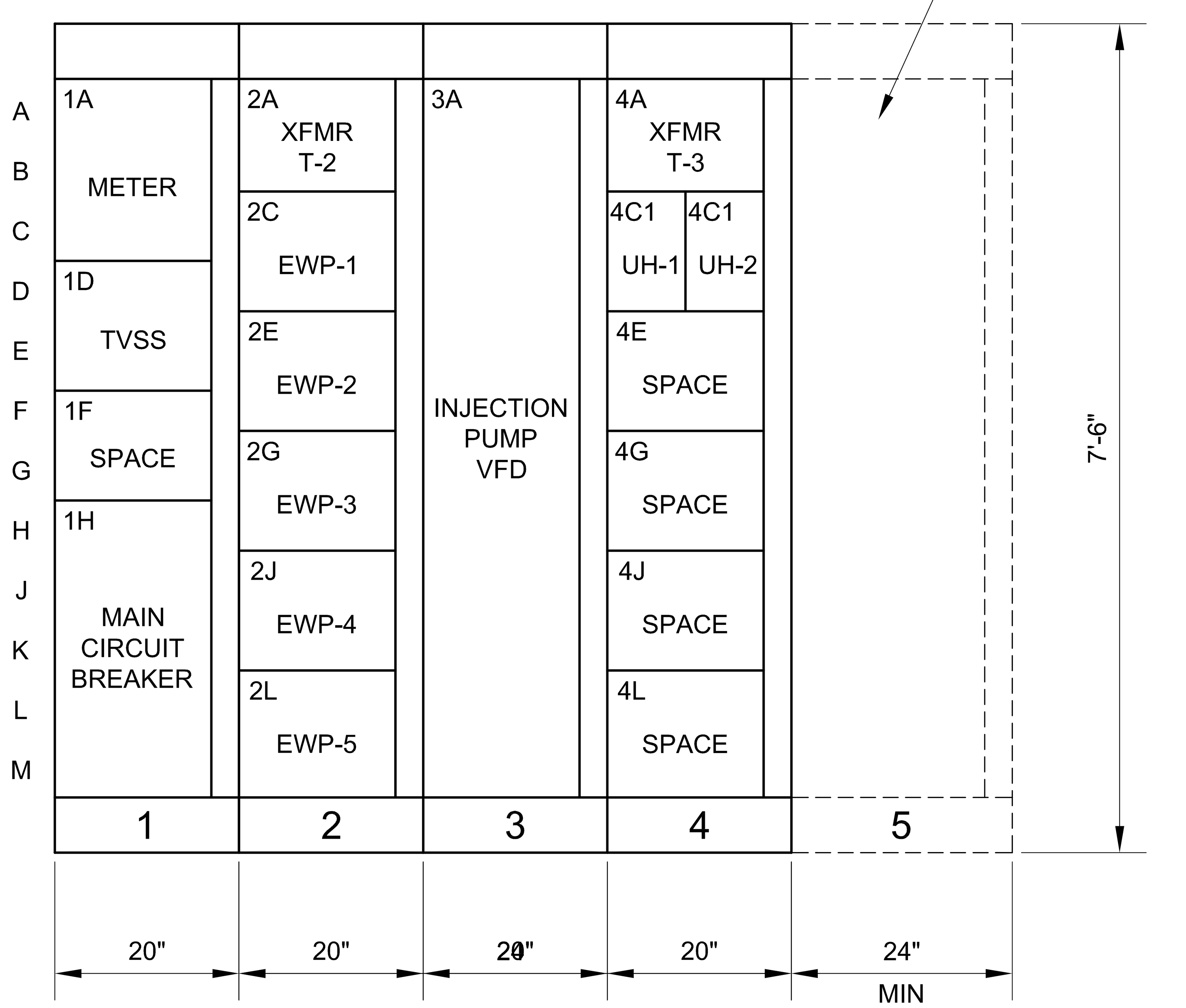
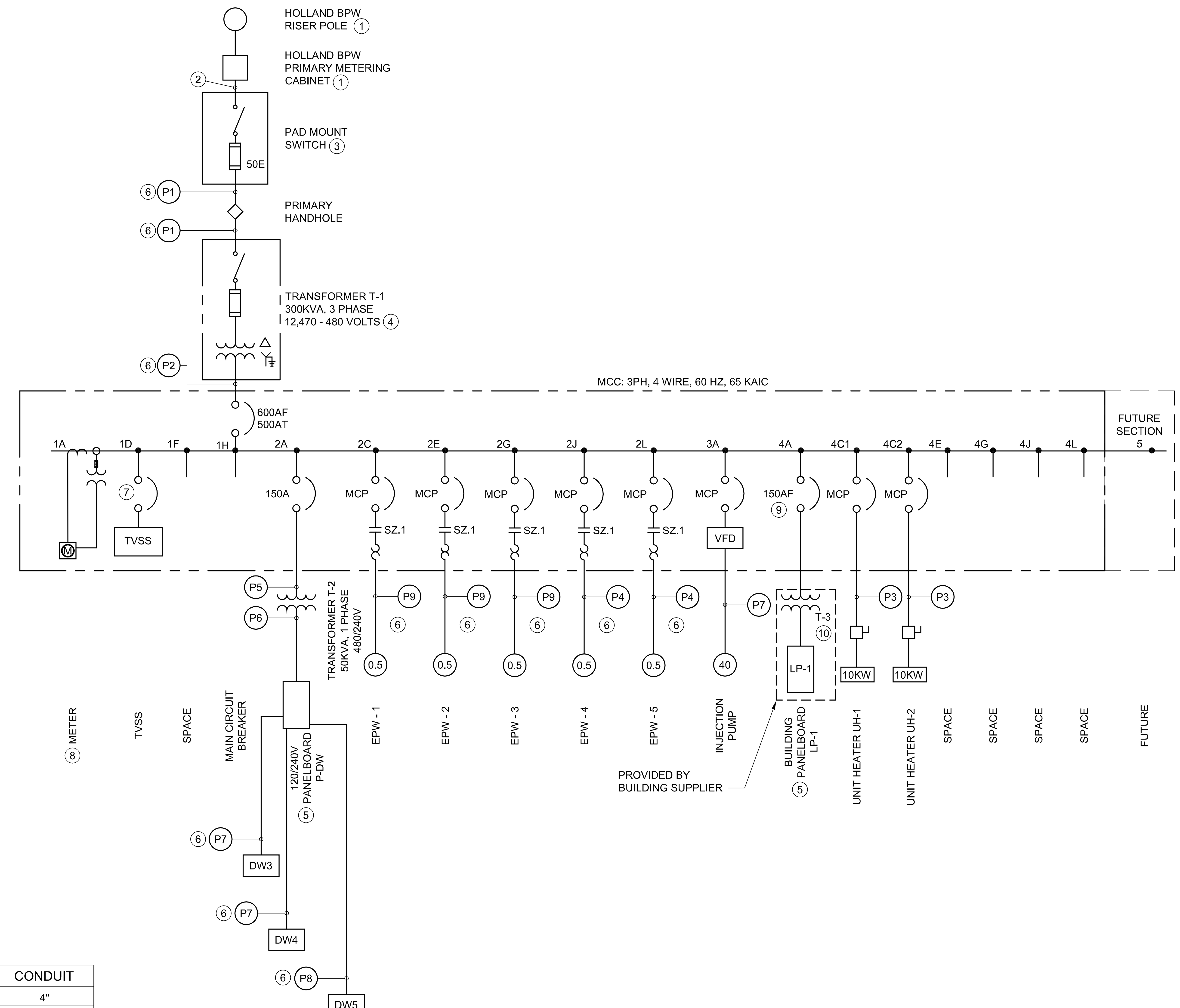
BUILDING 91
MOTOR CONTROL CENTER



MCC
ELEVATION
NOT TO SCALE



CIRCUIT NO.	CONDUCTORS	CONDUIT
P1	(3) # 2 (15-kV), 1 # 2 GND (600V)	4"
P2	2 SETS: (4) 250 MCM, (1) # 4 GND	2 SETS: 3"
P3	(3) # 12, (1) # 12 GND	3/4"
P4	(3) # 8, (1) # 10 GND	3/4"
P5	(2) # 1/0, (1) # 6 GND	1-1/4"
P6	(3) 350 MCM, (1) # 4 GND	3"
P7	(3) # 4, (1) # 8 GND	1"
P8	(3) # 1/0, (1) # 3 GND	2-1/2"
P9	(3) #10, (1) #10 GND	3/4"

GENERAL NOTES

1. REFER TO DRAWING E01 FOR GENERAL NOTES

KEY NOTES

1. BPW TO FURNISH AND INSTALL PRIMARY SERVICE AND METERING EQUIPMENT. PRIMARY SERVICE BY BPW SHALL INCLUDE RISER AT POLE AND UNDERGROUND CONDUCTORS TO METERING CABINET. BPW SHALL MAKE THE FINAL CONNECTION OF THE CUSTOMER'S TERMINATION TO BPW EQUIPMENT.
2. CONTRACTOR SHALL ROUTE UNDERGROUND PRIMARY FROM THE BPW METERING CABINET TO THE DISCONNECT SWITCH. PROVIDE A TWO HOLE NEMA STANDARD LUG FOR EACH CONDUCTOR AT SERVICE POINT.
3. PADMOUNTED SWITCH: 14.4-KV, 600 AMPERE, FUSED. PROVIDE SWITCH IN ACCORDANCE WITH SPECIFICATIONS AND BPW REQUIREMENTS. LOCATE ADJACENT TO BPW METERING CABINET AT A LOCATION THAT IS ACCESSIBLE TO BPW PERSONNEL.
4. TRANSFORMER T-1: PROVIDE PER SECTION 261265.
5. REFER TO DRAWING GW-E-06 FOR PANELBOARD SCHEDULE.
6. ROUTE IN UNDERGROUND CONDUIT.
7. PROVIDE MANUFACTURER'S STANDARD CIRCUIT BREAKER RATING FOR TVSS.
8. PROVIDE MULTI-FUNCTION DIGITAL POWER METER.
9. COORDINATE CIRCUIT BREAKER TRIP SETTING WITH BUILDING SUPPLIER.
10. SIZED BY BUILDING SUPPLIER, 30KVA MINIMUM.

AHutt
P:\BC-COLUMBUS\135656-pfizer-holland\CADD\2-Sheets\E-ELECTRICAL\E02.dwg
Mar 05, 2010 - 9:28am

BROWN AND CALDWELL
COLUMBUS, OHIO

SUBMITTED: ______ PROJECT MANAGER DATE: ______
APPROVED: ______ BROWN AND CALDWELL DATE: ______

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED: RA
DRAWN: KL
CHECKED: DM
CHECKED:
APPROVED:

EXTERNAL REFERENCES
STD22X34_no_grid.dwg

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	0	PRE- FINAL	DM	08/28/09	RI
	1	FINAL DESIGN	DM	10/16/09	RI
	2	ISSUED FOR BID	DM	11/13/09	RI
	3	ISSUED FOR CONSTRUCTION	DM	03/08/10	RI

ISSUED FOR CONSTRUCTION

GROUNDWATER EXTRACTION & TREATMENT
ELECTRICAL ONE LINE DIAGRAM
WARNER-LAMBERT COMPANY, LLC
HOLLAND, MI

FILENAME E02
BC PROJECT NUMBER 137875
CLIENT PROJECT NUMBER 148-N-18446717
DRAWING NUMBER GW-E-02
SHEET NUMBER 18 OF 23

7/18/09

APPENDIX B: Waste Analysis Plan

UIC WASTE ANALYSIS PLAN

Class I Hazardous Injection Wells

Warner-Lambert Company, LLC
a wholly-owned subsidiary of Pfizer Inc

Holland, Michigan Facility
Ottawa County

WDW No. 3: SW/4 of SW/4 of SW/4 of Section 20, Holland Township
WDW No. 4: SW/4 of SW/4 of SW/4 of Section 20, Holland Township
WDW No. 5: NW/4 of NW/4 of NW/4 of Section 29, Holland Township

US EPA Permit Nos.
WDW No.3: MI-139-1W-0003
WDW No.4: MI-139-1W-0004
WDW No.5: MI-139-1W-0005

November 2011

Revision of submittal: August, 2010

Revision of submittal: August, 2008

Prepared by:

Petrotek

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Fax: (303) 290-9580

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1.0 INTRODUCTION

1.A. Background

The purpose of this Waste Analysis Plan (WAP) is to characterize the wastewater to be injected into the Warner-Lambert Company LLC[1] Waste Disposal Well (WDW) No. 3, WDW No. 4 and WDW No. 5 at the Holland, Michigan facility. Warner-Lambert will be responsible for implementing this WAP. Until January 2008, the wells were operated as permitted, hazardous, non-commercial Class I industrial disposal wells dedicated to a bulk pharmaceutical manufacturing and research operation. Since that time, these wells converted for use to manage wastewater generated by a site groundwater remediation project, the characteristics of which only include a subset of the broader industrial wastewater characteristics previously injected. Concentrations of constituents disposed by injecting groundwater remediation derived wastewaters are lower than historical values based on more than 20 years of site groundwater monitoring data, as discussed in Section 3 of the 2010 Land Ban Exemption Petition Renewal.

Warner-Lambert has and shall continue to operate the wells consistent with Title 40 of the Code of Federal Regulations (40 CFR), Section §146.13 that requires operators of Class I underground injection wells to monitor and analyze the fluids injected "to yield representative data of their characteristics." This waste analysis plan has been prepared to fulfill the specifications of 40 CFR §146.68 such that the plan presents parameters for which the waste will be analyzed, methods and frequencies that will be used to test for these parameters, and methods that will be used to obtain representative samples of the waste to be analyzed.

1.B. Sources of Injectate

Wastewater to be injected in WDW Nos. 3, 4 and 5 is generated from site groundwater remediation activities and consists primarily of recovered groundwater with lesser amounts of storm water, well installation/operations/maintenance waters and associated maintenance and operations fluids. In general, this wastewater has a chemical signature that falls under the broader chemical characteristics of wastewater previously injected at the site. A brief description of the site's historic waste management and deep well injection activities is provided.

Historically, the Warner-Lambert Holland, Michigan facility primarily produced bulk active pharmaceutical ingredients and intermediates that were sent to other company affiliates for preparation of final dosage form and packaging. Raw materials brought to the facility were essentially pure chemicals and pharmaceutical intermediates. Manufacturing facility operations were discontinued in late 2007, and the manufacturing facilities have subsequently been dismantled.

The wastes and wastewaters historically produced at this facility included, but were not

[1] Warner-Lambert Company LLC was acquired by Pfizer Inc in 2000. Warner-Lambert Company is a wholly owned subsidiary of Pfizer Inc.

limited to: process waters; process wastewater and wash water; steam jet condensate; de-ionizer regeneration fluids; wastes derived from process development activities and off-specification products; wastes derived from air pollution control equipment; facility-wide cleaning and housekeeping and storm water run-off. Injectate historically was comprised of a mixture of these wastewaters that may have been untreated or treated in various ways.

1.C. Plan Summary

The Warner-Lambert wastewater characterization and monitoring program includes:

- Volume Monitoring
- Injectate Sampling and Analysis
- Quality Assurance/Quality Control

The WAP may be reviewed and, if necessary, revised if waste constituents are added to the approved waste stream that are likely to significantly alter the physical properties of the waste, or have the potential to impact the demonstration of hazardous waste containment. Any future revisions to the WAP, upon approval, will become part of the administrative record and constitute a minor modification of the permit. It should be noted that, as documented in the 1996, 2002 and 2008 permit renewal applications and illustrated by historical operations, compatibility problems between the waste and the subsurface rock matrix or with well construction materials that could affect the containment of waste were not projected and have not been considered an issue. Similarly, the groundwater recovered during site remediation activities will have less potential for injectate-rock-construction material incompatibilities, and as such these issues are not addressed in this WAP.

As noted previously, the wastewater to be injected in WDW Nos. 3, 4, and 5 will be generated from site groundwater remediation activities. These groundwater remediation activities are being conducted to address the facility's corrective action obligations pursuant to Part 111 of Michigan's Natural Resources and Environmental Protection Act (1994, as amended) as well as the Hazardous and Solid Waste Amendments (1984, as amended). The groundwater remediation plan, which includes installation of a slurry wall fully encircling the former manufacturing plant site with extraction of groundwater within the wall to maintain an inward gradient, was approved by the MDNRE on December 21, 2009. Pursuant to the MDNRE/MDEQ approval, it may be necessary from time to time to collect operational data characterizing water quality within the perimeter of the slurry wall. This may include collecting groundwater samples from the extraction system itself at various points upstream of the point of injection to monitor the performance of the remedial system. The scope and frequency of the collection of these types of operational data may change over time in response to operating conditions and/or requests from the MDNRE. These operational water quality data are not required for characterization of the injectate or compliance determinations under the UIC permit and are, therefore, outside the scope of the WAP. These data will be maintained at the site and made available to the US EPA upon request.

2.0 PROCEDURES

2.A. Volume Monitoring

As discussed in the text of the 2008 Permit Re-application and the 2010 Land Ban Exemption Renewal request, flow and pressure recorders will be utilized to continuously monitor injection pressure, annulus pressure, flow rate and totalized cumulative injectate volumes for the wells. A summary of recorded data will be provided to the US EPA per applicable permit requirements.

2.B. Waste Characterization

The following tables present injectate characterization parameters under the Warner-Lambert Class I well permits (MI-139-1W-0003, MI-139-1W-0004 and MI-139-1W-0005). Also included are applicable detection limits, regulatory or compliance limits (if any) and reporting units. Characterization parameters have been selected based on chemical constituents historically detected in site groundwater, evaluation of both characteristic (D-) and listed (F, P and U-) hazardous waste numbers applicable to site groundwater, and knowledge of historic site operations. Based on regulatory guidance and process knowledge, the identified injectate characterization parameters are intended to satisfy regulatory requirements and specifications listed in Attachment E of the applicable UIC permits.

Injectate will be monitored on a continuous, monthly and quarterly basis. Temperature, rate, and pressure will be monitored on a continuous basis during injection operations in accordance with applicable permit requirements. Specific gravity and pH will be monitored on a quarterly basis when injection operations take place. Tables 2-1 and 2-2 present injectate characterization constituents, regulatory limits and reporting units for continuous and monthly sampling.

Table 2-1
CONTINUOUS CHARACTERIZATION REQUIREMENTS

Test Parameter	Reporting Range	Minimum Resolution	Regulatory Limit	Reporting Units
Temperature	32-150	5	None	deg.F
Rate	0-100	2	75	gpm
Pressure	0-1500	5	1,048/1,049	psig

Table 2-2
QUARTERLY PHYSICAL/GENERAL CHARACTERIZATION REQUIREMENTS

Test Parameter	Reporting Limit	Regulatory Limit	Reporting Units
pH	0.5	>2, <12.5	pH units
Specific Gravity	0.9	None	-

Additional physical and chemical characteristics that will be monitored on a quarterly basis when injection operations take place are included on Table 2-3. The analyte list included on this table was developed to provide an accurate characterization of wastewater to be injected at the site, and is based primarily on an evaluation of: 1) constituents identified in site groundwater since 1990; 2) hazardous waste numbers applicable to identified groundwater constituents; and 3) generator knowledge.

Table 2-3
QUARTERLY CHEMICAL CHARACTERIZATION REQUIREMENTS

Test Parameter	Typical Reporting Limit *	UIC Permit Limits**	Units
Flash Point	68 deg. F	140 deg. F	deg. F
pH	0.5 units	2<pH<12.5	pH
Arsenic, Total (As)	0.005	5,000	mg/L
Barium, Total (Ba)	0.005	10,000	mg/L
Bicarbonate	10	NA	mg/L
Cadmium, Total (Cd)	0.0002	500	mg/L
Carbonate	10	NA	mg/L
Chloride	1.0	NA	mg/L
Chromium, Total (Cr)	0.005	10,000	mg/L
Cyanide, Total	0.005	10,000	mg/L
Iron	0.08	NA	mg/L
Lead, Total (Pb)	0.005	100	mg/L
Mercury, Total (Hg)	0.002	200	mg/L
Nitrate, Total	0.03	NA	mg/L
Potassium	0.2	NA	mg/L
Selenium, Total (Se)	0.005	5,000	mg/L
Silver, Total (Ag)	0.005	18,000	mg/L
Sulfate	1.0	NA	mg/L
Sulfide	1.0	NA	mg/L
Zinc, Total (Zn)	0.01	10,000	mg/L
Acetone	0.02	250,000	mg/L
Acetonitrile	0.001	100,000	mg/L
Aniline	0.02	600,000	mg/L
Benzene	0.001	100,000	mg/L
Chlorobenzene	0.001	1,000,000	mg/L
Chloroform	0.001	600,000	mg/L
2-Chlorophenol	0.005	400,000	mg/L

Test Parameter	Typical Reporting Limit *	UIC Permit Limits**	Units
Cresol, o-(2-methylphenol)	0.005	100,000	mg/L
Cresol, m-(3-methylphenol)	0.005	100,000	mg/L
Cresol, p-(4-methylphenol)	0.005	100,000	mg/L
Cresol, Total	0.005	100,000	mg/L
1,2 Dichloroethane	0.001	5,000	mg/L
1,1 Dichloroethylene (DCE)	0.001	7,000	mg/L
Dimethylformamide	25.0	100,000	mg/L
2,4-Dimethylphenol (o-Xylenol)	0.002	100,000	mg/L
Ethylbenzene	0.001	100,000	mg/L
N-Hexane	0.005	100,000	mg/L
Isopropanol	5.0	250,000	mg/L
Methanol	5.0	250,000	mg/L
Methyl Ethyl Ketone	0.005	100,000	mg/L
4-Methyl-2-pentanone (MIBK)	0.005	2,000	mg/L
Methylene Chloride	0.005	120,000	mg/L
Pentachlorophenol	0.02	1,000	mg/L
Phenol	0.005	1,000,000	mg/L
Phenytoin	0.03	1,000	mg/L
Pyridine	0.02	35,000	mg/L
Tetrachloroethylene	0.002	400,000	mg/L
Tetrahydrofuran	0.01	200,000	mg/L
Toluene	0.001	100,000	mg/L
1,1,1 Trichloroethane	0.001	200,000	mg/L
1,1,2 Trichloroethane	0.001	5,000	mg/L
Trichloroethylene	0.001	400,000	mg/L
Vinyl Chloride	0.001	160,000	mg/L
Xylene	0.002	100,000	mg/L

Notes: *reporting limits documented in quarterly analysis results may be higher than cited and/or standard method detection limits due to required sample dilution by laboratory.
**maximum concentrations based on values to be listed in UIC Permit Attachment E, the approved landban exemption petition, or limit for definition of hazardous waste cited for non-petition constituents, as applicable.

Table 2-3 compliance limits indicate concentrations that are not projected to be exceeded during future groundwater remediation activities. It is likely that average concentrations will be significantly lower than these values. Should the average concentration of any parameter exceed these values over 4 consecutive quarterly sampling events, the containment demonstration would be reviewed to ensure continued validity.

It should be noted that specific constituents that were evaluated as part of the previous Waste Analysis Plan have been omitted because these constituents were representative of injectate historically generated and disposed at the site during manufacturing operations, and are not projected to be present in remediation groundwater in significant concentrations.

2.C. Sampling and Analysis

For monthly and quarterly injectate characterization, a grab sample or suitable alternative will be collected during wastewater injection and evaluated for pH and specific gravity (Table 2-2) or organic and inorganic compounds (Table 2-3).

Warner-Lambert representatives or qualified contract personnel will collect the necessary on-site wastewater samples. Sampling procedures will be conducted at the direction of Warner-Lambert and the certified or accredited analytical laboratory and in accordance with the minimum standard US EPA procedures accepted on the date of this plan submittal. The sampler's name, sampling point, and date sampled will be documented. Additional discussion of the sampling procedure is presented in Section 3, Wastestream Information, and the attachments to this document.

Parameter measurements will be obtained and/or waste samples collected from the sample tap located at the discharge piping from the holding tank that will be used to collect remediation waste water prior to injection, or in the flowline downstream of any filtration, or at the wellhead from an active injector. The sample tap from the tank or flow line will be opened and the line flushed/purged until clear. Flow will then be sufficiently restricted from the sample tap flow line to allow complete filling of designated sample bottles or containers. Sufficient mixing of the waste stream will have occurred in the holding tank or flow line prior to sampling, thus ensuring collection of a representative sample.

Table 2-4 summarizes the sample preservation and analytical methods, and detection limits for each injectate characterization parameter. Preservation and analytical methods to be used will meet or exceed the standards cited below or as presented in Appendix I of 40 CFR Part 261, Table I of 40 CFR 136.3, or Appendix III of Part 261 that are in effect on the date of this plan submittal.

TABLE 2-4
WASTE PRESERVATION/ANALYTICAL METHODS QUANTIFICATION AND METHOD DETECTION LIMITS

Test Parameter	Preservation Method	Analytical Method	Anticipated Lower Quantification Limit (mg/L)*	Equipment
pH	N/A	US EPA 9045 PH probe US EPA 150.1	<1 to 14	Probe
Temperature	N/A	Thermometer	32°	Thermometer
Flash Point	None	ASTM - D93	70 - 140° F	Closed cup Flash point tester
Specific Gravity	None	Hydrometer ASTM D5057-90	0.9	Hydrometer
Arsenic, Total (As)	pH<2w/$HN0_3$	US EPA 200.8/6020A	0.005	ICP - MS
Barium, Total (Ba)	pH<2w/$HN0_3$	US EPA 200.8/6020A	0.005	ICP – MS
Bicarbonate	≤6°C	US EPA 4500-CO2 D	10	Titration
Cadmium, Total (Cd)	pH<2w/$HN0_3$	US EPA 200.8/6020A	0.0002	ICP - MS
Carbonate (Hardness)	pH<2w/$HN0_3$	US EPA 200.8/A2340C	2	ICP-MS / Titration
Chromium, Total (Cr)	pH<2w/$HN0_3$	US EPA 200.8/6020A	0.005	ICP - MS
Cyanide, Total	pH>12w/NaO H	US EPA 335.4/9012A	0.005	Cyanide distiller/Lachat
Iron, total (Fe)	pH<2w/$HN0_3$	US EPA 200.8/6020A	0.04	ICP - MS
Lead, Total (Pb)	pH<2w/$HN0_3$	US EPA 200.8/6020A	0.04	ICP - MS
Mercury, Total (Hg)	pH<2w/$HN0_3$	EPA 245.1/7470	0.0002	CVAA
Nitrate, total	≤6°C	US EPA 200.8/6500	0.03	IC
Potassium	HNO_3 to PH<2	US EPA 200.8/6020A 6010B	0.2	ICP - MS
Selenium, Total (Se)	pH<2w/$HN0_3$	US EPA 200.8/6020A	0.005	ICP - MS
Silver, Total (Ag)	pH<2w/$HN0_3$	US EPA 200.8/6020A	0.005	ICP - MS
Sulfate	≤6°C	US EPA 200.8/6500	1	IC
Zinc, Total (Zn)	pH<2w/$HN0_3$	US EPA 200.8/6020A	0.01	ICP - MS
Sulfide	Zinc Acetate/ NaOH	US EPA 9030 376.1/4500	1	Titration
Chloride	Cool to 4°	US EPA 9056	1	IC
Acetone	pH<2w/HCl	US EPA 8260B/624	0.02	GC/MS
Acetonitrile	pH<2w/HCl	US EPA 8260B/624	0.05	GC/MS
Aniline	Cool to 4°	US EPA 8270C/625	0.02	GC/MS
Benzene	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS
Chlorobenzene	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS

Test Parameter	Preservation Method	Analytical Method	Anticipated Lower Quantification Limit (mg/L)*	Equipment
Chloroform	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS
2-Chlorophenol	Cool to 4°	US EPA 8270C/625	0.005	GC/MS
Cresol, m-(3-methylphenol)	Cool to 4°	US EPA 8270C/625	0.005	GC/MS
Cresol,o-(2-methylphenol)	Cool to 4°	US EPA 8270C/625	0.005	GC/MS
Cresol, p-(4-methylphenol)	Cool to 4°	US EPA 8270C/625	0.005	GC/MS
Cresol, Total	Cool to 4°	US EPA 8270C/625	0.005	GC/MS
1,2- Dichloroethane	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS
1,1 DCE (dichloroethene)	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS
Dimethylformamide	pH<2w/HCl	US EPA 8015M	25.0	GC-FID
2,4-Dimethylphenol	Cool to 4°	US EPA 8270C/625	0.005	GC/MS
Ethylbenzene	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS
N-Hexane	pH<2w/HCl	US EPA 8260B/624	0.005	GC/Mass Spec.
Isopropanol	pH<2w/HCl	US EPA 8015	5.0	GC-FID
Methanol	pH<2w/HCl	US EPA 8015	5.0	GC-FID
Methyl Ethyl Ketone (2-Butanone)	pH<2w/HCl	US EPA 8260B/624	0.005	GC/MS
Methylene Chloride	pH<2w/HCl	US EPA 8260B/624	0.005	GC/MS
4-Methyl-2-pentanone (MIBK)	pH<2w/HCl	US EPA 8260B/624	0.005	GC/MS
Pentachlorophenol	Cool to 4°	US EPA 8270C/625	0.02	GC/MS
Phenanthrene	Cool to 4°	US EPA 8270C/625	0.005	GC/MS
Phenol	Cool to 4°	US EPA 8270C/625	0.002	GC/MS
Phenytoin (5,5-Diphenylhydantoin)	Cool to 4°	US EPA 8270C/625	0.03	GC/MS
Pyrene	Cool to 4°	US EPA 8270C/625	0.005	GC/MS
Pyridine	pH<2w/HCl	US EPA 8270C/625	0.02	GC/MS
Tetrachloroethylene	pH<2w/HCl	US EPA 8260B/624	0.002	GC/MS
Tetrahydrofuran	pH<2w/HCl	US EPA 8260B/624	0.01	GC/MS
Toluene	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS
1,1,1-Trichloroethane	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS
1,1,2-Trichloroethane	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS
Trichloroethylene	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS
Vinyl Chloride	pH<2w/HCl	US EPA 8260B/624	0.001	GC/MS
m,p-Xylene	pH<2w/HCl	US EPA 8260B/624	0.002	GC/MS

Notes: method = cited or alternate EPA method with equal or greater detection limit than method cited.
*The upper quantification limit is not provided because the constituents will be in remediation groundwater at concentrations that are anticipated to be well below any upper quantification value.

3.0 QUALITY ASSURANCE/QUALITY CONTROL

3.A. General Sampling and Analytical Information

Trained personnel are to conduct the sample collection and analysis. Sampling protocols outlined in this document are to be followed. Warner-Lambert will adhere to guidelines set forth in "Test Methods for Evaluating Solid Waste", SW-846 and "Methods for Chemical Analysis of Water and Wastes", EPA 600/4-79/020 or equivalents, for monthly and quarterly sampling, as appropriate. Approved sample preservation techniques from 40 CFR §136.3 or equivalent will be followed as appropriate. These will include preservation in plastic or glass sample containers provided by the laboratory and storage in a sample refrigerator or cooler for shipment to the laboratory. Offsite laboratories used for UIC waste characterization will participate in an accreditation or certification program recognized by state or federal entities. Warner-Lambert reserves the option to choose alternate laboratories for testing provided equivalent QA/QC standards are met.

QA/QC protocols will be followed for all sampling performed. Each sample that is taken will be accompanied by a Chain of Custody (COC) form. Warner-Lambert reserves the right to alter or substitute forms without modification to this WAP. Samples taken are to be logged in the field, sealed, and delivered to the laboratory with a COC form. Any Warner-Lambert or contract laboratory COC form used is to provide a record of sample handling starting with sample acquisition and documenting the process through laboratory analysis.

Standard COC protocols will be followed for sample waste collection, transport and analysis. Below are summaries of the minimum sampling and analysis protocols that will be followed for each characterization parameter:

Labeling

1. Sample ID including code or name, in addition to date and time
2. Name of sample collector; (include sampling company name if not Warner-Lambert);
3. Sample collection method;
4. Sample collection point;
5. Type of preservative (if any)
6. Required analysis

Reporting and Records Retention

Analytical reports and regulatory submittals regarding the nature and composition of injected fluids are to be maintained by Warner-Lambert until authorization is obtained from US EPA, in writing, to discard the records. Reports regarding waste minimization and characterization will be submitted as required by applicable RCRA regulations and the applicable UIC permit conditions. Laboratory reports submitted to US EPA will include, at a minimum, the following:

1. Reported concentration/value and analytical method;
2. Sample preservation technique, as appropriate;
3. Identification of analysis date and analyst;
4. Analytical method accuracy and reporting limits; and
5. Field documentation of sampling (i.e., COC).

3.B. Sampling Controls

The following sections present QA/QC controls and procedures that will be followed to ensure that the data collected meets data quality objectives (e.g., accuracy, precision, representativeness and sensitivity).

1. Equipment Blanks

Samples will be obtained directly from the sample tap on the injectate holding tank discharge piping system, or flow line downstream of any filtration, or at an injection well wellhead and will not be transferred to a secondary sample container or device before being sealed in the sample container to be shipped to the laboratory. In this case, no equipment blanks will be required.

If samples cannot be directly placed in the bottles intended for preservation and shipment, equipment blanks will be taken as deemed appropriate by Warner-Lambert. After sampling, sampling equipment (e.g., funnel, tubing) will be decontaminated according to the sampling plan protocol. The sampling equipment will be rinsed with deionized water and the rinsate collected in a sample container for transport to the laboratory for analysis of, at a minimum, the same parameters specified in the sampling plan above.

2. Trip Blanks

In the case of suspect contamination from any laboratory, trip blanks will be used and will consist of sample containers filled and sealed at the laboratory with laboratory grade water, which accompany the sample containers used throughout the sampling event. The sample containers shall be handled in the same manner as the samples. The trip blank(s) will be sent to the laboratory for analysis of, at a minimum, the same parameters specified in the sampling plan above. A minimum of one (1) trip blank per sampling event will be utilized, when deemed necessary by Warner-Lambert. At the discretion of Warner-Lambert, trip blanks may be submitted with any sample.

3. Sample Duplicates

On advance written request of US EPA, duplicate samples will be taken to further assess the QA/QC program of the laboratory conducting the analysis. Such samples will be collected from the same location as the primary samples. Any duplicate samples will be obtained in a manner to emphasize sample representativeness. Suitable procedures will involve consecutive sample collection from the same sample tap or equivalent alternative. The duplicate will be labeled with a sample number that will not conflict with the other samples, but will not be discernable to the laboratory as a duplicate sample. At US EPA's request, or at the discretion of Warner-Lambert representatives, one duplicate sample per selected sampling event will be taken and analyzed for the same parameters specified for the applicable sampling event.

4. Sample Chain-of-Custody Protocol

Sample chain-of-custody will be followed at all times during the sample collection and subsequent analysis. Chain-of-custody will be used to document the handling and control necessary to identify and trace a sample from collection through final analysis. Standard laboratory COC forms will be used that document the times and dates of all personnel handling the sample, and all sample containers will have labels sufficient to distinguish between samples.

3.C. Analytical Controls

1. Equipment Calibration

Warner-Lambert will require that selected laboratories maintain QA/QC data regarding the frequency and type of instrument calibration performed at the laboratory and in the field. Any calibration of thermometers, gauges, chromatographs, spectrometers and other analytical equipment will be conducted according to appropriate instrument manufacturer specifications and manufacturer recommended frequencies or as dictated by applicable laboratory QA/QC plans that have been developed by the laboratory for participation in applicable certification or accreditation programs.

2. Data Reduction

The process of transcription of the raw data into the reportable units will be conducted by the laboratory in accordance with the selected laboratory's QA/QC plan. Data reduction utilized in the analysis and the reporting process will be presented in the reports to the US EPA for each sampling event, as will be the parameters tested by the specific laboratory used at the time. Data will be recorded on hand written or computer work sheets that will include identification data, sample data and all data required for calculations, or on computer print-outs accompanied by operator notes and summaries.

3. Data Verification

Data verification will be conducted after each sampling event by assigned laboratory personnel and will include, at a minimum, review of chain-of-custody forms, equipment calibration records and data completeness. Spot checks of raw data versus reported data will be performed to review math and transcription accuracy, significant numbers and reporting units as applicable. In addition, certified laboratory standard quality assurance/quality control checklists will be utilized for individual test methods such as blanks, standards, and comparisons of internal lab test duplicate results. Problems with any of these items will be indicated in the analytical report presented to the agency.

4. Internal Quality Control

Per the laboratory QA/QC program, certified quality control samples will be run periodically with sample batches obtained from appropriate commercial sources, or the US EPA. Internal quality control will be addressed by disclosure of the laboratory's use of blanks, blind standards, matrix spikes and matrix spike duplicates, preparation of reagents, and laboratory duplicate or replicate analyses.

3.D. Actions

1. Laboratory Audits

Laboratory audits will be performed at a minimum of once every five years, and may be conducted on a more frequent basis should issues arise or if corrective actions are implemented. Audits will include both laboratory and will be performed by individuals who are qualified to perform required auditing services. Corrective actions will be implemented by laboratories if the analytical or sampling methods do not achieve plan objectives or data verification identifies inconsistencies in the results. Actions may entail re-sampling the waste stream and/or re-analyzing the fluid for a particular parameter, re-calibrating an analytical device, or other appropriate actions as dictated by the specific situation encountered. Action levels will be taken in accordance with SW 846 or other approved US EPA methods. Warner-Lambert representatives may, at their discretion, require re-sampling and retesting to confirm results that fall outside the historical range of expected analytical results, or outside equipment calibration curves.

2. Reports to US EPA Region 5 and MDNRE

Compliance Reports will contain results, data and sampling descriptions regarding the accuracy, completeness and repeatability of the reported analytical results. The report will contain a table that specifies the type of sample (blank, waste matrix, etc.), sampling date, sampling location, analytical method, method detection limit and analytical result. The results of analyses and all accompanying data, including chain-of-custody forms, will be reported with each quarterly report, unless prior arrangements have been made with the Agency.

3.E. Re-Characterization

The results of quarterly analytical testing will be reviewed by Warner-Lambert to ensure that remediation wastewater is sufficiently characterized. The waste characterization parameters will be modified if data indicate a change in the facility waste stream or as necessitated or required by regulation.

If site information leads Warner-Lambert to believe that remediation wastewater may contain additional or fewer constituents than those listed in Table 2-3, modifications to the analytical suite may be required. Any future revisions to the WAP, upon approval by EPA, will become part of the administrative record and constitute an updated permit requirement and constitute a minor modification of the permit.

APPENDIX C: Instrumentation Manuals

Reference Manual
00809-0100-4663, Rev BA
January 2010

Rosemount 8732

Integral Mount or Remote Mount Magnetic Flowmeter System with FOUNDATION™ fieldbus

FOUNDATION

ROSEMOUNT®

EMERSON™
Process Management

Integral Mount or Remote Mount Magnetic Flowmeter System with FOUNDATION™ fieldbus

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.

Rosemount Inc. has two toll-free assistance numbers:

Customer Central
Technical support, quoting, and order-related questions.

United States - 1-800-999-9307 (7:00 am to 7:00 pm CST)

Asia Pacific- 65 777 8211

Europe/ Middle East/ Africa - 49 (8153) 9390

North American Response Center
Equipment service needs.

1-800-654-7768 (24 hours—includes Canada)

Outside of these areas, contact your local Rosemount representative.

⚠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 Rosemount Sales Representative.

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Section 1 Introduction

SYSTEM DESCRIPTION

The Rosemount® 8700 Series Magnetic Flowmeter System consists of a sensor and transmitter, and measures volumetric flow rate by detecting the velocity of a conductive liquid that passes through a magnetic field.

There are four Rosemount magnetic flowmeter sensors:

- Flanged Rosemount 8705
- Flanged High-Signal Rosemount 8707
- Wafer-Style Rosemount 8711
- Sanitary Rosemount 8721

There are two Rosemount magnetic flowmeter transmitters:

- Rosemount 8712
- Rosemount 8732

The sensor is installed in-line with process piping — either vertically or horizontally. Coils located on opposite sides of the sensor create a magnetic field. Electrodes located perpendicular to the coils make contact with the process fluid. A conductive liquid moving through the magnetic field generates a voltage at the two electrodes that is proportional to the flow velocity.

The transmitter drives the coils to generate a magnetic field, and electronically conditions the voltage detected by the electrodes to provide a flow signal. The transmitter can be integrally or remotely mounted from the sensor.

This manual is designed to assist in the installation and operation of the Rosemount 8732 Magnetic Flowmeter Transmitter and the Rosemount 8700 Series Magnetic Flowmeter Sensors.

SAFETY MESSAGES

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. Refer to the safety messages listed at the beginning of each section before performing any operations.

⚠WARNING

Attempting to install and operate the Rosemount 8705, 8707 High-Signal, 8711 or 8721 Magnetic Sensors with the Rosemount 8712 or 8732 Magnetic Flowmeter Transmitter without reviewing the instructions contained in this manual could result in personal injury or equipment damage.

SERVICE SUPPORT

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.

⚠ See “Safety Messages” on page D-1 for complete warning information.

Section 2 Installation

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. Please refer to the following safety messages before performing any operation in this section.

SAFETY MESSAGES

⚠ This symbol is used throughout this manual to indicate that special attention to warning information is required.

⚠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 that the operating environment of the sensor and transmitter is consistent with the appropriate hazardous area approval.

Do not connect a Rosemount 8732 to a non-Rosemount sensor that is located in an explosive atmosphere.

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 8732 reference manual for any restrictions associated with a safe installation.

Before connecting a handheld 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.

Electrical shock can result in death or serious injury

Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

⚠WARNING

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.

To avoid possible damage to the sensor liner ends, do not use metallic or spiral-wound gaskets. If frequent removal is anticipated, take precautions to protect the liner ends. Short spool pieces attached to the sensor ends are often used for protection.

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 limits. Failure to observe these instructions could result in severe damage to the sensor lining and possible sensor replacement.

Emerson Process Management can supply lining protectors to prevent liner damage during removal, installation, and excessive bolt torquing.

TRANSMITTER SYMBOLS

Caution symbol — check product documentation for details ⚠

Protective conductor (grounding) terminal ⏚

PRE-INSTALLATION

Before installing the Rosemount 8732 Magnetic Flowmeter Transmitter, there are several pre-installation steps that should be completed to make the installation process easier:

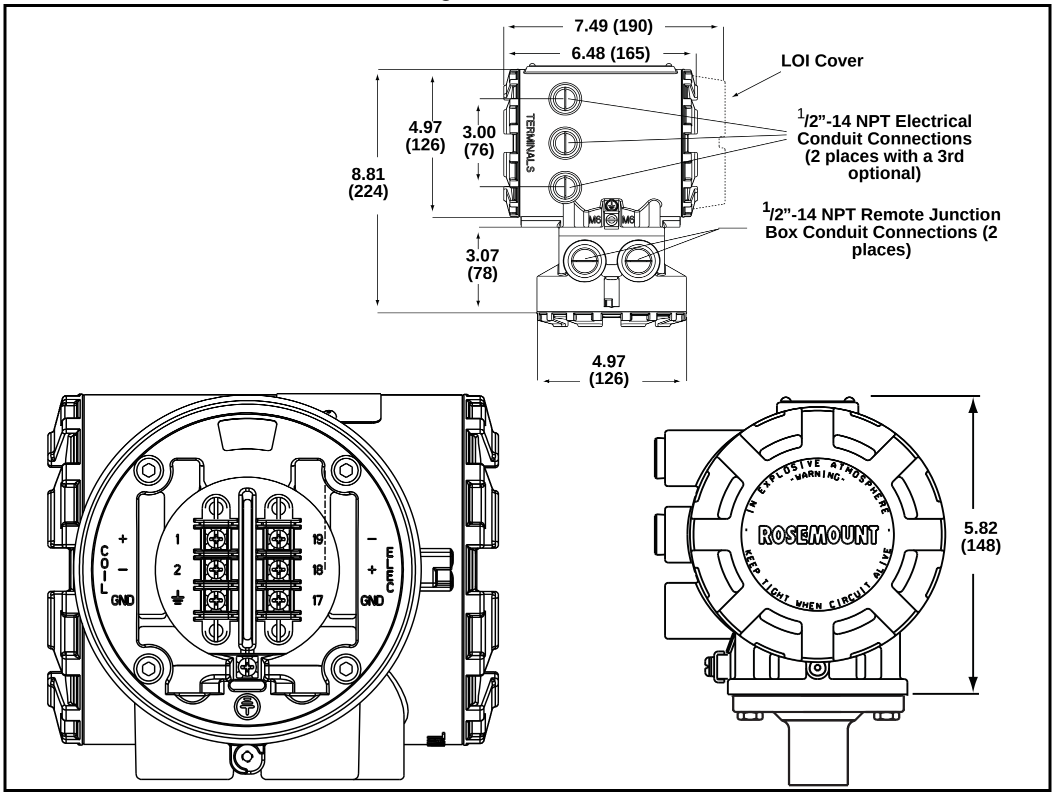
- Identify the options and configurations that apply to your application
- Set the hardware switches if necessary
- Consider mechanical, electrical, and environmental requirements

MECHANICAL CONSIDERATIONS

The mounting site for the 8732 transmitter should provide enough room for secure mounting, easy access to conduit ports, full opening of the transmitter covers, and easy readability of the LOI screen (see Figure 2-1). The transmitter should be mounted in a manner that prevents moisture in conduit from collecting in the transmitter.

If the 8732 is mounted remotely from the sensor, it is not subject to limitations that might apply to the sensor.

Figure 2-1. Rosemount 8732 Dimensional Drawing



ENVIRONMENTAL CONSIDERATIONS

To ensure maximum transmitter life, avoid temperature extremes and vibration. Typical problem areas include:

- high-vibration lines with integrally mounted transmitters
- warm-climate installations in direct sunlight
- outdoor installations in cold climates.

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

Rosemount 8732 transmitters require external power so there must be access to a suitable power source.

INSTALLATION PROCEDURES

Rosemount 8732 installation includes both detailed mechanical and electrical installation procedures.

Mount the Transmitter

Remote-mounted transmitters may be mounted on a pipe up to two inches in diameter or against a flat surface.

Pipe Mounting

To mount the transmitter on a pipe:

1. Attach the mounting bracket to the pipe using the mounting hardware.
2. Attach the 8732 to the mounting bracket using the mounting screws.

Surface Mounting

To surface mount the transmitter:

1. Attach the 8732 to the mounting location using the mounting screws.

Identify Options and Configurations

The standard application of the Rosemount 8732 includes a FOUNDATION fieldbus output. Be sure to identify options and configurations that apply to your situation, and keep a list of them nearby for consideration during the installation and configuration procedures.

Hardware Switches

The 8732 electronics board is equipped with two user-selectable hardware switches. These switches set the Transmitter Security and Simulate Mode. The standard configuration for these switches when shipped from the factory are as follows:

Transmitter Security:	OFF
Simulate Mode	OFF

Definitions of these switches and their functions are provided below. If you determine that the settings must be changed, see below.

Transmitter Security

The security switch on the 8732 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 function remains active at all times.

With the switch in the *ON* position, you may still access and review any of the operating parameters and scroll through the available choices, but no actual data changes are allowed. Transmitter security is set in the *OFF* position when shipped from the factory.

Simulate Mode

The Simulate Mode switch is used in conjunction with the Analog Input (AI) function block. The switch is used to enable flow measurement simulation. To enable the simulate enable feature, the switch must transition from OFF to ON after power is applied to the transmitter, preventing the transmitter from being accidentally left in simulate mode. Simulate Mode is set in the *OFF* position when shipped from the factory.

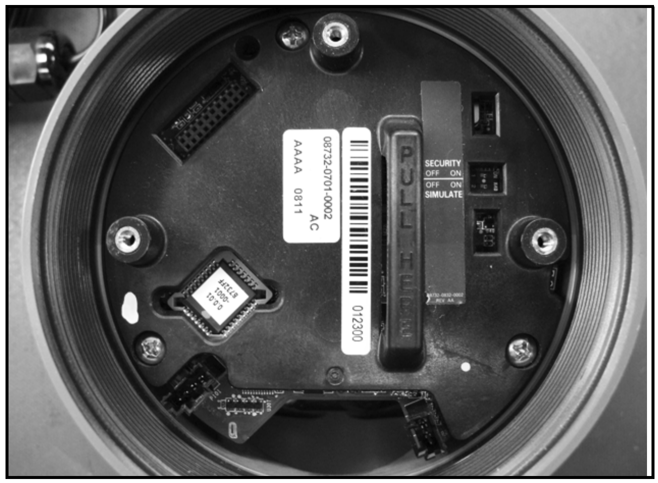
Changing Hardware Switch Settings

In most cases, it is not necessary to change the setting of the hardware switches. If you need 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. Disconnect power to the transmitter.
2. Remove electronics cover.
3. Remove display if applicable.
4. Identify the location of each switch (see Figure 2-2).
5. Change the setting of the desired switches with a small screwdriver.
6. Replace the electronics cover.

Figure 2-2. Rosemount 8732 Electronics Board and Hardware Switches



Conduit Ports and Connections

Both the sensor and transmitter junction boxes have ports for $^1/_2$-inch NPT conduit connections, with optional CM20 and PG 13.5 connections available. These connections should be made in accordance with national, local or plant electrical codes. Unused ports should be sealed with metal plugs and PTFE tape or other thread sealant. Connections should also be made in accordance with area approval requirements, see examples below for details. Proper electrical installation is necessary to prevent errors due to electrical noise and interference. Separate conduits are not necessary for the coil drive and signal cables connecting the transmitter to the sensor, but a dedicated conduit line between each transmitter and sensor is required. A shielded cable must be used.

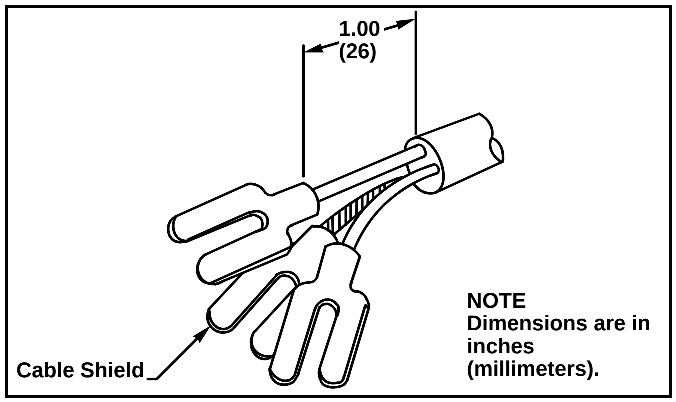
Example 1: Installing flanged sensors into an IP68 area. Sensors must be installed with IP68 cable glands and cable to maintain IP68 rating. Unused conduit connections must be properly sealed to prevent water ingress. For added protection, dielectric gel can be used to pot the sensor terminal block.

Example 2: Installing flowmeters into explosion proof/flameproof areas. Conduit connections and conduit must be rated for use in the hazardous area to maintain flowmeter approval rating.

Conduit Cables

Run the appropriate size cable through the conduit connections in your magnetic flowmeter system. Run the power cable from the power source to the transmitter. Do not run power cables and output signal cables in the same conduit. For remote mount installations, run the coil drive and electrode cables between the flowmeter and transmitter. Refer to Electrical Considerations for wire type. Prepare the ends of the coil drive and electrode cables as shown in Figure 2-3. Limit the unshielded wire length to 1-in. on both the electrode and coil drive cables. Excessive lead length or failure to connect cable shields can create electrical noise resulting in unstable meter readings.

Figure 2-3. Cable Preparation Detail



Electrical Considerations

Before making any electrical connections to the Rosemount 8732, consider the following standards and be sure to have the proper power supply, conduit, and other accessories. When preparing all wire connections, remove only the insulation required to fit the wire completely under the terminal connection. Removal of excessive insulation may result in an unwanted electrical short to the transmitter housing or other wire connections.

Transmitter Input Power

The 8732 transmitter is designed to be powered by 90-250 V AC, 50–60 Hz or 12–42 V DC. The eighth digit in the transmitter model number designates the appropriate power supply requirement.

Model Number	Power Supply Requirement
1	90-250 V AC
2	12-42 V DC

Supply Wire Temperature Rating
Use 12 to 18 AWG wire. For connections in ambient temperatures exceeding 140 °F (60 °C), use wire rated to at least 194 °F (90 °C).

Disconnects
Connect the device through an external disconnect or circuit breaker. Clearly label the disconnect or circuit breaker and locate it near the transmitter.

Requirements for 90-250 V AC Power Supply

Wire the transmitter according to national, local, and plant electrical requirements for the supply voltage. In addition, follow the supply wire and disconnect requirements on page 2-7.

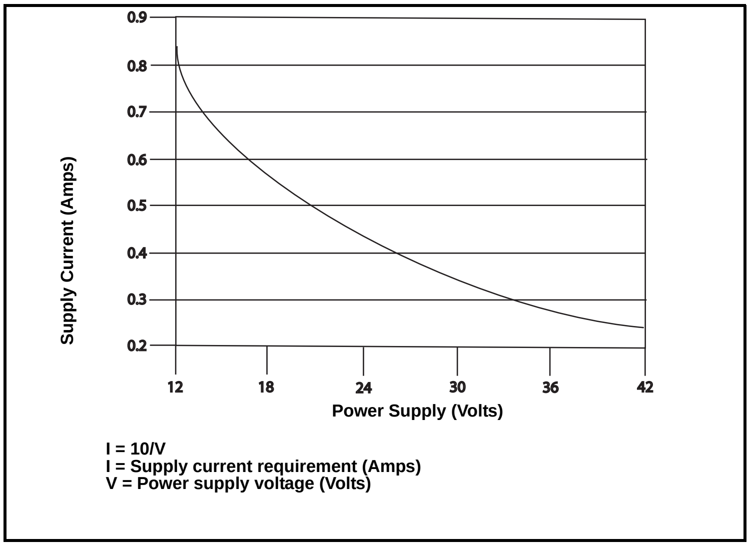
Requirements for 12-42 V DC Power Supply

Units powered with 12-42 V DC may draw up to 1 amp of current. As a result, the input power wire must meet certain gauge requirements.

Figure 2-4 shows the supply current for each corresponding supply voltage. For combinations not shown, you can calculate the maximum distance given the supply current, the voltage of the source, and the minimum start-up voltage of the transmitter, 12 V DC, using the following equation:

$$\text{MaximumResistance} = \frac{\text{SupplyVoltage} - 12\text{VDC}}{1\text{amp}}$$

Figure 2-4. Supply Current versus Input Voltage



Installation Category

The installation category for the Rosemount 8732 is (overvoltage) Category II.

Overcurrent Protection

The Rosemount 8732 Flowmeter Transmitter requires overcurrent protection of the supply lines. Maximum ratings of overcurrent devices are as follows:

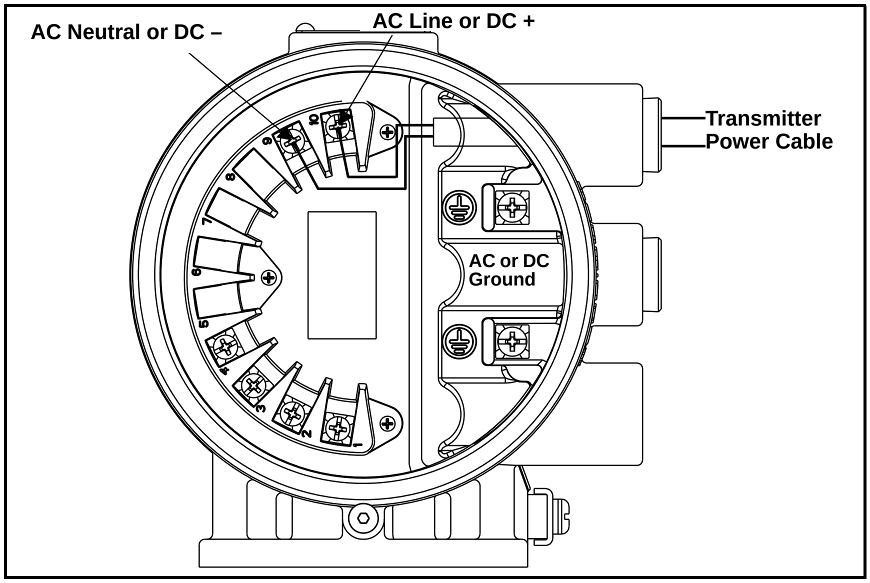
Power System	Fuse Rating	Manufacturer
110 V AC	250 V; 1 Amp, Quick Acting	Bussman AGCI or Equivalent
220 V AC	250 V; 2 Amp, Quick Acting	Bussman AGCI or Equivalent
42 V DC	50 V, 3 Amp, Quick Acting	Bussman AGCI or Equivalent

Connect Transmitter Power

To connect power to the transmitter, complete the following steps.

1. Ensure that the power source and connecting cable meet the requirements outlined on page 2-8.
2. Turn off the power source.
3. Open the power terminal cover.
4. Run the power cable through the conduit to the transmitter.
5. Connect the power cable leads as shown in Figure 2-5.
   a. Connect AC Neutral or DC- to terminal 9.
   b. Connect AC Line or DC+ to terminal 10.
   c. Connect AC Ground or DC Ground to the ground screw mounted inside the transmitter enclosure.

Figure 2-5. AC Transmitter Power Connections



Connect FOUNDATION fieldbus Wiring

The FOUNDATION fieldbus signal provides the output information from the transmitter.

