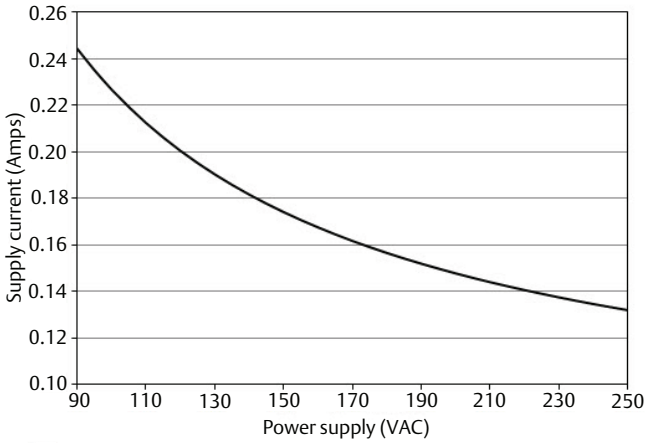
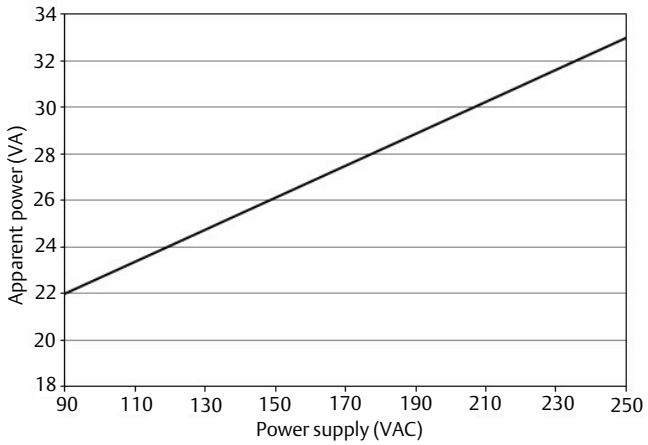


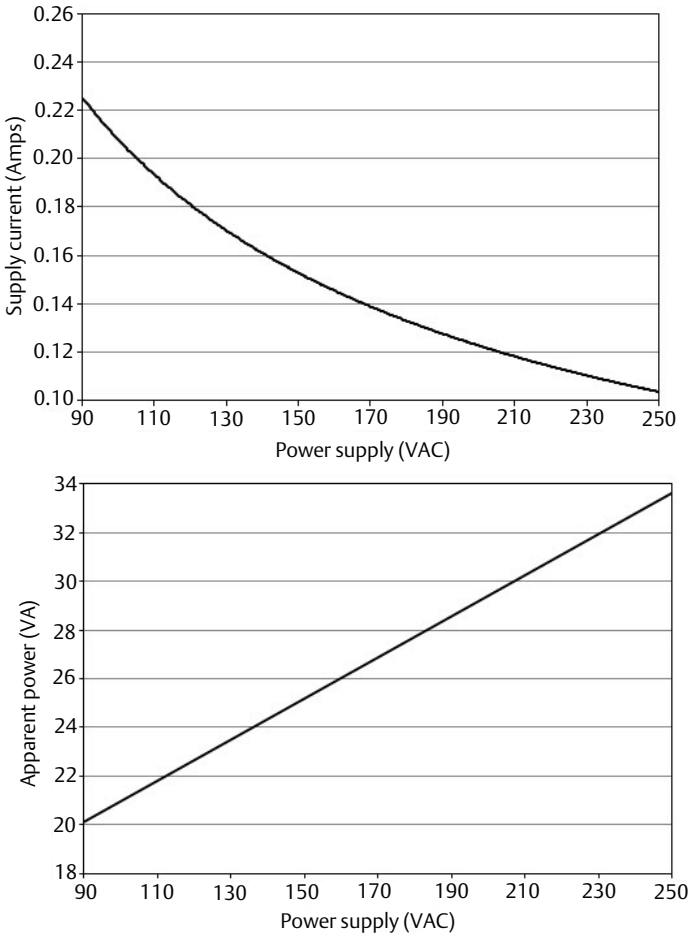
Figure 2-32. Field Mount Transmitter AC Power Requirements





Peak inrush is 35.7 A at 250 VAC supply, lasting approximately 1ms
Inrush for other supply voltages can be estimated with:
Inrush (Amps) = Supply (Volts)/7.0

Figure 2-33. Wall Mount Transmitter AC Power Requirements



Supply wire requirements

Use 10—18 AWG wire rated for the proper temperature of the application. For wire 10—14 AWG, use lugs or other appropriate connectors. For connections in ambient temperatures above 122 °F (50 °C), use a wire rated for 194 °F (90 °C). For DC powered transmitters with extended cable lengths, verify that there is a minimum of 12 VDC at the terminals of the transmitter with the device under load.

Disconnects

Connect the device through an external disconnect or circuit breaker per national and local electrical code.

Installation category

The installation category for the Rosemount 8750W is OVERVOLTAGE CAT II.

Overcurrent protection

The Rosemount 8750W Transmitter requires overcurrent protection of the supply lines. Fuse rating and compatible fuses are shown in Table 2-10 and Table 2-11.

Table 2-10. Field Mount Transmitter Fuse Requirements

Input voltage	Fuse rating	Compatible fuse
90—250 VAC rms	1 Amp, 250V, $I^2t \geq 1.5\ A^2s$ Rating, Fast Acting	Bussman AGC-1, Littelfuse 31201.5HXP
12—42 VDC	3 Amp, 250V, $I^2t \geq 14\ A^2s$ Rating, Fast Acting	Bel Fuse 3AG 3-R, Littelfuse 312003P, Schurter 0034.5135

Table 2-11. Wall Mount Transmitter Fuse Requirements

Input voltage	Fuse rating	Compatible fuse
90—250 VAC	2 Amp, Fast Acting	Bussman AGC-2
12—42 VDC	3 Amp, Fast Acting	Bussman AGC-3

Field mount transmitter power terminals

See Figure 2-23 for field mount terminal block connections.

For AC powered transmitter (90—250 VAC, 50/60 Hz)

- Connect AC Neutral to terminal 9 (AC N/L2) and AC Line to terminal 10 (AC/L1).

For DC powered transmitter

- Connect negative to terminal 9 (DC -) and positive to terminal 10 (DC +).
- DC powered units may draw up to 1.2A.

Wall mount transmitter power terminals

See Figure 2-24 for field mount terminal connections.

For AC powered transmitter (90—250 VAC, 50/60 Hz)

- Connect AC Neutral to terminal N and AC Line to terminal L1.

For DC powered transmitter

- Connect DC- to terminal N and DC+ to terminal L1.

2.12 Field mount transmitter cover jam screw

For flow meters shipped with a cover jam screw, the screw should be installed after the instrument has been wired and powered up. Follow these steps to install the cover jam screw:

1. Verify the cover jam screw is completely threaded into the housing.
2. Install the housing cover and verify the cover is tight against the housing.
3. Using a 2.5 mm hex wrench, loosen the jam screw until it contacts the transmitter cover.
4. Turn the jam screw an additional $^1/_2$ turn counterclockwise to secure the cover.

Note
Application of excessive torque may strip the threads.

5. Verify the cover cannot be removed.

2.13 Basic configuration

Once the magnetic flowmeter is installed and power has been supplied, the transmitter must be configured through the basic setup. The basic setup parameters can be configured through either a local operator interface (LOI) or a HART Communication device.

- For instructions on operation of the LOI or HART Communication device, refer to Section 4.
- If configuration beyond the basic setup parameters is required, refer to Section 5 for a complete list of device parameters.

Configuration settings are saved in nonvolatile memory within the transmitter.

2.13.1 Basic setup

Tag

LOI menu path	Field Mount: Basic Setup, Tag Wall Mount: XMTR INFO
Traditional Fast Keys	1, 3, 1
Device dashboard	2, 2, 9, 1, 1

Tag is the quickest and shortest way of identifying and distinguishing between transmitters. Transmitters can be tagged according to the requirements of your application. The tag may be up to eight characters long.

Flow units (PV)

LOI menu path	Field Mount: Basic Setup, Flow Units, PV Units Wall Mount: UNITS
Traditional Fast Keys	1, 3, 1
Device dashboard	2, 2, 1, 2

The *flow units* variable specifies the format in which the flow rate will be displayed. Units should be selected to meet your particular metering needs. See Table 2-12 for available units of measure.

Line size

LOI menu path	Field Mount: Basic Setup, Line Size Wall Mount: TUBE SIZE
Traditional Fast Keys	1, 3, 1
Device dashboard	2, 2, 1, 4, 2

The *line size* (sensor size) must be set to match the actual sensor connected to the transmitter. The size must be specified in inches. See Table 2-13 for available sensor sizes.

URV (Upper Range Value)

LOI menu path	Field Mount: Basic Setup, PV URV Wall Mount: ANALOG OUTPUT RANGE
Traditional Fast Keys	1, 3, 1
Device dashboard	2, 2, 1, 3, 3

The *upper range value* (URV) sets the 20 mA point for the analog output. This value is typically set to full-scale flow. The units that appear will be the same as those selected under the *flow units* parameter. The URV may be set between –39.3 ft/s to 39.3 ft/s (–12 m/s to 12 m/s). There must be at least 1 ft/s (0.3 m/s) span between the URV and LRV.

LRV (Lower Range Value)

LOI menu path	Field Mount: Basic Setup, PV LRV Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 3, 1
Device dashboard	2, 2, 1, 3, 2

The *lower range value* (LRV) sets the 4 mA point for the analog output. This value is typically set to zero flow. The units that appear will be the same as those selected under the *flow units* parameter. The LRV may be set between -39.3 ft/s to 39.3 ft/s (-12 m/s to 12 m/s). There must be at least 1 ft/s (0.3 m/s) span between the URV and LRV.

Calibration number

LOI menu path	Field Mount: Basic Setup, Cal Number Wall Mount: TUBE CAL NO.
Traditional Fast Keys	1, 3, 1
Device dashboard	2, 2, 1, 4, 1

The sensor *calibration number* is a 16-digit number generated at the Rosemount factory during flow calibration and is unique to each sensor and is located on the sensor tag.

PV damping

LOI menu path	Field Mount: Basic Setup, PV Damping Wall Mount: DAMPING
Traditional Fast Keys	1, 3, 1
Device dashboard	2, 2, 1, 3, 4

Primary variable damping allows selection of a response time, in seconds, to a step change in flow rate. It is most often used to smooth fluctuations in output.

Table 2-12. Available Flow Units

Volumetric units	Mass units
gal/sec	lbs/sec
gal/min	lbs/min
gal/hr	lbs/hr
gal/day	lbs/day
L/sec	kg/sec
L/min	kg/min
L/hr	kg/hr
L/day	kg/day
ft3/sec	(s) tons/min
ft3/min	(s) tons/hr
ft3/hr	(s) tons/day
ft3/day	(m) tons/min
cm3/min(1)	(m) tons/hr
m3/sec	(m) tons / day
m3/min	**Velocity units**
m3/hr	ft/sec
m3/day	m/sec
Impgal/sec	**Special units**
Impgal/min	Special (User Defined)

Table 2-12. Available Flow Units

Volumetric units
Impgal/hr
Impgal/day
B42/sec (1 barrel = 42 gallons)
B42/min (1 barrel = 42 gallons)
B42/hr (1 barrel = 42 gallons)
B42/day (1 barrel = 42 gallons)
B31/sec (1 barrel = 31 gallons)(2)
B31/min (1 barrel = 31 gallons)(2)
B31/hr (1 barrel = 31 gallons)(2)
B31/day (1 barrel = 31 gallons)(2)

1. Not available on Wall Mount Transmitter.
2. On Wall Mount Transmitter, 1 barrel = 31.5 gallons.

Table 2-13. Available Sensor Sizes

Sensor size	
0.10 in (2.5 mm)	18 in (450 mm)
0.15 in (4 mm)	20 in (500 mm)
0.25 in (6 mm)	24 in (600 mm)
0.30 in (8 mm)	28 in (700 mm)
0.50 in (15 mm)	30 in (750 mm)
0.75 in (20 mm)	32 in (800 mm)
1.0 in (25 mm)	36 in (900 mm)
1.5 in (40 mm)	40 in (1000 mm)
2.0 in (50 mm)	42 in (1050 mm)
2.5 in (65 mm)	44 in (1100 mm)
3.0 in (80 mm)	48 in (1200 mm)
4.0 in (100 mm)	54 in (1350 mm)
5.0 in (125 mm)(1)	56 in (1400 mm)
6.0 in (150 mm)	60 in (1500 mm)
8.0 in (200 mm)	64 in (1600 mm)
10 in (250 mm)	66 in (1650 mm)
12 in (300 mm)	72 in (1800 mm)
14 in (350 mm)	78 in (1950 mm)(1)
16 in (400 mm)	80 in (2000 mm)

1. Not available on Wall Mount Transmitter.

Section 3 Advanced Installation Details

Introduction . . . . . page 37
Safety messages . . . . . page 37
Hardware switches . . . . . page 37
Additional loops . . . . . page 40
Process reference connection . . . . . page 48
Coil housing configuration . . . . . page 48

3.1 Introduction

This section details some of the advanced installation considerations when utilizing the Rosemount™ 8750W Revision 4 Magnetic Flowmeter System.

3.2 Safety messages

⚠ WARNING

The electronics may store energy after power is removed. Allow ten minutes for charge to dissipate prior to removing electronics compartment cover.

Note
The electronics stack is electrostatically sensitive. Be sure to observe handling precautions for static-sensitive components.

3.3 Hardware switches

The electronics are equipped with four user-selectable hardware switches. These switches set the Alarm Mode, Internal/External Analog Power, Transmitter Security, and Internal/External Pulse Power.

Definitions of these switches and their functions are provided below. To change the settings, see below.

3.3.1 Alarm mode

If an event occurs that would trigger an alarm in the electronics, the analog output will be driven high or low, depending on the switch position. The switch is set in the HIGH position when shipped from the factory. Refer to Table 5-1 on page 87 and Table 5-2 on page 87 for analog output values of the alarm.

3.3.2 Transmitter security

The security switch on the Rosemount 8750W allows the user to lock out any configuration changes attempted on the transmitter. No changes to the configuration are allowed when the switch is in the ON position. The flow rate indication and totalizer functions remain active at all times.

With the switch in the ON position, access to review the operating parameters is available. No configuration changes are allowed.

Transmitter security is set in the OFF position when shipped from the factory.

3.3.3 Internal/external analog power

The 8750W 4—20 mA loop may be powered internally or by an external power supply. The internal /external power supply switch determines the source of the 4—20 mA loop power.

Transmitters are shipped from the factory with the switch set in the INTERNAL position.

The external power option is required for multidrop configurations. A 10—30 VDC external supply is required and the 4—20 mA power switch must be set to the EXTERNAL position. For further information on 4—20 mA external power, see "Analog output" on page 25.

3.3.4 Internal/external pulse power(1)

The Rosemount 8750W pulse loop may be powered internally or by an external power supply. The internal/ external pulse power is only available on the Field Mount Transmitter. The internal/external power supply switch determines the source of the pulse loop power.

Transmitters are shipped from the factory with the switch set in the EXTERNAL position.

A 5—28 VDC external supply is required when the pulse power switch is set to the EXTERNAL position. For further information on the pulse external power, see "Connect pulse output" on page 40.

3.3.5 Changing hardware switch settings

To change the switch settings, complete the steps below:

Note
The hardware switches are located on the top side of the electronics board and changing their settings requires opening the electronics housing. If possible, carry out these procedures away from the plant environment in order to protect the electronics.

1. Place the control loop into manual control.
2. Disconnect power to the transmitter.
3. Remove the electronics compartment cover. If the cover has a cover jam screw, this must be loosened prior to removal of the cover.
4. Remove the LOI, if applicable (not required for the Wall Mount Transmitter).

1. *Not available on Wall Mount Transmitter.*

5. Identify the location of each switch (see Figure 3-1 and Figure 3-2).
6. Change the setting of the desired switches with a small, non-metallic tool.
7. Replace the LOI if applicable, and the electronics compartment cover. If the cover has a cover jam screw, this must be tightened to comply with installation requirements. See "Field mount transmitter cover jam screw" on page 32 for details on the cover jam screw.
8. Return power to the transmitter and verify the flow measurement is correct.
9. Return the control loop to automatic control.

Figure 3-1. Field Mount Transmitter Electronics Stack and Hardware Switches

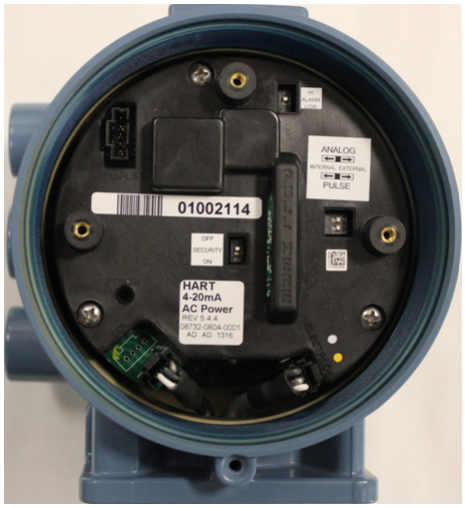
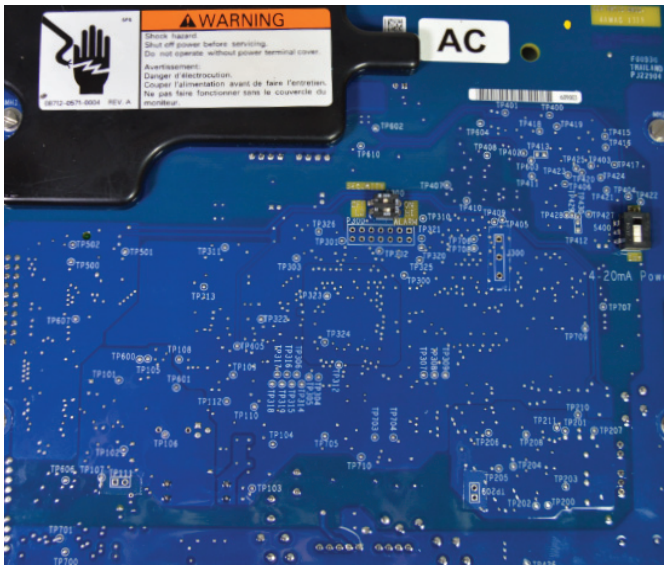


Figure 3-2. Wall Mount Transmitter Electronics Stack and Hardware Switches



3.4 Additional loops

There are three additional loop connections available on the 8750W Transmitter:

- Pulse output — used for external or remote totalization.
- Channel 1 can be configured as discrete input or discrete output.
- Channel 2 can be configured as discrete output only.

3.4.1 Connect pulse output

Field mount transmitter

The pulse output function provides a galvanically isolated frequency signal that is proportional to the flow through the sensor. The signal is typically used in conjunction with an external totalizer or control system. The default position of the internal/external pulse power switch is in the EXTERNAL position. The user-selectable power switch is located on the electronics board.

External

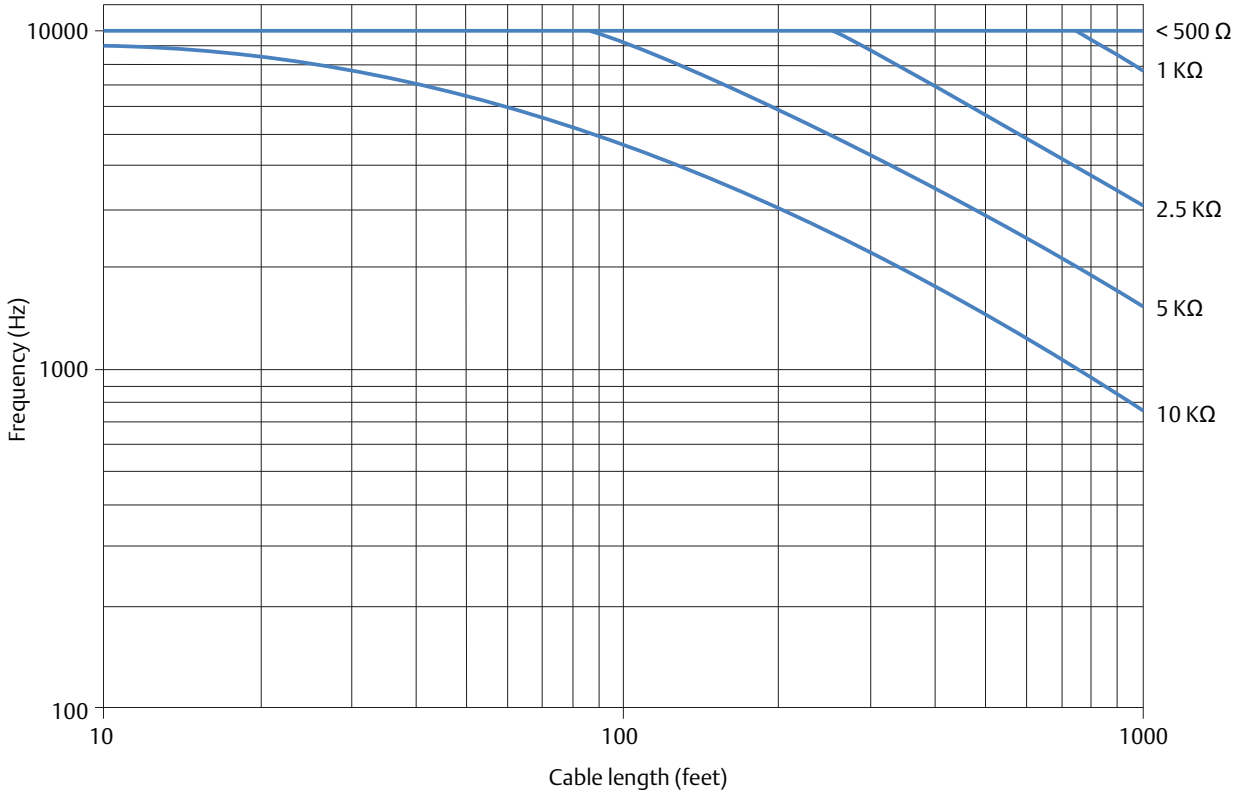
For transmitters with the internal/external pulse power switch set in the EXTERNAL position, the following requirements apply:

Supply voltage: 5 to 28 VDC
Maximum current: 100 mA
Maximum power: 1.0 W
Load resistance: 200 to 10k Ohms (typical value 1k Ohms)

Output option code	Supply voltage	Resistance vs cable length
A	5—28 VDC	See Figure 3-3 on page 41

Pulse mode: Fixed pulse width or 50% duty cycle
Pulse duration: 0.1 to 650 ms (adjustable)
Maximum pulse frequency: 10,000 Hz
FET switch closure: solid state switch

Figure 3-3. Field Mount Transmitter — Maximum Frequency vs. Cable Length

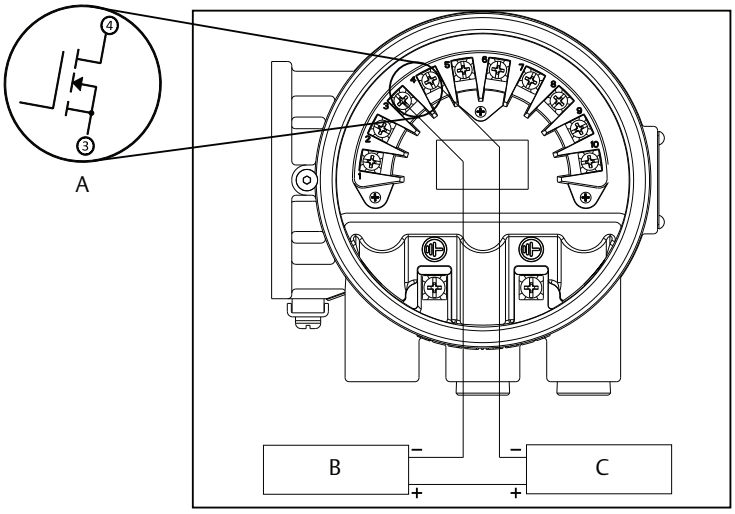


Complete the following steps to connect an external power supply.

1. Ensure the power source and connecting cable meet the requirements outlined previously.
2. Turn off the transmitter and pulse output power sources.
3. Run the power cable to the transmitter.
4. Connect - DC to terminal 3.
5. Connect + DC to terminal 4.

Refer to Figure 3-4 and Figure 3-5.

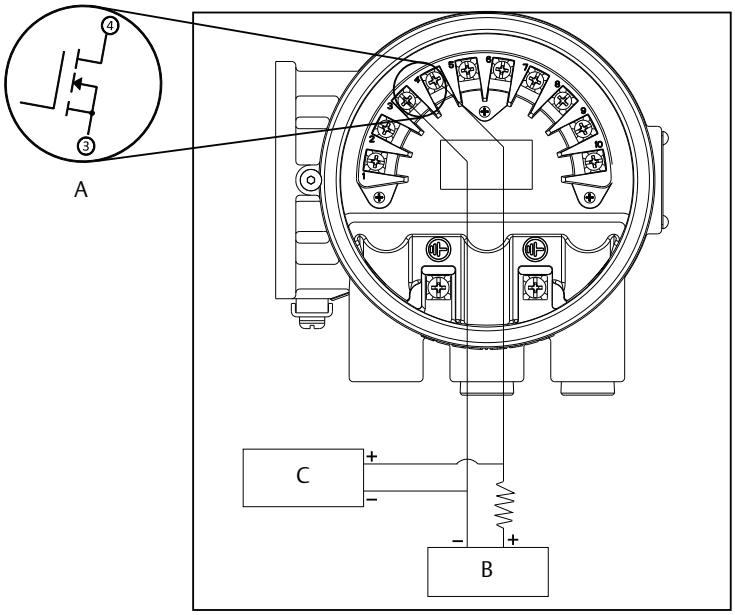
Figure 3-4. Field Mount Transmitter — Connecting Electromechanical Totalizer/Counter with External Power Supply



A. Schematic showing FET between terminal 3 and 4
B. 5—24 V DC power supply
C. Electro-mechanical counter

Note
Total loop impedance must be sufficient to keep loop current below maximum rating. A resistor can be added in the loop to raise impedance.

Figure 3-5. Field Mount Transmitter — Connecting to an Electronic Totalizer/Counter with External Power Supply



A. Schematic showing FET between terminal 3 and 4
B. 5—24 V DC power supply
C. Electronic counter

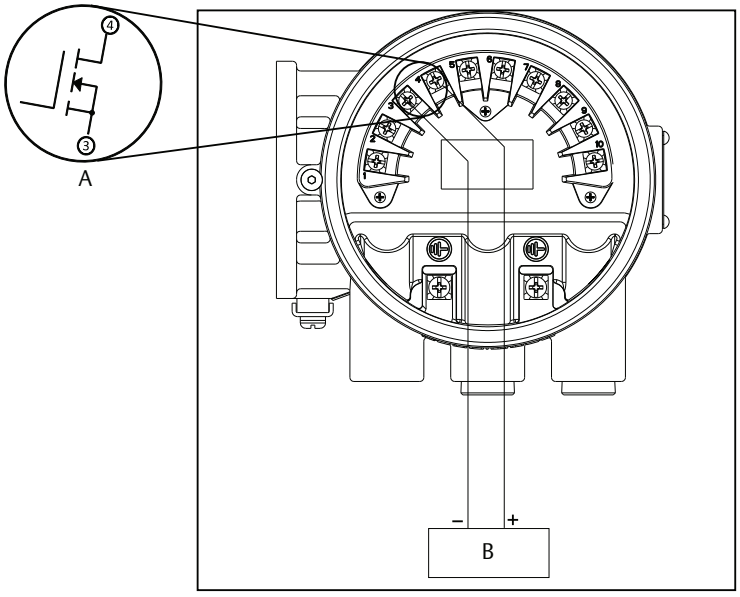
Note
Total loop impedance must be sufficient to keep loop current below maximum rating.

Internal

When the pulse switch is set to internal, the pulse loop will be powered from the transmitter. Supply voltage from the transmitter can be up to 12 VDC. Refer to Figure 3-6 and connect the transmitter directly to the counter. Internal pulse power can only be used with an electronic totalizer or counter and cannot be used with an electromechanical counter.

1. Turn off the transmitter.
2. Connect - DC to terminal 3.
3. Connect + DC to terminal 4.

Figure 3-6. Field Mount Transmitter — Connecting to an Electronic Totalizer/Counter with Internal Power Supply



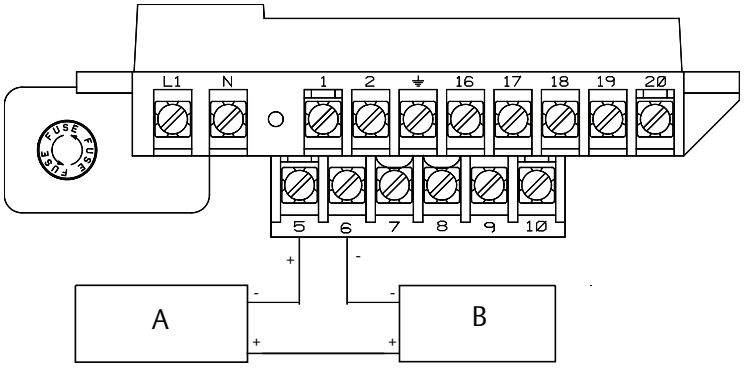
A. Schematic showing FET between terminal 3 and 4
B. Electronic counter

Wall mount transmitter

The pulse output function provides an isolated switch-closure frequency signal that is proportional to the flow through the sensor. The Wall Mount Transmitter is only available with an externally powered pulse output. The signal is typically used in conjunction with an external totalizer or control system. The following requirements apply:

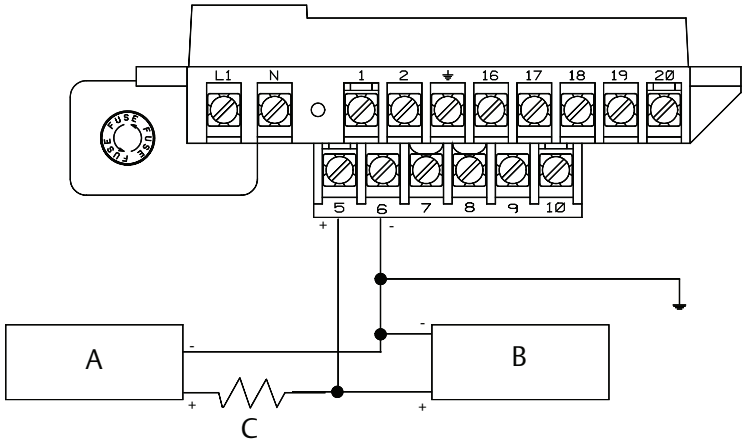
Supply Voltage: 5 to 24 V DC
Load Resistance: 1,000 to 100 k ohms (typical 5 k)
Pulse Duration: 1.5 to 500 msec (adjustable), 50% duty cycle below 1.5 msec
Maximum Power: 2.0 watts up to 4,000 Hz and 0.1 watts at 10,000 Hz
Switch Closure: solid state switch

Figure 3-7. Wall Mount Transmitter — Connecting to an Electromechanical Totalizer/Counter



A. Electromechanical counter
B. 5–28 VDC power supply

Figure 3-8. Wall Mount Transmitter — Connecting to an Electronic Totalizer/Counter



A. 5–28 VDC power supply
B. Electronic counter
C. 1k to 100k (typical 5k)

3.4.2 Connect discrete output

The discrete output control function can be configured to drive an external signal to indicate zero flow, reverse flow, empty pipe, diagnostic status, flow limit, or transmitter status. The following requirements apply:

Supply Voltage: 5 to 28 VDC
Maximum Voltage:

- Field Mount: 28 VDC at 240 mA
- Wall Mount: 2 W

Switch Closure:

- Field Mount: Solid state relay
- Wall Mount: Optically isolated solid state switch

For discrete output control, connect the power source and control relay to the transmitter. To connect external power for discrete output control, complete the following steps:

1. Ensure the power source and connecting cable meet the requirements outlined previously.
2. Turn off the transmitter and discrete power sources.
3. Run the power cable to the transmitter.
4. Connect channel 1.
   a. For Field Mount, connect -DC to terminal 5.
   b. For Field Mount, connect +DC to terminal 6.

   OR

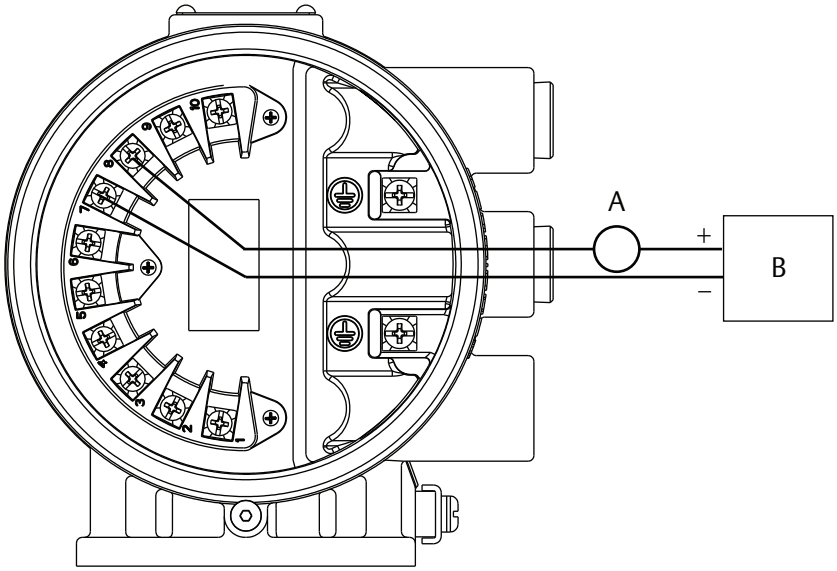
   a. For Wall Mount, connect -DC to terminal 10.
   b. For Wall Mount, connect +DC to terminal 9.
5. Connect channel 2.
   a. For Field Mount, connect -DC to terminal 7.
   b. For Field Mount, connect +DC to terminal 8.

   OR

   a. For Wall Mount, connect -DC to terminal 20.
   b. For Wall Mount, connect +DC to terminal 16.

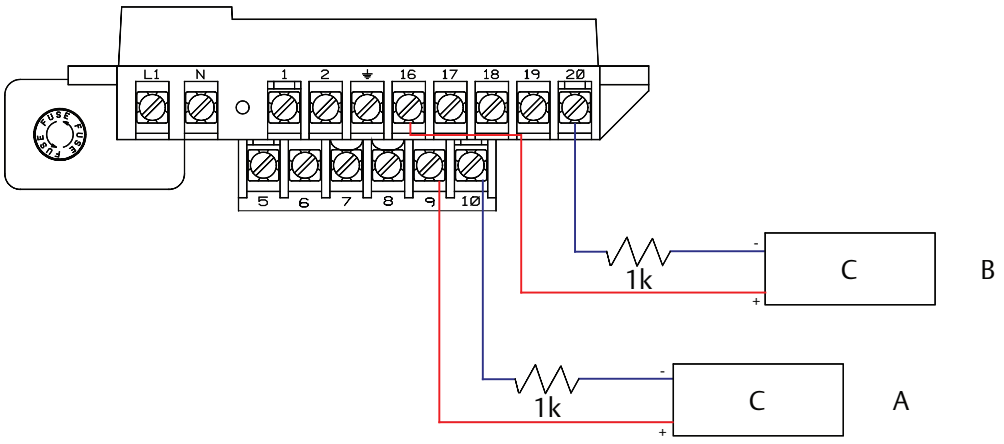
Refer to Figure 3-9 and Figure 3.5.

Figure 3-9. Field Mount Transmitter — Connect Discrete Output to Relay or Control System Input



A. Control relay or input
B. 5–28 VDC power supply

Figure 3-10. Wall Mount Transmitter — Connect Discrete Output to Relay or Control System Input



A. Digital output 1
B. Digital output 2
C. 5–28 VDC power supply

Note
Total loop impedance must be sufficient to keep loop current below maximum rating. A resistor can be added in the loop to raise impedance.

3.4.3 Connect discrete input

The discrete input can provide positive zero return (PZR) or net totalizer reset. The following requirements apply:

Supply Voltage: 5 to 28 VDC
Control Current: 1.5 — 20 mA
Input Impedance: 2.5 kΩ plus 1.2 V Diode drop. See Figure 3-12.

To connect the discrete input, complete the following steps.

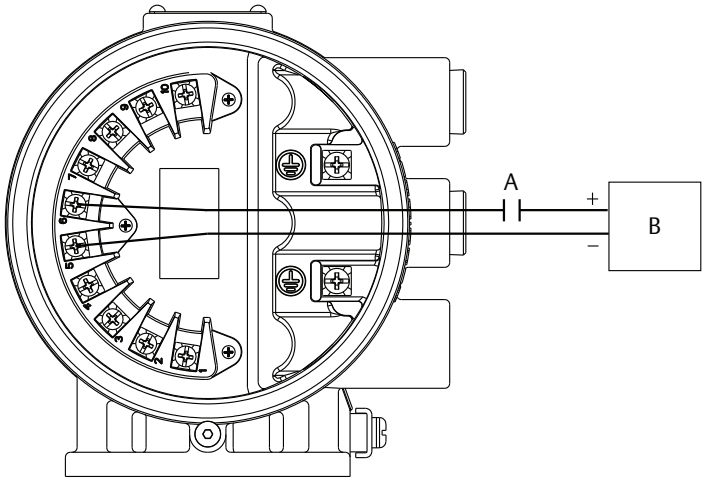
1. Ensure the power source and connecting cable meet the requirements outlined previously.
2. Turn off the transmitter and discrete power sources.
3. Run the power cable to the transmitter.
4. Connect terminals.
   a. For Field Mount, connect -DC to terminal 5.
   b. For Field Mount, connect +DC to terminal 6.

   OR

   a. For Wall Mount, connect -DC to terminal 10.
   b. For Wall Mount, connect +DC to terminal 9.

Refer to Figure 3-11 and Figure 3-13.

Figure 3-11. Field Mount Transmitter – Connect Discrete Input



A. Relay contact or control system output
B. 5-28 V DC power supply

Figure 3-12. Discrete Input Operating Range

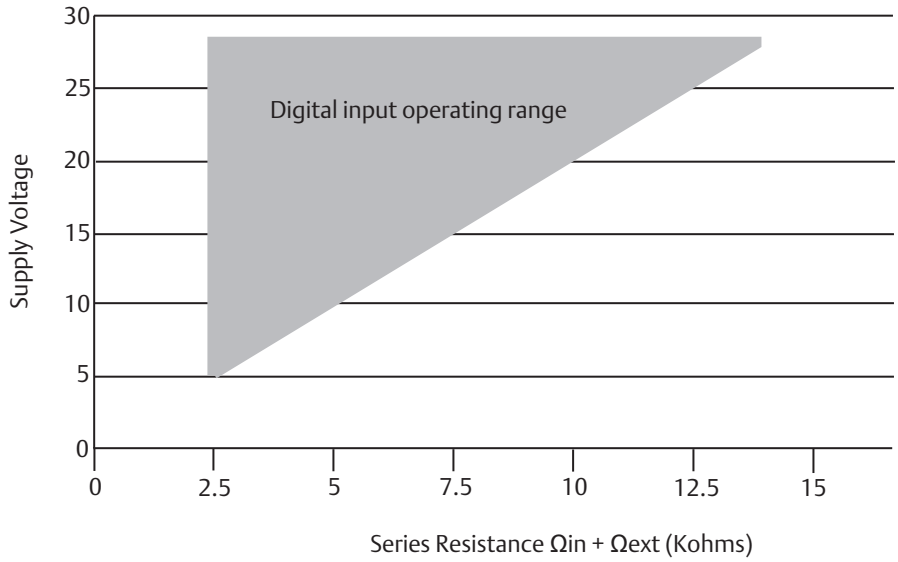
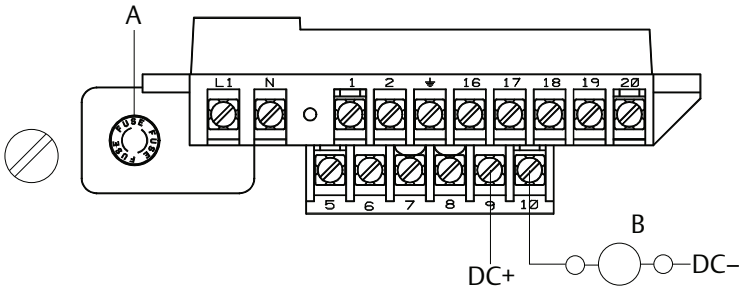


Figure 3-13. Wall Mount Transmitter – Connect Discrete Input



A. Fuse
B. Control relay or input

3.5 Process reference connection

Establishing a process reference for the sensor is one of the most important details of sensor installation. Proper process reference creates the lowest noise environment for the transmitter to make a stable reading. Refer to Table 2-8 and Table 2-9 on page 22 to determine which option to follow for proper installation.

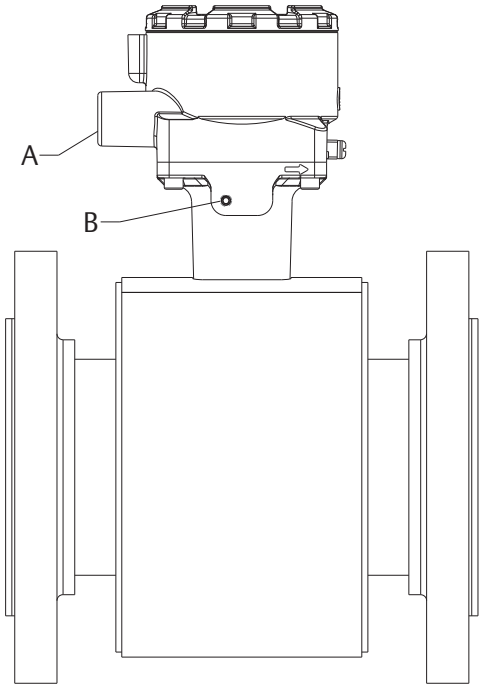
Note
Consult factory for installations requiring cathodic protection or situations where there are high electrical currents or high electrical potentials present in the process.

3.6 Coil housing configuration

The coil housing provides physical protection of the coils and other internal components from contamination and physical damage that might occur in an industrial environment. The coil housing is an all-welded and gasket-free design.

The 8750W model is available in one coil housing configuration (see Figure 3-14).

Figure 3-14. 8750W Housing Configuration (Flanged Shown)



A. 1/2-14 NPT conduit connection
B. No relief port (welded shut)

Section 4 Operation

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Wall mount transmitter LOI . . . . . page 56
Field Communicator interface . . . . . page 60
Process variables . . . . . page 82

4.1 Introduction

The Rosemount™ 8750W Magnetic Flowmeter features a full range of software functions, transmitter configurations, and diagnostic settings. These features can be accessed through the Local Operator Interface (LOI), a Field Communicator, AMS™ Device Manager, ProLink™ III, or a host control system. Configuration variables may be changed at any time; specific instructions are provided through on-screen instructions.

This section covers the basic features of the LOI (optional) and provides general instructions on how to navigate the configuration menus using the optical buttons on the Field Mount Transmitter. The section also covers the use of a Field Communicator and provides menu trees to access each function.

For detailed LOI configuration refer to Section 5: Advanced Configuration Functionality.

4.2 Field mount transmitter Loi

The optional LOI provides a communications center for the Rosemount 8750W.

The LOI allows an operator to:

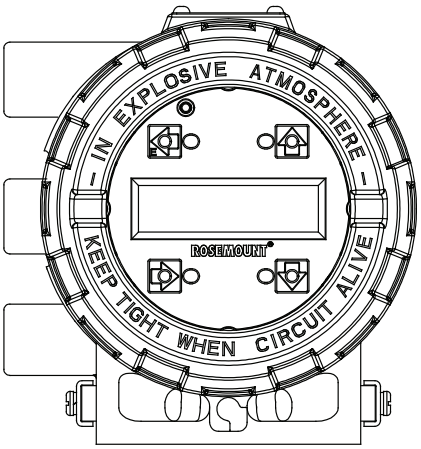
- Change transmitter configuration
- View flow and totalizer values
- Start/stop and reset totalizer values
- Run diagnostics and view the results
- Monitor transmitter status
- Other functions

4.2.1 Basic features

The basic features of the LOI include a display window and four navigational arrow keys (see Figure 4-1).

To activate the LOI, select the **DOWN** arrow two times. Select the **UP**, **DOWN**, **LEFT**, and **RIGHT** arrows to navigate the menu structure. A map of the LOI menu structure is shown on Figure 4-2 and Figure 4-3.

Figure 4-1. Field Mount Transmitter Local Operator Interface Keypad and Character Display



4.2.2 Data entry

The LOI keys are not alphanumeric. Alphanumeric and symbolic data is entered by the following procedure. Use the steps below to access the appropriate functions.

1. Select the arrow keys to navigate the menu structure (Figure 4-2 and Figure 4-3) in order to access the appropriate alphanumeric parameter.
2. Select the **UP**, **DOWN** or **RIGHT** arrow key to begin editing the parameter. (Use the **LEFT** arrow key to go back without changing the value).
   - For numerical data, toggle through the digits **0-9, decimal point**, and **dash**.
   - For alphabetical data, toggle through the letters of the alphabet **A-Z,** digits **0-9**, and the symbols **?, &, +, -, *, /, $, @,%,** and the **blank space**.
3. Select the **RIGHT** arrow key to highlight each character you want to change and then select the **UP** or **DOWN** arrow keys to select the value. If you go past a character that you wish to change, keep selecting the **RIGHT** arrow key to wrap around in order to arrive at the character you want to change.
4. Select "**E"** (the **LEFT** arrow key) when all changes are complete to save the entered values. Select the **LEFT** arrow key again to navigate back to the menu tree.

4.2.3 Data entry examples

Select the **DOWN** arrow key twice to access the menu structures shown in Figure 4-2 and Figure 4-3. Use the arrow keys to navigate to the desired parameters to review/change. Parameter values are classified as table values or select values. Table values are available from a predefined list. For parameters such as *line size* or *flow units*. Select values are integers. floating point numbers, or character strings and are entered one character at a time using the arrow keys for parameters such as *PV URV* and *calibration number*.

Table value example

Setting the sensor size:

1. Select the **DOWN** arrow key twice to access the menu. See Figure 4-2.
2. Using the arrow keys, select *line size* from the *basic setup* menu.
3. Select the **UP**/**DOWN** arrow to increase/decrease the sensor size to the next value.
4. When you reach the desired sensor size, select "**E"** (the left arrow).
5. Set the loop to manual if necessary, and select "**E"** again.

After a moment, the LOI will display VALUE STORED SUCCESSFULLY and then display the selected value.

Select value example

Changing the upper range limit:

1. Select the **DOWN** arrow key twice to access the menu. See Figure 4-2.
2. Using the arrow keys, select *PV URV* from the *basic setup* menu.
3. Select **RIGHT** arrow key to position the cursor.
4. Select **UP** or **DOWN** to set the number.
5. Repeat steps 3 and 4 until desired number is displayed, select "**E"** (the left arrow).
6. Set the loop to manual if necessary, and select "**E"** again.

After a moment, the LOI will display VALUE STORED SUCCESSFULLY and then display the selected value.

4.2.4 Totalizer functionality

Start totalizer

To start the totalizer, select the **DOWN** arrow to display the totalizer screen and select **"E"** to begin totalization. A symbol will flash in the lower right hand corner indicating that the meter is totalizing.

Pause totalizer

To pause the totalizer, select the **DOWN** arrow to display the totalizer screen and select the **RIGHT** arrow to pause the totalizer. This will hold the current totalizer values on the screen for reading or recording. The totalizer will continue to run even though the values are not changing. To unpause the totalizer, select the **RIGHT** arrow again. The totalizer value will instantly increment to the correct value and continuing running.

Stop totalizer

To stop the totalizer, select the **DOWN** arrow to display the totalizer screen and select **"E"** to end totalization. The flashing symbol will no longer display in the lower right hand corner indicating that the meter has stopped totalizing.

Reset totalizer

To reset the totalizer, select the **DOWN** arrow to display the totalizer screen and follow the procedure above to stop totalization. Once totalization has stopped, select the **RIGHT** arrow key to reset the NET total value to zero. To reset the GROSS, FORWARD, and REVERSE total values, you must change the *line size*. See "Basic configuration" on page 32 for details on how to change the line size.

4.2.5 Display lock

The Rosemount 8750W Field Mount Transmitter has display lock functionality to prevent unintentional configuration changes. The display can be locked manually or configured to automatically lock after a set period of time.

Manual display lock

To activate hold the **UP** arrow for three seconds and then following the on-screen instructions. When the display lock is activated, a lock symbol will appear in the lower right hand corner of the display. To deactivate the display lock, hold the **UP** arrow for three seconds and follow the on-screen instructions. Once deactivated, the lock symbol will no longer appear in the lower right hand corner of the display.

Auto display lock

1. Select the **DOWN** arrow key twice to access the menu. See Table 4-2.
2. Using the arrow keys, select **LOI config** from the *Detailed Setup* menu.
3. Select **DOWN** arrow to highlight *disp auto lock* and press the **RIGHT** arrow to enter the menu.
4. Select **DOWN** arrow to select the a*uto lock time*.
5. When you reach the desired time, select **"E"** (the left arrow).
6. Set the loop to manual if necessary, and select **"E"** again.

After a moment, the LOI will display VALUE STORED SUCCESSFULLY and then display the selected value.

4.2.6 Diagnostic messages

Diagnostic messages may appear on the LOI. See Table 6-1 on page 113, Table 6-2 on page 132, and Table 6-3 on page 132 for a complete list of messages, potential causes, and corrective actions for these messages.

4.2.7 Display symbols

When certain transmitter functions are active, a symbol will appear in the lower right corner of the display. The possible symbols include the following:

Display Lock

Totalizer

Reverse flow

Continuous meter verification

Figure 4-2. Field Mount Transmitter LOI Menu Tree (Diagnostics and Basic Setup)

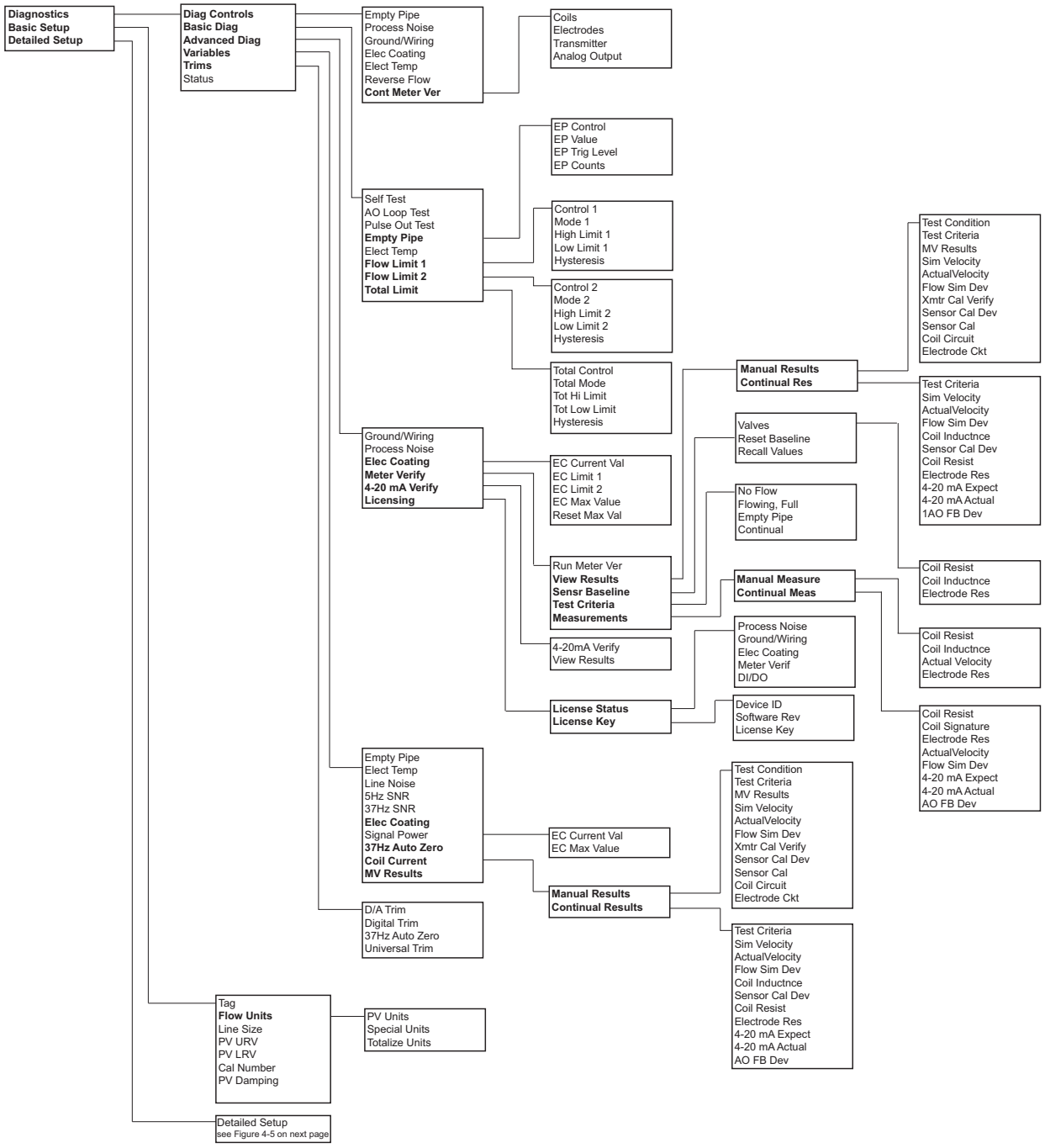
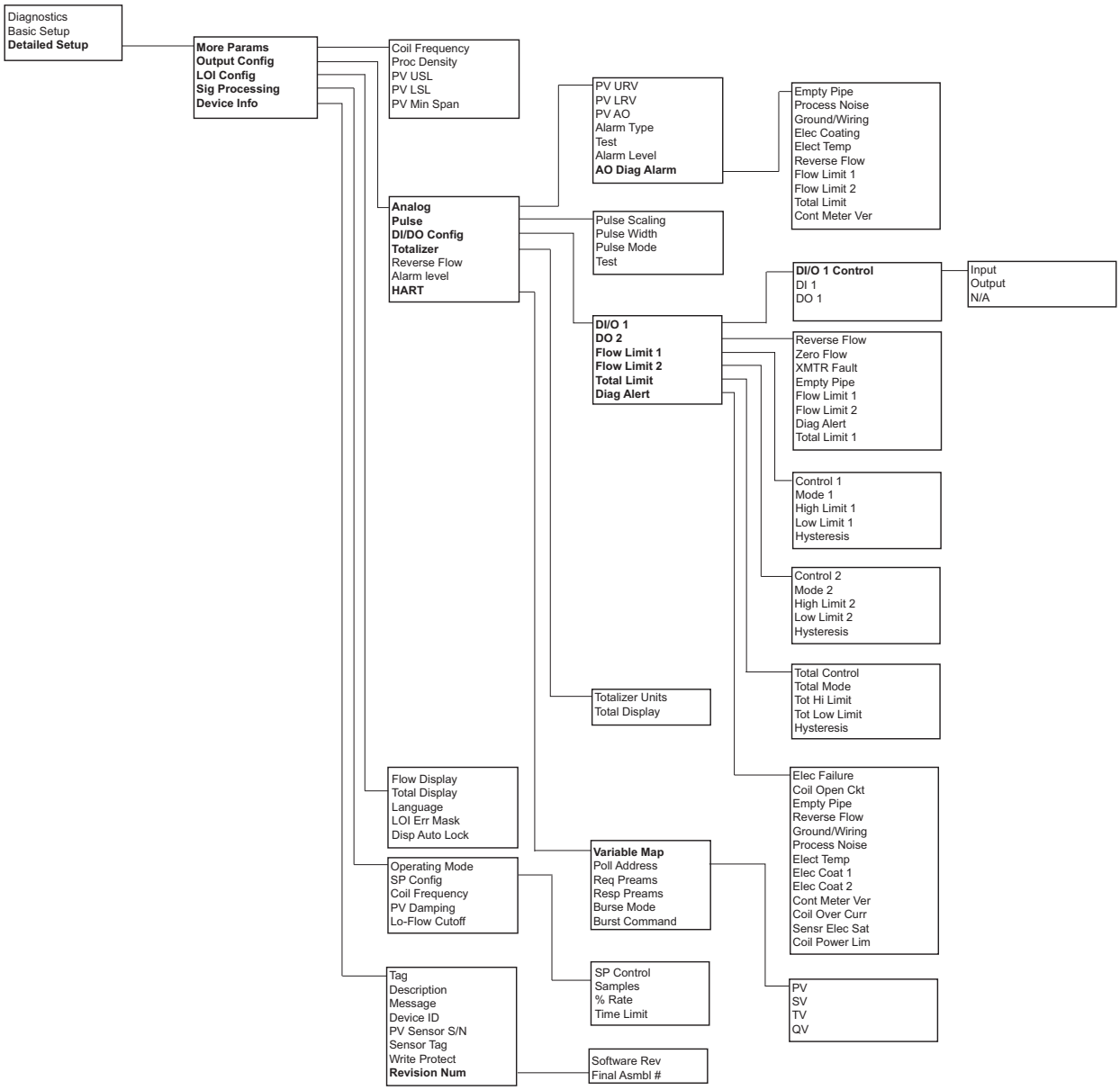


Figure 4-3. Field Mount Transmitter LOI Menu Tree (Detailed Setup)



4.3 Wall mount transmitter LOI

4.3.1 Basic features

The basic features of the LOI include display control, totalizer, data entry, and transmitter parameters. These features provide control of all transmitter functions, see Figure 4-4.

Totalizer keys

The totalizer keys enable you to start, stop, read, and reset the totalizer.

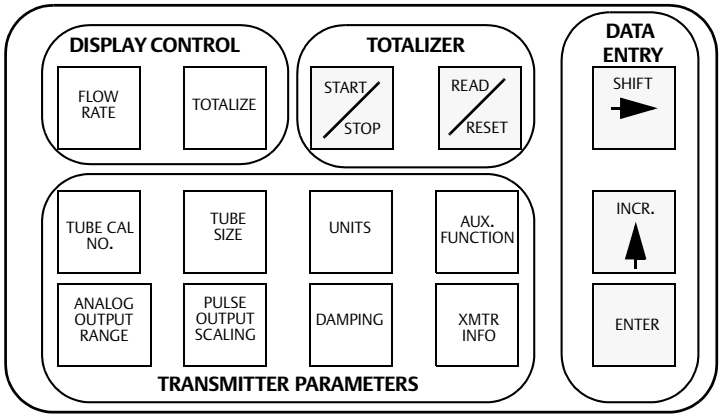
Data entry keys

The data entry keys enable you to move the display cursor, incrementally increase the value, or enter the selected value.

Transmitter parameter keys

The transmitter parameter keys provide direct access to the most common transmitter parameters and stepped access to the advanced functions of the 8750W through the **Aux. Function** key.

Figure 4-4. Local Operator Interface Keypad



4.3.2 Data entry

The LOI keypad does not have numerical keys. Numerical data is entered by the following procedure.

1. Access the appropriate function.
2. Select **SHIFT** to highlight the digit you want to enter or change.

3. Select **INCR.** to change the highlighted value.
   - For numerical data, **INCR.** toggle through the digits **0–9, decimal point**, and **dash**.
   - For alphabetical data, toggle through the letters of the alphabet **A–Z**, digits **0–9**, and the symbols **&**, **+**, **-**, *, **/**, **$**, @,**%**, and the **blank space**. (**INCR.** is also used to toggle through pre-determined choices that do not require data entry.)
4. Select **SHIFT** to highlight other digits you want to change and change them.
5. Select **ENTER**.

4.3.3 Data entry examples

Select the **TRANSMITTER PARAMETER** keys shown in Figure 4-4 to change the parameters, which are set in one of two ways, table values or select values.

Table values

Table values are parameters such as units that are available from a predefined list.

Select values

Select values are parameters that consist of a user-created number or character string, such as calibration number; values are entered one character at a time using the data entry keys.

Table value example

Setting the sensor line size:

1. Select **TUBE SIZE**.
2. Select **SHIFT** or **INCR.** to increase (incrementally) the size to the next value.
3. When you reach the desired size, select **ENTER**.
4. Set the loop to manual if necessary, and select **ENTER** again.

After a moment, the LOI will display the new tube size and the maximum flow rate.

Select value example

Changing the analog output range:

1. Select **ANALOG OUTPUT RANGE**.
2. Select **SHIFT** to position the cursor.
3. Select **INCR.** to set the number.
4. Repeat steps 2 and 3 until desired number is displayed.
5. Select **ENTER**.

After a moment, the LOI will display the new analog output range.

4.3.4 Totalizer functionality

Start totalizer

To start the totalizer, select the **TOTALIZE** button to bring up the totalizer screen. Select **START/STOP** to begin totalization. A flashing letter "T" on the LOI indicates that totalizer is activated.

Stop totalizer

To stop the totalizer, select the **TOTALIZE** button to bring up the totalizer screen. Select **START/STOP** to end totalization.

Pause totalizer

To pause the totalizer, select the **TOTALIZE** button and then select the **READ/ RESET** button. This will display the current value, but will not stop the totalization.

Reset totalizer

To reset the totalizer, select the **TOTALIZE** button. If totalizer is running, select **START/STOP** to stop the totalization and then select **READ/ RESET** button to reset net totalization. If totalizer is stopped, select **READ/ RESET** button to reset net totalization.To reset the GROSS, FORWARD, and REVERSE total values, you must change the *line size*. See "Basic configuration" on page 32 for details on how to change the line size.

4.3.5 Diagnostic messages

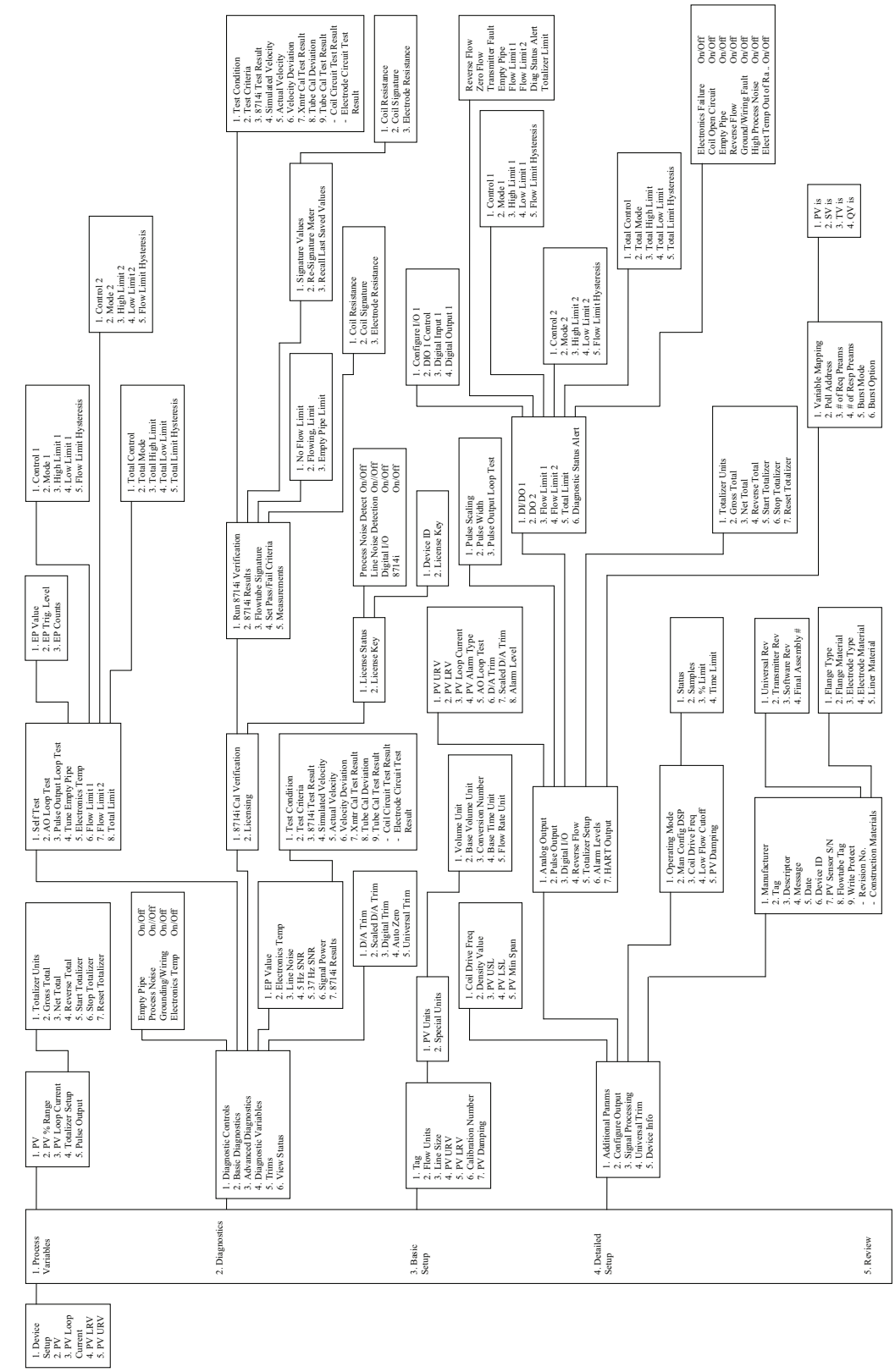
Diagnostic messages may appear on the LOI. See Table 6-1, Table 6-2, and Table 6-3 on page 132 for a complete list of messages, potential causes, and corrective actions for these messages.

4.3.6 Display symbols

When certain transmitter functions are active, a symbol will appear in the lower-right corner of the display. The possible symbols include the following:

Totalizer	
Reverse flow	

Figure 4-5. Wall Mount Transmitter LOI Menu Tree



4.4 Field Communicator interface

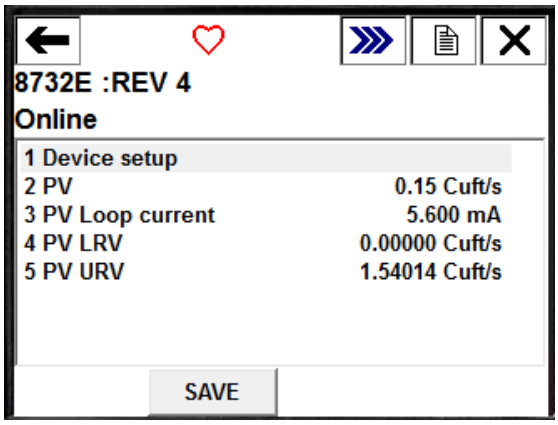
The transmitter can be configured with a Field Communicator using HART Protocol gaining access to the software functions, transmitter configurations, and diagnostic settings. Refer to the Field Communicator Manual for detailed instructions on how to connect to the device.

4.4.1 Field Communicator user interface

The 8750W device driver uses conditional formatting menus. If the diagnostic is not active, the diagnostic will not be displayed as a menu item in the Field Communicator. The Fast Key sequence and menu trees will be resequenced accordingly.

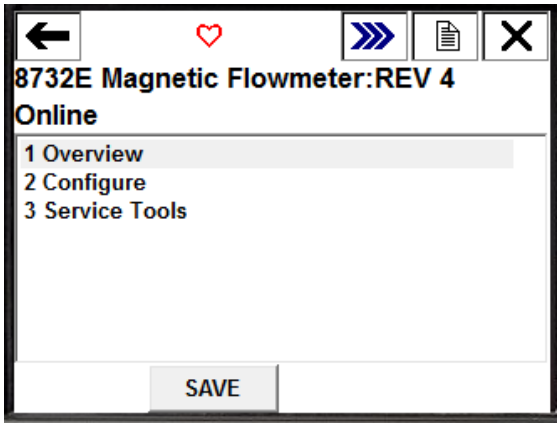
There are two styles of interface available for Field Communicators. The traditional interface is shown in Figure 4-6. The device dashboard interface is shown in Figure 4-7.

Figure 4-6. Traditional Interface



The traditional interface Fast Keys are located in Table 4-1 on page 61. The corresponding menu trees are located Figure 4-8 on page 78 and Figure 4-9 on page 79.

Figure 4-7. Device Dashboard Interface



The device dashboard interface Fast Keys are located in Table 4-2 on page 70. The corresponding menu tree is located Figure 4-10 on page 80 and Figure 4-11 on page 81.

Table 4-1. Traditional Field Communicator Fast Keys

Function	Traditional Fast Keys
Process variables	**1, 1**
Primary Variable (PV)	1, 1, 1
PV Percent of Range (PV % rnge)	1, 1, 2
PV Analog Output (AO) (PV Loop current)	1, 1, 3
Totalizer Setup	1, 1, 4
Totalizer Units	1, 1, 4, 1
Gross Total	1, 1, 4, 2
Net Total	1, 1, 4, 3
Reverse Total	1, 1, 4, 4
Start Totalizer	1, 1, 4, 5
Stop Totalizer	1, 1, 4, 6
Reset Totalizer	1, 1, 4, 7
Pulse Output	1, 1, 5
Diagnostics	**1, 2**
Diag Controls	1, 2, 1
Diagnostic Controls	1, 2, 1, 1
Empty Pipe	1, 2, 1, 1, --(1)
Process Noise	1, 2, 1, 1, --(1)
Grounding/Wiring	1, 2, 1, 1, --(1)
Electrode Coating	1, 2, 1, 1, --(1)
Electronics Temp	1, 2, 1, 1, --(1)
Reverse Flow	1, 2, 1, 2
Continual Ver.	1, 2, 1, 3
Coils	1, 2, 1, 3, 1 --(1)
Electrodes	1, 2, 1, 3, 2 --(1)
Transmitter	1, 2, 1, 3, 3 --(1)
Analog Output	1, 2, 1, 3, 4 --(1)
Basic Diagnostics	1, 2, 2
Self Test	1, 2, 2, 1
AO Loop Test	1, 2, 2, 2
4 mA	1, 2, 2, 2, 1
20 mA	1, 2, 2, 2, 2
Simulate Alarm	1, 2, 2, 2, 3

Table 4-1. Traditional Field Communicator Fast Keys

Function	Traditional Fast Keys
Other	1, 2, 2, 2, 4
End	1, 2, 2, 2, 5
Pulse Output Loop Test	1, 2, 2, 3
Tune Empty Pipe	1, 2, 2, 4
EP Value	1, 2, 2, 4, 1
EP Trig. Level	1, 2, 2, 4, 2
EP Counts	1, 2, 2, 4, 3
Electronics Temp	1, 2, 2, 5
Flow Limit 1	1, 2, 2, 6
Control 1	1, 2, 2, 6, 1
Mode 1	1, 2, 2, 6, 2
High Limit 1	1, 2, 2, 6, 3
Low Limit 1	1, 2, 2, 6, 4
Flow Limit Hysteresis	1, 2, 2, 6, 5
Flow Limit 2	1, 2, 2, 7
Control 2	1, 2, 2, 7, 1
Mode 2	1, 2, 2, 7, 2
High Limit 2	1, 2, 2, 7, 3
Low Limit 2	1, 2, 2, 7, 4
Flow Limit Hysteresis	1, 2, 2, 7, 5
Total Limit	1, 2, 2, 8
Total Control	1, 2, 2, 8, 1
Total Mode	1, 2, 2, 8, 2
Total High Limit	1, 2, 2, 8, 3
Total Low Limit	1, 2, 2, 8, 4
Total Limit Hysteresis	1, 2, 2, 8, 5
Advanced Diagnostics	1, 2, 3
Electrode Coat	1, 2, 3, 1
EC Value	1, 2, 3, 1, 1
EC Level 1 Limit	1, 2, 3, 1, 2
EC Level 2 Limit	1, 2, 3, 1, 3
Max EC Value	1, 2, 3, 1, 4
Clear Max Electrode	1, 2, 3, 1, 5
8714i Cal Verification	1, 2, 3, 2
Run 8714i Cal Verification	1, 2, 3, 2, 1
View Results	1, 2, 3, 2, 2

Table 4-1. Traditional Field Communicator Fast Keys

Function	Traditional Fast Keys
Manual Results	1, 2, 3, 2, 2, 1
Test Condition	1, 2, 3, 2, 2, 1, 1
Test Criteria	1, 2, 3, 2, 2, 1, 2
8714i Test Result	1, 2, 3, 2, 2, 1, 3
Simulated Velocity	1, 2, 3, 2, 2, 1, 4
Actual Velocity	1, 2, 3, 2, 2, 1, 5
Velocity Deviation	1, 2, 3, 2, 2, 1, 6
Xmter Cal Test Result	1, 2, 3, 2, 2, 1, 7
Sensor Cal Deviation	1, 2, 3, 2, 2, 1, 8
Sensor Cal Test Result	1, 2, 3, 2, 2, 1, 9
Coil Circuit Test Result(2)	1, 2, 3, 2, 2, 1, 10
Electrode Circuit Test Result(2)	1, 2, 3, 2, 2, 1, 11
Continual Results	1, 2, 3, 2, 2, 2
Continuous Limit	1, 2, 3, 2, 2, 2, 1
Simulated Velocity	1, 2, 3, 2, 2, 2, 2
Actual Velocity	1, 2, 3, 2, 2, 2, 3
Velocity Deviation	1, 2, 3, 2, 2, 2, 4
Coil Signature	1, 2, 3, 2, 2, 2, 5
Sensor Cal Deviation	1, 2, 3, 2, 2, 2, 6
Coil Resistance	1, 2, 3, 2, 2, 2, 7
Electrode Resistance	1, 2, 3, 2, 2, 2, 8
mA Expected	1, 2, 3, 2, 2, 2, 9
mA Actual(2)	1, 2, 3, 2, 2, 2, 10
mA Deviation(2)	1, 2, 3, 2, 2, 2, 11
Sensor Signature	1, 2, 3, 2, 3
Signature Values	1, 2, 3, 2, 3, 1
Coil Resistance	1, 2, 3, 2, 3, 1, 1
Coil Signature	1, 2, 3, 2, 3, 1, 2
Electrode Resistance	1, 2, 3, 2, 3, 1, 3
Re-Signature Meter	1, 2, 3, 2, 3, 2
Recall Last Saved Values	1, 2, 3, 2, 3, 3
Set Pass/Fail Criteria	1, 2, 3, 2, 4
No Flow Limit	1, 2, 3, 2, 4, 1
Flowing Limit	1, 2, 3, 2, 4, 2
Empty Pipe Limit	1, 2, 3, 2, 4, 3
Continuous Limit	1, 2, 3, 2, 4, 4

Table 4-1. Traditional Field Communicator Fast Keys

Function	Traditional Fast Keys
Measurements	1, 2, 3, 2, 5
Manual Measurements	1, 2, 3, 2, 5, 1
Coil Resistance	1, 2, 3, 2, 5, 1, 1
Coil Signature	1, 2, 3, 2, 5, 1, 2
Electrode Resistance	1, 2, 3, 2, 5, 1, 3
Continual Measurements	1, 2, 3, 2, 5, 2
Coil Resistance	1, 2, 3, 2, 5, 2, 1
Coil Signature	1, 2, 3, 2, 5, 2, 2
Electrode Resistance	1, 2, 3, 2, 5, 2, 3
Actual Velocity	1, 2, 3, 2, 5, 2, 4
mA Expected	1, 2, 3, 2, 5, 2, 5
mA Actual	1, 2, 3, 2, 5, 2, 6
4-20 mA Verify	1, 2, 3, 3
4-20 mA Verification	1, 2, 3, 3, 1
View Results	1, 2, 3, 3, 2
Licensing	1, 2, 3, 4
License Status	1, 2, 3, 4, 1
Process Noise Detect	1, 2, 3, 4, 1, 1 --(1)
Line Noise Detection	1, 2, 3, 4, 1, 2 --(1)
Electrode Coating	1, 2, 3, 4, 1, 3 --(1)
8714i	1, 2, 3, 4, 1, 4 --(1)
Digital I/O	1, 2, 3, 4, 1, 5 --(1)
License Key	1, 2, 3, 4, 2
Device ID	1, 2, 3, 4, 2, 1
License Key	1, 2, 3, 4, 2, 2
Diagnostic Variables	1, 2, 4
EP Value	1, 2, 4, 1
Electronics Temp	1, 2, 4, 2
Line Noise	1, 2, 4, 3
5 Hz SNR	1, 2, 4, 4
37 Hz SNR	1, 2, 4, 5
Electrode Coat	1, 2, 4, 6
EC Value	1, 2, 4, 6, 1
Max EC Value	1, 2, 4, 6, 2
Sig Power	1, 2, 4, 7
8714i Results	1, 2, 4, 8

Table 4-1. Traditional Field Communicator Fast Keys

Function	Traditional Fast Keys
Manual Results	1, 2, 4, 8, 1
Test Condition	1, 2, 4, 8, 1, 1
Test Criteria	1, 2, 4, 8, 1, 2
8714i Test Result	1, 2, 4, 8, 1, 3
Simulated Velocity	1, 2, 4, 8, 1, 4
Actual Velocity	1, 2, 4, 8, 1, 5
Velocity Deviation	1, 2, 4, 8, 1, 6
Xmtr Cal Test Result	1, 2, 4, 8, 1, 7
Sensor Cal Deviation	1, 2, 4, 8, 1, 8
Sensor Cal Test Result	1, 2, 4, 8, 1, 9
Coil Circuit Test Result(2)	1, 2, 4, 8, 1, 10
Electrode Circuit Test Result(2)	1, 2, 4, 8, 1, 11
Continual Results	1, 2, 4, 8, 2
Continuous Limit	1, 2, 4, 8, 2, 1
Simulated Velocity	1, 2, 4, 8, 2, 2
Actual Velocity	1, 2, 4, 8, 2, 3
Velocity Deviation	1, 2, 4, 8, 2, 4
Coil Signature	1, 2, 4, 8, 2, 5
Sensor Cal Deviation	1, 2, 4, 8, 2, 6
Coil Resistance	1, 2, 4, 8, 2, 7
Electrode Resistance	1, 2, 4, 8, 2, 8
mA Expected	1, 2, 4, 8, 2, 9
mA Actual(2)	1, 2, 4, 8, 2, 10
mA Deviation(2)	1, 2, 4, 8, 2, 11
Auto Zero Offset	1, 2, 4, 9
Trims	1, 2, 5
D/A Trim	1, 2, 5, 1
Scaled D/A Trim	1, 2, 5, 2
Digital Trim	1, 2, 5, 3
Auto Zero	1, 2, 5, 4
Universal Trim	1, 2, 5, 5
View Status	1, 2, 6
Basic setup	**1, 3**
Tag	1, 3, 1
Flow Units	1, 3, 2

Table 4-1. Traditional Field Communicator Fast Keys

Function	Traditional Fast Keys
PV Units	1, 3, 2, 1
Special Units	1, 3, 2, 2
Volume Unit	1, 3, 2, 2, 1
Base Volume Unit	1, 3, 2, 2, 2
Conversion Number	1, 3, 2, 2, 3
Base Time Unit	1, 3, 2, 2, 4
Flow Rate Unit	1, 3, 2, 2, 5
Line Size	1, 3, 3
PV URV	1, 3, 4
PV LRV	1, 3, 5
Calibration Number	1, 3, 6
PV Damping	1, 3, 7
Detailed setup	**1, 4**
Additional Parameters	1, 4, 1
Coil Drive Frequency	1, 4, 1, 1
Density Value	1, 4, 1, 2
PV USL	1, 4, 1, 3
PV LSL	1, 4, 1, 4
PV Minimum Span	1, 4, 1, 5
Configure Output	1, 4, 2
Analog Output	1, 4, 2, 1
PV URV	1, 4, 2, 1, 1
PV LRV	1, 4, 2, 1, 2
PV Loop Current	1, 4, 2, 1, 3
AO Alarm Type (PV Alrm typ)	1, 4, 2, 1, 4
AO Loop Test	1, 4, 2, 1, 5
D/A Trim	1, 4, 2, 1, 6
Scaled D/A Trim	1, 4, 2, 1, 7
Alarm Level	1, 4, 2, 1, 8
AO Diagnostic Alarm	1, 4, 2, 1, 9
Empty Pipe	1, 4, 2, 1, 9, 1 --(1)
Reverse Flow	1, 4, 2, 1, 9, 2 --(1)
Ground/Wiring Fault	1, 4, 2, 1, 9, 3 --(1)
High Process Noise	1, 4, 2, 1, 9, 4 --(1)
Elect Temp Out of Range	1, 4, 2, 1, 9, 5 --(1)

Table 4-1. Traditional Field Communicator Fast Keys

Function	Traditional Fast Keys
Electrode Coat Limit 2	1, 4, 2, 1, 9, 6 --(1)
Totalizer Limit 1	1, 4, 2, 1, 9, 7 --(1)
Flow Limit 1	1, 4, 2, 1, 9, 8 --(1)
Flow Limit 2	1, 4, 2, 1, 9, 9 --(1)
Cont. Meter Verification	1, 4, 2, 1, 9, 10 --(1)
Pulse Output	1, 4, 2, 2
Pulse Scaling	1, 4, 2, 2, 1
Pulse Width	1, 4, 2, 2, 2
Pulse Mode	1, 4, 2, 2, 3
Pulse Out Loop Test	1, 4, 2, 2, 4
DI/DO Output (Digital I/O)	1, 4, 2, 3
DI/DO 1	1, 4, 2, 3, 1
Configure I/O 1	1, 4, 2, 3, 1, 1
Input	1, 4, 2, 3, 1, 1, 1
Output	1, 4, 2, 3, 1, 1, 2
Not Available/Off	1, 4, 2, 3, 1, 1, 3
DIO 1 Control	1, 4, 2, 3, 1, 2
Digital Input 1	1, 4, 2, 3, 1, 3
Digital Output 1	1, 4, 2, 3, 1, 4
DO 2	1, 4, 2, 3, 2
Flow Limit 1	1, 4, 2, 3, 3
Control 1	1, 4, 2, 3, 3, 1
Mode 1	1, 4, 2, 3, 3, 2
High Limit 1	1, 4, 2, 3, 3, 3
Low Limit 1	1, 4, 2, 3, 3, 4
Flow Limit Hysteresis	1, 4, 2, 3, 3, 5
Flow Limit 2	1, 4, 2, 3, 4
Control 2	1, 4, 2, 3, 4, 1
Mode 2	1, 4, 2, 3, 4, 2
High Limit 2	1, 4, 2, 3, 4, 3
Low Limit 2	1, 4, 2, 3, 4, 4
Flow Limit Hysteresis	1, 4, 2, 3, 4, 5
Total Limit	1, 4, 2, 3, 5
Total Control	1, 4, 2, 3, 5, 1
Total Mode	1, 4, 2, 3, 5, 2
Total High Limit	1, 4, 2, 3, 5, 3

Table 4-1. Traditional Field Communicator Fast Keys

Function	Traditional Fast Keys
Total Low Limit	1, 4, 2, 3, 5, 4
Total Limit Hysteresis	1, 4, 2, 3, 5, 5
Diagnostic Status Alert	1, 4, 2, 3, 6
Electronics Failure	1, 4, 2, 3, 6, --(1)
Coil Open Circuit	1, 4, 2, 3, 6, --(1)
Empty Pipe	1, 4, 2, 3, 6, --(1)
Reverse Flow	1, 4, 2, 3, 6, --(1)
Ground/Wiring Fault	1, 4, 2, 3, 6, --(1)
High Process Noise	1, 4, 2, 3, 6, --(1)
Elect Temp Out of Range	1, 4, 2, 3, 6, --(1)
Electrode Coat Limit 1	1, 4, 2, 3, 6, --(1)
Electrode Coat Limit 2	1, 4, 2, 3, 6, --(1)
Cont. Meter Verification	1, 4, 2, 3, 6, --(1)
Coil Over Current	N/A
Sensor Electrode Saturated	N/A
Coil Power Limit	N/A
Reverse Flow	1, 4, 2, 4
Totalizer Setup	1, 4, 2, 5
Totalizer Units	1, 4, 2, 5, 1
Gross Total	1, 4, 2, 5, 2
Net Total	1, 4, 2, 5, 3
Reverse Total	1, 4, 2, 5, 4
Start Totalizer	1, 4, 2, 5, 5
Stop Totalizer	1, 4, 2, 5, 6
Reset Totalizer	1, 4, 2, 5, 7
Alarm Levels	1, 4, 2, 6
Alarm Level	1, 4, 2, 6, 1
Hi Alarm	1, 4, 2, 6, 2
Hi Sat	1, 4, 2, 6, 3
Low Sat	1, 4, 2, 6, 4
Low Alarm	1, 4, 2, 6, 5
HART Output	1, 4, 2, 7
Variable Mapping	1, 4, 2, 7, 1
PV is	1, 4, 2, 7, 1, 1
SV is	1, 4, 2, 7, 1, 2
TV is	1, 4, 2, 7, 1, 3

Table 4-1. Traditional Field Communicator Fast Keys

Function	Traditional Fast Keys
QV is	1, 4, 2, 7, 1, 4
Poll Address	1, 4, 2, 7, 2
Num Req Preams	1, 4, 2, 7, 3
Num Resp Preams	1, 4, 2, 7, 4
Burst Mode	1, 4, 2, 7, 5
Burst Option	1, 4, 2, 7, 6
PV	1, 4, 2, 7, 6, --(1)
% Range/Current	1, 4, 2, 7, 6, --(1)
Process Vars/Current	1, 4, 2, 7, 6, --(1)
Dynamic Vars	1, 4, 2, 7, 6, --(1)
LOI Config	1, 4, 3
Language	1, 4, 3, 1
Flowrate Display	1, 4, 3, 2
Totalizer Display	1, 4, 3, 3
Display Lock	1, 4, 3, 4
Meter type	1, 4, 3, 5
LOI Error Mask	1, 4, 3, 6
Signal Processing	1, 4, 4
Operating Mode	1, 4, 4, 1
Man Config DSP	1, 4, 4, 2
Status	1, 4, 4, 2, 1
Samples	1, 4, 4, 2, 2
% Limit	1, 4, 4, 2, 3
Time Limit	1, 4, 4, 2, 4
Coil Drive Freq	1, 4, 4, 3
Low Flow Cutoff	1, 4, 4, 4
PV Damping	1, 4, 4, 5
Universal Trim	1, 4, 5
Device Info	1, 4, 6
Manufacturer	1, 4, 6, 1
Tag	1, 4, 6, 2
Descriptor	1, 4, 6, 3
Message	1, 4, 6, 4
Date	1, 4, 6, 5
Device ID	1, 4, 6, 6
PV Sensor S/N	1, 4, 6, 7

Table 4-1. Traditional Field Communicator Fast Keys

Function	Traditional Fast Keys
Sensor Tag	1, 4, 6, 8
Write protect	1, 4, 6, 9
Revision No.[2]	1, 4, 6, 10
Universal Rev[2]	1, 4, 6, 10, 1--
Transmitter Rev[2]	1, 4, 6, 10, 2--
Software Rev[2]	1, 4, 6, 10, 3--
Final Assembly #[2]	1, 4, 6, 10, 4--
Construction Materials[2]	1, 4, 6, 11
Flange Type[2]	1, 4, 6, 11,1--
Flange Material[2]	1, 4, 6, 11, 2--
Electrode Type[2]	1, 4, 6, 11, 3--
Electrode Material[2]	1, 4, 6, 11, 4--
Liner Material[2]	1, 4, 6, 11, 5--
Device Reset	1, 4, 7
Review	**1, 5**

1. These items are in a list format without numeric labels.
2. To access these features, you must scroll to this option in the HART Field Communicator.

Table 4-2. Device Dashboard Fast Keys

Function	Fast Keys
Overview	**1**
Device Status	1, 1
Flow Rate	1, 2
Analog Output Value	1, 3
Upper Range Value	1, 4
Lower Range Value	1, 5
Run Meter Verification	1, 6
Meter Verification Results	1, 7
Device Information	1, 8
Tag	1, 8, 1, 1
Manufacturer	1, 8, 1, 2
Model	1, 8, 1, 3
Final Assembly Number	1, 8, 1, 4
Device ID	1, 8, 1, 5
Date	1, 8, 1, 6
Description	1, 8, 1, 7

Table 4-2. Device Dashboard Fast Keys

Function	Fast Keys
Message	1, 8, 1, 8
Universal Revision	1, 8, 2, 1
Device Revision	1, 8, 2, 2
Software Revision	1, 8, 2, 3
Hardware Revision	1, 8, 2, 4
DD Revision	1, 8, 2, 5
Sensor Serial Number	1, 8, 3, 1
Sensor Tag	1, 8, 3, 2
Calibration Number	1, 8, 3, 3
Line Size	1, 8, 3, 4
Lower Sensor Limit	1, 8, 3, 5
Upper Sensor Limit	1, 8, 3, 6
Minimum Span	1, 8, 3, 7
Liner Material	1, 8, 3, 8, 1
Electrode Type	1, 8, 3, 8, 2
Electrode Material	1, 8, 3, 8, 3
Flange Type	1, 8, 3, 8, 4
Flange Material	1, 8, 3, 8, 5
Write Protect	1, 8, 4, 1
Alarm Direction	1, 8, 4, 2
Alarm Type	1, 8, 4, 3
High Alarm	1, 8, 4, 4
High Saturation	1, 8,4,5
Low Saturation	1,8, 4, 6
Low Alarm	1, 8, 4, 7
Licenses	1, 8, 5
Configure	**2**
Guided Setup	2, 1
Initial Setup	2, 1, 1
Basic Setup	2, 1, 1, 1
Configure Display	2, 1, 1, 2
Special Units	2, 1, 1, 3
Outputs	2, 1, 2
Analog Output	2, 1, 2, 1
Pulse Output	2, 1, 2, 2

Table 4-2. Device Dashboard Fast Keys

Function	Fast Keys
Discrete Input/Output	2, 1, 2, 3
Totalizer	2, 1, 2, 4
Reverse Flow	2, 1, 2, 5
Burst Mode	2, 1, 2, 7
Variable Mapping	2, 1, 2, 8
Diagnostics	2, 1, 3
Configure Basic Diagnostics	2, 1, 3, 1
Upgrade License	2, 1, 3, 2
Configure Process Diagnostics	2, 1, 3, 3
Configure Meter Verification	2, 1, 3, 4
Re-Baseline Sensor	2, 1, 3, 5
Alerts	2, 1, 4
User Alert Configuration	2, 1, 4, 1
Analog Alarm Configuration	2, 1, 4, 2
Optimize Signal Processing	2, 1, 5
Manual Setup	2, 2
Flow Units	2, 2, 1, 2
Lower Range Value	2, 2, 1, 3, 2
Upper Range Value	2, 2, 1, 3, 3
Damping	2, 2, 1, 3, 4
Calibration Number	2, 2, 1, 4, 1
Line Size	2, 2, 1, 4, 2
Language	2, 2, 1, 5, 1
Flow Display	2, 2, 1, 5, 2
Totalizer Display	2, 2, 1, 5, 3
Display Lock	2, 2, 1, 5, 4
Density	2, 2, 2, 1, 6
Pulse Mode	2, 2, 2, 2, 2
Pulse Scaling	2, 2, 2, 2, 3
Pulse Width	2, 2, 2, 2, 4
Net Total	2, 2, 2, 3, 1
Gross Total	2, 2, 2, 3, 2
Reverse Total	2, 2, 2, 3, 3
Totalizer Control	2, 2, 2, 3, 4
Totalizer Units	2, 2, 2, 3, 5

Table 4-2. Device Dashboard Fast Keys

Function	Fast Keys
Polling Address	2, 2, 3, 1, 1
Burst Option	2, 2, 3, 1, 3
Primary Variable	2, 2, 3, 2, 1
Secondary Variable	2, 2, 3, 2, 2
Third Variable	2, 2, 3, 2, 3
Fourth Variable	2, 2, 3, 2, 4
Discrete I/O 1 Direction	2, 2, 4, 1, 1
Discrete Input 1	2, 2, 4, 1, 2
Discrete Output 1	2, 2, 4, 1, 3
Discrete Output 2	2, 2, 4, 2
Flow Limit 1	2, 2, 4, 3
High Limit 1	2, 2, 4, 3,1
Low Limit 1	2, 2, 4, 3, 2
Limit 1 Control	2, 2, 4, 3, 3
Limit 1 Status Alert	2, 2, 4, 3, 4
Flow Limit 2	2, 2, 4, 4
High Limit 2	2, 2, 4, 4, 1
Low Limit 2	2, 2, 4, 4, 2
Limit 2 Control	2, 2, 4, 4, 3
Limit 2 Status Alert	2, 2, 4, 4, 4
Flow Hysteresis	2, 2, 4, 6
Totalizer Limit	2, 2, 4, 5
Totalizer High Limit	2, 2, 4, 5, 1
Totalizer Low Limit	2, 2, 4, 5, 2
Totalizer Limit Control	2, 2, 4, 5, 3
Totalizer Limit Status Alert	2, 2, 4, 5, 4
Totalizer Hysteresis	2, 2, 4, 7
Diagnostics Status Alert	2, 2, 4, 8
Enable Diagnostics	2, 2, 5, 1
License Status	2, 2, 5, 2
Empty Pipe Value	2, 2, 5, 3, 1
Empty Pipe Trigger Level	2, 2, 5, 3, 2
Empty Pipe Counts	2, 2, 5, 3, 3
Electrode Coating Value	2, 2, 5, 6, 1
Electrode Coating Level 1 Limit	2, 2, 5, 6, 2

Table 4-2. Device Dashboard Fast Keys

Function	Fast Keys
Electrode Coating Level 2 Limit	2, 2, 5, 6, 3
Electrode Coating Maximum Value	2, 2, 5, 6, 4
Reset Maximum Electrode Coating Value	2, 2, 5, 6, 5
Diagnostic Analog Alarm	2, 2, 5, 9
Recall Last Baseline	2, 2, 6, 1, 5
No Flow Limit	2, 2, 6, 3, 1
Flowing Limit	2, 2, 6, 3, 2
Empty Pipe Limit	2, 2, 6, 3, 3
Continuous Meter Verification Limit	2, 2, 6, 4, 1
Enable Continuous Meter Verification Parameters	2, 2, 6, 4, 2
Coils	2, 2, 6, 4, 2, 1
Electrodes	2, 2, 6, 4, 2, 2
Transmitter	2, 2, 6, 4, 2, 3
Analog Output (Continuous Meter Verification)	2, 2, 6, 4, 2, 4
Coil Drive Frequency	2, 2, 8, 3
Auto Zero	2, 2, 8, 4
Digital Signal Processing (DSP) Operation	2, 2, 8, 5
DSP Control	2, 2, 8, 6, 1
Number of Samples	2, 2, 8, 6, 2
Percent of Rate	2, 2, 8, 6, 3
Time Limit	2, 2, 8, 6, 4
Tag	2, 2, 9, 1, 1
Date	2, 2, 9, 3, 1
Description	2, 2, 9, 3, 2
Message	2, 2, 9, 3, 3
Sensor Serial Number	2, 2, 9, 4, 1
Sensor Tag	2, 2, 9, 4, 2
Liner Material	2, 2, 9, 4, 3, 1
Electrode Type	2, 2, 9, 4, 3, 2
Electrode Material	2, 2, 9, 4, 3, 3
Flange Type	2, 2, 9, 4, 3, 4
Flange Material	2, 2, 9, 4,3, 5
Alarm Type	2, 2, 9, 5, 2
Alert Setup	2, 3
Flow/Totalizer Limits	2, 3, 1
Diagnostics	2, 3, 2

Table 4-2. Device Dashboard Fast Keys

Function	Fast Keys
Flow Limit 1	2, 3, 3
Flow Limit 2	2, 3, 4
Totalizer Limit	2, 3, 5
Analog Alarm	2, 3, 6
Discrete Output Alert	2, 3, 7
Calibration	2, 4
Universal Trim	2, 4, 1
Service tools	**3**
Alerts	3, 1
Refresh Alerts	3, 1, 1
Active Alerts	3, 1, 2
Variables	3, 2
Flow Rate	3, 2, 1, 1
Pulse Output	3, 2, 1, 2
Analog Output	3, 2, 1, 3
Net Total	3, 2, 1, 4, 1
Gross Total	3, 2, 1, 4, 2
Reverse Total	3, 2, 1, 4, 3
Empty Pipe Value	3, 2, 2, 1
Electronics Temperature	3, 2, 2, 2
Coil Current	3, 2, 2, 3
Line Noise	3, 2, 3, 1
Electrode Coating Value	3, 2, 3, 2
5 Hz Signal-to-Noise Ratio	3, 2, 3, 3, 1
37 Hz Signal-to-Noise Ratio	3, 2, 3, 3, 2
Signal Power	3, 2, 3, 3, 3
Continuous Meter Verification	3, 2, 4
Baseline Coil Resistance	3, 2, 4, 1, 1
Baseline Coil Inductance	3, 2, 4, 1, 2
Baseline Electrode Resistance	3, 2, 4, 1, 3
Continuous Sensor Measurements	3, 2, 4, 2
Continuous Measured Coil Resistance	3, 2, 4, 2, 1
Continuous Measured Coil Inductance	3, 2, 4, 2, 2
Continuous Coil Baseline Deviation	3, 2, 4, 2, 3
Continuous Measured Electrode Resistance	3, 2, 4, 2, 4
Continuous Transmitter Measurements	3, 2, 4, 3

Table 4-2. Device Dashboard Fast Keys

Function	Fast Keys
Continuous Simulated Velocity	3, 2, 4, 3, 1
Continuous Actual Velocity	3, 2, 4, 3, 2
Continuous Velocity Deviation	3, 2, 4, 3, 3
Continuous Analog Output Measurements	3, 2, 4, 4
Continuous Expected mA Value	3, 2, 4, 4, 1
Continuous Actual mA Value	3, 2, 4, 4, 2
Continuous mA Deviation	3, 2, 4, 4, 3
Trends	3, 3
Flow Rate Trend	3, 3, 1
Empty Pipe Trend	3, 3, 2
Electronics Temperature Trend	3, 3, 3
Line Noise Trend	3, 3, 4
5 Hz Signal-to-Noise Ratio Trend	3, 3, 5
37 Hz Signal-to-Noise Ratio Trend	3, 3, 6
Coil Inductance Trend	3, 3, 7
Coil Resistance Trend	3, 3, 8
Electrode Resistance Trend	3, 3, 9
Maintenance	3, 4
Re-Baseline Sensor	3, 4, 1, 1, 4
Recall Last Baseline	3, 4, 1, 1, 5
No Flow Limit	3, 4, 1, 2, 1
Flowing Limit	3, 4, 1, 2, 2
Empty Pipe Limit	3, 4, 1, 2, 3
Manual Sensor Measurements	3, 4, 1, 3
Manual Measured Coil Resistance	3, 4, 1, 3, 1
Manual Measured Coil Inductance	3, 4, 1, 3, 2
Manual Measured Electrode Resistance	3, 4, 1, 3, 3
Run Manual Meter Verification	3, 4, 1, 4
Manual Meter Verification Results	3, 4, 1, 5
Manual Coil Circuit Test Result	3, 4, 1, 5, 1, 3
Manual Electrode Circuit Test Result	3, 4, 1, 5, 1, 6
Manual Sensor Deviation	3, 4, 1, 5, 2, 3
Manual Sensor Test Result	3, 4, 1, 5, 2, 4
Manual Simulated Velocity	3, 4,1, 5, 3,1
Manual Actual Velocity	3, 4, 1, 5, 3, 2

Table 4-2. Device Dashboard Fast Keys

Function	Fast Keys
Manual Transmitter Deviation	3, 4, 1, 5, 3, 3
Manual Transmitter Test Result	3, 4, 1, 5, 3, 4
Manual Test Conditions	3, 4, 1, 5, 4, 1
Manual Overall Test Result	3, 4, 1, 5, 4, 2
Continuous Meter Verification Limit	3, 4, 2, 2
Enable Continuous Meter Verification Parameters	3, 4, 2, 3
Coils	3, 4, 2, 3, 1
Electrodes	3, 4, 2, 3, 2
Transmitter	3, 4, 2, 3, 3
Analog Output (Continuous Meter Verification)	3, 4, 2, 3, 4
4-20 mA Verification	3, 4, 3
Run Manual 4-20 mA Verification	3, 4, 3, 1
4 mA Measurement	3, 4, 3, 2
12 mA Measurement	3, 4, 3, 3
20 mA Measurement	3, 4, 3, 4
Low Alarm Measurement	3, 4, 3, 5
High Alarm Measurement	3, 4, 3, 6
Analog D/A Trim	3, 4, 4, 5
Scaled Analog D/A Trim	3, 4, 4, 6
Electronics (Digital) Trim	3, 4, 5
Master Reset	3, 4, 6
Simulate	3, 5
Analog Loop Test	3, 5, 1, 1
Pulse Loop Test	3, 5, 2, 1

Figure 4-8. Field Communicator Traditional Menu Tree (Basic Setup and Detailed Setup)

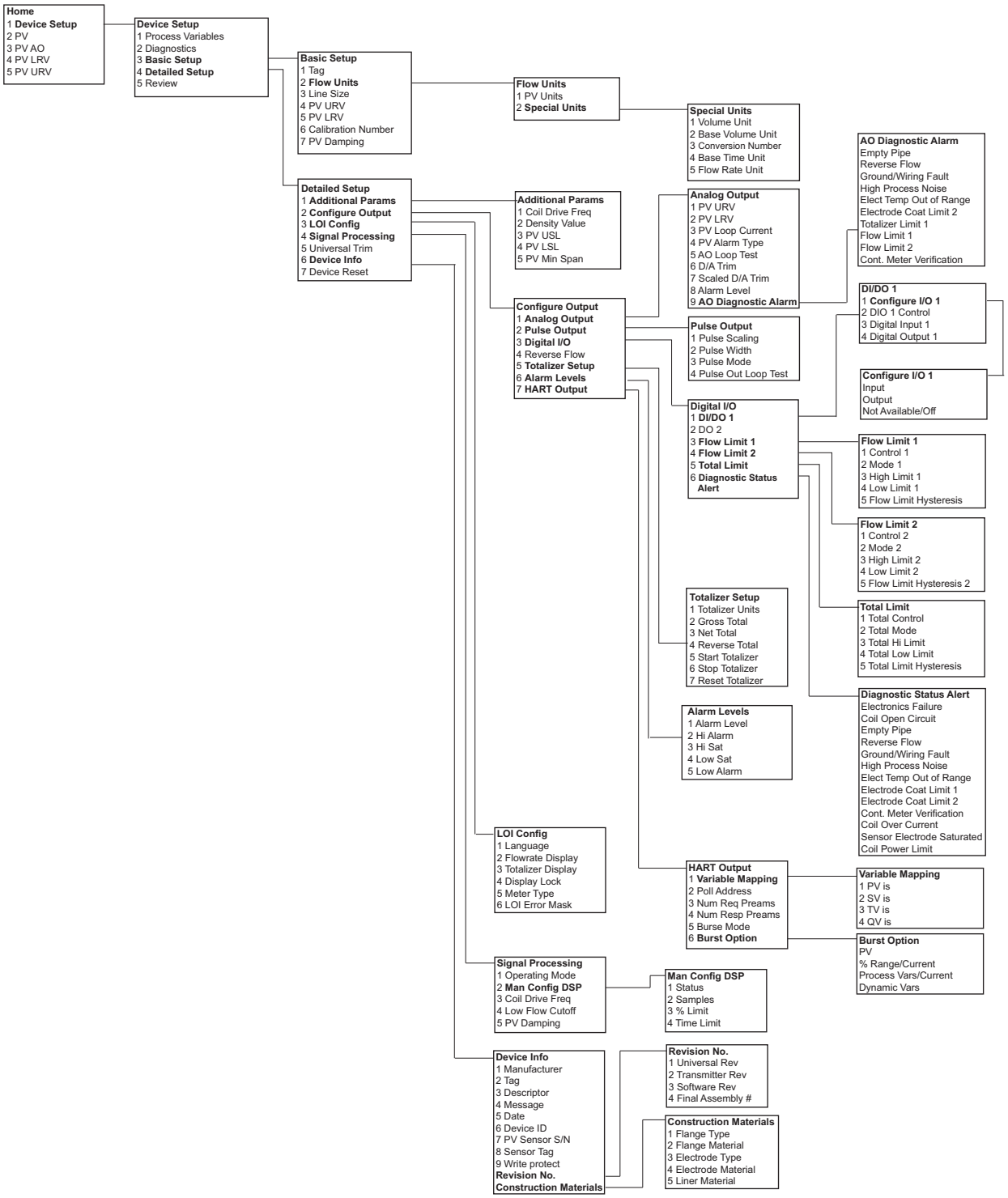


Figure 4-9. Field Communicator Traditional Menu Tree (Process Variables and Diagnostics)

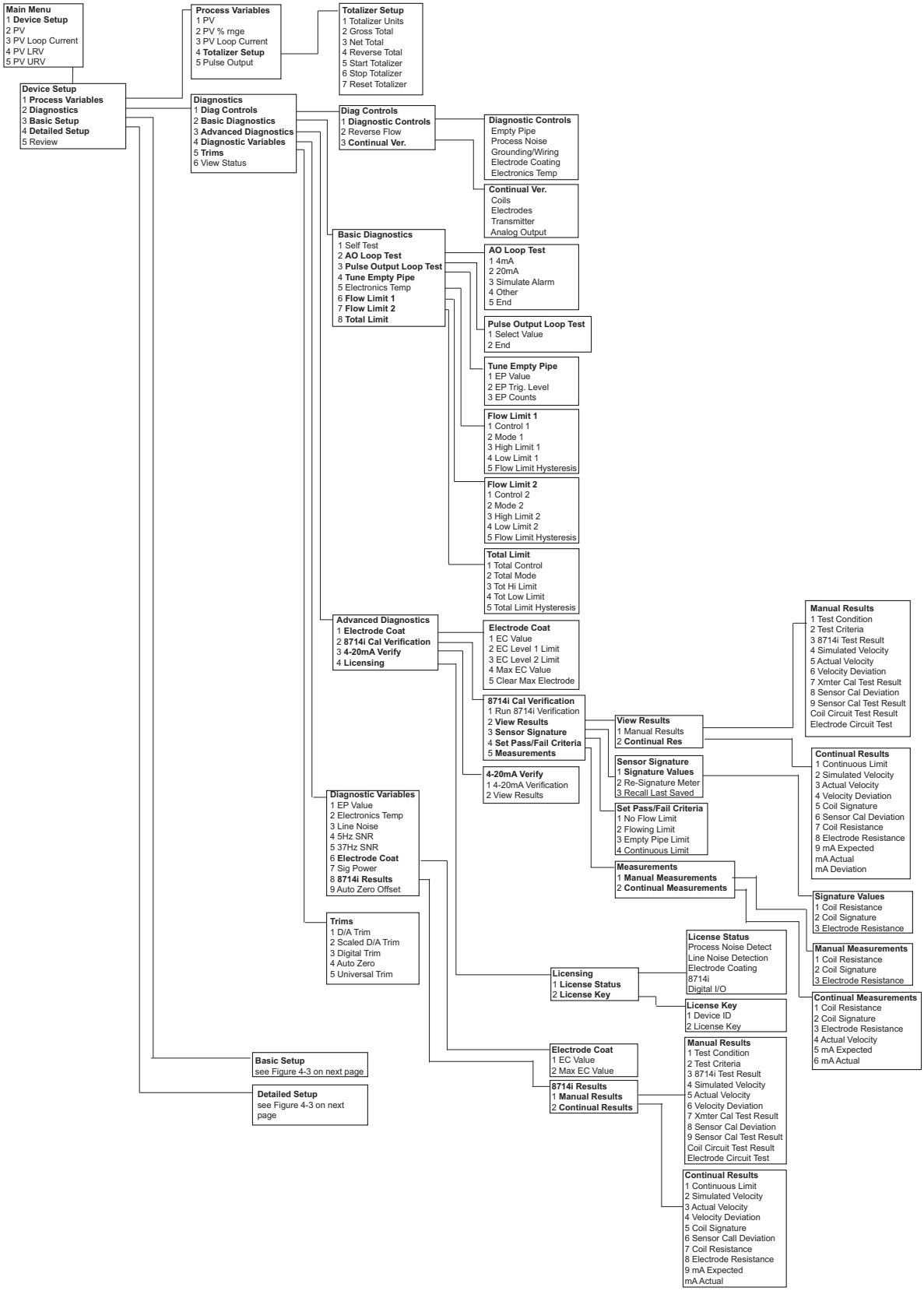


Figure 4-10. Field Communicator Dashboard Menu Tree (Overview and Configuring Guided/Manual Setup)

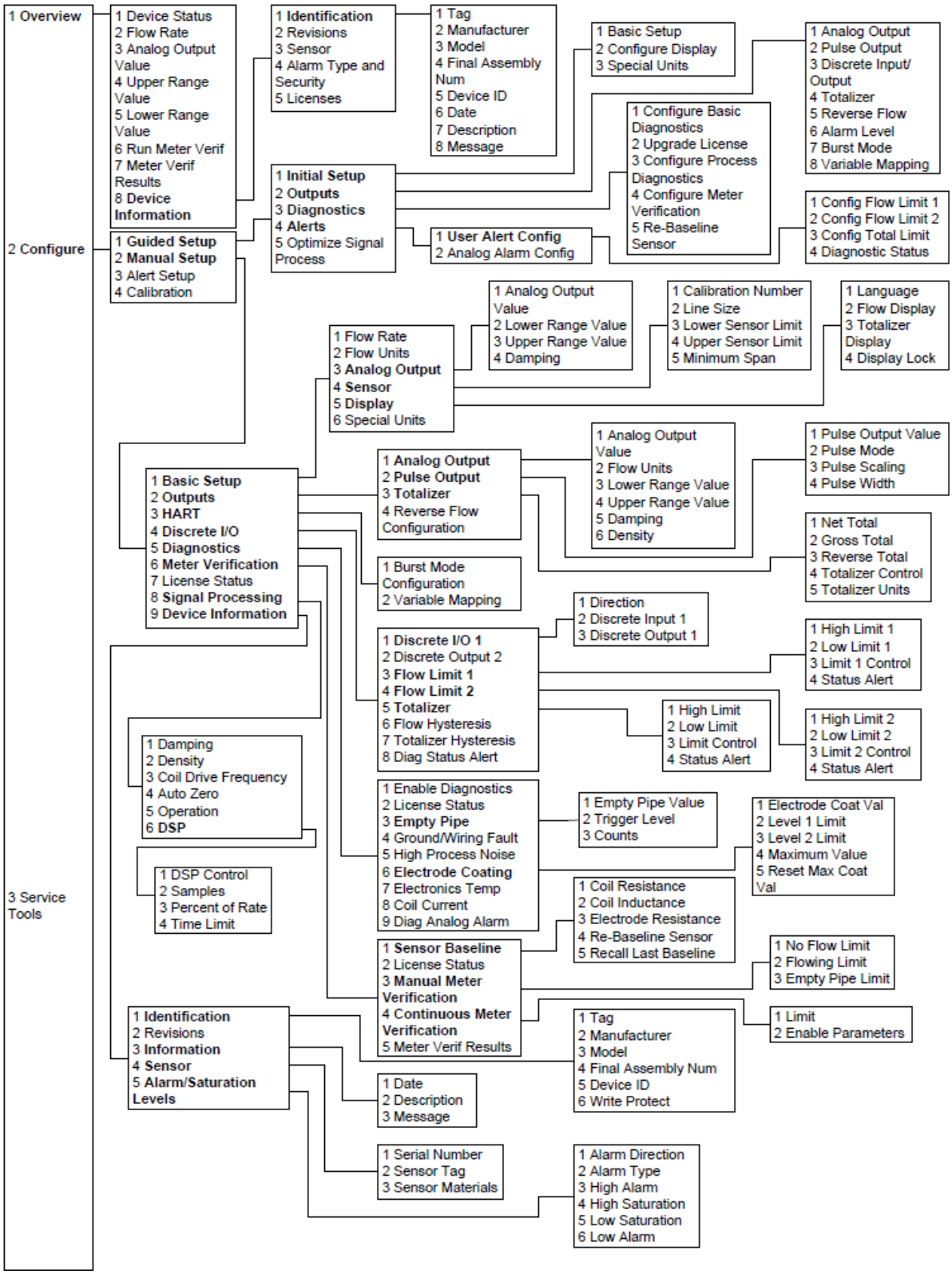
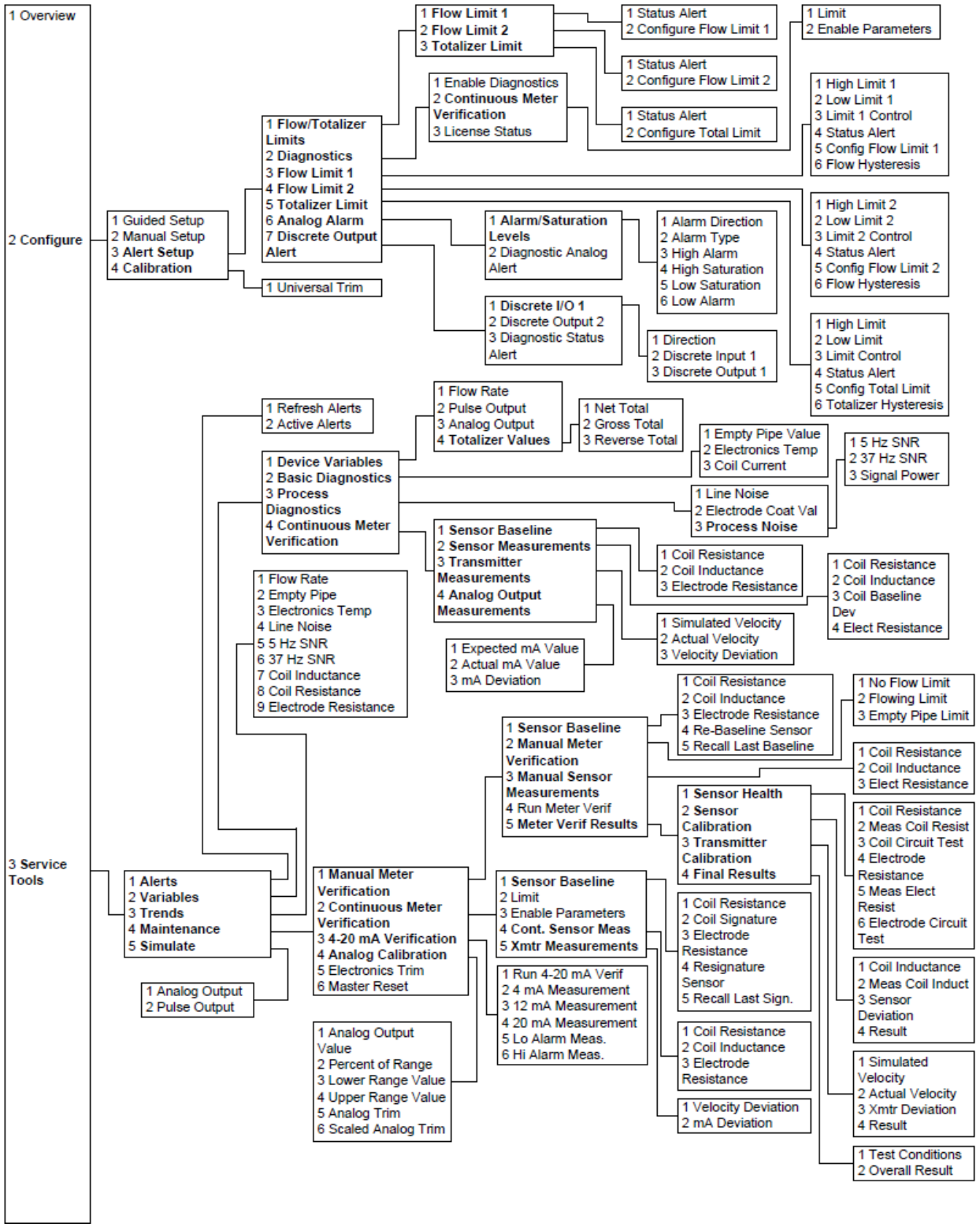


Figure 4-11. Field Communicator Dashboard Menu Tree (Configuring Alert Setup and Service Tools)



4.5 Process variables

LOI menu path	N/A
Traditional Fast Keys	1, 1
Device dashboard	1

Process variables are available through the Field Communicator or AMS software suite. These variables display flow in several ways that reflect your needs and the configuration of your flowmeter. When commissioning a flowmeter, review each process variable, its function and output, and take corrective action if necessary before using the flowmeter in a process application.

Primary variable (PV) - The actual measured flow rate of the process fluid. Use the *flow units* function to select the units for your application.

Percent of range - The process variable as a percentage of the analog output range, provides an indication where the current flow of the meter is within the configured range of the flowmeter. For example, the analog output range may be defined as 0 gal/min to 20 gal/min. If the measured flow is 10 gal/min, the percent of range is 50 percent.

Analog output - The *analog output* variable provides the analog value for the flow rate. The analog output refers to the industry standard output in the 4-20 mA range. The analog output and 4-20 mA loop can be verified using the Analog Feedback diagnostic capability internal to the transmitter (See "4-20 mA loop verification" on page 123).

Pulse output - The *pulse output* variable provides the pulse value in terms of a frequency for the flow rate.

4.5.1 PV - Primary variable

LOI menu path	Field Mount: Home screen if configured to display flow Wall Mount: FLOW RATE
Traditional Fast Keys	1, 1, 1
Device dashboard	1, 2

The *primary variable* shows the current measured flow rate. This value determines the analog output from the transmitter.

4.5.2 PV - Percent of range

LOI menu path	Field Mount: Home screen if configured to display percent span Wall Mount: N/A
Traditional Fast Keys	1, 1, 2
Device dashboard	3, 4, 4, 2

The *PV% range* shows where in the flow range the current flow value is as a percentage of the configured span.

4.5.3 PV - Analog output

LOI menu path	N/A
Traditional Fast Keys	1, 1, 3
Device dashboard	1,3

The *PV analog output* displays the mA output of the transmitter corresponding to the measured flow rate.

4.5.4 Pulse output

LOI menu path	N/A
Traditional Fast Keys	1, 1, 5
Device dashboard	3, 2, 1, 2

The *pulse output* displays the value of the pulse signal.

Section 5 Advanced Configuration Functionality

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Additional parameters ..... page 106
Configure special units ..... page 110

5.1 Introduction

This section contains information for advanced configuration parameters.

The software configuration settings for the Rosemount™ 8750W Magnetic Flowmeter can be accessed through a HART®-based communicator, Local Operator Interface (LOI), AMS™ Device Manager, ProLink™ III, or through a control system. Before operating the Rosemount 8750W in an actual installation, you should review all of the factory set configuration data to ensure that they reflect the current application.

5.2 Configure outputs

LOI menu path	Field Mount: Detailed Setup, Output Config Wall Mount: N/A
Traditional Fast Keys	1, 4, 2
Device dashboard	2, 2, 2

The *configure outputs* functionality is used to configure advanced features that control the analog, pulse, auxiliary, and totalizer outputs of the transmitter.

5.2.1 Analog output

LOI menu path	Field Mount: Detailed Setup, Output Config, Analog Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 1
Device dashboard	2, 2, 2, 1

The *analog output* function is used to configure all of the features of the 4-20 mA output.

Upper range value

LOI menu path	Field Mount: Detailed Setup, Output Config, Analog, PV URV Wall Mount: ANALOG OUTPUT RANGE
Traditional Fast Keys	1, 4, 2, 1
Device dashboard	2, 2, 2, 1, 4

The *upper range value* (URV) sets the 20 mA point for the *analog output*. This value is typically set to full-scale flow. The units that appear will be the same as those selected under the units parameter. The URV may be set between –39.3 ft/s to 39.3 ft/s (–12 m/s to 12 m/s) or the equivalent range based on the selected *flow units*. There must be at least 1 ft/s (0.3 m/s) span or equivalent between the URV and LRV.

Lower range value

LOI menu path	Field Mount: Detailed Setup, Output Config, Analog, PV LRV Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 1
Device dashboard	2, 2, 2, 1, 3

The *lower range value* (LRV) sets the 4 mA point for the analog output. This value is typically set to zero flow. The units that appear will be the same as those selected under the units parameter. The LRV may be set between –39.3 ft/s to 39.3 ft/s (–12 m/s to 12 m/s) or the equivalent range based on the selected *flow units*. There must be at least 1 ft/s (0.3 m/s) span or equivalent between the URV and LRV.

Alarm type

LOI menu path	Field Mount: Detailed Setup, Output Config, Analog, Alarm Type Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 1, 4
Device dashboard	2, 2, 9, 5, 1

The analog output *alarm type* displays the position of the alarm switch on the electronics board. There are two available positions for this switch:

- High
- Low

Alarm level

LOI menu path	Field Mount: Detailed Setup, Output Config, Analog, Alarm Level Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 1, 8 or 1, 4, 2, 6
Device dashboard	2, 2, 9, 5, 2

The *alarm level* configuration will drive the transmitter to preset values if an alarm occurs. There are two options:

- Rosemount Alarm and Saturation Values (see table Table 5-1 for specific values)
- NAMUR-Compliant Alarm and Saturation Values (see Table 5-2 for specific values)

Table 5-1. Rosemount Values

Level	4-20 mA saturation	4-20 mA alarm
Low	3.9 mA	3.75 mA
High	20.8 mA	22.5 mA

Table 5-2. NAMUR Values

Level	4-20 mA saturation	4-20 mA alarm
Low	3.8 mA	3.5 mA
High	20.5 mA	22.6 mA

AO diagnostic alarm

LOI menu path	Field Mount: Detailed Setup, Output Config, Analog, AO Diag Alarm Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 1, 9
Device dashboard	2, 2, 5, 9

There are diagnostics that, when under active conditions, do not drive the analog output to alarm level. The *AO diagnostic alarm* menu enables selection of these diagnostics to be associated with an analog alarm. If any of the selected diagnostics are active, it will cause the analog output to go to the configured alarm level. For a list of diagnostic alarms that can be configured to drive an analog alarm, see Table 5-3.

Table 5-3. Analog Alarm Diagnostic Options

Diagnostic	LOI menu path	Fast Keys	Description
Empty Pipe (1)	Detailed Setup, Output Config, Analog, AO Diag Alarm, Empty Pipe	1, 4, 2, 1, 9, 1	Drive to an alarm state when empty pipe is detected.
Reverse Flow	Detailed Setup, Output Config, Analog, AO Diag Alarm, Reverse Flow	1, 4, 2, 1, 9, 2	Drive to an alarm state when reverse flow is detected.

Table 5-3. Analog Alarm Diagnostic Options

Diagnostic	LOI menu path	Fast Keys	Description
Grounding/Wiring Fault[1]	Detailed Setup, Output Config, Analog, AO Diag Alarm, Ground/Wiring	1, 4, 2, 1, 9, 3	Drive to an alarm state when grounding or wiring fault is detected.
High Process Noise[1]	Detailed Setup, Output Config, Analog, AO Diag Alarm, Process Noise	1, 4, 2, 1, 9, 4	Drive to an alarm state when the transmitter detects high levels of process noise.
Electronics Temperature Out of Range[1]	Detailed Setup, Output Config, Analog, AO Diag Alarm, Elect Temp	1, 4, 2, 1, 9, 5	Drive to an alarm state when the temperature of the electronics exceeds allowable limits
Electrode Coating Limit 2[1][2]	Detailed Setup, Output Config, Analog, AO Diag Alarm, Elec Coating	1, 4, 2, 1, 9, 6	Drive to an alarm state when electrode coating reaches a point where it impacts the flow measurement
Totalizer Limit 1	Detailed Setup, Output Config, Analog, AO Diag Alarm, Total Limit	1, 4, 2, 1, 9, 7	Drive to an alarm state when the totalizer value exceeds the parameters set in the totalizer limit configuration (see page 5-x for more details on this functionality)
Flow Limit 1	Detailed Setup, Output Config, Analog, AO Diag Alarm, Flow Limit 1	1, 4, 2, 1, 9, 8	Drive to an alarm state when the flow rate exceeds the parameters set in the flow limit 1 configuration (see page 5-x for more details on this functionality)
Flow Limit 2	Detailed Setup, Output Config, Analog, AO Diag Alarm, Flow Limit 2	1, 4, 2, 1, 9, 9	Drive to an alarm state when the flow rate exceeds the parameters set in the flow limit 2 configuration (see page 5-x for more details on this functionality)
Continuous Meter Verification[1][2]	Detailed Setup, Output Config, Analog, AO Diag Alarm, Cont Meter Ver	1, 4, 2, 1, 9, --[3]	Drive to an alarm state when the continuous meter verification diagnostic detects a failure of one of the tests

1. See Section 6 for more details on each of the diagnostics.
2. Only available on the Field Mount Transmitter.
3. To access these features, you must scroll to this option in the HART Field Communicator.

5.2.2 Pulse output

LOI menu path	Field Mount: Detailed Setup, Output Config, Pulse Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 2
Device dashboard	2, 2, 2, 2

Under this function the *pulse output* of the Rosemount 8750W can be configured.

Pulse scaling

LOI menu path	Field Mount: Detailed Setup, Output Config, Pulse, Pulse Scaling Wall Mount: PULSE OUTPUT SCALING
Traditional Fast Keys	1, 4, 2, 2, 1
Device dashboard	2, 2, 2, 2, 3

Transmitter may be commanded to supply a specified frequency between 1 pulse/day at 39.37 ft/sec (12 m/s) to 10,000 Hz at 1 ft/sec (0.3 m/s).

Note
Line size, special units, and density must be selected prior to configuration of the *pulse scaling* factor.

The pulse output scaling equates one transistor switch closure pulse to a selectable number of volume units. The volume unit used for scaling pulse output is taken from the numerator of the configured flow units. For example, if gal/min had been chosen when selecting the *flow unit*, the volume unit displayed would be gallons.

Note
The pulse output scaling is designed to operate between 0 and 10,000 Hz. The minimum conversion factor value is found by dividing the minimum span (in units of volume per second) by 10,000Hz.

Note
The maximum *pulse scaling* frequency for transmitters with an intrinsically safe output (output option code B) is 5000 Hz.

When selecting pulse output scaling, the maximum pulse rate is 10,000Hz. With the 110 percent over range capability, the absolute limit is 11,000Hz. For example, if you want the Rosemount 8750W to pulse every time 0.01 gallons pass through the sensor, and the flow rate is 10,000 gal/min, you will exceed the 10,000 Hz full-scale limit:

$$\frac{10,000\,\text{gal}}{1\,\text{min}} \times \frac{1\,\text{min}}{60\,\text{s}} \times \frac{1\,\text{pulse}}{0.01\,\text{gal}} = 16,666\,\text{Hz}$$

The best choice for this parameter depends upon the required resolution, the number of digits in the totalizer, the extent of range required, and the maximum frequency limit of the external counter.

Pulse width

LOI menu path	Field Mount: Detailed Setup, Output Config, Pulse, Pulse Width Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 2, 2
Device dashboard	2, 2, 2, 2, 4

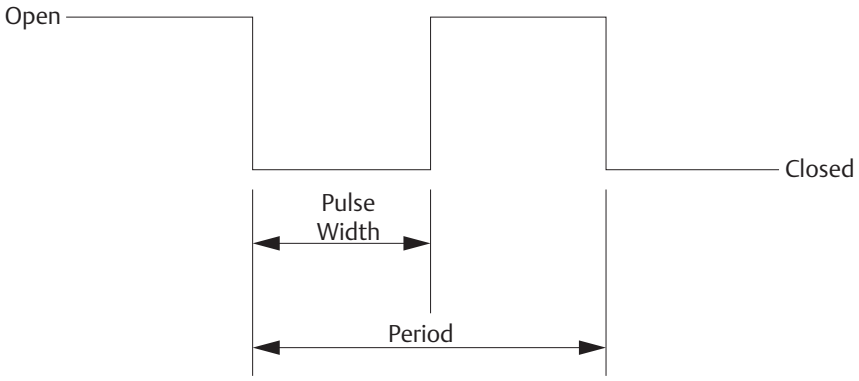
The factory default *pulse width* is 0.5 ms.

The width, or duration, of the pulse can be adjusted to match the requirements of different counters or controllers (see Figure 5-1). These are typically lower frequency applications (< 1000 Hz). The transmitter will accept values from 0.1 ms to 650 ms.

For frequencies higher than 1000 Hz, it is recommended to set the pulse mode to 50% duty cycle by setting the *pulse mode* to *frequency output*.

The *pulse width* will limit the maximum frequency output, If the *pulse width* is set too wide (more than 1/2 the period of the pulse) the transmitter will limit the pulse output. See example below.

Figure 5-1. Pulse Output



Example

If pulse width is set to 100 ms, the maximum output is 5 Hz; for a pulse width of 0.5 ms, the maximum output would be 1000 Hz (at the maximum frequency output there is a 50% duty cycle).

Pulse width	Minimum period (50% duty cycle)	Maximum frequency
100 ms	200 ms	$\frac{1\,\text{cycle}}{200\ \text{ms}} = 5\ \text{Hz}$
0.5 ms	1.0 ms	$\frac{1\,\text{cycle}}{1.0\ \text{ms}} = 1000\ \text{Hz}$

To achieve the greatest maximum frequency output, set the pulse width to the lowest value that is consistent with the requirements of the pulse output power source, pulse driven external totalizer, or other peripheral equipment.

Example

The maximum flow rate is 10,000 gpm. Set the pulse output scaling such that the transmitter outputs 10,000Hz at 10,000 gpm.

$$\text{Pulse Scaling} = \frac{\text{Flow Rate (gpm)}}{\left(60\frac{\text{s}}{\text{min}}\right) \times (\text{frequency})}$$

$$\text{Pulse Scaling} = \frac{10,000(\text{gpm})}{\left(60\frac{\text{s}}{\text{min}}\right) \times 10,000\text{Hz}}$$

$$\text{Pulse Scaling} = 0.0167\ \frac{\text{gal}}{\text{pulse}}$$

1 pulse = 0.0167 gal

Note
Changes to *pulse width* are only required when there is a minimum pulse width required for external counters, relays, etc.

Example

The external counter is ranged for 350 gpm and pulse is set for one gallon. Assuming the *pulse width* is 0.5 ms, the maximum frequency output is 5.833Hz.

$$\text{Frequency} = \frac{\text{Flow Rate (gpm)}}{\left(60\frac{\text{s}}{\text{min}}\right) \times \left(\text{pulse scaling}\ \frac{\text{gal}}{\text{pulse}}\right)}$$

$$\text{Frequency} = \frac{350\ \text{gpm}}{\left(60\frac{\text{s}}{\text{min}}\right) \times \left(1\frac{\text{gal}}{\text{pulse}}\right)}$$

Frequency = 5. 833 Hz

Example

The upper range value (20 mA) is 3000 gpm. To obtain the highest resolution of the pulse output, 10,000 Hz is scaled to the full scale analog reading.

$$\text{Pulse Scaling} = \frac{\text{Flow Rate(gpm)}}{\left(60\frac{\text{s}}{\text{min}}\right) \times (\text{frequency})}$$

$$\text{Pulse Scaling} = \frac{3,000(\text{gpm})}{\left(60\frac{\text{s}}{\text{min}}\right) \times 10,000\text{Hz}}$$

$$\text{Pulse Scaling} = 0.005\ \frac{\text{gal}}{\text{pulse}}$$

1 pulse = 0.005 gal

Pulse mode[1]

LOI menu path	Field Mount: Detailed Setup, Output Config, Pulse, Pulse Mode Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 2, 3
Device dashboard	2, 2, 2, 2, 2

The *pulse mode* configures the frequency output of the pulse. It can be set to either 50% duty cycle, or fixed. There are two options that *pulse mode* can be configured to:

- Pulse Output (user defines a fixed pulse width)
- Frequency Output (pulse width automatically set to 50% duty cycle)

To use *pulse width* settings, *pulse mode* must be set to *pulse output*.

5.2.3 Totalizer

The *totalizer* provides the total amount of fluid that has passed through the meter. There are three available totalizers:

- Net total - increments with forward flow and decrements with reverse flow (*reverse flow* must be enabled). Can be reset to zero using the net total reset function.
- Gross/forward total - will only increment with forward flow
- Reverse total - will only increment with reverse flow if *reverse flow* is enabled

The maximum value for the totalizers is based on 4, 294, 967, 296 (2^{32}) ft. or corresponding unit equivalent. If a totalizer reaches this value, it will automatically reset to zero and then continue counting.

The gross/forward and reverse totalizers can be reset by manually changing the *line size*.

Totalizer units

LOI menu path	Field Mount: Detailed Setup, Output Config, Totalizer, Totalizer Units Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 5, 1
Device dashboard	2, 2, 2, 3, 5

Totalizer units is used to configure the units in which the totalized value will be displayed. These units are independent of the flow units. *Totalizer units* are updated to match the *flow units* whenever the *flow units* are written.

1. *Pulse mode is only available on Field Mount Transmitter. Wall Mount Transmitter is set to Pulse Output and is not configurable.*

Totalizer display

LOI menu path	Field Mount: Detailed Setup, Output Config, Totalizer Setup, Total Display Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 3, 3
Device dashboard	2, 2, 1, 5, 3

The totalizer screen can be configured to display the net and gross totals or the forward and reverse totals.

Note
Gross and forward totals are the same value.

Start totalizer

LOI menu path	Field Mount: On totalizer screen, press **"E"** Wall Mount: START/STOP
Traditional Fast Keys	1, 4, 2, 5, 5
Device dashboard	2, 2, 2, 3, 4

Start totalizer starts the totalizer counting from its current value.

Stop totalizer

LOI menu path	Field Mount: On totalizer screen, press **"E"** Wall Mount: START/STOP
Traditional Fast Keys	1, 4, 2, 5, 6
Device dashboard	2, 2, 2, 3, 4

Stop totalizer interrupts the totalizer count until it is restarted again. This feature is often used during pipe cleaning or other maintenance operations.

Reset totalizer

LOI menu path	Field Mount: On totalizer screen, press **right arrow** (totalizer must be stopped) Wall Mount: READ/RESET
Traditional Fast Keys	1, 4, 2, 5, 7
Device dashboard	2, 2, 2, 3, 4

Reset totalizer resets the net totalizer value to zero. The totalizer must be stopped before resetting.

Note
The totalizer value is stored in the non-volatile memory of the electronics every three seconds. If power to the transmitter is interrupted, the totalizer value will start at the last saved value when power is reapplied.

5.2.4 Discrete input/output

This configuration option is only available if the auxiliary option suite (option code AX) was ordered. The auxiliary output suite provides two channels for control. The *discrete input* can provide positive zero return (PZR) and net totalizer reset. The *discrete output* control function can be configured to drive an external signal to indicate zero flow, reverse flow, empty pipe, diagnostic status, flow limit, or transmitter status. A complete list and description of the available auxiliary functions is provided below.

Digital input options (Channel 1 only)

- PZR (Positive Zero Return) - When conditions are met to activate the input, the transmitter will force the output to zero flow.
- Net Total Reset - When conditions are met to activate the input, the transmitter will reset the *net total* value to zero.

Digital output options

- Reverse Flow - The output will activate when the transmitter detects a reverse flow condition.
- Zero Flow - The output will activate when a no flow condition is detected.
- Transmitter Fault - The output will activate when a transmitter fault condition is detected.
- Empty Pipe - The output will activate when the transmitter detects an empty pipe condition.
- Flow Limit 1 - The output will activate when the transmitter measures a flow rate that meets the conditions established for the *flow limit 1* alert.
- Flow Limit 2 - The output will activate when the transmitter measures a flow rate that meets the conditions established for the *flow limit 2* alert.
- Diagnostic Status Alert - The output will activate when the transmitter detects a condition that meets the configured criteria of the *diagnostic status alert*.
- Total Limit - The output will activate when the transmitter net total value meets the conditions established for the *total limit alert*.

Channel 1

Channel 1 can be configured as either a discrete input (DI) or as a discrete output (DO).

DI/O 1 control

LOI menu path	Field Mount: Detailed Setup, Output Config, DI/DO Config, DI/O 1, DI/O Control Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 1, 1
Device dashboard	2, 2, 4, 1, 1

This parameter configures the auxiliary output channel 1. It controls whether channel 1 will be a discrete input or discrete output on terminals 5(-) and 6(+). Note that the transmitter must have been ordered with the auxiliary output suite (option code AX) to have access to this functionality.

Discrete input 1

LOI menu path	Field Mount: Detailed Setup, Output Config, DI/DO Config, DI/O 1, DI 1 Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 1, 1, 3
Device dashboard	2, 2, 4, 1, 2

This parameter displays the configuration for channel 1 when used as a discrete input. Refer to the list above for available discrete input functions.

Discrete output 1

LOI menu path	Field Mount: Detailed Setup, Output Config, DI/DO Config, DI/O 1, DO 1 Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 1, 2, 4
Device dashboard	2, 2, 4, 1, 3

This parameter displays the configuration for channel 1 when used as a discrete output. Refer to the list above for available discrete output functions.

Channel 2

Channel 2 is only available as discrete output only.

Discrete output 2

LOI menu path	Field Mount: Detailed Setup, Output Config, DI/DO Config, DO 2 Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 2
Device dashboard	2, 2, 4, 2

This parameter displays the configuration for channel 2. Refer to the list above for available discrete output functions.

Flow limit (1 and 2)

	Flow 1	Flow 2
LOI menu path	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 1 Wall Mount: AUX. FUNCTION	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 2 Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 3	1, 4, 2, 3, 4
Device dashboard	2, 2, 4, 3	2, 2, 4, 4

There are two configurable flow limits. Configure the parameters that will determine the criteria for activation of a HART alert if the measured flow rate falls within a set of configured criteria. This functionality can be used for operating simple batching operations or generating alerts when certain flow conditions are met. This parameter can be configured as a discrete output if the transmitter was ordered with auxiliary outputs enabled (option code AX). If a discrete output is configured for flow limit, the discrete output will activate when the conditions defined under mode configuration are met. See "Mode" on page 97.

Control

	Flow 1	Flow 2
LOI menu path	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 1, Control 1 Wall Mount: AUX. FUNCTION	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 2, Control 2 Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 3, 1	1, 4, 2, 3, 4, 1
Device dashboard	2, 2, 4, 3, 4	2, 2, 4, 4, 4

This parameter turns the flow limit HART alert **ON** or **OFF**.

ON - The transmitter will generate a HART alert when the defined conditions are met. If a discrete output is configured for flow limit, the discrete output will activate when the conditions for *mode* are met.

OFF - The transmitter will not generate a HART alert for the flow limit.

Mode

	Flow 1	Flow 2
LOI menu path	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 1, Mode 1 Wall Mount: AUX. FUNCTION	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 2, Mode 2 Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 3, 2	1, 4, 2, 3, 4, 2
Device dashboard	2, 2, 4, 3, 3	2, 2, 4, 4, 3

The *mode* parameter sets the conditions under which the flow limit HART alert will activate. High and low limits exist for each channel and can be configured independently.

> High limit - The HART alert will activate when the measured flow rate exceeds the *high limit* set point.

< Low limit - The HART alert will activate when the measured flow rate falls below the *low limit* set point.

In range - The HART alert will activate when the measured flow rate is between the *high limit* and *low limit* set points.

Out of range - The HART alert will activate when the measured flow rate exceeds the *high limit* set point or falls below the *low limit* set point.

High limit

	Flow 1	Flow 2
LOI menu path	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 1, High Limit 1 Wall Mount: AUX. FUNCTION	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 2, High Limit 2 Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 3, 3	1, 4, 2, 3, 4, 3
Device dashboard	2, 2, 4, 3, 1	2, 2, 4, 4, 1

Set the flow rate value that corresponds to the *high limit* set point for the flow limit alert.