Transmitter Communication Input

The FOUNDATION fieldbus communication requires a minimum of 9 V dc and a maximum of 32 V dc at the transmitter communication terminals.

NOTES

- **Do not** exceed 32 V dc at the transmitter communication terminals.
- **Do not** apply ac line voltage to the transmitter communication terminals.

Improper supply voltage can damage the transmitter.

Power Conditioning

Each fieldbus power supply **requires** a power conditioner to decouple the power supply output from the fieldbus wiring segment.

Field Wiring

⚠ Power independent of the coil power supply must be supplied for FOUNDATION fieldbus communications. Use shielded, twisted pair for best results. For new installations or to get maximum performance, twisted pair cable designed especially for fieldbus should be used. Table 2-1 details cable characteristics and ideal specifications.

Table 2-1. Ideal Cable Specifications for Fieldbus Wiring

Characteristic	Ideal Specification
Impedance	100 Ohms ± 20% at 31.25 kHz
Wire Size	18 AWG (0,8 mm^2)
Shield Coverage	90%
Attenuation	3 db/km
Capacitive Unbalance	2 nF/km

⚠ See “Safety Messages” on page 2-1 for complete warning information.

NOTE
The number of devices on a fieldbus segment is limited by the power supply voltage, the resistance of the cable, and the amount of current drawn by each device.

Transmitter Wiring Connection

To connect the 8732 to the FOUNDATION fieldbus (FF) segment, complete the following steps.

1. Ensure that the power source and connecting cable meet the requirements outlined above and in "Field Wiring" on page 2-8.
2. Turn off the transmitter and power sources.
3. Run the FOUNDATION fieldbus cable into the transmitter.
4. Connect -FF to Terminal 1.
5. Connect +FF to Terminal 2.

NOTE
Foundation fieldbus signal wiring for the 8732 is not polarity sensitive.

Refer to Figure 2-6 on page 2-9.

Figure 2-6. FOUNDATION fieldbus Signal Connections

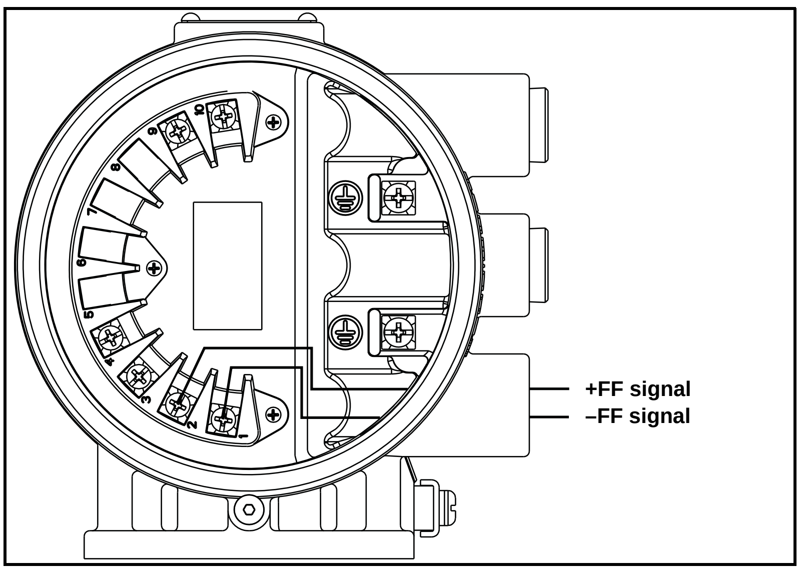
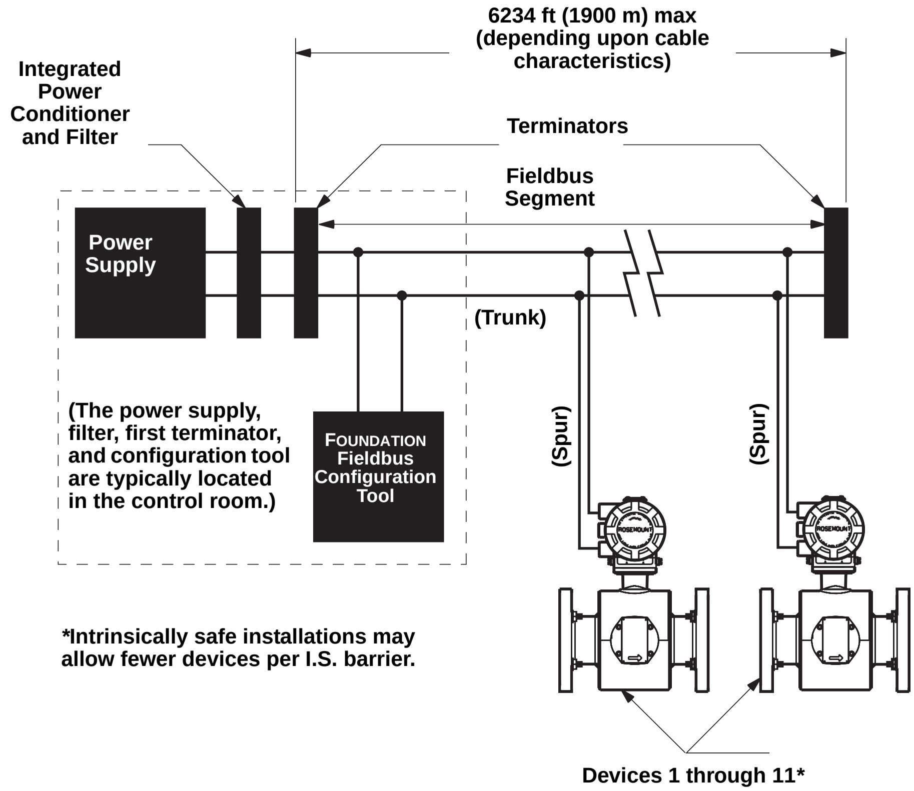


Figure 2-7. Rosemount 8732 Transmitter Field Wiring



SENSOR CONNECTIONS

This section covers the steps required to physically install the transmitter including wiring and calibration.

Rosemount Sensors

To connect the transmitter to a non-Rosemount sensor, refer to the appropriate wiring diagram in "Universal Sensor Wiring Diagrams" on page E-1. The calibration procedure listed is not required for use with Rosemount sensors.

Transmitter to Sensor Wiring

Flanged and wafer sensors have two conduit ports as shown in Figure 2-8. Either one may be used for both the coil drive and electrode cables. Use the stainless steel plug that is provided to seal the unused conduit port. Use Teflon tape or thread sealant appropriate for the installation when sealing the conduit.

A single dedicated conduit run for the coil drive and electrode cables is needed between a sensor and a remote transmitter. Bundled cables in a single conduit are likely to create interference and noise problems in your system. Use one set of cables per conduit run. See Figure 2-8 for proper conduit installation diagram and Table 2-2 for recommended cable. For integral and remote wiring diagrams refer to Figure 2-10.

Figure 2-8. Conduit Preparation

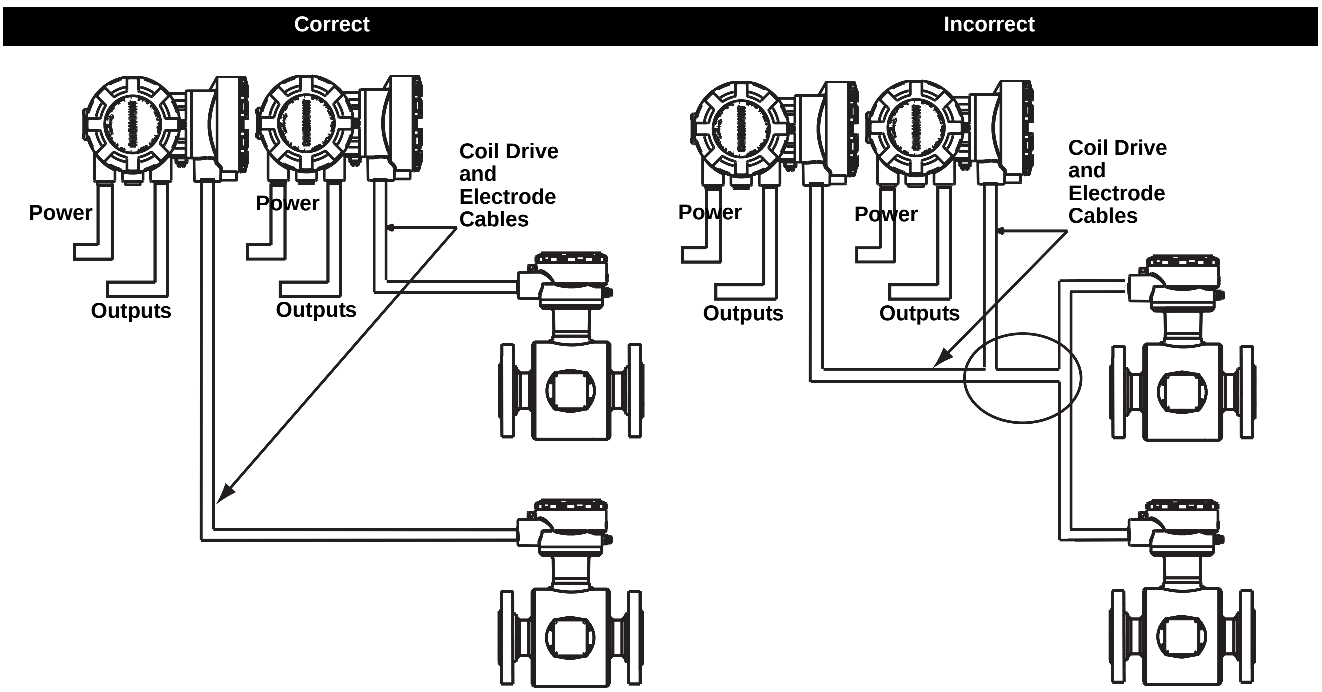


Table 2-2. Cable Requirements

Description	Units	Part Number
Signal Cable (20 AWG) Belden 8762, Alpha 2411 equivalent	ft m	08712-0061-0001 08712-0061-0003
Coil Drive Cable (14 AWG) Belden 8720, Alpha 2442 equivalent	ft m	08712-0060-0001 08712-0060-0003
Combination Signal and Coil Drive Cable (18 AWG)(1)	ft m	08712-0752-0001 08712-0752-0003

(1) *Combination signal and coil drive cable is not recommended for high-signal magmeter system. For remote mount installations, combination signal and coil drive cable should be limited to less than 330 ft. (100 m).*

Rosemount recommends using the combination signal and coil drive for N5, E5 approved sensors for optimum performance.

Remote transmitter installations require equal lengths of signal and coil drive cables. Integrally mounted transmitters are factory wired and do not require interconnecting cables.

Lengths from 5 to 1,000 feet (1.5 to 300 meters) may be specified, and will be shipped with the sensor.

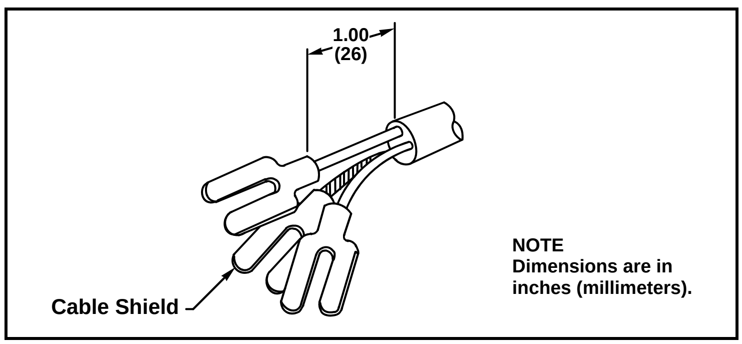
Conduit Cables

Run the appropriate size cable through the conduit connections in your magnetic flowmeter system. Run the power cable from the power source to the transmitter. Run the coil drive and electrode cables between the sensor and transmitter.

Prepare the ends of the coil drive and electrode cables as shown in Figure 2-9. Limit the unshielded wire length to 1-inch on both the electrode and coil drive cables.

NOTE
Excessive lead length or failure to connect cable shields can create electrical noise resulting in unstable meter readings.

Figure 2-9. Cable Preparation Detail

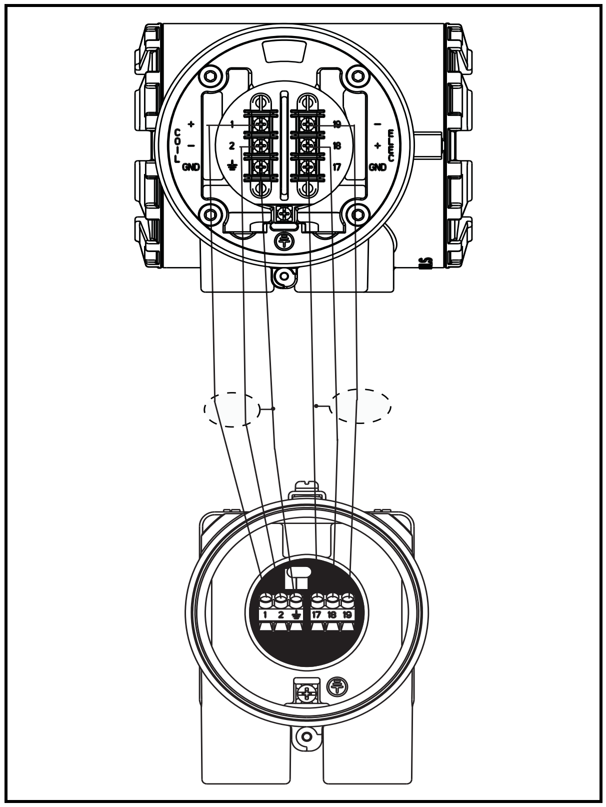


Sensor to Remote Mount Transmitter Connections

Connect coil drive and electrode cables as shown in Figure 2-10.

Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter, or replacement of the electronics board will be necessary.

Figure 2-10. Wiring Diagram



Rosemount 8732 Transmitter	Rosemount 8705/8707/8711/8721 Sensors
1	1
2	2
⏚	⏚
17	17
18	18
19	19

Section 3 Configuration

INTRODUCTION

This section covers basic operation, software functionality, and configuration procedures for the Rosemount 8732 Magnetic Flowmeter Transmitter. For information on connecting another manufacturer’s flowtube sensor, refer to “Universal Sensor Wiring Diagrams” on page E-1.

The Rosemount 8732 features a full range of software functions for configuration of output from the transmitter. Software functions are accessed through the LOI, AMS, a Handheld Communicator, or a control system. Configuration variables may be changed at any time and specific instructions are provided through on-screen instructions.

Table 3-1. Parameters

Basic Set-up Parameters	Page
Review	page 3-5
Process Variables	page 3-5
Basic Setup	page 3-7
Flow Units	page 3-7
Range Values	page 3-10
PV Sensor/Flowtube Sensor Calibration Number	page 3-11
Totalizer Setup	page 3-6

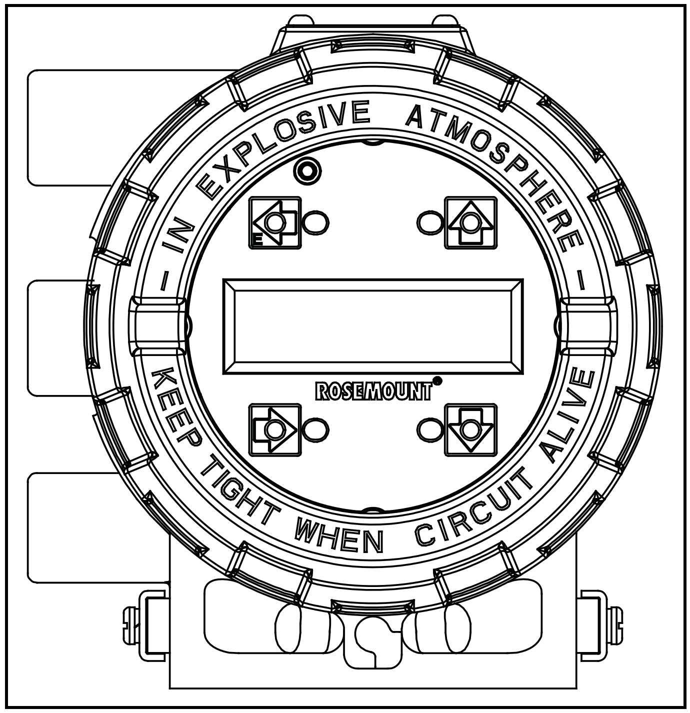
LOCAL OPERATOR INTERFACE

The optional Local Operator Interface (LOI) provides an operator communications center for the 8732. By using the LOI, the operator can access any transmitter function for changing configuration parameter settings, checking totalized values, or other functions. The LOI is integral to the transmitter electronics.

BASIC FEATURES

The basic features of the LOI include 4 navigational arrow keys that are used to access the menu structure. See Figure 3-1.

Figure 3-1. Local Operator Interface Keypad



Data Entry

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

1. Access the appropriate function.
2. Use the **RIGHT ARROW** key to move to the value to change.
3. Use the **UP** and **DOWN ARROWS** to change the highlighted 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**.
4. Use the **RIGHT ARROWS** to highlight other digits you want to change and change them.
5. Press **“E”** (the left arrow key) when all changes are complete to save the entered values.

LOI EXAMPLES

Use the **DOWN ARROW** to access the menu structure in Table 3-2. Use the **ARROW KEYS** to select the desired parameters to review/change. Parameters are set in one of two ways, Table Values or Select Values.

Table Values:
Parameters such as units, that are available from a predefined list

Select Values:
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 **ARROW KEYS**.

Table Value Example

Setting the TUBE SIZE:

1. Press the **DOWN** arrow to access the menu.
2. Select line size from the Basic set-up menu.
3. Press the **UP** or **DOWN** arrow to increase/decrease (incrementally) the tube size to the next value.
4. When you reach the desired size, press **“E”** (the left arrow).
5. Set the loop to manual if necessary, and press **“E”** again.

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

Select Value Example

Changing the ANALOG OUTPUT RANGE:

1. Press the **DOWN** arrow to access the menu.
2. Using the arrow keys, select PV URV from the Basic Setup menu.
3. Press **RIGHT** arrow key to position the cursor.
4. Press **UP** or **DOWN** to set the number.
5. Repeat steps 2 and 3 until desired number is displayed.
6. Press “**E”**.

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

Display Lock

The display can be locked to prevent unintentional configuration changes. The display lock can be activated through a HART communication device, or by holding the UP arrow for 10 seconds. When the display lock is activated, DL will appear in the lower left hand corner of the display. To deactivate the display lock (DL), hold the UP arrow for 10 seconds. Once deactivated, the DL will no longer appear in the lower left hand corner of the display.

Start Totalizer

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

Stop Totalizer

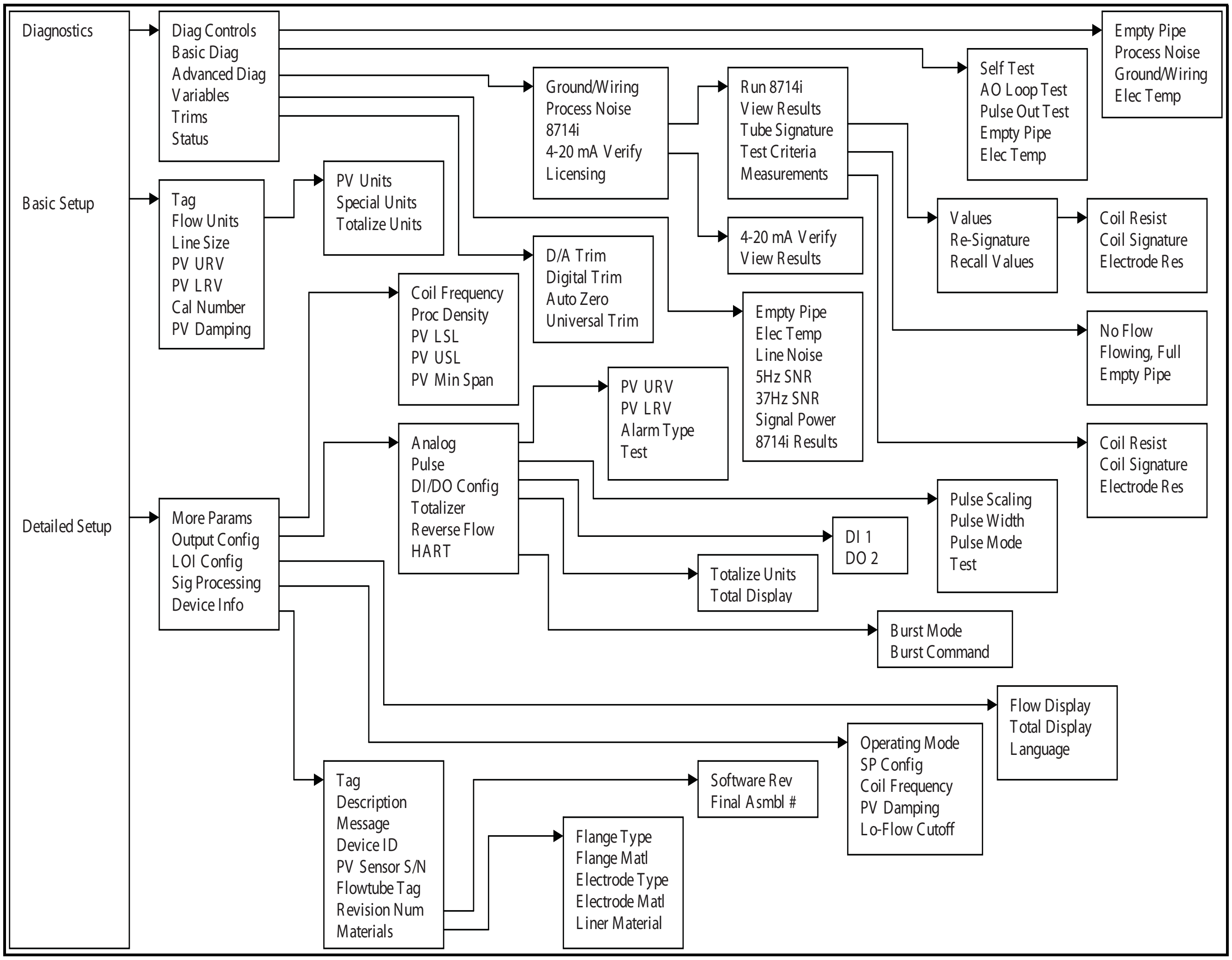
To stop the totalizer, press the **DOWN** arrow to display the totalizer screen and press “E” to end totalization. The flashing symbol will no longer display in the lower right hand corner indicating that the meter has stopped totalizing.

Reset Totalizer

To reset the totalizer, press the **DOWN** arrow to display the totalizer screen and follow the procedure above to stop totalization. Once totalization has stopped, press the **RIGHT** arrow key to reset the NET total value to zero.

To reset the gross total value, you must change the line size. See “Line Size” on page 3-9 for details on how to change the line size.

Table 3-2. LOI Menu Tree



DIAGNOSTIC MESSAGES

The following error messages may appear on the LOI screen. See Table 6-4 on page 6-5 for potential causes and corrective actions for these errors:

- Electronics Failure
- Coil open circuit
- Digital trim failure
- Auto zero failure
- Auto trim failure
- Flowrate > sensor limit
- Analog out of range
- PZR activated
- Electronics Temp Fail
- Pulse out of range
- Empty pipe
- Reverse flow
- Electronics temp out of range

The following error messages may appear on the LOI screen. See Table 6-4 on page 6-5 for potential causes and corrective actions for these errors:

- High Process Noise
- Grounding/Wiring Fault
- 4-20 mA Loop Verification Failed
- 8714i Failed

Review

Fast Keys	1, 5

The 8732 includes a capability that enables you to review the configuration variable settings.

The flowmeter configuration parameters set at the factory should be reviewed to ensure accuracy and compatibility with your particular application of the flowmeter.

NOTE
If you are using the LOI to review variables, each variable must be accessed as if you were going to change its setting. The value displayed on the LOI screen is the configured value of the variable.

PROCESS VARIABLES

Fast Keys	1, 1

The *process variables* measure 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

Process Variable (PV) – The actual measured flow rate in the line. Use the Process Variable 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 “8714i Meter Verification” on page C-8).

Totalizer Setup – Provides a reading of the total flow of the flowmeter since the totalizer was last reset. The totalizer value should be zero during commissioning on the bench, and the units should reflect the volume units of the flow rate. If the totalizer value is not zero, it may need to be reset. This function also allows for configuration of the totalizer parameters.

Pulse Output – The pulse output variable provides the pulse value for the flow rate.

PV - Primary Variable

Fast Keys	1, 1, 1

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

PV -% Range

Fast Keys	1, 1, 2

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

PV - Analog Output

Fast Keys	1, 1, 3

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

Totalizer Setup

Fast Keys	1, 1, 4

The *Totalizer Setup* menu allows for the viewing and configuration of the totalizer parameters.

Totalizer Units

Fast Keys	1, 1, 4, 1

Totalizer units allow for the configuration of the units that the totalized value will be displayed as. These units are independent of the flow units.

Measured Gross Total

Fast Keys	1, 1, 4, 2

Measured gross total provides the output reading of the totalizer. This value is the amount of process fluid that has passed through the flowmeter since the totalizer was last reset.

NOTE
To reset the measured gross total value, the line size must be changed.

Measured Net Total

Fast Keys	1, 1, 4, 3

Measured net total provides the output reading of the totalizer. This value is the amount of process fluid that has passed through the flowmeter since the totalizer was last reset. When reverse flow is enabled, the net total represents the difference between the total flow in the forward direction less the total flow in the reverse direction.

Measured Reverse Total

Fast Keys	1, 1, 4, 4

Measured reverse total provides the output reading of the totalizer. This value is the amount of process fluid that has passed through the flowmeter in the reverse direction since the totalizer was last reset. This value is only totalized when reverse flow is enabled.

Start Totalizer

Fast Keys	1, 1, 4, 5

Start totalizer starts the totalizer counting from its current value.

Stop Totalizer

Fast Keys	1, 1, 4, 6

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

Fast Keys	1, 1, 4, 7

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

NOTE
The totalizer value is saved in the Non-Volatile memory of the electronics every three seconds. Should power to the transmitter be interrupted, the totalizer value will start at the last saved value when power is re-applied.

Pulse Output

Fast Keys	1, 1, 5

The *Pulse Output* displays the current value of the pulse signal.

BASIC SETUP

Fast Keys	1, 3

The basic configuration functions of the Rosemount 8732 must be set for all applications of the transmitter in a magnetic flowmeter system. If your application requires the advanced functionality features of the Rosemount 8732, see Section 4 "Operation" of this manual.

Tag

Fast Keys	1, 3, 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

Fast Keys	1, 3, 2

Flow Units set the output units for the Primary Variable which controls the analog output of the transmitter.

Primary Variable Units

Fast Keys	1, 3, 2, 1

The *Primary Variable Units* specifies the format in which the flow rate will be displayed. Units should be selected to meet your particular metering needs.

Options for Flow Rate Units

• ft/sec	• B31/sec (1 Barrel = 31.5 gallons)
• m/sec	• B31/min (1 Barrel = 31.5 gallons)
• gal/sec	• B31/hr (1 Barrel = 31.5 gallons)
• gal/min	• B31/day (1 Barrel = 31.5 gallons)
• gal/hr	• lbs/sec
• gal/day	• lbs/min
• l/sec	• lbs/hr
• l/min	• lbs/day
• l/hr	• kg/sec
• l/day	• kg/min
• ft^3/sec	• kg/hr
• ft^3/min	• kg/day
• ft^3/hr	• (s)tons/min
• ft^3/day	• (s)tons/hr
• m^3/sec	• (s)tons/day
• m^3/min	• (m)tons/min
• m^3/hr	• (m)tons/hr
• m^3/day	• (m)tons/day
• Impgal/sec	• Special (User Defined, see "Special Units" on page 3-8)
• Impgal/min	
• 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)	

Special Units

Fast Keys	1, 3, 2, 2

The Rosemount 8732 provides a selection of standard unit configurations that meet the needs of most applications (see "Flow Units" on page 3-7). If your application has special needs and the standard configurations do not apply, the Rosemount 8732 provides the flexibility to configure the transmitter in a custom-designed units format using the *special units* variable.

Special Volume Unit

Fast Keys	1, 3, 2, 2, 1

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.

Base Volume Unit

Fast Keys	1, 3, 2, 2, 2

Base volume unit is the unit from which the conversion is being made. Set this variable to the appropriate option.

Conversion Number

Fast Keys	1, 3, 2, 2, 3

The special units *conversion number* is used to convert base units to special units. For a straight conversion of volume units from one to another, the conversion number 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.

Base Time Unit

Fast Keys	1, 3, 2, 2, 4

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.

Special Flow Rate Unit

Fast Keys	1, 3, 2, 2, 5

Special flow rate unit is a format variable that provides a record of the units to which you are converting. The Handheld 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 8732 LOI will display the four character designation as configured.

Example

To display flow in barrels per hour, and one barrel is equal to 31.0 gallons, the procedure would be:

Set the Volume Unit to BARL.
Set the Base Volume Unit to gallons.
Set the Input Conversion Number to 31.
Set the Time Base to Hour.
Set the Rate Unit to BR/H.

Line Size

Fast Keys	1, 3, 3

The *line size* (flowtube sensor size) must be set to match the actual flowtube sensor connected to the transmitter. The size must be specified in inches according to the available sizes listed below. If a value is entered from a control system or Handheld Communicator that does not match one of these figures, the value will go to the next highest option.

The line size (inches) options are as follows:

0.1, 0.15, 0.25, 0.30, 0.50, 0.75, 1, 1.5, 2, 2.5, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30, 32, 36, 40, 42, 44, 48, 54, 56, 60, 64, 72, 80

PV URV (Upper Range Value)

Fast Keys	1, 3, 4

The *upper range value* (URV), or analog output range, is preset to 30 ft/s at the factory. The units that appear will be the same as those selected under the units parameter.

The URV (20 mA point) can be set for both forward or reverse flow rate. Flow in the forward direction is represented by positive values and flow in the reverse direction is represented by negative values. The URV can be any value from –39.3 ft/s to +39.3 ft/s (-12 m/s to +12 m/s), as long as it is at least 1 ft/s (0.3 m/s) from the lower range value (4 mA point). The URV can be set to a value less than the lower range value. This will cause the transmitter analog output to operate in reverse, with the current increasing for lower (or more negative) flow rates.

NOTE
Line size, special units, and density must be selected prior to configuration of URV and LRV.

PV LRV (Lower Range Value)

Fast Keys	1, 3, 5

Set the *lower range value* (LRV), or analog output zero, to change the size of the range (or span) between the URV and LRV. Under normal circumstances, the LRV should be set to a value near the minimum expected flow rate to maximize resolution. The LRV must be between –39.3 ft/s to +39.3 ft/s (-12 m/s to +12 m/s).

NOTE
Line size, special units, and density must be selected prior to configuration of URV and LRV.

Example

If the URV is greater than the LRV, the analog output will saturate at 3.9 mA when the flow rate falls below the selected 4 mA point.

The minimum allowable span between the URV and LRV is 1 ft/s (0.3 m/s). Do not set the LRV within 1 ft/s (0.3 m/s) of the 20 mA point. For example, if the URV is set to 15.67 ft/s (4.8 m/s) and if the desired URV is greater than the LRV, then the highest allowable analog zero setting would be 14.67 ft/s (4.5 m/s). If the desired URV is less than the LRV, then the lowest allowable LRV would be 16.67 ft/s (5.1 m/s).

Calibration Number

Fast Keys	1, 3, 6

The tube *calibration number* is a 16-digit number used to identify flowtube sensors calibrated at the Rosemount factory. The calibration number is also printed inside the flowtube sensor terminal block or on the flowtube sensor name plate. The number provides detailed calibration information to the Rosemount 8732. To function properly within accuracy specifications, the number stored in the transmitter must match the calibration number on the flowtube sensor exactly.

NOTE
Flowtube Sensors from manufacturers other than Rosemount Inc. can also be calibrated at the Rosemount factory. Check the tube for Rosemount calibration tags to determine if a 16-digit tube calibration number exists for your flowtube sensor.

NOTE
Be sure the calibration number reflects a calibration to a Rosemount reference transmitter. If the calibration number was generated by a means other than a certified Rosemount flow lab, accuracy of the system may be compromised.

If your flowtube sensor is not a Rosemount flowtube sensor and was not calibrated at the Rosemount factory, contact your Rosemount representative for assistance.

If your flowtube sensor is imprinted with an eight-digit number or a k-factor, check in the flowtube sensor wiring compartment for the sixteen-digit calibration number. If there is no serial number, contact the factory for a proper conversion.

PV Damping

Fast Keys	1, 3, 7

Adjustable between 0.0 and 256 seconds

PV 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.

Section 4 Operation

INTRODUCTION

This section contains information for advanced configuration parameters and diagnostics.

The software configuration settings for the Rosemount 8732 can be accessed through a 375 Field Communicator or through a control system. The software functions for the 375 Field Communicator are described in detail in this section of the manual. It provides an overview and summary of communicator functions. For more complete instructions, see the communicator manual. Before operating the Rosemount 8732 in an actual installation, you should review all of the factory set configuration data to ensure that they reflect the current application.

DIAGNOSTICS

375	Transducer Block

Diagnostics are used to verify that the transmitter is functioning properly, to assist in troubleshooting, to identify potential causes of error messages, and to verify the health of the transmitter and sensor. Diagnostic tests can be initiated through the use of a 375 Field Communicator or through the control system.

Rosemount offers several different diagnostic suites providing various functionality.

Standard diagnostics included with every Rosemount 8732 transmitter are Empty Pipe detection, Electronics Temperature monitoring, Coil Fault detection, and various loop and transmitter tests.

Advanced diagnostics suite option one (D01 option) contains advanced diagnostics for High Process Noise detection and Grounding and Wiring fault detection.

Advanced diagnostics suite option two (D02 option) contains advanced diagnostics for the 8714i Meter Verification. This diagnostic is used to verify the accuracy and performance of the magnetic flow meter installation.

Diagnostic Controls

375	Transducer Block, Diagnostics

The diagnostic controls menu provides a centralized location for enabling or disabling each of the diagnostics that are available. Note that for some diagnostics to be available, a diagnostics suite package is required.

Empty Pipe Detection

Turn the empty pipe diagnostic on or off as required by the application. For more details on the empty pipe diagnostic, see Appendix C: Diagnostics.

Electronics Temperature Out of Range

Turn the electronics temperature diagnostic on or off as required by the application. For more details on the electronics temperature diagnostic, see Appendix C: Diagnostics.

High Process Noise Detection

Turn the high process noise diagnostic on or off as required by the application. For more details on the high process noise diagnostic, see Appendix C: Diagnostics.

Grounding / Wiring Fault Detection

Turn the grounding / wiring diagnostic on or off as required by the application. For more details on the grounding / wiring diagnostic, see Appendix C: Diagnostics.

Basic Diagnostics

375	Transducer Block, Diagnostics

The basic diagnostics menu contains all of the standard diagnostics and tests that are available in the 8732E transmitter.

Empty Pipe Limits

375	Transducer Block, Diagnostics, Basic Diagnostics

Empty Pipe allows you to view the current value and configure the diagnostic parameters. For more detail on this parameter see Appendix C: Diagnostics.

EP Value

375	Transducer Block, Diagnostics, Basic Diagnostics, Empty Pipe Limits

Read the current Empty Pipe Value. This number is a unitless number and is calculated based on multiple installation and process variables. For more detail on this parameter see Appendix C: Diagnostics.

EP Trigger Level

375	Transducer Block, Diagnostics, Basic Diagnostics, Empty Pipe Limits

Limits: 3 to 2000

Configure the threshold limit that the empty pipe value must exceed before the diagnostic alert activates. Default from the factory is set to 100. For more detail on this parameter see Appendix C: Diagnostics.

EP Counts

375	Transducer Block, Diagnostics, Basic Diagnostics, Empty Pipe Limits

Limits: 5 to 50

Configure the number of consecutive times that the empty pipe value must exceed the empty pipe trigger level before the diagnostic alert activates. Counts are taken at 1.5 second intervals. Default from the factory is set to 5. For more detail on this parameter see Appendix C: Diagnostics.

Electronics Temp Value

375	Transducer Block, Diagnostics, Basic Diagnostics

Electronics Temperature allows you to view the current value for the electronics temperature.

Advanced Diagnostics

375	Transducer Block, Diagnostics

The advanced diagnostics menu contains information on all of the additional diagnostics and tests that are available in the 8732 transmitter if one of the diagnostics suite packages was ordered.

Rosemount offers two advanced diagnostic suites. Functionality under this menu will depend on which of these suites are ordered.

Advanced diagnostics suite option one (D01 option) contains advanced diagnostics for High Process Noise detection and Grounding and Wiring fault detection.

Advanced diagnostics suite option two (D02 option) contains advanced diagnostics for the 8714i Meter Verification. This diagnostic is used to verify the accuracy and performance of the magnetic flow meter installation.

8714i Meter Verification

375	Transducer Block, Diagnostics, Advanced Diagnostics

This diagnostic allows you to test and verify that the sensor, transmitter, or both are working within specifications. For more details on this diagnostic, see Appendix C: Diagnostics.

Run 8714i

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification

Run the meter verification test to check the transmitter, sensor, or entire installation.

Full Meter Verification
Run the internal meter verification to check the entire installation, sensor and transmitter at the same time.

Transmitter Only
Run the internal meter verification to check the transmitter only.

Sensor Only
Run the internal meter verification to check the sensor only.

8714i Results

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification**

Review the results of the most recently performed 8714i Meter Verification test. Information in this section details the measurements taken and if the meter passed the verification test. For more details on these results and what they mean, see Appendix C: Diagnostics.

Test Condition

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the conditions that the 8714i Meter Verification test was performed under. For more details on this parameter see Appendix C: Diagnostics.

Test Criteria

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the criteria that the 8714i Meter Verification test was performed against. For more details on this parameter see Appendix C: Diagnostics.

8714i Result

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the results of the 8714i Meter Verification test as pass or fail. For more details on this parameter see Appendix C: Diagnostics.

Simulated Velocity

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the test velocity used to verify transmitter calibration. For more details on this parameter see Appendix C: Diagnostics.

Actual Velocity

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the velocity measured by the transmitter during the transmitter calibration verification test. For more details on this parameter see Appendix C: Diagnostics.

Velocity Deviation

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the deviation of the transmitter calibration verification test. For more details on this parameter see Appendix C: Diagnostics.

Transmitter Calibration Result

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the result of the transmitter calibration verification test as pass or fail. For more details on this parameter see Appendix C: Diagnostics.

Sensor Calibration Deviation

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the deviation of the sensor calibration verification test. For more details on this parameter see Appendix C: Diagnostics.

Sensor Calibration Result

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the result of the sensor calibration verification test as pass or fail. For more details on this parameter see Appendix C: Diagnostics.

Coil Circuit Result

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the result of the coil circuit test as pass or fail. For more details on this parameter see Appendix C: Diagnostics.

Electrode Circuit Result

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results**

Displays the result of the electrode circuit test as pass or fail. For more details on this parameter see Appendix C: Diagnostics.

Sensor Signature

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification**

The sensor signature describes the sensor characteristics to the transmitter and is an integral part of the sensor meter verification test. From this menu you can view the current stored signature, have the transmitter take and store the sensor signature, and re-call the last saved good values for the sensor signature. For more details on this parameter see Appendix C: Diagnostics.

Signature Values

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Sensor Signature**

Review the current values stored for the sensor signature. For more details on this parameter see Appendix C: Diagnostics.

Coil Resistance

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Sensor Signature, Signature Values**

View the reference value for the coil resistance taken during the sensor signature process.

Coil Signature

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Sensor Signature, Signature Values**

View the reference value for the coil signature taken during the sensor signature process.

Electrode Resistance

375	**Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Sensor Signature, Signature Values**

View the reference value for the electrode resistance taken during the sensor signature process.

Re-Signature Meter

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Sensor Signature

Have the transmitter measure and store the sensor signature values. These values will then be used as the baseline for the meter verification test. Use this when connecting to older Rosemount or competitors' sensors or installing the magnetic flowmeter system for the first time. For more details on this parameter see Appendix C: Diagnostics.

Recall Last Saved Values

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Sensor Signature

Recalls the last saved "good" values for the sensor signature.

Set Pass/Fail Criteria

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification

Set the maximum allowable deviation percentage test criteria for the 8714i Meter Verification test. There are three tests that this criteria can be set for:

- Full Pipe; No Flow (Best test condition) – Default is 2%
- Full Pipe; Flowing – Default is 3%
- Empty Pipe – Default is 5%

NOTE
If the 8714i Meter Verification test is done with an empty pipe, the electrode circuit will NOT be tested.

No Flow Limit

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Set Pass/Fail Criteria

Limits: 1 to 10 percent

Set the pass/fail test criteria for the 8714i Meter Verification test at Full Pipe, No Flow conditions.

Flowing Limit

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Set Pass/Fail Criteria

Limits: 1 to 10 percent

Set the pass/fail test criteria for the 8714i Meter Verification test at Full Pipe, Flowing conditions.

Empty Pipe Limit

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Set Pass/Fail Criteria

Limits: 1 to 10 percent

Set the pass/fail test criteria for the 8714i Meter Verification test at Empty Pipe conditions.

Measurements

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification

View the measured values taken during the meter verification process. These values are compared to the signature values to determine if the test passes or fails. Values are shown for the Coil Resistance, Coil Signature, and Electrode Resistance.

Coil Resistance

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, measurements

View the measured value for the coil resistance taken during the meter verification test.

Coil Signature

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, measurements

View the measured value for the coil signature taken during the meter verification test.

Electrode Resistance

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, measurements

View the measured value for the electrode resistance taken during the meter verification test.

Licensing

375	Transducer Block, Diagnostics, Advanced Diagnostics

If a diagnostic suite was not ordered initially, advanced diagnostics can be licensed in the field. Access the licensing information from this menu. For more details on licensing, see Appendix C: Diagnostics.

License Status

375	Transducer Block, Diagnostics, Advanced Diagnostics, Licensing

Determine if a diagnostics suite has been licensed, and if so, which diagnostics are available for activation.

License Key

375	Transducer Block, Diagnostics, Advanced Diagnostics, Licensing

A license key is required to activate diagnostics in the field if the diagnostic suite was not initially ordered. This menu allows for gathering of necessary data to generate a license key and also the ability to enter the license key once it has been received.

Device ID

375	Transducer Block, Diagnostics, Advanced Diagnostics, Licensing, License Key

This function displays the Device ID and Software Revision for the transmitter. Both of these pieces of information are required to generate a license key.

License Key

375	Transducer Block, Diagnostics, Advanced Diagnostics, Licensing, License Key

Allows you to enter a license key to activate a diagnostic suite.

Diagnostic Variables

375	Transducer Block, Diagnostics

From this menu, all of the diagnostic variable values can be reviewed. This information can be used to get more information about the transmitter, sensor, and process, or to get more detail about an alert that may have activated.

Empty Pipe Value

375	Transducer Block, Diagnostics, Diagnostic Variables

Read the current value of the Empty Pipe parameter. This value will read zero if Empty Pipe is turned off.

Electronics Temperature

375	Transducer Block, Diagnostics, Diagnostic Variables

Read the current value of the Electronics Temperature.

Line Noise

375	Transducer Block, Diagnostics, Diagnostic Variables

Read the current value of the amplitude of AC line noise measured on the transmitter's electrode inputs. This value is used in the grounding / wiring diagnostic.

5Hz SNR

375	Transducer Block, Diagnostics, Diagnostic Variables

Read the current value of the signal to noise ratio at 5 Hz. For optimum performance, a value greater than 100 is preferred. Values less than 25 will cause the High Process Noise alert to activate.

37Hz SNR

375	Transducer Block, Diagnostics, Diagnostic Variables

Read the current value of the signal to noise ratio at 37.5 Hz. For optimum performance, a value greater than 100 is preferred. Values less than 25 will cause the High Process Noise alert to activate.

Signal Power

375	Transducer Block, Diagnostics, Diagnostic Variables

Read the current value of the velocity of the fluid through the sensor. Higher velocities result in greater signal power.

8714i Results

375	Transducer Block, Diagnostics, Diagnostic Variables

Review the results of the 8714i Meter Verification tests. For more details on these results and what they mean, see Appendix C: Diagnostics.

Test Condition

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the conditions that the 8714i Meter Verification test was performed under. For more details on this parameter see Appendix C: Diagnostics.

Test Criteria

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the criteria that the 8714i Meter Verification test was performed against. For more details on this parameter see Appendix C: Diagnostics.

8714i Result

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the results of the 8714i Meter Verification test as pass or fail. For more details on this parameter see Appendix C: Diagnostics.

Simulated Velocity

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the test velocity used to verify transmitter calibration. For more details on this parameter see Appendix C: Diagnostics.

Actual Velocity

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the velocity measured by the transmitter during the transmitter calibration verification test. For more details on this parameter see Appendix C: Diagnostics.

Velocity Deviation

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the deviation of the transmitter calibration verification test. For more details on this parameter see Appendix C: Diagnostics.

Transmitter Calibration Result

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the result of the transmitter calibration verification test as pass or fail. For more details on this parameter see Appendix C: Diagnostics.

Sensor Calibration Deviation

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the deviation of the sensor calibration verification test. For more details on this parameter see Appendix C: Diagnostics.

Sensor Calibration Result

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the result of the sensor calibration verification test as pass or fail. For more details on this parameter see Appendix C: Diagnostics.

Coil Circuit Result

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the result of the coil circuit test as pass or fail. For more details on this parameter see Appendix C: Diagnostics.

Electrode Circuit Result

375	Transducer Block, Diagnostics, Diagnostic Variables, 8714i Results

Displays the result of the electrode circuit test as pass or fail. For more details on this parameter see Appendix C: Diagnostics.

Trims

375	Transducer Block, Diagnostics

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.

Electronics Trim

375	Transducer Block, Diagnostics, Trims

Electronics trim is the function by which the factory calibrates the transmitter. This procedure is rarely needed by customers. It is only necessary if you suspect the Rosemount 8732E is no longer accurate. A Rosemount 8714 Calibration Standard is required to complete a digital trim. Attempting an Electronics trim without a Rosemount 8714 Calibration Standard may result in an inaccurate transmitter or an error message. Electronics trim must be performed only with the coil drive mode set to 5 Hz and with a nominal sensor calibration number stored in the memory.

NOTE
Attempting an Electronics trim without a Rosemount 8714 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 power down the Rosemount 8732E to clear the message.

To simulate a nominal sensor with the Rosemount 8714, you must change the following five parameters in the Rosemount 8732E:

1. Sensor Calibration Number—1000015010000000
2. Units—ft/s
3. PV URV—AI EU at 100 = 30.00 ft/s
4. PV LRV—AI EU at 0 = 0 ft/s
5. Coil Drive Frequency—5 Hz

The instructions for changing the Sensor Calibration Number, Units, PV URV, and PV LRV are located in “Basic Setup” on page 3-14. Instructions for changing the Coil Drive Frequency can be found on page 4-12 in this section.

Set the loop to manual, if necessary, before you begin. Complete the following steps:

1. Power down the transmitter.
2. Connect the transmitter to a Rosemount 8714 sensor simulator.
3. Power up the transmitter with the Rosemount 8714 connected and read the flow rate. The electronics need about a 5-minute warm-up time to stabilize.
4. Set the 8714 calibrator to the 30 ft/s setting.
5. The flow rate reading after warm-up should be between 29.97 and 30.03 ft/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 Handheld Communicator. The digital trim takes about 90 seconds to complete. No transmitter adjustments are required.

Auto Zero

375	Transducer Block, Diagnostics, Trims

The auto zero function initializes the transmitter for use with the 37 Hz coil drive mode only. Run this function only with the transmitter and sensor installed in the process. The sensor must be filled with process fluid at zero flow. Before running the auto zero function, be sure the coil drive mode is set to 37 Hz (Auto Zero will not run with the coil drive frequency set at 5 Hz).

Set the loop to manual if necessary and begin the auto zero procedure. The transmitter completes the procedure automatically in about 90 seconds. A symbol appears in the lower right-hand corner of the display to indicate that the procedure is running.

Universal Trim

375	Transducer Block, Diagnostics, Trims

The universal auto trim function enables the Rosemount 8732E 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 your Rosemount sensor has a 16-digit calibration number, in-process calibration is not required. If it does not, or if your sensor is made by another manufacturer, complete the following steps for in-process calibration.

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.

Status

375	Transducer Block, Diagnostics

Review status information regarding the operation of the transducer block. This is where additional information can be reviewed regarding transmitter health and diagnostic messages.

ADVANCED CONFIGURATION

In addition to the basic configuration options and the diagnostic information and controls, the 8732 has many advanced functions that can also be configured as required by the application.

DETAILED SETUP

375	Transducer Block

The detailed setup function provides access to other parameters within the transmitter that can be configured such as coil drive frequency, output parameters, local display configuration, and other general information about the device.

Additional Parameters

375	Transducer Block, Detailed Setup

The additional parameters menu provides a means to configure optional parameters within the 8732E transmitter.

Coil Drive Frequency

375	Transducer Block, Detailed Setup, Additional Params

Coil drive frequency allows pulse-rate selection of the sensor 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 output, increase the coil drive frequency to 37 Hz. If the 37 Hz mode is selected, perform the auto zero function.

Density Value

375	Transducer Block, Detailed Setup, Additional Params

The density value is used to convert from a volumetric flow rate to a mass flow rate using the following equation:

$Q_m = Q_v \times \rho$

Where:

Q_m is the mass flow rate

Q_v is the volumetric flow rate, and

ρ is the fluid density

NOTE
A density value is required to configure the flow units for mass flow rate measurement.

Sensor Range: EU at 100%

375	Transducer Block, Detailed Setup, Additional Params

This parameter is the maximum value that the PV Range value can be set to. This is the upper measuring limit of the transmitter and sensor.

Sensor Range: EU at 0%

375	Transducer Block, Detailed Setup, Additional Params

This parameter is the minimum value that the PV Range value can be set to. This is the lower measuring limit of the transmitter and sensor.

Cal Min Span

375	Transducer Block, Detailed Setup, Additional Params

The PV minimum span is the minimum flow range that must separate the minimum and maximum configured PV Range values.

Reverse Flow

375	Transducer Block, Detailed Setup, Additional Params

Enable or disable the transmitter's ability to read reverse flow.

Reverse Flow allows the transmitter to read negative flow. This may occur when flow in the pipe is going the negative direction, or when either electrode wires or coil wires are reversed. This also enables the totalizer to count in the reverse direction.

Display Language

375	Transducer Block, Detailed Setup

This allows you to configure the language shown on the display. There are five options available:

- English
- Spanish
- Portuguese
- German
- French

Signal Processing

375	Transducer Block, Detailed Setup

The 8732E contains several advanced functions that can be used to stabilize erratic outputs caused by process noise. The signal processing menu contains this functionality.

Operating Mode

375	Transducer Block, Detailed Setup, Signal Processing

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.

Man Config DSP

375	Transducer Block, Detailed Setup, Signal Processing

Manually configure the digital signal processing parameters.

The 8732E transmitter includes digital signal processing capabilities that can be used to condition the output from the transmitter by enabling noise rejection. See Appendix D: Digital Signal Processing for more information on the DSP functionality.

Control

375	Transducer Block, Detailed Setup, Signal Processing, Man Config DSP

When ON is selected, the Rosemount 8732E 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. 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, maximum percent limit, and time limit) are described below.

Samples

375	Transducer Block, Detailed Setup, Signal Processing, Man Config DSP

0 to 125 Samples

The number of samples function sets the amount of time that inputs are collected and used to calculate the average value. Each second is divided into tenths (1/10) with the number of samples equaling the number of 1/10 second increments used to calculate the average.

For example, a value of:

1 averages the inputs over the past 1/10 second

10 averages the inputs over the past 1 second

100 averages the inputs over the past 10 seconds

125 averages the inputs over the past 12.5 seconds

% Limit

375	Transducer Block, Detailed Setup, Signal Processing, Man Config DSP

0 to 100 Percent

The maximum percent limit is a tolerance band set up on either side of the running average. The percentage value refers to deviation from the running average. For example, if the running average is 100 gal/min, and a 2 percent maximum limit is selected, then the acceptable range is from 98 to 102 gal/min.

Values within the limit are accepted while values outside the limit are analyzed to determine if they are a noise spike or an actual flow change.

Time Limit

375	Transducer Block, Detailed Setup, Signal Processing, Man Config DSP

0 to 256 Seconds

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 8732E 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. The selected signal processing configuration may be turned ON or OFF to suit your needs.

Coil Drive Frequency

375	Transducer Block, Detailed Setup, Signal Processing

Coil drive frequency allows pulse-rate selection of the sensor 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 output, increase the coil drive frequency to 37 Hz. If the 37 Hz mode is selected, perform the auto zero function with no flow and a full sensor.

Low Flow Cutoff

375	Transducer Block, Detailed Setup, Signal Processing

Low flow cutoff allows you to specify the flow rate, between 0.01 and 38.37 feet per second, below which the outputs are driven to zero flow. The units format for low flow cutoff cannot be changed. It is always displayed as feet per second regardless of the format selected. The low flow cutoff value applies to both forward and reverse flows.

Primary Variable Damping

375	Transducer Block, Detailed Setup, Signal Processing

0 to 256 Seconds

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.

Device Info

375	Transducer Block, Detailed Setup

Information variables are used for identification of flowmeters in the field and to store information that may be useful in service situations. Information variables have no effect on flowmeter output or process variables.

Device ID

375	Transducer Block, Detailed Setup, Device Info

This function displays the Device ID of the transmitter. This is one piece of information required to generate a license code to enable diagnostics in the field.

PV Sensor S/N

375	Transducer Block, Detailed Setup, Device Info

The PV sensor serial number is the serial number of the sensor connected to the transmitter and can be stored in the transmitter configuration for future reference. The number provides easy identification if the sensor needs servicing or for other purposes.

Sensor Tag

375	Transducer Block, Detailed Setup, Device Info

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

DSP Software Rev

375	Transducer Block, Detailed Setup, Device Info

This function displays the software revision number of the transmitter.

Construction Materials

375	Transducer Block, Detailed Setup, Device Info

Construction materials contain information about the sensor that is connected to the transmitter. This information is configured into the transmitter for later reference. This information can be helpful when calling the factory for support.

Flange Type

375	Transducer Block, Detailed Setup, Device Info, Construction Materials

Flange type enables you to select the flange type for your magnetic transmitter system. This variable only needs to be changed if you have changed your sensor. Options for this value are:

• ANSI 150	• PN 10
• ANSI 300	• PN 16
• ANSI 600	• PN 25
• ANSI 900	• PN 40
• ANSI 1500	• PN 64
• ANSI 2500	• Other
• Wafer	

Flange Material

375	Transducer Block, Detailed Setup, Device Info, Construction Materials

Flange material enables you to select the flange material for your magnetic transmitter system. This variable only needs to be changed if you have changed your sensor. Options for this value are:

- Carbon Steel
- 304L Stainless Steel
- 316L Stainless Steel
- Wafer
- Other

Electrode Type

375	Transducer Block, Detailed Setup, Device Info, Construction Materials

Electrode type enables you to select the electrode type for your magnetic transmitter system. This variable only needs to be changed if you have replaced electrodes or if you have replaced your sensor. Options for this value are:

- Standard
- Std & Ground
- Bullet
- Other

Electrode Material

375	Transducer Block, Detailed Setup, Device Info, Construction Materials

Electrode Material enables you to select the electrode material for your magnetic transmitter system. This variable only needs to be changed if you have replaced electrodes or if you have replaced your sensor. Options for this value are:

- 316L SST
- Nickel Alloy 276 (UNS N10276)
- Tantalum
- Titanium
- 80% Platinum – 20% Iridium
- Alloy 20
- Other

Liner Material

375	Transducer Block, Detailed Setup, Device Info, Construction Materials

Liner material enables you to select the liner material for the attached sensor. This variable only needs to be changed if you have replaced your sensor. Options for this value are:

- PTFE
- ETFE
- PFA
- Polyurethane
- Linatex
- Natural Rubber
- Neoprene
- Other

MODE

375	Transducer Block

Set and review the mode configuration for the transducer function block.

Block Mode: Target

375	Transducer Block, Mode

Operator requested mode for the function block. Only one selection may be made. Options include:

Auto
Use this mode when all configuration changes to the block are complete and the transmitter is ready to be returned to service.

OOS
Out of service mode. Use this mode when making configuration changes to parameters found in the function block. This removes the transmitter from operation until the mode is set back to Auto.

Block Mode: Actual

375	Transducer Block, Mode

This is the current mode of the function block. This mode may differ from the Target mode based on operating conditions.

Block Mode: Permitted

375	Transducer Block, Mode

This parameter defines which modes are available for a given function block.

Block Mode: Normal

375	Transducer Block, Mode

Displays the mode that the function block should be set to for normal operation.

Section 5 Sensor Installation

This section covers the steps required to physically install the magnetic sensor. For electrical connections and cabling see Section 2: "Installation". Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Please refer to the following safety messages before performing any operation in this section.

SAFETY MESSAGES

⚠ This symbol is used throughout this manual to indicate that special attention to warning information is required.

⚠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 that the operating environment of the sensor and transmitter is consistent with the appropriate hazardous area approval.

Do not connect a Rosemount 8732 to a non-Rosemount sensor that is located in an explosive atmosphere.

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 8732 reference manual for any restrictions associated with a safe installation.

Before connecting a Field 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.

Electrical shock can result in death or serious injury

Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

⚠WARNING

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.

To avoid possible damage to the sensor liner ends, do not use metallic or spiral-wound gaskets. If frequent removal is anticipated, take precautions to protect the liner ends. Short spool pieces attached to the sensor ends are often used for protection.

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 limits. Failure to observe these instructions could result in severe damage to the sensor lining and possible sensor replacement.

Emerson Process Management can supply lining protectors to prevent liner damage during removal, installation, and excessive bolt torquing.

SENSOR HANDLING

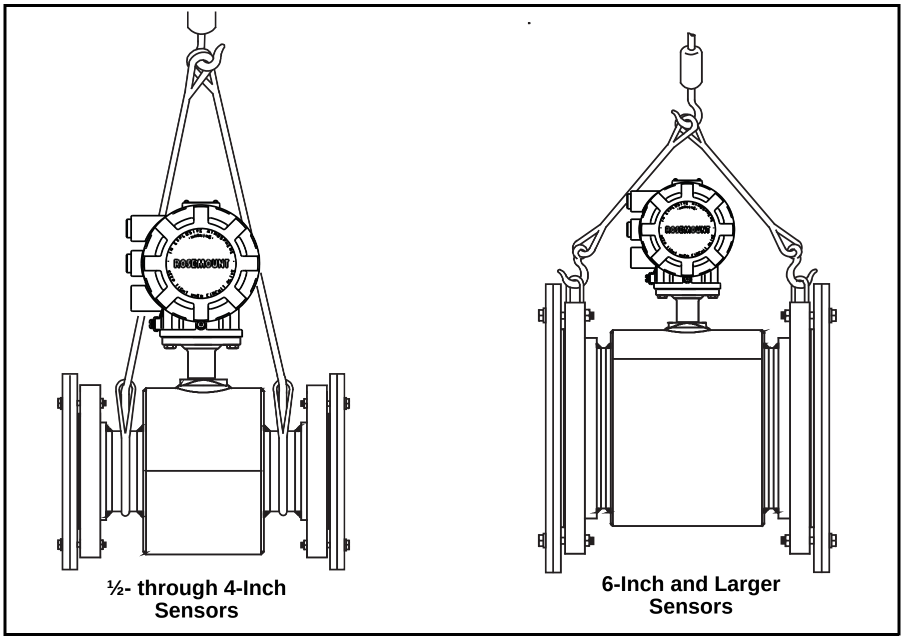
Handle all parts carefully to prevent damage. Whenever possible, transport the system to the installation site in the original shipping containers. PTFE-lined sensors are shipped with end covers that protect it from both mechanical damage and normal unrestrained distortion. Remove the end covers just before installation.

Flanged 6- through 36-inch sensors come with a lifting lug on each flange. The lifting lugs make the sensor easier to handle when it is transported and lowered into place at the installation site.

Flanged ½- to 4-inch sensors do not have lugs. They must be supported with a lifting sling on each side of the housing.

Figure 5-1 shows sensors correctly supported for handling and installation. Notice the plywood end pieces are still in place to protect the sensor liner during transportation.

Figure 5-1. Rosemount 8705 Sensor Support for Handling



See "Safety Messages" on pages 5-1 and 5-2 for complete warning information.

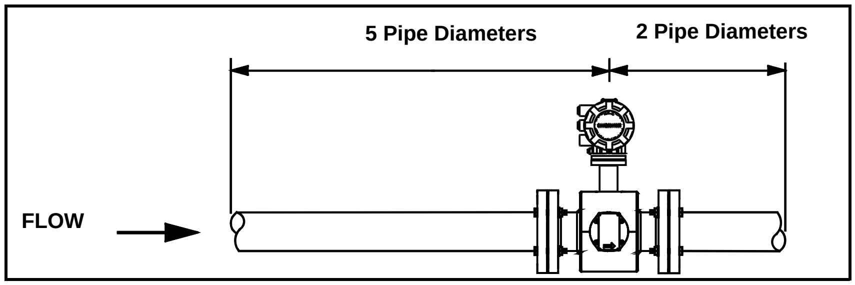
SENSOR MOUNTING

Physical mounting of a sensor is similar to installing a typical section of pipe. Conventional tools, equipment, and accessories (bolts, gaskets, and grounding hardware) are required.

Upstream/Downstream Piping

To ensure specification accuracy over widely varying process conditions, install the sensor a minimum of five straight pipe diameters upstream and two pipe diameters downstream from the electrode plane (see Figure 5-2).

Figure 5-2. Upstream and Downstream Straight Pipe Diameters



Sensor Orientation

The sensor should be installed in a position that ensures the sensor remains full during operation. Figures 5-3, 5-4, and 5-5 show the proper sensor orientation for the most common installations. The following orientations ensure that the electrodes are in the optimum plane to minimize the effects of entrapped gas.

Vertical installation allows upward process fluid flow and is generally preferred. Upward flow keeps the cross-sectional area full, regardless of flow rate. Orientation of the electrode plane is unimportant in vertical installations. As illustrated in Figures 5-3 and 5-4, avoid *downward* flows where back pressure does not ensure that the sensor remains full at all times.

Installations with reduced straight runs from 0 to five pipe diameters are possible. In reduced straight pipe run installations, performance will shift to as much as 0.5% of rate. Reported flow rates will still be highly repeatable.

Figure 5-3. Vertical Sensor Orientation

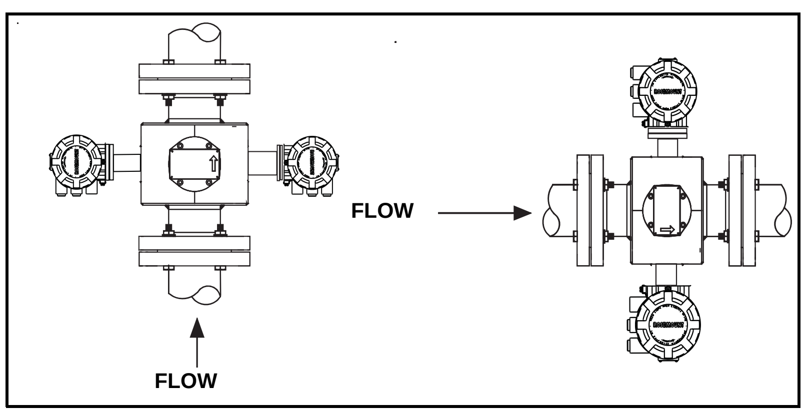
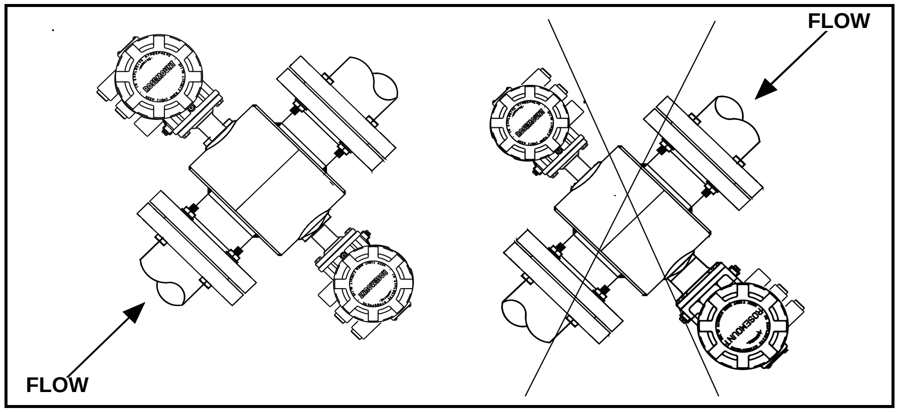
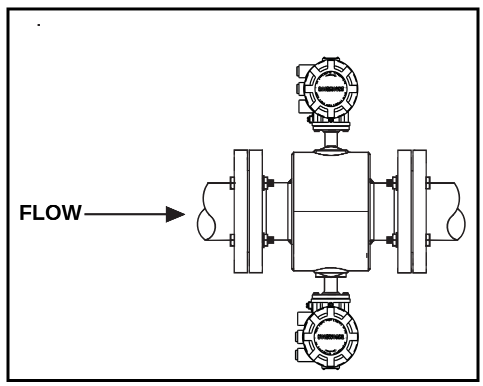


Figure 5-4. Incline or Decline Orientation



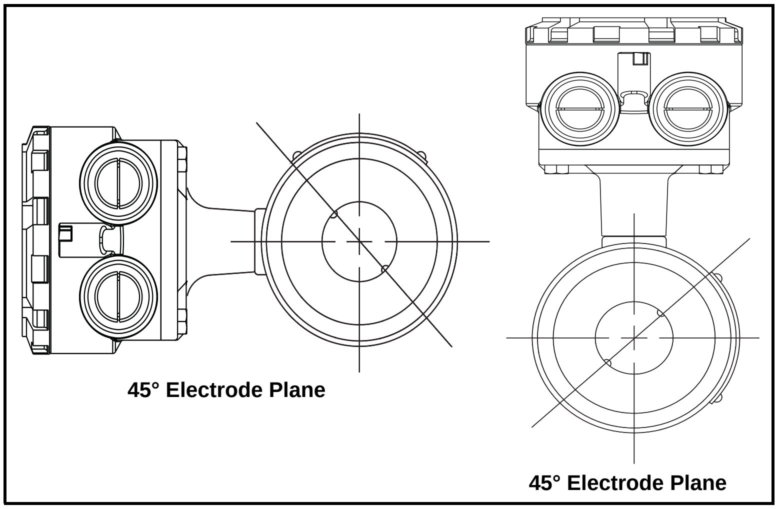
Horizontal installation should be restricted to low piping sections that are normally full. Orient the electrode plane to within 45 degrees of horizontal in horizontal installations. A deviation of more than 45 degrees of horizontal would place an electrode at or near the top of the sensor thereby making it more susceptible to insulation by air or entrapped gas at the top of the sensor.

Figure 5-5. Horizontal Sensor Orientation



The electrodes in the Rosemount 8711 are properly oriented when the top of the sensor is either vertical or horizontal, as shown in Figure 5-6. Avoid any mounting orientation that positions the top of the sensor at 45 degrees from the vertical or horizontal position.

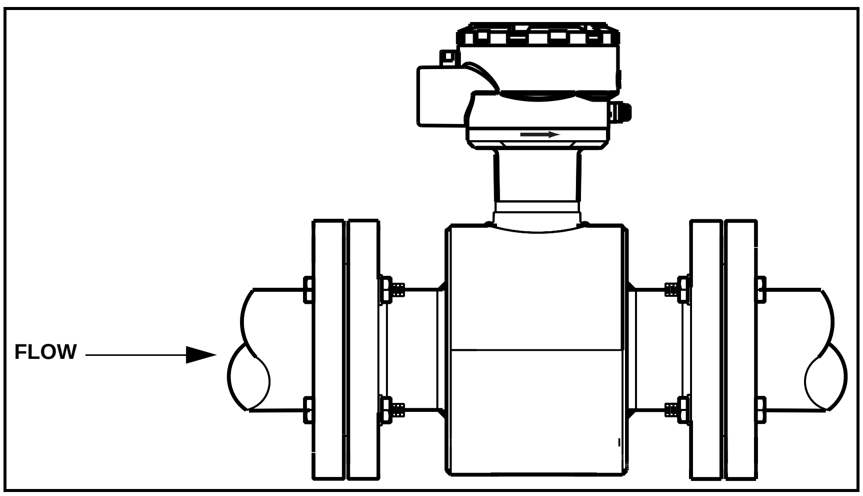
Figure 5-6. Rosemount 8711 Mounting Position



Flow Direction

The sensor should be mounted so that the FORWARD end of the flow arrow, shown on the sensor identification tag, points in the direction of flow through the sensor (see Figure 5-7).

Figure 5-7. Flow Direction



INSTALLATION (FLANGED SENSOR)

The following section should be used as a guide in the installation of the flange-type Rosemount 8705 and Rosemount 8707 High-Signal Sensors. Refer to page 5-10 for installation of the wafer-type Rosemount 8711 Sensor.

Gaskets

⚠ The sensor requires a gasket at each of its connections to adjacent devices or piping. The gasket material selected must be compatible with the process fluid and operating conditions. **Metallic or spiral-wound gaskets can damage the liner.** If the gaskets will be removed frequently, protect the liner ends. All other applications (including sensors with lining protectors or a grounding electrode) require only one gasket on each end connection, as shown in Figure 5-8. If grounding rings are used, gaskets are required on each side of the grounding ring, as shown in Figure 5-9.

Figure 5-8. Gasket Placement

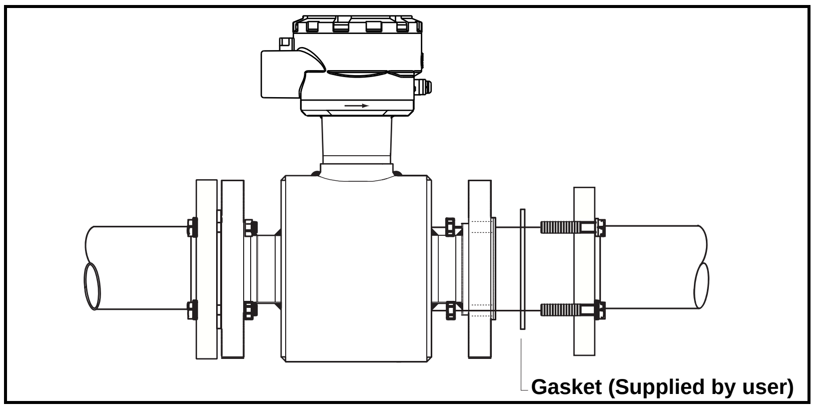
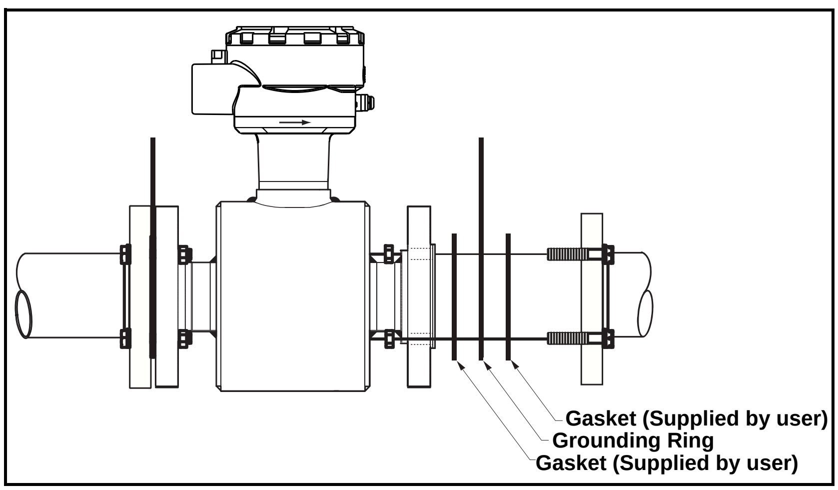


Figure 5-9. Gasket Placement with Non-attached Grounding Rings



Flange Bolts

Suggested torque values by sensor line size and liner type are listed in Table 5-1 on page 5-8 for ASME B16.5 (ANSI) flanges and Table 5-2 and Table 5-3 for DIN flanges. Consult the factory for other flange ratings. Tighten flange bolts in the incremental sequence as shown in Figure 5-10. See Table 5-1 and Table 5-2 for bolt sizes and hole diameters.

⚠ See ”Safety Messages” on pages 5-1 and 5-2 for complete warning information.

NOTE
Do not bolt one side at a time. Tighten each side simultaneously. Example:
1. Snug left
2. Snug right
3. Tighten left
4. Tighten right

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.

⚠ Always check for leaks at the flanges after tightening the flange bolts. Failure to use the correct flange bolt tightening methods can result in severe damage. All sensors require a second torquing 24 hours after initial flange bolt tightening.

Table 5-1. Flange Bolt Torque Specifications for Rosemount 8705 and 8707 High-Signal Sensors

		PTFE/ETFE liner		Polyurethane liner	
Size Code	Line Size	Class 150 (pound-feet)	Class 300 (pound-feet)	Class 150 (pound-feet)	Class 300 (pound-feet)
005	1/2-inch (15 mm)	8	8	—	—
010	1 inch (25 mm)	8	12	—	—
015	1 1/2 inch (40 mm)	13	25	7	18
020	2 inch (50 mm)	19	17	14	11
030	3 inch (80 mm)	34	35	23	23
040	4 inch (100 mm)	26	50	17	32
060	6 inch (150mm)	45	50	30	37
080	8 inch (200 mm)	60	82	42	55
100	10 inch (250 mm)	55	80	40	70
120	12 inch (300 mm)	65	125	55	105
140	14 inch (350 mm)	85	110	70	95
160	16 inch (400 mm)	85	160	65	140
180	18 inch (450 mm)	120	170	95	150
200	20 inch (500 mm)	110	175	90	150
240	24 inch (600 mm)	165	280	140	250
300	30 inch (750 mm)	195	415	165	375
360	36 inch (900 mm)	280	575	245	525

⚠ See "Safety Messages" on pages 5-1 and 5-2 for complete warning information.

Table 5-2. Flange Bolt Torque and Bolt Load Specifications for Rosemount 8705

		PTFE/ETFE liner							
		PN10		PN 16		PN 25		PN 40	
Size Code	Line Size	(Newton-meter)	(Newton)	(Newton-meter)	(Newton)	(Newton-meter)	(Newton)	(Newton-meter)	(Newton)
005	1/2-inch (15 mm)	7	3209	7	3809	7	3809	7	4173
010	1 inch (25 mm)	13	6983	13	6983	13	6983	13	8816
015	1 1/2 inch (40 mm)	24	9983	24	9983	24	9983	24	13010
020	2 inch (50 mm)	25	10420	25	10420	25	10420	25	14457
030	3 inch (80 mm)	14	5935	14	5935	18	7612	18	12264
040	4 inch (100 mm)	17	7038	17	7038	30	9944	30	16021
060	6 inch (150mm)	23	7522	32	10587	60	16571	60	26698
080	8 inch (200 mm)	35	11516	35	11694	66	18304	66	36263
100	10 inch (250 mm)	31	10406	59	16506	105	25835	105	48041
120	12 inch (300 mm)	43	14439	82	22903	109	26886	109	51614
140	14 inch (350 mm)	42	13927	80	22091	156	34578	156	73825
160	16 inch (400 mm)	65	18189	117	28851	224	45158	224	99501
180	18 inch (450 mm)	56	15431	99	24477	—	—	—	67953
200	20 inch (500 mm)	66	18342	131	29094	225	45538	225	73367
240	24 inch (600 mm)	104	25754	202	40850	345	63940	345	103014

Figure 5-10. Flange Bolt Torquing Sequence

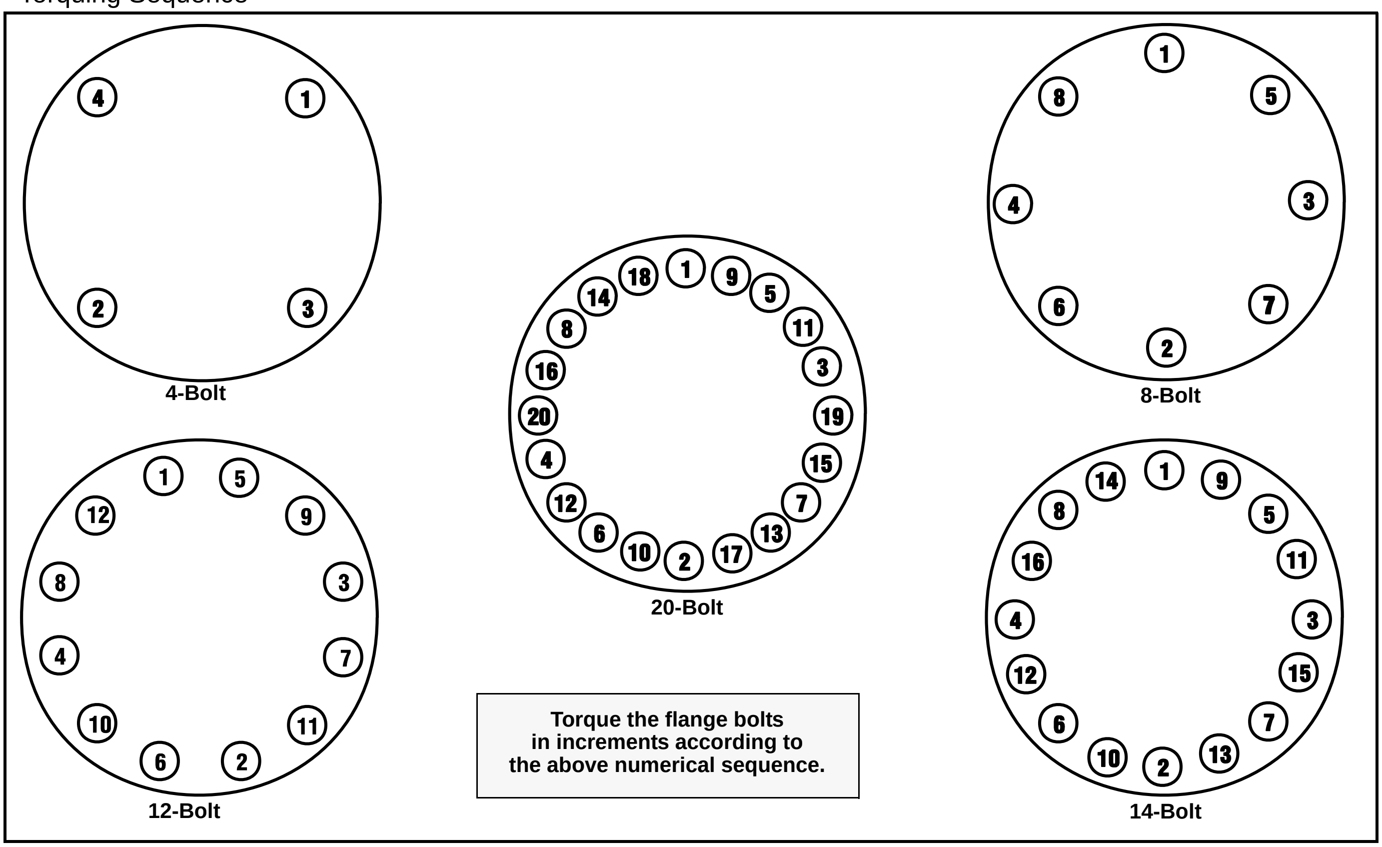


Table 5-3. Flange Bolt Torque and Bolt Load Specifications for Rosemount 8705

Size Code	Line Size	Polyurethane Liner PN 10 (Newton-meter)	PN 10 (Newton)	PN 16 (Newton-meter)	PN 16 (Newton)	PN 25 (Newton-meter)	PN 25 (Newton)	PN 40 (Newton-meter)	PN 40 (Newton)
005	1/2-inch (15 mm)	1	521	1	826	2	1293	6	3333
010	1 inch (25 mm)	2	1191	3	1890	5	2958	10	5555
015	1 1/2 inch (40 mm)	5	1960	7	3109	12	4867	20	8332
020	2 inch (50 mm)	6	2535	10	4021	15	6294	26	10831
030	3 inch (80 mm)	5	2246	9	3563	13	5577	24	19998
040	4 inch (100 mm)	7	3033	12	4812	23	7531	35	11665
060	6 inch (150mm)	16	5311	25	8425	47	13186	75	20829
080	8 inch (200 mm)	27	8971	28	9487	53	14849	100	24687
100	10 inch (250 mm)	26	8637	49	13700	87	21443	155	34547
120	12 inch (300 mm)	36	12117	69	19220	91	22563	165	36660
140	14 inch (350 mm)	35	11693	67	18547	131	29030	235	47466
160	16 inch (400 mm)	55	15393	99	24417	189	38218	335	62026
200	20 inch (500 mm)	58	15989	114	25361	197	39696	375	64091
240	24 inch (600 mm)	92	22699	178	36006	304	56357	615	91094

INSTALLATION (WAFER SENSOR)

The following section should be used as a guide in the installation of the Rosemount 8711 Sensor. Refer to page 5-7 for installation of the flange-type Rosemount 8705 and 8707 High-Signal sensor.

Gaskets

⚠ The sensor requires a gasket at each of its connections to adjacent devices or piping. The gasket material selected must be compatible with the process fluid and operating conditions. **Metallic or spiral-wound gaskets can damage the liner.** If the gaskets will be removed frequently, protect the liner ends. If grounding rings are used, a gasket is required on each side of the grounding ring.

Alignment and Bolting

1. On 1 1/2 - through 8-inch (40 through 200 mm) line sizes, place centering rings over each end of the sensor. The smaller line sizes, 0.15- through 1-inch (4 through 25 mm), do not require centering rings.
2. Insert studs for the bottom side of the sensor between the pipe flanges. Stud specifications are listed in Table 5-4. **Using carbon steel bolts on smaller line sizes, 0.15- through 1-inch (4 through 25 mm), rather than the required stainless steel bolts, will degrade performance.**

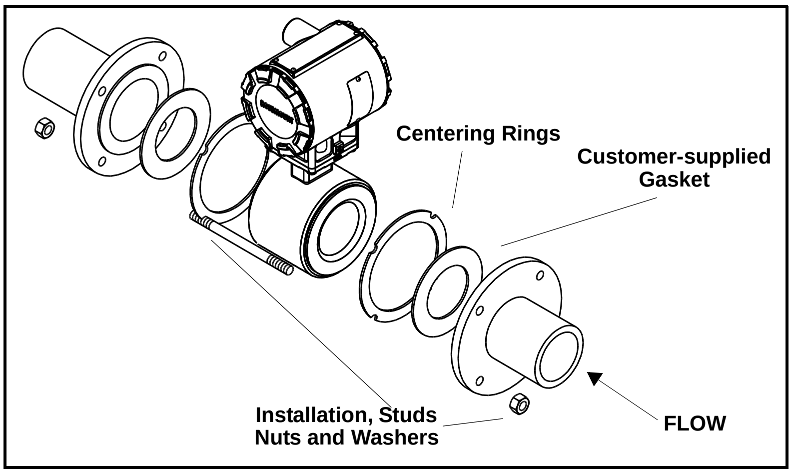
Table 5-4. Stud Specifications

Nominal Sensor Size	Stud Specifications
0.15 – 1 inch (4 – 25 mm)	316 SST ASTM A193, Grade B8M Class 1 threaded mounted studs
1 1/2 – 8 inch (40 – 200 mm)	CS, ASTM A193, Grade B7, threaded mounting studs

3. Place the sensor between the flanges. Make sure that the centering rings are properly placed in the studs. The studs should be aligned with the markings on the rings that correspond to the flange you are using.
4. Insert the remaining studs, washers, and nuts.
5. Tighten to the torque specifications shown in Table 5-5. Do not overtighten the bolts or the liner may be damaged.

NOTE
On the 4- and 6- inch PN 10-16, insert the sensor with rings first and then insert the studs. The slots on this ring scenario are located on the inside of the ring.

Figure 5-11. Gasket Placement with Centering Rings



Flange Bolts

Sensor sizes and torque values for both Class 150 and Class 300 flanges are listed in Table 5-5. Tighten flange bolts in the incremental sequence, shown in Figure 5-10.

NOTE
Do not bolt one side at a time. Tighten each side simultaneously. Example:
1. Snug left
2. Snug right
3. Tighten left
4. Tighten right
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.

⚠ Always check for leaks at the flanges after tightening the flange bolts. All sensors require a second torquing 24 hours after initial flange bolt tightening.

Table 5-5. Flange bolt Torque Specifications of Rosemount 8711 Sensors

Size Code	Line Size	Pound-feet	Newton-meter
15F	0.15 inch (4 mm)	5	6.8
30F	0.30 inch (8 mm)	5	6.8
005	$^{1}/_{2}$-inch (15 mm)	5	6.8
010	1 inch (25 mm)	10	13.6
015	$1^{1}/_{2}$ inch (40 mm)	15	20.5
020	2 inch (50 mm)	25	34.1
030	3 inch (80 mm)	40	54.6
040	4 inch (100 mm)	30	40.1
060	6 inch (150 mm)	50	68.2
080	8 inch (200 mm)	70	81.9

INSTALLATION (SANITARY SENSOR)

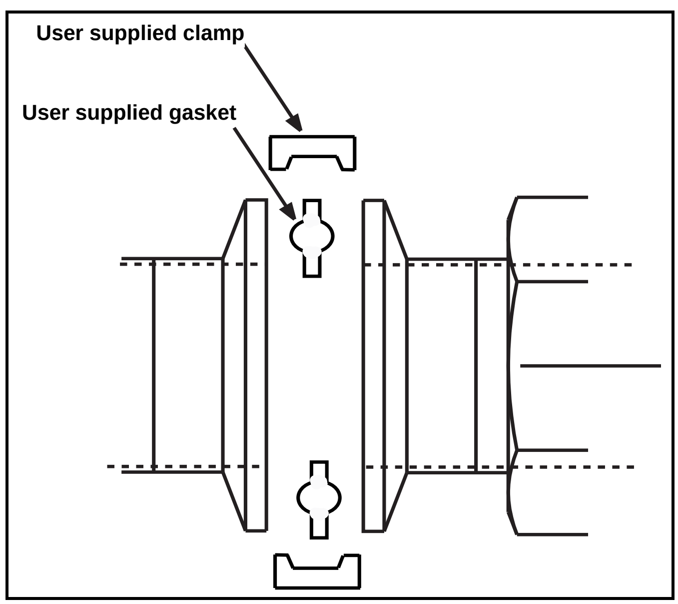
Gaskets

The sensor requires a gasket at each of its connections to adjacent devices or piping. The gasket material selected must be compatible with the process fluid and operating conditions. Gaskets are supplied with all Rosemount 8721 Sanitary sensors except when the process connection is an IDF sanitary screw type.

Alignment and Bolting

Standard plant practices should be followed when installing a magmeter with sanitary fittings. Unique torque values and bolting techniques are not required.

Figure 5-12. Rosemount 8721 Sanitary Installation



Process grounding the sensor is one of the most important details of sensor installation. Proper process grounding ensures that the transmitter amplifier is referenced to the process. This creates the lowest noise environment for the transmitter to make a stable reading. Use Table 5-6 to determine which grounding option to follow for proper installation.

NOTE
Consult factory for installations requiring cathodic protection or situations where there are high currents or high potential in the process.

The sensor case should always be earth grounded in accordance with national and local electrical codes. Failure to do so may impair the protection provided by the equipment. The most effective grounding method is direct connection from the sensor to earth ground with minimal impedance.

The Internal Ground Connection (Protective Ground Connection) located in side the junction box is the Internal Ground Connection screw. This screw is identified by the ground symbol: ⏚

Table 5-6. Grounding Installation

	Grounding Options			
Type of Pipe	**No Grounding Options**	**Grounding Rings**	**Grounding Electrodes**	**Lining Protectors**
Conductive Unlined Pipe	See Figure 5-13	Not Required	Not Required	See Figure 5-14
Conductive Lined Pipe	Insufficient Grounding	See Figure 5-14	See Figure 5-13	See Figure 5-14
Non-Conductive Pipe	Insufficient Grounding	See Figure 5-15	See Figure 5-16	See Figure 5-15

Figure 5-13. No Grounding Options or Grounding Electrode in Lined Pipe

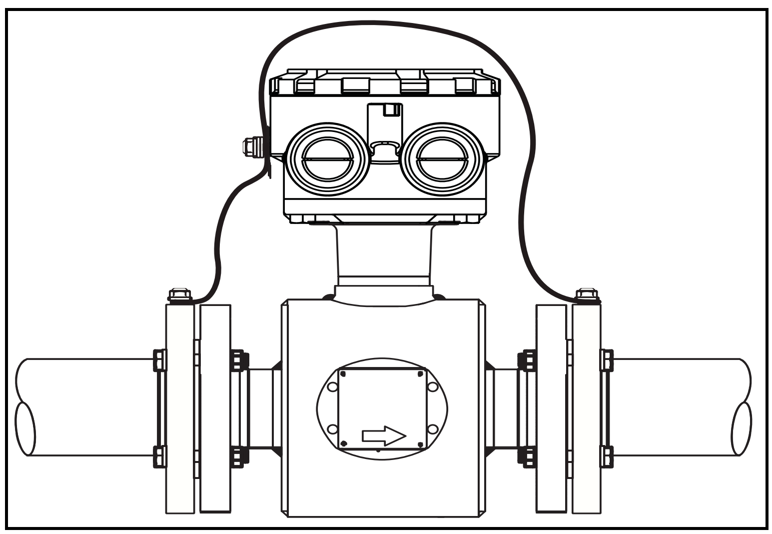


Figure 5-14. Grounding with Grounding Rings or Lining Protectors

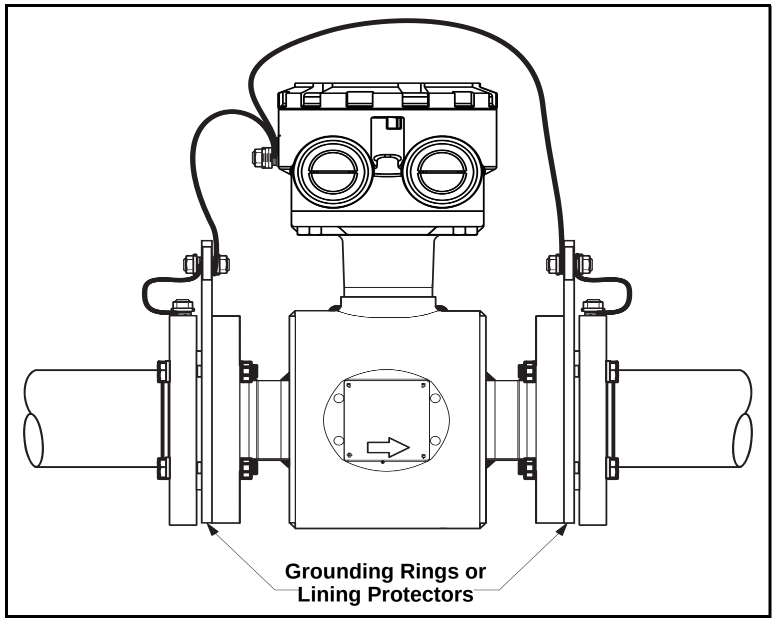


Figure 5-15. Grounding with Grounding Rings or Lining Protectors

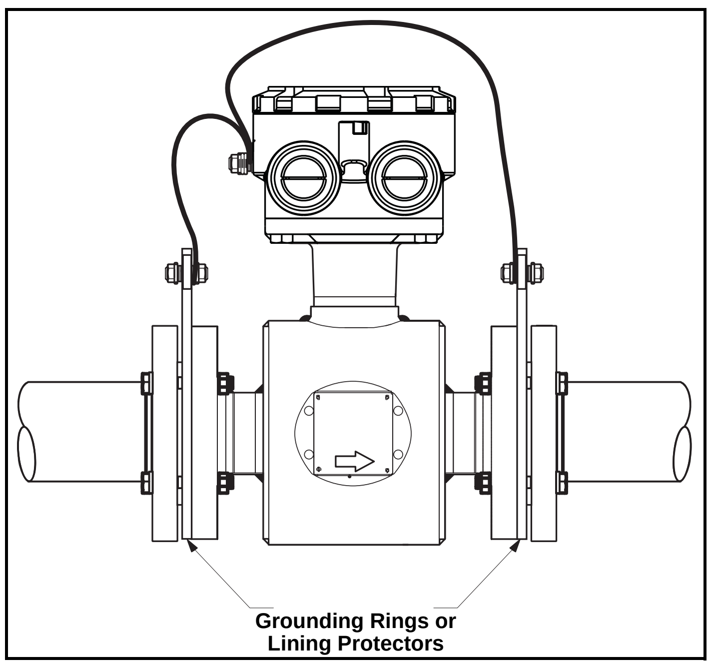
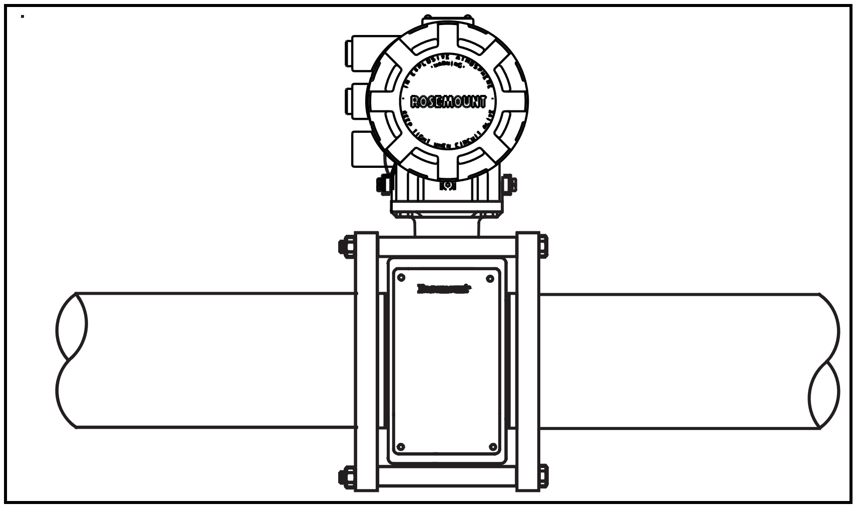


Figure 5-16. Grounding with Grounding Electrodes



PROCESS LEAK PROTECTION (OPTIONAL)

The Rosemount 8705 and 8707 High-Signal Sensor housing is fabricated from carbon steel to perform two separate functions. First, it provides shielding for the sensor magnetics so that external disturbances cannot interfere with the magnetic field and thus affect the flow measurement. Second, it provides the physical protection to the coils and other internal components from contamination and physical damage that might occur in an industrial environment. The housing is completely welded and gasket-free.

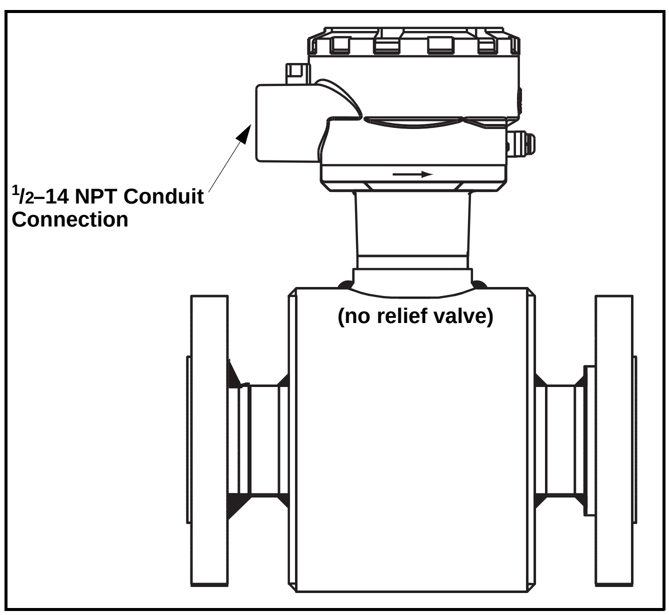
The three housing configurations are identified by the W0, W1, or W3 in the model number option code when ordering. Below are brief descriptions of each housing configuration, which are followed by a more detailed overview.

- **Code W0** — sealed, welded coil housing (standard configuration)
- **Code W1** — sealed, welded coil housing with a relief valve capable of venting fugitive emissions to a safe location (additional plumbing from the sensor to a safe area, installed by the user, is required to vent properly)
- **Code W3** — sealed, welded coil housing with separate electrode compartments capable of venting fugitive emissions (additional plumbing from the sensor to a safe area, installed by the user, is required to vent properly)

Standard Housing Configuration

The standard housing configuration is identified by a code W0 in the model number. This configuration does not provide separate electrode compartments with external electrode access. In the event of a process leak, these models will not protect the coils or other sensitive areas around the sensor from exposure to the pressure fluid (Figure 5-17).

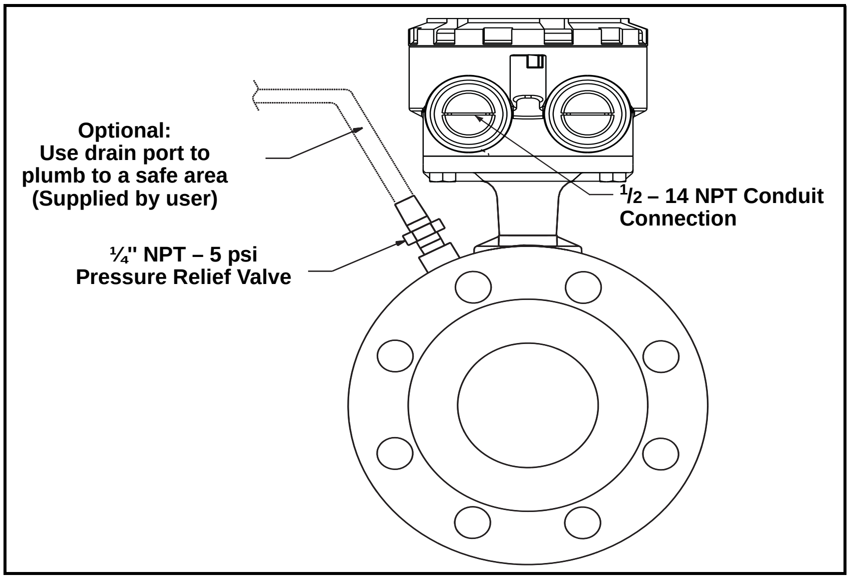
Figure 5-17. Standard Housing Configuration — Sealed Welded Housing (Option Code W0)



Relief Valves

The first optional configuration, identified by the W1 in the model number option code, uses a completely welded coil housing. This configuration does not provide separate electrode compartments with external electrode access. This optional housing configuration provides a relief valve in the housing to prevent possible overpressuring caused by damage to the lining or other situations that might allow process pressure to enter the housing. The relief valve will vent when the pressure inside the sensor housing exceeds 5 psi. Additional piping (provided by the user) may be connected to this relief valve to drain any process leakage to safe containment (see Figure 5-18).

Figure 5-18. Coil-Housing Configuration — Standard Welded Housing With Relief Valve (Option Code W1)



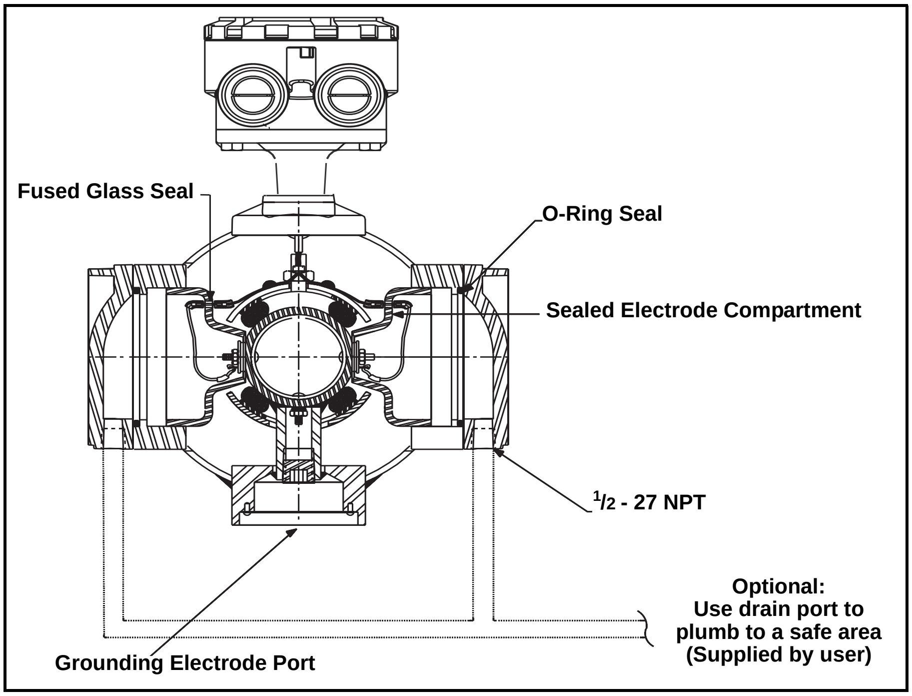
Process Leak Containment

The second optional configuration, identified as option code W3 in the model number, divides the coil housing into three compartments: one for each electrode and one for the coils. Should a damaged liner or electrode fault allow process fluid to migrate behind the electrode seals, the fluid is contained in the electrode compartment. The sealed electrode compartment prevents the process fluid from entering the coil compartment where it would damage the coils and other internal components.

The electrode compartments are designed to contain the process fluid at full line pressure. An o-ring sealed cover provides access to each of the electrode compartments from outside the sensor; drainports are provided in each cover for the removal of fluid.

NOTE
The electrode compartment could contain full line pressure and it must be depressurized before the cover is removed.

Figure 5-19. Housing Configuration — Sealed Electrode Compartment (Option Code W3)



If necessary, capture any process fluid leakage, connect the appropriate piping to the drainports, and provide for proper disposal (see Figure 5-19).

Section 6 Maintenance and Troubleshooting

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 your system. If the problem persists, consult your local Rosemount representative to determine if the material should be returned to the factory. Emerson Process Management 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. Please read the following safety messages before performing any operation described in this section. Refer to these warnings when appropriate throughout this section.

SAFETY INFORMATION

⚠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 that the operating environment of the sensor and transmitter is consistent with the appropriate FM or CSA approval.

Do not connect a Rosemount 8732 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.

The 8732 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 pin point the problem and make the appropriate adjustments.

If there are problems with a new magmeter installation, see “Installation Check and Guide” on page 6-2 for a quick guide to solve the most common installation problems. For existing magmeter installations, Table 6-4 lists the most common magmeter problems and corrective actions.

INSTALLATION CHECK AND GUIDE

Use this guide to check new installations of Rosemount magnetic flowmeter systems that appear to malfunction.

Before You Begin

Transmitter

Apply power to your system before making the following transmitter checks.

1. Verify that the correct sensor calibration number is entered in the transmitter. The calibration number is listed on the sensor nameplate.
2. Verify that the correct sensor line size is entered in the transmitter. The line size value is listed on the sensor nameplate.
3. Verify that the function blocks are not in Out of Service mode.
4. Verify that the transmitter is functioning correctly by using the 8714i Meter Verification diagnostic or the 8714D Calibration Reference Standard.

Sensor

Be sure that power to your system is removed before beginning sensor checks.

1. **For horizontal flow installations**, ensure that the electrodes remain covered by process fluid.

   For vertical or inclined installations, ensure that the process fluid is flowing up into the sensor to keep the electrodes covered by process fluid.
2. Ensure that the grounding straps on the sensor are connected to grounding rings, lining protectors, or the adjacent pipe flanges. Improper grounding will cause erratic operation of the system.

Wiring for Remote Configurations

1. The signal wire and coil drive wire must be twisted shielded cable. Emerson Process Management, Rosemount division. recommends 20 AWG twisted shielded cable for the electrodes and 14 AWG twisted shielded cable for the coils.
2. The cable shield must be connected at both ends of the electrode and coil drive cables. Connection of the signal wire shield at both ends is necessary for proper operation. It is recommended that the coil drive wire shield also be connected at both ends for maximum flowmeter performance
3. The signal and coil drive wires must be separate cables, unless Emerson Process Management specified combo cable is used. See Table 2-2 on page 2-11.
4. The single conduit that houses both the signal and coil drive cables should not contain any other wires.

Process Fluid

1. The process fluid conductivity should be 5 microsiemens (5 micro mhos) per centimeter minimum.
2. The process fluid must be free of air and gasses.
3. The sensor should be full of process fluid.

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 your system.

Table 6-1. Rosemount 8732 Basic Diagnostic Messages

Message	Potential Cause	Corrective Action
"Fieldbus Not Communicating"	Fieldbus segment is disconnected	Connect the fieldbus segment
	Fieldbus segment power missing	Verify the segment fieldbus voltage
	Electronics failure	Replace electronics
"Sensor Processor Not Communicating"	Transmitter input power (AC/DC) is not connected	Connect the input power. If the LCD displays a message, the input power is applied
	Electronics failure	Replace electronics
"Empty Pipe"	Empty Pipe	None - message will clear when pipe is full
	Wiring Error	Check that wiring matches appropriate wiring diagrams - see Appendix E: Universal Sensor Wiring Diagrams
	Electrode Error	Perform sensor tests C and D (see Table 6-5 on page 6-8)
	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
"Coil Open Circuit"	Improper wiring	Check coil drive wiring and sensor coils Perform sensor test A - Sensor Coil
	Other manufacturer's sensor	Change coil current to 75 mA Perform a Universal Auto Trim to select the proper coil current
	Circuit Board Failure	Replace Rosemount 8732 Electronics
	Coil Circuit OPEN Fuse	Return to factory for fuse replacement
"Auto Zero Failure" (Cycle power to clear messages, no changes were made)	Flow is not set to zero	Force flow to zero, perform autozero
	Unshielded cable in use	Change wire to shielded cable
	Moisture problems	See moisture problems in "Accuracy Section"
	Empty pipe is present	Fill sensor with process fluid
"Universal Trim Failure"	No flow in pipe while performing Universal Auto Trim	Establish a known flow in sensor, and perform Universal Auto-Trim calibration
	Wiring error	Check that wiring matches appropriate wiring diagrams - see "Universal Sensor Wiring Diagrams" on page E-1
	Flow rate is changing in pipe while performing Universal Auto-Trim routine	Establish a constant flow in sensor, 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 1000005010000001
	Wrong sensor size selected	Correct sensor size setting - See "Line Size" on page 3-9
	Sensor failure	Perform sensor tests C and D (see Table 6-5 on page 6-8)
"Electronics Failure"	Electronics self check failure	Replace Electronics
"Electronics Temp Fail"	Ambient temperature exceeded the electronics temperature limits	Move transmitter to a location with an ambient temperature range of -40 to 165 °F (-40 to 74 °C)
"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	Re-install sensor correctly, or switch either the electrode wires (18 and 19) or the coil wires (1 and 2)
"Flow Rate > Sensor Limit"	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 test A - Sensor Coil (see Table 6-5 on page 6-8)
"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 1000005010000001
	Calibrator is not set to 30 FPS	Change calibrator setting to 30 FPS
	Bad calibrator	Replace calibrator

Table 6-2. Rosemount 8732 Advanced Diagnostic Messages (Suite 1 - Option Code D01)

Message	Potential Cause	Corrective Action
Grounding/Wiring Fault	Improper installation of wiring	See “Sensor Connections” on page 2-11
	Coil/Electrode shield not connected	See “Sensor Connections” on page 2-11
	Improper process grounding	See “Grounding” on page 5-12
	Faulty ground connection	Check wiring for corrosion, moisture in the terminal block, and refer to “Grounding” on page 5-12
	Sensor not full	Verify sensor is full and empty pipe diagnostic is on
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 “Step 2: Process Noise” on page 6-7
	Chemical additives upstream of the sensor	Move injection point downstream of the sensor, or move the sensor Complete the possible solutions listed under “Step 2: Process Noise” on page 6-7
	Electrode not compatible with the process fluid	Refer to the Rosemount Magnetic Flowmeter Material Selection Guide (00816-0100-3033)
	Air in line	Move the sensor to another location in the process line to ensure that it is full under all conditions
	Electrode coating	Use bulletnose electrodes Downsize sensor to increases flowrate above 3 ft/s (1 m/s) Periodically clean sensor
	Styrofoam or other insulating particles	Complete the possible solutions listed under “Step 2: Process Noise” on page 6-7 Consult factory
	Low conductivity fluids (below 10 microsiemens/cm)	Trim electrode and coil wires - refer to “Installation” on page 2-1

Table 6-3. Rosemount 8732 Advanced Diagnostic Messages (Suite 2 - Option Code D02)

Message	Potential Cause	Corrective Action
8714i Failed	Transmitter Calibration Verification test failed	Verify pass/fail criteria Rerun 8714i Meter Verification under no flow conditions Verify calibration using 8714D Calibration Standard Perform digital trim Replace electronics board
	Sensor Calibration test failed	Verify pass/fail criteria Perform sensor test - see Table 6-5 on page 6-8
	Sensor Coil Circuit test failed	Verify pass/fail criteria Perform sensor test - see Table 6-5 on page 6-8
	Sensor Electrode Circuit test failed	Verify pass/fail criteria Perform sensor test - see Table 6-5 on page 6-8

TRANSMITTER TROUBLESHOOTING

Table 6-4. Advanced Troubleshooting–Rosemount 8732

Symptom	Potential Cause	Corrective Action
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
	Electrode Coating	Use bulletnose electrodes; Downsize sensor to increase flow rate above 3 ft/s; Periodically clean sensor
	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 A, B, C, and D (see Table 6-5 on page 6-8)
	Improper wiring	If electrode shield and signal wires are switched, flow indication will be about half of what is expected. Check wiring diagrams for your application.
	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 C and D (see Table 6-5 on page 6-8)
	Sensor failure–Shorted or open coil	Perform the sensor Tests A and B (see Table 6-5 on page 6-8)
	Transmitter failure	Verify transmitter operation with an 8714 Calibration Standard or replace the electronic board
Noisy Process	Chemical additives upstream of magnetic flowmeter	Complete the Noisy Process Basic procedure. 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	Complete the Noisy Process Basic procedure; Consult factory
	Electrode coating	Use replaceable electrodes in Rosemount 8705. Use a smaller sensor to increase flow rate above 3 ft/s. Periodically clean sensor.
	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 “Conduit Cables” on page 2-6 • Keep flow rate below 3 FPS • Integral mount transmitter • Use 8712-0752-1,3 cable • Use N0 approval sensor

Advanced Troubleshooting continued on next page

Table 6-4. Advanced Troubleshooting–Rosemount 8732

Symptom	Potential Cause	Corrective Action
Meter output is unstable	Medium to low conductivity fluids (10–25 microsiemens/cm) combined with cable vibration or 60 Hz interference	Eliminate cable vibration: • Integral mount • Move cable to lower vibration run • Tie down cable mechanically • Trim electrode and coil wires • See “Conduit Cables” on page 2-6 • Route cable line away from other equipment powered by 60 Hz • Use 8712-0752-1,3 cable
	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 “Mount the Transmitter” on page 2-3 for wiring and grounding procedures
	High local magnetic or electric fields	Move magnetic flowmeter (20–25 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 A, B, C, and D (See Table 6-5 on page 6-8)
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
	Electrode coating	Use bulletnose electrodes in the Rosemount 8705 Sensor. Downsize the sensor to increase the flow rate above 3 ft/s. Periodically clean the sensor
	Air in line	Move the sensor to another location in the process line to ensure that it is full under all conditions
	Flow rate is below 1 ft/s (specification issue)	See the accuracy specification for specific transmitter and sensor
	Insufficient upstream/downstream pipe diameter	Move sensor to location where 5 pipe diameters upstream and 2 pipe diameters downstream is possible
	Cables for multiple magmeters run through same conduit	Run only one conduit cable between each sensor and transmitter
	Auto zero was not performed when the coil drive frequency was changed from 5 Hz to 37.5 Hz	Perform the auto zero function with full pipe and no flow
	Sensor failure—shorted electrode	See Table 6-5 on page 6-8
	Sensor failure—shorted or open coil	See Table 6-5 on page 6-8
	Transmitter failure	Replace the electronics board
	Transmitter wired to correct sensor	Check wiring

QUICK TROUBLESHOOTING

Step 1: Wiring Errors

The most common magmeter problem is wiring between the sensor and the transmitter in remote mount installations. The signal wire and coil drive wire must be twisted shielded cable: 20 AWG twisted shielded cable for the electrodes and 14 AWG twisted shielded cable for the coils. Ensure that the cable shield is connected at both ends of the electrode and coil drive cables. Signal and coil drive wires must have their own cables. The single conduit that houses both the signal and coil drive cables should not contain any other wires. For more information on proper wiring practices, refer to "Transmitter to Sensor Wiring" on page 2-11.

Step 2: Process Noise

In some circumstances, process conditions rather than the magmeter can cause the meter output to be unstable. Possible solutions for addressing a noisy process situation are given below. When the output attains the desired stability, no further steps are required.

Use the Auto Zero function to initialize the transmitter for use with the 37.5 Hz coil drive mode only. Run this function only with the transmitter and sensor installed in the process. The sensor must be filled with process fluid with zero flow rate. Before running the auto zero function, be sure the coil drive mode is set to 37.5 Hz.

Set the loop to manual if necessary and begin the auto zero procedure. The transmitter completes the procedure automatically in about 90 seconds. A symbol appears in the lower right-hand corner of the display to indicate that the procedure is running.

1. Change the coil drive to 37.5 Hz. Complete the Auto Zero function, if possible (see "Coil Drive Frequency" on page 4-13).
2. Turn on Digital Signal Processing (see "Signal Processing" on page 4-25)
3. Increase the damping (see "Damping" on page 3-17).

If the preceding steps fail to resolve the process noise symptoms, consult your Rosemount sales representative about using a high-signal magnetic flowmeter system.

Step 3: Installed Sensor Tests

If a problem with an installed sensor is identified, Table 6-5 can assist in troubleshooting the sensor. Before performing any of the sensor tests, disconnect or turn off power to the transmitter. To interpret the results, the hazardous location certification for the sensor must be known. Applicable codes for the Rosemount 8705 are N0, N5, and KD. Applicable codes for the Rosemount 8707 are N0 and N5. Applicable codes for the Rosemount 8711 are N0, N5, E5, and KD. Always check the operation of test equipment before each test.

If possible, take all readings from inside the sensor junction box. If the sensor junction box is inaccessible, take measurements as close as possible. Readings taken at the terminals of remote-mount transmitters that are more than 100 feet away from the sensor may provide incorrect or inconclusive information and should be avoided. A sensor circuit diagram is provided in Figure 6-1 on page 6-9.