Low limit

	Flow 1	Flow 2
LOI menu path	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 1, Low Limit 1 Wall Mount: AUX. FUNCTION	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 2, Low Limit 2 Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 3, 4	1, 4, 2, 3, 4, 4
Device dashboard	2, 2, 4, 3, 2	2, 2, 4, 4, 2

Set the flow rate value that corresponds to the *low limit* set point for the flow limit alert.

Flow limit hysteresis

	Flow 1	Flow 2
LOI menu path	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 1, Hysteresis Wall Mount: AUX. FUNCTION	Field Mount: Detailed Setup, Output Config, DI/DO Config, Flow Limit 2, Hysteresis Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 3, 5	1, 4, 2, 3, 4, 5
Device dashboard	2, 2, 4, 6	

Set the hysteresis band for the flow limit to determine how quickly the transmitter comes out of alert status. The *hysteresis* value is used for both *flow limit 1* and *flow limit* 2. Changing this parameter under the configuration parameters for one channel will cause it to also change in the other channel.

Total limit

LOI menu path	Field Mount: Detailed Setup, Output Config, Totalizer, Total Limit Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 5
Device dashboard	2, 2, 4, 5

Configure the parameters that will determine the criteria for activating a HART alert if the measured net total falls within a set of configured criteria. This functionality can be used for operating simple batching operations or generating alerts when certain localized values are met. This parameter can be configured as a discrete output if the transmitter was ordered with auxiliary outputs enabled (option code AX). If a digital output is configured for *total limit*, the digital output will activate when the conditions for *total mode* are met.

Total control

LOI menu path	Field Mount: Detailed Setup, Output Config, Totalizer, Total Limit, Total Control Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 5, 1
Device dashboard	2, 2, 4, 5, 4

This parameter turns the total limit HART alert **ON** or **OFF**.

ON - The transmitter will generate a HART alert when the defined conditions are met.

OFF - The transmitter will not generate a HART alert for the total limit.

Total mode

LOI menu path	Field Mount: Detailed Setup, Output Config, Totalizer, Total Limit, Total Mode Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 5, 2
Device dashboard	2, 2, 4, 5, 3

The *total mode* parameter sets the conditions under which the total limit HART alert will activate. High and low limits exist for each channel and can be configured independently.

> High limit - The HART alert will activate when the totalizer value exceeds the *high limit* set point.

< Low limit - The HART alert will activate when the totalizer value falls below the *low limit* set point.

In range - The HART alert will activate when the totalizer value is between the *high limit* and *low limit* set points.

Out of range - The HART alert will activate when the totalizer value exceeds the *high limit* set point or falls below the *low limit* set point.

Total high limit

LOI menu path	Field Mount: Detailed Setup, Output Config, Totalizer, Total Limit, Tot Hi Limit Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 5, 3
Device dashboard	2, 2, 4, 5, 1

Set the net total value that corresponds to the *high limit* set point for the total high limit alert.

Total low limit

LOI menu path	Field Mount: Detailed Setup, Output Config, Totalizer, Total Limit, Tot Low Limit Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 5, 4
Device dashboard	2, 2, 4, 5, 2

Set the net total value that corresponds to the *low limit* set point for the total low limit alert.

Total limit hysteresis

LOI menu path	Field Mount: Detailed Setup, Output Config, Totalizer, Total Limit, Hysteresis Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 5, 5
Device dashboard	2,2, 4, 7

Set the hysteresis band for the total limit to determine how quickly the transmitter comes out of alert status.

Diagnostic status alert

LOI menu path	Field Mount: Detailed Setup, Output Config, Totalizer, Diagnostic Status Alert Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 2, 3, 6
Device dashboard	2, 2, 4, 8

The *diagnostic status alert* is used to turn on or off the diagnostics that will cause this alert to activate.

ON - The *diagnostic status alert* will activate when a transmitter detects a diagnostic designated as ON.

OFF - The *diagnostic status alert* will not activate when diagnostics designated as OFF are detected.

Alerts for the following diagnostics can be turned ON or OFF:

- Electronics Failure
- Coil Open Circuit
- Empty Pipe
- Reverse Flow
- Ground/Wiring Fault
- High Process Noise
- Electronics Temperature Out of Range
- Electrode Coat Limit 1(1)
- Electrode Coat Limit 2(1)
- Continuous Meter Verification(1)

1. Only available on Field Mount Transmitter.

5.3 Configure HART

The Rosemount 8750W has four HART variables available as outputs. The variables can be configured for dynamic readings including flow, total, and diagnostic values. The HART output can also be configured for burst mode or multi-drop communication if required.

5.3.1 Variable mapping

LOI menu path	Field Mount: Detailed Setup, Output Config, Hart, Variable Map Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 7, 1
Device dashboard	2, 2, 3, 2

Variable mapping allows configuration of the variables that are mapped to the secondary, tertiary and quaternary variables. The *primary variable* is fixed to output flow and cannot be configured.

Primary variable (PV)

LOI menu path	Field Mount: Detailed Setup, Output Config, Hart, Variable Map, PV Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 7, 1, 1
Device dashboard	2, 2, 3, 2, 1

The *primary variable* is configured for flow. This variable is fixed and cannot be configured. The *primary variable* is tied to the analog output.

Secondary variable (SV)

LOI menu path	Field Mount: Detailed Setup, Output Config, Hart, Variable Map, SV Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 7, 1, 2
Device dashboard	2, 2, 3, 2, 2

The *secondary variable* maps the second variable of the transmitter. This variable is a HART only variable and can be read from the HART signal with a HART enabled input card, or can be burst for use with a HART Tri-Loop™ to convert the HART signal to an analog output. Options available for mapping to this variable can be found in Table 5-4. The secondary variable for the Wall Mount Transmitter is set to pulse output and is not configurable.

Tertiary variable (TV)

LOI menu path	Field Mount: Detailed Setup, Output Config, Hart, Variable Map, TV Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 7, 1, 3
Device dashboard	2, 2, 3, 2, 3

The *tertiary variable* maps the third variable of the transmitter. This variable is a HART only variable and can be read from the HART signal with a HART enabled input card, or can be burst for use with a HART Tri-Loop to convert the HART signal to an analog output. Options available for mapping to this variable can be found in Table 5-4 and Table 5-5.

Quaternary variable (QV)

LOI menu path	Field Mount: Detailed Setup, Output Config, Hart, Variable Map, QV Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 7, 1, 4
Device dashboard	2, 2, 3, 2, 4

The *quaternary variable* maps the fourth variable of the transmitter. This variable is a HART only variable and can be read from the HART signal with a HART enabled input card, or can be burst for use with a HART Tri-Loop to convert the HART signal to an analog output. Options available for mapping to this variable can be found in Table 5-4 and Table 5-5.

Table 5-4. Field Mount Transmitter Available Variables

Pulse Output	Empty Pipe Value
Gross Total – TV Default	Transmitter Velocity Deviation
Net Total – SV Default	Electrode Coating Value
Reverse Total – QV Default	Electrode Resistance Value
Electronics Temp	Coil Resistance Value
Line Noise Value	Sensor Calibration Deviation Value
5 Hz Signal to Noise Value	mA Loop Deviation Value
37 Hz Signal to Noise Value	

Table 5-5. Wall Mount Transmitter Available Variables

Gross Total	Reverse Total
Net Total	Electronics Temp

5.3.2 Poll address

LOI menu path	Field Mount: Detailed Setup, Output Config, Hart Output, Poll Address Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 7, 2
Device dashboard	2, 2, 3, 1, 1

Poll address enables the poll address to be set for use in a multi-drop configuration. The *poll address* is used to identify each meter on the multi-drop line. Follow the on-screen instructions to set the poll address at a number from 1 to 15. To set or change the flowmeter address, establish communication with the selected Rosemount 8750W in the loop.

Note
The Rosemount 8750W poll address is set to zero at the factory, allowing standard operation in a point-to-point manner with a 4-20 mA output signal. To activate multi-drop communication, the transmitter poll address must be changed to a number between 1 and 15. This change deactivates the analog output, sets the output value to 4 mA, and disables the failure mode alarm signal.

5.3.3 Burst mode

LOI menu path	Field Mount: Detailed Setup, Output Config, HART, Burst Mode Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 7, 5
Device dashboard	2, 2, 3, 1, 2

The Rosemount 8750W includes a *burst mode* function that can be enabled to broadcast the primary variable or all dynamic variables approximately three to four times per second. *Burst mode* is a specialized function used in very specific applications. The *burst mode* function enables you to select the variables that are broadcast while in the burst mode.

Burst mode enables you to set the burst mode as **OFF** or **ON**:

- **OFF** - Turns *burst mode* off; no data are broadcast over the loop
- **ON** - Turns *burst mode* on; data selected under *burst option* are broadcast over the loop

Additional command options may appear that are reserved and do not apply to the Rosemount 8750W.

Burst option (burst command)

LOI menu path	Field Mount: Detailed Setup, Output Config, HART, Burst Command Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 7, 6
Device dashboard	2, 2, 3, 1, 3

Burst option enables you to select the variable(s) that is broadcast during the transmitter burst. Choose one of the following options:

- **1; PV; Primary Variable** - Selects the primary variable
- **2; %range/current; Percent of Range and Loop Current** - Selects the variable as percent of range and analog output
- **3; Process vars/crnt; All Variables and Loop Current** - Selects all variables and analog output
- **110; Dynamic vars; Dynamic Variables** - Burst all dynamic variables in the transmitter

Request preambles

LOI menu path	Field Mount: Detailed Setup, Output Config, HART, Req Preams Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 7, 3
Device dashboard	N/A

Request preambles is the number of preambles required by the Rosemount 8750W for HART communications.

Response preambles

LOI menu path	Field Mount: Detailed Setup, Output Config, HART, Resp Preams Wall Mount: N/A
Traditional Fast Keys	1, 4, 2, 7, 4
Device dashboard	N/A

Response preambles is the number of preambles sent by the Rosemount 8750W in response to any host request.

5.3.4 Configure LOI

LOI menu path	Field Mount: Detailed Setup, LOI Config Wall Mount: N/A
Traditional Fast Keys	1, 4, 3
Device dashboard	2, 2, 1, 5

The LOI configuration contains functionality to configure the display of the transmitter.

Flow display

LOI menu path	Field Mount: Detailed Setup, LOI Config, Flow Display Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 3, 2
Device dashboard	2, 2, 1, 5, 2

Use *flow display* to configure the parameters that will appear on the LOI flowrate screen. The flowrate screen displays two lines of information. Choose one of the following options:

- Flowrate and % of Span
- % of Span and Net Total
- Flowrate and Net Total
- % of Span and Gross Total
- Flowrate and Gross Total

Totalizer display

LOI menu path	Field Mount: Detailed Setup, LOI Config, Total Display Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 3, 3
Device dashboard	2, 2, 1, 5, 3

Use *totalizer display* to configure the parameters that will appear on the LOI totalizer screen. The totalizer screen has two lines of information. Choose one of the following options:

- Forward Total and Reverse Total
- Net Total and Gross Total

Language

LOI menu path	Field Mount: Detailed Setup, LOI Config, Language Wall Mount: N/A
Traditional Fast Keys	1, 4, 3, 1
Device dashboard	2, 2, 1, 5, 1

Use *language* to configure the display language shown on the LOI. Select one of the following options:

- English[1]
- Spanish
- Portuguese
- German
- French

1. *Wall Mount Transmitter is only available in English.*

LOI error mask

LOI menu path	Field Mount: Detailed Setup, LOI Config, LOI Err Mask Wall Mount: N/A
Traditional Fast Keys	N/A
Device dashboard	N/A

Use *LOI error mask* to turn off the analog output power error message (AO No Power). This may be desired if the analog output is not being used.

Display auto lock

LOI menu path	Field Mount: Detailed Setup, LOI Config, Disp Auto Lock Wall Mount: N/A
Traditional Fast Keys	1, 4, 3, 4
Device dashboard	2, 2, 1, 5, 4

Use *display auto lock* to configure the LOI to automatically lock the LOI after a set period of time. Select one of the following options:

- OFF
- 1 Minute
- 10 Minutes (default)

5.4 Additional parameters

The following parameters may be required for detailed configuration settings based on your application.

5.4.1 Coil drive frequency

LOI menu path	Field Mount: Detailed Setup, More Params, Coil Frequency Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 3, 1
Device dashboard	2, 2, 8, 3

Use *coil drive frequency* to change the pulse rate of the coils. Choose one of the following options:

- **5 Hz** - The standard coil drive frequency is 5 Hz, which is sufficient for nearly all applications.
- **37 Hz** - If the process fluid causes a noisy or unstable output, increase the coil drive frequency to 37.5 Hz. The 37 Hz coil drive frequency should only be used for sensor sizes 16-in. and smaller. If the 37 Hz mode is selected, perform the auto zero function for optimum performance.

See “Auto zero” on page 141.

5.4.2 Process density

LOI menu path	Field Mount: Detailed Setup, More Params, Proc Density Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1,4,3,1
Device dashboard	2,2,8,2

Use the *process density* value to convert from a volumetric flow rate to a mass flow rate using the following equation:

Qm = Qv x *p*

Where:

Qm is the mass flow rate

Qv is the volumetric flow rate, and

p is the fluid density

5.4.3 Reverse flow

LOI menu path	Field Mount: Detailed Setup, Output Config, Reverse Flow Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 3, 1
Device dashboard	2, 2, 5, 1, 5

Use *reverse flow* to enable or disable the transmitter's ability to read flow in the opposite direction of the flow direction arrow (see Figure 2-6 on page 11). This may occur when the process has bi-directional flow, or when either the electrode wires or the coil wires are reversed (see “Remote wiring” on page 159). This also enables the totalizer to count in the reverse direction.

5.4.4 Low flow cutoff

LOI menu path	Field Mount: Detailed Setup, Sig Processing, Low Flow Cutoff Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 4, 4
Device dashboard	2, 2, 8, 5, 2

Low flow cutoff allows the user to set a low flow limit to be specified. The analog output signal is driven to 4mA for flow rates below the set point. For the Field Mount Transmitter, the *low flow cutoff* units are the same as the PV units and cannot be changed. For the Wall Mount Transmitter, the low flow cutoff units are feet per second and cannot be changed. The *low flow cutoff* value applies to both forward and reverse flows.

5.4.5 PV damping

LOI menu path	Field Mount: Detailed Setup, Sig Processing, PV Damping Wall Mount: DAMPING
Traditional Fast Keys	1, 4, 4, 5
Device dashboard	2, 2, 8, 1

Primary variable damping allows selection of a response time, in seconds, to a step change in flow rate. It is most often used to smooth fluctuations in output.

5.4.6 Signal processing

LOI menu path	Field Mount: Detailed Setup, Sig Processing Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 3, 1
Device dashboard	2, 2, 8, 6

The Rosemount 8750W contains several advanced functions that can be used to stabilize erratic outputs caused by process noise. The signal processing menu contains this functionality.

If the 37 Hz coil drive mode has been set, and the output is still unstable, the damping and signal processing function should be used. It is important to set the coil drive mode to 37 Hz first, so the loop response time is not increased.

The Rosemount 8750W provides for a very easy and straightforward start-up, and also incorporates the capability to deal with difficult applications that have previously manifested themselves in a noisy output signal. In addition to selecting a higher coil drive frequency (37 Hz vs. 5 Hz) to isolate the flow signal from the process noise, the Rosemount 8750W microprocessor can actually scrutinize each input based on three user-defined parameters to reject the noise specific to the application.

See Section 7 for the detailed description of how the signal processing works.

Operating mode

LOI menu path	Field Mount: Detailed Setup, Sig Processing, Operating Mode Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 3, 1
Device dashboard	2, 2, 8, 5, 1

The *operating mode* function can be set to *normal* mode or *filter* mode. If set to *normal* mode, and the signal is noisy and provides an unstable flow reading, switch to *filter* mode. *Filter* mode automatically uses 37 Hz coil drive frequency and activates signal processing at the factory set default values. When using *filter* mode, perform an *auto zero* with *no flow* and a full sensor. Either of the parameters (coil drive mode or signal processing) may still be changed individually. Turning *signal processing* off or changing the coil drive frequency to 5 Hz will automatically change the *operating mode* from *filter* mode to *normal* mode.

Signal processing control

LOI menu path	Field Mount: Detailed Setup, Sig Processing, SP Control Wall Mount: AUX. FUNCTION, Signal Processing
Traditional Fast Keys	1, 4, 3, 1
Device dashboard	2, 2, 8, 6, 1

DSP can be turned on or off. When *on* is selected, the Rosemount 8750W output is derived using a running average of the individual flow inputs. DSP is a software algorithm that examines the quality of the electrode signal against user-specified tolerances. This average is updated at the rate of 10 samples per second with a coil drive frequency of 5 Hz, and 75 samples per second with a coil drive frequency of 37 Hz. The three parameters that make up signal processing (*number of samples*, *percent limit,* and *time limit*) are described below.

Number of samples

LOI menu path	Field Mount: Detailed Setup, Sig Processing, SP Control, Samples Wall Mount: AUX. FUNCTION, Signal Processing
Traditional Fast Keys	1, 4, 3, 1
Device dashboard	2, 2, 8, 6, 2

The *number of samples* sets the amount of time that inputs are collected and used to calculate the average value. Each second is divided into tenths with the number of samples equaling the number of increments used to calculate the average. This parameter can be configured for an integer value between 0 and 125. The default value is 90 samples.

Percent rate

LOI menu path	Field Mount: Detailed Setup, Sig Processing, SP Control, % Rate Wall Mount: AUX. FUNCTION, Signal Processing
Traditional Fast Keys	1, 4, 3, 1
Device dashboard	2, 2, 8, 6, 3

This parameter will set the tolerance band on either side of the running average, referring to percent deviation from the average flow rate. Values within the limit are accepted while values outside the limit are scrutinized to determine if they are a noise spike or an actual flow change. This parameter can be configured for an integer value between 0 and 100 percent. The default value is 2 percent.

Time limit

LOI menu path	Field Mount: Detailed Setup, Sig Processing, SP Control, Time Limit Wall Mount: AUX. FUNCTION, Signal Processing
Traditional Fast Keys	1, 4, 3, 1
Device dashboard	2, 2, 8, 6, 4

The *time limit* parameter forces the output and running average values to the new value of an actual flow rate change that is outside the percent limit boundaries. It thereby limits response time to flow changes to the time limit value rather than the length of the running average.

For example, if the number of samples selected is 100, then the response time of the system is 10 seconds. In some cases this may be unacceptable. By setting the time limit, you can force the Rosemount 8750W to clear the value of the running average and re-establish the output and average at the new flow rate once the time limit has elapsed. This parameter limits the response time added to the loop. A suggested time limit value of two seconds is a good starting point for most applicable process fluids. This parameter can be configured between zero and 256 seconds. The default value is two seconds.

5.5 Configure special units

Special units are used when the application requires units that are not included in the flow units available from the device. Refer to Table 2-12 on page 34 for a complete list of the available units.

5.5.1 Base volume unit

LOI menu path	Field Mount: Basic Setup, Flow Units, Special Units, Base Vol Units Wall Mount: AUX. FUNCTION, Special Units, Base Vol Units
Traditional Fast Keys	1, 3, 2, 2,2
Device dashboard	2, 2, 1, 6

Base volume unit is the unit from which the conversion is being made. Set this variable to the appropriate option.

5.5.2 Conversion factor

LOI menu path	Field Mount: Basic Setup, Flow Units, Special Units, Conv Factor Wall Mount: AUX. FUNCTION, Special Units, Conv Factor
Traditional Fast Keys	1, 3, 2, 2, 3
Device dashboard	2, 2, 1, 6

The special units *conversion factor* is used to convert base units to special units. For a straight conversion of units from one unit of measure to a different unit of measure, the *conversion factor* is the number of base units in the new unit.

For example, if you are converting from gallons to barrels and there are 31 gallons in a barrel, the conversion factor is 31.

5.5.3 Base time unit

LOI menu path	Field Mount: Basic Setup, Flow Units, Special Units, Base Time Unit Wall Mount: AUX. FUNCTION, Special Units, Base Time Unit
Traditional Fast Keys	1, 3, 2, 2, 4
Device dashboard	2, 2, 1, 6

Base time unit provides the time unit from which to calculate the special units.

For example, if your special units is a volume per minute, select **minutes**.

5.5.4 Special volume unit

LOI menu path	Field Mount: Basic Setup, Flow Units, Special Units, Volume Unit Wall Mount: AUX. FUNCTION, Special Units, Volume Unit
Traditional Fast Keys	1, 3, 2, 2, 1
Device dashboard	2, 2, 1, 6

Special volume unit enables you to display the volume unit format to which you have converted the base volume units. For example, if the special units are abc/min, the special volume variable is abc. The volume units variable is also used in totalizing the special units flow.

5.5.5 Special flow rate unit

LOI menu path	Field Mount: Basic Setup, Flow Units, Special Units, Rate Unit Wall Mount: AUX. FUNCTION, Special Units, Rate Unit
Traditional Fast Keys	1, 3, 2, 2, 5
Device dashboard	2, 2, 1, 6

Flow rate unit is a format variable that provides a record of the units to which you are converting. The Field Communicator will display a special units designator as the units format for your primary variable. The actual special units setting you define will not appear. Four characters are available to store the new units designation. The Rosemount 8750W LOI will display the four character designation as configured.

Example

To display flow in acre-feet per day, and acre-foot is equal to 43560 cubic feet, the procedure would be:

1. Set the *volume unit* to **ACFT**.
2. Set the *base volume unit* to **ft3**.
3. Set the *conversion factor* to **43560**.
4. Set the *time base unit* to **Day**.
5. Set the *flow rate unit* to **AF/D**.

Section 6 Advanced Diagnostics Configuration

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6.1 Introduction

Rosemount™ Magnetic Flowmeters provide device diagnostics that detect and warn of abnormal situations throughout the life of the meter - from Installation to Maintenance and Meter Verification. With flowmeter diagnostics enabled, plant availability and throughput can be improved, and costs through simplified installation, maintenance and troubleshooting can be reduced.

Table 6-1. Diagnostics Availability

Diagnostic name	Diagnostic category	Product capability
Basic diagnostics		
Tunable Empty Pipe	Process	Standard
Electronics Temperature	Maintenance	Standard
Coil Fault	Maintenance	Standard
Transmitter Fault	Maintenance	Standard
Reverse Flow	Process	Standard
Electrode Saturation(1)	Process	Standard
Coil Current(1)	Maintenance	Standard
Coil Power(1)	Maintenance	Standard
Advanced diagnostics		
High Process Noise	Process	Suite 1 (DA1)
Grounding and Wiring Fault	Installation	Suite 1 (DA1)
Coated Electrode Detection(1)	Process	Suite 1 (DA1)

Table 6-1. Diagnostics Availability

Diagnostic name	Diagnostic category	Product capability
Advanced diagnostics		
Commanded Meter Verification	Meter Health	Suite 2 (DA2)
Continuous Meter Verification(1)	Meter Health	Suite 2 (DA2)
4-20 mA Loop Verification(1)	Installation	Suite 2 (DA2)

1. Only available on Field Mount Transmitter.

Options for accessing diagnostics

Rosemount Magmeter Diagnostics can be accessed through the Local Operator Interface (LOI), a HART® Field Communicator, AMS™ Suite: Intelligent Device Manager, and ProLink™. Contact your local Rosemount representative to activate diagnostics or for diagnostic availability on existing transmitters.

Access diagnostics through the LOI for quicker installation, maintenance, and meter verification

Rosemount Magmeter Diagnostics are available through the LOI to make maintenance of every magmeter easier.

Access diagnostics through AMS Device Manager

The value of the Diagnostics increases significantly when AMS Device Manager is used. The user will see simplified screen flow and procedures on how to respond to the diagnostics messages.

Access diagnostics through ProLink III v. 3.2 to simplify maintenance and troubleshooting practices

Use ProLink III to access diagnostics and troubleshooting information using an intuitive interface and simplified procedures. Run

SMART™ Meter Verification, store the results, and print a report that can be filed or submitted as proof of verification.

6.2 Licensing and enabling

All advanced diagnostics are licensed by ordering option code DA1, DA2, or both. In the event that a diagnostic option is not ordered, advanced diagnostics can be licensed in the field through the use of a license key. Each transmitter has a unique license key specific to the diagnostic option code. A trial license(1) is also available to enable the advanced diagnostics. This temporary functionality will be automatically disabled after 30 days or when power to the transmitter is cycled, whichever occurs first. This trial code can be used a maximum of three times per transmitter. See the detailed procedures below for entering the license key and enabling the advanced diagnostics. To obtain a permanent or trial license key, contact your local Emerson™ Process Management representative.

1. *Trial license is only available on the Field Mount Transmitter.*

6.2.1 Licensing the Rosemount 8750W diagnostics

For licensing the advanced diagnostics, follow the steps below.

1. Power up the transmitter.
2. Verify the software version is 5.4.4 software or later.

LOI menu path	Field Mount: Detailed Setup, Device Info, Revision Num Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 6, 10, --(1)
Device dashboard	1, 8, 2

1. This item is in a list format without numeric labels.

3. Determine the Device ID.

LOI menu path	Field Mount: Detailed Setup, Device Info, Device ID Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 6, 6
Device dashboard	1, 8, 1, 5

4. Obtain a License Key from the local Rosemount representative.
5. Enter License Key.

LOI menu path	Field Mount: Diagnostics, Advanced Diagnostics, Licensing, License Key, License Key Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 3, 4, 2, 2
Device dashboard	1, 8, 5, 4

6. Enable Advanced Diagnostics.

LOI menu path	Field Mount: Diagnostics, Diag Controls Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 3
Device dashboard	2, 2, 5, 1

6.3 Tunable empty pipe detection

The *tunable empty pipe detection* provides a means of minimizing issues and false readings when the pipe is empty. This is most important in batching applications where the pipe may run empty with some regularity. If the pipe is empty, this diagnostic will activate, set the flow rate to zero, and deliver an alert.

Turning empty pipe on/off

LOI menu path	Field Mount: Diagnostics, Diag Controls, Empty Pipe Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 1, 1
Device dashboard	2, 2, 5, 1, 1

The *tunable empty pipe detection* diagnostic can be turned on or off as required by the application. The empty pipe diagnostic is shipped turned “On” by default.

6.3.1 Tunable empty pipe parameters

The *tunable empty pipe* diagnostic has one read-only parameter, and two parameters that can be custom configured to optimize the diagnostic performance.

Empty pipe (EP) value

LOI menu path	Field Mount: Diagnostics, Variables, Empty Pipe Wall Mount: XMTR INFO
Traditional Fast Keys	1, 2, 2, 4, 1
Device dashboard	2, 2, 5, 3, 1

This parameter shows the current *empty pipe value*. This is a read-only value. This number is a unit-less number and is calculated based on multiple installation and process variables such as sensor type, line size, process fluid properties, and wiring. If the empty pipe value exceeds the empty pipe trigger level for a specified number of updates, then the empty pipe diagnostic alert will activate.

Empty pipe (EP) trigger level

LOI menu path	Field Mount: Diagnostics, Basic Diagnostics, Empty Pipe, EP Trig Level Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 2, 4, 2
Device dashboard	2, 2, 5, 3, 2

Limits: 3 to 2000

Empty pipe trigger level is the threshold limit that the empty pipe value must exceed before the empty pipe diagnostic alert activates. The default setting from the factory is 100.

Empty pipe (EP) counts

LOI menu path	Field Mount: Diagnostics, Basic Diagnostics, Empty Pipe, EP Counts Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 2, 4, 3
Device dashboard	2, 2, 5, 3, 3

Limits: 2 to 50

Empty pipe counts is the number of consecutive updates that the transmitter must receive where the empty pipe value exceeds the empty pipe trigger level before the empty pipe diagnostic alert activates. The default setting from the factory is 5.

6.3.2 Optimizing tunable empty pipe

The *tunable empty pipe* diagnostic is set at the factory to properly diagnose most applications. If this diagnostic activates, the following procedure can be followed to optimize the empty pipe diagnostic for the application.

Example

1. Record the *empty pipe value* with a full pipe condition.

   Example: Full reading = 0.2

2. Record the *empty pipe value* with an empty pipe condition.

   Example: Empty reading = 80.0

3. Set the *empty pipe trigger level* to a value between the full and empty readings. For increased sensitivity to empty pipe conditions, set the trigger level to a value closer to the full pipe value.

   Example: Set the trigger level to 25.0

4. Set the *empty pipe counts* to a value corresponding to the desired sensitivity level for the diagnostic. For applications with entrained air or potential air slugs, less sensitivity may be desired.

   Example: Set the counts to 10

6.4 Electronics temperature

The Rosemount 8750W continuously monitors the temperature of the internal electronics. If the measured *electronics temperature* exceeds the operating limits of –40 to 140 °F (–40 to 60 °C) the transmitter will go into alarm and generate an alert.

6.4.1 Turning electronics temperature on/off

LOI menu path	Field Mount: Diagnostics, Diag Controls, Elect Temp Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 1, 1, -- [1]
Device dashboard	2, 2, 5, 1, 4

1. This item is in a list format without numeric labels.

The *electronics temperature* diagnostic can be turned on or off as required by the application.The *electronics temperature* diagnostic will be turned on by default.

6.4.2 Electronics temperature parameters

The *electronics temperature* diagnostic has one read-only parameter. It does not have any configurable parameters.

Electronics temperature

LOI menu path	Field Mount: Diagnostics, Variables, Elect Temp Wall Mount: XMTR INFO
Traditional Fast Keys	1, 2, 4, 2
Device dashboard	2, 2, 5, 7

This parameter shows the current temperature of the electronics. This is a read-only value.

6.5 Ground/wiring fault detection

The transmitter continuously monitors signal amplitudes over a wide range of frequencies. For the *ground/wiring fault detection* diagnostic, the transmitter specifically looks at the signal amplitude at frequencies of 50 Hz and 60 Hz which are the common AC cycle frequencies found throughout the world. If the amplitude of the signal at either of these frequencies exceeds 5 mV, that is an indication that there is a ground or wiring issue and that stray electrical signals are getting into the transmitter. The diagnostic alert will activate indicating that the ground and wiring of the installation should be carefully reviewed.

The *ground/wiring fault detection* diagnostic provides a means of verifying installations are done correctly. If the installation is not wired or grounded properly, this diagnostic will activate and deliver an alert. This diagnostic can also detect if the grounding is lost over-time due to corrosion or another root cause.

6.5.1 Turning ground/wiring fault on/off

LOI menu path	Field Mount: Diagnostics, Diag Controls, Ground/Wiring Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 1, 1, --[1]
Device dashboard	2, 2, 5, 1, 3

1. This item is in a list format without numeric labels.

The *ground/wiring fault detection* diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (DA1 Option) was ordered, then the *ground/wiring fault detection* diagnostic will be turned on. If DA1 was not ordered or licensed, this diagnostic is not available.

6.5.2 Ground/wiring fault parameters

The *ground/wiring fault detection* diagnostic has one read-only parameter. It does not have any configurable parameters.

Line noise

LOI menu path	Field Mount: Diagnostics, Variables, Line Noise Wall Mount: XMTR INFO
Traditional Fast Keys	1, 2, 4, 3
Device dashboard	2, 2, 5, 4, 1

The *line noise* parameter shows the amplitude of the line noise. This is a read-only value. This number is a measure of the signal strength at 50/60 Hz. If the *line noise* value exceeds 5 mV, then the *ground/wiring fault* diagnostic alert will activate.

6.6 High process noise detection

The *high process noise* diagnostic detects if there is a process condition causing an unstable or noisy reading that is not an actual flow variation. A common cause of high process noise is slurry flow, like pulp stock or mining slurries. Other conditions that cause this diagnostic to activate are high levels of chemical reaction or entrained gas in the liquid. If unusual noise or flow variation is seen, this diagnostic will activate and deliver an alert. If this situation exists and is left without remedy, it will add additional uncertainty and noise to the flow reading.

6.6.1 Turning high process noise on/off

LOI menu path	Field Mount: Diagnostics, Diag Controls, Process Noise Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 1, 1, --(1)
Device dashboard	2, 2, 5, 1, 2

1. This item is in a list format without numeric labels.

The *high process noise* diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (DA1 Option) was ordered, then the *high process noise* diagnostic will be turned on. If DA1 was not ordered or licensed, this diagnostic is not available.

6.6.2 High process noise parameters

The *high process noise* diagnostic has two read-only parameters. It does not have any configurable parameters. This diagnostic requires that flow be present in the pipe and the velocity be greater than1 ft/s (0.3 m/s).

5 Hz signal to noise ratio (SNR)

LOI menu path	Field Mount: Diagnostics, Variables, 5Hz SNR Wall Mount: XMTR INFO
Traditional Fast Keys	1, 2, 4, 4
Device dashboard	2, 2, 5, 5, 1

This parameter shows the value of the signal to noise ratio at the coil drive frequency of 5 Hz. This is a read-only value. This number is a measure of the signal strength at 5 Hz relative to the amount of process noise. If the transmitter is operating in 5 Hz mode, and the signal to noise ratio remains below 25 for one minute, then the *high process noise* diagnostic alert will activate.

37 Hz signal to noise ratio (SNR)

LOI menu path	Field Mount: Diagnostics, Variables, 37Hz SNR Wall Mount: XMTR INFO
Traditional Fast Keys	1, 2, 4, 5
Device dashboard	2, 2, 5, 5, 2

This parameter shows the current value of the signal to noise ratio at the coil drive frequency of 37 Hz. This is a read-only value. This number is a measure of the signal strength at 37 Hz relative to the amount of process noise. If the transmitter is operating in 37 Hz mode, and the signal to noise ratio remains below 25 for one minute, then the *high process noise* diagnostic alert will activate.

6.7 Coated electrode detection

The *coated electrode detection* diagnostic provides a means of monitoring insulating coating buildup on the measurement electrodes. If coating is not detected, buildup over time can lead to a compromised flow measurement. This diagnostic can detect if the electrode is coated and if the amount of coating is affecting the flow measurement. There are two levels of electrode coating (EC). This diagnostic is only available on the Field Mount Transmitter.

Limit 1 indicates when coating is starting to occur, but has not compromised the flow measurement.

Limit 2 indicates when coating is affecting the flow measurement and the meter should be serviced immediately.

6.7.1 Turning coated electrode detection on/off

LOI menu path	Field Mount: Diagnostics, Diag Controls, Elec Coating Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 1
Device dashboard	2, 2, 5, 1, 5

The *coated electrode detection* diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (DA1 option) was ordered, then the *coated electrode detection* diagnostic will be turned on. If DA1 was not ordered or licensed, this diagnostic is not available.

6.7.2 Coated electrode parameters

The *coated electrode detection* diagnostic has four parameters. Two are read-only and two are configurable parameters. The electrode coating parameters need to be initially monitored to accurately set the electrode coating limit levels for each application.

EC value

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Elec Coating, EC Current Val Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 1, 1
Device dashboard	2, 2, 5, 6, 1

The *electrode coating value* reads the value of the coated electrode detection diagnostic.

Electrode coating (EC) level 1 limit

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Elec Coat, EC Limit 1 Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 1, 2
Device dashboard	2, 2, 5, 6, 2

Set the criteria for the *electrode coating limit 1* which indicates when coating is starting to occur, but has not compromised the flow measurement. The default value for this parameter is 1000 k Ohm.

Electrode coating (EC) level 2 limit

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Elec Coat, EC Limit 2 Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 1, 3
Device dashboard	2, 2, 5, 6, 3

Set the criteria for the *electrode coating limit 2* which indicates when coating is affecting the flow measurement and the meter should be serviced immediately. The default value for this parameter is 2000 k Ohm.

Maximum electrode coating (EC)

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Elec Coat, EC Max Value Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 1, 4
Device dashboard	2, 2, 5, 6, 4

The *maximum electrode coating value* reads the maximum value of the *coated electrode detection* diagnostic since the last maximum value reset.

Clear maximum electrode value

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Elec Coat, Reset Max Val Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 1, 5
Device dashboard	2, 2, 5, 6, 5

Use this method to reset the *maximum electrode coating value*.

6.8 4-20 mA loop verification

The *4-20 mA loop verification* diagnostic provides a means of verifying the analog output loop is functioning properly. This is a manually initiated diagnostic test. This diagnostic checks the integrity of the analog loop and provides a health status of the circuit. If the verification does not pass, this will be highlighted in the results given at the end of the check. This diagnostic is only available on the Field Mount Transmitter.

The *4-20 mA loop verification* diagnostic is useful for testing the analog output when errors are suspected. The diagnostic tests the analog loop at five different mA output levels:

- 4 mA
- 12 mA
- 20 mA
- Low alarm level
- High alarm level

6.8.1 Initiating 4-20 mA loop verification

LOI menu path	Field Mount: Diagnostics, Advanced Diag, 4-20mA Verify, 4-20mA Verify Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 3, 1
Device dashboard	3, 4, 3, 1

The *4-20 mA loop verification* diagnostic can be initiated as required by the application. If the advanced diagnostics suite 2 (DA2 Option) was ordered, then the *4-20 mA loop verification* diagnostic will be available. If DA2 was not ordered or licensed, this diagnostic is not available.

6.8.2 4-20 mA loop verification parameters

The *4-20 mA loop verification* diagnostic has five read-only parameters plus an overall test result. It does not have any configurable parameters.

4-20 mA loop verification test result

LOI menu path	Field Mount: Diagnostics, Advanced Diag, 4-20mA Verify, View Results Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 3, 2
Device dashboard	3, 4, 3

Shows the results of the *4-20 mA loop verification* test as either passed or failed.

4 mA measurement

LOI menu path	N/A
Traditional Fast Keys	N/A
Device dashboard	3, 4, 3, 2

Shows the measured value of the 4 mA loop verification test.

12 mA measurement

LOI menu path	N/A
Traditional Fast Keys	N/A
Device dashboard	3, 4, 3, 3

Shows the measured value of the 12 mA loop verification test.

20 mA measurement

LOI menu path	N/A
Traditional Fast Keys	N/A
Device dashboard	3, 4, 3, 4

Shows the measured value of the 20 mA loop verification test.

Low alarm measurement

LOI menu path	N/A
Traditional Fast Keys	N/A
Device dashboard	3, 4, 3, 5

Shows the measured value of the low alarm verification test.

High alarm measurement

LOI menu path	N/A
Traditional Fast Keys	N/A
Device dashboard	3, 4, 3, 6

Shows the measured value of the high alarm verification test.

6.9 SMART™ Meter Verification

The *SMART Meter Verification* diagnostic provides a means of verifying the flowmeter is within calibration without removing the sensor from the process. This diagnostic test

provides a review of the transmitter and sensor's critical parameters as a means to document verification of calibration. The results of this diagnostic provide the deviation amount from expected values and a pass/fail summary against user-defined criteria for the application and conditions. The *SMART Meter Verification* diagnostic can be configured to run continuously in the background during normal operation, or it can be manually initiated as required by the application.

6.9.1 Sensor baseline (signature) parameters

The *SMART Meter Verification* diagnostic functions by taking a baseline sensor signature and then comparing measurements taken during the verification test to these baseline results.

The sensor signature describes the magnetic behavior of the sensor. Based on Faraday's law, the induced voltage measured on the electrodes is proportional to the magnetic field strength. Thus, any changes in the magnetic field will result in a calibration shift of the sensor. Having the transmitter take an initial sensor signature when first installed will provide the baseline for the verification tests that are done in the future. There are three specific measurements that are stored in the transmitter's non-volatile memory that are used when performing the calibration verification.

Coil circuit resistance

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Sensr Baseline, Values, Coil Resist Wall Mount: XMTR INFO
Traditional Fast Keys	1, 2, 3, 2, 3, 1, 1
Device dashboard	2, 2, 6, 1, 1

The *coil circuit resistance* is a measurement of the coil circuit health. This value is used as a baseline to determine if the coil circuit is still operating correctly.

Coil inductance (signature)

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Sensr Baseline, Values, Inductance Wall Mount: XMTR INFO
Traditional Fast Keys	1, 2, 3, 2, 3, 1, 2
Device dashboard	2, 2, 6, 1, 2

The *coil inductance* is a measurement of the magnetic field strength. This value is used as a baseline to determine if a sensor calibration shift has occurred.

Electrode circuit resistance

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Sensr Baseline, Values, Electrode Res Wall Mount: XMTR INFO
Traditional Fast Keys	1, 2, 3, 2, 3, 1, 3
Device dashboard	2, 2, 6, 1, 3

The *electrode circuit* resistance is a measurement of the electrode circuit health. This value is used as a baseline to determine if the electrode circuit is still operating correctly.

6.9.2 Establishing the sensor baseline (signature)

The first step in running the *SMART Meter Verification* test is establishing the reference signature that the test will use as the baseline for comparison. This is accomplished by having the transmitter take a signature of the sensor.

Reset baseline (re-signature meter)

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Sensr Baseline, Reset Baseline Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 3, 2, 3, 2
Device dashboard	2, 2, 6, 1, 4

Having the transmitter take an initial sensor signature when first installed will provide the baseline for the verification tests that are done in the future. The sensor signature should be taken during the start-up process when the transmitter is first connected to the sensor, with a full line, and ideally with no flow in the line. Running the sensor signature procedure when there is flow in the line is permissible, but this may introduce some noise into the *electrode circuit resistance* measurement. If an empty pipe condition exists, then the sensor signature should only be run for the coils.

Once the sensor signature process is complete, the measurements taken during this procedure are stored in non-volatile memory to prevent loss in the event of a power interruption to the meter. This initial sensor signature is required for both manual and continuous SMART Meter Verification.

Recall values (recall last saved)

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Sensr Baseline, Recall Values Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 3, 2, 3, 3
Device dashboard	2, 2, 6, 1, 5

In the event that the sensor baseline was reset accidentally or incorrectly, this function will restore the previously saved sensor baseline values.

6.9.3 SMART Meter Verification test criteria

The SMART Meter Verification diagnostic provides the ability to customize the test criteria to which the verification must be tested. The test criteria can be set for each of the flow conditions discussed above.

No flow limit

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Test Criteria, No Flow Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 3, 2, 4, 1
Device dashboard	2, 2, 6, 3, 1

Set the test criteria for the no flow condition. The factory default for this value is set to five percent with limits configurable between one and ten percent. This parameter applies to manually initiated test only.

Flowing full limit

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Test Criteria, Flowing Full Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 3, 2, 4, 2
Device dashboard	2, 2, 6, 3, 2

Set the test criteria for the flowing, full condition. The factory default for this value is set to five percent with limits configurable between one and ten percent. This parameter applies to manually initiated tests only.

Empty pipe limit

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Test Criteria, Empty Pipe Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 3, 2, 4, 3
Device dashboard	2, 2, 6, 3, 3

Set the test criteria for the empty pipe condition. The factory default for this value is set to five percent with limits configurable between one and ten percent. This parameter applies to manually initiated test only.

Continuous limit

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Test Criteria, Continual Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 2, 4, 4
Device dashboard	2, 2, 6, 4, 1

Set the test criteria for the *continuous SMART Meter Verification* diagnostic. The factory default for this value is set to five percent with limits configurable between two and ten percent. If the tolerance band is set too tightly, under empty pipe conditions or noisy flowing conditions, a false failure of the transmitter test may occur.

6.10 Run manual SMART Meter Verification

LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Run Meter Ver Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 3, 2, 1
Device dashboard	1, 6

The *SMART Meter Verification* diagnostic will be available if the advanced diagnostic suite (DA2) was ordered. If DA2 was not ordered or licensed, this diagnostic will not be available. This method will initiate the manual meter verification test.

6.10.1 Test conditions

SMART Meter Verification can be initiated under three possible test conditions. This parameter is set at the time that the *sensor baseline* or *SMART Meter Verification* test is manually initiated.

No flow

Run the *SMART Meter Verification* test with a full pipe and no flow in the line. Running the *SMART Meter Verification* test under this condition provides the most accurate results and the best indication of magnetic flowmeter health.

Flowing full

Run the *SMART Meter Verification* test with a full pipe and flow in the line. Running the *SMART Meter Verification* test under this condition provides the ability to verify the magnetic flowmeter health without shutting down the process flow in applications when a shutdown is not possible. Running the diagnostic under flowing conditions can cause a false test failure if there is significant process noise present.

Empty pipe

Run the *SMART Meter Verification* test with an empty pipe. Running the *SMART Meter Verification* test under this condition provides the ability to verify the magnetic flowmeter health with an empty pipe. Running the verification diagnostic under empty pipe conditions will not check the electrode circuit health.

6.10.2 Test scope

The manually initiated *SMART Meter Verification* test can be used to verify the entire flowmeter installation or individual parts such as the transmitter or sensor. This parameter is set at the time that the *SMART Meter Verification* test is manually initiated. There are three test scopes from which to choose.

All

Run the *SMART Meter Verification* test and verify the entire flowmeter installation. This parameter results in the diagnostic performing the transmitter calibration verification, sensor calibration verification, coil health check, and electrode health check. Transmitter calibration and sensor calibration are verified to the percentage associated with the test condition selected when the test was initiated. This setting applies to manually initiated tests only.

Transmitter

Run the *SMART Meter Verification* test on the transmitter only. This results in the verification test only checking the transmitter calibration to the limits of the test criteria selected when the verification test was initiated. This setting applies to manually initiated tests only.

Sensor

Run the *SMART Meter Verification* test on the sensor only. This results in the verification test checking the sensor calibration to the limits of the test criteria selected when the *SMART Meter Verification* test was initiated, verifying the coil circuit health, and the electrode circuit health. This setting applies to manually initiated tests only.

6.11 Continuous SMART Meter Verification

LOI menu path	Field Mount: Diagnostics, Diag Controls, Cont Meter Ver Wall Mount: N/A
Traditional Fast Keys	1, 2, 1, 3
Device dashboard	2, 2, 6, 4

Continuous SMART Meter Verification can be used to monitor and verify the health of the flowmeter system. The continuous SMART Meter Verification will not report results until 30 minutes after powering up to ensure the system is stable and to avoid false failures. Continuous SMART Meter Verification is only available on the Field Mount Transmitter.

6.11.1 Test scope

Continuous SMART Meter Verification can be configured to monitor the sensor coils, electrodes, transmitter calibration, and analog output. All of these parameters can be individually enabled or disabled. These parameters apply to continuous SMART Meter Verification only.

Coils

LOI menu path	Field Mount: Diagnostics, Diag Controls, Cont Meter Ver, Coils Wall Mount: N/A
Traditional Fast Keys	1, 2, 1, 3, 1
Device dashboard	2, 2, 6, 4, 2, 1

Continuously monitor the sensor coil circuit by enabling this continuous SMART Meter Verification parameter.

Electrodes

LOI menu path	Field Mount: Diagnostics, Diag Controls, Cont Meter Ver, Electrodes Wall Mount: N/A
Traditional Fast Keys	1, 2, 1, 3, 2
Device dashboard	2, 2, 6, 4, 2, 2

Continuously monitor the electrode resistance by enabling this continuous SMART Meter Verification parameter.

Transmitter

LOI menu path	Field Mount: Diagnostics, Diag Controls, Cont Meter Ver, Transmitter Wall Mount: N/A
Traditional Fast Keys	1, 2, 1, 3, 3
Device dashboard	2, 2, 6, 4, 2, 3

Continuously monitor the transmitter calibration by enabling this continuous SMART Meter Verification parameter.

Analog output

LOI menu path	Field Mount: Diagnostics, Diag Controls, Cont Meter Ver, Analog Output Wall Mount: N/A
Traditional Fast Keys	1, 2, 1, 3, 4
Device dashboard	2, 2, 6, 4, 2, 4

Continuously monitor the analog output signal by enabling this continuous SMART Meter Verification parameter.

6.12 SMART Meter Verification test results

If the SMART Meter Verification test is manually initiated, the transmitter will make several measurements to verify the transmitter calibration, sensor calibration, coil circuit health, and electrode circuits health. The results of these tests can be reviewed and recorded on the "Calibration Verification Report" on page 137. This report can be used to validate that the meter is within the required calibration limits to comply with governmental regulatory agencies.

Depending on the method used to view the results, they will be displayed in either a menu structure, as a method, or in the report format. When using the HART Field Communicator, each individual component can be viewed as a menu item. When using the LOI, the parameters are viewed as a method using the left arrow key to cycle through the results. In AMS Device Manager, the "Calibration Verification Report" on page 137 is populated with the necessary data eliminating the need to manually complete the report.

When using AMS Device Manager, there are two possible methods that can be used to print the report.

Method one involves using the print functionality within the EDDL screen. This print functionality essentially prints a screen shot of the report. If using a standard DD, then a screen capture will need to be taken using the "Print Screen" button on the keyboard and pasting the image into a word document.

Method two involves using the print feature within AMS Device Manager while on the status screen. This will result in a printout of all of the information stored on the status tabs. Page two of the report will contain all of the necessary calibration verification result data.

The results are displayed in the order found in the table below. Each parameter displays a value used in the *SMART Meter Verification* diagnostic evaluation of the meter health.

Table 6-2. Manual Smart Meter Verification Test Result Parameters

	Parameter	Field mount LOI menu path (Diagnostics, Variables, MV Results, Manual Results)	Traditional Fast Keys	Device Dashboard Fast Keys
1	Test Condition	Test Condition	1, 2, 3, 2, 2, 1, 1	3, 4, 1, 5, 4, 1
2	Test Criteria	Test Criteria	1, 2, 3, 2, 2, 1, 2	3, 4, 1, 3
3	8714i Test Result	MV Results	1, 2, 3, 2, 2, 1, 3	3, 4, 1, 5, 4, 2
4	Simulated Velocity	Sim Velocity	1, 2, 3, 2, 2, 1, 4	3, 4, 1, 5, 3, 1
5	Actual Velocity	Actual Velocity	1, 2, 3,2, 2, 1, 5	3, 4, 1, 5, 3, 2
6	Velocity Deviation	Flow Sim Dev	1, 2, 3, 2, 2, 1, 6	3, 4, 1, 5, 3, 3
7	Xmtr Cal Test Result	Xmtr Cal Verify	1, 2, 3, 2, 2, 1, 7	3, 4, 1, 5, 3, 4
8	Sensor Cal Deviation	Sensor Cal Dev	1, 2, 3, 2, 2, 1, 8	3, 4, 1, 5, 2, 3
9	Sensor Cal Test Result	Sensor Cal	1, 2, 3, 2, 2, 1, 9	3, 4, 1,5, 2, 4
10	Coil Circuit Test Result	Coil Circuit	1, 2, 3, 2, 2, 1, --[1]	3, 4, 1, 5, 1, 3
11	Electrode Circuit Test Result	Electrode Ckt	1, 2, 3, 2, 2, 1, --[1]	3, 4,1, 5, 1, 6

Table 6-3. Continuous Smart Meter Verification Test Result Parameters[1]

	Parameter	Field mount LOI menu path (Diagnostics, Variables, MV Results, Continual Res,...)	Traditional Fast Keys	Device Dashboard Fast Keys
1	Continuous Limit	Test Criteria	1, 2, 3, 2, 2, 2, 1	3, 4, 2, 2
2	Simulated Velocity	Sim Velocity	1, 2, 3, 2, 2, 2, 2	3, 2, 4, 3, 1
3	Actual Velocity	Actual Velocity	1, 2, 3, 2, 2, 2, 3	3, 2, 4, 3, 2
4	Velocity Deviation	Flow Sim Dev	1, 2, 3, 2, 2, 2, 4	3, 2, 4, 3, 3
5	Coil Signature	Coil Inductance	1, 2, 3, 2, 2, 2, 5	3, 2, 4, 2, 2
6	Sensor Cal Deviation	Sensor Cal Dev	1, 2, 3, 2, 2, 2, 6	3, 2, 4, 2, 3
7	Coil Resistance	Coil Resist	1, 2, 3, 2, 2, 2, 7	3, 2, 4, 2, 1
8	Electrode Resistance	Electrode Res	1, 2, 3, 2, 2, 2, 8	3, 2, 4, 2, 4
9	mA Expected	4-20 mA Expect	1, 2, 3, 2, 2, 2, 9	3, 2, 4, 4, 1
10	mA Actual	4-20 mA Actual	1, 2, 3, 2, 2, 2, --[2]	3, 2, 4, 4, 2
11	mA Deviation	AO FB Dev	1, 2, 3, 2, 2, 2, --[2]	3, 2, 4, 4, 3

1. Only available on Field Mount Transmitter.
2. To get to this value, use the down arrow to scroll through the menu list.

6.13 SMART Meter Verification measurements

The *SMART Meter Verification* test will make measurements of the coil resistance, coil signature, and electrode resistance and compare these values to the values taken during the sensor signature process to determine the sensor calibration deviation, the coil circuit health, and the electrode circuit health. In addition, the measurements taken by this test can provide additional information when troubleshooting the meter.

Coil circuit resistance

	Manual	Continuous
LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Manual Measure, Coil Resist Wall Mount: XMTR INFO	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Continual Meas, Coil Resist Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 2, 5, 1, 1	1, 2, 3, 2, 5, 2, 1
Device dashboard	3, 4, 1, 3, 1	3, 2, 4, 2, 1

The *coil circuit resistance* is a measurement of the coil circuit health. This value is compared to the coil circuit resistance baseline measurement taken during the sensor signature process to determine coil circuit health. This value can be continuously monitored using *continuous SMART Meter Verification*.

Coil signature

	Manual	Continuous
LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Manual Measure, Coil Inductance; Wall Mount: XMTR INFO	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Continual Meas, Coil Inductance Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 2, 5, 1, 2	1, 2, 3, 2, 5, 2, 2
Device dashboard	3, 4, 1, 3, 2	3, 2, 4, 2, 2

The *coil signature* is a measurement of the magnetic field strength. This value is compared to the coil signature baseline measurement taken during the sensor signature process to determine sensor calibration deviation. This value can be continuously monitored using *continuous SMART Meter Verification*.

Electrode circuit resistance

	Manual	Continuous
LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Manual Measure, Electrode Res Wall Mount: XMTR INFO	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Continual Meas, Electrode Res Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 2, 5, 1, 3	1, 2, 3, 2, 5, 2, 3
Device dashboard	3, 4, 1, 3, 3	3, 2, 4, 2, 4

The *electrode circuit resistance* is a measurement of the electrode circuit health. This value is compared to the electrode circuit resistance baseline measurement taken during the sensor signature process to determine electrode circuit health. This value can be continuously monitored using *continuous SMART Meter Verification*.

Actual velocity

	Manual	Continuous
LOI menu path	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Manual Measure, Actual Velocity Wall Mount: XMTR INFO	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Continual Meas, Actual Velocity Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 2, 2, 1, 5	1, 2, 3, 2, 5, 2, 4
Device dashboard	3, 4, 1, 5, 3, 2	3, 2, 4, 3, 2

The *actual velocity* is a measurement of the simulated velocity signal. This value is compared to the simulated velocity to determine transmitter calibration deviation. This value can be continuously monitored using *continuous SMART Meter Verification*.

Flow simulation deviation

	Manual	Continuous
LOI menu path	Field Mount: Diagnostics, Variables, MV Results, Manual Results, Flow Sim Dev Wall Mount: XMTR INFO	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Continual Meas, Flow Sim Dev Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 2, 2, 1, 6	1, 2, 3, 2, 2, 2, 4
Device dashboard	3, 4, 1, 5, 3, 3	3, 2, 4, 3, 3

The *flow simulation deviation* is a measurement of the percent difference between the simulated velocity and the actual measured velocity from the transmitter calibration verification test. This value can be continuously monitored using *continuous SMART Meter Verification*.

4-20 mA expected value

	Manual	Continuous
LOI menu path	Field Mount: Diagnostics, Advanced Diag, 4-20 mA Verify, View Results Wall Mount: N/A	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Continual Meas, 4-20 mA Expect Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 3, 2	1, 2, 3, 2, 5, 2, 5
Device dashboard	N/A	3, 2, 4, 4, 1

The *4-20 mA expected value* is the simulated analog signal used for the 4-20 mA meter verification test. This value is compared to the actual analog signal to determine analog output deviation. This value can be continuously monitored using *continuous SMART Meter Verification*.

4-20 mA actual value

	Manual	Continuous
LOI menu path	Field Mount: Diagnostics, Advanced Diag, 4-20 mA Verify, View Results Wall Mount: N/A	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Continual Meas, 4-20 mA Actual Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 3, 2	1, 2, 3, 2, 5, 2, 6
Device dashboard	N/A	3, 2, 4, 4, 1

The *4-20 mA actual value* is the measured analog signal used for the 4-20 mA meter verification test. This value is compared to the simulated analog signal to determine analog output deviation. This value can be continuously monitored using *continuous SMART Meter Verification*.

4-20 mA deviation

	Manual	Continuous
LOI menu path	Field Mount: Diagnostics, Advanced Diag, 4-20 mA Verify, View Results Wall Mount: N/A	Field Mount: Diagnostics, Advanced Diag, Meter Verify, Measurements, Continual Meas, AO FB Dev Wall Mount: N/A
Traditional Fast Keys	1, 2, 3, 3, 2	1, 2, 3, 2, 2, 2, --(1)
Device dashboard	N/A	3, 2, 4, 4, 1

1. To get to this value, the down arrow must be used to scroll through the menu list.

The *4-20 mA deviation* is a measurement of the percent difference between the simulated analog signal and the actual measured analog signal from the analog output verification test. This value can be continuously monitored using *continuous SMART Meter Verification*.

6.14 Optimizing the SMART Meter Verification

The *SMART Meter Verification* diagnostic can be optimized by setting the test criteria to the desired levels necessary to meet the compliance requirements of the application. The following examples below will provide some guidance on how to set these levels.

Example

An effluent meter must be certified annually to comply with environmental regulations. This example regulation requires that the meter be certified to five percent.

Since this is an effluent meter, shutting down the process may not be viable. In this instance the *SMART Meter Verification* test will be performed under flowing conditions. Set the *test criteria* for *flowing, full* to five percent to meet the requirements of the governmental agencies.

Example

A pharmaceutical company requires bi-annual verification of meter calibration on a critical feed line for one of their products. This is an internal standard, and the plant requires a calibration record be kept on-hand. Meter calibration on this process must meet two percent. The process is a batch process so it is possible to perform the calibration verification with the line full and with no flow.

Since the *SMART Meter Verification* test can be run under no flow conditions, set the *test criteria* for *no flow* to two percent to comply with the necessary plant standards.

Example

A food and beverage company requires an annual calibration of a meter on a product line. The plant standard calls for the accuracy to be three percent or better. They manufacture this product in batches, and the measurement cannot be interrupted when a batch is in process. When the batch is complete, the line goes empty.

Since there is no means of performing the *SMART Meter Verification* test while there is product in the line, the test must be performed under empty pipe conditions. The *test criteria* for *empty pipe* should be set to three percent, and it should be noted that the electrode circuit health cannot be verified.

6.14.1 Optimizing continuous SMART Meter Verification

Example

For *continuous SMART Meter Verification*, there is only one test criteria value to configure, and it will be used for all flow conditions. The factory default is set to five percent to minimize the potential for false failures under empty pipe conditions. For best results, set the criteria to match the maximum value of the three test criteria set during manual meter verification (*no flow, flowing full, and empty pipe*).

For example, a plant might set the following manual meter verification test criteria: two percent for *no flow*, three percent for *flowing full*, and four percent for *empty pipe*. In this case, the maximum test criterion is four percent, so the test criteria for *continuous SMART Meter Verification* should be set to four percent. If the tolerance band is set too tightly, under empty pipe conditions or noisy flowing conditions, a false failure of the transmitter test may occur.

6.15 Calibration Verification Report

Calibration verification report parameters	
User Name:_____	Calibration Conditions: ❑ Internal ❑ External
Tag Number: _____	Test Conditions: ❑ Flowing ❑ No Flow, Full Pipe ❑ Empty Pipe
Flowmeter information and configuration	
Software Tag: _____	PV URV (20 mA scale):_____
Calibration Number:_____	PV LRV (4 mA scale): _____
Line Size:_____	PV Damping: _____
Transmitter calibration verification results	**Sensor calibration verification results**
Simulated Velocity:_____	Sensor Deviation %: _____
Actual Velocity:_____	Sensor Test: ❑ PASS / ❑ FAIL / ❑ NOT TESTED
Deviation %: _____	Coil Circuit Test: ❑ PASS / ❑ FAIL / ❑ NOT TESTED
Transmitter: ❑ PASS / ❑ FAIL / ❑ NOT TESTED	Electrode Circuit Test: ❑ PASS / ❑ FAIL / ❑ NOT TESTED
Summary of calibration verification results	
Verification Results: The result of the flowmeter verification test is: ❑ PASSED / ❑ FAILED	
Verification Criteria: This meter was verified to be functioning within _____ % of deviation from the original test parameters.	
Signature: _____	Date:_____

Section 7 Digital Signal Processing

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Process noise profiles . . . . . page 140
High process noise diagnostic . . . . . page 140
Optimizing flow reading in noisy applications . . . . . page 141
Explanation of signal processing algorithm . . . . . page 145

7.1 Introduction

Magmeters are used in applications that can create noisy flow readings. The Rosemount™ 8750W Magnetic Flowmeter has the capability to deal with difficult applications that have previously manifested themselves in a noisy output signal. In addition to selecting a higher coil drive frequency (37 Hz vs. 5 Hz) to isolate the flow signal from the process noise, the Rosemount 8750W microprocessor has digital signal processing capable of rejecting the noise specific to the application. This section explains the different types of process noise, provides instructions for optimizing the flow reading in noisy applications, and provides a detailed description of the digital signal processing functionality.

7.2 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Read the following safety messages before performing any operation described in this section.

⚠WARNING

Explosions could result in death or serious injury.

- Verify the operating atmosphere of the sensor and transmitter is consistent with the appropriate hazardous locations certifications.
- Do not remove transmitter cover in explosive atmospheres when the circuit is alive.
- Before connecting a HART®-based communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

Failure to follow safe installation and servicing guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.
- Do not perform any service other than those contained in this manual unless qualified.
- Process leaks could result in death or serious injury.

High voltage that may be present on leads could cause electrical shock.

- Avoid contact with leads and terminals.

7.3 Process noise profiles

7.3.1 1/f noise

This type of noise has higher amplitudes at lower frequencies, but generally degrades over increasing frequencies. Potential sources of 1/f noise include chemical mixing and slurry flow particles rubbing against the electrodes.

7.3.2 Spike noise

This type of noise generally results in a high amplitude signal at specific frequencies which can vary depending on the source of the noise. Common sources of spike noise include chemical injections directly upstream of the flowmeter, hydraulic pumps, and slurry flows with low concentrations of particles in the stream. The particles bounce off of the electrode generating a “spike” in the electrode signal. An example of this type of flow stream would be a recycle flow in a paper mill.

7.3.3 White noise

This type of noise results in a high amplitude signal that is relatively constant over the frequency range. Common sources of white noise include chemical reactions or mixing that occurs as the fluid passes through the flowmeter and high concentration slurry flows where the particulates are constantly passing over the electrode head. An example of this type of flow stream would be a basis weight stream in a paper mill.

7.4 High process noise diagnostic

The transmitter continuously monitors signal amplitudes over a wide range of frequencies. For the high process noise diagnostic, the transmitter specifically looks at the signal amplitude at frequencies of 2.5 Hz, 7.5 Hz, 32.5 Hz, and 42.5 Hz. The transmitter uses the values from 2.5 and 7.5 Hz and calculates an average noise level. This average is compared to the amplitude of the signal at 5 Hz. If the signal amplitude is not 25 times greater than the noise level, and the coil drive frequency is set at 5 Hz, the *high process noise diagnostic* will trip indicating that the flow signal may be compromised. The transmitter performs the same analysis around the 37.5 Hz coil drive frequency using the 32.5 Hz and 42.5 Hz values to establish a noise level.

7.5 Optimizing flow reading in noisy applications

If the flow reading of the Rosemount 8750W is unstable, first check the wiring, grounding, and process reference associated with the magnetic flowmeter system. Ensure the following conditions are met:

- Ground straps are attached to the adjacent flange or ground ring
- Grounding rings, lining protectors, or a process reference electrode are being used in lined or non-conductive piping

The causes of unstable transmitter output can usually be traced to extraneous voltages on the measuring electrodes. This “process noise” can arise from several causes including electrochemical reactions between the fluid and the electrode, chemical reactions in the process itself, free ion activity in the fluid, or some other disturbance of the fluid/electrode capacitive layer. In such noisy applications, an analysis of the frequency spectrum reveals process noise that typically becomes significant below 15 Hz.

In some cases, the effects of process noise may be sharply reduced by elevating the coil drive frequency above the 15 Hz region. The Rosemount 8750W coil drive mode is selectable between the standard 5 Hz and the noise-reducing 37 Hz. The 37 Hz coil drive frequency should only be used on sensor sizes 16-in. and smaller.

7.5.1 Coil drive frequency

LOI menu path	Field Mount: Device Setup, Detailed Setup, Additional Params, Coil Drive Freq Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 1, 1
Device dashboard	2, 2, 8, 3

This parameter changes the pulse rate of the magnetic coils.

5 Hz

The standard coil drive frequency is 5 Hz, which is sufficient for nearly all applications.

37 Hz

If the process fluid causes a noisy or unstable flow reading, increase the coil drive frequency to 37 Hz. If the 37 Hz mode is selected, perform the auto zero function for optimum performance.

7.5.2 Auto zero

LOI menu path	Field Mount: Device Setup, Diagnostics, Trims, Auto Zero Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 5, 4
Device dashboard	2, 2, 8, 4

To ensure optimum accuracy when using 37 Hz coil drive mode, there is an auto zero function that should be initiated. When using 37 Hz coil drive mode it is important to zero the system for the specific application and installation.

The auto zero procedure should be performed only under the following conditions:

- With the transmitter and sensor installed in their final positions. This procedure is not applicable on the bench.
- With the transmitter in 37 Hz coil drive mode. Never attempt this procedure with the transmitter in 5 Hz coil drive mode.
- With the sensor full of process fluid at zero flow.

These conditions should cause an output equivalent to zero flow.

Set the loop to manual if necessary and begin the auto zero procedure. The transmitter completes the procedure automatically in about 90 seconds. A clock symbol will appear in the lower right-hand corner of the display to indicate that the procedure is running.

Note
Failure to complete an *auto zero* may result in a flow velocity error of 5 to10% at1 ft/s (0.3 m/s). While the output level will be offset by the error, the repeatability will not be affected.

7.5.3 Digital signal processing (DSP)

LOI menu path	Field Mount: Device Setup, Detailed Setup, Signal Processing Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 4
Device dashboard	2, 2, 8, 6

The Rosemount 8750W contains several advanced functions that can be used to stabilize erratic outputs caused by process noise. The signal processing menu contains this functionality.

If the 37 Hz coil drive frequency has been set, and the output is still unstable, the damping and signal processing function should be used. It is important to set the coil drive frequency to 37 Hz to increase the flow sampling rate.

The Rosemount 8750W provides an easy and straightforward start-up, and also incorporates the capability to deal with difficult applications that have previously manifested themselves in a noisy output signal. In addition to selecting a higher coil drive frequency (37 Hz vs. 5 Hz) to isolate the flow signal from the process noise, the Rosemount 8750W microprocessor can actually scrutinize each input based on three user-defined parameters to reject the noise specific to the application.

Operating mode

LOI menu path	Field Mount: Device Setup, Detailed Setup, Signal Processing, Operating Mode Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 4, 1
Device dashboard	2, 2, 8, 5

The *operating mode* should be used only when the signal is noisy and gives an unstable output. *Filter mode* automatically uses 37 Hz coil drive mode and activates signal processing at the factory set default values. When using *filter mode*, perform an *auto zero* with no flow and a full sensor. Either of the parameters, coil drive mode or signal processing, may still be changed individually. Turning signal processing off or changing the coil drive frequency to 5 Hz will automatically change the *operating mode* from *filter mode* to *normal mode*.

This software technique, known as signal processing, "qualifies" individual flow signals based on historic flow information and three user-definable parameters, plus an on/off control. These parameters are described below.

Status

LOI menu path	Field Mount: Device Setup, Detailed Setup, Signal Processing, Main Config DSP, Status Wall Mount: N/A
Traditional Fast Keys	1, 4, 4, 2, 1
Device dashboard	2, 2, 8, 6, 1

Enable or disable the DSP capabilities. When ON is selected, the Rosemount 8750W output is derived using a running average of the individual flow inputs. Signal processing is a software algorithm that examines the quality of the electrode signal against user-specified tolerances. The three parameters that make up signal processing (number of samples, maximum percent limit, and time limit) are described below.

Number of samples

LOI menu path	Field Mount: Device Setup, Detailed Setup, Signal Processing, Main Config DSP, Samples Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 4, 2, 2
Device dashboard	2, 2, 8, 6, 2

The *number of samples* sets the amount of time that inputs are collected and used to calculate the average value. Each second is divided into tenths with the number of samples equaling the number of increments used to calculate the average. This parameter can be configured for an integer value between 1 and 125. The default value is 90 samples.

For example:

- A value of 1 averages the inputs over the past $^{1}/_{10}$ second
- A value of 10 averages the inputs over the past 1 second
- A value of 100 averages the inputs over the past 10 seconds
- A value of 125 averages the inputs over the past $12^{1}/_{2}$ seconds

Percent limit

LOI menu path	Field Mount: Device Setup, Detailed Setup, Signal Processing, Main Config DSP, % Limit Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 4, 2, 3
Device dashboard	2, 2, 8, 6, 3

This parameter will set the tolerance band on either side of the running average, referring to percent deviation from the average. Values within the limit are accepted while value outside the limit are scrutinized to determine if they are a noise spike or an actual flow change. This parameter can be configured for an integer value between 0 and 100 percent. The default value is 2 percent.

Time limit

LOI menu path	Field Mount: Device Setup, Detailed Setup, Signal Processing, Main Config DSP, Time Limit Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 4, 4, 2, 4
Device dashboard	2, 2, 8, 6, 4

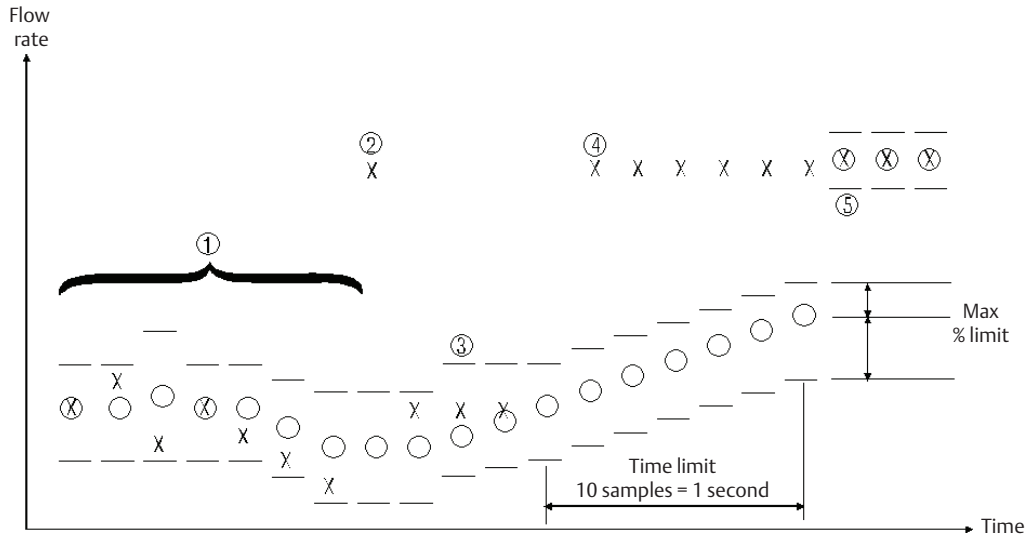
The *time limit* parameter forces the output and running average values to the new value of an actual flow rate change that is outside the *percent limit* boundaries. It thereby limits response time to flow changes to the time limit value rather than the length of the running average.

If the number of samples selected is 100, then the response time of the system is 10 seconds. In some cases this may be unacceptable. Setting the *time limit* forces the Rosemount 8750W to clear the value of the running average and re-establish the output and average at the new flow rate once the time limit has elapsed. This parameter limits the response time added to the loop. A suggested time limit value of two seconds is a good starting point for most applicable process fluids. This parameter can be configured for a value between 0.6 and 256 seconds. The default value is 2 seconds.

7.6 Explanation of signal processing algorithm

An example plotting flow rate versus time is given below to help visualize the signal processing algorithm.

Figure 7-1. Signal Processing Functionality



X. Input flow signal from sensor
O. Average flow signals and transmitter output, determined by the *number of samples* parameter

Tolerance band, determined by the *percent limit* parameter.

- Upper value = average flow + [(percent limit/100) average flow]
- Lower value = average flow - [(percent limit/100) average flow]

1. This scenario is that of a typical non-noisy flow. The input flow signal is within the percent limit tolerance band, therefore qualifying itself as a good input. In this case the new input is added directly into the running average and is passed on as a part of the average value to the output.

2. This signal is outside the tolerance band and therefore is held in memory until the next input can be evaluated. The running average is provided as the output.

3. The previous signal currently held in memory is simply rejected as a noise spike since the next flow input signal is back within the tolerance band. This results in complete rejection of noise spikes rather than allowing them to be “averaged” with the good signals as occurs in the typical analog damping circuits.

4. As in number 2 above, the input is outside the tolerance band. This first signal is held in memory and compared to the next signal. The next signal is also outside the tolerance band (in the same direction), so the stored value is added to the running average as the next input and the running average begins to slowly approach the new input level.

5. To avoid waiting for the slowly incrementing average value to catch up to the new level input, an algorithm is provided. This is the “time limit” parameter. The user can set this parameter to eliminate the slow ramping of the output toward the new input level.

Section 8 Maintenance

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Replacing the Rosemount 8750W Transmitter electronics stack ..... page 149
Replacing the terminal block ..... page 151
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8.1 Introduction

This section covers basic transmitter maintenance. Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Read the following safety messages before performing any operation described in this section. Refer to these warnings when appropriate throughout this section.

8.2 Safety information

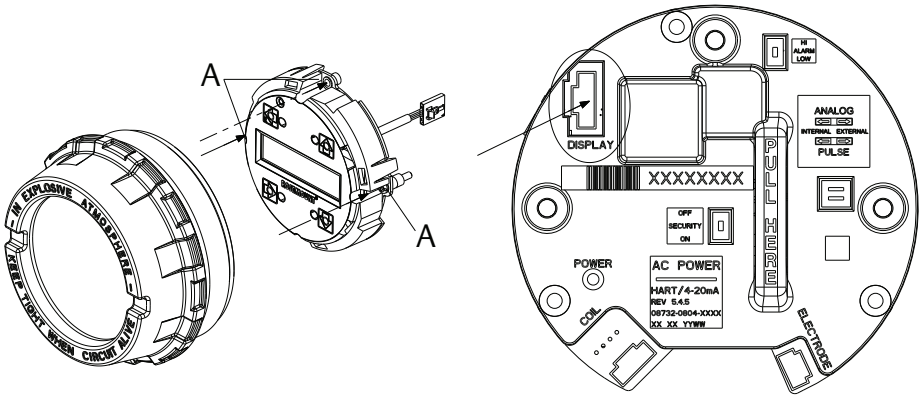
⚠WARNING

Failure to follow these guidelines could result in death or serious injury.

- Installation and servicing instructions are for use by qualified personnel only. Do not perform any servicing other than that contained in the operating instructions, unless qualified.
- Verify the operating environment of the sensor and transmitter is consistent with the appropriate hazardous area approval.
- Do not connect a Rosemount™ 8750W Magnetic Flowmeter to a non-Rosemount sensor that is located in an explosive atmosphere.
- Mishandling products exposed to a hazardous substance may result in death or serious injury. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

8.3 Installing a Local Operator Interface (LOI)

Figure 8-1. Field Mount Transmitter–Installing a LOI



A. Mounting screws x3

1. If the transmitter is installed in a control loop, secure the loop.
2. Remove power from the transmitter.
3. Remove the cover on the electronics compartment of the transmitter housing. If the cover has a cover jam screw, loosen it before removing the cover. See Figure 2-16 on page 19 for details on the cover jam screw.
4. On the electronics stack, locate the serial connection labeled “DISPLAY”. See Figure 8-1.
5. Plug the serial connector from the back of the LOI into the receptacle on the electronics stack. The LOI can be rotated in 90 degree increments to provide the best viewing position. Rotate the LOI to the desired orientation, taking care to not exceed 360 degrees of rotation. Exceeding 360 degrees of rotation could damage the LOI cable and/or connector.
6. Once the serial connector is installed on the electronics stack, and the LOI is oriented in the desired position, tighten the three mounting screws.
7. Install the extended cover with the glass viewing pane and tighten to metal-to-metal contact. If the cover has a cover jam screw, this must be tightened to comply with installation requirements. Return power to the transmitter and verify that it is functioning correctly and reporting the expected flow rate.
8. If installed in a control loop, return the loop to automatic control.

8.4 Replacing the Rosemount 8750W Transmitter electronics stack

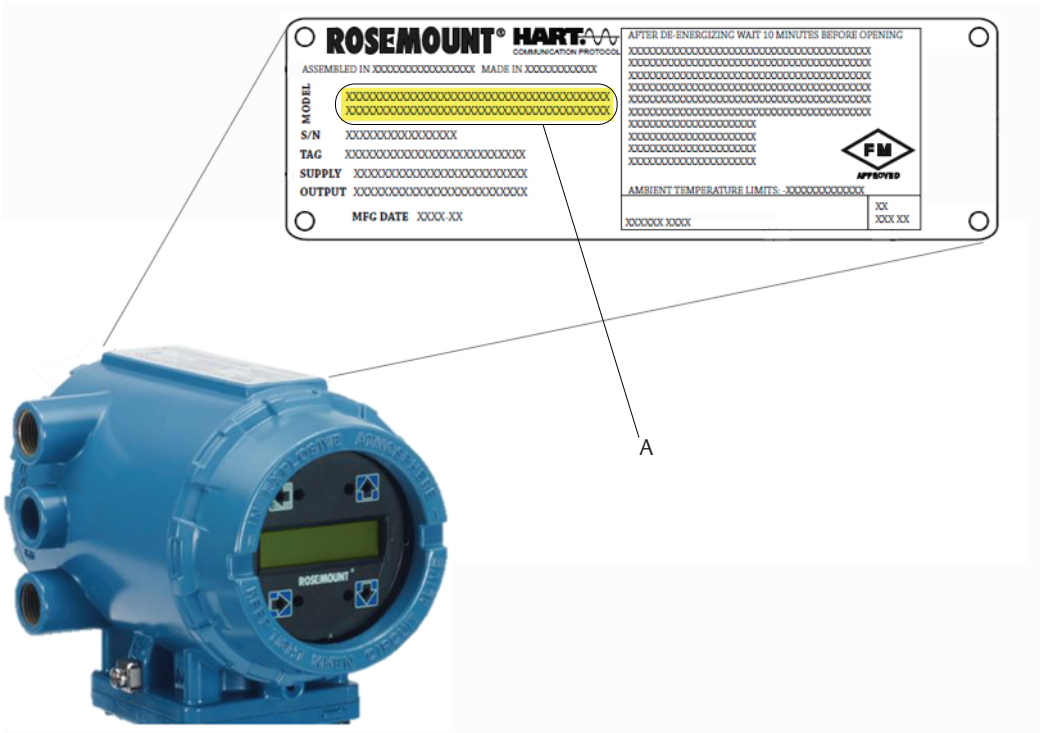
8.4.1 Field mount transmitter

Prior to installing the replacement electronics stack, it is important to verify the transmitter housing you have is the Rosemount 8750WM Transmitter.

Follow the steps below to confirm the transmitter housing is compatible with this electronics kit.

1. Verify the model number is Rosemount 8750WM. If the transmitter model is not Rosemount 8750WM, then these electronics are not compatible. See Figure 8-2 for the location of the model number. Consult the Rosemount 8750W Product Data Sheet (document number 00813-0100-4750) for details on ordering a new transmitter.

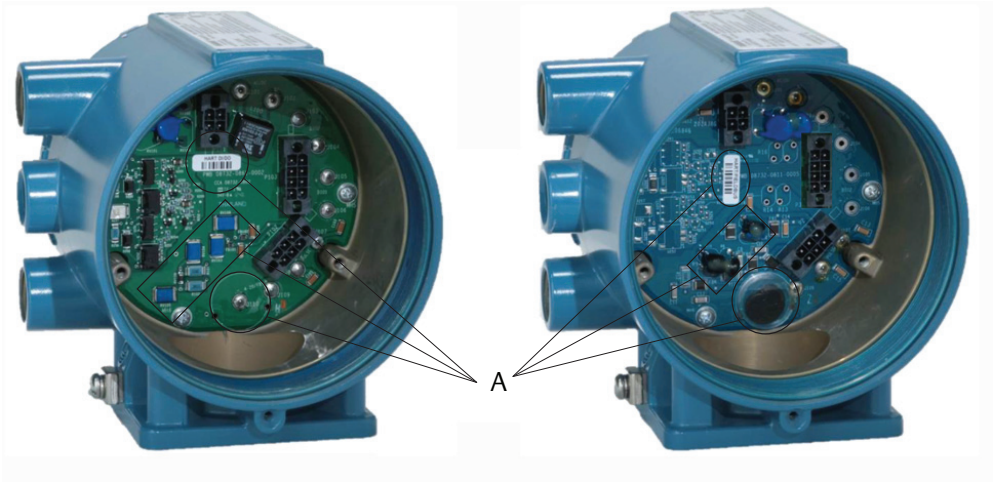
Figure 8-2. Field Mount – Transmitter Nameplate Location



A. Transmitter model number

2. Verify the electronics board inside the housing is green and looks like the board pictured on the left in Figure 8-3. If the board is not green, or does not look like the board pictured, then the electronics are not compatible.

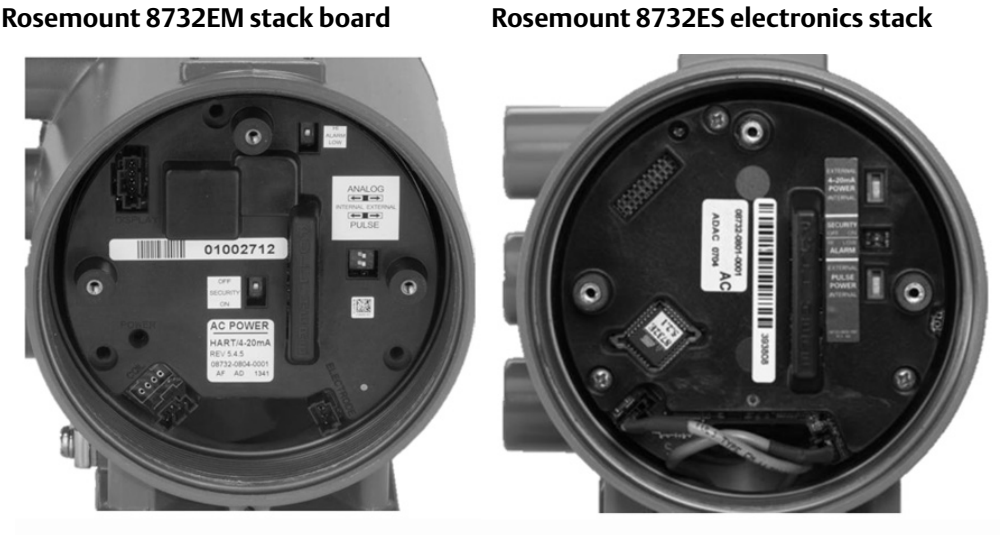
Figure 8-3. Field Mount – Transmitter Housing Electronics Board Identification



A. Key indicators

3. Confirm the electronics stack is for an Rosemount 8750W Transmitter. Refer to the picture on the left in Figure 8-4.

Figure 8-4. Field Mount – Electronics Stack Identification



8.5 Replacing the terminal block

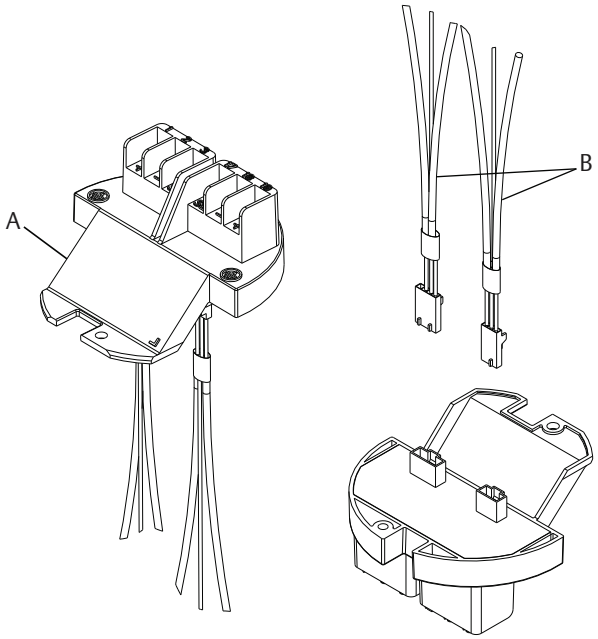
8.5.1 Removing the terminal block

1. Disconnect power to the transmitter and the remote cabling connected to the terminal block.
2. To disconnect the terminal block from the junction box housing, remove the two mounting screws and the two divider mounting screws (if applicable).
3. Remove the coil and electrode wire clips.

8.5.2 Installing the terminal block

1. Connect the coil and electrode clips to the new terminal block.
2. Press the terminal block into its keyed position, and tighten the two mounting screws. Install the divider with the two mounting screws (if applicable).
3. Reconnect remote cabling and replace junction box cover.
4. Reconnect power to the transmitter.

Figure 8-5. Terminal Block



A. Terminal block
B. Coil and electrode lead wires

8.6 Trims

LOI menu path	Field Mount: Diagnostics, Trims Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 5
Device dashboard	3, 4

Trims are used to calibrate the analog loop, calibrate the transmitter, re-zero the transmitter, and calibrate the transmitter with another manufacturer's sensor. Proceed with caution whenever performing a trim function.

8.6.1 D/A trim

LOI menu path	Field Mount: Diagnostics, Trims, D/A Trim Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 5, 1
Device dashboard	3, 4, 4, 5

The *D/A trim* is used to calibrate the 4-20mA analog loop output from the transmitter. For maximum accuracy, the analog output should be trimmed for your system loop. Use the following steps to complete the output trim function.

1. Set the loop to manual, if necessary.
2. Connect a precision ammeter in the 4-20mA loop.
3. Initiate the *D/A trim* function.
4. Enter the 4mA meter value when prompted to do so.
5. Enter the 20mA meter value when prompted to do so.
6. Return the loop to automatic control, if necessary.

The 4-20mA trim is now complete. The *D/A trim* can be repeated to check the results. Alternatively, the analog output test can also be used to verify loop performance.

8.6.2 Scaled D/A trim

LOI menu path	Field Mount: Device Setup, Diagnostics, Trims, Scaled D/A Trim Wall Mount: N/A
Traditional Fast Keys	1, 2, 5, 2 or 1, 4, 2, 1, 7
Device dashboard	3, 4, 4, 6

A *scaled D/A trim* enables calibration of the flowmeter analog output using a different scale than the standard 4-20mA output scale. Non-scaled D/A trimming (described above), is typically performed using an ammeter where calibration values are entered in units of milliamperes. Scaled D/A trimming enables trimming of the flowmeter using a scale that may be more convenient based upon the method of measurement.

For example, it may be more convenient to make current measurements by direct voltage readings across the loop resistor. If the loop resistor is 500 ohms, and calibration of the meter will be done using voltage measurements across this resistor, the trim points can be rescaled from 4-20mA to 4-20mA x 500 ohm or 2-10VDC. Once the scaled trim points have been entered as 2 and 10, calibration of the flowmeter can be done by entering voltage measurements directly from the voltmeter.

8.6.3 Digital trim

LOI menu path	Field Mount: Device Setup, Diagnostics, Trims, Digital Trim Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 5, 3
Device dashboard	3, 4, 5

Digital trim is the function by which the factory calibrates the transmitter. This procedure is rarely needed by users. It is only necessary if the Rosemount 8750W is suspected to be no longer accurate. A Rosemount 8714D Calibration Standard is required to complete a *digital trim*. Attempting a *digital trim* without a Rosemount 8714D Calibration Standard may result in an inaccurate transmitter or an error message. The *digital trim* must be performed with the coil drive mode set to 5Hz and with a nominal sensor calibration number stored in the memory.

Note
Attempting a *digital trim* without a Rosemount 8714D Calibration Standard may result in an inaccurate transmitter, or a “DIGITAL TRIM FAILURE” message may appear. If this message occurs, no values were changed in the transmitter. Simply cycle power on the Rosemount 8750W to clear the message.

To simulate a nominal sensor with the Rosemount 8714D Calibration Standard, change/verify the following five parameters in the Rosemount 8750W:

1. Calibration Number-1000015010000000
2. Units-ft/s
3. PV URV-20mA = 30.00 ft/s
4. PV LRV-4mA = 0 ft/s
5. Coil Drive Frequency-5Hz

Note
Before changing any of the configuration parameters, be sure to record the original values so that the transmitter can be returned to the original configuration prior to being placed back into operation. Failure to return the settings to the original configuration will result in incorrect flow and totalizer readings.

The instructions for changing the calibration number, units, PV URV, and PV LRV are located in "Basic setup" on page 32. Instructions for changing the coil drive frequency can be found on "Coil drive frequency" on page 106.

Set the loop to manual (if necessary) and then complete the following steps:

1. Power down the transmitter.
2. Connect the transmitter to a Rosemount 8714D Calibration Standard.
3. Power up the transmitter with the Rosemount 8714D connected and read the flow rate. The electronics need about a 5-minute warm-up time to stabilize.
4. Set the 8714D Calibration Standard to the 30 ft/s (9.1 m/s) setting.
5. The flow rate reading after warm-up should be between 29.97 (9.1 m/s) and 30.03 ft/s (9.2 m/s).
6. If the reading is within the range, return the transmitter to the original configuration parameters.
7. If the reading is not within this range, initiate a digital trim with the LOI or Field Communicator. The digital trim takes about 90 seconds to complete. No transmitter adjustments are required.

8.6.4 Universal trim

LOI menu path	Field Mount: Device Setup, Diagnostics, Trims, Universal Trim Wall Mount: AUX. FUNCTION
Traditional Fast Keys	1, 2, 5, 5
Device dashboard	2, 4, 1

The universal auto trim function enables the Rosemount 8750W to calibrate sensors that were not calibrated at the Rosemount factory. The function is activated as one step in a procedure known as in-process calibration. If a Rosemount sensor has a 16-digit calibration number, in-process calibration is not required. If it does not, or if the sensor is made by another manufacturer, complete the following steps for in-process calibration. Refer to Appendix D: Implementing a Universal Transmitter.

1. Determine the flow rate of the process fluid in the sensor.

Note
The flow rate in the line can be determined by using another sensor in the line, by counting the revolutions of a centrifugal pump, or by performing a bucket test to determine how fast a given volume is filled by the process fluid.

2. Complete the universal auto trim function.

When the routine is completed, the sensor is ready for use.

8.7 Review

LOI menu path	Field Mount: Device Setup, Review Wall Mount: XMTR INFO
Traditional Fast Keys	1, 5
Device dashboard	N/A

The 8750W includes a capability to review the configuration variable settings.

The flowmeter configuration parameters set at the factory should be reviewed to ensure accuracy and compatibility with the particular application of the flowmeter.

Note
If the LOI is used to review variables, each variable must be accessed as if changing its setting. The value displayed on the LOI screen is the configured value of the variable.

Section 9 Troubleshooting

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Installation check and guide . . . . . page 158
Diagnostic messages . . . . . page 160
Basic troubleshooting . . . . . page 170
Sensor troubleshooting . . . . . page 174
Technical support . . . . . page 178
Service . . . . . page 178

9.1 Introduction

This section covers basic transmitter and sensor troubleshooting. Problems in the magnetic flowmeter system are usually indicated by incorrect output readings from the system, error messages, or failed tests. Consider all sources when identifying a problem in the system. If the problem persists, consult the local Emerson™ Process Management representative to determine if the material should be returned to the factory. Emerson offers several diagnostics that aid in the troubleshooting process. Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Read the following safety messages before performing any operation described in this section. Refer to these warnings when appropriate throughout this section.

The Rosemount™ 8750W performs self-diagnostics on the entire magnetic flowmeter system: the transmitter, the sensor, and the interconnecting wiring. By sequentially troubleshooting each individual piece of the magmeter system, it becomes easier to identify the problem and make the appropriate adjustments.

If there are problems with a new magmeter installation, see "Installation check and guide" below for a quick guide to solve the most common installation problems. For existing magmeter installations, Table 9-7 on page 170 lists the most common magmeter problems and corrective actions.

9.2 Safety messages

⚠WARNING

Failure to follow these guidelines could result in death or serious injury.

- Installation and servicing instructions are for use by qualified personnel only. Do not perform any servicing other than that contained in the operating instructions, unless qualified. Verify the operating environment of the sensor and transmitter is consistent with the appropriate hazardous area approval.
- Mishandling products exposed to a hazardous substance may result in death or serious injury. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

9.3 Installation check and guide

Use this guide to check new installations of Rosemount magnetic flowmeter systems that appear to malfunction.

9.3.1 Transmitter

Before applying power to the magnetic flowmeter system, perform the following transmitter checks:

1. Record the transmitter model number and serial number.
2. Visually inspect the transmitter for any damage including the terminal block.
3. Verify the proper wiring connections have been made for the power and outputs.

Apply power to the magnetic flowmeter system before making the following transmitter checks:

1. Check for an active error message or status alert. Refer to "Diagnostic messages".
2. Verify the correct sensor calibration number is entered in the transmitter. The calibration number is listed on the sensor nameplate.
3. Verify the correct sensor line size is entered in the transmitter. The line size value is listed on the sensor nameplate.
4. Verify the analog range of the transmitter matches the analog range in the control system.
5. Verify the forced analog output and forced pulse output of the transmitter produces the correct output at the control system.
6. If desired, use a Rosemount 8714D to verify the transmitter calibration.

9.3.2 Sensor

Be sure that power to magnetic flowmeter system is removed before beginning the following sensor checks:

1. Record the sensor model number and serial number.
2. Visually inspect the sensor for any damage including inside the remote junction box, if applicable.
3. For horizontal flow installations, ensure the electrodes remain covered by process fluid. For vertical or inclined installations, ensure the process fluid is flowing up into the sensor to keep the electrodes covered by process fluid.
4. Verify the flow arrow is pointing in the same direction as forward flow.
5. Ensure the grounding straps on the sensor are connected to grounding rings or the adjacent pipe flanges. Improper grounding will cause erratic operation of the system. Sensors with a ground electrode will not require the grounding straps to be connected.

9.3.3 Remote wiring

1. The electrode signal and coil drive wires must be separate cables, unless Rosemount specified combo cable is used. See "Wiring the transmitter" on page 19.
2. The electrode signal wire and coil drive wire must be twisted shielded cable. Rosemount recommends 20 AWG twisted shielded cable for the electrode signal and 14 AWG twisted shielded cable for the coil drive. See "Wiring the transmitter" on page 19.
3. See Appendix B: Product Certifications regarding wiring installation requirements.
4. See Appendix C: Wiring Diagrams for component and/or combination cable wiring.
5. Verify there is minimal exposed wiring and shielding. Less than 1-in. (25 mm) is recommended.
6. The single conduit that houses both the electrode signal and coil drive cables should not contain any other wires. This includes wires from other magmeters.

Note
For installations requiring intrinsically safe electrodes, the signal and coil drive cables must be run in Individual conduits.

9.3.4 Process fluid

1. The process fluid should have a minimum conductivity of 5 microsiemens/cm (5 micro mhos/cm).
2. The process fluid must be free of air and gases.
3. The sensor must be full of process fluid.
4. The process fluid must be compatible with the wetted materials - liner, electrodes, ground rings, and lining protectors. Refer to the Rosemount Technical Note titled "Rosemount Magnetic Flowmeter Material Selection Guide" (document number 00816-0100-3033) for details.

9.4 Diagnostic messages

Problems in the magnetic flowmeter system are usually indicated by incorrect output readings from the system, error messages, or failed tests. Consider all sources in identifying a problem in the system.

Table 9-1. Basic Diagnostic Messages

Error message	Potential cause	Corrective action
Empty Pipe	Empty pipe	• None - message will clear when pipe is full
	Wiring error	• Check that wiring matches appropriate wiring diagrams
	Electrode error	• Perform sensor tests - see Table 9-8 on page 175
	Conductivity less than 5 microsiemens per cm	• Increase conductivity to greater than or equal to 5 microsiemens per cm
	Intermittent diagnostic	• Adjust tuning of empty pipe parameters - see Section 8.4.1
Coil Open Circuit	Improper wiring	• Check coil drive wiring and sensor coils Perform sensor tests - see Table 9-8 on page 175
	Other manufacturer's sensor	• Change coil current to 75 mA - set calibration numbers to 10000550100000030 • Perform a universal auto-trim to select the proper coil current
	Electronics board failure	• Replace 8750W electronics stack
	Coil circuit open fuse	• Return the unit to the factory for fuse replacement
Auto Zero Failure	Flow is not set to zero	• Force flow to zero, perform auto zero trim
	Unshielded cable in use	• Change wire to shielded cable
	Moisture problems	• See Table 9-8 on page 175
Auto-Trim Failure	No flow in pipe while performing Universal Auto Trim	• Establish a known flow rate, and perform universal auto-trim calibration
	Wiring error	• Check that wiring matches appropriate wiring diagrams - see "Implementing a Universal Transmitter" on page 221
	Flow rate is changing in pipe while performing Universal Auto-Trim routine	• Establish a constant flow rate, and perform universal auto-trim calibration
	Flow rate through sensor is significantly different than value entered during Universal Auto-Trim routine	• Verify flow in sensor and perform universal auto-trim calibration
	Incorrect calibration number entered into transmitter for Universal Auto-Trim routine	• Replace sensor calibration number with 1000005010000000
	Wrong sensor size selected	• Correct sensor size setting - see "Line size" on page 33
	Sensor failure	• Perform sensor tests - see Table 9-8 on page 175
Electronics Failure	Electronics self check failure	• Cycle power to see if diagnostic message clears • Replace Electronics stack
Electronics Temp Fail	Ambient temperature exceeded the electronics temperature limits	• Move transmitter to a location with an ambient temperature range of -40 to 140 °F (-40 to 60 °C)

Table 9-1. Basic Diagnostic Messages

Error message	Potential cause	Corrective action
Reverse Flow	Electrode or coil wires reverse	• Verify wiring between sensor and transmitter
	Flow is reverse	• Turn ON Reverse Flow Enable to read flow
	Sensor installed backwards	• Install sensor correctly, or switch either the electrode wires (18 and 19) or the coil wires (1 and 2)
PZR Activated (Positive Zero Return)	External voltage applied to terminals 5 and 6	• Remove voltage to turn PZR off
Pulse Out of Range	The transmitter is trying to generate a frequency greater than allowed	• Standard pulse - increase pulse scaling to prevent pulse output from exceeding 11,000 Hz • Intrinsically safe pulse - Increase pulse scaling to prevent pulse output from exceeding 5,500 Hz • Pulse output is in fixed pulse mode and is trying to generate a frequency greater than the pulse width can support - see "Pulse width" on page 89 • Verify the sensor calibration number and line size are correctly entered in the electronics
Analog Out of Range	Flow rate is greater than analog output range	• Reduce flow, adjust URV and LRV values • Verify the sensor calibration number and line sizes are correctly entered in the electronics
Flowrate > 43 ft/sec	Flow rate is greater than 43 ft/sec	• Lower flow velocity, increase pipe diameter
	Improper wiring	• Check coil drive wiring and sensor coils • Perform sensor tests - see Table 9-8 on page 175
Digital Trim Failure (Cycle power to clear messages, no changes were made)	The calibrator (8714B/C/D) is not connected properly	• Review calibrator connections
	Incorrect calibration number entered into transmitter	• Replace sensor calibration number with 1000015010000000
	Calibrator is not set to 30 FPS	• Change calibrator setting to 30 FPS
	Bad calibrator or calibrator cable	• Replace calibrator and/or calibrator cable
Coil Over Current[(1)]	Improper wiring	• Check coil drive wiring and sensor coils Perform sensor tests - see Table 9-8 on page 175
	Transmitter failure	• Replace the electronics stack
Coil Power Limit[(1)]	Improper wiring	• Check coil drive wiring and sensor coils Perform sensor tests - see Table 9-8 on page 175
	Incorrect calibration number	• Verify configured calibration number matches sensor tag
	Transmitter connected to other manufacturer's sensor	• Change coil current to 75 mA - set calibration number to 10000550100000030 • Perform a universal auto-trim to select the proper coil current
	Coil drive frequency set to 37 Hz	• Sensor may not be compatible with 37 Hz. Switch coil drive frequency to 5 Hz.
	Sensor failure	• Perform sensor tests - see Table 9-8 on page 175

Table 9-1. Basic Diagnostic Messages

Error message	Potential cause	Corrective action
No AO Power[1]	Improper wiring	• Check the analog loop wiring - see "Wiring the transmitter" on page 19
	No external loop power	• Verify the analog power switch position (internal/external) • For externally powered loop, verify power supply requirements - see "Powering the transmitter" on page 28
	No loop resistance (open loop)	• Install resistance across the analog output terminals • Disable message using *LOI Error Mask* parameter
	Transmitter failure	• Replace the electronics stack
Electrode Saturation[1]	Improper wiring	• See "Wiring the transmitter" on page 19
	Improper process reference	• See "Process reference connection" on page 17
	Improper earth grounding	• Verify earth ground connections - see "Wiring the transmitter" on page 19
	Application requires special transmitter	• Replace transmitter with transmitter that includes special option F0100

1. Only available on the Field Mount Transmitter.

Table 9-2. Advanced Process Diagnostic Messages

Error message	Potential cause	Corrective action
Grounding/Wiring Fault	Improper installation of wiring	• See "Wiring the transmitter" on page 19
	Coil/electrode shield not connected	• See "Wiring the transmitter" on page 19
	Improper process grounding	• See "Process reference connection" on page 17
	Faulty ground connection	• Check wiring for corrosion, moisture in the terminal block -see "Process reference connection" on page 17
	Sensor not full	• Verify sensor is full • Enable empty pipe detection
High Process Noise	Slurry flows - mining/pulp stock	• Decrease the flow rate below 10 ft/s (3 m/s) • Complete the possible solutions listed under "Troubleshooting high process noise" on page 166
	Chemical additives upstream of the sensor	• Move injection point downstream of the sensor or move the sensor to a new location • Complete the possible solutions listed under "Troubleshooting high process noise" on page 166
	Electrode not compatible with the process fluid	• Refer to the Rosemount Magnetic Flowmeter Material Selection Guide (document number 00816-0100-3033)
	Gas/air in line	• Move the sensor to another location in the process line to ensure that it is full under all conditions
	Electrode coating	• Enable coated electrode detection diagnostic • Use bullet-nose electrodes • Downsize sensor to increase flowrate above 3 ft/s (1 m/s) • Periodically clean sensor
	Styrofoam or other insulating particles	• Complete the possible solutions listed under "Troubleshooting high process noise" on page 166 • Consult factory
	Low conductivity fluids (below 10 microsiemens/cm)	• Trim electrode and coil wires - see "Sensor location" on page 12 • Use integral mount transmitter • Set coil drive frequency to 37 Hz
Electrode Coating Level 1[1]	Coating is starting to buildup on electrode and interfering with measurement signal	• Schedule maintenance to clean electrode • Use bullet nose electrodes • Downsize sensor to increase flow rate above 3 ft/s (1 m/s)
	Process fluid conductivity has changed	• Verify process fluid conductivity
Electrode Coating Level 2[1]	Coating has built-up on electrode and is interfering with measurement signal	• Schedule maintenance to clean electrode • Use bullet nose electrodes • Downsize sensor to increase flow rate above 3 ft/s (1 m/s)
	Process fluid conductivity has changed	• Verify process fluid conductivity

1. Only available on the Field Mount Transmitter.

Table 9-3. Advanced Meter Verification Messages

Error message	Potential cause	Corrective action
8714i Failed	Transmitter calibration verification test failed	• Verify pass/fail criteria • Rerun SMART™ Meter Verification (8714i) under no flow conditions • Verify calibration using 8714 Calibration Standard • Perform digital trim • Replace electronics board
	Sensor calibration test failed	• Verify pass/fail criteria • Rerun SMART Meter Verification (8714i) • Perform sensor tests - see Table 9-8 on page 175
	Sensor coil circuit test failed	• Verify pass/fail criteria • Rerun SMART Meter Verification (8714i) • Perform sensor tests - see Table 9-8 on page 175
	Sensor electrode circuit test failed	• Verify electrode resistance has a baseline (signature) value from a full pipe baseline • Verify test condition was selected properly • Verify pass/fail criteria • Rerun SMART Meter Verification (8714i) • Perform sensor tests - see Table 9-8 on page 175
4-20 mA loop verification failed(1)	Analog loop not powered	• Check 4-20 mA internal/external loop power switch - see "Internal/external analog power" on page 38 • Check external supply voltage to the transmitter • Check for parallel paths in the current loop
	Transmitter failure	• Perform transmitter self test • Perform manual analog loop test and D/A trim if necessary • Replace the electronics board
Continuous Meter Verification Error(1)	Transmitter calibration verification test failed	• Verify pass/fail criteria • Run manual SMART Meter Verification (8714i) under no flow conditions • Verify calibration using 8714D Calibration Standard • Perform digital trim • Replace electronics stack
	Sensor calibration test failed	• Run manual SMART Meter Verification (8714i) • Perform sensor tests - see Table 9-8 on page 175
	Sensor coil circuit test failed	• Run manual SMART Meter Verification (8714i) • Perform sensor tests - see Table 9-8 on page 175
	Sensor electrode circuit test failed	• Run manual SMART Meter Verification (8714i) • Perform sensor tests - see Table 9-8 on page 175 • Verify electrode resistance has a signature value from a full pipe baseline
Simulated Velocity Out of Spec(1)	Unstable flow rate during the verification test or noisy process	• Run manual transmitter verification test with no flow and a full pipe
	Transmitter drift or faulty electronics	• Verify transmitter electronics with 8714D Calibration Standard. The dial on the 8714D should be set to 30 ft/s (9.14 m/s). The transmitter should be set up with the nominal calibration number (1000015010000000) and 5 Hz coil drive frequency. • Perform an electronics trim using the 8714 • If the electronics trim doesn't correct the issue, replace the electronics

Table 9-3. Advanced Meter Verification Messages

Error message	Potential cause	Corrective action
Coil Resistance Out of Spec[1]	Moisture in the terminal block of the sensor or shorted coil	• Perform sensor tests - see Table 9-8 on page 175 • If the problem persists, replace the sensor
Coil Signature Out of Spec[1]	Moisture in the terminal block of the sensor or shorted coil	• Perform sensor tests - see Table 9-8 on page 175 • If the problem persists, replace the sensor
	Calibration shift caused by heat cycling or vibration	• Perform sensor tests - see Table 9-8 on page 175 • If the problem persists, replace the sensor
Electrode Resistance Out of Spec[1]	Moisture in the terminal block of the sensor	• Perform sensor tests - see Table 9-8 on page 175 • If the problem persists, replace the sensor
	Electrode coating	• Enable coated electrode detection diagnostic • Use bullet-nose electrodes • Downsize sensor to increases flowrate above 3 ft/s (1 m/s) • Periodically clean sensor
	Shorted electrodes	• Perform sensor tests - see Table 9-8 on page 175 • If the problem persists, replace the sensor
Analog Output Out of Spec[1]	Unstable flow rate during the verification test or noisy process	• Run manual transmitter verification test with no flow and a full pipe
	Analog output is no longer within accuracy specifications	• Check the analog loop wiring. Excessive loop resistance can cause an invalid test

1. Only available on the Field Mount Transmitter.

9.4.1 Troubleshooting empty pipe

The following actions can be taken if empty pipe detection is unexpected:

1. Verify the sensor is full.
2. Verify the sensor has not been installed with a measurement electrode at the top of the pipe.
3. Decrease the sensitivity by setting the *empty pipe trigger level* to a value of at least 20 counts above the *empty pipe value* read with a full pipe.
4. Decrease the sensitivity by increasing the *empty pipe counts* to compensate for process noise. The *empty pipe counts* is the number of consecutive *empty pipe value* readings above the *empty pipe trigger level* required to set the *empty pipe diagnostic*. The count range is 2-50, factory default set at 5.
5. Increase process fluid conductivity above 50 microsiemens/cm.
6. Properly connect the wiring between the sensor and the transmitter. Corresponding terminal block numbers in the sensor and transmitter must be connected.
7. Perform the sensor electrical resistance tests. For more detailed information, consult Table 9-8 on page 175.

9.4.2 Troubleshooting ground/wiring fault

If transmitter detects high levels (greater than 5mV) 50/60 Hz noise caused by improper wiring or poor process grounding:

1. Verify the transmitter is earth grounded.
2. Connect ground rings, grounding electrode, or grounding straps. Grounding diagrams can be found in "Process reference connection" on page 17.
3. Verify the sensor is full.
4. Verify wiring between sensor and transmitter is prepared properly. Shielding should be stripped back less than 10-in. (25 mm).
5. Use separate shielded twisted pairs for wiring between sensor and transmitter.
6. Properly connect the wiring between the sensor and the transmitter. Corresponding terminal block numbers in the sensor and transmitter must be connected.

9.4.3 Troubleshooting high process noise

The transmitter detected high levels of process noise. If the signal to noise ratio is less than 25 while operating in 5 Hz mode, proceed with the following steps:

1. Increase transmitter coil drive frequency to 37 Hz[1] (refer to "Coil drive frequency" on page 106) and, if possible, perform auto zero function ("Auto zero" on page 141).

1. *37 Hz only available on line sizes 16-in. (400 mm)*

2. Verify sensor is electrically connected to the process with process reference electrode, grounding rings with grounding straps, or lining protector with grounding straps.

3. If possible, redirect chemical additions downstream of the magmeter.

4. Verify process fluid conductivity is above 10 microsiemens/cm.

If the signal to noise ratio is less than 25 while operating in 37 Hz mode, proceed with the following steps:

1. Turn on the Digital Signal Processing (DSP) technology and follow the setup procedure (see Section 7: Digital Signal Processing). This will minimize the level of damping in the flow measurement and control loop while also stabilizing the reading to minimize valve actuation.

2. Increase damping to stabilize the signal (refer to "PV damping" on page 108). This will add response time to the control loop.

3. Move to a Rosemount High-Signal flowmeter system. This flowmeter will deliver a stable signal by increasing the amplitude of the flow signal by ten times to increase the signal to noise ratio. For example if the signal to noise ratio (SNR) of a standard magmeter is 5, the High-Signal would have a SNR of 50 in the same application. The Rosemount High-Signal system is comprised of the 8707 sensor which has modified coils and magnetics and the 8712H High-Signal transmitter.

Note
In applications where very high levels of noise are a concern, it is recommended that a dual-calibrated Rosemount High-Signal 8707 sensor be used. These sensors can be calibrated to run at lower coil drive current supplied by the standard Rosemount transmitters, but can also be upgraded by changing to the 8712H High-Signal transmitter.

1/f noise

This type of noise has higher amplitudes at lower frequencies, but generally degrades over increasing frequencies. Potential sources of 1/f noise include chemical mixing and slurry flow particles rubbing against the electrodes. This type of noise can be mitigated by switching to the 37 Hz coil drive frequency.

Spike noise

This type of noise generally results in a high amplitude signal at specific frequencies which can vary depending on the source of the noise. Common sources of spike noise include chemical injections directly upstream of the flowmeter, hydraulic pumps, and slurry flows with low concentrations of particles in the stream. The particles bounce off of the electrode generating a "spike" in the electrode signal. An example of this type of flow stream would be a recycle flow in a paper mill. The type of noise can be mitigated by switching to the 37 Hz coil drive frequency and enabling the digital signal processing.

White noise

This type of noise results in a high amplitude signal that is relatively constant over the frequency range. Common sources of white noise include chemical reactions or mixing that occurs as the fluid passes through the flowmeter and high concentration slurry flows where the particulates are constantly passing over the electrode head. An example of this type of flow stream would be a basis weight stream in a paper mill. This type of noise can be mitigated by switching to the
37 Hz coil drive frequency and enabling the digital signal processing.

9.4.4 Troubleshooting coated electrode detection

In the event that electrode coating is detected, use the following table to determine the appropriate course of action.

Table 9-4. Troubleshooting the Electrode Coating Diagnostic(1)

Error message	Potential causes of error	Steps to correct
Electrode Coating Level 1	• Insulating coating is starting to build up on the electrode and may interfere with the flow measurement signal • Process fluid conductivity has decreased to a level close to operational limits of the meter	• Verify process fluid conductivity • Schedule maintenance to clean the electrodes • Use bullet nose electrodes • Replace the meter with a smaller diameter meter to increase the flow velocity to above 3 ft/s (1 m/s)
Electrode Coating Level 2	• Insulating coating has built up on the electrodes and is interfering with the flow measurement signal • Process fluid conductivity has decreased to a level below the operational limits of the meter	• Verify process fluid conductivity • Schedule maintenance to clean the electrodes • Use bullet nose electrodes • Replace the meter with a smaller diameter meter to increase the flow velocity to above 3 ft/s (1 m/s)

1. Only available with Field Mount Transmitter.

9.4.5 Troubleshooting 4-20 mA loop verification

In the event that the 4-20 mA Loop Verification fails, use the following table to determine the appropriate course of action.

Table 9-5. Troubleshooting the Analog Loop Verification Diagnostic(1)

Test	Potential cause	Corrective action
4-20 mA Loop Verification Failure	• Analog loop not powered	• Check analog loop wiring • Check loop resistance • Check analog loop power switch – see “Powering the transmitter” on page 28 • Check external supply voltage to the transmitter • Check for parallel paths in the current loop
	• Analog drift	• Perform D/A trim
	• Transmitter failure	• Perform transmitter self-test • Perform manual analog loop test • Replace the electronics stack

1. Only available with Field Mount Transmitter.

9.4.6 Troubleshooting the SMART Meter Verification test

In the event that the SMART Meter Verification test fails, use the following table to determine the appropriate course of action. Begin by reviewing the SMART Meter Verification results to determine the specific test that failed.

Table 9-6. Troubleshooting the SMART Meter Verification Diagnostic

Test	Potential cause	Corrective action
Transmitter Verification Test	• Unstable flow reading during the test • Noise in the process • Transmitter drift • Faulty electronics	• Rerun SMART Meter Verification (8714i) under No Flow conditions. • Check the transmitter calibration with the 8714D Calibration Standard. • Perform a digital trim. • Replace the electronics stack.
Sensor Calibration Verification	• Moisture in the sensor terminal block • Calibration shift caused by heat cycling or vibration	• Rerun SMART Meter Verification (8714i). • Perform the sensor checks detailed in "Sensor" on page 158. • Remove the sensor and send back for evaluation and/or recalibration.
Coil Circuit Health	• Moisture in the sensor terminal block • Shorted coil	
Electrode Circuit Health	• Electrode resistance baseline was not taken after installation • Test condition was not selected properly • Moisture in the sensor terminal block • Coated electrodes • Shorted electrodes	

9.5 Basic troubleshooting

When troubleshooting a magmeter, it is important to identify the issue. Table 9-7 below provides common symptoms displayed by a magmeter that is not functioning properly. This table provides potential causes and suggested corrective actions for each symptom.

Table 9-7. Common Magmeter Issues

Symptom	Potential cause	Corrective action
Output at 0 mA	• No power to transmitter	• Check power source and connections to the transmitter.
	• Analog output improperly configured	• Check the analog power switch position. • Verify wiring and analog power.
	• Electronics failure	• Verify transmitter operation with an 8714D Calibration Standard or replace the electronic stack.
	• Blown fuse	• Check the fuse and replace with an appropriately rated fuse, if necessary.
Output at 4 mA	• Transmitter in multidrop mode	• Configure Poll Address to 0 to take transmitter out of multidrop mode.
	• Low Flow Cutoff set too high	• Configure Low Flow Cutoff to a lower setting or increase flow to a value above the low flow cutoff.
	• PZR Activated	• Open PZR switch at terminals 5 and 6 to deactivate the PZR.
	• Flow is in reverse direction	• Enable Reverse Flow function.
	• Shorted coil	• Coil check – perform sensor test.
	• Empty pipe	• Fill pipe.
	• Electronics failure	• Verify transmitter operation with an 8714D Calibration Standard or replace the electronics stack.
Output will not reach 20 mA	• Loop resistance is greater than 600 ohms	• Reduce loop resistance to less than 600 ohms. • Perform analog loop test.
	• Insufficient supply voltage to analog output	• Verify analog output supply voltage. • Perform analog loop test.
Output at 20.8 mA	• Transmitter not ranged properly	• Reset the transmitter range values – see “URV (Upper Range Value)” on page 33. • Check tube size setting in transmitter and make sure it matches the actual tube size – see “Line size” on page 33.

Table 9-7. Common Magmeter Issues

Symptom	Potential cause	Corrective action
Output at alarm level	• Electronics failure	• Cycle power. If alarm is still present, verify transmitter operation with an 8714 D Calibration Standard or replace the electronics stack.
	• Open coil circuit	• Check coil drive circuit connections at the sensor and at the transmitter.
	• Analog output diagnostic alarm is active	• See "AO diagnostic alarm" on page 87.
	• Coil power or coil current is over limit	• Check coil drive circuit connections at the sensor and at the transmitter. • Cycle power. If alarm is still present, verify transmitter operation with an 8714 D Calibration Standard or replace the electronics stack.
	• Connected to incompatible sensor	• See "Implementing a Universal Transmitter" on page 221.
Pulse output at zero, regardless of flow	• Wiring error	• Check pulse output wiring at terminals 3 and 4. Refer to wiring diagram for pulse counter and pulse output. See "Connect pulse output" on page 40.
	• PZR activated	• Remove signal at terminals 5 and 6 to deactivate the PZR.
	• No power to transmitter	• Check pulse output wiring at terminals 3 and 4. Refer to wiring diagram for pulse counter and pulse output. • Power the transmitter.
	• Reverse flow	• Enable Reverse Flow function.
	• Electronics failure	• Verify transmitter operation with an 8714D Calibration Standard or replace the electronics stack.
	• Pulse output incorrectly configured	• Review configuration and correct as necessary.
Communication problems with the Field Communicator	• 4–20 mA output configuration	• Check analog power switch (internal/external). The Field Communicator requires a 4–20 mA output to function.
	• Communication interface wiring problems	• Incorrect load resistance (250 Ohm minimum, 600 Ohm maximum);check appropriate wiring diagram.
	• Low batteries in the Field Communicator	• Replace the batteries in the Field Communicator – see the communicator manual for instructions.
	• Old revision of software in the Field Communicator	• Consult your Emerson Process Management representative about updating to the latest revision of software.
Error Messages on LOI or Field Communicator	• Many possible causes depending upon the message	• See Table 9-1 on page 160, Table 9-2 on page 163, and Table 9-3 on page 164 for the LOI or Field Communicator messages.
Discrete input does not register	• Input signal does not provide enough counts	• Verify the discrete input provided meets the requirements in "Connect discrete output" on page 44. • Perform a loop test to validate the analog control loop. • Perform a D/A trim. This allows the calibration of the analog output with an external reference at operating endpoints of the analog output.

Table 9-7. Common Magmeter Issues

Symptom	Potential cause	Corrective action

Reading does not appear to be within rated accuracy	• Transmitter, control system, or other receiving device not configured properly	• Check all configuration variables for the transmitter, sensor, communicator, and/or control system
		• Check these other transmitter settings:
		  • Sensor calibration number
		  • Units
		  • Line size
		• Perform a loop test to check the integrity of the circuit

	• Electrode Coating	• Enable Coated Electrode Detection diagnostic • Use bullet-nose electrodes • Downsize sensor to increase flow rate above 3 ft/s • Periodically clean sensor
	• Gas/air in line	• Move the sensor to another location in the process line to ensure that it is full under all conditions
	• Moisture problem	• Perform the sensor tests - see Table 9-8 on page 175
	• Insufficient upstream/downstream pipe diameter	• Move sensor to a new location with five pipe diameters upstream and two pipe diameters downstream if possible
	• Cables for multiple magmeters run through same conduit	• Use dedicated conduit run for each sensor and transmitter
	• Improper wiring	• If electrode shield and electrode signal wires are switched, flow indication will be about half of what is expected. Check wiring diagrams.
	• Flow rate is below 1 ft/s (specification issue)	• See accuracy specification for specific transmitter and sensor
	• Auto zero was not performed when the coil drive frequency was changed from 5 Hz to 37 Hz	• Set the coil drive frequency to 37 Hz, verify the sensor is full, verify there is no flow, and perform the auto zero function
	• Sensor failure–shorted electrode	• Perform the sensor tests - see Table 9-8 on page 175
	• Sensor failure–shorted or open coil	• Perform the sensor tests - see Table 9-8 on page 175
	• Transmitter failure	• Verify transmitter operation with a Rosemount 8714 Calibration Standard or replace the electronics board

Table 9-7. Common Magmeter Issues

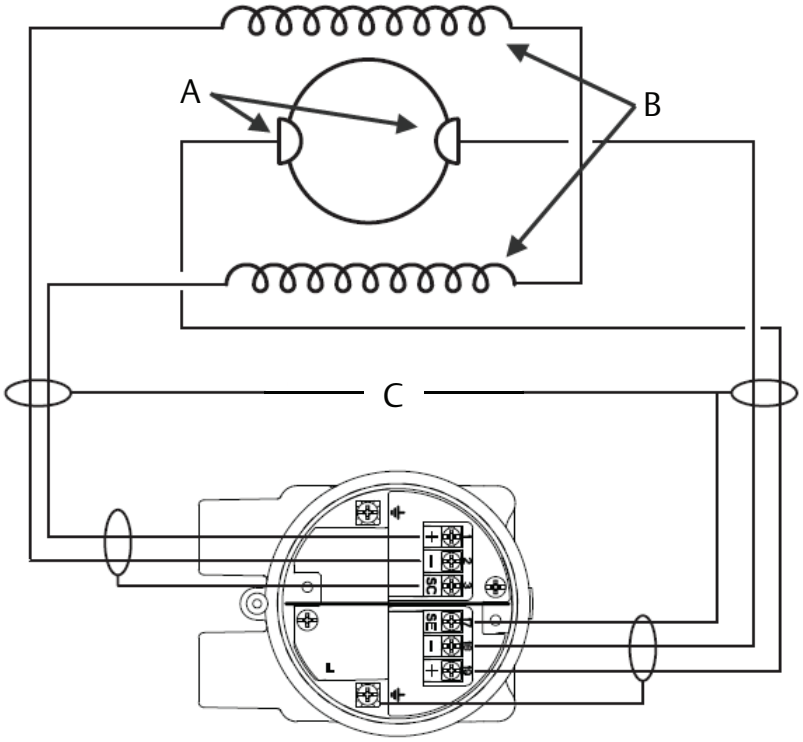
Symptom	Potential cause	Corrective action
Noisy process	• Chemical additives upstream of magnetic flowmeter	• See "Troubleshooting high process noise" on page 166 • Move injection point downstream of magnetic flowmeter, or move magnetic flowmeter
	• Sludge flows–mining/coal/ sand/slurries (other slurries with hard particles)	• Decrease flow rate below 10 ft/s
	• Styrofoam or other insulating particles in process	• See "Troubleshooting high process noise" on page 166 • Consult factory
	• Electrode coating[1]	• Enable Coated Electrode Detection diagnostic • Use a smaller sensor to increase flow rate above 3 ft/s • Periodically clean sensor
	• Gas/air in line	• Move the sensor to another location in the process line to ensure that it is full under all conditions
	• Low conductivity fluids (below 10 microsiemens/cm)	• Trim electrode and coil wires – see "Cable preparation" on page 23 • Keep flow rate below 3 FPS • Integral mount transmitter • Use component cable - see Table 2-12 on page 34
Meter output is unstable	• Medium to low conductivity fluids (10–25 microsiemens/cm) combined with cable vibration or 60 Hz interference	• Eliminate cable vibration • Move cable to lower vibration run • Tie down cable mechanically • Use an integral mount • Trim electrode and coil wires - see "Cable preparation" on page 23 • Route cable line away from other equipment powered by 60 Hz • Use component cable - see Table 2-12 on page 34
	• Electrode incompatibility	• Check the Technical Data Sheet, Magnetic Flowmeter Material Selection Guide (document number 00816-0100-3033), for chemical compatibility with electrode material
	• Improper grounding	• Check ground wiring – see "Process reference connection" on page 48 for wiring and grounding procedures
	• High local magnetic or electric fields	• Move magnetic flowmeter (20- to 25-ft. away is usually acceptable)
	• Control loop improperly tuned	• Check control loop tuning
	• Sticky valve (look for periodic oscillation of meter output)	• Service valve
	• Sensor failure	• Perform the sensor tests - see Table 9-8 on page 175
	• Analog output loop problem	• Check that the 4 to 20 mA loop matches the digital value Perform analog output test

1. Only available with Field Mount Transmitter.

9.6 Sensor troubleshooting

This section describes manual tests that can be performed on the sensor to verify the health of individual components. The tests will require the use of a digital multimeter capable of measuring conductance in nanosiemens and an LCR meter. A sensor circuit diagram is shown in Figure 9-1. The tests described below will check for continuity or isolation of the internal components of the sensor.

Figure 9-1. Sensor Circuit Diagram (Simplified)



A. Electrodes
B. Coils
c. Sensor housing

9.6.1 Installed sensor tests

If a problem with an installed sensor is identified, refer to Table 9-8 on page 175 to assist in troubleshooting the sensor. Disconnect or turn off power to the transmitter before performing any of the sensor tests. Always check the operation of test equipment before each test.

If possible, take all readings from the lead wire clips (removal of terminal block is required for access). If the lead wire clips are inaccessible, take measurements at the sensor terminal block or through remote cabling as close to the sensor as possible. Readings taken through remote cabling that is more than 100-ft. (30 m) in length may provide incorrect or inconclusive information and should be avoided.

The expected values in the test below assume the measurements have been taken directly at the clips. Refer to Figure 9-2 on page 176 for electrode and coil wire keyed positions in the clips.

Table 9-8. Sensor Tests and Expected Values

Test	Sensor location	Required equipment	Measuring at connections	Expected value	Potential cause	Corrective action
A. Sensor coil	Installed or uninstalled	Multimeter	1 and 2 = R	2 Ω ≤ R ≤ 18 Ω	• Open or shorted coil	• Remove and replace sensor
B. Shields to case	Installed or uninstalled	Multimeter	17 and 3 3 and case ground 17 and case ground	< 0.3 Ω	• Moisture in terminal block • Leaky electrode • Process behind liner	• Clean terminal block • Remove sensor
C. Coil to coil shield	Installed or uninstalled	Multimeter	1 and 3 2 and 3	∞Ω (< 1nS) ∞Ω (< 1nS)	• Process behind liner • Leaky electrode • Moisture in terminal block	• Remove sensor and dry • Clean terminal block • Confirm with sensor coil test
D. Electrode to electrode shield	Installed	LCR (Set to Resistance and 120 Hz)	18 and 17 = R_1 19 and 17 = R_2	R_1 and R_2 should be stable $\lvert R_1 - R_2 \rvert \leq 300\Omega$	• Unstable R_1 or R_2 values confirm coated electrode • Shorted electrode • Electrode not in contact with process • Empty pipe • Low conductivity • Leaky electrode • Process reference ground not connected properly	• Remove coating from sensor wall • Use bullet-nose electrodes • Repeat measurement • Remove sensor and complete tests in Table 9-9 • Connect process reference ground per "Process reference connection" on page 17
E. Electrode to electrode	Installed	LCR (set to resistance and 120 Hz)	18 and 19	Should be stable and same relative magnitude of R_1 and R_2 from Test D	• See Test D above	• See Test D above

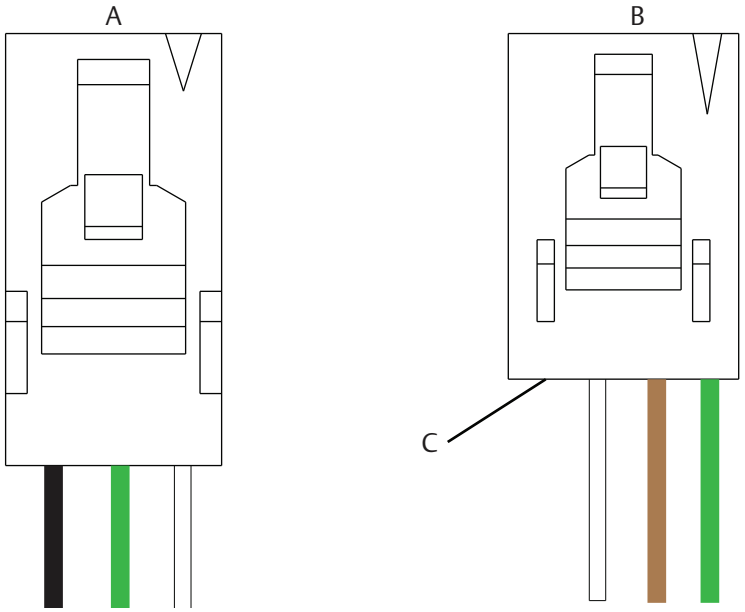
To test the sensor, a multimeter capable of measuring conductance in nanosiemens is preferred. Conductance is the reciprocal of resistance.

Or:

$$1 \text{ nanosiemens} = \frac{1}{1 \text{gigaohm}}$$

$$1 \text{ nanosiemens} = \frac{1}{1 \times 10^{9} \text{ohm}}$$

Figure 9-2. Coil and Electrode Lead Wire Clips



A. Electrode lead wire
B. Coil lead wire
C. Open slot

9.6.2 Uninstalled sensor tests

Sensor troubleshooting can also be performed on an uninstalled sensor. If test results from installed sensor tests are inconclusive, the next step is remove the sensor and perform the tests outlined in Table 9-9. Take measurements from the feed-through pins and directly on the electrode head inside the sensor. The measurement electrodes, 18 and 19, are on opposite sides in the inside diameter of the sensor. If applicable, the third process reference electrode is between the two measurement electrodes.

The expected values in the test below assume the measurements have been taken directly at the pins.

Table 9-9. Uninstalled Sensor Tests and Expected Values

Test	Sensor location	Required equipment	Measuring at connections	Expected value	Potential cause	Corrective action
A. Terminal to front electrode	Uninstalled	Multimeter	18 and electrode 18 (1)	≤ 1Ω	• Shorted electrode • Open electrode • Coated electrode	• Replace sensor • Remove coating from sensor wall
B. Terminal to back electrode	Uninstalled	Multimeter	19 and electrode 19 (1)	≤ 1Ω	• Shorted electrode • Open electrode • Coated electrode	• Replace sensor • Remove coating from sensor wall
C. Terminal to reference electrode	Uninstalled	Multimeter	17 and process reference electrode (2)	≤ 0.3Ω	• Shorted electrode • Open electrode • Coated electrode	• Replace sensor • Remove coating from sensor wall
D. Terminal to case ground	Uninstalled	Multimeter	17 and safety ground	≤ 0.3Ω	• Moisture in terminal block • Leaky electrode • Process behind liner	• Clean terminal block • Replace terminal block • Replace sensor
E. Electrode to electrode shield	Uninstalled	Multimeter	18 and 17	∞Ω (<1 nS)	• Shorted electrode • Leaky electrode • Moisture in terminal block	• Replace sensor • Clean terminal block • Replace terminal block
			19 and 17	∞Ω (<1 nS)	• Shorted electrode • Leaky electrode • Moisture in terminal block	• Replace sensor • Clean terminal block • Replace terminal block
F. Electrode shield to coil	Uninstalled	Multimeter	17 and 1	∞Ω (<1 nS)	• Process in coil housing • Moisture in terminal block	• Replace sensor • Clean terminal block • Replace terminal block

1. When the connection head is in the vertical upright position and the flow arrow (see Figure 2-7 on page 11) on the connection head flange points to the right, the front of the meter will be facing towards you. Electrode 18 is on the front of the meter. If you cannot determine the front of the meter, measure both electrodes. One electrode should result in an open reading, while the other electrode should be less than 1 Ω .
2. Only valid if the sensor has a process reference electrode.

9.7 Technical support

Email addresses:

Worldwide: flow.support@emerson.com

Asia-Pacific: APflow.support@emerson.com

Middle East and Africa: FlowTechnicalSupport@emerson.com

North and South America		Europe and Middle East		Asia Pacific	
United States	800-522-6277	U.K.	0870 240 1978	Australia	800 158 727
Canada	+1 303-527-5200	The Netherlands	+31 (0) 318 495 555	New Zealand	099 128 804
Mexico	+41 (0) 41 7686 111	France	0800 917 901	India	800 440 1468
Argentina	+54 11 4837 7000	Germany	0800 182 5347	Pakistan	888 550 2682
Brazil	+55 15 3238 3677	Italy	8008 77334	China	+86 21 2892 9000
Venezuela	+58 26 1731 3446	Central & Eastern	+41 (0) 41 7686 111	Japan	+81 3 5769 6803
		Russia/CIS	+7 495 981 9811	South Korea	+82 2 3438 4600
		Egypt	0800 000 0015	Singapore	+65 6 777 8211
		Oman	800 70101	Thailand	001 800 441 6426
		Qatar	431 0044	Malaysia	800 814 008
		Kuwait	663 299 01		
		South Africa	800 991 390		
		Saudi Arabia	800 844 9564		
		UAE	800 0444 0684		

9.8 Service

To expedite the return process outside the United States, contact the nearest Rosemount representative.

Within the United States and Canada, call the North American Response Center using the 800-654-RSMT (7768) toll-free number. The Response Center, available 24 hours a day, will assist you with any needed information or materials.

The center will ask for product, model, and serial numbers and will provide a Return Material Authorization (RMA) number. The center will also ask for the name of the process material to which the product was last exposed.

Mishandling products exposed to a hazardous substance may result in death or serious injury. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

The North American Response Center will detail the additional information and procedures necessary to return goods exposed to hazardous substances.

Appendix A Specifications and Reference Data

Field mount transmitter specifications . . . . . page 179
Wall mount transmitter specifications . . . . . page 183
Sensor specifications . . . . . page 187

A.1 Field mount transmitter specifications

A.1.1 Functional specifications

Transmitter coil drive current

500 mA

Flow rate range

Capable of processing signals from fluids that are traveling between 0.04 and 39 ft/s (0.01 to 12 m/s) for both forward and reverse flow in all sensor sizes. Full scale continuously adjustable between –39 and 39 ft/s (–12 to 12 m/s).

Conductivity limits

Process liquid must have a conductivity of 5 microsiemens/cm (5 micromhos/cm) or greater.

Power supply

90 - 250 VAC, 50/60 Hz or 12 - 42 VDC

Line power fuses

90-250 VAC systems

1A, 250V, $I^2t \geq 1.5\ A^2s$ Rating, Fast Acting Bussman AGC-1, Littelfuse 31201.5HXP

12-42 VDC systems

3 Amp, 250V, $I^2t \geq 14\ A^2s$ Rating, Fast Acting Bel Fuse 3AG 3-R, Littelfuse 312003P, Schurter 0034.5135

Power consumption

15 W maximum - DC
40 VA maximum - AC

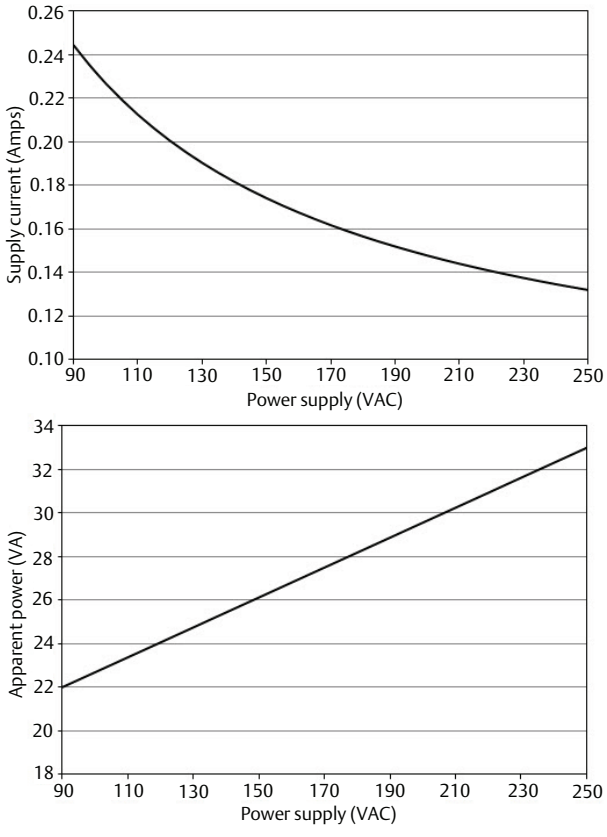
Switch-on current

AC: Maximum 35.7 A (< 5ms) at 250 VAC
DC: Maximum 42 A (< 5ms) at 42 VDC

AC power supply requirements

Units powered by 90 - 250 VAC have the following power requirements.

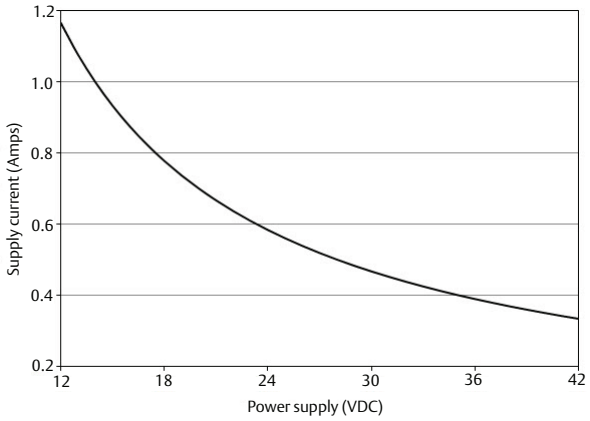
Figure A-1. Field Mount Transmitter AC Power Requirements



DC supply current requirements

Units powered by 12 VDC power supply may draw up to 1.2 A of current steady state.

Figure A-2. Field Mount Transmitter DC Power Requirements



Ambient temperature limits

Operating

–40 to 140 °F (–40 to 60 °C) without local operator interface

–4 to 140 °F (–20 to 60 °C) with local operator interface

The Local Operator Interface (LOI) will not display at temperatures below -20°C

Storage

–40 to 185 °F (–40 to 85 °C) without local operator interface

–22 to 176 °F (–30 to 80 °C) with local operator interface(1)

Humidity limits

0–95% RH to 140 °F (60 °C)

Altitude

2000 meters maximum

Enclosure rating

Type 4X, IEC 60529, IP66 (transmitter)

Transient protection rating

Built in transient protection that conforms to:

- IEC 61000-4-4 for burst currents
- IEC 61000-4-5 for surge currents.
- IEC 611185-2.2000, Class 3 up to 2 kV and up to 2 kA protection.

Turn-on time

- Five minutes to rated accuracy from power up
- Five seconds from power interruption

Start-up time

50ms from zero flow

Low flow cut-off

Adjustable between 0.01 and 38.37 ft/s (0.003 and 11.7 m/s). Below selected value, output is driven to the zero flow rate signal level.

Overrange capability

Signal output will remain linear until 110% of upper range value or 44 ft/s (13 m/s). The signal output will remain constant above these values. Out of range message displayed on LOI and the Field Communicator.

Damping

Adjustable between 0 and 256 seconds

A.1.2 Advanced diagnostics capabilities

Basic

Self test
Transmitter faults
Analog output test
Pulse output test
Tunable empty pipe
Reverse flow
Coil circuit fault
Electronics temperature
Coil current
Electrode saturation

Process diagnostics (DA1)

Ground/wiring fault
High process noise
Electrode coating diagnostic

SMART™ Meter Verification (DA2)

SMART Meter Verification (continuous or on-demand) 4-20 mA loop verification

A.1.3 Output signals

Analog output adjustment

4–20 mA, switch-selectable as internally or externally powered.