Table 6-5. Sensor Test

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	$2\Omega \leq R \leq 18\Omega$	• Open or Shorted Coil	• Remove and replace sensor
B. Shields to Case	Installed or Uninstalled	Multimeter	17 and ⏚ ⏚ and case ground 17 and case ground	$< 0.2\Omega$	• Moisture in terminal block • Leaky electrode • Process behind liner	• Clean terminal block • Remove sensor
C. Coil Shield to Coil	Installed or Uninstalled	Multimeter	1 and ⏚ 2 and ⏚	$\infty\Omega$ (< 1nS) $\infty\Omega$ (< 1nS)	• Process behind liner • Leaky electrode • Moisture in terminal block	• Remove sensor and dry • Clean terminal block • Confirm with sensor coil test
D. Electrode Shield to Electrode	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 NO: $\lvert R_1 - R_2 \rvert \leq 300\Omega$ N5, E5, CD, ED: $\lvert R_1 \quad R_2 \rvert \leq 1500\Omega$	• Unstable R_1 or R_2 values confirm coated electrode • Shorted electrode • Electrode not in contact with process • Empty Pipe • Low conductivity • Leaky electrode	• Remove coating from sensor wall • Use bulletnose electrodes • Repeat measurement • Pull sensor, complete test in Table 6-6 and Table 6-7 on page 6-10 out of line.

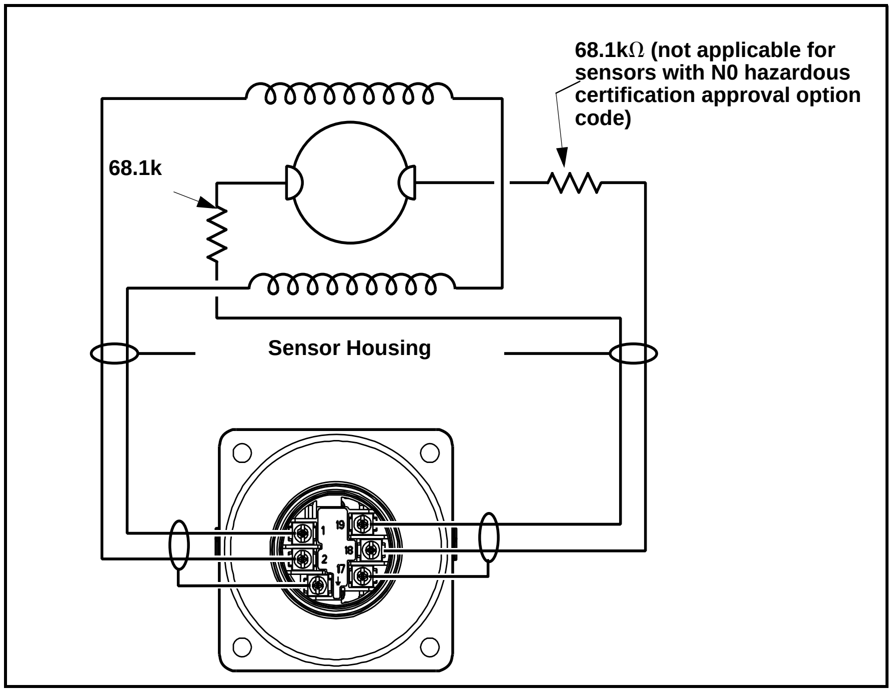
To test the sensor, a multimeter capable of measuring conductance in nanosiemens is preferred. Nanosiemens is the reciprocal of resistance.

$$1\text{nanosiemens} = \frac{1}{1\text{gigaohm}}$$

or

$$1\text{nanosiemens} = \frac{1}{1 \times 10^{9}\text{ohm}}$$

Figure 6-1. Sensor Circuit Diagram

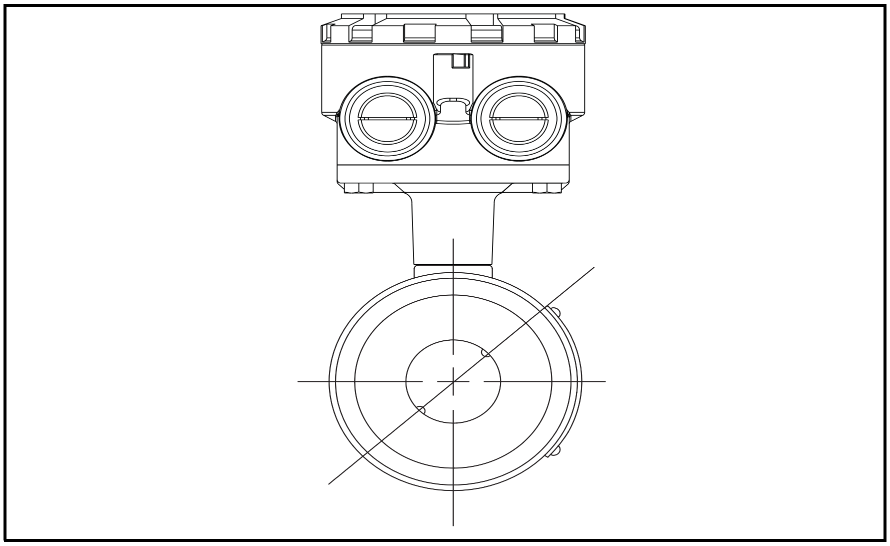


Step 4: Uninstalled Sensor Tests

An uninstalled sensor can also be used for sensor troubleshooting. To interpret the results, the hazardous location certification for the sensor must be known. Applicable codes for the Rosemount 8705 are N0, N5, and KD. Applicable codes for the Rosemount 8707 are N0 and N5. Applicable codes for the Rosemount 8711 are N0, N5, E5, and KD.

A sensor circuit diagram is provided in Figure 6-1. Take measurements from the terminal block and on the electrode head inside the sensor. The measurement electrodes, 18 and 19, are on opposite sides in the inside diameter. If applicable, the third grounding electrode is in between the other two electrodes. On Rosemount 8711 sensors, electrode 18 is near the sensor junction box and electrode 19 is near the bottom of the sensor (Figure 6-2). The different sensor models will have slightly different resistance readings. Flanged sensor resistance readings are in Table 6-6 while wafer sensor resistance readings are in Table 6-7.

Figure 6-2. 45° Electrode Plane



To insure accuracy of resistance readings, zero out multimeter by shorting and touching the leads together.

Table 6-6. Uninstalled Rosemount 8705 / 8707 Flanged Sensor Tests

	Hazardous Location Certifications	
Measuring at Connections	**N0**	**N5, KD**
18 and Electrode(1)	$\leq 275\Omega$	$61k\Omega \leq R \leq 75k\Omega$
19 and Electrode(1)	$\leq 275\Omega$	$61k\Omega \leq R \leq 75k\Omega$
17 and Grounding Electrode	$\leq 0.3\Omega$	$\leq 0.3\Omega$
17 and Ground Symbol	$\leq 0.3\Omega$	$\leq 0.3\Omega$
17 and 18	Open	Open
17 and 19	Open	Open
17 and 1	Open	Open

(1) It is difficult to tell from visual inspection alone which electrode is wired to which number terminal in the terminal block. Measure both electrodes. One electrode should result in an open reading, while the other electrode should be less than 275Ω.

Table 6-7. Uninstalled Rosemount 8711 Wafer Sensor Tests

	Hazardous Location Certification	
Measuring at Connections	**N0**	**N5, E5, CD**
18 and Electrode(1)	$\leq 0.3\Omega$	$61k\Omega \leq R \leq 75k\Omega$
19 and Electrode(2)	$\leq 275\Omega$	$61k\Omega \leq R \leq 75k\Omega$
17 and Grounding Electrode	$\leq 0.3\Omega$	$\leq 0.3\Omega$
17 and Grounding Symbol	$\leq 0.3\Omega$	$\leq 0.3\Omega$
17 and 18	Open	Open
17 and 19	Open	Open
17 and 1	Open	Open

(1) Measure the electrode closest to the junction box
(2) Measure the electrode farthest away from the junction box.

Appendix A Reference Data

FUNCTIONAL SPECIFICATIONS

Sensor Compatibility

Compatible with Rosemount 8705, 8711, 8721, and 570TM sensors.
Compatible with Rosemount 8707 sensor with D2 Dual calibration option.
Compatible with AC and DC powered sensors of other manufacturers.

Sensor Coil Resistance

350 Ω maximum

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 for 8732E. Excludes the effect of interconnecting cable length in remote mount transmitter installations.

Power Supply

90 -250 V AC ±10%, 50–60 Hz or 12-42 V DC

AC Power Supply Requirements

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

Figure A-1. AC Current Requirements

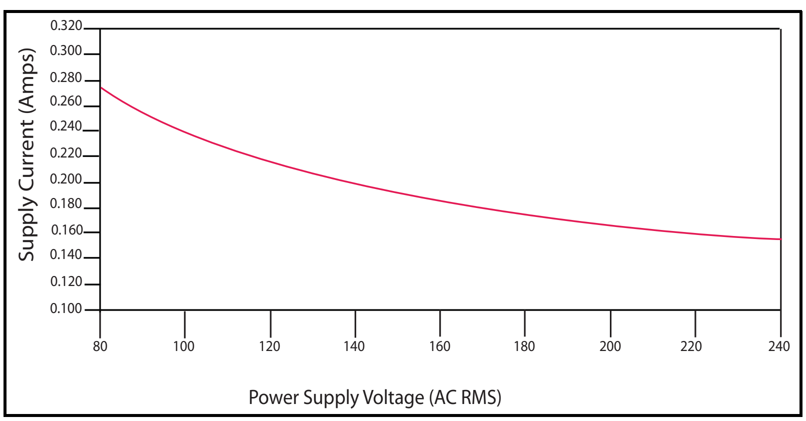
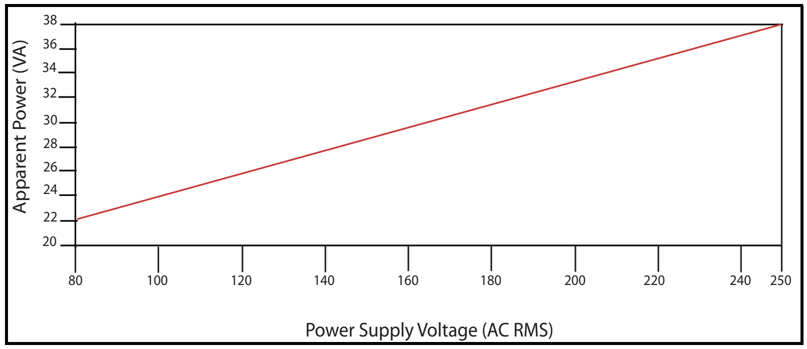


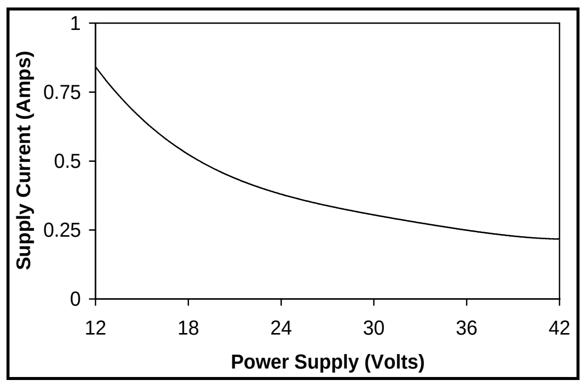
Figure A-2. Apparent Power



DC Supply Current Requirements

Units powered by 12-42 V DC power supply may draw up to 1 amp of current steady state.

Figure A-3. DC Current Requirements



Installation Coordination

Installation (overvoltage) Category II

Power Consumption

10 watts maximum

Switch-on current
AC: Maximum 26 A (< 5 ms) at 250 V AC

DC: Maximum 30 A (< 5 ms) at 42 V DC

Ambient Temperature Limits

Operating
–58 to 165 °F (–50 to 74 °C) without local operator interface

13 to 149 °F (–25 to 65 °C) with local operator interface

Storage
–40 to 185 °F (–40 to 85 °C)

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

Humidity Limits

0–100% RH to 150 °F (65 °C)

Enclosure Rating

NEMA 4X CSA Type 4X, IEC 60529, IP66 (transmitter), Pollution Degree 2

Output Signal

Manchester-encoded digital signal that conforms to IEC 1158-2 and ISA 50.02

FOUNDATION™ FIELDBUS SPECIFICATIONS

Schedule Entries

Seven (7)

Links

Twenty (20)

Virtual Communications Relationships (VCRs)

One (1) predefined (F6, F7) Nineteen (19) configurable (see Table 1)

Table A-1. Block Information

Block	Execution Time (Milliseconds)
Resource (RB)	—
Transducer (TB)	—
Analog Input (AI)	10
Proportional/Integral/ Derivative (PID)	10
Integrator (INT)	10
Arithmetic (AR)	10

Reverse Flow

Detects and reports reverse flow

Software Lockout

A write-lock switch and software lockout are provided in the resource function block.

Turn-on Time

5 minutes to rated accuracy from power up; 10 seconds from power interruption.

Start-up Time

50 ms from zero flow.

Low Flow Cutoff

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 local display and field communicator.

Damping

Adjustable between 0 and 256 seconds.

Sensor Compensation

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

8732E transmitters and other manufacturer's 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 "Universal Trim" on page 4-11.

Diagnostics

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

Advanced (D01 Suite)
Ground/wiring fault
High process noise

Advanced (D02 Suite)
8714i Meter Verification

PERFORMANCE SPECIFICATIONS

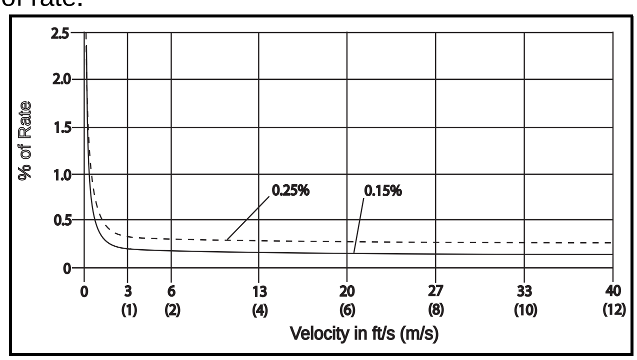
(System specifications are given using the frequency output and with the unit at reference conditions.)

Accuracy

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

Rosemount 8732E with 8705/8707 Sensor:
Standard system accuracy is ±0.25% of rate ±1.0 mm/sec from 0.04 to 6 ft/s (0.01 to 2 m/s); above 6 ft/s (2 m/s), the system has an accuracy of ±0.25% of rate ±1.5 mm/sec.

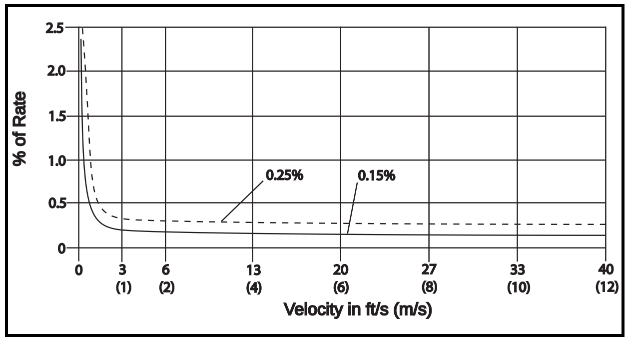
Optional high accuracy is ±0.15% of rate ±1.0 mm/sec from 0.04 to 13 ft/s (0.01 to 4 m/s); above 13 ft/s (4 m/s), the system has an accuracy of ±0.18% of rate.(1)



Rosemount 8732E with 8711 Sensor:
Standard system accuracy is ±0.25% of rate ±2.0 mm/sec from 0.04 to 39 ft/s (0.01 to 12 m/s).

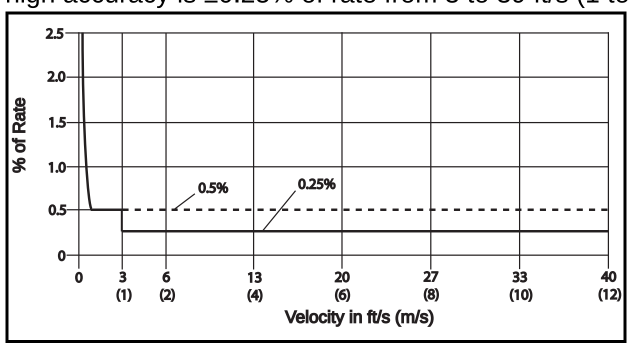
(1) *For Sensor sizes greater than 12 in. (300 mm) the high accuracy is ±0.25% of rate from 3 to 39 ft/sec (1 to 12 m/sec).*

Optional high accuracy is ±0.15% of rate ±1.0 mm/sec from 0.04 to 13 ft/s (0.01 to 4 m/s); above 13 ft/s (4 m/s), the system has an accuracy of ±0.18% of rate.



Rosemount 8732E with 8721 Sensor:
Standard system accuracy is ±0.5% of rate from 1 to 39 ft/s (0.3 to 12 m/s); between 0.04 and 1.0 ft/s (0.01 and 0.3 m/s), the system has an accuracy of ±0.005 ft/s (0.0015 m/s).

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



Rosemount 8732E with Legacy 8705 Sensors:
Standard system accuracy is ±0.5% of rate from 1 to 39 ft/s (0.3 to 12 m/s); between 0.04 and 1.0 ft/s (0.01 and 0.3 m/s), the system has an accuracy of ±0.005 ft/s (0.0015 m/s).

Rosemount 8732E with Legacy 8711 Sensors:
Standard system accuracy is ±0.5% of rate from 3 to 39 ft/s (1 to 12 m/s); between 0.04 and 3.0 ft/s (0.01 and 1 m/s), the system has an accuracy of ±0.015 ft/s (0.005 m/s).

Rosemount 8732E with 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.

Vibration Effect

IEC 60770-1

Repeatability

±0.1% of reading

Stability

±0.1% of rate over six months

Ambient Temperature Effect

±0.25% change over operating temperature range

EMC Compliance

EN61326-1 1997 + A1/A2/A3 (Industrial) electromagnetic compatibility (EMC) for process and laboratory apparatus.

PHYSICAL SPECIFICATIONS

Materials of Construction

Housing
Low copper aluminum, NEMA 4X and IEC 60529 IP66

Pollution Degree 2

Paint
Polyurethane

Cover Gasket
Rubber

Electrical Connections

Two $^1/_2$–14 NPT connections provided on the transmitter housing (optional third connection available). PG13.5 and CM20 adapters are available. Screw terminals provided for all connections. Power wiring connected to transmitter only. Integrally mounted transmitters are factory wired to the sensor.

Transmitter Weight

Approximately 7 pounds (3.2 kg). Add 1 pound (0.5 kg) for Option Code M5.

Appendix B Approval Information

PRODUCT CERTIFICATIONS

Approved Manufacturing Locations

Rosemount Inc. — Eden Prairie, Minnesota, USA

Fisher-Rosemount Technologias de Flujo, S.A. de C.V. —
Chihuahua Mexico

Emerson Process Management Flow — Ede, The Netherlands

Emerson Process Management Flow Technologies Co., Ltd. — Nanjing, China

European Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found on our website at www.rosemount.com. A hard copy may be obtained by contacting our local sales office.

ATEX Directive

Rosemount Inc. complies with the ATEX Directive.

Type n protection type in accordance with EN50 021

- Closing of entries in the device must be carried out using the appropriate EExe or EExn metal cable gland and metal blanking plug or any appropriate ATEX approved cable gland and blanking plug with IP66 rating certified by an EU approved certification body.

For Rosemount 8732E transmitters:

Complies with Essential Health and Safety Requirements:
EN 60079-0: 2006
IEC 60079-1: 2007
EN 60079-7: 2007
EN 60079-11: 2007
EN 60079-26: 2004
EN 50281-1-1: 1998 + A1

European Pressure Equipment Directive (PED) (97/23/EC)

Rosemount 8705 and 8707 Magnetic Flowmeter sensors in line size and flange combinations:

Line Size: $1^{1}/_{2}$ in. - 24 in. with all DIN flanges and ANSI 150 and
ANSI 300 flanges. Also available with ANSI 600 flanges in limited line sizes.

Line Size: 30 in. - 36 in. with AWWA 125 flanges
QS Certificate of Assessment - EC No. PED-H-20
Module H Conformity Assessment

Rosemount 8711 Magnetic Flowmeter Sensors
Line Sizes: 1.5, 2, 3, 4, 6, and 8 in.
QS Certificate of Assessment - EC No. PED-H-20
Module H Conformity Assessment

Rosemount 8721 Sanitary Magmeter Sensors
in line sizes of 1 1/2 in. and larger:
Module A Conformity Assessment

All other Rosemount 8705/8707/8711/8721
Sensors —
in line sizes of 1 in. and less:
Sound Engineering Practice

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

Mandatory CE-marking for sensors in accordance with Article 15 of the PED can be found on the sensor body (CE 0575).

Sensor category I is assessed for conformity per module A procedures.

Sensor categories II – IV, use module H for conformity assessment procedures.

Electro Magnetic Compatibility (EMC) (2004/108/EC)

Models 8712D - EN 50081-1: 1992, EN 50082-2: 1995,
Model 8732E - EN 61326: 1997: A1 + A2 + A3

Installed signal wiring should not be run together and should not be in the same cable tray as AC power wiring.

Device must be properly grounded or earthed according to local electric codes.

To improve protection against signal interference, shielded cable is recommended.

Low Voltage Directive (93/68/EEC)

Model 8712D - EN 61010 -1: 1995

Low Voltage Directive (2006/95/EC)

Model 8732E - EN 61010 -1: 2001

Other important guidelines

Only use new, original parts.

To prevent the process medium escaping, do not unscrew or remove process flange bolts, adapter bolts or bleed screws during operation.

Maintenance shall only be done by qualified personnel.

CE *CE Marking*

Compliance with all applicable European Union Directives. (Note: CE Marking is not available on Rosemount 8712H).

IECEx Scheme

For Rosemount 8732E transmitters:

Rosemount complies with all of the stated standards below:
IEC 60079-0 : 2004
IEC 60079-1 : 2007-04
IEC 60079-11 : 2006
IEC 60079-26 : 2006
IEC 60079-7 : 2006-07
IEC 61010-1 : 2001
IEC 61241-0 : 2004
IEC 61241-1 : 2004

C-Tic Marking
Complies with IEC 61326-1 : 1997 + A1, A2, A3.

HAZARDOUS LOCATIONS PRODUCT APPROVALS OFFERING

The Rosemount 8700 Series magnetic flowmeters offer many different hazardous locations certifications. The table below provides an overview of the available hazardous area approval options. Equivalent hazardous locations certifications for sensor and transmitter must match in integrally mounted magnetic flowmeter systems. Remote mounted magnetic flowmeter systems do not require matched hazardous location certifications. For complete information about the hazardous area approval codes listed, see Hazardous Location Certifications starting on page B-5.

Table B-1. Factory Mutual (FM) Approvals Offering

Transmitter	8732E			8712D(1)			8712H(1)
Sensor	**8705**	**8707**	**8711**	**8705**	**8707**	**8711**	**8707**
FM Category	**Hazardous Area Approval Code**						
Non-Classified Locations							
Transmitter	NA	NA	NA	NA	NA	NA	N0
Sensor	NA	N0	NA	NA	N0	NA	N0
Suitable for Class I, Division 1							
Explosion-Proof							
Trans: Groups C, D T6	E5(2)	-	E5	-	-	-	-
Sensor: Groups C, D T6	E5(2)	-	E5	-	-	-	-
Explosion-Proof with Intrinsically Safe Output							
Trans: Groups C, D T6	E5(2)(3)	-	E5(3)	-	-	-	-
Sensor: Groups C, D T6	E5(2)	-	E5	-	-	-	-
Suitable for Class I, Division 2							
Non-Flammable Fluids							
Trans: Groups A,B,C,D T4	N0	N0	N0	N0	N0	N0	N0
Sensor: Groups A,B,C,D T5	N0	N0(4)	N0	N0	N0(4)	N0	N0(4)
Flammable Fluids							
Trans: Groups A,B,C,D T4	N5	N5	N5	N5	N5	N5	N5
Sensor: Groups A,B,C,D T5	N5	N5(4)	N5	N5	N5(4)	N5	N5(4)
Non-Flammable Fluids with Intrinsically Safe Output							
Trans: Groups A,B,C,D T4	N0(3)	N0(3)	N0(3)	-	-	-	-
Sensor: Groups A,B,C,D T5	N0	N0(4)	N0	-	-	-	-
Other Certifications	**Product Certification Code(5)**						
European Pressure Equipment Directive (PED)	PD	-	PD	PD	-	PD	-
NSF 61 Drinking Water(6)	DW	-	DW	DW	-	DW	-

(1) Remote Transmitter Only
(2) Available in line sizes 0.5 in. to 8 in. (15 mm to 200 mm) only
(3) For I.S. Output, Output Code B must be ordered
(4) 8707 Sensor has Temp Code - T3C
(5) Product Certification Codes are added to the Sensor model number only
(6) Only available with PTFE (all line sizes) or Polyurethane (4 in. or larger) Lining Materials and 316L SST Electrodes

Table B-2. Canadian Standards Association (CSA) Approvals Offering

Transmitter	8732E			8712D(1)			8712H(1)
Sensor	**8705**	**8707**	**8711**	**8705**	**8707**	**8711**	**8707**
CSA Category	**Hazardous Area Approval Code**						
Non-Classified Locations							
Transmitter	NA	-	NA	NA	-	NA	-
Sensor	NA	-	NA	NA	-	NA	-
Suitable for Class I, Division 2							
Non-Flammable Fluids							
Trans: Groups A,B,C,D T4	N0	N0	N0	N0	N0	N0	N0
Sensor: Groups A,B,C,D T5	N0	N0(2)	N0	N0	N0(2)	N0	N0(2)
Other Certifications	**Product Certification Code(3)**						
European Pressure Equipment Directive (PED)	PD	-	PD	PD	-	PD	-
NSF 61 Drinking Water(4)	DW	-	DW	DW	-	DW	-

(1) Remote Transmitter Only
(2) 8707 Sensor has Temp Code - T3C
(3) Product Certification Codes are added to the Sensor model number only
(4) Only available with PTFE (all line sizes) or Polyurethane (4 in. or larger) Lining Materials and 316L SST Electrodes

Table B-3. ATEX Approvals Offering

Transmitter	8732E			8712D(1)			8712H(1)
Sensor	**8705**	**8707**	**8711**	**8705**	**8707**	**8711**	**8707**
ATEX Category	**Hazardous Area Approval Code**						
Non-Hazardous							
Trans: LVD and EMC	NA	-	NA	NA	-	NA	-
Sensor: LVD and EMC	NA	-	NA	NA	-	NA	-
Equipment Category 2							
Gas Group IIB							
Trans: Ex d IIB T6	ED	-	ED	-	-	-	-
Sensor: Ex e ia IIC T3...T6	KD(2)	-	KD(2)	-	-	-	-
Gas Group IIC							
Trans: Ex d IIC T6	E1	-	E1	-	-	-	-
Sensor: Ex e ia IIC T3...T6	E1	-	E1	-	-	-	-
Gas Group IIB with Intrinsically Safe Output							
Trans: Ex de [ia] IIB T6	ED(3)	-	ED(3)	-	-	-	-
Sensor: Ex e ia IIC T3...T6	KD(2)	-	KD(2)	-	-	-	-
Gas Group IIC with Intrinsically Safe Output							
Trans: Ex de [ia] IIC T6	E1(3)	-	E1(3)	-	-	-	-
Sensor: Ex e ia IIC T3...T6	E1	-	E1	-	-	-	-
Equipment Category 3							
Gas Group IIC							
Trans: Ex nA nL IIC T4	N1	-	N1	N1	-	N1	-
Sensor: Ex nA [L] IIC T3...T6	N1	-	N1	N1	-	N1	-
Equipment Category 1 - Dust Environment							
Dust Environment Only							
Trans: Dust Ignition Proof	ND	-	ND	-	-	-	-
Sensor: Dust Ignition Proof	ND	-	ND	-	-	-	-
Other Certifications	**Product Certification Code(4)**						
European Pressure Equipment Directive (PED)	PD	-	PD	PD	-	PD	-
NSF 61 Drinking Water(5)	DW	-	DW	DW	-	DW	-

(1) Remote Transmitter Only
(2) With integral mount transmitter, approval is valid for Gas Group IIB
(3) For I.S. Output, Output Code B must be ordered
(4) Product Certification Codes are added to the Sensor model number only
(5) Only available with PTFE (all line sizes) or Polyurethane (4 in. or larger) Lining Materials and 316L SST Electrodes

Table B-4. IECEx Approvals Offering

Transmitter	8732E(1)		
Sensor	**8705**	**8707**	**8711**
IECEx Category	**Hazardous Area Approval Code**		
Non-Hazardous			
Trans: LVD and EMC	NA	-	NA
Sensor: LVD and EMC	NA	-	NA
Equipment Category 2			
Gas Group IIB			
Trans: Ex d IIB T6	EF	-	EF
Gas Group IIC			
Trans: Ex d IIC T6	E7	-	E7
Gas Group IIB with Intrinsically Safe Output			
Trans: Ex de [ia] IIB T6	EF(2)	-	EF(3)
Gas Group IIC with Intrinsically Safe Output			
Trans: Ex de [ia] IIC T6	E1(3)	-	E1(3)
Equipment Category 3			
Gas Group IIC			
Trans: Ex nA nL IIC T4	N7	-	N7

Equipment Category 1 - Dust Environment			
Dust Environment Only			
Trans: Dust Ignition Proof	NF	-	NF
Other Certifications	**Product Certification Code(3)**		
European Pressure Equipment Directive (PED)	PD	-	PD
NSF 61 Drinking Water(4)	DW	-	DW

(1) Available in remote mount configuration only. Requires equivalent ATEX approval on the sensor
(2) For I.S. Output, Output Code B must be ordered
(3) Product Certification Codes are added to the Sensor model number only
(4) Only available with PTFE (all line sizes) or Polyurethane (4 in. or larger) Lining Materials and 316L SST Electrodes

HAZARDOUS LOCATION CERTIFICATIONS

Equivalent Hazardous Location Certifications for sensor and transmitter must match in integrally-mounted magnetic flowmeter systems. Remote-mounted systems do not require matched hazardous location certification option codes.

Transmitter Approval Information

Table B-5. Transmitter Option Codes

	Rosemount 8732E		Rosemount 8712D	Rosemount 8712H
Approval Codes	HART	FOUNDATION fieldbus		
NA	•	•	•	
N0	•	•	•	•
N1	•	•	•	
N5	•	•	•	•
N7	•	•		
ND	•	•		
NF	•	•		
E1	•	•		
E5	•	•		
E7	•	•		
ED	•	•		

North American Certifications

Factory Mutual (FM)

NOTE
For intrinsically safe (IS) outputs on the 8732E output option code B must be selected.
IS outputs for Class I, Division 1, Groups A, B, C, D.
Temp Code – T4 at 60°C

NOTE
For the 8732E transmitters with a local operator interface (LOI) or display, the lower ambient temperature limit is -20 °C.

N0 Division 2 Approval (All transmitters)

Reference Rosemount Control Drawing 08732-1052 (8732E).

Class I, Division 2, Groups A, B, C, D
Temp Codes – T4 (8712 at 40°C)
T4 (8732 at 60°C: -50 °C ≤ Ta ≤ 60 °C)

Dust-ignition proof Class II/III, Division 1, Groups E, F, G
Temp Codes – T4 (8712 at 40°C), T5 (8732 at 60°C)

Enclosure Type 4X

N5 Division 2 Approval (All Transmitters)
For sensors with IS electrodes only

Reference Rosemount Control Drawing 08732-1052 (8732E).

Class I, Division 2, Groups A, B, C, D
Temp Codes – T4 (8712 at 40°C),
T4 (8732 at 60°C: -50 °C ≤ Ta ≤ 60 °C)

Dust-ignition proof Class II/III, Division 1, Groups E, F, G
Temp Codes – T4 (8712 at 40°C), T5 (8732 at 60°C)

Enclosure Type 4X

E5 Explosion-Proof Approval (8732E)

Reference Rosemount Control Drawing 08732-1052

Explosion-Proof for Class I, Division 1, Groups C, D
Temp Code – T6 at 60°C

Dust-ignition proof Class II/III, Division 1, Groups E, F, G
Temp Code – T5 at 60°C

Class I, Division 2, Groups A, B, C, D
Temp Codes – T4 (8732 at 60°C)

Enclosure Type 4X

Canadian Standards Association (CSA)

N0 Division 2 Approval

Reference Rosemount Control Drawing 08732-1051 (8732E)

Class I, Division 2, Groups A, B, C, D
Temp Codes – T4 (8732 at 60°C: -50 °C ≤ Ta ≤ 60 °C)

Dust-ignition proof Class II/III, Division 1, Groups E, F, G
Temp Codes – T4 (8712 at 40°C), T5 (8732 at 60°C)

Enclosure Type 4X

European Certifications

E1 ATEX Flameproof

Hydrogen gas group
8732 - Certificate No.: KEMA 07ATEX0073 X ⟨Ex⟩ II 2G
Ex de [ia] IIC T6 (-50 °C ≤ Ta ≤ +60 °C)
with LOI T6 (-20 °C ≤ Ta ≤ +60 °C)
V_{max} = 250 V AC or 42 V DC
CE 0575

ED ATEX Flameproof

8732 - Certificate No.: KEMA 07ATEX0073 X ⟨Ex⟩ II 2G
Ex de [ia] IIB T6 (-50 °C ≤ Ta ≤ +60 °C)
with LOI T6 (-20 °C ≤ Ta ≤ +60 °C)
V_{max} = 250 V AC or 42 V DC
CE 0575

ND ATEX Dust

8732 - Certificate No.: KEMA 06ATEX0006 ⟨Ex⟩ II 1D
max ΔT = 40 °K(1)
Amb. Temp. Limits: (-20 °C ≤ Ta ≤ + 65 °C)
V_{max} = 250 V AC or 42 V DC
IP 66
CE 0575

SPECIAL CONDITIONS FOR SAFE USE (KEMA 07ATEX0073 X):
If the Rosemount 8732 Flow Transmitter is used integrally with the Rosemount 8705 or 8711 Sensors, it shall be assured that the mechanical contact areas of the Sensor and Flow Transmitter comply with the requirements for flat joints according to standard EN/IEC 60079-1 clause 5.2.

The relation between ambient temperature, process temperature, and temperature class is to be taken from *Table B-8 on page B-13*

The electrical data is to be taken from *Table B-7 on page B-12*

If the Rosemount 8732 Flow Transmitter is used integrally with the Junction Box, it shall be assured that the mechanical contact areas of the Junction Box and Flow Transmitter comply with the requirements for flanged joints according to standard EN/IEC 60079-1 clause 5.2.

Per EN60079-1: 2004 the gap of the joint between transmitter and remote junction box/sensor is less than required per table 1 clause 5.2.2, and is only approved for use with an approved Rosemount transmitter and approved junction box/sensor.

INSTALLATION INSTRUCTIONS:
The cable and conduit entry devices and blanking elements shall be of a certified flameproof type, suitable for the conditions of use and correctly installed. With the use of conduit, a certified stopping box shall be provided immediately to the entrance of the enclosure.

SPECIAL CONDITIONS FOR SAFE USE (X) (03ATEX2159X):
The relation between ambient temperature, process temperature and temperature class is to be taken from *Table B-8 on page B-13.*

(1) Max surface temperature is 40 °C above the ambient temperature conditions. Tmax = 100 °C

INSTALLATION INSTRUCTIONS:
The cable and conduit entry devices and the closing elements shall be of a certified increased safety type, suitable for the conditions of use and correctly installed.

At ambient temperatures above 50 °C, the flow meter shall be used with heat resistant cables with a temperature rating of at least 90 °C.

A Junction Box in type of explosion protection increased safety “e” may be attached to the base of the Rosemount 8732E Flow Transmitter, permitting remote mounting of the Rosemount 8705 and 8711 Sensors.

Ambient temperature range of the Junction Box: -50 °C to +60 °C.

The Junction Box is classified as:
II 2 G Ex e IIB T6 and certified under KEMA 07ATEX0073 X.

N1 ATEX Type n

8712D - ATEX Certificate No: BASEEFA 05ATEX0170X
EEx nA nL IIC T4 (Ta = -50 °C to + 60 °C)
V_{max} = 42 V DC
CE 0575

8732 - ATEX Certificate No: BASEEFA 07ATEX0203X
Ex nA nL IIC T4 (Ta = -50 °C to + 60 °C)
V_{max} = 42 V DC
CE 0575

Remote Junction Box

8732 - Certificate No.: KEMA 07ATEX0073 X ⟨Ex⟩ II 2G
ATEX Ex e [(1)] T6 (Ta = -50 °C to +60 °C)
When installed per drawing 08732-1060
After de-energizing, wait 10 minutes before opening cover
CE 0575

(1) *IIC for E1*
IIB for ED

International Certifications

E7 IECEx Flameproof

8732 - Certificate No.: KEM 07.0038X
Ex de [ia] IIC T6 (-50 °C ≤ Ta ≤ +60 °C)
V_{max} = 250 V AC or 42 V DC

EF IECEx Flameproof

8732 - Certificate No.: KEM 07.0038X
Ex de [ia] IIB T6 (-50 °C ≤ Ta ≤ +60 °C)
V_{max} = 250 V AC or 42 V DC

NF IECEx Dust

8732 - Certificate No.: KEM 07.0038X
Ex tD A20 IP66 T 100 °C
T6 (-20 °C ≤ Ta ≤ +60 °C)
V_{max} = 250 V AC or 42 V DC

SPECIAL CONDITIONS FOR SAFE USE (KEM 07.0038X):
If the Rosemount 8732 Flow Transmitter is used integrally with the Rosemount 8705 or 8711 Sensors, it shall be assured that the mechanical contact areas of the Sensor and Flow Transmitter comply with the requirements for flat joints according to standard EN/IEC 60079-1 clause 5.2.

The relation between ambient temperature, process temperature, and temperature class is to be taken from *Table B-8 on page B-13*

The electrical data is to be taken from *Table B-7 on page B-12*

If the Rosemount 8732 Flow Transmitter is used integrally with the Junction Box, it shall be assured that the mechanical contact areas of the Junction Box and Flow Transmitter comply with the requirements for flanged joints according to standard EN/IEC 60079-1 clause 5.2.

INSTALLATION INSTRUCTIONS:
The cable and conduit entry devices and blanking elements shall be of a certified flameproof type, suitable for the conditions of use and correctly installed. With the use of conduit, a certified stopping box shall be provided immediately to the entrance of the enclosure.

N7 IECEx Type n

8712D - Certificate No: IECEx BAS 07.0036X

EEx nA nL IIC T4 (Ta = -50 °C to + 60 °C)
V_{max} = 42 V DC

8732 - Certificate No: IECEx BAS 07.0062X

Ex nA nL IIC T4 (Ta = -50 °C to + 60 °C)
V_{max} = 42 V DC

Remote Junction Box

8732 - Certificate No.: KEM 07.0038X
IECEx Ex e [(1)] T6 (Ta = -50 °C to + 60 °C)
When installed per drawing 08732-1060
After de-energizing, wait 10 minutes before opening cover

(1) *IIC for E7*
IIB for EF

Table B-6. Sensor Approval Information

Approval Codes	Rosemount 8705 Sensor		Rosemount 8707 Sensor		Rosemount 8711 Sensor		Rosemount 8721 Sensors
	For Non-flammable Fluids	For Flammable Fluids	For Non-flammable Fluids	For Flammable Fluids	For Non-flammable Fluids	For Flammable Fluids	For Non-flammable Fluids
NA	•						•
N0	•		•		•		
ND	•	•	•	•	•	•	•
N1	•	•			•	•	
N5	•	•	•	•	•	•	
N7	•	•			•	•	
ND	•	•			•	•	
NF	•	•			•	•	
E1	•	•			•	•	
E5[(1)]	•	•			•	•	
KD[(2)]	•	•					

(1) Available in line sizes up to 8 in. (200 mm) only.
(2) Refer to Table B-8 on page B-13 for relation between ambient temperature, process temperature, and temperature class.

North American Certifications

Factory Mutual (FM)

N0 **Division 2 Approval for Non-Flammable Fluids (All Sensors)**

Class I, Division 2, Groups A, B, C, D
Temp Code – T5 (8705/8711 at 60°C)
Temp Code – T3C (8707 at 60°C)

Dust-Ignition proof Class II/III, Division 1, Groups E, F, G
Temp Code – T6 (8705/8711 at 60°C)
Temp Code – T3C (8707 at 60°C)

Enclosure Type 4X

N0 **for 8721 Hygienic Sensor**

Factory Mutual (FM) Ordinary Location;
CE Marking; 3-A Symbol Authorization #1222;
EHEDG Type EL

N5 **Division 2 Approval for Flammable Fluids (All Sensors)**

Class I, Division 2, Groups A, B, C, D
Temp Code – T5 (8705/8711 at 60°C)
Temp Code – T3C (8707 at 60°C)

Dust-Ignition proof Class II/III, Division 1, Groups E, F, G
Temp Code – T6 (8705/8711 at 60°C)
Temp Code – T3C (8707 at 60°C)

Enclosure Type 4X

E5 **Explosion-Proof (8705 and 8711 Only)**

Explosion-Proof for Class I, Division 1, Groups C, D
Temp Code – T6 at 60°C

Dust-Ignition proof Class II/III, Division 1, Groups E, F, G
Temp Code – T6 at 60°C

Class I, Division 2, Groups A, B, C, D
Temp Code – T5 at 60°C

Enclosure Type 4X

Canadian Standards Association (CSA)

N0 Suitable for Class I, Division 2, Groups A, B, C, D
Temp Code – T5 (8705/8711 at 60°C)
Temp Code – T3C (8707 at 60°C)

Dust-Ignition proof Class II/III, Division 1, Groups E, F, G

Enclosure Type 4X

N0 **for 8721 Hygienic Sensor**

Canadian Standards Association (CSA) Ordinary Location;
CE Marking; 3-A Symbol Authorization #1222;
EHEDG Type EL

European Certifications

ND **ATEX Dust**

8732 - Certificate No.: KEMA 06ATEX0006 Ex II 1D max
T = 40 °K(1) Amb. Temp. Limits: (-20 °C = Ta = +65 °C)
Vmax = 40 V DC (pulsed)
IP 66
CE 0575

N1 **ATEX Non-Sparking/Non-incendive (8705/8711 Only)**

Certificate No: KEMA02ATEX1302X Ex II 3G

EEx nA [L] IIC T3... T6
Ambient Temperature Limits -20 to 65°C

SPECIAL CONDITIONS FOR SAFE USE (X):
The relation between ambient temperature, process temperature and temperature class is to be taken from the table under (15-description) above. - (See Table 13) The electrical data is to be taken from the summary under (15-electrical data above). (See Table 12)

E1 ATEX Increased Safety (Zone 1)
KD with IS Electrodes (8711 only)

Certificate No: KEMA03ATEX2052X Ex II 1/2G
EEx e ia IIC T3... T6 (Ta = -20 to +60°) (See *Table B-8 on page B-13*)
CE 0575
V_{max} = 40 V DC (pulsed)

SPECIAL CONDITIONS FOR SAFE USE (X):
If the Rosemount 8732 Flow Transmitter is used integrally with the Rosemount 8705 or Rosemount 8711 Sensors, it shall be assured that the mechanical contact areas of the Sensor and Flow Transmitter comply with the requirements for flat joints according to standard EN 50018, clause 5.2. The relation between ambient temperature, process temperature and temperature class is to be taken from the table under (15-description) above. - (See Table 11) The electrical data is to be taken from the summary under (15-electrical data above). (See Table 12)

INSTALLATION INSTRUCTIONS:
At ambient temperature above 50 °C, the flowmeter shall be used with heat resistant cables with a temperature rating of at least 90 °C.

A fuse with a rating of maximum 0,7 A according to IEC 60127-1 shall be included in the coil excitation circuit if the sensors are used with other flow transmitters (e.g. Rosemount 8712).

E1 ATEX Increased Safety (Zone 1)
KD with IS Electrodes (8705 only)

Certificate No. KEMA 03ATEX2052X Ex II 1/2G
EEx e ia IIC T3... T6 (Ta = -20 to 60 °C) (See *Table B-8 on page B-13*)
CE 0575
V_{max} = 40 V DC (pulsed)

SPECIAL CONDITIONS FOR SAFE USE (X):
If the Rosemount 8732 Flow Transmitter is used integrally with the Rosemount 8705 or Rosemount 8711 Sensors, it shall be assured that the mechanical contact areas of the Sensor and Flow Transmitter comply with the requirements for flat joints according to standard EN 50018, clause 5.2. The relation between ambient temperature, process temperature and temperature class is to be taken from the table under (15-description) above. - (See Table 11) The electrical data is to be taken from the summary under (15-electrical data above). (See Table 12)

INSTALLATION INSTRUCTIONS:
At ambient temperature above 50 °C, the flowmeter shall be used with heat resistant cables with a temperature rating of at least 90 °C.

A fuse with a rating of maximum 0.7 A according to IEC 60127-1 shall be included in the coil excitation circuit.

Table B-7. Electrical Data

Rosemount 8732 Flow Transmitter	
Power supply:	250 V AC, 1 A or 42 Vdc, 2,5 A, 20 W maximum
Foundation fieldbus output:	30 V DC, 30 mA, 1 W maximum
Rosemount 8705 and 8711 Sensors	
Coil excitation circuit:	40 V DC (pulsed), 0,5 A, 20 W maximum
Electrode circuit:	Intrinsically Safe Electrode Circuit: U_i = 5 V, I_i = 0.2 mA, P_i = 1 mW, U_m = 250 V
Rosemount 8732E Flow Transmitter:	
Power supply:	250 V AC, 1 A or 42 Vdc, 2, 5 A, 20 W maximum
FOUNDATION™ fieldbus output:	Intrinsically Safe Output:
	U_i = 30 V
	I_i = 380 mA
	P_i = 5,32 W
	C_i = 924 pF
	L_i = 0 mH

Table B-8. Relation between ambient temperature, process temperature, and temperature class(1)

Meter Size (Inches)	Maximum Ambient Temperature	Maximum Process Temperature	Temperature Class
1/2	115°F (65°C)	239°F (115°C)	T3
1	149°F (65°C)	248°F (120°C)	T3
1	95°F (35°C)	95°F (35°C)	T4
1 1/2	149°F (65°C)	257°F (125°C)	T3
1 1/2	122°F (50°C)	148°F (60°C)	T4
2	149°F (65°C)	257°F (125°C)	T3
2	149°F (65°C)	167°F (75°C)	T4
2	104°F (40°C)	104°F (40°C)	T5
3 - 36	149°F (65°C)	266°F (130°C)	T3
3 - 36	149°F (65°C)	194°F (90°C)	T4
3 - 36	131°F (55°C)	131°F (55°C)	T5
3 - 36	104°F (40°C)	104°F (40°C)	T6
6	115°F (65°C)	275°F(135°C)	T3
6	115°F (65°C)	230°F (110°C)	T4
6	115°F (65°C)	167°F (75°C)	T5
6	140°F (60°C)	140°F (60°C)	T6
8-60	115°F (65°C)	284°F (140°C)	T3
8-60	115°F (65°C)	239°F (115°C)	T4
8-60	115°F (65°C)	176°F (80°C)	T5
8-60	115°F (65°C)	156°F (69°C)	T6

Table B-9. Relation between the maximum ambient temperature, the maximum process temperature, and the temperature class(2)

Maximum Ambient Temperature	Maximum process temperature °F (°C) per temperature class			
	T3	T4	T5	T6
0.5 in. sensor size				
149°F (65°C)	297°F (147°C)	138°F (59°C)	54°F (12°C)	18°F (-8°C)
140°F (60°C)	309°F (154°C)	151°F (66°C)	66°F (19°C)	28°F (-2°C)
131°F (55°C)	322°F (161°C)	163°F (73°C)	79°F (26°C)	41°F (5°C)
122°F (50°C)	334°F (168°C)	176°F (80°C)	90°F (32°C)	54°F (12°C)
113°F (45°C)	347°F (175°C)	189°F (87°C)	102°F (39°C)	66°F (19°C)
104°F (40°C)	351°F (177°C)	199°F (93°C)	115°F (46°C)	79°F (26°C)
95°F (35°C)	351°F (177°C)	212°F (100°C)	127°F (53°C)	90°F (32°C)
86°F (30°C)	351°F (177°C)	225°F (107°C)	138°F (59°C)	102°F (39°C)
77°F (25°C)	351°F (177°C)	237°F (114°C)	151°F (66°C)	115°F (46°C)
68°F (20°C)	351°F (177°C)	248°F (120°C)	163°F (73°C)	127°F (53°C)
1.0 in. sensor size				
149°F (65°C)	318°F (159°C)	158°F (70°C)	72°F (22°C)	34°F (1°C)
140°F (60°C)	331°F (166°C)	171°F (77°C)	84°F (29°C)	46°F (8°C)
131°F (55°C)	343°F (173°C)	183°F (84°C)	97°F (36°C)	59°F (15°C)
122°F (50°C)	351°F (177°C)	196°F (91°C)	109°F (43°C)	72°F (22°C)
113°F (45°C)	351°F (177°C)	207°F (97°C)	122°F (50°C)	84°F (29°C)
104°F (40°C)	351°F (177°C)	219°F (104°C)	135°F (57°C)	97°F (36°C)
95°F (35°C)	351°F (177°C)	232°F (111°C)	145°F (63°C)	109°F (43°C)
86°F (30°C)	351°F (177°C)	244°F (118°C)	158°F (70°C)	122°F (50°C)
77°F (25°C)	351°F (177°C)	257°F (125°C)	171°F (77°C)	135°F (57°C)
68°F (20°C)	351°F (177°C)	270°F (132°C)	183°F (84°C)	145°F (63°C)

(1) This table is applicable for CD and KD option codes only.
(2) This table is applicable for N1 option codes only.

Maximum Ambient Temperature	Maximum process temperature °F (°C) per temperature class T3	T4	T5	T6
1.5 in. sensor size				
149°F (65°C)	297°F (147°C)	160°F (71°C)	88°F (31°C)	55°F (13°C)
140°F (60°C)	307°F (153°C)	171°F (77°C)	97°F (36°C)	66°F (19°C)
131°F (55°C)	318°F (159°C)	181°F (83°C)	108°F (42°C)	77°F (25°C)
122°F (50°C)	329°F (165°C)	192°F (89°C)	118°F (48°C)	88°F (31°C)
113°F (45°C)	340°F (171°C)	203°F (95°C)	129°F (54°C)	97°F (36°C)
104°F (40°C)	351°F (177°C)	214°F (101°C)	140°F (60°C)	108°F (42°C)
95°F (35°C)	351°F (177°C)	223°F (106°C)	151°F (66°C)	118°F (48°C)
86°F (30°C)	351°F (177°C)	234°F (112°C)	160°F (71°C)	129°F (54°C)
77°F (25°C)	351°F (177°C)	244°F (118°C)	171°F (77°C)	140°F (60°C)
68°F (20°C)	351°F (177°C)	255°F (124°C)	181°F (83°C)	151°F (66°C)
2.0 in. sensor size				
149°F (65°C)	289°F (143°C)	163°F (73°C)	95°F (35°C)	66°F (19°C)
140°F (60°C)	300°F (149°C)	172°F 78(°C)	104°F (40°C)	75°F (24°C)
131°F (55°C)	309°F (154°C)	183°F (84°C)	115°F (46°C)	84°F (29°C)
122°F (50°C)	318°F (159°C)	192°F (89°C)	124°F (51°C)	95°F (35°C)
113°F (45°C)	329°F (165°C)	201°F (94°C)	135°F (57°C)	104°F (40°C)
104°F (40°C)	338°F (170°C)	212°F (100°C)	144°F (62°C)	115°F (46°C)
95°F (35°C)	349°F (176°C)	221°F (105°C)	153°F (67°C)	124°F (51°C)
86°F (30°C)	351°F (177°C)	232°F (111°C)	163°F (73°C)	135°F (57°C)
77°F (25°C)	351°F (177°C)	241°F (116°C)	172°F (78°C)	144°F (62°C)
68°F (20°C)	351°F (177°C)	252°F (122°C)	183°F (84°C)	153°F (67°C)
3 to 60 in. sensor size				
149°F (65°C)	351°F (177°C)	210°F (99°C)	117°F (47°C)	75°F (24°C)
140°F (60°C)	351°F (177°C)	223°F (106°C)	129°F (54°C)	90°F (32°C)
131°F (55°C)	351°F (177°C)	237°F (114°C)	144°F (62°C)	102°F (39°C)
122°F (50°C)	351°F (177°C)	250°F (121°C)	156°F (69°C)	117°F (47°C)
113°F (45°C)	351°F (177°C)	264°F (129°C)	171°F (77°C)	129°F (54°C)
104°F (40°C)	351°F (177°C)	266°F (130°C)	183°F (84°C)	144°F (62°C)
95°F (35°C)	351°F (177°C)	266°F (130°C)	198°F (92°C)	156°F (69°C)
86°F (30°C)	351°F (177°C)	266°F (130°C)	203°F (95°C)	171°F (77°C)
77°F (25°C)	351°F (177°C)	266°F (130°C)	203°F (95°C)	176°F (80°C)
68°F (20°C)	351°F (177°C)	266°F (130°C)	203°F (95°C)	176°F (80°C)

Figure B-1. ATEX Installation
(1 of 6)

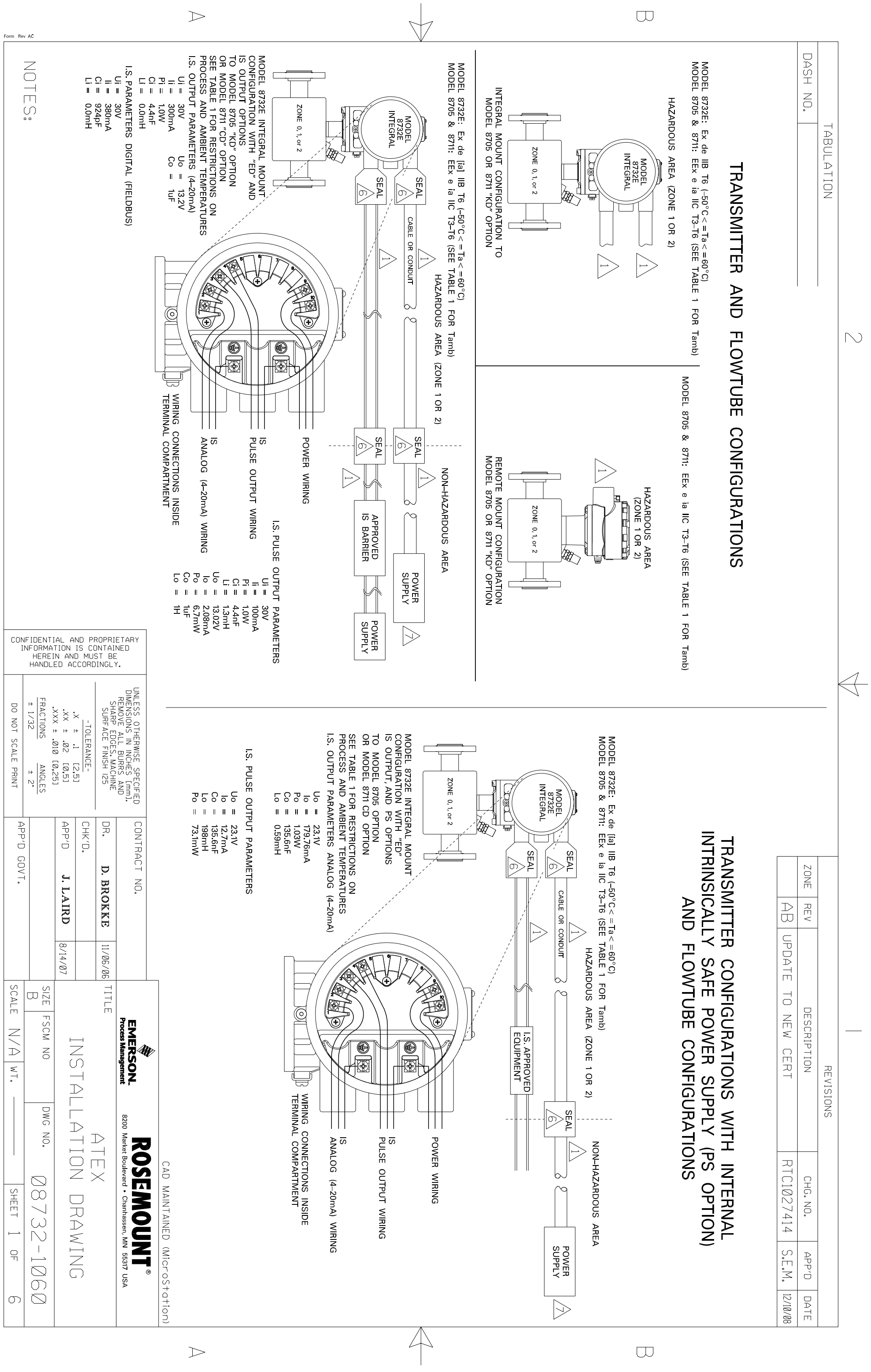


Figure B-2. ATEX Installation
(2 of 6)

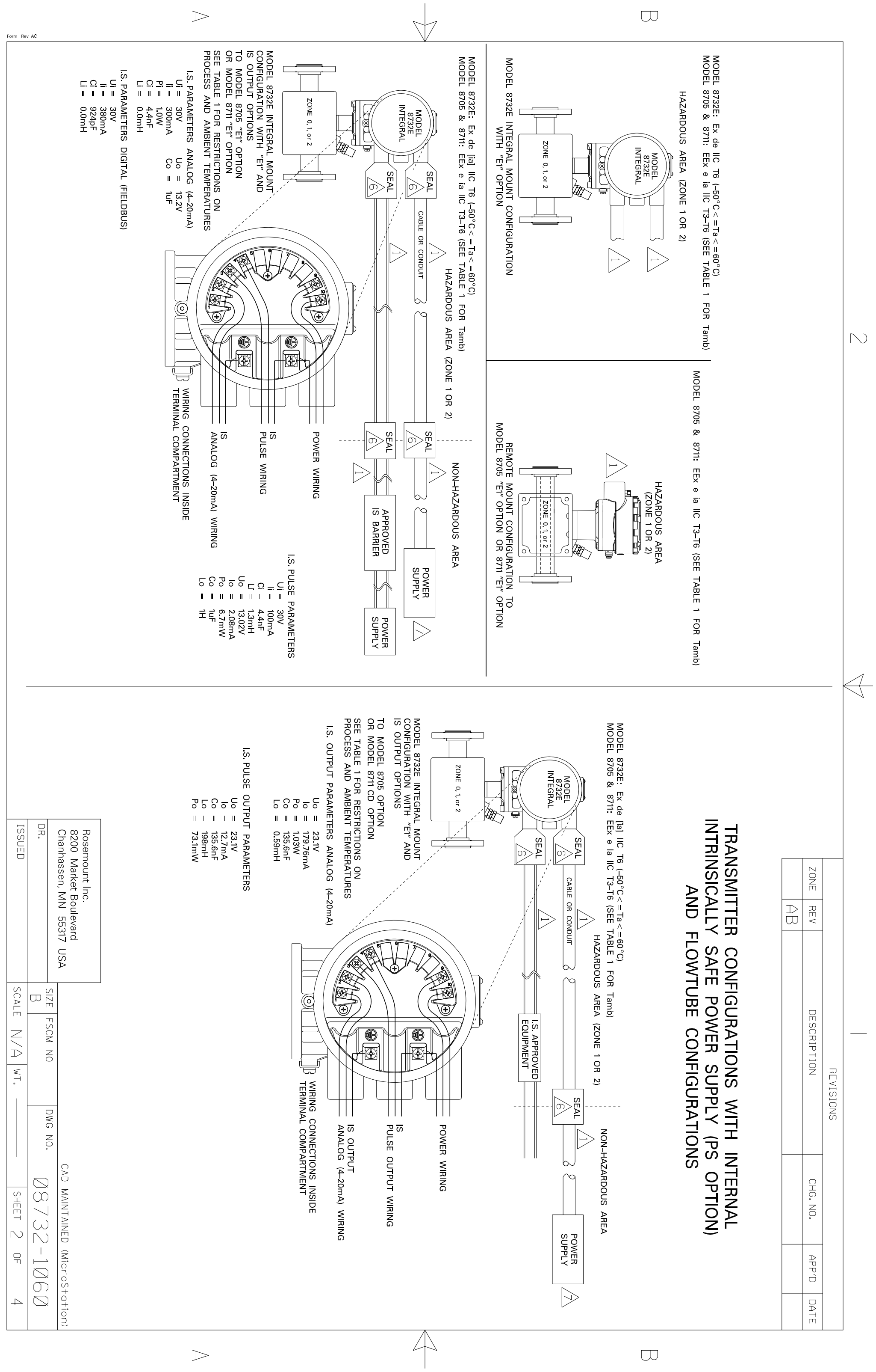


Figure B-3. ATEX Installation
(3 of 6)

REVISIONS					
ZONE	REV	DESCRIPTION	CHG. NO.	APP'D	DATE
	AB				

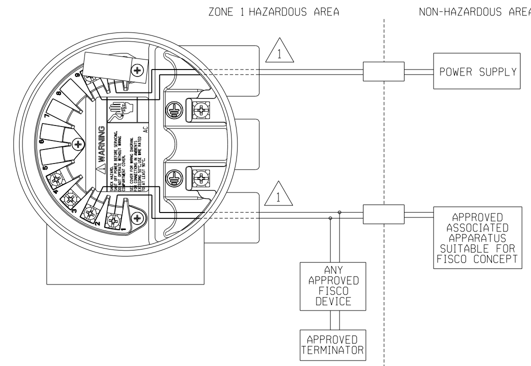
FISCO CONCEPT

THE FISCO CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Vmax), THE CURRENT (Imax), AND THE POWER (Pmax) WHICH AN INTRINSICALLY SAFE APPARATUS CAN RECEIVE AND REMAIN INTRINSICALLY SAFE CONSIDERING FAULTS, MUST BE EQUAL OR GREATER THAN VOLTAGE (Voc), AND CURRENT (Isc) WHICH CAN BE DELIVERED BY THE ASSOCIATED APPARATUS, CONSIDERING FAULTS AND APPLICABLE FACTORS.
IN ADDITION, THE MAXIMUM UNPROTECTED CAPACITANCE (C_i) AND THE INDUCTANCE (L_i) OF EACH APPARATUS (OTHER THAN THE TERMINATION) CONNECTED TO THE FIELDBUS MUST BE LESS THAN OR EQUAL TO 5 nF AND 10 uH RESPECTIVELY.

IN EACH SEGMENT ONLY ONE ACTIVE DEVICE, NORMALLY THE ASSOCIATED APPARATUS, IS ALLOWED TO PROVIDE THE NECESSARY ENERGY FOR THE FIELDBUS SYSTEM. THE VOLTAGE (Voc) OF THE ASSOCIATED APPARATUS IS LIMITED TO A RANGE OF 14 TO 17.5 VDC.
ALL OTHER EQUIPMENT CONNECTED TO THE BUS CABLE HAS TO BE PASSIVE, MEANING THAT THEY ARE NOT ALLOWED TO PROVIDE ENERGY TO THE SYSTEM, EXCEPT A LEAKAGE CURRENT OF 50uA FOR EACH CONNECTED DEVICE. SEPARATELY POWERED EQUIPMENT NEEDS GALVANIC ISOLATION TO ASSURE THAT THE INTRINSICALLY SAFE FIELDBUS CIRCUIT REMAINS PASSIVE.
THE CABLE USED TO INTERCONNECT DEVICES NEEDS TO HAVE THE PARAMETERS IN THE FOLLOWING RANGE:

Loop Resistance Rc:	15.....150 Ohm/km
Inductance per unit length Lc:	0.4.....1 mH/km
Capacitance per unit length Cc:	45.....200 nF
Length of trunk cable:	less than or equal to 1000m
Length of spur cable:	less than or equal to 60m

AT EACH END OF THE TRUNK CABLE AN APPROVED INFALLIBLE LINE TERMINATION WITH THE FOLLOWING PARAMETERS IS SUITABLE:
R = 90.....102 Ohm C = 0.....2.2uF
ONE OF THE ALLOWED TERMINATIONS MIGHT ALREADY BE INTEGRATED IN THE ASSOCIATED APPARATUS. THE NUMBER OF PASSIVE APPARATUS CONNECTED TO THE BUS SEGMENT IS NOT LIMITED DUE TO I.S. REASONS. IF THE ABOVE RULES ARE RESPECTED, UP TO A TOTAL LENGTH OF 1000 m (SUM OF TRUNK AND ALL SPUR CABLES) OF CABLE IS PERMITTED.
THE INDUCTANCE AND THE CAPACITANCE OF THE CABLE WILL NOT IMPAIR THE INTRINSIC SAFETY OF THE INSTALLATION.



FISCO PARAMETERS

U_i (Vmax) = 30V
I_i (Imax) = 380mA
P_i (Pmax) = 5.32W
C_i = 924pF
L_i = 0.0uH
LEAKAGE CURRENT: LESS THAN OR EQUAL TO 50uA
TEMPERATURE CLASSIFICATION: T4
MAX AMBIENT TEMP: (-50°C LESS THAN OR EQUAL TO Ta LESS THAN OR EQUAL TO 60°C)

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR.	SIZE B	FSCM NO	DWG NO. 08732-1060
ISSUED	SCALE N/A	WT.	SHEET 3 OF 6

Form Rev AC

Figure B-4. ATEX Installation
(4 of 6)

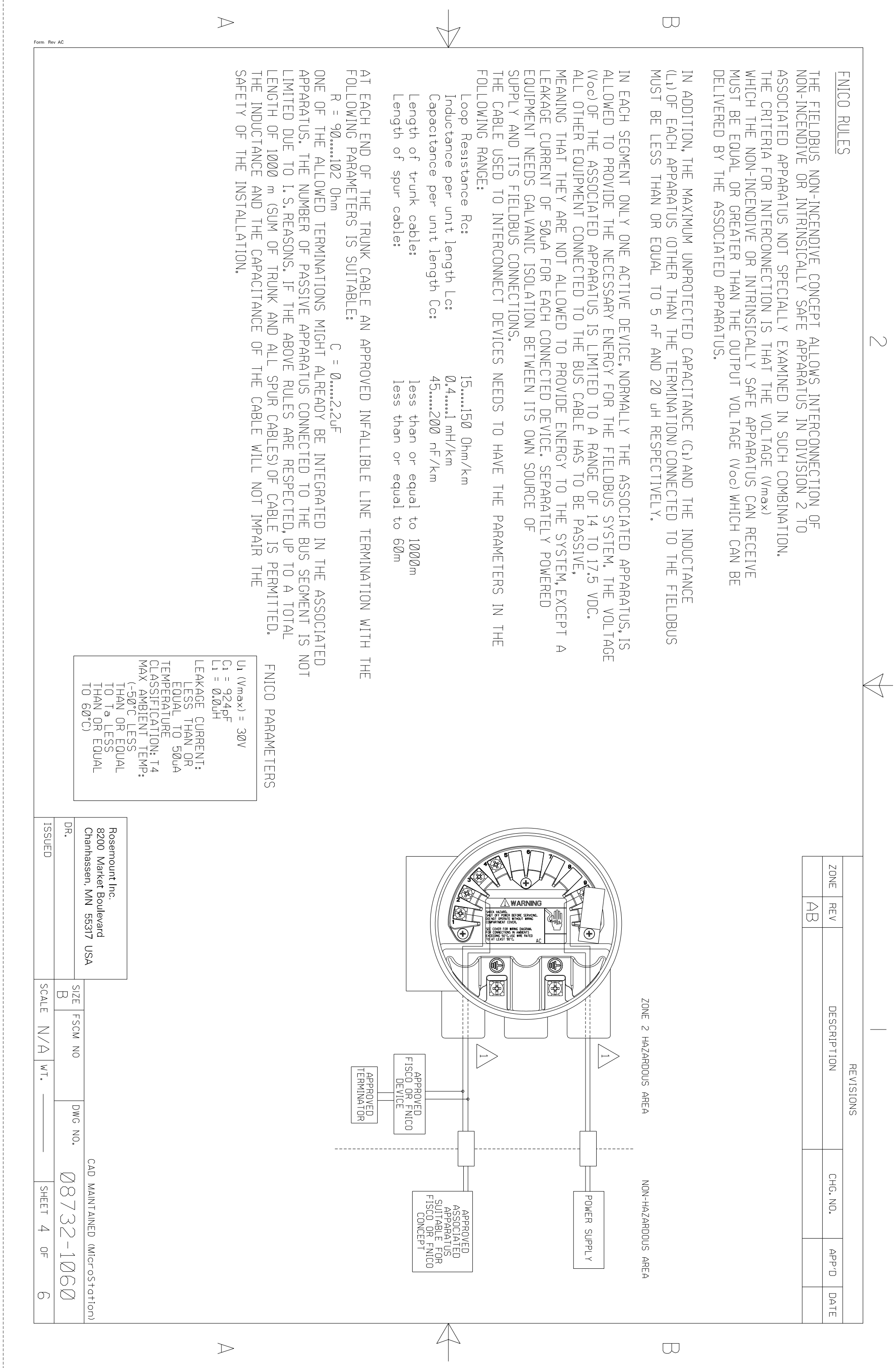


Figure B-5. ATEX Installation
(5 of 6)

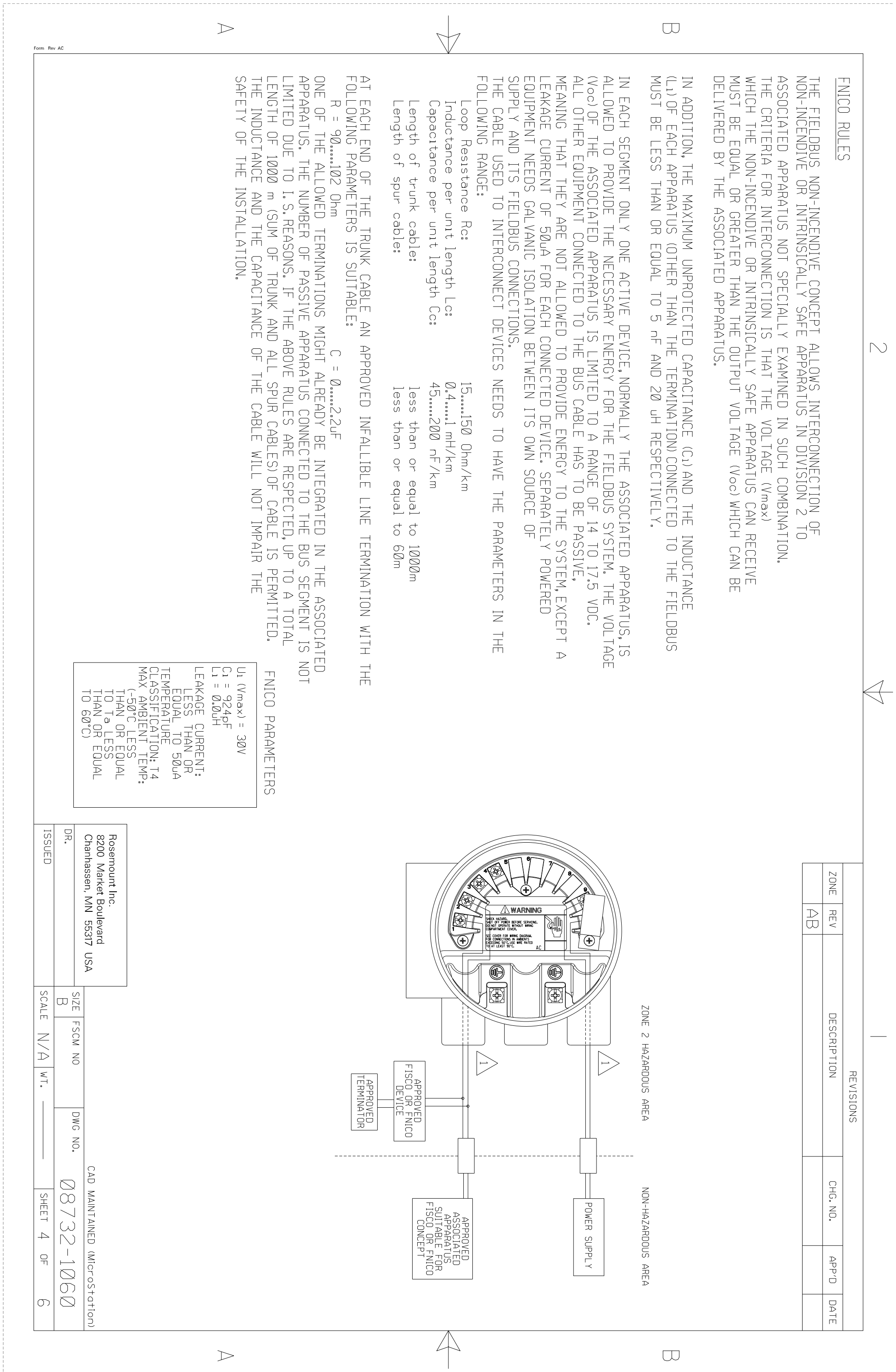


Figure B-6. ATEX Installation
(6 of 6)

REVISIONS					
ZONE	REV	DESCRIPTION	CHG. NO.	APP'D	DATE
	AB				

TABLE 2 - TYPE 'n' FLOWTUBE TEMPERATURE LIMITS ✻

0.5 INCH	TEMPERATURE CODE RATINGS (°C)			
	T3	T4	T5	T6
AMBIENT	PROCESS	PROCESS	PROCESS	PROCESS
65	147	59	12	-8
60	154	66	19	-2
55	161	73	26	5
50	168	80	32	12
45	175	87	39	19
40	177	93	46	26
35	-	100	53	32
30	-	107	59	39
25	-	114	66	46
20	-	120	73	53

'-' = VALUE IS SAME AS THAT SHOWN IN ROW ABOVE

TABLE 5 - TYPE 'n' FLOWTUBE TEMPERATURE LIMITS ✻

2.0 INCH	TEMPERATURE CODE RATINGS (°C)			
	T3	T4	T5	T6
AMBIENT	PROCESS	PROCESS	PROCESS	PROCESS
65	143	73	35	19
60	149	78	40	24
55	154	84	46	29
50	159	89	51	35
45	165	94	57	40
40	170	100	62	46
35	176	105	67	51
30	177	111	73	57
25	-	116	78	62
20	-	122	84	67

'-' = VALUE IS SAME AS THAT SHOWN IN ROW ABOVE

TABLE 3 - TYPE 'n' FLOWTUBE TEMPERATURE LIMITS ✻

1.0 INCH	TEMPERATURE CODE RATINGS (°C)			
	T3	T4	T5	T6
AMBIENT	PROCESS	PROCESS	PROCESS	PROCESS
65	159	70	22	1
60	166	77	29	8
55	173	84	36	15
50	177	91	43	22
45	-	97	50	29
40	-	104	57	36
35	-	111	63	43
30	-	118	70	50
25	-	125	77	57
20	-	132	84	63

'-' = VALUE IS SAME AS THAT SHOWN IN ROW ABOVE

TABLE 6 - TYPE 'n' FLOWTUBE TEMPERATURE LIMITS ✻

3-60 INCH	TEMPERATURE CODE RATINGS (°C)			
	T3	T4	T5	T6
AMBIENT	PROCESS	PROCESS	PROCESS	PROCESS
65	177	99	47	24
60	-	106	54	32
55	-	114	62	39
50	-	121	69	47
45	-	129	77	54
40	-	130	84	62
35	-	-	92	69
30	-	-	95	77
25	-	-	-	80
20	-	-	-	-

'-' = VALUE IS SAME AS THAT SHOWN IN ROW ABOVE

TABLE 4 - TYPE 'n' FLOWTUBE TEMPERATURE LIMITS ✻

1.5 INCH	TEMPERATURE CODE RATINGS (°C)			
	T3	T4	T5	T6
AMBIENT	PROCESS	PROCESS	PROCESS	PROCESS
65	147	71	31	13
60	153	77	36	19
55	159	83	42	25
50	165	89	48	31
45	171	95	54	36
40	177	101	60	42
35	-	106	66	48
30	-	112	71	54
25	-	118	77	60
20	-	124	83	66

'-' = VALUE IS SAME AS THAT SHOWN IN ROW ABOVE

✻ UPPER TEMPERATURE LIMITS FOR AMBIENT AND PROCESS TEMPERATURES

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR.	SIZE B	FSCM NO	DWG NO. 08732-1060
ISSUED	SCALE N/A	WT. ———	SHEET 6 OF 6

Figure B-7. FM Certified I.S. Output (1 of 4)

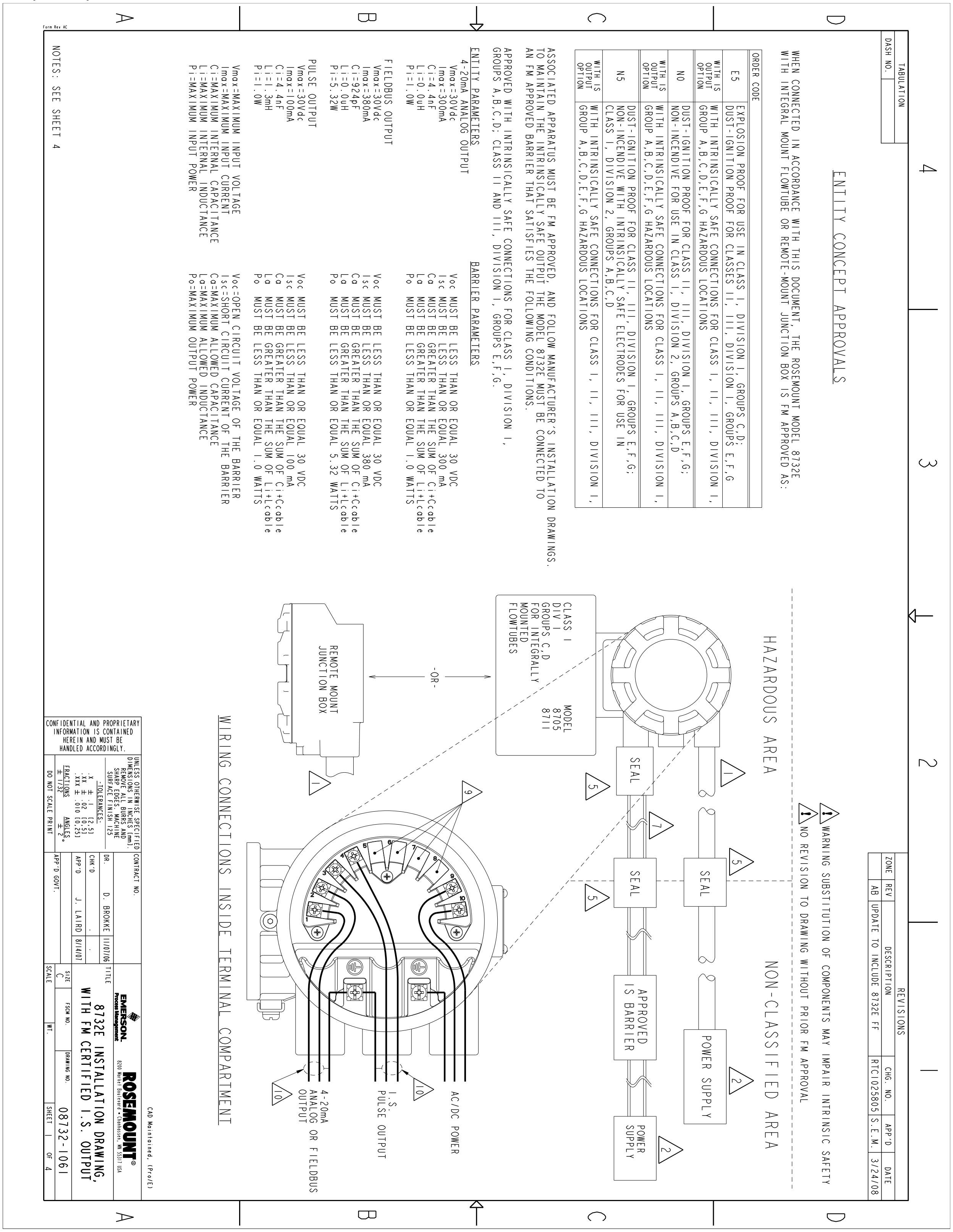


Figure B-8. FM Certified I.S. Output (2 of 4)

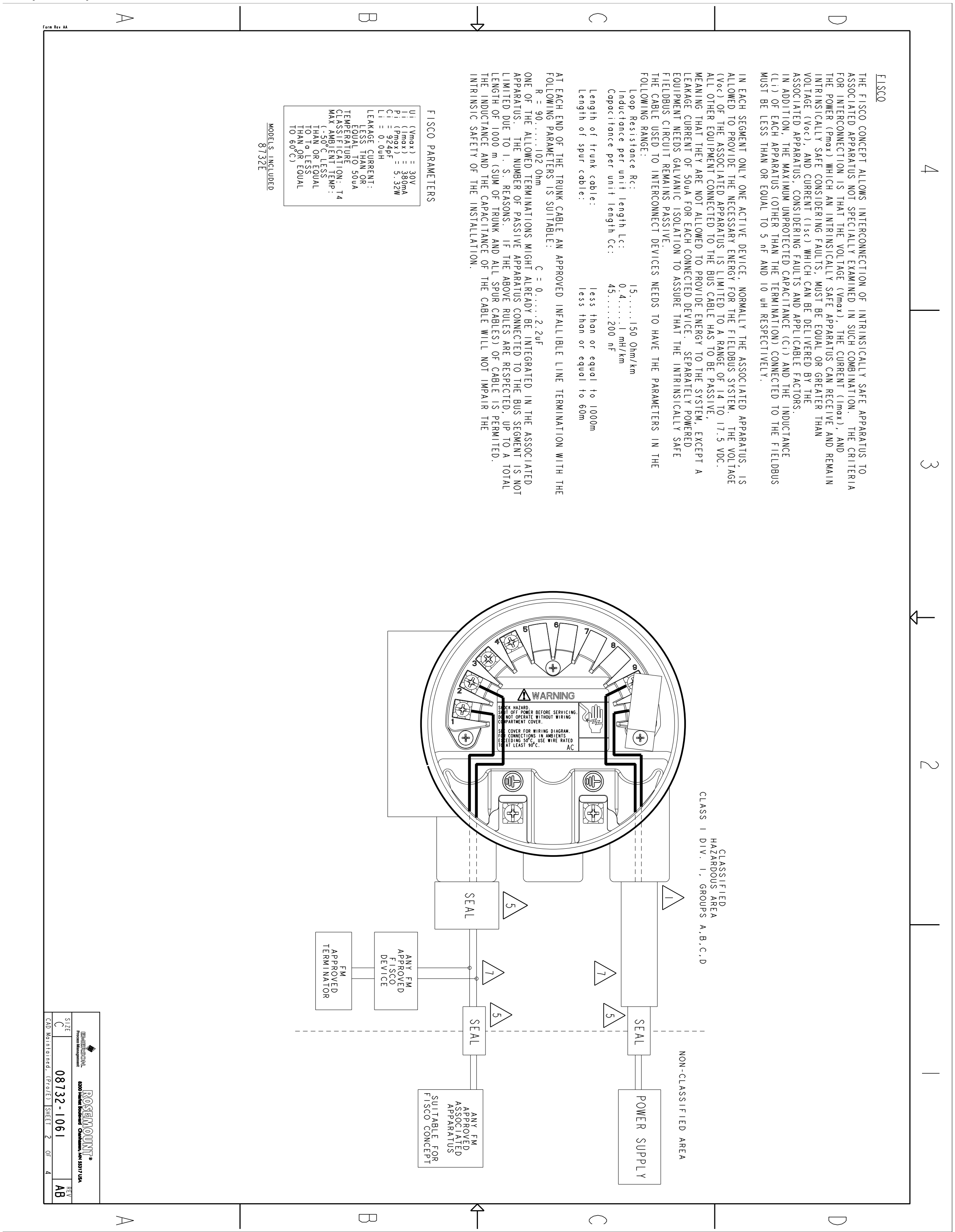


Figure B-9. FM Certified I.S. Output (3 of 4)

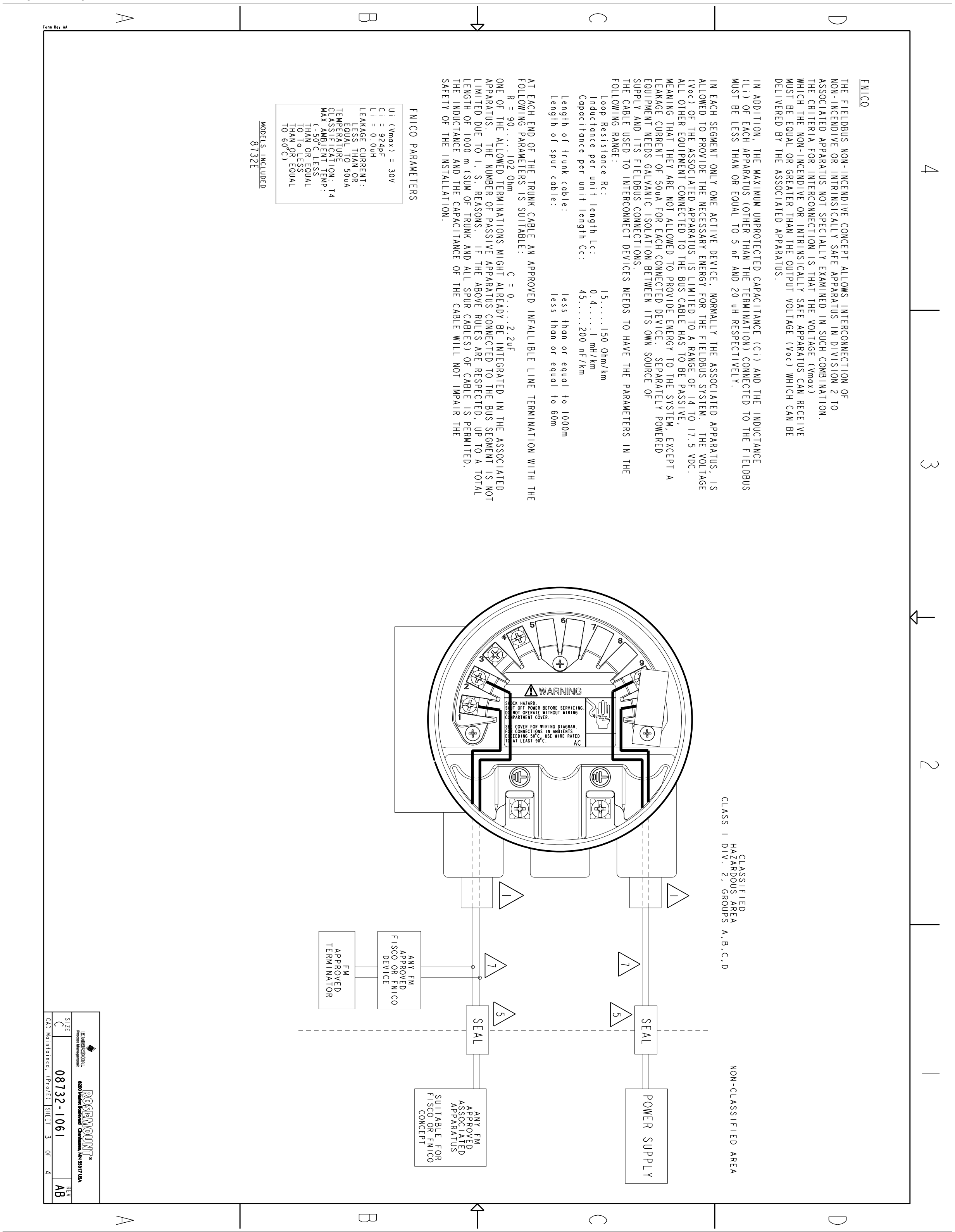


Figure B-10. FM Certified I.S.
Output (4 of 4)

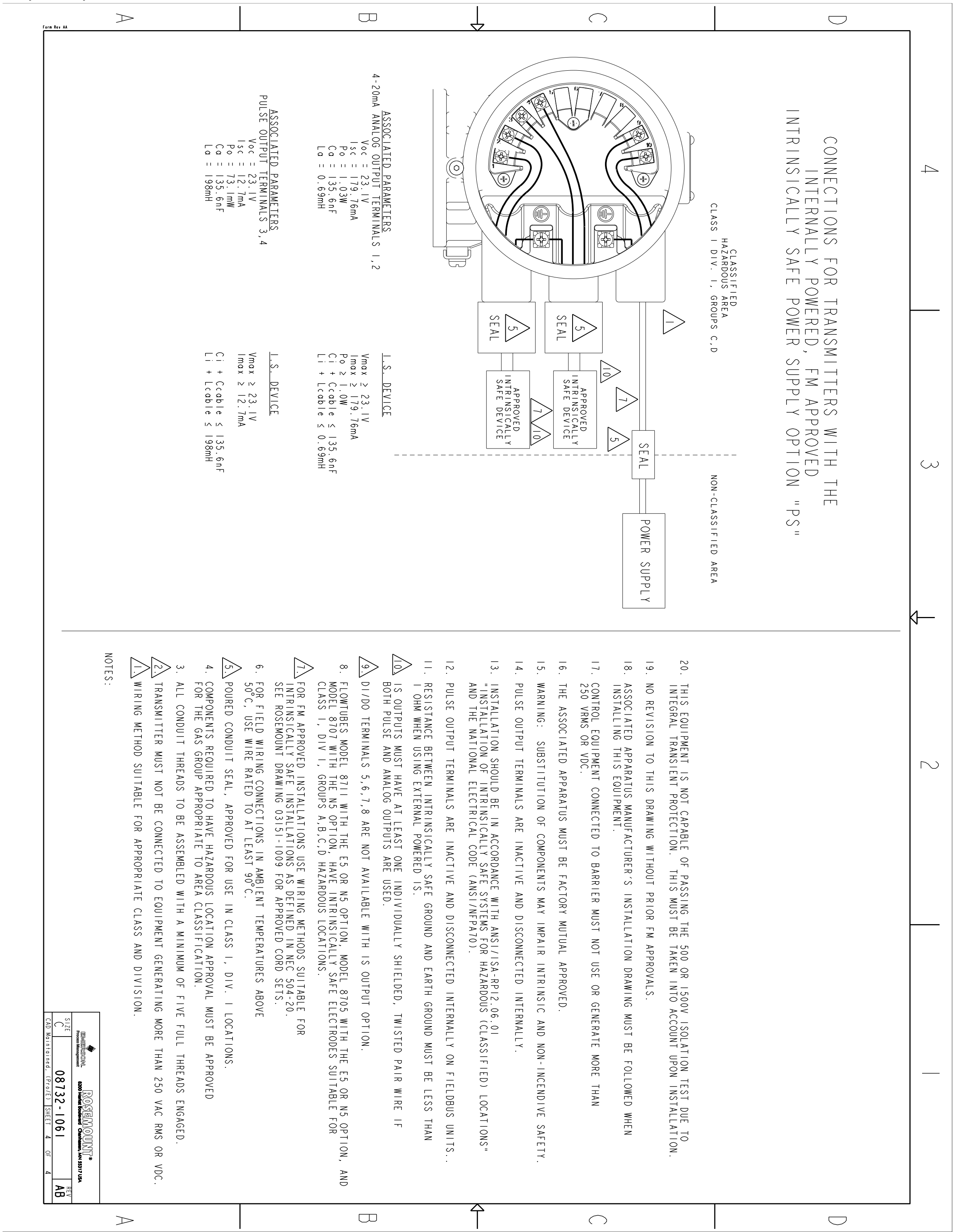


Figure B-11. CSA Certified I.S. Output (1 of 2)

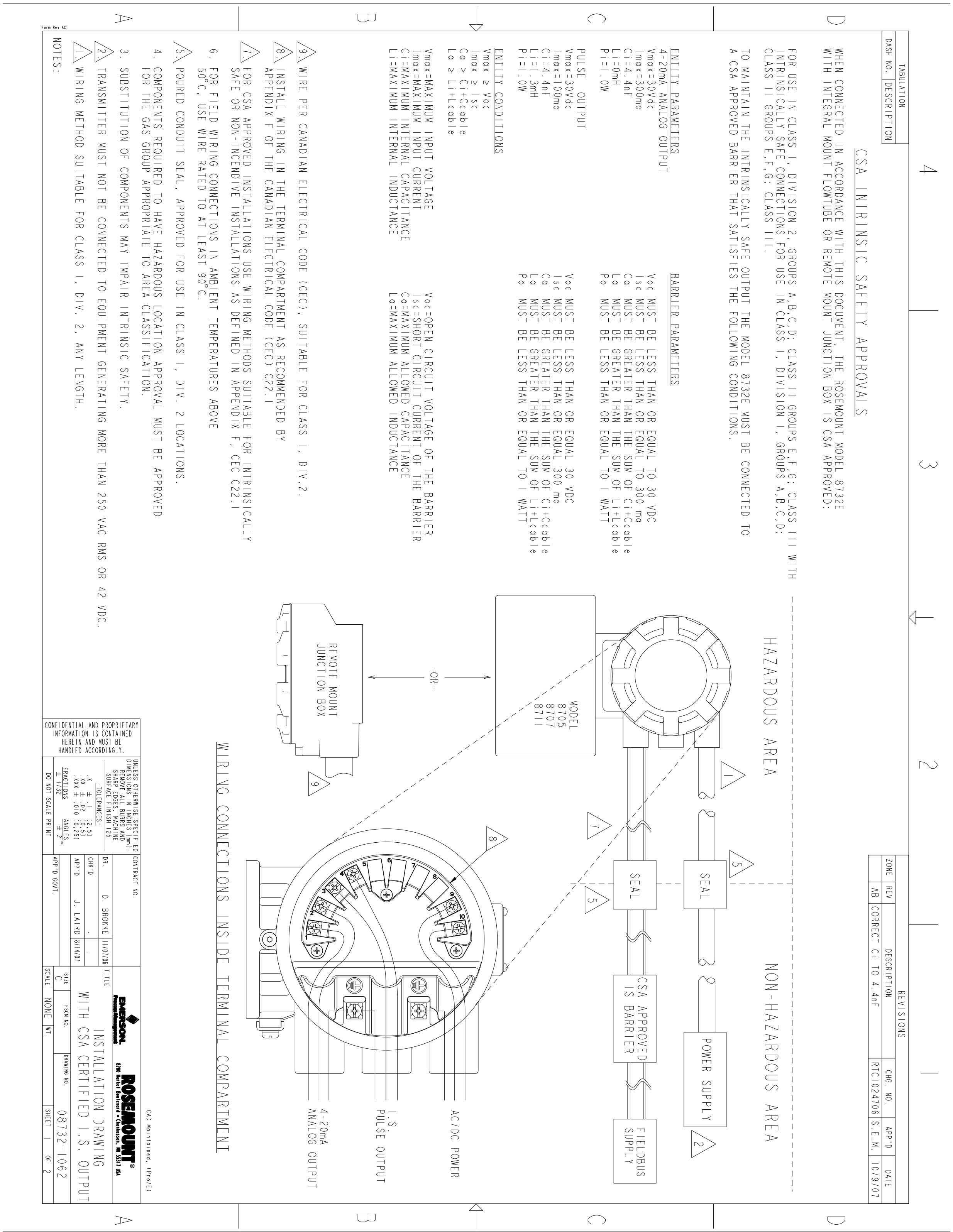


Figure B-12. CSA Certified I.S. Output (2 of 2)

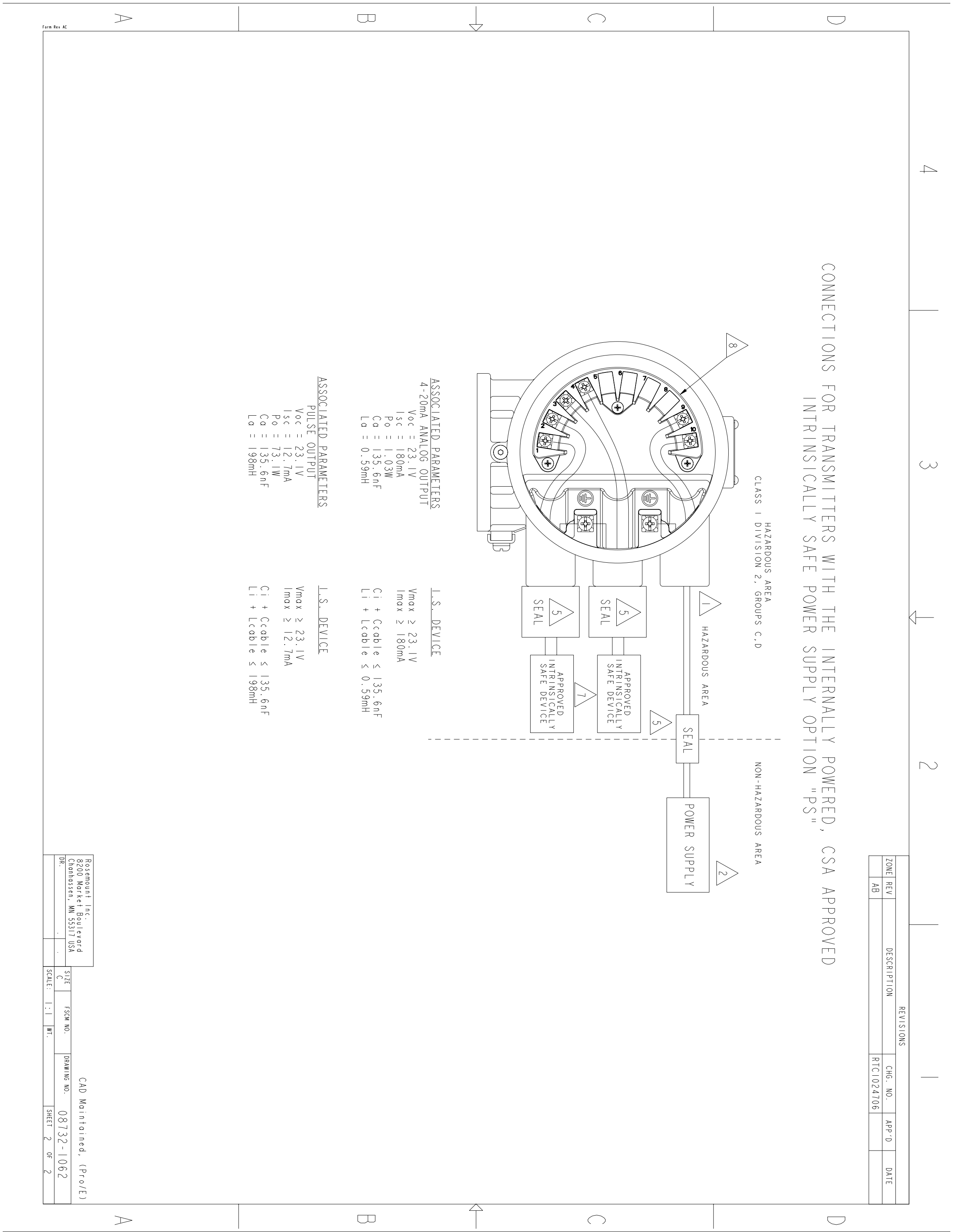


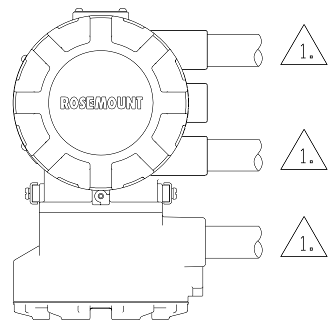
Figure B-13. CSA Installation

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY

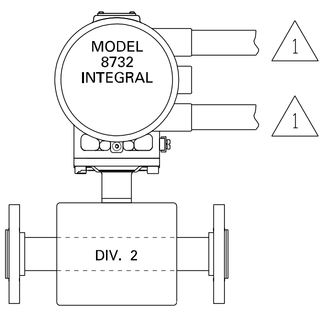
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AE	UPDATE TRANSMITTER, JUNCTION BOX VIEWS	RTC1029252	S.E.M.	10/12/09

HAZARDOUS (CLASSIFIED) LOCATION

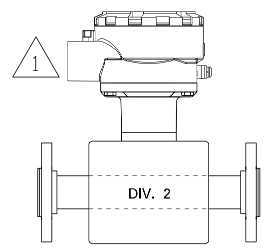
DUST-IGNITION PROOF FOR
CLASS II/III, DIV. 1, GROUPS E, F, & G;
SUITABLE FOR
CLASS I, DIV. 2, GROUPS A, B, C, & D.
CSA ENCLOSURE TYPE 4X
AMBIENT TEMP. LIMITS: -50°C TO +60°C.



REMOTE MOUNT CONFIGURATION



MODEL 8705, 8707, 8711, OR 8750W INTEGRAL,
"STANDARD PRODUCT OFFERING"



MODEL 8705, 8707, 8750W REMOTE
OR
MODEL 8711 REMOTE
"STANDARD PRODUCT OFFERING"

1. INSTALL PER CANADIAN ELECTRICAL CODE (CEC).

2. MODEL 8705, 8707, 8711, & 8750W FLOWTUBES HAVE NON-INCENDIVE ELECTRODES FOR CLASS I, DIVISION 2, GROUPS A, B, C, AND D.

WARNING EXPLOSIVE HAZARD-
SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV 2

WARNING EXPLOSIVE HAZARD-
DO NOT SET UP SWITCHES UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS

CAD MAINTAINED (MicroStation)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

-TOLERANCE-
.X ± .1 [2,5]
.XX ± .02 [0,5]
.XXX ± .010 [0,25]
FRACTIONS ± 1/32
ANGLES ± 2°

DO NOT SCALE PRINT

CONTRACT NO.	
DR. C.SCRIBNER	4/18/95
CHK'D	
APP'D. J.TEMPLIN	8/25/95
APP'D. GOVT.	

EMERSON. Process Management
ROSEMOUNT®
8200 Market Boulevard • Chanhassen, MN 55317 USA

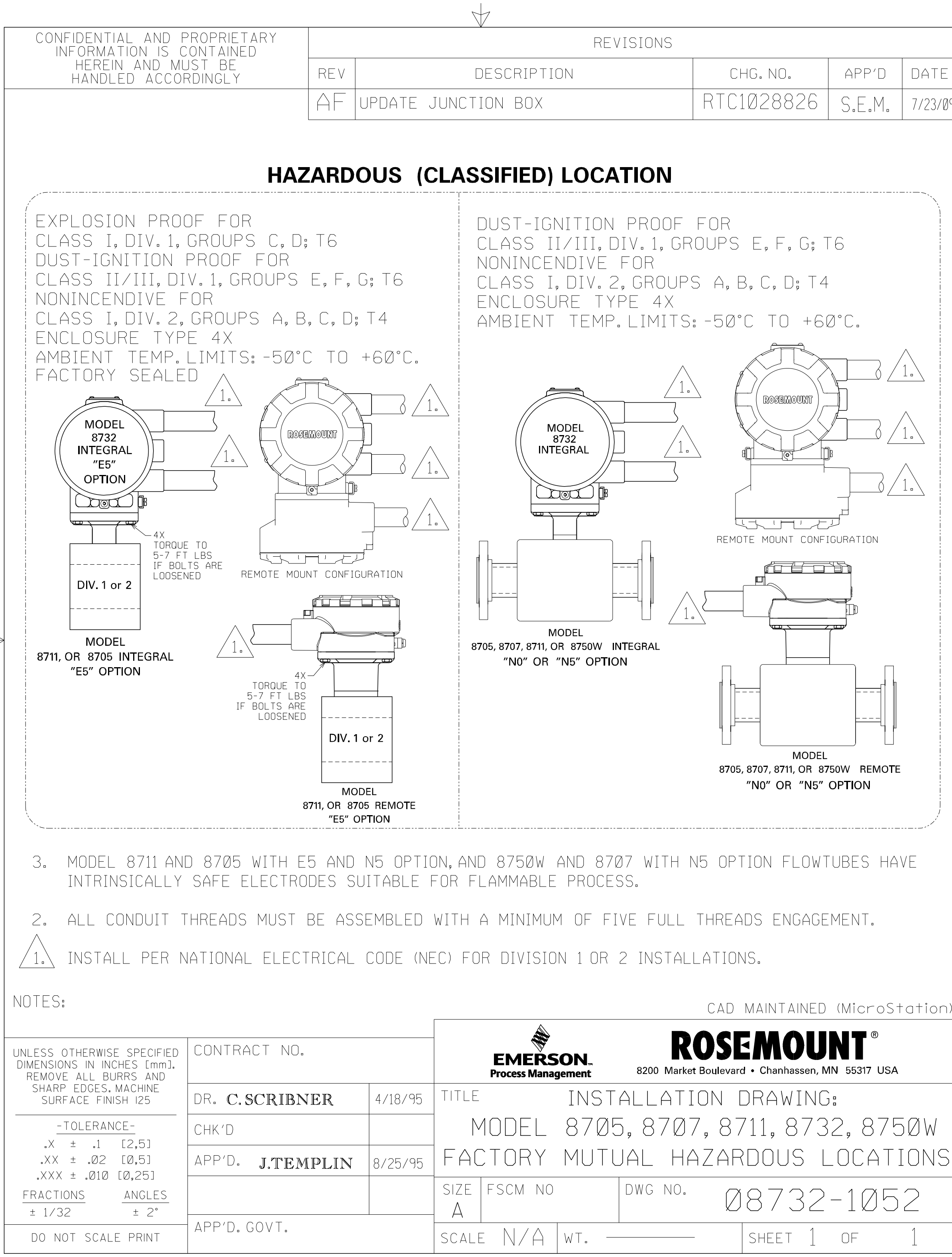
TITLE INSTALLATION DRAWING:
MODEL 8732, 8705, 8707, 8711, 8750W
CSA

SIZE	FSCM NO	DWG NO.
A		08732-1051

SCALE N/A | WT. ———— | SHEET 1 OF 1

Form Rev AC

Figure B-14. Factory Mutual Hazardous Locations



Appendix C Diagnostics

DIAGNOSTIC AVAILABILITY

Rosemount Magmeters provide device diagnostics that powers PlantWeb and informs the user of abnormal situations throughout the life of the meter - from installation to maintenance and meter verification. With Rosemount Magmeter diagnostics enabled, users can change their practices to improve plant availability and output, and reduce costs through simplified installation, maintenance and troubleshooting.

Table C-1. Rosemount Magmeter Diagnostics

Diagnostics	Mag User Practice	8732 FF
Basic		
Empty Pipe	Process Management	•
Electronics Temperature	Maintenance	•
Coil Fault	Maintenance	•
Transmitter Faults	Maintenance	•
Reverse Flow	Process Management	•
Advanced (Suite 1)		D01 Option
High Process Noise	Process Management	•
Grounding/Wiring Fault	Installation	•
Advanced (Suite 2)		D02 Option
8714i Meter Verification	Meter Verification	•

Options for Accessing Diagnostics

Rosemount Magmeter Diagnostics can be accessed through the 375 Field Communicator, AMS Device Manager, or any other FOUNDATION fieldbus configuration tool.

Access Diagnostics through AMS Intelligent Device Manager for the Ultimate Value

The value of the Diagnostics increases significantly when AMS is used. AMS provides a simplified screen flow and procedures for how to respond to the Diagnostic messages.

LICENSING AND ENABLING

All non-basic diagnostics must be licensed by ordering option code D01, D02, 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. To obtain a license key, contact your local Rosemount Representative. Each transmitter has a unique license key specific to the diagnostic option code. See the detailed procedures below for entering the license key and enabling the advanced diagnostics.

Licensing the 8732 Diagnostics

For licensing the advanced diagnostics, follow the steps below.

1. Power-up the 8732 transmitter
2. Verify that you have 1.01.001 software or later

375	Transducer Block, Diagnostics, Advanced Diagnostics, Licensing
AMS Tab	License

3. Determine the Device ID

375	Transducer Block, Diagnostics, Advanced Diagnostics, Licensing, License Key, Device ID
AMS Tab	License

4. Obtain a License Key from your local Rosemount Representative.
5. Enter License Key

375	Transducer Block, Diagnostics, Advanced Diagnostics, Licensing, License Key, License Key
AMS Tab	License

6. Enable Advanced Diagnostics

375	Transducer Block, Diagnostics, Diagnostic Controls
AMS Tab	Diagnostics

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 0, and deliver a PlantWeb alert.

Turning Empty Pipe On/Off

375	Transducer Block, Diagnostics, Diagnostic Controls
AMS Tab	Diagnostics

The Empty Pipe diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (D01 Option) was ordered, then the Empty Pipe diagnostic will be turned on. If D01 was not ordered, the default setting is off.

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 Value

375	Transducer Block, Diagnostics, Basic Diagnostics, Empty Pipe Limits, EP Value
AMS Tab	Diagnostics

Reads the current Empty Pipe Value. This is a read-only value. This number is a unitless 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 Trigger Level

375	Transducer Block, Diagnostics, Basic Diagnostics, Empty Pipe Limits, EP Trigger Level
AMS Tab	Diagnostics

Limits: 3 to 2000

This value configures 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 Counts

375	Transducer Block, Diagnostics, Basic Diagnostics, Empty Pipe Limits, EP Counts
AMS Tab	Diagnostics

Limits: 5 to 50

This value configures the number of consecutive updates that the Empty Pipe Value must exceed the Empty Pipe Trigger Level before the Empty Pipe diagnostic alert activates. The default setting from the factory is 5.

Optimizing Tunable Empty Pipe

The Tunable Empty Pipe diagnostic is set at the factory to properly diagnose most applications. If this diagnostic unexpectedly activates, the following procedure can be followed to optimize the Empty Pipe diagnostic for the application.

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

Troubleshooting Empty Pipe

The following actions can be taken if Empty Pipe detection is unexpected.

1. Verify the sensor is full.
2. Verify that 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 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 activate the Empty Pipe alert. The count range is 5-50, with 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. Confirm the resistance reading between coil ground (ground symbol) and coil (1 and 2) is infinity, or open. Confirm the resistance reading between electrode ground (17) and an electrode (18 or 19) is greater than 2 kohms and rises. For more detailed information, consult Table 6-5 on page 6-8.

GROUND/WIRING FAULT DETECTION

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 a PlantWeb alert. This diagnostic can also detect if the grounding is lost over-time due to corrosion or another root cause.

Turning Ground/Wiring Fault On/Off

375	Transducer Block, Diagnostics, Basic Diagnostics, Empty Pipe Limits, EP Counts
AMS Tab	Diagnostics

The Ground/Wiring Fault diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (D01 Option) was ordered, then the Ground/Wiring Fault diagnostic will be turned on. If D01 was not ordered or licensed, this diagnostic is not available.

Ground/Wiring Fault Parameters

The Ground/Wiring Fault diagnostic has one read-only parameter. It does not have any configurable parameters.

Line Noise

375	Transducer Block, Diagnostics, Diagnostic Variables, Line Noise
AMS Tab	Diagnostics

Reads the current 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.

Troubleshooting Ground/Wiring Fault

The transmitter detected high levels of 50/60 Hz noise caused by improper wiring or poor process grounding.

1. Verify that the transmitter is earth grounded.
2. Connect ground rings, grounding electrode, lining protector, or grounding straps. Grounding diagrams can be found in “Grounding” on page 5-12.
3. Verify sensor is full.
4. Verify wiring between sensor and transmitter is prepared properly. Shielding should be stripped back less than 1 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.

Ground/Wiring Fault Functionality

The transmitter continuously monitors signal amplitudes over a wide range of frequencies. For the Ground/Wiring Fault 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.

HIGH PROCESS NOISE DETECTION

The High Process Noise diagnostic detects if there is a process condition causing unstable or noisy readings, but the noise is not real flow variation. One 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 variation is seen, this diagnostic will activate and deliver a PlantWeb alert. If this situation exists and is left without remedy, it will add additional uncertainty and noise to the flow reading.

Turning High Process Noise On/Off

375	Transducer Block, Diagnostics, Diagnostic Controls
AMS Tab	Diagnostics

The High Process Noise diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (D01 Option) was ordered, then the High Process Noise diagnostic will be turned on. If D01 was not ordered or licensed, this diagnostic is not available.

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 > 1 ft/s.

5 Hz Signal to Noise Ratio

375	Transducer Block, Diagnostics, Diagnostic Variables, 5Hz SNR
AMS Tab	Diagnostics

Reads the current 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 approximately one minute, then the High Process Noise diagnostic alert will activate.

37 Hz Signal to Noise Ratio

375	Transducer Block, Diagnostics, Diagnostic Variables, 37Hz SNR
AMS Tab	Diagnostics

Reads 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 approximately one minute, then the High Process Noise diagnostic alert will activate.

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 (refer to “Coil Drive Frequency” on page 4-13) and, if possible, perform Auto Zero function (refer to “Auto Zero” on page 4-12).
2. Verify sensor is electrically connected to the process with grounding 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 (refer to Appendix D: 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 3-11). This will add dead-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.

High Process Noise Functionality

The High Process Noise diagnostic is useful for detecting situations where the process fluid may be causing electrical noise resulting in a poor measurement from the magnetic flowmeter. There are three basic types of process noise that can affect the performance of the magnetic flowmeter system.

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 the general background noise of the plant.

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.

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 high consistency pulp stock stream (>10%) in a paper mill.

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 alert will activate 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.

8714I METER VERIFICATION

The 8714i Meter Verification diagnostic provides a means of verifying the flowmeter is within calibration without removing the sensor from the process. This is a manually initiated diagnostic test that provides a review of the transmitter and sensors critical parameters as a means to document verification of calibration. The results of running this diagnostic provide the deviation amount from expected values and a pass/fail summary against user-defined criteria for the application and conditions.

Initiating 8714i Meter Verification

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification
AMS Tab	Diagnostics

The 8714i Meter Verification diagnostic can be initiated as required by the application. If the advanced diagnostic suite (D02) was ordered, then the 8714i Meter Verification diagnostic will be available. If D02 was not ordered or licensed, this diagnostic will not be available.

Sensor Signature Parameters

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.

Establishing the baseline sensor signature

The first step in running the 8714i 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.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Sensor Signature, Re-Signature
AMS Tab	Context Menu, Diagnostics and Tests,

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 signature measurements. 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.

8714i Meter Verification Test Parameters

The 8714i has a multitude of parameters that set the test criteria, test conditions, and scope of the calibration verification test.