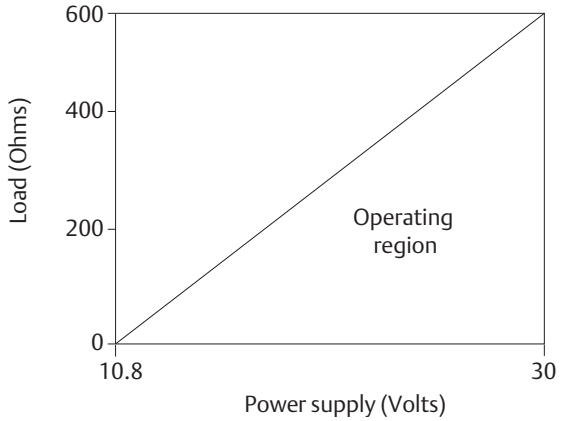
Analog loop load limitations

Internally powered 24 VDC max, 500 ohms max loop resistance

Externally powered 10.8 - 30 VDC max.

Loop resistance is determined by the voltage level of the external power supply at the transmitter terminals.

Figure A-3. Analog Loop Load Limitations



R_{max} = 31.25 (V_{ps} – 10.8)
V_{ps} = Power Supply Voltage (Volts)
R_{max} = Maximum Loop Resistance (Ohms)

The analog output is automatically scaled to provide 4mA at lower range value and 20 mA at upper range value. Full scale continuously adjustable between -39 and 39 ft/s (-12 to 12 m/sec), 1 ft/s (0.3 m/s) minimum span.

HART® communications is a digital flow signal. The digital signal is superimposed on the 4–20 mA signal and is available for the control system interface. A minimum of 250 Ohms loop resistance is required for HART communications.

Scalable pulse frequency adjustment

0-10,000 Hz, switch-selectable as internally or externally powered. Pulse value can be set to equal desired volume in selected engineering units. Pulse width adjustable from 0.1 to 650 ms.

Internally powered: Outputs up to 12 VDC

Externally powered: Input 5 - 28 VDC

Output testing

Analog output test

Transmitter may be commanded to supply a specified current between 3.5 and 23 mA.

Pulse output test

Transmitter may be commanded to supply a specified frequency between 1 and 10,000 Hz.

Optional discrete output function (AX option)

Externally powered at 5 - 28 VDC, 240 mA max, solid state switch closure to indicate either:

Reverse flow

Activates switch closure output when reverse flow is detected.

Zero flow

Activates switch closure output when flow goes to 0 ft/s or below low flow cutoff.

Empty pipe

Activates switch closure output when an empty pipe condition is detected.

Transmitter faults

Activates switch closure output when a transmitter fault is detected.

Flow limit 1, Flow limit 2

Activates switch closure output when the transmitter measures a flow rate that meets the conditions established for this alert. There are two independent flow limit alerts that can be configured as discrete outputs.

Totalizer limit

Activates switch closure output when the transmitter measures a total flow that meets the conditions established for this alert.

Diagnostic status

Activates switch closure output when the transmitter detects a condition that meets the configured criteria of this output.

Optional discrete input function (AX option)

Externally powered at 5 - 28 VDC, 1.4 - 20 mA to activate switch closure to indicate either:

Net total reset

Resets the net totalizer value to zero.

Positive zero return (PZR)

Forces outputs of the transmitter to zero flow.

Security lockout

Security lockout switch on the electronics board can be set to deactivate all LOI and HART-based communicator functions to protect configuration variables from unwanted or accidental change.

LOI lockout

The display can be manually locked to prevent unintentional configuration changes. The display lock can be activated through a HART communication device, or by holding the UP arrow for 3 seconds and then following the on-screen instructions. When the display lock is activated, a lock symbol will appear in the lower right hand corner of the display. To deactivate the display lock, hold the UP arrow for 3 seconds and follow the on-screen instructions.

Display auto lock can be configured from the LOI with the following settings: OFF, 1 Minute, or 10 Minutes

A.1.4 Sensor compensation

Rosemount Sensors are calibrated in a flow lab at the factory and are assigned a calibration number. The calibration number must be entered into the transmitter, enabling interchangeability of sensors without calculations or a compromise in standard accuracy.

Rosemount 8750W transmitters and other manufacturers' sensors can be calibrated at known process conditions or at the Rosemount NIST-Traceable Flow Facility. Transmitters calibrated on site require a two-step procedure to match a known flow rate. This procedure can be found in the operations manual.

A.1.5 Performance specifications

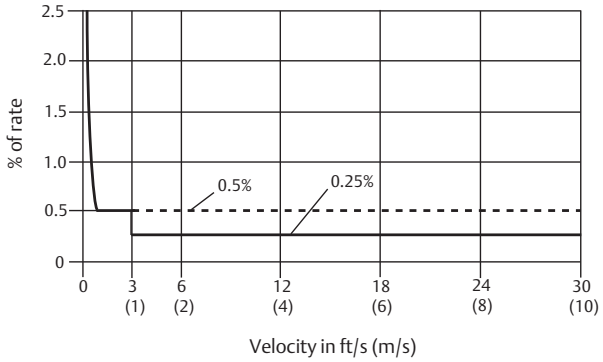
System specifications are given using the frequency output and with the unit at reference conditions.

Accuracy

Includes the combined effects of linearity, hysteresis, and repeatability.

Standard system accuracy is ±0.5% of rate from 1 to 39 ft/s (0.3 to 12 m/s). Accuracy is ±0.005 ft/s (0.0015 m/s) from the low flow cutoff to 1 ft/s (0.3 m/s).

Optional high accuracy is ±0.25% of rate from 3 to 39 ft/s (1 to 12 m/s).



Other manufacturers' sensors

When calibrated in the Rosemount Flow Facility, system accuracies as good as 0.5% of rate can be attained.

There is no accuracy specification for other manufacturers' sensors calibrated in the process line.

A.1.6 Analog output effects

Analog output has the same accuracy as frequency output plus an additional ±4 µA at room temperature.

Repeatability

±0.1% of reading

Response time (Analog Output)

20 ms max response time to step change in input

Stability

±0.25% of rate over six months

Ambient temperature effect

±0.25% change over operating temperature range

A.1.7 Physical specifications

Materials of construction

Standard housing

Low copper aluminum

Type 4X and IEC 60529 IP66

Paint

Polyurethane coat (1.3 to 5 mils thick)

Optional housing

Type 4X and IEC 60529 IP66

Cover gasket

Buna-N

Electrical connections

Conduit entries: 1/2-in. NPT standard. (Optional third connection available). Thread adapters are provided when ordered with M20 conduit entry.

Terminal block screws: 6-32 (No. 6) suitable for up to 14 AWG wire.

Safety grounding screws: external stainless assembly, M5; internal 8-32 (No. 8)

Vibration rating

2G per IEC 61298

Dimensions

See Product Data Sheet.

Weight

Aluminum - approximately 7 lbs. (3.2 kg).

Add 1 pound (0.5 kg) for display option code M4 or M5.

A.2 Wall mount transmitter specifications

A.2.1 Functional specifications

Transmitter coil drive current

500 mA

Flow rate range

Capable of processing signals from fluids that are traveling between 0.04 and 39 ft/s (0.01 to 12 m/s) for both forward and reverse flow in all sensor sizes. Full scale continuously adjustable between –39 and 39 ft/s (–12 to 12 m/s).

Conductivity limits

Process liquid must have a conductivity of 5 microsiemens/cm (5 micromhos/cm) or greater.

Power supply

90 - 250 VAC, 50/60Hz or 12 - 42VDC

Line power fuses

90-250VAC systems

2 Amp, Fast Acting, Bussman AGC-2

12-42VDC systems

3 Amp, Fast Acting, Bussman AGC-3

Power consumption

15 W maximum - DC

40 VA maximum - AC

Switch-on current

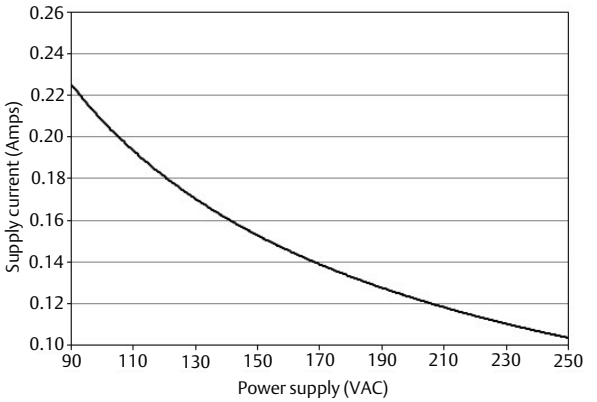
AC: Maximum 35.7 A (< 5 ms) at 250 VAC

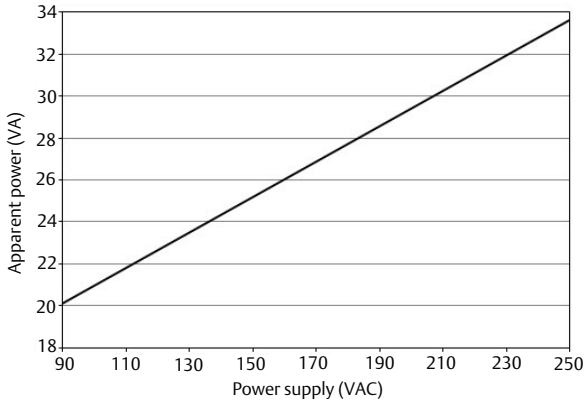
DC: Maximum 42 A (< 5 ms) at 42 VDC

AC power supply requirements

Units powered by 90 - 250 VAC have the following power requirements.

Figure A-4. Wall Mount Transmitter AC Power Requirements

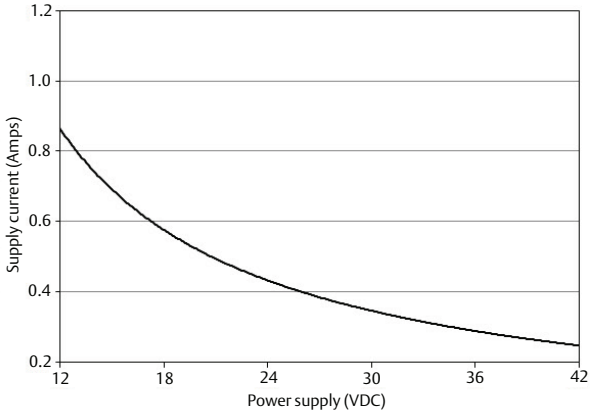




DC supply current requirements

Units powered by 12 VDC power supply may draw up to 1.2 A of current steady state.

Figure A-5. Wall Mount Transmitter DC Power Requirements



Ambient temperature limits

Operating

–40 to 165 °F (–40 to 74 °C) without local operator interface

–20 to 140 °F (–29 to 60 °C) with local operator interface

The Local Operator Interface (LOI) will not display at temperatures below -20 °C

Storage

–40 to 176 °F (–40 to 80 °C) with and without local operator interface

Humidity limits

0–95% RH to 140 °F (60 °C)

Altitude

2000 meters maximum

Enclosure rating

Type 4X, IEC 60529, IP66 (transmitter)

Transient protection rating

Built in transient protection that conforms to:

- IEC 61000-4-4 for burst currents
- IEC 61000-4-5 for surge currents

Turn-on time

- Five minutes to rated accuracy from power up
- Five seconds from power interruption

Start-up time

50ms from zero flow

Low flow cut-off

Adjustable between 0.01 and 38.37 ft/s (0.003 and 11.7 m/s). Below selected value, output is driven to the zero flow rate signal level.

Overrange capability

Signal output will remain linear until 110% of upper range value or 44 ft/s (13 m/s). The signal output will remain constant above these values. Out of range message displayed on LOI and the Field Communicator.

Damping

Adjustable between 0 and 256 seconds

A.2.2 Advanced diagnostics capabilities

Basic

Self test
Transmitter faults
Analog output test
Pulse output test
Tunable empty pipe
Reverse flow
Coil circuit fault
Electronics temperature

Process diagnostics (DA1)

Ground/wiring fault
High process noise

SMART Meter Verification (DA2)

SMART Meter Verification (on-demand)
4-20 mA loop verification

A.2.3 Output signals

Analog output adjustment

4–20 mA, switch-selectable as internally or externally powered.

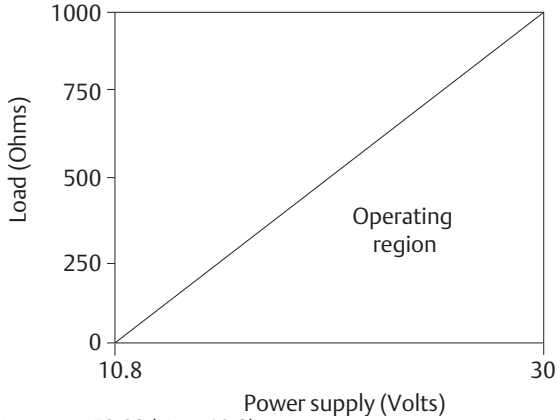
Analog loop load limitations

Internally powered 24 VDC max, 500 ohms max loop resistance

Externally powered 10.8 - 30 VDC max.

Loop resistance is determined by the voltage level of the external power supply at the transmitter terminals.

Figure A-6. Analog Loop Load Limitations



R_{max} = $52.08 (V_{ps} - 10.8)$
V_{ps} = Power Supply Voltage (Volts)
R_{max} = Maximum Loop Resistance (Ohms)

The analog output is automatically scaled to provide 4mA at lower range value and 20 mA at upper range value. Full scale continuously adjustable between -39 and 39 ft/s (-12 to 12 m/sec), 1 ft/s (0.3 m/s) minimum span.

HART communications is a digital flow signal. The digital signal is superimposed on the 4–20 mA signal and is available for the control system interface. A minimum of 250 Ohms loop resistance is required for HART communications.

Scalable pulse frequency adjustment

0-10,000 Hz, switch-selectable as internally or externally powered. Pulse value can be set to equal desired volume in selected engineering units. Pulse width adjustable from 0.1 to 650 ms.

Internally powered: Outputs up to 12 VDC

Externally powered: Input 5 - 28 VDC

Output testing

Analog output test

Transmitter may be commanded to supply a specified current between 3.5 and 23 mA.

Pulse output test

Transmitter may be commanded to supply a specified frequency between 1 and 10,000 Hz.

Optional discrete output function (AX option)

Externally powered at 5 - 28 VDC, 240 mA max, solid state switch closure to indicate either:

Reverse flow

Activates switch closure output when reverse flow is detected.

Zero flow

Activates switch closure output when flow goes to 0 ft/s or below low flow cutoff.

Empty pipe

Activates switch closure output when an empty pipe condition is detected.

Transmitter faults

Activates switch closure output when a transmitter fault is detected.

Flow limit 1, Flow limit 2

Activates switch closure output when the transmitter measures a flow rate that meets the conditions established for this alert. There are two independent flow limit alerts that can be configured as discrete outputs.

Totalizer limit

Activates switch closure output when the transmitter measures a total flow that meets the conditions established for this alert.

Diagnostic status

Activates switch closure output when the transmitter detects a condition that meets the configured criteria of this output.

Optional discrete input function (AX option)

Externally powered at 5 - 28 VDC, 1.4 - 20 mA to activate switch closure to indicate either:

Net total reset

Resets the net totalizer value to zero.

Positive zero return (PZR)

Forces outputs of the transmitter to zero flow.

Security lockout

Security lockout switch on the electronics board can be set to protect configuration variables from unwanted or accidental changes.

A.2.4 Sensor compensation

Rosemount Sensors are calibrated in a flow lab at the factory and are assigned a calibration number. The calibration number must be entered into the transmitter, enabling interchangeability of sensors without calculations or a compromise in standard accuracy.

Rosemount 8750W transmitters and other manufacturers' sensors can be calibrated at known process conditions or at the Rosemount NIST-Traceable Flow Facility. Transmitters calibrated on site require a two-step procedure to match a known flow rate. This procedure can be found in the operations manual.

A.2.5 Performance specifications

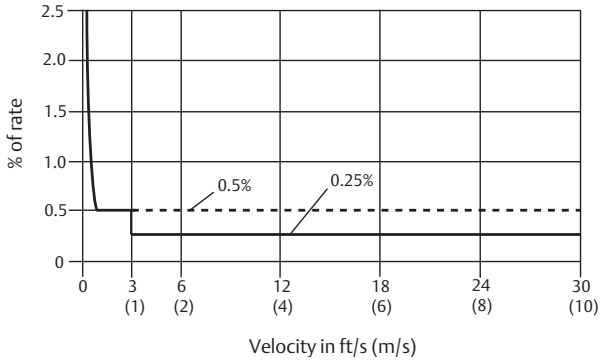
System specifications are given using the frequency output and with the unit at reference conditions.

Accuracy

Includes the combined effects of linearity, hysteresis, and repeatability.

Standard system accuracy is ±0.5% of rate from 1 to 39 ft/s (0.3 to 12 m/s). Accuracy is ±0.005 ft/s (0.0015 m/s) from the low flow cutoff to 1 ft/s (0.3 m/s).

Optional high accuracy is ±0.25% of rate from 3 to 39 ft/s (1 to 12 m/s).



Other manufacturers' sensors

When calibrated in the Rosemount Flow Facility, system accuracies as good as 0.5% of rate can be attained.

There is no accuracy specification for other manufacturers' sensors calibrated in the process line.

A.2.6 Analog output effects

Analog output has the same accuracy as frequency output plus an additional ±4 µA at room temperature.

Repeatability

±0.1% of reading

Response time (Analog Output)

20 ms max response time to step change in input

Stability

±0.25% of rate over six months

Ambient temperature effect

±0.25% change over operating temperature range

A.2.7 Physical specifications

Materials of construction

Standard housing

Low copper aluminum

Type 4X and IEC 60529 IP66

Paint

Polyurethane coat (1.3 to 5 mils thick)

Optional housing

Type 4X and IEC 60529 IP66

Cover gasket

Silicone rubber

Electrical connections

Conduit entries: 1/2-in. NPT standard. (Optional third connection available). Thread adapters are provided when ordered with M20 conduit entry.

Terminal block screws: 6-32 (No. 6) suitable for up to 14 AWG wire.

Vibration rating

2G per IEC 61298

Dimensions

See Product Data Sheet.

Weight

Approximately 9 lbs. (4.0 kg).

Add 1 pound (0.5 kg) for display option code M4 or M5.

A.3 Sensor specifications

A.3.1 Functional specifications

Service

Utility, water, and wastewater fluids

Line sizes

1/2–in. to 48-in. (15 mm to 1200 mm)

Sensor coil resistance

9 - 17 Ω

Interchangeability

Rosemount 8750W Sensors are interchangeable with Rosemount 8750W Transmitters. System accuracy is maintained regardless of line size or optional features. Each sensor nameplate has a 16-digit calibration number that can be entered into a transmitter through the Local Operator Interface (LOI) or the Field Communicator.

Upper range limit

39.37 ft/s (12 m/s)

Process temperature limits

PTFE lining

–20 to 248 °F (–29 to 120 °C)

Polyurethane lining

0 to 140 °F (–18 to 60 °C)

Neoprene lining

0 to 176 °F (–18 to 80 °C)

Ambient temperature limits

–20 to 140 °F (–29 to 60 °C)

Pressure limits

See Table A-1, Table A-2 and Table A-3

Vacuum limits

PTFE lining

Full vacuum to 248 °F (120 °C) through 4-in. (100 mm) line sizes. Consult factory for vacuum applications with line sizes of 6-in. (150 mm) or larger.

All other standard sensor lining materials

Full vacuum to maximum material temperature limits for all available line sizes.

Submergence protection (IP68)

The remote mount Rosemount 8750W sensor is rated IP68 for submergence. IP68 rating requires the transmitter must be remote mount. Installer must use IP68 approved cable glands, conduit connections, and/or conduit plugs. For more details on proper installation techniques for IP68 submersible application, reference Rosemount Technical Note (document number 00840-0100-4750) available on EmersonProcess.com/Rosemount.

Conductivity limits

Process liquid must have a minimum conductivity of 5 microsiemens/cm (5 micromhos/cm) or greater.

Table A-1. Temperature vs. Pressure Limits for ASME B16.5 Class Flanges(1)

Sensor temperature vs. pressure limits for ASME B16.5 Class Flanges (1/2- to 24-in. line sizes)				
Flange material	**Flange rating**	**Pressure**		
		@ -20 to 100 °F (-29 to 38 °C)	**@ 200 °F (93 °C)**	**@ 300 °F (149 °C)**
Carbon Steel	Class 150	285 psi	260 psi	230 psi
	Class 300	740 psi	675 psi	655 psi
304 Stainless Steel	Class 150	275 psi	235 psi	205 psi
	Class 300	720 psi	600 psi	530 psi

1. Liner temperature limits must also be considered.

Table A-2. Temperature vs. Pressure Limits for AS2129 Flanges(1)

Sensor temperature vs. pressure limits for AS2129 Table D and E Flanges (4- to 24-in. line sizes)				
Flange material	**Flange rating**	**Pressure**		
		@ -29 to 50 °C (-20 to 122 °F)	**@ 100 °C (212 °F)**	**@ 150 °C (302 °F)**
Carbon Steel	D	101.6 psi	101.6 psi	101.6 psi
	E	203.1 psi	203.1 ps.i	203.1 psi

1. Liner temperature limits must also be considered.

Table A-3. Temperature vs. Pressure Limits for EN 1092-1 Flanges(1)

Sensor temperature vs. pressure limits for EN 1092-1 Flanges (15 mm to 600 mm line sizes)				
Flange material	**Flange rating**	**Pressure**		
		@ -29 to 50 °C (-20 to 122 °F)	**@ 100 °C (212 °F)**	**@ 150°C (302 °F)**
Carbon Steel	PN 10	10 bar	10 bar	9.7 bar
	PN 16	16 bar	16 bar	15.6 bar
	PN 25	25 bar	25 bar	24.4 bar
	PN 40	40 bar	40 bar	39.1 bar
304 Stainless Steel	PN 10	9.1 bar	7.5 bar	6.8 bar
	PN 16	14.7 bar	12.1 bar	11.0 bar
	PN 25	23 bar	18.9 bar	17.2 bar
	PN 40	36.8 bar	30.3 bar	27.5 bar

1. Liner temperature limits must also be considered.

Table A-4. Temperature vs. Pressure Limits for GB/T 9119 Flanges[1]

Flange material	Flange rating	Pressure (Mpa)		
		≤ 20 °C	@ 100 °C (212 °F)	@ 150°C (302 °F)
Carbon Steel Group3E0	PN 10	1.00	0.92	0.88
	PN 16	1.60	1.48	1.40
	PN 40	4.00	3.71	3.52
304 SST Group11E0	PN 10	1.00	0.90	0.81
	PN 16	1.60	1.45	1.31
	PN 40	4.00	3.63	3.27

1. Liner temperature limits must also be considered.

Table A-5. Temperature vs. Pressure Limits for JIS B2220 Flanges[1]

Flange material	Flange rating	Pressure (Mpa)	
		≤ 50 °C (122 °F)	@ 120 °C (248 °F)
Carbon Steel	10K	1.4	1.4
304 Stainless Steel (15mm to 65mm)	10K	1.4	1.4
304 Stainless Steel (≤ 80mm)	10K	1.4	1.0

1. Liner temperature limits must also be considered.

A.3.2 Physical specifications

Non-wetted materials

Sensor pipe

Type 304/304L SST

Flanges

Carbon steel, Type 304/304L SST

Coil housing

Rolled carbon steel

Paint

Polyurethane coat (1.3 to 5 mils thick)

Wetted process materials

Lining

PTFE, Polyurethane, Neoprene

Electrodes

316L SST, Nickel Alloy 276 (UNS N10276), Tantalum,

80% Platinum-20% Iridium, Titanium

Flat-faced flanges

Flat-faced flanges are manufactured with full-face liners. Available in Neoprene only.

Process connections

ASME B16.5

Class 150: 1/2-in. to 24-in. (15 mm to 600 mm)

Class 300: 1/2-in. to 24-in. (15 mm to 600 mm)

AWWA C207

Class D: 30-in. and 48-in. (750 mm and 1200 mm)

Class E: 40-in. and 48-in. (1000 mm and 1200 mm)

Class F: 30-in. and 36-in. (750 mm and 900 mm)

EN 1092-1

PN10: 6-in. to 24-in., 36-in., 40-in., 48-in. (150 mm to 600 mm, 900 mm, 1000 mm, 1200 mm)

PN16: 2-in. to 24-in., 36-in., 40-in. (50 mm to 600 mm, 900 mm, 1000 mm)

PN 25: 8-in. to 24-in. (200 mm to 600 mm)

PN40: 1/2-in. to 24-in. (15 mm to 600 mm)

AS2129

Table D and E: 1/2-in. to 40-in., 48-in. (15 mm to 1000 mm, 1200 mm)

AS4087

PN16, PN21: 2-in. to 40-in., 48-in. (8-in. excluded) (50 mm to 1000 mm, 1200 mm)

PN35: 2-in. to 36-in. (8-in. excluded) (50 mm to 900 mm)

GB/T9119

PN10: 8-in. to 24-in., 36-in., 40-in., 48-in. (200 mm to 600 mm, 900 mm, 1000 mm, 1200 mm)

PN16: 4-in. to 24-in., 36-in., 40-in. (100 mm to 600 mm, 900 mm, 1000 mm)

PN40: 1/2-in. to 24-in. (15 mm to 600 mm)

JIS B2220

10K, 20K: 1/2-in. to 24-in. (15 mm to 600 mm)

Electrical connections

Conduit entries: 1/2-in. NPT standard

Terminal block screws: 6-32 (No. 6) suitable for up to 14 AWG wire

Safety grounding screws: external stainless assembly, M5; internal 8-32 (No. 8)

Process reference electrode - (optional)

A process reference electrode can be installed similarly to the measurement electrodes through the sensor lining on Rosemount 8750W sensors. It will be made of the same material as the measurement electrodes.

Grounding rings - (optional)

Grounding rings can be installed between the flange and the sensor face on both ends of the sensor. Single ground rings can be installed on either end of the sensor. They have an I.D. slightly larger than the sensor I.D. and an external tab to attach ground wiring. Grounding rings are available in 316L SST and Nickel Alloy 276 (UNS N10276). See Product Data Sheet.

Dimensions

See the Product Data Sheet.

Weight

See the Product Data Sheet.

Appendix B Product Certifications

European Directive Information . . . . . page 193
Certifications . . . . . page 193
IEC EC and ATEX Approval Information . . . . . page 198

Table B-1. Rosemount™ 8750W Magnetic Flowmeter Platform Rating

Order code	Platform rating	Region	Agency	Certification number
—	Ordinary Locations[1]	USA, Canada, EU, CU[2]	FM	3030548(FM) or 70030489(CSA)
Z1	ATEX Non-Sparking and Dust for Non-Flammable Fluids	EU	DEKRA	15ATEX0003 X
ND	ATEX Dust	EU	DEKRA	15ATEX0003 X
Z2	InMetro Non-Sparking and Dust for Non-Flammable Fluids	Brazil	PENDING[3]	PENDING
Z3	NEPSI Non-Sparking and Dust for Non-Flammable Fluids	China	NEPSI	GYJ15.1228X
Z5	DIP (Dust-Ignitionproof) Class II and III, Div 1. Non-Incendive, Class I Div 2 for Non-Flammable Fluids	USA	FM	3030548
Z6	CSA, Class I Div 2 for Non-Flammable Fluids; DIP, NI	USA and Canada	CSA	70030489
Z7	IECEx Non-Sparking and Dust for Non-Flammable Fluids	Global	DEKRA	IECEx DEK 15.0001X
NF	IECEx Dust	Global	DEKRA	IECEx DEK 15.0001X
Z9	KTL Non-Sparking and Dust for Non-Flammable Fluids	Korea	KTL[3]	PENDING

1. Complies with only the local country Product safety, Electromagnetic, Pressure and other applicable regulations. Cannot be used in a classified or zoned hazardous location environment.
2. Custom Union (Russia, Belarus and Kazakhstan).
3. Planned submittal or in process with Agency.

Table B-2. Approval Markings and Logos

Symbol[1]	Marking or symbol name	Region	Meaning of marking or symbol
CE	CE	European Union	Compliance with all applicable European Union Directives
Ex	ATEX	European Union	Compliance with Equipment and Protective systems intended for use in Potentially Explosive Atmospheres directive (ATEX) (94/9/EC)
N96	C-tick	Australia	Compliance with Australian applicable electromagnetic compatibility standards
FM APPROVED	FM Approved	United States	Compliance with the applicable ANSI standards
C SP® US	CSA	US = United States C = Canada	Indicates that the product was tested and has met the applicable certification requirements for the noted countries
EAC	Eurasian Conformity (EAC)	Eurasian Customs Union (Russia, Belarus and Kazakhstan)	Compliance with all of the applicable technical regulations of the EAC Customs Union
Segurança INMETRO DEKRA OCP 0089	INMETRO	Brazil	Compliance with all of the applicable technical regulations of Brazil
Ex NEPSI	NEPSI	China	Compliance with all of the applicable technical regulations of China
KCs	KCS	Korea	Compliance with all of the applicable technical regulations of Korea

1. Ordinary Location labels will be marked with CE, C-tick, FM, CSA and EAC logos.

B.1 European Directive Information

A copy of the EC Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EC Declaration of Conformity can be found at EmersonProcess.com/Rosemount.

B.1.1 Electro Magnetic Compatibility (EMC)(2004/108/EC) and (2014/30/EU)

EN 61326-1: 2013

B.1.2 Low Voltage Directive (LVD) (2006/95/EC) and (2014/35/EU)

EN 61010-1: 2010

B.1.3 Ingress Protection Rating for dust and water

Degree of protection, per EN-IEC 60079-0 and EN-IEC 60529: IP66[1]

Degree of protection, per EN-IEC 60079-0 and EN-IEC 60529: IP66, IP68 (10 m, 48 h)[2]

Degree of protection, per EN-IEC 60079-0 and ISO 20653: IP69K[3]

B.1.4 European Pressure Equipment Directive (PED) (97/23/EC) and (2014/68/EU)

PED Certification requires the "PD" option code.

CE marked models that are ordered without the "PD" option will be marked "Not Complaint to (97/23/EC)"

Mandatory CE-marking with notified body number 0575, for all flowtubes is located on the flowmeter label.

Category I assessed for conformity per module A procedures.

Categories II – III assessed for conformity per module H procedures.

QS Certificate of Assessment

EC No. 4741-2014-CE-HOU-DNV: Module H Conformity Assessment

1. *The transmitter is rated IP66 when integral or remote mounted, it is not IP68 nor IP69K rated.*
2. *The IP68 rating only applies to the flowtube and the remote junction box when the transmitter is remotely mounted. The IP68 rating is only valid at a depth of 10 meters for 48 hours.*
3. *The IP69K rating only applies to the flowtube and the remote junction box when the transmitter is remotely mounted. The temperature K = 80 °C.*

B.1.5 Rosemount 8750W Flanged Flowtubes

Line size 40 mm to 600 mm ($1^1/_2$- to 24-in.)

EN 1092-1 flanges and ASME B16.5 class 150 and ASME B16.5 Class 300 flanges.

Also available in ASME B16.5 Class 600 flanges in limited line sizes.

All other Rosemount Flanged Flowtubes – line sizes of 25 mm (1-in.) and less: Sound Engineering Practice (SEP).

Flowtubes that are SEP are outside the scope of PED and cannot be marked for compliance with PED.

B.2 Certifications

B.2.1 Factory Mutual (FM)

Ordinary Location Certification for FM Approvals

As standard, the transmitter and flowtube have been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM Approvals, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Rosemount 8750W Magnetic Flowtube and Transmitter

Z5 All Flowtubes and Integral or Remote Mount Transmitters (Transmitter mount codes T or R)
Non-Incendive for Class I, Division 2, Groups ABCD: T4
Dust-Ignition Proof for Class II/III, Division 1, Groups EFG:
T5 -29 °C ≤ T_a ≤ 60 °C
Enclosure Type 4X, IP66/68 (IP68 flowtube only with Remote mount transmitter)
Install per drawing 8750W-1052

Special Condition for Safe Use (X):

1. Flowtube to be used only in a non-flammable process.

Rosemount 8750W Magnetic Flowtube and Transmitter

Z5 All Flowtubes and Wall Mount Transmitter (Transmitter mount code W)
Non-Incendive for Class I, Division 2, Groups ABCD: T4
Dust-Ignition Proof for Class II/III, Division 1, Groups EFG: T4
-29 °C ≤ T_a ≤ 40 °C
Enclosure Type 4X, IP66/68 (IP68 flowtube only)
Install per drawing 8750W-1052

Special Condition for Safe Use (X):

1. Flowtube to be used only in a non-flammable process.

B.2.2 CSA

Ordinary Location Certification

The transmitter and flowtube have been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by CSA, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Rosemount 8750W Magnetic Flowtube and Transmitter

Z6 Non-Incendive for Class I, Division 2, Groups ABCD: T4
Dust-Ignition Proof for Class II/III, Division 1, Groups EFG: T4
-29 °C ≤ T_a ≤ 60 °C (Transmitter mount codes T or R)
-29 °C ≤ T_a ≤ 40 °C (Transmitter mount code W)
Enclosure Type 4X, IP66/68/69K[1]
Install per drawing 8750W-1051

Special Condition for Safe Use (X):

1. Flowtube to be used only in a non-flammable process.

1. *The transmitter is rated IP66 when integral or remote mounted, it is not IP68 nor IP69K rated. The IP68 rating only applies to the flowtube and the remote junction box when the transmitter is remotely mounted. The IP68 rating is only valid at a depth of 10 meters for 48 hours. The IP69K rating only applies to the flowtube and the remote junction box when the transmitter is remotely mounted. The temperature K = 80°C.*

Figure B-1. Rosemount 8750W Declaration of Conformity

EMERSON. Process Management

ROSEMOUNT

CE

EC Declaration of Conformity

No: RFD 1098 Rev. G

We,

Emerson Process Management
Rosemount Flow
12001 Technology Drive
Eden Prairie, MN 55344
USA

declare under our sole responsibility that the product(s),

Rosemount Model 8750W Magnetic Flowmeters

to which this declaration relates, is in conformity with the provisions of the European Community Directives, including the latest amendments, as shown in the attached schedule.

Assumption of conformity is based on the application of harmonized or applicable technical standards and, when applicable or required, a European Community notified body certification, as shown in the attached schedule.

(signature)

22 February 2016
(date of issue)

Mark Fleigle
(name - printed)

Vice President Technology and New Products
(function name - printed)

F FILE ID: 8750W CE Marking

Page 1 of 3

RFD1098.docx

EMERSON. Process Management

ROSEMOUNT

CE

Schedule

EC Declaration of Conformity RFD 1098 Rev. G

LVD Directive (2006/95/EC) and (2014/35/EU) as of 20 April 2016

All Models: EN 61010-1: 2010

EMC Directive (2004/108/EC) and (2014/30/EU) as of 20 April 2016

All Models: EN 61326-1: 2013

PED Directive (97/23/EC) and (2014/68/EU) as of 19 July 2016

Model 8750W Magnetic Flowtube with Option "PD", in Line Sizes 1.5" – 24"

Equipment without the 'PD' option is NOT PED compliant and cannot be used in the EEA without further assessment unless the installation is exempt under Article 1, paragraph 3 of the PED Directive (97/23/EC) or (2014/68/EU)

QS Certificate of Assessment - EC No. 4741-2014-CE-HOU-DNV
Module H Conformity Assessment
ASME B31.3: 2010

Model 8750W in Line Sizes 0.5" – 1.0"
Sound Engineering Practice
ASME B31.3: 2010

FILE ID: 8750W CE Marking Page 2 of 3 RFD1098.docx

EMERSON. Process Management

ROSEMOUNT

CE

Schedule

EC Declaration of Conformity RFD 1098 Rev. G

ATEX Directive (94/9/EC) and (2014/34/EU) as of 20 April 2016

Model 8750W Magnetic Flow Transmitter and Flow Tubes

CERTIFICATE: DEKRA 15ATEX0003 X
Equipment Marking Summary:

Ex

II 3 G	Ex nA [ic] IIC T4 Gc
II 3 G	Ex nA ic IIC T5...T4 Gc
II 3 D	Ex tc IIIC T 80°C...T 130°C Dc

EN 60079-0: 2012 +A11:2013
EN 60079-15: 2010
EN 60079-11: 2012
EN 60079-31: 2014

PED Notified Body

DNV GL [Notified Body Number: 0575]
Veritasveien 1, N-1322
Hovik, Norway

Or

DNV Nemko Presafe AS [Notified Body number: 2460]
P.O. Box 73, Blindern
0314 Oslo, Norway

FILE ID: 8750W CE Marking Page 3 of 3 RFD1098.docx

B.3 IEC EC and ATEX Approval Information

1. Equipment markings:
   a. Type Examination Certificate (ATEX): DEKRA 15ATEX0003 X
   b. Certificate of Conformity (IECEx): IECEx DEK 15.0001X
2. Required documentation
   a. 8750W-2052 Installation Drawing Model 8750W ATEX/IECEx Hazardous (Ex) Locations
3. Referenced documentation
   a. 00825-0300-4750.pdf, Quick Start Guide
   b. 00809-0300-4750.pdf, Reference Manual
   c. 8750W-AP01, Approvals Document
   d. 8750W-1504 Installation Drawing, 8750W Transmitter Wiring
4. The Required and Referenced Documents listed above address the following items:
   a. Instructions for safety i.e.
      i. Putting into service
      ii. Use
      iii. Assembling and dismantling
      iv. Maintenance, overhaul and repair
      v. Installation
      vi. Adjustment
   b. Where necessary, training instructions
   c. Details which allow a decision to be made as to whether the equipment can be used safely in the intended area under the expected operating conditions
   d. Electrical parameters, maximum surface temperatures and other limit values
      i. Electrical -
         1. See document 8750W-2052

Rosemount 8750W Flow Transmitter	
Power input	90 - 250 VAC, 0.45 A, 40 VA 12 - 42 VDC, 1.2 A, 15 W
Pulsed circuit	Internally powered (Active): Outputs up to 12 VDC, 12.1 mA, 73 mW Externally powered (Passive): Input up to 28 VDC, 100 mA, 1 W
4-20mA output circuit	Internally Powered (Active): Outputs up to 25 mA, 24 VDC, 600 mW Externally Powered (Passive): Input up to 25 mA, 30 VDC, 750 mW
Modbus®	Internally Powered (Active): Outputs up to 100 mA, 3.3 VDC, 100 mW

Rosemount 8750W Flow Transmitter	
Um	250 V
Coil excitation	500 mA, 40 V max, 9 W max
Rosemount 8750W Flowtube[1]	
Coil excitation input	500 mA, 40 V max, 20 W max
Electrode	5 V, 200 uA, 1 mW

1. Provided by the transmitter.

Special Conditions for Safe Use (X):

1. When “Special Paint Systems” are applied, instructions for safe use regarding potential electrostatic charging hazard have to be followed.
2. Terminals 1, 2, 3, 4 for data communication, cannot withstand the 500 V isolation test between signal and ground, due to integral transient protection. This must be taken into account upon installation.
3. Conduit entries must be installed to maintain the enclosure ingress rating of IP66 (Transmitter and Flow Tube), IP68 or IP69K (Flow Tube) as applicable.
4. The flow tube and transmitter are not allowed to be thermally insulated

   e. Where necessary, the essential characteristics of tools which may be fitted to the equipment
      i. No proprietary tools required.
   f. List of the standards, including the issue date, with which the equipment is declared to comply:
      i. ATEX - EN 60079-0: 2012 + A11: 2013,
         EN 60079-11: 2012,
         EN 60079-15: 2010,
         EN 60079-31: 2014
      ii. IECEx - IEC 60079-0: 2011,
         IEC 60079-11: 2011,
         IEC 60079-15: 2010,
         IEC 60079-31: 2013
   g. Supply wire requirements:
      Use 10 - 18 AWG wire rated for the proper temperature of the application. For wire 10 - 14 AWG, use lugs or other appropriate connectors. For connections in ambient temperatures above 122 °F (50 °C), use a wire rated for 194 °F (90 °C).
   h. Contact address:
      Rosemount Inc.
      12001 Technology Drive
      Eden Prairie, MN 55344
      United States of America

See Ordering info in Product data

Table B-3. Nomenclature Magnetic Flowmeter System Model 8750W and Electrical Data

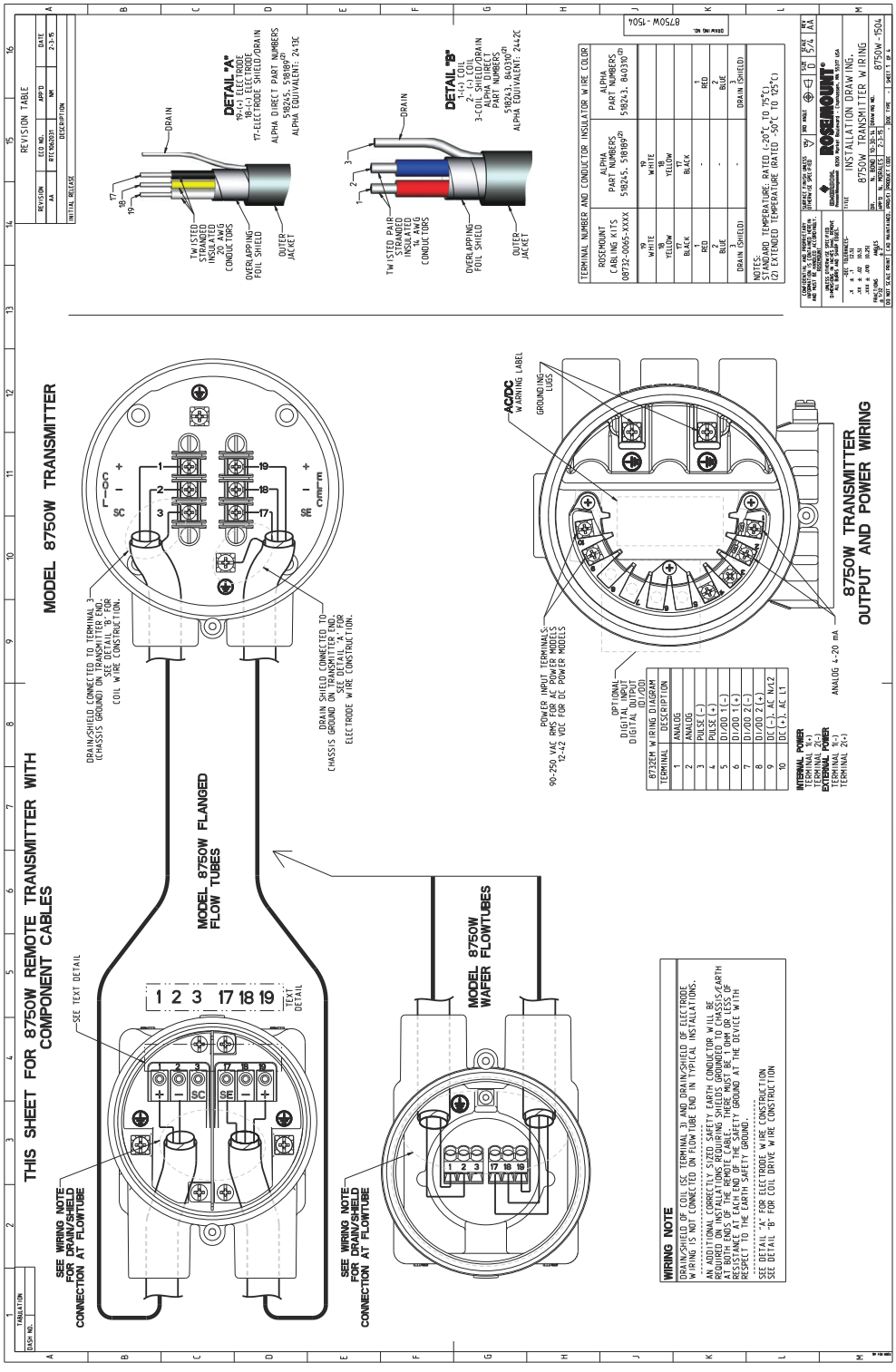
8750W	...	R	1	A	2	...	F	005	...	Z1	...	M4	...	AX	...	V1	...	RH50
I		II	III	IV	V		VI	VII		VIII		IX		X		XI		IX

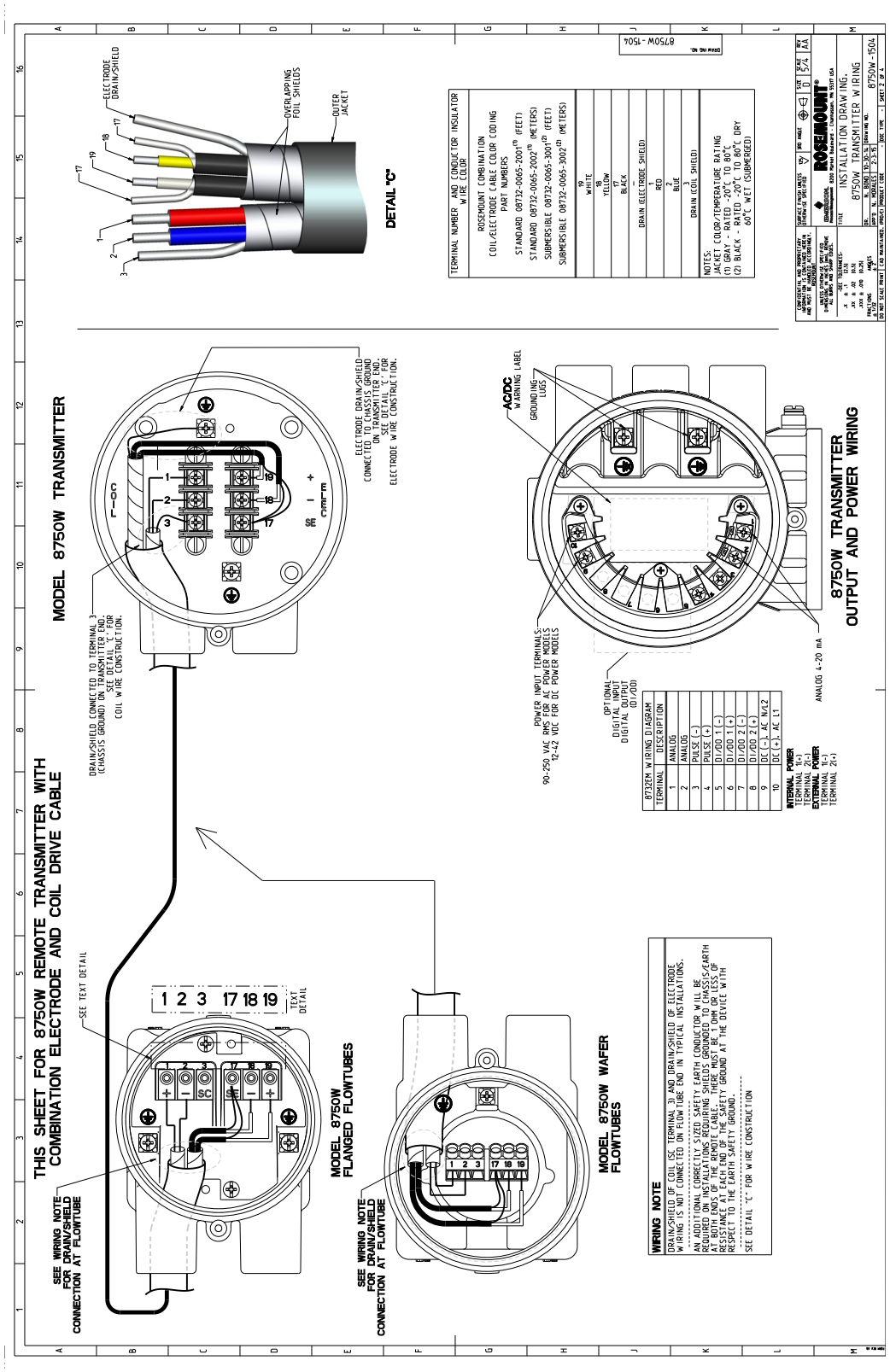
Designation	Explanation	Value	Explanation
I	Model	8750W	Flow Meter System Model 8750W
II	Transmitter mount	R	Remote mount
		T	Integral mount
III	Transmitter power supply	1	AC (90 - 250 Vac, 50/60 Hz), not for Ex nA
		2	DC (12 - 42 Vdc)
IV	Transmitter outputs	A	4–20 mA with digital HART Protocol and scalable pulse output
		M	Modbus RS-485
		0	Spare flow tube, no transmitter
V	Conduit entries	1 or 4	1/2–14 NPT female
		2 or 5	CM20, M20 female
VI	Electrode type	A, B, E, F	Seal of electrodes comply with IEC 61010-1.
		0	Spare transmitter, no flow tube
VII	Line size	005 to 480	1/2-in. NPS (15 mm) to 48-in. NPS (1200 mm)
		000	Spare transmitter, no flow tube
VIII	Safety approvals	Z1 ATEX	Ⓔx II 3 GEx nA [ic] IIC T4 Gc(1) Ⓔx II 3 GEx nA ic IIC T5...T4 Gc(2) Ⓔx II 3 DEx tc IIIC T80 °C...T130 °C Dc(3)
		Z7 IECEx	Ex nA [ic] IIC T4 Gc(1) Ex nA ic IIC T5...T4 Gc(2) Ex tc IIIC T80 °C...T130 °C Dc(3)
		ND ATEX	Ⓔx II 3 DEx tc IIIC T80 °C...T130 °C Dc(3)
		NF IECEx	Ex tc IIIC T80 °C...T130 °C Dc(3)
IX	Transmitter display	M4	LOI
		M5	Display
X	Transmitter discrete input/output	AX	Two discrete channels (DI/DO 1, DO 2)
XI	Specials paint	Vx	Special paint systems(4)
XII	Remote cable option	RTxx(5)	Standard temperature component
		RHxx(5)	Extended temperature component

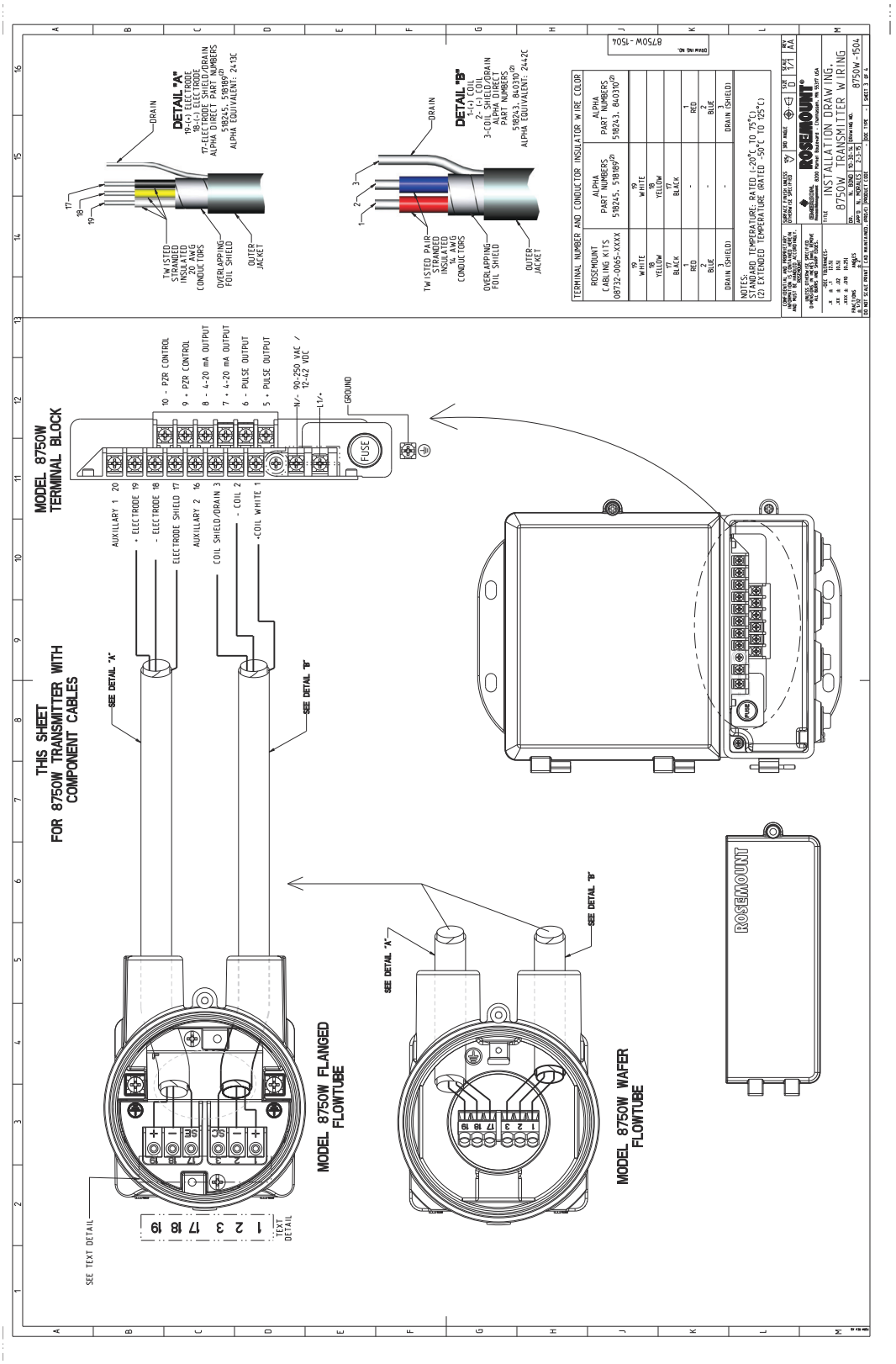
1. Rosemount 8750W Transmitter DC Power Supply only.
2. Rosemount 8750W Flow Tube only.
3. Rosemount 8750W Transmitter AC and DC Power Supply and Rosemount 8750W Flow Tube.
4. Subject to special conditions for safe use.
5. Length = xx × 10-ft, max. 500-ft.

Appendix C Wiring Diagrams

Figure C-1. Rosemount™ 8750W Transmitter Installation and Wiring




THIS SHEET FOR 8750W REMOTE TRANSMITTER WITH COMBINATION ELECTRODE AND COIL DRIVE CABLE
MODEL 8750W TRANSMITTER
8750W WIRING DIAGRAM
TERMINAL DESCRIPTION
1 ANALOG
2 ANALOG
3 PULSE (-)
4 PULSE (+)
5 DI/DO 1 (-)
6 DI/DO 1 (+)
7 DI/DO 2 (-)
8 DI/DO 2 (+)
9 DC (-), AC N/L2
10 DC (+), AC L1
INTERNAL POWER
TERMINAL 1(-)
TERMINAL 2(+)
EXTERNAL POWER
TERMINAL 1(-)
TERMINAL 2(+)
ANALOG 4-20 mA
OPTIONAL DIGITAL INPUT DIGITAL OUTPUT (DI/DO)
POWER INPUT TERMINALS: 90-250 VAC (50/60 Hz) FOR AC POWER MODELS 12-42 VDC FOR DC POWER MODELS
AC/DC WARNING LABEL
GROUNDING LUGS
8750W TRANSMITTER OUTPUT AND POWER WIRING
DRAIN/SHIELD CONNECTED TO TERMINAL 3 (CHASSIS GROUND ON TRANSMITTER END). SEE DETAIL 'C' FOR COIL WIRE CONSTRUCTION.
ELECTRODE DRAIN/SHIELD CONNECTED TO CHASSIS GROUND ON TRANSMITTER END. SEE DETAIL 'C' FOR ELECTRODE WIRE CONSTRUCTION.
SEE WIRING NOTE FOR DRAIN/SHIELD CONNECTION AT FLOWTUBE
SEE TEXT DETAIL
1 2 3 17 18 19
TEXT DETAIL
MODEL 8750W FLANGED FLOWTUBES
SEE WIRING NOTE FOR DRAIN/SHIELD CONNECTION AT FLOWTUBE
MODEL 8750W WAFER FLOWTUBES
WIRING NOTE
DRAIN/SHIELD OF COIL (SC TERMINAL 3) AND DRAIN/SHIELD OF ELECTRODE WIRING IS NOT CONNECTED ON FLOW TUBE END IN TYPICAL INSTALLATIONS.
AN ADDITIONAL CORRECTLY SIZED SAFETY EARTH CONDUCTOR WILL BE REQUIRED ON INSTALLATIONS REQUIRING SHIELDS GROUNDED TO CHASSIS/EARTH AT BOTH ENDS OF THE CABLE. THIS CONDUCTOR MUST BE 5mm OR LESS OF RESISTANCE EQUIVALENT AND IS TO BE GROUNDED AT THE DEVICE WITH RESPECT TO THE EARTH SAFETY GROUND.
SEE DETAIL 'C' FOR WIRE CONSTRUCTION
DETAIL "C"
ELECTRODE DRAIN/SHIELD
OVERLAPPING FOIL SHIELDS
OUTER JACKET
TERMINAL NUMBER AND CONDUCTOR INSULATOR WIRE COLOR
ROSEMOUNT COMBINATION COIL/ELECTRODE CABLE COLOR CODING PART NUMBERS
STANDARD 08732-0065-2001 (FEET)
STANDARD 08732-0065-2002 (METERS)
SUBMERSIBLE 08732-0065-3001 (FEET)
SUBMERSIBLE 08732-0065-3002 (METERS)
19 WHITE
18 YELLOW
17 BLACK
DRAIN (ELECTRODE SHIELD)
RED
BLUE
3
DRAIN (COIL SHIELD)
NOTES:
JACKET COLOR/TEMPERATURE RATING
(1) GRAY - RATED -20°C TO 80°C
(2) BLACK - RATED -20°C TO 60°C DRY
60°C WET (SUBMERGED)
8750W - 1504
ROSEMOUNT
INSTALLATION DRAWING
8750W TRANSMITTER WIRING
8750W - 1504


DETAIL "A"
DETAIL "B"
TERMINAL NUMBER AND CONDUCTOR INSULATOR WIRE COLOR
ROSEMOUNT CABLING KITS 08732-0065-XXXX
ALPHA PART NUMBERS 5182 45, 5181 89(2)
ALPHA PART NUMBERS 5182 43, 840310(2)
NOTES:
STANDARD TEMPERATURE: RATED (-20°C TO 75°C).
(2) EXTENDED TEMPERATURE (RATED -50°C TO 125°C)
8750W - 1504
ROSEMOUNT
8750W TRANSMITTER WIRING
INSTALLATION DRAWING,
MODEL 8750W TERMINAL BLOCK
10 - PZR CONTROL
9 + PZR CONTROL
8 - 4-20 mA OUTPUT
7 + 4-20 mA OUTPUT
6 - PULSE OUTPUT
5 + PULSE OUTPUT
+/- 90-250 VAC / 12-42 VDC
L1/+
GROUND
FUSE
AUXILLARY 1 20
+ ELECTRODE 19
- ELECTRODE 18
ELECTRODE SHIELD 17
AUXILLARY 2 16
COIL SHIELD/DRAIN 3
- COIL 2
+COIL WHITE 1
THIS SHEET FOR 8750W TRANSMITTER WITH COMPONENT CABLES
SEE DETAIL "A"
SEE DETAIL "B"
SEE TEXT DETAIL
1 2 3 17 18 19
TEXT DETAIL
MODEL 8750W FLANGED FLOWTUBE
MODEL 8750W WAFER FLOWTUBE

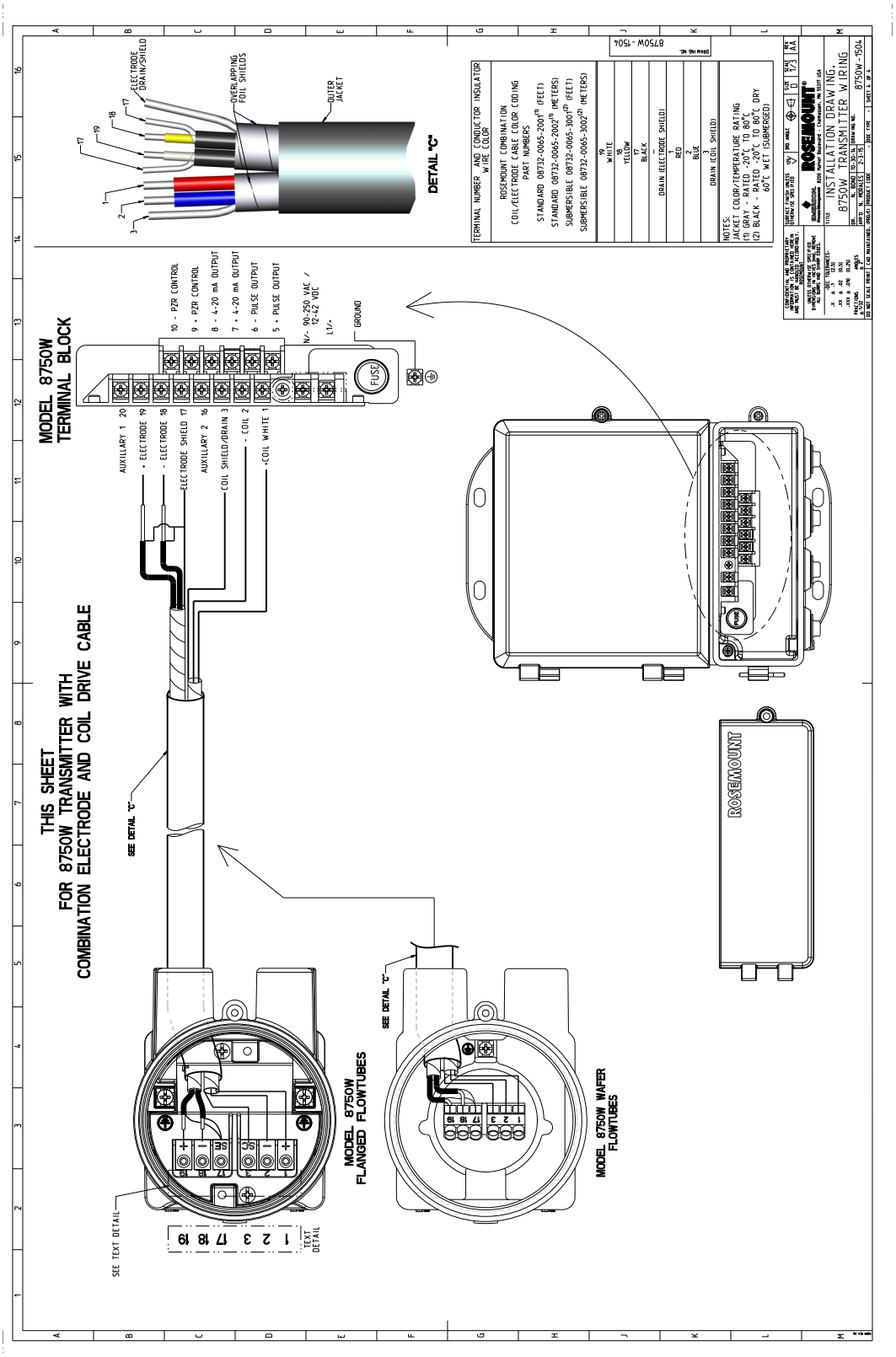
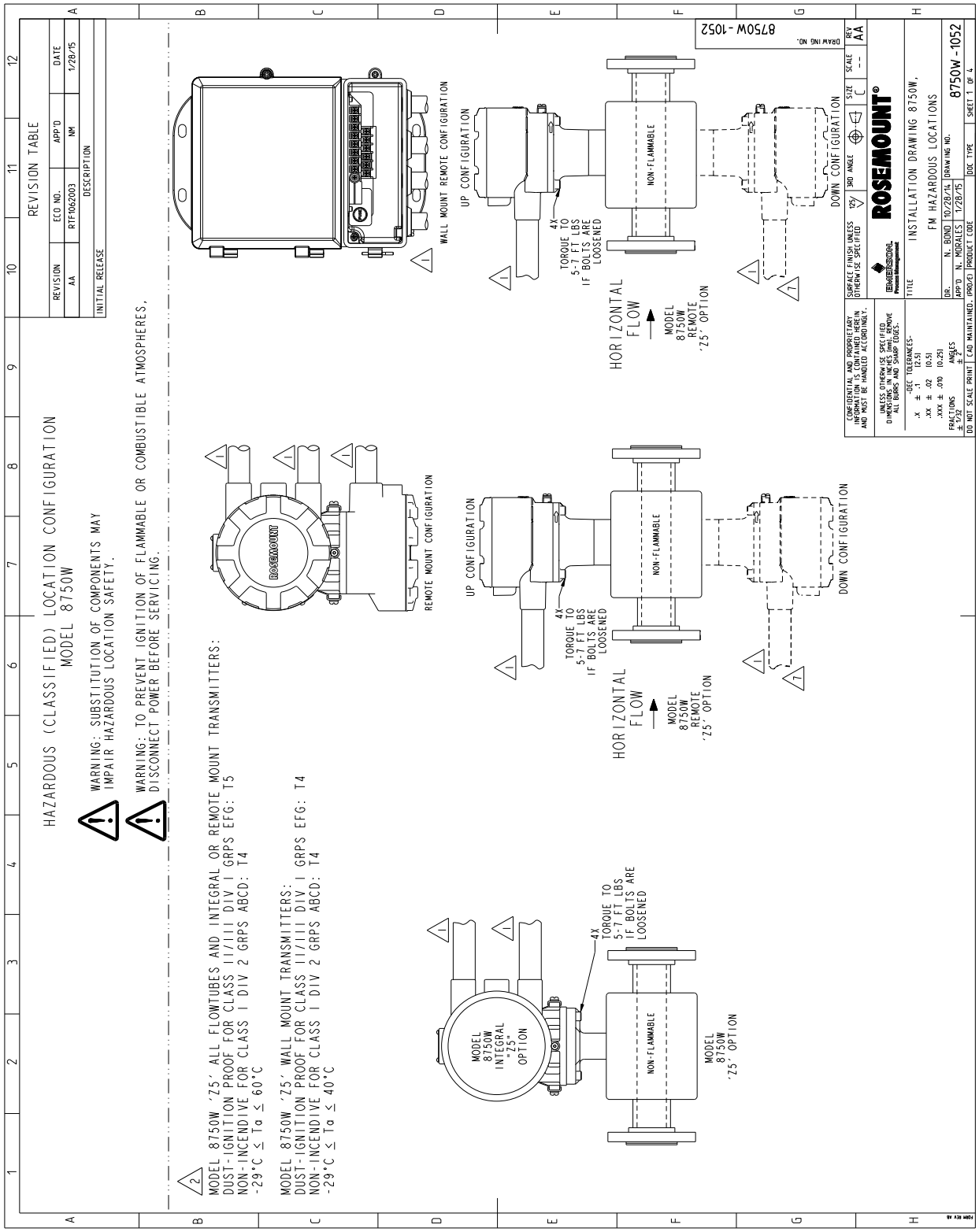
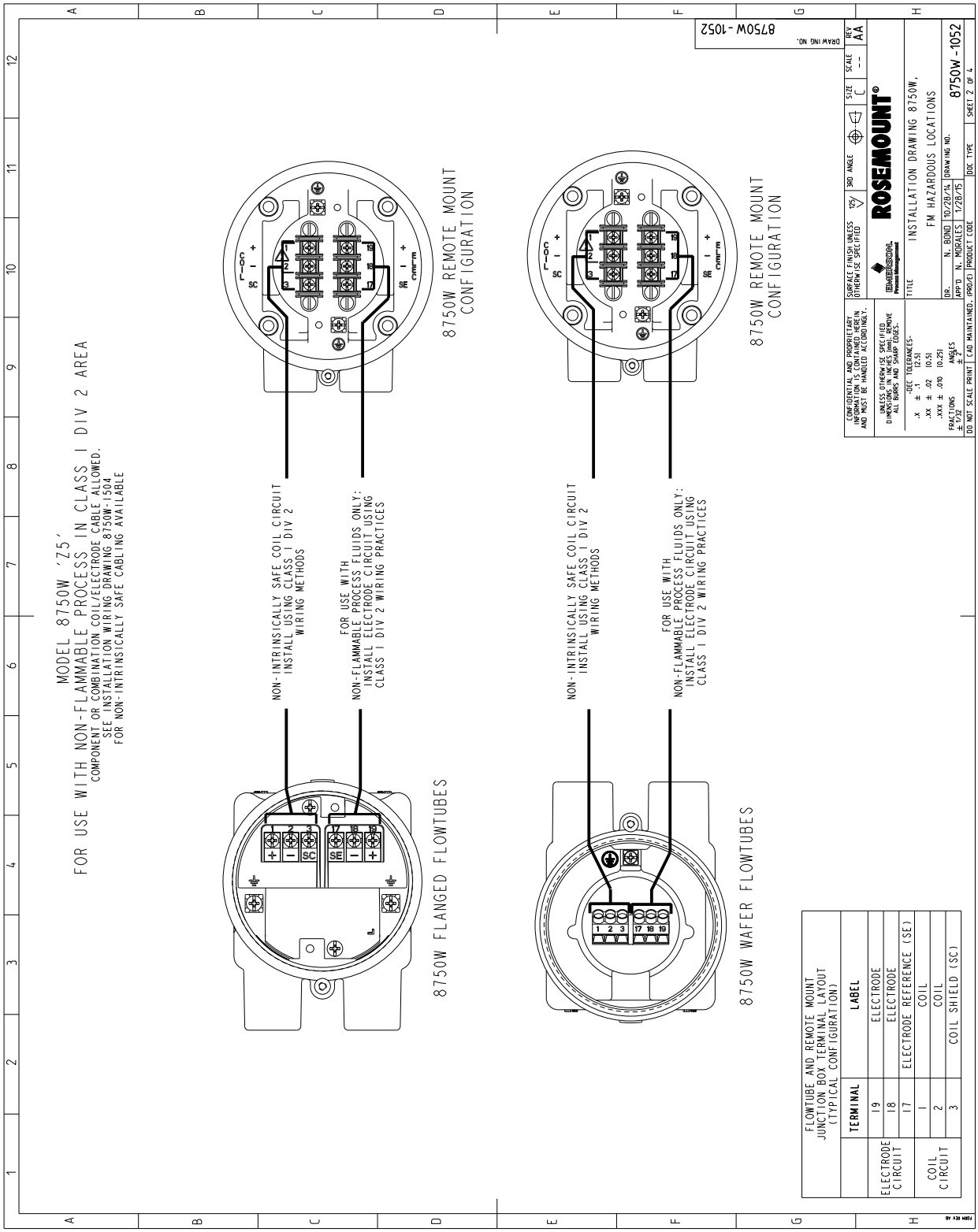
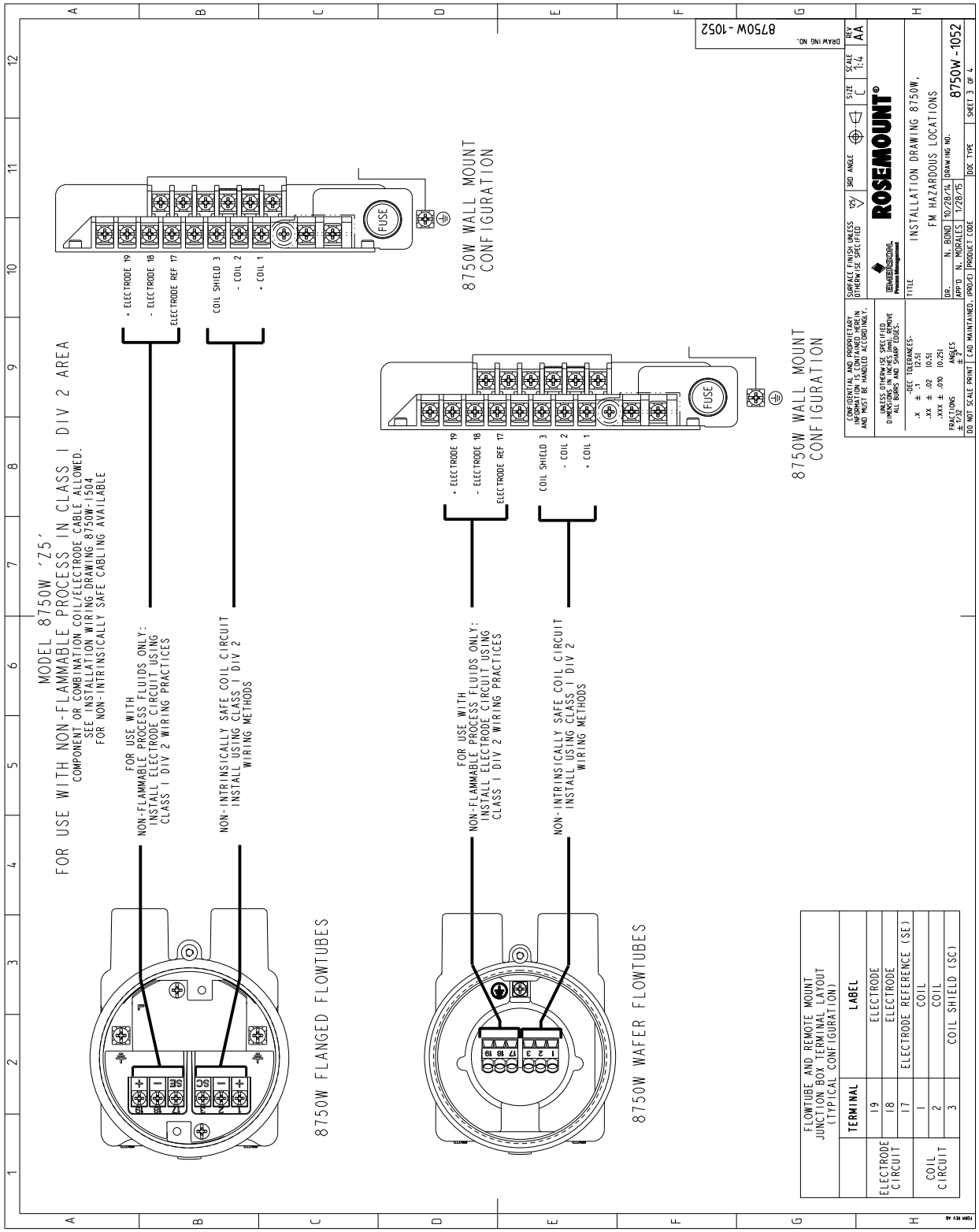

MODEL 8750W
TERMINAL BLOCK
THIS SHEET
FOR 8750W TRANSMITTER WITH
COMBINATION ELECTRODE AND COIL DRIVE CABLE
DETAIL "C"
TERMINAL NUMBER AND CONDUCTOR INSULATOR WIRE COLOR
ROSEMOUNT COIL/ELECTRODE CABLE COLOR CODING PART NUMBERS
STANDARD 08732-0065-2001 (FEET)
STANDARD 08732-0065-2002 (METERS)
SUBMERSIBLE 08732-0065-3001 (FEET)
SUBMERSIBLE 08732-0065-3002 (METERS)
NOTES:
JACKET COLOR/TEMPERATURE RATING
(1) GRAY - RATED -20°C TO 80°C
(2) BLACK - RATED -20°C TO 80°C DRY
60°C WET (SUBMERGED)
ROSEMOUNT
INSTALLATION DRAWING
8750W TRANSMITTER WIRING
8750W-1504
MODEL 8750W
FLANGED FLOWTUBES
MODEL 8750W WAFER
FLOWTUBES
SEE TEXT DETAIL
SEE DETAIL "C"
ROSEMOUNT

Figure C-2. FM Hazardous Location Installation




MODEL 8750W '75'
FOR USE WITH NON-FLAMMABLE PROCESS IN CLASS I DIV 2 AREA
COMPONENT OR COMBINATION COIL/ELECTRODE CABLE ALLOWED.
SEE INSTALLATION WIRING DRAWING 8750W-1504
FOR NON-INTRINSICALLY SAFE CABLING AVAILABLE
NON-INTRINSICALLY SAFE COIL CIRCUIT
INSTALL USING CLASS I DIV 2
WIRING METHODS
FOR USE WITH
NON-FLAMMABLE PROCESS FLUIDS ONLY:
INSTALL ELECTRODE CIRCUIT USING
CLASS I DIV 2 WIRING PRACTICES
8750W REMOTE MOUNT
CONFIGURATION
8750W FLANGED FLOWTUBES
8750W WAFER FLOWTUBES
FLOWTUBE AND REMOTE MOUNT
JUNCTION BOX TERMINAL LAYOUT
(TYPICAL CONFIGURATION)
TERMINAL
LABEL
ELECTRODE CIRCUIT
19 ELECTRODE
18 ELECTRODE
17 ELECTRODE REFERENCE (SE)
COIL CIRCUIT
1 COIL
2 COIL
3 COIL SHIELD (SC)
8750W-1052
DRAWING NO.
REV AA
SCALE --
SIZE C
ROSEMOUNT
INSTALLATION DRAWING 8750W,
FM HAZARDOUS LOCATIONS
8750W-1052
SHEET 2 OF 4


FOR USE WITH NON-FLAMMABLE PROCESS IN CLASS I DIV 2 AREA
MODEL 8750W 'Z5'
COMPONENT OR COMBINATION COIL/ELECTRODE CABLE ALLOWED.
SEE INSTALLATION WIRING DRAWING 8750W-1504
FOR NON-INTRINSICALLY SAFE CABLING AVAILABLE
FOR USE WITH NON-FLAMMABLE PROCESS FLUIDS ONLY: INSTALL ELECTRODE CIRCUIT USING CLASS I DIV 2 WIRING PRACTICES
NON-INTRINSICALLY SAFE COIL CIRCUIT INSTALL USING CLASS I DIV 2 WIRING METHODS
8750W FLANGED FLOWTUBES
8750W WALL MOUNT CONFIGURATION
+ ELECTRODE 19
- ELECTRODE 18
ELECTRODE REF 17
COIL SHIELD 3
- COIL 2
+ COIL 1
FUSE
8750W WALL MOUNT CONFIGURATION
8750W WAFER FLOWTUBES
FLOWTUBE AND REMOTE MOUNT JUNCTION BOX TERMINAL LAYOUT (TYPICAL CONFIGURATION)
TERMINAL
LABEL
ELECTRODE CIRCUIT
19 ELECTRODE
18 ELECTRODE
17 ELECTRODE REFERENCE (SE)
COIL CIRCUIT
1 COIL
2 COIL
3 COIL SHIELD (SC)
DRAWING NO. 8750W-1052
ROSEMOUNT
INSTALLATION DRAWING 8750W, FM HAZARDOUS LOCATIONS
8750W-1052
SHEET 3 OF 4

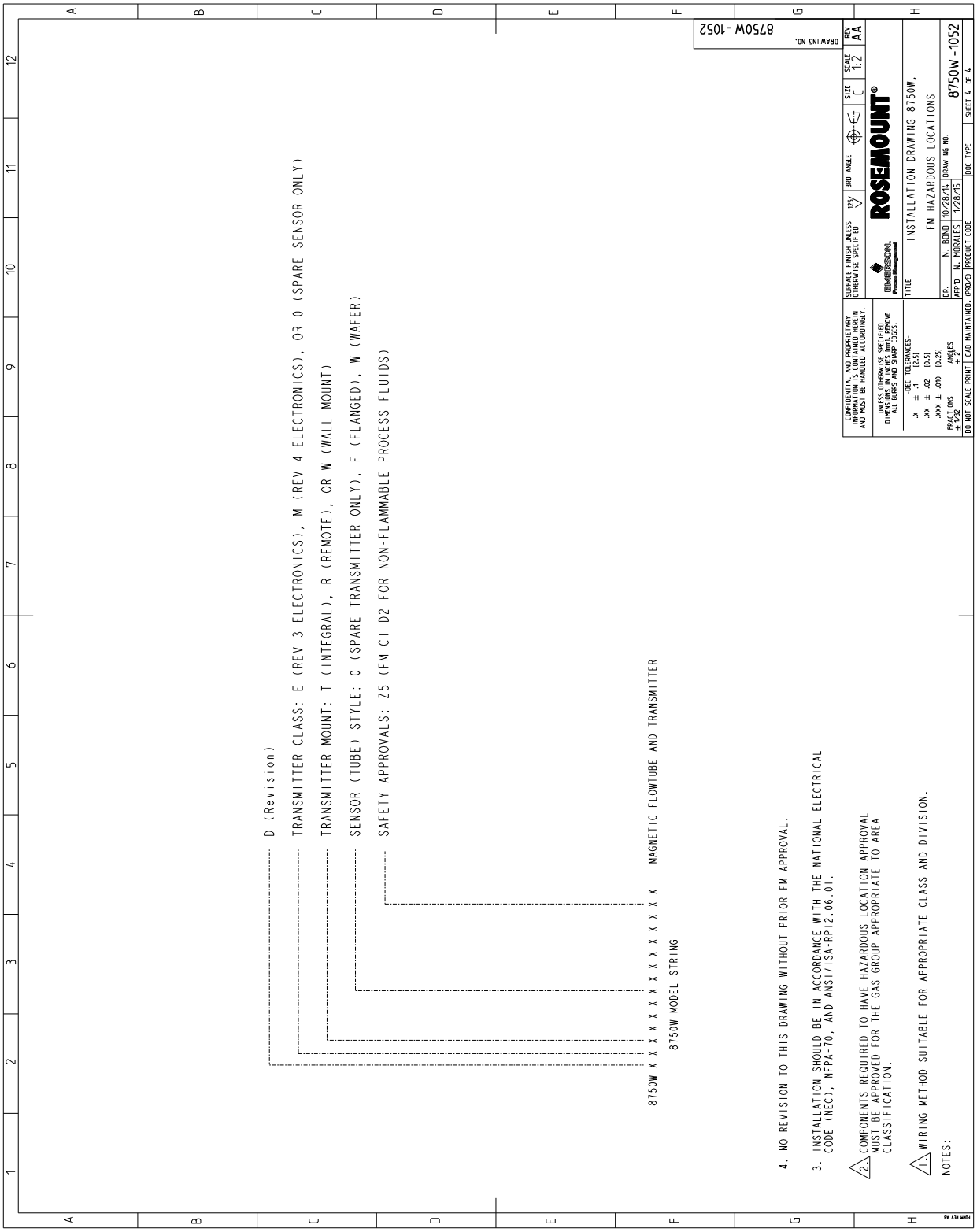
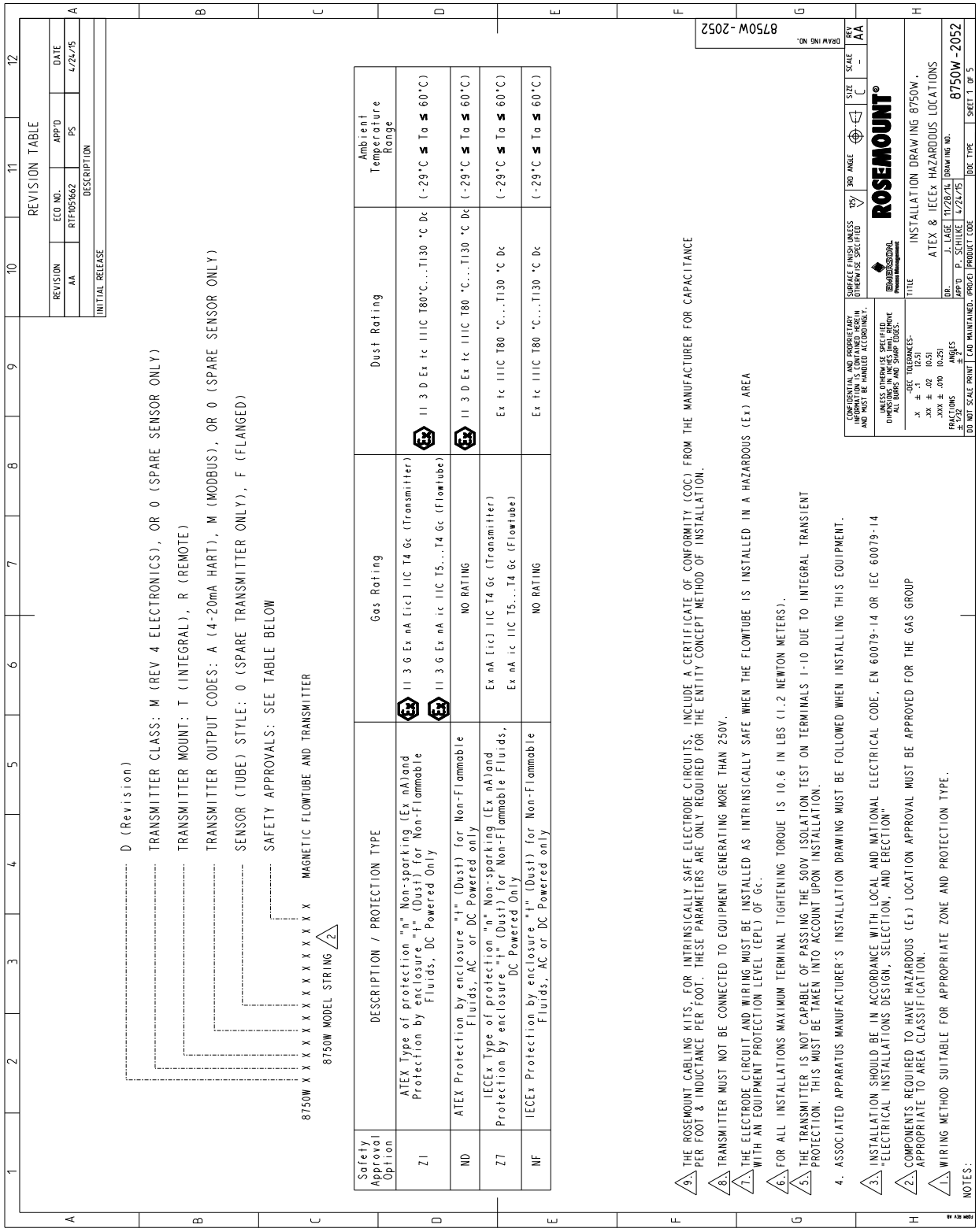
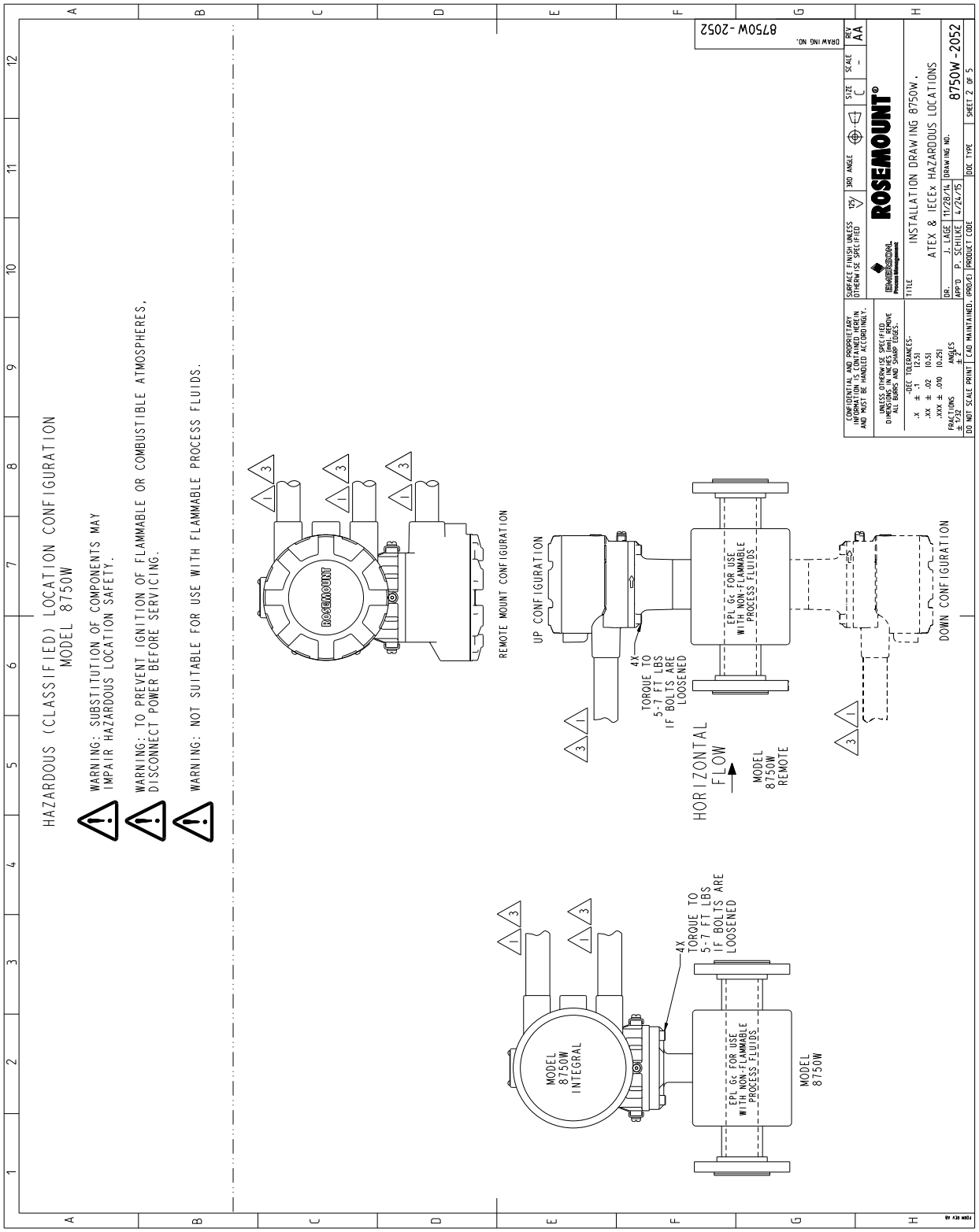
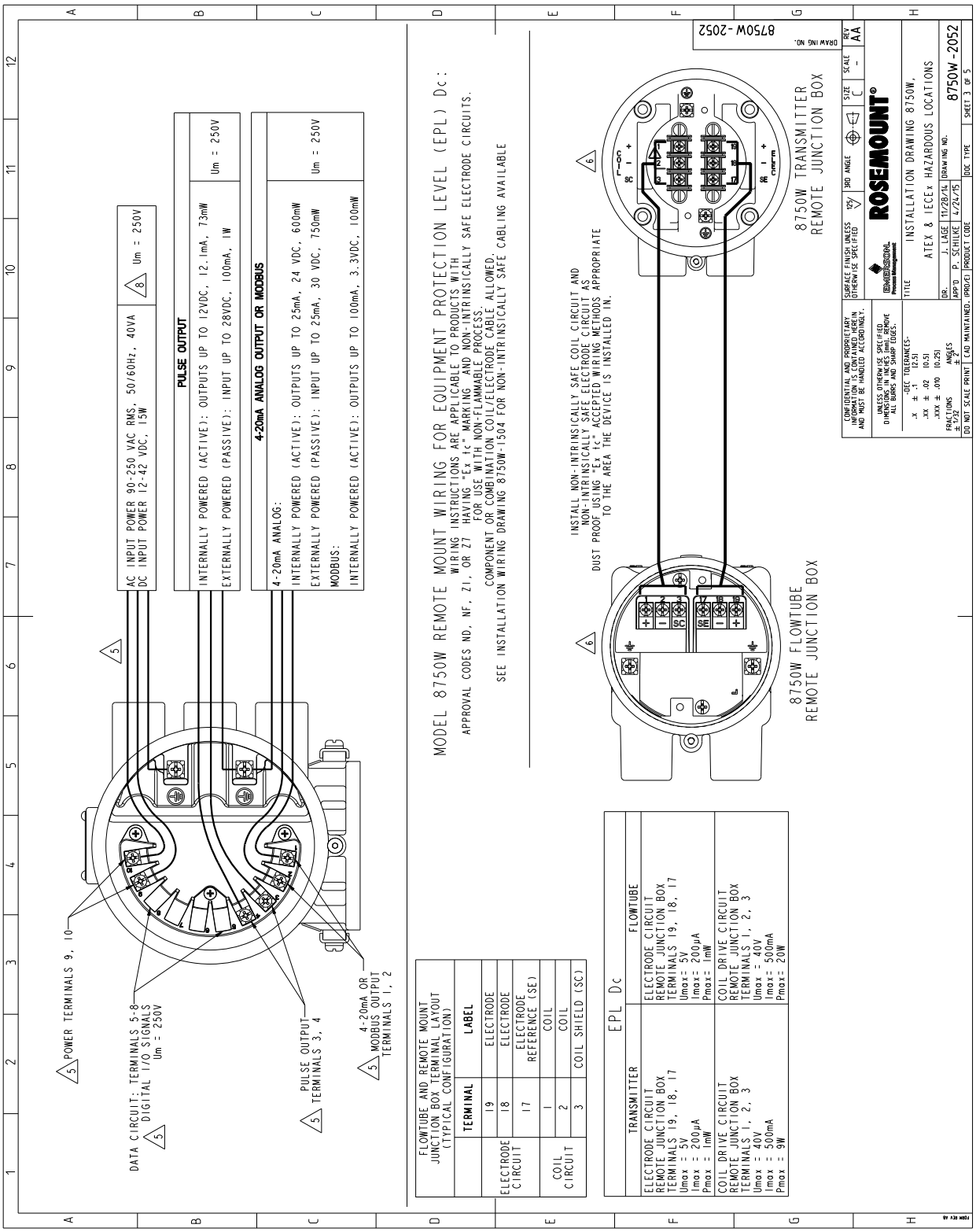
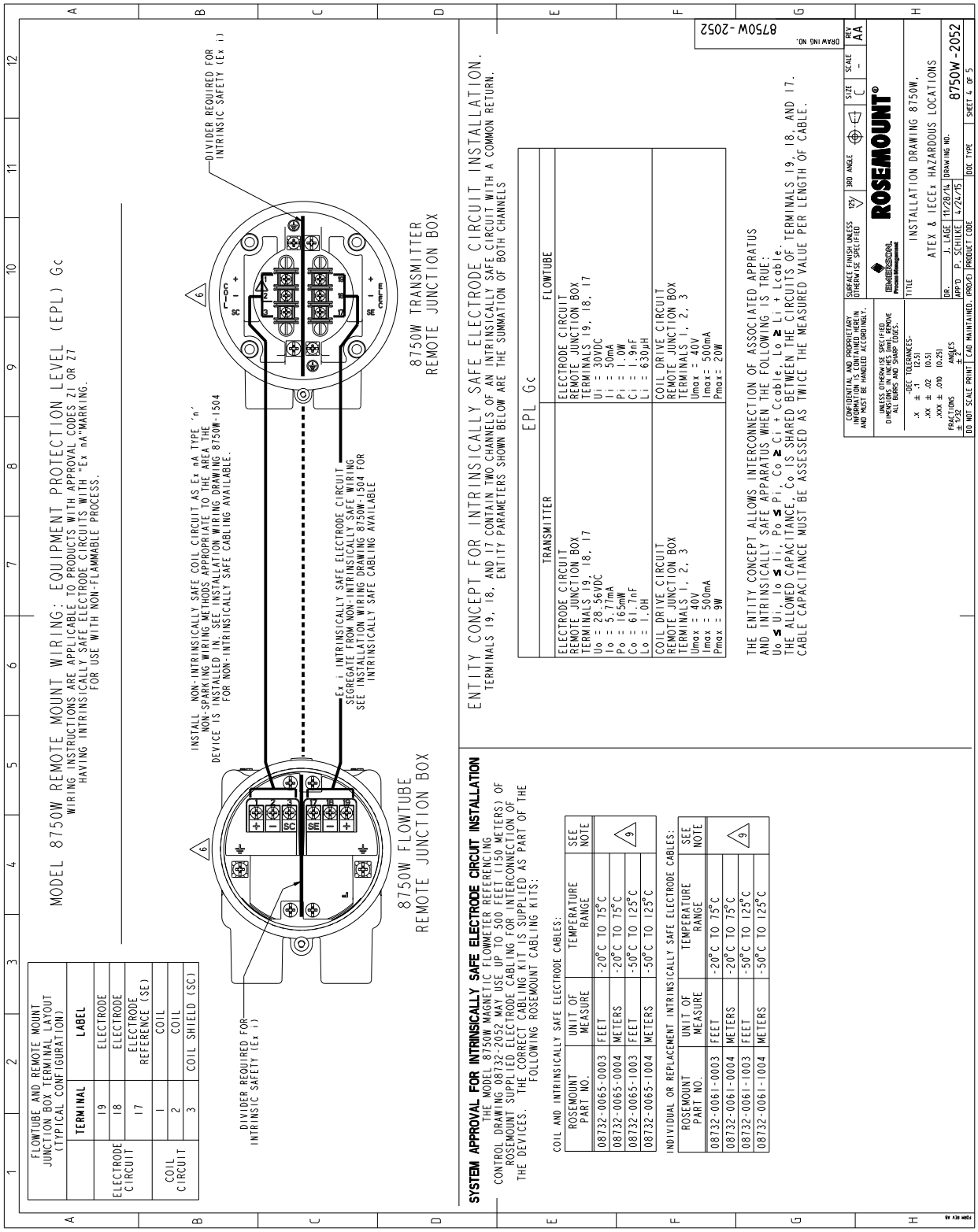

8750W-1052
DRAWING NO.
REV AA
SCALE 1:2
SIZE C
3RD ANGLE
SURFACE FINISH UNLESS OTHERWISE SPECIFIED
ROSEMOUNT®
INSTALLATION DRAWING 8750W, FM HAZARDOUS LOCATIONS
8750W-1052
SHEET 4 OF 4
CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY.
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES.
DO NOT SCALE PRINT
CAD MAINTAINED
D (Revision)
TRANSMITTER CLASS: E (REV 3 ELECTRONICS), M (REV 4 ELECTRONICS), OR 0 (SPARE SENSOR ONLY)
TRANSMITTER MOUNT: T (INTEGRAL), R (REMOTE), OR W (WALL MOUNT)
SENSOR (TUBE) STYLE: 0 (SPARE TRANSMITTER ONLY), F (FLANGED), W (WAFER)
SAFETY APPROVALS: Z5 (FM CI D2 FOR NON-FLAMMABLE PROCESS FLUIDS)
8750W X X X X X X X X X X X X MAGNETIC FLOWTUBE AND TRANSMITTER
8750W MODEL STRING
4. NO REVISION TO THIS DRAWING WITHOUT PRIOR FM APPROVAL.
3. INSTALLATION SHOULD BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC), NFPA-70, AND ANSI/ISA-RP12.06.01.
2. COMPONENTS REQUIRED TO HAVE HAZARDOUS LOCATION APPROVAL MUST BE APPROVED FOR THE GAS GROUP APPROPRIATE TO AREA CLASSIFICATION.
1. WIRING METHOD SUITABLE FOR APPROPRIATE CLASS AND DIVISION.
NOTES:

Figure C-3. IEC EC and ATEX Hazardous Area Installation




HAZARDOUS (CLASSIFIED) LOCATION CONFIGURATION
MODEL 8750W
WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR HAZARDOUS LOCATION SAFETY.
WARNING: TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING.
WARNING: NOT SUITABLE FOR USE WITH FLAMMABLE PROCESS FLUIDS.
REMOTE MOUNT CONFIGURATION
UP CONFIGURATION
4X TORQUE TO 5-7 FT LBS IF BOLTS ARE LOOSENED
EPL Gc FOR USE WITH NON-FLAMMABLE PROCESS FLUIDS
HORIZONTAL FLOW
MODEL 8750W REMOTE
DOWN CONFIGURATION
MODEL 8750W INTEGRAL
MODEL 8750W
8750W-2052
ROSEMOUNT
INSTALLATION DRAWING 8750W.
ATEX & IECEx HAZARDOUS LOCATIONS
8750W-2052


MODEL 8750W REMOTE MOUNT WIRING FOR EQUIPMENT PROTECTION LEVEL (EPL) Dc:
WIRING INSTRUCTIONS ARE APPLICABLE TO PRODUCTS WITH
APPROVAL CODES ND, NF, ZI, OR Z7 HAVING "Ex ic" MARKING AND NON-INTRINSICALLY SAFE ELECTRODE CIRCUITS.
FOR USE WITH NON-FLAMMABLE PROCESS.
COMPONENT OR COMBINATION COIL/ELECTRODE CABLE ALLOWED.
SEE INSTALLATION WIRING DRAWING 8750W-1504 FOR NON-INTRINSICALLY SAFE CABLING AVAILABLE
AC INPUT POWER 90-250 VAC RMS, 50/60Hz, 40VA
DC INPUT POWER 12-42 VDC, 15W
Um = 250V
PULSE OUTPUT
INTERNALLY POWERED (ACTIVE): OUTPUTS UP TO 12VDC, 12.1mA, 73mW
EXTERNALLY POWERED (PASSIVE): INPUT UP TO 28VDC, 100mA, 1W
Um = 250V
4-20mA ANALOG OUTPUT OR MODBUS
4-20mA ANALOG:
INTERNALLY POWERED (ACTIVE): OUTPUTS UP TO 25mA, 24 VDC, 600mW
EXTERNALLY POWERED (PASSIVE): INPUT UP TO 25mA, 30 VDC, 750mW
MODBUS:
INTERNALLY POWERED (ACTIVE): OUTPUTS UP TO 100mA, 3.3VDC, 100mW
Um = 250V
POWER TERMINALS 9, 10
DATA CIRCUIT: TERMINALS 5-8
DIGITAL I/O SIGNALS
Um = 250V
PULSE OUTPUT
TERMINALS 3, 4
4-20mA OR
MODBUS OUTPUT
TERMINALS 1, 2
FLOWTUBE AND REMOTE MOUNT
JUNCTION BOX TERMINAL LAYOUT
(TYPICAL CONFIGURATION)
TERMINAL
LABEL
ELECTRODE CIRCUIT
19
ELECTRODE
18
ELECTRODE
17
ELECTRODE REFERENCE (SE)
COIL CIRCUIT
1
COIL
2
COIL
3
COIL SHIELD (SC)
EPL Dc
TRANSMITTER
FLOWTUBE
ELECTRODE CIRCUIT
REMOTE JUNCTION BOX
TERMINALS 19, 18, 17
Umax = 5V
Imax = 200µA
Pmax = 1mW
ELECTRODE CIRCUIT
REMOTE JUNCTION BOX
TERMINALS 19, 18, 17
COIL DRIVE CIRCUIT
REMOTE JUNCTION BOX
TERMINALS 1, 2, 3
Umax = 40V
Imax = 500mA
Pmax = 20W
COIL DRIVE CIRCUIT
REMOTE JUNCTION BOX
TERMINALS 1, 2, 3
Umax = 40V
Imax = 500mA
Pmax = 9W
INSTALL NON-INTRINSICALLY SAFE COIL CIRCUIT AND
NON-INTRINSICALLY SAFE ELECTRODE CIRCUIT AS
DUST PROOF USING "Ex ic" ACCEPTED WIRING METHODS APPROPRIATE
TO THE AREA THE DEVICE IS INSTALLED IN.
8750W FLOWTUBE
REMOTE JUNCTION BOX
8750W TRANSMITTER
REMOTE JUNCTION BOX
DRAWING NO.
8750W-2052
CONFIDENTIAL AND PROPRIETARY
INFORMATION IS CONTAINED HEREIN
AND MUST BE HANDLED ACCORDINGLY.
UNLESS OTHERWISE SPECIFIED
DIMENSIONS IN INCHES [mm]. REMOVE
ALL BURRS AND SHARP EDGES.
-DEC TOLERANCES-
.X ± .1 [2.5]
.XX ± .02 [0.5]
.XXX ± .010 [0.25]
FRACTIONS ±1/32 ANGLES ±2°
DO NOT SCALE PRINT
SURFACE FINISH UNLESS OTHERWISE SPECIFIED 125
3RD ANGLE
SIZE C
SCALE -
REV AA
ROSEMOUNT
TITLE
INSTALLATION DRAWING 8750W,
ATEX & IECEx HAZARDOUS LOCATIONS
DR. J. LAGE 11/28/14
APP'D P. SCHILKE 4/24/15
DRAWING NO. 8750W-2052
DOC TYPE
SHEET 3 OF 5
CAD MAINTAINED. (PRO/E) PRODUCT CODE


MODEL 8750W REMOTE MOUNT WIRING: EQUIPMENT PROTECTION LEVEL (EPL) Gc
WIRING INSTRUCTIONS ARE APPLICABLE TO PRODUCTS WITH APPROVAL CODES ZI OR Z7
HAVING INTRINSICALLY SAFE ELECTRODE CIRCUITS WITH "Ex nA"MARKING.
FOR USE WITH NON-FLAMMABLE PROCESS.
FLOWTUBE AND REMOTE MOUNT JUNCTION BOX TERMINAL LAYOUT (TYPICAL CONFIGURATION)
TERMINAL
LABEL
ELECTRODE CIRCUIT
19 ELECTRODE
18 ELECTRODE
17 ELECTRODE REFERENCE (SE)
COIL CIRCUIT
1 COIL
2 COIL
3 COIL SHIELD (SC)
DIVIDER REQUIRED FOR INTRINSIC SAFETY (Ex i)
INSTALL NON-INTRINSICALLY SAFE COIL CIRCUIT AS Ex nA TYPE 'n' NON-SPARKING WIRING METHODS APPROPRIATE TO THE AREA THE DEVICE IS INSTALLED IN. SEE INSTALLATION WIRING DRAWING 8750W-1504 FOR NON-INTRINSICALLY SAFE CABLING AVAILABLE.
Ex i INTRINSICALLY SAFE ELECTRODE CIRCUIT SEGREGATE FROM NON-INTRINSICALLY SAFE WIRING SEE INSTALLATION WIRING DRAWING 8750W-1504 FOR INTRINSICALLY SAFE CABLING AVAILABLE
8750W FLOWTUBE REMOTE JUNCTION BOX
8750W TRANSMITTER REMOTE JUNCTION BOX
DIVIDER REQUIRED FOR INTRINSIC SAFETY (Ex i)
SYSTEM APPROVAL FOR INTRINSICALLY SAFE ELECTRODE CIRCUIT INSTALLATION
THE MODEL 8750W MAGNETIC FLOWMETER REFERENCING CONTROL DRAWING 08732-2052 MAY USE UP TO 500 FEET (150 METERS) OF ROSEMOUNT SUPPLIED ELECTRODE CABLING FOR INTERCONNECTION OF THE DEVICES. THE CORRECT CABLING KIT IS SUPPLIED AS PART OF THE FOLLOWING ROSEMOUNT CABLING KITS:
COIL AND INTRINSICALLY SAFE ELECTRODE CABLES:
ROSEMOUNT PART NO. | UNIT OF MEASURE | TEMPERATURE RANGE | SEE NOTE
08732-0065-0003 | FEET | -20°C TO 75°C | 9
08732-0065-0004 | METERS | -20°C TO 75°C
08732-0065-1003 | FEET | -50°C TO 125°C
08732-0065-1004 | METERS | -50°C TO 125°C
INDIVIDUAL OR REPLACEMENT INTRINSICALLY SAFE ELECTRODE CABLES:
ROSEMOUNT PART NO. | UNIT OF MEASURE | TEMPERATURE RANGE | SEE NOTE
08732-0061-0003 | FEET | -20°C TO 75°C | 9
08732-0061-0004 | METERS | -20°C TO 75°C
08732-0061-1003 | FEET | -50°C TO 125°C
08732-0061-1004 | METERS | -50°C TO 125°C
ENTITY CONCEPT FOR INTRINSICALLY SAFE ELECTRODE CIRCUIT INSTALLATION.
TERMINALS 19, 18, AND 17 CONTAIN TWO CHANNELS OF AN INTRINSICALLY SAFE CIRCUIT WITH A COMMON RETURN.
ENTITY PARAMETERS SHOWN BELOW ARE THE SUMMATION OF BOTH CHANNELS
EPL Gc
TRANSMITTER
ELECTRODE CIRCUIT
REMOTE JUNCTION BOX
TERMINALS 19, 18, 17
Uo = 28.56VDC
Io = 5.77mA
Po = 165mW
Co = 61.7nF
Lo = 1.0H
COIL DRIVE CIRCUIT
REMOTE JUNCTION BOX
TERMINALS 1, 2, 3
Umax = 40V
Imax = 500mA
Pmax = 9W
FLOWTUBE
ELECTRODE CIRCUIT
REMOTE JUNCTION BOX
TERMINALS 19, 18, 17
Ui = 30VDC
Ii = 50mA
Pi = 1.0W
Ci = 1.9nF
Li = 630µH
COIL DRIVE CIRCUIT
REMOTE JUNCTION BOX
TERMINALS 1, 2, 3
Umax = 40V
Imax = 500mA
Pmax = 20W
THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF ASSOCIATED APPRATUS AND INTRINSICALLY SAFE APPARATUS WHEN THE FOLLOWING IS TRUE:
Uo ≤ Ui, Io ≤ Ii, Po ≤ Pi, Co ≥ Ci + Ccable, Lo ≥ Li + Lcable.
THE ALLOWED CAPACITANCE, Co IS SHARED BETWEEN THE CIRCUITS OF TERMINALS 19, 18, AND 17. CABLE CAPACITANCE MUST BE ASSESSED AS TWICE THE MEASURED VALUE PER LENGTH OF CABLE.
CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY.
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES.
DECIMAL TOLERANCES: .X ± .1 [2.5] .XX ± .02 [0.5] .XXX ± .010 [0.25]
FRACTIONS ± 1/32 ANGLES ± 2°
SURFACE FINISH UNLESS OTHERWISE SPECIFIED
3RD ANGLE
SIZE C
SCALE -
REV AA
DRAWING NO. 8750W-2052
ROSEMOUNT
TITLE
INSTALLATION DRAWING 8750W, ATEX & IECEx HAZARDOUS LOCATIONS
DR. J. LAGE 11/28/14
APP'D P. SCHULKE 1/2/15
DRAWING NO. 8750W-2052
DO NOT SCALE PRINT
CAD MAINTAINED (PRO/E)
PRODUCT CODE
DOC TYPE
SHEET 4 OF 5

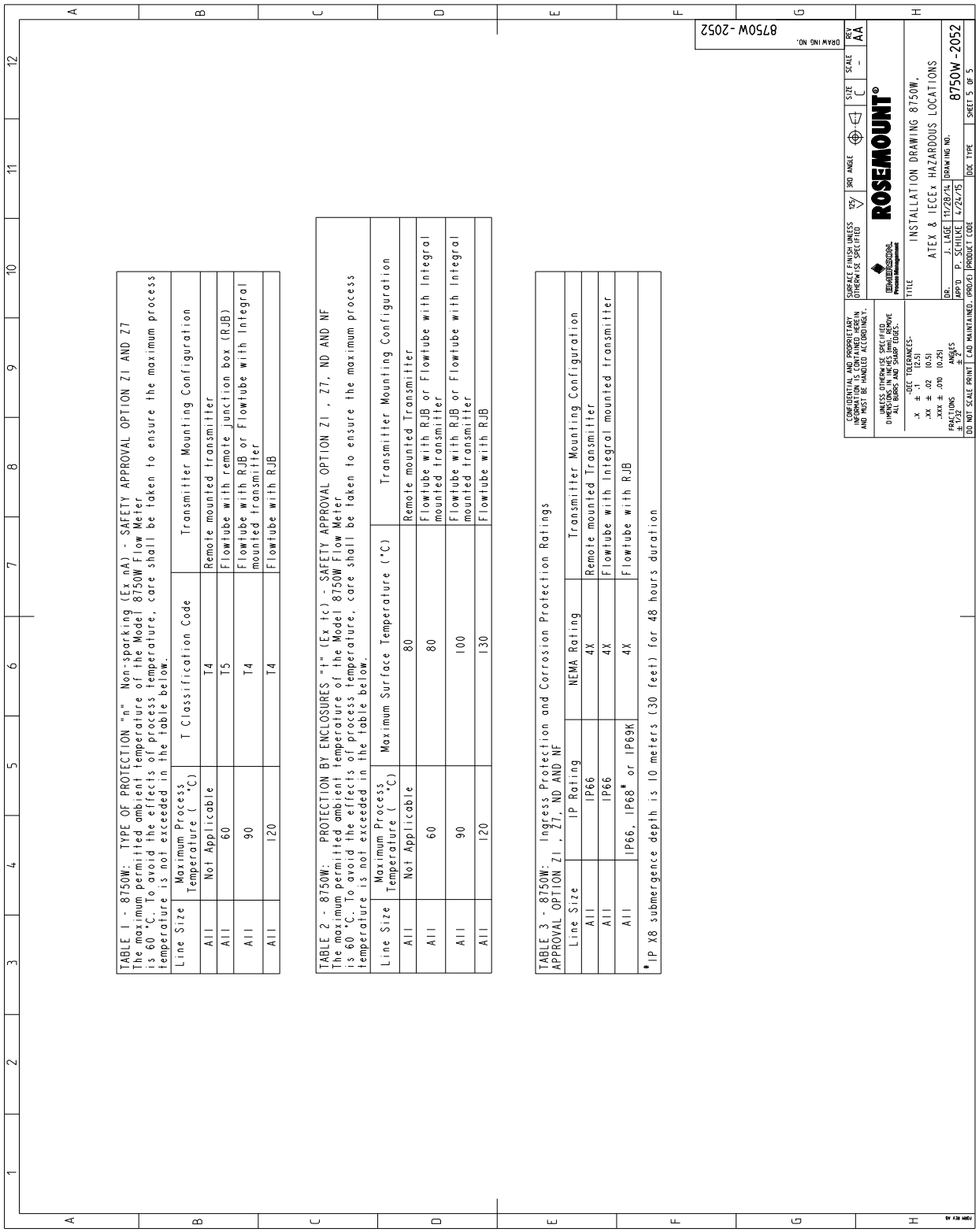


TABLE 1 - 8750W: TYPE OF PROTECTION "n" Non-sparking (Ex nA) - SAFETY APPROVAL OPTION Z1 AND Z7
The maximum permitted ambient temperature of the Model 8750W Flow Meter is 60 °C. To avoid the effects of process temperature, care shall be taken to ensure the maximum process temperature is not exceeded in the table below.

Line Size	Maximum Process Temperature (°C)	T Classification Code	Transmitter Mounting Configuration
All	Not Applicable	T4	Remote mounted transmitter
All	60	T5	Flowtube with remote junction box (RJB)
All	90	T4	Flowtube with RJB or Flowtube with Integral mounted transmitter
All	120	T4	Flowtube with RJB

TABLE 2 - 8750W: PROTECTION BY ENCLOSURES "t" (Ex tc) - SAFETY APPROVAL OPTION Z1 , Z7, ND AND NF
The maximum permitted ambient temperature of the Model 8750W Flow Meter is 60 °C. To avoid the effects of process temperature, care shall be taken to ensure the maximum process temperature is not exceeded in the table below.

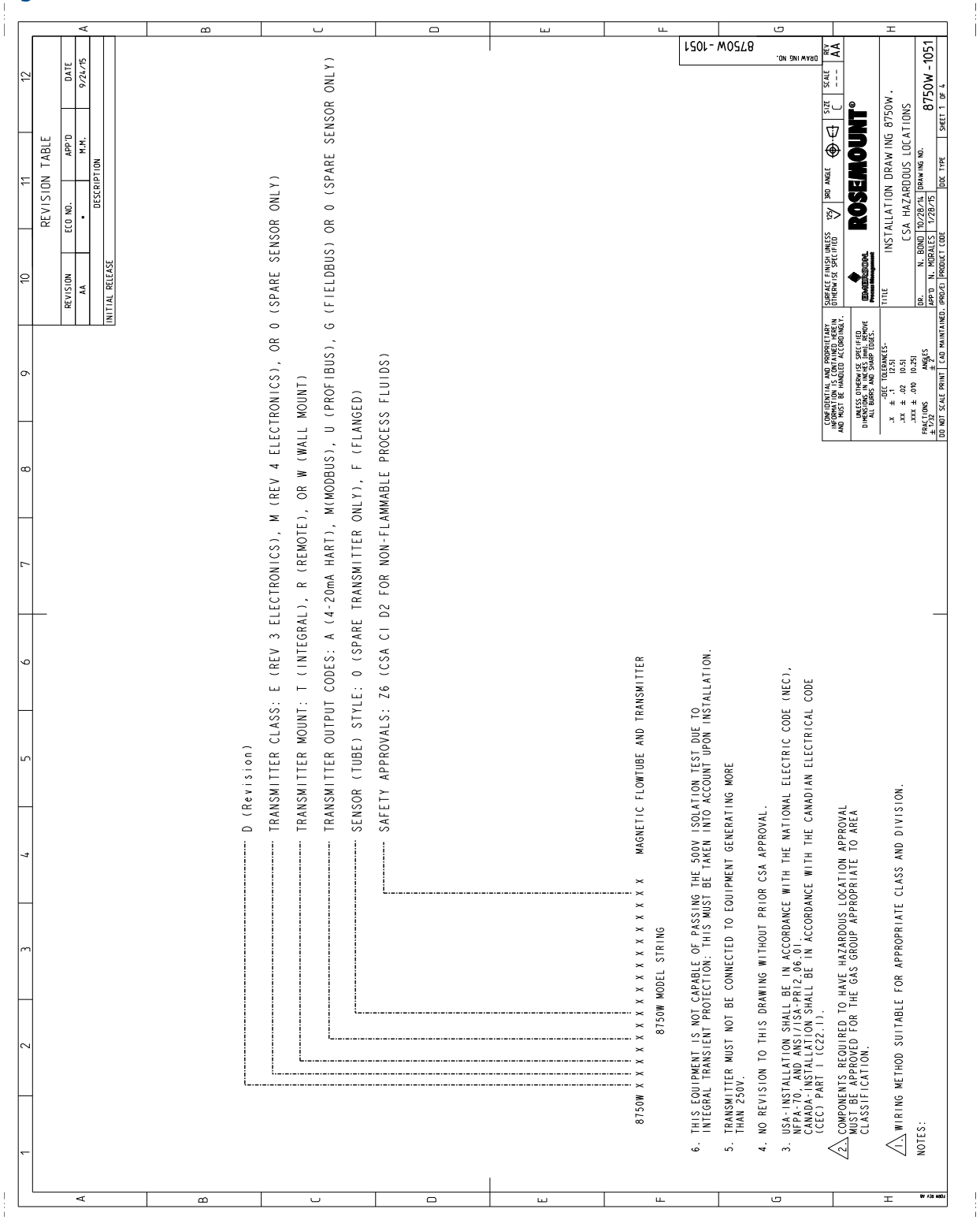
Line Size	Maximum Process Temperature (°C)	Maximum Surface Temperature (°C)	Transmitter Mounting Configuration
All	Not Applicable	80	Remote mounted Transmitter
All	60	80	Flowtube with RJB or Flowtube with Integral mounted transmitter
All	90	100	Flowtube with RJB or Flowtube with Integral mounted transmitter
All	120	130	Flowtube with RJB

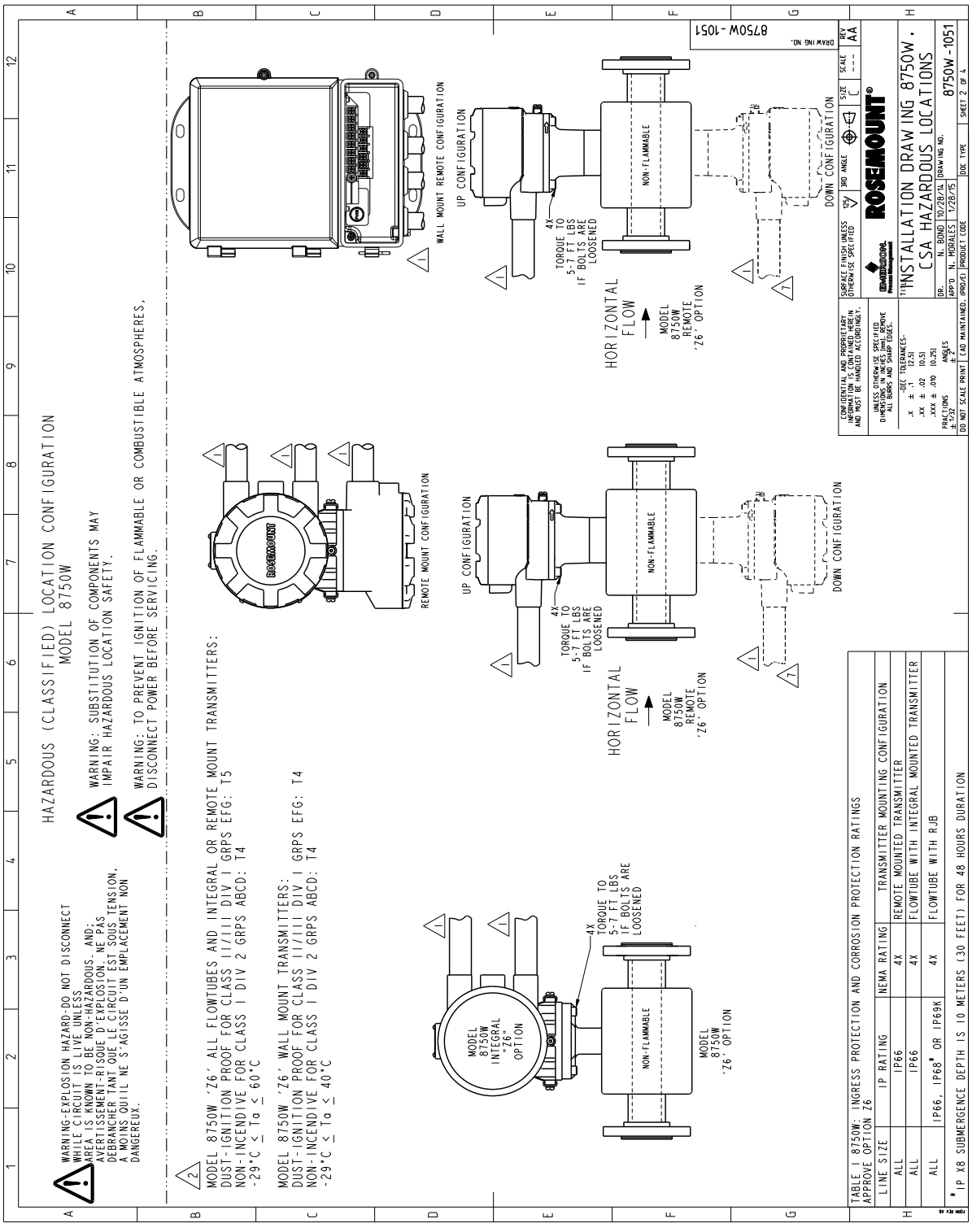
TABLE 3 - 8750W: Ingress Protection and Corrosion Protection Ratings
APPROVAL OPTION Z1 , Z7, ND AND NF

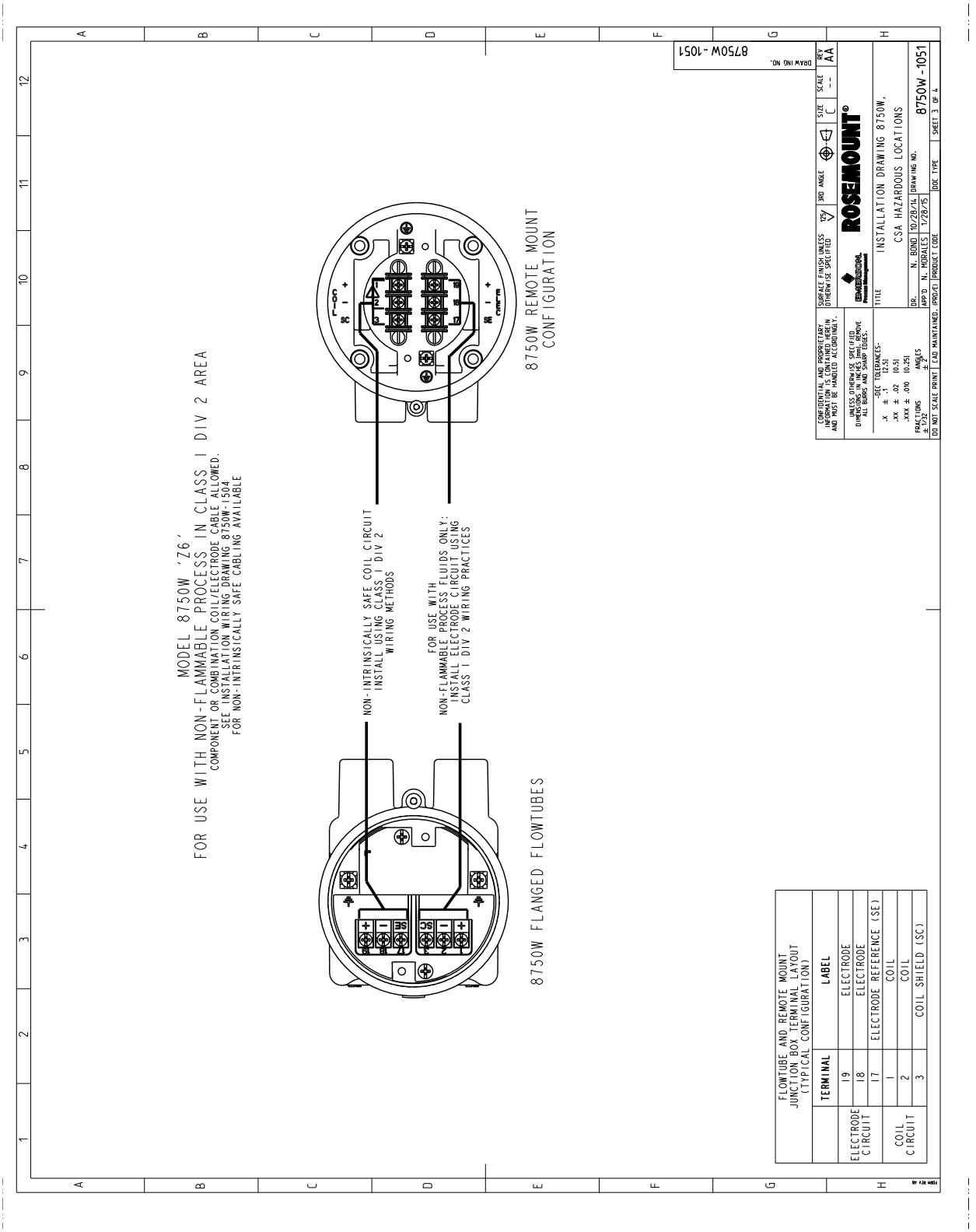
Line Size	IP Rating	NEMA Rating	Transmitter Mounting Configuration
All	IP66	4X	Remote mounted Transmitter
All	IP66	4X	Flowtube with Integral mounted transmitter
All	IP66, IP68* or IP69K	4X	Flowtube with RJB

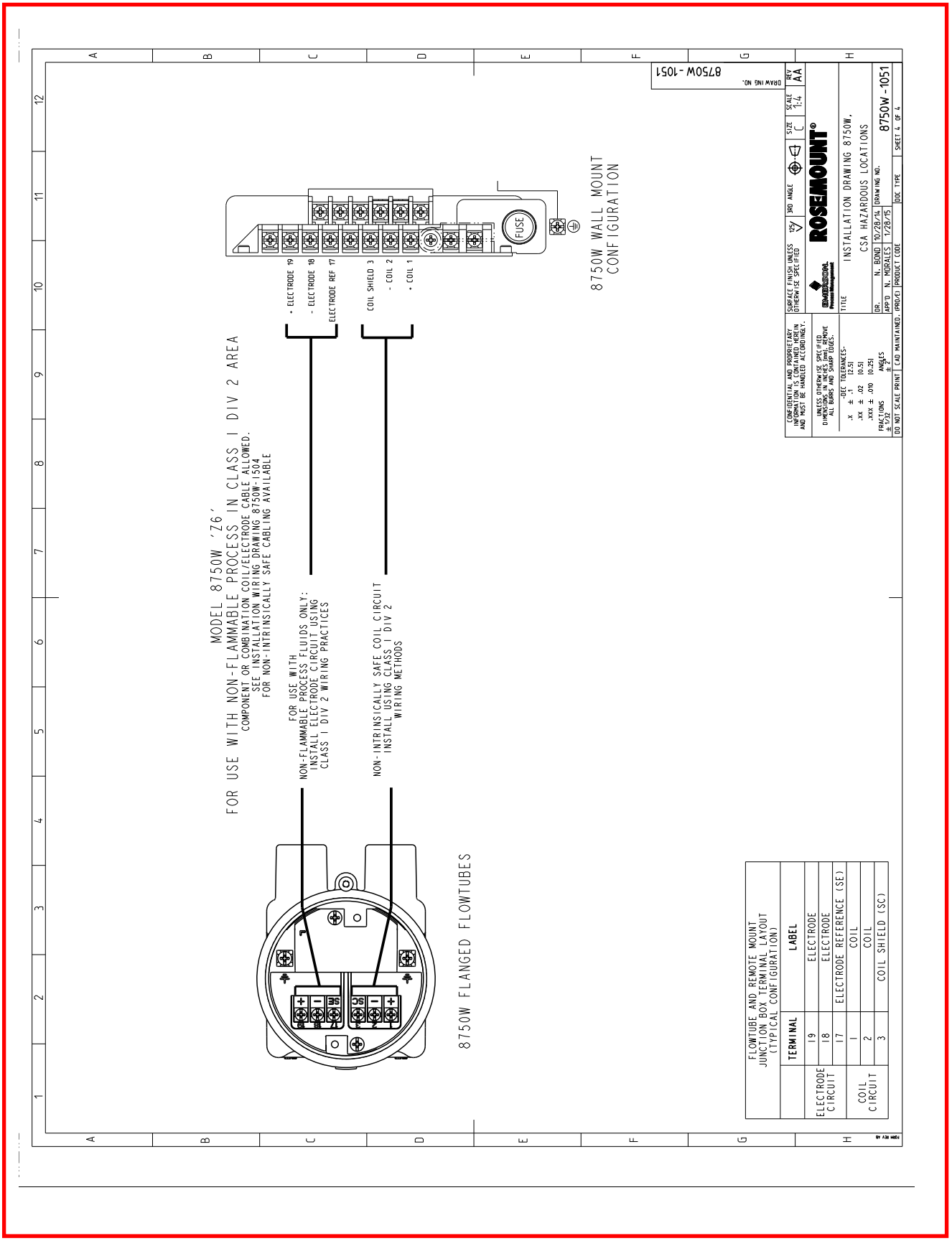
* IP X8 submergence depth is 10 meters (30 feet) for 48 hours duration

Figure C-4. CSA Hazardous Area Installation



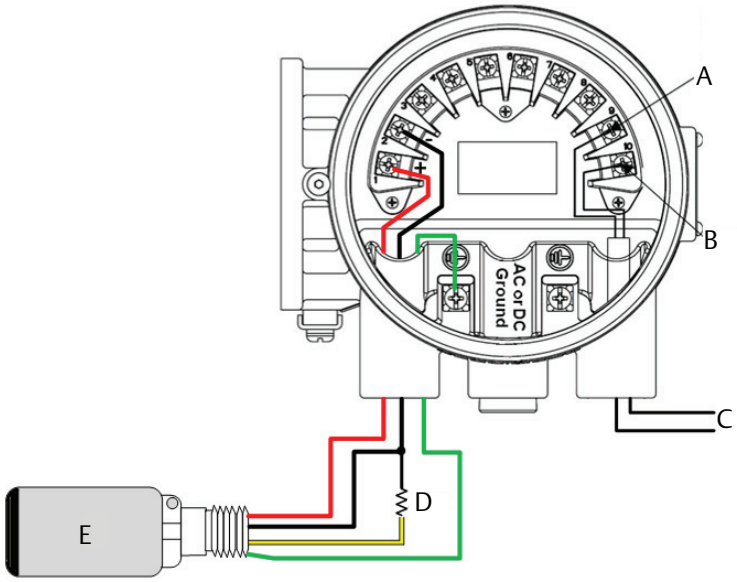

HAZARDOUS (CLASSIFIED) LOCATION CONFIGURATION
MODEL 8750W
WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR HAZARDOUS LOCATION SAFETY.
WARNING: TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING.
WARNING-EXPLOSION HAZARD-DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS. AND; AVERTISSEMENT-RISQUE D'EXPLOSION. NE PAS DEBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION, A MOINS QUIL NE S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.
MODEL 8750W 'Z6' ALL FLOWTUBES AND INTEGRAL OR REMOTE MOUNT TRANSMITTERS:
DUST-IGNITION PROOF FOR CLASS II/III DIV I GRPS EFG: T5
NON-INCENDIVE FOR CLASS I DIV 2 GRPS ABCD: T4
-29°C ≤ Ta ≤ 60°C
MODEL 8750W 'Z6' WALL MOUNT TRANSMITTERS:
DUST-IGNITION PROOF FOR CLASS II/III DIV I GRPS EFG: T4
NON-INCENDIVE FOR CLASS I DIV 2 GRPS ABCD: T4
-29°C ≤ Ta ≤ 40°C
REMOTE MOUNT CONFIGURATION
WALL MOUNT REMOTE CONFIGURATION
UP CONFIGURATION
DOWN CONFIGURATION
4X TORQUE TO 5-7 FT LBS IF BOLTS ARE LOOSENED
HORIZONTAL FLOW
MODEL 8750W REMOTE 'Z6' OPTION
MODEL 8750W INTEGRAL "Z6" OPTION
NON-FLAMMABLE
MODEL 8750W 'Z6' OPTION
TABLE I 8750W: INGRESS PROTECTION AND CORROSION PROTECTION RATINGS
APPROVE OPTION Z6
LINE SIZE | IP RATING | NEMA RATING | TRANSMITTER MOUNTING CONFIGURATION
ALL | IP66 | 4X | REMOTE MOUNTED TRANSMITTER
ALL | IP66 | 4X | FLOWTUBE WITH INTEGRAL MOUNTED TRANSMITTER
ALL | IP66, IP68* OR IP69K | 4X | FLOWTUBE WITH RJB
* IP X8 SUBMERGENCE DEPTH IS 10 METERS (30 FEET) FOR 48 HOURS DURATION
8750W-1051
DRAWING NO.
REV AA
SCALE ---
SIZE C
3RD ANGLE
ROSEMOUNT®
INSTALLATION DRAWING 8750W, CSA HAZARDOUS LOCATIONS
8750W-1051
SHEET 2 OF 4


MODEL 8750W 'Z6'
FOR USE WITH NON-FLAMMABLE PROCESS IN CLASS I DIV 2 AREA
COMPONENT OR COMBINATION COIL/ELECTRODE CABLE ALLOWED.
SEE INSTALLATION WIRING DRAWING 8750W-1504
FOR NON-INTRINSICALLY SAFE CABLING AVAILABLE
NON-INTRINSICALLY SAFE COIL CIRCUIT
INSTALL USING CLASS I DIV 2
WIRING METHODS
FOR USE WITH
NON-FLAMMABLE PROCESS FLUIDS ONLY:
INSTALL ELECTRODE CIRCUIT USING
CLASS I DIV 2 WIRING PRACTICES
8750W REMOTE MOUNT
CONFIGURATION
8750W FLANGED FLOWTUBES
FLOWTUBE AND REMOTE MOUNT
JUNCTION BOX TERMINAL LAYOUT
(TYPICAL CONFIGURATION)
TERMINAL
LABEL
ELECTRODE CIRCUIT
19 ELECTRODE
18 ELECTRODE
17 ELECTRODE REFERENCE (SE)
COIL CIRCUIT
1 COIL
2 COIL
3 COIL SHIELD (SC)
8750W-1051
ROSEMOUNT
INSTALLATION DRAWING 8750W,
CSA HAZARDOUS LOCATIONS
8750W-1051
SHEET 3 OF 4


8750W-1051
REV AA
SCALE 1:4
SIZE C
3RD ANGLE
ROSEMOUNT
INSTALLATION DRAWING 8750W, CSA HAZARDOUS LOCATIONS
8750W-1051
SHEET 4 OF 4
8750W WALL MOUNT CONFIGURATION
FUSE
• ELECTRODE 19
- ELECTRODE 18
ELECTRODE REF 17
COIL SHIELD 3
- COIL 2
• COIL 1
FOR USE WITH NON-FLAMMABLE PROCESS IN CLASS I DIV 2 AREA
MODEL 8750W 'Z6'
COMPONENT OR COMBINATION COIL/ELECTRODE CABLE ALLOWED.
SEE INSTALLATION WIRING DRAWING 8750W-1504
FOR NON-INTRINSICALLY SAFE CABLING AVAILABLE
FOR USE WITH
NON-FLAMMABLE PROCESS FLUIDS ONLY:
INSTALL ELECTRODE CIRCUIT USING
CLASS I DIV 2 WIRING PRACTICES
NON-INTRINSICALLY SAFE COIL CIRCUIT
INSTALL USING CLASS I DIV 2
WIRING METHODS
8750W FLANGED FLOWTUBES
FLOWTUBE AND REMOTE MOUNT
JUNCTION BOX TERMINAL LAYOUT
(TYPICAL CONFIGURATION)
TERMINAL
LABEL
ELECTRODE CIRCUIT
19 ELECTRODE
18 ELECTRODE
17 ELECTRODE REFERENCE (SE)
COIL CIRCUIT
1 COIL
2 COIL
3 COIL SHIELD (SC)

C.1 Emerson™ 775 Wireless THUM™ Adapter

Figure C-5. Emerson 775 Wireless THUM Adapter with Field Mount Internal Analog Power



Wiring guide

Red to XMTR (+) pin 1

Black to XMTR (-) pin 2 and 250 Ω

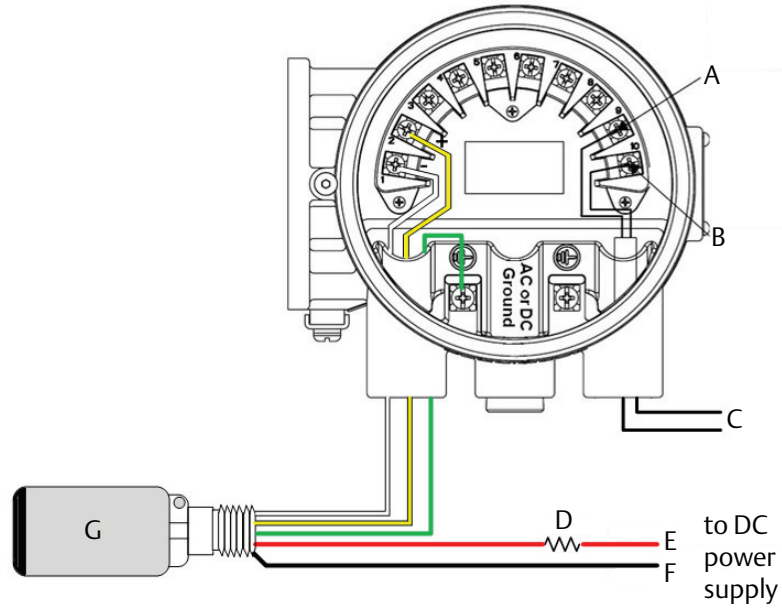
Yellow to 250 Ω

Green to XMTR housing

White no connection

A. AC neutral or DC -
B. AC line or DC +
C. Transmitter power
D. 250 Ω
E. THUM Adapter

Figure C-6. Emerson 775 THUM Adapter with Field Mount External Analog Power



Wiring guide

White to XMTR (-) pin 1

Yellow to XMTR (+) pin 2

Red to 250 Ω to + 4-20 mA

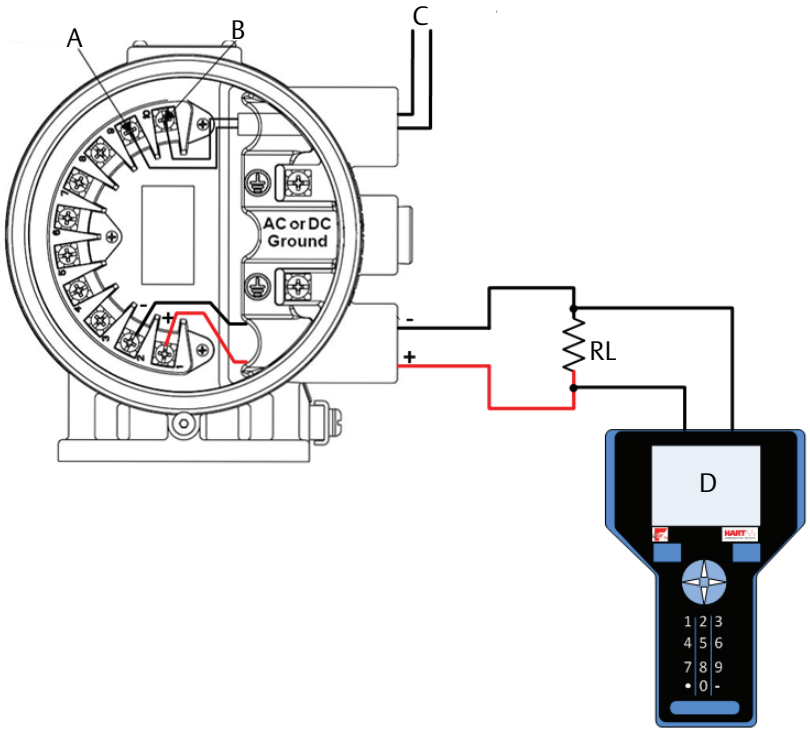
Black to - 4-20 mA

Green to XMTR housing

A. AC neutral or DC -
B. AC line or DC +
C. Transmitter power
D. 250 Ω
E. 4-20 mA +
F. 4-20 mA -
G. THUM Adapter

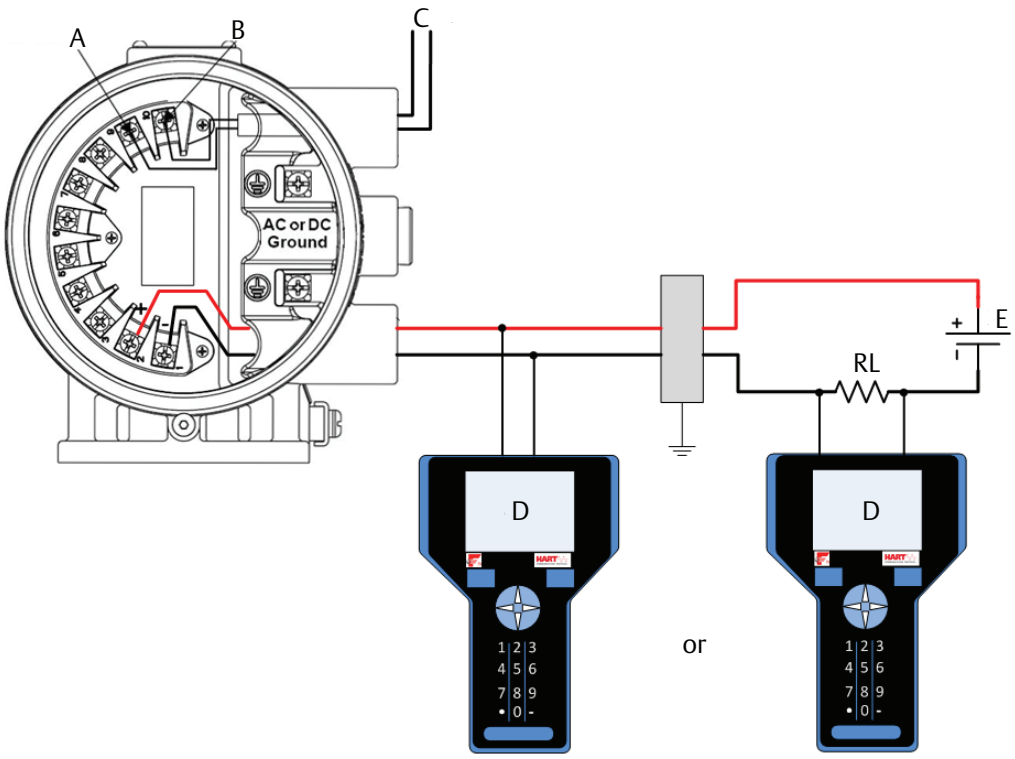
C.2 475 Field Communicator

Figure C-7. 475 Field Communicator with Field Mount Internal Analog Power



A. AC neutral or DC -
B. AC line or DC +
C. Transmitter power
D. 475 Field Communicator

Figure C-8. 475 Field Communicator with Field Mount External Analog Power



A. AC neutral or DC -
B. AC line or DC +
C. Transmitter power
D. 475 Field Communicator
E. 24 VDC

Appendix D Implementing a Universal Transmitter

Safety messages . . . . . page 221
Rosemount sensors . . . . . page 225
Brooks Sensors . . . . . page 227
Endress and Hauser Sensors . . . . . page 229
Fischer and Porter Sensors . . . . . page 230
Foxboro Sensors . . . . . page 236
Kent Veriflux VTC Sensor . . . . . page 240
Kent Sensors . . . . . page 241
Krohne Sensors . . . . . page 242
Taylor Sensors . . . . . page 243
Yamatake Honeywell Sensors . . . . . page 245
Yokogawa Sensors . . . . . page 246
Generic manufacturer sensors . . . . . page 247

D.1 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Read the following safety messages before performing any operation described in this section.