Test Conditions for the 8714i Meter Verification

There are three possible test conditions that the 8714i Meter Verification test can be initiated under. This parameter is set at the time that the Sensor Signature or 8714i Meter Verification test is initiated.

No Flow

Run the 8714i Meter Verification test with a full pipe and no flow in the line. Running the 8714i Meter Verification test under this condition provides the most accurate results and the best indication of magnetic flowmeter health.

Flowing, Full

Run the 8714i Meter Verification test with a full pipe and flow in the line. Running the 8714i Meter Verification test under this condition provides the ability to verify the magnetic flowmeter health without shutting down the process flow in applications where a shutdown is not possible. Running the calibration verification under flowing conditions can cause false fails if the flow rate is not at a steady flow, or if there is process noise present.

Empty Pipe

Run the 8714i Meter Verification test with an empty pipe. Running the 8714i Meter Verification test under this condition provides the ability to verify the magnetic flowmeter health with an empty pipe. Running the calibration verification under empty pipe conditions will not check the electrode circuit health.

8714i Meter Verification Test Criteria

The 8714i Meter Verification diagnostic provides the ability for the user to define the test criteria that the verification must test to. The test criteria can be set for each of the flow conditions discussed above.

375	Transducer Block, Diagnostics, Diagnostic Variables, Line Noise
AMS Tab	8714i

No Flow

Set the test criteria for the No Flow condition. The factory default for this value is set to two percent with limits configurable between one and ten percent.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Set Pass/Fail Criteria, No Flow Limit
AMS Tab	8714i

Flowing, Full

Set the test criteria for the Flowing, Full condition. The factory default for this value is set to three percent with limits configurable between one and ten percent.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Set Pass/Fail Criteria, Flowing Limit
AMS Tab	8714i

Empty Pipe

Set the test criteria for the Empty Pipe condition. The factory default for this value is set to three percent with limits configurable between one and ten percent.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Set Pass/Fail Criteria, Empty Pipe Limit
AMS Tab	8714i

8714i Meter Verification Test Scope

The 8714i Meter Verification 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 8714i Meter Verification test is initiated.

All

Run the 8714i Meter Verification test and verify the entire flowmeter installation. This parameter results in the verification test 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.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Run 8714i
AMS Tab	Context Menu, Diagnostics and Tests, 8714i Meter Verification

Transmitter

Run the 8714i 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 8714i Meter Verification test was initiated.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Run 8714i
AMS Tab	Context Menu, Diagnostics and Tests, 8714i Meter Verification

Sensor

Run the 8714i 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 8714i Meter Verification test was initiated, verifying the coil circuit health, and the electrode circuit health.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Run 8714i
AMS Tab	Context Menu, Diagnostics and Tests, 8714i Meter Verification

8714i Meter Verification Test Results Parameters

Once the 8714i Meter Verification test is initiated, the transmitter will make several measurements to verify the transmitter calibration, sensor calibration, coil circuit health, and electrode circuit health. The results of these tests can be reviewed and recorded on the calibration verification report found on page C-16. This report can be used to validate that the meter is within the required calibration limits to comply with governmental regulatory agencies such as the Environmental Protection Agency or Food and Drug Administration.

Viewing the 8714i Meter Verification Results

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 375 Field Communicator, each individual component can be viewed as a menu item. In AMS, the calibration report is populated with the necessary data eliminating the need to manually complete the report found on page C-16.

NOTE
When using AMS there are two possible methods that can be used to print the report. Method one involves taking a screen capture of the 8714i Report tab. Using Ctrl + Alt + PrntScrn will capture the active window and allow for pasting of the report directly into a word processing program.

Method two involves using the print feature within AMS 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 following order:

Test Condition

Review the test condition that the 8714i Meter Verification test was performed under.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, Test Condition
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

Test Criteria

Review the test criteria used to determine the results of the 8714i Meter Verification tests.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, Test Criteria
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

8714i Result

Displays the overall result of the 8714i Meter Verification test as either a Pass or Fail.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, 8714i Result
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

Simulated Velocity

Displays the simulated velocity used to verify the transmitter calibration.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, Simulated Vel
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

Actual Velocity

Displays the velocity measured by the transmitter during the transmitter calibration verification process.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, Actual Velocity
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

Velocity Deviation

Displays the deviation in the actual velocity compared to the simulated velocity in terms of a percentage. This percentage is then compared to the test criteria to determine if the transmitter is within calibration limits.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, Velocity Dev
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

Transmitter Calibration Verification

Displays the results of the transmitter calibration verification test as either a Pass or Fail.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, Xmtr Cal Result
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

Sensor Calibration Deviation

Displays the deviation in the sensor calibration. This value tells how much the sensor calibration has shifted from the original baseline signature. This percentage is compared to the test criteria to determine if the sensor is within calibration limits.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, Sensor Cal Dev
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

Sensor Calibration Verification

Displays the results of the sensor calibration verification test as either a Pass or Fail.=

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, Sensor Cal Rslt
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

Coil Circuit Verification

Displays the results of the coil circuit health check as either a Pass or Fail.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, Coil Ckt Result
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

Electrode Circuit Verification

Displays the results of the electrode circuit health check as either a Pass or Fail.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, 8714i Results, Electrode Ckt Res
AMS Tab	Context Menu, Device Diagnostics, 8714i Report

Optimizing the 8714i Meter Verification

The 8714i 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 every year to comply with Environmental Protection Agency and Pollution Control Agency standards. These governmental agencies require that the meter be certified to five percent accuracy.

Since this is an effluent meter, shutting down the process may not be viable. In this instance the 8714i 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 semi-annual verification of meter calibration on a critical feed line for one of their products. This is an internal standard, but plant requirements require a calibration record be kept on-hand. Meter calibration on this process must meet one 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 8714i Meter Verification test can be run under no flow conditions, set the test criteria for No Flow to one percent to comply with the necessary plant standards.

Example

A food and beverage company requires an annual verification 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 8714i 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.

Troubleshooting the 8714i Meter Verification Test

In the event that the 8714i Meter Verification test fails, the following steps can be used to determine the appropriate course of action. Begin by reviewing the 8714i results to determine the specific test that failed.

Figure C-1. Troubleshooting the 8714i Meter Verification Test Table

Test	Potential Causes of Failure	Steps to Correct
Transmitter Verification Test Failed	• Unstable flow rate during the verification test • Noise in the process • Transmitter drift • Faulty electronics	• Perform the test with no flow in the pipe • Check calibration with an external standard like the 8714D • Perform a digital trim • Replace the electronics
Sensor Verification Failed	• Moisture in the terminal block of the sensor • Calibration shift caused by heat cycling or vibration	• Remove the sensor and send back for recalibration.
Coil Circuit Health Failed	• Moisture in the terminal block of the sensor • Shorted Coil	• Perform the sensor checks detailed on page 6-8.
Electrode Circuit Health Failed	• Moisture in the terminal block of the sensor • Coated Electrodes • Shorted Electrodes	• Perform the sensor checks detailed on page 6-8.

8714i Meter Verification Functionality

The 8714i Meter Verification diagnostic functions by taking a baseline sensor signature and then comparing measurements taken during the verification test to these baseline results.

Sensor Signature Values

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

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 when the 8714i Meter Verification diagnostic is initiated.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Sensor Signature, Signature Values, Coil Resistance
AMS Tab	Config/Setup, 8714i

Coil Signature

The Coil Signature is a measurement of the magnetic field strength. This value is used as a baseline to determine if a sensor calibration shift has occurred when the 8714i Meter Verification diagnostic is initiated.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Sensor Signature, Signature Values, Coil Signature
AMS Tab	Config/Setup, 8714i

Electrode Circuit Resistance

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 when the 8714i Meter Verification diagnostic is initiated.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Sensor Signature, Signature Values, Electrode Resistance
AMS Tab	Config/Setup, 8714i

8714i Meter Verification Measurements

The 8714i 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

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.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Measurements, Coil Resistance
AMS Tab	Config/Setup, 8714i

Coil Signature

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.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Measurements, Coil Signature
AMS Tab	Config/Setup, 8714i

Electrode Circuit Resistance

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.

375	Transducer Block, Diagnostics, Advanced Diagnostics, 8714i Meter Verification, Measurements, Electrode Resistance
AMS Tab	Config/Setup, 8714i

ROSEMOUNT MAGNETIC FLOWMETER CALIBRATION VERIFICATION REPORT

Calibration Verification Report Parameters

User Name: ____

Calibration Conditions: ☐ Internal ☐ External

Tag #:____

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

Simulated Velocity:_______________________________________

Actual Velocity:____

Deviation %:____

Transmitter: PASS / FAIL / NOT TESTED

Sensor Calibration Verification Results

Sensor Deviation %:_______________________________________

Sensor: PASS / FAIL / NOT TESTED

Coil Circuit Test: 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:____

Appendix D Digital Signal Processing

SAFETY MESSAGES

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Please read the following safety messages before performing any operation described in this section.

Warnings

⚠WARNING

Explosions could result in death or serious injury:

- Verify that the operating atmosphere of the sensor and transmitter is consistent with the appropriate hazardous locations certifications.
- Do not remove the transmitter cover in explosive atmospheres when the circuit is alive.
- Before connecting a Field 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.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

⚠WARNING

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:

- The electrode compartment may contain line pressure; it must be depressurized before the cover is removed.

⚠WARNING

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

- Avoid contact with leads and terminals.

PROCEDURES

If the output of your Rosemount 8732 is unstable, first check the wiring and grounding associated with the magnetic flowmeter system. Ensure that the following conditions are met:

- Ground straps are attached to the adjacent flange or ground ring?
- Grounding rings, lining protectors, or grounding electrodes are being used in lined or nonconductive piping?
- Both of the shields are attached at both ends?

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 8732 coil drive mode is selectable between the standard 5 Hz and the noise-reducing 37 Hz. See “Coil Drive Frequency” on page 4-26 for instructions on how to change the coil drive mode to 37 Hz.

Auto Zero

To ensure optimum accuracy when using 37 Hz coil drive mode, there is an auto zero function that must be initiated during start-up. The auto zero operation is also discussed in the start-up and configuration sections. 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.

Signal Processing

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 8732 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 8732 microprocessor can actually scrutinize each input based on three user-defined parameters to reject the noise specific to the application.

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:

1. Number of samples: The number of samples function sets the amount of time that inputs are collected and used to calculate the average value. Each second is divided into tenths ($^1/_{10}$) with the number of samples equaling the number of $^1/_{10}$ second increments used to calculate the average. Factory Preset Value = 90 samples.

   For example, a value of:

   1 averages the inputs over the past $^1/_{10}$ second

   10 averages the inputs over the past 1 second

   100 averages the inputs over the past 10 seconds

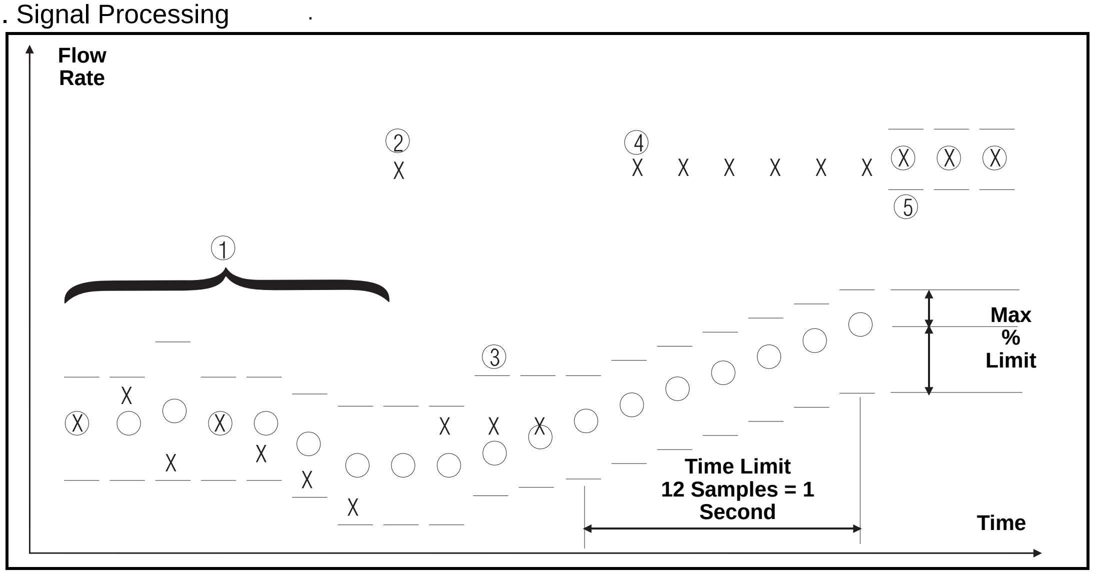
   125 averages the inputs over the past 12.5 seconds

2. Maximum Percent Limit: The tolerance band set up 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. Factory Preset Value = 2 percent.
3. Time Limit: Forces the output and running average values to the new value of an actual flow rate change that is outside the percent limit boundaries, thereby limiting response time to real flow changes to the time limit value rather than the length of the running average. Factory Preset Value = 2 seconds.

How Does It Really Work?

The best way to explain this is with the help of an example, plotting flow rate versus time

Figure D-1. Signal Processing



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, a shortcut 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.

When Should Signal Processing Be Used?

The Rosemount 8732 offers three separate functions that can be used in series for improving a noisy output. The first step is to toggle the coil drive to the 37 Hz mode and initialize with an auto zero. If the output is still noisy at this stage, signal processing should be actuated and, if necessary, tuned to match the specific application. Finally, if the signal is still too unstable, the traditional damping function can be used.

NOTE
Failure to complete an Auto Zero will result in a small (<1%) error in the output. While the output level will be offset by the error, the repeatability will not be affected.

Appendix E Universal Sensor Wiring Diagrams

The wiring diagrams in this section illustrate the proper connections between the Rosemount 8732 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 manufacturers' sensors is provided. If the manufacturer for your sensor is not included, see the drawing for generic connections.

Any trademarks used herein regarding sensors not manufactured by Rosemount are owned by the particular manufacturer of the sensor.

Table E-1. Sensor Cross References

Rosemount Transmitter	Sensor Manufacturer	Page Number
Rosemount		
Rosemount 8732	Rosemount 8705, 8707, 8711	page E-3
Rosemount 8732	Rosemount 8701	page E-4
Brooks		
Rosemount 8732	Model 5000	page E-6
Rosemount 8732	Model 7400	page E-7
Endress and Hauser		page E-5
Rosemount 8732	Generic Wiring for Sensor	page E-8
Fischer and Porter		page E-9
Rosemount 8732	Model 10D1418	page E-9
Rosemount 8732	Model 10D1419	page E-10
Rosemount 8732	Model 10D1430 (Remote)	page E-11
Rosemount 8732	Model 10D1430	page E-12
Rosemount 8732	Model 10D1465, 10D1475 (Integral)	page E-13
Rosemount 8732	Generic Wiring for Sensors	page E-14
Foxboro		
Rosemount 8732	Series 1800	page E-15
Rosemount 8732	Series 1800 (Version 2)	page E-16
Rosemount 8732	Series 2800	page E-17
Rosemount 8732	Generic Wiring for Sensors	page E-18
Kent		
Rosemount 8732	Veriflux VTC	page E-19
Rosemount 8732	Generic Wiring for Sensors	page E-20
Krohne		
Rosemount 8732	Generic Wiring for Sensors	page E-21
Taylor		
Rosemount 8732	Series 1100	page E-23
Rosemount 8732	Generic Wiring for Sensors	page E-23
Yamatake Honeywell		
Rosemount 8732	Generic Wiring for Sensors	page E-24
Yokogawa		
Rosemount 8732	Generic Wiring for Sensors	page E-25
Generic Manufacturer Wiring		page E-26
Rosemount 8732	Generic Wiring for Sensors	page E-26

ROSEMOUNT SENSORS

Rosemount 8705/8707/8711/8721 Sensors to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure .

Figure E-1. Wiring Diagram to a Rosemount 8732 Transmitter

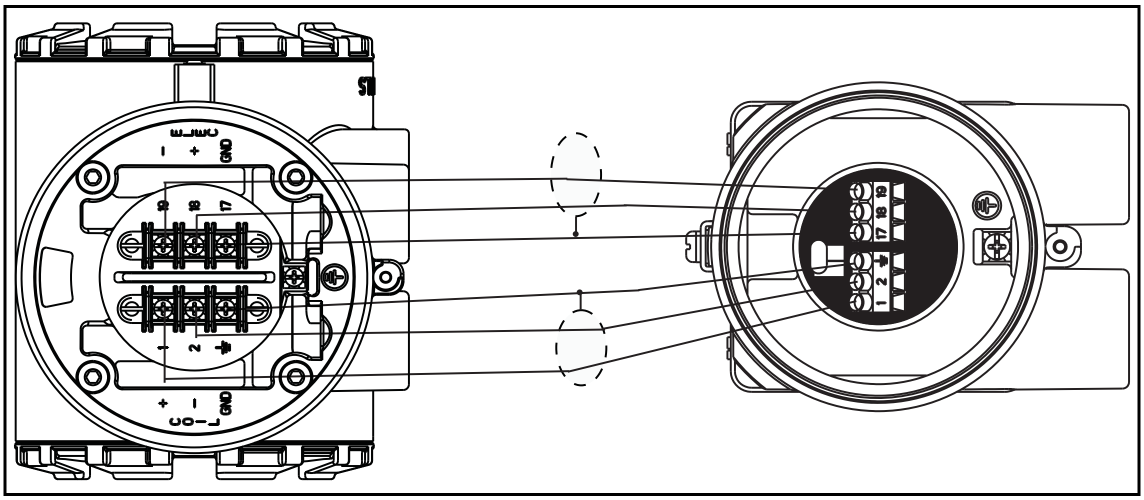
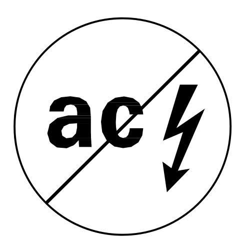


Table E-2. Rosemount 8705/8707/8711/8721 Sensor Wiring Connections

Rosemount 8732 Transmitters	Rosemount 8705/8707/8711/8721 Sensors
1	1
2	2
⏚	⏚
17	17
18	18
19	19

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Rosemount 8701 Sensor to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-2 on page E-4.

Figure E-2. Wiring Diagram for Rosemount 8701 Sensor and Rosemount 8732 Transmitter

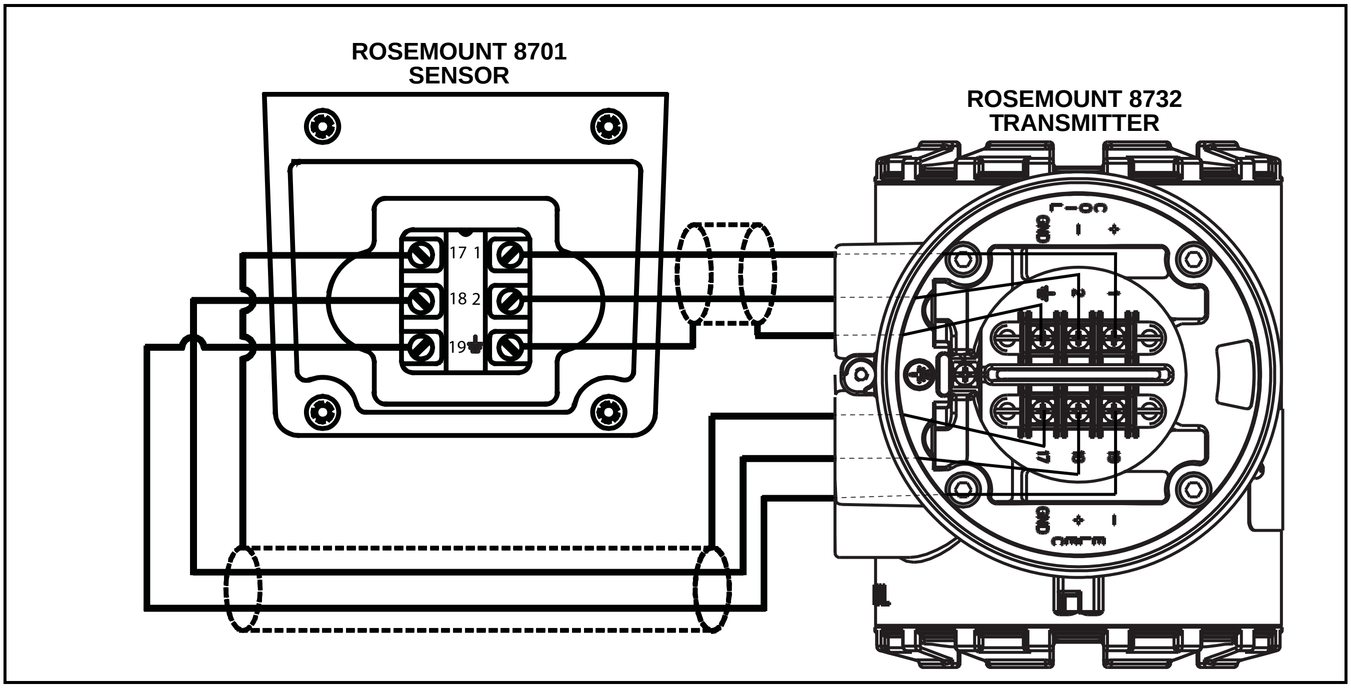
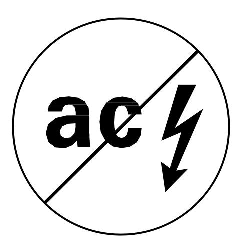


Table E-3. Rosemount 8701 Sensor Wiring Connections

Rosemount 8732	Rosemount 8701 Sensors
1	1
2	2
⏚	⏚
17	17
18	18
19	19

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



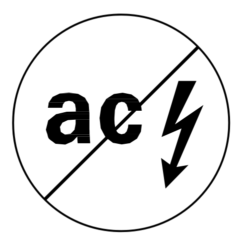
Connecting Sensors of Other Manufacturers

Before connecting another manufacturer's sensor to the Rosemount 8732 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 that 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 "Mount the Transmitter" on page 2-3.
6. Verify that 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 220V operation are typically wired in parallel and must be rewired in series.)
7. Verify that the sensor is in good working condition. Use the manufacturer's recommended test procedure for verification of sensor condition. Perform the basic checks:
   a. Check the coils for shorts or open circuits.
   b. Check the sensor liner for wear or damage.
   c. Check the electrodes for shorts, leaks, or damage.
8. Connect the sensor to the transmitter in accordance with reference wiring diagrams. See Appendix E: Universal Sensor Wiring Diagrams for specific drawings.
9. Connect and verify all connections between the sensor and the transmitter, then apply power to the transmitter.
10. Perform the Universal Auto Trim function.

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



BROOKS SENSORS

Connect coil drive and electrode cables as shown in Figure E-3.

Model 5000 Sensor to Rosemount 8732 Transmitter

Figure E-3. Wiring Diagram for Brooks Sensor Model 5000 and Rosemount 8732

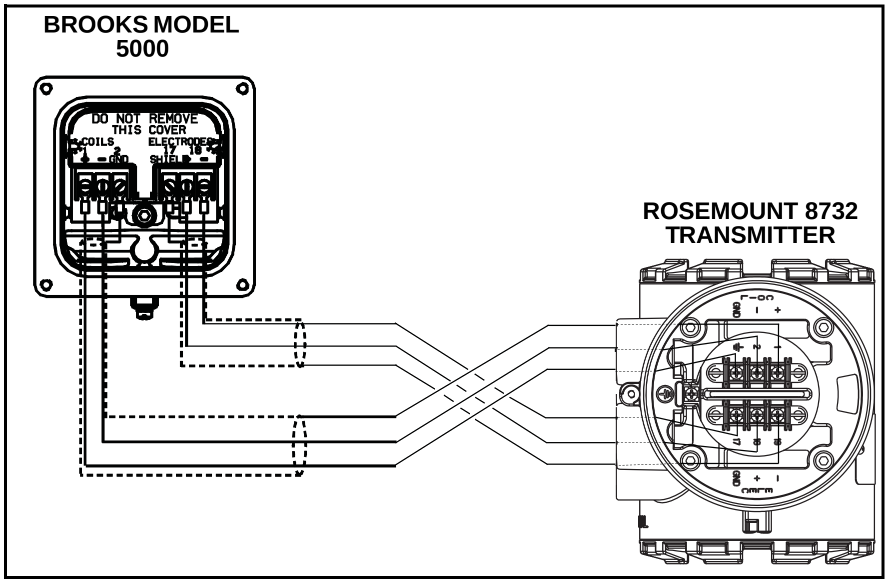
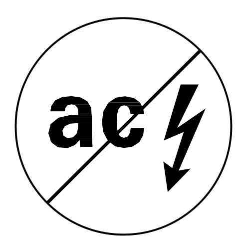


Table E-4. Brooks Model 5000 Sensor Wiring Connections

Rosemount 8732	Brooks Sensors Model 5000
1	1
2	2
⏚	⏚
17	17
18	18
19	19

⚠CAUTION	
This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.	

Model 7400 Sensor to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-4.

Figure E-4. Wiring Diagram for Brooks Sensor Model 7400 and Rosemount 8732

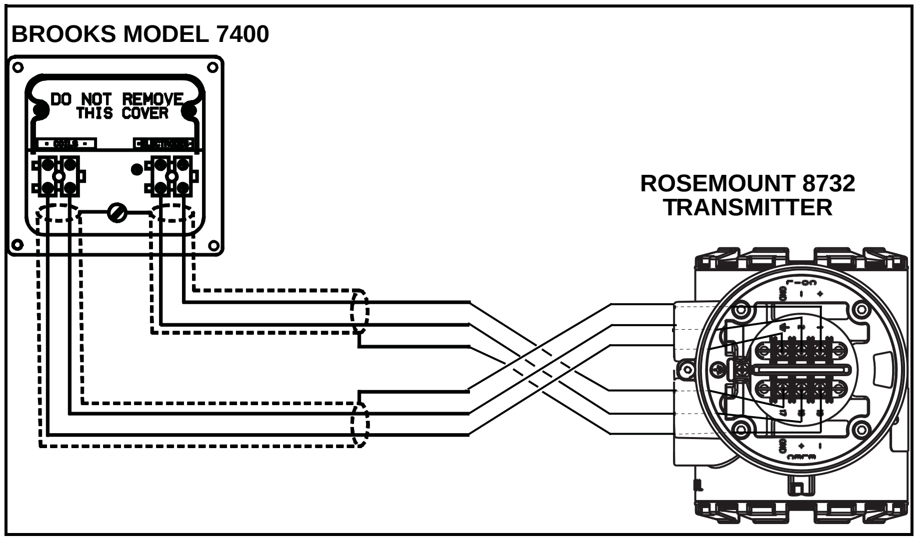
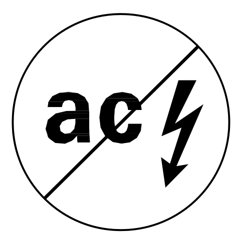


Table E-5. Brooks Model 7400 Sensor Wiring Connections

Rosemount 8732	Brooks Sensors Model 7400
1	Coils +
2	Coils –
⏚	⏚
17	Shield
18	Electrode +
19	Electrode –

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



ENDRESS AND HAUSER SENSORS

Endress and Hauser Sensor to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-5.

Figure E-5. Wiring Diagram for Endress and Hauser Sensors and Rosemount 8732

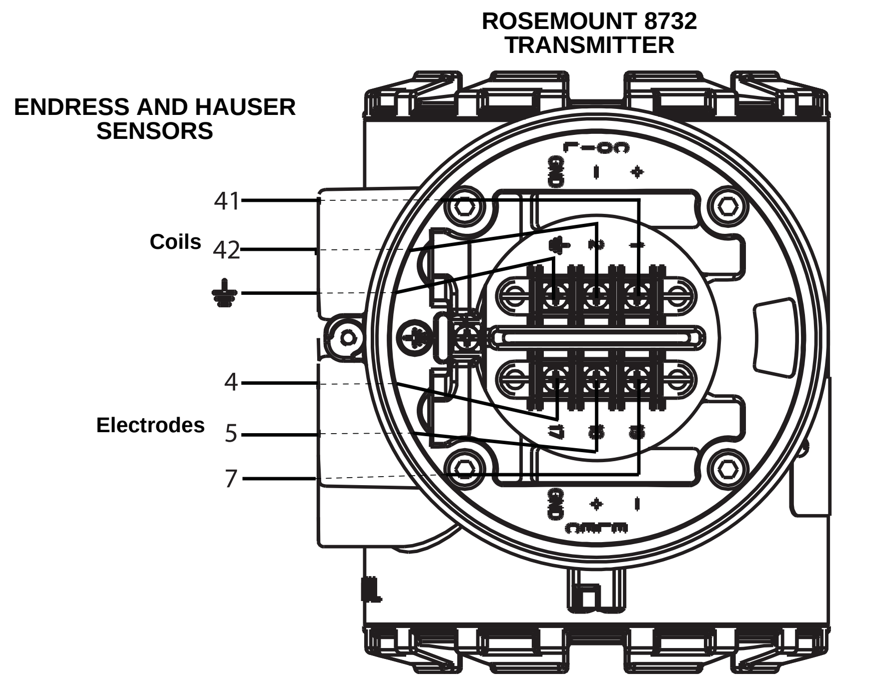
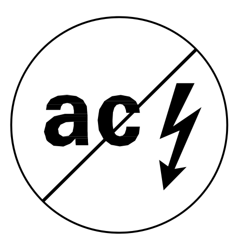


Table E-6. Endress and Hauser Sensor Wiring Connections

Rosemount 8732	Endress and Hauser Sensors
1	41
2	42
⏚	14
17	4
18	5
19	7

⚠CAUTION	
This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.	

FISCHER AND PORTER SENSORS

Connect coil drive and electrode cables as shown in Figure E-6.

Model 10D1418 Sensor to Rosemount 8732 Transmitter

Figure E-6. Wiring Diagram for Fischer and Porter Sensor Model 10D1418 and Rosemount 8732

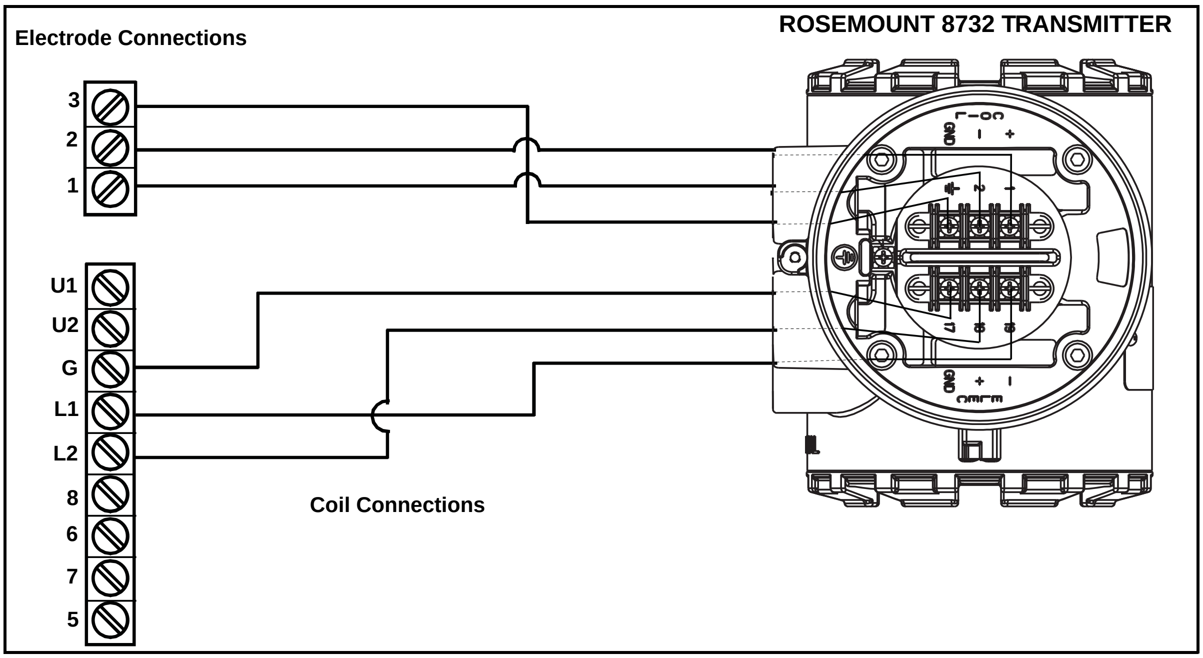
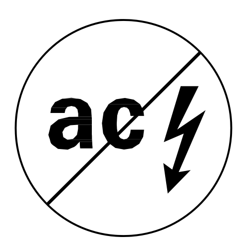


Table E-7. Fischer and Porter Model 10D1418 Sensor Wiring Connections

Rosemount 8732	Fischer and Porter Model 10D1418 Sensors
1	L1
2	L2
⏚	Chassis Ground
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Model 10D1419 Sensor to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-7.

Figure E-7. Wiring Diagram for Fischer and Porter Sensor Model 10D1419 and Rosemount 8732

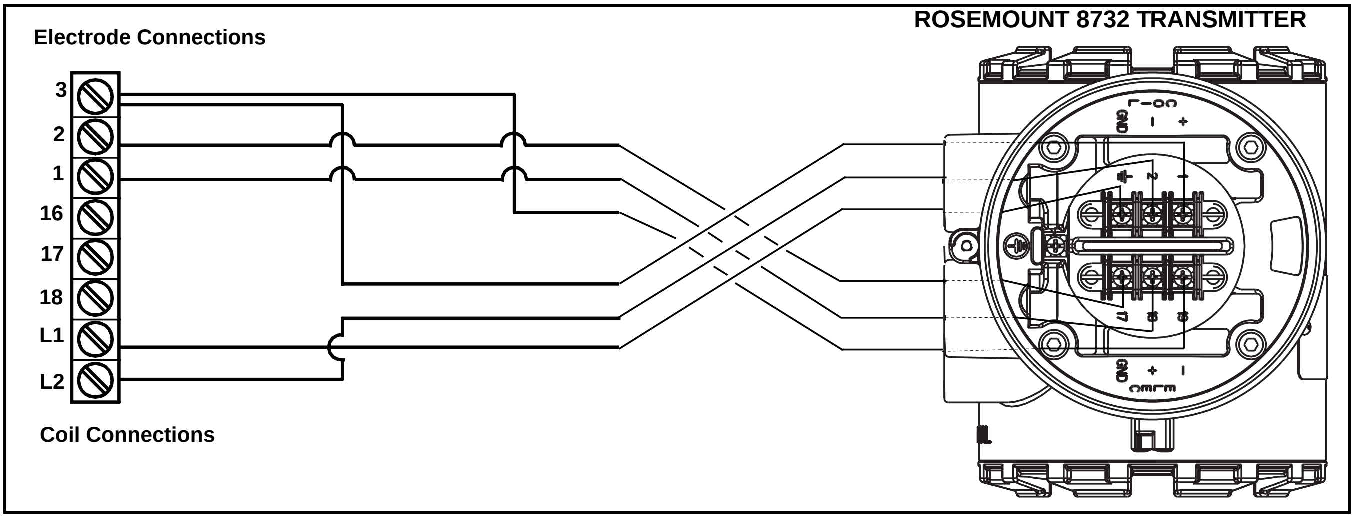
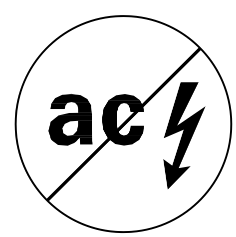


Table E-8. Fischer and Porter Model 10D1419 Sensor Wiring Connections

Rosemount 8732	Fischer and Porter Model 10D1419 Sensors
1	L1
2	L2
⏚	3
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Model 10D1430 Sensor (Remote) to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-8.

Figure E-8. Wiring Diagram for Fischer and Porter Sensor Model 10D1430 (Remote) and Rosemount 8732

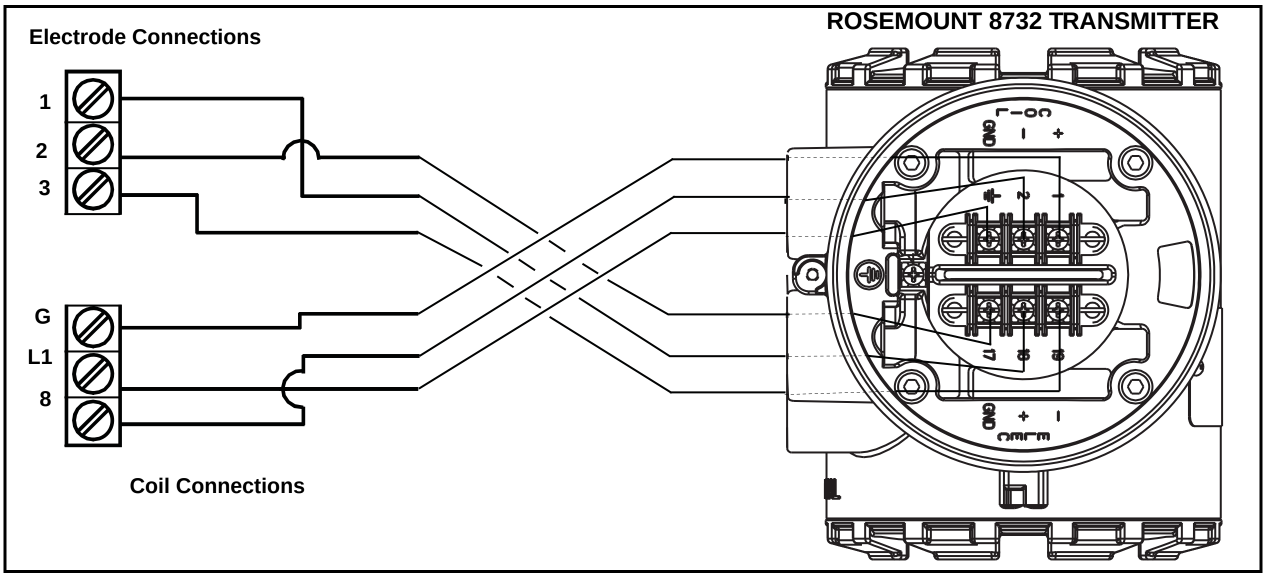
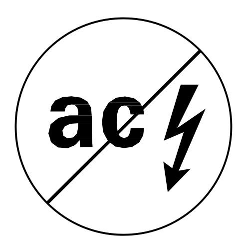


Table E-9. Fischer and Porter Model 10D1430 (Remote) Sensor Wiring Connections

Rosemount 8732	Fischer and Porter Model 10D1430 (Remote) Sensors
1	L1
2	8
⏚	G
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Model 10D1430 Sensor (Integral) to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-9.

Figure E-9. Wiring Diagram for Fischer and Porter Sensor Model 10D1430 (Integral) and Rosemount 8732

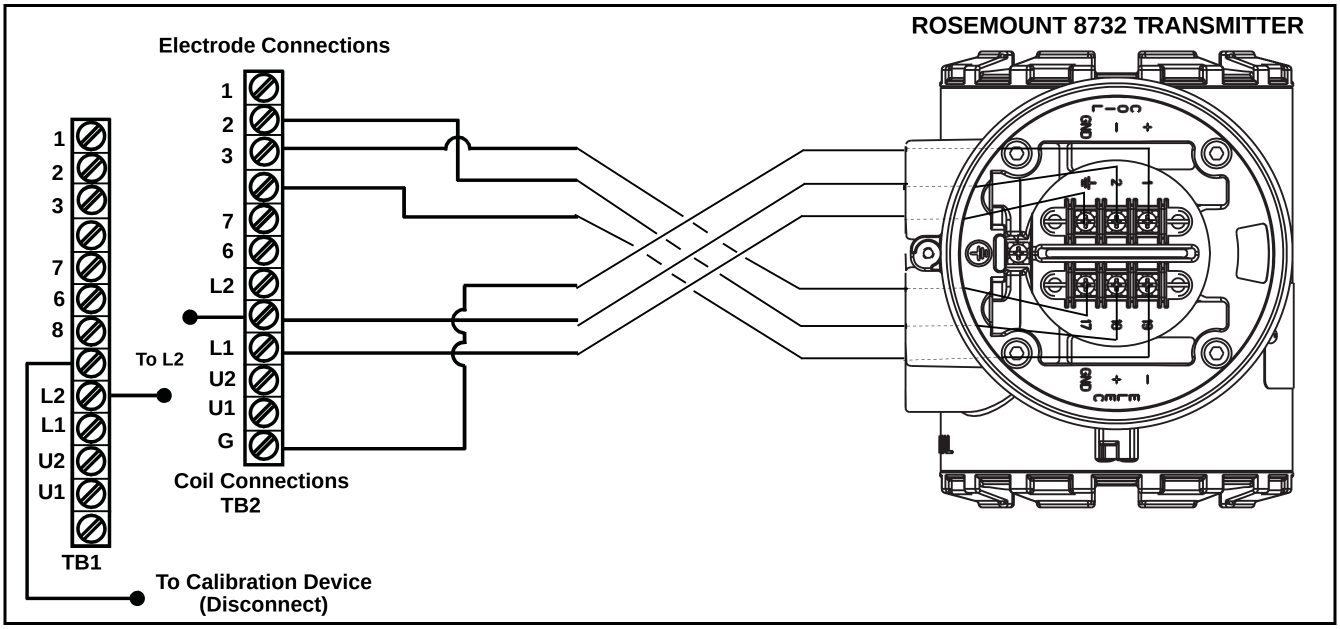
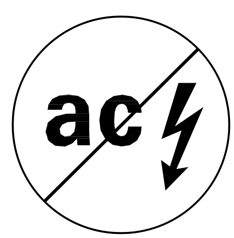


Table E-10. Fischer and Porter Model 10D1430 (Integral) Sensor Wiring Connections

Rosemount 8732	Fischer and Porter Model 10D1430 (Integral) Sensors
1	L1
2	L2
⏚	G
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Model 10D1465 and Model 10D1475 Sensors (Integral) to 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-10.

Figure E-10. Wiring Diagram for Fischer and Porter Sensor Model 10D1465 and Model 10D1475 (Integral) and Rosemount 8732

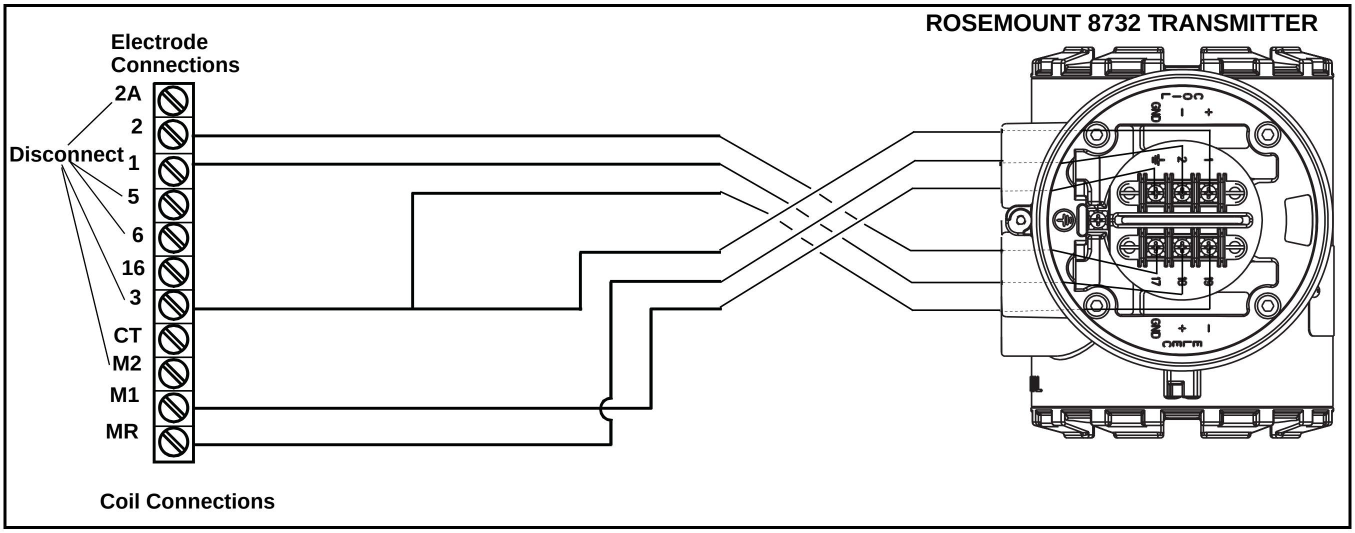
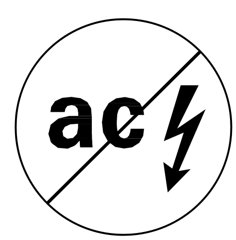


Table E-11. Fischer and Porter Model 10D1465 and 10D1475 Sensor Wiring Connections

Rosemount 8732	Fischer and Porter Model 10D1465 and 10D1475 Sensors
1	MR
2	M1
⏚	3
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Fischer and Porter Sensor to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-11.

Figure E-11. Generic Wiring Diagram for Fischer and Porter Sensors and Rosemount 8732

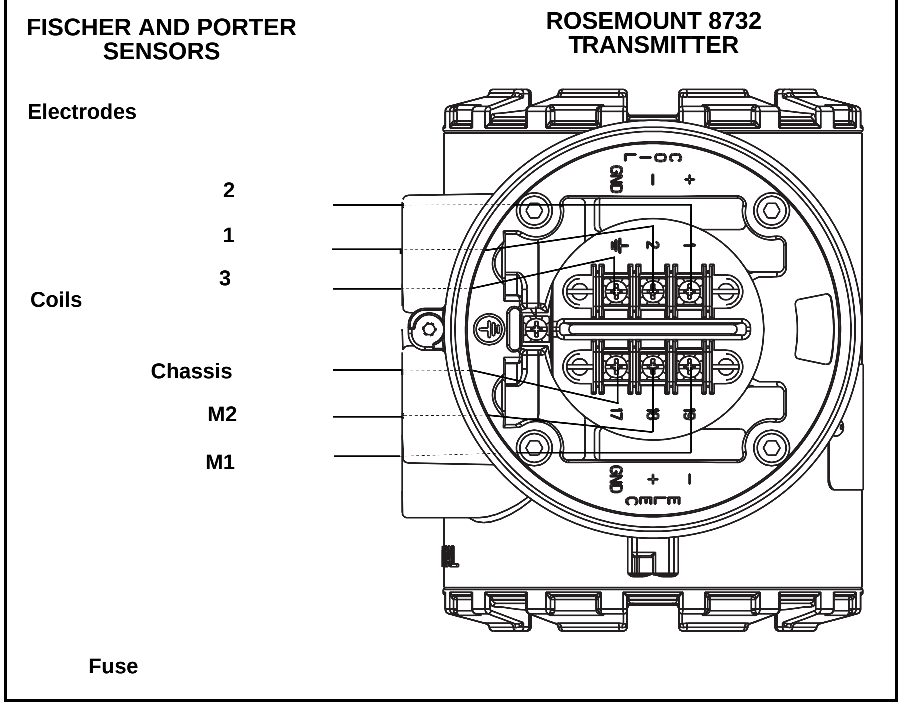
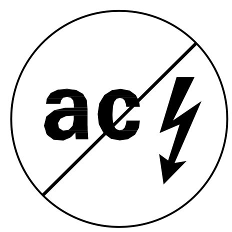


Table E-12. Fischer and Porter Generic Sensor Wiring Connections

Rosemount 8732	Fischer and Porter Sensors
1	M1
2	M2
⏚	Chassis Ground
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



FOXBORO SENSORS

Connect coil drive and electrode cables as shown in Figure E-12.

Series 1800 Sensor to Rosemount 8732 Transmitter

Figure E-12. Wiring Diagram for Foxboro Series 1800 and Rosemount 8732

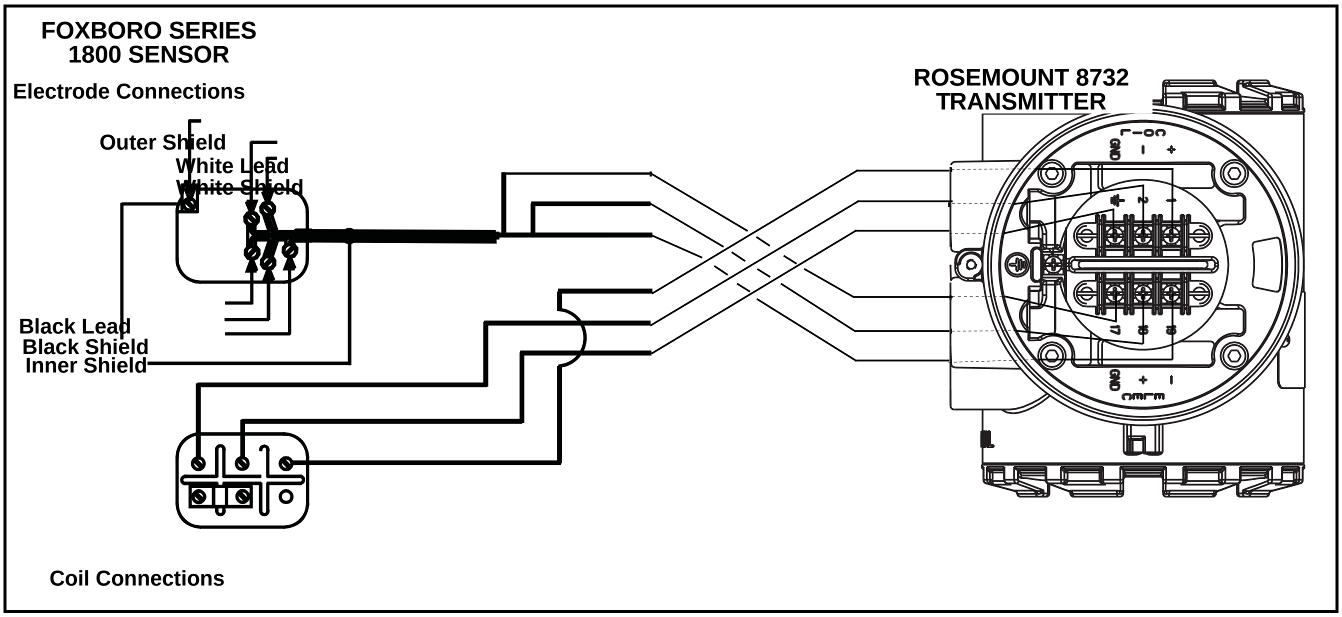
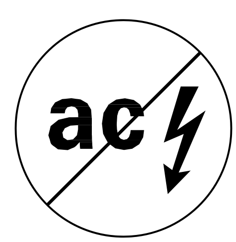


Table E-13. Foxboro Generic Sensor Wiring Connections

Rosemount 8732	Foxboro Series 1800 Sensors
1	L1
2	L2
⏚	Chassis Ground
17	Any Shield
18	Black
19	White

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Series 1800 (Version 2) Sensor to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-13.

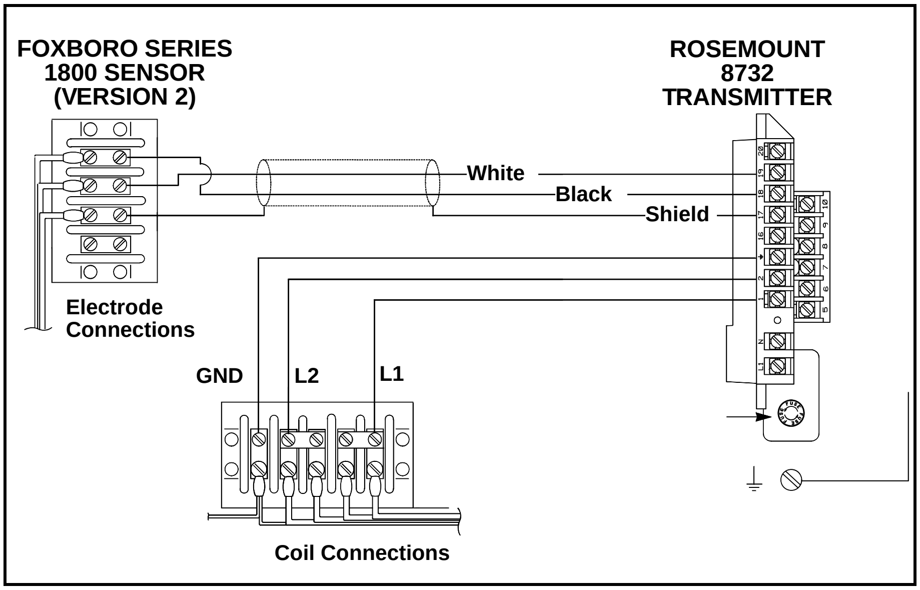


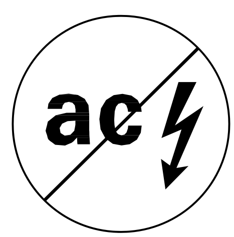
Figure E-13. Wiring Diagram for Foxboro Series 1800 (Version 2) and Rosemount 8732

Table E-14. Foxboro Generic Sensor Wiring Connections

Rosemount 8732	Foxboro Series 1800 Sensors
1	L1
2	L2
⏚	Chassis Ground
17	Any Shield
18	Black
19	White

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Series 2800 Sensor to 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-14.

Figure E-14. Wiring Diagram for Foxboro Series 2800 and Rosemount 8732

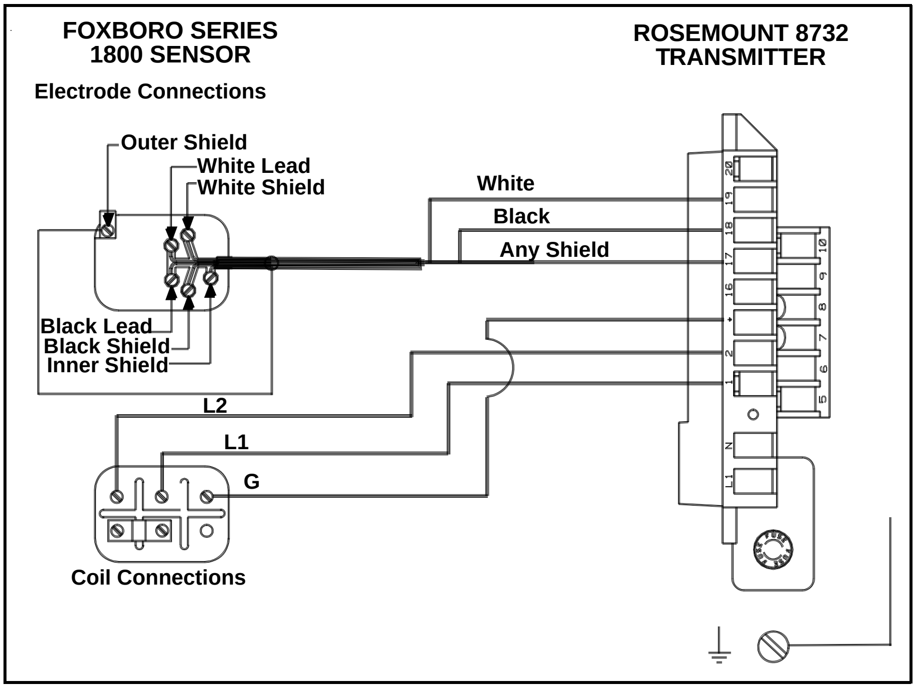
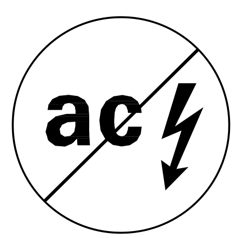


Table E-15. Foxboro Series 2800 Sensor Wiring Connections

Rosemount 8732	Foxboro Series 2800 Sensors
1	L1
2	L2
⏚	Chassis Ground
17	Any Shield
18	Black
19	White

⚠CAUTION	
This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.	

Foxboro Sensor to 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-15.

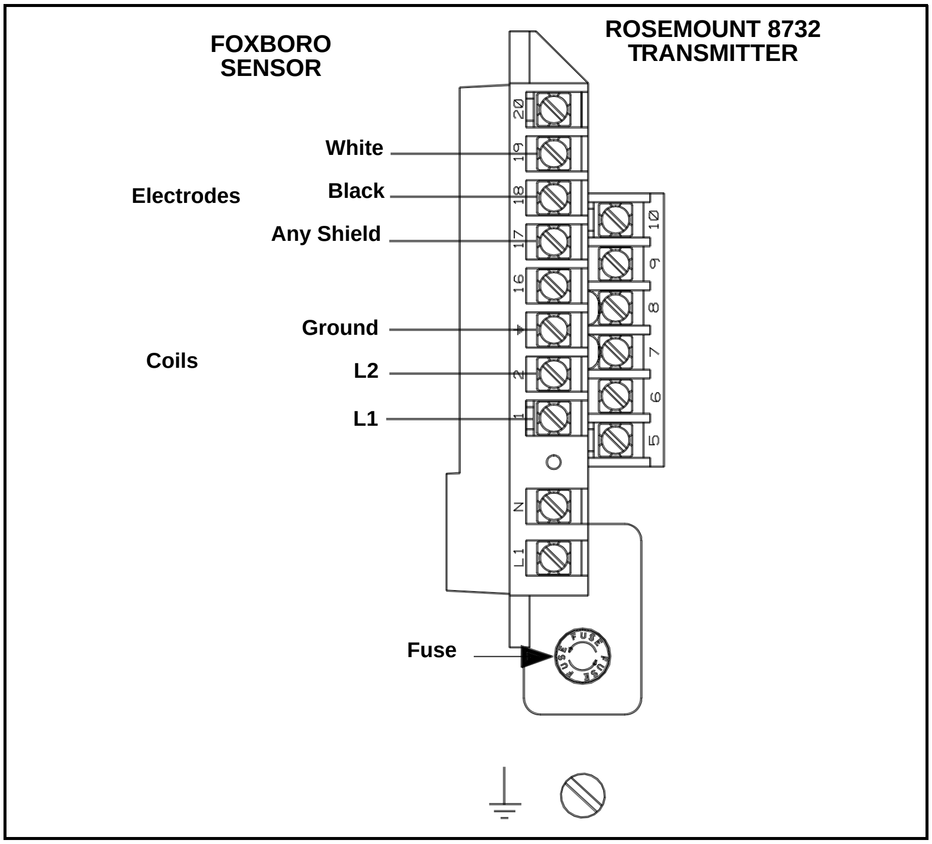


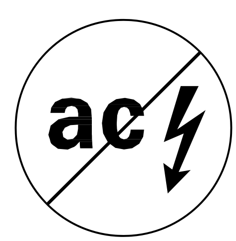
Figure E-15. Generic Wiring Diagram for Foxboro Sensors and Rosemount 8732

Table E-16. Foxboro Sensor Wiring Connections

Rosemount 8732	Foxboro Sensors
1	L1
2	L2
⏚	Chassis Ground
17	Any Shield
18	Black
19	White

⚠**CAUTION**

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



KENT VERIFLUX VTC SENSOR

Connect coil drive and electrode cables as shown in Figure E-16.