⚠WARNING

The Rosemount™ 8750W Magnetic Flowmeter has not been evaluated for use with other manufacturers' magnetic flowmeter sensors in hazardous (Ex or Classified) areas. Special care should be taken by the end-user and installer that the Rosemount 8750W Transmitter meets the safety and performance requirements of the other manufacturer’s equipment.

D.1.1 Universal capability

The Rosemount 8750W Transmitter has the ability to drive other manufacturers' sensors and report a flow rate. In addition to providing a flow measurement, all of the diagnostic functionality is also available in a universal application. This capability can provide additional information into the installation, process, and meter health, in addition to enabling a common maintenance practice for all magnetic flowmeter installations and helping to reduce spares inventory of magnetic flowmeter transmitters.

This section will detail how to wire the transmitter to other manufacturers' sensors and to configure the universal capabilities.

D.1.2 Three-step process

There are three easy steps when implementing a universal transmitter.

1. Review the existing application. Verify the existing sensor is in good working order, and that it is compatible with a universal transmitter. Use Table D-1 to help verify if the Rosemount universal transmitter is compatible with the existing sensor. Verifying the sensor is functioning correctly while the Universal transmitter may be able to drive the existing sensor, if the sensor is not in good working order, the universal transmitter may not function correctly.

2. Connect the universal transmitter to the existing sensor using the wiring diagrams in this appendix. If the existing sensor is not listed in this appendix, contact Rosemount technical support for more details on the application of the universal capabilities.

3. Configure the transmitter following the guidelines in Section 4 and 5 setting up parameters as needed. One of the key configuration parameters is the sensor calibration number. There are several methods to determine the calibration number, but the most common method will be to use the universal trim capability. This functionality is detailed in this appendix. Accuracy of the meter when the universal trim is used to determine the calibration number will be dependent on the accuracy of the known flow rate used in the trim process.

In addition to the universal trim, there are two other methodologies for determining a calibration number for the sensor.

Method 1: Have the sensor sent to a Rosemount service center for determination of a calibration number compatible with the universal transmitter. This is the most accurate method for determining the calibration number and will provide a ±0.5% of rate measurement accuracy from 3 to 40 fps (1 to 10 m/s).

Method 2: Involves the conversion of the existing sensor calibration number / meter factors to an equivalent Rosemount 16-digit calibration number. Accuracy of the meter using this methodology is estimated to be in the range of 2-3%. Contact Rosemount technical support for more information on this method or to determine a calibration number for the existing sensor.

Once these steps are completed, the meter will begin measuring flow. Verify that the measured flow rate is within the expected range and that the mA output correctly corresponds to the measured flow rate. Also verify the reading in the control system matches the reading at the transmitter. Once these items have been verified, the loop can be placed into automatic control as needed.

Universal trim

LOI menu path	Field Mount: Device Setup, Detailed Setup, Additional Params, Universal Auto Trim Wall Mount: AUX. FUNCTION
Fast Keys	1, 2, 5, 5

The universal auto trim function enables the Rosemount 8750W Transmitter to determine a calibration number for sensors that were not calibrated at the Rosemount factory. The function is activated as one step in a procedure known as in-process calibration. If the sensor has a 16-digit Rosemount calibration number, in-process calibration is not required.

1. Determine the flow rate of the process fluid in the sensor.

Note
The flow rate in the line can be determined by using another sensor in the line, by counting the revolutions of a centrifugal pump, or by performing a bucket test to determine how fast a given volume is filled by the process fluid.

2. Complete the universal auto trim function.

3. When the routine is completed, the sensor is ready for use.

Wiring the universal transmitter

The wiring diagrams in this section illustrate the proper connections between the transmitter and most sensors currently on the market. Specific diagrams are included for most models, and where information for a particular model of a manufacturer is not available, a generic drawing pertaining to that manufacturer's sensors is provided. If the manufacturer for the existing sensor is not included, see the drawing for generic connections.

Any trademarked names used herein regarding sensors not manufactured by Rosemount are owned by the particular manufacturer of the sensor.

Table D-1. Transmitter and Sensor Reference

Rosemount transmitter	Sensor manufacturer	Page number
Rosemount		
Rosemount 8750W	Rosemount 8750W	page 225
Brooks		
Rosemount 8750W	Model 5000	page 227
Rosemount 8750W	Model 7400	page 228
Endress and Hauser		page 226
Rosemount 8750W	Generic Wiring for Sensor	page 229
Fischer and Porter		
Rosemount 8750W	Model 10D1418	page 230
Rosemount 8750W	Model 10D1419	page 231
Rosemount 8750W	Model 10D1430 (Remote)	page 232
Rosemount 8750W	Model 10D1430	page 233
Rosemount 8750W	Model 10D1465, 10D1475 (Integral)	page 234
Rosemount 8750W	Generic Wiring for Sensors	page 235
Foxboro		
Rosemount 8750W	Series 1800	page 236
Rosemount 8750W	Series 1800 (Version 2)	page 237
Rosemount 8750W	Series 2800	page 238
Rosemount 8750W	Generic Wiring for Sensors	page 239

Table D-1. Transmitter and Sensor Reference

Rosemount transmitter	Sensor manufacturer	Page number
Kent		
Rosemount 8750W	Veriflux VTC	page 240
Rosemount 8750W	Generic Wiring for Sensors	page 241
Krohne		
Rosemount 8750W	Generic Wiring for Sensors	page 242
Taylor		
Rosemount 8750W	Series 1100	page 244
Rosemount 8750W	Generic Wiring for Sensors	page 244
Yamatake Honeywell		
Rosemount 8750W	Generic Wiring for Sensors	page 245
Yokogawa		
Rosemount 8750W	Generic Wiring for Sensors	page 246
Generic manufacturer wiring		
Rosemount 8750W	Generic Wiring for Sensors	page 247

D.2 Rosemount sensors

D.2.1 Rosemount 8750W Sensors to transmitter

Connect coil drive and electrode cables as shown in Figure D-1 on page 225.

Figure D-1. Wiring to a Rosemount 8750W Transmitter

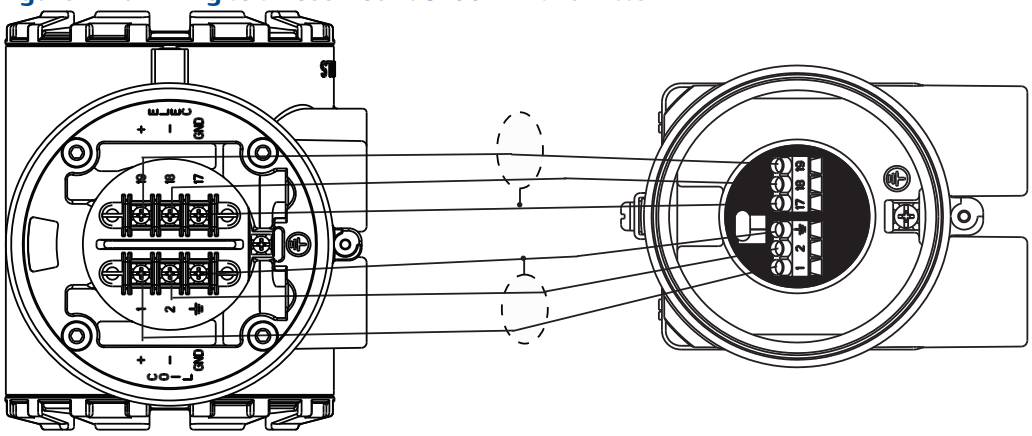


Table D-2. Rosemount 875W Sensor Wiring Connections

Rosemount 8750W Transmitters	Rosemount 8750W Sensors
1	1
2	2
3	3
17	17
18	18
19	19

⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.2.2 Connecting sensors of other manufacturers

Before connecting another manufacturer's sensor to the transmitter, it is necessary to perform the following functions.

⚠ 1. Turn off the AC power to the sensor and transmitter. Failure to do so could result in electrical shock or damage to the transmitter.

2. Verify the coil drive cables between the sensor and the transmitter are not connected to any other equipment.

3. Label the coil drive cables and electrode cables for connection to the transmitter.

4. Disconnect the wires from the existing transmitter.

5. Remove the existing transmitter. Mount the new transmitter. See "Quick Installation and Start-Up" on page 3.

6. Verify the sensor coil is configured for series connection. Other manufacturers sensors may be wired in either a series or parallel circuit. All Rosemount magnetic sensors are wired in a series circuit. (Other manufacturers AC sensors (AC coils) wired for 220 V operation are typically wired in parallel and must be rewired in series.)

7. Verify the sensor is in good working condition. Use the manufacturer's recommended test procedure for verification of sensor condition. Perform the basic checks:

8. Check the coils for shorts or open circuits.

9. Check the sensor liner for wear or damage.

10. Check the electrodes for shorts, leaks, or damage.

11. Connect the sensor to the transmitter in accordance with reference wiring diagrams. See Appendix C: Wiring Diagrams for specific drawings.

12. Connect and verify all connections between the sensor and the transmitter, then apply power to the transmitter.

13. Perform the Universal Auto Trim function.

⚠ CAUTION

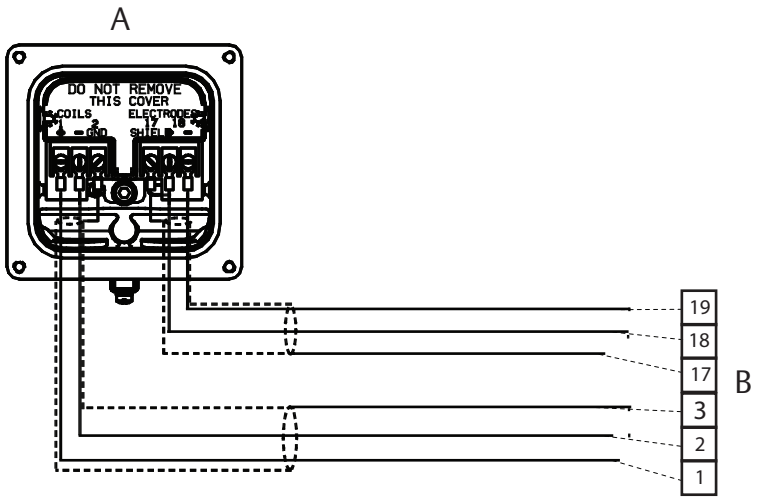
Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.3 Brooks Sensors

Connect coil drive and electrode cables as shown in Figure D-2.

D.3.1 Model 5000 Sensor to Rosemount 8750W Transmitter

Figure D-2. Wiring for Brooks Sensor Model 5000 and Rosemount 8750W



A. Brooks model 5000
B. Rosemount 8750W Transmitter
Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-3. Brooks Model 5000 Sensor Wiring Connections

Rosemount 8750W	Brooks Sensors model 5000
1	1
2	2
3	3
17	17
18	18
19	19

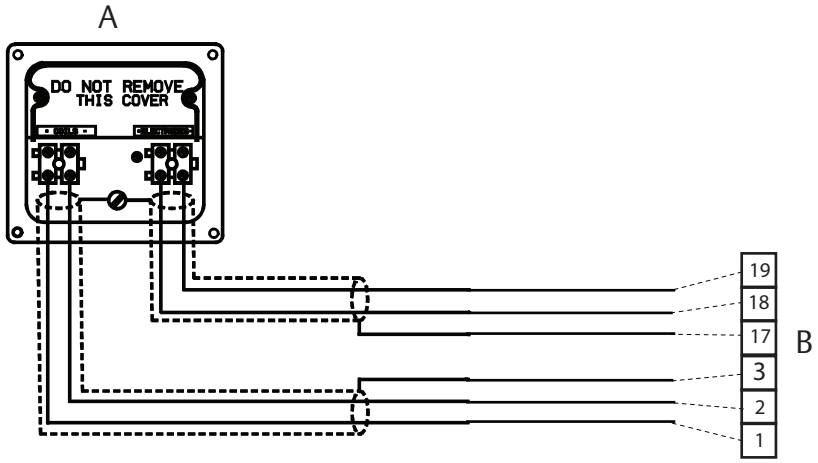
⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.3.2 Model 7400 Sensor to Rosemount 8750W Transmitter

Connect coil drive and electrode cables as shown in Figure D-3.

Figure D-3. Wiring for Brooks Sensor Model 7400 and Rosemount 8750W



A. Brooks model 7400
B. Rosemount 8750W Transmitter
Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-4. Brooks Model 7400 Sensor Wiring Connections

Rosemount 8750W	Brooks Sensors model 7400
1	Coils +
2	Coils –
3	3
17	Shield
18	Electrode +
19	Electrode –

⚠ CAUTION

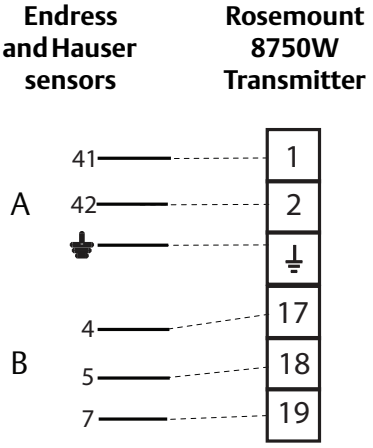
Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.4 Endress and Hauser Sensors

Connect coil drive and electrode cables as shown in Figure D-4.

D.4.1 Endress and Hauser Sensor to Rosemount 8750W Transmitter

Figure D-4. Wiring for Endress and Hauser Sensors and Rosemount 8750W



A. Coils
B. Electrodes
Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-5. Endress and Hauser Sensor Wiring Connections

Rosemount 8750W	Endress and Hauser Sensors
1	41
2	42
3	14
17	4
18	5
19	7

⚠ CAUTION

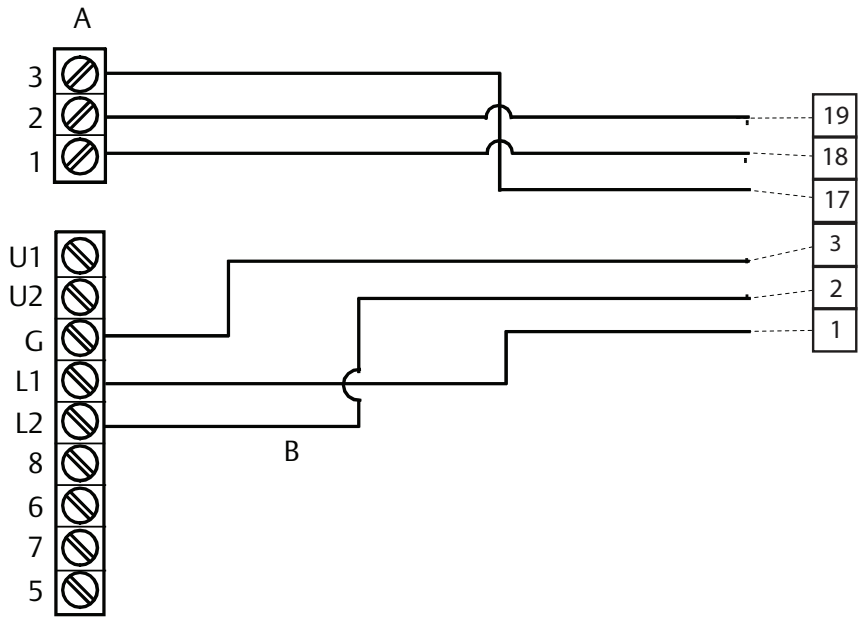
Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.5 Fischer and Porter Sensors

Connect coil drive and electrode cables as shown in Figure D-5.

D.5.1 Model 10D1418 Sensor to Rosemount 8750W Transmitter

Figure D-5. Wiring for Fischer and Porter Sensor Model 10D1418 and Rosemount 8750W



A. Electrode connections
B. Coil connections
Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-6. Fischer and Porter Model 10D1418 Sensor Wiring Connections

Rosemount 8750W	Fischer and Porter Model 10D1418 Sensors
1	L1
2	L2
3	Chassis ground
17	3
18	1
19	2

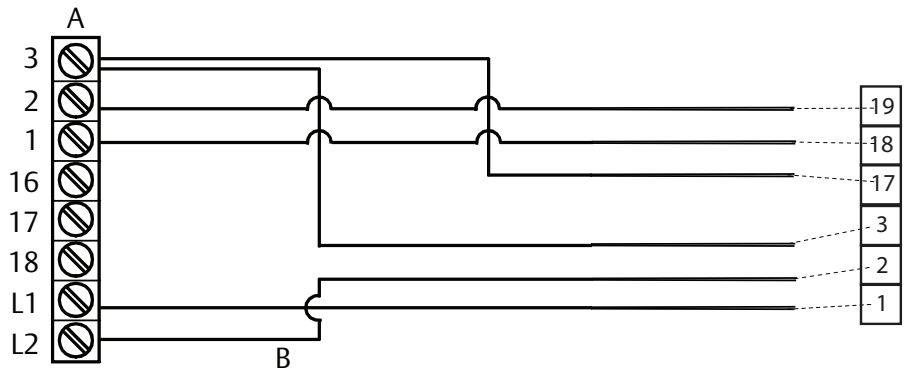
⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.5.2 Model 10D1419 Sensor to Rosemount 8750W Transmitter

Connect coil drive and electrode cables as shown in Figure D-6.

Figure D-6. Wiring for Fischer and Porter Sensor Model 10D1419 and Rosemount 8750W



A. Electrode connections
B. Coil connections
Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-7. Fischer and Porter Model 10D1419 Sensor Wiring Connections

Rosemount 8750W	Fischer and Porter Model 10D1419 Sensors
1	L1
2	L2
3	3
17	3
18	1
19	2

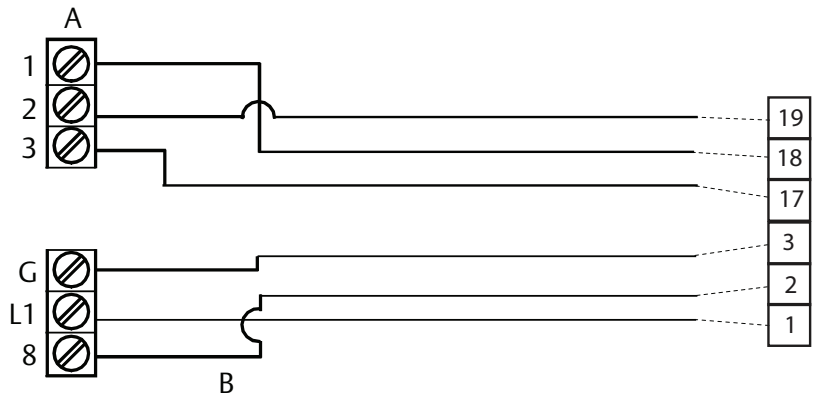
⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.5.3 Model 10D1430 Sensor (Remote) to Rosemount 8750W Transmitter

Connect coil drive and electrode cables as shown in Figure D-7.

Figure D-7. Wiring for Fischer and Porter Sensor Model 10D1430 (Remote) and Rosemount 8750W



A. Electrode connections
B. Coil connections
Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-8. Fischer and Porter Model 10D1430 (Remote) Sensor Wiring Connections

Rosemount 8750W	Fischer and Porter Model 10D1430 (Remote) Sensors
1	L1
2	8
3	G
17	3
18	1
19	2

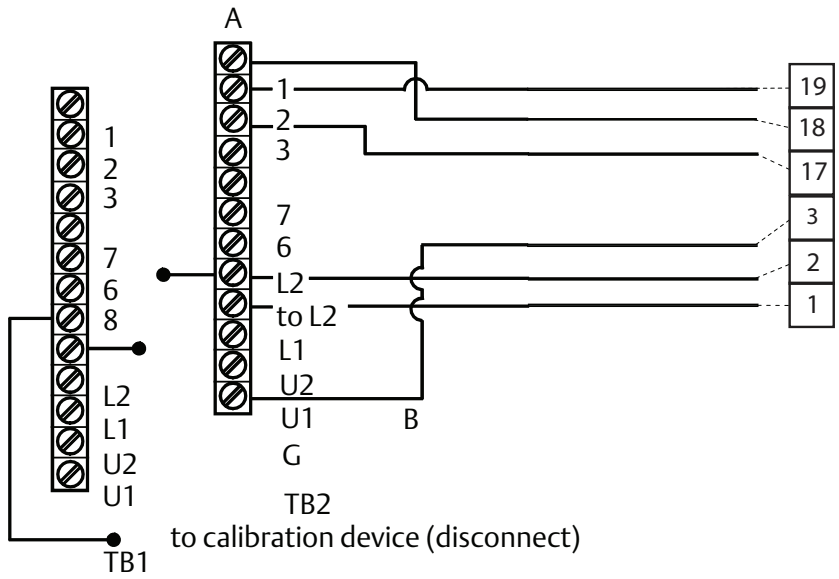
⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.5.4 Model 10D1430 Sensor (Integral) to Rosemount 8750W Transmitter

Connect coil drive and electrode cables as shown in Figure D-8.

Figure D-8. Wiring for Fischer and Porter Sensor Model 10D1430 (Integral) and Rosemount 8750W



A. Electrode connections
B. Coil connections
Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-9. Fischer and Porter Model 10D1430 (Integral) Sensor Wiring Connections

Rosemount 8750W	Fischer and Porter Model 10D1430 (Integral) Sensors
1	L1
2	L2
3	G
17	3
18	1
19	2

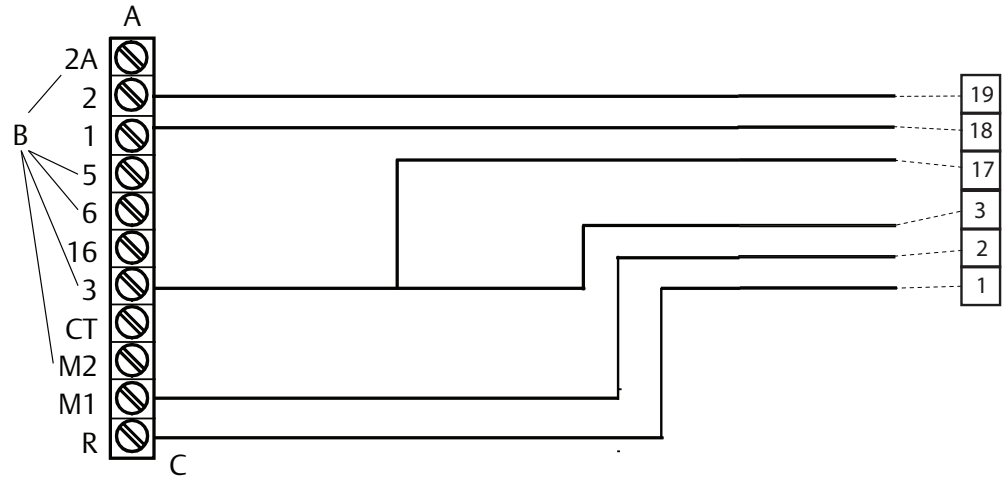
⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.5.5 Model 10D1465 and Model 10D1475 Sensors (Integral) to Rosemount 8750W Transmitter

Connect coil drive and electrode cables as shown in Figure D-9.

Figure D-9. Wiring for Fischer and Porter Sensor Model 10D1465 and Model 10D1475 (Integral) and Rosemount 8750W



A. Electrode connections
B. Disconnect
C. Coil connections

Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-10. Fischer and Porter Model 10D1465 and 10D1475 Sensor Wiring Connections

Rosemount 8750W	Fischer and Porter Model 10D1465 and 10D1475 Sensors
1	MR
2	M1
3	3
17	3
18	1
19	2

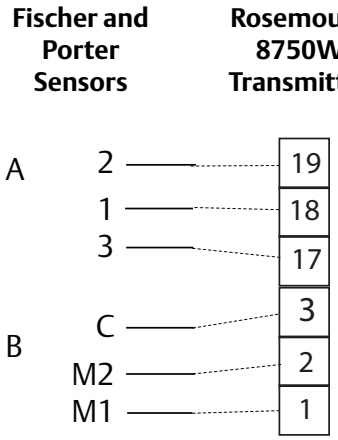
⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.5.6 Fischer and Porter Sensor to Rosemount 8750W Transmitter

Connect coil drive and electrode cables as shown in Figure D-10.

Figure D-10. Generic Wiring for Fischer and Porter Sensors and Rosemount 8750W



A. Electrodes
B. Coils
C. Chassis ground
Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-11. Fischer and Porter Generic Sensor Wiring Connections

Rosemount 8750W	Fischer and Porter Sensors
1	M1
2	M2
3	Chassis ground
17	3
18	1
19	2

⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

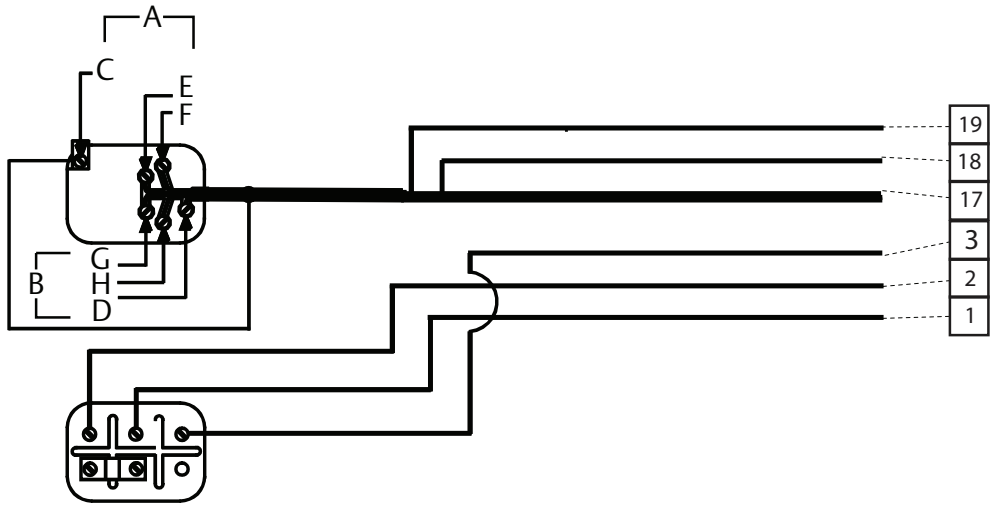
D.6 Foxboro Sensors

Connect coil drive and electrode cables as shown in Figure D-11.

D.6.1 Series 1800 sensor to Rosemount 8750W Transmitter

Figure D-11. Wiring for Foxboro Series 1800 and Rosemount 8750W

Foxboro Series 1800 Sensor **Rosemount 8750W Transmitter**



A. Electrode connections
B. Coil connections
C. Outer shield
D. Inner shield
E. White lead
F. White shield
G. Black lead
H. Black shield

Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-12. Foxboro Series1800 Sensor Wiring Connections

Rosemount 8750W	Foxboro Series 1800 Sensors
1	L1
2	L2
3	Chassis ground
17	Any shield
18	Black
19	White

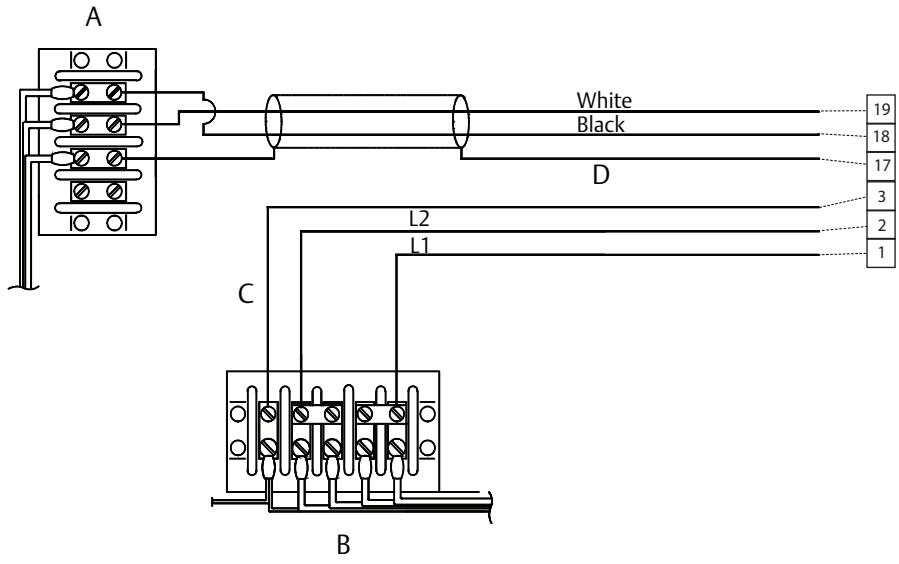
⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.6.2 Series 1800 (version 2) Sensor to Rosemount 8750W Transmitter

Connect coil drive and electrode cables as shown in Figure D-12.

Figure D-12. Wiring for Foxboro Series 1800 (Version 2) and Rosemount 8750W



A. Electrode connections
B. Coil connections
C. Chassis ground
D. Shield

Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-13. Foxboro Series 1800 (Version 2) Sensor Wiring Connections

Rosemount 8750W	Foxboro Series 1800 Sensors
1	L1
2	L2
3	Chassis ground
17	Any shield
18	Black
19	White

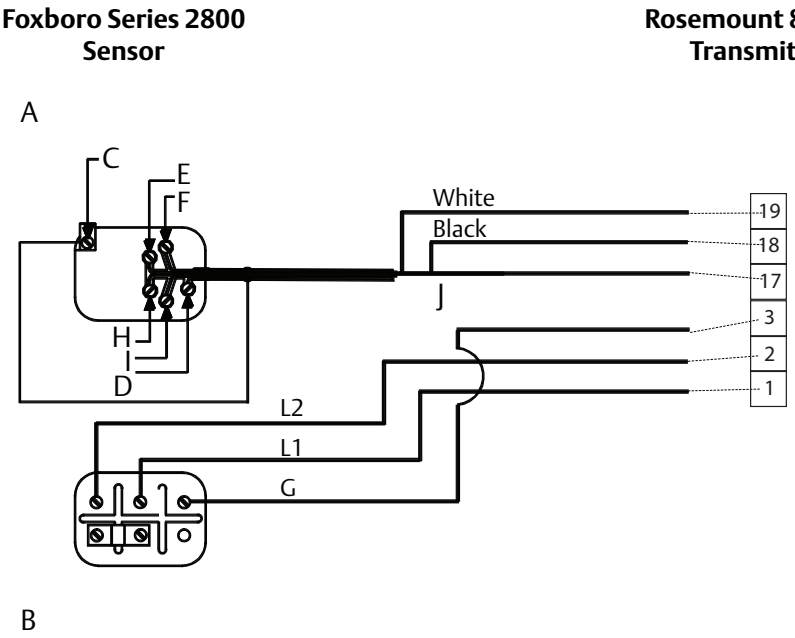
⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.6.3 Series 2800 Sensor to 8750W Transmitter

Connect coil drive and electrode cables as shown in Figure D-13.

Figure D-13. Wiring for Foxboro Series 2800 and Rosemount 8750W



A. Electrode connections
B. Coil connections
C. Outer shield
D. Inner shield
E. White lead
F. White shield
H. Black lead
I. Black shield
J. Any shield

Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-14. Foxboro Series 2800 Sensor Wiring Connections

Rosemount 8750W	Foxboro Series 2800 Sensors
1	L1
2	L2
3	Chassis ground
17	Any shield
18	Black
19	White

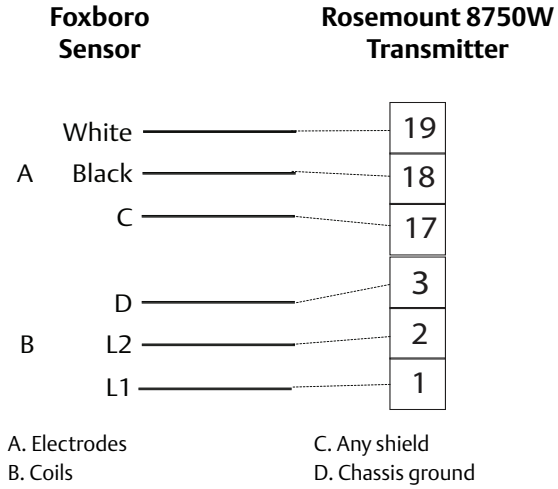
⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.6.4 Foxboro Sensor to 8750W Transmitter

Connect coil drive and electrode cables as shown in Figure D-14.

Figure D-14. Generic Wiring for Foxboro Sensors and Rosemount 8750W



A. Electrodes
B. Coils
C. Any shield
D. Chassis ground

Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-15. Foxboro Generic Sensor Wiring Connections

Rosemount 8750W	Foxboro Sensors
1	L1
2	L2
3	Chassis ground
17	Any shield
18	Black
19	White

⚠ CAUTION

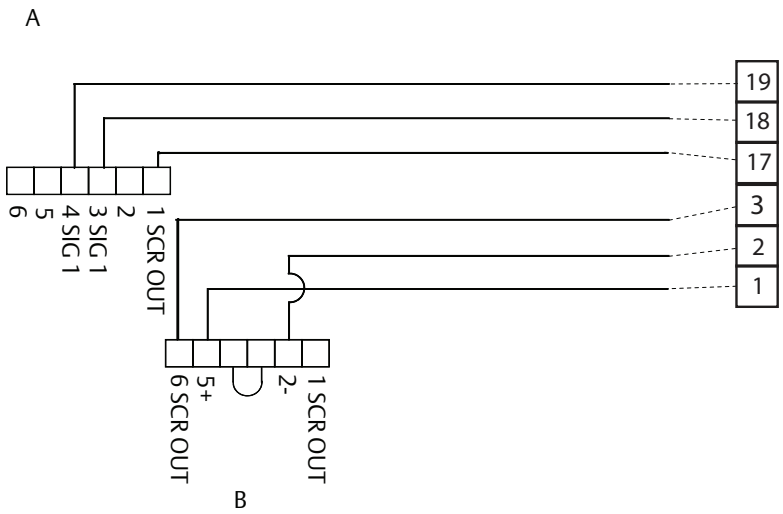
Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.7 Kent Veriflux VTC Sensor

Connect coil drive and electrode cables as shown in Figure D-15.

D.7.1 Veriflux VTC Sensor to 8750W Transmitter

Figure D-15. Wiring for Kent Veriflux VTC Sensor and Rosemount 8750W



A. Electrode connections
B. Coil connections
Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-16. Kent Veriflux VTC Sensor Wiring Connections

Rosemount 8750W	Kent Veriflux VTC Sensors
1	2
2	1
3	SCR OUT
17	SCR OUT
18	SIG1
19	SIG2

⚠ CAUTION

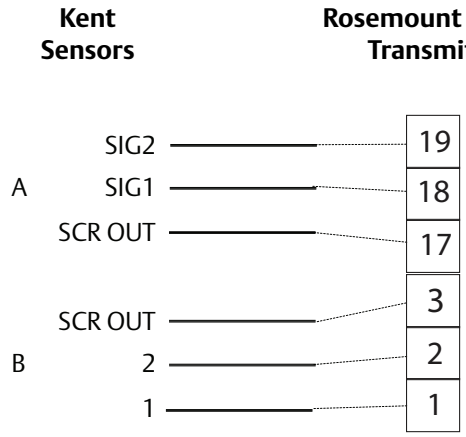
Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.8 Kent Sensors

Connect coil drive and electrode cables as shown in Figure D-16.

D.8.1 Kent Sensor to Rosemount 8750W Transmitter

Figure D-16. Generic Wiring for Kent Sensors and Rosemount 8750W



A. Electrodes
B. Coils
Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-17. Kent Sensor Wiring Connections

Rosemount 8750W	Kent Sensors
1	1
2	2
3	SCR OUT
17	SCR OUT
18	SIG1
19	SIG2

⚠ CAUTION

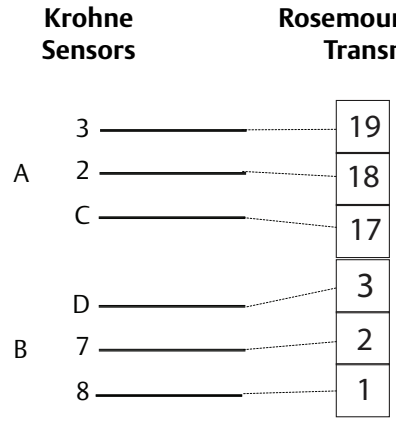
Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.9 Krohne Sensors

Connect coil drive and electrode cables as shown in Figure D-17.

D.9.1 Krohne Sensor to Rosemount 8750W Transmitter

Figure D-17. Generic Wiring for Krohne Sensors and Rosemount 8750W



A. Electrodes
B. Coils
C. Electrode shield
D. Coil shield

Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-18. Krohne Sensor Wiring Connections

Rosemount 8750W	Krohne Sensors
1	8
2	7
3	Coil shield
17	Electrode shield
18	2
19	3

⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

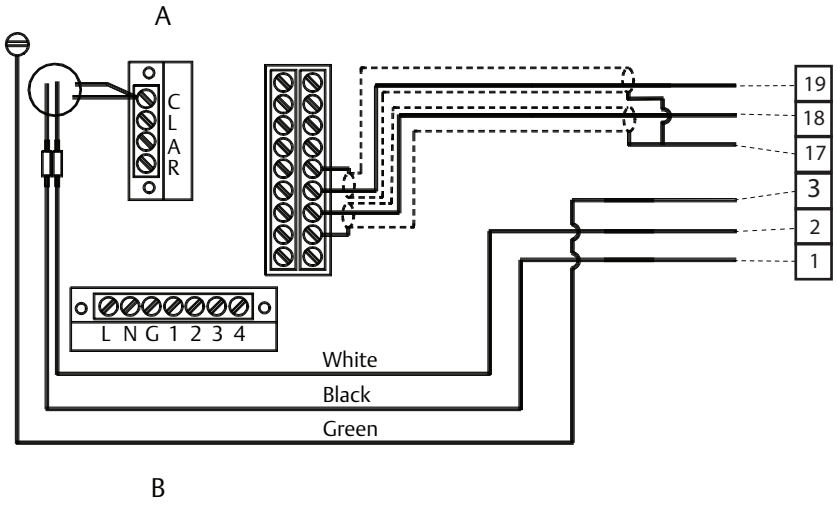
D.10 Taylor Sensors

Connect coil drive and electrode cables as shown in Figure D-18.

D.10.1 Series 1100 Sensor to Rosemount 8750W Transmitter

Figure D-18. Wiring for Taylor Series 1100 Sensors and Rosemount 8750W

Taylor Series 1100 Sensor **Rosemount 8750W Transmitter**



A. Electrode connections
B. Coil connections

Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-19. Taylor Series 1100 Sensor Wiring Connections

Rosemount 8750W	Taylor Series 1100 Sensors
1	Black
2	White
3	Green
17	S1 and S2
18	E1
19	E2

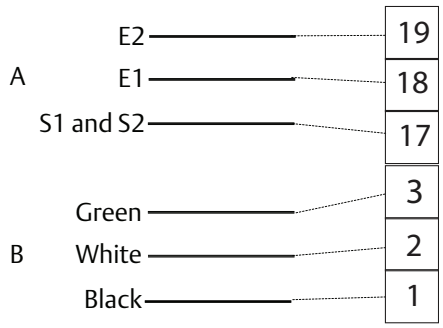
⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.10.2 Taylor Sensor to Rosemount 8750W Transmitter

Connect coil drive and electrode cables as shown in Figure D-19.

Figure D-19. Generic Wiring for Taylor Sensors and Rosemount 8750W



A. Electrodes
B. Coils

Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-20. Taylor Sensor Wiring Connections

Rosemount 8750W	Taylor Sensors
1	Black
2	White
3	Green
17	S1 and S2
18	E1
19	E2

⚠ CAUTION

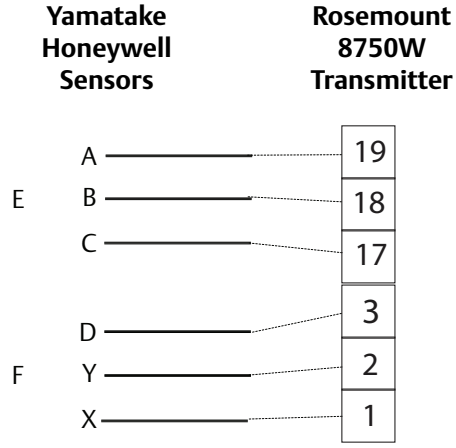
Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.11 Yamatake Honeywell Sensors

Connect coil drive and electrode cables as shown in Figure D-20.

D.11.1 Yamatake Honeywell Sensor to Rosemount 8750W Transmitter

Figure D-20. Generic Wiring for Yamatake Honeywell Sensors and Rosemount 8750W



D. Chassis ground
E. Electrodes
F. Coils

Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-21. Yamatake Honeywell Sensor Wiring Connections

Rosemount 8750W	Yamatake Honeywell Sensors
1	X
2	Y
3	Chassis ground
17	C
18	B
19	A

⚠ CAUTION

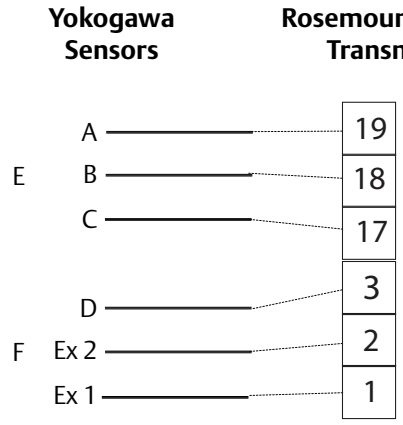
Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.12 Yokogawa Sensors

Connect coil drive and electrode cables as shown in Figure D-21.

D.12.1 Yokogawa Sensor to Rosemount 8750W Transmitter

Figure D-21. Generic Wiring for Yokogawa Sensors and Rosemount 8750W



D. Chassis ground
E. Electrodes
F. Coils

Refer to Figure D-1 on page 225 for actual terminal block configuration drawing.

Table D-22. Yokogawa Sensor Wiring Connections

Rosemount 8750W	Yokogawa sensors
1	EX1
2	EX2
3	Chassis ground
17	C
18	B
19	A

⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

D.13 Generic manufacturer sensors

D.13.1 Identify the terminals

First check the sensor manufacturer's manual to identify the appropriate terminals. Otherwise, perform the following procedure.

Identify coil and electrode terminals

1. Select a terminal and touch an ohmmeter probe to it.
2. Touch the second probe to each of the other terminals and record the results for each terminal.
3. Repeat the process and record the results for every terminal.

Coil terminals will have a resistance of approximately 3-300 ohms.

Electrode terminals will have an open circuit.

Identify a chassis ground

1. Touch one probe of an ohmmeter to the sensor chassis.
2. Touch the other probe to the each sensor terminal and the record the results for each terminal.

The chassis ground will have a resistance value of one ohm or less.

D.13.2 Wiring connections

Connect the electrode terminals to Rosemount 8750W Transmitter terminals 18 and 19. The electrode shield should be connected to terminal 17.

Connect the coil terminals to Rosemount 8750W Transmitter terminals 1, 2, and 3.

If the Rosemount 8750W Transmitter indicates a reverse flow condition, switch the coil wires connected to terminals 1 and 2.

⚠ CAUTION

Do not connect mains or line power to the magnetic flowtube sensor or to the transmitter coil excitation circuit.

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ROSEMOUNT

EMERSON
Process Management

TAB 3

MEAS KPSI 710

- **Submersible Level Transducer**
- **±0.50% FSO Static Accuracy**
- **Custom Built in Two Days**
- **Two Year Warranty**

DESCRIPTION

The MEAS KPSI 710 is a submersible hydrostatic level transducer specifically designed to meet the rigorous environments encountered in liquid level measurement and control. It can be configured to perform to specifications under most adverse, reactive conditions.

All MEAS KPSI Transducers utilize a highly accurate pressure sensor assembly specifically designed for hostile fluids and gases. The assembly is integrated with supporting electronics in a durable waterproof housing constructed of 316 stainless steel or titanium. The attached electrical cable is custom manufactured and includes Kevlar® members to prevent errors due to cable elongation, and a unique water block feature that self-seals in the event of accidental cuts to the cable. Each transducer is shipped with a SuperDry™ Vent Filter that prevents moisture from entering the vent tube for at least one year without maintenance, even in the most humid environments.

FEATURES

- Custom Polyurethane or ETFE Cable Lengths
- Welded 316SS or Titanium
- Custom Level Ranges up to 700 ft (210m) H2O
- Multiple Analog Outputs
- Multiple Nose Piece Styles
- Optional Lifetime Lightning Protection
- Shipped with Long Life Vent Filter

APPLICATIONS

- Lift Stations
- Pump Control
- Level Control
- Surface Water Monitoring
- Landfill Leachate
- Well Monitoring
- Groundwater Monitoring

SPECIFICATIONS

Parameter		Comment
LEVEL RANGES		
Full Scale Level Ranges (intermediate level ranges are available)	2.3 thru 700 ft H2O (0.70 thru 210 m H2O)	Vented Gage Reference
	10 thru 700 ft H2O (3 thru 210 m H2O)	Sealed Gage Reference
	35 thru 700 ft H2O (10 thru 210 m H2O)	Absolute Gage Reference
Proof Pressure	1.5 x FS	
Burst Pressure	2.0 x FS	

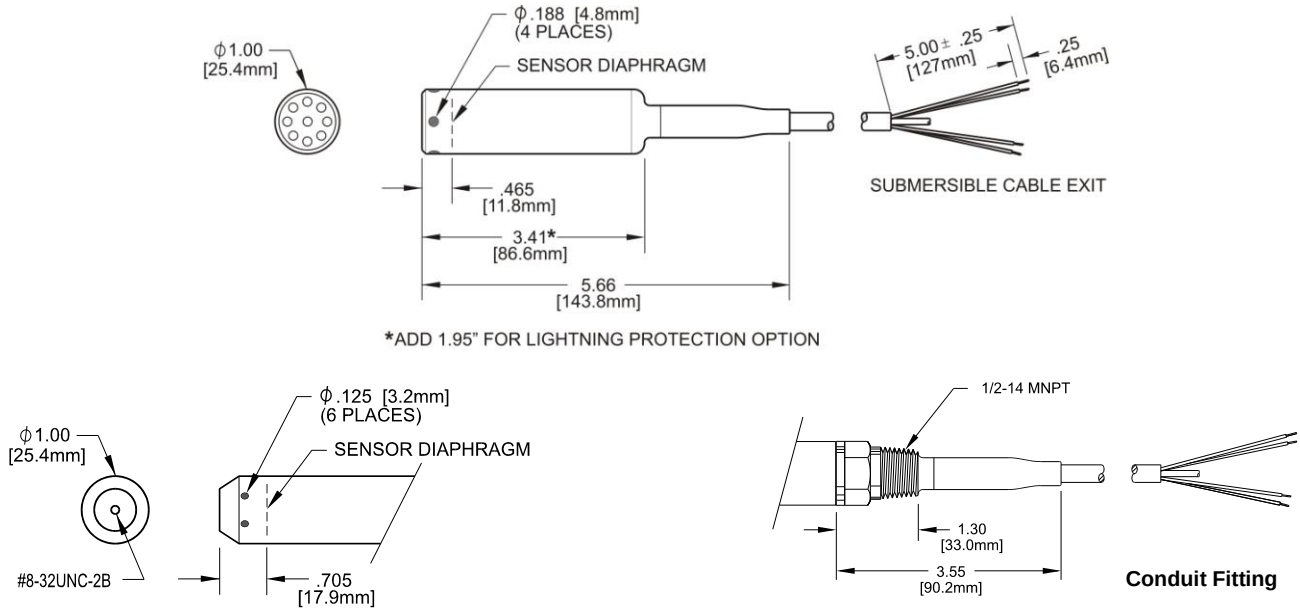
MEAS KPSI 710

SPECIFICATIONS

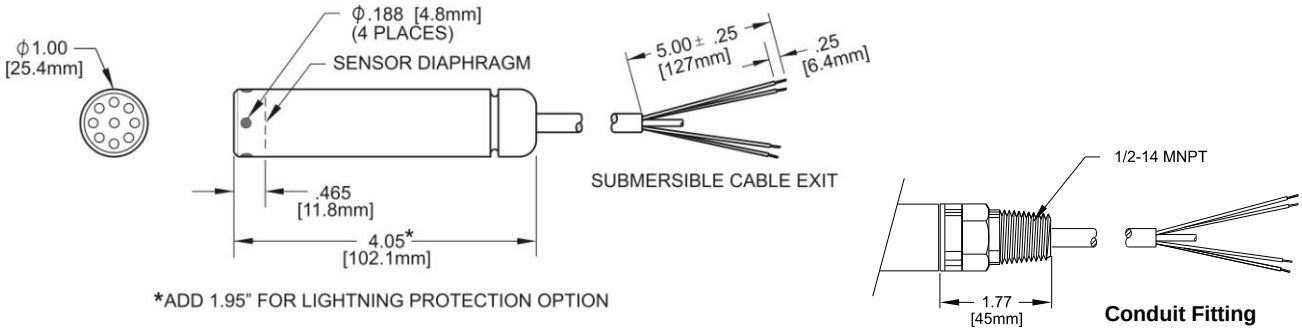
STATIC PERFORMANCE		
Static Accuracy (combined effects of non-linearity, hysteresis and repeatability, best fit straight line method)	±0.50% FSO	BFSL method
Resolution	+0.0001% FS	
ENVIRONMENTAL		
Wetted Materials	316 SS or Titanium; Delrin®; polyurethane or Viton®	Delrin® and Viton® are registered trademarks of DuPont.
Compensated Temp Range	0 to 50ºC	
Thermal Error (maximum allowable deviation from the Best Fit Straight Line due to a change in temperature)	±0.05% FSO/ºC ±0.1% FSO/ºC	worst case over compensated temperature range for ranges < 12 ft (4 m) H_2O
Operating Temp Range	-20 to 60 ºC	when attached to polyurethane cable
Protection Rating	IP 68, NEMA 6P	
ELECTRICAL		
Excitation	9-28V – VDC output 9-28V – mA output 15-28V – VDC output 10-28V – VDC output	0-5V, 0-2.5V, 0-4V 4-20 0-10V 1.5-7.5V
Input Current	20 mA max 3.5 mA max	for mA output for VDC output
Output	4-20mA, 0-5 VDC, 0-2.5VDC, 0-4VDC, 0-10VDC, 1.5-7.5VDC	for ranges < 5 ft (1.5m) H2O, only 4-20mA output is available
Zero Offset	±0.25 mA for mA output < 0.25 VDC for VDC output	
Output Impedance	See loop diagram for mA output 20 ohm for VDC output	
Insulation Resistance	100 mega ohm at 50 VDC	
Circuit Protection	Polarity, surge/shorted output	
CERTIFICATIONS		
	CE compliant	EN 61326-1:2001 and 61326-2-3:2006
	UL, CUL and FM	Class I, II, III, Div 1, Groups A,B,C,D,E,F&G
	WEEE/RoHS	Waste from Electrical and Electronic Equipment (WEEE) and Restrictions on the use of Hazardous Substances (RoHS)
PHYSICAL		
Approximate Weight	0.44 lbs (198 g) transducer 0.05 lbs/ft (79 g/m) cable	
Cable Jacket Material	Polyurethane (standard) ETFE (optional)	ETFE is a fluoropolymer material, Tefzel® or equivalent. Tefzel® and Kevlar® are registered trademarks of DuPont.
Cable Pull Strength	200 lbs (90 kg)	
Cable Number of Conductors	4	
Cable Conductor Size	22 AWG	
Cable Seal	Molded Polyurethane Viton® Gland	for polyurethane cable for ETFE cable
TEMPERATURE OUTPUT OPTION (not intrinsically safety approved)		
Temperature Range	-20 to 60ºC	available for 4-20mA output versions only
Output Signal	4-20mA	
Temperature Measurement Accuracy	±4ºC	
LIGHTNING PROTECTION (power supply needs to be limited to 150mA to avoid lock up of the gas tube after a suppression event)		
Life Expectancy	>1,000 Operations	
Peak Clamping Voltage	36 Volts	
Response Time	<10 nsecs	
Shunts	20,000 Amperes	

MEAS KPSI 710

DIMENSIONS



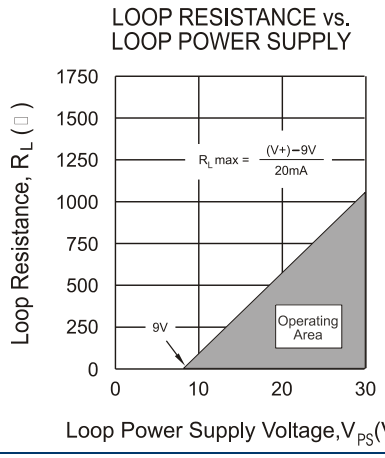
Molded Cable Seal Configuration for Polyurethane Cable



Gland Cable Seal Configuration for ETFE cable

ELECTRICAL TERMINATION / LOOP RESISTANCE / CERTIFICATIONS

ELECTRICAL TERMINATION		
22AWG CONDUCTORS IN A SHIELDED CABLE WITH VENT TUBE		
4-20 mA	RED	+ EXCITATION
	BLACK	- EXCITATION
0-5 VDC	RED	+ EXCITATION
	BLACK	- EXCITATION
	WHITE	+ SIGNAL
ALL	DRAIN WIRE	SHIELD



MEAS KPSI 710

ORDERING INFORMATION

MODEL	SUBMERSIBLE LEVEL TRANSDUCER
7 1 0	±0.50% FSO Static Accuracy
↓ ↓ ↓	**MATERIAL**
	S Stainless Steel
	T Titanium
	↓ **REFERENCE FORMAT**
	1 Vented gage
	3 Sealed gage
	4 Absolute
	↓ **OUTPUT**
	3 0-5 VDC
	F 0-2.5 V
	G 0-4 V
	H 0-10 V
	J 1.5-7.5V
	4 4-20mA
	6 4-20mA temperature measurement option
	↓ **PRESSURE CONNECTION**
	A Open-face nosecap
	B Ported nose cap
	E Piezometer nosecap
	2 1/4" - 18 NPT male fitting
	7 1/2" - 14 NPT male fitting
	↓ **ELECTRICAL CONNECTION**
	0 Molded cable seal
	4 1/2" - 14 NPT male conduit fitting with molded cable seal
	A Gland cable seal
	B 1/2" - 14 NPT male conduit fitting with gland cable seal
	↓ **LIGHTNING PROTECTION**
	A None
	B Full Lightning Protection
	↓ **LEVEL RANGE (at MAX output)**[1]
	# # # . # # #
	↓ ↓ ↓ ↓ ↓ ↓ ↓
	0 0 8 . 6 7 0
	LEVEL RANGE (at MIN output)[1]
	# # # . # # #
	↓ ↓ ↓ ↓ ↓ ↓ ↓
	0 0 0 . 0 0 0
	MOISTURE PROTECTION
	A None (sealed/absolute only)
	B Vent Filter
	C Aneroid Bellows
	↓ **CABLE TYPE**
	1 Polyurethane
	2 ETFE
	↓ **CABLE LENGTH**
	# # # # (in feet)
	↓ ↓ ↓ ↓ **LABEL**[2]
	0 0 5 0 A psi
	B ft H_2O
	C m H_2O
	↓
7 1 0	

Notes:

1 The part number requires two level range limits, corresponding to the maximum and minimum analog outputs of the transducer, to be specified in **pounds per square inch (psi)** to three decimal places. The lower level range is typically 000.000 unless otherwise required. For reverse output requirements, enter the lower level range for the maximum output signal and the upper range for the minimum output. Use the following conversion factors:

ft H_2O / 2.3073 = psi
m H_2O / 0.703265 = psi

Examples: 10 ft H_2O / 2.3073 = 4.334 psi (enter 004.334 in the part number)
10m H_2O / 0.703265 = 14.219 psi (enter 014.219 in the part number)

For sealed gage reference add local atmosphere when converting to psi. Contact PSI for assistance.
Example: 10 ft H_2O / 2.3073 +14.7 = 19.034 psi (enter 019.034 in the part number)

2 Units of measure on standard PSI label. Contact PSI if private labeling is required.

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DIVIDER

KPSI®

Level Transducers

KPSI®

User's Manual

18th Edition

February 2010

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Our Company

Pressure Systems is an ISO9001:2000 certified U.S. manufacturer of submersible and non-submersible (above ground) pressure transducers for environmental, industrial and municipal applications. Our KPSI™ Level and Pressure Transducers have been specified in thousands of projects throughout the United States, Canada and Europe by geologists, system integrators, national engineering firms and a variety of government agencies. Typical applications include, but are not limited to, pump control, tank level monitoring, sewage lift station operation, reservoirs, weirs, flumes, site remediation, watershed management, storm water/well monitoring, pump/pipeline pressures and compressor pressures.

Website and E-Mail

You may visit our website at www.PressureSystems.com to look at our latest new product releases, application notes, product certifications and specifications, as well as Intrinsic Safety control installation drawings. E-mail your questions and comments to us: sales@PressureSystems.com.

E-commerce

Orders may be placed on-line by visiting our e-commerce site *(www.LEVELandPRESSURE.com)* or by contacting the factory or local representative.

Applicable Products

This manual provides information applicable to the use of the following KPSI Level and Pressure Transducers:

Please note: Series 500 and Series 550 (waterMONITOR) have separate manuals.

Level Transducers (Submersible)
Series 700/710/720/730/735
Series 320/330/335/340
Series 300DS
Series 705
Series 750

Pressure Transducers (Non-submersible)
Series 27/28/30

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1.0 Product Description

General Characteristics

KPSI™ Level and Pressure Transducers use isolated-diaphragm sensors that are specifically designed for use with hostile fluids and gases. These sensors utilize a silicon pressure cell that has been fitted into a stainless steel or titanium package with an integral, compliant stainless steel or titanium barrier diaphragm. This sensor assembly is housed in a rugged 316 stainless steel or titanium case which provides for a variety of level ranges from 2.3 ft (0.75 m) H_2O through 4614 ft (1408 m) H_2O and pressure inputs from 0-1 (7 kPa) through 0-15000 psi (103 mPa). Our devices feature internal signal conditioning. Standard outputs are 4-20 mA and VDC.

All units containing active electronic components have surge and reverse polarity protection. For ease of use in the field, our transducers are permanently laser engraved with our logo and name, wiring information, part number (P/N), serial number (S/N), date of manufacture (DOM), range, excitation and output. Transducers are offered in diameters of 1.0 (25 mm) and 0.75 inches (19 mm).

Care and Handling

Our transducers are designed for rugged use. However, they need protection from over pressure and sharp impact. When lowering them into a liquid, penetrate the surface slowly and only to the depth necessary. Avoid dropping the unit from above the surface. Clean all transducers by rinsing them in a mild detergent. Direct probing of the diaphragm or attempts to remove protective screens will damage the sensor, voiding the warranty.

Calibration

All transducers are shipped with calibration information unique to each transducer. Make sure you keep each calibration report. However, should you misplace your calibration sheet, you can contact the factory and request a duplicate. All KPSI™ Transducer calibrations are traceable to the National Institute of Standards and Technology (NIST).

Approvals

Most of our products have UL and FM certification for intrinsic safety. Their respective installation control drawings can be downloaded from our website. Several of our product lines also carry ABS approval. Most products are CE compliant to EN 61326-1:2006 and EN 61326-2-3:2006. CE compliant units are labeled accordingly.

2.0 Product Accessories and Options

WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD

In hazardous locations:

- **Avoid building up static charge on case of data protector and plastic accessories.**
- **Use damp rag to wipe data protector and plastic accessories to avoid static build up.**

Nose Caps

There are several different user-installable nose caps for the 700, 710, 720, 730, 735 submersible level transducers. The ported nose cap (Delrin) with #8-32UNC-2B threaded hole is best used where weights are required and for those installations where users may encounter sharp, protruding objects. The open-face nose cap which allows maximum contact with the liquid media is ideal for wastewater and "greasy" applications where clogging of the sensor is a concern. The piezometer nose cap allows the unit to be buried in saturated soil without damage to the sensor diaphragm. The 1/4" male NPT pressure nose cap is not only useful for calibration purposes but also allows the device to be used as a submersible or above ground pressure transducer.

WARNING: Caution must be exercised when inserting a screw into the nose cap as the maximum insertion length should not exceed 0.175".

810 SuperDry™ Vent Filter or 815 Aneroid Bellows

All submersible transducers with vented gauge format are supplied with a protective barrier that guards against moisture buildup in the cable vent tube. The 810 SuperDry™ vent filter is installed free of charge and is guaranteed to operate maintenance free for one year. We also offer the 815 Aneroid Bellows as a maintenance free option that can be used on submersibles with accuracies of: ±1%, ±0.5%, or ±0.25% FSO. These barriers ensure reliable operation and long life as they protect sensitive electronic components from mildew and prevent the formation of a liquid column in the vent tube. Any such liquid column directly affects calibration of the transducer.

Sacrificial Anodes

Our sacrificial anodes are made from a special zinc alloy formulated to guarantee continued effectiveness over long periods. Because the anodes are 95% galvanic, they will not corrode unless there is an electrolytic demand. The anode maintains a high driving potential throughout its 12 month life, is self-sluffing and always exposes new zinc for the best possible protection. For those applications where cable buoyancy is a problem, the sacrificial anode can be substituted for hanging weights.

Sacrificial Anodes provide cathodic protection against galvanic corrosion for our submersible pressure transducers. Galvanic corrosion occurs when dissimilar metals are placed in contact with an electrolyte. This condition causes a potential difference to exist between the two metals, causing electron flow between them. Corrosion of the less corrosion-resistant metal is increased and attack of the more resistant metal is decreased. The 820 Sacrificial Anode is clamped to the exterior of a one-inch bore submersible transducer. We also offer a 1" diameter pencil anode, the 825, that attaches to the nose cap of either a 3/4" or 1" bore submersible transducer.

Absolute/Sealed Gage Transducer

The sealed gage option for submersible transducers eliminates the need for a vent filter. The standard output of a sealed gauge transducer is 4 mA at 14.70 psia. Before ordering a sealed gauge transducer, the customer should determine the altitude (above sea level) of the installation and inform PSI's Customer Service of this value before order entry. During manufacture, the output of the transducer will be adjusted to compensate for the altitude difference, if applicable.

Polyurethane & ETFE Jacketed Cable

Most installations of our submersible level transducers connect our polyurethane or ETFE cable to a junction box. From this junction box (P/N 840), users typically run their own cable to the required instrumentation. Polyurethane-jacketed cable is used for most applications while ETFE material is recommended for more aggressive environments.

Specifications for our standard polyurethane and ETFE jacketed cable are as follows:

Specifications	Standard Submersible Cable	Standard Non-Submersible Cable
Weight	0.05 lbs/ft (0.07 kg/m)	0.025 lbs/ft (0.035 kg/m)
Min. OD	0.28" (7.10 mm)	0.189" (4.8 mm)
Max OD	0.31" (7.87 mm)	0.19" (4.9 mm)
Conductors	4 - 22 AWG	22 AWG
Insulation Conductors Outer jacket	PVC Polyurethane or ETFE	Color coded PVC
Shield	36 gauge spiral tinned copper wire foil shield with drain wire	Aluminum/polyester foil facing outward
Vent Tube	Polyethylene, .060" ID (1.52 mm)	Drain wire 7/32 tinned copper

- **Chemical resistance of polyurethane:** Potable Water, Wastewater, Borax, Butane, Animal Fat, Carbonic Acid, Citric Acid, Cod Liver Oil, Corn Oil, Glycerin, Glycol, Mineral Oils, Potassium Nitrate, Potassium Sulfate, Silicone Oils, Stoddard Solvent, Tannic Acid (10), Tartaric Acid, Turbine Oil.

- **Chemical resistance of ETFE:** Acetic Acid (Glacial), Acetic Anhydride, Acetone, Aluminum Chloride, Anti-Freeze, Bromine, Calcium Chloride, Calcium Hydroxide, Chlorine, Copper Chloride, Ferrous Chloride, Hydrochloric Acid, Ketones, Lacquer Thinners, Sulfuric Acid.

The vented cable termination end is specially prepared at the factory to eliminate the potential for moisture migration. Where the lead wires emerge from under the jacket, there's potting material and a shrink tube "boot", every effort should be made to leave this feature intact. Should the cable be longer than needed for the installation, it is recommended that the excess length be accommodated in a service loop and that the potted end of the cable **NOT** be shortened.

The cable attached to this instrument is specifically engineered for submersible applications. The polyurethane outer jacket provides long term reliability under most conditions. The cable should be handled carefully, however, as the jacket may be subject to cutting should it be "raked" over extremely sharp edges. To guard against water incursion should an inadvertent minor cut occur, we have incorporated an exclusive "water block" feature immediately beneath the jacket. The cable is fully shielded, with the shield connected to the metal housing at the transducer end and terminated in a drain wire at the termination or user end. The shield should always be terminated to a good earth ground, unless the transducer is installed in an area where galvanic corrosion is known to be a serious problem.

Lightning Protection

Lightning and surge protection for VDC, SDI-12 and 4-20 mA output are available. This is achieved through the use of 2 protectors, one is integral to the transducer housing and one is provided for the outside line located at the surface and grounded to a DIN-Rail. Please remember this option must be factory installed at the time of order entry or as a factory upgrade. **This option cannot be installed in the field.** Lightning protection is also available for unit only. Contact customer service for details.

Featuring quick response and low clamping voltages, these devices protect against fast rising voltage transients as well as severe current surges associated with lightning discharges up to 20,000 amperes. Following a surge, the protector automatically restores the line to normal operation and awaits the next surge without having to reset a breaker or replace a fuse. The power supply needs to be limited to 150 mA to avoid lock up of the gas tube after a suppression event. **Transducers installed with this option have a lifetime warranty *against damage due to voltage surge***.

Please note: When using the lightning protection option on 4-20 mA products, users should take into account the additional series resistance of this option when selecting the loop power supply. This option will increase total loop resistance by 88 Ohms.

½" Male NPT Conduit Fitting

Submersible level transducers can be attached to a rigid conduit and the cable run through the conduit. To achieve this, all of our submersible transducers can be fitted with an optional ½" NPT male conduit fitting (specify "Electrical Connection Option 4" when ordering) where the cable exits the transducer. This fitting can be mated to a standard rigid conduit.

Electrical Outputs

We offer the industry standard 0-5 VDC and 4-20 mA outputs. In addition we also offer a variety of voltage output ranges.

Reverse Signal Output

For some applications, it is important to know how far the water is from the top of the tank or the surface of the ground. If specified by the customer, our factory can set the transducer so that zero pressure reads full scale electrical output and maximum pressure reads zero electrical output.

Temperature Output

A temperature output option is available for most transducers having 4-20 mA pressure output. The temperature sensor requires an excitation of 9-28 VDC and is calibrated for a temperature range of -20 to 60ºC with an accuracy of ±4ºC.

Output Option 6 (4-20mA output for -20 to 60ºC) (mA Reading x 5) - 40 = Temperature ºC

Example:	Reading is 20mA	(20 x 5) - 40 = 60ºC
	Reading is 12mA	(12 x 5) - 40 = 20ºC
	Reading is 4mA	(4 x 5) - 40 = -20ºC

Cable Hanger

We can supply an optional cable hanger (P/N 12-90-0931) to help end users secure the cable. The cable hanger can be positioned anywhere on the cable by pushing the ends together. Once positioned, the cable hanger expands and provides a snug grip on the cable.

When mounting the transducer in a well casing, the cable hanger can be secured to a hook on the well plate or an eye bolt may be attached to the side of the well casing. The cable hanger loop is then secured to the eye bolt by using any number of types of fasteners. A similar technique can be used when working in stilling wells for surface water level measurement. In this case, the loop-end of the cable hanger can be attached directly to a screw or bolt bored into the still well shelf.

Submersible Cable Splicing Kit

Our field-installable cable splice kit (P/N 830) allows you to splice polyurethane and ETFE submersible cable. It is most commonly used for well applications where the more expensive ETFE cable is required for suspension in corrosive media where the liquid level is fairly shallow, but the well is hundreds of feet in depth. It is also used in emergency situations where cable must be spliced together to get an application up and running.

3.0 Installation & Maintenance Tips

WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD

In hazardous locations:

- **Avoid building up static charge on case of data protector and plastic accessories.**
- **Use damp rag to wipe data protector and plastic accessories to avoid static build up.**

General Installation Procedures

The following is important installation and preventive maintenance information. Our Customer Service or Applications Engineering Support staff can provide additional instruction.

1. **Transducer Anchors:** Most users either suspend our submersible transducers in stilling wells or attach them to rigid conduit. This is done to prevent damage to the transducer from shock caused by water turbulence. It is not advisable to tie your transducer to a pump or to piping, as any problem with the transducer could require that the pump be pulled from the installation. This could prove to be *very expensive*. (Please refer to the Cable Anchoring Schemes drawing in **Appendix A**.)

   Some applications use our optional bracket (P/N 49-06-00PC) to clamp the transducer to a fixed object (i.e., wall, ladder, step) or require the unit to be suspended without any protective still well or attachment device. In all installations, care should be taken to ensure no damage occurs to the cable.

2. **Transducer Submersion:** Damage to submersible cable is one of the most frequent causes of transducer failure. Lower your transducer into the liquid slowly, making sure the cable does not drag over sharp edges and only to the depth necessary. Avoid dropping the unit from the surface. This does not apply to Series 27, 28, and 30 transducers.

3. **SuperDry™ Vent Filter (Desiccant) or Aneroid Bellows Installation** (For submersible transducers vented gage pressure format only) ***Always*** install a desiccant vent filter or aneroid bellows immediately after transducer installation**.** Failure to use one or the other could result in premature failure of the transducer; which would not be covered by warranty. If you use a desiccant filter, you should establish a regular maintenance schedule. You should change your vent filter when it is 75% spent (pink color). Replacement filters are available at a nominal cost from the factory. Do not remove the old vent filter until a new one is available. The most common failure mode of our transducers is moisture and corrosion damage due to lack of use or maintenance of the vent filter. This will allow air into the desiccant filter and allows the transducer to properly vent with changes in barometric pressure.

   To install/replace either the aneroid bellows or the vent filter, simply unplug the old unit from the vent tube and plug the 0.062" x 1" stainless steel connector tube (supplied with each filter or bellows) into the vent tube. (Installation and mounting instructions are supplied with each aneroid bellows and vent filter.) The diagram on page 16 shows typical vent filter and aneroid bellows hookups.

4. **Cable Protection** An inexpensive way to protect the cable from damage is to order the submersible pressure transducer with a ½" conduit attachment. Connect an inexpensive flexible 5/8" garden hose to the ½" conduit fitting with an equally inexpensive female PVC ½" NPT x 3/4" NHT swivel fitting, available at your local hardware store

5. **Bending of Cable** Our polyurethane and ETFE jacketed cables are quite flexible. Care needs to be taken to ensure that when bending the cable to suit your installation you do not crimp the vent tube inside the cable. Consequently, do not bend the cable more than a radius of 1 inch.

6. **Cable Compression** Many users require a compression fitting to secure our ETFE and polyurethane jacketed cable as it enters a junction box. Care needs to be taken that you do not over-tighten the fitting so as to damage the cable.

7. **4-20 mA Wiring** When connecting a 2-wire 4-20 mA transducer to a typical power supply and mA meter, verify that the meter has an input impedance of at least 10 Ohms. If you are unsure of the input impedance, then a 10 Ohm resistor may be placed in series with the meter and transducer. Connect the + (red) lead of the transducer to the + terminal of the power supply. If the 10 Ohm resistor is required, connect it to the - (black) lead of the transducer. Use a short length of 22 AWG or heavier wire to connect the + terminal of the meter to the resistor (if it is required) or the - (black) wire of the transducer. Connect the - terminal of the meter to the - terminal of the power supply with a length of 22 AWG or heavier wire. Connect the drain wire from the transducer to a good earth ground. (See **Appendix**, page **14** for wiring diagram.) Please refer to "**Maximum Cable Lengths and Minimum Supply Voltage**" in **Appendix C**, page **22** to verify minimum loop supply voltage requirements.

8. **VDC Wiring** To connect a 3 wire VDC output transducer to a typical power supply and the voltmeter, connect the - terminal of the power supply to the - input terminal of the meter with a length of 22 AWG or heavier wire. Connect the - excitation (black) lead of the transducer to the - input terminal of the meter. Connect the + input terminal of the meter to the signal lead (white) of the transducer. Connect the + terminal of the power supply to the + lead (red) of the transducer. Connect the drain wire to a good earth ground. (See **Appendix A**, **page 14**.)

9. **The Model 750** comes standard with a field removable diaphragm protector (one-inch or 25 mm standoff). The diaphragm protector can easily be taken off by removing six (6) fasteners located on the bottom of the unit.

10. **Sealed-Gage Transducer Configured For Altitude Above Sea Level** Since sealed-gauge transducers are normally calibrated at sea level, there may be considerable error induced when used at a higher elevation. If the transducer was calibrated without taking into consideration the difference in atmospheric pressure at sea level and the higher elevation, an offset error will occur. In order to eliminate error due to this difference, the customer must identify the elevation where the transducer will be installed. The nominal atmospheric pressure at the location is calculated and the transducer will be ranged accordingly. Not all KPSI Transducers are available in a sealed pressure format. Please refer to the appropriate datasheet for availability.

11. **Position Sensitivity** The transducer should be installed so that the diaphragm located behind the nose cap is oriented in a vertical position, otherwise the unit could exhibit an offset.

General Maintenance Tips for Submersible Transducers

1. **Desiccant Maintenance**

WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD

In hazardous locations:

- **Avoid building up static charge on case of data protector and plastic accessories.**
- **Use damp rag to wipe data protector and plastic accessories to avoid static build up.**

If you use a desiccant vent filter, you should establish a regular maintenance schedule. You should change your vent filter when it is 75% spent (pink color). Replacement filters are available at a nominal cost from the factory. Do not remove the old vent filter until a new one is available. Remember that Pressure Systems' improved 810 SuperDry™ Vent Filter are designed to be effective for at least one year before requiring replacement.

2. **Clogged Nose Piece or Dirty Diaphragm**

Either of these conditions could result in erroneous readings from your transducer.

WARNING: NEVER attempt to clean your transducer's nose piece or diaphragm with any object. This will dent the sensor diaphragm and cause permanent damage to the transducer.

Your transducer may be cleaned in accordance with the procedures listed in step 4, below.

3. **Cleaning your transducer**

Materials required:

- Plastic bowls 8-12 inches (200-300 mm) in diameter and 4-6 inches (100 - 150 mm) deep
- Supply of clean, lint-free cleaning rags
- 32 ounce bottle of "The Works-Tub and Shower Cleaner" (a mild detergent) manufactured by Lime-O-Sol Company in Ashley, IN 46705 and available locally through Wal-Mart, K-Mart, Target, and Ace Hardware stores at $2 to $4 per bottle

Preparation: Prior to cleaning your pressure transducer, ensure that all procedures have been followed in the proper cleaning of the cable and transducer to remove any hazardous materials. The vent filter (or bellows) must be properly attached. The cable should be coiled to ensure ease of handling and it must be protected against the possibility of accidental abrasion and/or penetration of the cable jacket by sharp objects. A lead length of 1 to 1 ½ feet (0.3 - 0.45 m) of cable from the transducer should be allowed to facilitate handling during cleaning. The protective covering (or similar protective device) that is shipped with each transducer should be attached to the transducer at all times. It should only be removed prior to installation or cleaning.

Your work surface needs to be clean and free of clutter and large enough to accommodate all materials required in addition to the transducer and cable. Fill one of the bowls with fresh water, one with a mild detergent mixed with water and the last with 16 ounces (0.45 kg) of "The Works".

Cleaning:

Step 1: Holding the cable 6 inches (150 mm) from the transducer, immerse the unit in the bowl containing the mild detergent and stir for 20-30 seconds. Remove and rinse in the bowl containing the fresh water, using the same stirring motion used in the mild detergent. Rinse and wipe dry.

Step 2: Holding the body of the transducer with one hand so that you are looking at the retaining screen protecting the sensor, carefully remove the sensor nose piece by simply unscrewing it from the transducer body. *Do not touch the sensor diaphragm with your finger or any other object. Also, do not try to dry the inside portion of the transducer, as you risk damaging the pressure sensor*.

Step 3: Place the transducer in a vertical position with the sensing end facing downward in the bowl containing "The Works" solution for approximately 15-20 seconds. Rinse in the bowl containing clean water and wipe dry the external casing only. Place the protective screen in the same solution for 15-20 seconds, rinse and wipe dry.

Step 4: Holding the transducer in a vertical position so that you can see the face of the sensor, screw the protective nose piece back into place.

4. Cleaning the Lightning Protection Data Line Protector

WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD

In hazardous locations:

- **Avoid building up static charge on case of data protector and plastic accessories.**
- **Use damp rag to wipe data protector and plastic accessories to avoid static build up.**

4.0 Warranty and Product Return Procedure

Any transducer/transmitter that is less than 2 years old (see DOM) which does not meet the product's specifications and exhibits **no obvious physical damage to the housing, sensor, or cable (cuts),** will be replaced under warranty.

Units 2-3 years old: Units that fall within this age group and exhibit no obvious physical damage to the housing, sensor, or cable (cuts), may be replaced at a discounted list price.

Units greater than 3 years old: Units that fall within this age group are not replaced under warranty.

Merchandise Return Procedures

Contact the **Applications Support Group** or the **Customer Service Department** at Pressure Systems if your transducer is not operating properly. Our staff is available for troubleshooting at **(757) 865-1243** or toll free at **1-800-328-3665** during normal working hours, Eastern time. If your transducer or accessory needs to be returned to Pressure Systems, obtain a *Returned Merchandise Authorization* (RMA) from the Customer Service Department prior to shipment. Be prepared to supply the following information when requesting the RMA:

- Part number
- Serial number
- Complete description of problems/symptoms
- **Bill To** and **Ship To** address
- Purchase order number (not required for warranty repairs)
- Customer contact and telephone number

The above information, including the RMA number, must be on the customer's shipping documents that accompany the equipment to be repaired. Pressure Systems also requests that the outside of the shipping container be labeled with the RMA number to assist in tracking the repairs. All equipment should be sent to the following address:

ATTN: KPSI TRANSDUCER REPAIR DEPARTMENT (7-digit RMA number)
Pressure Systems, Inc.
34 Research Drive
Hampton, Virginia 23666

Prior to returning to Pressure Systems, the transducer and cable must be cleaned per instructions provided on the cleaning certificate supplied when the transducer was delivered. The certificate can also be found on Pressure Systems website:

www.PressureSystems.com/cleaning.html

The completed certificate must accompany the transducer when shipped to Pressure Systems. If the transducer has been used in media other than potable water, PSI customer service must be notified at the same time an RMA number is requested. PSI reserves the right to reject any shipment deemed to be unsanitary or environmentally unsafe to handle. If these guidelines are not met, the package will be sent back unopened and at the customer's expense. ***Please***

include the attached vent filter or aneroid bellow with each returned vented gage submersible transducer.

Pressure Systems will return warranty items prepaid via UPS GROUND. If the customer desires another method of return shipment, Pressure Systems will prepay and add the shipping charges to the repair bill.

Incoming freight charges are the customer's responsibility. The customer is also responsible for shipping charges to and from Pressure Systems for all equipment not under warranty.

Once the return is received, it typically takes 5-10 working days for the technician to make a fault determination.

A cable reconnect fee will be charged when the customer requests a different length of cable.

Restocking Policy

Pressure Systems does allow standard products to be returned for credit in the event it is no longer required, providing the products are in new and unused condition. A restocking fee will be assessed depending on the model type and variety.

A **25% restocking fee** applies to the following models, providing they are vented-gage reference format and [pressure ranges above 3 psig (20 kPa) and below 100 psig (690 kPa)].

27	320	700	710
28	342	705	720
Display Meters - all models			750

A **50% restocking fee** applies to the following models. This also applies to all other models with sealed-gage and absolute pressure formats as well as vented-gage reference formats with [pressure ranges below 3 psig (20 kPa) and above 100 psig (690 kPa)].

30	335
300DS	730
330	735

NOTE: Expedite premiums and shipping charges are non-refundable.

Please consult the individual manuals for the Series 500 and Series 550 (waterMONITOR) for the restocking policy.

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Appendix A

Drawings and Diagrams

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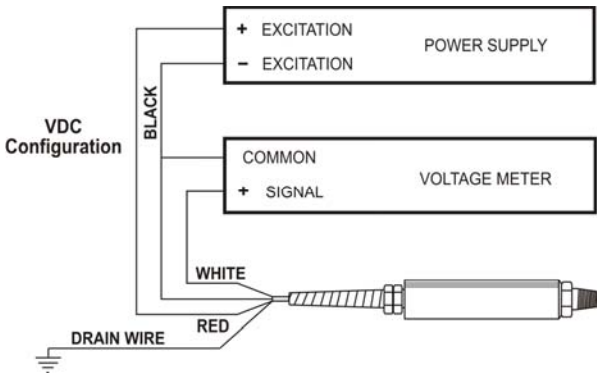
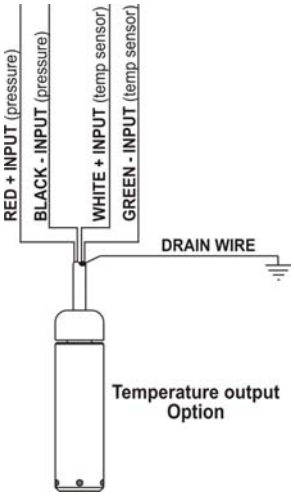
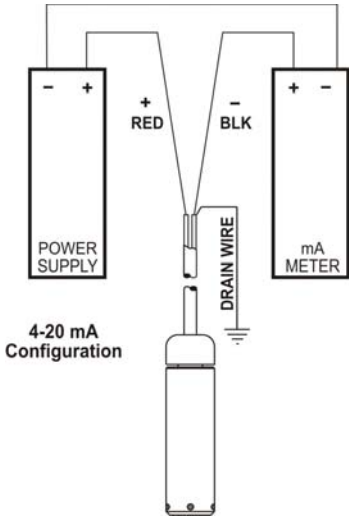
Wiring Diagram VDC, mA, and Temp Output



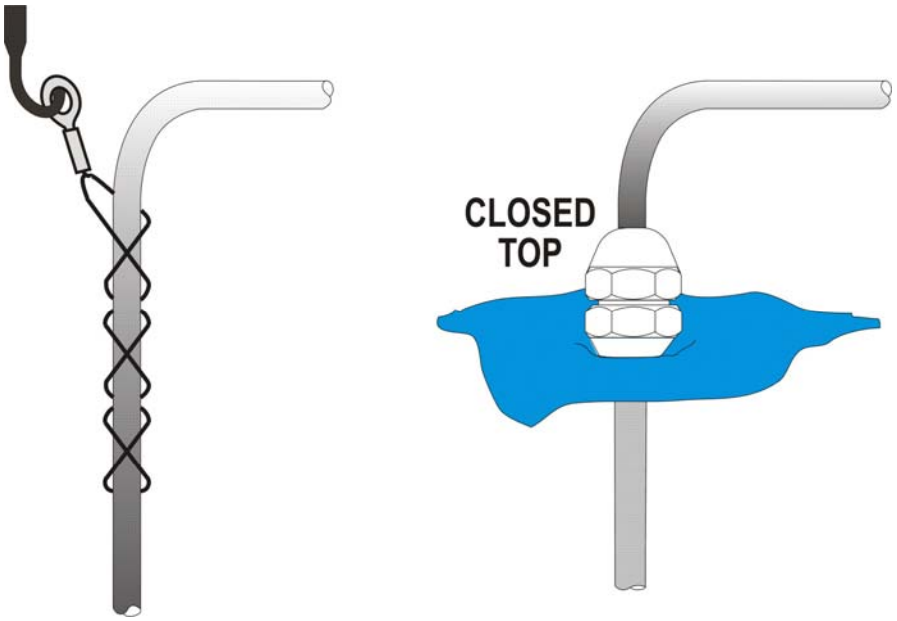




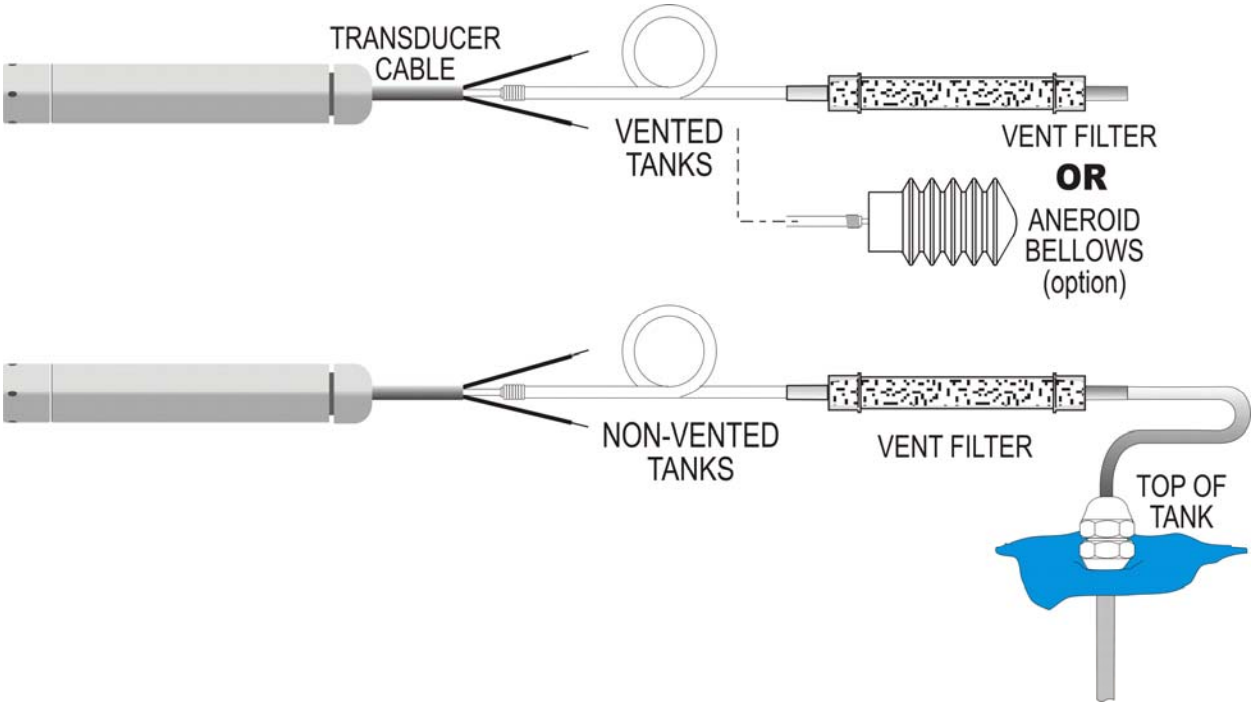
Notes:

1. These diagrams depict typical installations. Refer to your power supply and instrumentation Manufacturer for the specifics of your application.

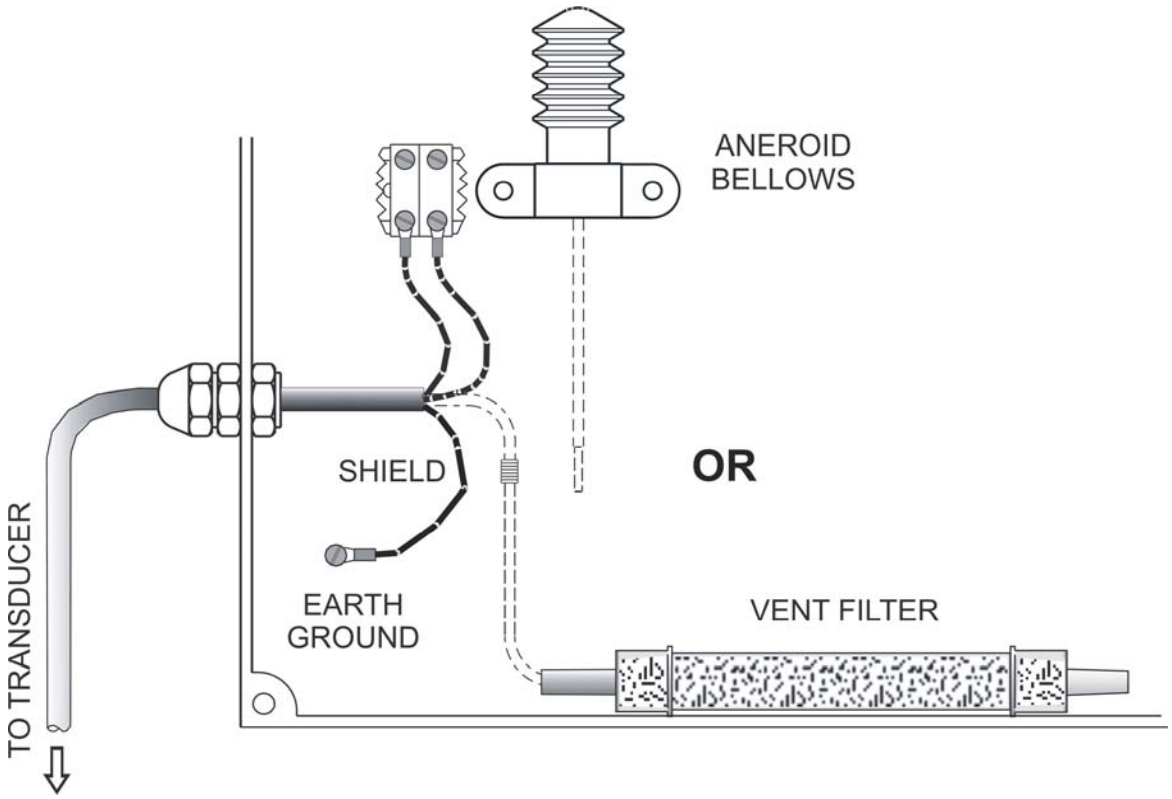
Cable Anchoring Schemes



Reference Connection Schemes



Submersible Cable Termination



Appendix B

1. Question: What installation ideas do you have to help me get rid of electrical noise interfering with the signal?

Answer: An ounce of prevention goes a long way. Either try to eliminate the source of noise or move the transducer as far away from it as possible. We strongly encourage you to secure our cable shield to a good earth ground and that you use a 4-20 mA signal output. Armed with these precautions and the fact that many of our transducers are CE approved for electromagnetic interference, you should have few problems.

2. Question: The cable on the submersible transducer always seems to get cut and damaged. What am I doing wrong?

Answer: This is the most common problem that our users encounter. Make sure that all of your colleagues and staff understand the importance of handling the cable with care. The cable should not be bent around rough or sharp edges. Always use a cable reel during transport. Where possible, suspend the unit in a perforated 2" (50 mm) PVC pipe and thread the cable through protective conduit to the nearest junction box.

3. Question: I have an application where the transducer is frequently damaged by voltage spikes. What can be done to prevent this?

Answer: At a minimum, make sure the cable shield is connected to an earth ground as near as possible to the transducer. We can provide a surge protection kit for both our submersible and non-submersible transducers. See page 4. These kits will handle typical spikes that might come in through the power lines as well as surges that travel through the ground due to nearby lightning strikes

4. Question: How much impact shock can your submersible transducers withstand?

Answer: Our transducers are not shock tested and the lower pressure ranges can be damaged if dropped from several feet onto an unforgiving surface like concrete. We recommend that the protective shipping foam remain in place until the unit is installed.

5. Question: What is the response time of your transducer?

Answer: From initial power up, the transducer output will stabilize within a fraction of a second. The frequency response is rather low, probably less than 1 kHz, but it depends on the application, the media, plumbing, etc. Call our factory for application assistance if frequency response is critical in your application.

6. Question: How do I attach your vent filter or aneroid bellows to my cable vent tube?

Answer: The vent filter can be mounted anywhere convenient, preferably out of the weather. It can be mounted in any position and connects to the cable vent tube via the extension tube with metal connector tube provided. The aneroid bellows must be mounted in a way that its movement is not encumbered. It is provided with a mounting base.

7. Question: What is the best way to mark my cable?

Answer: Use white vinyl marking tape available from your local hardware or electronic stores. These same stores may also sell cable marking kits.

8. Question: Any ideas for preventing marine growth on your submersible transducers?

Answer: You might want to try waterproof grease. Remove the threaded nose cap to facilitate applying the grease**. Take care not to damage the diaphragm when applying the grease and not to trap air bubbles against the sensing diaphragm.**

9. Question: How many measurements can you make before the diaphragm on the sensor fails?

Answer: In normal operation - millions of cycles. We find that sensor failure is rarely due to diaphragm fatigue.

10. Question: What is the turnaround time on repairs?

Answer: Once we receive a unit into our facility it takes less than 10 working days to complete an evaluation.

11. Question: What is the longest length of cable you have attached to a submersible transducer?

Answer: Two thousand feet (610 meters).

12. Question: Why do you use 316 SS housings and sensors for your standard transducers?

Answer: It offers a good combination of corrosion resistance and reasonable cost. As an option, we do offer titanium for more aggressive environments.

13. Question: What wire gauge should I limit myself to when connecting to your 22 AWG wire?

Answer: Use 22 AWG or heavier.

14. Question: Does it make any difference if I mount the transducer in a vertical or horizontal position?

Answer: Yes. Our units will experience a certain amount of position sensitivity. You should mount it in a vertical position throughout the measurement cycle. If you lay the transducer down, the user must realize than an offset will occur.

15. Question: What happens when you freeze your transducer in a column of water?

Answer: We have frozen our transducers in a container of water in a home freezer, with no resulting damage. However, depending on the level range of the unit, over pressure of the unit is possible. In harsh environments where debris is common and ice shifts, you might expect damage to both the transducer and cable.

16. Question: Why would I choose a KPSI Transducer versus a competitor?

Answer: Reliable, long lasting products
Rapid delivery
Lightning protection lifetime warranty
Excellent pre & post sales/application support
No hassle service

Appendix C

Troubleshooting Techniques

Quick Check Procedure

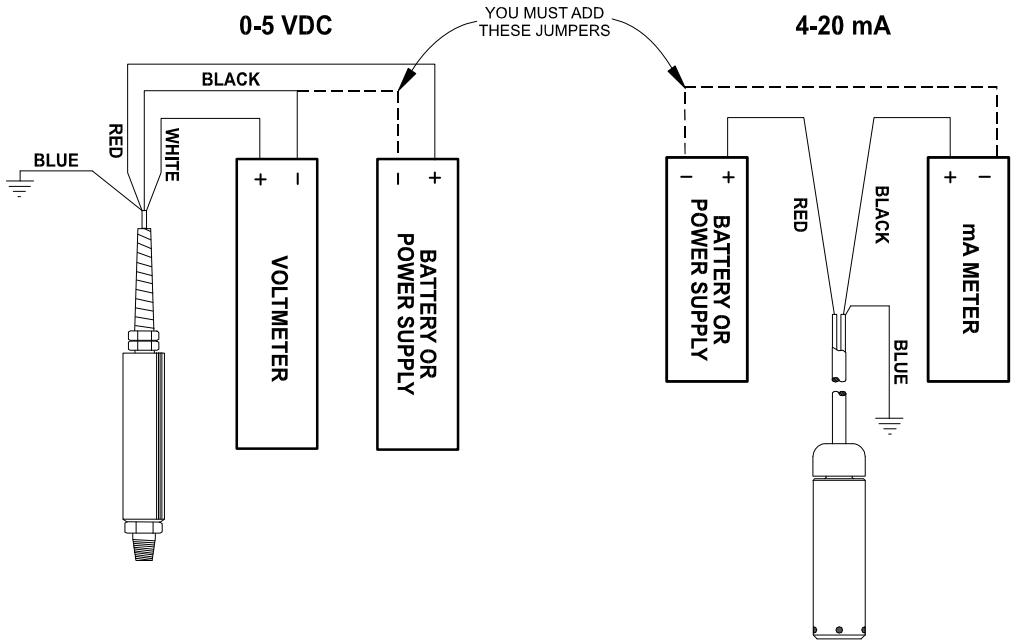
The following is a quick field checkout procedure for KPSI Level and Pressure Transducers. It will be referred to throughout the troubleshooting section.

Should a problem be encountered with a transducer or transmitter, it is sometimes helpful to test the transducer independently from the rest of the system, thereby establishing where to concentrate the troubleshooting effort.

On the next page is a simple hookup diagram for the most common types of electrical output, a 0-5 VDC transducer and a 4-20 mA transmitter. In either case, the "power supply" can be a common 12 volt lantern battery, or even a 9 volt transistor radio battery, although the lifetime of a 9 volt battery will be limited. The meter should be a digital type capable of reading at least 2 digits to the right of the decimal point. Use 22 gage or heavier hookup wire or clip leads for jumpers. If your unit has other than a 0-5 VDC or 4-20 mA output, please call Applications Support at **(800) 328-3665** for assistance.

Once your transducer is correctly configured per one of the diagrams below, orient the transducer in a vertical position with the pressure port down and then read the zero output on your meter. For a 0-5 VDC output, the zero should be between 0 and 0.10 volts, and for a 4-20 mA output, between 3.80 and 4.20 mA. For Series 300, the values do not change for VDC output but the values for mA are between 3.80 and 4.20 mA. If the output is outside of these limits, you may, at your option, choose to troubleshoot the transducer per the suggested measurements shown below. Otherwise, contact our Customer Service Department at **(800) 328-3665** for a Return Material Authorization number (RMA).

If the zero output is within these limits, the problem will more than likely be found elsewhere in your system.



When an error is observed at a customer's installation, it is important to determine if the fault lies in the transducer or the instrument reading the transducer signal, ie. digital panel meter, programmable logic controller, etc. . To do this, a second instrument should be used to confirm the observations. The second instrument may be a handheld DMM (Digital Multi-Meter) or a dedicated milliammeter capable of reading 4-20 mA of current to a resolution of at least 0.1 mA. The diagram above illustrates the attachment of the meter in series with the black (negative signal) wire of the transducer using a 9-28 VDC power supply for transducer excitation. Some suggested power supplies are:

- 1 - 12 VDC automotive battery.
- 2 - 6 VDC lantern batteries connected in series (for a total of 12 VDC).
- 2 - 9 VDC transistor batteries connected in series (for a total of 18 VDC).

Batteries are suggested to power the transducer during testing to eliminate the possibility that line noise is passing through an improperly filtered, grounded, or damaged power supply. All measurements should be recorded and sent to Pressure Systems along with the transducer to assist in the evaluation process.

Further Measurements:

0-5 VDC	Should read:	4-20 mA	Should read:
+Excitation (white) to Shield (drain)	> 2.5 Mohms	+Excitation (red) to Shield (drain)	> 2.5 Mohms
-Excitation (black) to Shield (drain)	> 2.5 Mohms	-Excitation (black) to Shield (drain)	> 2.5 Mohms
+Output (red) to Shield (drain)	> 2.5 Mohms	Shield (drain) to Housing	< 2 ohms
Shield (blue) to Housing	< 2 ohms		

Maximum Cable Lengths and Minimum Supply Voltage

The maximum length of cable to be used with our submersible transducers is largely dependent upon the type of electrical output of the transducer. For a 0-5 VDC output, a maximum cable length of 100 feet (30 m) is recommended. A voltage output is more susceptible to electrical interference than a 4-20 mA signal. A 4-20 mA signal can be transmitted much longer distances, depending upon such factors as temperature, wire size, length of the wire, power supply, and voltage requirements of any devices to be powered. At 25ºC the 22 AWG conducting copper wire used in our polyurethane jacketed cable has a resistance of 16.45 ohms per 1000 feet (304 m).

Using Ohms Law (E=IR) where E=voltage, I=current and R =resistance, one finds that a 20 mA signal requires .329 volts to drive it along 1000 feet (304 m) of 22 AWG copper wire (E=16.45 x .020). This drop is seen on both the supply and return wire for a total loop voltage drop of 0.658 volts

To find out how much voltage is required to drive our Series 700 submersible level transducer's 4-20 mA signal 10,000 feet, just add the minimum power requirement of the 700 (9 VDC) to the resistance offered by 10,000 feet (3048 m) of our polyurethane jacketed cable (10,000÷1000 x .658=6.58). The resulting power requirement is 15.58 VDC (9 + 6.58).

Connect the cable shield (drain wire) to a good earth ground. This will protect the transducer from relatively minor transient voltages. The only exception to this rule is if high rates of electrolytic corrosion have been previously experienced with grounded submersible devices. In this case it may be better to leave the shield disconnected.

Please note: When using products with the lightning protection option on 4-20 mA products, users should take into account the additional series resistance of this option when selecting the loop power supply. This option will increase total loop resistance by 88 Ohms.

Troubleshooting Techniques

1. Symptom: ***Transducer fails to give output of any kind.***

Procedure: Isolate the problem to either the transducer or the power supply/readout. See the Quick Check Procedures (above) for this check. If it can be determined that the transducer is no longer operable, remove it from service for further analysis. If the transducer output falls within the limits described above, the fault lies somewhere else in your system.

2. Symptom: ***Transducer has failed and has been removed for analysis.***

Procedure: Inspect the cable for physical damage. Cuts in the cable jacket can result in liquid incursion into the transducer housing, which can cause permanent damage. If operational, the cable can be repaired by using a splice kit (P/N 830) supplied by Pressure Systems.

Inspect the transducer housing. It should be intact and free of corrosion. If the outer surface of the transducer is pitted, this could be an indication of galvanic corrosion caused by stray ground currents. If this is the case, the transducer will probably require replacement. If the external case exhibits none of these characteristics, carefully unscrew the nosepiece and look into the pressure sensing end of the transducer. The concentric rings of the sensing diaphragm should be visible. If they are not, it could be that residue has accumulated on the diaphragm, preventing it from responding properly to pressure changes. The transducer can be cleaned by gently swishing the transducer back and forth in a bucket of warm, soapy water until the residue softens and washes off. (See **Cleaning Your Transducer**, page 8.) ***Under no circumstances should any object or tool be used to remove residue from the sensing diaphragm or else permanent damage will be done.*** If cleaning the diaphragm does not solve the problem, the transducer should be returned to the factory for repair or replacement.

3. Symptom: ***Transducer develops a negative offset and gets worse over time (actual level exceeds specified level).***

Procedure: This may be a sign that moisture has entered the reference (vent) tube in the cable and is inside the transducer housing. This is usually the result of not maintaining the desiccant vent filter or of operating the transducer without a desiccant filter or aneroid bellows. If caught early enough, the transducer can be saved by coiling the cable and transducer in a pan and baking it in an oven at 50°C (122°F) for a minimum of 2 hours. *Be careful that the oven temperature does not exceed 50ºC (122°F)* or both the transducer and the cable can be damaged. **Alternatively**, suspend both the cable and transducer in a vertical position (with vent tube down), overnight to allow water to drain from the transducer and vent tube.

4. Symptom: ***Transducer suddenly fails during or just after a nearby lightning event.***

Procedure: This failure is usually caused by overvoltage due to ground transients resulting from a direct or indirect lightning event. These transients can travel

distances of a mile or more. The transducer may be returned to the factory for repair and optional retrofit of our ***lightning protection system.*** This system carries a lifetime warranty against transducer damage due to lightning.

5. Symptom: ***Transducer response to pressure/level input changes becomes sluggish.***

Procedure: This is usually a sign that the sensing end of the transducer has become fouled with residue. The transducer must be removed from service and the sensing diaphragm cleaned as described in Item 2, (warm, soapy water). If fouling persists, the transducer may be replaced with a Series 705 or Series 750 (non-fouling) transducer, which is specifically designed for trouble-free operation in a high residue environment.

6. Symptom: ***Output reading is within limits but "freezes" at one point.***

Procedure: In certain environments "crust" may form over the sensing diaphragm, preventing the sensor from identifying change in level. Removing the transducer from service and cleaning it (as described in Item 2) will generally solve the problem. To combat marine growth, you might try wrapping the transducer with copper wire similar to that found in wire scouring pads for cleaning dishes. Marine growth occurs on the copper and eventually erodes the copper and drops off or the copper is manually removed during routine maintenance. Alternatively, there are various companies that will impregnate/coat the 316 stainless steel with anti-fouling chemicals of coatings. Level transducers temporarily removed from the well or sump should not be stored dry, but should be stored in a bucket of fresh water in order to prevent "crust" formation.

7. Symptom: ***Readings increase very slowly over time***.

Procedure: Our cable is shipped coiled and consequently takes time to straighten when installed. Attaching a weight to the transducer (e.g., one of our sacrificial anodes) will help. To prevent cable stretch with lengths greater than 200 feet (60 m), secure the Kevlar fibers (just under the cable jacket) to your junction box or other secure object.

8. Symptom: ***No electrical output from your transducer.***

Procedure: Check all electrical connections to ensure they are correct and secure. Double check your power supply or use a battery (as described previously) to ensure the transducer is getting power. If all checks OK, the problem could be a circuit board or the sensor in your transducer. The unit must be returned to the factory for evaluation. The most probable cause of this type of failure is damage to the submersible cable jacket allowing water to leak down the cable and into the transducer housing or lightning damage.

9. Symptom: ***Formation of marine growth on a submersible transducer.***

Procedure: Certain transducer construction materials, for example, 316 stainless steel, attract marine life (snails) and algae. Clean the transducer diaphragm by

soaking it in a bucket of warm water with a non-aggressive cleaning solution. You can also coat the transducer with marine grease. This may be the most effective and inexpensive way to protect your transducer.

10. Symptom: ***Submersible transducer exhibits corrosion or pitting on body or diaphragm***

Procedure: Dissimilar metals (for example, your transducer housing and your pump housing) in an electrolytic environment (fluid in your well) can lead to *galvanic corrosion* of the metal that is nearer the anodic end of the galvanic series. Likewise, a voltage potential between the ground wire of the transducer and the ground of other equipment in the well can lead to *galvanic corrosion*. Installation of a P/N 820 or 825 sacrificial anode will help protect your transducer from *galvanic corrosion*. Our sacrificial anodes are made of a zinc alloy that, being nearer the anodic end of the galvanic series than the 316 stainless steel or titanium housing of the transducer, will corrode before the transducer.

11. Symptom: ***The transducer is buried in dirt or silt and the readings seem to be erroneous.***

Procedure: Use of a piezometer nosepiece in this application would help. This nosepiece can be easily installed in the field and features a very fine screen to keep dirt from fouling the diaphragm, but allows the diaphragm to sense moisture levels.

12. Symptom: ***Transducer has an offset error.***

Procedure: Our submersible transducers perform best when the sensing end is pointing in a downward manner. Keep in mind that you can experience offset error due to the position sensitivity or orientation change of the sensor. Offset errors are more prominent in low pressure applications with the sensing end of the transducer lying flat or pointing upward.

13. Symptom: ***I am testing a Series 700 4-20mA sensor for use with our data logger. On page A-2 of the KPSI Level and Pressure Transducers User's Manual, I see the standard 4-20mA configuration. Does the recording channel of my data logger become the mA meter?***

Procedure: Most data loggers cannot measure current (mA) directly. When this is the case a load resistor must be used to convert the current (mA) output into an appropriate voltage. If the User's Manual for your particular instrument does not illustrate a preferred method for recording current (mA) data then you should attach your transducer signal wires to your data logger in the following manner.

Transducer red wire - Data Logger Excitation Terminal
(The minimum excitation for a Series 700 Transducer is 9VDC)
Transducer black wire – Data Logger signal input (+) terminal

Attach a Load resistor between the Data Logger signal input (+) terminal and the Data Logger signal input (-) terminal.

Attach a separate piece of wire between the Data Logger signal input (-) and analog ground.

In this configuration you will turn your data logger into a milliammeter. The size of your load resistor can be calculated in the following manner.

D/0.02=R

Where:

Data logger input range = D
Full scale output of transducer = 0.02 A (20 mA)
Load Resistor Value = R

Pick an appropriate standard value

250 Ohms results in 1 to 5 VDC at 4 and 20 mADC
125 Ohms results in 0.5 to 2.5 VDC (500 to 2500 mVDC) at 4 and 20 mADC

At this point the discussion needs to address IR loss (voltage drop) in series circuits. Note that Series 700 transducers need a minimum of 9 VDC to operate correctly. When the transducer is operating correctly it will output a current which, when driven through a resistor, will generate some amount of voltage drop. If the resistor value is 250 Ohms then the voltage measured across that resistor will be 0.004 A * 250 Ohms = 1.000 VDC and 0.020 A * 250 Ohms = 5 VDC. Notice that, if the available voltage from the data logger is12 VDC then 12 VDC - 5 VDC = 7 VDC which is less than the voltage required by the transducer to operate. If this scenario were to occur the transducer would actually stop functioning correctly when its output reached 12 mADC (50% of transducer full scale range). In this case the appropriate choice for a load resistor value is 125 Ohms.

14. Symptom: ***I have a Series 700 4-20mA transducer rated for 7.5 PSIG attached to a pressure source that is outputting 7.5 PSIG. With 20VDC being supplied I am getting 19.94 mA. I can't find the upper range allowance for the sensor, but this seems low to me. Does this mA reading fall into the acceptable range for the transducer with the settings I've specified?***

Procedure: When evaluating a transducer it is sometimes convenient to make some broad generalizations in order to rapidly determine the condition of the unit. In general, transducers that output a 4-20 mADC signal have a 16 mADC span (4 - 20 = 16). If the transducers accuracy is reported as being some percentage of its full-scale range then the following table could be used in conjunction with the instructional notations to determine whether a more detailed analysis of data quality is required.

Model	Accuracy	Accuracy in mADC
700	1.00%FS	±0.16 ma
710	0.50%FS	±0.08 ma
720	0.25%FS	±0.05 ma
730	0.10%FS	±0.016 ma
735	0.05%FS	±0.008 ma

In order to approximately determine how many milliamps a transducer should output at a given depth.

1. Determine the depth (in feet) at which the transducer is sited.
2. Divide the depth value (from step 1) by the transducer full-scale range (in feet). - Record the value.
3. Multiply the value calculated in step 2 by 16 (the transducer span in milliamps).
4. Add 4 to the product of step 3. This is the approximate value in milliamps that should be output by the transducer at its current depth.

In order to approximately determine the depth of a transducer (in feet) using a given value of milliamps.

1. Divide the full-scale range of the transducer (in feet) by 16. Record this value.
2. Subtract 4 from the milliamp output of the transducer. Record this value
3. Multiply the result of step one by the result of step 2. This is the approximate depth at which the transducer is sited.

If the resulting numbers are reasonably close to some verified value for current water depth, then the unit is functioning. In order to determine the quality of measurement, additional steps need to be performed.

Appendix D

Calibration Calculations

Pressure Systems ships a calibration sheet with every KPSI™ Transducer. This sheet lists the actual values that were output by the transducer, when it was being manufactured, at several different pressures. In addition, two coefficients are provided that can be used to calculate the actual depth from any given mA output value. These coefficients are derived from a Least Squares Best Fit Straight Line (BFSL) calibration using the data listed on the datasheet. Our accuracy specification is referenced to the line described by the BFSL coefficients and so the transducer may not output exactly 4 mADC at zero pressure and 20 mADC at full-scale. As an example here is an example of data for a typical transducer.

Calibration Report

Test Date: 02/28/08
Test Time: 13:02:57
Model No: 320T14B0A008.670000.000B10030B
Serial No: 0802048
Pressure Range: 0.00 to 8.67 PSIG
Excitation: 9-28 VDC
Output: 4-20 mA

Test Temps: ROOM = 25.3 DegC

PCU Serial No: TRF048

Target Test Pressure	BFSL Rm Temp Outputs	Run #1 Rm Temp Outputs	Run #1 Error %FSO	Run #2 Rm Temp Outputs	Run #2 Error %FSO
0.00	4.0017	3.9995	-0.0134	3.9981	-0.0222
1.73	7.2050	7.2003	-0.0295	7.2066	0.0098
3.47	10.4096	10.4111	0.0091	10.4144	0.0297
5.20	13.6133	13.6182	0.0305	13.6207	0.0461
6.94	16.8176	16.8158	-0.0114	16.8174	-0.0014
8.67	20.0219	20.0173	-0.0290	20.0190	-0.0184
6.94	16.8171	16.8162	-0.0057	16.8172	0.0006
5.20	13.6127	13.6176	0.0305	13.6175	0.0299
3.47	10.4083	10.4131	0.0298	10.4110	0.0167
1.73	7.2049	7.2067	0.0115	7.2059	0.0065
0.00	4.0020	4.0001	-0.0118	4.0000	-0.0124

Maximum Static Error: 0.0523 %FSO
Maximum Non-repeatability: -0.0393 %FSO

Electrical termination: RED: +SUPPLY
BLACK: -SUPPLY
BLUE: SHIELD

Slope1: 0.5411 PSIG/mA
Zero Offset1: 0.0000 PSIG

Slope2: 1.8479 mA/PSIG
Zero Offset2: 4.0017 mA

Conversion Factor: 1.0000

Notes:

Calculations:

Method 1: Calculate pressure in desired units, using sensor's output as independent variable.
PSIG = 0.5411(mA - 4.0017) + 0.0000

Method 2: Calculate predicted sensor output in desired units using pressure as the independent variable.
mA = 1.8479(PSIG - 0.0000) + 4.0017

In this case, even though the offset or 0 PSIG output was 4.0017 mADC and the full-scale point was 20.0219 mADC the unit actually performed better than its specified accuracy of ±0.25% of full-scale range as indicated in the Error % FS column.

The calculation for pressure is illustrated below:

PSIG = (Span*Output (in mA)) + Offset

And, to convert to feet of water

Feet H_2O = PSIG * 2.3073

measurement
SPECIALTIES
34 Research Drive, Hampton, VA 23666 USA
757-865-1243, Toll Free 800-328-3665
Fax 757-865-8744
E-mail sales@PressureSystems.com
www.PressureSystems.com
online orders www.LevelandPressure.com

TAB 4

SonTek
a xylem brand

The SonTek Flow Display is an external device that displays data collected from the SonTek-IQ and SonTek-IQ Plus.

FAST • EASY • SEAMLESS

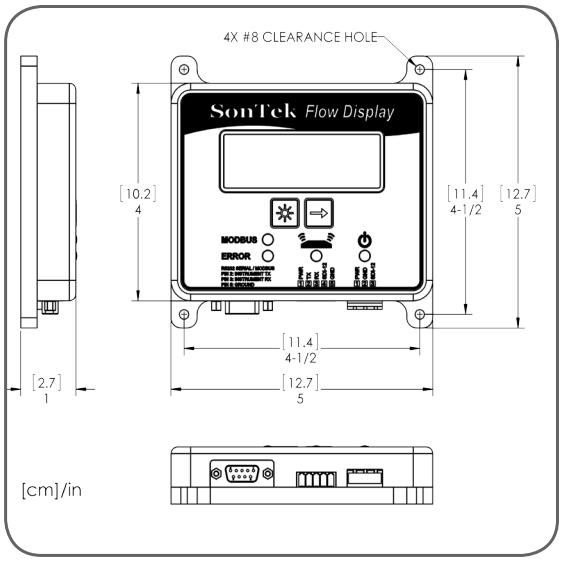
Life just got a little bit easier with the SonTek Flow Display! View data fast and efficiently without having to connect to a computer - simply arrive at the monitoring site and instantly see status and data with a simple touch of a keypad display.

Need to download the data? The display's pass-through design allows you to connect to a laptop and download data directly for products such as the SonTek-IQ.

Additionally there are options for four channels of 4-20 mA analog outputs – making integration in to monitoring projects fast and easy – all in one box! Other features include:

- Seamless integration – replaces the cable adaptor
- LCD provides 4 lines of 20 characters of information
- Two keys – Backlight and arrow key allow for cycling through the data
- Status lights to indicate Modbus communications, Modbus Error, SonTek IQ communications and Power

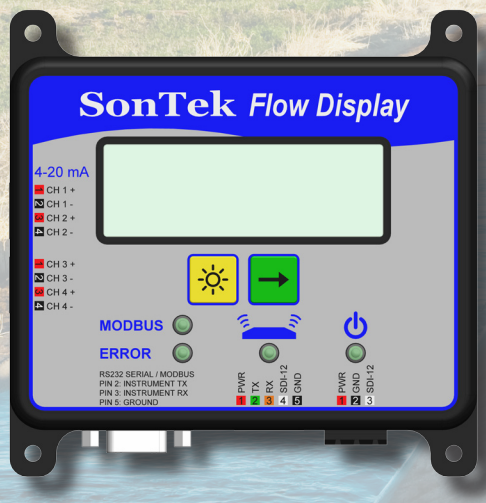
PRODUCT DIMENSIONS



Like what you see and want more information?

Contact us for a quote or question at inquiry@sontek.com or call our support center at +1.858.546.8327.

SonTek Flow Display



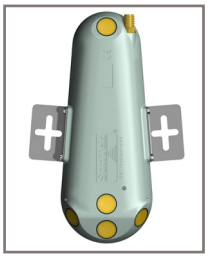
Easily cycle through eight data screens presented in the SonTek Flow Display

- System Status
- Flow/Stage/Mean Velocity
- Volume
- Velocity/Depth/Temperature
- System Information
- Output type (Modbus, SDI-12, RS232, and Real Time)
- Output Units

POWER CONSUMPTION

- Standard Flow Display consumes 0.15 W
- Flow Display with Analog outputs, not using the outputs: 0.2W
- Flow Display with Analog Output in use: 0.5 -3 W (depending on configuration and number of channels in use)
- Exact power consumption will depend on user configuration and use of the back light

LEARN MORE! Looking for a complete open channel solution? The SonTek-IQ is the ideal flow meter, developed specifically for irrigation canals and turn-outs. Here is a FREE online event to tell you more!



Collecting Open Channel Flow Data Using the SonTek-IQ

Online Event (Pre-recorded)
http://www.sontek.com/training.php

SonTek-IQ™ Series
Standard, Plus and Pipe

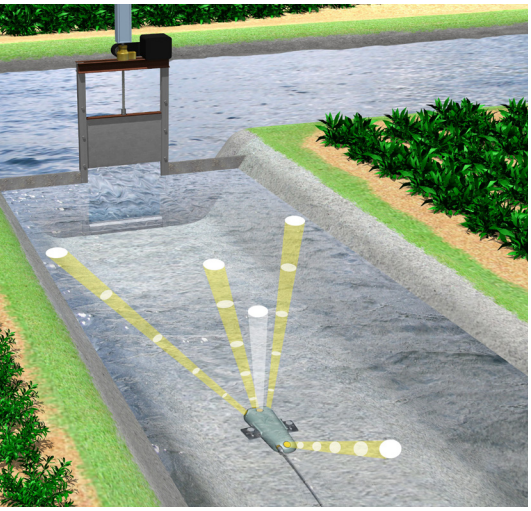
FLOW, TOTAL VOLUME, LEVEL AND VELOCITY

SonTek

a xylem brand

Built to Last. Made to Perform.

Developed with assistance from the Cooperative State Research, Education, and Extension Service of the U.S. Department of Agriculture, the SonTek-IQ Series are three products that provide high quality flow, total volume, level and velocity data for challenging conditions that fit your budget. Custom flow algorithms, carefully designed and tested, ensure all these products in the Series will deliver the data you need to make smart decisions about your water. Each system offers four independent velocity beams that can accurately map the cross-section velocity, both in the center and out towards each edge. High-resolution profile data combined with smart and flexible programming means the IQ adeptly meets the widest variety of environments and flow conditions, from irrigation canals to wastewater collections and CSOs*; from industrial pipes to natural streams. In many cases, very high-accuracy flow data can be instantly obtained with no velocity indexing required. Additionally, the built-in pressure sensor (standard with each system), works in tandem with the vertical acoustic beam to measure the water level, delivering the most robust stage measurements ever.



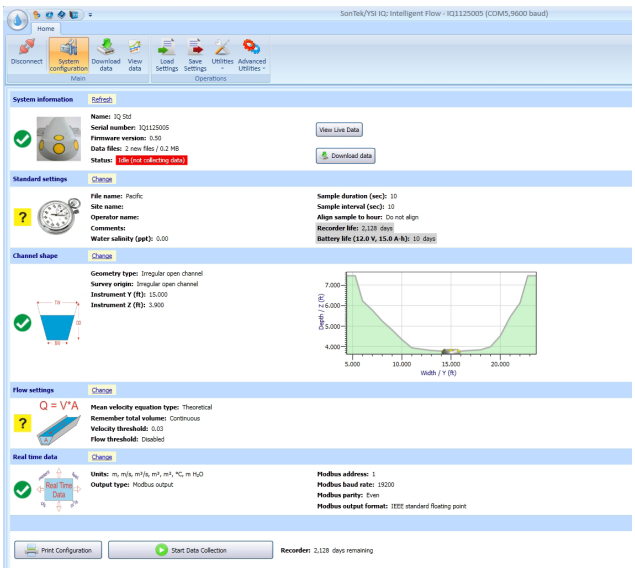
- Fully self-contained, all-in-one design
- Measure flow in man-made or natural channels, pipes or streams between 8 cm (3 inches) and 5 m (16 ft) deep
- Uses SonTek's exclusive SmartPulse^{HD}® adaptive sampling technology under all conditions
- Four, pulsed Doppler velocity beams for great section coverage
- Specialized flow algorithms for open channels and/or closed pipes, including irregular shapes
- Handles very slow and reversing flow conditions
- Self-calibrating water level using vertical beam and pressure sensor
- RS-232, SDI-12, Modbus, Analog communication/output

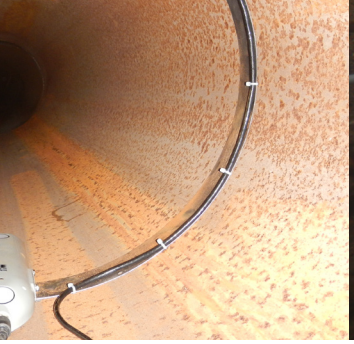
*The SonTek-IQ Series is not IS or ATEX certified. Do not use in areas with explosion risk.

Whether you need just a practical and cost-effective solution for a single canal, or you operate a large public utility with dozens of monitoring sites, there's a SonTek-IQ right for your application. Simply input the channel geometry using the intuitive SonTek-IQ software and you are outputting accurate flow data in minutes!

The SonTek-IQ software package is the starting point for interfacing with the instrument.

The "SmartPage" has built-in icons that guide users through the configuration steps to collect the best possible data. Want to run some statistics on the data? You can do that too, with just one click.





SonTek-IQ Standard: Big Quality for Small Budgets

The SonTek-IQ Standard version is a "no frills" option for the budget-minded operator. But with the SonTek-IQ Standard, low budgets do not mean low quality data! Using the same powerful SmartPulse^{HD} technology that is used in the SonTek-IQ Plus system, you won't be sacrificing quality while monitoring your flow.

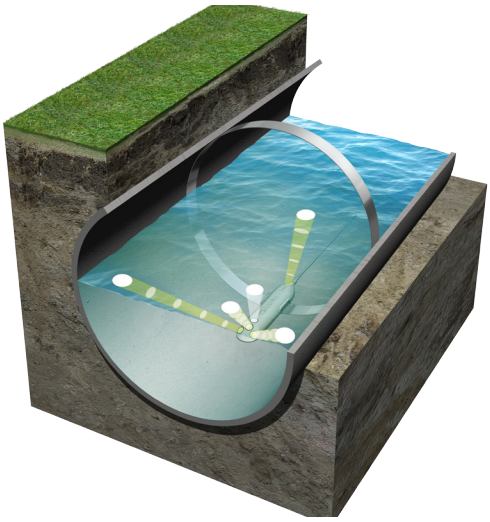
The Standard version allows measurement for depths up to 1.5 m in open-channels only, and basic data parameters output for display or export based on a dynamic, single integrated velocity cell.

SonTek-IQ Plus: Monitoring in Complex Environments

The SonTek-IQ Plus version offers a flow monitoring solution for larger canals and natural environments with depths up to 5 m. With the ability to collect velocity profiling data in cells as small as 2 cm across a channel horizontally and vertically, this version offers the user complete flexibility in applications and detailed flow velocity parameters for those times when "just flow" isn't enough.

The SonTek-IQ Plus is capable of handling not just regular trapezoidal canals, but any irregular/naturally-shaped channel, up to 5 m deep, where flow, velocity and/or level need to be measured. And with the flexibility of the SonTek-IQ software, the opportunities are endless.

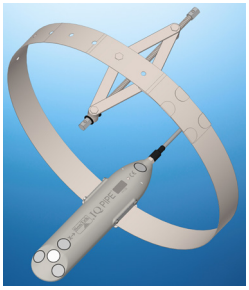
SonTek-IQ Pipe: Accurate Flow in Totally or Partially Full Pipes



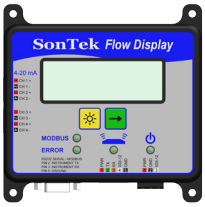
The SonTek-IQ Pipe is intended as either a bottom or top mounted flow meter that can be used in most industrial or agricultural applications. Unlike many other flow meters available today, the SonTek-IQ Pipe automatically determines if the pipe is full or partially full, and identifies the best technique to use to measure the velocity of the water. This information is then used to compute flow, along with accurate water level data provided by the vertical beam and/or pressure sensor. All this without additional configuration.

With a special form factor, the SonTek-IQ Pipe can provide accurate flow values in pipes from 0.5 all the way to 5.0 m, independent of whether these pipes are full or have only a few inches of water in them.

SonTek-IQ ACCESSORIES AND SPECIFICATIONS

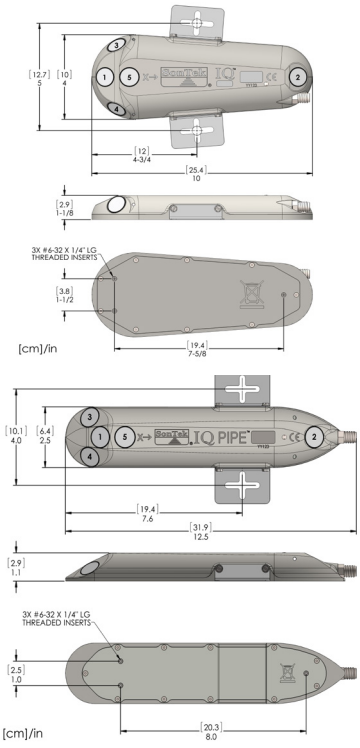


Custom-fit for the IQ Pipe, this easy to use mounting ring will make system installation a breeze. Fits pipe diameters from 16 in (41 cm) to 72 in (183 cm).



With the press of a single button, data is yours with the SonTek-IQ Flow Display. No PC required!

Product Dimensions



Specifications	SonTek-IQ Standard	SonTek-IQ Plus	SonTek-IQ Pipe
Application	Regular Canals	All Open Channels	Pipes & Culverts
Velocity Measurement			
-Sampling Range	0.05 – 1.5 m (0.16 - 5 ft)	0.05– 5.0 m (0.16 - 16 ft)	0.05 – 5.0 m (0.16 - 16 ft)
-Number of Cells	1	Up to 100	Up to 100
-Cell Size	Dynamically Integrated	2 cm – 10 cm (0.8 - 4 in)	2 cm – 10 cm (0.8 - 4 in)
Advanced Data Reprocessing	N/A	✓	✓
Increased Number of Data Fields	N/A	✓	✓
Velocity Measurement			
-Velocity Range	±5 m/s (16 ft/s)		
-Resolution	0.0001 m/s (0.0003 ft/s)		
-Accuracy	±1% of measured velocity, ±0.5 cm/s (0.2 in/s)		
Water Level			
-Vertical Beam Range	~~0.05 – 1.5 m (0.2 - 5 ft) (Standard),~~ 0.05 - 5.0 m (0.2 - 16 ft) (~~Plus~~/Pipe)		
-Water Level Accuracy	0.1% of measured depth or ±0.003 m (0.01 ft) whichever is greater		
-Pressure Sensor Range[1]	30 m (98 ft; 42 psi)		
-Pressure Sensor Accuracy	0.1% of full scale		
Acoustics			
-Acoustic Frequency	3.0 MHz		
-(2) Along Axis Beams	25° off vertical axis, along axis of channel		
-(2) Skew Beams	~~60° off vertical and 60° off center axis of channel (Standard/Plus),~~ 37° off vertical and 45° off center axis of channel (Pipe)		
Communications	RS232, SDI-12, Modbus, Analog (via optional Flow Display)		
Data Storage	4 GB (approximately 1 year)		
Operating/Storage Temperature	-5 to 60° C (23 - 140° F)		
Temperature Sensor	Accuracy ± 0.2° C; Resolution ± 0.01° C		
Tilt Sensor	Accuracy ± 1.0°		
SmartPulse[HD]	Yes		
Power			
-Input	9-15 VDC		
-Consumption	0.5 – 1.0 W (0.02 when idle)		

[1]For use in pressurized pipes. Housing rated to 42 psi.

xylem
Let's Solve Water

Founded in 1992 and advancing environmental science globally, SonTek manufactures acoustic Doppler instrumentation for water velocity measurement in oceans, rivers, lakes, harbors, canals, estuaries, industrial pipes and laboratories. SonTek's sophisticated and proprietary technology serves as the foundation for some of the industry's most trusted flow data collection systems. SonTek is headquartered in San Diego, California, and is a brand of Xylem Inc.

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SonTek-IQ® Series
Intelligent Flow
Featuring
SmartPulse^{HD}
User's Manual

Firmware Version 2.1
Software Version 2.1

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P/N 45-0068 Rev J

WARRANTY, TERMS, AND CONDITIONS

Thank you for purchasing the SonTek-IQ Intelligent Flow meter. The instrument was thoroughly tested at the factory and found to be in excellent working condition. If the shipping crate appears damaged, or if the system is not operating properly, please contact SonTek immediately.

This system is covered under a two year limited warranty that extends to all parts and labor for any malfunction due to workmanship or errors in the manufacturing process. The warranty is valid only if you properly maintain and operate this system under normal use as outlined in the User's Manual. The warranty does not cover shortcomings that are due to the design, or any incidental damages as a result of errors in the measurements.

SonTek will repair and/or replace, at its sole option, any product established to be defective with a product of like type. CLAIMS FOR LABOR COSTS AND/OR OTHER CHARGES RESULTING FROM THE USE OF SonTek GOODS AND/OR PRODUCTS ARE NOT COVERED BY THIS LIMITED WARRANTY.

SonTek DISCLAIMS ALL EXPRESS WARRANTIES OTHER THAN THOSE CONTAINED ABOVE AND ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE. SonTek DISCLAIMS AND WILL NOT BE LIABLE, UNDER ANY CIRCUMSTANCE, IN CONTRACT, TORT OR WARRANTY, FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND, INCLUDING BUT NOT LIMITED TO LOST PROFITS, BUSINESS INTERRUPTION LOSSES, LOSS OF GOODWILL, OR LOSS OF BUSINESS OR CUSTOMER RELATIONSHIPS.

If your system is not functioning properly, first try to identify the source of the problem. If additional support is required, we encourage you to contact us immediately. We will work to resolve the problem as quickly as possible.

If the system needs to be returned to the factory, please contact SonTek to obtain a Service Request (SR) number. We reserve the right to refuse receipt of shipments without SRs. We require the system to be shipped back in the original shipping container using the original packing material with all delivery costs covered by the customer (including all taxes and duties). If the system is returned without appropriate packing, the customer will be required to cover the cost of a new packaging crate and material.

The warranty for repairs performed at an authorized SonTek Service Center is one year.

CONTACT INFORMATION

Any questions, concerns, or suggestions can be directed to SonTek by telephone, fax, or email. Office hours are 7:30 a.m. to 4:30 p.m., Pacific Time, Monday through Friday. After-hours Technical Support is available for emergencies in the field at the phone number below.

Phone : (858) 546-8327

Fax : (858) 546-8150

Email : inquiry@sontek.com (General information)

sales@sontek.com (Sales information)

support@sontek.com (After-Sales Support information)

Web : http://www.sontek.com

See our web site for information concerning new products and software/firmware upgrades.

RECORD OF CHANGES

Date	Version	Changes
September 15, 2011	45-0068 Rev A	Original Engineering Release
November 4, 2011	45-0068 Rev B	Additions and updates
January 31, 2012	45-0068 Rev C	Additions for IQ Flow Display, System Status, CE Certification, Assorted Editing.
October 02, 2012	45-0068 Rev D	Pre-release
October 03, 2012	45-0068 Rev E	Addition of IQ-Pipe system to SonTek-IQ Series
June 24, 2013	45-0068 Rev F	Software/Firmware v1.60 Release
April 15, 2015	45-0068 Rev G	All stainless steel hardware and non-ATEX/IS
July 1, 2015	45-0068 Rev H	Software/Firmware v2.00 Release
August 31, 2016	45-0068 Rev J	Software/Firmware v2.1 Release

Declaration of Conformity

Manufacturer's Name: SonTek – a Xylem brand
Manufacturer's Address: 9940 Summers Ridge Road
San Diego, CA 92121-3091 U.S.A.

SonTek - a xylem brand, declares that the product(s):

Equipment Type: Flow Meter

Model: SonTek-IQ

Product Name: SonTek-IQ, SonTek-IQ Plus, SonTek-IQ Pipe

Conforms to the following European Union Council Directives and Standards as of 10/11/11:

EMC DIRECTIVE 2004/108/EC:

-IEC/EN 61326-1: 2006, GROUP 1, CLASS A
-CISPR 11: 2009, Class "A"
-IEC 61000-4-2: 2008
-IEC 61000-4-3: 2006
-IEC 61000-4-4: 2004
-IEC 61000-4-5: 2005
-IEC 61000-4-6: 2008
-IEC 61000-4-11: 2004

Hakan Erdem
General Manager
SonTek – a Xylem brand

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Section 1. Getting Started: Operational Overview

Thank you for purchasing a SonTek-IQ Series product. This instrument is an Intelligent Flow measurement device with many new automated features designed to help you get the best flow data possible. We have spent years researching and developing this new platform. It is a small but powerful acoustic system with a host of features to make measuring flow fun and easy. Please take some time to read this manual before connecting with your IQ or installing it in the field. We hope you enjoy many years of high quality data from your new IQ.

1.1. System Components

Figure 1 is an inventory of the IQ and accessories that should have arrived from the factory. Please take a few minutes to make sure that all of the components are included.

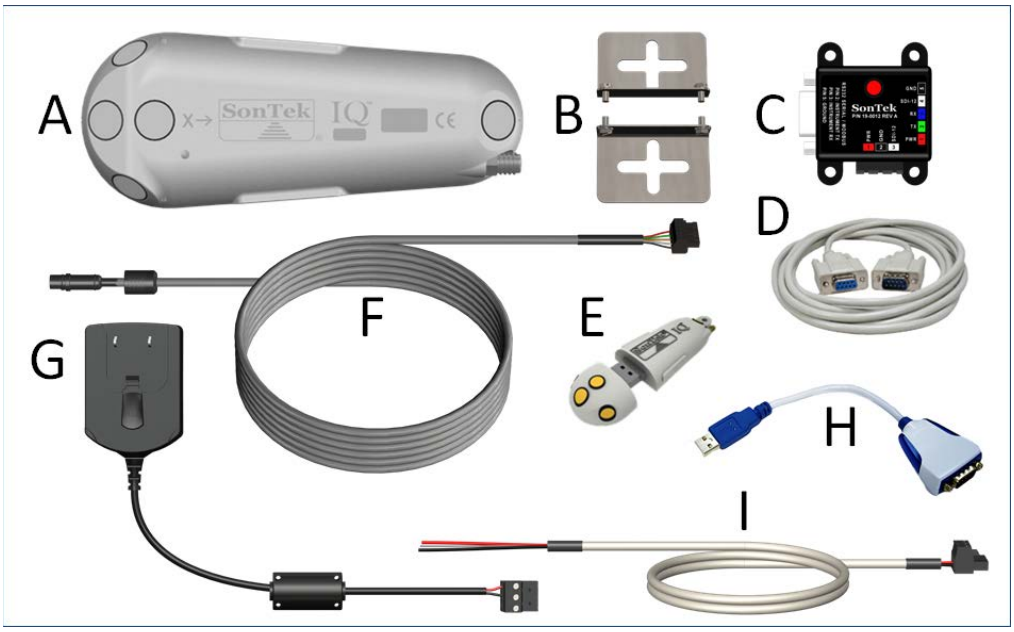


Figure 1. IQ shipping box and contents

There are three SonTek-IQ products available: The **IQ Standard,** the **IQ Plus**, and the **IQ Pipe.** Both the Standard and Plus models are physically identical and are shipped with the same components. The difference between versions is in the number of measurement options and data parameters available. The IQ Standard is more economical, while the IQ Plus provides a greater level of detail in the flow and velocity measurements. The **SonTek-IQ Pipe** is slightly different in shape from the SonTek-IQ Standard and SonTek-IQ Plus, as it is slightly taller and narrower than the SonTek-IQ. In either case, Item A represents the flow meter shipped from the factory. All other standard items shipped are the same. The SonTek-IQ Pipe has an option for a ring mount for when other mounting options are not available. This does not apply to the SonTek-IQ or IQ Plus. In addition, the SonTek-IQ and SonTek-IQ Plus have an option for a riser mount that does not apply to the SonTek-IQ Pipe.

Itemized list of IQ components

Item	Item
A	SonTek-IQ or SonTek-IQ Pipe
B	Mounting Brackets (2) with screws
C	Cable adaptor
D	RS232 cable (6-ft/1.8-m)
E	IQ USB Thumb Drive
F	IQ Power/Communications Cable
G	AC Power Supply
H	USB to Serial adaptor
I	Battery hookup cable

Item A: SonTek-IQ – A multi-beam acoustic flow meter with five 3.0 MHz transducers (Figure 2). Redundant water level data are recorded from the vertical beam and pressure sensor. Data download and communication are available via **RS232**, **Modbus**, or **SDI-12**. The system is designed to be mounted in the bottom of a channel or culvert for the SonTek-IQ and SonTek-IQ Plus. For pipes and closed conduits the SonTek-IQ Pipe should be used (Figure 3). All three instruments measure water level, flow, velocity, and temperature. Flow rates and total flow volume are computed internally based upon a user-supplied survey of the channel shape and instrument location.

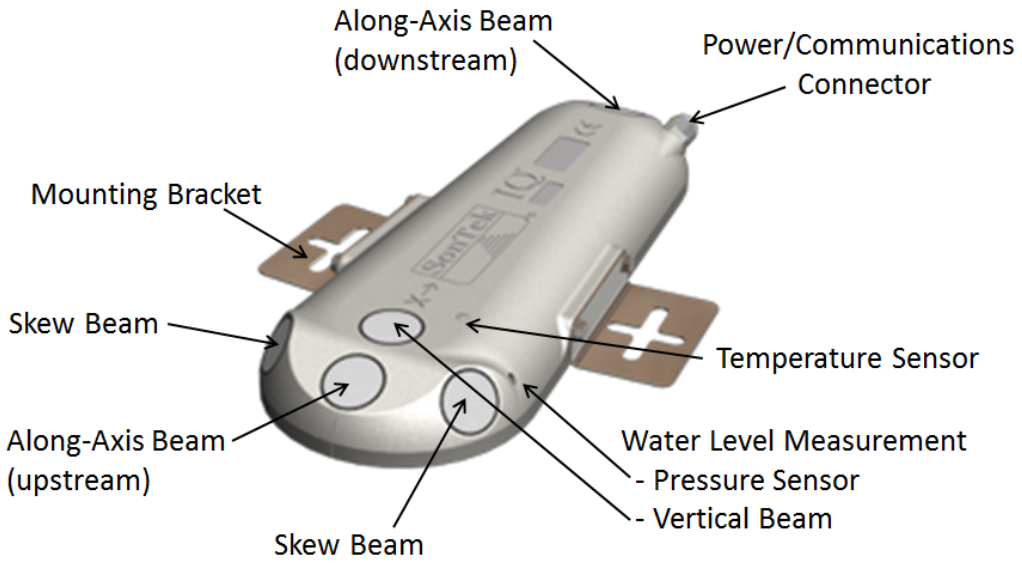


Figure 2. SonTek-IQ Standard and IQ Plus attributes

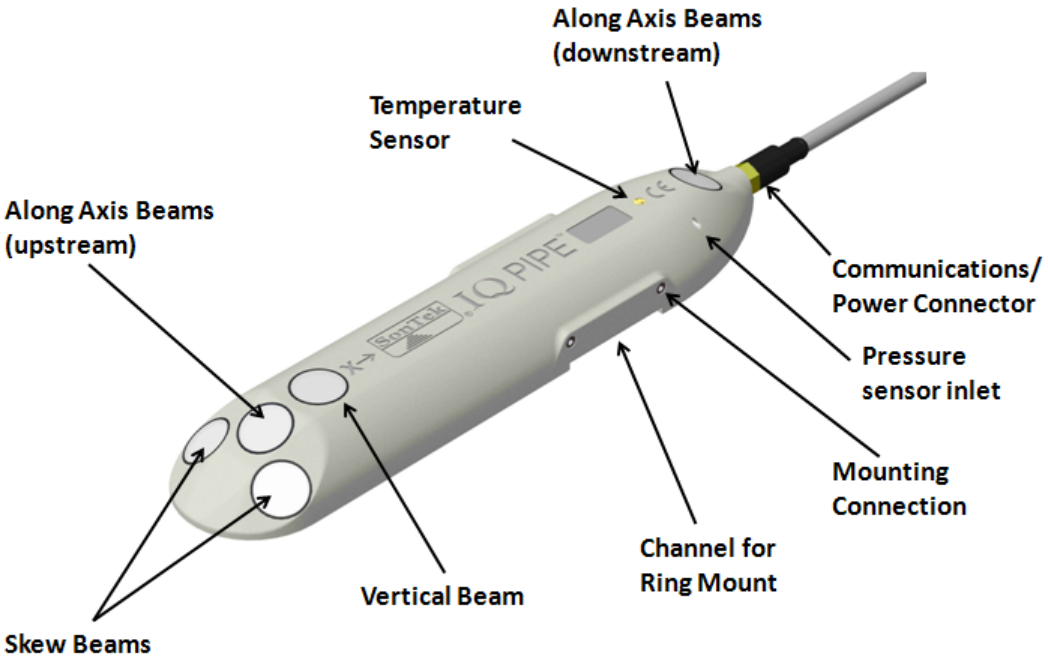


Figure 3. SonTek-IQ Pipe attributes

Item B: Mounting brackets – Attach the mounting brackets to the side of the SonTek-IQ or SonTek-IQ Pipe with four mounting screws (flat-head screwdriver or 1/4" socket driver) for easy installation in the bottom of a channel. Mounting bracket slots are 12.7 cm (5 in.) apart. These slots allow for orienting the x-axis of the IQ parallel to the flow. In Figure 4, the flow would be moving from left to right.

Figure 4. IQ mounting brackets

***Note:** The same mounting brackets are used on the SonTek-IQ as the SonTek-IQ Pipe. Only use the mounting bracket inserts on the sides of the IQ. DO NOT MOUNT USING THE INSERTS ON THE BOTTOM OF THE IQ.

Item C: IQ Cable Adaptor – Provides easy and convenient input for a 9-15 VDC power source and system communications. **RS-232**, **Modbus**, and **SDI-12** connections provide a simple solution for integrating an IQ with a datalogger, Programmable Logic Controller (PLC), or Remote Terminal Unit (RTU). A Red LED lights up on the adaptor when the instrument is receiving power (Figure 5).

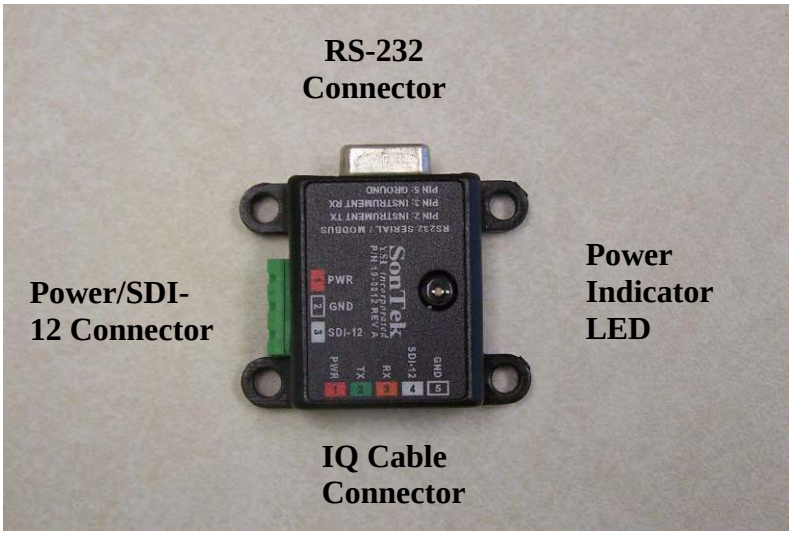


Figure 5. IQ cable adaptor

Item D: RS232 cable – Connects the IQ cable adaptor with a computer, laptop, datalogger, RTU, or PLC.

Item E: USB Thumb Drive / memory stick – Provides IQ software installation files, USB drivers and user documentation.

Item F: IQ Power and Communications Cable – Standard cable length is 10 m. The 5-pin connector is keyed for connection to the SonTek-IQ and IQ cable adaptor (Figure 6).

Figure 6. IQ power and communication cable

Important note: The IQ Connector is waterproof once it is plugged in, but **this connection is NOT wet-mateable and should NOT be done underwater**. To avoid damaging the system, please connect the IQ connector to the IQ in the dry air before submerging. The cable adaptor connector on the other end of the cable should never get wet. This end of the cable should be enclosed and protected from the rain and weather. The cable adaptor connector can be removed to facilitate passing the IQ cable through a small conduit or pipe. The wire leads are color coded to the terminal connections on the cable adaptor (see Figure 5).

Item G: AC Power Supply – Provides users a quick and easy way to provide 12 V DC power to the IQ. Simply plug the 3-pin connector into the IQ cable adaptor and the other end into an outlet. The AC power adaptor comes with four slide-on adaptors for various AC power sources used around the world (Figure 7).

Figure 7. IQ Power supply with international adaptors

Item H: SonTek supplied USB to Serial adapter (Shown in Figure 18) **–** Recommended for the fastest, most reliable communication. Download and run the driver as a Setup Executable from the Comments section of the table here: **http://www.ftdichip.com/Drivers/D2XX.htm**

Item I: Spare power connector/battery hookup cable (not pictured) **–** A 3-pin connector and 1.5 m (5-ft) of cable for easy battery connection to the IQ cable adaptor (Figure 5). Input voltage levels are 9-15 VDC. Power (red) and ground (black) wires are provided with a third pin available to bring in SDI-12 communications.

Other items included with SonTek-IQ products not shown in the inventory are the tool kit and a laminated Quick Start Guide.

Optional Item: IQ Flow Display – Allows users to view data collected by the SonTek-IQ without the need of connecting to a laptop. The flow display (Figure 8) essentially replaces the cable adaptor and provides an option for four channels of 4-20 mA analog outputs. In addition, the Flow Display has status indicator lights for power, IQ, Modbus communications and errors.

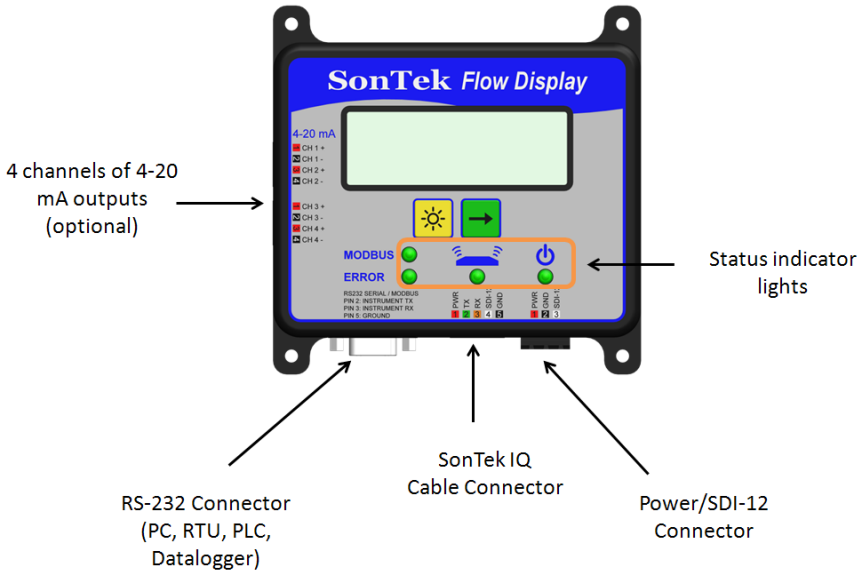


Figure 8. Optional SonTek Flow Display

Optional Item: IQ Riser Mount – Users who will be installing the IQ in soft bed channels or canals with sand or mud sediments should consider ordering the optional IQ Riser Mount to prevent burial. The riser mount elevates the IQ by one inch (2.5 cm) and allows material to pass underneath. It has the same slot pattern and spacing as the standard mounting brackets (Figure 9).

***Note: DO NOT MOUNT USING THE INSERTS ON THE BOTTOM OF THE IQ**

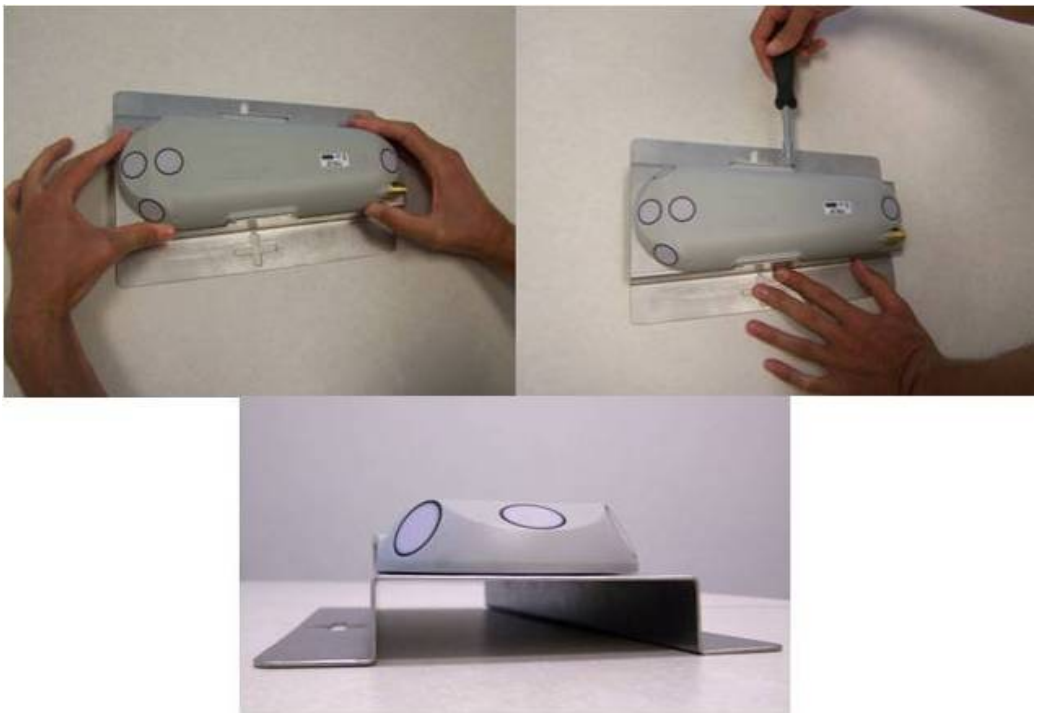


Figure 9. Optional IQ riser mount

Optional Item: SonTek-IQ Pipe Ring Mount – For the SonTek-IQ Pipe only, SonTek offers a Pipe Ring that can be used to mount systems inside of a pipe. The Ring consists of a metal band and a "Scissor Jack" that stretches the ring, and locks it in place inside the pipe. To use the Pipe Ring:

- Start by removing the two nuts and screws from the Scissor Jack to release the two arms (Figure 10).

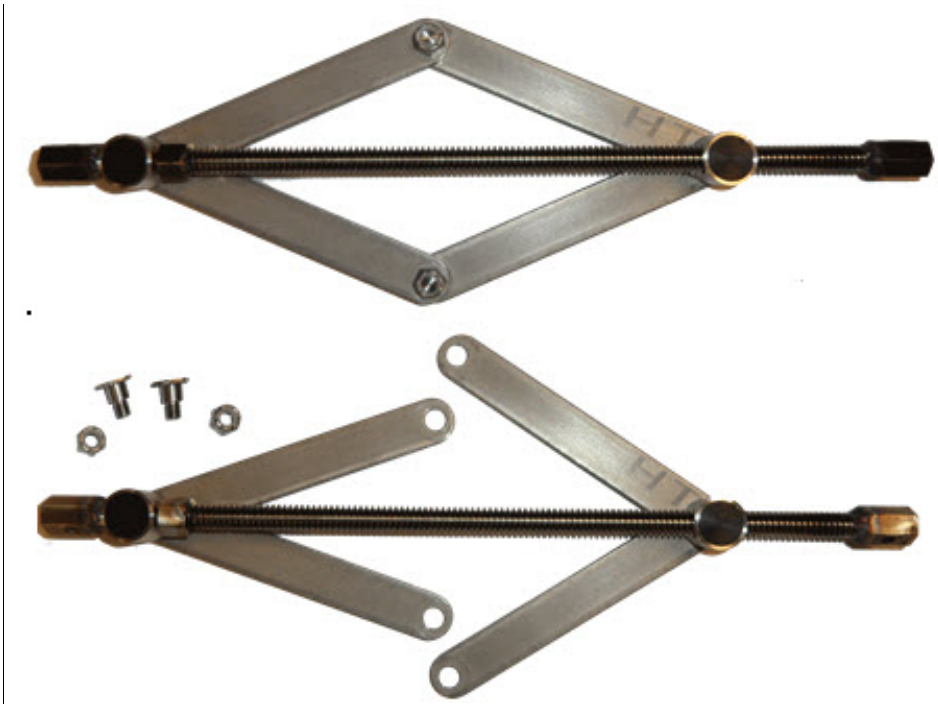


Figure 10. Opening the Scissor Jack

- Attach one side of the Scissor Jack arms through the hole at the end of the Pipe Ring with the double slots (Figure 11).

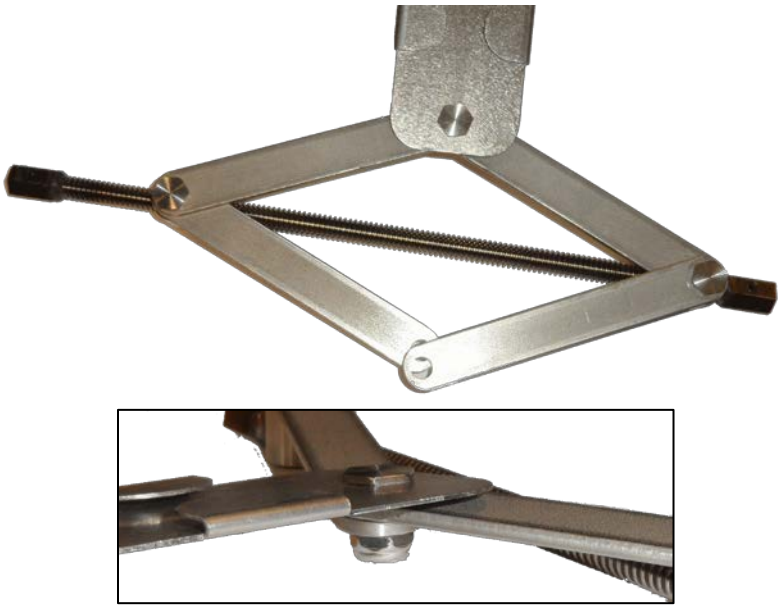


Figure 11. Attaching the Scissor Jack to the SonTek Pipe Ring and close up of the the screw/nut holding the two pieces together

- Insert the opposite side of the Pipe Ring through the double slots. Align the hole of the desired pipe diameter (see printed on the ring) with the Scissor Jack arms, and secure the Scissor Jack arms to the Pipe Ring with the remaining nut and screw (Figure 12).

Figure 12 . Pipe Ring with Scissor Jack. Align arms with desired pipe diameter and secure with the provided screw/nut.

- Using the two mounting brackets attached to the Pipe Ring, attach the SonTek-IQ Pipe using the provided screws (Figure 13).

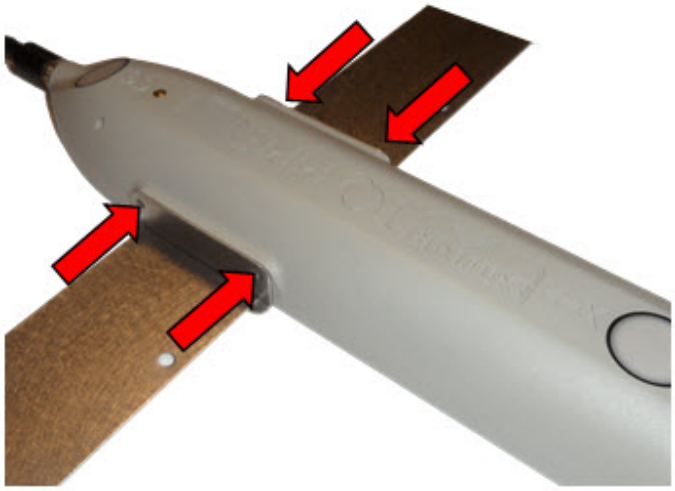


Figure 13. Slide the brackets to the desired location and attach the SonTek-IQ Pipe with the four provided screws (red arrows).

- Once assembled, slide the Pipe Ring inside of the pipe and rotate the Scissor Jack to expand the ring so that it is tight inside the pipe. The Pipe Ring must not move or vibrate when properly tightened (Figure 14).

Figure 14 . SonTek Pipe Ring insatalled in a pipe with the SonTek-IQ Pipe system

IMPORTANT:

1. For FULL pipe applications, the scissor jack must NOT be installed directly opposite of the IQ Pipe; otherwise, the jack will interfere with the acoustic vertical beam.
2. The system is typically installed with the cable pointed downstream. An arrow indicating positive (downstream) flow direction is printed on the top to the instrument. See Section 5.3.4 for details. It can be installed with the cable upstream, provided that you check the box next to Reverse Flow in the software.

1.2. Interconnecting the System

Connect the cable to the IQ while in the air.

- Insert the keyed cable connector into the underwater connector on the downstream end of the IQ (this must be done in a dry environment) as seen in Figure 15.
- Tighten the locking sleeve on the cable connector by rotating clockwise until finger tight.

Figure 15. Connecting to IQ to the power and communications cable

***Note:** The same procedure and hardware are used to fix the brackets on the SonTek-IQ Pipe for mounting directly to a closed conduit or pipe.

Next, connect the five-pin terminal connector to the cable adaptor (Figure 16). Be sure that all wires are tightly connected to the five pin terminal connector to ensure proper communication with the IQ. If the terminal connection needs to be removed to pass the communication cable through a conduit or other device, the cable wires are color coded to match the labels on the cable adaptor or Flow Display.

In cases where the Flow Display is used, the same connections are used; the display replaces the cable adaptor and allows users to view data collected in the field without a laptop.

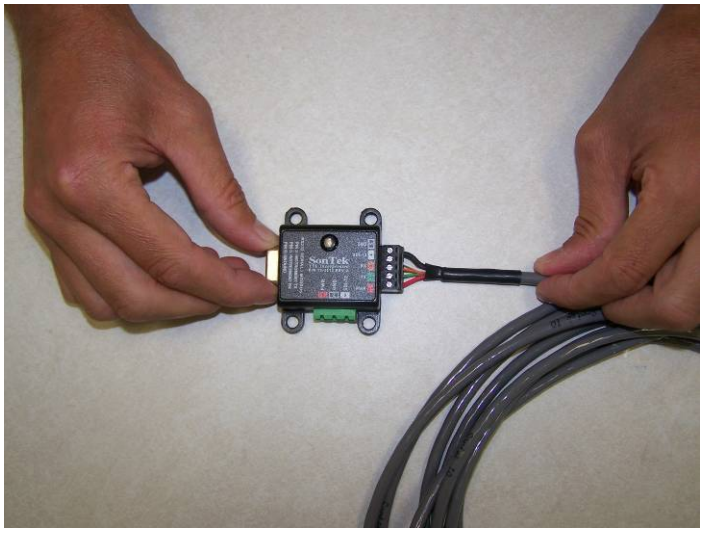


Figure 16. Connecting the IQ to the cable adaptor

Connect the three-pin power connector from the power supply to the cable adaptor (Figure 17).

- The red LED on the cable adaptor will indicate when the system is receiving power.
- This connector has terminal inputs for positive, ground and SDI-12 communications.

Figure 17. Connecting the power supply to the cable adaptor

Lastly, connect the USB to Serial adaptor to the computer.

- Connect the serial (RS232) connector to the cable adaptor and the USB connector to the computer.

- If your computer has a built in serial port, we do not recommend using this port as it may not be reliable at the high data rates used by the IQ. We recommend using the USB to serial converter included with the system (Figure 18).

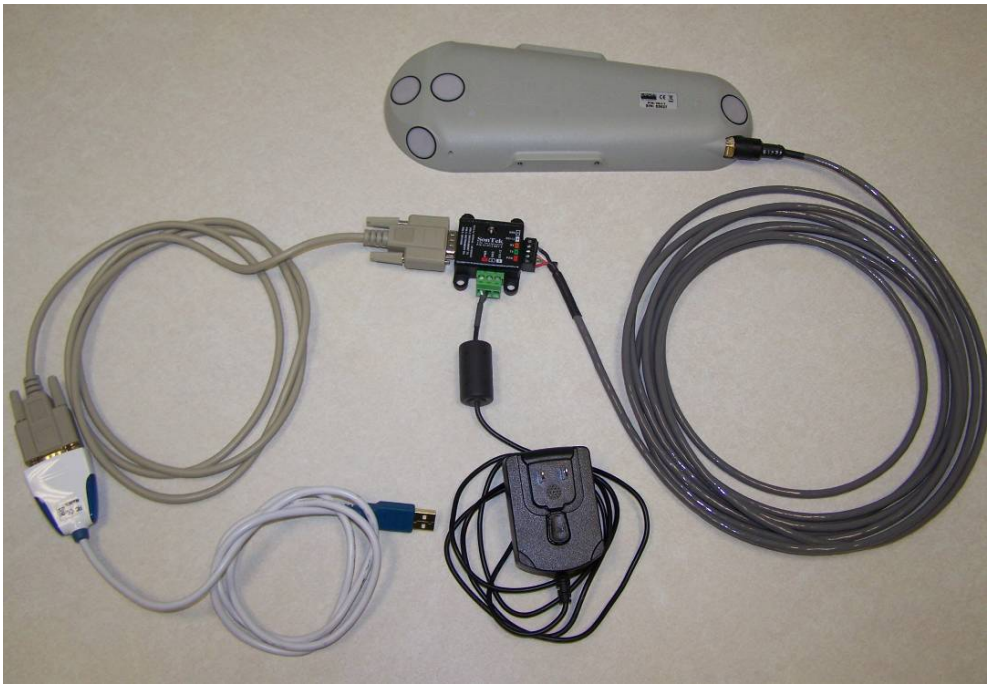


Figure 18. Connecting the USB-Serial adaptor to cable adaptor

***Note:** The same connections are used for the SonTek-IQ Pipe.

In cases where the flow display is used in place of the cable adaptor, the connections should be as presented below (Figure 19).

Figure 19. Flow Display interconnection when replacing the cable adaptor

1.3. Installing the IQ Software

The IQ software is provided on the USB memory stick. To install the software, plug the USB memory stick into a computer or laptop. The software installation will normally start automatically; if it does not, double-click on the **Setup.exe** file to start the installation process. If your computer does not have the Visual C++ 2010 Runtime Libraries, these components will be installed first (Figure 20).

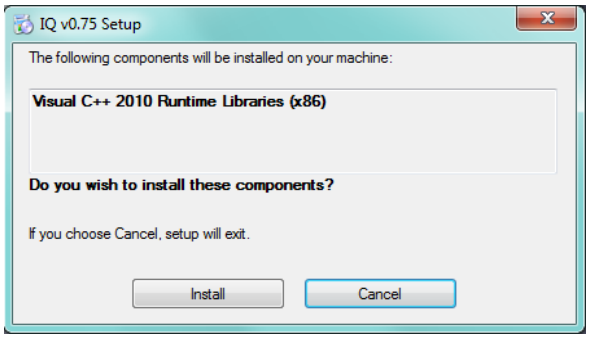


Figure 20. IQ Software setup

Select the “Install” button to continue.

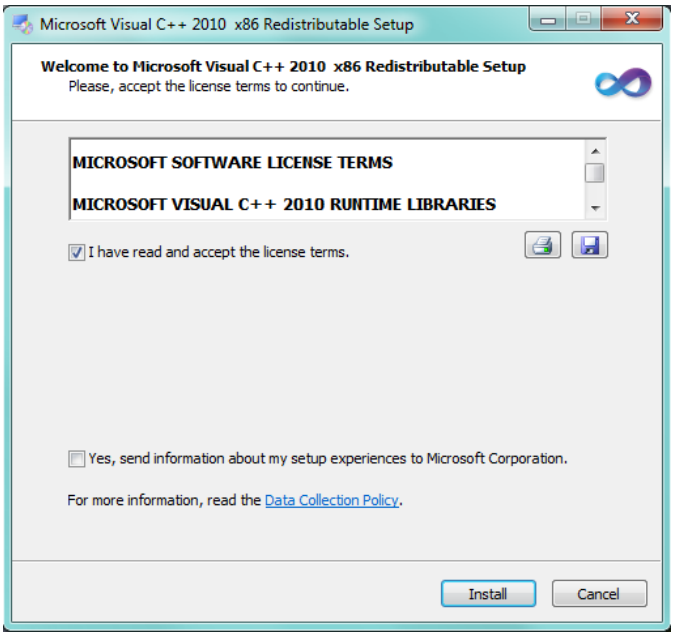


Figure 21. IQ Software – License Agreement

After reading the Software License Terms, check the box next to “I have read and accept the license terms” and select the “Install” button to continue (Figure 21). After the Visual C++ Runtime libraries are installed, select the “Finish” button to continue (Figure 22).

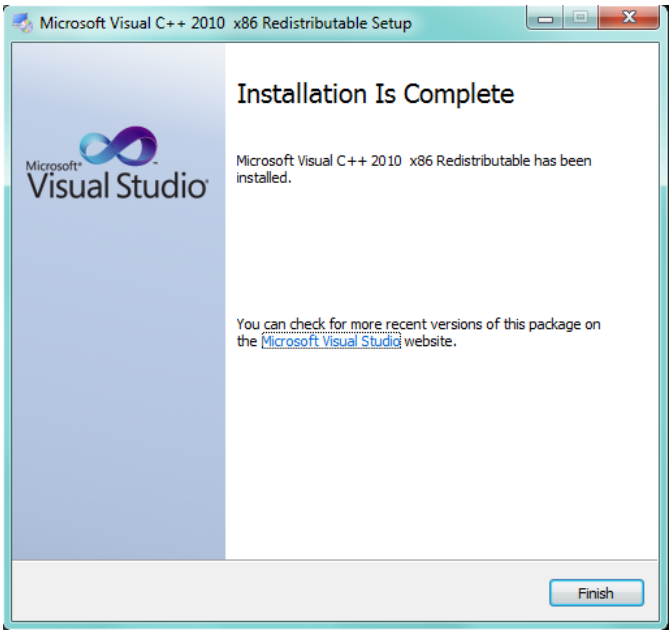


Figure 22. IQ Software setup – Finish Install

Select the "Next" button to continue with the IQ software installation (Figure 23).

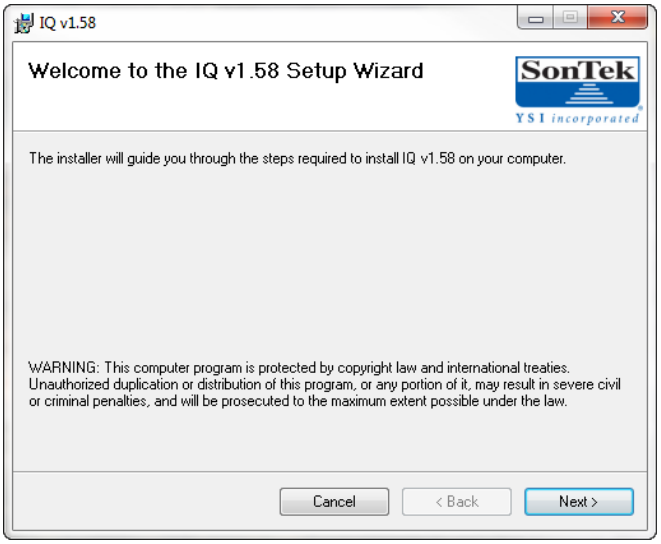


Figure 23. IQ Setup Wizard

We recommend using the default folder as the installation directory in this window (Figure 24). Also, if more than one user account will need access to the IQ software, please select the **Everyone** option. Select the **Next** button to continue.

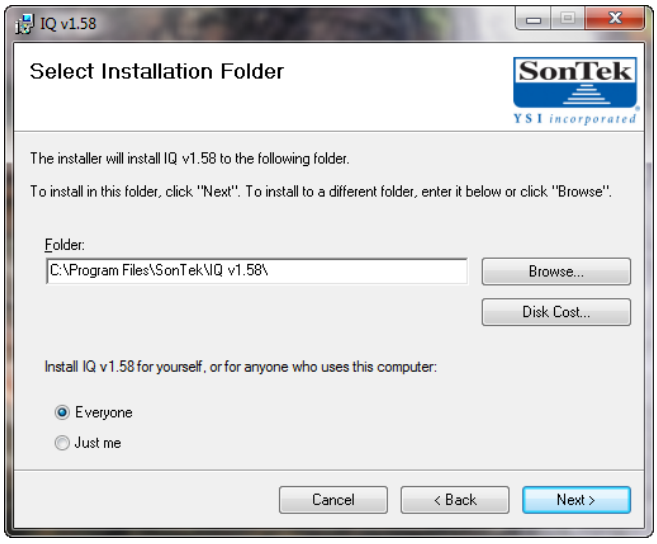


Figure 24. IQ Software setup – Data Folder

After a successful installation, **Close** the dialog window and use Windows Update to check for new Microsoft updates that may be required by the IQ software (Figure 25).

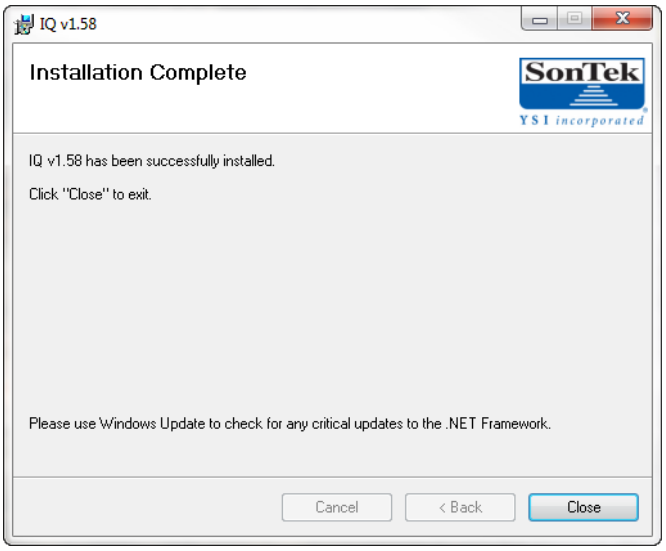


Figure 25. IQ Software setup – Installation Complete

A desktop shortcut icon will appear on your computer when installation is complete. Double-click this icon with the mouse to begin using the IQ software (Figure 26).

Figure 26. IQ Software desktop shortcut

Once the IQ software starts, you can connect to an IQ, plan a deployment, view data, or perform one of many functions discussed in the following sections (Figure 27).

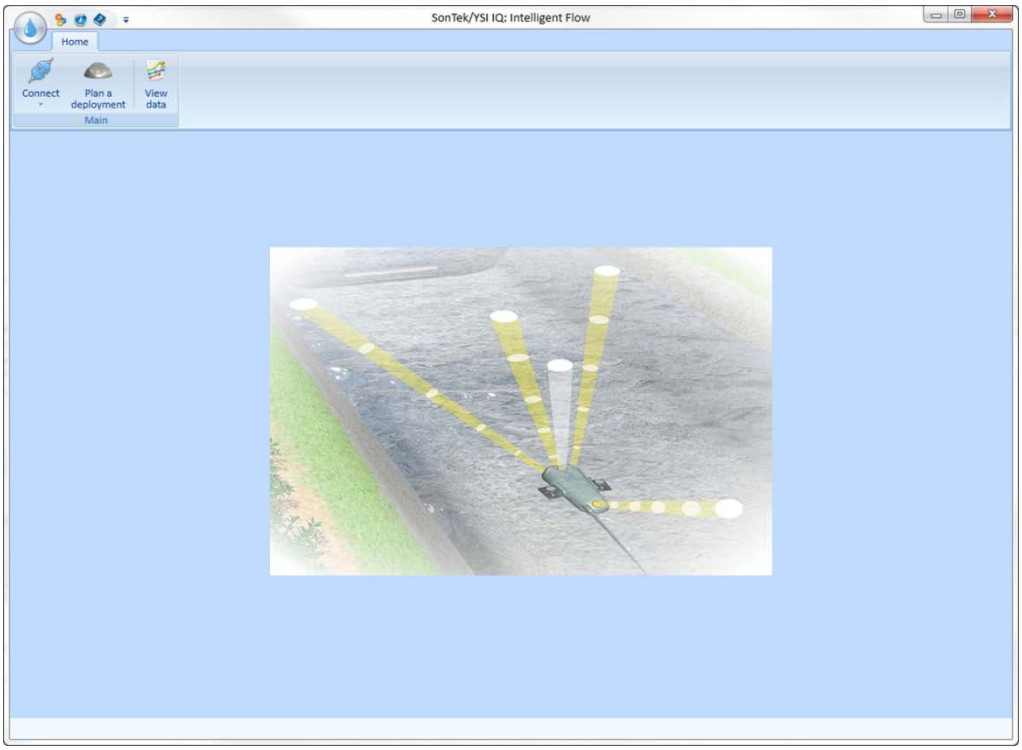


Figure 27. IQ Software Main Window

Section 2. IQ Software Overview

This section is designed as an overview of the features and functions of the IQ software. This software is primarily used to configure the IQ for flow measurements and to view the data collected. There are a number of settings and parameters that you will need to become familiar with before installing the IQ in the field.

2.1. Using the IQ Software

The IQ Software operates like most Microsoft Windows applications. Users can navigate to menus and select items using the mouse or a laptop mouse pad. Text appearing in blue anywhere within the software will typically have a help hyperlink associated with it. When hovering over the text with the mouse, it will turn from blue to red if a hyperlink is available. Left-click on the text with the mouse to display the help hyperlink (Figure 28).

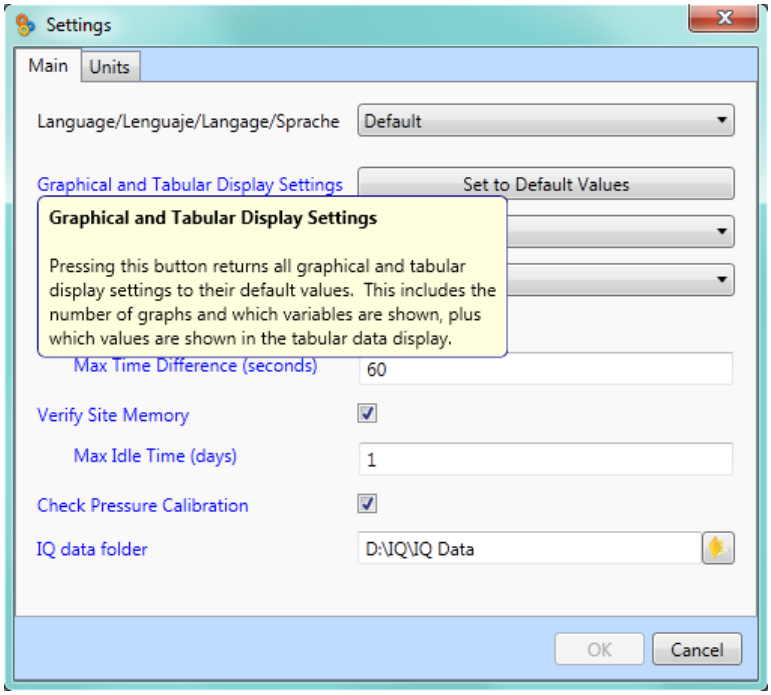


Figure 28. Help Hyperlink

Some of the icons in the software will automatically open a small help pop-up window when the mouse hovers over them (Figure 29).

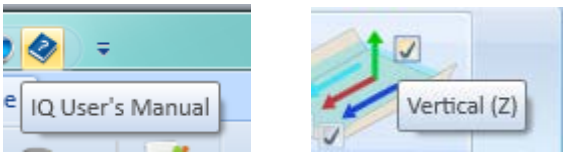


Figure 29. Help pop-up windows

Descriptions and instructions for using the software and changing settings are presented in the following sections.

2.2. IQ Software Main Window

Looking at the upper left corner of the main software window, you will see several icons in the title bar and a few more large icons with text in the main Ribbon. The title bar icons are always the same and are always accessible from any location in the software. The number of functions on the Main Ribbon will change to provide more or lessfunctions related to the current operation (Figure 30). We will first discuss the functions of the title bar icons before moving on to the details of the Main Ribbon.

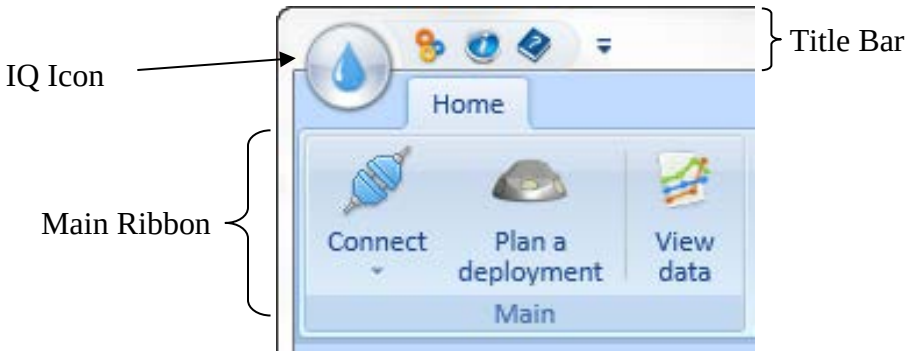


Figure 30. Title Bar and Main Ribbon Locations

2.2.1. Title Bar Quick Links

It is not necessary to connect to the instrument to view the software items discussed in this section. We begin with the general IQ software settings, version information, and documentation found in the title bar (Figure 31).

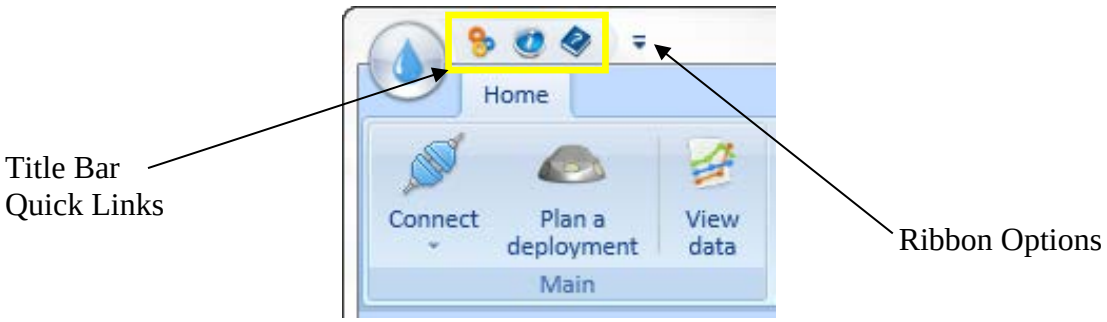


Figure 31. Quick links to settings, information, and documentation

Settings – provides a direct link to the IQ Software Settings window.

About IQ – provides information about the software version as well as contact information for SonTek Support.

Documentation – provides a direct link to the SonTek-IQ User's Manual in PDF format

Ribbon Options – This menu has two functions: Locate the Quick Links below the Main Ribbon and minimize the Main Ribbon. These functions can be helpful when working on a small computer screen. You can also minimize the Main Ribbon by double clicking on the Home tab. Double click the Home tab again to maximize the Main Ribbon.

2.3. IQ Software General Settings

To view the IQ software **Settings**, select the settings quick link icon or navigate to the settings menu from the IQ Icon. The IQ software settings window has two navigation tabs at the top of the window as seen in Figure 32. The Main tab has a variety of software and system parameters. The Units tab sets the displayed units for all of the graphical and tabulated data.

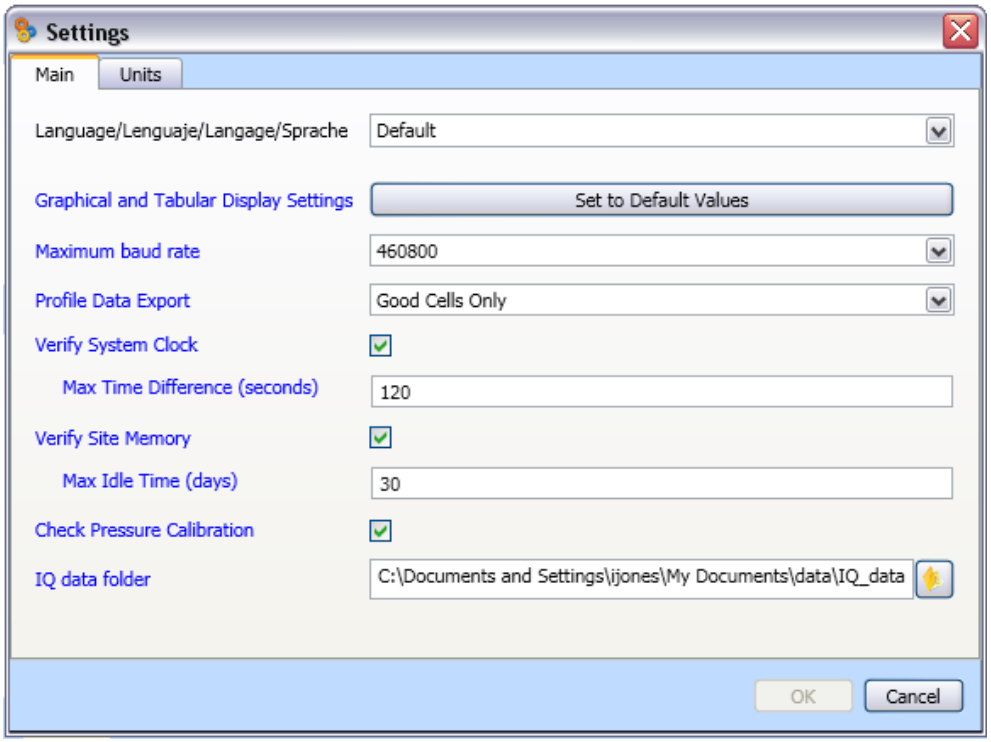


Figure 32. IQ Software Main Settings

IQ Settings – Main Tab

Language: The IQ supports multiple languages. The language displayed in the IQ software is selected here from the top pull-down menu.

Set to Default Values: Select this button to reset all graphical and tabular displays in the data analysis windows to their default values. This will reset the number of graphs and the variables displayed.

Maximum Baud Rate: Defines the maximum baud rate for communications with the instrument (default is 460800). Long cable runs or noisy environments may require slower baud rates for effective communication with the IQ. This setting does not affect Modbus communications; it affects only communications between the IQ and the IQ software.

Profile Data Export: The range of the IQ is predefined at the factory. If the IQ is deployed at a water depth that is less than the system range, some of the measured velocity cells will be located above the existing water surface or past the sides of the channel. To export only those cells located below the water surface and within the channel, use the “Good Cells Only” setting. To export all cells from the measured profile regardless of their location relative to the water surface, select “All Cells”.

Verify the System Clock: A checkbox that tells the IQ software to compare the IQ clock to the PC clock upon each connection.

Max Time Difference (seconds): This field allows you to define the maximum difference between the IQ clock and the PC clock. If the period is greater than the user-defined interval, you will be prompted to reset the IQ clock to match the computer time or you can input a time.

Verify Site Memory: This checkbox enables/disables several intelligent functions related to the Site Memory. Site Memory is an internal function that assesses the flow in the channel over time to develop a channel history. This history helps to improve the flow measurements as time passes. Initially, it takes about 5 to 30 minutes to develop a good Site Memory. If the "Verify Site Memory" parameter is enabled, the software will prompt you to reset the Site Memory when the IQ determines that flow in the channel has changed significantly based on the recent Site Memory.

Max Idle Time (days): If the IQ has not collected data for a period greater than this value, the software will prompt you to see if they want to reset Site Memory. You should only reset the Site Memory if conditions in the channel have changed significantly.

Check Pressure Calibration: This checkbox automatically tells the software to check to see if the pressure sensor has been recently calibrated to account for changes in atmospheric pressure. If this option is unchecked and if the pressure sensor has not been calibrated for more than one day, you will be prompted to do so the next time communication with the IQ is established. Because the IQ can measure water depth acoustically with the vertical beam, this data can be used to perform regular calibrations of the pressure sensor to remove atmospheric pressure changes while collecting data. It is recommended that this is enabled.

IQ data folder: The IQ stores and accesses all downloaded data from a common folder. This setting specifies the data folder location and name.

- If you are manually transferring IQ data files into the IQ data folder, place the files into a subdirectory matching the IQ file name.
- Example: Suppose the IQ data folder is **C:\IQData**, and you manually want to transfer a data file named **SampleData_20110805_120000.IQ** into your IQ data directory.
  - Create a folder **C:\IQData\SampleData**.
  - Move the data file into that folder.
  - Close and re-open the IQ software. You will now be able to view the data file from the **View Data** menu.

IQ Settings – Units Tab

The **Units** tab, presented in Figure 33, allows users to customize the displayed dimensions or units for each measured parameter. Units defined here are only used in the IQ software for graphical and tabular data. These settings are **NOT** applied to the RS-232 Serial/Modbus data output by the IQ. Units for the output data sent to the serial port must be specified in the Output Settings section on the IQ Smart Page when configuring the system. Changes to the settings in this window will require the software to restart before continuing. For convenience, two buttons are provided that will return all units settings to default Metric or default English.

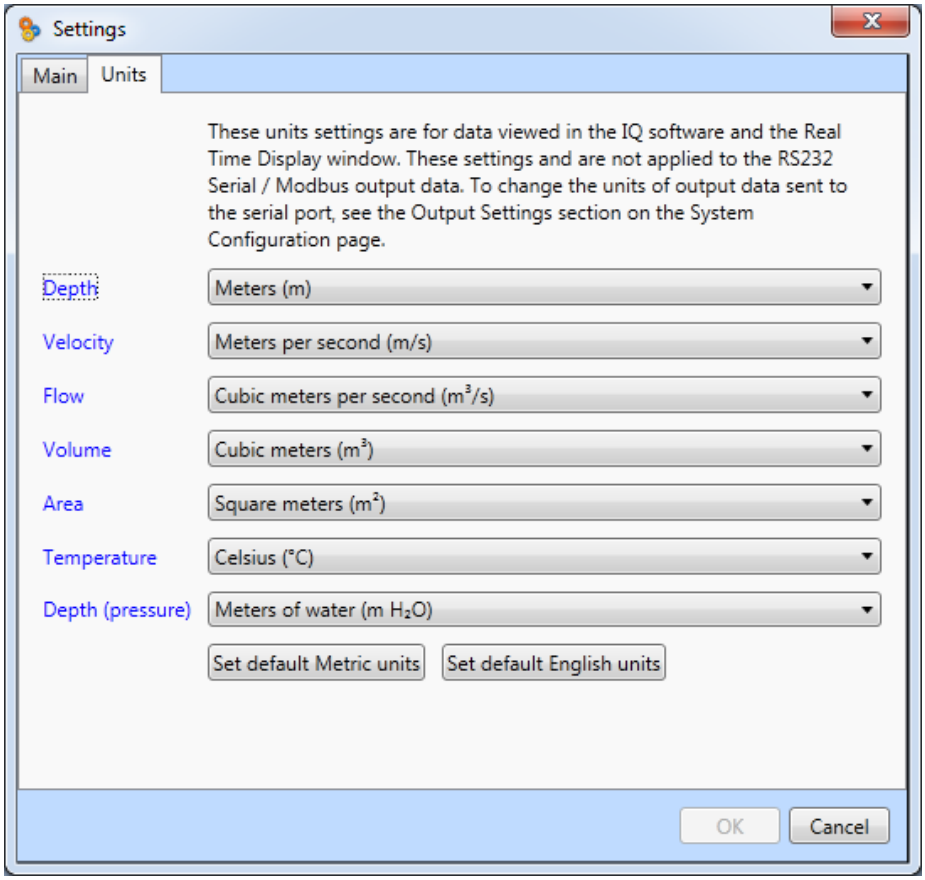


Figure 33. IQ Software Units Settings

Users can also access several functions by clicking on the IQ Icon in the software title bar (Figure 34).

Figure 34. IQ Icon

2.4. IQ Software Maintenance Functions

Users can access the maintenance functions by clicking on the IQ icon in the upper left corner of the main window and then selecting "Maintenance" (Figure 35).

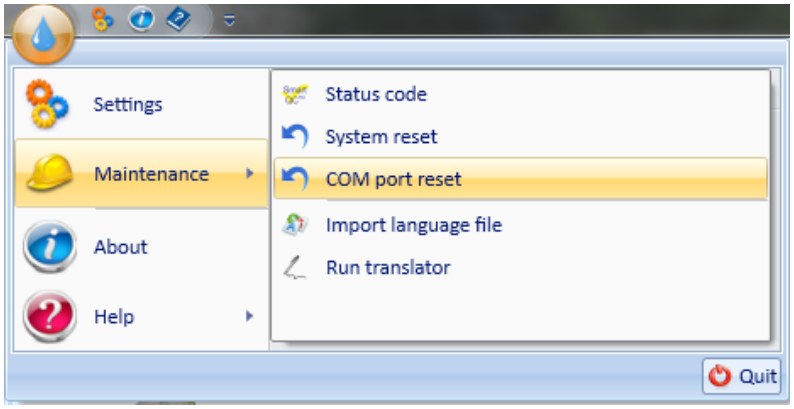


Figure 35. IQ Icon Menu and Software Maintenance Menu

- The IQ Icon menu has all of the same quick links as the title bar plus a new menu item for maintenance functions.
- The *Status code* and *System reset* functions are found in multiple locations in the IQ software.
- The *Flow Display Upgrade* is found in the maintenance menu and is used for upgrading the firmware of the Flow Display.
- The *Import language file* and *Run translator* functions are only found in the software maintenance menu.

IQ Maintenance – Status Code

The SonTek-IQ has several SmartQC™ functions designed to warn you of potential problems at a measurement site (Section 7.1). The Status Code lookup is provided for easy interpretation of any Status Code reported by the IQ, an example is provided in Figure 36.

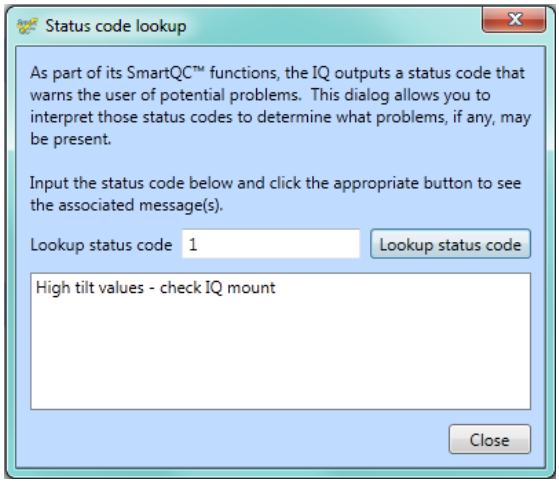
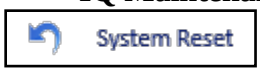


Figure 36. Status Code Lookup

IQ Maintenance – System Reset



The system reset function can be used if communication with the IQ cannot be established or if the system stops responding. This function forces the IQ baud rate to the default setting and interrupts data sampling. If the IQ still does not respond after a system reset, check all cable connections and make sure that the system is getting power (red LED on cable adapter is on).

IQ Maintenance – Flow Display Upgrade

This menu item is only available when **not** connected to an IQ Product. Periodically, upgrades may be available for the firmware inside the IQ Flow Display. This option allows users to upgrade the flow display firmware. The software provides detailed on-screen instructions for the upgrade; a brief summary is below.

- Save the new flow display firmware file, provided by SonTek, to your PC.
- From the maintenance menu, select the **Flow Display Upgrade** option.
- Disconnect the IQ from the flow display; connect the flow display to your PC. Disconnect power to the flow display and wait 5 seconds.
- While holding both flow display keys down, connect power to the display – this places the display in upgrade mode. Click OK on your PC to start the upgrade.
- Follow on-screen instructions once the upgrade is complete.

IQ Maintenance – COM Port Reset

This option is available for users to specify a COM port by number. This function will attempt a System Reset and connect to the specified COM port. The COM port number can be confirmed in the Device Manager from the PC Control Panel. This function is accessed through the main IQ Icon at the top left corner of the software window. Select “Maintenance” and then “COM port reset”. This will activate a small window to enter the COM port number. The software will attempt to connect and report whether the connection was successful.

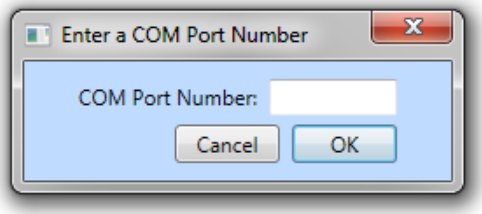


Figure 37. Enter a COM Port Number

IQ Maintenance – Import Language File

The IQ software was designed to support multiple languages. Language files can be edited and distributed by users. If you receive a language file from SonTek support or from a known and trusted source, use this function to import the file. Once the file is

imported, navigate to Settings> Main>Language, to select the new language file from the Language Menu.

IQ Maintenance – Run Translator

Run the IQ software translator to create your own custom translations (Figure 38). This function opens a separate window with a spreadsheet containing all of the text displayed in the IQ software. The IQ software variable or "Id" is in the left column. The word or phrase that you will see displayed in the software is shown in center column. Users can enter their own translated phrase in the right hand column in any language. Saved files become available as a language option in the Settings> Main> Language menu. You are not required to translate all of the text; the original text (center column) will be used wherever the translated value is left blank.

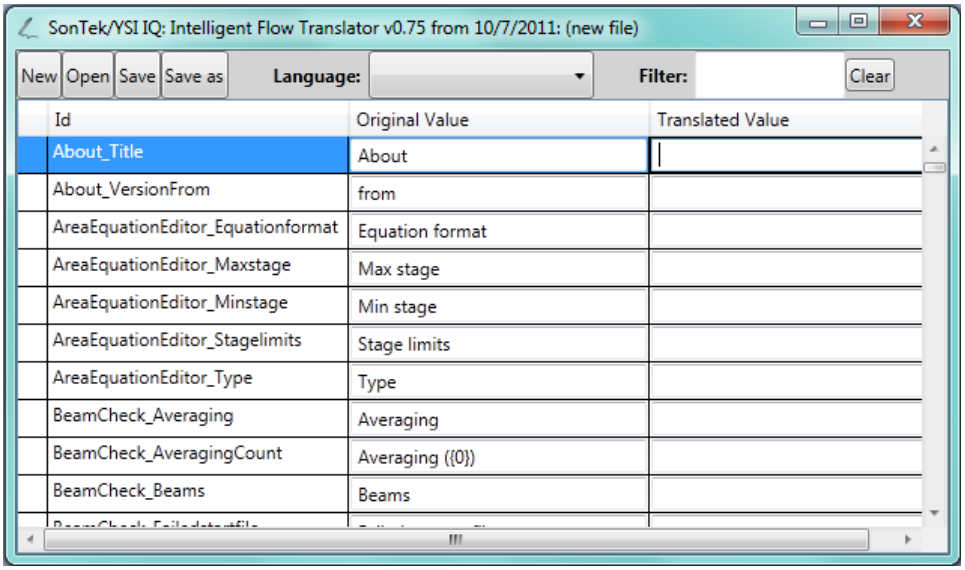


Figure 38. Language Translator

About IQ – provides information about the software version as well as contact information for SonTek Support (Figure 39).

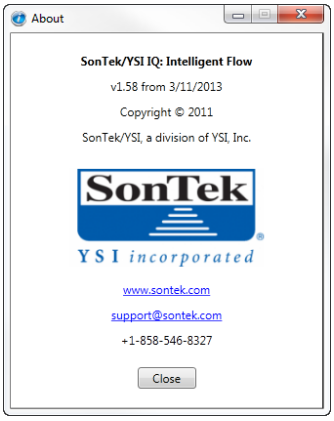


Figure 39. IQ About window

Help – Documentation

The Help menu provides links to the IQ software User's Manual. These are PDF files that can be saved and copied to a convenient location.

2.5. IQ Software Main Ribbon

The IQ software has a series of icons located in the Main Ribbon at the top of the window. The number of icons and associated functions shown here depends on the current software operation. For example, after connecting to an IQ, more icons will appear in the Main Ribbon. However, once connected, the main section of the ribbon will always display the same five functions. Afterselecting one of these main functions, more ribbon functions will appear to the right of the main ribbon section.

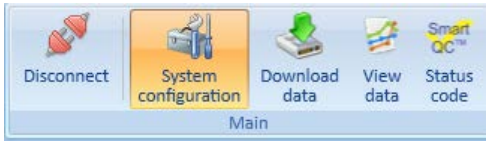
2.5.1. Main Ribbon – Not connected

Connect: Allows users to connect or open communications to the IQ.

Plan a deployment: Allows you to prepare for a future deployment by setting parameters for data collection.

View data: Opens the View data window where users can open files and visualize collected data. Details are presented in Section 6.

2.5.2. Main Ribbon – Connected



Disconnect: Disconnects the computer's communication port from the IQ. If the IQ is collecting data – disconnect does **not** stop the system from collecting data. Once data collection begins, you can connect, disconnect, and download data from the IQ without interrupting measurements.

System configuration: This icon brings you to the main page for configuring the IQ for a deployment or data collection. This configuration page is also known as the IQ SmartPage.

Download data: Takes you to a new window to download data. Users can download single files, multiple files, or all files during data collection or when idle. Even the current data file can be downloading data without interrupting the current measurement.

View data: Brings you to a new window to visualize collected data in graphs and tables. Data from single files or multiple files can be displayed for analysis.

Status code: The IQ automatically performs many functions to identify potential problems at a deployment site (Section 7.1). If a status code is reported, select this icon to decode the status code number.

2.5.3. Main Ribbon – Connected – System configuration – Operations

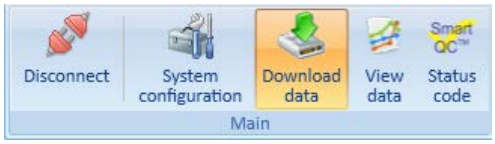
Load Settings: Used in conjunction with deployment planning, users can select a previously saved setup file to load on an IQ. This file will have the extension **.sontek_system_config**.

Save Settings: Used to save current configuration and deployment settings to a file that can be loaded again in the future or loaded on a different IQ. Files saved will have the extension **.sontek_system_config**.

Utilities: This icon opens a mini-ribbon with the following common utility functions: set system clock, reset site memory, calibrate pressure, Beam Check, firmware upgrade, and format recorder.

Advanced Utilities: This icon opens a mini-ribbon with several advanced functions that are typically only used when working with SonTek Support: factory defaults, direct connection, load configuration, and system reset.

2.5.4. Main Ribbon – Connected – Download data



Selecting the "Download data" function from the main ribbon will open a new window for selecting files to be downloaded. There are no other ribbon icons in this window.

2.5.5. Main Ribbon – Connected – View Data

The "View Data" function on the main ribbon opens the data visualization window in the IQ software. There are many functions for viewing, analyzing, and exporting data. These functions will be described in later sections. One of the new features of the IQ is that you can view recently collected data even while the IQ is still sampling. The IQ has a powerful onboard processor that can handle many operations simultaneously.

2.5.6. Main Ribbon – Not Connected – View Data

You do not have to be connected to an IQ to view a data file. However, when not connected, the disconnect, system configuration, and download data functions will be hidden. Section 2.5 is intended to familiarize you with different ribbon displays that you will frequently see when using the IQ software. See Section 3 for planning a deployment, Section 4 for downloading data, and Section 5 for data analysis.

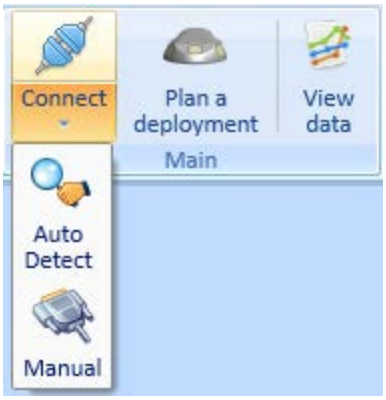
Section 3. Planning a Deployment – IQ Smart Page

There are two methods for setting up a SonTek-IQ before a deployment: (1) connect to the IQ and enter the appropriate settings while connected or (2) plan a deployment before connecting and upload the settings when convenient. Both methods will begin the IQ setup process by displaying the IQ Smart Page.

- IQ configuration files can be downloaded and saved from the IQ while connected.
- IQ configuration files can be created and saved from a deployment planning session.
- By planning deployments and saving configuration files, you can easily distribute the same settings to several instruments.

3.1. Accessing the IQ Smart Page

Start by opening the IQ software. To view the IQ Smart Page, select either the **Connect** or **Plan a deployment** function from the main ribbon area. The **Connect** button provides two options: Auto Detect or Manual (Figure 39). If you select **Auto Detect**, the software will automatically scan all the COM ports on the computer and present the available ports for connection (Figure 40). If more than one IQ is connected to your computer, you will be asked to choose a COM port. If there is only one IQ, the software will automatically connect to the system.



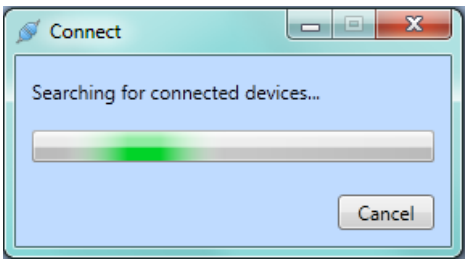


Figure 40. IQ Software searching for devices

If you choose **Manual**, the software will ask you to choose a COM port (Figure 40).

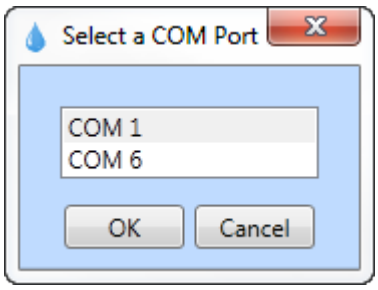


Figure 41. Manually connect by choosing a COM port

If you select **Plan a deployment**, you will be asked to identify the IQ model type to plan a new deployment or you can open an existing configuration file for editing (Figure 42). After choosing an option, you will be taken to the IQ Smart Page.

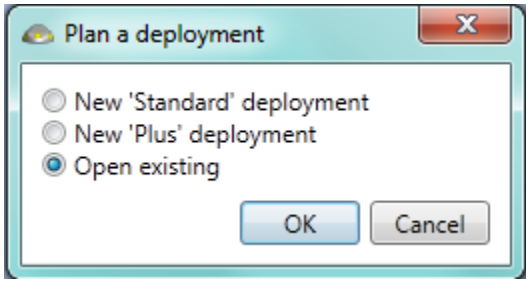


Figure 42. Plan a deployment dialog

The IQ Smart Page is designed to provide a quick and easy method for you to configure your system for collecting data. Several settings are required. The IQ Smart Page (Figure 43) provides feedback during the setup procedure to indicate completed steps and settings that still need to be checked. The IQ Smart Page is a complete overview of the IQ's current configuration including potential problems with the setup options.

- The IQ Smart Page has five sections
  - System information
  - Standard settings
  - Channel shape
  - Flow settings
  - Output settings

- IQ Smart Page section status indicators

  – Section recently updated, ready for deployment

  – Section not updated recently, settings are ok for deployment

  – Section not updated recently, user should verify settings before deployment

- There is a text button to “Refresh” or “Change” the settings in each section.
- Each section shows a brief summary of the important settings for that section.

If you are planning a deployment and are not connected to an IQ, the System information section will only display the IQ model (Standard, Plus or Pipe) and the **Start Data Collection** button will be hidden.

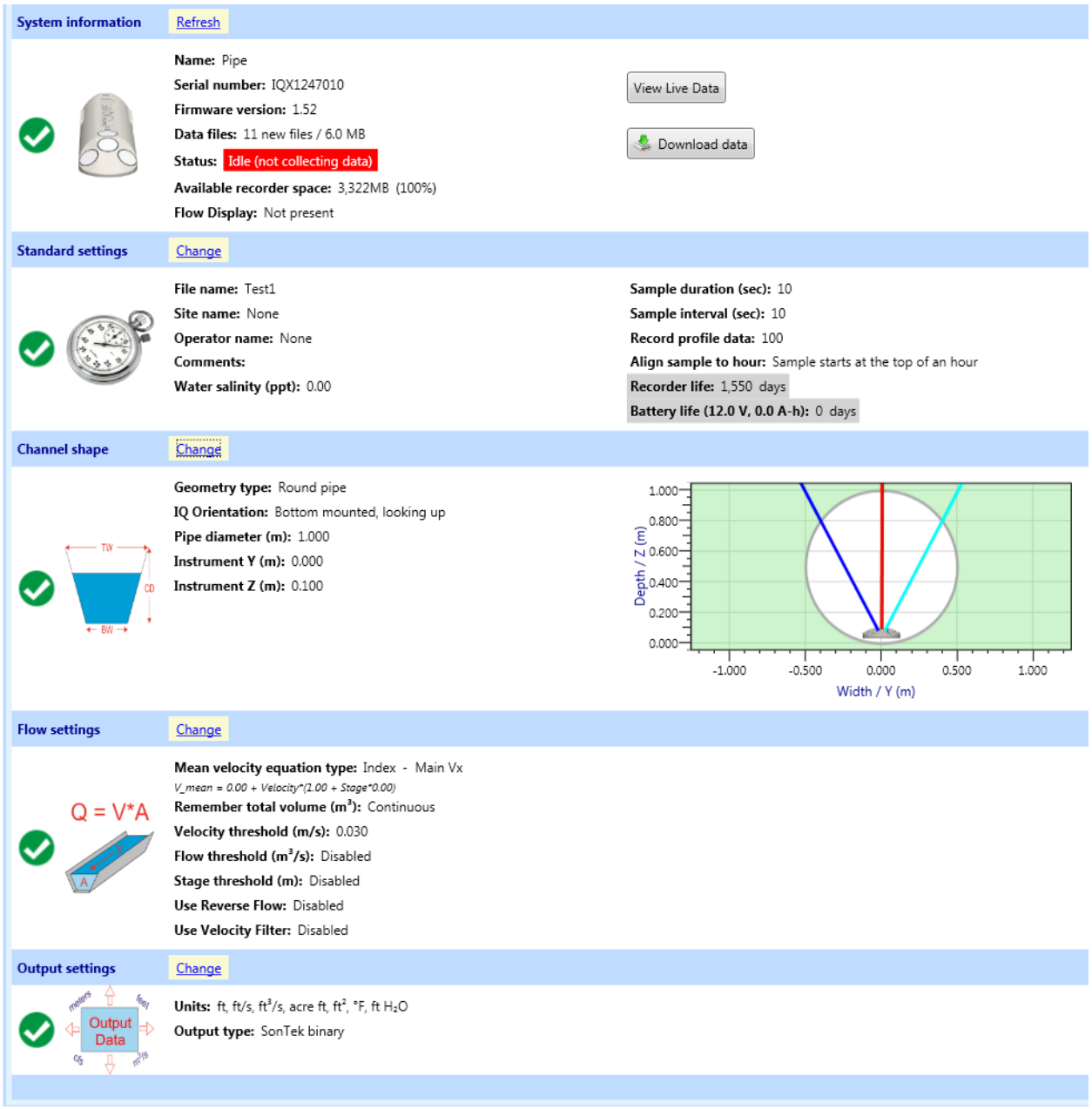


Figure 43. IQ Smart Page – Connected to an IQ

If this is the first time you are connecting to your IQ, you may be prompted to calibrate the pressure sensor (Figure 44). Because atmospheric pressure changes continually, the amount of pressure from the atmosphere must be removed or calibrated out of the raw pressure measurement. The IQ will perform this calibration on a regular basis while measuring. Select either button to continue to the IQ Smart Page.

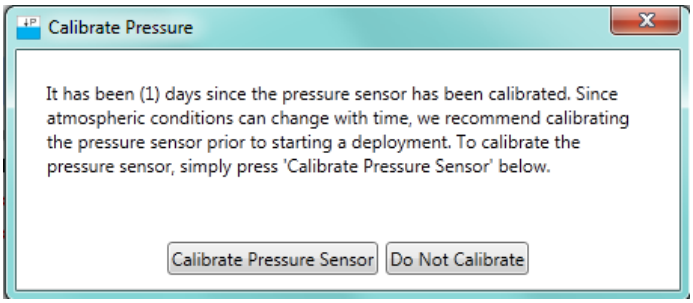
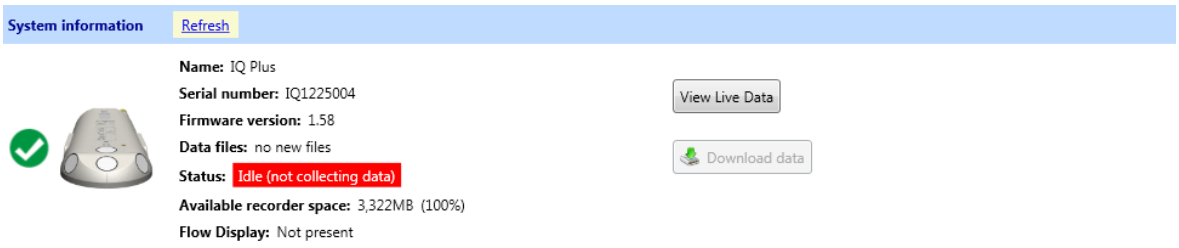


Figure 44. Calibrate Pressure dialog

The following IQ Smart Page descriptions will assume that you have connected to an IQ and are configuring the system manually.

3.1.1. IQ Smart Page – System Information



The System information section on the IQ Smart Page provides general information about the IQ, the sampling status, and the available recorder space. Use the "Refresh" button to update the information here when connected to an IQ.

Name: Defines the type of IQ system: IQ Standard (Std) or IQ Plus or IQ Pipe

Serial Number: Every IQ has a unique serial number.

Firmware version: The firmware version used by the instrument.

Data Files: The number of new data files available and the amount of space occupied by these files on the recorder.

Status: Indicates the system sampling status: RED-Idle (not collecting data) or GREEN-Active (collecting data).

Flow Display: Indicates if a flow display is currently being used. Three different cases can be seen here: No display connected, standard display present, and display with 4-20 mA present.

Available recorder space: Shows how many megabytes of space are available on the recorder and the percentage of free space.

View Live Data: Presents a table with the most recent data collected by the instrument. View live data can be used when the system is idle or when collecting data if the output type is SonTek binary. SonTek Binary is the only output type that will allow you to view live data.

Download data: Allows users to download data from the system. This is the same function as Download data in the ribbon.

3.1.2. IQ Smart Page – Standard Settings

The IQ Smart Page Standard settings section is where users can view and change input details about the deployment site and the sampling scheme. Selecting the **Change** button will open a dialog where you can change or enter values for each field (Figure 45).

File Name: Is the file name under which data are recorded to the internal recorder. You can enter up to 10 letters or numbers. Symbols and spaces are not allowed. The IQ automatically appends a time stamp to avoid duplicate file names. For example, if you enter "Test", on the recorder the data file name will be *Test_20111028_134109.IQ*. The time stamp format is YYYYMMDD_HHMMSS (Year, Month, Day, Hour, Minute, Second). If this field is left empty, the default file name is the IQ serial number.

Site Name: Allows for a short description of the site, up to 32 characters.

Operator Name: The name of the person configuring or deploying the IQ, up to 32 characters.

Comments: Users can enter up to 120 characters and spaces to describe the site or the deployment conditions.

Water Salinity (ppt): User input salinity in parts per thousand. An appropriate salinity value is necessary for accurate calculations. Most fresh water can be considered 0 ppt while typical salinity values for seawater are between 30 and 35 ppt.

Sample duration (sec): Determines the period of time (in seconds) that the system averages data for each sample. Typically, sample durations are 2-5 minutes (120 – 600 seconds), but these values depend on field conditions – default setting is 120 seconds. For turbulent channels, longer durations may provide more consistent flow rates. The minimum is 1 and the maximum is 3600 seconds. *Note: Sample durations less than 10 seconds should be used for laboratory testing only; flow will not be calculated.*

Sample interval (sec): The period (in seconds) from the start of one sample to the start of the next, typical values are 5-15 minutes (300 – 900 seconds); default value is 900 seconds. The minimum is 10 and maximum is 3600 seconds.

Record profile data: Determines the interval at which detailed profile data are recorded (IQ Plus and IQ Pipe only). Profile data includes measured velocity profiles (a velocity from each cell) and Signal to Noise (SNR) ratios. A value of "1" here will record a profile with each sample while a "0" turns off profile recording. If you would like to have the option to recalculate flow during post-processing, this parameter must be set to "1". Recording profiles can significantly increase file size and shorten the length of time that data can be recorder.

Align sample to hour: This setting determines how the timing of data is related to the start of each hour; users can align samples to start or end at the top of the hour.

- Do Not Align means that data collection is started immediately upon your request, and is not specifically aligned to the start of each hour.
- Sample Starts at the Top of the Hour means that the timing of samples is set so that samples will align with the top the hour (i.e. 9:00:00). Based on the sample interval and duration, the IQ will start the first sample at the time that ensures that a sample will align with the top of the next hour. The IQ will not wait for the top of the hour to begin, but will begin when it can align the timing correctly.
- Sample Ends at the Top of the Hour means that the timing of samples is set so that a sample will end at the top of the next hour (i.e. 9:00:00). Based on the sample interval and duration, it starts the first sample at the first time that ensures that a sample will end at the top of the next hour.

Maximum file size (MB): This setting will determine the maximum size of files on the recorder. During data collection, the current data file will be closed once this limit is reached and a new file will be started. The sample numbers will maintain continuity from file to file meaning that if one file ends at sample 500, the next file will start with sample number 501. Sample numbers will restart at 1 only after stopping and restarting the instrument.
File sizes will be approximate (not exactly 1MB) because the size of the file is not monitored in real-time. It is estimated from the sample settings and then closed at a particular sample number.

Battery Life: Input the nominal voltage and capacity of the battery that is used to power the IQ. Estimated battery life is based on the operating parameters and whether a flow display is being used. If the flow display is being used it is important to note that calculations on deployment determined by the software will be accurate as long as the flow display is connected when the calculations are done.

- Battery Voltage (volts): voltage for battery used during the deployment. Operating range is 9 to 15 VDC.
- Battery Capacity (amp-hours): the expected capacity (in amp-hours) of the battery used for the deployment
- Estimated Battery Life (days): calculated based on user supplied battery information and instrument configuration. Site conditions may influence this estimate – this value is only an estimate.

Details of the battery life calculations are shown below.

- BattV = battery voltage (user supplied, volts)
- BattC = battery capacity (user supplied, amp-hours)
- SD = sample duration (seconds)
- SI = sample interval (seconds)
- ActiveP = power consumption when active (W) = see table below
- IdleP = power consumption when system idle (W) = see table below
- 0.8 = SonTek recommends a safety margin of 20% for battery life calculations

Flow Display	Output Format	ActiveP (W)	IdleP (W)
No	Modbus	0.75	0.15
No	Any other	0.75	0.03
Standard Display	Any	0.85	0.11
Display w/ 4-20 mA	4-20 mA analog	2.00	1.50
Display w/ 4-20 mA	Any other	0.90	0.17

Two equations are used to calculate the battery life.

$$MeanPower(W) = \frac{(SD * ActiveP) + \big((SI - SD) * IdleP\big)}{SI}$$

$$BatteryLife(days) = \frac{0.8 * BattV * BattC}{24 * MeanPower}$$

Example:

- BattV=12 V, BattC=30 A-h, SD=120 s, SI=900 s, standard flow display, Modbus output
- MeanP = 0.330 W
- Battery life = 36.4 days

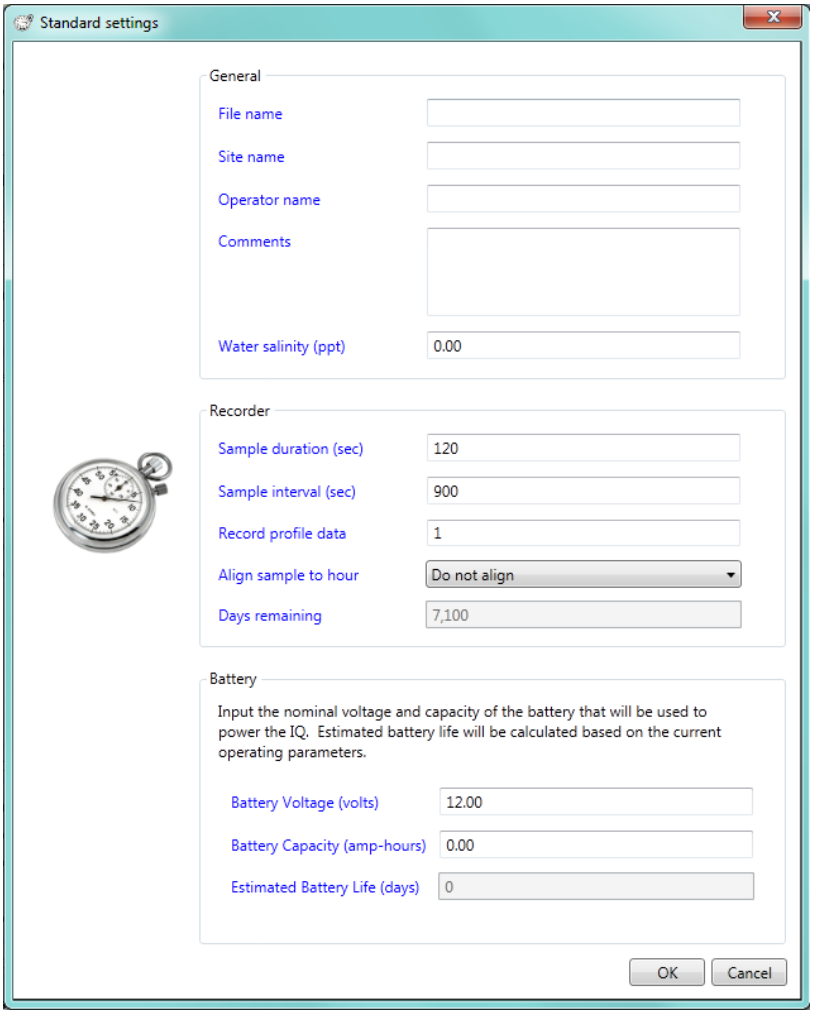


Figure 45. IQ Standard Settings dialog

While entering values for settings, it is possible to enter values that are incorrect (Figure 46). If the IQ software detects an incorrect value, it will highlight the value and associated fields in red.

To get help with the error, click on the red box next to the incorrect field.

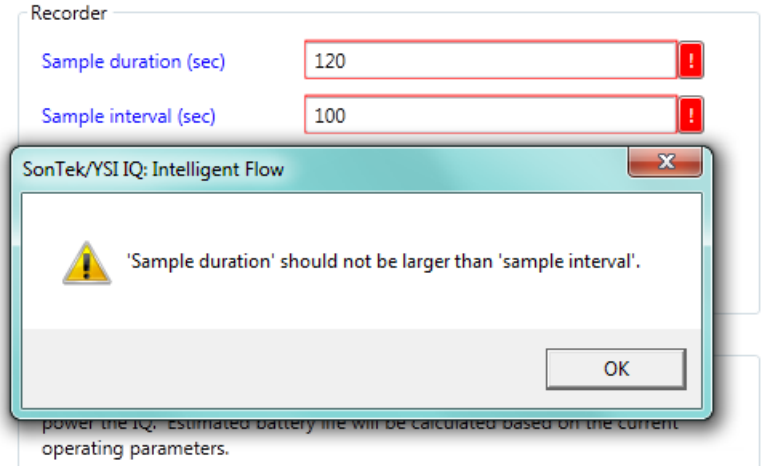
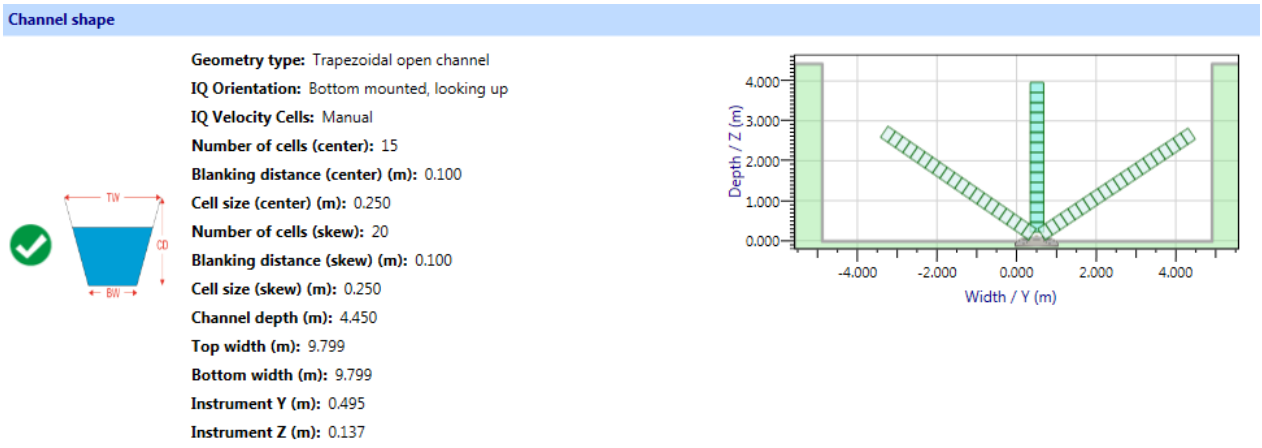


Figure 46. IQ Software help with incorrect settings

3.1.3. IQ Smart Page – Channel Shape



In order to calculate flow correctly, the channel shape needs to be well defined.
This section provides a simple method for entering a wide variety of channel types.:

- To update the information in this section, select the **Change** button.
- Enter the dimensions of the channel where the IQ will be installed.
- Channel dimensions should be as accurate as possible.
- Use built-in templates for common cross-sections, or enter survey points from a cross-sectional survey to define an irregular channel.
- Note the warning icon on the left side of the section summary indicating that you must complete this section before beginning data collection.

Figure 47 presents two different channel geometries entered into the IQ Software.

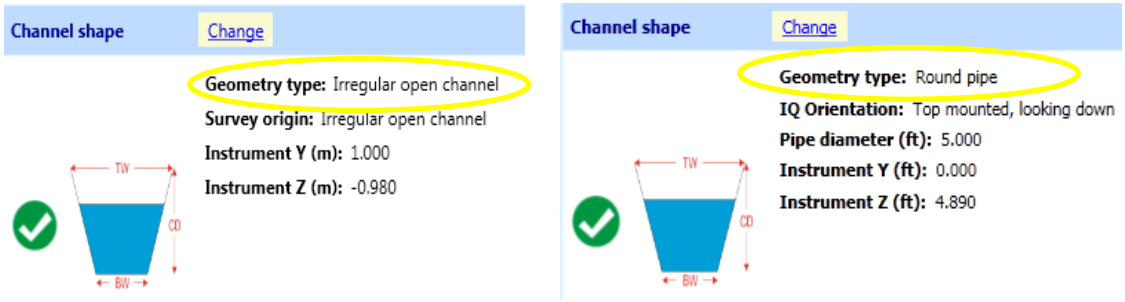


Figure 47. IQ Smart Page channel shapes

Geometry type: specifies the shape of the Channel.

Irregular Open Channel: An open channel of any shape defined by up to 200 user supplied survey points.

Trapezoidal Open Channel: A regular open channel defined by three parameters: bottom width, top width, and channel depth, typically used on known cross-sections that are completely clean.

Trapezoidal Culvert: The same as Trapezoidal Open Channel, except that the channel is closed at the top, the channel is defined by width at the bottom, width at the top, and channel depth.

Round Pipe: A regular closed conduit or pipe that is defined by the diameter. Elliptical Pipe: A regular closed conduit or pipe defined by the width and height.

Irregular Pipe: A closed conduit of any shape defined by up to 200 user defined supplied survey points.

Stage / area equation: (IQ Plus and IQ Pipe only) A set of equations that relates the cross-sectional area of the channel to the measured stage level. Users can enter multiple equations to define complex channel geometries and flow conditions.

Survey origin: The origin of the horizontal distances as measured from either the right or left bank.

- The right bank is the right side of the channel when facing downstream
- The left bank is the left side of the channel when facing downstream

IQ Orientation (only for closed channels or pipes) – Normal operation is for the system to be bottom mounted (up-looking); however, in pipe applications that are always full the system can be installed at the top of the pipe looking down (example provided in Figure 48). **This option is only available in the IQ Pipe instrument.**

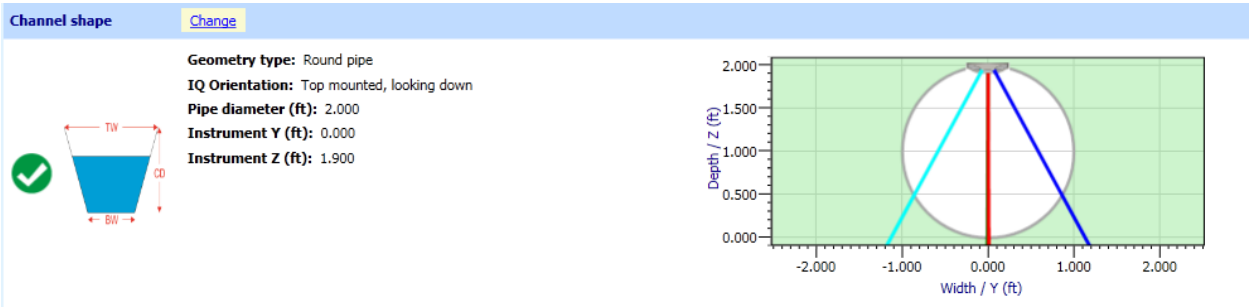


Figure 48. Example of using the IQ Orientation (inverted) in a closed channel

It is important to note that the locations of where the beams are profiling are mapped on the Channel Shape diagram (via dark blue, light blue, red and green lines). This feature is applied for all IQ products. In addition, it is important to note beams will stop profiling based on the entered geometry – this helps prevent side lobe interference and makes for a better measurement.

IQ Velocity Cells: The velocity cell measurements can be automatically configured using SmartPulse (default) or set manually. The Manual setting disables SmartPulse to allow the user to set the cell size, number of cells and blanking distance for the center and skew beams independently. Cells programmed beyond the water surface will not be used in the velocity measurement. However, care must be taken by the user to set up the skew beams so that they do not hit the walls of the channel, otherwise those data will be contaminated. The Manual setting is subject to these parameters:

- The IQ only pings in IC (incoherent) mode.
- The minimum cell size and blanking distance are 4cm.
- The minimum operational depth for manual mode with 5 or more cells is 12cm. For 4 or less cells, it is 10cm.

Pipe Diameter: The IQ Pipe algorithms are based on a pipe diameter ranging from 0.46m (18”) to 1.83m (72”). Diameter settings outside of this range may not generate accurate theoretical flows. A velocity index may be necessary for accurate flow calculations. IQ status code 2048 is used to warn users that settings are outside of recommended theoretical range. All samples that meet the above criteria are flagged with this code.

Instrument Y: The horizontal location of the IQ in the channel. This distance is measured from the origin. For trapezoidal shapes, the origin is in the middle of the channel. For irregular channels, the origin is located on the side of the channel.

Instrument Z: The vertical location of the IQ in the channel. This distance is measured from the origin. For trapezoidal shapes, the origin is in the middle of the channel. For irregular channels, the origin is located on the side of the channel.

Figure 49 presents the general Channel shape dialog.

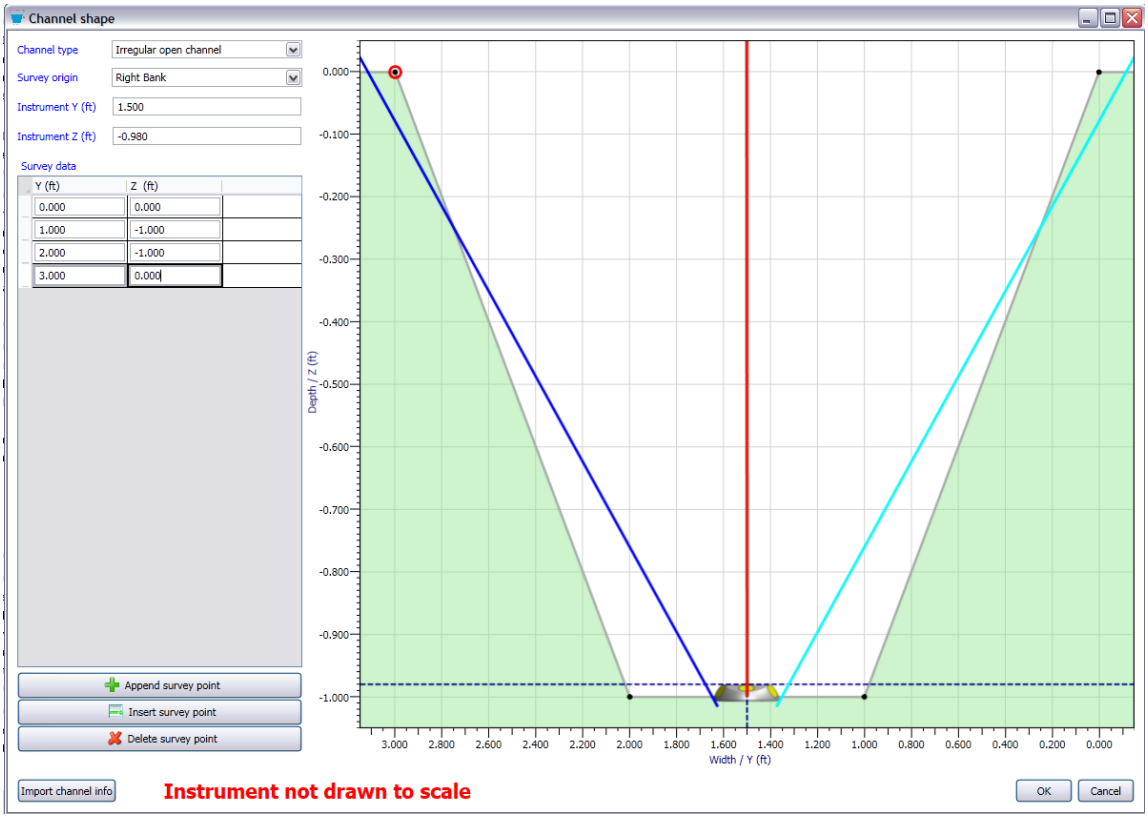


Figure 49. Channel shape dialog

The Channel shape dialog provides a quick and easy way to enter the channel dimensions at the measurement site. The options in this window will change depending on the type of channel selected.

- The channel dimensions can be entered manually in the spreadsheet (for Irregular Open Channel and Irregular Pipe).
  - Use **Append survey point** to add a new row to the end of the columns.
  - Use **Insert survey point** to insert a row above the currently selected row.
  - Use **Delete survey point** to remove the currently selected row.
- Select the spreadsheet cell with the mouse to update the value.
- Selecting a point on the figure will outline the point in red and highlight the location of the point in the spreadsheet.
- The channel and the IQ in the figure appear as if you are standing in the channel looking downstream. The right bank is on the right side of the figure and the left bank is on the left. The water in this channel would be flowing into the figure.
- The **Import channel info** button can be used to import data from an IQ configuration file (*.sontek_system_config) or a Comma Separated Values file (CSV).

After selecting the “Import channel info” button, if you choose to import a CSV file, a new window will appear for defining the columns of the CSV file (Figure 50).

- Users can indicate if field descriptors are on the first line of data with the checkbox
- A drop down menu allows for identification of channel type
- Width and height drop down menus are used to identify appropriate data columns

- The Invert Z check box is used for raw survey data – data that has not been referenced to a bench mark
- The Units drop down menu allows users to select the unit for length

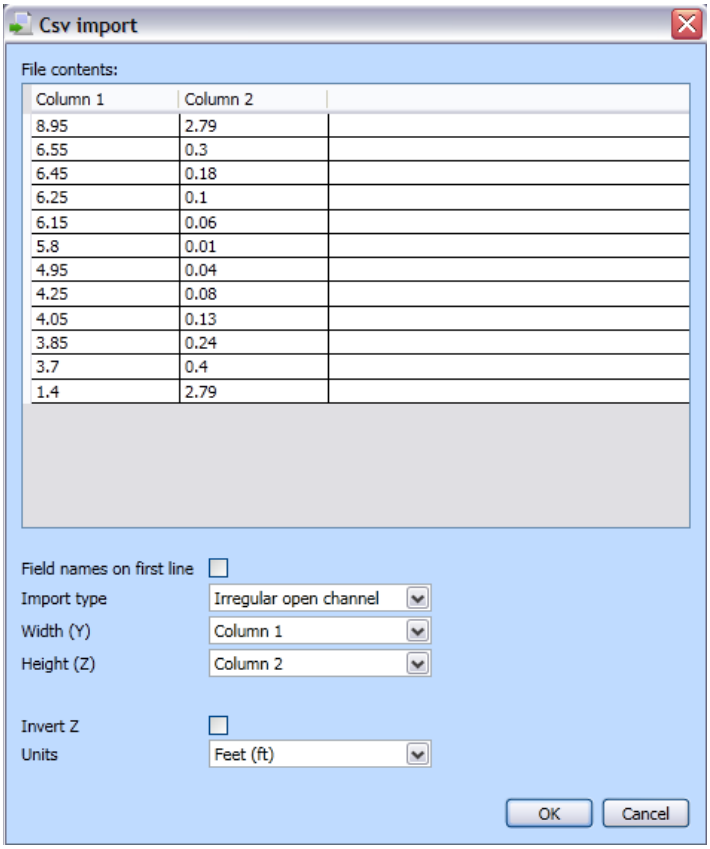
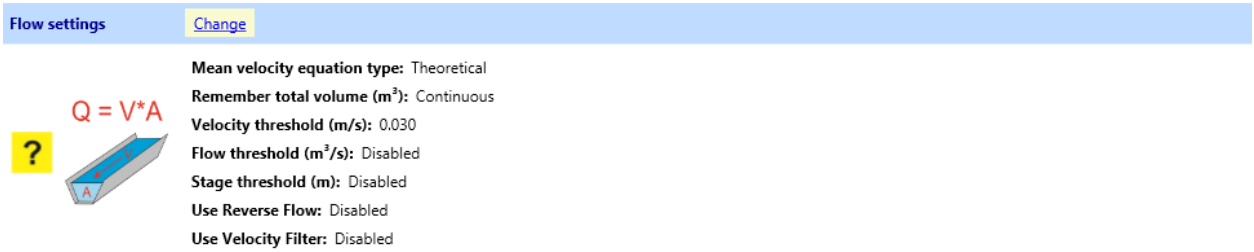


Figure 50. CSV import window

3.1.4. IQ Smart Page – Flow Settings



Flow is the mean water velocity multiplied by the cross-sectional area of the channel. Flow is a volume of water that moves through a channel in a specific amount of time. The IQ measures the water velocity profile and uses the channel dimensions to calculate the most accurate flow measurement possible. This section allows users to configure the flow calculation settings and to set threshold limits on the Velocity, Flow, and Stage. Figure 51 presents the Flow Settings Window.

Select the **Change** button to edit the IQ Flow settings. A new window will appear with a variety of options to consider.

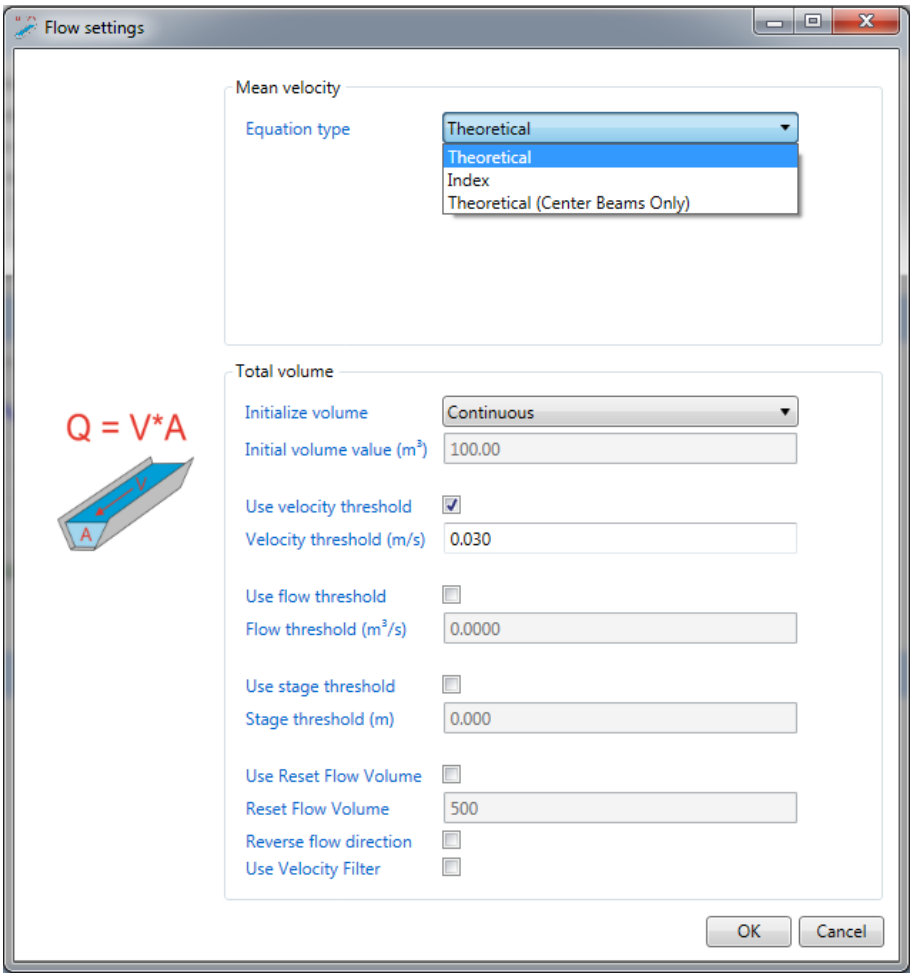


Figure 51. Configuring Flow Settings

Equation type: The equation type defines the relationship between the measured velocity and the mean velocity in the channel.

Theoretical: A theoretical model of velocity distribution that uses the location and magnitude of velocity measurements to calculate flow. This equation is based on years of scientific research and field measurements.

Index: Is an empirical relationship between a measured velocity and the channel mean velocity. A Velocity index is calculated with a series of measurements over time for different flow rates. The velocity type, velocity offset, velocity coefficient, and stage coefficient are determined experimentally at a site. This option is only available on the IQ Plus.

Theoretical (Center Beams Only): Theoretical flow will be computed using the velocity profiles from the center beams only. The same algorithm is used to compute theoretical flow. This algorithm integrates over the entire channel using the center beam velocity profile for the vertical and horizontal distribution of velocity. This function can be used if installation sites are causing interference with the skew beams or if the instrument is installed in a narrow channel. This option is available when using the Recalculate Flow feature in post-processing.

Flow algorithms are dependent on instrument type. The table below describes the flow algorithms based on instrument type.

Flow Algorithm	IQ Standard	IQ Plus	IQ Pipe
Open Channel All		T/R	R
Closed Conduits All		R	T/R
Open Channel Trapezoid	T	T/R	R
Open Channel Irregular	T	T/R	R

T = Theoretical Flow Algorithm
R = Index Velocity Rating

It is important to note that although both the IQ Plus and IQ Pipe can be installed in either open channels or closed conduits, the theoretical pipe flow algorithms only exist in the IQ Pipe system and theoretical open channel flow algorithms only exist in the IQ Plus (and IQ Standard). If an IQ Pipe is installed in an open channel, or an IQ Plus is installed inside a pipe, flow (volumetric discharge) must be computed outside of the system using the index velocity (rating) method.

Total volume: The total volume delivered through the channel based on measured flow rate multiplied by time.

Initialize volume: This setting determines the starting value for total volume calculations each time data collection is started. There are three options for initializing the volume calculation.

Continuous: The default setting for which volume continues to accumulate from the last measured value after the IQ has been stopped and re-started. It is important to note that the continuous setting will include an estimate of water volume for the period that the IQ was not collecting data. Based on previous measurements, the total volume is adjusted to include the volume of water that flowed while the IQ was not sampling.

Initialize: If you would like to begin measurements with a nonzero starting volume, use this setting and enter the **Initial volume value**. After data collection starts, the Initialize volume setting will automatically switch to the Continuous setting so that the volume will continue to accumulate whenever data collection stops and starts. When installing an IQ at a new site, the system would typically use this setting with an Initial volume value of zero so that only data from the new site is included in the Total Volume measurement.

Reset: Use this setting if you would like the total volume to start at zero each time data collection is started.

Use velocity threshold: Allows you to filter velocity data based on the entered value. When this option is selected, flow rate and total volume data are only accumulated when the magnitude of the mean velocity exceeds the velocity threshold value. Note that the IQ uses the magnitude of this value, or the absolute value. For example, if the velocity threshold value is 2.0, then measured mean velocities of 2.1 and -2.1 both exceed the threshold.

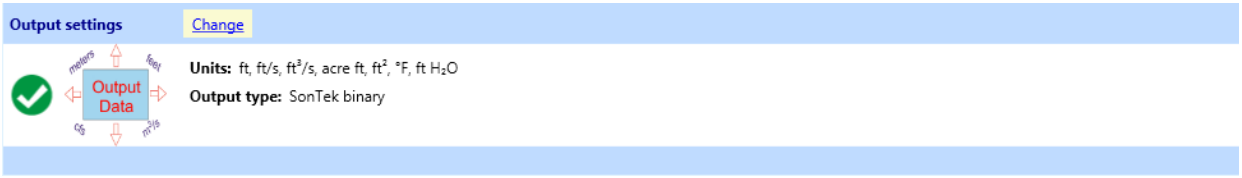
Use stage threshold: Accumulate volume only when the stage is above the entered value. The entered value is considered the minimum stage value. For stages below this value, volume is not accumulated and flow is not computed. For stage levels above this value, flow rate is calculated and total volume is accumulated.

Use Reset Flow Volume: Enable to zero the volumes after the specified number of samples. This option should be used mainly when operating with the flow display using analog outputs. In this scenario, if the volume totals don't reset to zero (if they just get bigger and bigger) the flow volume data will eventually max out the analog value. Or, to avoid overrunning the maximum analog value, the user would have to set the max channel range so high that the analog output would have very little resolution. This allows an automatic reset of the total volumes (negative, positive, and total) to zero after a specified number of samples.

Reverse flow direction: Use the check box to enable this feature, which allows you to reverse the sign (+/-) on measured velocities and flow direction. This option should be selected when the system is pointing downstream (cable is pointing upstream).

Use velocity filter: Use the check box to enable this feature, which allows you to filter out poor quality velocity and flow data. This option is recommended for turbulent flow.

3.1.5. IQ Smart Page – Output Settings



The SonTek-IQ is capable of outputting data in a variety of usable formats. Output data formats are compatible with many data loggers, PLCs, and RTUs. The IQ Smart Page Output settings section displays the current settings for the output format and the units of the output variables. Select the ***Change*** button to edit the Output settings (Figure 52).

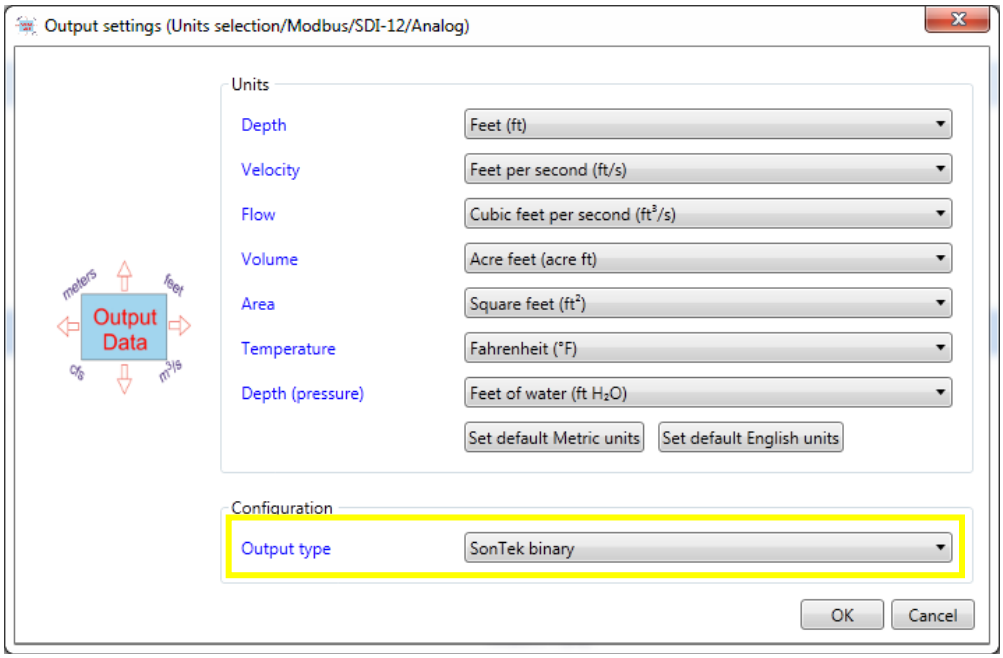


Figure 52. Configuring Output data settings

- Units for each type of output variable are set in the Output settings dialog
- Buttons for default metric and default English units are provided

- To use the **View live data** function in the IQ Smart Page System information section, the output type must be set to SonTek Binary. This is the default setting. SonTek Binary is a communication protocol that allows you to view the live data. The IQ does not output in a SonTek Binary format.
- Additional output options in the "Output type" pull-down menu are :
  - ASCII output (RS232)
  - Analog output (4-20 mA)
  - SDI-12
  - Modbus

ASCII output (RS232): Use this output type to communicate with dataloggers and computers through a serial COM port. Port settings are 9600 baud, no parity, and 1 stop bit. No additional settings are required.

Analog output (4-20 mA): Analog output (4-20 mA) configures the IQ to control up to four analog signals generated by the IQ Flow display. Use the pull down menu next to each of the four channels in the configuration dialog to set the output data variable. Once the variable is selected, enter a minimum and maximum value. The Min and Max values specify the range of the analog signal generated by the IQ. For example, if the data variable on channel 1 is Flow and the Min value setting is zero, the IQ will output a 4 mA signal on channel 1 when the calculated Flow is zero (Figure 53). After selecting the data variable, the units column will display the current units of the variable. To change the units, use the Units drop-down menus in the Output settings window.

Important note: Using analog outputs will significantly increase power consumption and decrease battery life. The exact impact on power consumption and battery life cannot be reliably predicted. If you are using analog outputs, it is best to have access to a constant power source (i.e. AC main supply). If you are running from a battery (with or without solar panel), you should budget for up to 2.0 W of continuous power consumption when using the analog outputs.

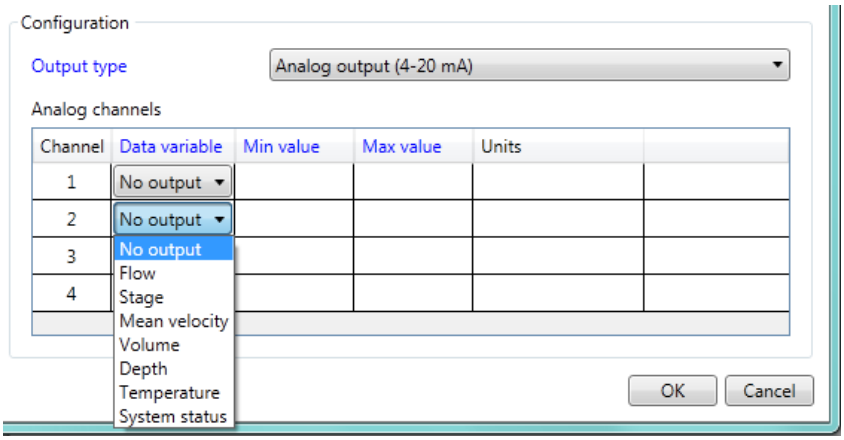


Figure 53. Configuring Analog output in the Output settings dialog

SDI-12 output: Select this option to interface the SonTek-IQ with an SDI-12 datalogger or network. The SDI-12 connection on the cable adaptor is used to access these data with this setting. The SDI-12 default network address is 0. Each instrument in a SDI-12 data collection network must have a unique address; values from **0-9**, lower case **a-z**, and upper case **A-Z** are allowed, Figure 54 presents the SDI-12 Configuration dialog.

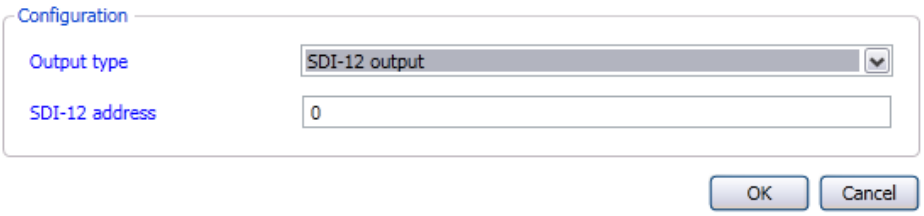


Figure 54. Configuring SDI-12 output in the Output settings dialog

Modbus output: The SonTek-IQ can act as a Modbus slave device over the RS232 port on the cable adaptor. Devices on a Modbus network must have a unique address number between 1 and 247. The default baud rate is 19200, but values from 300 to 115000 are supported. Longer cable runs may require lower baud rates for error-free communications. The default parity is even with options for odd and none. The output format on most Modbus data collection networks is IEEE standard floating point. An option for Inverse floating point is also included. Figure 55 presents the Modbus Configuration dialog.

Important Note: Using Modbus output will increase power consumption, when using this option the IQ software will incorporate this factor when making battery life calculations.

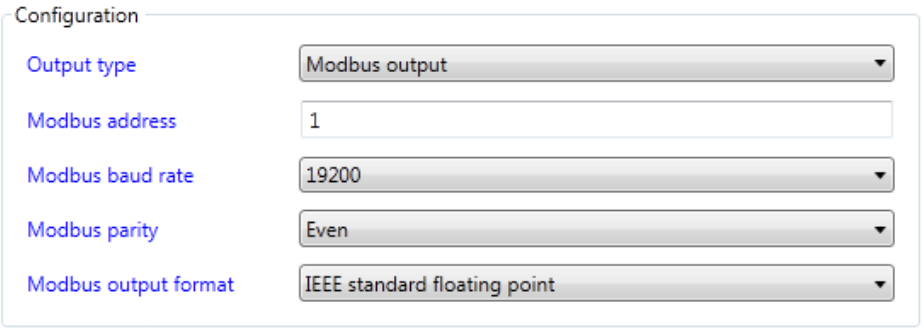


Figure 55. Configuring Modbus output in the Outputs settings dialog

3.1.6. IQ Smart page – Print Configuration and Start Data Collection

Two buttons at the bottom of the IQ Smart Page are used to **Print Configuration** and **Start Data Collection**. After configuring all of the options on the IQ Smart Page, you should see a next to each section. If all sections are green, you are ready to begin collecting data. Be sure to check the settings in any section with or next to it.

- If an IQ is deployed and collecting data, the Smart Page will have a Stop Data Collection button in place of the Start Data Collection button.
- The number of days available for data collection is next to the start button.
- **Print Configuration** generates a printer friendly IQ Smart Page that can be used for record keeping with all of the IQ configuration information.
- Once the system is configured, simply click **Start Data Collection** at the bottom of the Smart Page to deploy the instrument.
- While collecting data you can stay connected or disconnect from the IQ, it will continue sampling until you select the **Stop Data Collection** button.

3.2. System Configuration – Download data

To download data, connect the USB-Serial adaptor to the IQ cable adaptor and open the software. Click on connect and the IQ Smart Page will open. Data can be downloaded in two ways (Figure 56):

- Select the download data button in the main ribbon
- Select the download data button in the IQ Smart Page System information section

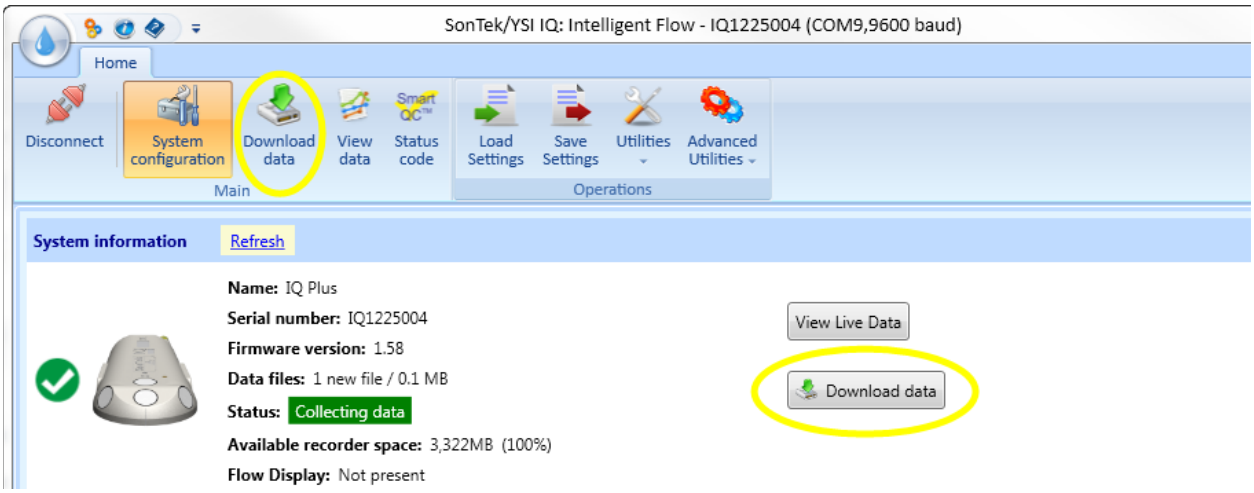


Figure 56. Download data buttons on the IQ Smart Page

Both options will take you to the Download data window (Figure 57). Once the Download data window is open, you will see a list of new files currently stored onboard the IQ. All data files always remain on the recorder until it is formatted. Only new files are shown in the list until they are downloaded and saved to the IQ Data directory. This directory is defined in the IQ Software Settings. If there are no new files on the recorder, the Download data buttons will be disabled until a new file is available for download.

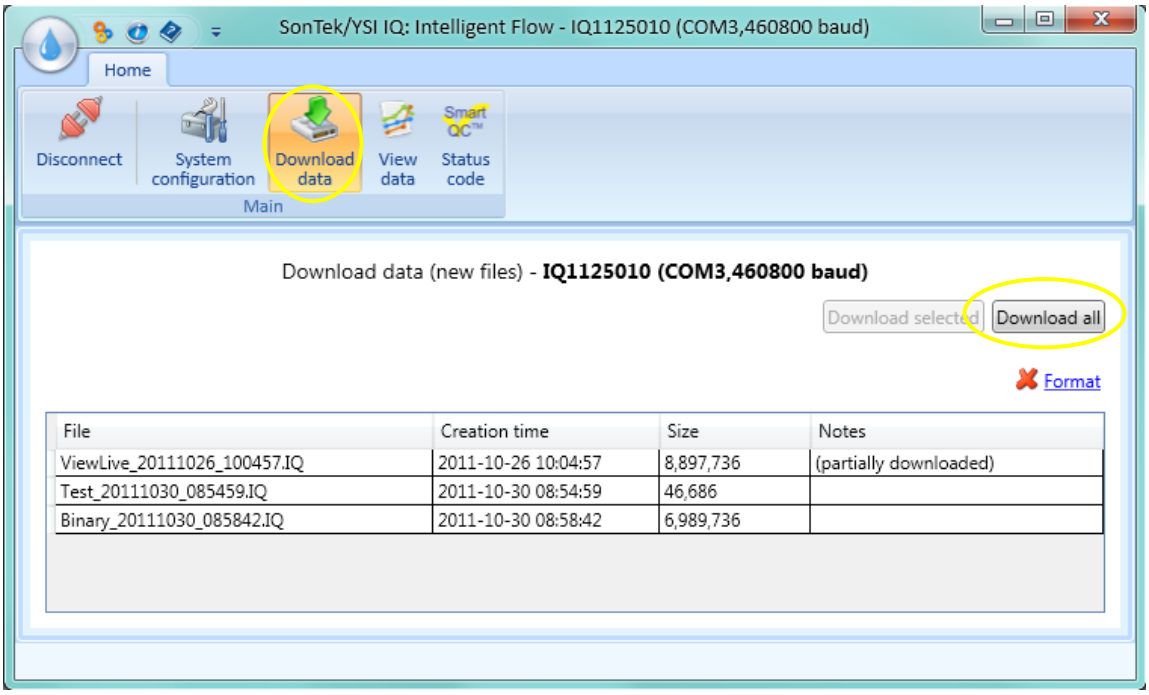


Figure 57. Download data window

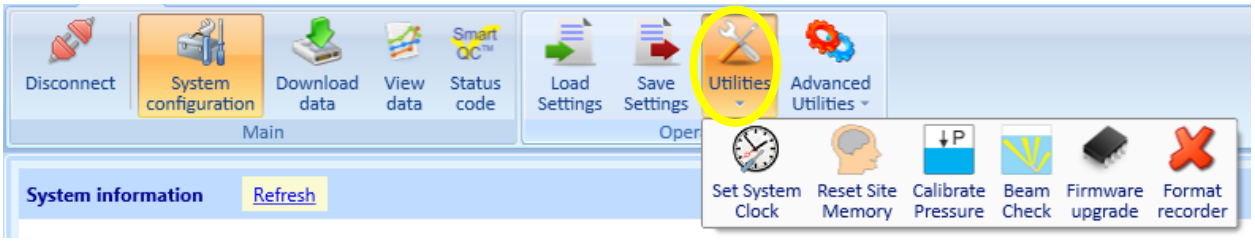
- The IQ serial number, COM port, and baud rate are displayed at the top of the page.
- The maximum baud rate can be changed in the IQ Software settings using the title bar quick-link .
- Users can select individual files from the list or multiple files by holding "Shift" and clicking on several file names. Use the **Download Selected** button to retrieve one or more files.
- Use the **Download all** button to retrieve all of the listed files.
- Use the **Format** button to delete all data on the recorder.
- Double-click on a file to download that file.
- All files are downloaded to the user-defined directory in the Settings → IQ data folder and are organized into sub-folders based on site name.
- The Notes section will display "(partially downloaded)" if data has been added to a file since the last download. IQ data files are continuous and data will be appended to the current file until the data collection is manually stopped or there has been a change to the system configuration.

The IQ software is designed with a database structure. Users must indicate where data will be stored using the Settings button. The software is not designed for multiple user access to files. As such it is recommended that files are stored in a local drive. Sub folders are named according to file name (done in the instrument deployment phase).

If files need to be transferred between computers, it is highly recommended to do the following:

- If a folder containing IQ data does not exist in one directory – copy the entire folder (and its contents) from one local drive to the other local drive.
- When copying files from one folder to another – make sure folder names are exactly the same.
- The software will create supplementary hidden files in the same folder that your data files are located. They will have ".fastdat" or ".wsp" extensions. Deleting these files may cause a loss of software settings (including flow that is "Recalculated") and is thus not recommended.

3.3. System Configuration – Utilities



There are several common utility functions accessible from the main ribbon when viewing the IQ Smart Page. The IQ will perform some of these functions automatically based on the options selected in software Settings, but you can access them anytime from here.

Set System Clock: Allows users to synchronize the IQ clock to the PC clock or input another reference date and time (Figure 58). The **System Date Time** is the current time onboard the IQ. If the **Verify system clock** option is enabled in the software settings, the IQ will automatically prompt you to correct the time if it differs from the PC time upon connection.

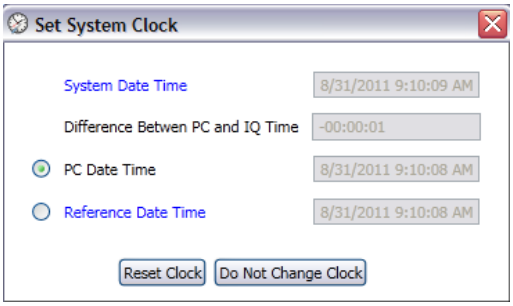


Figure 58. Set Sytem Clock window

Reset Site Memory: This function clears all memory related to the flow conditions at the site. This includes total volume parameters relating to flow conditions in the channel.

- Use **Reset Site Memory** to clear total volume parameters and start accumulating new data from zero.
- **Important:** this function should be used whenever a system is installed at a new site or site conditions have changed.
- If the **Verify site memory** option is enabled in the software settings, the IQ will automatically prompt you to reset the site memory if it detects significant changes in channel flow conditions.

Calibrate Pressure: This function adjusts the pressure sensor for changes in atmospheric pressure.

- The pressure sensor calibration can be performed when the system is in the air or if the IQ is submerged in water at a depth greater than 0.1 meter (0.3 ft).
- The IQ can calibrate the pressure sensor while underwater if the surface conditions are stable (smooth water surface).
- The IQ will evaluate the surface conditions and inform you if an underwater calibration is possible.
- If the **Check pressure calibration** option is enabled in the software settings, the IQ will automatically prompt you for a pressure calibration when the last calibration is no longer valid.
- While sampling, the IQ will calibrate the pressure sensor on a regular basis if conditions are acceptable.
- While idle, the IQ will prompt you to calibrate the sensor if no recent measurements have been collected.

Beam Check: Provides real-time information about the status of the acoustic beams. This function can be used to troubleshoot measurement problems and help to identify buried beams. See the next section for a complete description of this function.

Firmware Upgrade: Used to upload new firmware to the instrument. On occasion, new firmware will be made available to IQ users. You may receive IQ firmware from SonTek support personnel or it may be posted on SonTek's website. Do not accept or load firmware from any other source. To load firmware, select the **Firmware upgrade** button and navigate to the firmware file location. All firmware files will have a .yfw extension.

Format Recorder: Deletes all data from the recorder. After selecting this button, you will be given one chance to cancel the operation. Once the recorder is formatted, data files will no longer be available for download. Please be sure to download and verify that all data has saved correctly before formatting the recorder.

3.3.1. Utilities-Beam Check

After selecting the Beam Check button, the main ribbon will add a "Beams" section and a "Functions" section.

- Use the color-coded check boxes on each beam to turn transducers on and off.
- To view a previously recorded Beam Check file, select stop to end sampling and then select **Open Beam Check File** to view data (Figure 59).

Figure 59. Opening a Beam Check File

- Use **Start** to begin sampling again.
- Beams are color-coded to match the SNR data graphed on the plot.
- Use **Disabled** to view each sample independently or use **Enabled** to accumulate Beam Check samples for averaging.
- You can record Beam Check data to a file, pause sampling, and stop sampling.
- Figure 60 presents the Beam Check window.

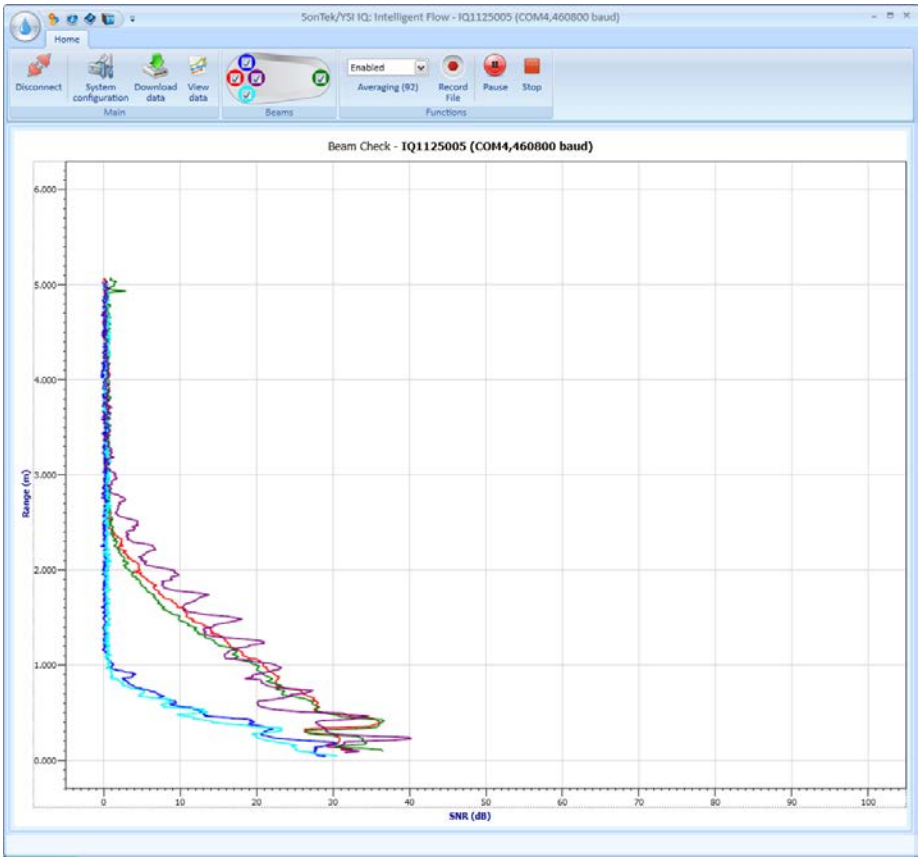


Figure 60. IQ Software Beam Check window

3.4. System Configuration – Advanced Utilities

Advanced Utilities are used for less common functions, and are commonly used when working with SonTek Support personnel.

Factory defaults: Resets the instrument to the configuration as shipped from the factory.

Direct connection: A command line terminal window for direct communication.

Load configuration: A configuration file is different from a setup file created using "Save settings". Configuration files contain calibration data specific to each instrument and are only available from the manufacturer. These files will have .ini as the file name extension.

Modify configuration: This is an advanced troubleshooting feature that should only be used under the instruction of SonTek Support. When changed, some of the system configuration settings will affect the IQ operation and could result in data loss.

System Reset: This is a full system reset typically used when troubleshooting; this is effectively a system reboot. If you are having trouble communicating with an IQ, use this function to restart the IQ and re-establish communications.

4-20 mA Calibration: When using the flow display with optional 4-20 mA analog outputs (see 0), the outputs should be calibrated on the data collection system that will be used.

- Connect all channels of the 4-20 mA analog outputs on the flow display to the data collection system that will be used.
- Connect the IQ to the flow display and then to a PC. Run the IQ software and select **Advanced Utilities – 4-20 mA Calibration**. Figure 61 shows the display screen.

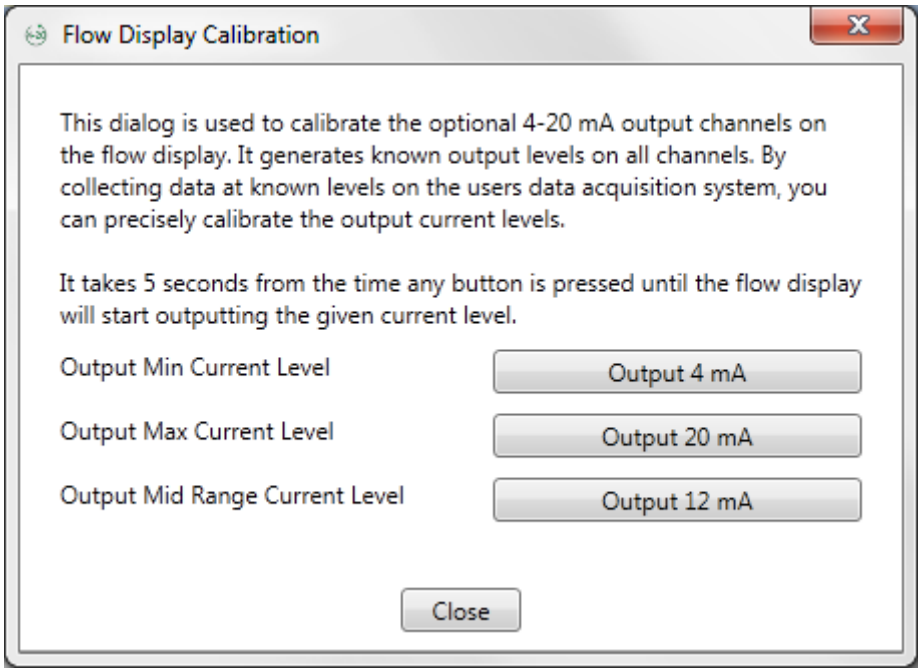


Figure 61. Flow Display Calibration

- Click the **Output 4 mA** button; wait 5 seconds for the value to be set. Verify the current output on each channel of your analog data collection system. This current will correspond to the programmed minimum value for that channel.
- Click the **Output 20 mA** button; wait 5 seconds for the value to be set. Verify the current output on each channel of your analog data collection system. This current will correspond to the programmed maximum value for that channel.
- A third option, **Output 12 mA**, can be used to verify the calibration with one point exactly in the middle.
- **MinAmp** is the value measured for **Output 4 mA**, and **MaxAmp** is the value measured for Output 20 mA, and **MinValue**/**MaxValue** are the user-specified min and max ranges for that channel, then the formula below gives the IQ value for any given **MeasuredAmp**.

$$\text{MeasuredAmp} = \text{MinValue} + \left(\frac{(\text{MeasuredAmp-MinAmp})}{(\text{MaxAmp-MinAmp})} * (\text{MaxValue-MinValue}) \right)$$

- Example:
  - Analog channel 1 is programmed to output flow, with a min value setting of 0 cfs (cubic feet per second) and a max value setting of 40 cfs.
  - During calibration, 3.97 mA was measured for **Output 4 mA**.
  - During calibration, 19.93 mA was measured for **Output 20 mA**.
  - The system should measure close to 11.95 mA for **Output 12 mA** to verify operation.
  - A measured value of 10.50 mA would yield a flow of 16.37 cfs.

Section 4. Installing the IQ in a Channel

The previous sections described most of the IQ software operations and settings involved in configuring a system for deployment. Now it is time to install your IQ in a channel and begin collecting some flow data – in most cases the SonTek-IQ and IQ Plus are the most appropriate systems to use in an open channel. The low profile design and acoustic range of the IQ make it suitable for almost any channel. Proper site selection and mounting will be key factors in getting the best possible data from your IQ.

The minimum input voltage to the IQ system is 9VDC. Due to the resistance in the wires, there will be a voltage drop over the length of the power & communications cable when the system is actively pinging and drawing current. Therefore, it is important that the user supply an appropriate level supply voltage at the 'dry' end of the cable to insure that the supply voltage to the instrument will exceed the 9VDC minimum. Longer cables will require a higher minimum input voltage to compensate for the larger voltage loss.

Note for wastewater applications: The SonTek-IQ is not certified ATEX or Intrinsically Safe. Do not use in areas where there is risk of flammability or explosion.

4.1. SonTek-IQ Site Selection

Site selection is one of the most important factors in data quality. For the best possible data, use the following guidelines:

- The SonTek-IQ should be installed in a straight section of channel, avoiding any curves and abrupt changes in elevation.
- Try to find an area with uniform flow conditions and low turbulence.
- Look for a clean and consistent cross-section, with minimal chance of sedimentation that could change the cross sectional area or potentially bury the IQ.
- SonTek highly recommends installing the SonTek-IQ at least ten channel widths downstream or upstream of control points (gates) and flow disturbances.
- Figure 62 and Figure 63 present examples of SonTek-IQ site selection.

**Figure 62. Example of a poor installtion site:
upstream is a contol gate; downstream is a drop in elevation with turbulent flow**

Figure 63. Example of a good installation site (long straight section of channel)

4.2. Mounting the SonTek-IQ Standard and IQ Plus

Whenever possible, we recommend using stainless steel fasteners and hardware with the mounting brackets to avoid problems with corrosion. The SonTek-IQ comes with standard L-shaped mounting brackets to secure the system to the bottom of the channel. In addition to the standard brackets, you can purchase a riser mount. The riser mount should be used in locations where sedimentation or burial of the instrument could occur. The riser mount elevates the SonTek-IQ approximately 1” or 2.5 cm off the bottom of the channel (Figure 64). This added elevation will help to prevent sediment from accumulating around the transducers.

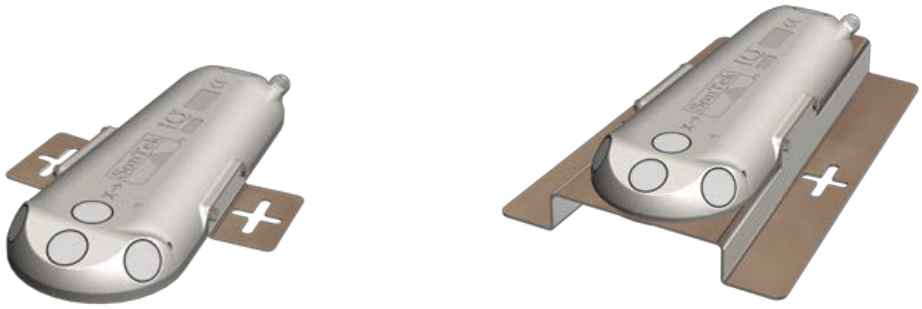


Figure 64. Standard mounting option (left) and optional riser mount (right)

Every installation will be slightly different, but you should ALWAYS:

- Mount the IQ in the center of the channel at the bottom.
- Certify that the longitudinal axis (X-direction) is aligned with the axis of the channel.
- Secure the IQ cable to the bottom and side of the channel; when possible, protect the cable by routing it through a conduit.
    - SonTek recommends AVOIDING bending the cable as it comes out of the IQ as debris can be caught on the bend and damage the cable
    - If a cable needs to be bent near the IQ, keep a bend radius no smaller than 4 inches (10 cm). See Figure 65.