Veriflux VTC Sensor to 8732 Transmitter

Figure E-16. Wiring Diagram for Kent Veriflux VTC Sensor and Rosemount 8732

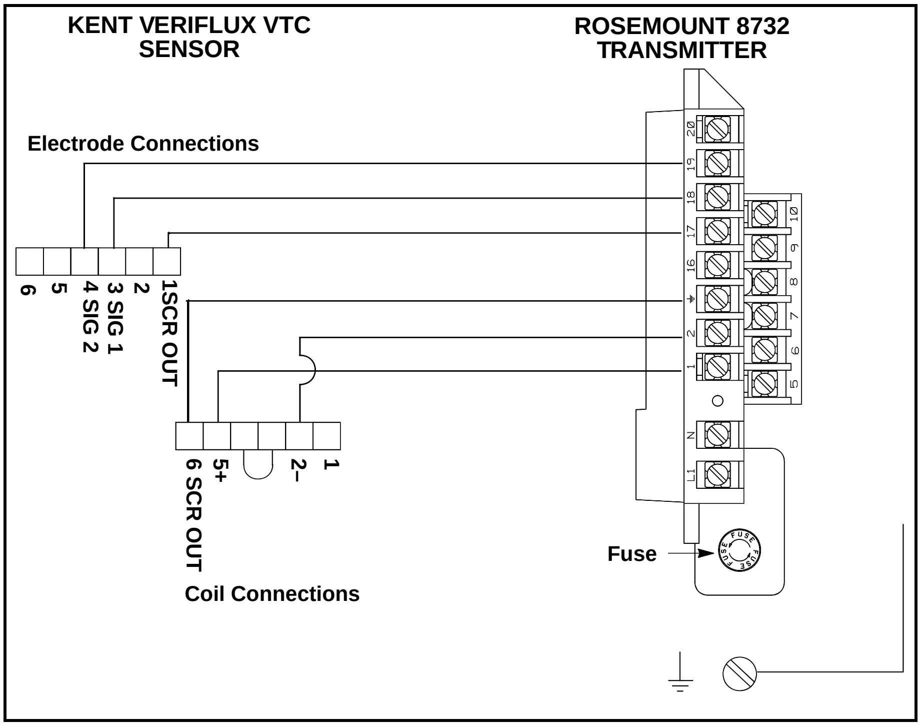
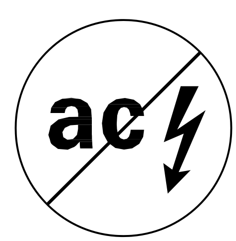


Table E-17. Kent Veriflux VTC Sensor Wiring Connections

Rosemount 8732	Kent Veriflux VTC Sensors
1	2
2	1
⏚	SCR OUT
17	SCR OUT
18	SIG1
19	SIG2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



KENT SENSORS

Kent Sensor to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-17.

Figure E-17. Generic Wiring Diagram for Kent Sensors and Rosemount 8732

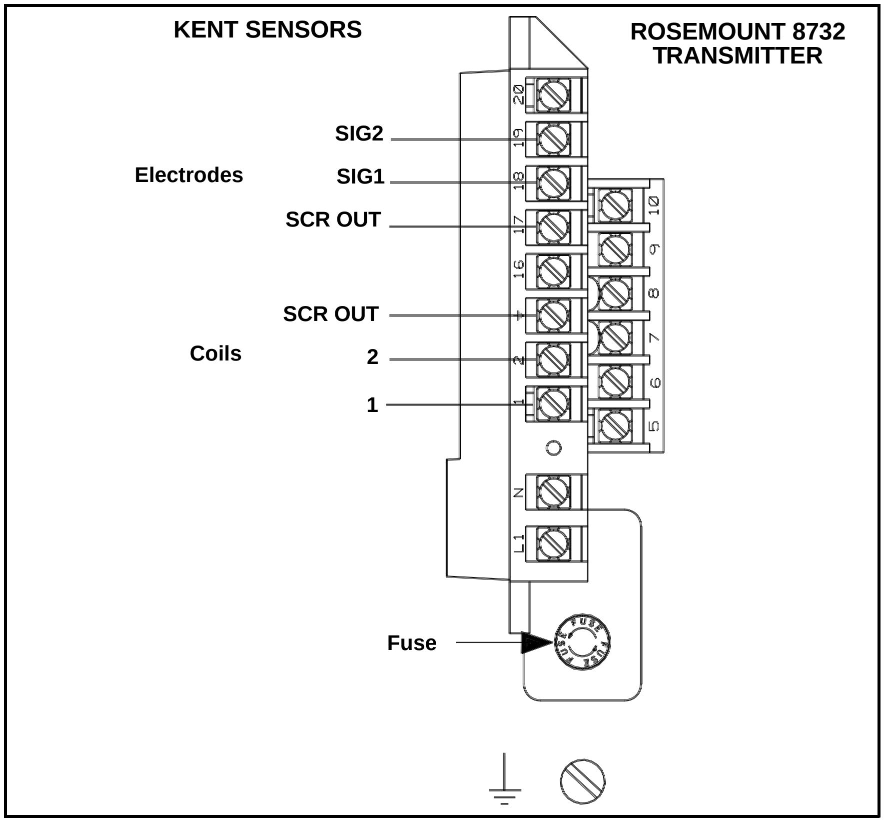
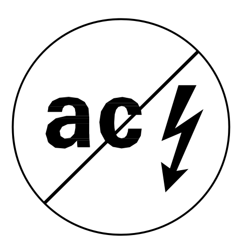


Table E-18. Kent Sensor Wiring Connections

Rosemount 8732	Kent Sensors
1	1
2	2
⏚	SCR OUT
17	SCR OUT
18	SIG1
19	SIG2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



KROHNE SENSORS

Connect coil drive and electrode cables as shown in Figure E-18.

Krohne Sensor to Rosemount 8732 Transmitter

Figure E-18. Generic Wiring Diagram for Krohne Sensors and Rosemount 8732

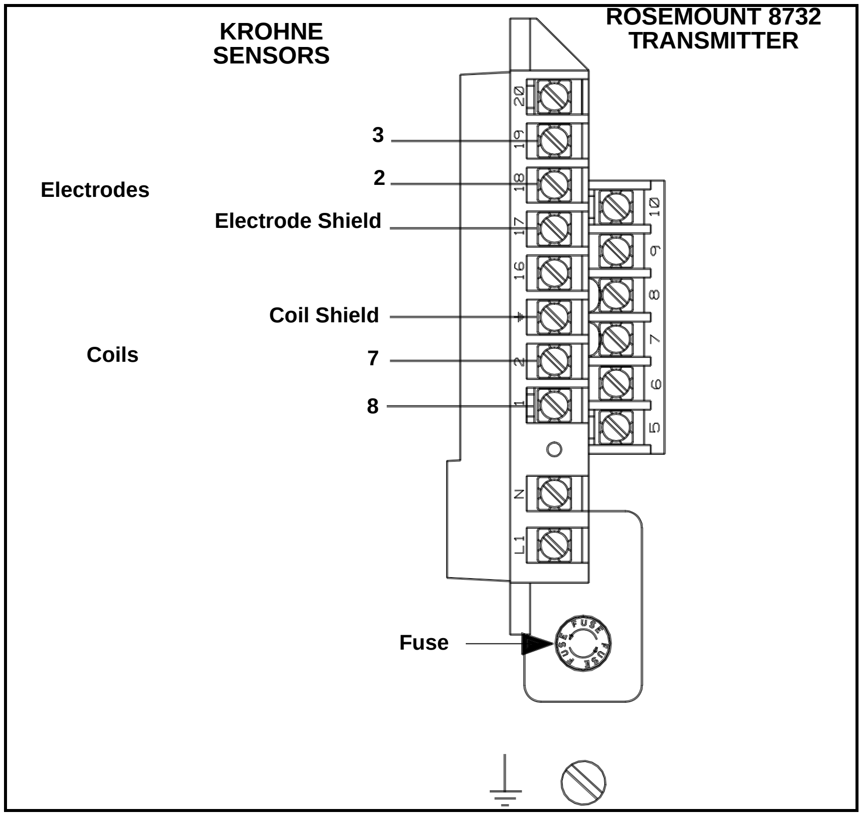
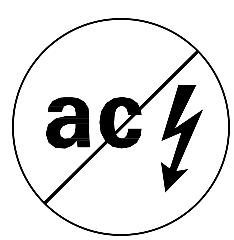


Table E-19. Krohne Sensor Wiring Connections

Rosemount 8732	Krohne Sensors
1	8
2	7
⏚	Coil Shield
17	Electrode Shield
18	2
19	3

⚠CAUTION	
This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.	

TAYLOR SENSORS

Series 1100 Sensor to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-19.

Figure E-19. Wiring Diagram for Taylor Series 1100 Sensors and Rosemount 8732

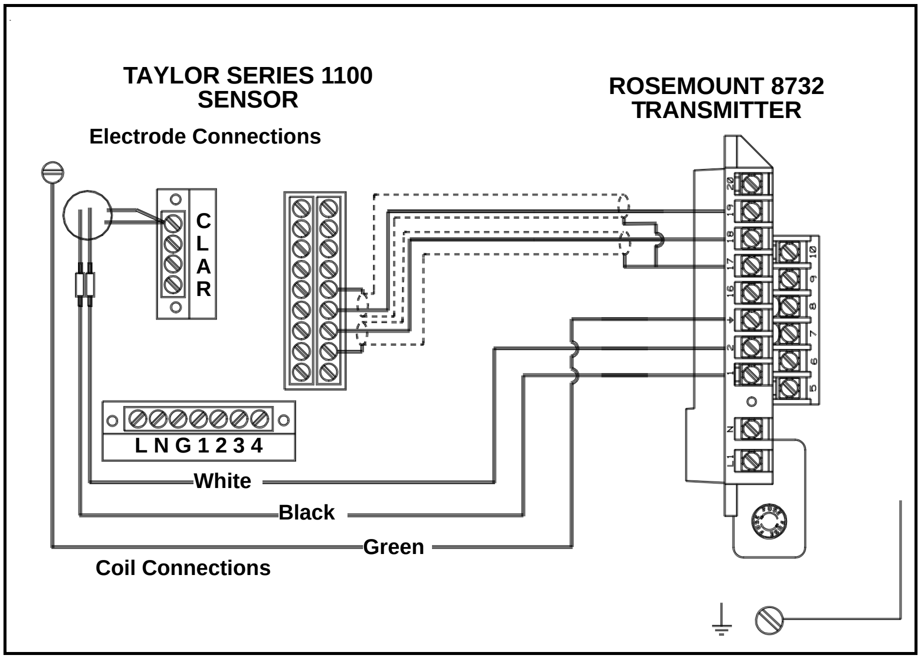
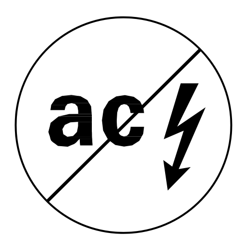


Table E-20. Taylor Series 1100 Sensor Wiring Connections

Rosemount 8732	Taylor Series 1100 Sensors
1	Black
2	White
⏚	Green
17	S1 and S2
18	E1
19	E2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Taylor Sensor to Rosemount 8732 Transmitter

Connect coil drive and electrode cables as shown in Figure E-20.

Figure E-20. Generic Wiring Diagram for Taylor Sensors and Rosemount 8732

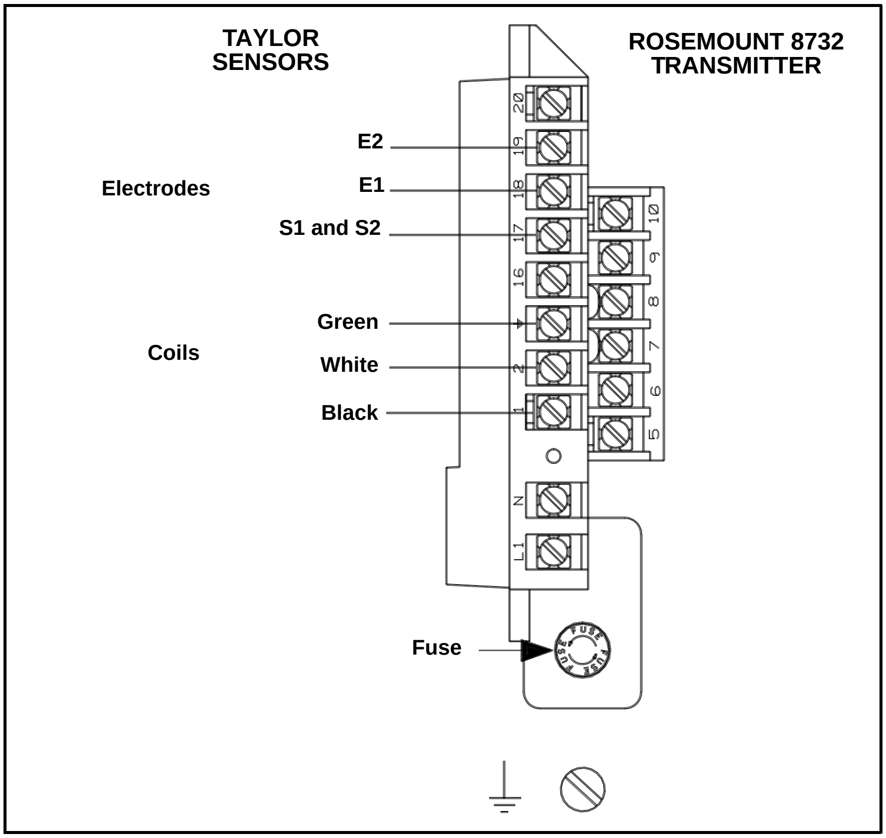
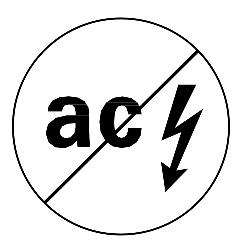


Table E-21. Taylor Sensor Wiring Connections

Rosemount 8732	Taylor Sensors
1	Black
2	White
⏚	Green
17	S1 and S2
18	E1
19	E2

⚠CAUTION

This is a pulsed DCDC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



YAMATAKE HONEYWELL SENSORS

Connect coil drive and electrode cables as shown in Figure E-21.

Yamatake Honeywell Sensor to Rosemount 8732 Transmitter

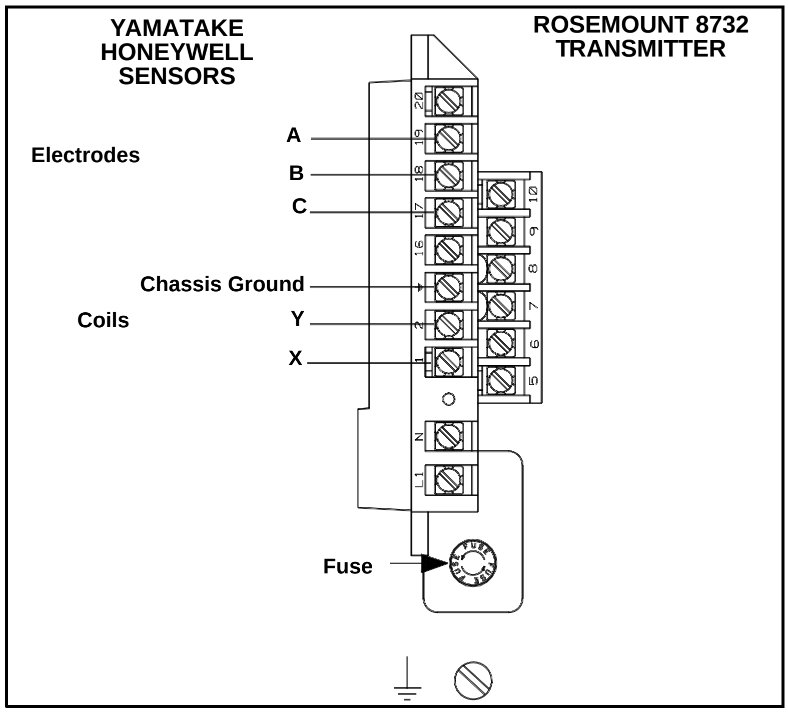


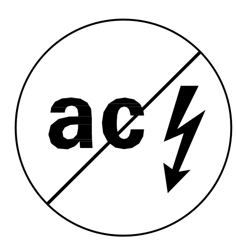
Figure E-21. Generic Wiring Diagram for Yamatake Honeywell Sensors and Rosemount 8732

Table E-22. Yamatake Honeywell Sensor Wiring Connections

Rosemount 8732	Yamatake Honeywell Sensors
1	X
2	Y
⏚	Chassis Ground
17	C
18	B
19	A

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



YOKOGAWA SENSORS

Connect coil drive and electrode cables as shown in Figure E-22.

Yokogawa Sensor to Rosemount 8732 Transmitter

Figure E-22. Generic Wiring Diagram for Yokogawa Sensors and Rosemount 8732

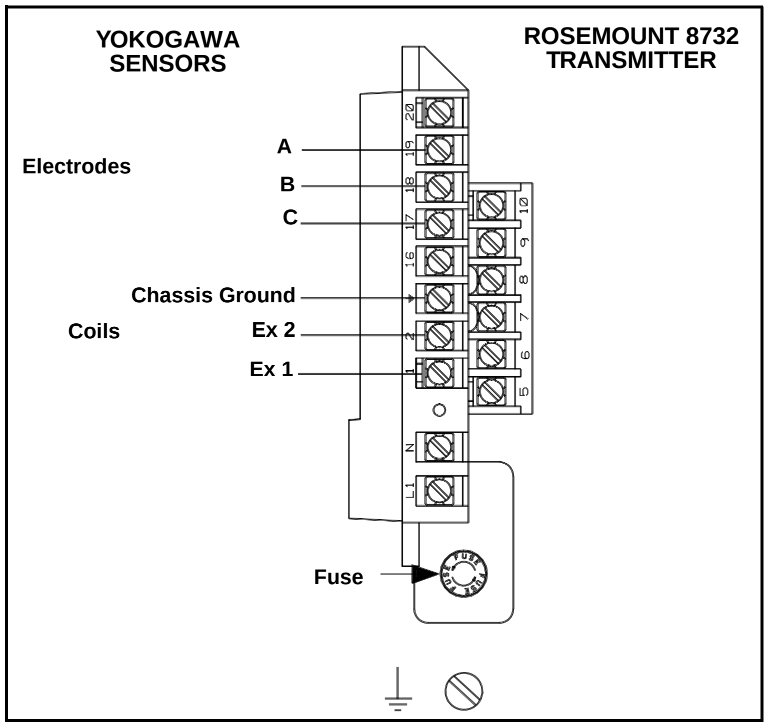
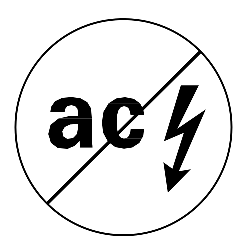


Table E-23. Yokogawa Sensor Wiring Connections

Rosemount 8732	Yokogawa Sensors
1	EX1
2	EX2
⏚	Chassis Ground
17	C
18	B
19	A

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



GENERIC MANUFACTURER SENSORS

Generic Manufacturer Sensor to Rosemount 8732 Transmitter

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.

Wiring Connections

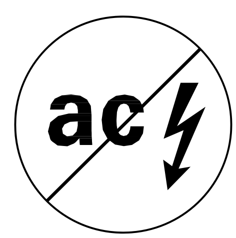
Connect the electrode terminals to Rosemount 8732 terminals 18 and 19. The electrode shield should be connected to terminal 17.

Connect the coil terminals to Rosemount 8732 terminals 1, 2, and ⏚.

If the Rosemount 8732 Transmitter indicates a reverse flow condition, switch the coil wires connected to terminals 1 and 2.

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Appendix F Resource Block

This section contains information on the resource block for the Rosemount 8732 Magnetic Flowmeter Transmitter. Descriptions of all resource block parameters, errors, and diagnostics are included. Also, the modes, alarm detection, status handling, virtual communication relationships (VCRs), and troubleshooting are discussed.

Definition

The resource block defines the physical resources of the device, such as measurement and memory. The resource block also handles functionality, such as shed times, that is common across multiple blocks. The block has no linkable inputs or outputs, and it performs memory-level diagnostics.

PARAMETERS AND DESCRIPTIONS

Table F-1 lists all of the configurable parameters of the resource block, including the descriptions and index numbers for each parameter. Newer software revisions have added functionality and some index numbers have changed. To determine the software revision of a transmitter, check the parameter SOFTWARE_REVISION_MAJOR. The most recent transmitters have a label on the electronic board stack.

Table F-1. Resource Block Parameters

Parameter	Index Number Rev 5	Description
ACK_OPTION	38	ACK_OPTION is a selection of whether alarms associated with the function block will be automatically acknowledged.
ADVISE_ACTIVE	82	Active advisory alarms.
ADVISE_ALM	83	Alarm indicating advisory alarms. These conditions do not have a direct impact on the process or device integrity.
ADVISE_ENABLE	80	Enables or disables the advisory conditions within a device.
ADVISE_MASK	81	Mask of advisory Alarm. Corresponds bit for bit to the Advisory Active. A bit on means that the failure is masked out from alarming.
ADVISE_PRI	79	Designates the alarming priority of the advisory alarm.
ALARM_SUM	37	This parameter shows the current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block. In the Rosemount 8732 Magnetic Flowmeter Transmitter, the two resource block alarms are *write alarm* and *block alarm*.
ALERT_KEY	04	ALERT_KEY shows the identification number of the plant unit. This information may be used in the host for sorting alarms, etc.

Parameter	Index Number Rev 5	Description
BLOCK_ALM	36	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the active status in the status parameter. As soon as the unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the active status, if the subcode has changed.
BLOCK_ERR	06	This parameter reflects the error status of the hardware or software components associated with a block. It is a bit string, so multiple errors may be shown.
CLR_FSAFE	30	Writing a Clear to this parameter will clear the device FAULT_ STATE if the field condition has cleared.
CONFIRM_TIME	33	This parameter represents the minimum time between retries of alert reports.
CYCLE_SEL	20	This parameter is used to select the block execution method for this resource. The Rosemount 8732 supports the following executions: Scheduled: Blocks are only executed based on the schedule in FB_START_LIST. Block Execution: A block may be executed by linking to another block's completion.
CYCLE_TYPE	19	This parameter identifies the block execution methods available for this resource.
DD_RESOURCE	09	This string identifies the tag of the resource that contains the device description for this resource.
DD_REV	13	DD_REV is a revision of the DD associated with the resource—used by an interface device to locate the DD file for the resource.
DEFINE_WRITE_LOCK	60	This parameter is an enumerated value describing the implementation of the WRITE_LOCK.
DETAILED_STATUS	55	DETAILED_STATUS is an additional status bit string.
DEV_REV	12	This parameter represents the manufacturer revision number associated with the resource—used by an interface device to locate the DD file for the resource.
DEV_STRING	43	Used to load new licensing into the device. The value can be written but will always read back with a value of 0.
DEV_TYPE	11	This parameter represents the manufacturer's model number associated with the resource—used by interface devices to locate the DD file for the resource (Rosemount 8732).
DIAG_OPTION	46	Indicates which diagnostics licensing options are enabled.
DISTRIBUTOR	42	References the company that is responsible for the distribution of this device.
DOWNLOAD_MODE	67	DOWNLOAD_MODE gives access to the boot block code for over-the-wire downloads.
FAILED_ACTIVE	72	Active fail alarms.
FAILED_ALM	73	Alarm indicating a failure within a device which makes the device non-operational.
FAILED_ENABLE	70	Enables or disables the failure conditions within a device.
FAILED_MASK	71	Mask of Failure Alarm. Corresponds bit of bit to the Fail Active. A bit on means that the failure is masked out from alarming.
FAILED_PRI	69	Designates the alarming priority of the fail alarm.
FAULT_STATE	28	Condition set by loss of communication to an output block, fault promoted to an output block or physical contact. When FAULT_ STATE condition is set, then output function blocks will perform their FAULT_ STATE actions.
FB_OPTION	45	Indicates which function block licensing options are enabled.
FEATURES	17	This parameter is used to show supported resource block options.
FEATURE_SEL	18	Used to show selected resource block options. The Rosemount 8732 Magnetic Flowmeter Transmitter supports the following options: Unicode: Tells the host to use unicode for string values Reports: Enables alarms; must be set for alarming to work Software Lock: Software write locking enabled but not active; WRITE_LOCK must be set to activate Hardware Lock: Hardware write locking enabled but not active; WRITE_LOCK follows the status of the security switch
FINAL_ASSY_NUM	54	FINAL_ASSEMBLY_NUMBER is used for identification purposes and is associated with the overall field device.

Parameter	Index Number Rev 5	Description
FREE_SPACE	24	This parameter represents the percent of memory available for further configuration (zero in a preconfigured device).
FREE_TIME	25	This parameter represents the percent of the block processing time that is free to process additional blocks.
GRANT_DENY	14	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block (not used by the device).
HARD_TYPES	15	HARD_TYPES shows the types of hardware available as channel numbers. For the Rosemount 8732, this parameter is limited to scalar (i.e., analog) inputs.
HARDWARE_REV	52	This parameter represents the hardware revision of the hardware that has the resource block in it.
HEALTH_INDEX	84	Parameter representing the overall health of the device, 100 being perfect and 1 being non-functioning. The value is based on the active PWA alarms.
ITK_VER	41	FOUNDATION fieldbus Interoperability Test Kit Version
LIM_NOTIFY	32	Maximum number of unconfirmed alert notify messages allowed.
MAINT_ACTIVE	77	Active maintenance alarms.
MAINT_ALM	78	Alarm indicating the device needs maintenance soon. If the condition is ignored, the device will eventually fail.
MAINT_PRI	74	Designates the alarming priority of the maintenance alarm.
MAINT_ENABLE	75	Enables or disables the maintenance conditions within a device.
MAINT_MASK	76	Mask of Maintenance Alarm. Corresponds bit for bit to the Maintenance Active. A bit on means that the failure is masked out from alarming.
MANUFAC_ID	10	Manufacturer identification number—used by an interface device to locate the DD file for the resource (001151 for Rosemount).
MAX_NOTIFY	31	Maximum number of unconfirmed alert notify messages possible.
MEMORY_SIZE	22	Available configuration memory in the empty resource. To be checked before attempting a download.
MESSAGE_DATE	57	MESSAGE_DATE is the date associated with the MESSAGE_TEXT parameter.
MESSAGE_TEXT	58	MESSAGE_TEXT is used to indicate changes made by the user to the device's installation, configuration, or calibration.
MIN_CYCLE_T	21	Time duration of the shortest cycle interval of which the resource is capable.
MISC_OPTION	47	Indicates which miscellaneous licensing options are enabled.
MODE_BLK	05	The actual, target, permitted, and normal modes of the block: Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that the target mode may take on Normal: Most common mode for the actual mode
NV_CYCLE_T	23	NV_CYCLE_T is the interval between which copies of nonvolatile (NV) parameters are written to NV memory. Zero denotes that NV parameters are never written to NV memory.
OUTPUT_BOARD_SN	53	This parameter represents the output board serial number.
PWA_SIMULATE	85	Parameter allows simulation of PWA alarms.
RB_SFTWR_REV_ALL	51	Software revision string containing the following fields: major revision, minor revision, build, time of build, day of week of build, month of build, day of month of build, year of build, initials of builder.
RB_SFTWR_REV_BUILD	50	This parameter shows the build of software that the resource block was created with.
RB_SFTWR_REV_MAJOR	48	This parameter shows the major revision of the software that the resource block was created with.
RB_SFTWR_REV_MINOR	49	This parameter shows the minor revision of the software that the resource block was created with.
RECOMMENDED_ACTION	68	Enumerated list of recommended actions displayed with an alert.

Parameter	Index Number Rev 5	Description
RESTART	16	Allows a manual restart to be initiated. Several degrees of restart are possible: 1 Run: Nominal state when not restarting 2 Restart resource: Not used 3 Restart with defaults: Set parameters to default values (see START_WITH_DEFAULTS below for which parameters are set). 4 Restart processor: Does a warm start of the central processing unit (CPU).
RS_STATE	07	RS_STATE denotes the state of the function block application state machine.
SAVE_CONFIG_NOW	61	This parameter controls saving of configuration in EEPROM.
SAVE_CONFIG_BLOCKS	62	Number of EEPROM blocks that have been modified since the last burn. This value will count down to zero when the configuration is saved.
SECURITY_IO	65	SECURITY_JUMPER denotes the status of security jumper/switch.
SELF_TEST	59	SELF_TEST instructs the resource block to perform a self-test.
SET_FSAFE	29	Allows the FAULT_ STATE condition to be manually initiated by selecting Set.
SHED_RCAS	26	This parameter represents the time duration at which to give up on computer writes to function block RCas locations.
SHED_ROUT	27	This parameter represents the time duration at which to give up on computer writes to function block ROut locations.
SIMULATE_IO	64	SIMULATE_JUMPER shows the status of the simulate jumper/switch.
SIMULATE_STATE	66	SIMULATE_STATE represents the state of the simulate function.
ST_REV	01	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
START_WITH_DEFAULTS	63	START_WITH_DEFAULTS controls what defaults are used at power-up.
STRATEGY	03	The strategy field can be used to identify grouping of blocks. These data are not checked or processed by the block.
SUMMARY_STATUS	56	This parameter represents an enumerated value of repair analysis.
TAG_DESC	02	The user description of the intended application of the block.
TEST_RW	08	A parameter for a host to use to test reading and writing. Not used by the device at all.
UPDATE_EVT	35	This alert is generated by any change to the static data.
WRITE_ALM	40	This alert is generated if the write lock parameter is cleared.
WRITE_LOCK	34	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated.
WRITE_PRI	39	WRITE_PRI represents the priority of the alarm generated by clearing the write lock.
XD_OPTION	44	Indicates which transducer block licensing block options are enabled.

RESOURCE BLOCK ERRORS

Table F-2 lists conditions reported in the BLOCK_ERR parameter. Conditions in *italics* are inactive for the resource block and are given here only for your reference.

Table F-2. Resource BLOCK_ERR Conditions

Condition Number	Condition Name and Description
1	**Block Configuration Error**: A feature in FEATURES_SEL is set that is not supported by FEATURES or an execution cycle in CYCLE_SEL is set that is not supported by CYCLE_TYPE.
2	**Link Configuration Error**: A link used in one of the function blocks is improperly configured.
3	**Simulate Active**: The simulation jumper is in place. Simulate active is not an indication that the I/O blocks are using simulated data.
4	*Local Override*
5	*Device Fault State Set*
6	*Device Needs Maintenance Soon*
7	*Input failure/process variable has bad status*
8	*Output Failure: The output is bad based primarily upon a bad input.*
9	**Memory Failure**: A memory failure has occurred in FLASH, RAM, or EEPROM memory.
10	**Lost Static Data**: Static data that are stored in nonvolatile memory have been lost.
11	**Lost NV Data**: Nonvolatile data that are stored in nonvolatile memory have been lost.
12	*Readback Check Failed*
13	Device Needs Maintenance Now
14	**Power Up**: The device was just powered-up.
15	**Out of Service**: The actual mode is out of service.

MODES

The resource block supports two modes of operation as defined by the MODE_BLK parameter:

- **Automatic (Auto)**—The block is processing its normal background memory checks.
- **Out of Service (O/S)**—The block is not processing its tasks. When the resource block is in O/S, all blocks within the resource (device) are forced into O/S. The BLOCK_ERR parameter shows **OUT OF SERVICE**. In this mode, you can make changes to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the resource block are defined in Table F-2.

A write alarm is generated whenever the WRITE_LOCK parameter is cleared. The priority of the write alarm is set in the following parameter:

- WRITE_PRI

Alarms are grouped into five levels of priority, as shown in Table F-3.

Table F-3. Alarm Priorities

Priority Number	Priority Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3–7	Alarm conditions of priority 3–7 are advisory alarms of increasing priority.
8–15	Alarm conditions of priority 8–15 are critical alarms of increasing priority.

Status Handling

There are no status parameters associated with the resource block.

VCR

The number of configurable virtual communication relationships or VCRs is 18. The parameter is not contained or viewable within the resource block, but it does apply to all blocks.

TROUBLESHOOTING

Refer to Table F-4 to troubleshoot resource block problems.

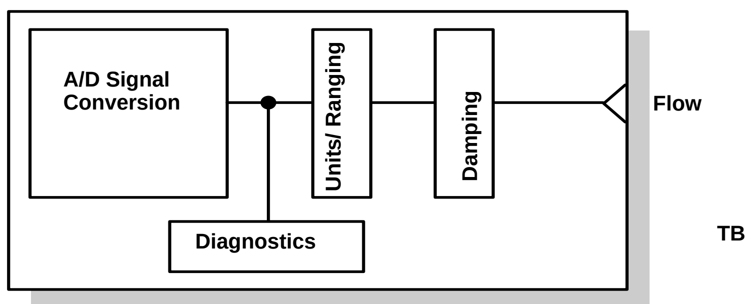
Table F-4. Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS.	Target mode not set	Set target mode to something other than OOS.
	Memory failure	BLOCK_ERR will show the lost NV Data or Lost Static Data bit set. Restart the device by setting RESTART to Processor. If the block error does not clear, call the factory.
Block alarms will not work.	Features	FEATURES_SEL does not have Alerts enabled. Enable the Alerts bit.
	Notification	LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.
	Status options	STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.

Appendix G Transducer Block

This appendix contains information on the transducer block for the Rosemount 8732 Magnetic Flowmeter Transmitter (see Figure G-1). Descriptions of all transducer block parameters, errors, and diagnostics are listed. Also, the modes, alarm detection, status handling, application information, and troubleshooting are discussed.

Figure G-1. Transducer Block Diagram



Definition

The transducer block contains the actual flow measurement data. This data includes information about sensor type, engineering units, digital filter settings, damping, and diagnostics. Only a single channel is defined in the Rosemount 8732. Channel 1 provides flow measurements to the analog input (AI) block.

PARAMETERS AND DESCRIPTIONS

Table G-1 lists all of the configurable parameters of the transducer block, indicating the descriptions and index numbers for each parameters.

Table G-1. Transducer Block Parameters

Parameter	Index Number	Definition
ALERT_KEY	4	ID number of the transmitter–may be used on the host for sorting alarms
BLOCK_ALM	8	Block alarm
COIL_DRIVE_FREQ	35	Frequency at which the coils are being driven (5 or 37.5 Hz)
DAMPING	30	Damping filter value (in seconds)
DENSITY_UNIT	31	Unit code associated with DENSITY_VALUE. Valid values are lb/cubic feet, or kg/cubic meter
DENSITY_VALUE	75	User entered density value to be used by the transducer block when calculating flow rate in mass flow units
DIAGNOSTIC_HANDLING	60	On/Off handling for diagnostics
ELECTRODE_MATERIAL	51	Enumerated string indicating flange material of installed flowtube
ELECTRODE_TYPE	52	Enumerated string indicating electrode type of installed flowtube
EP_TRIG_COUNTS	40	Number of EP measurements that must be above the trigger level to set empty pipe
EP_TRIG_LEVELS	41	Empty Pipe Trigger Levels
FLANGE_MATERIAL	54	Enumerated string indicating liner material of installed flowtube
FLANGE_TYPE	53	Enumerated string indicating liner material of installed flowtube
FLOW_TUBE_SERIAL_NUMBER	49	Flow tube serial number from physical tag on flowtube
FLOW_TUBE_TAG	48	Text String Identifier of flowtube
LICENSE_KEY	78	Key/password to enable diagnostic features. Any changes to the licensing will be shown in the LICENSE_STATUS parameter
LINER_MATERIAL	50	Enumerated string indicating liner material of installed flowtube
LOI_LANG	39	Selects the language to be used in the local display for status and diagnostics messages
LOW_FLOW_CUTOFF	37	When flow rate is less than this entered value, flow rate output will be set to 0 ft/s
MODE_BLK	5	Mode of the record of the block–contains the actual, target, permitted, and normal modes
SENSOR_CAL_DATE	25	Date of the last sensor calibration–intended to reflect the calibration of the sensor
SENSOR_CAL_LOC	24	Location of the last sensor calibration–describes the physical location at which the calibration was performed
SENSOR_CAL_METHOD	23	Method of the last sensor calibration–ISO defines several standard methods of calibration (This parameter is intended to record that method or if some other method was used.)
SENSOR_CAL_WHO	26	Name of the person responsible for the last sensor calibration
STATUS_MESSAGE_MFG	61	Used by manufacturing to test groups to simulate status codes
STRATEGY	3	Can be used to help group the blocks (Not checked or processed by the block)
TAG_DESC	2	Static tag–ASCII character string
TUBE_CAL_NO	33	Sensor gain and zero offset number used in flow calculation (Number entered is locate on physical tag of the sensor.)
TUBE_SIZE	34	Tube Size. See Tube Size for actual line sizes
UPDATE_EVT	7	Update event

FLOW-SPECIFIC BLOCK CONFIGURATION VALUES

Once the transmitter is installed and communication is established, configuration must be completed. Three parameters must be entered for proper configuration:

- Sensor calibration number
- Engineering units (configured via AI block)
- Sensor size

The sensor calibration number can be found on the sensor nameplate. A list of all possible sensor sizes and engineering units are listed in Table G-2 and Table G-3. Mass units (lb, kg, ton, and ston) require configuration of the DENSITY_VALUE.

Table G-2. Supported Line Sizes

User-Defined Sensor Line Size	
0.1 in. (3 mm)	16 in. (400 mm)
0.15 in. (4 mm)	18 in. (450 mm)
0.25 in. (6 mm)	20 in. (500 mm)
0.3 in (8 mm)	24 in. (600 mm)
0.5 in. (15 mm)	28 in. (700 mm)
0.75 in. (20 mm)	30 in. (750 mm)
1 in. (25 mm)	32 in (800 mm)
1.5 in. (40 mm)	36 in. (900 mm)
2 in. (50 mm)	40 in. (1000 mm)
2.5 in. (65 mm)	42 in. (1050 mm)
3 in. (80 mm)(1)	48 in. (1200 mm)
4 in. (100 mm)	54 in. (1350 mm)
6 in. (150 mm)	56 in. (1400 mm)
8 in. (200 mm)	60 in. (1500 mm)
10 in. (250 mm)	64 in. (1600 mm)
12 in. (300 mm)	72 in. (1800 mm)
14 in. (350 mm)	80 in. (2000 mm)

(1) Default Factory Configuration

Table G-3. Supported Engineering Units

User Defined Engineering Units			
• ft/s(1)	• CFS	• bbl/s	• kg/s
• ft/m	• CFM	• bbl/min	• kg/min
• ft/h	• CFH	• bbl/h	• kg/h
• m/s	• ft^3/d	• bbl/d	• kg/d
• m/h	• m^3/s	• cm^3/s	• STon/s
• gal/s	• m^3/min	• cm^3/min	• STon/min
• GPM	• m^3/h	• cm^3/h	• STon/h
• gal/h	• m^3/d	• cm^3/d	• STon/d
• gal/d	• IGAL/s	• lb/s	• t/s
• L/s	• IGAL/min	• lb/min	• t/min
• L/min	• IGAL/h	• lb/h	• t/h
• L/h	• IGAL/d	• lb/d	• t/d
• L/d			

(1) Default factory configuration

TRANSDUCER BLOCK ERRORS

The following conditions are reported in the BLOCK_ERR and XD_ERROR parameters. Conditions in *italics* are inactive for the transducer block and are given here only for your reference.

Table G-4. Transducer BLOCK_ERR and XD_ERR Conditions

Condition Number	Condition Name and Description
1	*Block Configuration Error*
2	*Link Configuration Error*
3	*Simulate Active*
4	*Local Override*
5	*Device Fault State Set*
6	Device Needs Maintenance Soon
7	Input Failure/Process Variable Has Bad Status
8	*Output Failure*
9	*Memory Failure*
10	*Lost Static Data*
11	*Lost NV Data*
12	*Readback Check Failed*
13	Device Needs Maintenance Now
14	**Power Up**: The device was just powered-up.
15	**Out of Service**: The actual mode is out of service.
16	**Unspecified Error**: An unidentified error occurred.
17	**General Error**: A general error that cannot be specified below occurred.
18	**Calibration Error**: An error occurred during calibration of the device, or a calibration error was detected during normal operations.
19	**Configuration Error**: An error occurred during configuration of the device, or a configuration error was detected during normal operations.
20	**Electronics Failure**: An electrical component failed.
21	**Mechanical Failure**: A mechanical component failed.
22	**I/O Failure**: An input/output (I/O) failure occurred.
23	**Data Integrity Error**: Data stored in the device are no longer valid due to a nonvolatile memory checksum failure, a data verify after write failure, etc.
24	**Software Error**: The software has detected an error due to an improper interrupt service routine, an arithmetic overflow, a watchdog time-out, etc.
25	**Algorithm Error**: The algorithm used in the transducer block produced an error due to overflow, data reasonableness failure, etc.

TRANSDUCER BLOCK DIAGNOSTICS

In addition to the BLOCK_ERR and XD_ERROR parameters, more detailed information on the measurement status can be obtained via DETAILED_STATUS. Table G-5 lists the potential errors and the possible corrective actions for the given values. Reset the transmitter by cycling power and then, if the error persists, perform the corrective action as described in Table G-5. More detailed and descriptive corrective actions are listed in Section 4: Operation and Section 6: Maintenance and Troubleshooting.

Table G-5. TB_DETAILED_STATUS Descriptions and Corrective Actions

Value	Name and Description	Corrective Action
0x00000001	DSP hardware not compatible with software	Send to service center[(1)]
0x00000002	Electronics failure	Replace the electronics board stack
0x00000004	Coil drive open circuit	Perform sensor electrical resistance checks
0x00000008	Empty Pipe Detected	Verify sensor is full
0x00000010	Calibration failure	Cycle transmitter power to clear message
0x00000020	Auto Zero failure	Repeat Auto Zero process
0x00000040	Sensor high limit exceeded	Lower the process flowrate
0x00000080	Sensor processor not communicating	Replace electronics
0x00000100	Universal Trim failure	Re-run Universal Trim with steady state flow
0x00000200	Reverse flow detected	Verify sensor is not installed backwards
0x00000400	Electronics Temp outside limits	Status message – no corrective action
0x00002000	High Process Noise	Increase the coil drive frequency to 37.5 Hz
0x00008000	Grounding/Wiring Fault	Connect process grounding

(1) See Section 6: Maintenance and Troubleshooting for detailed instructions on how to return products to an authorized service center or factory.

MODES

The transducer block supports two modes of operation as defined by the MODE_BLK parameter:

- **Automatic (Auto)**—The channel outputs reflect the analog input measurement.
- **Out of Service (O/S)**—The block is not processed. Channel outputs are not updated and the status is set to **BAD: OUT OF SERVICE** for each channel. The BLOCK_ERR parameter shows **OUT OF SERVICE**. In this mode, you can make changes to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Alarm Detection

Alarms are not generated by the transducer block. By correctly handling the status of the channel values, the down stream block (AI) will generate the necessary alarms for the measurement. The error that generated this alarm can be determined by looking at BLOCK_ERR and XD_ERROR.

Status Handling

Normally, the status of the output channels reflects the status of the measurement value, the operating condition of the measurement electronics card, and any active alarm condition.

In Auto mode, OUT reflects the value and status quality of the output channels.

TROUBLESHOOTING

Refer to Table G-6 to troubleshoot transducer block problems.

Table G-6. Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave out of service (OOS).	Target mode not set	Set target mode to something other than OOS.
	Resource block	The actual mode of the resource block is OOS. See Appendix F: Resource Block: and Section 3: Configuration.
PVor SV is BAD	Measurement	See Diagnostics, Table G-4.
		Flow is above SENSOR_RANGE.EU100.
PV or SV is UNCERTAIN	Measurement	Flow is above PRIMARY_VALUE_RANGE.EU100.

Appendix H 375 Field Communicator Operation

HANDHELD COMMUNICATOR

NOTE
Please refer to the Handheld Communicator manual for detailed instructions on the use, features, and full capabilities of the Handheld Communicator.

⚠WARNING

Explosions can result in death or serious injury.

Do not make connections to the serial port or NiCad recharger jack in an explosive atmosphere.

Before connecting the Handheld 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.

CONNECTIONS AND HARDWARE

The 375 Field Communicator exchanges information with the transmitter from the control room, the instrument site, or any wiring termination point in the loop. Be sure to install the instruments in the loop in accordance with intrinsically safe or non-incendive field wiring practices. Explosions can result if connections to the serial port or NiCad recharger jack are made in an explosive situation. The Handheld Communicator should be connected in parallel with the transmitter. Use the loop connection ports on the rear panel of the Handheld Communicator (see Figure H-1). The connections are non-polarized.

Figure H-1. Rear Connection Panel

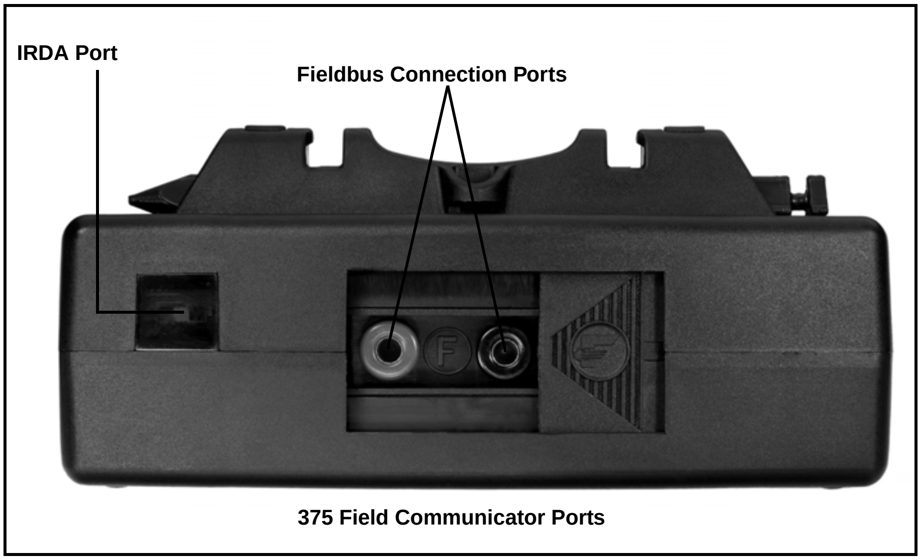
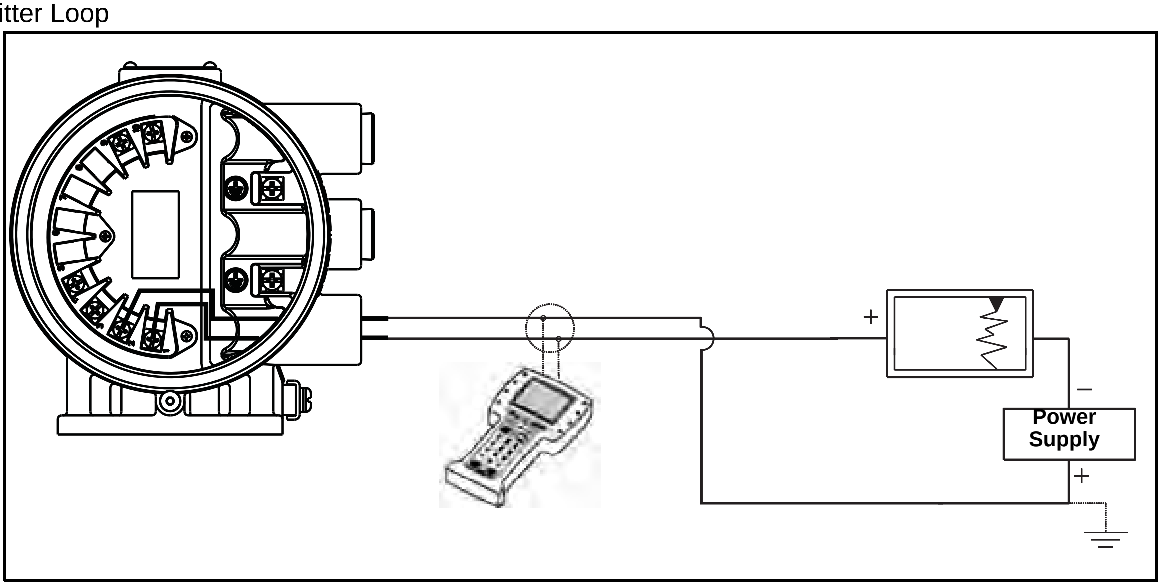


Figure H-2. Connecting the Handheld Communicator to a Transmitter Loop



BASIC FEATURES

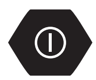
The basic features of the Handheld Communicator include Action Keys, Function Keys, and Alphanumeric and Shift Keys.

Figure H-3. The Handheld Communicator

Action Keys

The Action Keys

As shown in Figure H-3, the action keys are the six blue, white, and black keys located above the alphanumeric keys. The function of each key is described as follows:

ON/OFF Key 

Use this key to power the Handheld Communicator. When the communicator is turned on, it searches for a transmitter on the FOUNDATION filedbus loop.

If a FOUNDATION fieldbus compatible device is found, the communicator displays the Online Menu with device ID (8732) and tag (TRANSMITTER).

Directional Keys 

Use these keys to move the cursor up, down, left, or right. The right arrow key also selects menu options, and the left arrow key returns to the previous menu.

Tab Key 

Use this key to quickly access important, user-defined options when connected to a device. Pressing the Hot Key turns the Handheld Communicator on and displays the Hot Key Menu. See Customizing the Hot Key Menu in the Handheld Communicator manual for more information.

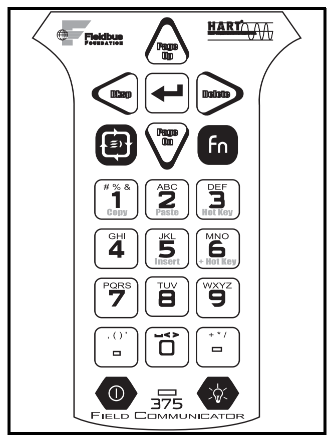
Function Key 

Use the four software-defined function keys, located below the LCD, to perform software functions. On any given menu, the label appearing above a function key indicates the function of that key for the current menu. As you move among menus, different function key labels appear over the four keys. For example, in menus providing access to on-line help, the HELP label may appear above the F1 key. In menus providing access to the Home Menu, the HOME label may appear above the F3 key. Simply press the key to activate the function. See your Handheld Communicator manual for details on specific Function Key definitions.

Alphanumeric and Shift Keys

The Alphanumeric keys perform two functions: the fast selection of menu options and data entry.

Figure H-4. Handheld Communicator Alphanumeric and Shift Keys



Data Entry

Some menus require data entry. Use the Alphanumeric and Shift keys to enter all alphanumeric information into the Handheld Communicator. If you press an Alphanumeric key alone from within an edit menu, the bold character in the center of the key appears. These large characters include the numbers zero through nine, the decimal point (.), and the dash symbol (—).

To enter an alphabetic character, first press the Shift key that corresponds to the position of the letter you want on the alphanumeric key. Then press the alphanumeric key. For example, to enter the letter R, first press the right Shift key, then the "6" key (see Figure H-4 on page H-4). Do not press these keys simultaneously, but one after the other.

MENUS AND FUNCTIONS

The Handheld Communicator is a menu driven system. Each screen provides a menu of options that can be selected as outlined above, or provides direction for input of data, warnings, messages, or other instructions.

Main Menu

The Main Menu provides the following options:

- *Offline* - The Offline option provides access to offline configuration data and simulation functions.
- *Online* - The Online option checks for a device and if it finds one, brings up the Online Menu.
- *Transfer* - The Transfer option provides access to options for transferring data either from the Handheld Communicator (Memory) to the transmitter (Device) or vice versa. Transfer is used to move off-line data from the Handheld Communicator to the flowmeter, or to retrieve data from a flowmeter for off-line revision.

NOTE
Online communication with the flowmeter automatically loads the current flowmeter data to the Handheld Communicator. Changes in on-line data are made active by pressing SEND (F2). The transfer function is used only for off-line data retrieval and sending.

- *Frequency Device* - The Frequency Device option displays the frequency output and corresponding flow output of flow transmitters.
- *Utility* - The Utility option provides access to the contrast control for the Handheld Communicator LCD screen and to the autopoll setting used in multidrop applications.

Once selecting a Main Menu option, the Handheld Communicator provides the information you need to complete the operation. If further details are required, consult the Handheld Communicator manual.

Online Menu

The Online Menu can be selected from the Main Menu as outlined above, or it may appear automatically if the Handheld Communicator is connected to an active loop and can detect an operating flowmeter.

NOTE
The Main Menu can be accessed from the Online Menu. Press the left arrow action key to deactivate the on-line communication with the flowmeter and to activate the Main Menu options.

When configuration variables are reset in the on-line mode, the new settings are not activated until the data are sent to the flowmeter.
Press SEND (F2) to update the process variables of the flowmeter.

On-line mode is used for direct evaluation of a particular meter, re-configuration, changing parameters, maintenance, and other functions.

Diagnostic Messages

The following is a list of messages used by the Handheld Communicator (HC) and their corresponding descriptions.

Variable parameters within the text of a message are indicated with *<variable parameter>*.

Reference to the name of another message is identified by *[another message]*.

Table H-1. Handheld Communicator Diagnostic Messages

Message	Description
Add item for ALL device types or only for this ONE device type	Asks the user whether the hot key item being added should be added for all device types or only for the type of device that is connected.
Command Not Implemented	The connected device does not support this function.
Communication Error	Either a device sends back a response indicating that the message it received was unintelligible or the HC cannot understand the response from the device.
Configuration memory not compatible with connected device	The configuration stored in memory is incompatible with the device to which a transfer has been requested.
Device Busy	The connected device is busy performing another task.
Device Disconnected	Device fails to respond to a command
Device write protected	Device is in write-protect mode Data can not be written
Device write protected – do you still want to shut off?	Device is in write-protect mode – press YES to turn the HC off and lose the unsent data.
Display value of variable on hot key menu?	Asks whether the value of the variable should be displayed adjacent to its label on the hot key menu if the item being added to the hot key menu is a variable.
Download data from configuration memory to device	Prompts user to press SEND softkey to initiate a memory to device transfer.
Exceed field width	Indicates that the field width for the current arithmetic variable exceeds the device- specified description edit format
Exceed precision	Indicates that the precision for the current arithmetic variable exceeds the device- specified description edit form
Ignore next 50 occurrences of status?	Asked after displaying device status – softkey answer determines whether next 50 occurrences of device status will be ignored or displayed
Illegal character	An invalid character for the variable type was entered.
Illegal date	The day portion of the date is invalid.
Illegal month	The month portion of the date is invalid.
Illegal year	The year portion of the date is invalid.
Incomplete exponent	The exponent of a scientific notation floating point variable is incomplete.
Incomplete field	The value entered is not complete for the variable type.
Looking for a device	Polling for multidropped devices at addresses 1–15
Mark as read only variable on hot key menu?	Asks whether the user should be allowed to edit the variable from the hot key menu if the item being added to the hot key menu is a variable
No device configuration in configuration memory	There is no configuration saved in memory available to re-configure off-line or transfer to a device.
No Device Found	Poll of address zero fails to find a device, or poll of all addresses fails to find a device if auto-poll is enabled
No hot key menu available for this device	There is no menu named “hot key” defined in the device description for this device.
No off-line devices available	There are no device descriptions available to be used to configure a device off-line.
No simulation devices available	There are no device descriptions available to simulate a device.
No UPLOAD_VARIABLES in ddl for this device	There is no menu named “upload_variables” defined in the device description for this device – this menu is required for off-line configuration.
No Valid Items	The selected menu or edit display contains no valid items.