Figure 65. When installing an IQ, it is always best to keep the cable STRAIGHT as it comes out the back of the instrument to keep debris from snaging on the cable. However, if the cable needs to be bent, keep the bend radius at 4 in (10 cm) or larger to avoid stress on the cable over time.

- Mount the IQ so that it is level. Pitch and roll should be less than 5 degrees. You can check pitch and roll from the IQ Smart Page using "View Live Data".
- Use non-corrosive (preferably 316 stainless steel) hardware.

When installing a monitoring station, it is important to secure the deployment site to protect cables, batteries, and connectors from weather and vandalism. It may also be necessary to install a conduit to protect the IQ cable from vibration or floating debris (Figure 66).

Figure 66. IQ mounted in channel with a cable conduit

When positioning the IQ, it is important to understand that the mount can create flow disturbances. To minimize turbulence around the instrument, everything should be secured and mounted downstream of the IQ. If you decide to use a custom mount, be sure that it is a smooth hydrodynamic shape. If the IQ will be mounted some distance above the bottom (to prevent burial or allow easy removal), it is best if the mount allows the flow to continue underneath it– so that water can flow above and below the instrument to minimize the flow disturbance.

IMPORTANT: Do NOT use the screw inserts on the underside to mount the SonTek-IQ. Only use the screw inserts on the side of the SonTek-IQ, when mounting the system.

Appendix C provides a technical drawing of the IQ for designing custom mounting options.

4.3. Cross-sectional Survey Procedure

Prior to any installation activities, the cross-sectional area of the installation site should be surveyed or measured as accurately as possible (Figure 67). If the channel has a solid bottom with a uniform shape (such as a uniform concrete trapezoid) a survey may not be necessary. Accurate

measurement of the channel dimensions is critical; if there is any question, we strongly recommend that you perform a detailed channel survey to verify the shape of the cross section.

The accuracy of the IQ volume and flow calculations is highly dependent on the cross-sectional area of the site. Periodic verification of the cross-sectional area is recommended as conditions at the site could change over time. If possible, use local benchmarks during the channel survey.

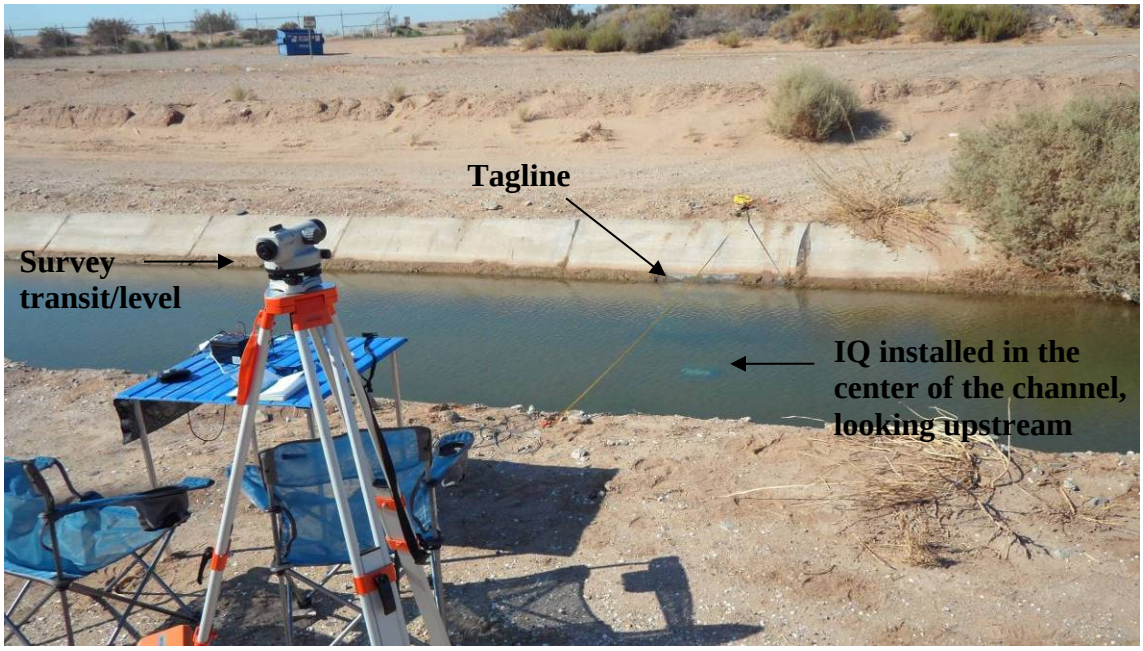


Figure 67. Survey of cross-sectional area of the flow-monitoring site

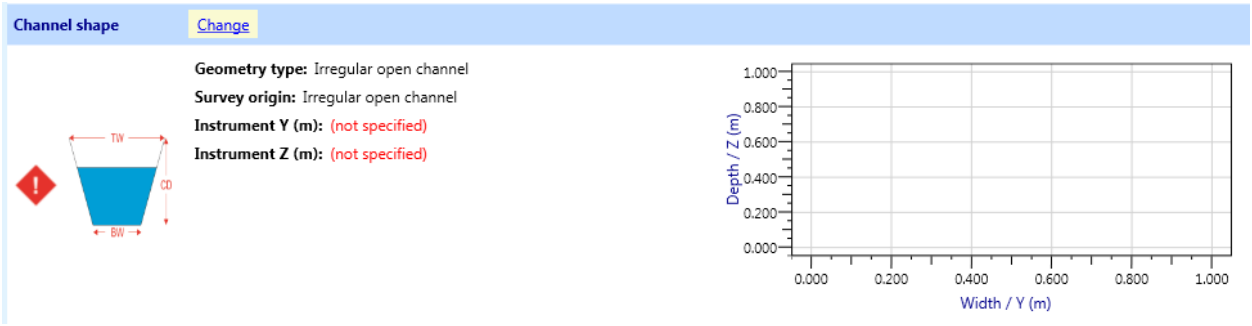
After a site has been selected, SonTek highly recommends completing a cross-section survey of the site. Below is a basic channel cross-section survey procedure:

1) Setup a survey transit/level at the site – be sure to use the bubble level on the transit.
2) Install a tagline across the channel making sure that the tagline is perpendicular to flow.
3) The survey should include points that are higher than the highest water level expected for the site.
4) Collect tagline or station information (Y-data) and corresponding elevation (Z-data). Elevation data are collected using the survey rod and transit.
5) Approximately 10-40 survey points should be taken across the width of the channel. The appropriate number of points will depend on channel size and uniformity. It is important to accurately characterize and define the channel, especially any inflection/transition points. A maximum of 200 points are allowed.
6) Accurately survey in the instrument location and elevation after it is installed.
7) When possible, SonTek recommends using permanent benchmarks near monitoring sites in order to track changes at the site

   Important note: If sedimentation is likely– this will have a direct impact on the accuracy of the IQ flow and volume data as the cross-sectional area will be changing.

4.4. Entering Channel Shape Data

The survey data or channel dimensions are the most important settings on the IQ Smart Page. Accurate flow calculations implicitly rely on an accurate cross-sectional area. See Section 3.1.3 for instructions on entering the survey data. You can quickly navigate to the Channel Shape dialog by selecting the **Change** button in the Channel shape section of the IQ Smart Page.



Once the channel shape dialog is open, for an Irregular open channel, complete the table with the survey data you previously collected (Figure 68).

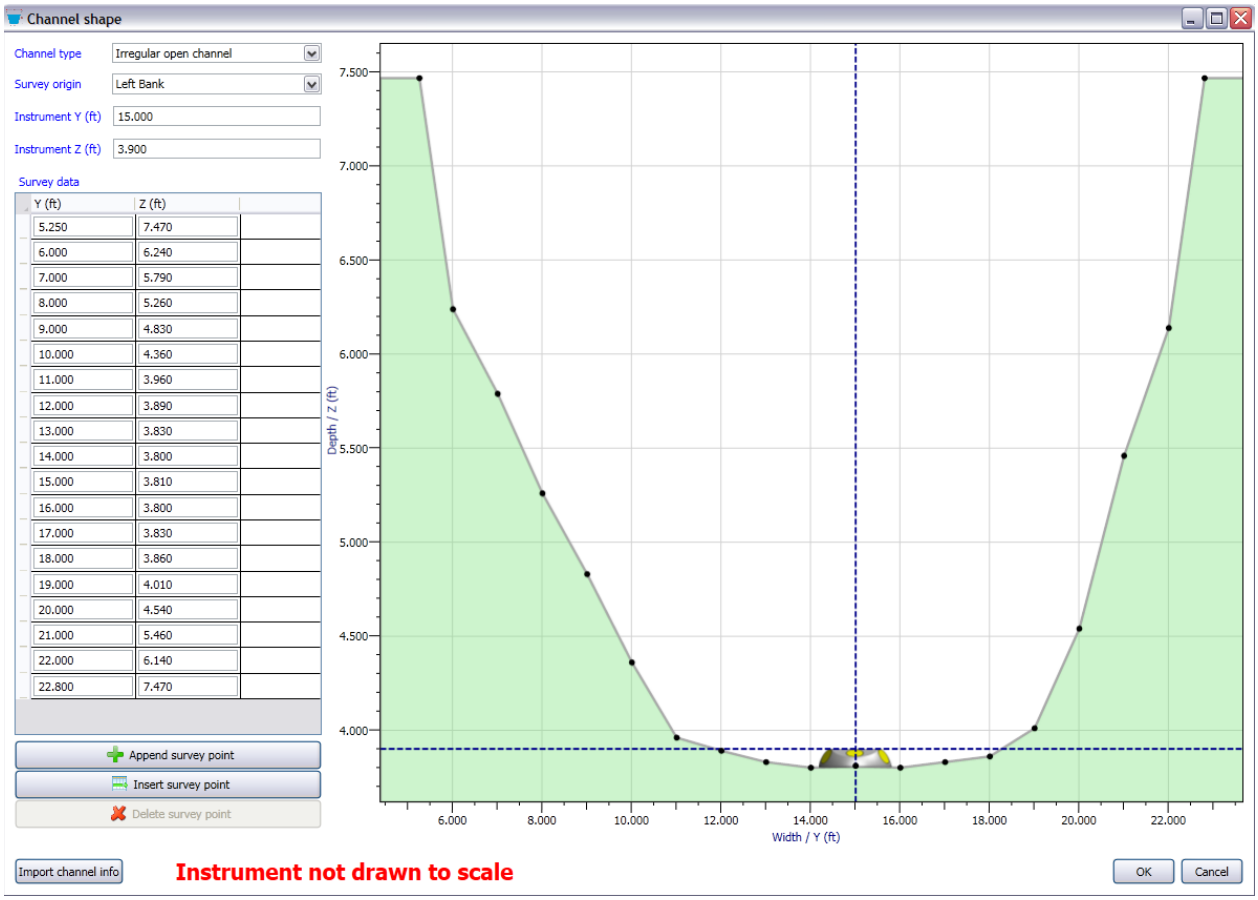


Figure 68. Inputting survey data for an Irregular open channel

If you are installing the IQ in a Trapezoidal channel, you only need to fill in the channel dimensions (Figure 69)

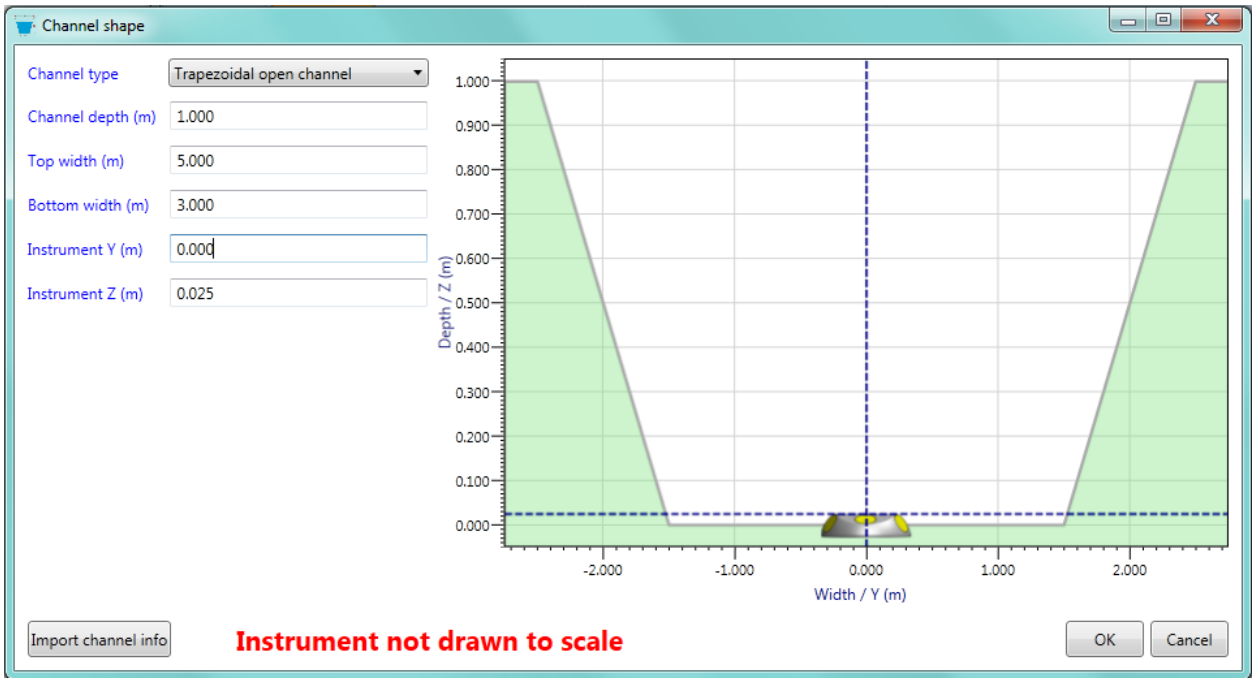


Figure 69. Inputting dimensions for a Trapezoidal channel

Section 5. Installing the IQ in a closed conduit

5.1. Site Selection

Both the SonTek-IQ Plus and IQ Pipe utilize four acoustic beams to measure the water velocity distributed inside of the pipe. From these data, the volumetric discharge (flow) can be computed based on a custom algorithm. With very rare exceptions, the SonTek-IQ Pipe is the most appropriate instrument for closed conduits. If a SonTek-IQ Plus system is installed inside of a pipe, no theoretical flow algorithms are available for direct (internal) flow computations and therefore flow can only be computed through a velocity index method outside of the system (using the index velocity provided by the SonTek-IQ Plus system).

The minimum input voltage to the IQ system is 9VDC. Due to the resistance in the wires, there will be a voltage drop over the length of the power & communications cable when the system is actively pinging and drawing current. Therefore, it is important that the user supply an appropriate level supply voltage at the 'dry' end of the cable to insure that the supply voltage to the instrument will exceed the 9VDC minimum. Longer cables will require a higher minimum input voltage to compensate for the larger voltage loss.

Note for wastewater applications: The SonTek-IQ is not certified ATEX or Intrinsically Safe. Do not use in areas where there is risk of flammability or explosion.

Care must be taken to ensure the system is installed in a section of the pipe where the flow regime will be as uniform as possible.

- The SonTek-IQ Pipe should be installed in a region of the pipe that is free from flow

disturbances and excessive turbulence, such as intersections, abrupt changes in pipe diameter, or the presence of obstructions inside the pipe.

- The system should be installed in a straight section of the pipe, away from any bends or turns both upstream and downstream.
- It is recommended that the installation location be at least 10 pipe diameters in either direction from an obstruction or flow diversion (for example, in a 1-ft diameter pipe, the section should be straight for a total of 20 ft, with the instrument mounted in the middle of this section).
- Sections of the pipe where significant aeration occurs should be avoided, as the presence of bubbles could affect the velocity measurement.
- The instrument must be firmly attached to the inside of the pipe. It should not move or vibrate during the measurement.
- The instrument must be kept free from debris and sedimentation, as it will not be able to measure flow if it is obstructed by debris or buried by sediment.

5.2. Evaluating the closed conduit cross-section

Cross-section area is one of the most important parameters when configuring the instrument for data collection. Experience has detailed that errors in channel geometry create the largest errors when collecting flow data; therefore, for best possible data quality care should be taken when entering channel geometry. The diameter and shape of the closed conduit should always be evaluated or inspected. Environmental conditions over time and these conditions can have an impact on shape and diameter.

- For concrete pipes or culverts, erosion over time can change the inner shape of the closed channel.
- Load from weight bearing culverts can change the shape of the closed conduit, this can also be a factor for the structural integrity if the close channel.
- Take care in estimating channel dimensions (i.e., inner diameter and outer diameter).
- Be sure to have accurate measurements for where the system is located in the channel (Instrument Y and Instrument Z).

5.3. Mounting the IQ Pipe

When mounting the system inside of a pipe, the following important observations must be made. Failure to follow the instructions in this section can result in invalid data being collected:

5.3.1. General Installation Instructions

- The SonTek-IQ Pipe is normally installed on the bottom of the pipe, with the transducers pointing upwards.
    - In pipes and culverts that are *always* full, ONLY the IQ Pipe can be installed at the top looking down. This may provide for a more secure installation site, with reduced risks of the system being buried by sediment. Care must be taken to ensure the pipe is ALWAYS full.
- The longitudinal axis (X-direction) SonTek-IQ Pipe must be aligned with the axis of the pipe.
- The SonTek-IQ Pipe must be installed as level as possible. The forward portion of the

instrument should not be higher than the back, or vice-versa.

- The instrument comes with two mounting brackets to facilitate installation. It can also be installed using an expansion ring secured to the inside of the pipe (see Pipe Ring section below).
- The instrument's height is 29 mm (1.15 in). Measure the SonTek-IQ Pipe elevation after installation. System elevation is measured from the top of the SonTek-IQ Pipe, at the horizontal transducer and is defined as the height of the top of the system relative to the bottom of the pipe (the inside wall). If mounted directly to the bottom, the Instrument Z would be entered as 0.29 m (0.096 ft).
- Secure the deployment site as needed to protect cables and connectors from damage (from debris and animals) and vandalism.

5.3.2. Alignment

- A critical part of the installation inside of a pipe is the alignment with the center of the pipe. If the system is off to the side (left or right) of the center of the pipe, the flow can be affected as the theoretical flow algorithms assume the system is centered in the middle of the pipe.
- This is not always an easy task to perform, especially for larger pipes, but a critical step and care should be taken to properly measure the pipe's diameter and identify its center.

5.3.3. Location Inside the Pipe

- **Pipe Entrance:** SonTek recommends that the installation location be at least 10 pipe diameters from the entrance of a pipe. In some rare cases, it may be possible to shorten this to 5 pipe diameters, AS LONG AS the flow conditions at the system are steady!
- **Pipe Exit:** The IQ Pipe can be mounted closer to a pipe's exit than its entrance (typically less than 10 pipe diameters). The advantages are that installation and maintenance is significantly easier because of access. Also, the flow is fairly well developed by this point.
- **Partially submerged pipe:** In this case, it is best to mount the system close to the pipe's exit IF the flow conditions are stable at the exit. It should be noted that at times the pipe exit will act as a weir and the flow will start to draw down (transition) inside the pipe to a critical flow point (possibly right at the exit). If this is the case for your pipe, make sure the IQ Pipe is away from the drawdown section.
- **Pipe transitions:** In some pipe sections the pipe diameter will change abruptly. Usually it is only a few inches but this can cause the flow conditions to change inside the pipe in proximity to it. These should be treated similar to a pipe entrance condition so the IQ Pipe should be mounted at least 5 to 10 pipe diameters away in either direction.

5.3.4. Cable Installation Instructions

- The system should be installed with the cable pointed downstream. An arrow indicating positive (downstream) flow direction is printed on the top to the instrument. If the system can only be installed with the cable pointing upstream, make sure to check the box next to **reverse flow direction** in the flow settings.
- For the sections of the cable that are inside the pipe, the cable needs to be anchored to the inside pipe wall at no more than 5-ft between anchors points.
- SonTek recommends that the cable be mounted straight downstream of the system. If

the cable needs to be bent, make sure the bend radius is not smaller than 4 inches (10 cm) as shown in Figure 65.

- For larger pipe diameters, it may be possible to install the cable inside a conduit, though this should be avoided for smaller diameters as it can cause flow disturbances, especially if the conduit is large.
- If the pipe is partially submerged it is best if the cable be run to the top of the pipe (or above the water-line) and then inside a conduit to the pipe's exit. This minimizes the potential for cable snags and offers the best protection to the cable.
- Once outside the pipe, the cable must be protected inside of a conduit.

5.3.5. SonTek Pipe Ring Installation

- SonTek supplies a Pipe Ring that can be used to mount systems inside of a pipe.
- For details of how to use the Pipe Ring, please see Section 1.1.

5.4. Entering the channel shape

The survey data or channel dimensions are the most important settings on the IQ Smart Page. Accurate flow calculations implicitly rely on an accurate cross-sectional area. See Section 3.1.3 for instructions on entering the survey data. You can quickly navigate to the Channel Shape dialog by selecting the **Change** button in the Channel shape section of the IQ Smart Page.

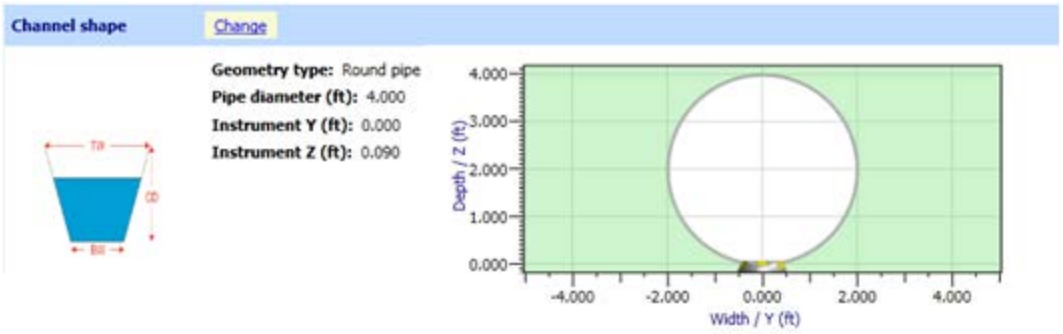


Figure 70. Channel dimensions and instrument position

Once the channel shape dialog is open, for an Irregular Pipe complete the table with the survey data you previously collected using the same protocol outlined in Section 4.4.

Section 6. Data Analysis and Visualization – View Data

The SonTek-IQ software includes several tools and functions for visualizing and analyzing all data collected. The software organizes and saves all downloaded data to a simple database structure on your computer. The **View data** window displays all of the data you have collected and provides a suite of plotting functions to examine and compare flow conditions at all of your measurement sites. To access the visualization and analysis tools, select the "View data" button in the main ribbon after starting the IQ software.

The **View data** window is available with or without a connection to the IQ. If you are connected to a system, you can view data as soon as the download is complete. This provides a quick and convenient way to evaluate the data you have just collected at a site.

The IQ software includes a sample data file that you can use to explore the ViewData functions before your own data are available.

- The file name is **SampleData**.
- If you are organizing data by site name, look for **Sample Data Site Name**.
- The sample data file is available only with software versions 1.10 and higher
    - It will be copied to your PC only for new software installations; it is copied when you select the IQ data directory (the first time you use the **View Data** function).
    - It will not be copied if you are upgrading an older version of the IQ software.
- If you are using an older version of the IQ software and want access to the sample data file, do the following
    - Un-install your existing version of the IQ software.
    - Install the latest IQ software (version 1.10 or higher).
    - Select your desired IQ data directory from the software settings menu (see Section 2.3). This can be the same directory used for the older version of the IQ software. Any existing data files will automatically be available. The sample data file will be added to this directory.

The IQ stores and accesses all downloaded data from a common folder. This setting specifies the data folder location and name.

- If you are manually transferring IQ data files into the IQ data folder, place the files into a subdirectory matching the IQ file name.
- Example: Suppose the IQ data folder is **C:\IQData**, and you manually want to transfer a data file named **SampleData_20110805_120000.IQ** into your IQ data directory.
    - Create a folder **C:\IQData\SampleData**.
    - Move the data file into that folder.
    - Close and re-open the IQ software. You will now be able to view the data file from the **View Data** menu.

6.1. Tour of the View data window

The View data window is packed full of features and functions. Once you are familiar with the layout and operation of this window, it will be a valuable tool for analyzing your flow data. There are four main sections in the View data window: the data files, the data table, charts, and ribbon functions (Figure 71).

Data files: The data files are displayed along the left side of the window. This section can be organized by site name, file name, system serial number, or operator. All IQ files on your local computer will be displayed here. To view a data file, use the small triangle icon to expand a folder and select one or more files. Selected files and folders will be outlined in green. To deselect a file, simply click on the IQ icon next to the file name.

Data Table: The data table is located along the bottom on the View data window. This table lists the sample variables. The data columns can be moved horizontally by dragging them with the mouse and sorted vertically by selecting the column header. Clicking on a row of data will highlight the corresponding sample in the data figures.

Charts: The charts fill most of the View data window's main area. The charts are very configurable and can be ordered and organized in a number of ways. The time series charts are in the middle of the window and the profile chart is oriented vertically along the right side of the window (IQ Plus and IQ Pipe only). You can have up to six individual time series charts and the profile chart can display SNR and velocity profile data.

Ribbon functions: The ribbon is located at the top of the View data window. All of the data processing and plotting functions are here. Use these buttons to select which variables to display in the table, export data, calculate statistics, and show or hide plotted lines.

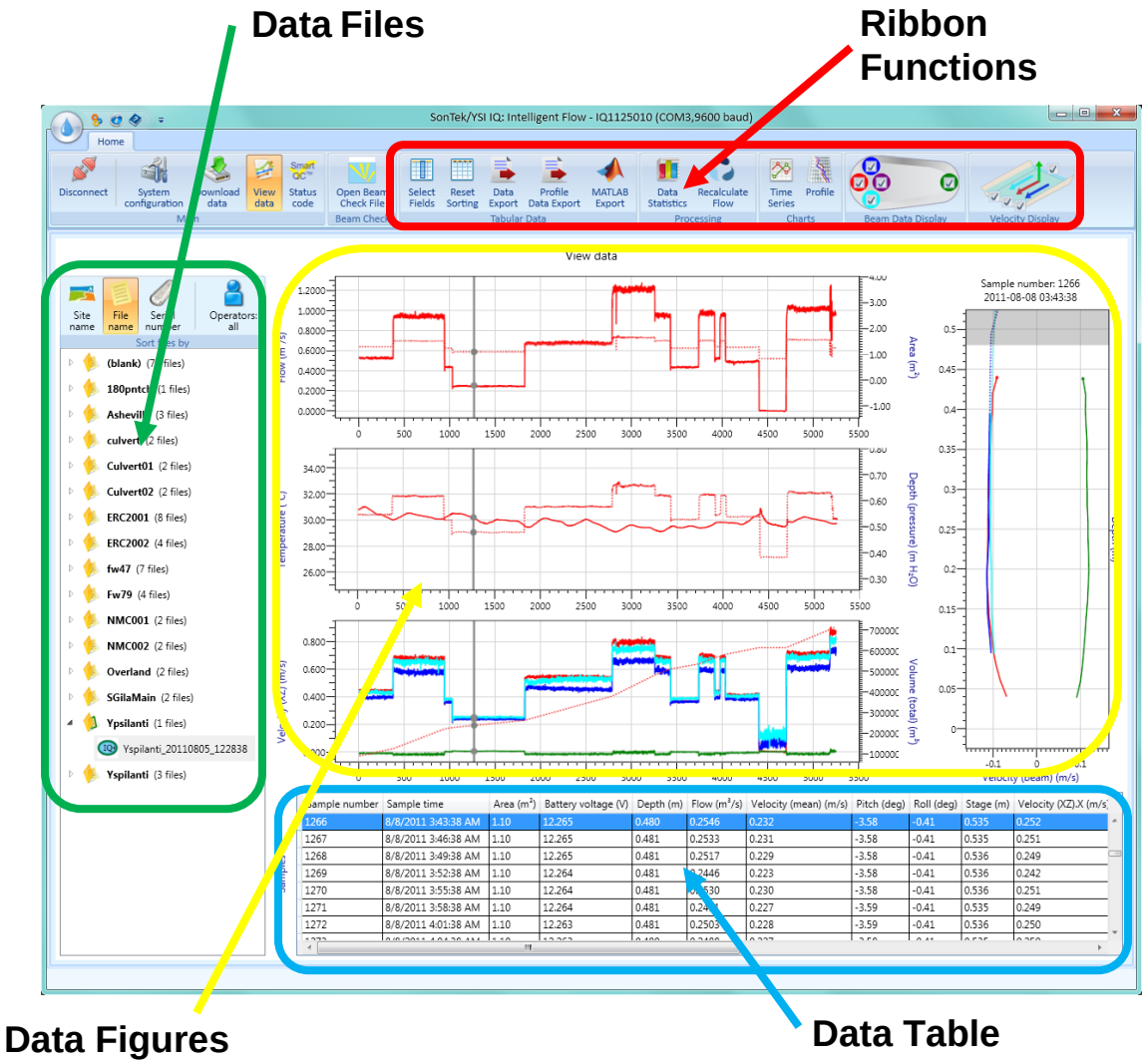


Figure 71. View Data window

6.2. Using View Data

The easiest way to learn how to use the many functions on the View data window is to try them and see what happens. The original IQ data files are never changed or modified. None of the functions in this window will harm your data in anyway. Each function provides a simple and meaningful way to look at and organize IQ flow data.

6.2.1. Organizing your data files

As you begin using your SonTek-IQ, you will undoubtedly start to accumulate a large number of data files. Each downloaded file is stored on your computer in the folder or directory specified in the Software Settings page (see Section 2.3). The IQ software will create a new folder in the database for each new file name. It is always a good practice to enter a File name and a Site name in the IQ Smart Page when configuring a system for deployment. This will help to keep your data organized and accessible.

We do not recommend moving files within the directory structure created for the IQ database. Moving files from one folder to another could make it difficult to find that file in the future.

The View data window can automatically sort your data files by **Site Name**, **File Name**, **Serial Number**, and **Operator Name** (Figure 72). The sorting options are enabled by clicking on the appropriate button at the top of the data files section in the View data window.

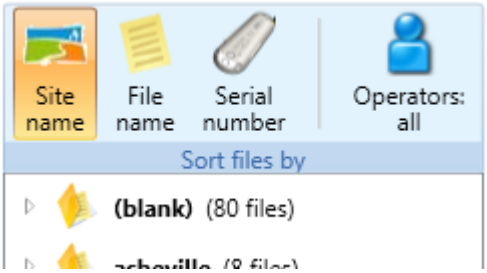


Figure 72. Sorting data files

If you do not include a **Site name** or **Operator name** when configuring your IQ for deployment, the files will be sorted under the **(blank)** heading at the top of the list.

6.2.2. Loading a Data file

To begin visualizing a data file, click on the small white triangle next to a data folder in the data file section of the View data window. This will open the folder and list all of the sorted files. To load a file and begin viewing the data, select the file name or the IQ icon next to the file name. A single click with the mouse loads the data for viewing (Figure 73). A second click will remove the data from the charts and table.

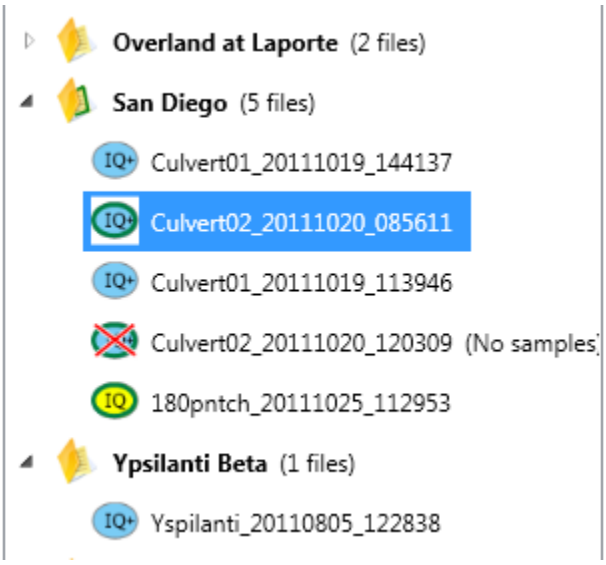


Figure 73. Loading a data file

For convenience and quick navigation, there are several visual indicators used in the data file section to show the status of each file.

- After selecting a file, the IQ icon and the containing folder will be outlined in green
- Select multiple files to display with a single click on the IQ icon or the folder name, click again to remove data from charts and table.
- IQ+ indicates the file was collected with an IQ Plus
- IQ indicates the file was collected with an IQ Standard
- PIPE indicates the file was collected by an IQ Pipe
- If a data file is empty, the icon next to the folder will display a red "X" when selected.
- Right click on the file name to view the settings used to collect the data (Figure 74)

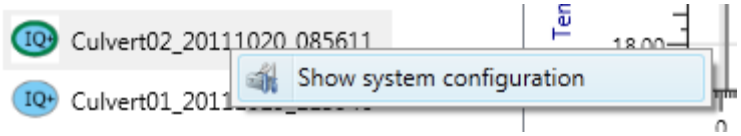


Figure 74. Right click on file name to see IQ settings

6.3. The Data Table

The Tabular Data in the View data window is a list of all the samples for each selected field or variable. The IQ software will remember which fields are selected and it will display the same fields in the table the next time the software is started. After loading a data file, you will see data displayed in the data table (Figure 75).

Samples

Sample number	Sample time	Area (m^2)	Battery voltage (V)	Depth (m)	Flow (m^3/s)	Pitch (deg)	Roll (deg)	Stage (m)	Velocity (mean) (m/s)
1	10/20/2011 8:56:45 AM	0.02	11.452	0.057	0.0033	4.78	-4.39	0.057	0.193
2	10/20/2011 8:57:50 AM	0.02	11.452	0.057	0.0030	4.78	-4.39	0.057	0.176
3	10/20/2011 8:58:55 AM	0.02	11.452	0.057	0.0052	4.78	-4.38	0.057	0.303
4	10/20/2011 9:00:00 AM	0.02	11.452	0.057	0.0046	4.78	-4.39	0.057	0.271
5	10/20/2011 9:01:05 AM	0.02	11.452	0.057	0.0068	4.78	-4.39	0.057	0.398
6	10/20/2011 9:02:10 AM	0.02	11.452	0.057	0.0051	4.78	-4.38	0.057	0.298
7	10/20/2011 9:03:15 AM	0.02	11.452	0.057	0.0083	4.78	-4.38	0.057	0.488

Figure 75. The Data table

- Use the scroll bars along the bottom and right side of the table to move to any row or column in the table.
- Clicking on the column header will sort the entire data set by the ascending or descending order of data in the selected column.
- Organize and order the columns by clicking on the column header and dragging the column to a new location in the table.
- Selecting a row or cell will locate the data point in all of the time series charts with a vertical gray line and an icon at the point

6.3.1. Tabular Data Functions

The Tabular Data functions located in the main ribbon of the View Data window are used to select which fields are displayed in the table, to reset the row sorting, and to export data. Activate these functions by clicking on the button.

Select Fields: Opens a small window with a list of check boxes to select which fields are shown in the data table. Simply click the checkbox to include the data field in the table at the bottom of the screen. You can also use the **Select All** and **Deselect All** buttons for activating and deactivating data fields (Figure 76).

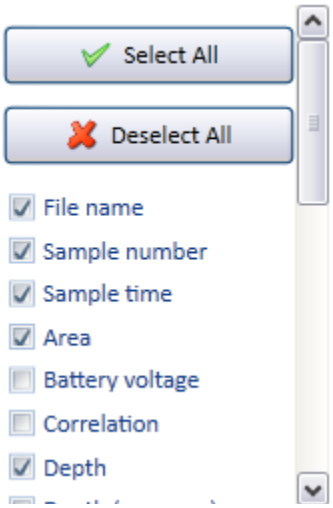


Figure 76. Selecting data fields for tabular data output.

Reset Sorting: Tabular data can be sorted by clicking on the column header of the data table. To remove the column sorting, use the Reset Sorting function to reorganize the rows by Sample number.

Data Export: Export selected files to a user-defined location such as a .csv file (Comma Separate Variable). The default location is the IQ Data folder that has the same name as the first selected file. If multiple files are selected – all files will be exported as one CSV file with the first file name in the group of files. Only the fields or variables currently displayed in the data Table will be exported.

Profile Data Export (IQ Plus and IQ Pipe only): If you are using an IQ Plus, you have access to a vast amount of data. The IQ Plus can store information about each velocity profile sample. Each profile sample includes data from each beam for the Signal to Noise Ratio (SNR), the Standard Deviation, the Channel Velocities, and Beam Velocities. A CSV file for each of these fields will be created with different file extensions (.SNR, .STDDEV, .VEL, and .VELBEAM respectively).

MATLAB Export (IQ Plus and IQ Pipe only): This function exports data collected by the IQ Plus in a MATLAB file (.mat file). The file will be saved in the IQ data folder named after the File name. You can import the .mat file into MATLAB using the load command. IQ fields and settings are organized in data structures.

6.4. Processing Data

In general, most data processing is performed onboard the IQ. The IQ has many built-in intelligent features to provide the best possible flow data as conditions at your measurement site evolve over time. If you have an IQ Plus, significant changes in a channel may prompt you to reprocess your flow data with a new channel shape or new flow conditions. The View data window provides a way for you to reprocess flow data and to calculate statistics on specific fields. These processing functions do not change the raw data files. Any processing that you apply can be undone later.

6.4.1. Processing Data Functions

Two processing functions are available in the View data window to help you to evaluate your data statistically and to recalculate flow if conditions in the channel should change.

Data Statistics: Use this function to calculate statistics on the fields displayed in the Data table. Add or remove fields with the Select Fields function in the Tabular Data section of the ribbon. To begin the statistical analysis, select the desired time span based upon Sample Number or Time (Figure 77).

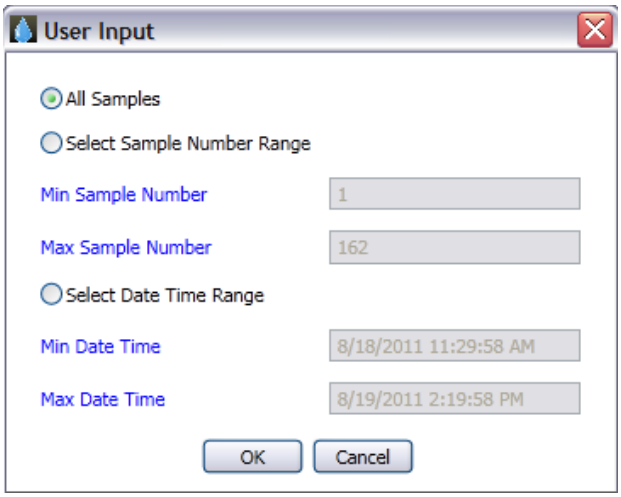
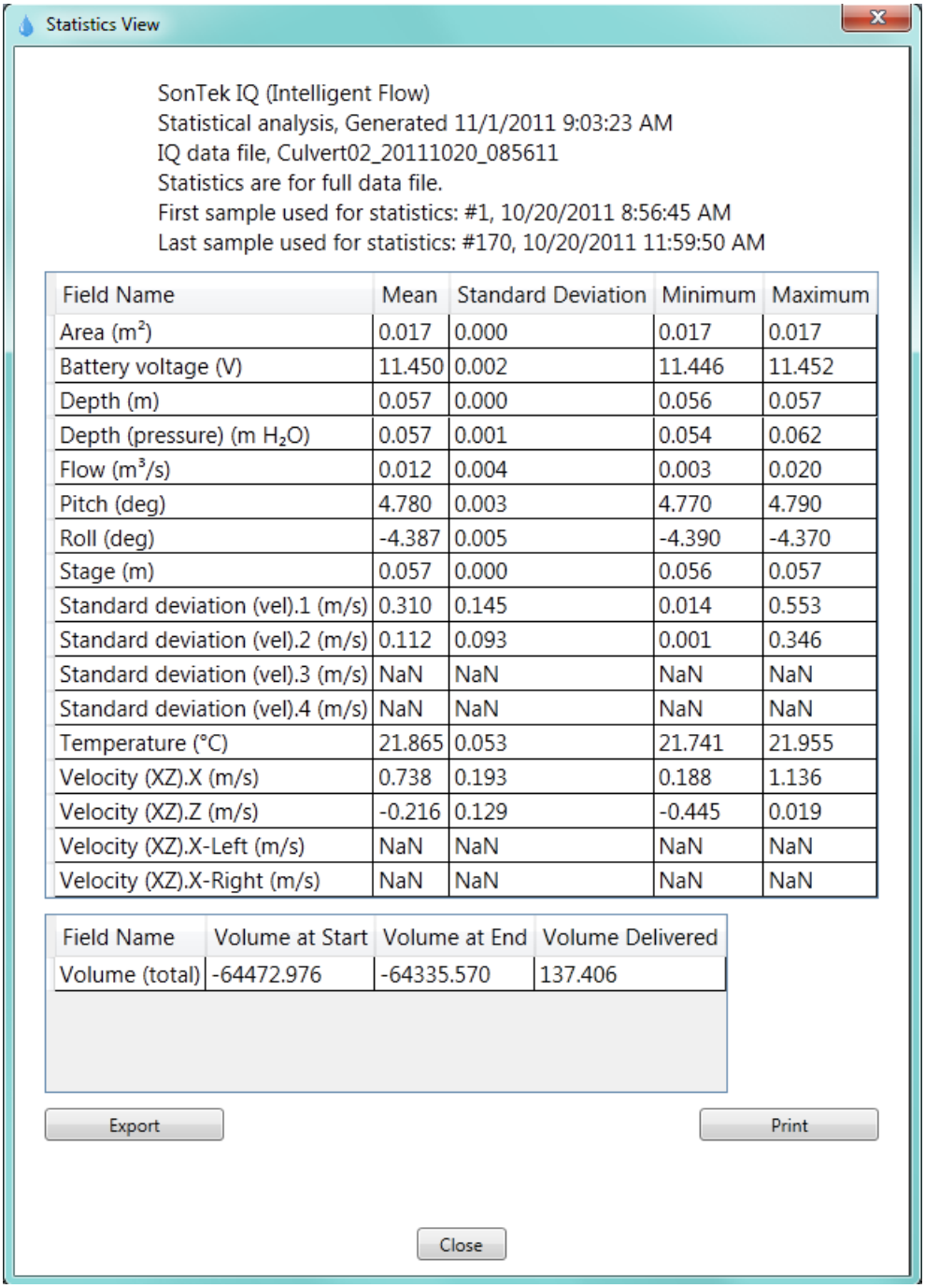


Figure 77. Selecting data statistical analysis

Once the desired sample range is selected, a new window with a table of statistics for each field is displayed (Figure 78).

- A general summary appears above the table
- Each row of the table has the Field name, Mean, Standard Deviation, Minimum, and Maximum values.
- Fields that have errors or fields that are unavailable will have a “NaN” value in the cell.
- A scroll bar may appear on the right side of the window if there are a large number of fields
- You can export the table as a CSV file or print the statistical data in window.



Field Name	Mean	Standard Deviation	Minimum	Maximum
Area (m^2)	0.017	0.000	0.017	0.017
Battery voltage (V)	11.450	0.002	11.446	11.452
Depth (m)	0.057	0.000	0.056	0.057
Depth (pressure) (m H_2O)	0.057	0.001	0.054	0.062
Flow (m^3/s)	0.012	0.004	0.003	0.020
Pitch (deg)	4.780	0.003	4.770	4.790
Roll (deg)	-4.387	0.005	-4.390	-4.370
Stage (m)	0.057	0.000	0.056	0.057
Standard deviation (vel).1 (m/s)	0.310	0.145	0.014	0.553
Standard deviation (vel).2 (m/s)	0.112	0.093	0.001	0.346
Standard deviation (vel).3 (m/s)	NaN	NaN	NaN	NaN
Standard deviation (vel).4 (m/s)	NaN	NaN	NaN	NaN
Temperature (°C)	21.865	0.053	21.741	21.955
Velocity (XZ).X (m/s)	0.738	0.193	0.188	1.136
Velocity (XZ).Z (m/s)	-0.216	0.129	-0.445	0.019
Velocity (XZ).X-Left (m/s)	NaN	NaN	NaN	NaN
Velocity (XZ).X-Right (m/s)	NaN	NaN	NaN	NaN

Field Name	Volume at Start	Volume at End	Volume Delivered
Volume (total)	-64472.976	-64335.570	137.406

Figure 78. Data statistics window

Recalculate Flow (IQ Plus and IQ Pipe only): A post-processing function that allows users to re-calculate flow by changing channel geometry or flow settings. Selecting this function will open a limited version of the IQ Smart Page showing the IQ configuration for the data file. You can edit each section as you would if you were configuring a system for deployment (Figure 79).

- To change channel shape or flow settings, click on the **Change** button in the appropriate section.
- Flow settings can be changed to reprocess data using a velocity index as well applying new thresholds to data for volume calculations. You can also enable and disable Reverse Flow and Velocity Filtering.
- When finished, click **Recalculate flow with new settings**, and your data will be reprocessed using the new settings. Only the last recalculated flow will be saved. **Note**: You cannot recalculate flow unless you have set Log Profile Data to "1" under Standard Settings on the SmartPage .
- If you want to undo the new settings, click **Revert to original flow calculations**, and your original data will be restored.
- The original field data files are never changed and can always be recovered. Any modified flow calculations are stored in a separate file.

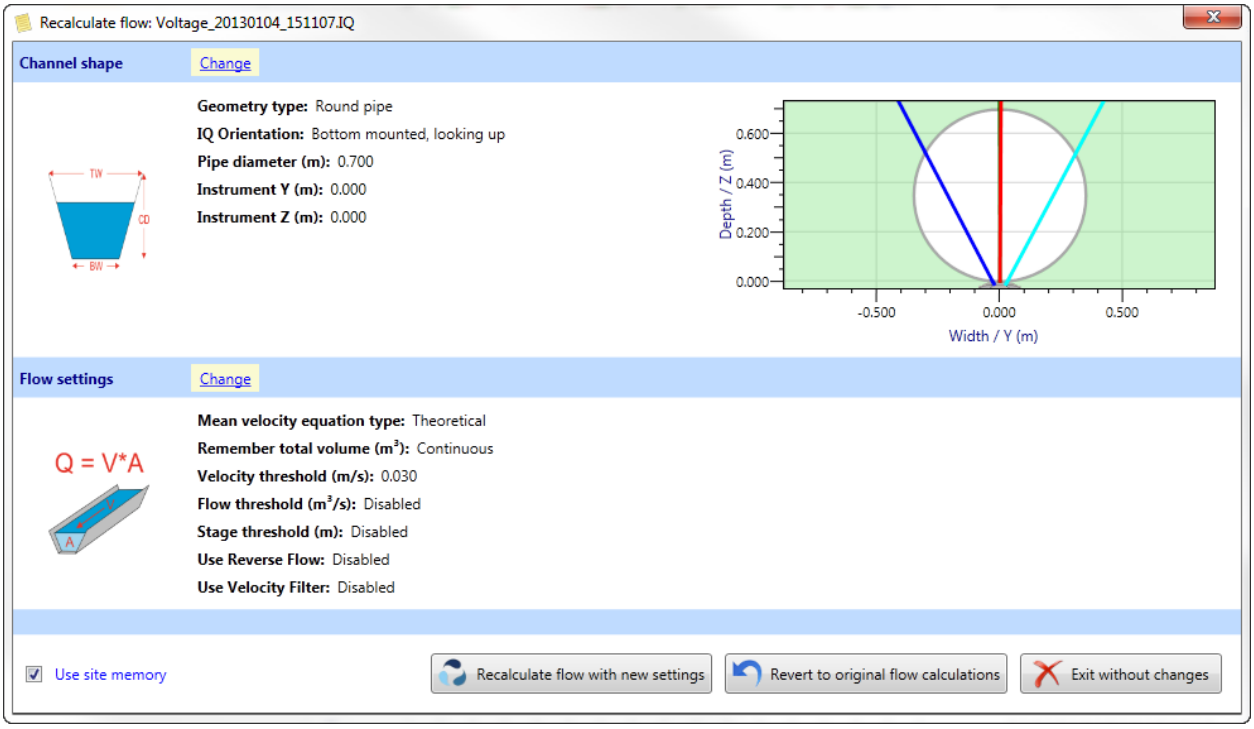


Figure 79. Recalculate Flow (IQ Plus and Pipe only)

6.5. Working with Charts

There are two types of charts displayed in the IQ software View data window: Time series and Profile. The Time series charts are the horizontally oriented charts in the center of the View data window and the Profile chart is the vertical chart located along the right side of the window. These charts share several common navigation features.

- Left click inside the chart area and hold the mouse button to drag the data view.
- To zoom: Hold the Alt key, left click and hold mouse button while dragging a zoom window inside a chart.
- Right click in the chart to see more chart options (Figure 80).

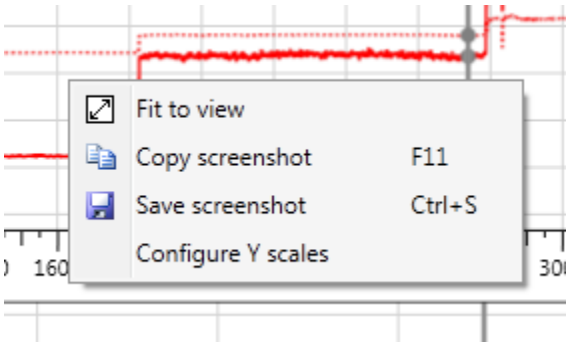


Figure 80. Left mouse button chart options

- Use **Fit to view** to return to the original zoom level.
- Use **Configure Y scales** to manually set the vertical axes on the Time Series charts.
- To scroll the chart view only in the vertical or horizontal direction, left-click on the vertical or horizontal axis holding the mouse button and dragging the axis.
- To zoom the chart view only in the vertical or horizontal direction, right-click an axis and drag along the axis direction to increase or decrease the axis range.

6.5.1. Chart Functions

Use the chart functions located in the main ribbon of the View data window to add or remove fields from the Time Series and Profile charts.

Time Series: Time series charts can be configured in a number of ways. Select the **Time Series** function to open a small window to add charts to the View data window and to add fields to the individual charts (Figure 81).

- Users can select data fields for both the Left and Right vertical axes.
- Data plotted versus the Left axis will be a solid line
- Data plotted against the Right axis will be a dotted line.
- Time series fields with multiple variables will be color coded to match either the Beam Data Display or the Velocity Display check boxes.
- Time series can be plotted with the horizontal axis as sample number or sample time.
- Not all fields are available for the IQ Standard.

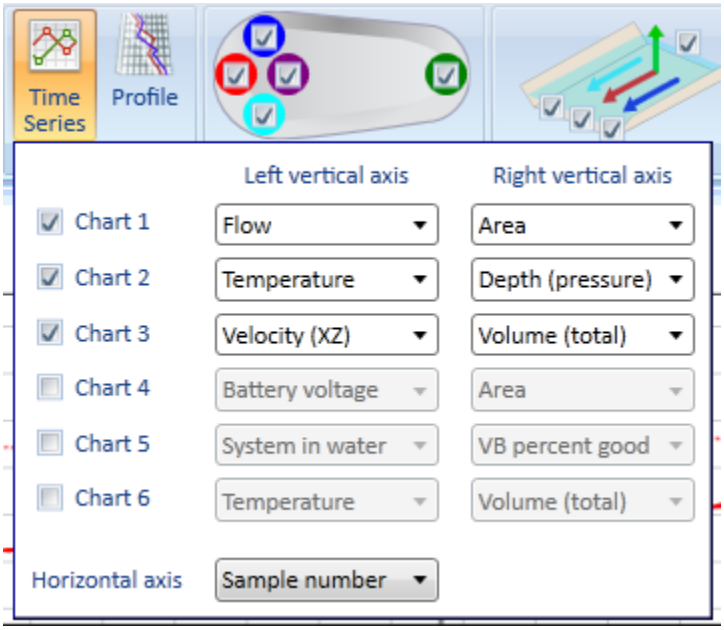


Figure 81. Time Series chart field selection dialog

Profile (IQ Plus and IQ Pipe only): Use the Profile function in the main ribbon to select the field to display in the Profile chart located along the right side of the View data window (Figure 82).

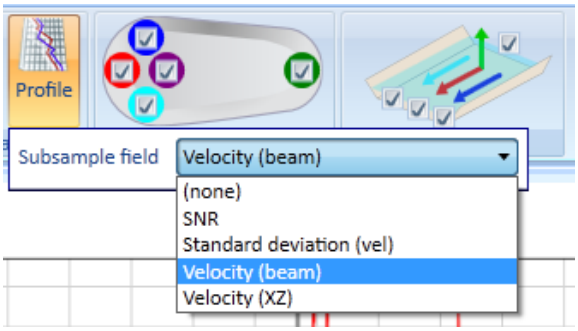


Figure 82. Profile chart Subsample field selection dialog

- Select **(none)** to remove the Profile chart from the View data window
- Selecting any other field will plot multiple color-coded lines in the Profile chart.
- Colors in the Profile chart correspond to individual Beams or measured water Velocities.
- The Profile chart will include a gray shaded area to indicate the region above the current water level.
- Figure 83 presents velocity profile data.

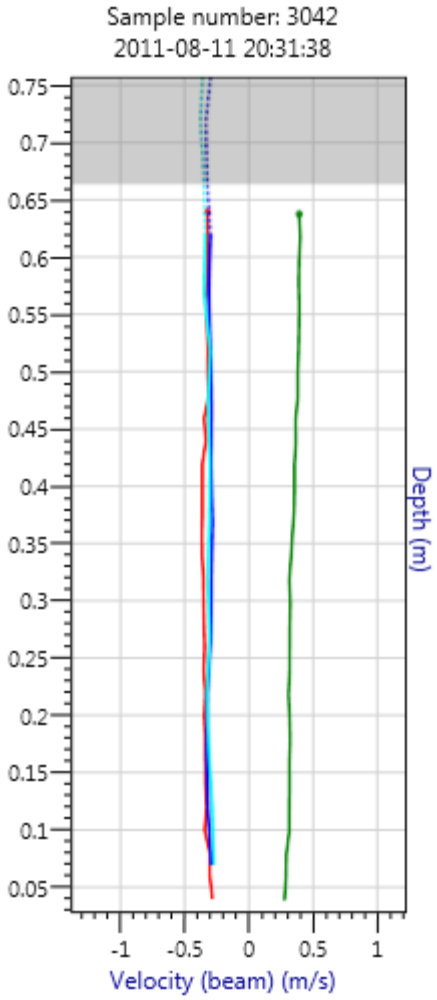


Figure 83. Profile chart

6.5.2. Display Functions

The **Beam Data Display** and **Velocity Display** functions in the View data window are provided as a quick method to enable or disable lines in charts. Beam and Velocity data can be plotted in Time series charts along with SNR. Velocity and SNR profile data are plotted in the Profile chart. Beam data, as the name implies, are raw data collected from a single transducer or beam. Velocity data are processed or calculated from these raw beam data and are a combination of data collected from all the beams.

- Activate or deactivate a Beam or Velocity graph series (line) by toggling its check box.
- The color surrounding the Beam corresponds to the color of the line on the chart
- The color of the Velocity arrow corresponds to the color of the line on the chart

Section 7. Output Data Settings

The SonTek-IQ supports four different output data types. These are listed, along with SonTek Binary,under the output type dropdown. However, SonTek Binary is not an output format, rather a communication protocol used by SonTek to display the live data from the IQ. It is included in the output type dropdown as a convenience (Figure 84). You can select an output type from the IQ Smart Page while configuring a system for deployment. Instructions for configuring the options for each output data type are presented in Section 3.1.5. This section provides complete definitions for each output type and the data fields available.

- The type of data output used by the SonTek-IQ must be selected when configuring the system with the IQ Software. The default is SonTek binary.
- The output units are selected in the same menu. Note that the output units may be different from the units displayed when viewing live data in the IQ software.

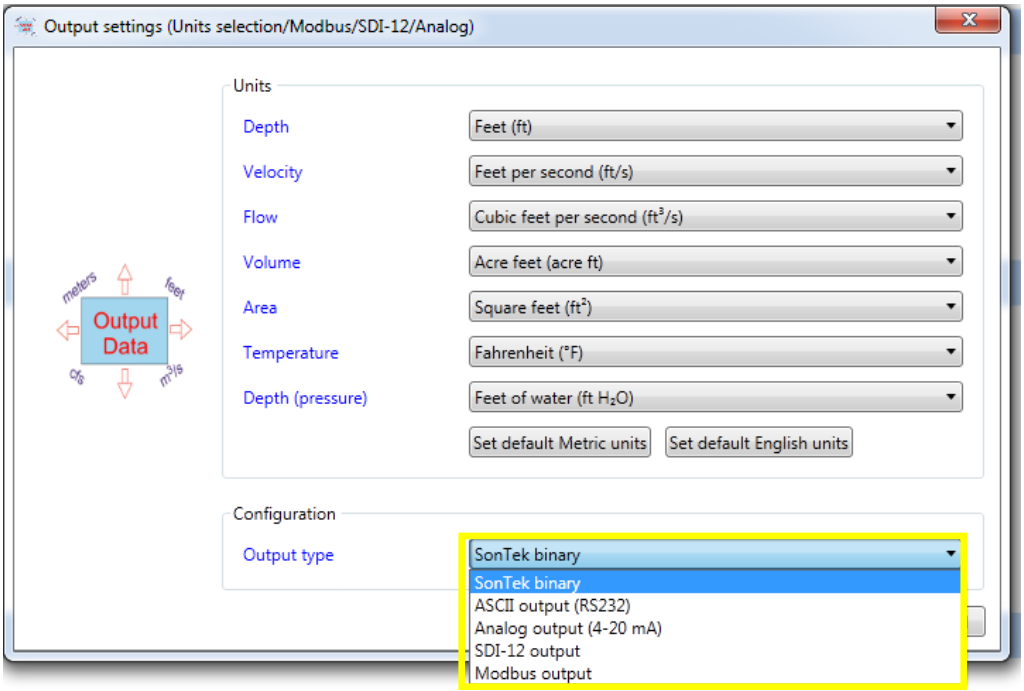


Figure 84. SonTek-IQ data output types

7.1. IQ System Status

The IQ output data includes a valuable diagnostic and monitoring value called **System Status**.

- If **System Status** has a value of zero, no potential problems have been detected, and the IQ can be said to be "All Clear".
- If **System Status** has any value other than zero, the IQ has detected some sort of problem that may affect data quality. You should evaluate the issue as soon as possible, and clear up the potential problem if possible.
- **System Status** is available in all output data output formats.
  - We strongly encourage users to monitor this value to help determine when a site visit may be needed.

When calculating this value, the IQ analyzes all data to look for potential problems. If any problems are found, the IQ sets a flag within the **System Status** value.

- We use a technique called bitwise encoding so that multiple flags are incorporated within this single value.
- In bitwise encoding, we use a different number (each of which is a power of 2) for each flag. The value 1 indicates one flag, 2 is second flag, 4 is a third, and so on.
- If multiple flags are set, the values add together. For example, a value of 5 indicates the flags for 1 and 4 are both set.
- With bitwise encoding, each value of **System Status** corresponds to a unique combination of flag(s) that are currently set.

To make it easy to interpret the **System Status** value:

- The IQ software includes a utility to interpret the status value.
  - This utility can be accessed from several locations (see Section 2.4 and Section 2.5.2).
- With the IQ Flow Display, any **System Status** messages are available in real time from the LCD display (see Section D-4.).

Table 1 lists all System Status flags, the message that is associated with them, and a brief description of the potential problem.

Table 1. System Status Flags

Flag Value	Message	Description
0	All clear	No potential problems have been detected.
1	High tilt values – check IQ mount	One or more tilt values are greater than 5º; this may affect data quality. Inspect the IQ mount.
2	Tilt values have changed; IQ may have moved	One or more tilt values have changed significantly since the start of data collection. This may indicate the IQ has moved. Inspect the IQ mount.
4	Recorder space low – less than 14 days remaining	Less than 2 weeks of recording time remain on the internal recorder. Data should be downloaded and the recorder formatted as soon as possible.
8	No valid depth data; check for debris or burial	The instrument is in the water but no valid depth data is available. There are several possible causes that may include debris, burial, highly uneven water surface, or too much air in the water.
16	One or more beams may be buried	One or more of the profiling transducers may be coverer or buried, potentially affecting data quality.
32	Low battery voltage	Battery voltage is less than 9.0 V. Check the power supply – replace or charge as appropriate.
64	Internal recorder is full	No internal recording space is remaining, so data is no longer being recorded by the IQ. Data should be downloaded immediately and the recorder formatted.
128	Stage is outside defined channel; no flow data will be reported	The depth measured by the IQ is beyond the defined limits of the channel. No flow calculations are possible (flow data is reported as 0). This may indicate a problem with the depth data, or an error in

		the definition of channel geometry.
256	Invalid temperature data; IQ may need repair	The temperature sensor may have failed, which will affect the quality of data. The IQ should be inspected and may need to be returned for service.
512	Low SNR warning	The SNR is less than 10 dB.
1024	Velocity sample filtered - turbulent or low flow detected	When velocity filtering is enabled, velocity spikes are removed and the flow becomes zero.
2048	Pipe Size Warning	Dimensions are outside of recommended range
4096	Vertical beam range exceeded	Pressure depth is greater than maximum vertical beam range.
8192	Poor depth warning	Pressure depth is greater than 0.04 and less than maximum vertical beam range.

7.2. SonTek Binary

The SonTek Binary option is the default output data type. However, it should be understood that SonTek Binary is not an actual output format. It is a proprietary communication protocol that allows users to view live data. Users who do not need to use real-time data (i.e. not connected to a datalogger or a Modbus network) or users who will only communicate with the IQ using the IQ software should use this output data type. Data is recorded and stored on the IQ in a proprietary file format. The IQ software uses this format to manage the data. To output the data to an external device or database, one of the four supported format outputs need to be selected.

- The SonTek binary output format type must be selected to use **View Live Data** from the IQ software. Selecting **View Live Data** (Figure 85) on the IQ Smart Page shows a summary of the last measurement from the system. This function can be useful to view the latest data, or to check the orientation (pitch and roll) of the IQ during the installation process.

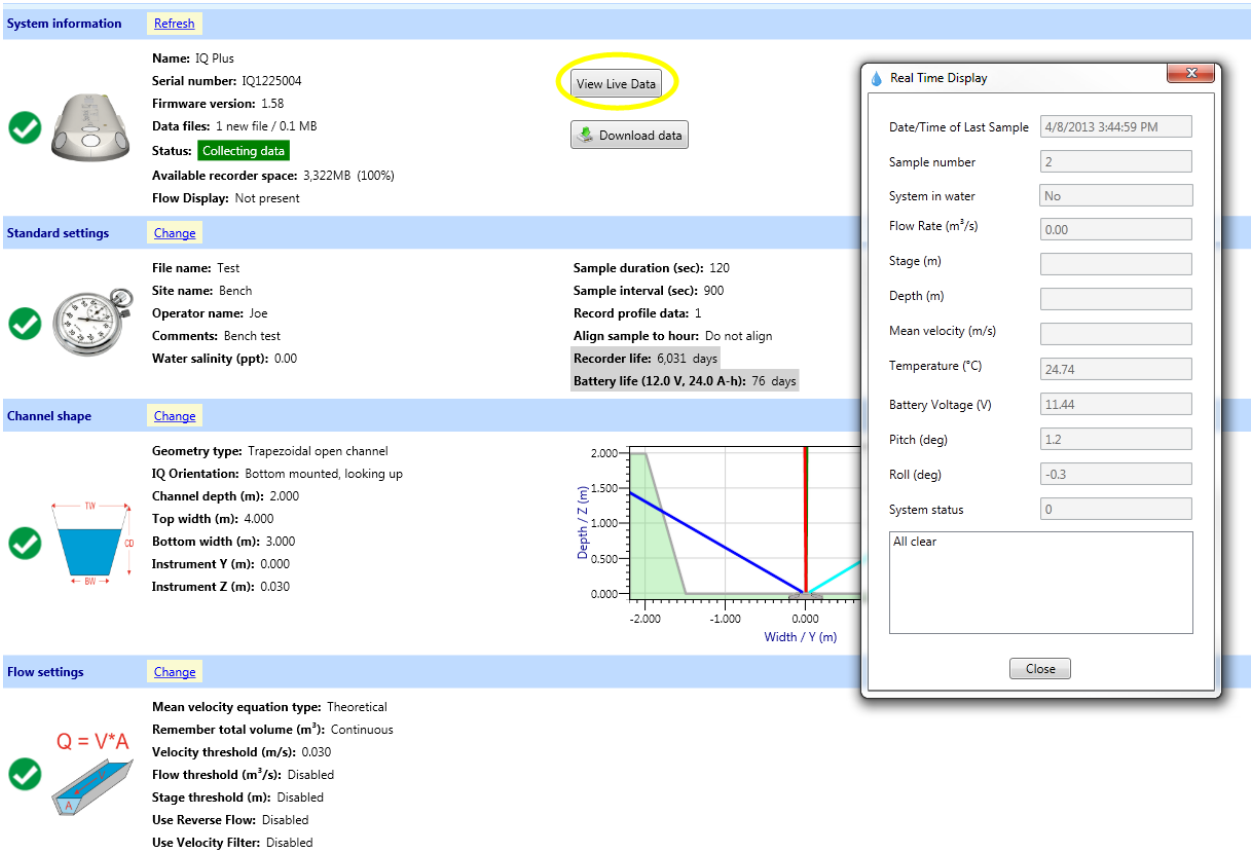


Figure 85. View live data window

7.3. ASCII Output (RS232)

The RS232 ASCII Output setting lets you connect to the SonTek-IQ using any device that can accept and interpret ASCII characters over an RS232 serial line. This could be a datalogger or other recording equipment. The IQ is configured and data collection is started using the IQ software. To select RS232 ASCII output, select **ASCII Output (RS232)** from the **Output Settings** menu. All data collected are stored onboard the IQ and is available for download using the IQ software. While sampling, the IQ outputs ASCII data to the RS232 COM port.

- The IQ outputs one text line of data for each sample collected.
- These data are output at the end of each sampling interval.

- The units for all output data are specified in the **Output Settings** configuration menu.
- Each sample includes several data parameters separated by commas. The number and order of parameters differs for the IQ Standard and IQ Plus systems.
- RS232 serial parameters are fixed at:
  - 9600 baud
  - 8 data bits
  - 1 stop bit
  - No parity

7.3.1. IQ Standard ASCII Output Values

Example of output from an IQ Standard (Table 2):

```
1125010,2,2011,10,31,12,19,28,-0.0429,-0.937,-0.643,290.7893,0.042,-
0.735,0.066,20.55,0,-0.735,-0.016,-0.670,-0.728,11.45,3.9,-3.6,100,

1125010,3,2011,10,31,12,19,40,-0.0369,-0.937,-0.553,290.3402,0.042,-
0.632,0.066,20.56,0,-0.632,0.042,-0.692,-0.821,11.46,3.9,-3.6,100,

1125010,4,2011,10,31,12,19,52,-0.0342,-0.937,-0.513,289.9264,0.042,-
0.587,0.066,20.56,0,-0.587,0.111,-0.695,-0.752,11.45,3.9,-3.6,100,
```

Table 2. IQ Standard – Output Field Definitions

Parameter	Contents	Notes
1	SonTek-IQ ID	System serial number
2	Sample number	Sequential sample number
3	Year	Year of sample start
4	Month	Month of sample start
5	Day	Day of sample start
6	Hour	Hour of sample start
7	Minute	Minute of sample start
8	Second	Second of sample start
9	Flow rate	Flow rate (using defined channel geometry)
10	Stage	Stage (water depth of the user-defined channel)
11	Mean velocity	Mean velocity
12	Volume (Total)	Total water volume (based on all measured flow)
13	Depth	Depth (relative to the top of the instrument)
14	Velocity Index	Downstream velocity in center of channel
15	Area	Cross-sectional area of user-defined channel
16	Temperature	Water temperature
17	System Status	System status (Section 7.1)
18	Velocity (XZ).X-Center	Center beams' X velocity (downstream velocity in center of channel)
19	Velocity (XZ).Z-Center	Center beams' Z velocity (vertical velocity in center of channel)
20	Velocity (XZ).X-Left	Left beam X velocity (downstream velocity along the left bank)
21	Velocity (XZ).X-Right	Right beam X velocity (downstream velocity along the right bank)
22	Battery	Battery voltage
23	Pitch	Pitch angle in degrees
24	Roll	Roll angle in degrees
25	System in water	Percentage of sample during which instrument was submerged (100% means it was submerged for entire sample)

7.3.2. IQ Plus and IQ Pipe ASCII Output Values

Example of ASCII output from an IQ Plus and IQ Pipe (Table 3):

```
1125010,8,2011,10,31,12,17,03,0.0000,-0.937,0.000,293.2300,0.042,-
0.574,0.066,20.54,0,-0.574,-0.196,-0.670,-1.800,11.44,3.9,-
3.6,100,0.042,0.041,965.8429,-752.6129,0.138,69.1,76.8,48.0,51.3

1125010,9,2011,10,31,12,17,15,0.0000,-0.937,0.000,293.2300,0.042,-
0.573,0.066,20.54,0,-0.573,-0.201,-0.681,-2.090,11.44,3.9,-
3.6,100,0.042,0.039,965.8429,-752.6129,0.138,69.2,76.9,48.0,48.2
```

Table 3. IQ Plus – Output Field Definitions

Parameter	Contents	Notes (Units based on User Setup)
1	SonTek-IQ ID	System serial number
2	Sample number	Sequential sample number
3	Year	Year of sample start
4	Month	Month of sample start
5	Day	Day of sample start
6	Hour	Hour of sample start
7	Minute	Minute of sample start
8	Second	Second of sample start
9	Flow rate	Flow rate (using defined channel geometry)
10	Stage	Stage (water depth of the user-defined channel)
11	Mean velocity	Mean velocity
12	Volume (Total)	Total water volume (based on all measured flow)
13	Depth	Depth (relative to the top of the instrument)
14	Index Velocity	User-specified if using Index Velocity calculation method, or same as Velocity (XZ).X if none specified.
15	Area	Cross-sectional area of user-defined channel
16	Temperature	Water temperature
17	System Status	System status (Section 7.1)
18	Velocity (XZ).X-Center	Center beams' X velocity (downstream velocity in center of channel)
19	Velocity (XZ).Z-Center	Center beams' Z velocity (vertical velocity in center of channel)
20	Velocity (XZ).X-Left	Left beam X velocity (downstream velocity along the left bank)
21	Velocity (XZ).X-Right	Right beam X velocity (downstream velocity along the right bank)
22	Battery	Battery voltage
23	Pitch	Pitch angle in degrees
24	Roll	Roll angle in degrees
25	System in water	Percentage of sample during which instrument was submerged (100% means it was submerged for entire sample)
26	Range	Acoustically measured distance to water surface
27	Adjusted Pressure	Measurement with atmospheric pressure removed
28	Positive Volume	Total volume of water in the positive downstream direction
29	Negative Volume	Total volume of water in the negative upstream direction
30	Cell End	Distance to the farthest measurement cell
31	SNR (Beam 1)	SNR for beam 1 (acoustic signal strength in dB)
32	SNR (Beam 2)	SNR for beam 2 (acoustic signal strength in dB)
33	SNR (Beam 3)	SNR for beam 3 (acoustic signal strength in dB)
34	SNR (Beam 4)	SNR for beam 4 (acoustic signal strength in dB)

7.4. Analog Output

Optional analog outputs are available via the SonTek-IQ flow display (Figure 86).

- The flow display supports four channels of 4-20 mA outputs.
- The analog output connectors have terminals (+ and -) for each analog channel (see Appendix D-2.).
- Each channel generates an analog signal proportional to one value measured by the IQ; the exact configuration of channels is selected by the user.
- Analog outputs are not a preferred method of collecting data from the IQ; a lot of resolution and information is lost when converting IQ data to analog signals. However when they are needed, the analog outputs do provide an easy way to integrate with established data acquisition systems.
- When using the analog outputs, we strongly recommend that you calibrate the output of each channel with your data acquisition system. The IQ software provides a function for outputting calibration values (see Section 3.3).
- Using the analog outputs will significantly increase power consumption – the IQ Software will provide calculations. However, it is highly dependent on instrument configuration, number of channels used, and level of interfacing with the flow display.

How the analog outputs are configured depends on your goals. Here is a suggested configuration.

- The units used for all variables when configuring the analog outputs will match all other output units as specified by the user (see Section 3.1.5).
- Channel 1: Flow
  - Min Value: this should match the minimum flow value expected in the channel (commonly 0). If the channel has bi-directional flow, minimum value may be a negative number.
  - Max Value: this should match the maximum flow expected in the channel. If the flow exceeds this value, the output will stay at the maximum value of 20 mA.
  - Example: min value 0 cfs, max value 40 cfs
    - 0 cfs will output 4 mA
    - 20 cfs will output 12 mA
    - 40 cfs will output 20 mA
    - 45 cfs will output 20 mA
- Channel 2: Stage
  - Min Value: this should match the minimum stage expected in the channel. This may be 0 or may be the survey elevation corresponding to the bottom of the channel.
  - Max Value: this should match the maximum stage expected in the channel, which will typically be the top of the defined channel.
- Channel 3: Mean Velocity
  - Min Value: this should match the minimum velocity expected in the channel (commonly 0). If the channel has bi-directional flow, the minimum value may be a negative number.
  - Max Value: this should match the maximum velocity expected in the channel, which can vary widely depending on the type of channel.
- Channel 4: System Status
  - This variable indicates if there are any potential problems with the system (see Section 7.1). We strongly encourage monitoring this value; any value other than 0 indicates that the IQ site should be inspected.
  - Min value: this would normally be 0.
  - Max value: this would normally be 511 (this is the maximum value for system status).

- The IQ software provides a utility to interpret the system status variable in order to understand what different values mean (see Section 7.1).

General instructions for configuring the analog outputs are below.

- Select the data variable of interest using the drop-down box for each channel.
- Use the Min/Max value boxes to scale the analog outputs. Min/Max should be scaled based on the range of values expected in the field.

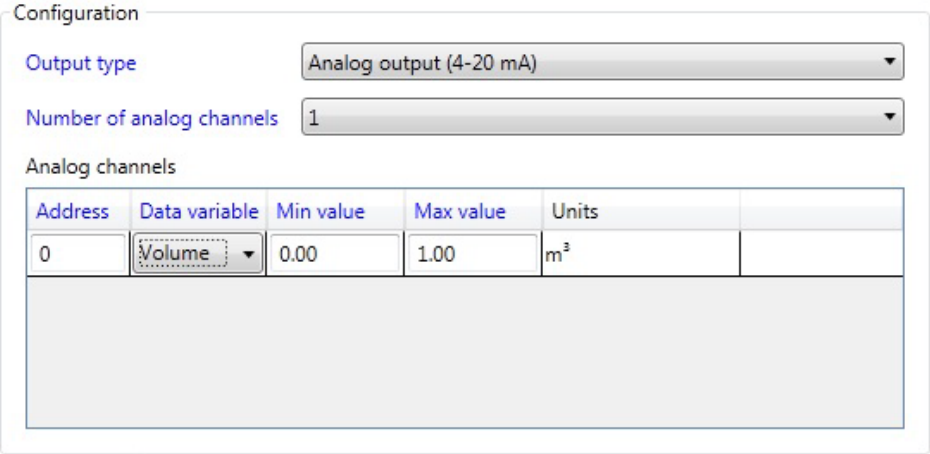


Figure 86. Analog outputs configure window

7.5. SDI-12 Output

SDI-12 is a standardized ASCII based serial communication protocol. The SonTek-IQ is capable of communicating with a datalogger over an SDI-12 network. The terminal connection for SDI-12 is located on the cable adaptor next to the ground terminal connection. In SDI-12 mode, data collection is controlled by the datalogger and NOT by the SonTek-IQ. The IQ will wait for commands from the datalogger to begin a measurement and to transfer the data collected.

It is possible to have an SDI-12 and a serial port (RS232) connected to the IQ at the same time. The IQ cable adaptor supports both types of connections independently. However, this is **NOT recommended during the initial setup** of the IQ. Since the instrument is controlled by the datalogger, it is important that the SonTek-IQ is NOT connected to the datalogger during instrument setup to avoid possible configuration errors.

The following are some important notes about the SDI-12/SonTek-IQ interface.

- Configure the SonTek-IQ with the IQ software prior to connecting to the SDI-12 network
- All measurements are controlled by the datalogger. If the datalogger never sends any commands, the IQ will never collect any data!
- You do **NOT** have to start the data collection using the **Start Data Collection** button. The IQ starts when it receives a valid measurement command from the datalogger.
- Each instrument on the SDI-12 network must have a unique address
- Certain settings in the IQ software will have no effect when using SDI-12.
  - **Align sample to hour** is not used because samples are initiated by the datalogger.
  - **Sample interval** is not used with SDI-12. However, this parameter should still be set by the user to allow for accurate recorder and battery life calculations.
- Users must configure the "Sample duration"
- To output flow data, a channel geometry must be input

- You can download data from the SonTek-IQ while it is connected to a datalogger
- After configuring/checking the IQ Smart Page settings, disconnect and exit the program.

7.5.1. SDI-12 hardware setup

See Figure 87 for connecting your SDI-12 wire (shown in white) to the 3-pin power connector. This connector is used with the cable adaptor shown in Figure 5. Once the wires are connected to the 3-pin connector, simply insert the 3-pin connector into the cable adaptor and attach the other end of the SDI-12 line (white wire) to the correct terminal on the datalogger.

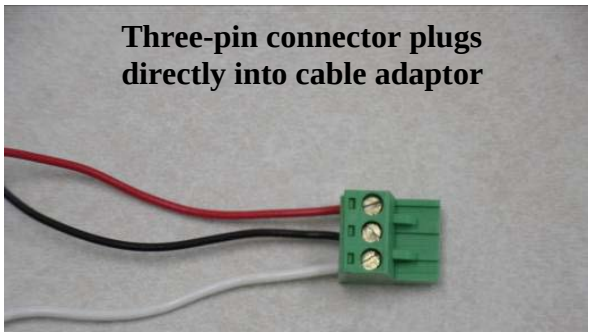


Figure 87. Connecting the SDI-12 communications line

After selecting the SDI-12 output type, the configuration area of the Output settings window will display an input text box for an SDI-12 address. When setting up an SDI-12 network, each instrument on the network must have a unique address (Figure 88).

- The SonTek-IQ SDI-12 default address is 0.
- SonTek-IQ SDI-12 addresses can be single digit numbers **0-9**, lower case letters **a-z**, and upper case letters **A-Z** for a total of 62 unique addresses on a local network.

After the SDI-12 address is entered, be sure to confirm all settings on the IQ Smart Page including the channel dimensions. **If the channel dimensions are not defined, the IQ will be unable to calculate and report flow conditions.** Once the IQ Smart Page settings are complete, you can connect the SonTek-IQ to the datalogger or SDI-12 network. Please refer to the documentation included with your datalogger to complete the SDI-12 setup procedures.

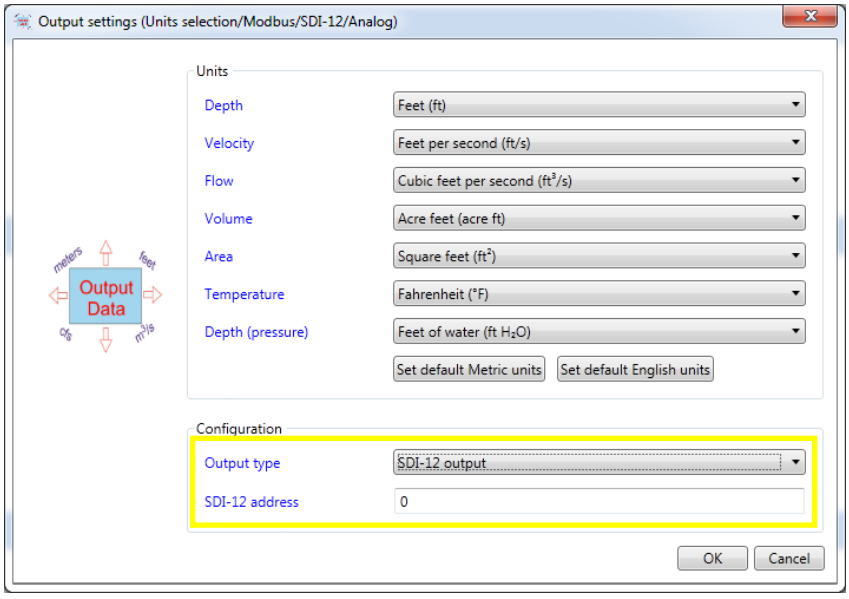


Figure 88. SDI-12 configuartion in IQ software

7.5.2. SDI-12 Commands

The SonTek-IQ requires a 2 second overhead time to complete all calculations. As such, the sample will be ready after a period no more than 2 seconds longer than the specified sample duration.

- **IMPORTANT**: Be sure the data logger allows sufficient time between samples for both the sample duration and overhead time.

The most common SDI-12 commands are:

- **Identify Command - I command:** Returns the IQ firmware version and serial number.

  Command: **aI!**
  Response: **a13SonTek IQ 160IQ1215001**

  where:

  a is the sensor address assigned by the user. The default is 0, but this could be 0-9 or any upper or lower case letter (a-z and A-Z).

  13SonTek IQ is a signature string that is always returned

  160 is the firmware version onboard the responding IQ (v1.60)

  IQ1215001 is the IQ serial number

- **Measure Command - M command:** Initiates a new measurement sequence. Data values generated in response to this command are stored in the IQ's buffer for subsequent retrieval using D commands. Data will remain in the buffer until another M, C or V command is executed. An example is provided below:

  Command: **aMc!**
  Response: **atttn**

  where:

  a is the sensor address assigned by the user. The default is 0, but this could be 0-9 or any upper or lower case letter (a-z and A-Z).

  M is the upper case ASCII character representing the Measure command.

  c is the data line to be retrieved. Depending on system configuration, c can be a value from 0 through 7, where a value of 1-7 represents an additional data line to be retrieved, and a value of 0 (or null) represents the main data lines from the single integrated velocity cell.

  ttt is a 3-digit integer (000-999) specifying the maximum time, in seconds, the sensor will take to complete the command and have measurement data available in its buffer.

When making a new measurement, this value is equal to the Sample Duration + 2 seconds. This provides extra time for the IQ to write data to the buffer. When reporting additional data lines from a previous measurement (using a c value from 1-7), this value will be 000.

n is a single-digit integer (0-9) specifying the number of values that will be placed in the data buffer. If "n" is zero (0), no data will be available using subsequent "D" commands.

Table 4. SDI-12 M Parameters

Number	Parameter name
1	Flow rate (using the user-defined channel geometry)
2	Stage (water depth relative to the user-defined channel)
3	Mean velocity (throughout the channel cross section)
4	Total volume (based on all measured flow)
5	Water depth (best available data from either the VB or the adjusted pressure*)
6*	Index velocity (provides the user 9 options, Velocity (XZ).X-Center, Velocity (XZ).Z-Center, Velocity (XZ).X-Left, Velocity (XZ).X-Right, Average of all Vx, Beams 1-4 velocity)
7	Cross-sectional area of channel
8	Water temperature
9	System Status (Section 7.1)

***** This will usually be the VB depth, but in the case where the VB % good is too low, this will be adjusted pressure.

Note: In all practical cases, either Velocity (XZ).X-Center and Average of All Vx will be the best data to use. Velocity (XZ).X-Center will be the historic data parameter to use, while Average of all Vx is a new parameter that averages out all of the Vx data from the four beams, potentially eliminating noise in the data.

M1 and **M2** commands report additional parameters from the previous measurement (these commands do not initiate a new measurement). The M1 command (Table 5) outputs an extended list of parameters to be returned following an M command. This command does not initiate a new measurement.

Table 5. SDI-12 M1 Parameters

Number	Parameter name
1	Velocity (XZ).X-Center (downstream velocity in the center of the channel)
2	Velocity (XZ).Z-Center (vertical velocity in the center of the channel)
3	Velocity (XZ).X-Left (downstream velocity along the left bank)
4	Velocity (XZ).X-Right (downstream velocity along the right bank)
5	Battery voltage
6	Pitch angle in degrees
7	Roll angle in degrees
8	Percentage of the sample during which the instrument was submerged (100% means the IQ was submerged for the entire sample)

The M2 command (Table 6) outputs an extended list of parameters to be returned following an M command. This command does not initiate a new measurement.

Table 6. SDI-12 M2 Parameters

Number	Parameter name
1	Range to water surface from vertical beam
2	Water depth (from pressure adjusted for atmospheric pressure)
3	Total volume (based only on positive measured flow)
4	Total volume (based only on negative measured flow)
5	End Cell (distance to farthest good measurement cell)
6	SNR for beam 1 (acoustic signal strength in dB)
7	SNR for beam 2 (acoustic signal strength in dB)
8	SNR for beam 3 (acoustic signal strength in dB)
9	SNR for beam 4 (acoustic signal strength in dB)

- **Concurrent Measurement Command - C command:** Initiates a new measurement; reports all measured and calculated parameters. A concurrent measurement is one that occurs while other SDI-12 sensors on the bus are also taking measurements. This command is similar to the aM! command; however, the nn field has an extra digit (allowing additional output parameters), and the sensor does not issue a service request when it has completed the measurement. Communicating with other sensors will not abort a concurrent measurement. Data values generated in response to this command are stored in the sensor's buffer for subsequent collection using D commands. Data will remain in the buffer until another M, C, or V command is executed.

  Command: **aC!**
  Response: **atttnn**

  where:

  a is the sensor address assigned by the user. The default is 0, but this could be 0-9 or any upper or lower case letter (a-z and A-Z).

  C is the upper case ASCII character representing the Concurrent Measurement command.

  ttt is a 3-digit integer (000-999) specifying the maximum time, in seconds, the sensor will take to complete the command and have measurement data available in its buffer.

  n is a two digit integer (0-9) specifying the number of values that will be placed in the data buffer. If "n" is zero (0), no data will be available using subsequent "D" commands.

Table 7. SDI-12 C Parameters

Number	Parameter name
1	Flow rate (using the user-defined channel geometry)
2	Stage (water depth relative to the user-defined channel)
3	Mean velocity (throughout the channel cross section)
4	Total volume (based on all measured flow)
5	Water depth (best available data from either the VB or the adjusted pressure*)
6	Index velocity (downstream velocity in the center of the channel)
7	Cross-sectional area of channel
8	Water temperature
9	System Status (Section 7.1)
10	Velocity (XZ).X-Center (downstream velocity in the center of the channel)
11	Velocity (XZ).Z-Center (vertical velocity in the center of the channel)
12	Velocity (XZ).X-Left (downstream velocity along the left bank)
13	Velocity (XZ).X-Right (downstream velocity along the right bank)
14	Battery voltage
15	Pitch angle in degrees
16	Roll angle in degrees
17	Percentage of the sample during which the instrument was submerged (100% means the IQ was submerged for the entire sample)
18	Range to water surface from vertical beam
19	Water depth (from pressure adjusted for atmospheric pressure)
20	Total volume (based only on positive measured flow)
21	Total volume (based only on negative measured flow)
22	End Cell (distance to farthest good measurement cell)
23	SNR for beam 1 (acoustic signal strength in dB)
24	SNR for beam 2 (acoustic signal strength in dB)
25	SNR for beam 3 (acoustic signal strength in dB)
26	SNR for beam 4 (acoustic signal strength in dB)

*This will usually be the VB depth, but in the case where the VB % good is too low, this will be adjusted pressure

- **Send Data Command - D command:** Return data parameters from a measurement. Typically, you would initiate a measurement with the **M** command, retrieving the main parameters from that measurement using **D** commands. After the **M** command, you can send the **M1** and **M2** commands to move additional parameters to the data registers. Alternatively, you can issue the **C** command to retrieve all of the data at once.

The Send Data Command (**D**) returns sensor data generated as the result of previous **aMc!**, **aC!**, or **aV!** commands. Values returned will contain 33 characters or less. The sensor's data buffer will not be altered by this command.

Command: **aD0! through aD9!**
Response: **a±d.d…±d.d**

where:

a is the sensor address assigned by the user. The default is 0, but this could be 0-9 or any upper or lower case letter (a-z and A-Z).

D0…D9 are the upper case ASCII characters representing the Send Data command.
± is a polarity sign (+ or -).

d.d represents numeric digits (data values). A decimal may be used in any position in the value after the polarity sign. If a decimal is not used, it will be assumed to be after the last digit.

If one or more values were specified, and an aD0! returns no data, it means that the measurement was aborted, and a new M, C, or V command must be sent. The exact response to a D command depends on the type of SDI-12 data collection being used. The outputs of the M and C commands are shown above.

- **Continuous Measurements Command– R Command:** The Continuous Measurement command (R) was added to the Version 1.2 SDI-12 Specification. Sensors that are able to monitor continuously the phenomena to be measured, such as a shaft encoder, do not require a start measurement command. They can be read directly with the R commands (R0!…R9!). The R commands work exactly like the D (D0!…D9!) commands.

  Command: **aR!** or **aR0!**
  Response: **a+0** or **a+1**

  where:

  a is the sensor address assigned by the user. The default is 0, but this could be 0-9 or any upper or lower case letter (a-z and A-Z).

  R or R0 are the upper case ASCII characters representing the Continuous Measurements command.

- **Verify Command – V Command:** Causes a verify sequence to be performed. The result of this command is similar to the **aM!** command except that the values generated are fixed test data and the results of diagnostic checksum tests. Data generated in response to this command are placed in the sensor's buffer for subsequent collection using **D** commands. Data are stored in the buffer until another **M**, **C**, or **V** command is executed.

  Command: **aV!**
  Response Description: **atttn**

  where:

  a is the sensor address assigned by the user. The default is 0, but this could be 0-9 or any upper or lower case letter (a-z and A-Z).

  V is the upper case ASCII character representing the Verify command.

ttt is a 3-digit integer (always 000) specifying the maximum time, in seconds, the sensor will take to complete the command and have data available in its buffer.

n is a single-digit integer (always 3) specifying the number of values that will be placed in the data buffer. Issuing a '0V0!' command to get the values will return '0+123+456-789'.

- **Send Acknowledge Command – A Command:** Returns a simple status response that includes the address of the sensor. Any measurement data in the sensor's buffer is not disturbed.

  Command: **a!**
  Response: **a**

  where:

  a is the sensor address (0-9)

7.6. Modbus

The SonTek-IQ is capable of serial communication using the Modbus protocol.

- No additional modules or converters are necessary for connecting the SonTek-IQ to a Modbus network.
- To connect to a Modbus network, first configure the SonTek-IQ for Modbus data output using the IQ Software.
- The RS232 serial port on the cable adaptor or flow display is used for both RS232 and Modbus communications.
- Unlike SDI-12, the IQ will sample continuously based on its settings and will output the latest measurement when polled by the Modbus network controller.
- Using Modbus output, the system will have slightly higher power consumption and decreased battery life – the IQ software will include these types of settings into its battery life calculations.

7.6.1. IQ Software configuration for Modbus

In order for the SonTek-IQ to collect data properly using Modbus output, the instrument must be configured to collect data (i.e. sampling interval and duration, channel geometry, etc) and sampling must be started.

- The instrument collects data and is polled as a slave on the Modbus network
- Address range is 1-247
- Default baud rate is 19200 (and can go as high as 115200)
- Default Modbus parity is Even (options for None and Odd)
- For even parity, there is one stop bit
- No flow control

- The SonTek-IQ operates in RTU (Remote Terminal Unit) mode.
- Modbus output format default is IEEE standard floating point (Inverted floating point is also offered)
- Figure 89 presents an example Modbus configuration.

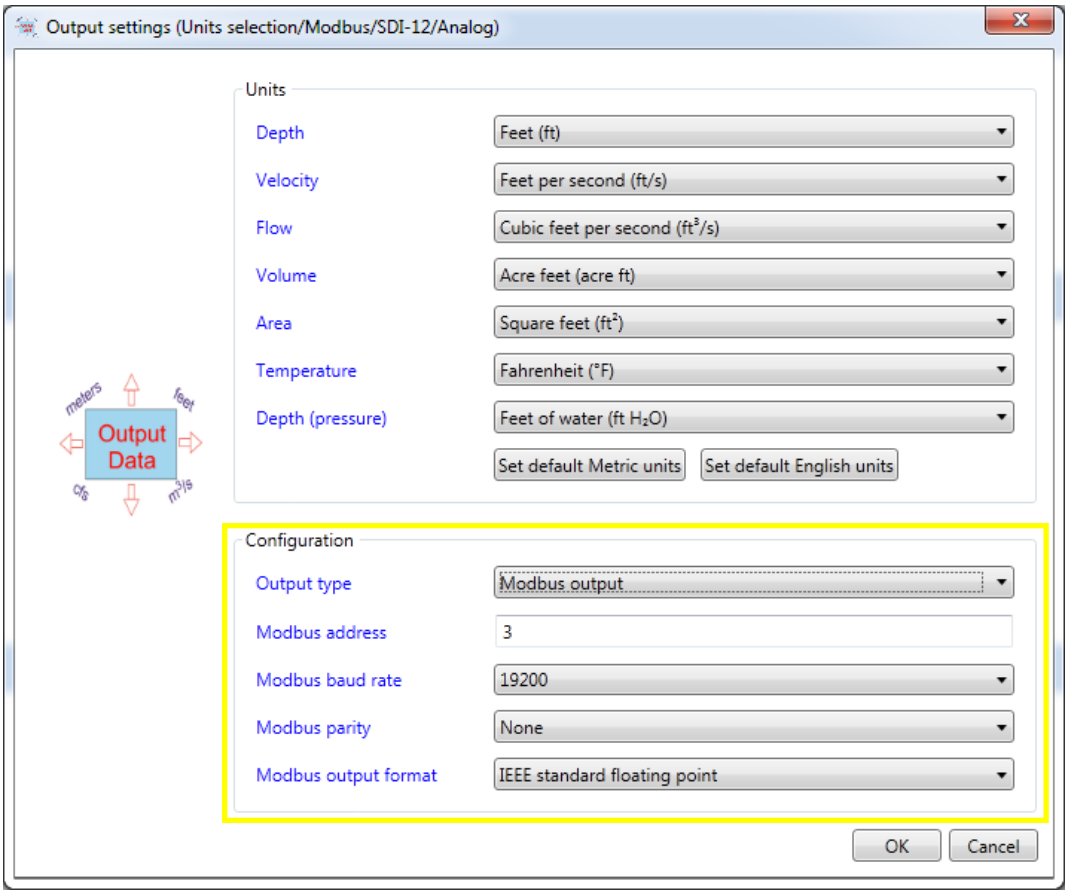


Figure 89. Modbus configuration using the IQ software

7.6.2. Modbus hardware setup

Use the IQ software to configure the system. When all status icons on the IQ Smart Page are green, start the data collection, disconnect, and exit the IQ software. Connect the SonTek-IQ to the Modbus network (Figure 90).

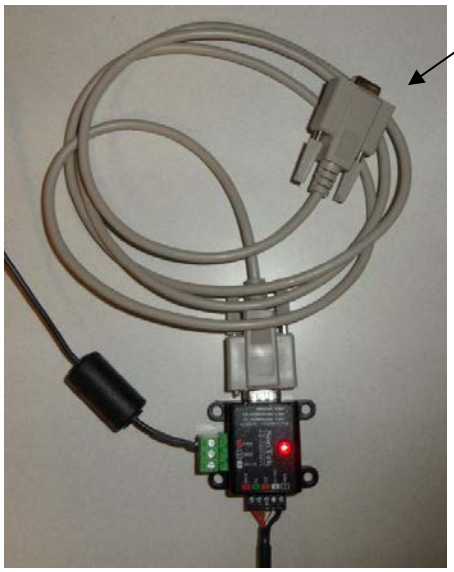


Figure 90. Connect to Modbus network using the RS232 cable

7.6.3. Modbus Data Output

Modbus data from the IQ are reported on both input and holding registers.

- Use the Modbus "read input registers" command (function code 04 or 4x) to read the sample header and the sample.
    - Sometimes these are referred to as the "30,000" analog input registers.
- Use the Modbus "read holding registers" command (function code 03 or 3x) to read the sample header and the sample.
    - Sometimes these are referred to as the "40,000" analog output holding registers.
- Each parameter is output as a floating-point number in two adjacent registers.
- The first header value is stored at register address 0. There are 8 header values.
- The first sample value is stored at register address 100
- There are 52 input registers used to report the 26 sample parameters (addresses 100-150) defined in Table 8.
- The units of the output data (meters, feet, etc.) are set in the IQ Software by the user in the Output settings window.

Table 8. Modbus Register Addresses and Parameter Descriptions

Address	Parameter name
0	IQ serial number
2	IQ sequential sample number
4	Year – start time of current IQ sample
6	Month – start time of current IQ sample
8	Day – start time of current IQ sample
10	Hour – start time of current IQ sample
12	Minute – start time of current IQ sample
14	Second – start time of current IQ sample
100	Flow rate (using the user-defined channel geometry)
102	Stage (water depth relative to the user-defined channel)
104	Mean velocity (throughout the channel cross section)
106	Total volume (based on all measured flow)
108	Water depth (amount of water above instrument from pressure)
110	Index velocity (user-specified if using the Index Velocity method, or same as Velocity (XZ).X if none specified)
112	Cross-sectional area of channel
114	Water temperature
116	System Status (Section 7.1)
118	Velocity (XZ).X-Center (downstream velocity in the center of the channel)
120	Velocity (XZ).Z-Center (vertical velocity in the center of the channel)
122	Velocity (XZ).X-Left (downstream velocity along the left bank)
124	Velocity (XZ).X-Right (downstream velocity along the right bank)
126	Battery voltage
128	Pitch angle in degrees
130	Roll angle in degrees
132	Percentage of instrument submerged (100% is fully submerged)
134	Range to water surface from vertical beam
136	Water depth (from pressure adjusted for atmospheric pressure)
138	Total volume (based only on positive measured flow)

140	Total volume (based only on negative measured flow)
142	End Cell (distance to farthest good measurement cell)
144	SNR for beam 1 (acoustic signal strength in dB)
146	SNR for beam 2 (acoustic signal strength in dB)
148	SNR for beam 3 (acoustic signal strength in dB)
150	SNR for beam 4 (acoustic signal strength in dB)

Section 8. Troubleshooting

8.1. Cannot Establish Communications with the SonTek-IQ

Establishing communication between your PC and the IQ will normally be a simple process.

- Connect the cable from the IQ to the cable adaptor, from the cable adaptor to the power supply, and from the cable adaptor through the USB to RS232 converter and into your PC.
- Turn the power supply on.
- Open the IQ software and click the **Connect** button.

If you are not able to establish communication, the steps outlined in the following sections will usually locate the problem.

8.1.1. Verify All Connections

- Make sure that the connectors (five-pin IQ connector and three-pin power connector) are attached firmly to the cable adapter or flow display.
- Make sure that the wires are firmly attached to the connectors that plug into the cable adaptor or flow display.
  - Check 5-pin connector wiring from the IQ communication cable into the cable adaptor/flow display. The colors of the wires should match the labels on the adaptor/display.
- Make sure that the IQ cable is correctly connected to the SonTek-IQ
  - If the system is in the water, do NOT disconnect the system and reconnect.
  - This connector should only be disconnected and reconnected in a dry environment.
- Make sure that the SonTek-IQ is connected to a power source
  - The SonTek-IQ requires 9-15VDC, if the system is receiving power, the LED on the cable adaptor/flow display should be illuminated bright red
  - Use a voltmeter to verify the power supply is providing sufficient voltage.
- Make sure that the cable adaptor/flow display is connected securely to the PC/laptop.
  - SonTek highly recommends using the USB-Serial adaptor provided with the system.
  - We have tested this converter and it is more reliable and faster than many other USB-Serial products (including built in serial ports).

8.1.2. Use the System and COM Port Reset Functions

If the SL software cannot connect to the SL, it will prompt you to send a reset to the system.

- The System Reset function can also be found in the Maintenance menu accessed from the SL icon in the upper left corner of the software (Figure 91).
- Select System Reset and provide the correct serial COM port number when prompted. In many cases, this will successfully establish communication with the system.
- If it still will not connect, select COM Port Reset and enter the appropriate number before trying to connect again.

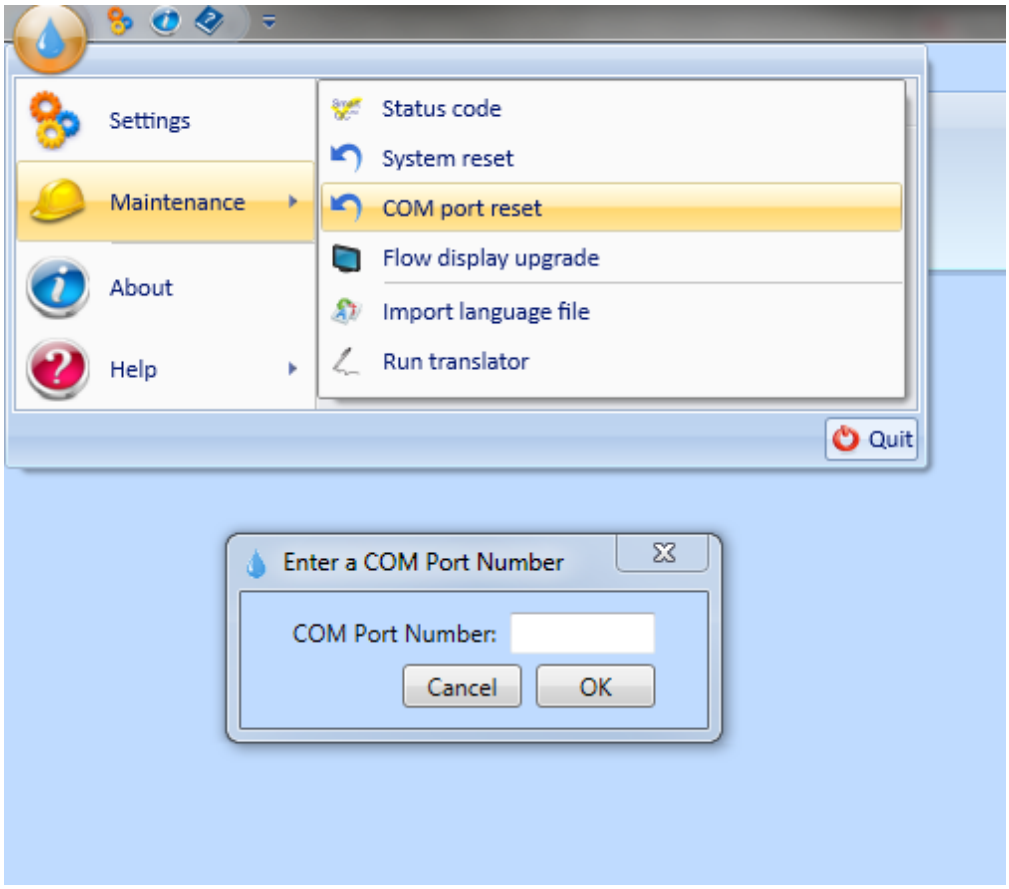


Figure 91. IQ System and COM Port Reset Function

8.1.3. Cycle power

If you are still not able to establish communication with the IQ, cycle the power supply in order to complete a full reset of the system

- Disconnect the system from the power source (the wall outlet or battery) or disconnect the power connector from the cable adaptor.
- After disconnecting, wait 30 seconds and then reconnect power to the system

8.1.4. Lower Maximum Baud Rate

If communications is still unsuccessful or intermittent, lower the Maximum Baud Rate in the software Settings.

See Figure 92:

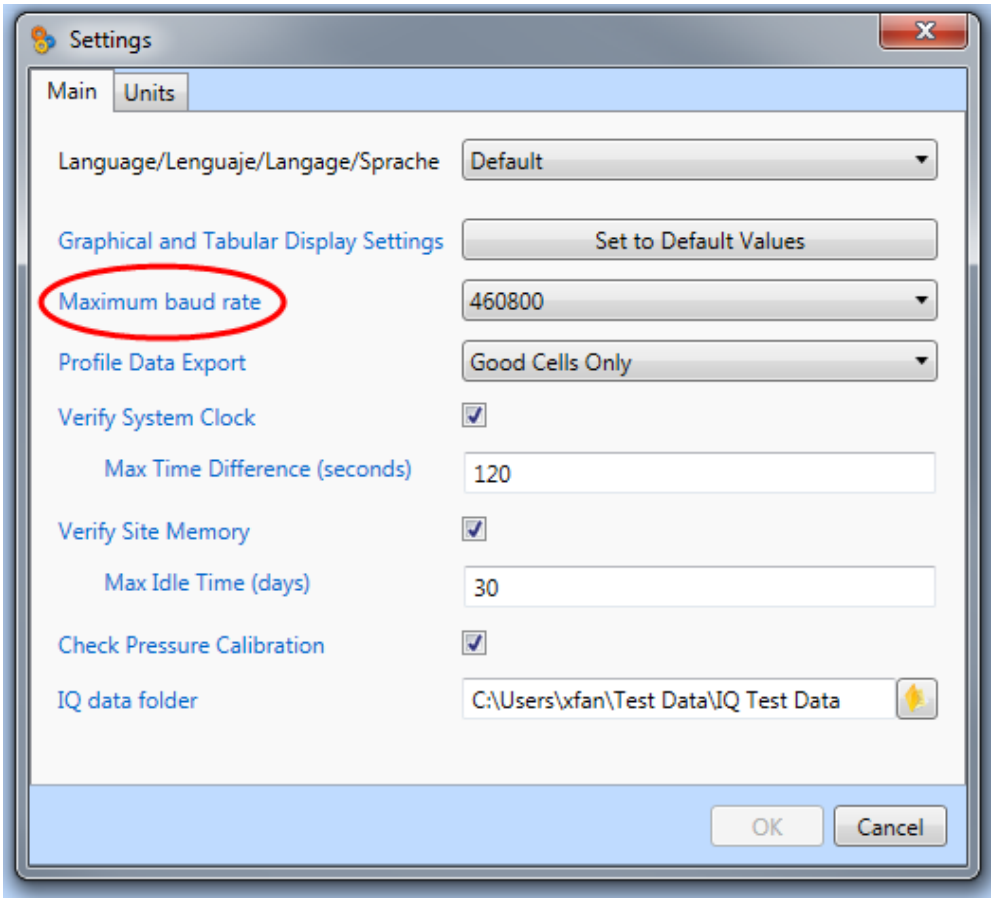


Figure 92. Maximum Baud Rate

8.2. Beam Check

- Beam Checks are preformed to ensure that the acoustic beams are functioning correctly
- When deployed in the field a Beam Check can be used to verify that the transducers or beams are not obstructed
- Beam Check is found under Utilities → Beam Check. Once opened, a graphic will be displayed as in Figure 93.

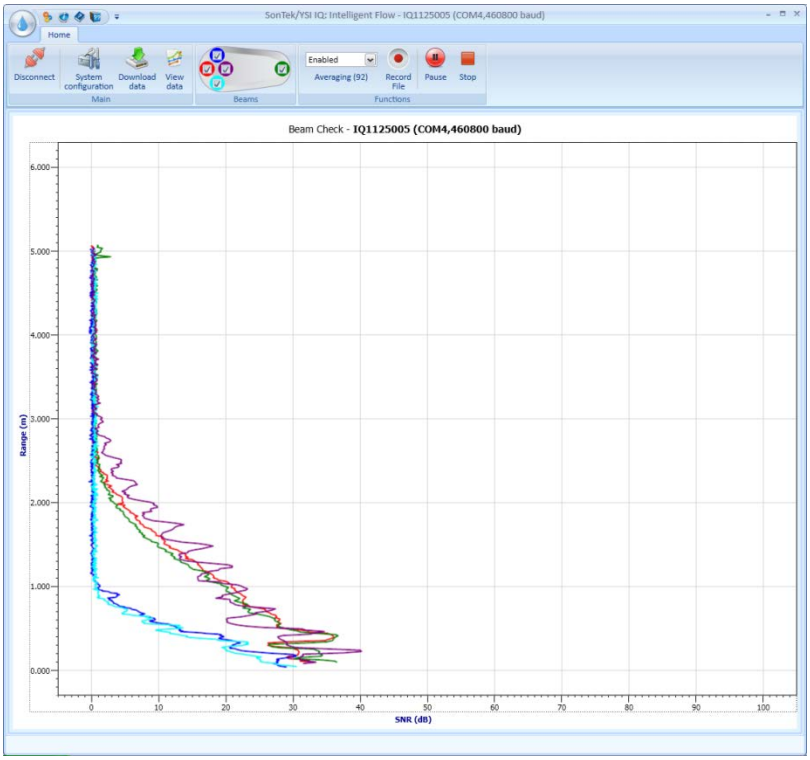


Figure 93. Beam Check window in SonTek-IQ software

- The plot presents signal to noise ratio (SNR), effectively the strength of the signal received from the instrument (horizontal axis) versus range from the instrument on the vertical axis
- In most cases, the along axis beams, beams 1 and 2 (red and green respectively) and the skew beams 3 and 4 (light blue and dark blue) should present similar data
  - If along axis beams or the skew beams do not have similar plots it is possible that the there is an obstruction in the channel cross-section
- The purple line is the vertical beam – the first major peak moving up from the bottom of the figure should correspond to the local water depth
  - In the field, this trace will have multiple reflections, which correspond to the vertical beam rebounding off the surface and channel bottom.

8.3. Cannot retrieve data from the internal recorder

If you have trouble retrieving data from the internal recorder, review the following items.

- The SonTek-IQ software retrieves data from the internal recorder using a higher baud rate to speed up the download process.
- When you connect with the IQ, the software runs a series of tests to determine the highest possible baud rates. For most situations, this provides fast and reliable communication.
- The maximum reliable baud rate is a function of the length and quality of the communication cable, the computer, and the operating environment (for external sources of noise). In some cases, a lower baud rate may be needed.
- If you are having problems with data download, you may try reducing the maximum baud rate that can be used from the software settings menu. See Section 2.3 for details.
- Some computers have poor quality serial ports and are unable to receive large amounts of data at high baud rates.

  - We do not recommend using the built in serial ports in a PC. Many of these ports cannot reliably run the high baud rates used for data download.
  - We always recommend using the USB to serial converter included with the IQ.
  - If problem persists, try using another computer.

8.4. Software Version and Firmware Version

- For best results please use the most recent version of firmware and software, which can be found at the SonTek website (www.sontek.com/software.php)
  - Be sure to check for the most recent version of firmware for the IQ product as well as the flow display
  - Firmware versions are indicated in the System Information of the IQ Software Smart Page
- Once at the website follow the instructions to update the software and firmware
- In order to download files from the website, you will have to login by providing a user name and password. New users will be required to create an account.

8.5. Missing data from a deployment

The SonTek-IQ internal recorder was designed for high reliability; recorder failures are extremely rare.

- Missing data is most commonly traced to problems with the power supply
- When analyzing recorded data, look at the measured battery voltage as this provides information on the condition of the power supply.
- Check that sufficient recorder space remained for data collection
- If any real-time data logging is available (typically SDI-12 or the analog output modules), compare data from these systems for that period.
- If the system was connected to an SDI-12 data logger, that data logger is required to initiate each velocity sample. Check data logger operation and cable continuity to ensure that data collection commands were reaching the SonTek-IQ

8.6. Cannot communicate with an external device

If you cannot establish communications between the SonTek-IQ and an external real-time device (SDI-12 data logger or Modbus unit for example), review the following items.

- Have you completed all steps required to place the SonTek-IQ in the appropriate output mode (Section 3)?
- The IQ software must first be programmed using the RS-232 serial interface.
- Disconnect the IQ and exit the program before connecting other networks or dataloggers.
- Do you have the correct address specified?
- Do you have the correct Baud rate?
- Do you have the correct output format?

8.7. Unreasonable Data

If data from the SonTek-IQ does not appear reasonable, review the following list.

Evaluate the deployment site

- Is the IQ in an area with stable flow conditions?
- Is the IQ oriented correctly with respect to the direction of flow?
- Is the SonTek-IQ mounted level?
- Are there any underwater objects that could cause interference?
- Do all beams have a clear, unobstructed path?
- Is there any debris caught on the system that could be influencing data collection?
- Is the system buried or partially buried by sediment?

Consider the SonTek-IQ Standard Settings

- Is the value of the Sample Duration long enough to eliminate instrument noise and real variations in flow?
- We do not recommend using a Sample Duration settings less than 30 seconds; settings from 120 to 900 seconds are more common

Look at signal-to-noise ratio data (SNR)

- SNR should be greater than 3 dB
- Evaluate signal strength and noise data for potential problems

Check water level data

- Was the system able to measure water level accurately?
- Was water depth sufficient for reliable operation (more than 3 inches or 8 cm)?

Check temperature sensor and battery voltage data

- Is temperature data reasonable for the deployment environment?
- Is the power supply sufficient and reliable?

8.8. Protection from Biological Fouling

The SonTek-IQ has excellent resistance to biological fouling and can operate reliably even with biological growth on the transducers.

- Biological growth may cause a loss in signal strength, but it does not affect the water velocity measurements.

- Both the transducers and the underwater housing can be coated with commercial anti-fouling paints to prevent biological growth.
    - Anti-fouling paint is typically only required in warm environments where algae and similar biological growth is common.
- Thick layers of anti-fouling paint on the transducers will cause a decrease in acoustic signal strength and will reduce the effective measurement range of the IQ.
- For most applications, the loss of signal strength caused by anti-fouling paint does not have a significant effect on instrument performance.

Within the United States, SonTek recommends using an anti-fouling paint called Interlux Tri-Lux. This paint contains a biocide (a copper derivative) that allows its use on all metals. For information on Interlux paints, see http://www.yachtpaint.com/usa/.

Normal anti-fouling paints, which use cuprous oxide based biocides, cannot be used on some metals as they cause galvanic corrosion.

- Outside the United States, anti-fouling paints containing TBT can be used on metal systems with a suitable primer.
- On plastic systems, any type of anti-fouling paint can be used.
- Our experience with the above paint (Interlux Tri-Lux) on SonTek systems causes us to recommend its use for all systems.

When applying the anti-fouling paint:

- Follow the instructions provided with the paint on all areas except the transducers.
- When painting the transducers, apply only one coat. Make the paint as smooth and uniform as possible, and avoid trapping any air bubbles on the transducer face.
- If anti-fouling protection is desired for some portion of the cable, the paint can be applied directly to the polyurethane jacket

8.9. SonTek Support Information

Any questions, concerns, or suggestions can be directed to SonTek by telephone, fax, or email. Office hours are 7:30 a.m. to 4:30 p.m., Pacific Time, Monday through Friday. After-hours Technical Support is available for emergencies in the field at the phone number below.

Phone: (858) 546-8327
Fax: (858) 546-8150
Web: http://www.sontek.com

inquiry@sontek.com (General information)
sales@sontek.com (Sales information)
support@sontek.com (Support information)

Appendix A. Field Descriptions

This appendix provides a description of the major terms and abbreviations used in discussing the SonTek-IQ.

Align Sample To Hour: this setting determines how the timing of data is related to the start of each hour.

***Do Not Align*:** means that data collection is started immediately upon the user request, and is not specifically aligned to the start of each hour.

Sample Ends at the Top of the Hour: means that the timing of samples is set so that a sample will end at the top of the next hour (i.e. 9:00:00). Based on the sample interval and duration, it starts the first sample at the first time that ensures that a sample will end at the top of the next hour.

Sample Starts at the Top of the Hour: means that the timing of samples is set so that a sample will start at the top of the next hour (i.e. 9:00:00). Based on the sample interval and duration, it starts the first sample at the first time that ensures that a sample will start at the top of the next hour.

Analog Data Variable: each external analog channel generates a signal proportional to an IQ data value; this variable specifies what data value is used to scale the signal.

Analog Min and Max Value: the minimum and maximum values used to specify the range of the analog signal. For 4-20 mA converters, the min value will generate an output of 4 mA while the max value will generate an output of 20 mA.

Analog output (4-20 mA): configures the system to control external converters (an optional part of the IQ flow display) that generate up to four analog signals (4-20 mA) each proportional to a single IQ data variable.

Area: the calculated cross sectional area of the channel, based on water depth and the user-supplied channel shape.

ASCII output (RS232): outputs data over the IQ RS232 serial port (9600 8-N-1) using standard ASCII characters.

Battery Voltage: This is the voltage powering the IQ during data collection.

Battery capacity: This is the expected capacity, in amp-hours, of the battery that will be used to power the IQ during data collection. Battery life calculations assume the battery has a full charge. If the battery has not been fully charged, the battery life will be reduced.

Bottom Width: bottom width of a trapezoidal channel (in units of m, ft, etc)

Channel Depth: the vertical depth of an open channel (in units of m, ft, etc) from the bottom to the top of the channel bank.

Channel Type: Several channel types are supported for flow calculations (Irregular Open Channel, Trapezoidal Open Channel, Trapezoidal Culvert, and Stage/Area Equations). All calcula-

tions are supported by the IQ Plus and IQ Pipe, while the IQ Standard only allows for the Trapezoidal Channel and Irregular Open Channel.

Irregular Open Channel can be an open channel of any shape defined by up to 200 user supplied survey points.
Trapezoidal Open Channel is a regularly shaped open channel defined by three parameters: width at the bottom of the channel, width at the top of the channel, and channel depth.
Trapezoidal Culvert is the same as Trapezoidal Open Channel, except that the channel is closed with a solid top.
Round Pipe is a regular closed conduit or pipe that is defined by the diameter.
Elliptical Pipe is a regular closed conduit or pipe defined by the pipe width and pipe height.
Irregular Pipe can be a closed conduit of any shape defined by up to 200 user defined supplied survey points.
Stage/Area Equation (IQ Plus and IQ Pipe Only) is a set of one or more user supplied equations that relates the measured stage to the cross sectional flow area.

Check Pressure Calibration: If this option is selected, the software will automatically check the pressure sensor to be sure it has been reliably calibrated for changing atmospheric conditions. If it is not enabled, and if the pressure sensor has not been calibrated for more than 1 day, you will be prompted to perform the pressure sensor calibration when connecting to the system.

Comments: Up to 120 characters are allowed. This is typically a short description of the details of the deployment.

Data Statistics: Key statistical values can be calculated for a range of IQ data. Max sample number represents the last sample number to be used in this range of data.

Depth: this specifies the units used for any length or distance variable, including water depth and channel dimensions.

Estimated battery life: Battery life is calculated based on the user-supplied battery voltage and capacity, and the conditions at the site. This value is an estimate only, and actual results may vary. A number of factors, including the level of charge in the battery and cold weather, may significantly decrease battery life below the expected values shown here. Battery life will also be affected by the presence of the flow display; if the flow display is connected, this is taken into account in battery life calculations.

File Name: this determines the file name under which data is stored to the internal recorder. You can select up to 10 letters or numbers; spaces or symbols are not allowed. The system automatically adds a date and time stamp to the file name, to avoid duplicate file names. For example, if you set file name TEST, the data file names will look like TEST_YYYYMMDD_HHMMSS (for year, month, day, hour, minute, second).

Flow: this specifies the units used for the computed flow rate value.

Flow Threshold: this specifies the minimum flow rate threshold used when the “Use Flow Threshold” option is enabled.

IEEE Standard Floating Point: a format specified by the IEEE standard; this is the default setting for most Modbus data collection platforms.

IQ Orientation: In a closed conduit, the IQ can either be installed on the bottom looking up or on the top looking down. Naturally, installation on the top will only work if the channel is always completely full. This setting tells the instrument how it is installed and is critical for accurate data collection and analysis. The location/orientation of the instrument will be shown accordingly, so be sure to check that you have the correct setting.

Index (IQ Plus and IQ Pipe only): An empirically determined, user-supplied index relationship can be used to relate system velocity to mean velocity in the channel. This requires three index coefficients to define the relationship between measured and mean velocity.

Initialize: with this setting in total volume calculations, the user provides an initial volume amount (the Initial Volume Value) and the instrument accumulates volume from that point. After starting data collection, the instrument automatically switches to the Continuous setting, so that volume will continue to accumulate whenever data collection is stopped and started. When installing the instrument at a new site, the system would typically be set for Initialize with an Initial Volume Value of 0, so that the accumulated volume represents only data from the new site.

Initialize Volume: this setting determines the starting value for total volume calculations each time data collection is started.

Instrument Y/Z: this specifies the location of the instrument within the channel. Y is the horizontal location across the width of the channel and Z is the vertical location. The instrument location is always specified as the top of the instrument's vertical beam. For an irregular open channel, instrument location is relative to the same Y/Z origin as all other survey data. For a trapezoidal open channel or a trapezoidal culvert, the bottom center of the channel is defined as location Y=0, Z=0. Negative Y values are moving towards the left bank, and positive Y values are moving towards the right bank when looking downstream.

Instrument Z: This specifies the height of the instrument within the channel. Instrument height is always measured from the top of the instrument's vertical beam. The IQ measures water depth above the vertical beam. Stage is computed as this water depth plus Instrument Z. This computed Stage value is used in the Stage/Area equation(s).

Initialize Volume: This setting determines the starting value for total volume calculations each time data collection is started.

Continuous: this is the default setting. With this setting, volume continues to accumulate from the last measured value when data collection is stopped and re-started; this includes an estimate of the volume of water for the period that was not measured.

Initialize: with this setting, the user provides an initial volume amount (the Initial Volume Value) and the instrument accumulates volume from that point. After starting data collection, the instrument automatically switches to the Continuous setting, so that volume will continue to accumulate whenever data collection is stopped and started. When installing the instrument at a new site, the system would typically be set for Initialize with an Initial Volume Value of 0, so that the accumulated volume represents only data from the new site.

Initial Volume Value: When using the Initialize setting above, this specifies the starting value for total volume calculations. The units match the total volume output units setting.

Inverse Floating Point: uses an alternative format that is needed for some Modbus system configurations.

IQ Data Folder: the IQ software stores and accesses all downloaded data from a common data folder. This setting specifies that data folder location and name. Within this folder, the IQ software follows a specific structure for how files from different systems and sites are stored. We recommend that you do not manually move any files into or within this folder, but instead allow the IQ software to control automatically the data file organization.

Irregular Open Channel: can be an open channel of any shape defined by up to 200 user supplied survey points.

Maximum Baud Rate: This setting determines the maximum baud rate at which the software will communicate and download data from the IQ. When connecting to the system, the software runs tests to determine the maximum effective baud rate that can be achieved. In most cases, the maximum baud rate can be left at the default value of 460800, and the software will automatically determine the best baud rate to use. If you are experiencing communication problems with the IQ, particularly when using a long cable (30 m/100 ft or more), you can try to set a lower maximum baud rate to see if this helps. In general, settings of 57600 / 38400 / 19200 may be good values to try. Note that a lower maximum baud rate will significantly increase the time required to download data files.

Maximum Idle Time: One thing that may indicate the site memory needs to be reset is if the system has been idle for an extended period. This parameter specifies what that period is; the default value is 30 days. If the IQ has not collected data for a period greater than this value, the software will ask you if you wish to reset the site memory. If channel conditions have changed during that period, you should reset the site memory. If channel conditions have not changed significantly, you should not reset the site memory.

Mean-Velocity Calculation Method: This parameter is required for internal flow.

Modbus: configures the system to act as a Modbus slave device over the RS232 serial port.

Modbus Address: Each instrument in a Modbus data collection network must have a unique address from 1 to 247.

Modbus Baud Rate: This specifies the baud rate for serial communication used when collecting data in a Modbus data collection network. The default value for Modbus is 19200; values from 300 to 115200 are supported. For longer cable runs (greater than 15 m / 50 feet), be sure to use a low enough baud rate for reliable communications.

Modbus Output Format: All Modbus data are output as floating point numbers; this setting determines how data inside the floating-point numbers are formatted.

Modbus Parity: specifies the parity for serial communication used when collecting data in a Modbus data collection network. The default setting is EVEN; settings of EVEN, ODD and NONE are supported.

Number of Analog Channels: the IQ can control from 1 to 4 external analog output devices. Each channel generates an analog signal (4-20 mA) proportional to a data variable from the IQ.

Operator Name: this is usually the name of the person configuring the IQ and setting up the site. Up to 32 characters are allowed. If an operator name is provided, data files can be organized and viewed based upon the operator name.

Output Type: the IQ supports a number of different methods of data output types for integration with an external data logger or network.

SonTek Binary is a proprietary protocol used only to communicate with SonTek software.
ASCII output (RS232) outputs data over the RS232 serial port (9600 baud, 8 data bits, 1 stop bit, no parity) using standard ASCII characters.
Analog output (4-20 mA) configures the system to control up to four analog signals generated by the IQ. Each analog signal (4-20 mA) is proportional to a single IQ data variable.
SDI-12 configures the system to interface to an SDI-12 data logger.
Modbus configures the system to act as a Modbus slave device over the RS232 serial port.

Pressure: specifies the units used for the measured water pressure.

Profile Export Data: This option determines how much data are included when exporting profile data.

Good Cells Only exports only data for those cells determined to be valid. This is determined by the measured depth and the shape of the channel.
All Cells exports all profile data that were recorded. Many of these cells may be past the surface or the walls of the channel and may not represent valid data.

Recorder Days Remaining: based on current instrument settings and the amount of free space on the recorder, this displays how long the system can run before the recorder runs out of free space. When the recorder is full, data collection will continue and output data (i.e. via an external data logger) will still be available, but data will no longer be stored to the instrument recorder. The system will give a warning if you restart data collection when the recorder is full.

Record Profile Data (IQ Plus and IQ Pipe Only): setting determines the interval at which detailed profile data are recorded. Depending on the system configuration, this may include SNR and/or velocity data. A value of 1 indicates profile data are recorded with each sample. A value of N indicates profile data are recorded with every N samples (i.e. every 100 samples). A value of 0 indicates profile data are not recorded. The recording of profile data has a significant impact on file size and recorder life, and this impact should be considered when setting this parameter.

Reference Date and Time: is initially set to the PC clock time when the dialog was opened. If you un-select Use PC Time, you can manually enter a date and time to be sent to the IQ clock.

Reset: with this setting in total volume calculations, the volume value starts at 0 each time data collection is stopped and re-started.

Sample Duration (seconds): determines the period of time (in seconds) that the system averages data for each sample. Settings as short as 10 seconds are allowed; however, we do not recommend settings less than 30 seconds. We suggest using the largest value possible based on the required data output rate and power limitations. Settings of 60 to 900 seconds (1 to 15 minutes) are common. Longer averaging times will reduce the amount of variability (noise) in flow data.

Sample Interval (seconds): This determines the period (in seconds) from the start of one sample to the start of the next; it must be greater than or equal to the sample duration. Setting this value greater than the sample duration will reduce total power consumption, as the system enters a low power state between samples. When interfacing with an external data logger using SDI-12, the data logger will control the exact timing between samples, and the setting of this sample interval is ignored. For proper recorder life calculations, sample interval should match the time between samples as programmed into the data logger.

SDI-12: configures the system to interface to an SDI-12 datalogger.

SDI-12 Address: each instrument in a SDI-12 data collection network must have a unique address. Address values from **0-9**, lower case **a-z**, and upper case **A-Z** are allowed.

Site Name: is normally a short description of installation site. Up to 32 characters are allowed. If a site name is provided, data files can be organized and viewed based upon the site name.

SonTek Binary is a proprietary output data format used only with the SonTek-IQ software.

Stage/Area Equation (IQ Plus and IQ Pipe Only): set of one or more equations defining the mathematical relationship between stage and area. Two equation formats, Quadratic and Power, are supported. Min and max stage values must be defined for each equation.

Survey Data: an irregular open channel must be defined by user supplied survey points. A minimum of 3 and a maximum of 200 survey points are allowed. Y is the horizontal location across the width of the channel and Z is the vertical location. The setting of survey origin determines whether lower Y values are near the left or right bank of the channel (when looking downstream).

Survey Origin: when providing channel survey data for an irregular open channel, this specifies the origin of the horizontal (Y) survey data. Left Bank indicates that smaller Y values are towards the left side of the channel when looking downstream. Right Bank indicates that smaller Y values are towards the right side of the channel when looking downstream.

System Date and Time: is the reading of the IQ clock at the time the dialog was opened.

Temperature: specifies the units used for water temperature.

Theoretical: A power law based theory, using the location of the measured velocity data within the overall channel geometry, to determine the relationship between measured velocity and mean channel velocity.

Top Width: defines the width of a trapezoidal channel (in units of m, ft, etc.) at the top of the channel bank.

Trapezoidal Culvert: is the same as Trapezoidal Open Channel, except that the channel is closed with a solid top. The most common example of this is a rectangular culvert that might pass under a road or bridge.

Trapezoidal Open Channel: is a regularly shaped open channel defined by three parameters: width at the bottom of the channel, width at the top of the channel, and channel depth.

Use Flow Threshold: When this option is selected, total volume data are only accumulated when the magnitude of the measured flow rate exceeds the flow threshold. Note that we use magnitude, or absolute value, for this comparison. As such, the magnitude of a flow rate of -2.1 m^3/s would exceed a flow threshold of 2.0 m^3/s, and that datum would be accumulated for total volume calculations.

Flow Threshold: This specifies the minimum flow rate threshold used when Use Flow Threshold is enabled.

Use Stage Threshold: When this option is selected, total volume data are only accumulated when the measured stage exceeds the stage threshold.

Stage Threshold: This specifies the minimum stage threshold used when Use Stage Threshold is enabled.

Use Velocity Threshold: when this option is selected, total volume data are only accumulated when the magnitude of the mean velocity exceeds the velocity threshold. Note that we use magnitude, or absolute value, for this comparison. Therefore, the magnitude of a velocity of -2.1 m/s would exceed a velocity threshold of 2.0 m/s, and that datum would be accumulated for total volume calculations.

Velocity Threshold: specifies the minimum velocity threshold used when Use Velocity Threshold is enabled.

Velocity: measurement of the speed of the water for a given direction.

Verify System Clock: If this option is selected, the software will automatically compare the system clock to the PC clock each time you connect to the system. If the time difference between the two clocks is greater than the value specified by Maximum Time Difference, the software will notify you of the difference in time and will allow you to reset the clock if desired.

Maximum Time Difference: If Verify System Clock is set to Yes, the system clock is compared to the PC clock each time you connect to the system. If the time difference between the two clocks is greater than the value specified by Maximum Time Difference, the software will notify you of the difference in time and will allow you to reset the clock if desired.

Verify Site Memory: The IQ maintains a record of the flow conditions for the current measurement site. This record includes the total volume of water delivered and details about the vertical and horizontal distribution of velocity within the canal. These parameters help the system perform the most accurate flow calculations possible. When an instrument is first installed at a new site, it takes the system a short period (~5-30 minutes) to "learn" the conditions at the new site—this assumes that the site is under regular flow conditions. If the IQ is moved to a new site, or if

the conditions at a given site change (perhaps due to cleaning of the channel, or a long time span when the canal is not used), the site memory should be reset to allow the system to quickly adapt to the new conditions. This parameter enables/disables several features that attempt to determine automatically if the site memory should be reset. If this parameter is enabled, the software will ask if you wish to reset the site memory if anything occurs that would suggest site memory might need to be reset.

Volume: specifies the units used for the computed total water volume.

Water salinity: user input salinity is used to calculate sound speed, which is required for system operation. Salinity should be input with the best possible accuracy (ideally within 1 ppt) to ensure accurate sound speed data. Freshwater can be considered 0 ppt. Typical values for seawater are 30-35 ppt.

Appendix B. Principles of Operation

This document introduces the operating principles of the SonTek-IQ products (SonTek-IQ, SonTek-IQ Plus and SonTek-IQ Pipe) Doppler current meters. It does not attempt to provide a detailed discussion of all technical issues, nor does it provide a detailed description of SonTek-IQ products operation. To learn more about specific SonTek-IQ applications, please refer to other sections of the *SonTek-IQ User's Manual* or contact SonTek Support.

B-1. Overview

SonTek-IQ products are Doppler current meters designed for water velocity, level, and flow measurements in the field. The SonTek-IQ product line provides the technological advantages of complex/expensive current profilers, but in a simple, inexpensive, and easy to use package. SonTek-IQ products attributes include:

- Horizontally and vertically integrated velocity measurement (using along axis and skew beams)
- Measurements to the maximum possible extent of the water column
- Invariant factory calibration — no periodic recalibration required
- Simple operation (very few user entries needed)
- Excellent performance for low and high flows
- Accuracy — 1% of measured velocity
- Water level measured by vertical beam and pressure sensor
- Built-in temperature sensor

The SonTek-IQ product line combines horizontally and vertically integrated velocity data with precise stage measurements to determine real-time flow data. A variety of real-time flow calculations are supported and are presented below:

- Natural streams
- Regular (trapezoidal) channels (typically concrete lined)
- Irregular channels (typically, not lined or earthen channels)
- Pipes and closed conduits (SonTek-IQ Pipe)
- Theoretical flow calculations
- Full support for index velocity sites (SonTek-IQ Plus)
- Calculation of total water volume for water deliveries

B-2. The Doppler Shift

The SonTek-IQ products measures the velocity of water using a physical principle called the Doppler shift. This principle states that if a source of sound is moving relative to the receiver, the frequency of the sound at the receiver is shifted from the transmit frequency. For a Doppler current meter, this can be expressed as:

$F_d = (2 F_0 V/C)$

Where:

F_d = Change in received frequency (Doppler shift)

F_0 = Frequency of transmitted sound

V = Represents the relative velocity between source and receiver (i.e., motion that changes the distance between the two); positive V indicates that the distance from source to receiver is increasing

C = Speed of sound

The SonTek-IQ products are a *monostatic* Doppler current meter. Figure B1 illustrates the operation of a monostatic Doppler current meter.

- Monostatic means the same transducer is used as transmitter and receiver.
- The transducer generates a short pulse of sound at a known frequency (F_0), which then propagates through the water.
- The transducer is constructed to generate a narrow beam of sound where the majority of energy is concentrated in a cone a few degrees wide.
- As the sound travels through the water, it is reflected in all directions by particulate matter (i.e., sediment, biological matter, bubbles).
- Some of the reflected energy travels back along the transducer axis, where the transducer receives it.
- The IQ electronics measure the change in frequency of the received signal.
- The Doppler shift measured by a single transducer relates to the velocity of the water along the axis of the acoustic beam of that transducer.
- If the distance between the transducer and the target is decreasing, frequency (F_D) increases; if the distance is increasing, frequency (F_D) decreases. Motion perpendicular to the line-connecting source and receiver has no effect on the frequency of received sound.

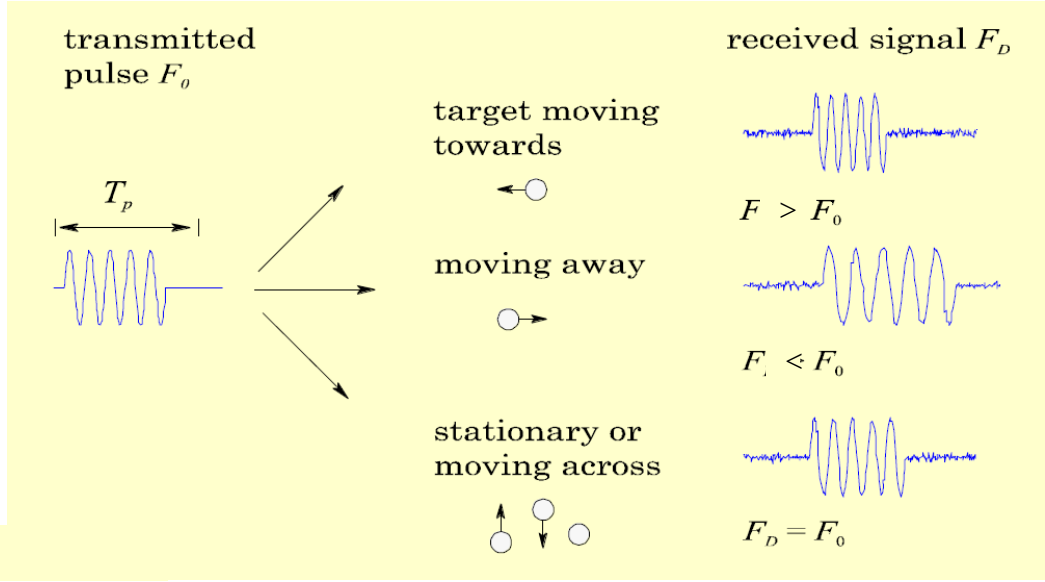


Figure B1. Measuring water velocity using a target with a monostatic Doppler system

The location of measurements made by a monostatic Doppler current meter is a function of the time at which the return signal is sampled.

- The time since the pulse was transmitted determines how far the pulse has propagated, and thus specifies the location of the particles that are the source of the reflected signal.

- By measuring the return signal at different times following the transmit pulse (T_P), the SonTek-IQ measures the water velocity at different distances from the transducer.
- It is important to note that SonTek-IQ products measure the velocity of particles in the water, and not the velocity of the water itself.
- The velocity of particles in the water is assumed to match the velocity of the water. This assumption has been tested extensively and found to be highly reliable. So much so that SonTek and many other companies have built their business upon this assumption.
- If there is no particulate matter in the water, the IQ is unable to measure velocity. In general, the practical limitation of clear water is not whether the IQ can make velocity measurements, but what is the maximum range (distance from the system) at which the IQ can measure velocity. In clear water, the maximum measurement range may be reduced.

Important Note: *Clear water* is a relative term; visual inspection is not a good way to determine particulate matter concentration. Beam Check, in the Utilities Tab of the IQ software can be used to make an on-site field determination of range.

B-3. Beam Geometry

The SonTek-IQ product line is a class of flowmeter that is typically mounted in the bottom of open channels or pipes. In cases where a closed conduit is known to always be full flowing, the instrument can be mounted to the top of the conduit looking down. Regardless of being mounted at the bottom or top of the channel, the SonTek-IQ products measure velocity along the axis of flow as well as horizontally using the along-axis beams skew beams respectively.

- The IQ is mounted such that the along axis transducer are aligned with the center of the channel (Figure B2).

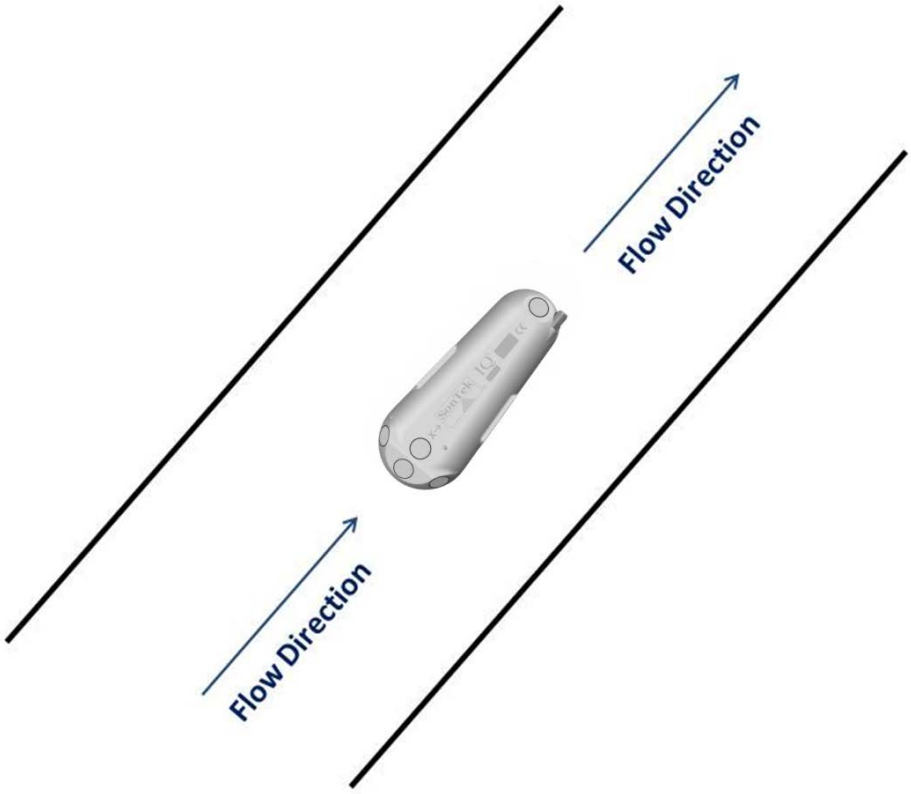


Figure B2. IQ orientation relative to flow

Note: SonTek-IQ and IQ Plus are represented in the Figure above – the same instructions apply for the SonTek-IQ Pipe.

- The IQ uses four transducers to measure velocity — two along-axis beams and two skew beams. This beam geometry optimizes the balance between total measurement range and performance in shallow water.
    - Along axis beams are 25° off the vertical axis
    - Skew beams are 60° off the vertical axis and 60° of the center axis of channel

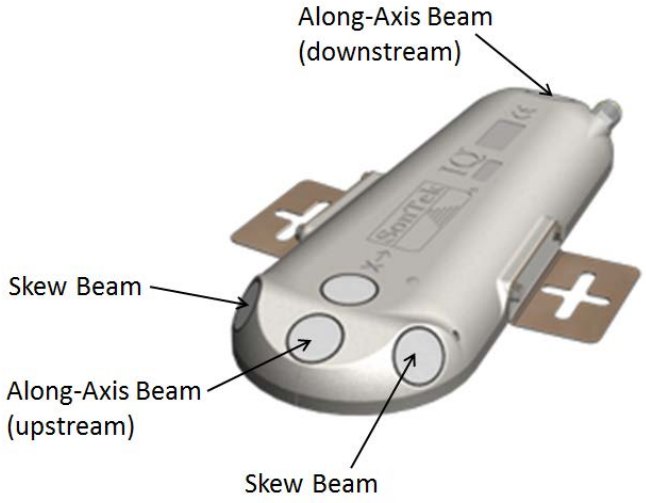


Figure B3. Beam geometry for the SonTek-IQ

- The SonTek-IQ Pipe uses four transducers to measure velocity — two along-axis beams and two skew beams. This beam geometry optimizes the balance between total measurement range and performance in shallow water (Figure B2).
    - Along axis beams are 25° off the vertical axis
    - Skew beams are 37° off the vertical axis and 45° of the center axis of channel

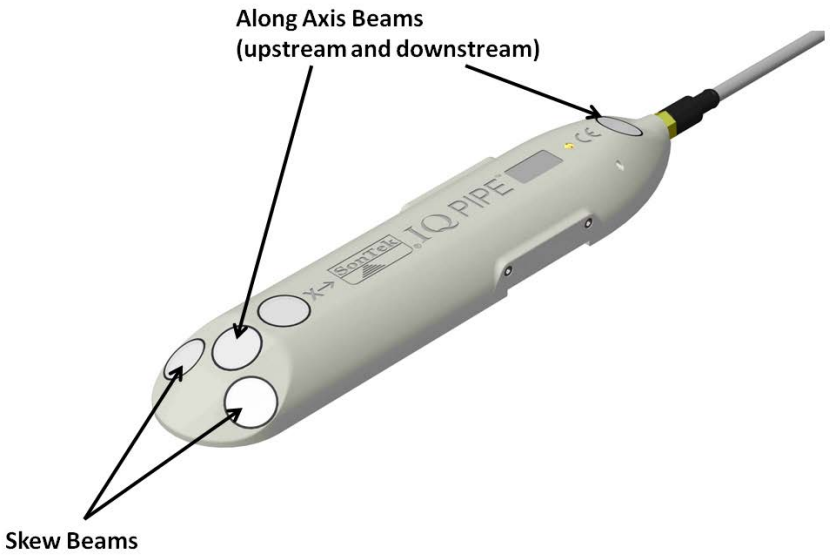


Figure B4. Beam geometry for the SonTek-IQ Pipe

- The IQ products use the relative orientation of the transducers to calculate the 3D water velocity.
- The velocity measured by one transducer is the projection of the 2D water velocity onto the axis of the acoustic beam, and is referred to as the beam velocity.
- Beam velocities are converted to XY (Cartesian) velocities using the beam geometry.
- The X velocity for the IQ is the along-channel water velocity; the Z velocity is the vertical water velocity (typically very small).
- The IQ typically measures as much of the water column as possible — from a short distance above the transducer head all the way to the water surface.
- The starting point of the velocity measurement is 0.02 m above the transducer. This distance (called the *blanking distance*) is required for the transducers to recover after transmitting the acoustic pulse.
- The IQ dynamically adjusts the ending point of the velocity measurement based on the measured *water level* from the vertical acoustic beam. This lets the IQ automatically optimize operation with changing water level.

B-4. Water Level Measurement

Water level is determined by using a vertical beam and integrated pressure sensor.

- The vertical beam sends a short sound pulse and listens for the reflection from the surface.
- The surface reflection is very strong and clearly defined, allowing SonTek-IQ products to precisely measure the time at which the return reflection is received.
- To convert the reflection time to surface range, SonTek-IQ products needs to know the speed of sound in the water at the site, which is primarily a function of temperature and salinity.
    - SonTek-IQ products have an internal temperature sensor that automatically compensates for changing conditions by continually updating the sound speed used for surface range calculations.

  - Salinity is user defined (i.e., SonTek-IQ products do not automatically adjust for salinity variations).
- The vertical beam can operate with water depths from 0.08 to 1.5 m (from the base) for the SonTek-IQ, and 0.08 to 5 m for the SonTek-IQ Plus and IQ Pipe.
- Both the vertical beam and pressure measurements can be used for water depth. The IQ firmware has a set of algorithms to determine which measurement is best for water depth in real time. These water depth algorithms were modified in firmware version 2.00 to provide water depth estimates even when conditions are not ideal. These water depth estimates will be accompanied by two new status codes to identify poor conditions. Previous firmware versions including 1.60 would stop reporting water depth if vertical beam measurements and/or pressure sensor calibrations were poor.
- When submerged measurement conditions are good, the vertical beam measurement is used to calibrate the pressure sensor in real time for up-looking instrument orientations. This calibration removes fluctuations in pressure due to changes in atmospheric conditions. If atmospheric pressure variation is not removed (by vertical beam calibration) this can lead to inaccurate water depths and consequently inaccurate flow computations when using the pressure sensor for water depth.
- For up or down orientations with the system in air, the pressure sensor is zeroed during each sample if the standard deviation of the subsample pressure measurements is low. This is basically a pressure spike filter.
- For down-looking systems when submerged:
  - The pressure sensor is not calibrated with the vertical beam.
  - If the IQ detects water, the vertical beam is used for water depth when vertical beam percent good is equal to or greater than 30%.
  - If the vertical beam percent good is below 30%, the vertical dimension of the channel/pipe is used as the water depth.
- For up-looking systems when submerged:
  - If vertical beam percent good is greater than 30% use vertical beam for water depth and calibrate pressure sensor.
  - If vertical beam percent good is below 30% use pressure for water depth if calibration has occurred within the last 6 hours.
  - If vertical beam percent good is below 30% and pressure has not been calibrated for more than 6 hours, use pressure for water depth subject to the following conditions and status codes:
    - If pressure depth is less than 0.04 m, do not report water depth or flow
    - If pressure depth is greater than 0.04 m and less than instrument maximum vertical beam range, use pressure for water depth and activate status code 8192, “Poor depth warning”. Water depth and flow will still be reported but should be used with caution.
    - If pressure depth is greater than maximum beam range, use pressure for depth and activate status code 4096, “Vertical beam range exceeded”. Water depth and flow will still be reported but should be used with caution.

- If an over pressure condition exists (pipe or closed channel), use vertical beam for water depth when vertical beam percent good is equal to or greater than 30% otherwise use channel vertical dimension.
- For pressurized pipes, note the pressure sensor range, as well as the IQ's (all models) housing rating is 30 m of water (or 42 psi).

B-5. Flow Calculations

One of the primary functions of the SonTek-IQ products is to provide real-time flow data and total volume data for water deliveries. SonTek-IQ products combine water velocity data and level data with user-supplied channel geometry information about the installation site to calculate flow and volume. SonTek-IQ products support flow calculations for a variety of environments.

- Natural streams (defined by a series of survey points)
- Regular and irregular (trapezoidal) channels (typically concrete lined)
- Regular (trapezoidal) culverts with a closed top (SonTek-IQ Plus)
- Any channel that can be represented with a stage/area equation (SonTek-IQ Plus)
- Pipes and other closed conduits (SonTek-IQ Pipe)

    - **It is important to note that although both the IQ Plus and IQ Pipe can be installed in either open channels or closed conduits, pipe flow algorithms only exist in the IQ Pipe system and open channel flow algorithms only exist in the IQ Plus (and IQ Standard).**
    - **If an IQ Pipe is installed in an open channel, or an IQ Plus is installed inside a pipe, flow (volumetric discharge) must be computed outside of the system using the index velocity. For best results, SonTek strongly recommends that the SonTek-IQ Plus be used in open channels and the SonTek-IQ Pipe be used in closed conduits.**

SonTek-IQ products combine channel geometry with stage to calculate the cross-sectional area. The area is then multiplied by the mean channel velocity to determine flow. The relationship between the velocity measured by SonTek-IQ products and the mean channel velocity can be determined two ways.

- Theoretical flow calculations
- Index velocity calibration

SonTek-IQ products can use the measured flow rate to compute the total volume. Total volume is the cumulative sum of flow rate multiplied by time. An example of this type of data is total irrigation volume. This the amount of water delivered through an irrigation channel over a given time span. Total volume is available both in real-time display and output, as well as in the recorded data.

B-5-1. Theoretical Flow Calculations

Theoretical flow calculations are used when no reference flow data are available; that is, only

channel geometry and data measured directly by the SonTek-IQ products are utilized. For theoretical flow calculations SonTek-IQ products make use of the following information.

- The largest variations of velocity occur with changing depth
- SonTek-IQ products measure a vertically integrated velocity over the largest possible portion of the water column, including information about the variation of vertical velocity
    - The SonTek-IQ outputs average velocity data from 0.08 – 1.5 m
    - The SonTek-IQ Plus and IQ Pipe outputs velocity profile data from 0.08 – 5.0 m
- A power-law velocity profile model is used, assuming a 1/6 power-law coefficient for open channels and pipes.
- The theoretical flow model accounts for the portion of the vertical velocity profile measured by the SonTek-IQ product. It determines the relationship between the mean velocities measured in this portion of the water column with the mean velocity through the vertical profile.
- The model provides a velocity scaling factor that relates the SonTek-IQ product measured velocity to the mean channel velocity.
- The flow model is customized based on specified channel type — open channel, round pipe (full/partially full), elliptical pipe (full/partially full), or closed culvert (full/partially full).

B-6-1 Index Velocity Calibration

An index velocity calibration is a popular technique for monitoring discharge when reference discharge measurements are available.

- Discharge measurements are made at a variety of water levels and flow conditions.
- IQ water velocity data and stage data are collected at the same time as reference discharge measurements.
- These data are analyzed to determine an empirical relationship between the IQ measured velocity and the mean channel velocity. This empirical relationship is then input into the IQ, which outputs calibrated flow data in real time.
- The empirical index relationship uses the following form:

$$V_{mean} = V_{intercept} + V_{meas} * (V_{slope} + (StageCoef * Stage))$$

where:

V_{mean} = mean velocity in the channel
$V_{intercept}$ = user-supplied* velocity offset (cm/s or ft/s)
V_{meas} = IQ measured velocity
V_{slope} = user-supplied* velocity scale factor (no units)
StageCoef = user-supplied* water depth coefficient (1/s)
Stage = measured stage (total water depth) (m or ft)

***Important**: These constants are empirically derived coefficients based on several user-made, independent discharge measurements. These coefficients relate IQ product measured velocity to mean channel velocity as determined by the independent measurements. The details of how these constants are derived are beyond the scope of this appendix. For more information, contact SonTek.

An index velocity calibration will usually supply more accurate flow data than a theoretical flow calculation. However, an index calibration requires extensive reference data and data analysis

expertise to construct — for many applications, this is not practical. In these situations, the theoretical flow calculations can provide good quality flow data.

B-6. SonTek-IQ Data

Below are details on collecting data with the SonTek-IQ product line.

B-6.1 Sampling Strategy

The SonTek-IQ products average data for a fixed interval for each reported water velocity sample.

- The IQ samples velocity (via ping) each second. The type of velocity pings depends upon flow conditions.
- The IQ pings the vertical beam once per second to measure stage data.
- Pings are accumulated over a user-specified sample duration (typically 1 to 15 minutes) and average values for velocity, stage, and a variety of diagnostic data are reported.
- The sampled data are normally recorded to the IQ's internal recorder, and can also be reported to an external data logger.
- The IQ can operate continuously (i.e., start the next sample immediately after completing a sample), or it can enter a low power (i.e., sleep) state between samples to conserve power.

B-6.2 Velocity Data

The IQ velocity data are determined using three types of acoustic pulses. The IQ automatically determines the best pulse scheme to provide the best possible velocity data.

- The IQ can measure water velocities from ±0.001 to 5 m/s.
- The IQ also measures flow direction and will accurately report reversing flow.
    - The standard IQ outputs average velocity
    - The IQ Plus outputs velocity profiles
- Data are output in Cartesian coordinates (XY) relative to system orientation.
- If one transducer is buried or blocked, the IQ may switch to a one-beam solution for velocity.
- Velocity data are accurate to 1% of the measured velocity (after accounting for random noise).
- The IQ provides diagnostic parameters with each sample to verify the quality and accuracy of these data.
- The IQ calibration will not change with time; the system never requires re-calibration.

B-6.3 Accuracy of Velocity data

The IQ is well suited to low-flow applications to less than 0.01 m/s. When discussing the accuracy of the IQ water velocity data, we are referring to the presence of any bias in mean velocity measurements. Velocity data may have random short-term variations (noise) that do not reflect a bias to velocity data. Two factors influence the accuracy of IQ velocity data: sound speed and beam geometry.

- With properly specified salinity data, sound speed errors are negligible (less than 0.25%).

- Beam geometry is fixed during system construction and will not change with time (unless there is catastrophic physical damage to the system).
- The IQ calibration is specified to 1.0% of the measured velocity.
- There is no potential for zero offset or drift in velocity measurements and no inherent minimum measurable velocity.

B-6.4 Signal-to-Noise Ratio

The IQ measures velocity by looking at the reflections of an acoustic pulse from particles in the water.

- The magnitude of the reflection is called signal strength. It varies with the amount and type of suspended material, and with the distance from the transducers.
- Signal strength decreases with distance from the transducer due to geometric spreading and sound absorption.
- The distance at which signal strength approaches the electronics noise level determines the maximum measurement range of the IQ.
- Signal strength is commonly used as the signal-to-noise ratio (SNR), which compares the magnitude of the received signal to the ambient electronics noise level.
- SNR is reported in logarithmic scale.
- Signal strength data are measured and recorded in internal logarithmic units called counts.
  - Signal strength and noise level are recorded in counts; one count equals 0.43 dB.
  - Signal strength is converted to SNR by subtracting the noise level and converting to dB.
- The IQ requires a minimum SNR (≈3 dB) to make accurate velocity measurements.

For the IQ, the location and size of the measurement volume is variable over a range up to 1.5 m for the standard IQ and up to 5.0 m from the IQ Plus.

- Signal strength and SNR reported are the mean value over the measurement volume.
- Signal strength decreases with range from the transducers and will vary with conditions in the water. For good operating conditions, SNR should be greater than 3 dB.

The IQ will continuously change vertical extent of the measurement based on water depth.

- In most conditions, the IQ is able to measure to the specified maximum range of 5 m for the IQ Plus and 1.5 m for the standard IQ.
- If at any point the signal strength is too low for reliable velocity measurements, the IQ will end the measurement volume at that range. In this situation, the system will automatically cut off the measurement volume at the maximum effective range. The exact limits of the measurement volume are recorded with each sample.

Signal strength is primarily a function of the amount and type of particulate matter in the water. While signal strength cannot be immediately converted to sediment concentration, it provides an excellent qualitative picture of sediment fluctuations and, with proper calibration, can be used to estimate sediment concentration.

B-7. Flow Data

With each sample, the IQ records cross-sectional area and flow.

- Cross-sectional area depends on the user-supplied channel geometry and water level determined by the vertical beam and pressure sensor.
- Typically, the accuracy of area data is most strongly influenced by the accuracy of channel geometry, rather than uncertainty in stage data.

The IQ can also be programmed to calculate total volume in addition to flow rate.

- Total volume is the cumulative sum of flow rate multiplied by elapsed time, and represents the total volume of water than has passed the IQ.
- Total volume can be accumulated continuously between files (when data collection is interrupted and restarted) or reset with each data file. Several methods are also provided to reset total volume (restart the accumulation at zero) within a data file, if required.
- Total volume can be output in a variety of different units as required by the user.

The accuracy of flow data depends on a few factors.

- Accuracy of cross-sectional area
- Accuracy of velocity data
- Method used to relate measured velocity to mean channel velocity

In general, the largest factor in determining the accuracy of flow data is the method used to relate measured velocity to mean velocity. Some guidelines are presented below:

- A well-established index calibration can give real-time flow accuracy of about 2-3% of the measured flow.
- Theoretical flow calculations in a regular channel (i.e., trapezoidal, concrete lined) may give accuracy of about 3-5%. This can be strongly affected by nearby intake or outlet structures or by nearby changes in channel geometry (including bends in the channel).
- Theoretical flow calculations in natural streams are difficult. They can provide reasonable results in streams with a simple, uniform cross section, but are notably limited in wide, shallow streams where velocity can vary dramatically across the width of the stream.

B-8. Data Output

The IQ offers several options for data output, including SDI-12, Modbus, RS232 ASCII and 4-20 mA outputs.

- Only one output type (RS232, RS422, SDI-12, Modbus, analog outputs) can be used at a time.
- The SDI-12 serial bus can be used to output a portion of the IQ sample data, including velocity and limited diagnostic data. Multi-cell velocity data can also be output in real-time using SDI-12.
    - For SDI-12 operation, the IQ is programmed using the RS-232 serial bus, and then Connected to an SDI-12 datalogger.
    - The IQ's SDI-12 interface is compatible with SDI-12 revisions 1.0, 1.1, 1.2, and 1.3. Options are provided to allow integration with a variety of data logger types.
    - When using SDI-12, the external data logger controls the timing of IQ's data collection.

  - Sample duration must be configured for the IQ to provide accurate battery life calculations when using SDI-12.
- The Modbus protocol provides a standardized means to acquire reliable digital data from a variety of sensors.
- The IQ can optionally be set up to generate analog output signals.
  - The IQ can generate up to four analog output signals at the same time.
  - Analog outputs can be either 4-20 mA or 0-5 VDC (only one analog output type can be used on a single system at any given time).
  - An external analog converter and special software are required to generate the analog output signals.
  - Each analog output signal can represent one variable.
  - The user specifies the range of values represented by the analog output signal, customizing the output range to the particular environment.

The IQ can record data to the internal recorder at the same time as any of the above data outputs are being used. SonTek encourages users to always record (and regularly download and archive) data on the internal recorder to ensure full access to diagnostic data.

B-9. Speed of Sound Calculations

The IQ uses sound speed to convert Doppler shift to water velocity. This section describes how to correct IQ velocity data for errors in the sound speed used for data collection.

- Since the IQ uses an internal temperature sensor for automatic sound speed compensation, user corrections are rarely needed.
- The only time sound speed corrections are normally required is if salinity has been incorrectly specified.

In shallow water, speed of sound is a function of temperature and salinity. Generally, a temperature change of 5^{o}C or a salinity change of 12 parts per thousand (ppt) results in a change in sound speed of one percent. The full range of typical temperature and salinity levels (from -5 to 60^{o}C and 0-60 ppt) gives a sound speed range of 1375-1600 m/s (total change of 14%).

IQ velocities scale directly with sound speed; that is, a 1% error in sound speed results in a 1% error in velocity measurements. The following formula is used for post-processing corrections and can be directly applied to the output velocity data of the IQ.

$$V_{true} = V_{orig} (C_{true} / C_{orig})$$

where:

V_{true} = Corrected velocity measurements
V_{orig} = Uncorrected (original) velocity measurements
C_{true} = True speed of sound
C_{orig} = Speed of sound used in original calculations

Errors in sound speed also affect the physical location of the IQ measurement volume, although these errors are generally very small. To calculate the correct location of the IQ measurement volume, use the following formula.

$$Z_{true} = Z_{orig} (C_{true} / C_{orig})$$

where:

Z_{true} = Corrected measurement volume location
Z_{orig} = Uncorrected (original) measurement volume location
C_{true} = True speed of sound
C_{orig} = Speed of sound used in original calculations

Appendix C. Specifications and Technical Drawings

C-1 Specifications

Parameter	SonTek-IQ Plus & IQ Pipe*	SonTek-IQ Standard
Minimum Operating Depth	0.08 m / 0.3 ft	0.08 / 0.3 ft
Maximum Operating Depth	5.0 m / 16.5 ft	1.5 m / 5.0 ft
Horizontal and vertical beam width	1.4°	1.4°
Side Lobe Suppression	>60 dB	>60 dB
True Compass Tilt Accuracy	±1°	±1°
Water Level Range (Vertical Beam)	0.05 – 5 m	0.05 – 1.5 m
Water Level Accuracy	0.1% of measured depth or ±0.003 m (0.01 ft) whichever is greater	0.1% of measured depth or ±0.003 m (0.01 ft) whichever is greater
Pressure Sensor Range	30 m	30 m
Pressure Sensor Accuracy	0.1% of full scale	0.1% of scale
Power Input	9 – 15 VDC	9 – 15 VDC
Power Consumption (data collection)	0.5 – 1.0 W	0.5 – 1.0 W
Power Consumption (idle)	< 0.03 W	< 0.03 W
Pressure Rating	20 m	20 m
Communications	RS232, SDI-12, ModBus	RS232, SDI-12, ModBus
Velocity Range	±5 m/s	±5 m/s
Resolution	0.0001 m/s (0.00003ft/s)	0.0001 m/s (0.00003ft/s)
Velocity Accuracy	±1% of measured velocity, ±0.5 cm/s (0.015 ft/s)	±1% of measured velocity, ±0.5 cm/s (0.015 ft/s)
Temperature Sensor Resolution/ Accuracy	±0.01°C /±0.1°C	±0.01°C /±0.1°C
Smart Pulse enabled	Profiling, 100 cell maximum output	Average velocity output
Operating and Storage Temperature	-5 to 60° C	-5 to 60° C
Velocity Indexing	Enabled	Disabled
Memory	4 GB	4 GB
Data	Reprocessing, Diagnostics, Display and Export	Display and Export

***Note**: For optimal performance, the SonTek-IQ Pipe is recommended for pipes ranging 0.5 – 5m.

C-2 Technical Drawing

- If the SonTek-IQ or IQ Plus is installed directly on the bottom of the channel, the system elevation is 1.125 inch (0.029 m).

- System Elevation is defined as the distance from the bottom of the instrument/channel to the top of the vertical beam (assuming the bottom of the channel is referenced to 0.00.

- However, if the system is installed with a riser mount or other custom option, this elevation is best determined using survey equipment.
- A technical drawing of the IQ highlighting the dimensions of the instrument is presented below. English units in inches are presented, with metric units in brackets [cm].

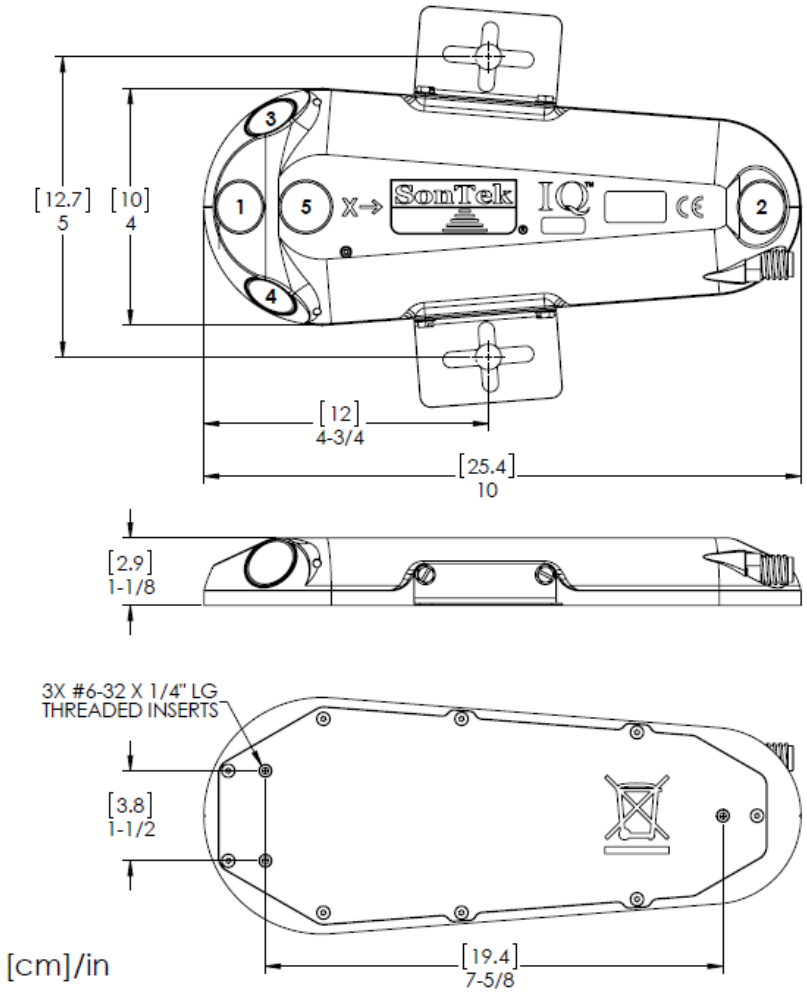


Figure C1. Technical drawing of the SonTek-IQ and IQ Plus with mounting options

- If the SonTek-IQ Pipe is installed directly on the bottom of the channel, the system elevation is 1.15 inches (0.029 m).
    - System Elevation is defined as the distance from the bottom of the instrument/channel to the top of the vertical beam (assuming the bottom of the channel is referenced to 0.00.
- However, if the system is installed inverted at the top of a closed conduit, the system elevation will be equal to the maximum depth of the closed conduit minus the system elevation.

- A technical drawing of the IQ Pipe highlighting the dimensions of the instrument is presented below. English units in inches are presented, with metric units in brackets [cm].

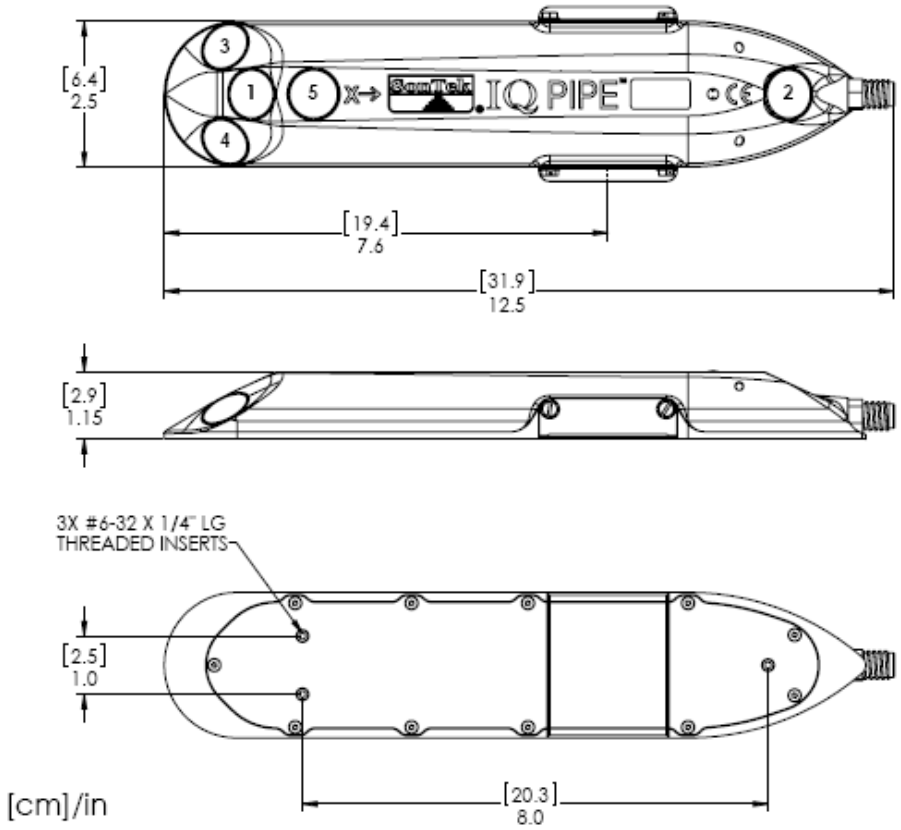


Figure C2. Technical drawing of the SonTek-IQ Pipe

Appendix D. SonTek Flow Display (for IQ products only)

The IQ Flow Display is an LCD display that can be connected to the SonTek-IQ. The Flow Display allows you to view data without the need to connect to a laptop. The Flow Display is operated from the same power supply as the SonTek-IQ. Below is a list of features:

- There are two versions of the Flow Display.
  - The standard display with LCD only.
  - The analog output display that includes four channels of 4-20 mA output (Figure D1).
- The display allows pass through communications to the SonTek-IQ for downloading and interfacing with a data logger.
- The display has four LED status lights showing system power, if an IQ is connected, when Modbus communication is active, and if there are any errors.
- The display includes a backlight for easier viewing.
- An arrow key allows users to scroll through multiple screens of data.

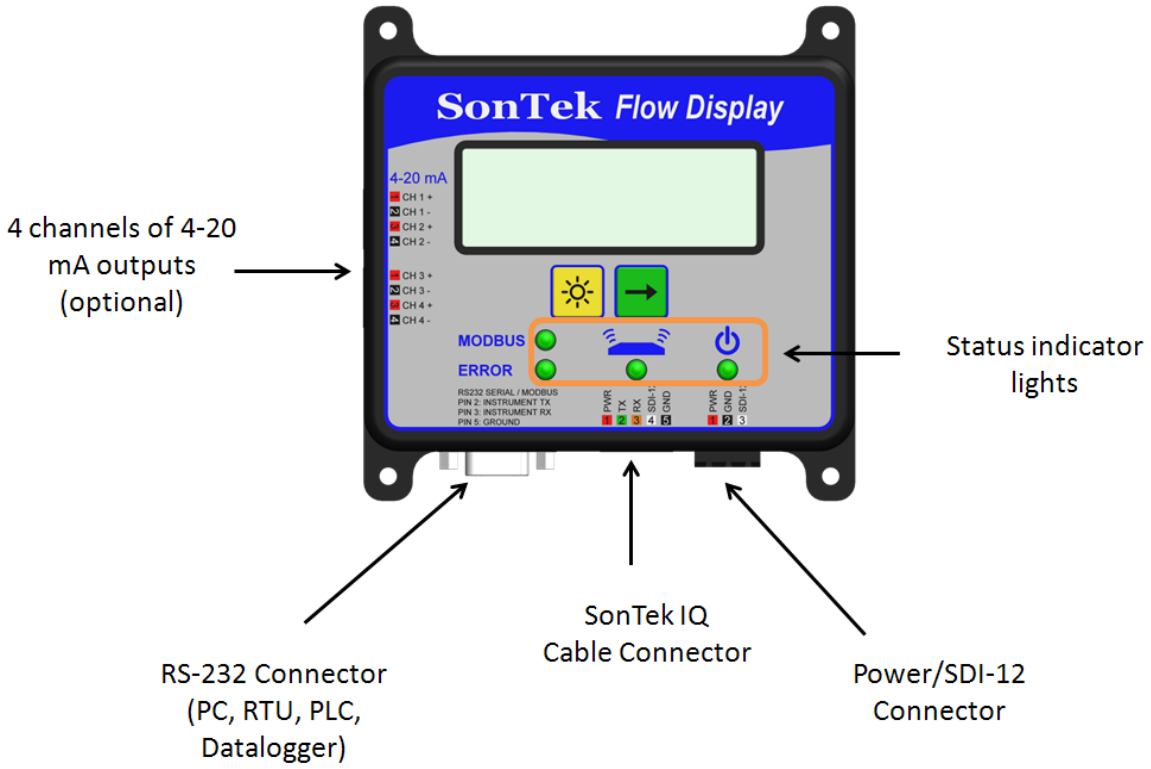


Figure D1. SonTek-IQ Flow Display with analog outputs

D-1. Firmware and Software Requirements

The SonTek Flow Display was released in February 2012.

- The SonTek-IQ must be running firmware version 1.1 or higher.
- For full support, you should install IQ software version 1.10 or higher.

In most cases, no specific software actions are required to configure the flow display.

- When connected to the IQ, the System Information portion of the screen (see Section 3.1.1) indicates the following.
  - If there is a flow display present.
  - If present, whether it is a standard flow display or a flow display with the 4-20 mA analog outputs.
  - What display firmware version is installed.
- The output units used by the flow display are the same as for any other data output, and are set in the IQ software (see Section 3.1.5).
- If you have a flow display with the optional 4-20 mA outputs, and you are using these outputs to integrate with an external data logger, these outputs must be specifically configured.
- Guidelines for configuring the analog outputs are given in Section 3.1.5.

D-2. Interconnection and Operation

The connection of the Flow Display follows the same procedure as the cable adaptor (Section 1.2).

- When using the Flow Display, the cable adaptor is not needed.
- Figure D2 shows the connection of the IQ to the Flow Display.
- It is important to note that there are two options for the Flow Display – a standard version and one with four channels of analog outputs (Figure D2).
- The RS232 connector (bottom left) allows for direct communication with SonTek-IQ via laptop, RTU, PLC, or data logger.
- The IQ connects to the 5-pin connector (bottom middle).
- Power and SDI-12 connectors use the 3-pin connector (bottom right).
- When present, the upper left of the Flow Display has two 4-pin connectors for the four 4-20 mA output channels.
- The exact pin-outs and standard wire colors for each connector are labeled on the Flow Display.

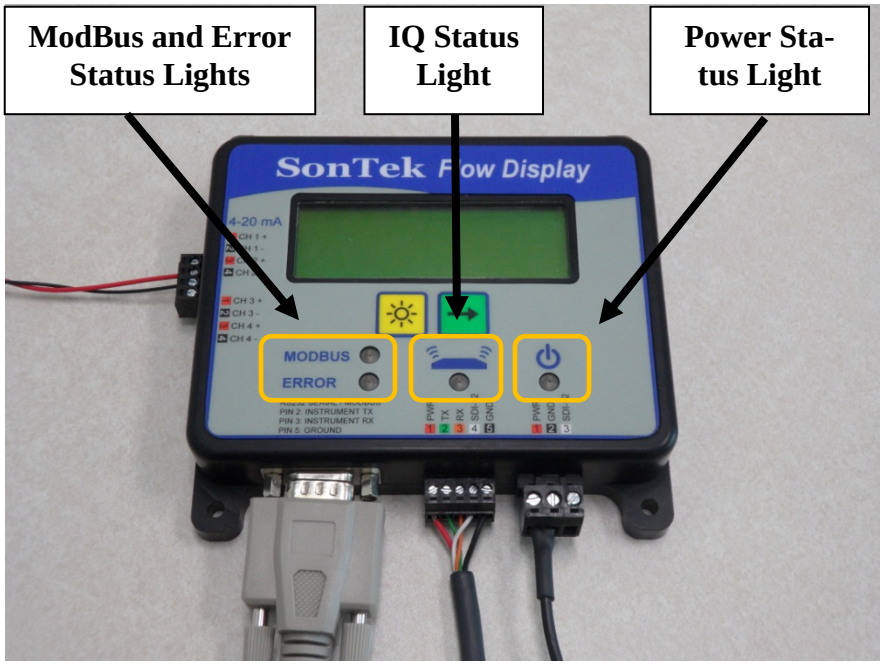


Figure D2. SonTek-IQ Flow Display with analog outputs

D-3. Status Lights

The Flow Display includes four status LEDs (see figure above).

- The power status light (right side LED, green) indicates when a DC power supply is connected to the flow display.
- The IQ status light (middle LED, green) indicates when communication is successfully established between the IQ and Flow Display.
- The Modbus status light (left side, upper LED, yellow) will light for 1 second each time a Modbus communication packet is received.
  - Any Modbus communication must match all parameters (baud rate, parity, data bits, stop bits) that have been selected for Modbus communication (see Section 3.1.5).
- The Error status light (left side, lower LED, red) is used for two purposes.
  - It indicates that an invalid Modbus packet was received.
    - Serial communication was received at parameters (baud rate, parity, data bits, stop bits) matching those selected for Modbus communications, but the communication was not a valid Modbus packet.
    - In this case, the Error LED will remain on until a valid Modbus packet is received.
    - The error light does NOT come on if a valid Modbus packet is received, but that packet is not addressed to the specified IQ Modbus address.
  - If the IQ **System Status** value indicates there is a potential problem with the IQ data, the Error LED will turn on.
    - The IQ **System Status** value is described in detail in section 7.1.

- If system status is 0, this means "All Clear" – no potential problems with the IQ data have been detected.
- If system status is greater than 0, one or more potential problems have been detected. The exact value of **System Status** indicates what the potential problem is.
- Whenever **System Status** is not 0, the Error LED will turn on and remain on until **System Status** returns to 0. A description of the potential problem will be shown on the Flow Display LCD screen.
- Whenever system status indicates a potential problem, we recommend that you evaluate the site to determine the nature of the problem and resolve it if possible.

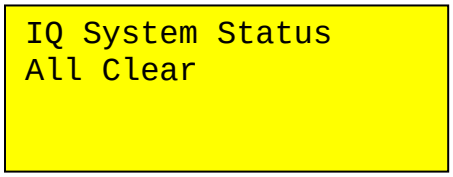
D-4. Using the Flow Display

The Flow Display provides two keys for interfacing with the instrument.

Illuminates the LCD screen for 15 seconds

Cycles through different screens of data from the IQ (effectively a "Next" button). The user can cycle through eight screens using the arrow key. Each screen presents four lines of 20 characters of data.

The **Status Screen** indicates any possible errors with the deployment.

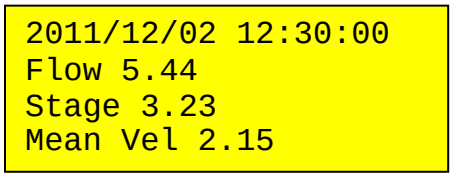


The following are possible status messages based on the data collected. Status messages are designed to prompt you for action (section 7.1).

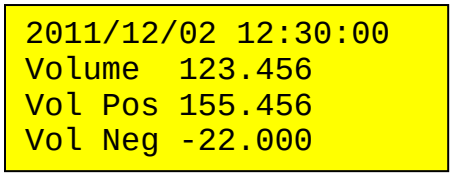
- **All Clear** – No potential problems have been detected.
- **High Tilt Values** – One or more tilt values is greater than 5º; this may affect data quality.
- **IQ may have moved** – One or more tilt values have changed significantly since the start of the deployment; this may indicate the IQ has moved.
- **Recorder space low** – Less than 2 weeks of recording time remain on the recorder; data should be downloaded and the recorder formatted as soon as possible.
- **No depth data** – There are a variety of possible causes that may include debris, burial, highly uneven water surface, or too much air in the water.
- **Beam(s) are buried** – One or more of the profiling transducers may be coverer or buried, potentially affecting data quality.
- **Low battery voltage** – Battery voltage is less than 9.0 V; the power supply should be checked and replaced or charged as appropriate.
- **Recorder is full** – No internal recording space is remaining; data should be downloaded immediately and the recorder formatted.

- **Stage too high** – The depth measured by the IQ is beyond the defined limits of the channel; no flow calculations are possible (flow will be reported as 0). This may indicate a problem with depth data, or an error in the definition of channel geometry.
- **Bad temperature data** – The temperature sensor may have failed, which will affect the quality of data. The IQ should be inspected and may need to be returned for service.

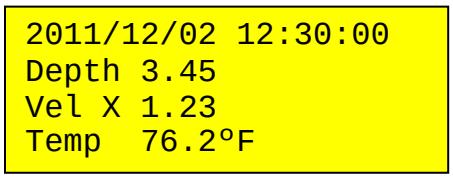
The **Flow/Stage/Mean Velocity Screen** shows flow, stage and mean velocity as well as the time of the last sample.



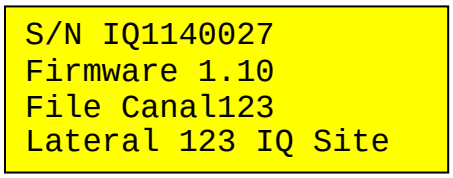
The **Volume Screen** shows total volume (sum of the positive and negative accumulated volume), positive volume (accumulated from positive velocity data) and negative volume (accumulated from negative velocity data).



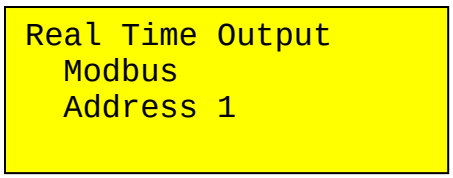
The **Velocity / Depth / Temperature Screen** presents water depth, velocity in the X direction and temperature data.

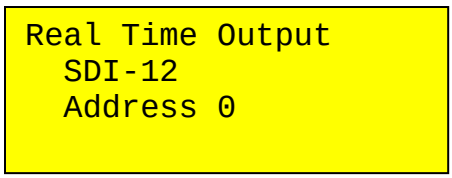


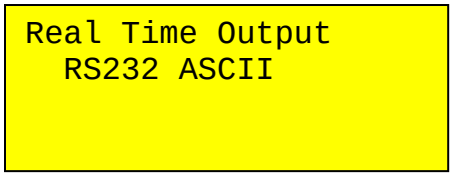
The **System Info Screen** presents serial number, firmware version, file name, and site name.

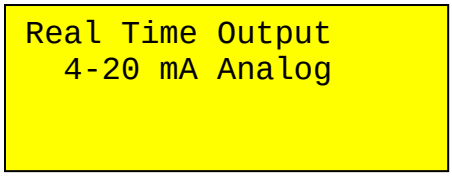


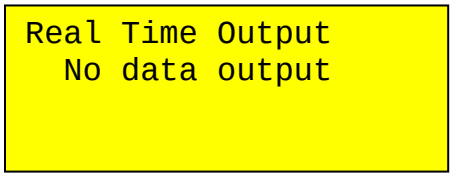
The **Output Type Screen** presents the type of data output the user has specified. If appropriate, the instrument address will be shown.



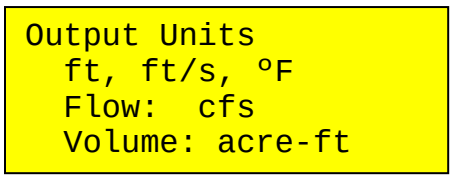








The **Units Screen** presents the units for which data are displayed. The selection of units is done within the IQ software (see Section 3.1.5) and cannot be modified using the Flow Display.



D-5. Power Consumption

- Since the Flow Display and IQ use the same power source, overall battery life will be determined by the sum of the two.
- The IQ software detects if a flow display is present, and includes that in the battery life calculations (see Section 3.1.2).
  - When doing battery life calculations, you should use the system as it will be used in the field (i.e. if using a flow display, make sure this flow display is connected when you do battery life calculations).
  - If using the "Plan a Deployment" feature, the software assumes that a flow display is not present for all battery life calculations.
- Some typical power consumption values are below.
  - The standard Flow Display consumes approximately 0.10 W of power.
  - The Flow Display with analog outputs, when not using the outputs, consumes approximately 0.20 W.
  - When using the analog outputs, it consumes between 0.5 -3.0 W depending on configuration, number of channels in use, and the data values being output.
  - There is no reliable way to estimate battery life when using the 4-20 mA analog output signals.
  - Use of the backlight increases the power consumption of the Flow Display.
  - Since the backlight only remains on for 15 seconds at a time, it will generally not have a significant impact on battery life.

D-6. Limitations

The SonTek-IQ Flow Display is limited for use with the SonTek-IQ family of products. It cannot be used with the Argonaut family of products (SW, SL, and XR).

D-7. Technical Specifications

A technical drawing of the Flow Display is shown in Figure D3. Dimensions are given in centimeters in brackets [ ], and inches.

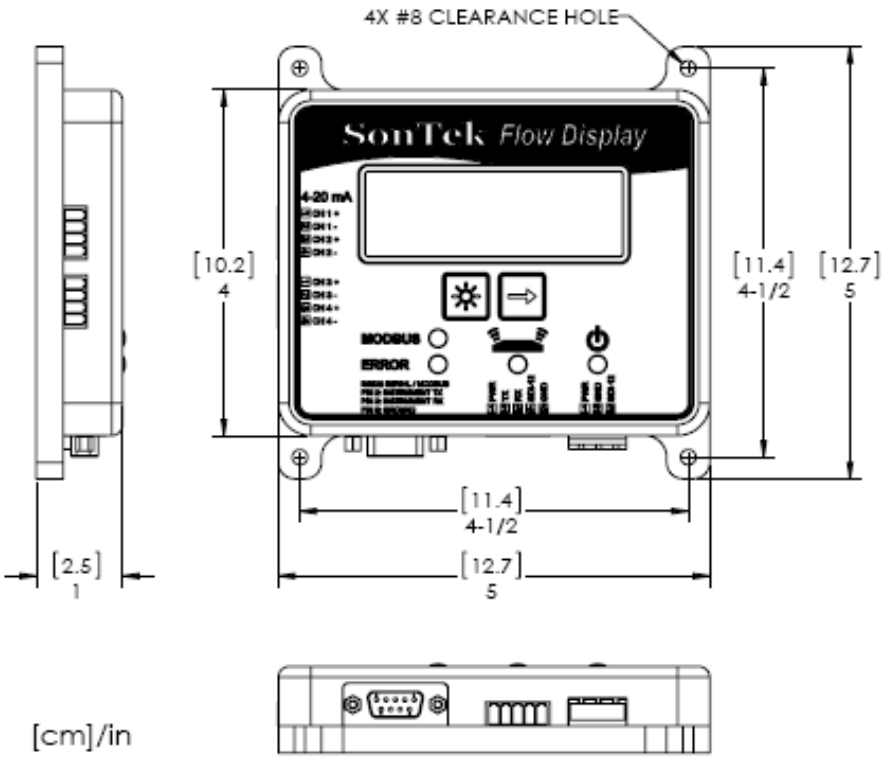


Figure D3. SonTek-IQ Flow Display technical drawing

Technical specifications for the optional 4-20 mA analog outputs:

- The maximum drive voltage for the outputs is approximately 29 V. This means the total load on each channel should be no more than about 1400 ohms.
- The 4-20 mA analog outputs use a 16-bit digital-to-analog converter to generate the output current.

D-8. Upgrading the firmware for the Flow Display

To upgrade the firmware of the flow display, click on the **File** tab at the top of the screen. Hover over the Maintenance option and then select Flow Display Upgrade (Figure D4).

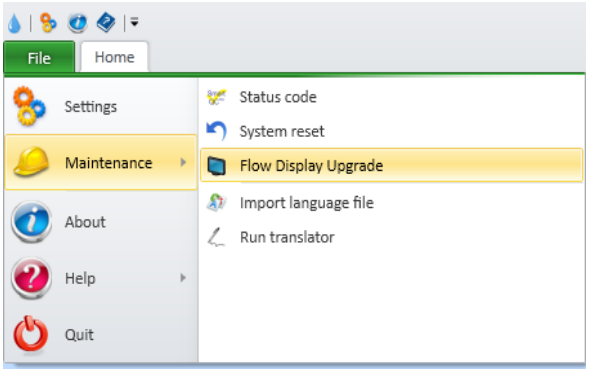


Figure D4. Menu option to upgrade the firmware of the flow display

This menu item is only available when **not** connected to an IQ Product. Periodically, upgrades may be available for the firmware inside the IQ Flow Display. This option allows users to upgrade the flow display firmware. The software provides detailed on-screen instructions for the upgrade; a brief summary is below.

- Save the new flow display firmware file, provided by SonTek, to your PC.
- From the maintenance menu, select the **Flow Display Upgrade** option.
- Disconnect the IQ from the flow display; connect the flow display to your PC. Disconnect power to the flow display and wait 5 seconds.
- While holding both flow display keys down, connect power to the display – this places the display in upgrade mode. Click OK on your PC to start the upgrade.

Follow on-screen instructions once the upgrade is complete.

Appendix E. Software Changes

Version 1.52

- Support for the SonTek-IQ Pipe and firmware v1.52

Version 1.60

- Manually select a COM port to bypass the automatic Connect feature
- New vertical beam settings to improve measurements in very shallow water
- Low level (raw data) incoherent velocity measurement filtering enabled
- User option for high level velocity filtering
- User option to reverse the flow for IQs installed looking downstream instead of upstream
- New error code warning (code 512) for low SNR
- New error code warning (code 1024) for turbulent or low flow conditions
- New error code warning (code 2048) for pipe diameter settings outside of recommended range

Version 2.00

- New option for resetting a specific COM port by number
- SNR time series plot now available for IQ Standard systems
- Maximum file size option in Standard settings
- Disable the skew beam for Theoretical flow calculations
- Reset total volume after user specified number of samples
- Modify configuration option added to Advanced Utilities

Version 2.1

- Modbus data from the IQ are reported on both input and holding registers
- Minimum voltage changed from 10V to 9V
- Sampling Duration minimum lowered from 10 seconds to 1 second
- IQ velocity cell measurements can be manually configured in the Channel Shape dialog
- COM Port Reset function added to the Maintenance menu
- Maximum baud rate feature added to the Settings menu

TAB 5

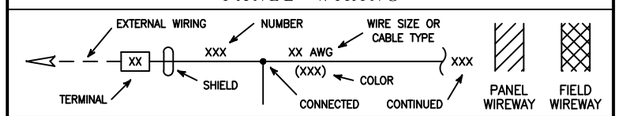
ABBREVIATIONS

A	AMPERES	MFR	MANUFACTURER
ABS	ACRYLONITRILE BUTADIENE STYRENE	MH	MANHOLE
AC	ALTERNATING CURRENT	MIN	MINIMUM
A/C	AIR CONDITIONER	MINS	MINUTES
AE	ANALYZER ELEMENT	MLO	MAIN LUGS ONLY
AF	CIRCUIT BREAKER FRAME SIZE	MOV	MOTOR OPERATED VALVE
AFD	ADJUSTABLE FREQUENCY DRIVE	MS	MOISTURE SWITCH
AI	ANALOG INPUT	MTG	MOUNTING
AIT	ANALYZER INDICATING TRANSMITTER	MTS	MANUAL TRANSFER SWITCH
AMB	AMBER COLOR (A)	MUX	MULTIPLEXER
AO	ANALOG OUTPUT	N	NEUTRAL
AS	ANALYZER SWITCH	NC	NORMALLY CLOSED
AT	AMPERE TRIP	NO	NORMALLY OPEN
ATS	AUTOMATIC TRANSFER SWITCH	NP	NAMEPLATE
AUTO	AUTOMATIC	NPT	NATIONAL PIPE THREAD
AWG	AMERICAN WIRE GAUGE	NTS	NOT TO SCALE
BATT	BATTERY	(N)	NEW
BGE	BEIGE COLOR	OIT	OPERATOR INTERFACE TERMINAL
BLK	BLACK COLOR	OL	OVERLOAD
BLU	BLUE COLOR (B)	ORN	ORANGE COLOR (O)
BRN	BROWN COLOR	PA	PUBLIC ADDRESS
CAT	CATEGORY	PB	PULL BOX
CB	CIRCUIT BREAKER	PC	PHOTOCELL
CLR	CLEAR COLOR	PE	PRESSURE ELEMENT
COAX	COAXIAL	PF	POWER FACTOR
COM	COMMON	PFR	POWER (PHASE) FAIL RELAY
COMM	COMMUNICATIONS	PH	PHASE
CPT	CONTROL POWER TRANSFORMER	PIT	PRESSURE INDICATING TRANSMITTER
CPU	CENTRAL PROCESSING UNIT	PLC	PROGRAMMABLE LOGIC CONTROLLER
CPVC	CHROLINATED POLYVINYL CHLORIDE	PNLBD	PANELBOARD
CR	CONTROL RELAY	PNK	PINK COLOR
CS	CONTROL STATION	PNL	PANEL
CT	CURRENT TRANSFORMER	POS	POSITION
DC	DIRECT CURRENT	POT	POTENTIOMETER
DCS	DISTRIBUTED CONTROL SYSTEM	PRI	PRIMARY
DE	DENSITY ELEMENT	PS	PRESSURE SWITCH
DI	DIGITAL INPUT	PSI	POUNDS PER SQUARE INCH
DIT	DENSITY INDICATING TRANSMITTER	PSIA	POUNDS PER SQUARE INCH ABSOLUTE
DISC	DISCONNECT	PSIG	POUNDS PER SQUARE INCH GAUGE
DO	DIGITAL OUTPUT	PT	PRESSURE TRANSMITTER
DPDT	DOUBLE POLE DOUBLE THROW	PTFE	POLYTETRAFLUOROETHYLENE (TEFLON)
DWG	DRAWING	PTT	PUSH TO TEST
E	EMERGENCY	PUR	PURPLE COLOR (P)
ELEV	ELEVATION	PVC	POLYVINYL CHLORIDE
EMT	ELECTRICAL METALLIC TUBING	PVDF	POLYVINYLIDENE FLUORIDE (KYNAR)
ETM	ELASPED TIME METER	PWR	POWER
(E)	EXISTING	QTY	QUANTITY
F	FUSE	RECEPT	RECEPTACLE
FE	FLOW ELEMENT	RED	RED COLOR (R)
FIT	FLOW INDICATING TRANSMITTER	REF	REFERENCE
FLA	FULL LOAD AMPERES	REM	REMOTE
FLUOR	FLUORESCENT	RGS	RIGID GALVANIZED STEEL
FO	FIBER OPTICS	RIO	REMOTE INPUT/OUTPUT
FS	FLOW SWITCH	RMS	ROOT MEAN SQUARED
FVNR	FULL VOLTAGE NON-REVERSING	RTD	RESISTIVE THERMAL DEVICE
FVR	FULL VOLTAGE REVERSING	RTU	REMOTE TELEMETRY UNIT
(F)	FUTURE	RVAT	REDUCED VOLTAGE AUTO TRANSFORMER
G	GROUND	(R)	RELOCATED
GEN	GENERATOR	SEC	SECONDS, SECONDARY
GFCI	GROUND FAULT CIRCUIT INTERRUPTER	SER	SERIAL
GND	GROUND	SHD	SHIELD
GRN	GREEN COLOR (G)	SIC	SPEED INDICATING CONTROLLER
GRY	GRAY COLOR	SIT	SPEED INDICATING TRANSMITTER
H	HAND	SP	SETPOINT
HH	HAND HOLE	SPDT	SINGLE POLE DOUBLE THROW
HOA	HAND-OFF-AUTO	SPST	SINGLE POLE SINGLE THROW
HP	HORSEPOWER	SS	SOFT STARTER
HRS	HOURS	SV	SOLENOID VALVE
HS	HAND SWITCH	SW	SWITCH
HTR	HEATER	SWBD	SWITCHBOARD
HZ	HERTZ	SWGR	SWITCHGEAR
IMC	INTERMEDIATE METALLIC CONDUIT	TB	TERMINAL BLOCK
INCAND	INCANDESCENT	TDOD	TIME DELAY ON DE-ENERGIZATION
IND	INDICATION	TDOE	TIME DELAY ON ENERGIZATION
INST	INSTRUMENT	TE	TEMPERATURE ELEMENT
I/O	INPUT/OUTPUT	TEL	TELEMETRY
ISB	INTRINSICALLY SAFE BARRIER	TELCO	TELEPHONE COMPANY
ISR	INTRINSICALLY SAFE RELAY	TEMP	TEMPERATURE
JB	JUNCTION BOX	TIT	TEMPERATURE INDICATING TRANSMITTER
KAIC	THOUSAND AMP INTERRUPTING CURRENT	TM	THERMAL MAGNETIC
KCMIL	THOUSAND CIRCULAR MILS	TR	TIME DELAY RELAY
KVA	KILOVOLT AMPERE	TS	TEMPERATURE SWITCH
L	LINE	TT	TEMPERATURE TRANSMITTER
LBL	LIGHT BLUE COLOR	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
LBS	POUNDS	UPS	UNINTERRUPTIBLE POWER SUPPLY
LCP	LOCAL CONTROL PANEL	V	VOLTAGE
LCS	LOCAL CONTROL STATION	VA	VOLT AMPS
LE	LEVEL ELEMENT	VAR	VOLT AMPERE REACTIVE
LIT	LEVEL INDICATING TRANSMITTER	VFD	VARIABLE FREQUENCY DRIVE
LOC	LOCAL	VLT	VIOLET COLOR
LOR	LOCAL-OFF-REMOTE	VM	VOLTMETER
LP	LIGHTING PANEL	W	WATTS
LR	LATCHING RELAY	WHT	WHITE COLOR (W)
LS	LEVEL SWITCH	WP	WEATHERPROOF
LT	LEVEL TRANSMITTER	WS	TORQUE SWITCH
LTG	LIGHTING	XFMR	TRANSFORMER
M	MOTOR STARTER	XMTR	TRANSMITTER
MA	MILLIAMPERE	YEL	YELLOW COLOR (Y)
MAX	MAXIMUM	ZIC	POSITION INDICATING CONTROLLER
MCC	MOTOR CONTROL CENTER	ZIT	POSITION INDICATING TRANSMITTER
MCP	MOTOR CIRCUIT PROTECTOR	ZS	LIMIT SWITCH

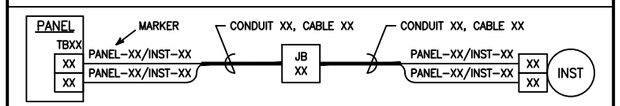
ELECTRICAL SYMBOLS

- CIRCUIT BREAKER OR MOTOR CIRCUIT PROTECTOR
- TOGGLE SWITCH
- OPERATOR CONTACT NORMALLY OPEN
- OPERATOR CONTACT NORMALLY CLOSED
- LOCK-OUT STOP PUSHBUTTON
- EMERGENCY STOP PUSHBUTTON
- SELECTOR SWITCH
- NORMALLY OPEN CONTROL RELAY CONTACT
- NORMALLY CLOSED CONTROL RELAY CONTACT
- NORMALLY OPEN TIME DELAY ON DE-ENERGIZATION
- NORMALLY CLOSED TIME DELAY ON DE-ENERGIZATION
- NORMALLY OPEN TIME DELAY ON ENERGIZATION
- NORMALLY CLOSED TIME DELAY ON ENERGIZATION
- NORMALLY OPEN SWITCH CLOSES ON RISING FLOW
- NORMALLY CLOSED SWITCH OPENS ON RISING FLOW
- NORMALLY OPEN SWITCH CLOSES ON RISING LEVEL
- NORMALLY CLOSED SWITCH OPENS ON RISING LEVEL
- NORMALLY OPEN SWITCH CLOSES ON RISING PRESS
- NORMALLY CLOSED SWITCH OPENS ON RISING PRESS
- NORMALLY OPEN SWITCH CLOSES ON RISING TEMP
- NORMALLY CLOSED SWITCH OPENS ON RISING TEMP
- NORMALLY OPEN SWITCH CLOSES ON LIMIT/POSITION
- NORMALLY CLOSED SWITCH OPENS ON LIMIT/POSITION
- FIXED JUMPER
- CURRENT TRANSFORMER
- FUSE & RATING
- POWER TRANSFORMER
- MOTOR STARTER COIL
- SOLENOID
- METAL OXIDE VARISTOR
- HEATING ELEMENT
- OVERLOAD RELAY
- COOLING FAN
- MULTIPLE CELL BATTERY
- DUPLEX RECEPTACLE
- CONTROL RELAY COIL TIME DELAY RELAY COIL
- STROBE LIGHT
- INDICATOR LAMP
- INDICATOR LAMP PUSH TO TEST
- SOLENOID VALVE
- AUDIBLE ALARM HORN
- TWISTED PAIR CABLE
- 6P4C & 8P8C UTP/STP NETWORK CONNECTOR
- BAYONET & THREADED COAX & F/O CONNECTOR
- GROUNDING STUD
- ISOLATED GROUND
- CHASSIS GROUND
- EARTH GROUND

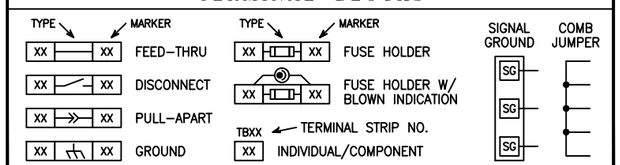
PANEL WIRING



INTERCONNECT WIRING



TERMINAL BLOCKS



GENERAL NOTES

1. NOT SUPPLIED BY MCC-CS.
2. EXISTING EQUIPMENT.
3. SUPPLIED BY MCC-CS, MOUNTED & WIRED BY OTHERS.
4. SUPPLIED BY OTHERS, MOUNTED & WIRED BY MCC-CS.
5. NOTE PERTAINS ONLY TO SHEET ON WHICH IT APPEARS (X)
6. (XX) BILL OF MATERIAL ITEM [XX] NAMEPLATE SCHEDULE ITEM
7. PANEL WIRING: 600V STRANDED TINNED COPPER, TYPE MTW.
8. 120VAC POWER AND CONTROL WIRING: 16 AWG MINIMUM.
9. 24VDC POWER AND CONTROL WIRING: 16 AWG MINIMUM.
10. ANALOG SIGNAL WIRING: TSP, 16 AWG MIN, BELDEN 8719.
11. USE WIRING LUGS WITH ALL NON-CAGED TERMINATIONS.
12. WIRE MARKERS: HEATSHRINK, WHITE W/ BLACK LETTERING.
13. SHRINK WIRE MARKERS LOOSELY TO ALLOW FOR ROTATION.
14. UNLESS OTHERWISE NOTED, NUMBER WIRING AS TERMINALS.
15. DISCONNECT TERMINAL HINGE SIDE OPPOSITE FIELD WIRING.
16. MOUNTING PAN COMPONENTS IDENTIFIED W/ KROY LABELS.
17. BOND ENCLOSURES, DOORS, & PANS WITH 12 AWG WIRING.
18. MOUNT ALL COMPONENTS W/ STAINLESS STEEL HARDWARE.
19.
20.

WIRING COLORS

480/277 VAC POWER, PHASE A	BRN
480/277 VAC POWER, PHASE B	ORN
480/277 VAC POWER, PHASE C	YEL
480/277 VAC NEUTRAL	GRY
240/120 VAC POWER, LINE 1	BLK
240/120 VAC POWER, LINE 2	RED
208/120 VAC POWER, PHASE A	BLK
208/120 VAC POWER, PHASE B	RED
208/120 VAC POWER, PHASE C	BLU
120 VAC UPS POWER	BLK
120 VAC UPS NEUTRAL	WHT
120 VAC NEUTRAL	WHT
120 VAC CONTROL	RED
120 VAC DIGITIAL INPUTS	RED
120 VAC DIGITIAL OUTPUTS	RED
125 VDC POWER	GRY
125 VDC CONTROL	GRY
125 VDC COMMON	GRY
24 VDC POWER	BLU
24 VDC CONTROL	BLU
24 VDC DIGITAL INPUTS	BLU
24 VDC DIGITAL OUTPUTS	BLU
24 VDC COMMON	BLU
12 VDC POWER/COMMON	LBL
4-20mA CONTROL, POSITIVE	CLR
4-20mA CONTROL, NEGATIVE	BLK
UNSPECIFIED FOREIGN	YEL
CHASSIS GROUND	GRN

DRAWING LIST

DRAWING	SHEETS	TITLE	REV LEVEL
2846-B00	1	STORM WATER LIFT STATION PANEL COVER SHEET & DRAWING LIST	4.1
2846-B01	1	STORM WATER LIFT STATION PANEL ELEVATION VIEWS & COMPONENT LAYOUT	3.0
2846-B01	2	STORM WATER LIFT STATION PANEL ELEVATION VIEWS & COMPONENT LAYOUT	4.1
2846-B01	3	STORM WATER LIFT STATION PANEL ELEVATION VIEWS & COMPONENT LAYOUT	4.1
2846-B02	1	STORM WATER LIFT STATION PANEL NAMEPLATE SCHEDULE & PANEL LABELS	3.0
2846-B03	1	STORM WATER LIFT STATION PANEL BILL OF MATERIALS	4.1
2846-B04	1	STORM WATER LIFT STATION PANEL POWER DISTRIBUTION SCHEMATIC	3.0
2846-B04	2	STORM WATER LIFT STATION PANEL POWER DISTRIBUTION SCHEMATIC	4.1
2846-B04	3	STORM WATER LIFT STATION PANEL POWER DISTRIBUTION SCHEMATIC	3.0
2846-B04	4	STORM WATER LIFT STATION PANEL POWER DISTRIBUTION SCHEMATIC	3.0
2846-B05	1	STORM WATER LIFT STATION PANEL PLC CHASSIS DIAGRAM	3.0
2846-B06	1	STORM WATER LIFT STATION PANEL NETWORK DIAGRAM	3.0
2846-B07	1	STORM WATER LIFT STATION PANEL ANALOG INPUT MODULE SCHEMATIC 1	4.1
2846-B08	1	STORM WATER LIFT STATION PANEL DISCRETE INPUT MODULE SCHEMATIC 1	3.0
2846-B09	1	STORM WATER LIFT STATION PANEL DISCRETE OUTPUT MODULE SCHEMATIC 1	3.0

NOTE:
MODIFICATIONS FOR 7003628 ARE SHOWN ON THE FOLLOWING DRAWINGS:
A01 SHT. 2
A01 SHT. 3
A03
A04 SHT. 2
A07

PRIMEX
WATER SYSTEM INTEGRATOR AND CONTROLS PROVIDER
859 COTTING COURT, SUITE G
VACAVILLE, CA 95688 707-449-0341
WWW.PRIMEXCONTROLS.COM

DIMENSIONS

UNLESS OTHERWISE SPECIFIED
INCHES
AND TOLERANCES FOR
1 PLACE DIMS ± 0.1
2 PLACE DIMS ± 0.01
3 PLACE DIMS ± 0.002
ANGULAR DIMS ± 30'
FRACTION DIMS ± 1/32"
0" — 1"
THIS LINE EQUALS ONE INCH
IF NOT ONE INCH ON THIS SHEET
ADJUST SCALES ACCORDINGLY

REVISIONS

NO.	DATE	REVISION	BY	APP
1.0	8/13	SUBMITTAL	PC	RP
2.0	10/13	PRODUCTION	PC	RP
3.0	12/13	AS-BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET SUPERCEDES 2846-B REV 3.0

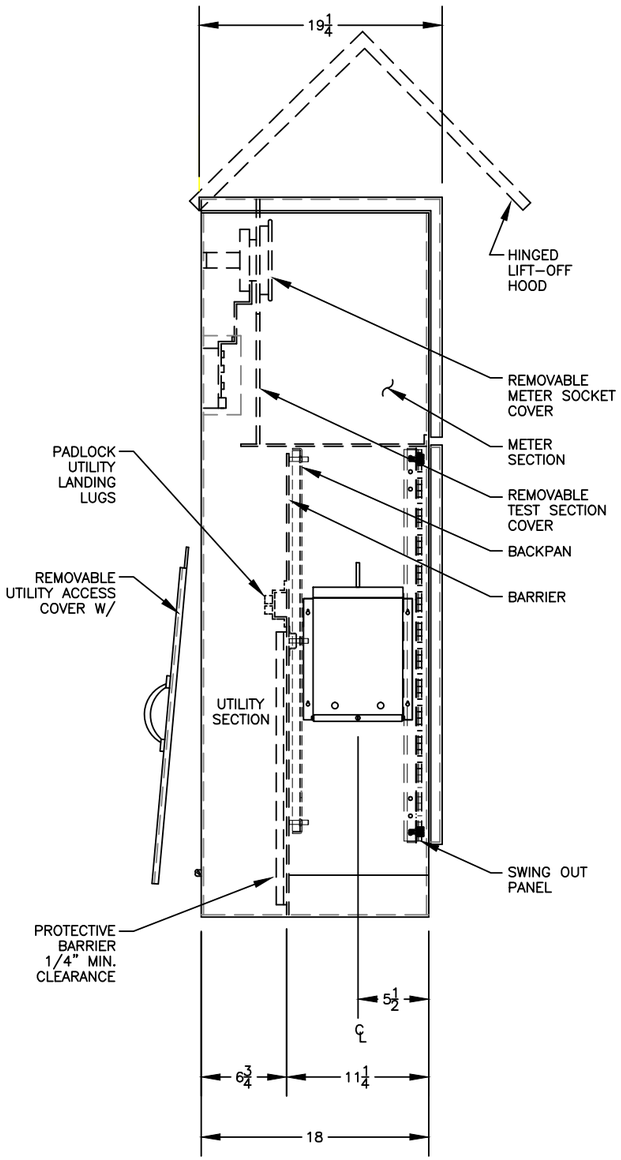
TESTING

TEST	DATE	BY

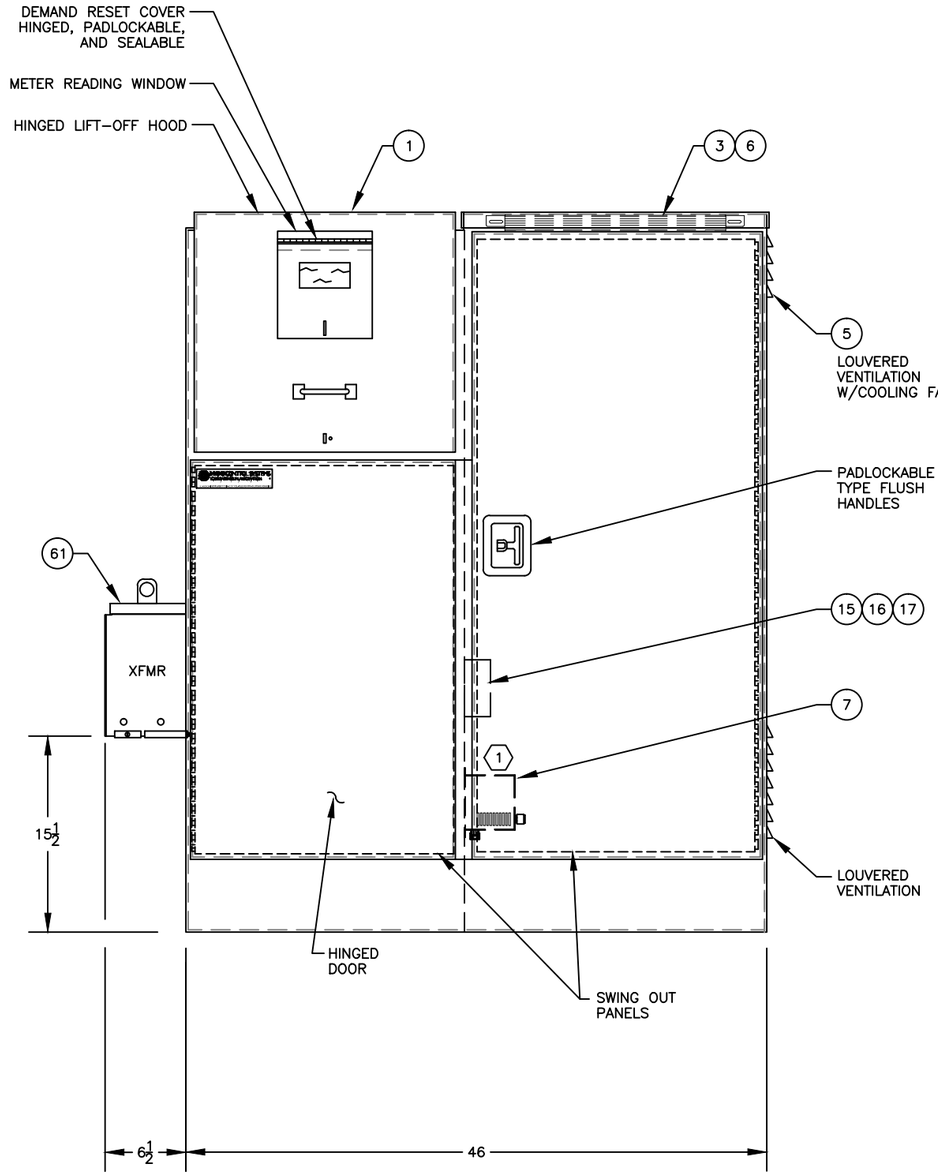
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS
TITLE: STORM WATER LIFT STATION PANEL COVER SHEET & DRAWING LIST
CUSTOMER: CONCO WEST, INC

DESIGNED BY	RP	DATE:	8/13
DRAWN BY	PC	SCALE:	N/A
CHECKED BY	DV	REF:	
APPROVED BY	RP	SHEET	1 OF 1

SIZE: B
DRAWING: 7003628- A00

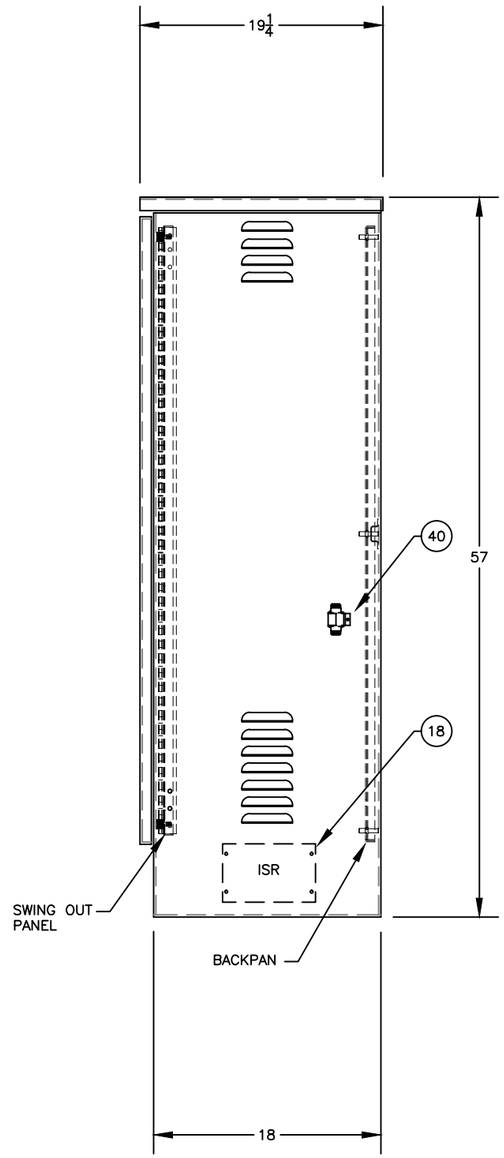


LEFT SIDE VIEW



FRONT ELEVATION VIEW
TYPE 3R PEDESTAL ENCLOSURE

(1) MINIMUM 4" CLEARANCE ABOVE, 2" CLEARANCE BELOW, & 2" CLEARANCE ON LEFT/RIGHT SIDE



RIGHT SIDE VIEW

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DIMENSIONS

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AND TOLERANCES FOR

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2 PLACE DIMS ± 0.01
3 PLACE DIMS ± 0.002
ANGULAR DIMS ± 30'
FRACTION DIMS ± 1/32"

0" 1"

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REVISIONS

NO.	DATE	REVISION	BY	APP
1.0	8/13	SUBMITTAL	PC	RP
2.0	10/13	PRODUCTION	PC	RP
3.0	12/13	AS-BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET SUPERCEDES 2846-B REV 3.0

TESTING

TEST	DATE	BY

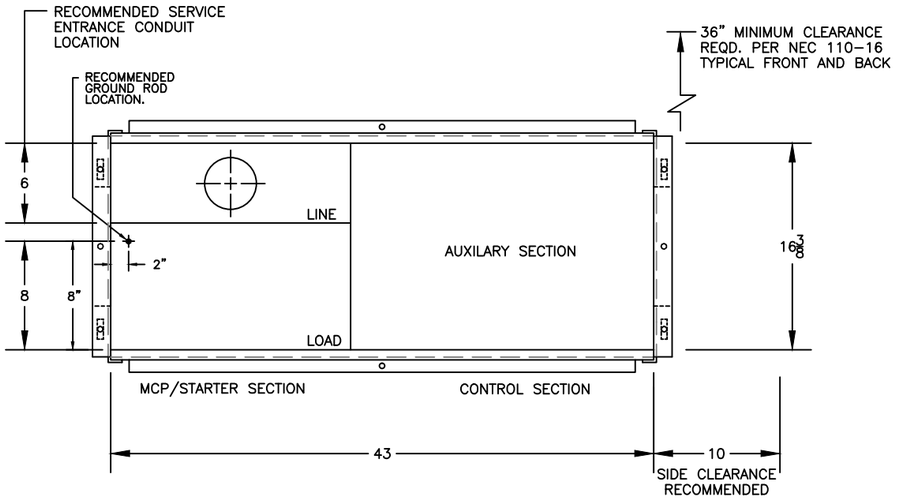
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL ELEVATION VIEWS & COMPONENT LAYOUT

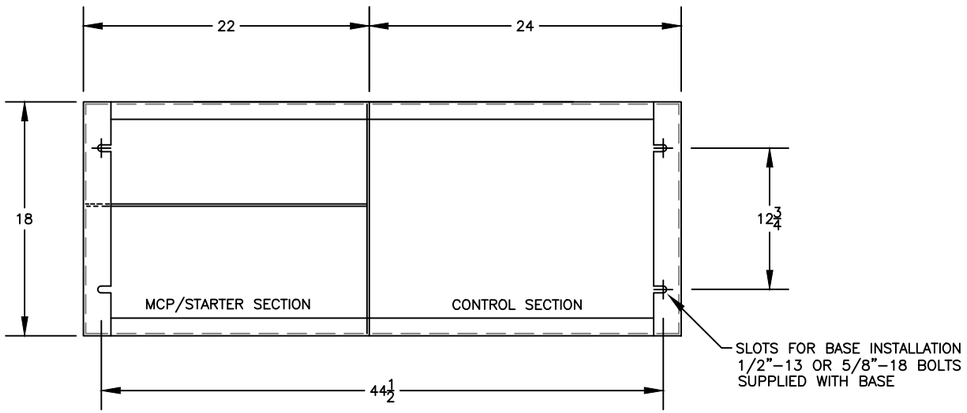
CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: 1 : 12
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 1 OF 3

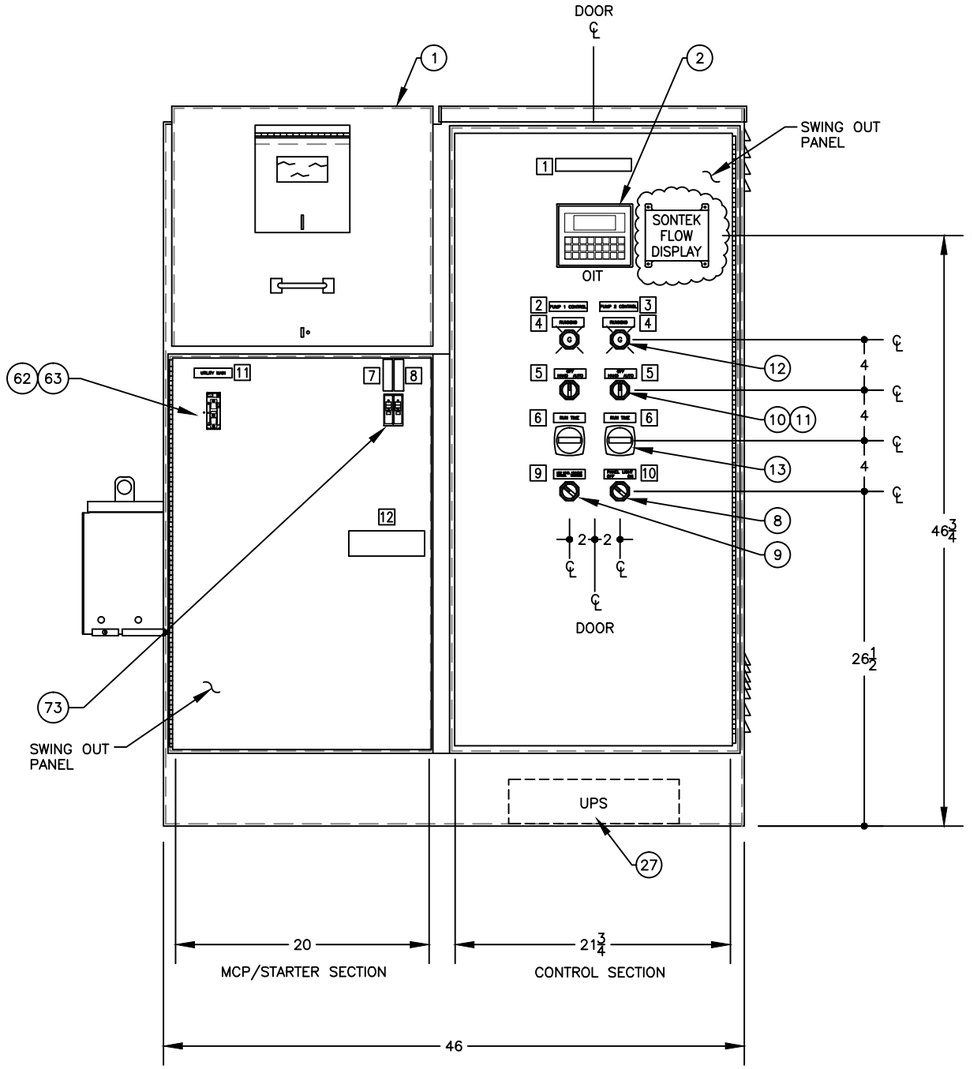
SIZE: B
DRAWING: 7003628– A01



PLAN VIEW



BOTTOM VIEW
MOUNTING SLOT DETAIL



FRONT ELEVATION VIEW
(OUTER DOORS REMOVED FOR CLARITY)

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AND TOLERANCES FOR

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3 PLACE DIMS ± 0.002
ANGULAR DIMS ± 30'
FRACTION DIMS ± 1/32"

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REVISIONS

NO.	DATE	REVISION	BY	APP
1.0	8/13	SUBMITTAL	PC	RP
2.0	10/13	PRODUCTION	PC	RP
3.0	12/13	AS-BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET SUPERCEDES 2846-B REV 3.0

TESTING

TEST	DATE	BY

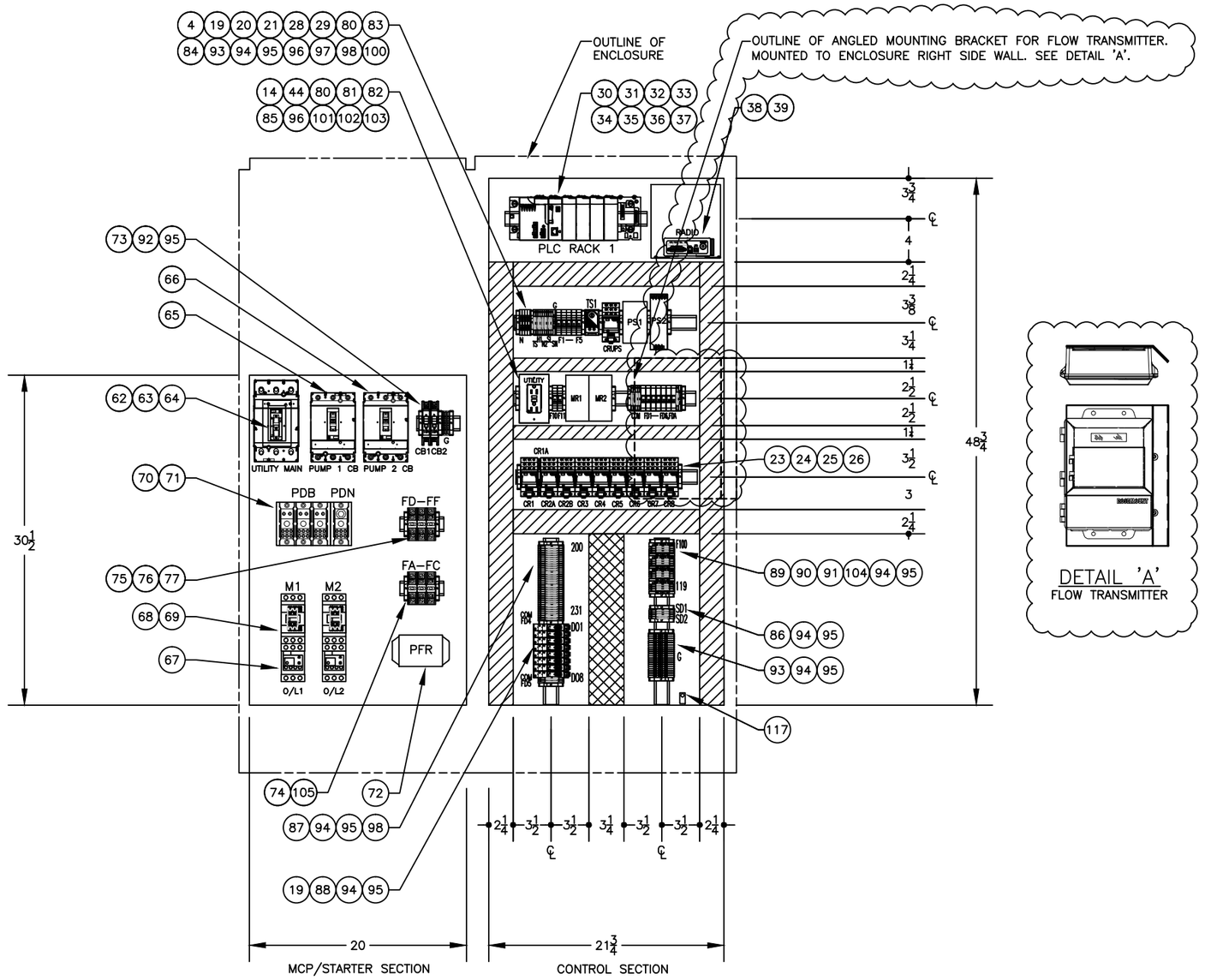
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL ELEVATION VIEWS & COMPONENT LAYOUT

CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: 1 : 12
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 2 OF 3

SIZE: B
DRAWING: 7003628- A01



MTG PAN LAYOUT

PRIMEX
WATER SYSTEM INTEGRATOR
AND CONTROLS PROVIDER

859 COTTING COURT, SUITE G
VACAVILLE, CA 95688 707-449-0341
WWW.PRIMEXCONTROLS.COM

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3 PLACE DIMS ± 0.002
ANGULAR DIMS ± 30'
FRACTION DIMS ± $\frac{1}{32}$"

0" 1"

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NO.	DATE	REVISION	BY	APP
1.0	8/13	SUBMITTAL	PC	RP
2.0	10/13	PRODUCTION	PC	RP
3.0	12/13	AS-BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET
SUPERCEDES
2846–B
REV 3.0

TESTING

TEST	DATE	BY

PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL ELEVATION VIEWS & COMPONENT LAYOUT

CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: 1 : 12
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 3 OF 3

SIZE: B
DRAWING: 7003628– A01

NAMEPLATE SCHEDULE

ITEM	DESCRIPTION	QTY	LTR SIZE	N/P SIZE	TAG NAME	INSCRIPTION	NOTES
1	NAMEPLATE	1	1/4	1 X 6	N/A	OPERATOR INTERFACE	A,B,C,H
2	NAMEPLATE	1	3/16	1 X 3	N/A	PUMP 1 CONTROL	A,B,C,H
3	NAMEPLATE	1	3/16	1 X 3	N/A	PUMP 2 CONTROL	A,B,C,H
4	NAMEPLATE	2	3/16	.75 X 2.5	LT2, LT3	RUNNING	A,B,C,H
5	NAMEPLATE	2	3/16	.75 X 2.5	SW3 SW4	HAND OFF AUTO	A,B,C,H
6	NAMEPLATE	2	3/16	.75 X 2.5	ETM1, ETM2	RUN TIME	A,B,C,H
7	NAMEPLATE	1	3/16	.75 X 2.5	N/A	CONTROLS	A,B,C,H
8	NAMEPLATE	1	3/16	.75 X 2.5	N/A	UTILITY	A,B,C,H
9	NAMEPLATE	1	3/16	.75 X 2.5	SW2	LOW LEVEL LOCKOUT NORMAL OVERRIDE	A,B,C,H
10	NAMEPLATE	1	3/16	.75 X 2.5	SW1	PANEL LIGHT OFF ON	A,B,C,H
11	NAMEPLATE	1	3/16	.75 X 2.5	N/A	UTILLITY MAIN	A,B,C,H
12	NAMEPLATE	1	1/4 3/16 3/16 3/16	2 X 6	N/A	– CAUTION – FOREIGN VOLTAGE SOURCES PRESENT MULTIPLE DISCONNECT SWITCHES REQUIRED TO DE–ENERGIZE	A,B,D,H

NAMEPLATE NOTES

NOTE	DESCRIPTION
A	LAYOUT ALL INSCRIPTION ENGRAVING AS SHOWN.
B	CENTER ENGRAVING HORIZONTALLY AND VERTICALLY.
C	NAMEPLATE MATERIAL: PHENOLIC, BLACK WITH WHITE CORE.
D	NAMEPLATE MATERIAL: PHENOLIC, RED WITH WHITE CORE.
E	NAMEPLATE MATERIAL: PHENOLIC, WHITE WITH BLACK CORE.
F	NAMEPLATE MATERIAL: PHENOLIC, GRAY WITH BLACK CORE.
G	NAMEPLATE MATERIAL: PHENOLIC, YELLOW WITH BLACK CORE.
H	NAMEPLATE TO BE ATTACHED WITH ADHESIVE STRIPS.
J	NAMEPLATE TO BE ATTACHED WITH SILICONE ADHESIVE.
K	NAMEPLATE TO BE ATTACHED WITH STAINLESS STEEL SCREWS.
L	LEGEND PLATE BY MANUFACTURER, PROVIDED BY MCC–CS.
M	LEGEND PLATE TO BE ATTACHED WITH OPERATOR BEZEL.

INDUSTRIAL CONTROL PANEL

MCC CONTROL SYSTEMS
YOUR PARTNER IN AUTOMATION

859 COTTING COURT, SUITE G
VACAVILLE, CALIFORNIA 95688
707-449-0341 www.mccwater.com

PANEL NAME
STORM WATER LIFT STATION
ENCLOSURE
TYPE 3R
FACTORY SHOP
VACAVILLE
JOB NO.-DWGS
2846–B

SUPPLY POWER REQUIREMENTS		WIRING TERMINATIONS TERMINAL - TORQUE	
VOLTAGE	480	FUSE BLOCK 8MM	14 IN–LBS
PHASE	3	FEED-THRU 8MM	14 IN–LBS
HERTZ	60	FEED-THRU 6MM	9 IN–LBS
AMPERES	123	FEED-THRU 5MM	7 IN–LBS
SHORT CIRCUIT CURRENT RATING		DISCONNECT 5MM	7 IN–LBS
18 KA RMS SYMMETRICAL		GND BLOCK 8MM	14 IN–LBS
		GND BLOCK 6MM	9 IN–LBS
		GND BLOCK 5MM	7 IN–LBS

CLASS 1 POWER CIRCUITS USE COPPER CONDUCTORS ONLY WITH MINIMUM 60°C TEMP RATING. CLASS 2 POWER CIRCUITS USE COPPER CONDUCTORS ONLY

FUSE CHART

NO. / RANGE	AMP	VOLTS
FA – FC	1	480VAC
FD – FE	15	480VAC
FF	30	120VAC
F1 – F5	2A	120VAC
F10 – F11	1A	120VAC
FD1 – FD6	2A	24VDC
FDA	3A	24VDC
F100 – F116	1/8A	24VDC

CAUTION: TO REDUCE THE RISK OF FIRE, REPLACE ONLY WITH THE SAME TYPE & RATING OF FUSE

CAUTION

DE-ENERGIZE THIS CONTROL PANEL BEFORE PERFORMING ANY REPAIRS

FOR QUESTIONS REGARDING THE PROPER REPAIR OR REPLACEMENT OF COMPONENTS IN THIS CONTROL PANEL ASSEMBLY CONTACT M.C.C. AND PROVIDE THE (JOB NO.-DWGS) INFORMATION AS LISTED ABOVE

PRINT PANEL LABEL FULL SIZE AND AFFIX TO INSIDE OF ENCLOSURE.

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DIMENSIONS

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3 PLACE DIMS ± 0.002
ANGULAR DIMS ± 30'
FRACTION DIMS ± 1/32"

0" 1"

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NO.	DATE	REVISION	BY	APP
1.0	8/13	SUBMITTAL	PC	RP
2.0	10/13	PRODUCTION	PC	RP
3.0	12/13	AS–BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET SUPERCEDES
2846–B
REV 3.0

TESTING

TEST	DATE	BY

PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL NAMEPLATE SCHEDULE & PANEL LABELS

CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: N/A
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 1 OF 1

SIZE: B
DRAWING: 7003628– A02

BILL OF MATERIALS

ITEM	DESCRIPTION	TAG NO.	MANUFACTURER	PART N0.	QTY
1	ENCLOSURE, TYPE 3R, PEDESTAL W/SWING OUT DOORS	STORM WATER LIFT STATON	MYERS	MEU6D-M200TB-GRN	1
2	OPERATOR INTERFACE	OIT	MAPLE SYSTEMS	OIT3185	1
3	ENCLOSURE WORKLIGHT FLUORESCENT	LT	HOFFMAN	LF120V18	1
4	FAN THERMOSTAT SWITCH	TS1	HOFFMAN	ATEMNO	1
5	ENCLOSURE COOLING FAN W/BRACKET, 4-INCH		HOFFMAN	A4AXFN	1
6	FLUORESCENT BLULB		GRAINGER	F15T8/CW	1
7	ENCLOSURE HEATER, 100W, 120VAC, W/ TS	HTR	HOFFMAN	DAH1001A	1
8	2-POSITION SELECTOR SWITCH, MAINTAINED	SW1	ALLEN BRADLEY	800H-HR2A	1
9	2-POSITION SELECTOR SWITCH, SPRING RETURN	SW2	ALLEN BRADLEY	800H-HR5A	1
10	3-POSITION SELECTOR SWITCH, MAINTAINED	SW3, SW4	ALLEN BRADLEY	800H-JR2B	2
11	CONTACT BLOCK, 1 N.C.	SW3, SW4	ALLEN BRADLEY	800T-XD2	2
12	GREEN PILOT LIGHT	LT2, LT3	ALLEN BRADLEY	800H-QR10G	2
13	ETM, 120VAC, NON-RESET, ROUND	ETM1, ETM2	REDINGTON	3400-1000	2
14	RECEPTACLE, DUPLEX, NEMA 5-15R	UTILITY1	WEIDMULLER	6720005421	1
15	SINGLE RECEPTACLE, 2P, 3W, 15A-125V, WHITE	UPS RECEPTACLE	LEVITON	5015-W	1
16	SINGLE RECEPTACLE FACE PLATE, WHITE	UPS RECEPTACLE	< VARIES >	< VARIES >	1
17	RECEPTACLE DEVICE BOX, 1 1/2"		< VARIES >	< VARIES >	1
18	INTRINSICALLY SAFE RELAY	ISR	WARRICK	67C1A0A	1
19	DIGITAL OUTPUT INTERPOSING RELAY, 1P, 24VDC, LED, DIODE	DO1-DO8	FINDER	4C.01.9.024.0050.SPA	8
20	POWER RELAY, 120VAC, 3-POLE, LED, 16A	CR-UPS	FINDER	62.33.8.120.0040	1
21	POWER RELAY SOCKET	CR-UPS	FINDER	92.03	1
22	LED INDICATOR FOR SERIES 62	CR-UPS	FINDER	99.02.0.230.59	1
23	POWER RELAY, 120VAC, 3-POLE, LED, 16A	CR1-CR8	FINDER	62.33.8.120.0040	9
24	POWER RELAY SOCKET	CR1-CR8	FINDER	92.03	9
25	LED INDICATOR FOR SERIES 62	CR1-CR8	FINDER	99.02.0.230.59	9
26	CONTROL RELAY, 1-POLE	CR1A	FINDER	38.51.0.125.0060	1
27	UNINTERRUPTIBLE POWER SUPPLY, 750VA	UPS	APC	SMT750	1
28	12VDC POWER SUPPLY, 3A, 55W	PS1	WEIDMULLER	9927480012	1
29	24VDC POWER SUPPLY, 5A, 120W	PS2	WEIDMULLER	8951340000	1
30	M340 6-SLOT RACK	RACK 1	MODICON	BMXXBP0600	1
31	M340 PLC POWER SUPPLY	PS1	MODICON	BMXCPS2010	1
32	M340 PROCESSOR	PROCESSOR	MODICON	BMXP341000	1
33	M340 4 CHANNEL ANALOG INPUT MODULE	AI1	MODICON	BMXAMI0410	1
34	M340 CONNECTOR CABLE FOR ANALOG INPUT MODULE		MODICON	BMXFTW301S	1
35	M340 16 POINT DICRETE IN/OUT PUT MODULE	DI1, DO1	MODICON	BMXDDM3202K	1
36	M340 CONNECTOR CABLE FOR DISCRETE IN/OUT PUT MODULE		MODICON	BMXFCW303	1
37	M340 SERIAL COMMUNICATION MODULE		MODICON	BMXNOM0200	1
38	RADIO	RADIO	MDS	SD4CSS	1
39	RADIO SHELF		MCC-CS	CUSTOM	1
40	LIGHTNING ARRESTOR		POLYPHASER	IS-50NX-C0	1
41	3/8" COAXIAL CABLE W/ONE END		TALLEY	TIMA40X-50	1
42	3/8" MALE END		TALLEY	EZ400NMH	2
43	ANTENNA CABLE		TALLEY	CXTA58G-3	1
44	MONITORING RELAY, MINICAS 120, 120VAC	MR1-MR2	FLYGT	14-407129	2
45	PATCH CABLE	E1	L-COM	TRD815BLK-3	1
46	PATCH CABLE	E2	L-COM	CUSTOM	1
47	SERIAL CONVERTER, DB-9 TO RJ45		L-COM	RA098M	1
48					
49					
50					
51					
52					
53					
54					
55	SONTEK-IQ FLOW DISPLAY		XYLEM	SON-FD-ANA	1
56	FLOW TRANSMITTER		ROSEMOUNT	MODEL 8712E	1
57					
58					
59					
60					

BILL OF MATERIALS

ITEM	DESCRIPTION	TAG NO.	MANUFACTURER	PART N0.	QTY
61	TRANSFORMER, 3KVA, 480/120VAC	XFMR	SQUARE D	7400-3S1F	1
62	MAIN CIRCUIT BREAKER, 200A, 3P	UTILITY MAIN	SQUARE D	JDL36200	1
63	CIRCUIT BREAKER HANDLE PADLOCK ATTACHMENT		SQUARE D	S29371	1
64					
65	CIRCUIT BREAKER 600VA/250VDC, 90 AMPS	PUMP 1 CB	SQUARE D	HDL36090	1
66	CIRCUIT BREAKER 600VA/250VDC, 90 AMPS	PUMP 2 CB	SQUARE D	HDL36090	1
67	OVERLOAD RELAY	O/L-1, O/L-2	SQUARE D	LRD365	2
68	CONTACTOR	M1, M2	SQUARE D	LC1D65A	2
69	CONTACTOR AUX CONTACT	M1, M2	SQUARE D	LADN20	2
70	POWER DISTRIBUTION BLOCK, 1P	PDN	SQUARE D	9080LBA162104	1
71	POWER DISTRIBUTION BLOCK, 3P	PDB	SQUARE D	9080LBA362106	1
72	PHASE FAILURE RELAY	PFR	SYMCOM	MS250-A	1
73	CIRCUIT BREAKER, 1-POLE, 15A	CB1, CB2	SQUARE D	QOU115	2
74	3-POLE FUSE HOLDER	FA-FC	BUSSMAN	BM6033PQ	1
75	3-POLE FUSE HOLDER	FD-FF	BUSSMAN	BM6033PQ	1
76	PRIMARY FUSE, 600VAC, 15A	FD-FE	BUSSMAN	FNQ-R-15	2
77	SECONDARY FUSE, 600VAC, 30A	FF	BUSSMAN	FNM-30	1
78					
79					
80	TERMINAL BLOCK, FUSED, 120VAC, 1/4 X 1-1/4	F1-F5, F10,F11	WEIDMULLER	1014300000	7
81	TERMINAL BLOCK, FUSED, 24VDC, 1/4 X 1-1/4	FD1 - FD6	WEIDMULLER	1014100000	6
82	TERMINAL BLOCK, FUSED, 12VDC, 1/4 X 1-1/4	FDA	WEIDMULLER	1014100000	1
83	TERMINAL BLOCK, INCOMING POWER	N	WEIDMULLER	1020100000	4
84	TERMINAL BLOCK, 120VAC POWER DISTRIBUTION	N,TS,H1,N2,SL,SN	WEIDMULLER	1020000000	8
85	TERMINAL BLOCK, 24VDC POWER DISTRIBUTION	COM, 12ND	WEIDMULLER	1020000000	4
86	TERMINAL BLOCK, 24VDC FIELD	SR1,SR2	WEIDMULLER	1020000000	4
87	TERMINAL BLOCK, PLC DIGITAL INPUTS	200-231,FD4,COM	WEIDMULLER	1020000000	34
88	TERMINAL BLOCK, PLC DIGITAL OUTPUTS	FD5, COM	WEIDMULLER	1020000000	2
89	TERMINAL BLOCK, PLC ANALOG INPUTS	101-118	WEIDMULLER	1020000000	12
90	GROUND TERMINAL BLOCK, ANALOG INPUTS	104-119	WEIDMULLER	1010000000	4
91	ANALOG TERMINAL BLOCK, FUSED, 24VDC, 5 X 20 MM	FD100-FD116	WEIDMULLER	1011300000	4
92	GROUND TERMINAL BLOCK, INCOMING POWER	G	WEIDMULLER	1010100000	3
93	GROUND TERMINAL BLOCK, POWER DISTRIBUTION	G	WEIDMULLER	1010000000	20
94	TERMINAL BLOCK END COVER		WEIDMULLER	1050000000	12
95	MOUNTING RAIL CLAMP		WEIDMULLER	1061200000	31
96	TERMINAL BLOCK JUMPER, BLACK, 3-POLE	COM, N2, H1	WEIDMULLER	1718090000	3
97	TERMINAL BLOCK JUMPER, BLACK, 4-POLE	N	WEIDMULLER	1718100000	1
98	TERMINAL BLOCK JUMPER, BLACK, 8-POLE	201 - 231	WEIDMULLER	1718140000	2
99	TERMINAL BLOCK MARKER		WEIDMULLER	CUSTOM	2 EA
100	FUSE, 1/4 X 1-1/4, GLASS, SLOW-BLOW, 2A	F1- F5	LITTELFUSE	313002.	5
101	FUSE, 1/4 X 1-1/4, GLASS, SLOW-BLOW, 1A	F10, F11	LITTELFUSE	313001.	2
102	FUSE, 1/4 X 1-1/4, CERAMIC, FAST-ACTING, 3A	FDA	LITTELFUSE	314003.	1
103	FUSE, 1/4 X 1-1/4, CERAMIC, FAST-ACTING, 2A	FD1-FD6	LITTELFUSE	314002.	6
104	FUSE, 5 X 20 MM, GLASS, FAST-ACTING, 1/8A	FD100-FD104	LITTELFUSE	235.125	4
105	600VAC FUSE, 1A	FA-FC	BUSSMAN	FNQ-R-1	3
106	WIREWAY WITH COVER, WHITE, 1 X 4		< VARIES >	< VARIES >	1.5 FT.
107	WIREWAY WITH COVER, WHITE, 2 X 4		< VARIES >	< VARIES >	10 FT.
108	WIREWAY WITH COVER, WHITE, 3 X 4		< VARIES >	< VARIES >	1.5 FT.
109	WIREWAY WITH COVER, WHITE, 4 X 4		< VARIES >	< VARIES >	0
110	MOUNTING RAIL, STANDARD 35 MM		< VARIES >	< VARIES >	5.5 FT.
111	WIRE, MTW, 4 AWG, BLK		< VARIES >	< VARIES >	LOT
112	WIRE, MTW, 10 AWG, BLK		< VARIES >	< VARIES >	LOT
113	WIRE, MTW, 12 AWG, BLK, WHT, GRN		< VARIES >	< VARIES >	LOT
114	WIRE, MTW, 14 AWG, BLK, WHT, GRN, YEL		< VARIES >	< VARIES >	LOT
115	WIRE, MTW, 14 AWG, BLU		< VARIES >	< VARIES >	LOT
116	WIRE, MTW, 16 AWG, BLU		< VARIES >	< VARIES >	LOT
117	ENCLOSURE GROUNDING LUG		BURNDY	KA2U	1
118	NAMEPLATES		MCC-CS	2846-B02	LOT
119					
120					

PRIMEX
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DIMENSIONS

UNLESS OTHERWISE SPECIFIED
INCHES
AND TOLERANCES FOR

1 PLACE DIMS ± 0.1
2 PLACE DIMS ± 0.01
3 PLACE DIMS ± 0.002
ANGULAR DIMS ± 30'
FRACTION DIMS ± 1/32"

0" — 1"

THIS LINE EQUALS ONE INCH
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ADJUST SCALES ACCORDINGLY

REVISIONS

NO.	DATE	REVISION	BY	APP
1.0	8/13	SUBMITTAL	PC	RP
2.0	10/13	PRODUCTION	PC	RP
3.0	12/13	AS-BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET
SUPERCEDES
2846-B
REV 3.0

TESTING

TEST	DATE	BY

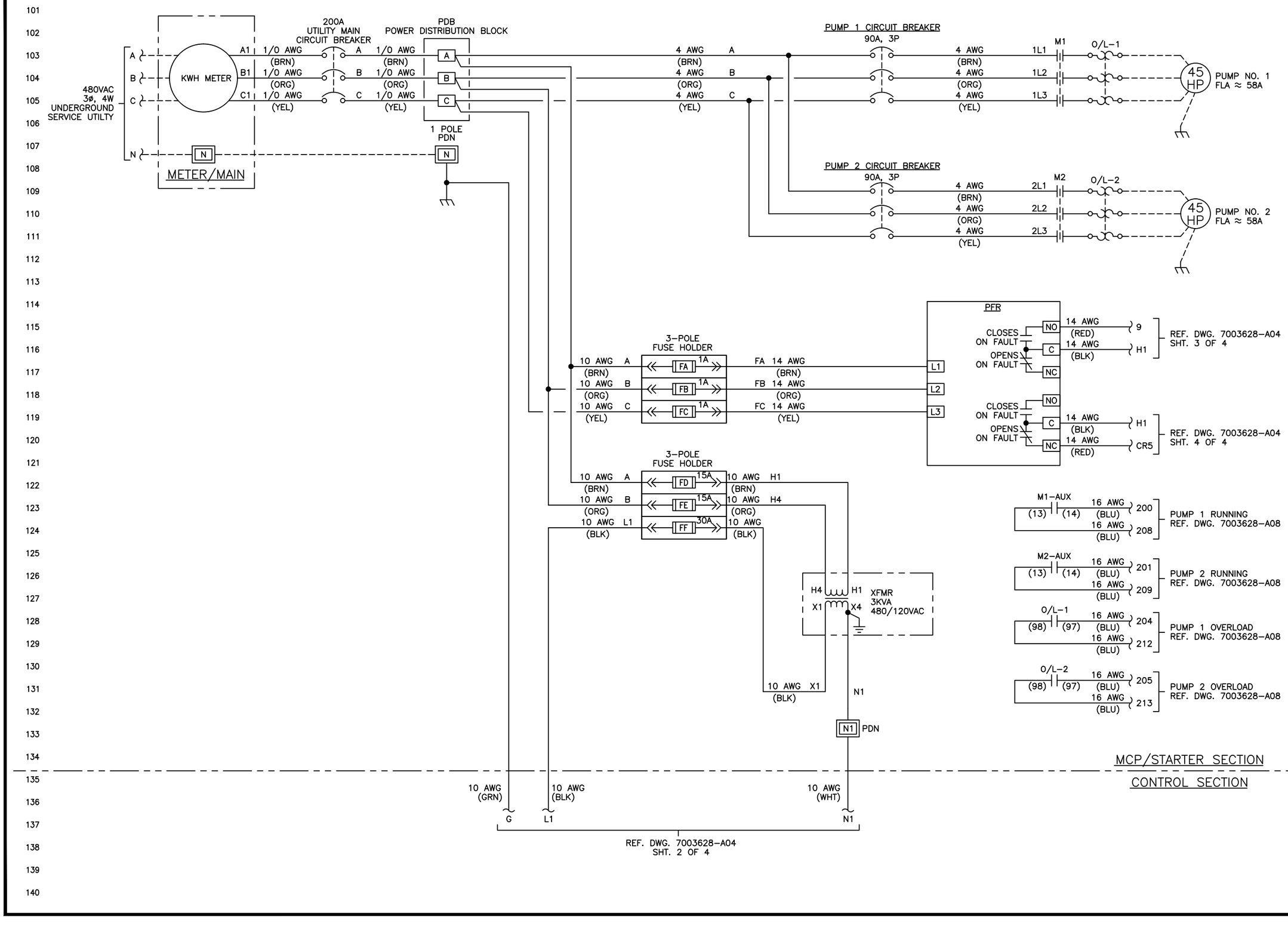
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL BILL OF MATERIALS

CUSTOMER: CONCO WEST, INC

DESIGNED BY	RP	DATE:	8/13
DRAWN BY	PC	SCALE:	N/A
CHECKED BY	DV	REF:	
APPROVED BY	RP	SHEET	1 OF 1

SIZE: B
DRAWING: 7003628- A03



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3.0	12/13	AS-BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET SUPERCEDES 2846-B REV 3.0

TESTING

TEST	DATE	BY

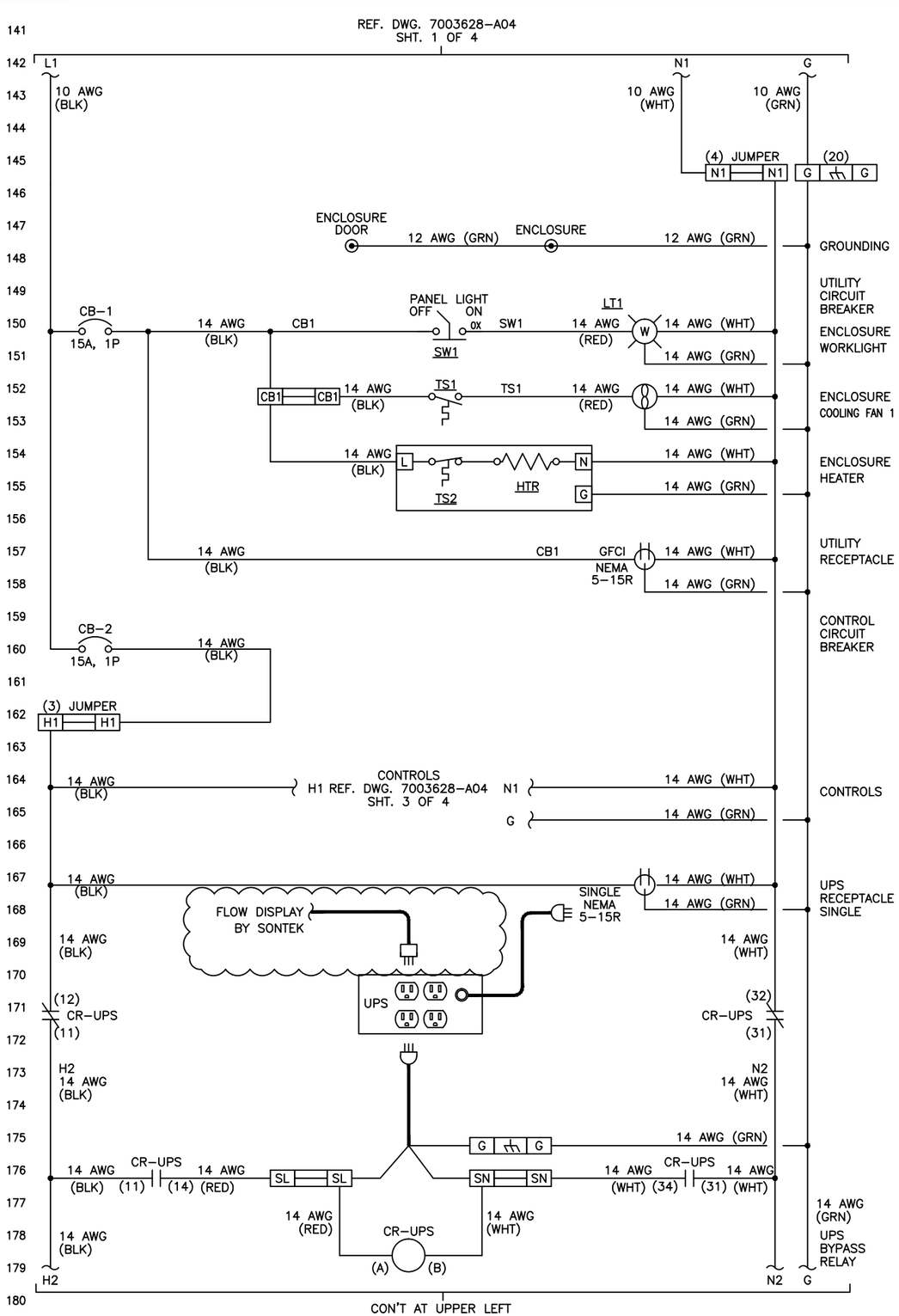
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

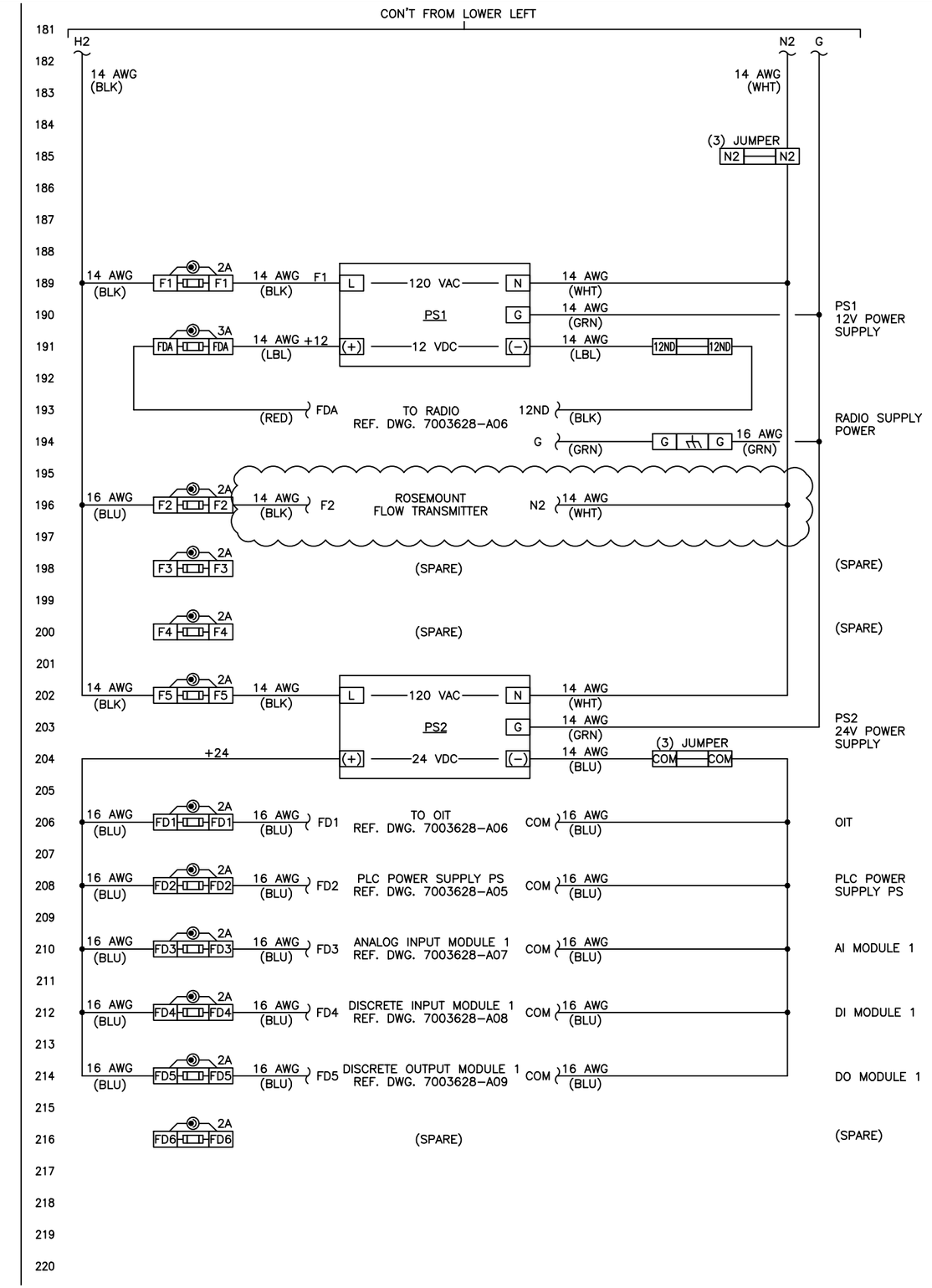
TITLE: STORM WATER LIFT STATION PANEL POWER DISTRIBUTION SCHEMATIC

CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: N/A
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 1 OF 4

SIZE: B
DRAWING: 7003628- A04





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3.0	12/13	AS-BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET SUPERCEDES 2846-B REV 3.0

TESTING

TEST	DATE	BY

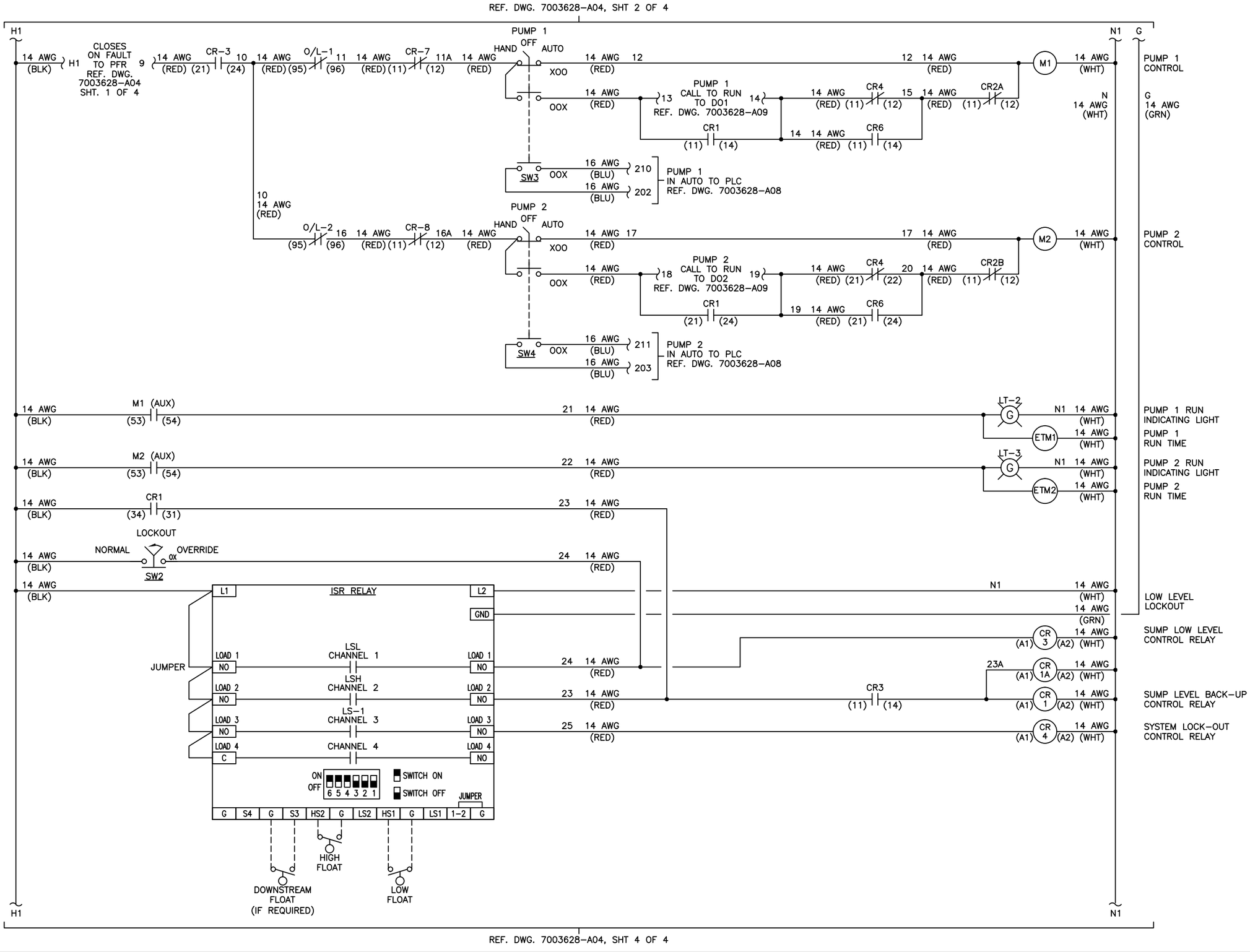
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL POWER DISTRIBUTION SCHEMATIC

CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: N/A
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 2 OF 4

SIZE: B
DRAWING: 7003628- A04



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3.0	12/13	AS-BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET SUPERCEDES 2846-B REV 3.0

TESTING

TEST	DATE	BY

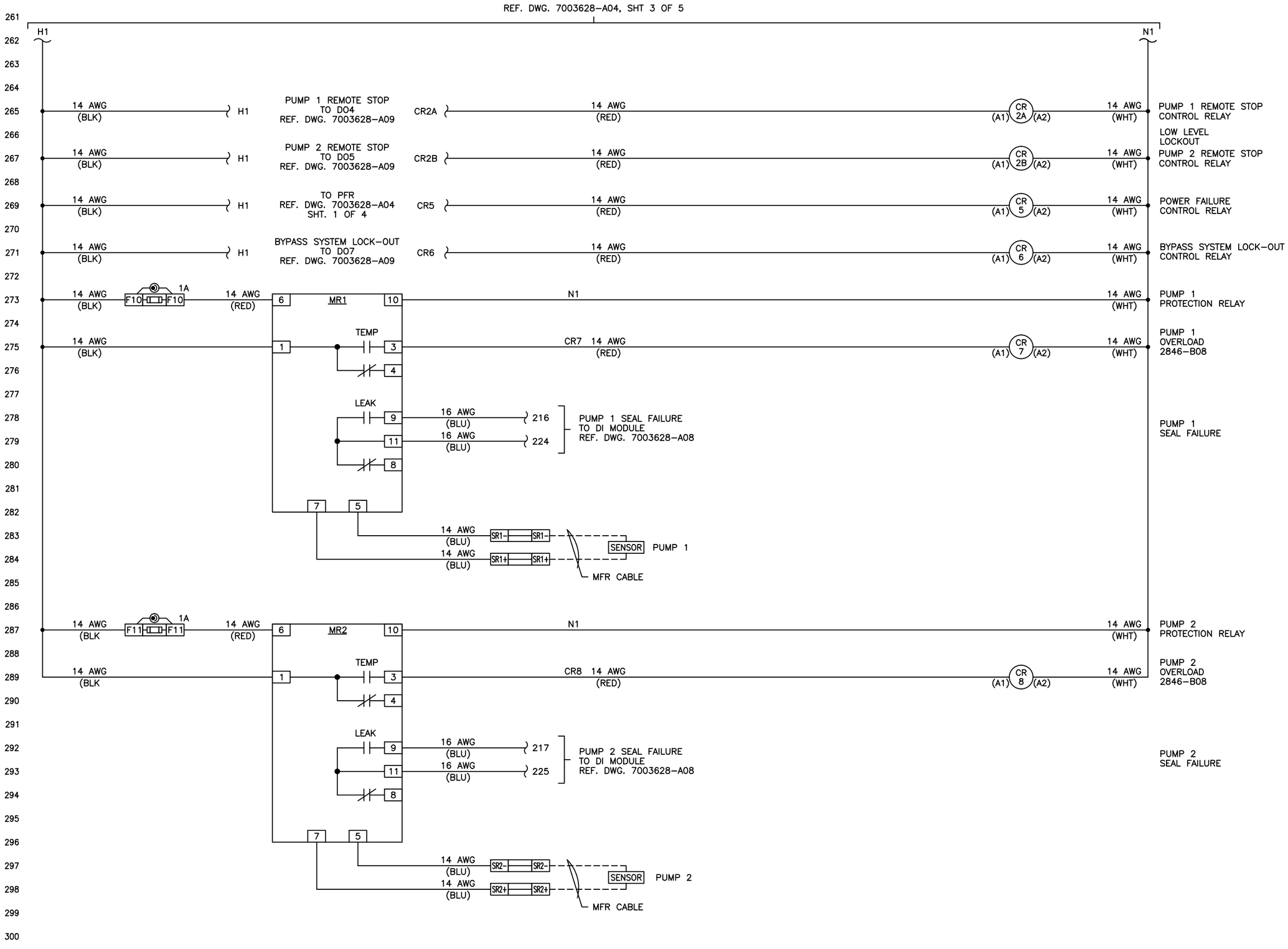
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL POWER DISTRIBUTION SCHEMATIC

CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: N/A
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 3 OF 4

SIZE: B
DRAWING: 7003628- A04



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TESTING

TEST	DATE	BY

PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

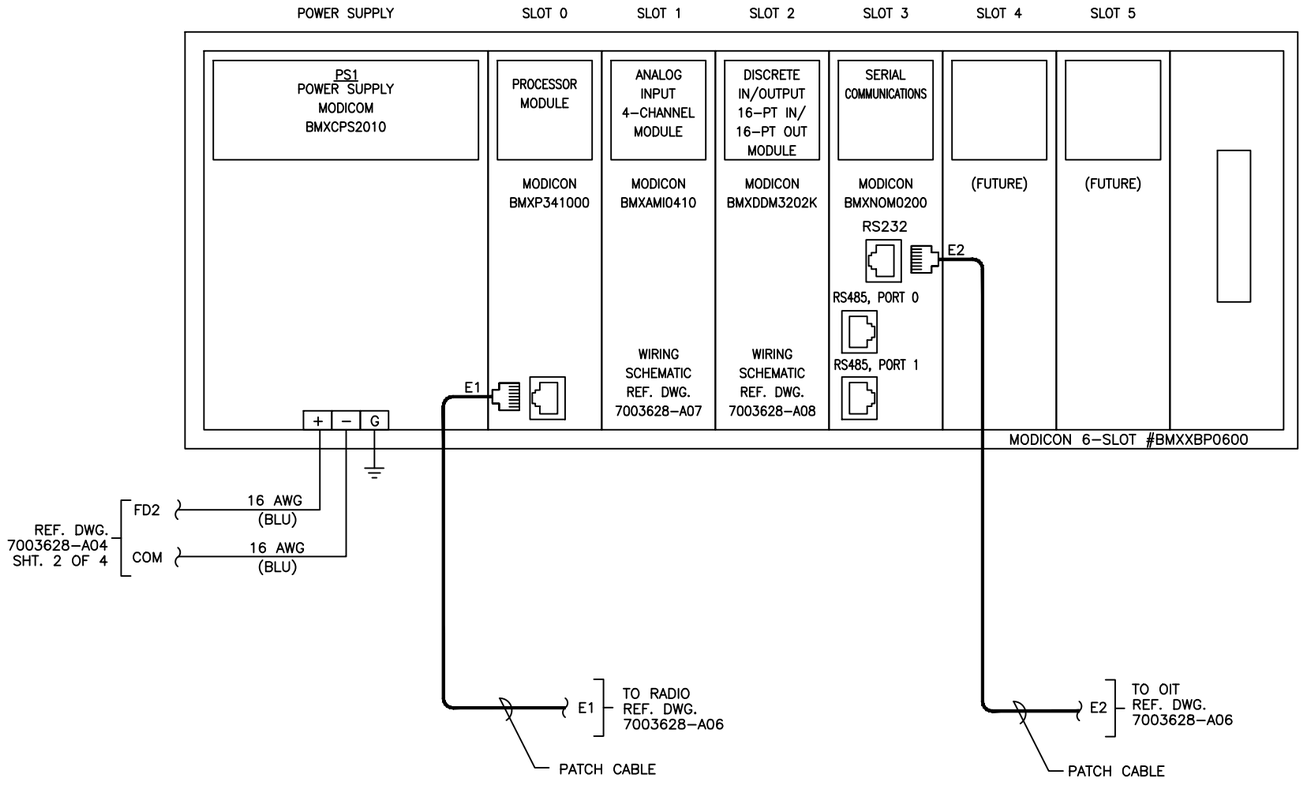
TITLE: STORM WATER LIFT STATION PANEL POWER DISTRIBUTION SCHEMATIC

CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: N/A
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 4 OF 4

SIZE: B
DRAWING: 7003628- A04

RACK 1 DIAGRAM



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THIS DRAWING SET SUPERCEDES
2846-B
REV 3.0

TESTING

TEST	DATE	BY

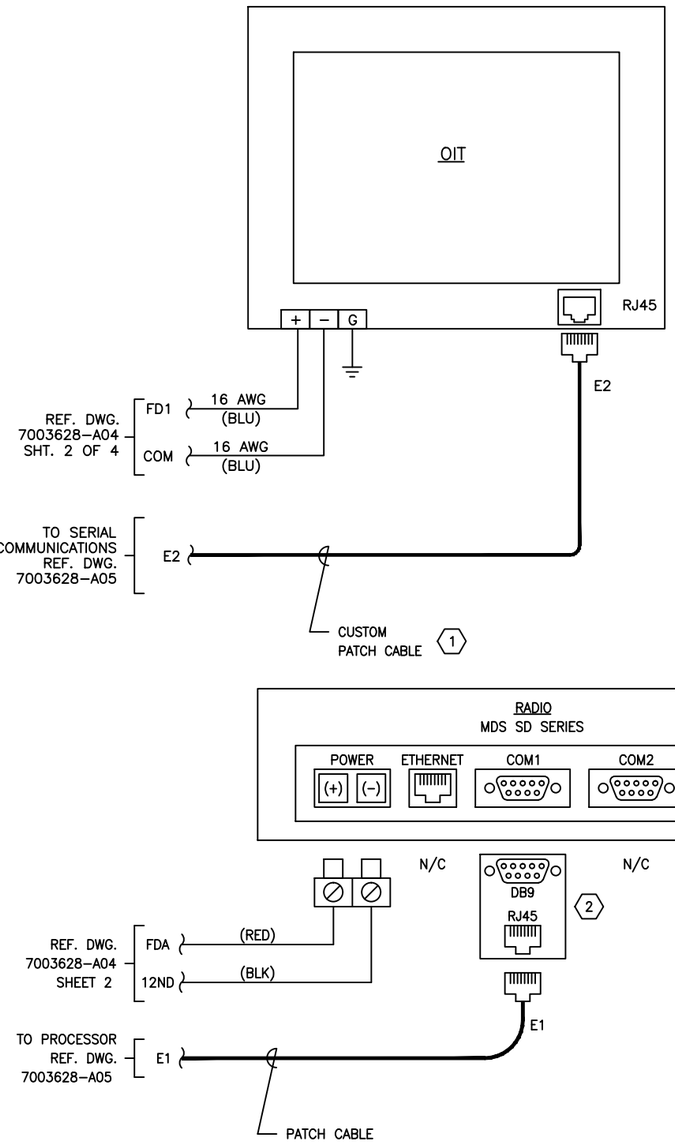
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

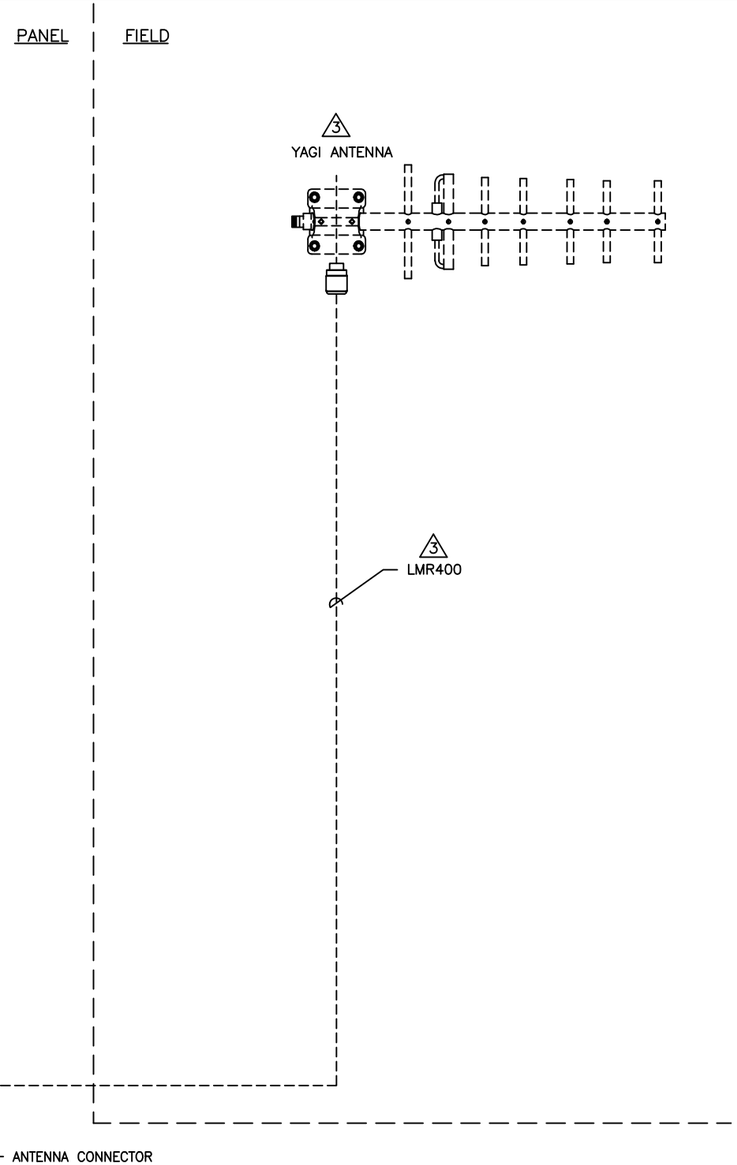
TITLE: STORM WATER LIFT STATION PANEL PLC CHASSIS DIAGRAM

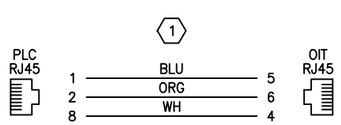
CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: N/A
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 1 OF 1

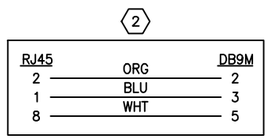
SIZE: B
DRAWING: 7003628- A05







OIT TO PLC CONNECTION DIAGRAM



PLC TO RADIO CONNECTION DIAGRAM

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4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET
SUPERCEDES
2846−B
REV 3.0

TESTING

TEST	DATE	BY

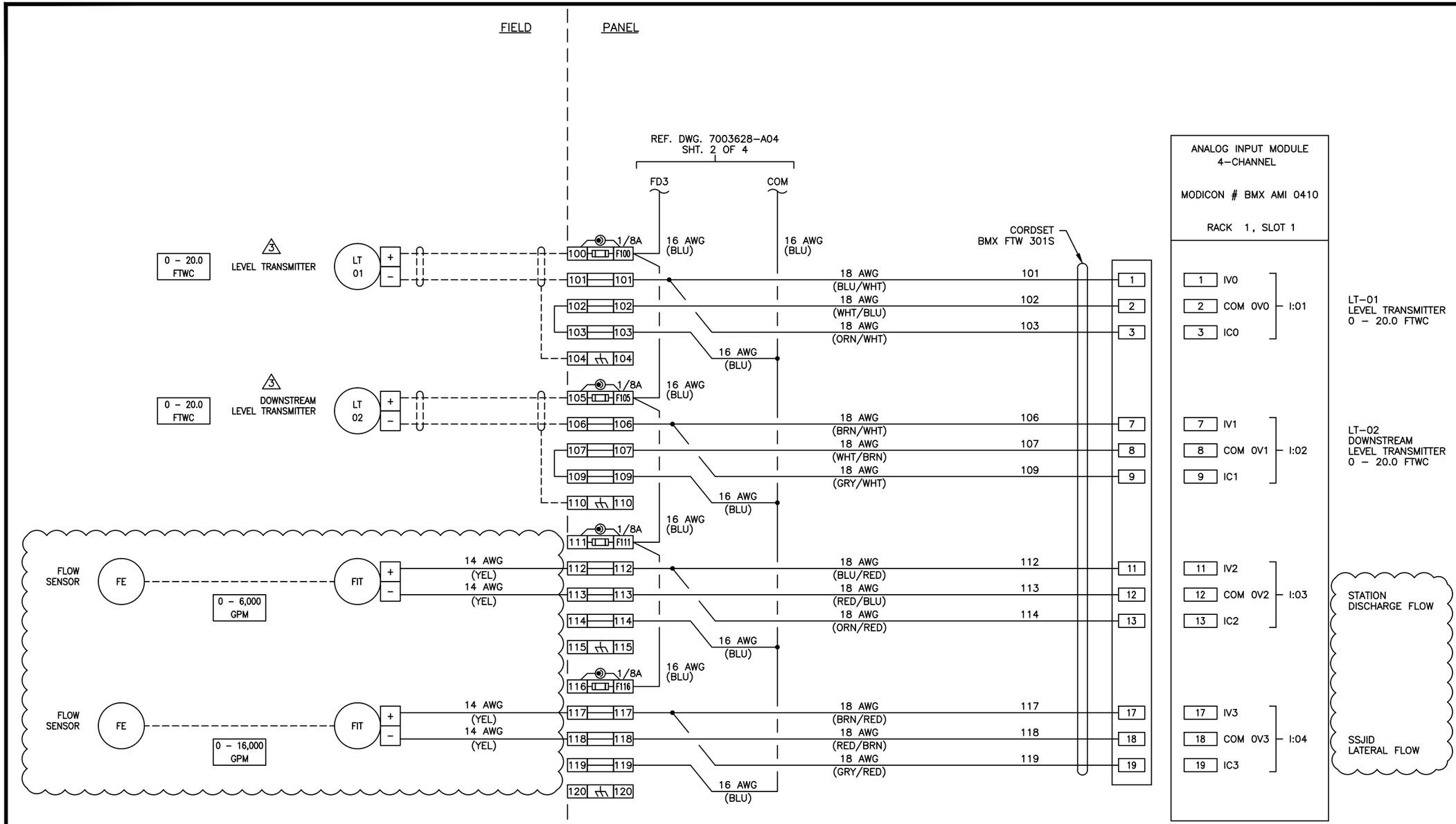
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL NETWORK DIAGRAM

CUSTOMER: CONCO WEST, INC

DESIGNED BY	RP	DATE:	8/13
DRAWN BY	PC	SCALE:	N/A
CHECKED BY	DV	REF:	
APPROVED BY	RP	SHEET	1 OF 1

SIZE: B
DRAWING: 7003628− A06



PRIMEX
WATER SYSTEM INTEGRATOR
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4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET
SUPERCEDES
2846-B
REV 3.0

TESTING

TEST	DATE	BY

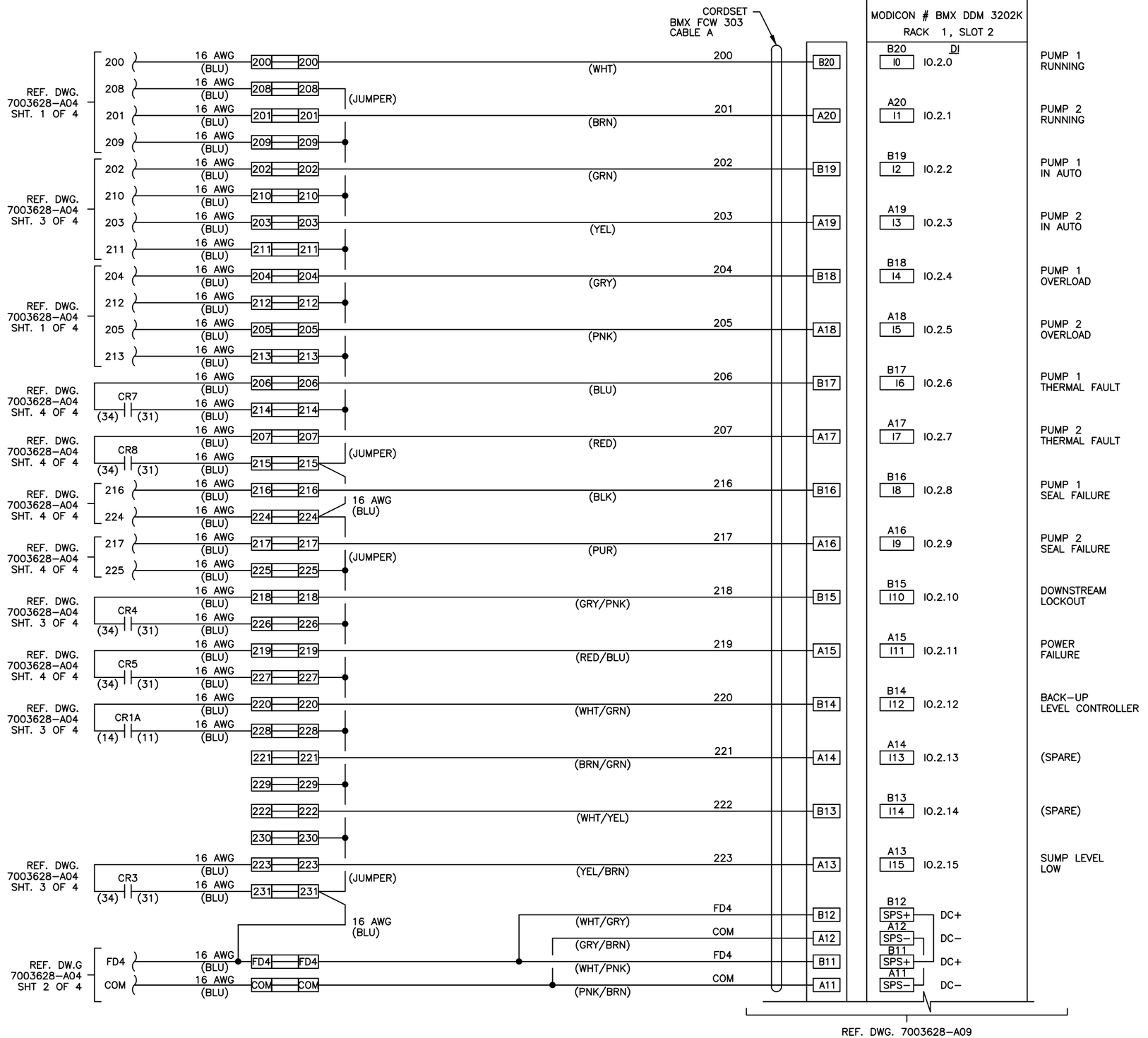
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL ANALOG INPUT MODULE SCHEMATIC 1

CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: N/A
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 1 OF 1

SIZE: B
DRAWING: 7003628- A07



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3 PLACE DIMS ± 0.002
ANGULAR DIMS ± 30'
FRACTION DIMS ± 1/32"
0" 1"
THIS LINE EQUALS ONE INCH
IF NOT ONE INCH ON THIS SHEET
ADJUST SCALES ACCORDINGLY

REVISIONS

NO.	DATE	REVISION	BY	APP
1.0	8/13	SUBMITTAL	PC	RP
2.0	10/13	PRODUCTION	PC	RP
3.0	12/13	AS-BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET SUPERCEDES 2846-B REV 3.0

TESTING

TEST	DATE	BY

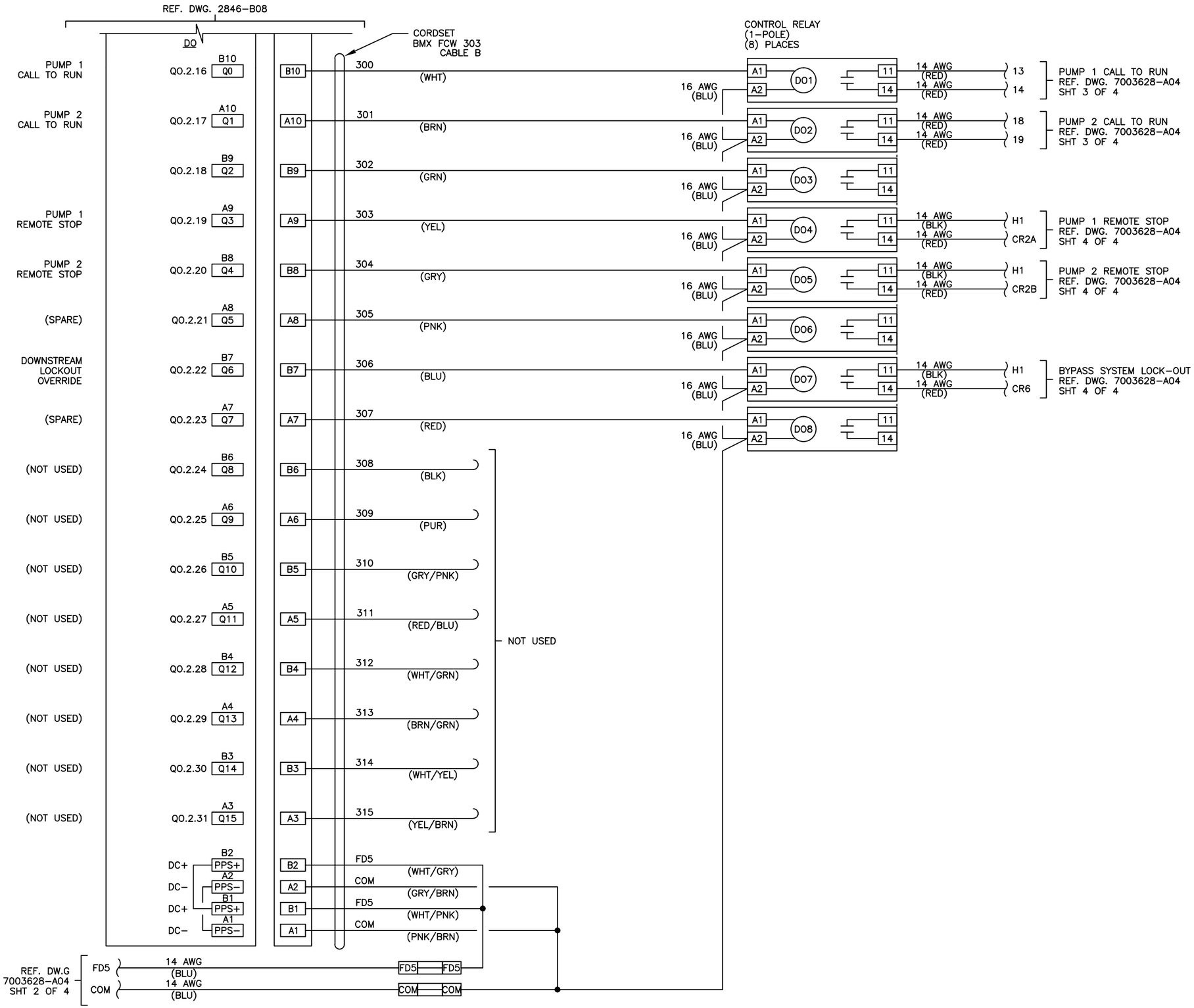
PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL DISCRETE INPUT MODULE SCHEMATIC 1

CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: N/A
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 1 OF 1

SIZE: B
DRAWING: 7003628- A08



PRIMEX
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VACAVILLE, CA 95688 707-449-0341
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INCHES
AND TOLERANCES FOR

1 PLACE DIMS ± 0.1
2 PLACE DIMS ± 0.01
3 PLACE DIMS ± 0.002
ANGULAR DIMS ± 30'
FRACTION DIMS ± 1/32"

0" 1"

THIS LINE EQUALS ONE INCH
IF NOT ONE INCH ON THIS SHEET
ADJUST SCALES ACCORDINGLY

REVISIONS

NO.	DATE	REVISION	BY	APP
1.0	8/13	SUBMITTAL	PC	RP
2.0	10/13	PRODUCTION	PC	RP
3.0	12/13	AS-BUILT	LR	RP
4.1	9/25/17	FIELD MOD 1	LR	LT

THIS DRAWING SET
SUPERCEDES
2846-B
REV 3.0

TESTING

TEST	DATE	BY

PROJECT: CENTERPOINT INTERMODAL CENTER PHASE 1 ON SITE IMPROVEMENTS

TITLE: STORM WATER LIFT STATION PANEL DISCRETE OUTPUT MODULE SCHEMATIC 1

CUSTOMER: CONCO WEST, INC

DESIGNED BY: RP	DATE: 8/13
DRAWN BY: PC	SCALE: N/A
CHECKED BY: DV	REF:
APPROVED BY: RP	SHEET: 1 OF 1

SIZE: B
DRAWING: 7003628- A09

Centerpoint Storm Pump Station
Installation, Operation, & Maintenance Manual
City of Manteca

FLYGT 3102 PUMP
O&M MANUAL

Manufacturer Representative:

Shape, Inc.

5115-A Johnson Dr.
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Tel. (925) 485-9720
Fax (925) 485-6085

General Contractor:

Conco-West, Inc.

PO Box 1360
Manteca, CA 95336
Tel. (209) 239-110
Fax (209) 239-2384

Installation, Operation, and
Maintenance Manual

898565_11.0

Flygt 3102

FLYGT
a xylem brand

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1 Introduction and Safety

1.1 Introduction

Purpose of the manual

The purpose of this manual is to provide necessary information for working with the unit. Read this manual carefully before starting work.

Read and keep the manual

Save this manual for future reference, and keep it readily available at the location of the unit.

Intended use

WARNING:

Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment and the surroundings. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.

Other manuals

See also the safety requirements and information in the original manufacturer's manuals for any other equipment furnished separately for use in this system.

1.2 Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product and its surroundings
- Product malfunction

Hazard levels

Hazard level	Indication
DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	Notices are used when there is a risk of equipment damage or decreased performance, but not personal injury.

Special symbols

Some hazard categories have specific symbols, as shown in the following table.

Electrical hazard	Magnetic fields hazard
Electrical Hazard:	CAUTION:

1.3 User safety

All regulations, codes, and health and safety directives must be observed.

The site

- Observe lockout/tagout procedures before starting work on the product, such as transportation, installation, maintenance, or service.
- Pay attention to the risks presented by gas and vapors in the work area.
- Always be aware of the area surrounding the equipment, and any hazards posed by the site or nearby equipment.

Qualified personnel

This product must be installed, operated, and maintained by qualified personnel only.

Protective equipment and safety devices

- Use personal protective equipment as needed. Examples of personal protective equipment include, but are not limited to, hard hats, safety goggles, protective gloves and shoes, and breathing equipment.
- Make sure that all safety features on the product are functioning and in use at all times when the unit is being operated.

1.4 Ex-approved products

Follow these special handling instructions if you have an Ex-approved unit.

Personnel requirements

These are the personnel requirements for Ex-approved products in potentially explosive atmospheres:

- All work on the product must be carried out by certified electricians and Xylem-authorized mechanics. Special rules apply to installations in explosive atmospheres.
- All users must know about the risks of electric current and the chemical and physical characteristics of the gas, the vapor, or both present in hazardous areas.
- Any maintenance for Ex-approved products must conform to international and national standards (for example, IEC/EN 60079-17).

Xylem disclaims all responsibility for work done by untrained and unauthorized personnel.

Product and product handling requirements

These are the product and product handling requirements for Ex-approved products in potentially explosive atmospheres:

- Only use the product in accordance with the approved motor data.
- The Ex-approved product must never run dry during operation. The volute must be filled with liquid during operation. Dry running during service and inspection is only permitted outside the classified area.
- Before you start work on the product, make sure that the product and the control panel are isolated from the power supply and the control circuit, so they cannot be energized.
- Do not open the product while it is energized or in an explosive gas atmosphere.

- Intrinsically safe circuits are normally required for the automatic level-control system by the level regulator if mounted in zone 0.
- The yield stress of fasteners must be in accordance with the approval drawing and the product specification.
- Do not modify the equipment without approval from an Ex-approved Xylem representative.
- Only use original Xylem spare parts that are provided by an Ex-approved Xylem representative.
- The thermal detectors that are fitted to the stator windings must be connected correctly to a separate motor control circuit and in use. The detectors disconnect the power supply to the motor timely. This action prevents the rise of temperatures above the temperature value for the approval classification.
- The width of flameproof joints is more than the values specified in the tables of the IEC 60079–1 standard.
- The gap of flameproof joints is less than the values specified in Table 1 of the IEC 60079–1 standard.

Guidelines for compliance

Compliance is fulfilled only when you operate the unit within its intended use. Do not change the conditions of the service without the approval of an Ex-approved Xylem representative. When you install or maintain explosion proof products, always comply with the directive and applicable standards (for example, IEC/EN 60079–14).

Minimum permitted liquid level

See the dimensional drawings of the product for the minimum permitted liquid level according to the approval for explosion proof products. If the information is missing on the dimensional drawing, the product must be fully submerged. Level-sensing equipment must be installed if the product can be operated at less than the minimum submersion depth.

Monitoring equipment

For additional safety, use condition-monitoring devices. Examples of condition-monitoring devices include, but are not limited to, the following:

- Level indicators
- Temperature detectors in addition to the stator thermal detectors

Any thermal detectors or thermal protection devices delivered with the pump must be installed and in use at all times.

1.5 Special hazards

Biological hazards

The product is designed for use in liquids that can be hazardous to your health. Observe these rules when you work with the product:

- Make sure that all personnel who may come into contact with biological hazards are vaccinated against diseases to which they may be exposed.
- Observe strict personal cleanliness.

WARNING: Biological Hazard

Infection risk. Rinse the unit thoroughly with clean water before working on it.

Wash the skin and eyes

Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

Condition	Action
Chemicals or hazardous fluids in eyes	1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.
Chemicals or hazardous fluids on skin	1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least 1 minute. 3. Seek medical attention, if necessary.

1.6 Protecting the environment

Emissions and waste disposal

Observe the local regulations and codes regarding:

- Reporting of emissions to the appropriate authorities
- Sorting, recycling and disposal of solid or liquid waste
- Clean-up of spills

Exceptional sites

CAUTION: Radiation Hazard

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

1.7 Spare parts

CAUTION:

Only use the manufacturer's original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the warranty.

1.8 Warranty

For information about warranty, see the sales contract.

2 Transportation and Storage

2.1 Inspect the delivery

2.1.1 Inspect the package

1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. File a claim with the shipping company if anything is out of order.
   If the product has been picked up at a distributor, make a claim directly to the distributor.

2.1.2 Inspect the unit

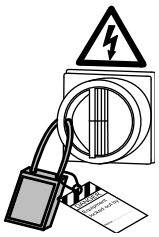
1. Remove packing materials from the product.
   Dispose of all packing materials in accordance with local regulations.
2. Inspect the product to determine if any parts have been damaged or are missing.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
   For your personal safety, be careful when you handle nails and straps.
4. Contact a sales representative if there is any issue.

2.2 Transportation guidelines

Precautions

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



Position and fastening

The unit can be transported either horizontally or vertically. Make sure that the unit is securely fastened during transportation, and cannot roll or fall over.

2.2.1 Lifting

Always inspect the lifting equipment and tackle before starting any work.

WARNING: Crush Hazard

1) Always lift the unit by its designated lifting points. 2) Use suitable lifting equipment and ensure that the product is properly harnessed. 3) Wear personal protective equipment. 4) Stay clear of cables and suspended loads.

NOTICE:

Never lift the unit by its cables or hose.

Lifting equipment

Lifting equipment is always required when handling the unit. It must fulfill the following requirements:

- The minimum height (contact your local sales and service representative for information) between the lifting hook and the floor must be sufficient to lift the unit.
- The lifting equipment must be able to hoist the unit straight up and down, preferably without the need for resetting the lifting hook.
- The lifting equipment must be securely anchored and in good condition.
- The lifting equipment must support the weight of the entire assembly and must only be used by authorized personnel.
- Two sets of lifting equipment must be used to lift the unit for repair work.
- The lifting equipment must be dimensioned to lift the unit with any remaining pumped media in it.
- The lifting equipment must not be oversized.

CAUTION: Crush Hazard

Over-dimensioned lifting equipment can lead to injury. A site-specific risk analysis must be done.

2.3 Temperature ranges for transportation, handling and storage

Handling at freezing temperature

At temperatures below freezing, the product and all installation equipment, including the lifting gear, must be handled with extreme care.

Make sure that the product is warmed up to a temperature above the freezing point before starting up. Avoid rotating the impeller/propeller by hand at temperatures below the freezing point. The recommended method to warm the unit up is to submerge it in the liquid which will be pumped or mixed.

NOTICE:

Never use a naked flame to thaw the unit.

Unit in as-delivered condition

If the unit is still in the condition in which it left the factory - all packing materials are undisturbed - then the acceptable temperature range during transportation, handling and storage is: –50°C (–58°F) to +60°C (+140°F).

If the unit has been exposed to freezing temperatures, then allow it to reach the ambient temperature of the sump before operating.

Lifting the unit out of liquid

The unit is normally protected from freezing while operating or immersed in liquid, but the impeller/propeller and the shaft seal may freeze if the unit is lifted out of the liquid into a surrounding temperature below freezing.

Follow these guidelines to avoid freezing damage:

1. Empty all pumped liquid, if applicable.
2. Check all liquids used for lubrication or cooling, both oil and water-glycol mixtures, for the presence of unacceptable amounts of water. Change if needed.

Water-glycol mixtures: Units equipped with an internal closed-loop cooling system are filled with a mixture of water and 30% glycol. This mixture remains a flowing liquid at temperatures down to –13°C (9°F). Below –13°C (9°F), the viscosity increases such that the glycol mixture will lose its flow properties. However, the glycol-water mixture will not solidify completely and thus cannot harm the product.

2.4 Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE:

Protect the product against humidity, heat sources, and mechanical damage.

NOTICE:

Do not place heavy weights on the packed product.

Long-term storage

If the unit is stored more than six months, then the following apply:

- Before operating the unit after storage, it must be inspected with special attention to the seals and the cable entry.
- The impeller/propeller must be rotated every other month to prevent the seals from sticking together.

Packaging material stacking limit

If the packaging material has an indicated stacking limit, then it is valid for 23°C (73°F) and 50% relative humidity. Depending on the material, other temperature and humidity ranges can reduce the stacking limit.

3 Product Description

Products included

Pump	Non-explosion proof drive unit	Explosion proof drive unit	High Efficiency motor (LSPM)	C-hydraulic	D-hydraulic	F-hydraulic	L hydraulic	P hydraulic	M-hydraulic (Grinder)	N hydraulic (Hard Iron™)	Adaptive N™ hydraulic
3102.060	X										X [1]
3102.070		X									X [1]
3102.090		X		X	X	X	X	X			
3102.095		X								X	
3102.160	X										X [3]
3102.170	X								X		
3102.181	X			X	X	X	X	X			
3102.185	X									X	
3102.190		X									X [3]
3102.760	X										X [2]
3102.770		X									X [2]
3102.800	X		X	X							
3102.810		X	X	X							
3102.820	X		X							X	
3102.830		X	X							X	
3102.890		X							X		
3102.900	X		X								X [3]
3102.910		X	X								X [3]
3102.920	X		X								X [1]
3102.930		X	X								X [1]
3102.960	X		X								X [2]
3102.970		X	X								X [2]

[1] Hard-Iron™
[2] Stainless steel
[3] Cast iron, gray

Pump-specific information

For the specific weight, current, voltage, power ratings, and speed of the pump, see the data plate of the pump.

3.1 Pump design

The pump is submersible, and driven by an electric motor.

For a list of pump version and corresponding motor type, see *Technical Reference* on page 69.

Intended use

The product is intended for moving wastewater, sludge, raw and clean water. Always follow the limits that are given in *Technical Reference* on page 69. If there is a question regarding the intended use of the equipment, please contact a local sales and service representative before proceeding.

DANGER: Explosion/Fire Hazard

Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is EN/ATEX-, MSHA- or FM-approved, then see the specific EX information in the Safety chapter before taking any further actions.

NOTICE:

Do NOT use the unit in highly corrosive liquids.

Spare parts

- Modifications to the unit or installation should only be carried out after consulting with Xylem.
- Original spare parts and accessories that are authorized by Xylem are essential for compliance. The use of other parts can invalidate any claims for warranty or compensation. For more information contact your Xylem representative.

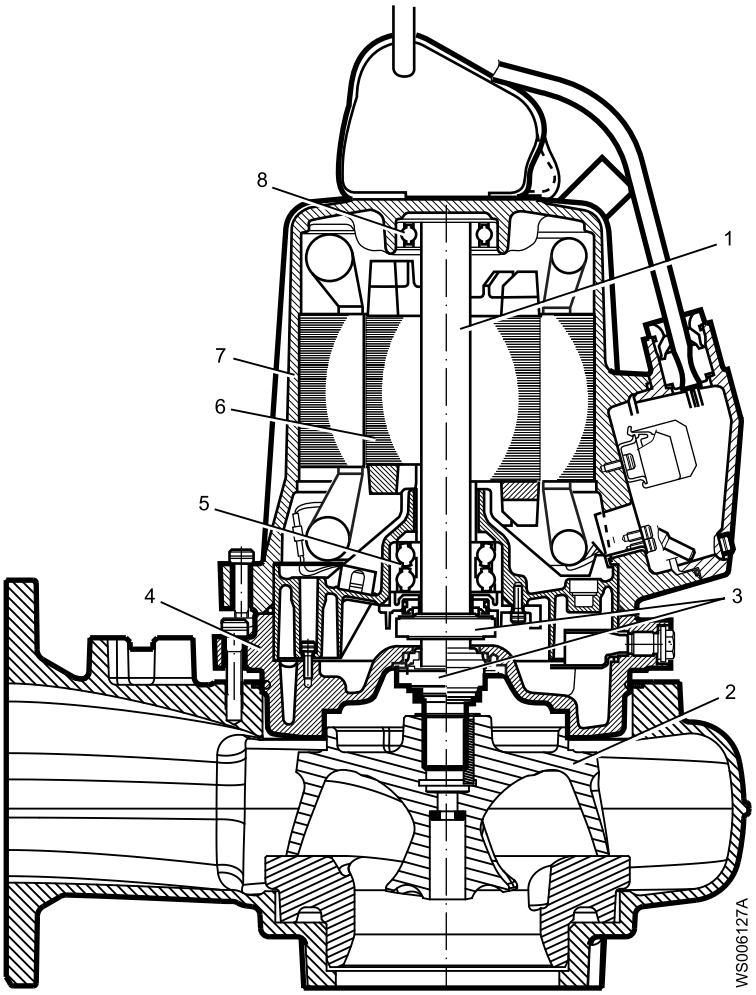
Pressure class

LT	Low head
MT	Medium head
HT	High head
SH	Super high head

Experior™ product concept

Experior™ is a product concept including N-technology, Premium efficiency motor, and the intelligent control SmartRun™.

Parts



Position	Denomination	Description
1	Shaft	The shaft is made of stainless steel, with an integrated rotor.
2	Impeller	There are multiple types of impellers. For information about the pumps impellers, see Parts List.
3	Mechanical seals	One inner and one outer seal in a combination of materials: • Aluminium oxide Al_2O_3 • Silicon carbide RSiC • Corrosion-resistant cemented carbide WCCR For information about the pumps mechanical seals, see Parts List.
4	Oil housing	The oil housing includes a coolant that lubricates and cools the seals; the housing acts as a buffer between the pumped fluid and the drive unit.
5	Main bearing	The bearing consisting of a two-row angular contact ball bearing.
6	Motor	For information about the motor, see *Technical Reference* on page 69.
7	Stator housing	The pump is cooled by the ambient liquid/air.
8	Support bearing	The bearing consisting of a single-row ball bearing.

3.2 Monitoring equipment

The following applies to the monitoring equipment of the pump:

- The stator incorporates three thermal contacts connected in series that activate the alarm and stops the pump at overtemperature
- The thermal contacts open at 125°C (257°F).

- Ex-approved pumps must have thermal contacts connected to the control panel.
- The sensors must be connected to either the MiniCAS II monitoring equipment or an equivalent equipment.
- The monitoring equipment must be of a design that makes automatic restart impossible.
- Information in the junction box shows if the pump is equipped with optional sensors.

Optional sensors

FLS FLS is a miniature float switch for detection of liquid in the stator housing. Due to its design it is best suited for pumps in a vertical position. The FLS sensor is installed in the bottom of the stator housing.

CLS CLS is a sensor for detection of water in the oil housing. The sensor initiates an alarm when the oil contains approximately 35% water. The sensor is installed in the bearing housing/bearing holder with its sensing part in the oil housing. The CLS sensor is not applicable to Ex-approved pumps.

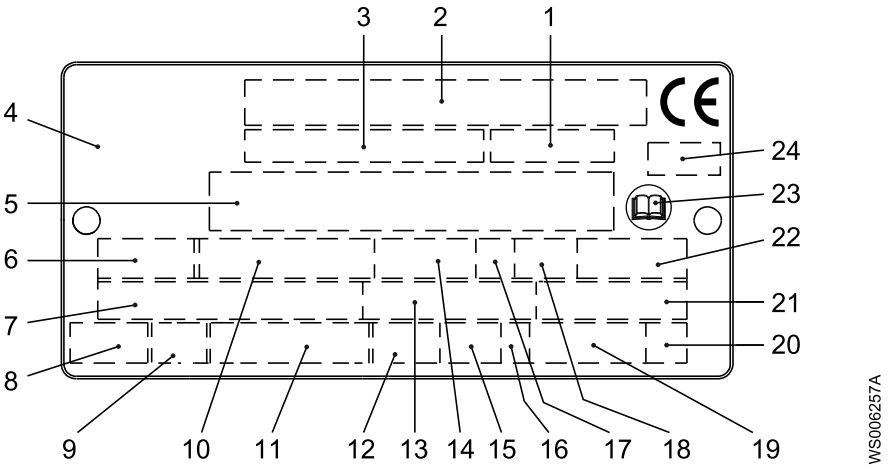
NOTICE:

The CLS sensor body is made of glass. Handle the sensor with care.

One CLS and one FLS sensor can be used in the same pump, if they are connected in parallel.

3.3 The data plate

The data plate is a metal label that is located on the main body of the products. The data plate lists key product specifications. Specially approved products also have an approval plate.



1. Curve code or Propeller code
2. Serial number
3. Product number
4. Country of origin
5. Additional information
6. Phase; type of current; frequency
7. Rated voltage
8. Thermal protection
9. Thermal class
10. Rated shaft power
11. International standard
12. Degree of protection
13. Rated current
14. Rated speed
15. Maximum submergence
16. Direction of rotation: L=left, R=right
17. Duty class
18. Duty factor
19. Product weight
20. Locked rotor code letter
21. Power factor
22. Maximum ambient temperature

23. Read installation manual
24. Notified body, only for EN-approved Ex products

Figure 1: The data plate

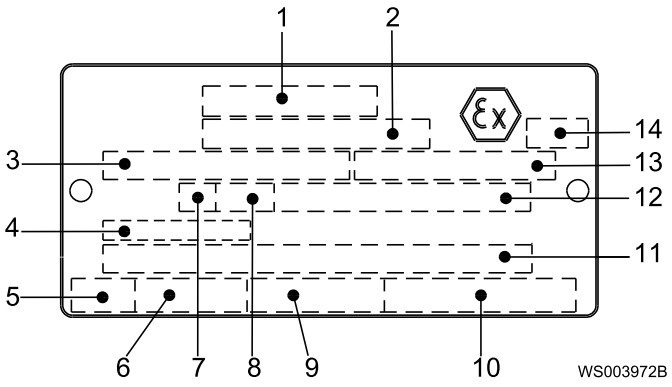
3.4 Approvals

Product approvals for hazardous locations

Pump	Approval
• 3102.070 • 3102.090 • 3102.095 • 3102.190 • 3102.770 • 3102.810 • 3102.830 • 3102.890 • 3102.910 • 3102.930 • 3102.970	European Norm (EN) • ATEX Directive • EN 60079-0:2012/A11:2013, EN 60079-1:2007, EN 13463-1:2009, EN 13463-5:2011 • Ex II 2 G c Ex d IIB T4 Gb
	IEC • IECEx scheme • IEC 60079-0, IEC 60079-1 • Ex d IIB T4 Gb
	FM (FM Approvals) • Explosion proof for use in Class I, Div. 1, Group C and D • Dust ignition proof for use in Class II, Div. 1, Group E, F and G • Suitable for use in Class III, Div. 1, Hazardous Locations
	CSA Ex • Explosion proof for use in Class I, Div. 1, Group C and D

EN approval plate

This illustration describes the EN approval plate and the information that is contained in its fields.

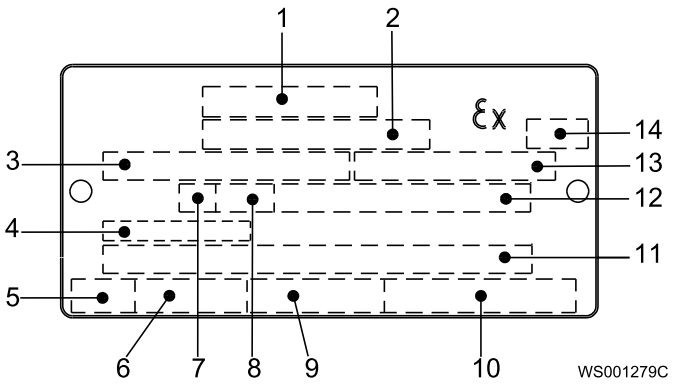


1. Approval
2. Approval authority and Approval number
3. Approved for drive unit
4. Cable entry temperature
5. Stall time
6. Starting current or Rated current
7. Duty class
8. Duty factor
9. Input power
10. Rated speed
11. Additional information
12. Maximum ambient temperature
13. Serial number
14. ATEX marking

IEC approval plate

This illustration describes the IEC approval plate and the information that is contained in its fields.

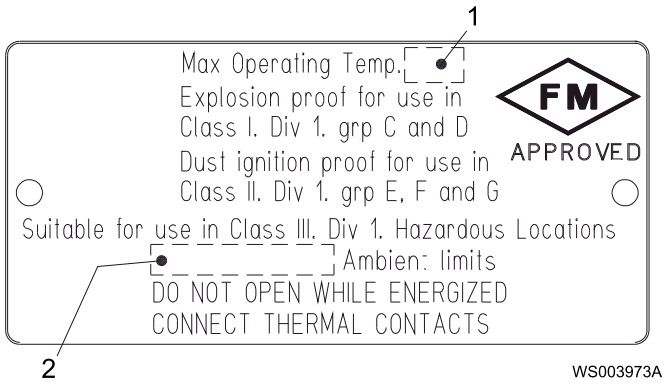
International Norm; not for EU member countries.



1. Approval
2. Approval authority and Approval number
3. Approved for drive unit
4. Cable entry temperature
5. Stall time
6. Starting current or Rated current
7. Duty class
8. Duty factor
9. Input power
10. Rated speed
11. Additional information
12. Maximum ambient temperature
13. Serial number
14. ATEX marking

FM approval plate

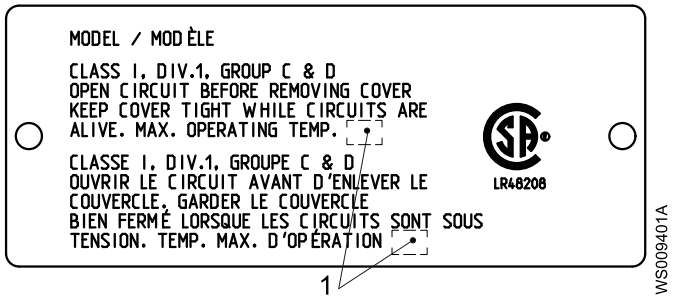
This illustration describes the FM approval plate and the information that is contained in its fields.



1. Temperature class
2. Maximum ambient temperature

CSA approval plate

This illustration describes the CSA approval plate and the information that is contained in its fields.



1. Temperature class

3.5 Product denomination

Reading instruction

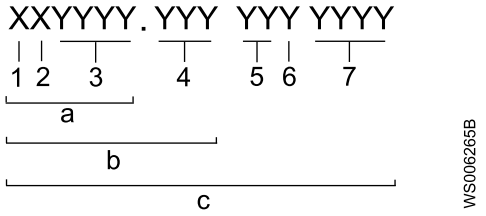
In this section, code characters are illustrated accordingly:

X = letter

Y = digit

The different types of codes are marked up with a, b and c. Code parameters are marked up with numbers.

Codes and parameters



Type of Callout	Number	Indication
Type of code	a	Sales denomination
	b	Product code
	c	Serial number
Parameter	1	Hydraulic end
	2	Type of installation
	3	Sales code
	4	Version
	5	Production year
	6	Production cycle
	7	Running number

4 Installation

4.1 Install the pump

Before starting work, make sure that the safety instructions in the chapter *Introduction and Safety* on page 3 have been read and understood.

DANGER: Electrical Hazard

Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.

DANGER: Inhalation Hazard

Before entering the work area, make sure that the atmosphere contains sufficient oxygen and no toxic gases.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

Hazardous atmospheres

DANGER: Explosion/Fire Hazard

Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is EN/ATEX-, MSHA- or FM-approved, then see the specific EX information in the Safety chapter before taking any further actions.

WARNING: Explosion/Fire Hazard

Do not install CSA-approved products in locations that are classified as hazardous in the National Electric Code(TM), ANSI/NFPA 70-2005.

General requirements

These requirements apply:

- Use the pump dimensional drawing in order to ensure proper installation.

Before installing the pump, do the following:

- Provide a suitable barrier around the work area, for example, a guard rail.
- Make sure that equipment is in place so that the unit cannot roll or fall over during the installation process.
- Check the explosion risk before you weld or use electric hand tools.
- Check that the cable and cable entry have not been damaged during transport.

- Always remove all debris and waste material from the sump, inlet piping, and discharge connection, before you install the pump.
- If the unit has a permanent magnet motor, then ensure that you have read and understood all safety instructions regarding permanent magnet motors.

NOTICE:

Do not run the pump dry.

NOTICE:

Never force piping to make a connection with a pump.

Authority regulation

Vent the tank of a sewage station in accordance with local plumbing codes.

Fasteners

- Only use fasteners of the correct size and material.
- Replace all corroded or damaged fasteners.
- Make sure that all the fasteners are correctly tightened and that there are no missing fasteners.

4.1.1 Install with P-installation

In the P-installation, the pump is installed on a stationary discharge connection, and operates either completely or partially submerged in the pumped liquid. These requirements and instructions only apply when the installation is made according to the dimensional drawing.

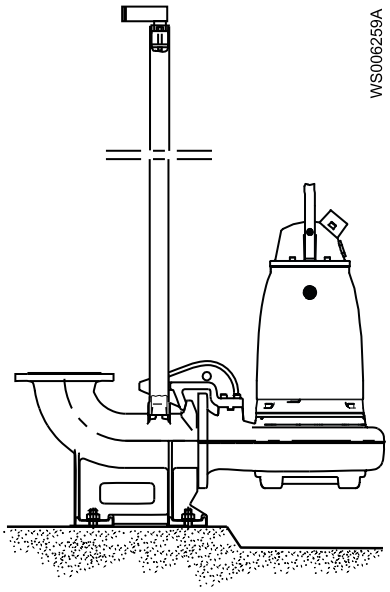


Figure 2: P-installation

These items are required:

- Guide bars
- Guide bar bracket for attaching the guide equipment to the access frame or to the upper part of the sump
- Cable holder for holding the cable
- Access frame (with covers) to which the upper guide bar bracket and cable holder can be attached
- Discharge connection for connecting the pump to the discharge line

  The discharge connection has a flange which fits the pump housing flange and a bracket for attaching the guide equipment.

- Fasteners for the discharge connection
- Anchor bolts

1. Install the access frame:
   a) Place the access frame in position and align it horizontally.
   b) Grout the frame in place.
2. Grout the anchor bolts in place.

   Be careful when you align and position the discharge connection in relation to the access frame.
3. Place the discharge connection in position, and tighten the nuts.
4. Install the guide bars:
   a) Secure the guide bars in the bracket.
   b) Check that the guide bars are placed vertically. Use a level or a plumb line.
5. Connect the discharge pipe to the discharge connection.
6. Lower the pump along the guide bars.

   When it reaches the bottom position, the pump automatically connects to the discharge connection.
7. Secure the motor cable:
   a) Fasten the permanent lifting device to the pump and to the access frame. For example, you can use a stainless-steel lifting chain with shackles.
   b) Fasten the cable to the cable holder.

      Make sure that the cable cannot be sucked into the pump inlet or that it is neither sharply bent, or pinched. Support straps are required for deep installations.
   c) Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

      Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* on page 38.

Clean all debris from the sump before starting the pump.

4.1.2 Install with S-installation

In the S-installation, the pump is transportable and intended to operate either completely or partially submerged in the pumped liquid. The pump is equipped with a connection for hose or pipe and stands on a base stand.

These requirements and instructions only apply when the installation is made according to the dimensional drawing. For information about the different installation types, see Parts List.

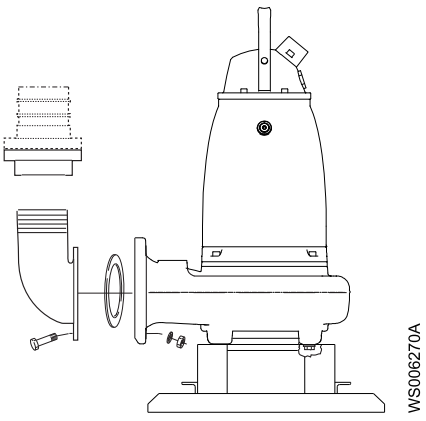


Figure 3: S-installation

1. Run the cable so that it has no sharp bends. Make sure that it is not pinched, and cannot be sucked into the pump inlet.
2. Connect the discharge line.
3. Lower the pump into the sump.
4. Place the pump on the base and make sure it cannot fall over or sink.

   Alternatively, the pump can be suspended with a lifting chain just above the sump bottom. Make sure that the pump cannot rotate at start-up or during operation.
5. Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

   Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* on page 38.

4.1.3 Install with T/Z-installation

This installation is not applicable for these versions:

- .170
- .890

In the T-installation, the pump is installed in a vertical position in a dry well next to the wet sump. These requirements and instructions only apply when the installation is made according to the dimensional drawing.

In the Z-installation, the pump is installed in a horizontal position on a support stand in a dry well next to the wet sump. The following requirements and instructions are for Z-installations that comply to the dimensional drawing.

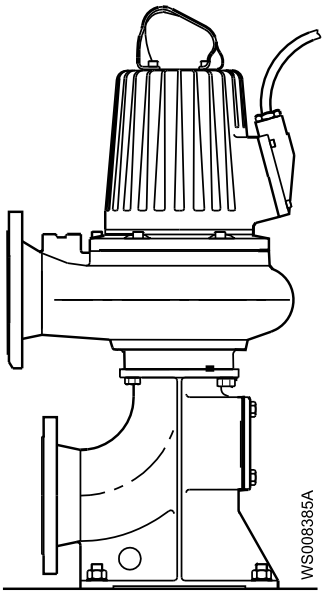


Figure 4: T-installation

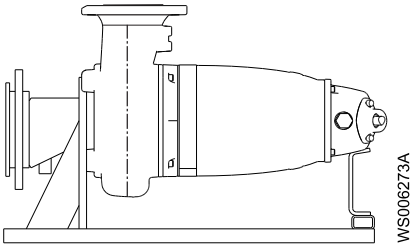
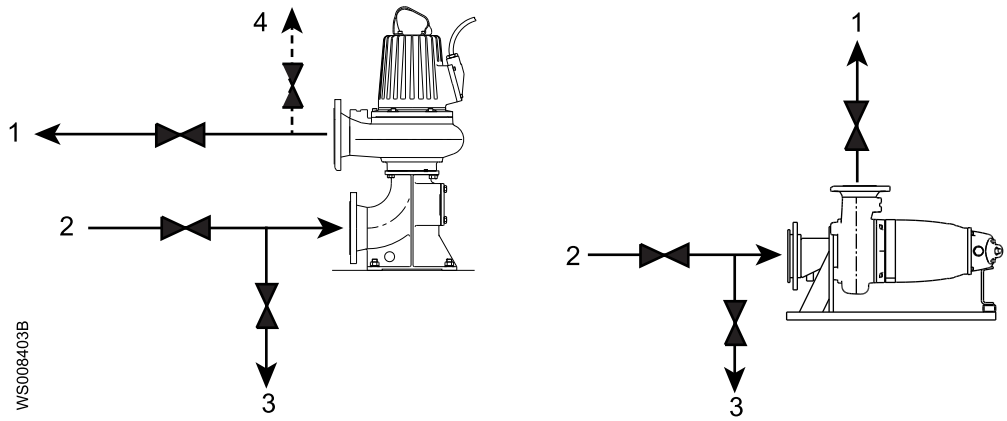


Figure 5: Z-installation

These items are required:

- Anchor bolts for anchoring the pump to a base.
- Shut-off valves that allow you to remove the pump from service



1. Outlet line
2. Inlet line
3. Line to drain
4. Air vent

Figure 6: T-, Z-installation shutoff and air vent valves (generic pumps shown)

NOTICE:

The risk of freezing is particularly high in T- or Z-installations.

1. Fasten the pump:
   a) Bolt the stationary suction connection to the concrete base.
   b) Bolt the pump to the suction connection.
2. Make sure that the pump is vertical for the T-installation or horizontal for the Z-installation.
3. Connect the suction line and discharge line.
4. Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

   Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* on page 38.
5. Make sure that the weight of the pump does not put strain on the piping.

4.1.4 Install with F-installation

In the F-installation, the pump is free standing and installed primarily in a small sump on a firm surface. The pump is intended to operate completely or partially submerged in the pumped liquid. The pump is equipped with a connection for hose or pipe and with supporting legs and/or a strainer. These requirements and instructions are for F-installations that comply to the dimensional drawing.

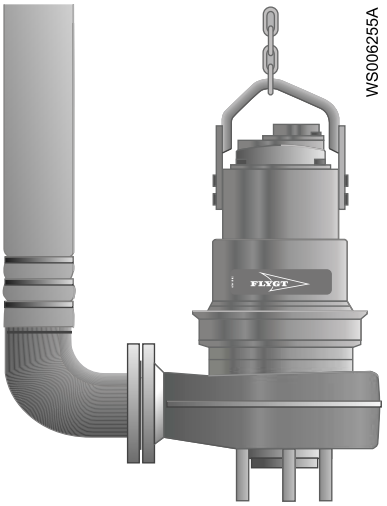


Figure 7: F-installation

These items are required:

- Nipple pipe/Flange/Coupling
- Pipe or hose

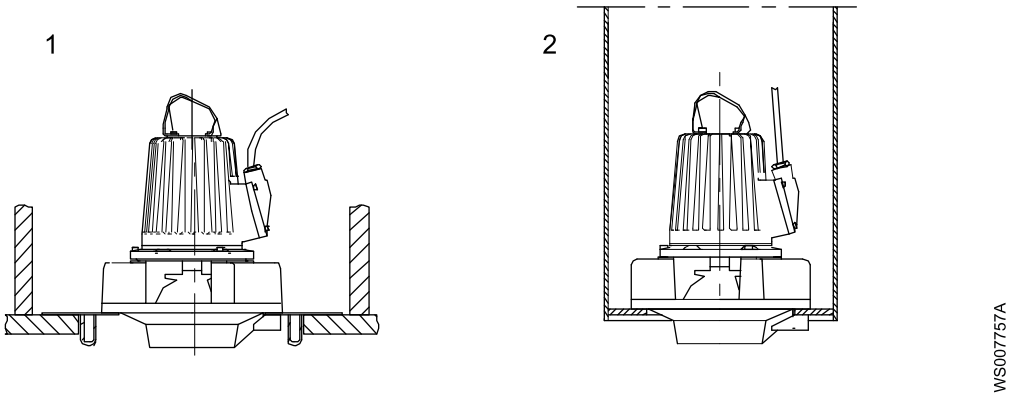
1. Run the cable so that is has no sharp bends, is not pinched, and cannot be sucked into the pump inlet.
2. Fit the nipple pipe/flange/coupling.
3. Lower the pump into the sump.
4. Place the pump on the sump bottom and make sure it cannot fall over.
5. Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

   Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* on page 38.

4.1.5 Install with L-installation

In the L-installation, the pump is installed in a vertical, semipermanent, wet well column pipe arrangement. The well is divided into a suction part and a discharge part. The pump end is equipped with guide vanes.

These requirements and instructions only apply when the installation is made according to the dimensional drawing.



1. Concrete installation
2. Column installation

Figure 8: L-installation alternatives

These items are required:

- Plate 416 13 0x or column pipe 416 12 xx for L-installation
- Anchor bolts for L -installation
- Cable holder

1. Select one of the following steps:

Type of installation	Action
Concrete installation	1. Place the plate for L-installation in position and align it horizontally. 2. Grout the anchor bolts in place. 3. Protect the bolts with corrosion-protective compound.
Column installation	1. Cast the column pipe in concrete or install the pre-fabricated column. 2. Place the column in position and align it horizontally. 3. Grout the anchor bolts in place at the top flange of the column pipe. 4. Protect the bolts with corrosion-protective compound.

2. Run a cable between the pump and the starter and monitoring equipment.

   Make sure that the cable is not sharply bent or pinched.

3. Connect the motor cable and the starter and monitoring equipment according to the separate instructions.

   Make sure that the impeller rotation is correct. For more information, see *Check the impeller rotation* on page 38.

4. Install the pump.
   a) Fasten the lifting device to the pump.

      Use a stainless steel lifting chain with shackles.

   b) Lower the pump into the correct position according to the dimensional drawing.

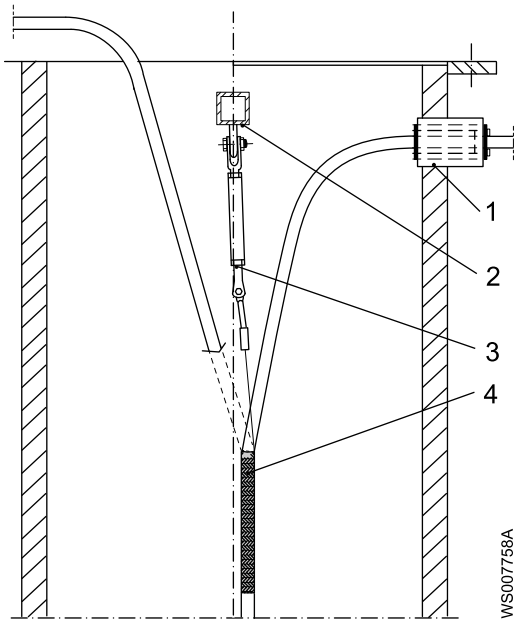
      Make sure that the pump cannot rotate at start-up or during operation.

5. Secure the motor cable:
   a) Install the cable support grip and the turnbuckle.

      Use a support that is positioned over the center of the column.

      Make sure that the cable is kept taut in the center of the column pipe and that it is not sharply bent or pinched.

   b) If the discharge column is pressurized, then install a cable entry seal unit in the side of the column.



1. Cable entry seal unit
2. Support
3. Turnbuckle
4. Cable support grip

Make sure that the impeller rotation is correct. For more information, see .

Clean all debris from the column pipe before starting the pump.

4.1.6 Install with X-installation

In the X-installation, the pump has no pre-determined mechanical connection. The flange is drilled.

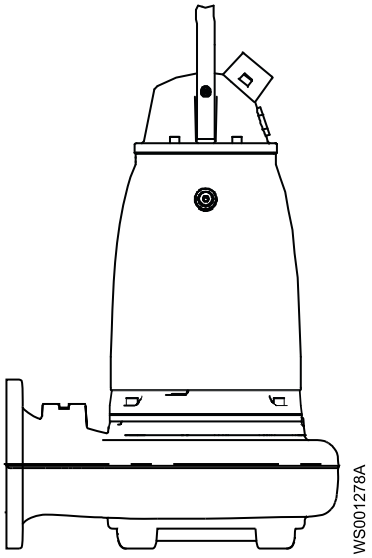


Figure 9: X-installation

NOTICE:

A pump prepared for X-installation is only approved to be used in P- or S-installation. Never use it in T- or Z-installation

For installation instructions, see appropriate mechanical accessories.

4.2 Make the electrical connections

General precautions

DANGER: Electrical Hazard

Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized. This applies to the control circuit as well.

WARNING: Electrical Hazard

Risk of electrical shock or burn. A certified electrician must supervise all electrical work. Comply with all local codes and regulations.

WARNING: Electrical Hazard

There is a risk of electrical shock or explosion if the electrical connections are not correctly carried out, or if there is fault or damage on the product. Visually inspect equipment for damaged cables, cracked casings or other signs of damage. Make sure that electrical connections have been correctly made.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

WARNING: Crush Hazard

Risk of automatic restart.

CAUTION: Electrical Hazard

Prevent cables from becoming sharply bent or damaged.

NOTICE:

Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the cable ends dry at all times.

Requirements

These general requirements apply for electrical installation:

- The supply authority must be notified before installing the pump if it will be connected to the public mains. When the pump is connected to the public power supply, it may cause flickering of incandescent lamps when started.
- The mains voltage and frequency must agree with the specifications on the data plate. If the pump can be connected to different voltages, then the connected voltage is specified by a yellow sticker close to the cable entry.
- The fuses and circuit breakers must have the proper rating, and the pump overload protection (motor protection breaker) must be connected and set to the rated current according to the data plate and if applicable the cable chart. The starting current in direct-on-line start can be up to six times higher than the rated current.
- The fuse rating and the cables must be in accordance with the local rules and regulations.
- If intermittent operation is prescribed, then the pump must be provided with monitoring equipment supporting such operation.
- If stated on the data plate, then the motor is convertible between different voltages.
- The thermal contacts/thermistors must be in use.
- For FM-approved pumps, a leakage sensor must be connected and in use in order to meet approval requirements.

Cables

These are the requirements to follow when you install cables:

- The cables must be in good condition, not have any sharp bends, and not be pinched.
- The cables must not be damaged and must not have indentations or be embossed (with markings, etc.) at the cable entry.
- The cable entry seal sleeve and washers must conform to the outside diameter of the cable.
- The minimum bending radius must not be below the accepted value.

- If using a cable which has been used before, a short piece must be peeled off when refitting it so that the cable entry seal sleeve does not close around the cable at the same point again. If the outer sheath of the cable is damaged, then replace the cable. Contact a sales or authorized service representative.
- The voltage drop in long cables must be taken into account. The drive unit's rated voltage is the voltage measured at the cable connection point in the pump.
- The screened cable must be used according to the European CE and EMC requirements if a Variable Frequency Drive (VFD) is used. For more information, contact a sales or authorized service representative (VFD-supplier).
- Make sure that the cable is long enough for maintenance work.
- For SUBCAB® cables, the twisted pair copper foil must be trimmed.
- All unused conductors must be insulated.

Grounding (earthing)

Grounding (earthing) must be done in compliance with all local codes and regulations.

DANGER: Electrical Hazard

All electrical equipment must be grounded (earthed). Test the ground (earth) lead to verify that it is connected correctly and that the path to ground is continuous.

WARNING: Electrical Hazard

If the power cable is jerked loose, then the ground (earth) conductor must be the last conductor to come loose from its terminal. Make sure that the ground (earth) conductor is longer than the phase conductors at both ends of the cable.

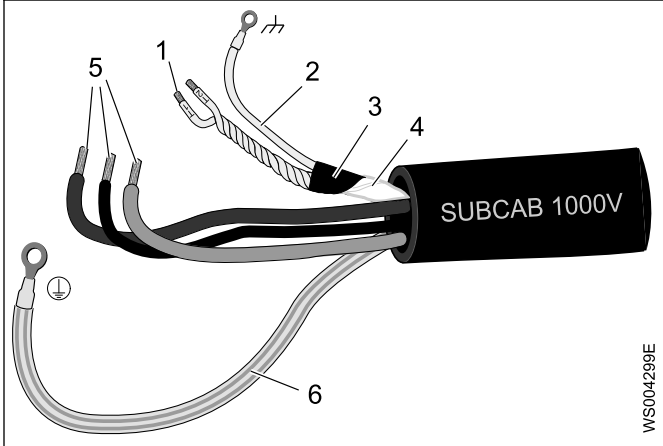
WARNING: Electrical Hazard

Risk of electrical shock or burn. You must connect an additional ground- (earth-) fault protection device to the grounded (earthed) connectors if persons are likely to come into contact with liquids that are also in contact with the pump or pumped liquid.

4.2.1 Prepare the SUBCAB® cables

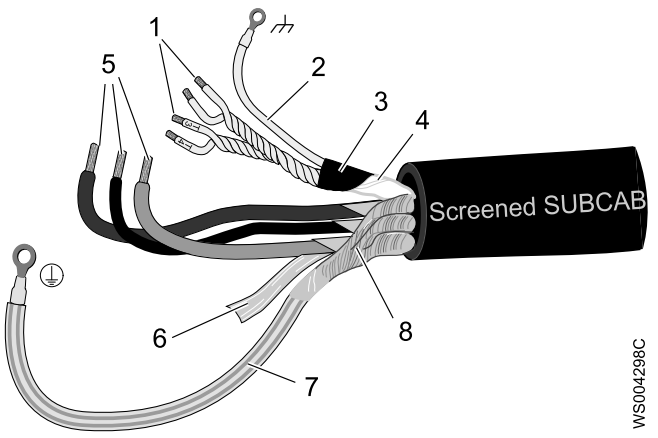
This section applies to SUBCAB® cables with twisted-pair control cores.

The prepared SUBCAB® cable



1. T1+T2 twisted pairs in control element
2. Drain wire in control element (bare copper wire)
3. Screened copper pt-foil
4. Insulation sheath (jacket) or PT-foil for control element
5. Power cores
6. Ground (earth) core

The prepared screened SUBCAB® cable



1. T1+T2 and T3+T4 twisted pairs in control element
2. Drain wire in control element (bare copper wire)
3. Screened copper pt-foil
4. Insulation sheath (jacket) for control element
5. Power cores
6. Aluminum foil
7. Ground (earth) core with green/yellow shrink hose
8. Uncovered screen/braided wire

1. Peel off the outer sheath at the end of the cable.
2. Prepare the control element:
   a) Peel the sheath (if applicable) and the copper foil.
      The copper foil is a screen and is conductive. Do not peel more than necessary, and remove the peeled foil.

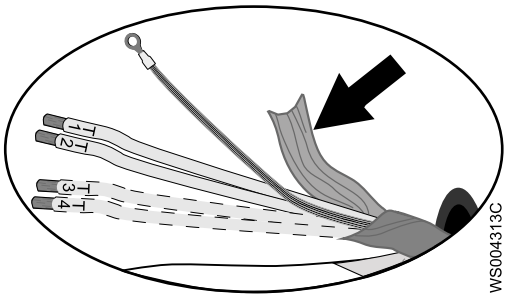


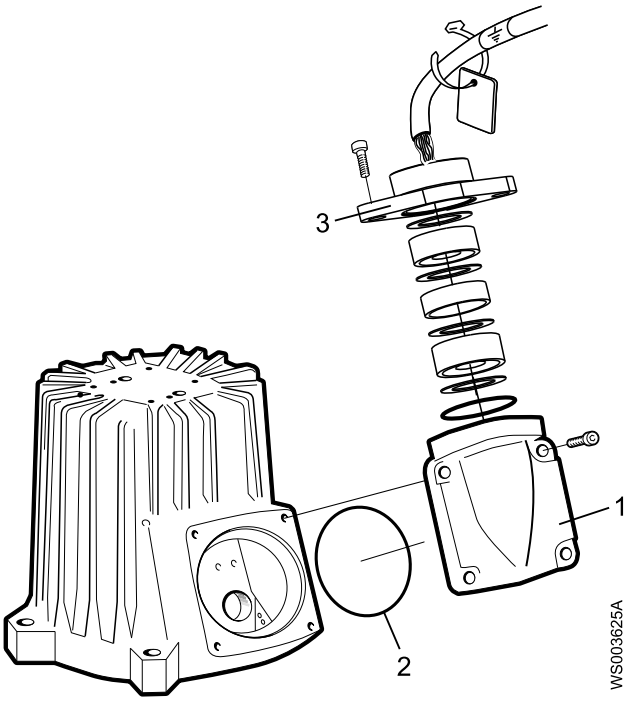
Figure 10: Copper foil on control element.

   b) Put a white shrink hose over the drain wire and the cable terminal.
   c) Fit a cable lug on the drain wire.
   d) Twist T1+T2 and T3+T4.
   e) Put a shrink hose over the control element.
      Make sure that the conductive copper foil and drain wire is covered.
3. Prepare the ground (earth) core for SUBCAB™ cable:
   a) Peel the yellow-green insulation from the ground (earth) core.
   b) Check that the ground (earth) core is at least 10% longer than the phase cores in the cabinet.
   c) If applicable, put a cable lug on the ground core.
4. Prepare the ground (earth) core for screened SUBCAB™ cable:
   a) Untwist the screens around the power cores.
   b) Put a yellow-green shrink hose over the ground (earth) core.
      Leave a short piece uncovered.
   c) If applicable, put a cable lug on the screened ground core.
   d) Twist all power core screens together to create a ground (earth) core and fit a cable terminal to the end.
   e) Check that the ground (earth) core is at least 10% longer than the phase cores in the cabinet.
5. Connect to ground (earth):
   - Screw: Fit cable terminals to the ground (earth) core and the power cores.
   - Terminal block: Leave the core ends as they are.
6. Prepare the main leads:
   a) Remove the aluminum foil around each power core.
   b) Peel the insulation from each power core.

4.2.2 Connect the motor cable to the pump

NOTICE:

Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the end of the motor cable dry at all times.



1. Entrance cover
2. O-ring
3. Entrance flange

1. Remove the entrance cover and the O-ring from the stator housing.

   This provide access to the terminal board/closed end splices.
2. Check the data plate to see which connections are required for the power supply.
3. Arrange the connections on the terminal board/closed end splices in accordance with the required power supply.
4. Connect the mains leads (L1, L2, L3, and ground (earth)) according to applicable cable chart.

   The ground (earth) lead must be 50 mm (2.0 in.) longer than the phase leads in the junction box of the unit.
5. Make sure that the pump is correctly connected to ground (earth).
6. Make sure that any thermal contacts incorporated in the pump are properly connected to the terminal block/closed end splices.
7. Install the entrance cover and the O-ring on the stator housing.
8. Fasten the screws on the entrance flange so that the cable insertion assembly bottoms out.

4.2.3 Connect the motor cable to the starter and monitoring equipment

DANGER: Explosion/Fire Hazard

Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is EN/ATEX-, MSHA- or FM-approved, then see the specific EX information in the Safety chapter before taking any further actions.

NOTICE:

Thermal contacts are incorporated in the pump.

NOTICE:

Thermal contacts must never be exposed to voltages higher than 250 V, breaking current maximum 5 A. It is recommended that they are connected to 24 V over separate fuses to protect other automatic equipment.

The single phase pumps must be equipped with a starter which has start and run capacitors.

A specially Flygt designed starter is required for the operation of single phase pumps. The connection of the motor cable to the starter is shown in the wiring diagram.

1. If thermal contacts are included in the pump installation, then connect the T1 and T2 control conductors to the monitoring equipment.

   If the temperature of the pumped liquid is above 40°C (104°F), then do not connect the T1 and T2 leads to thermal contacts.

   NOTICE:

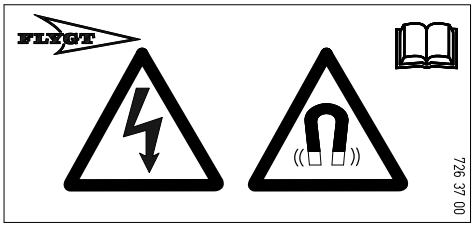
   The thermal contacts are incorporated in the stator. Connect them to 24 V over separate fuses to protect other automatic equipment.

2. Connect the mains leads (L1, L2, L3, and ground (earth)) to the starter equipment.

   For information about the phase sequence and the color codes of the leads, see Cable charts.

3. Applicable for permanent magnet motor; ensure that the warning label is attached to the cable end. In case the label is missing, attach the spare label to the cable end.

   The label is delivered with the pump.



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4. Check the functionality of the monitoring equipment:
   a) Check that the signals and the tripping function work properly.
   b) Check that the relays, lamps, fuses, and connections are intact.

   Replace any defective equipment.

4.2.4 Cable charts

Description

This topic contains general connection information. It also provides cable charts that show connection alternatives for use with different cables and power supply.

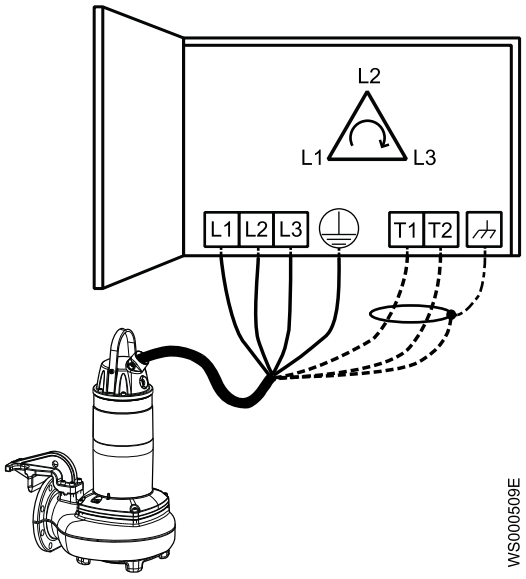
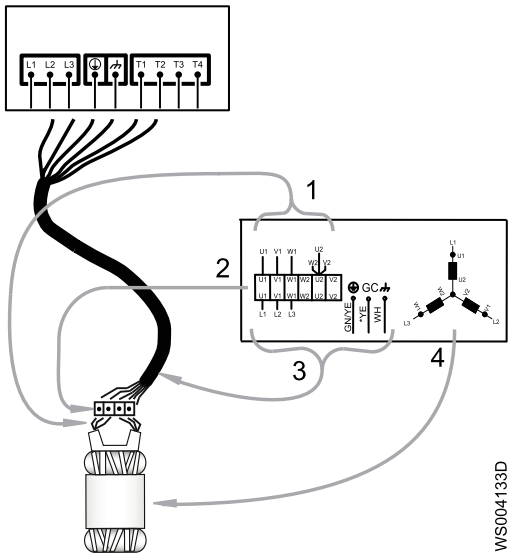


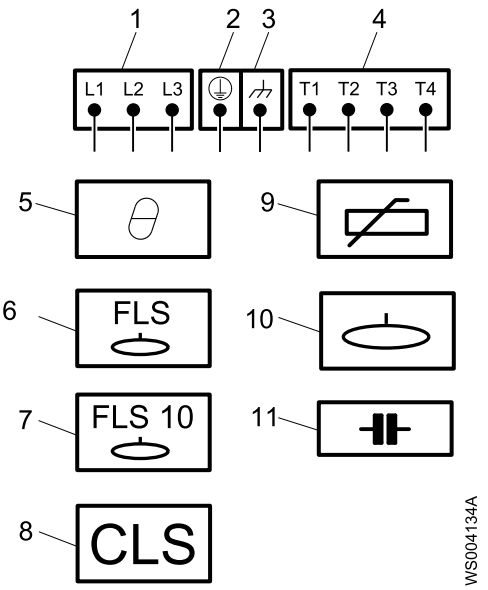
Figure 11: Phase sequence

Connection locations

The figures in this section illustrate how to interpret the connection strip symbols.



1. Stator leads
2. Terminal board
3. Power cable leads
4. Stator (internal connection illustrated)



1. Starter equipment and mains leads (L1, L2, L3)
2. ground (earth)
3. Functional ground
4. Control leads (T1, T2, T3, T4)
5. Thermal contact
6. FLS
7. FLS 10
8. CLS
9. Thermistor
10. Level sensor
11. Capacitor

Color code standard

Code	Description
BN	Brown
BK	Black
WH	White
OG	Orange
GN	Green
GNYE	Green-Yellow
RD	Red
GY	Grey
BU	Blue
YE	Yellow

4.2.4.1 Colors and markings of leads

Motor connection

Colours and marking of main leads

COLOUR STANDARD

BN=Brown
BK=Black
WH=White
OG=Orange
GN=Green
GN/YE=Green-Yellow
RD=Red
GY=Grey
BU=Blue
YE=Yellow

STATOR LEADS

U1,U5 RD
U2,U6 GN
V1,V5 BN
V2,V6 BU
W1,W5 YE
W2,W6 BK
T1,T2 WH/YE

*SUBCAB AWG
* * Ground Conductor is stranded around cores
GC=Ground Check

772 17 00 (REV 6)

Mains 1~	Mains 3~	SUBCAB 7GX Screenflex 7GX	SUBCAB 4GX Screenflex 4GX	SUBCAB AWG	SUBCAB Screened
1	L1	BK 1	BN	RD	BN
2	L2	BK 2	BK	BK	BK
3	L3	BK 3	GY	WH	GY
	L1	BK 4	-	-	-
	L2	BK 5	-	-	-
	L3	BK 6	-	-	-
⏚		GN/YE	GN/YE	GN/YE	**Screen/PE from cores
⏚		Screen (WH)	Screen (WH)	-	Screen (WH)
GC		-	-	YE	-

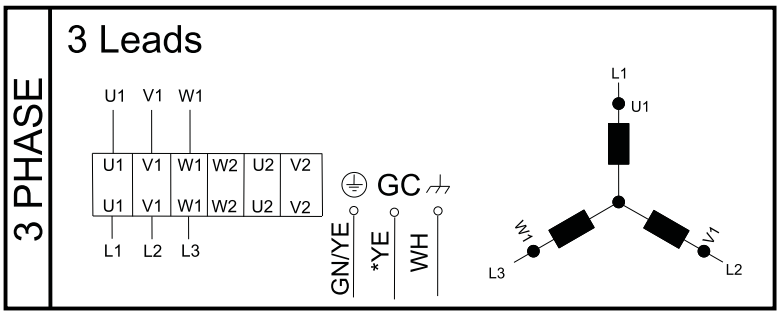
WS004125B

For markings on sensor leads, see *Sensors connection* on page 35.

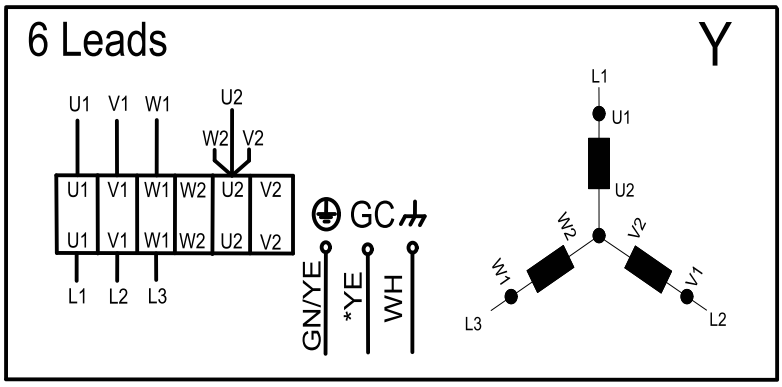
4.2.4.2 Connections included

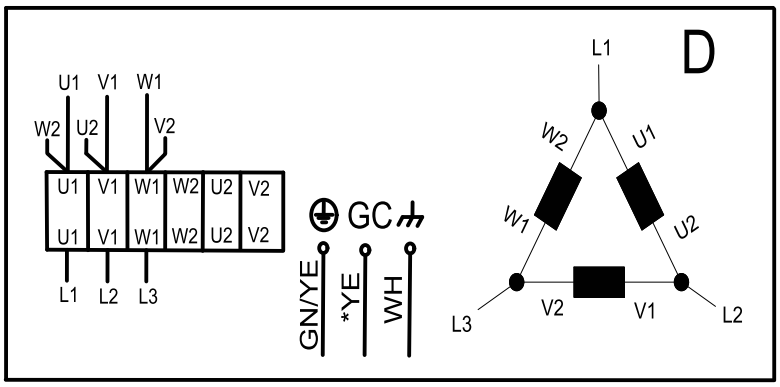
- *3-phase connection* on page 32
- *1-phase connection* on page 34
- *Sensors connection* on page 35
- *Screened cable connection* on page 35

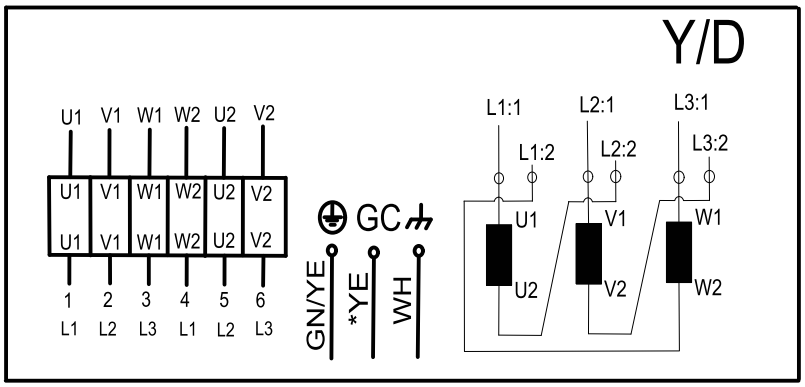
4.2.4.3 3-phase connection



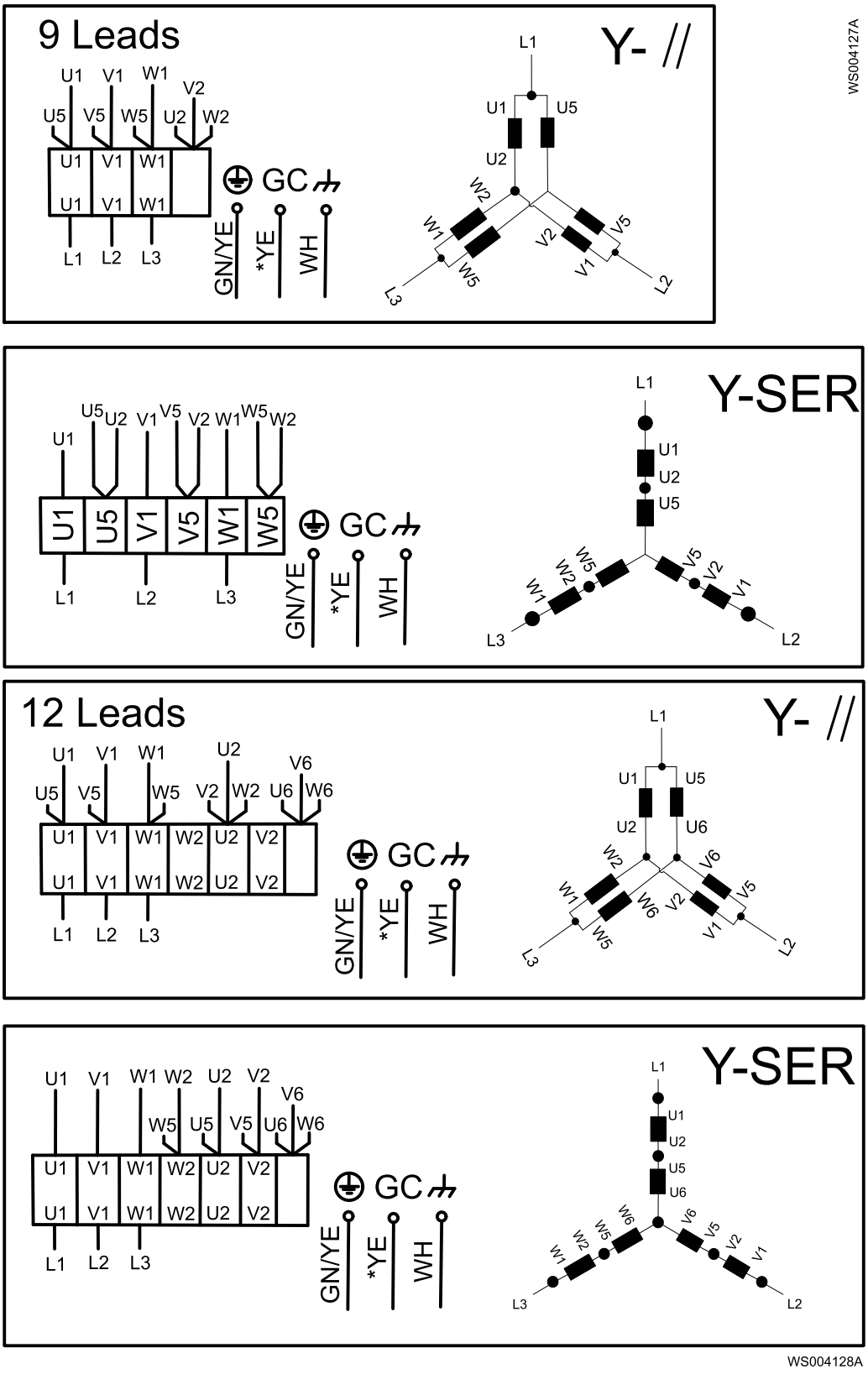
WS009162A



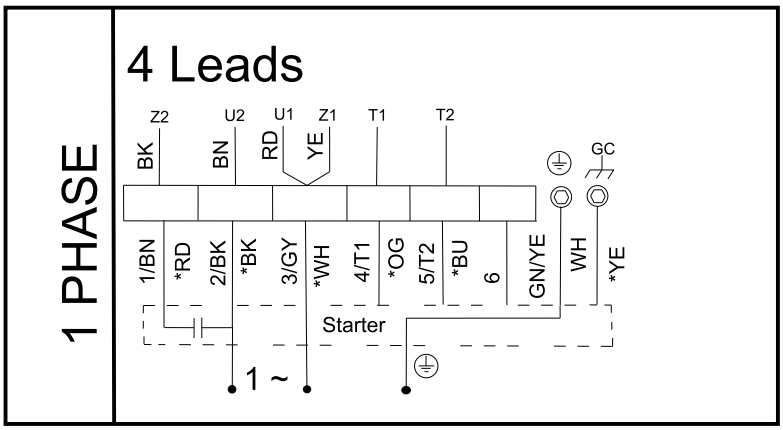


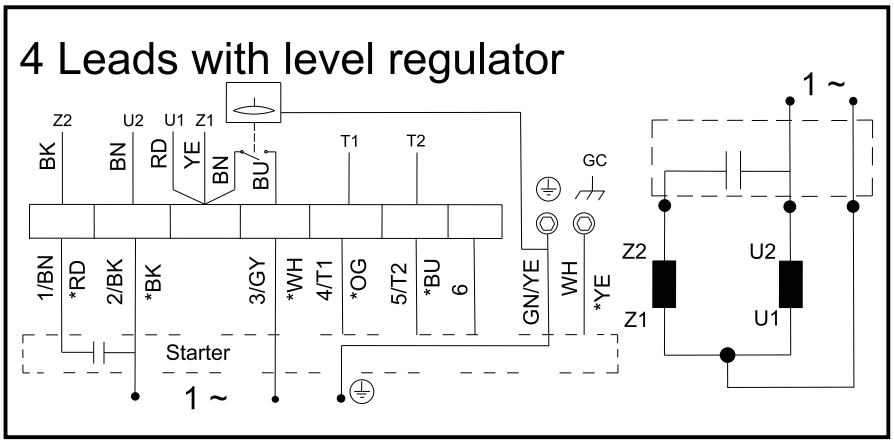


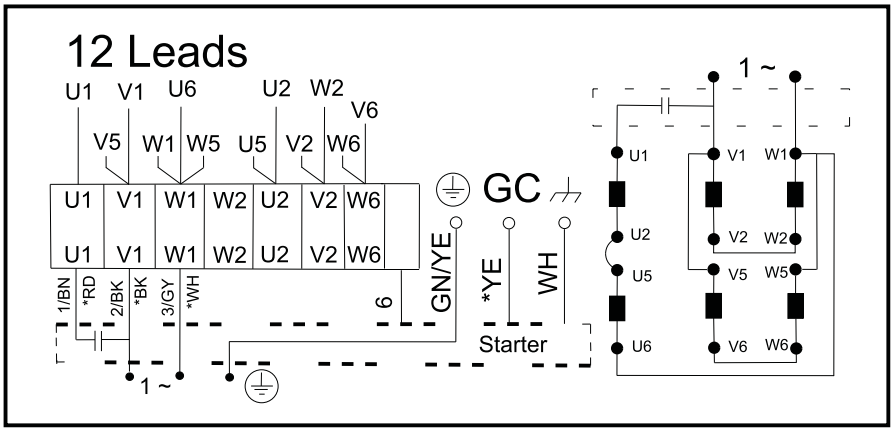
WS004126A


9 Leads
Y- //
U1 V1 W1 V2
U5 V5 W5 U2 W2
U1 V1 W1
U1 V1 W1
L1 L2 L3
GC
GN/YE
*YE
WH
L1
U1
U5
U2
W2
W1
W5
V2
V5
V1
L2
L3
WS004127A
Y-SER
U5 U2 V1 V5 V2 W1 W5 W2
U1
U1 U5 V1 V5 W1 W5
L1 L2 L3
GC
GN/YE
*YE
WH
L1
U1
U2
U5
W5
W2
W1
V5
V2
V1
L3
L2
12 Leads
Y- //
U1 V1 W1 U2 V6
U5 V5 W5 V2 W2 U6 W6
U1 V1 W1 W2 U2 V2
U1 V1 W1 W2 U2 V2
L1 L2 L3
GC
GN/YE
*YE
WH
L1
U1
U5
U2
U6
W2
V6
W1
W6
V2
V5
W5
V1
L3
L2
Y-SER
U1 V1 W1 W2 U2 V2 V6
W5 U5 V5 U6 W6
U1 V1 W1 W2 U2 V2
U1 V1 W1 W2 U2 V2
L1 L2 L3
GC
GN/YE
*YE
WH
L1
U1
U2
U5
U6
W6
W5
V6
W2
V5
W1
V2
V1
L3
L2
WS004128A

4.2.4.4 1-phase connection

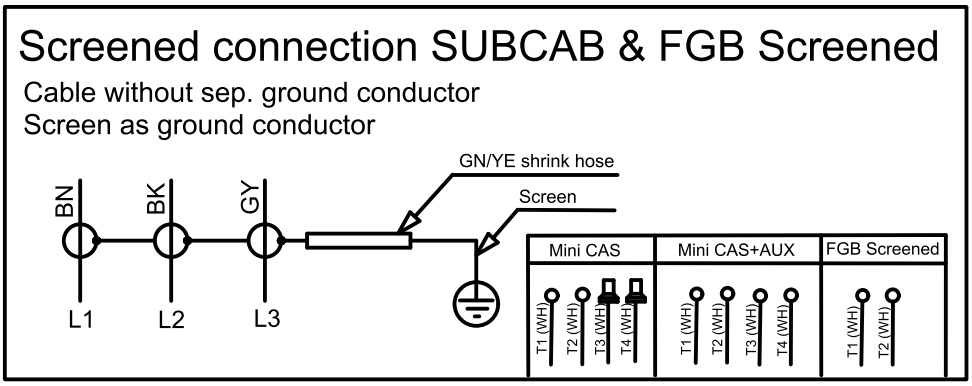


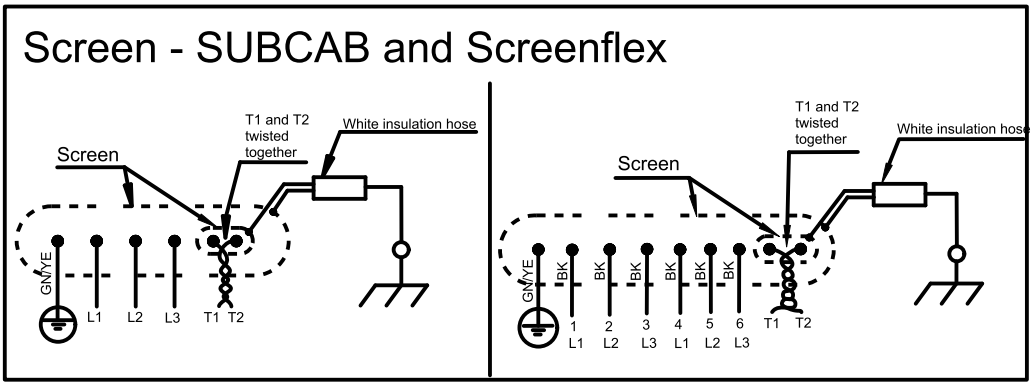




WS004129B

4.2.4.5 Screened cable connection

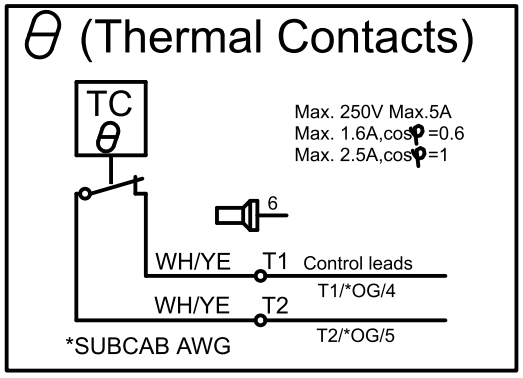


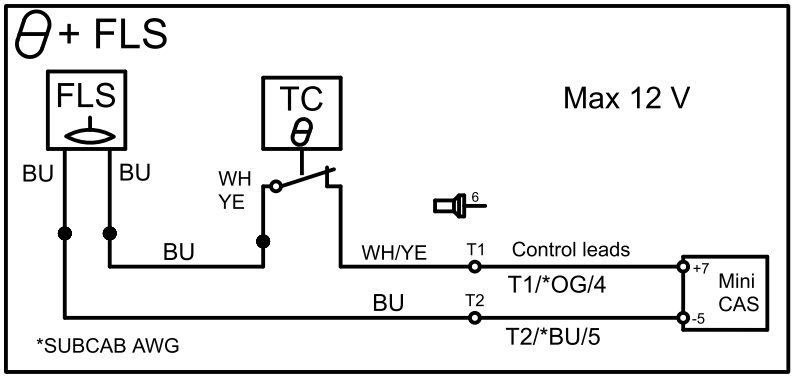


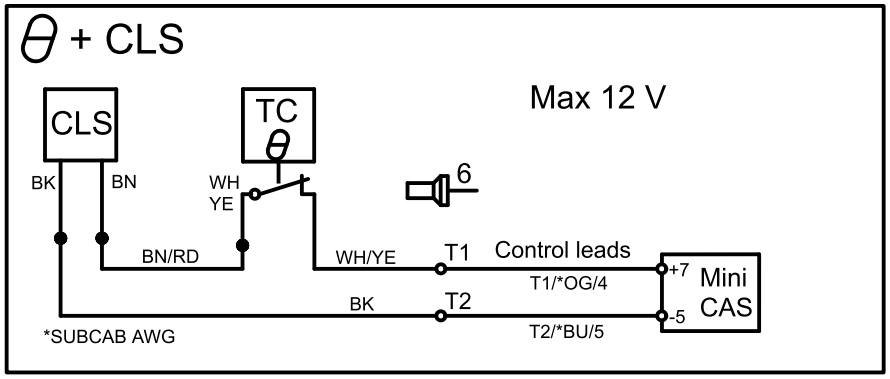
4.2.4.6 Sensors connection

Not all charts are applicable for every product.

SENSORS	Control	SUBCAB 7GX & 4GX Screenflex	SUBCAB AWG	SUBCAB screened
	T1	WH T1	OG	WH T1
	T2	WH T2	BU	WH T2
	T3	-	-	WH T3
	T4	-	-	WH T4







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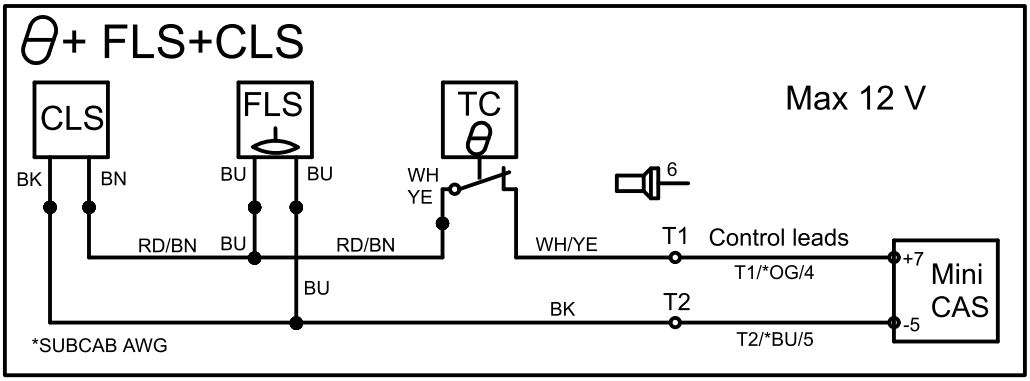
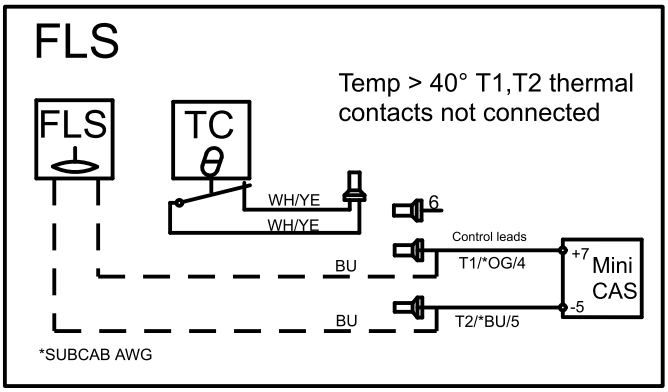




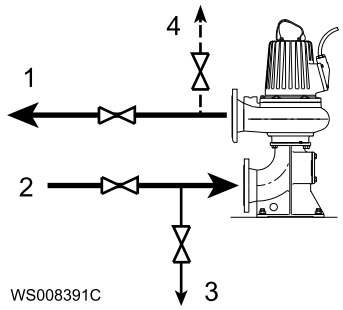
Sensor connection characteristics

The values have a 10 % tolerance.

Sensors	Value (mA)	Definition
FLS and thermal contact	0	Overtemperature
	7.8	OK
	36	Leakage
CLS and thermal contact	0	Overtemperature
	5.5	OK
	29	Leakage (5 seconds delay)
CLS, FLS and thermal contact	0	Overtempterature
	13.3	OK
	36–42	Leakage (0/5 seconds delay)

4.3 T-installation: Bleed air before starting pump

1. Open the valve on the air vent line and bleed out the air. See the following figure.



1. Outlet line
2. Inlet line

3. Line to drain
4. Air vent

Figure 12: T-installation

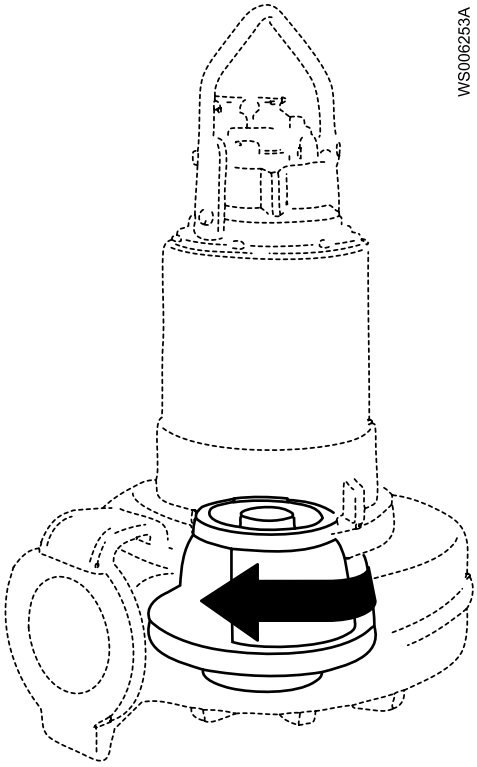
2. Close the valve on the air vent line before the pump is started.

4.4 Check the impeller rotation

CAUTION: Crush Hazard

The starting jerk can be powerful. Make sure nobody is close to the unit when it is started.

1. Start the motor.
2. Stop the motor after a few seconds.
3. Check that the impeller rotates according to this illustration.



The correct direction of impeller rotation is clockwise when you look at the pump from above.

4. If the impeller rotates in the wrong direction, then do one of these steps:
   - If the motor has a 1-phase connection, then contact a sales or authorized service representative.
   - If the motor has a 3-phase connection, then transpose two phase leads and do this procedure again.

5 Operation

5.1 Precautions

Before taking the unit into operation, check the following:

- All recommended safety devices are installed.
- The cable and cable entry have not been damaged.
- All debris and waste material has been removed.

NOTICE:

Never operate the pump with the discharge line blocked, or the discharge valve closed.

WARNING: Crush Hazard

Risk of automatic restart.

Distance to wet areas

WARNING: Electrical Hazard

Risk of electrical shock or burn. You must connect an additional ground- (earth-) fault protection device to the grounded (earthed) connectors if persons are likely to come into contact with liquids that are also in contact with the pump or pumped liquid.

CAUTION: Electrical Hazard

Risk of electrical shock or burn. The equipment manufacturer has not evaluated this unit for use in swimming pools. If used in connection with swimming pools then special safety regulations apply.

Noise level

NOTICE:

The sound power level of the product is lower than 70 dB(A). However, in some installations the resulting sound pressure level may exceed 70 dB(A) at certain operating points on the performance curve. Make sure that you understand the noise level requirements in the environment where the product is installed. Failure to do so may result in hearing loss or violation of local laws.

5.2 Estimate zinc anode replacement intervals

The mass and surface area of the zinc anodes are designed to protect the pump surface for 1 year in sea water with an average temperature of 20°C (68°F). Shorter inspection intervals and anode replacement can be required, depending upon the water temperature and the chemical composition as well as the presence of other metals in the vicinity of the pump.

The rate of zinc consumption, and the appropriate inspection intervals, can be estimated by measuring how much zinc is consumed during the first two months following installation.

Anodes are replaced when the anode mass is reduced to a selected fraction of its initial mass. The recommended interval for the selection fraction is 0.25–0.50 (25–50%).

1. Remove, weigh, and reinstall one or more of the exterior zinc anodes before starting up the pump.
2. After two months, remove and weigh the same zinc anode or anodes again.

3. Divide the lapsed time in days (between steps 1 and 2) by the anode weight loss in grams to get the calculated anode consumption rate (days/gram).

   If multiple anodes were weighed, then use the anode which has lost the most weight for this calculation.
4. Calculate future replacement intervals so that they occur when the selected fraction of zinc is remaining.

5.3 Start the pump

CAUTION: Crush Hazard

The starting jerk can be powerful. Make sure nobody is close to the unit when it is started.

NOTICE:

Make sure that the rotation of the impeller is correct. For more information, see Check the impeller rotation.

1. Check the oil level in the oil housing.
2. Remove the fuses or open the circuit breaker, and check that the impeller can rotate freely.

WARNING: Crush Hazard

Never put your hand into the pump housing.

3. Conduct insulation test phase to ground. To pass, the value must exceed 5 megaohms.
4. Check that the monitoring equipment works.
5. Start the pump.

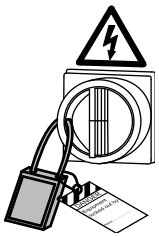
6 Maintenance

Precautions

Before starting work, make sure that the safety instructions in the chapter *Introduction and Safety* on page 3 have been read and understood.

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



WARNING: Biological Hazard

Infection risk. Rinse the unit thoroughly with clean water before working on it.

CAUTION: Crush Hazard

Make sure that the unit cannot roll or fall over and injure people or damage property.

Make sure that you follow these requirements:

- Check the explosion risk before you weld or use electrical hand tools.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product and its components have been thoroughly cleaned.
- Make sure that the work area is well-ventilated before you open any vent or drain valves, remove any plugs, or disassemble the unit.
- Do not open any vent or drain valves or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.

Ground continuity verification

A ground (earth) continuity test must always be performed after service.

Maintenance guidelines

During the maintenance and before reassembly, always remember to perform these tasks:

- Clean all parts thoroughly, particularly O-ring grooves.
- Change all O-rings, gaskets, and seal washers.
- Lubricate all springs, screws, O-rings with grease.

During the reassembly, always make sure that existing index markings are in line.

The reassembled drive unit must always be insulation-tested and the reassembled pump must always be test-run before normal operation.

6.1 Torque values

All screws and nuts must be lubricated to achieve correct tightening torque. Screws that are screwed into stainless steel must have the threads coated with suitable lubricants to prevent seizing.

If there is a question regarding the tightening torques, then contact a sales or authorized service representative.

Screws and nuts

Table 1: Stainless steel, A2 and A4, torque Nm (ft-lbs)

Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
50	1.0 (0.74)	2.0 (1.5)	3.0 (2.2)	8.0 (5.9)	15 (11)	27 (20)	65 (48)	127 (93.7)	220 (162)	434 (320)
70, 80	2.7 (2)	5.4 (4)	9.0 (6.6)	22 (16)	44 (32)	76 (56)	187 (138)	364 (268)	629 (464)	1240 (915)
100	4.1 (3)	8.1 (6)	14 (10)	34 (25)	66 (49)	115 (84.8)	248 (183)	481 (355)	–	–

Table 2: Steel, torque Nm (ft-lbs)

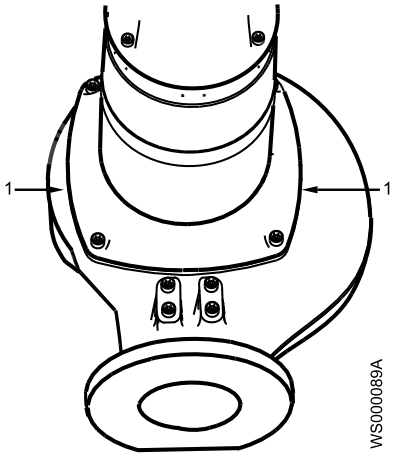
Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
8.8	2.9 (2.1)	5.7 (4.2)	9.8 (7.2)	24 (18)	47 (35)	81(60)	194 (143)	385 (285)	665 (490)	1310 (966.2)
10.9	4.0 (2.9)	8.1 (6)	14 (10)	33 (24)	65 (48)	114 (84)	277 (204)	541 (399)	935 (689)	1840 (1357)
12.9	4.9 (3.6)	9.7 (7.2)	17 (13)	40 (30)	79 (58)	136 (100)	333 (245)	649 (480)	1120 (825.1)	2210 (1630)

Hexagon screws with countersunk heads

For hexagon socket head screws with countersunk head, maximum torque for all property classes must be 80% of the values for property class 8.8 above.

6.2 Change the oil

This image shows the plugs that are used to change the oil.



1. Oil plug

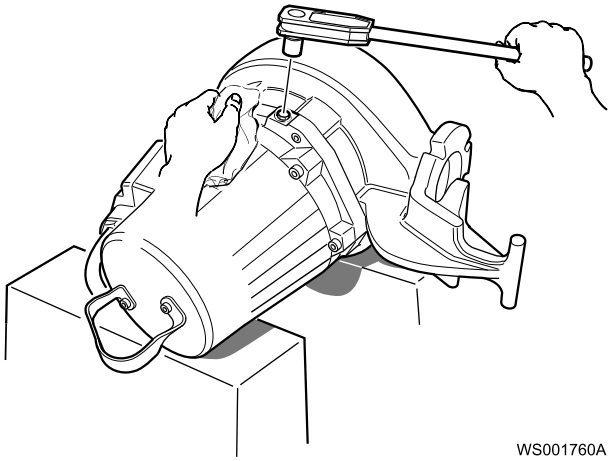
Empty the oil

CAUTION: Compressed Gas Hazard

Air inside the chamber may cause parts or liquid to be propelled with force. Be careful when opening. Hold a rag over the plug to prevent liquid from spraying out.

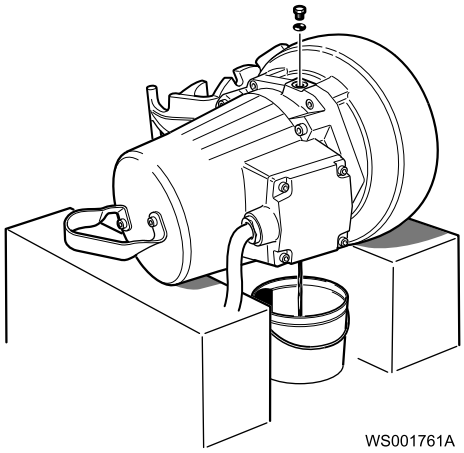
1. Place the pump in a horizontal position and unscrew the oil plug.

   If the pump has a hole with the markings "oil out" it is important that this hole is used for drainage.



2. Place a container under the pump and turn the pump.
3. Unscrew the other oil plug.

   If this hole has the markings "oil in", raise the pump upright for a short period of time during drainage in order to drain all the oil.



Fill with oil

The oil should be a medical white oil of paraffin type that fulfills FDA 172.878 (a) and viscosity close to VG32. Examples of suitable oil types are the following:

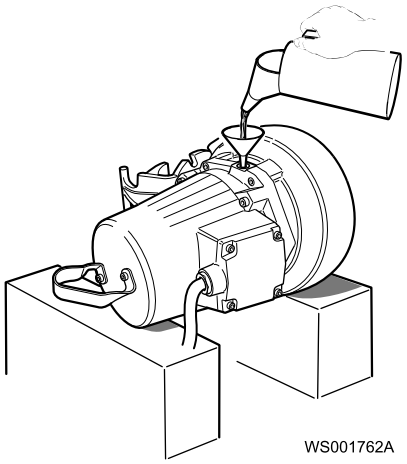
- Statoil MedicWay 32™
- BP Enerpar M 004™
- Shell Ondina 927™
- Shell Ondina X430™

1. Replace the O-rings of the oil plugs.
2. Refit an oil plug in the hole that faces downwards or is marked "oil out", and tighten.

   Tightening torque: 10-40 Nm (7.5-29.5 ft-lb)
3. Fill with oil through the hole on the opposite side or the hole marked "oil in".

   If the hole is marked "oil in", slightly tilt the pump and lower it again in order to fill the pump with the correct quantity.

   Quantity: approximately 1.0 L (1.1 qt).



4. Refit the oil plug and tighten.
   Tightening torque: 10-40 Nm (7.5-29.5 ft-lb).

6.3 Service the pump

Type of maintenance	Purpose	Inspection interval
Initial inspection	A Xylem-authorized personnel checks the pump condition. From the results, the personnel recommends the intervals for the periodical inspection and overhaul for the installation.	Within the first year of operation.
Periodical inspection	The inspection prevents operational interruptions and machine breakdowns. The measures to increase performance and pump efficiency are decided for each application. They can include such things as impeller trimming, wear part control and replacement, control of zinc-anodes and control of the stator.	Up to every year Applies to normal applications and operating conditions at media (liquid) temperatures <40°C (104°F).
Overhaul	The overhaul lengthens the operating lifetime of the product. It includes the replacement of key components and the measures that are taken during an inspection.	Up to every three years Applies to normal applications and operating conditions at media (liquid) temperatures <40°C (104°F).

NOTICE:

Shorter intervals may be required when the operating conditions are extreme, for example with very abrasive or corrosive applications or when the liquid temperatures exceed 40°C (104°F).

6.3.1 Inspection

Service item	Action
Cable	1. If the outer jacket is damaged, replace the cable. 2. Check that the cables do not have any sharp bends and are not pinched.
Connection to power	Check that the connections are properly secured.
Electrical cabinets	Check that they are clean and dry.
Impeller	1. Check the impeller clearance. 2. Adjust the impeller, if necessary.

Service item	Action
Stator housing	1. Drain all liquid, if any. 2. Check the resistance of the leakage sensor. Normal value approximately1500 ohms, alarm approximately 430 ohms.
Insulation	Use a megger maximum 1000 V. 1. Check that the resistance between the ground (earth) and phase lead is more than 5 megohms. 2. Conduct a phase-to-phase resistance check.
Junction box	Check that it is clean and dry.
Lifting device	Check that the local safety regulations are followed.
Lifting handle	1. Check the screws. 2. Check the condition of the lifting handle and the chain. 3. If necessary, replace.
O-rings	1. Replace the oil plug O-rings. 2. Replace the O-rings at the entrance or junction cover. 3. Grease the new O-rings.
Overload protection and other protections	Check the correct settings.
Personnel safety devices	Check the guard rails, covers, and other protections.
Rotation direction	Check the impeller rotation.
Oil housing	Fill with new oil, if necessary.
Terminal block/closed end splice	Check that the connections are properly secured.
Thermal contacts	Normally closed circuit; interval 0–1 ohm.
Voltage and amperage	Check the running values.

6.3.2 Overhaul

The basic repair kit includes O-rings, seals, and bearings.

For an overhaul, do the following in addition to the tasks listed under Inspection.

Service item	Action
Support and main bearing	Replace the bearings with new bearings.
Mechanical seal	Replace with new seal units.

6.3.3 Service in case of alarm

For information about indication values for sensors, see *Sensors connection* on page 35.

Alarm source	Action
CLS	Check for water in the oil housing. If the oil contains too much water, then do the following: 1. Drain the oil and water. 2. Replace with new oil.
FLS	1. Check for liquid in the stator housing. 2. Drain all liquid, if any. 3. Check the mechanical seal unit, the O-rings, and the cable entry, if liquid was found.
Thermal contact	Check the start and stop levels.
The overload protection	Check that the impeller can rotate freely.

6.4 Replace the impeller

Required tools:

- 8 mm hexagon bit adapter with an extension of at least 125 mm (4.92 in)
- Impeller puller

  If applicable, contact your local sales and service representative for correct type and size.
- Rod (wood or copper) for locking the impeller in place, if applicable
- Two crowbars, if applicable

CAUTION: Cutting Hazard

Worn parts can have sharp edges. Wear protective clothing.

NOTICE:

When laying the pump on its side, do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard and rough surfaces.

If you fail with the impeller installation, then you must redo the installation procedure from the beginning.

6.4.1 Replace the C- or D-impeller

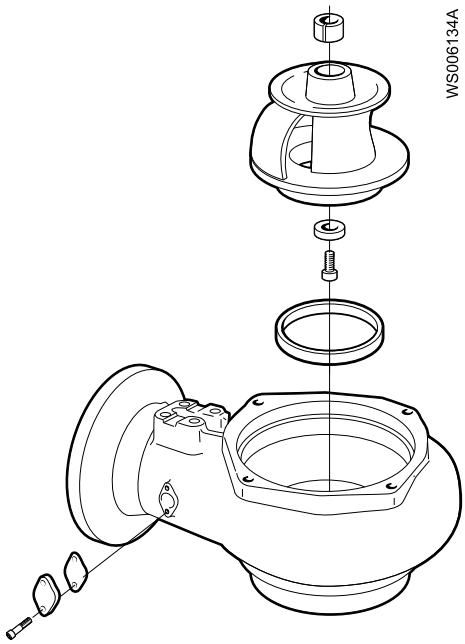


Figure 13: C-impeller

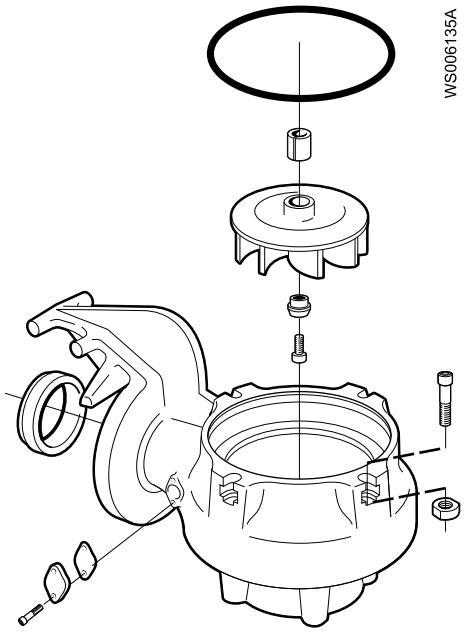


Figure 14: D-impeller

6.4.1.1 Remove the impeller: C, D

CAUTION: Cutting Hazard

Worn parts can have sharp edges. Wear protective clothing.

1. Remove the pump housing or the suction cover.

2. Remove the impeller screw.
   If applicable, use the rod.

Figure 15: C-impeller

Figure 16: D-impeller

3. Remove the washer.
4. Remove the impeller.
   Use the impeller puller or the crowbars.

Figure 17: D-impeller

5. Remove the conical sleeve.

6.4.1.2 Install the impeller: C, D

1. Prepare the shaft:

a) Polish off any flaws with a fine emery cloth.

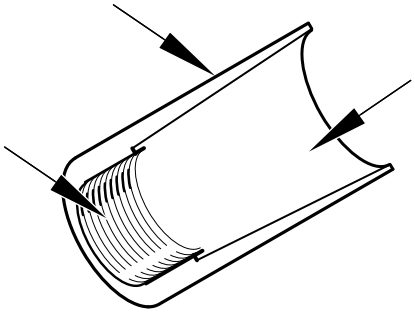
The end of the shaft must be clean and free from burrs.

b) Coat the inner conic, the outer cylindrical surfaces, and the thread of the conical sleeve with a thin layer of grease.

The proper lubrication is grease for bearings, for example Exxon Mobil Unirex N3, Mobil Mobilith SHC 220 or equivalent.

NOTICE:

Surplus grease can cause the impeller to become loose. Remove surplus grease from conical and/or cylindrical surfaces of shafts and/or sleeves.



WS006895A

2. Mount the impeller:

a) Fit the conical sleeve onto the shaft.

WS002022A

b) Lubricate the impeller screw threads and contact surface.

Ensure that all parts are clean.

c) Fit the washer on the lubricated impeller screw.

d) Press the impeller onto the shaft with the impeller screw.

NOTICE:

The impeller may get jammed against the oil housing bottom. Pull out the impeller a couple of mm, when mounting a C impeller with the pressure class LT.

3. Tighten the impeller screw.

If applicable, use the rod.

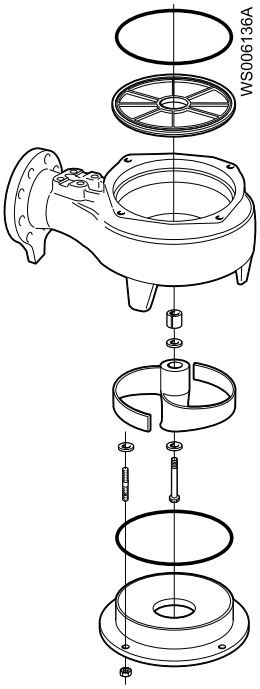
Tightening torque: 65 Nm (48 ft-lbs)

Tighten a further 1/8 turn, 45° after tightening to the correct torque.

Check that the impeller can rotate freely.

4. Mount the pump housing:
   a) T-, Z-installation only: Fit a new lubricated O-ring to the pump housing.
   b) Fit the pump housing.
   c) Fit and tighten the lubricated screws.
      Tightening torque: 57 Nm (42 ft-lb).

6.4.2 Replace the F-impeller



6.4.2.1 Remove the F-impeller

CAUTION: Cutting Hazard
Worn parts can have sharp edges. Wear protective clothing.

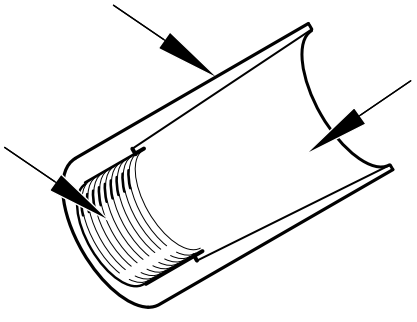
1. Remove the suction cover.
   If necessary, then pry off the suction cover.
2. Remove the impeller screw, the ring, and the washers.
   If applicable, use the rod.

3. Remove the impeller.
   Use the impeller puller or the crowbars.
   Use the impeller screw to push the impeller.
4. Remove the conical sleeve.

6.4.2.2 Install the F-impeller

1. Prepare the shaft:
   a) Polish off any flaws with a fine emery cloth.
      The end of the shaft must be clean and free from burrs.
   b) Coat the inner conic, the outer cylindrical surfaces, and the thread of the conical sleeve with a thin layer of grease.
      The proper lubrication is grease for bearings, for example Exxon Mobil Unirex N3, Mobil Mobilith SHC 220 or equivalent.

   NOTICE:
   Surplus grease can cause the impeller to become loose. Remove surplus grease from conical and/or cylindrical surfaces of shafts and/or sleeves.



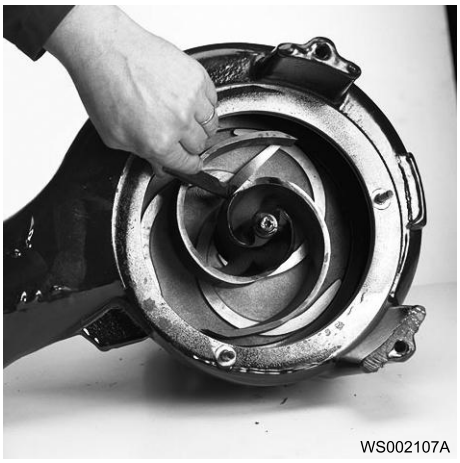
2. Mount the impeller:
   a) Fit the conical sleeve onto the shaft.
   b) Fit one plain washer with a thickness of 2 mm (0.08 in), eight adjustment washers with a thickness of 0.5 mm (0.02 in), and eight adjustment washers with a thickness of 0.2 mm (0.008 in) onto the impeller.

   c) Lubricate the impeller screw threads and contact surface.
      Ensure that all parts are clean.
   d) Press the impeller onto the shaft with the impeller screw.
3. Fasten the impeller:
   a) Prevent the impeller from rotating by inserting the rod through the pump housing outlet.
   b) Tighten the impeller screw.
      If applicable, use the rod.
      Tightening torque: 65 Nm (48 ft-lb).
      Tighten a further 1/8 turn, 45° after tightening to the correct torque.

Check that the impeller can rotate freely.

4. Adjust the impeller:
   a) Measure the distance between the edge of the impeller and the pump housing cover.

      The correct distance should be 0.5-1.5 mm (0.02-0.06 in). Add or remove the appropriate number of adjusting washers in order to achieve correct distance.



   b) Tighten the impeller screw.

      If applicable, use the rod.

      Tightening torque: 65 Nm (48 ft-lb).

      Check that the impeller can rotate freely.
5. Fit a new lubricated O-ring to the into the groove in the pump housing.

6. Mount the suction cover:
   a) Fit the studs on the pump housing.
      Use Loctite 603 locking liquid in order to secure the studs.
   b) Fit two adjustment washers with a thickness of 2 mm (0.08 in) and 8-10 adjustment washers with a thickness of 0.25 mm (0.01 in), onto each stud.

   c) Fit the suction cover to the studs.
   d) Fit the lock nuts onto the studs.
   e) Tighten the nuts.
      Tightening torque: 17 Nm (13 ft-lb)

7. Adjust the suction cover:
   a) Measure the distance between the impeller and the suction cover.
      The correct distance should be 0.5-1 mm (0.02-0.04 in). Add or remove the appropriate number of adjusting washers in order to achieve the correct distance.

b) Tighten the nuts.
Tightening torque: 17 Nm (13 ft-lb).

8. Raise the pump to a vertical position.
Check that the impeller can rotate freely.

6.4.3 Replace the M-impeller

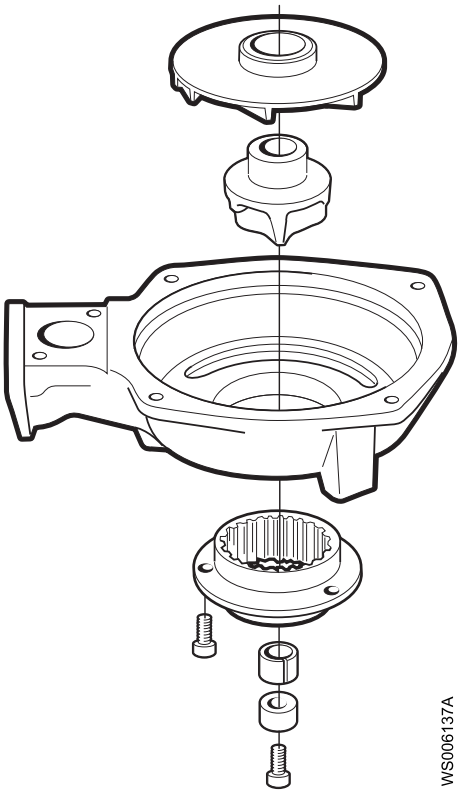


Figure 18: M-impeller

6.4.3.1 Remove the M-impeller

CAUTION: Cutting Hazard
Worn parts can have sharp edges. Wear protective clothing.

1. Remove the pump housing.
2. Remove the impeller screw and outer sleeve.
   If applicable, use the rod.

3. Refit the impeller screw.

WS001993A

4. Fit the impeller puller and pull off the impeller and cutting wheel.
   Place a protector between the screw head and the impeller puller.

WS002006A

5. Remove the conical sleeve.

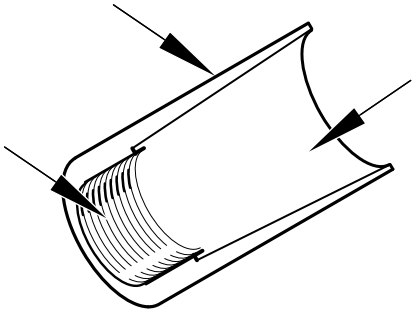
WS001987A

6.4.3.2 Install the M-impeller

1. Prepare the shaft:
   a) Polish off any flaws with a fine emery cloth.
      The end of the shaft must be clean and free from burrs.
   b) Coat the inner conic, the outer cylindrical surfaces, and the thread of the conical sleeve with a thin layer of grease.
      The proper lubrication is grease for bearings, for example Exxon Mobil Unirex N3, Mobil Mobilith SHC 220 or equivalent.

NOTICE:

Surplus grease can cause the impeller to become loose. Remove surplus grease from conical and/or cylindrical surfaces of shafts and/or sleeves.



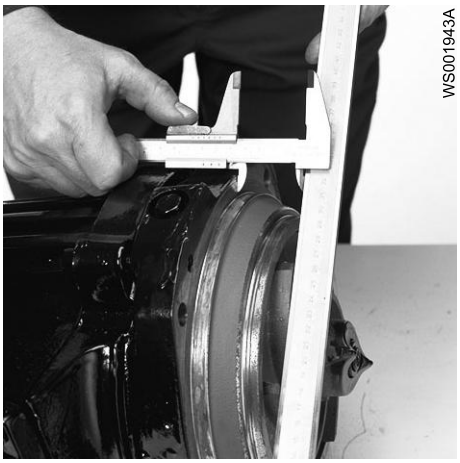
2. Mount the impeller:
   a) Fit the conical sleeve onto the shaft.

   b) Fit the cutting wheel into the impeller.
   c) Fit the outer sleeve onto the lubricated impeller screw.
   d) Fit the impeller with the cutting wheel onto the shaft with the impeller screw.

      Do not tighten the impeller screw.
3. Adjust the impeller:
   a) Use a straightedge and a vernier to measure the distance between the vanes of the impeller and the shoulder for the pump housing on the oil housing bottom.

Pressure class	Phase	Hz	Distance
LT	1	60	43.5±0.3 mm (1.71±0.01 in.)
LT	3	50, 60	46.0±0.3 mm (1.81±0.01 in.)
HT	1,3	50, 60	43.5±0.3 mm (1.71±0.01 in.)

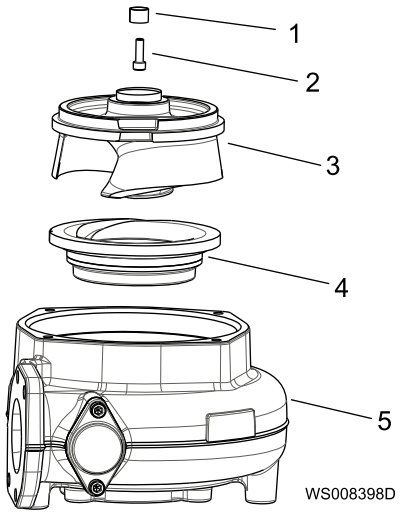
   b) Slide the impeller on to the shaft until you reach the correct distance.



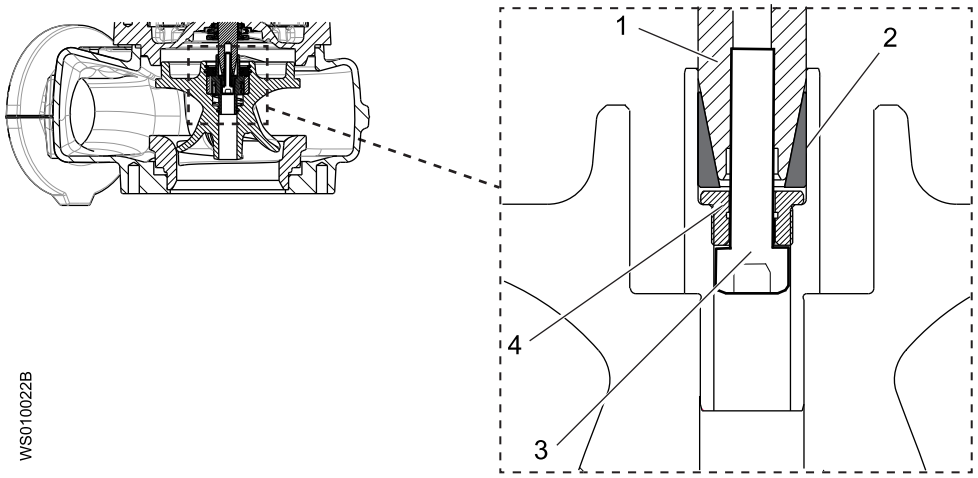
4. Tighten the impeller screw.
   If applicable, use the rod.
   Tightening torque: 65 Nm (48 ft-lbs)
   Tighten a further 1/8 turn, 45° after tightening to the correct torque.

   Check that the impeller can rotate freely.
5. Mount the pump housing:
   a) Fit a new lubricated O-ring into the pump housing.
   b) Fit the pump housing.
   c) Fit and tighten the lubricated screws.
      Tightening torque: 57 Nm (42 ft-lb).

6.4.4 Replacing the Adaptive N™ impeller



1. Conical sleeve
2. Impeller screw
3. Impeller
4. Insert ring
5. Pump housing



1. Shaft end
2. Conical sleeve
3. Impeller screw
4. Adjusting screw

CAUTION: Cutting Hazard

Worn parts can have sharp edges. Wear protective clothing.

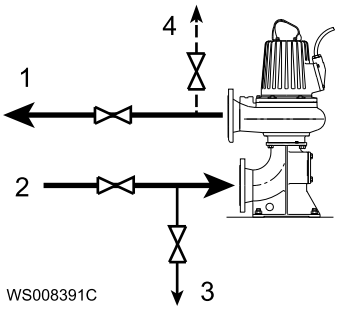
NOTICE:

When laying the pump on its side, do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard and rough surfaces.

6.4.4.1 Prepare the pump for removal: T-, Z-installations

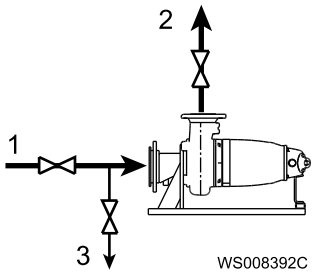
The pump must be removed from the installation to change the impeller.

1. Close the valves on the inlet and outlet lines.
   See the following figures.



1. Outlet line
2. Inlet line
3. Line to drain
4. Air vent

Figure 19: T-installation (generic pump shown)



1. Inlet line
2. Outlet line
3. Line to drain

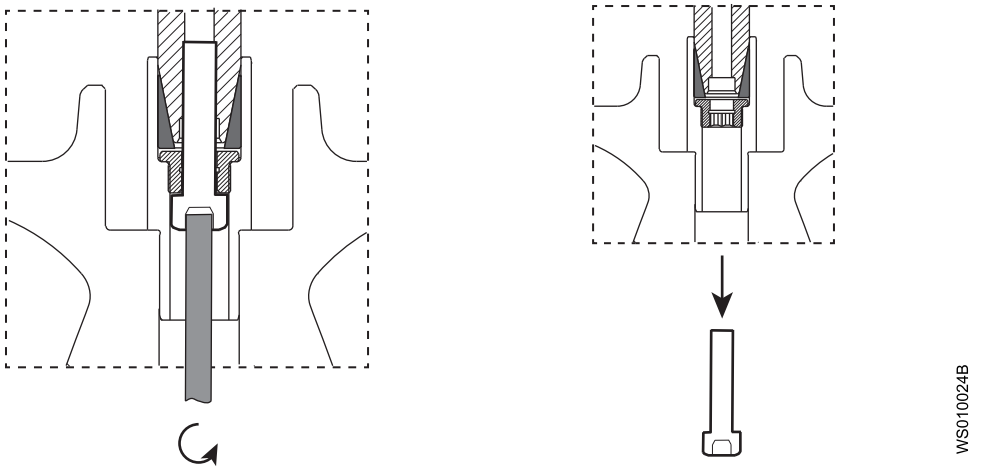
Figure 20: Z-installation (generic pump shown)

2. Drain the pump by opening the valve on the drain line.
3. Remove the pump from the installation.

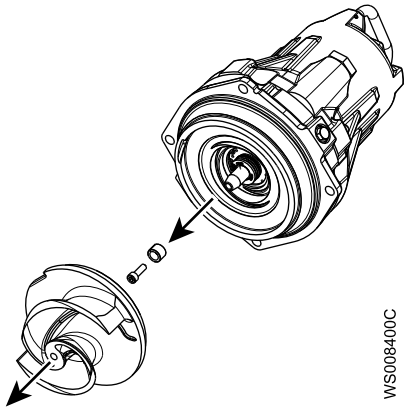
6.4.4.2 Remove the Adaptive N™ impeller: P, S, T, Z installations

To see which pumps are Adaptive N™, see *Product Description* on page 10.

1. Remove the pump housing.
2. Remove the impeller.
   a) Loosen the impeller screw.



   b) Remove the impeller.
      Use the impeller puller or the crowbars.
   c) Remove the impeller screw and the conical sleeve.

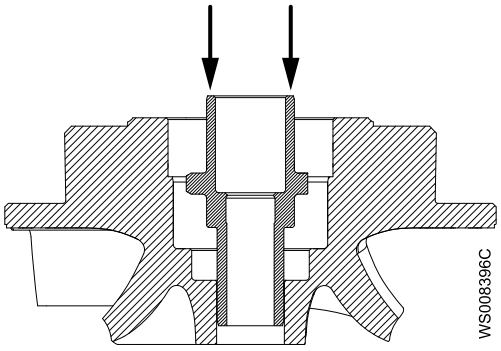


6.4.4.3 Install the Adaptive N™ impeller: P, S, T, Z installations

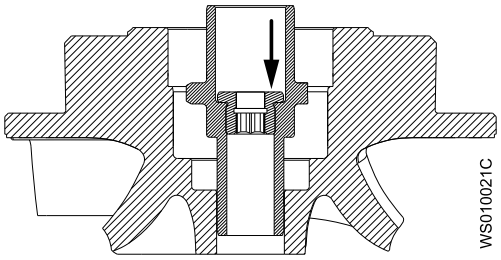
To see which pumps are Adaptive N™, see *Product Description* on page 10.

1. Before mounting the impeller, check that the sleeve moves freely up and down by pushing on it.

   When the sleeve is released, it should be fully pushed out again. If the sleeve does not move freely, or does not come fully out, then replace the impeller unit.

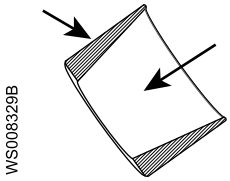


2. Check that the adjusting screw is correctly positioned in the new impeller.



3. Prepare the shaft:
   a) Polish off any flaws with a fine emery cloth.

      The end of the shaft must be clean and free from burrs.
   b) Coat the inner conic and the outer cylindrical surfaces of the sleeve with a thin layer of grease.

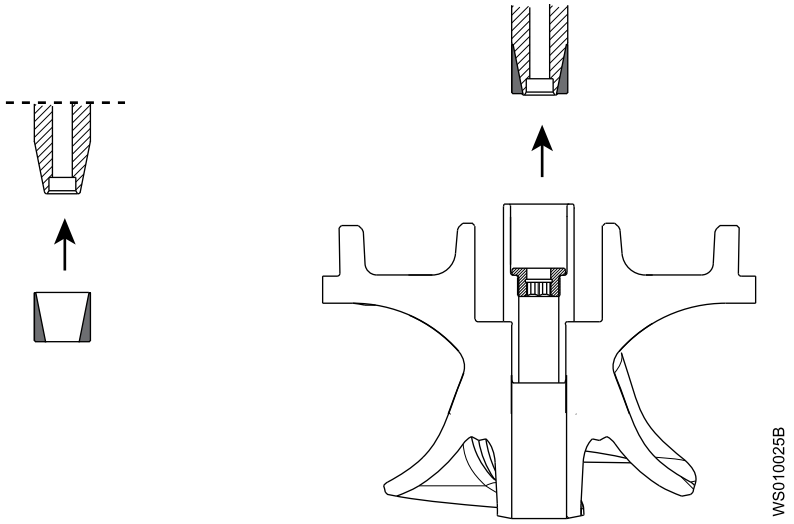


      The proper lubrication is grease for bearings, for example Exxon Mobil Unirex N3, Mobil Mobilith SHC 220 or equivalent.

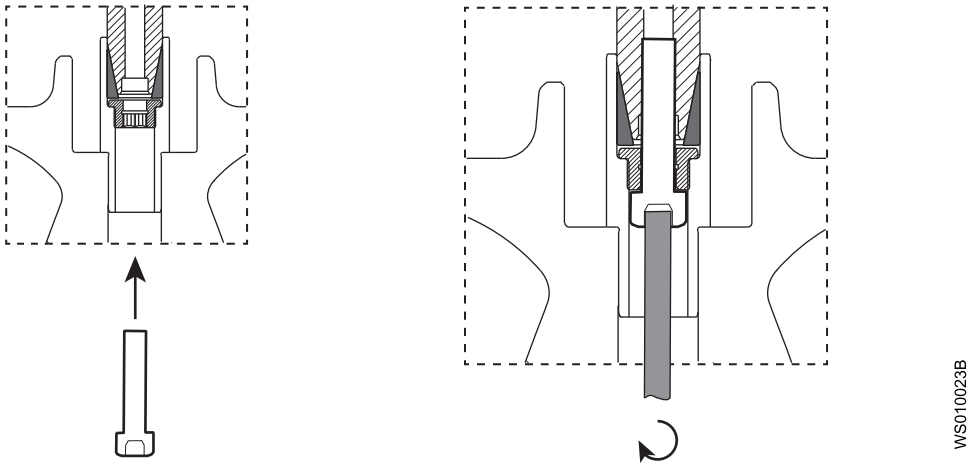
      NOTICE:

      Surplus grease can cause the impeller to become loose. Remove surplus grease from conical and/or cylindrical surfaces of shafts and/or sleeves.

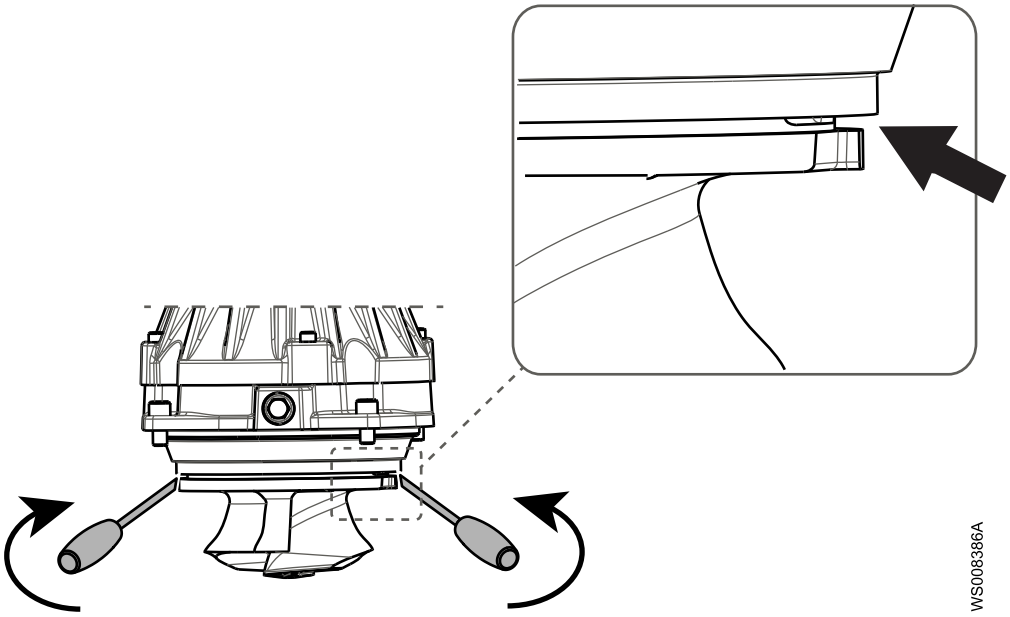
4. Mount the impeller sleeve and impeller.



5. Secure the impeller in place with the screw.



6. Check that the impeller is in its lowest position:
   a) Insert two screwdrivers as shown in the following figure, and push the impeller downwards.



7. Mount the pump housing:

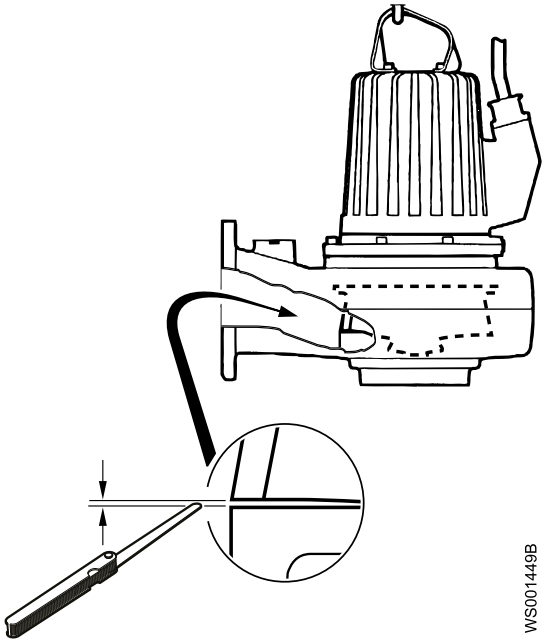
a) Fit the pump housing.
b) Fit and tighten the lubricated screws.
   Tightening torque: 57 Nm (42 ft-lb).

8. Loosen the impeller screw and turn the adjustment screw clockwise until the impeller makes contact with the insert ring.
9. Tighten the impeller screw.
   Tightening torque: 65 Nm (48 ft-lb).
   Tighten a further 1/8 turn, 45°, after tightening to the correct torque.
10. Check that the impeller can rotate freely.

WARNING: Crush Hazard

Beware of the pinch point hazard between the rotating impeller and the guide pin.

11. Check with an extended feeler gauge that the impeller clearance is 0.1–0.6 mm (0.004–0.024 in).



12. Re-install the pump.
    T-installations: See the instructions in *T-installation: Bleed air before starting pump* on page 37.

7 Troubleshooting

Introduction

DANGER: Electrical Hazard

Troubleshooting a live control panel exposes personnel to hazardous voltages. Electrical troubleshooting must be done by a qualified electrician.

Follow these guidelines when troubleshooting:

- Disconnect and lock out the power supply except when conducting checks that require voltage.
- Make sure that no one is near the unit when the power supply is reconnected.
- When troubleshooting electrical equipment, use the following:
  - Universal instrument multimeter
  - Test lamp (continuity tester)
  - Wiring diagram

7.1 The pump does not start

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
An alarm signal has been triggered on the control panel.	Check that: • The impeller rotates freely. • The sensor indicators do not indicate an alarm. • The overload protection is not tripped.

Cause	Remedy
The pump does not start automatically, but can be started manually.	Check that: • The start level regulator is functioning. Clean or replace if necessary. • All connections are intact. • The relay and contactor coils are intact. • The control switch (Man/Auto) makes contact in both positions. Check the control circuit and functions.
The installation is not receiving voltage.	Check that: • The main power switch is on. • There is control voltage to the start equipment. • The fuses are intact. • There is voltage in all phases of the supply line. • All fuses have power and that they are securely fastened to the fuse holders. • The overload protection is not tripped. • The motor cable is not damaged.
The impeller is stuck.	Clean: • The impeller • The sump in order to prevent the impeller from clogging again.

If the problem persists, then contact a sales or authorized service representative.

Always state the serial number of the product, see *Product Description* on page 10.

7.2 The pump does not stop when a level sensor is used

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

Cause	Remedy
The pump is unable to empty the sump to the stop level.	Check that: • There are no leaks from the piping and/or discharge connection. • The impeller is not clogged. • The non-return valve(s) are functioning properly. • The pump has adequate capacity. For information: Contact a sales or authorized service representative.

Cause	Remedy
There is a malfunction in the level-sensing equipment.	• Clean the level regulators. • Check the functioning of the level regulators. • Check the contactor and the control circuit. • Replace all defective items.
The stop level is set too low.	Raise the stop level.

If the problem persists, then contact a sales or authorized service representative.
Always state the serial number of the product, see *Product Description* on page 10.

7.3 The pump starts-stops-starts in rapid sequence

Cause	Remedy
The pump starts due to back-flow which fills the sump to the start level again.	Check that: • The distance between the start and stop levels is sufficient. • The non-return valve(s) work(s) properly. • The length of the discharge pipe between the pump and the first non-return valve is sufficiently short.
The self-holding function of the contactor malfunctions.	Check: • The contactor connections. • The voltage in the control circuit in relation to the rated voltages on the coil. • The functioning of the stop-level regulator. • Whether the voltage drop in the line at the starting surge causes the contactor's self-holding malfunction.

If the problem persists, then contact a sales or authorized service representative.
Always state the serial number of the product, see *Product Description* on page 10.

7.4 The pump runs but the motor protection trips

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
The motor protection is set too low.	Set the motor protection according to the data plate and if applicable the cable chart.
The impeller is difficult to rotate by hand.	• Clean the impeller. • Clean out the sump. • Check that the impeller is properly trimmed.
The drive unit is not receiving full voltage on all three phases.	• Check the fuses. Replace fuses that have tripped. • If the fuses are intact, then notify a certified electrician.
The phase currents vary, or they are too high.	Contact a sales or authorized service representative.
The insulation between the phases and ground in the stator is defective.	1. Use an insulation tester. With a 1000 V DC megger, check that the insulation between the phases and between any phase and ground is > 5 megaohms. 2. If the insulation is less, then do the following: Contact a sales or authorized service representative.
The density of the pumped fluid is too high.	Make sure that the maximum density is 1100 kg/m3 (9.2 lb/US gal) • Change the impeller, or • Change to a more suitable pump • Contact a sales or authorized service representative.
There is a malfunction in the overload protection.	Replace the overload protection.

If the problem persists, then contact a sales or authorized service representative.

Always state the serial number of the product, see *Product Description* on page 10.

7.5 The pump delivers too little or no water

DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.

WARNING: Electrical Hazard

The permanent-magnet motor generates voltage when the shaft rotates, even if power sources are disconnected. Never perform any electrical work if the shaft could rotate.

NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
The impeller rotates in the wrong direction.	• If it is a 3-phase pump, then transpose two phase leads. • If it is a 1-phase pump, then do the following: Contact a sales or authorized service representative.
One or more of the valves are set in the wrong positions.	• Reset the valves that are set in the wrong position. • Replace the valves, if necessary. • Check that all valves are correctly installed according to media flow. • Check that all valves open correctly.
The impeller is difficult to rotate by hand.	• Clean the impeller. • Clean out the sump. • Check that the impeller is properly trimmed.
The pipes are obstructed.	To ensure a free flow, clean out the pipes.
The pipes and joints leak.	Find the leaks and seal them.
There are signs of wear on the impeller, pump, and casing.	Replace the worn parts.
The liquid level is too low.	• Check that the level sensor is set correctly. • Depending on the installation type, add a means for priming the pump, such as a foot valve.

If the problem persists, then contact a sales or authorized service representative. Always state the serial number of the product, see *Product Description* on page 10.

8 Technical Reference

8.1 Application limits

Data	Description
Liquid temperature	40°C (104°F) maximum The pump can be operated at full load only if at least half the stator housing is submerged. 3102.060, 3102.160, 3102.181, 3102.185, 3102.760 • Warm-liquid version: 70°C (158°F) maximum
pH of the pumped media (liquid)	5.5–14
Liquid density	1100 kg/m³ (9.2 lb per US gal) maximum
Depth of immersion	Maximum 20 m (65 ft)
Other	For the specific weight, current, voltage, power ratings, and speed of the pump, see the data plate of the pump.

8.2 Motor data

Feature	Description
Motor type	3102.060/.070/.090/.095/.160/.170/.181/.185/.190/.760/.770/.890: • Squirrel-cage induction motor 3102.800/.810/.820/.830/.900/.910/.920/.930/.960/.970: • Line-started, permanent-magnet synchronous motor
Frequency	50 Hz or 60 Hz
Supply	1-phase or 3-phase
Starting method	Star-delta Soft starter Direct on-line Variable Frequency Drive (VFD)
Maximum starts per hour	30 evenly spaced starts per hour
Code compliance	IEC 60034-1
Voltage variation without overheating	±10%, if it does not run continuously at full load
Voltage imbalance tolerance	2%
Stator insulation class	H (180°C [360°F])

Motor encapsulation

Motor encapsulation is in accordance with IP68.

Xylem |ˈzīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services, and agricultural settings. With its October 2016 acquisition of Sensus, Xylem added smart metering, network technologies and advanced data analytics for water, gas and electric utilities to its portfolio of solutions. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com

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Visit our Web site for the latest version of this document and more information

The original instruction is in English. All non-English instructions are translations of the original instruction.

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