Table H-1. Handheld Communicator Diagnostic Messages

Message	Description
OFF KEY DISABLED	Appears when the user attempts to turn the HC off before sending modified data or before completing a method
On-line device disconnected with unsent data – RETRY or OK to lose data	There is unsent data for a previously connected device. Press RETRY to send data, or press OK to disconnect and lose unsent data.
Out of memory for hot key configuration – delete unnecessary items	There is no more memory available to store additional hot key items. Unnecessary items should be deleted to make space available.
Overwrite existing configuration memory	Requests permission to overwrite existing configuration either by a device-to-memory transfer or by an off-line configuration; user answers using the softkeys
Press OK...	Press the OK softkey – this message usually appears after an error message from the application or as a result of hart communications.
Restore device value?	The edited value that was sent to a device was not properly implemented. Restoring the device value returns the variable to its original value.
Save data from device to configuration memory	Prompts user to press SAVE softkey to initiate a device-to-memory transfer
Saving data to configuration memory	Data is being transferred from a device to configuration memory.
Sending data to device	Data is being transferred from configuration memory to a device.
There are write only variables which have not been edited. Please edit them.	There are write-only variables which have not been set by the user. These variables should be set or invalid values may be sent to the device.
There is unsent data. Send it before shutting off?	Press YES to send unsent data and turn the HC off. Press NO to turn the HC off and lose the unsent data.
Too few data bytes received	Command returns fewer data bytes than expected as determined by the device description
Transmitter Fault	Device returns a command response indicating a fault with the connected device
Units for <variable label> has changed – unit must be sent before editing, or invalid data will be sent	The engineering units for this variable have been edited. Send engineering units to the device before editing this variable.
Unsent data to on-line device – SEND or LOSE data	There is unsent data for a previously connected device which must be sent or thrown away before connecting to another device.
Use up/down arrows to change contrast. Press DONE when done.	Gives direction to change the contrast of the HC display
Value out of range	The user-entered value is either not within the range for the given type and size of variable or not within the min/max specified by the device.
<message> occurred reading/writing <variable label>	Either a read/write command indicates too few data bytes received, transmitter fault, invalid response code, invalid response command, invalid reply data field, or failed pre- or post-read method; or a response code of any class other than SUCCESS is returned reading a particular variable.
<variable label> has an unknown value – unit must be sent before editing, or invalid data will be sent	A variable related to this variable has been edited. Send related variable to the device before editing this variable.

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EMERSON™
Process Management

Reference Manual
00809-0100-4664, Rev AA
July 2009

Rosemount 8712

Remote Mount Magnetic Flowmeter System

CE HART FIELD COMMUNICATIONS PROTOCOL

ROSEMOUNT

EMERSON
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Remote Mount Magnetic Flowmeter System

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. Rosemount Inc. has two toll-free assistance numbers: **Customer Central** Technical support, quoting, and order-related questions. United States - 1-800-999-9307 (7:00 am to 7:00 pm CST) Asia Pacific- 65 777 8211 Europe/ Middle East/ Africa - 49 (8153) 9390 **North American Response Center** Equipment service needs. 1-800-654-7768 (24 hours—includes Canada) Outside of these areas, contact your local Emerson Process Management representative.

⚠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.

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Section 1 Introduction

SYSTEM DESCRIPTION

The Rosemount® 8700 Series Magnetic Flowmeter System consists of a sensor and transmitter, and measures volumetric flow rate by detecting the velocity of a conductive liquid that passes through a magnetic field.

There are four Rosemount magnetic flowmeter sensors:

- Flanged Rosemount 8705
- Flanged High-Signal Rosemount 8707
- Wafer-Style Rosemount 8711
- Sanitary Rosemount 8721

There are two Rosemount magnetic flowmeter transmitters:

- Rosemount 8712
- Rosemount 8732

The sensor is installed in-line with process piping — either vertically or horizontally. Coils located on opposite sides of the sensor create a magnetic field. Electrodes located perpendicular to the coils make contact with the process fluid. A conductive liquid moving through the magnetic field generates a voltage at the two electrodes that is proportional to the flow velocity.

The transmitter drives the coils togenerate a magnetic field, and electronically conditions the voltage detected by the electrodes to provide a flow signal. The transmitter can be integrally or remotely mounted from the sensor.

This manual is designed to assist in the installation and operation of the Rosemount 8712 Magnetic Flowmeter Transmitter and the Rosemount 8700 Series Magnetic Flowmeter Sensors.

SAFETY MESSAGES

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. Refer to the safety messages listed at the beginning of each section before performing any operations.

⚠WARNING

Attempting to install and operate the Rosemount 8705, Rosemount 8707 High-Signal, Rosemount 8711, or Rosemount 8721 Magnetic Sensors with the Rosemount 8712 or Rosemount 8732 Magnetic Flowmeter Transmitter without reviewing the instructions contained in this manual could result in personal injury or equipment damage.

SERVICE SUPPORT

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.

⚠ See “Safety Messages” on page D-1 for complete warning information.

Section 2 Installation

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. Please refer to the following safety messages before performing any operation in this section.

SAFETY MESSAGES

⚠ This symbol is used throughout this manual to indicate that special attention to warning information is required.

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Please refer to the following safety messages before performing any operation in this section.

⚠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 that the operating environment of the sensor and transmitter is consistent with the appropriate hazardous area approval.

Do not connect a Rosemount 8712 to a non-Rosemount sensor that is located in an explosive atmosphere.

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 8712 reference manual for any restrictions associated with a safe installation.

Before connecting a handheld 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.

Electrical shock can result in death or serious injury

Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

⚠WARNING

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.

To avoid possible damage to the sensor liner ends, do not use metallic or spiral-wound gaskets. If frequent removal is anticipated, take precautions to protect the liner ends. Short spool pieces attached to the sensor ends are often used for protection.

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 limits. Failure to observe these instructions could result in severe damage to the sensor lining and possible sensor replacement.

TRANSMITTER SYMBOLS

Caution symbol — check product documentation for details ⚠

Protective conductor (grounding) terminal ⏚

PRE-INSTALLATION

Before installing the Rosemount 8712 Magnetic Flowmeter Transmitter, there are several pre-installation steps that should be completed to make the installation process easier:

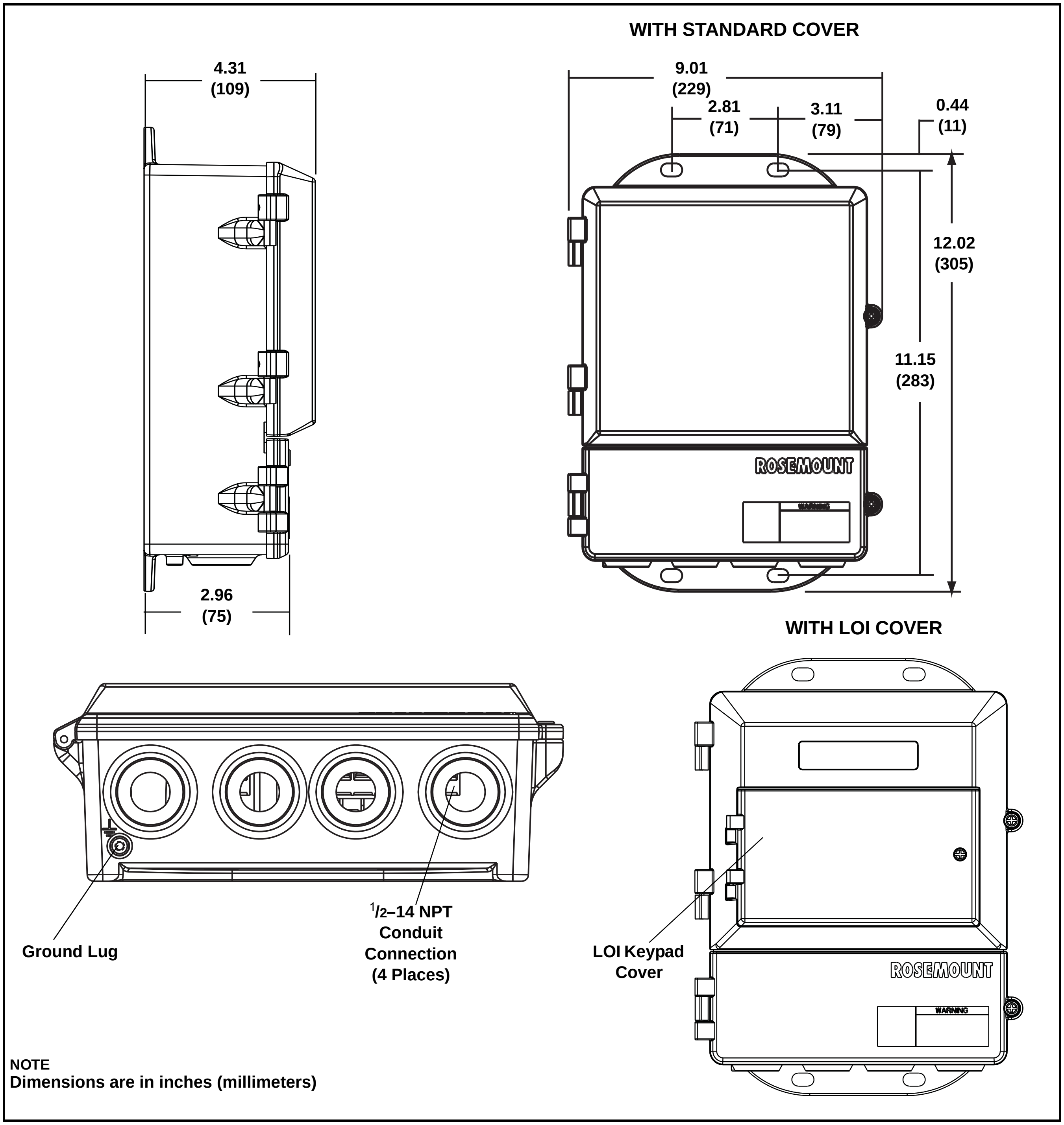
- Identify the options and configurations that apply to your application
- Set the hardware switches if necessary
- Consider mechanical, electrical, and environmental requirements

Mechanical Considerations

The mounting site for the Rosemount 8712 transmitter should provide enough room for secure mounting, easy access to conduit ports, full opening of the transmitter covers, and easy readability of the LOI screen (see Figure 2-1). The transmitter should be mounted in a manner that prevents moisture in the conduit from collecting in the transmitter.

The 8712 is mounted separately from the sensor, it is not subject to limitations that might apply to the sensor.

Figure 2-1. Rosemount 8712 Dimensional Drawing



Environmental Considerations

To ensure maximum transmitter life, avoid excessive heat and vibration. Typical problem areas:

- high-vibration lines with integrally mounted transmitters
- warm-climate installations in direct sunlight
- outdoor installations in cold climates.

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

Rosemount 8712 transmitters require external power and there must be access to a suitable power source.

INSTALLATION PROCEDURES

Rosemount 8712 installation includes both detailed mechanical and electrical installation procedures.

Mount the Transmitter

At a remote site the transmitter may be mounted on a pipe up to two inches in diameter or against a flat surface.

Pipe Mounting

To mount the transmitter on a pipe:

1. Attach the mounting plate to the pipe using the mounting hardware.
2. Attach the 8712 to the mounting plate using the mounting screws.

Surface Mounting

To surface mount the transmitter:

1. Attach the 8712 to the mounting location using the mounting screws.

Identify Options and Configurations

The standard application of the 8712 includes a 4–20 mA output and control of the sensor coils. Other applications may require one or more of the following configurations or options:

- Multidrop Communications
- PZR (Positive Zero Return)
- Auxiliary Output
- Pulse Output

Additional options may apply. Be sure to identify those options and configurations that apply to your situation, and keep a list of them nearby for consideration during the installation and configuration procedures.

Hardware Switches

The 8712 electronics board is equipped with three user-selectable hardware switches. These switches set the Failure Alarm Mode, Internal/External Analog Power, and Transmitter Security. The standard configuration for these switches when shipped from the factory are as follows:

Failure Alarm Mode:	HIGH
Internal/External Analog Power:	INTERNAL
Transmitter Security:	OFF

Changing Hardware Switch Settings

In most cases, it is not necessary to change the setting of the hardware switches. If you need to change the switch settings, complete the steps outlined in the manual.

Definitions of these switches and their functions are provided below. If you determine that the settings must be changed, see below.

Failure Alarm Mode

If the 8712 experiences a catastrophic failure in the electronics, the current output can be driven high (23.25 mA) or low (3.75 mA). The switch is set in the *HIGH* (23.25 mA) position when it is shipped from the factory.

Internal/External Analog Power

The Rosemount 8712 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 V DC external supply is required and the 4-20mA power switch must be set to “EXT” position. For further information on 4–20 mA external power, see Connect 4–20 mA Loop External Power Source on page 2-9.

Transmitter Security

The security switch on the 8712 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, you may still access and review any of the operating parameters and scroll through the available choices, but no actual data changes are allowed. Transmitter security is set in the *OFF* position when shipped from factory.

Changing Hardware Switch Settings

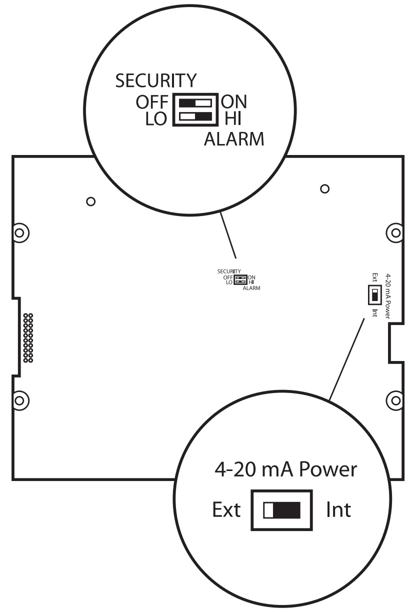
In most cases, it is not necessary to change the setting of the hardware switches. If you need to change the switch settings, complete the steps below:

NOTE
The hardware switches are located on the non-component 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. Disconnect power to the transmitter.
2. Loosen the housing door screw and open the housing door.
3. Identify the location of each switch (see Figure 2-2).
4. Change the setting of the desired switches with a small screwdriver.
5. Close the housing door and tighten the housing door screw.

Figure 2-2. Rosemount 8712 Electronics Board and Hardware Switches



Conduit Ports and Connections

Both the sensor and transmitter junction boxes have ports for $^1/_2$-in. NPT conduit connections. These connections should be made in accordance with local or plant electrical codes. Unused ports should be sealed with metal plugs. Proper electrical installation is necessary to prevent errors due to electrical noise and interference. Separate conduits are not necessary for the two cables, but a dedicated conduit line between each transmitter and sensor is required. Shielded cable must be used for best results in electrically noisy environments.

Example 1: Installing flanged sensors into an IP68 area. Sensors must be installed with IP68 cable glands and cable to maintain IP68 rating. Unused conduit connections must be properly sealed to prevent water ingress. For added protection, dielectric gel can be used to pot the sensor terminal block.

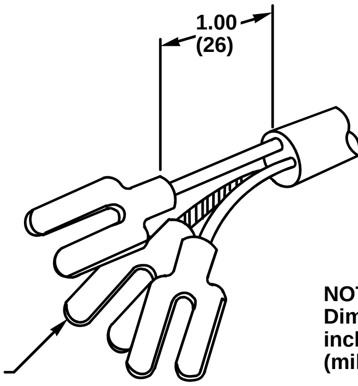
Example 2: Installing flowmeters into explosion proof/flameproof areas. Conduit connections and conduit must be rated for use in the hazardous area to maintain flowmeter approval rating.

Conduit Cables

Run the appropriate size cable through the conduit connections in your magnetic flowmeter system. Run the power cable from the power source to the transmitter. Run the coil drive and electrode cables between the flowmeter and transmitter. Refer to Electrical Considerations for wire type. Prepare the ends of the coil drive and electrode cables as shown in Figure 2-3. Limit the unshielded wire length to 1-inch on both the electrode and coil drive cables. Excessive lead length or failure to connect cable shields can create electrical noise resulting in unstable meter readings.

- Installed signal wiring should not be run together and should not be in the same cable tray as AC or DC power wiring.
- Device must be properly grounded or earthed according to local electric codes.
- Rosemount combination cable model number 08712-0752-0001 (ft) or 08712-0752-0003 (m) is required to be used to meet EMC requirements.

Figure 2-3. Cable Preparation Detail



Electrical Considerations

Before making any electrical connections to the Rosemount 8712, consider the following standards and be sure to have the proper power supply, conduit, and other accessories.

Transmitter Input Power

The 8712 transmitter is designed to be powered by 90-250 V AC, 50–60 Hz or 12–42 V DC. The eight digit in the transmitter model number designates the appropriate power supply requirement.

Model Number	Power Supply Requirement
2	12-42 V DC
1	90-250 V AC

Supply Wire Temperature Rating
Use 12 to 18 AWG wire. For connections in ambient temperatures exceeding 140 °F (60 °C), use wire rated to at least 194 °F (90 °C).

Disconnects
Connect the device through an external disconnect or circuit breaker. Clearly label the disconnect or circuit breaker and locate it near the transmitter.

Requirements for 90-250 V AC Power Supply

Wire the transmitter according to local electrical requirements for the supply voltage. In addition, follow the supply wire and disconnect requirements on page 2-9.

Requirements for 12-42 V DC Power Supply

Units powered with 12-42 V DC may draw up to 1 amp of current. As a result, the input power wire must meet certain gauge requirements.

Figure 2-4 shows the surge current for each corresponding supply voltage. For combinations not shown, you can calculate the maximum distance given the supply current, the voltage of the source, and the minimum start-up voltage of the transmitter, 12 V DC, using the following equation:

$$\text{Maximum Resistance} = \frac{\text{Supply Voltage} - 12\text{VDC}}{1 \text{ amp}}$$

Use Table 2-1 and Table 2-2 to determine the maximum wire length allowable for your power supply and maximum resistance.

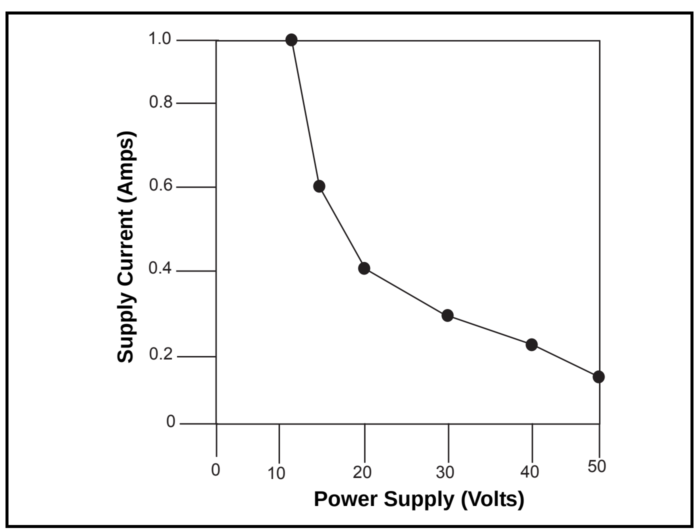
Table 2-1. Length of Annealed Copper (cu) Wires

Types of Power Supply Wires		Maximum Length of the Wire for Each Corresponding Power Supply Source			
Wire Gauge	**Annealed Cu milliohms/ft (milliohms/m)**	**42 V DC Supply ft (m)**	**30 V DC Supply ft (m)**	**20 V DC Supply ft (m)**	**12.5 V DC Supply ft (m)**
20	0.01015 (0.033292)	1478 (451)	887 (270)	394 (120)	25 (8)
18	0.006385 (0.020943)	2349 (716)	1410 (430)	626 (191)	39 (12)
16	0.004016 (0.013172)	3735 (1139)	2241 (683)	996 (304)	62 (19)
14	0.002525 (0.008282)	5941 (1811)	3564 (1087)	1584 (483)	99 (30)
12	0.001588 (0.005209)	9446 (2880)	5668 (1728)	2519 (768)	157 (48)
10	0.000999 (0.003277)	15015 (4578)	9009 (2747)	4004 (1221)	250 (76)

Table 2-2. Length of Hand-drawn Copper (cu) Wires

Types of Power Supply Wires		Maximum Length of the Wire for Each Corresponding Power Supply Source			
Wire Gauge	**Annealed Cu milliohms/ft (milliohms/m)**	**42 V DC Supply ft (m)**	**30 V DC Supply ft (m)**	**20 V DC Supply ft (m)**	**12.5 V DC Supply ft (m)**
18	0.00664 (0.021779)	2259 (689)	1355 (413)	602 (184)	38 (11)
16	0.004176 (0.013697)	3592 (1095)	2155 (657)	958 (292)	60 (18)
14	0.002626 (0.008613)	5712 (1741)	3427 (1045)	1523 (464)	95 (29)
12	0.001652 (0.005419)	9080 (2768)	5448 (1661)	2421 (738)	151 (46)
10	0.01039 (0.003408)	14437 (4402)	8662 (2641)	3850 (1174)	241 (73)

Figure 2-4. Supply Current versus Input Voltage



Installation Category

The installation category for the Rosemount 8712 is (Overvoltage) Category II.

Overcurrent Protection

The Rosemount 8712 Flowmeter Transmitter requires overcurrent protection of the supply lines. Maximum ratings of overcurrent devices are as follows:

Power System	Fuse Rating	Manufacturer
90–250 V AC	2 Amp, Quick Acting	Bussman AGCI or Equivalent
12-42 V DC	3 Amp, Quick Acting	Bussman AGC3 or Equivalent

OPTIONS, CONSIDERATIONS, AND PROCEDURES

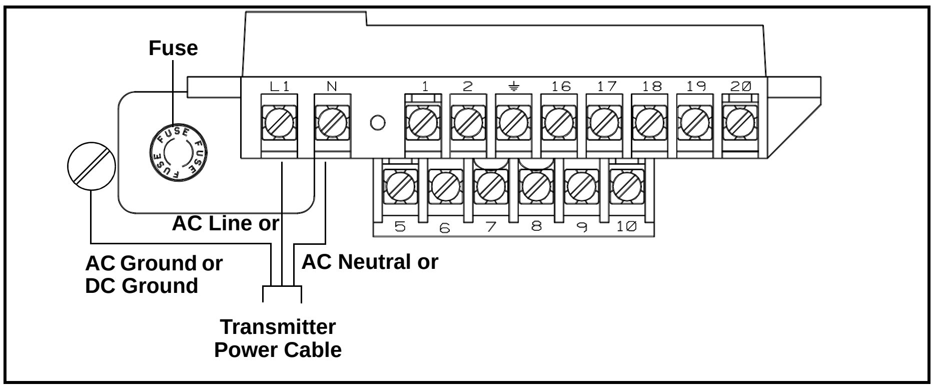
If the application of the 8712 includes the use of options such as multidrop communications, auxiliary output control, or pulse output, certain requirements may apply in addition to those previously listed. Be prepared to meet these requirements before attempting to install and operate the Rosemount 8712.

Connect Transmitter Power

To connect power to the transmitter, complete the following steps.

1. Ensure that the power source and connecting cable meet the requirements outlined on page 2-8.
2. Turn off the power source.
3. Open the power terminal cover.
4. Run the power cable through the conduit to the transmitter.
5. Loosen the terminal guard for terminals L1 and N.
6. Connect the power cable leads as shown in Figure 2-5.
   a. Connect AC Neutral or DC- to terminal N.
   b. Connect AC Line or DC+ to terminal L1.
   c. Connect AC Ground or DC Ground to the ground screw mounted on the transmitter enclosure.

Figure 2-5. Transmitter Power Connections



Connect 4–20 mA Loop External Power Source

The 4–20 mA output loop provides the process variable output from the transmitter. Its signal may be powered internally or externally. The default position of the internal/external analog power switch is in the *internal* position. The user-selectable power switch is located on the electronics board.

Internal
The 4–20 mA analog power loop may be powered from the transmitter itself. Resistance in the loop must be 1,000 ohms or less. If a Handheld Communicator or control system will be used, it must be connected across a minimum of 250 ohms resistance in the loop.

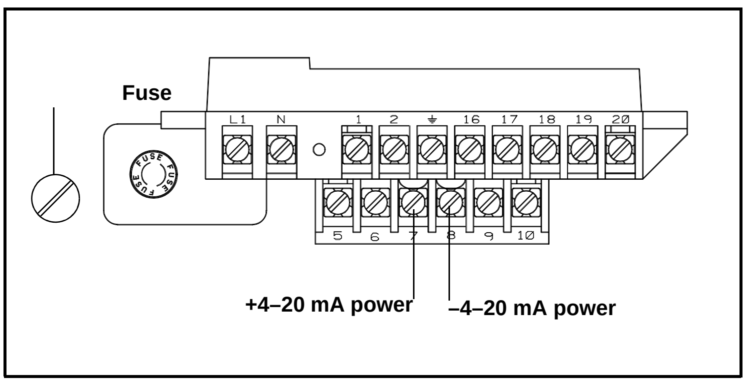
External
HART multidrop installations require a 10–30 V DC external power source (see Multidrop Communications on page 3-16). If a Handheld Communicator or control system is to be used, it must be connected across a minimum of 250 ohms resistance in the loop.

To connect external power to the 4–20 mA loop, complete the following steps.

1. Ensure that the power source and connecting cable meet the requirements outlined above and in Electrical Considerations on page 2-7.
2. Turn off the transmitter and analog power sources.
3. Run the power cable into the transmitter.
4. Connect –DC to Terminal 8.
5. Connect +DC to Terminal 7.

Refer to Figure 2-6 on page 2-10.

Figure 2-6. 4–20 mA Loop Power Connections



Connect Pulse Output Power Source

The pulse output function provides an isolated switch-closure 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 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

The pulse output option requires an external power source. Complete the following steps to connect an external power supply.

1. Ensure that 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 6.
5. Connect +DC to terminal 5.

Refer to Figure 2-7 and Figure 2-8.

Figure 2-7. Connecting to a Electromechanical Totalizer/Counter

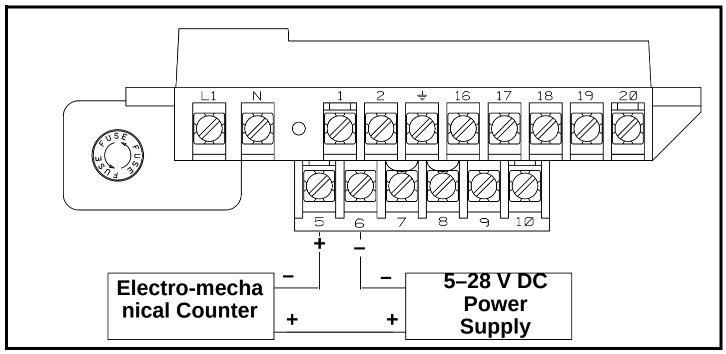
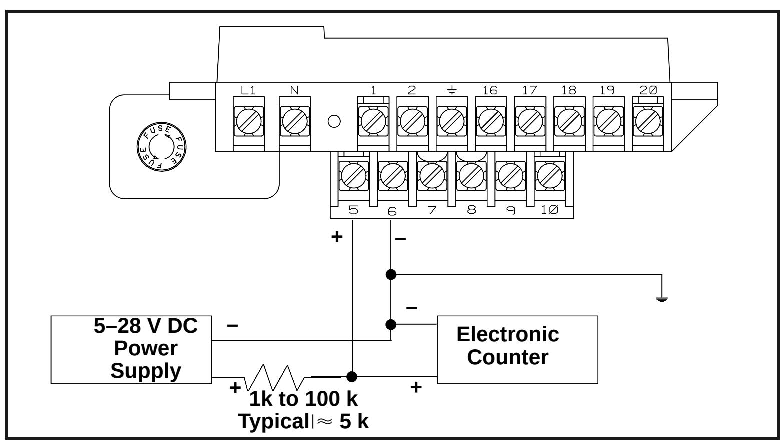


Figure 2-8. Connecting to a Electronic Totalizer/Counter without Integral Power Supply



Connect Auxiliary Channel 1

Auxiliary channel 1 can be configured as either a digital input or a digital output. When configured as an input, the following requirements apply:

Supply Voltage:	5 to 28V DC
Maximum Power:	2 watts
Switch Closure:	optically isolated solid state switch
Maximum Impedance	2.5 k Ω

When using channel 1 as a digital input, the power source and the control relay must be connected to the transmitter. See Figure 2-9 for more details on this connection.

When configured as an output, the following requirements apply:

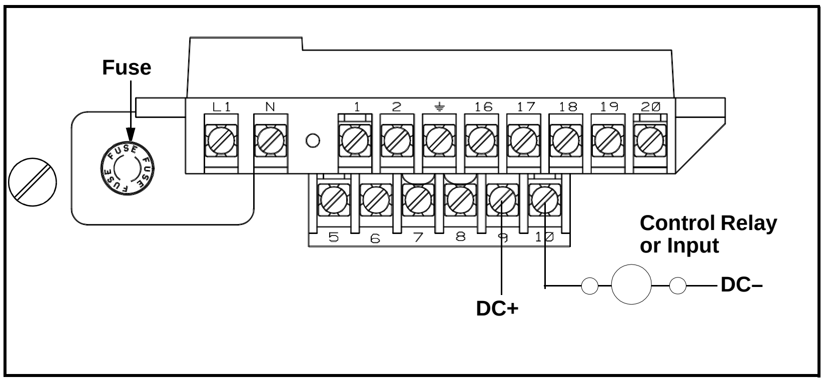
Supply Voltage:	5 to 28V DC
Maximum Power:	2 watts
Switch Closure:	optically isolated solid state switch

When using channel 1 as a digital output, the power source must be connected to the transmitter. See Figure 2-10 for more details on this connection.

When connecting power to channel 1, complete the following steps:

1. Ensure that the power source and connecting cable meet the requirements outlined previously.
2. Turn off the transmitter and auxiliary power sources.
3. Run the power cable to the transmitter.
4. Connect –DC to terminal 10.
5. Connect +DC to terminal 9.

Figure 2-9. Connect Digital Input 1 to Relay or Input to Control System



Connect Auxiliary Channel 2

Auxiliary channel 2 is configured to provide a digital output based on the configuration parameters set in the transmitter.

The following requirements apply to this channel:

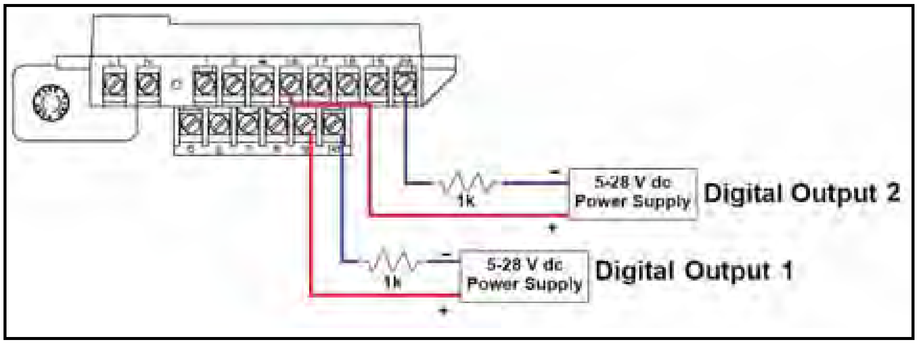
Supply Voltage:	5 to 28V DC
Maximum Power:	2 watts
Switch Closure:	optically isolated solid state switch

When connecting power to channel 2, complete the following steps:

1. Ensure that the power source and connecting cable meet the requirements outlined previously.
2. Turn off the transmitter and auxiliary power sources.
3. Run the power cable to the transmitter.
4. Connect –DC to terminal 20.
5. Connect +DC to terminal 16.

See Figure 2-10 for more details on this connection.

Figure 2-10. Connecting Digital Outputs



SENSOR CONNECTIONS

This section covers the steps required to physically install the transmitter including wiring and calibration.

Rosemount Sensors

To connect the transmitter to a non-Rosemount sensor, refer to the appropriate wiring diagram in Appendix D: Wiring Diagrams. The calibration procedure listed is not required for use with Rosemount sensors.

Transmitter to Sensor Wiring

Flanged and wafer sensors have two conduit ports as shown in Figures 4-13, 4-14, 4-15, and 4-16. Either one may be used for both the coil drive and electrode cables. Use the stainless steel plug that is provided to seal the unused conduit port.

A single dedicated conduit run for the coil drive and electrode cables is needed between a sensor and a remote transmitter. Bundled cables in a single conduit are likely to create interference and noise problems in your system. Use one set of cables per conduit run. See Figure 2-11 for proper conduit installation diagram and Table 2-3 for recommended cable. For integral and remote wiring diagrams refer to Figure 2-13.

Figure 2-11. Conduit Preparation

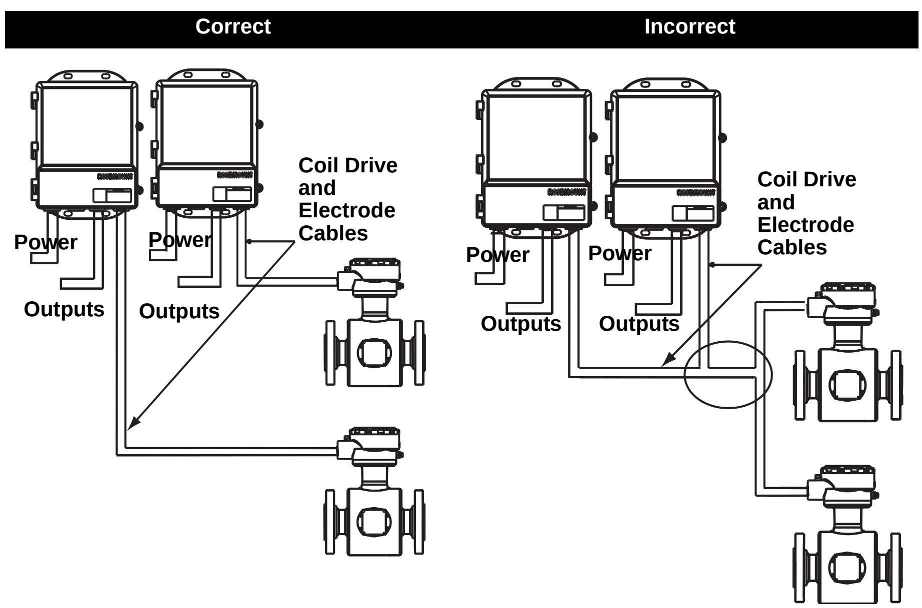


Table 2-3. Cable Requirements

Description	Units	Part Number
Signal Cable (20 AWG) Belden 8762, Alpha 2411 equivalent	ft m	08712-0061-0001 08712-0061-0003
Coil Drive Cable (14 AWG) Belden 8720, Alpha 2442 equivalent	ft m	08712-0060-0001 08712-0060-0003
Combination Signal and Coil Drive Cable (18 AWG)(1)	ft m	08712-0752-0001 08712-0752-0003

(1) Combination signal and coil drive cable is not recommended for high-signal magmeter system. For remote mount installations, combination signal and coil drive cable should be limited to less than 300 ft. (100 m).

Rosemount recommends using the combination signal and coil drive for N5, E5 approved sensors for optimum performance.

Remote transmitter installations require equal lengths of signal and coil drive cables. Integrally mounted transmitters are factory wired and do not require interconnecting cables.

Lengths from 5 to 1,000 feet (1.5 to 300 meters) may be specified, and will be shipped with the sensor.

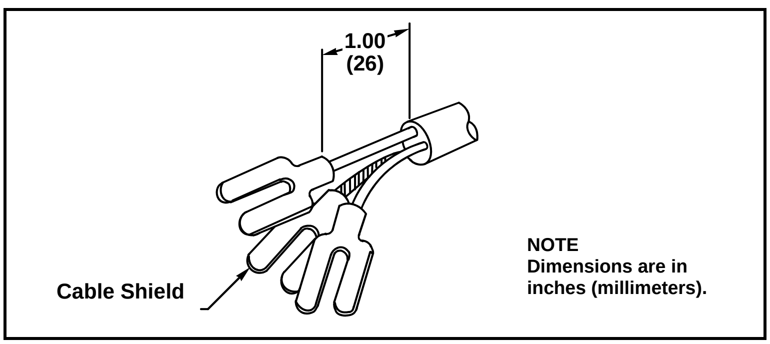
Conduit Cables

Run the appropriate size cable through the conduit connections in your magnetic flowmeter system. Run the power cable from the power source to the transmitter. Run the coil drive and electrode cables between the flowmeter and transmitter.

Prepare the ends of the coil drive and electrode cables as shown in Figure 2-12. Limit the unshielded wire length to 1-inch on both the electrode and coil drive cables.

NOTE
Excessive lead length or failure to connect cable shields can create electrical noise resulting in unstable meter readings.

Figure 2-12. Cable Preparation Detail

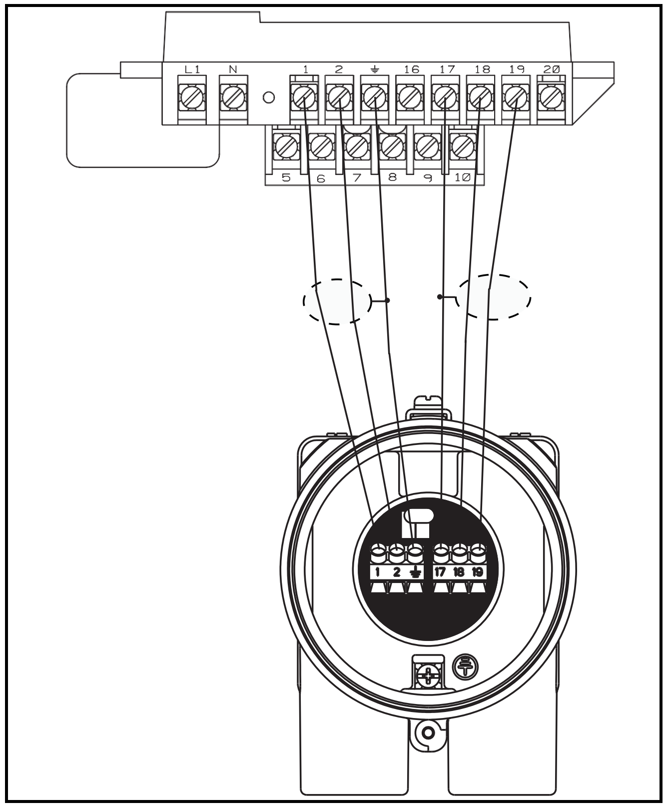


Sensor to Remote Mount Transmitter Connections

Connect coil drive and electrode cables as shown in Figure 2-13.

Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter, or replacement of the electronics board will be necessary.

Figure 2-13. Wiring Diagram



Rosemount 8712 Transmitter	Rosemount 8705/8707/8711/8721 sensors
1	1
2	2
⏚	⏚
17	17
18	18
19	19

Section 3 Configuration

INTRODUCTION

This section covers basic operation, software functionality, and configuration procedures for the Rosemount 8712 Magnetic Flowmeter Transmitter. For information on connecting another manufacturer's sensor, refer to "Universal Sensor Wiring Diagrams" on page E-1.

The Rosemount 8712 features a full range of software functions for configuration of output from the transmitter. Software functions are accessed through the LOI, AMS, a Handheld Communicator, or a control system. Configuration variables may be changed at any time and specific instructions are provided through on-screen instructions.

Table 3-1. Parameters

Basic Set-up Parameters	Page
Review	page 3-6
Process Variables	page 3-6
Basic Setup	page 3-8
Flow Units	page 3-8
Range Values	page 3-11
PV Sensor Calibration Number	page 3-12
Totalizer Setup	page 3-7

INSTALLATION CHECK AND GUIDE

Use this guide to check new installations of Rosemount magnetic flowmeter systems that appear to malfunction.

Before You Begin

Transmitter

Apply power to your system before making the following transmitter checks.

1. Verify that the correct sensor calibration number is entered in the transmitter. The calibration number is listed on the sensor nameplate.
2. Verify that the correct sensor line size is entered in the transmitter. The line size value is listed on the sensor nameplate.
3. Verify that the analog range of the transmitter matches the analog range in the control system.
4. Verify that the forced analog output of the transmitter produces the correct output at the control system.

Sensor

Be sure that power to your system is removed before beginning sensor checks.

1. **For horizontal flow installations**, ensure that the electrodes remain covered by process fluid.

   For vertical or inclined installations, ensure that the process fluid is flowing up into the sensor to keep the electrodes covered by process fluid.
2. Ensure that the grounding straps on the sensor are connected to grounding rings, lining protectors, or the adjacent pipe flanges. Improper grounding will cause erratic operation of the system.

Wiring

1. The signal wire and coil drive wire must be twisted shielded cable. Emerson Process Management, Rosemount division. recommends 20 AWG twisted shielded cable for the electrodes and 14 AWG twisted shielded cable for the coils.
2. The cable shield must be connected at both ends of the electrode and coil drive cables. Connection of the shield at both ends is absolutely necessary for proper operation.
3. The signal and coil drive wires must be separate cables, unless Emerson Process Management specified combo cable is used.
4. The single conduit that houses both the signal and coil drive cables should not contain any other wires.

Process Fluid

1. The process fluid conductivity should be 5 microsiemens (5 micro mhos) per centimeter minimum.
2. The process fluid must be free of air and gasses.
3. The sensor should be full of process fluid.

Refer to Section 6 "Maintenance and Troubleshooting" for further information.

LOCAL OPERATOR INTERFACE

The optional Local Operator Interface (LOI) provides an operator communications center for the 8712. By using the LOI, the operator can access any transmitter function for changing configuration parameter settings, checking totalized values, or other functions. The LOI is integral to the transmitter housing.

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 3-1.

Display Control Keys

The display control keys provide control over the variable displayed on the LOI screen. Push **FLOW RATE** to display the process variable, or push **TOTALIZE** to display the totalized value.

Totalizer Keys

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

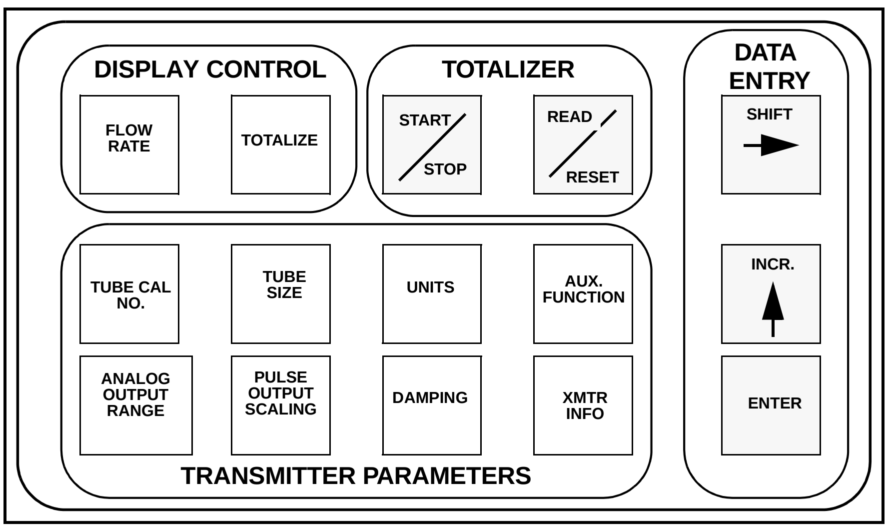
Data Entry Keys

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 8712 through the **AUX. FUNCTION** key.

Figure 3-1. Local Operator Interface Keypad



Data Entry

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

1. Access the appropriate function.
2. Use **SHIFT** to highlight the digit you want to enter or change.
3. Use **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 l,**&, +, -, *, /, $,** @,**%,** and the **blank space**. (**INCR.** is also used to toggle through pre-determined choices that do not require data entry.)
4. Use **SHIFT** to highlight other digits you want to change and change them.
5. Press **ENTER**.

Selecting Options

To select pre-defined software options on the LOI, use the following procedure:

1. Access the appropriate option.
2. Use **SHIFT** or **INCR.** to toggle between the applicable choices.
3. Press **ENTER** when the desired choice is displayed on the screen.

LOI EXAMPLES

Use the TRANSMITTER PARAMETER keys shown in Figure 3-1 to change the parameters, which are set in one of two ways, table values or select values.

Table Values:
Parameters such as units, that are available from a predefined list

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

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

Select Value Example

Changing the ANALOG OUTPUT RANGE:

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

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

Table 3-2. LOI Data Entry Keys and Functions

Data Entry Keys	Function Performed
Shift	• Moves the blinking cursor on the display one character to the right • Scrolls through available values
Increment	• Increments the character over the cursor by one • Steps through all the digits, letters, and symbols that are applicable to the present operation • Scrolls through available values
Enter	Stores the displayed value previously selected with the SHIFT and INCR. keys
Display Control Keys	Function Performed
Flow Rate	Displays the user-selected parameters for flow indication
Totalize	Displays the present totalized output of the transmitter, and activates the Totalizer group of keys The choices, **Forward** and **Reverse** totals or **Net** and **Gross** totals, are selected in Auxiliary Functions
Start/Stop	Starts the totalizing display if it is stopped, and stops the display if it is running
Read/Reset	Resets the net totalizing display to zero if it is stopped, and halts the display if the display is running

Table 3-2. LOI Data Entry Keys and Functions

Transmitter Parameters Keys	Function Performed	
Tube Cal No.	Identifies the calibration number when using Rosemount sensors, or other manufacturers' sensors calibrated at the Rosemount factory	
Tube Size	Specifies the sensor size and identifies the corresponding maximum flow (0.1 - through 80-inch line sizes)	
Units	Specifies the desired units: Gal/Min Liters/Min ImpGal/Min CuMeter/Hr Ft/Sec Meters/Sec Special (user defined) For a complete list of available units, see Table 3-3 on page 3-9	
Auxiliary Functions	Function	Options
	Run 8714i	Runs the meter verification diagnostic
	Operating Mode	Normal or Filter
	Coil Pulse Mode	5 or 37 Hz
	Flow rate Display	Flow–% Span, Flow–Totalize, %Span–Totalize
	Totalizer Display	Forward–Reverse or Net–Gross
	Totalizer Units	Configure the totalizer units of measure
	Signal Processing	On/Off
	Special Units	Volume units, base volume units, conversion, time base, rate units
	Process Density	Required for units of mass flow
	DI/DO 1 Config	Configure Auxiliary Channel 1
	Digital Output 2	Configure Auxiliary Channel 2
	Flow Limit 1	Configure Flow Limit 1 Alert
	Flow Limit 2	Configure Flow Limit 2 Alert
	Totalizer Limit	Configure Totalizer Limit Alert
	Diagnostic Status Alert	Configure Diagnostic Status Alert
	Reverse Flow Enable	Reverse Flow/Zero Flow
	Licensed Options	On/Off
	License Key	Field license advanced functionality
	Diagnostics Enable	Turn diagnostics On/Off
	8714i Setup	Configure test criteria parameters
	Re-signature Sensor	Base line sensor characteristics
	Recall Last Signature	Recall previous signature values
	Empty Pipe	Configure empty pipe diagnostic parameters
	Universal Auto Trim	In-process Sensor Calibration
	Low Flow Cutoff	0.01 ft/s to 1 ft/s
	Pulse Width	Pulse Width
	Analog Output Zero	4 mA Value
	Analog Output Test	Analog Output Loop Test
	Pulse Output Test	Pulse Output Loop Test
	Transmitter Test	Test the Transmitter
	4–20 mA Output Trim	Adjust the 4–20 mA Output
	Auto Zero	Zero Sensor for 37 Hz Coil Drive Operation
	Electronics Trim	Transmitter Calibration
Analog Output Range	Sets the desired 20 mA point – **must set the sensor size first**	
Pulse Output Scaling	Sets one pulse to a selectable number of volume units – **must set the sensor size first**	
Damping	Sets response time (single pole time constant), in seconds, to a step change in flow rate	
Transmitter Information	Allows you to view and change useful information about the transmitter and sensor	
Empty Pipe Tuning	Allowable range 3.0 - 2000.0	

DIAGNOSTIC MESSAGES

The following error messages may appear on the LOI screen. See "Maintenance and Troubleshooting" on page 6-1 for potential causes and corrective actions for these errors:

- Electronics Failure
- Coil open circuit
- Digital trim failure
- Auto zero failure
- Auto trim failure
- Flow rate >42 ft/sec
- Analog out of range
- PZR activated
- Empty pipe
- Reverse flow
- Reverse flow indicator
  (A flashing letter "R" on the LOI indicates a reverse flow)
- Totalizer indicator
  (A flashing letter "T" on the LOI indicates to totalizer is activated)

Review

Fast Keys	1, 5

The 8712 includes a capability that enables you to review the configuration variable settings.

The flowmeter configuration parameters set at the factory should be reviewed to ensure accuracy and compatibility with your particular application of the flowmeter.

NOTE
If you are using the LOI to review variables, each variable must be accessed as if you were going to change its setting. The value displayed on the LOI screen is the configured value of the variable.

PROCESS VARIABLES

Fast Keys	1, 1

The *process variables* measure 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

Process Variable (PV) – The actual measured flow rate in the line. Use the Process Variable 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.

Totalizer Setup – Provides a reading of the total flow of the flowmeter since the totalizer was last reset. The totalizer value should be zero during commissioning on the bench, and the units should reflect the volume units of the flow rate. If the totalizer value is not zero, it may need to be reset. This function also allows for configuration of the totalizer parameters.

Pulse Output – The pulse output variable provides the pulse value for the flow rate.

PV - Primary Variable

Fast Keys	1, 1, 1
LOI Key	FLOW RATE

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

PV -% Range

Fast Keys	1, 1, 2

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

PV - Analog Output

Fast Keys	1, 1, 3

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

Totalizer Setup

Fast Keys	1, 1, 4
LOI Key	AUX. FUNCTION

The *Totalizer Setup* menu allows for the viewing and configuration of the totalizer parameters.

Totalizer Units

Fast Keys	1, 1, 4, 1
LOI Key	AUX. FUNCTION

Totalizer units allow for the configuration of the units that the totalized value will be displayed as. These units are independent of the flow units.

Measured Gross Total

Fast Keys	1, 1, 4, 2
LOI Key	TOTALIZE

Measured gross total provides the output reading of the totalizer. This value is the amount of process fluid that has passed through the flowmeter since the totalizer was last reset.

NOTE
To reset the measured gross total value, the line size must be changed.

Measured Net Total

Fast Keys	1, 1, 4, 3
LOI Key	TOTALIZE

Measured net total provides the output reading of the totalizer. This value is the amount of process fluid that has passed through the flowmeter since the totalizer was last reset. When reverse flow is enabled, the net total represents the difference between the total flow in the forward direction less the total flow in the reverse direction.

Measured Reverse Total

Fast Keys	1, 1, 4, 4
LOI Key	TOTALIZE

Measured reverse total provides the output reading of the totalizer. This value is the amount of process fluid that has passed through the flowmeter in the reverse direction since the totalizer was last reset. This value is only totalized when reverse flow is enabled.

Start Totalizer

Fast Keys	1, 1, 4, 5
LOI Key	START/STOP

Start totalizer starts the totalizer counting from its current value.

Stop Totalizer

Fast Keys	1, 1, 4, 6
LOI Key	START/STOP

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

Fast Keys	1, 1, 4, 7
LOI Key	READ/RESET

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

NOTE
The totalizer value is saved in the Non-Volatile memory of the electronics every three seconds. Should power to the transmitter be interrupted, the totalizer value will start at the last saved value when power is re-applied.

Pulse Output

Fast Keys	1, 1, 5

The *Pulse Output* displays the current value of the pulse signal.

BASIC SETUP

Fast Keys	1, 3

The basic configuration functions of the Rosemount 8712 must be set for all applications of the transmitter in a magnetic flowmeter system. If your application requires the advanced functionality features of the Rosemount 8712, see Section 4 "Operation" of this manual.

Tag

Fast Keys	1, 3, 1
LOI Key	XMTR INFO

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

Fast Keys	1, 3, 2

Flow Units set the output units for the Primary Variable which controls the analog output of the transmitter.

Primary Variable Units

Fast Keys	1, 3, 2, 1
LOI Key	UNITS

The *Primary Variable Units* specifies the format in which the flow rate will be displayed. Units should be selected to meet your particular metering needs.

Table 3-3. Options for Flow Rate Units

• ft/sec	• B31/sec (1 Barrel = 31.5 gallons)
• m/sec	• B31/min (1 Barrel = 31.5 gallons)
• gal/sec	• B31/hr (1 Barrel = 31.5 gallons)
• gal/min	• B31/day (1 Barrel = 31.5 gallons)
• gal/hr	• lbs/sec
• gal/day	• lbs/min
• l/sec	• lbs/hr
• l/min	• lbs/day
• l/hr	• kg/sec
• l/day	• kg/min
• ft^3/sec	• kg/hr
• ft^3/min	• kg/day
• ft^3/hr	• (s)tons/min
• ft^3/day	• (s)tons/hr
• m^3/sec	• (s)tons/day
• m^3/min	• (m)tons/min
• m^3/hr	• (m)tons/hr
• m^3/day	• (m)tons/day
• Impgal/sec	• Special (User Defined, see "Special Units" on page 3-9)
• Impgal/min	
• 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)	

Special Units

Fast Keys	1, 3, 2, 2
LOI Key	AUX. FUNCTION

The Rosemount 8712 provides a selection of standard unit configurations that meet the needs of most applications (see "Flow Units" on page 3-8). If your application has special needs and the standard configurations do not apply, the Rosemount 8712 provides the flexibility to configure the transmitter in a custom-designed units format using the *special units* variable.

Special Volume Unit

Fast Keys	1, 3, 2, 2, 1

Special volume unit enables you to display the volume unit format to which you have converted the base volume units. For example, if the desired special units are cubic cm/min, the special volume variable can be represented as cc or cm3. The volume units variable is also used in totalizing the special units flow.

Base Volume Unit

Fast Keys	1, 3, 2, 2, 2

Base volume unit is the unit from which the conversion is being made. Set this variable to the appropriate option.

Conversion Number

Fast Keys	1, 3, 2, 2, 3

The special units *conversion number* is used to convert base units to special units. For a straight conversion of volume units from one to another, the conversion number is the number of base units in the new unit. For example, if you are converting from liters to cm3 and there are 0.001 liters in a cm3, the conversion factor is 0.001.

Base Time Unit

Fast Keys	1, 3, 2, 2, 4

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.

Special Flow Rate Unit

Fast Keys	1, 3, 2, 2, 5

Special flow rate unit is a format variable that provides a record of the units to which you are converting. The Handheld 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 8712 LOI will display the four character designation as configured.

Example

To display flow in cubic cm per minute, and one cm3 is equal to 0.001 liters, the procedure would be:

Set the Volume Unit to cm3 or cc.
Set the Base Volume Unit to liters.
Set the Input Conversion Number to 0.001.
Set the Time Base to Min.
Set the Rate Unit to CC/M.

Line Size

Fast Keys	1, 3, 3
LOI Key	TUBE SIZE

The *line size* (sensor size) must be set to match the actual sensor connected to the transmitter. The size must be specified in inches according to the available sizes listed below. If a value is entered from a control system or Handheld Communicator that does not match one of these figures, the value will go to the next highest option.

The line size (inches) options are as follows:

0.1, 0.15, 0.25, 0.30, 0.50, 0.75, 1, 1.5, 2, 2.5, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30, 32, 36, 40, 42, 44, 48, 54, 56, 60, 64, 72, 80

PV URV (Upper Range Value)

Fast Keys	1, 3, 4
LOI Key	ANALOG OUTPUT RANGE

The *upper range value* (URV), or analog output range, is preset to 30 ft/s at the factory. The units that appear will be the same as those selected under the units parameter.

The URV (20 mA point) can be set for both forward or reverse flow rate. Flow in the forward direction is represented by positive values and flow in the reverse direction is represented by negative values. The URV can be any value from –39.3 ft/s to +39.3 ft/s (-12 m/s to +12 m/s), as long as it is at least 1 ft/s (0.3 m/s) from the lower range value (4 mA point). The URV can be set to a value less than the lower range value. This will cause the transmitter analog output to operate in reverse, with the current increasing for lower (or more negative) flow rates.

NOTE
Line size, special units, and density must be selected prior to configuration of URV and LRV.

PV LRV (Lower Range Value)

Fast Keys	1, 3, 5
LOI Key	AUX. FUNCTION

Set the *lower range value* (LRV), or analog output zero, to change the size of the range (or span) between the URV and LRV. Under normal circumstances, the LRV should be set to a value near the minimum expected flow rate to maximize resolution. The LRV must be between
–39.3 ft/s to +39.3 ft/s (-12 m/s to +12 m/s).

NOTE
Line size, special units, and density must be selected prior to configuration of URV and LRV.

Example

If the URV is greater than the LRV, the analog output will saturate at 3.9 mA when the flow rate falls below the selected 4 mA point.

The minimum allowable span between the URV and LRV is 1 ft/s (0.3 m/s). Do not set the LRV within 1 ft/s (0.3 m/s) of the 20 mA point. For example, if the URV is set to 15.67 ft/s (4.8 m/s) and if the desired URV is greater than the LRV, then the highest allowable analog zero setting would be 14.67 ft/s (4.5 m/s). If the desired URV is less than the LRV, then the lowest allowable LRV would be 16.67 ft/s (5.1 m/s).

Calibration Number

Fast Keys	1, 3, 6
LOI Key	TUBE CAL NO.

The sensor *calibration number* is a 16-digit number used to identify sensors calibrated at the Rosemount factory. The calibration number is also printed inside the sensor terminal block or on the sensor name plate. The number provides detailed calibration information to the Rosemount 8712. To function properly within accuracy specifications, the number stored in the transmitter must match the calibration number on the sensor exactly.

NOTE
Sensors from manufacturers other than Rosemount Inc. can also be calibrated at the Rosemount factory. Check the sensor for Rosemount calibration tags to determine if a 16-digit calibration number exists for your sensor.

NOTE
Be sure the calibration number reflects a calibration to a Rosemount reference transmitter. If the calibration number was generated by a means other than a certified Rosemount flow lab, accuracy of the system may be compromised.

If your sensor is not a Rosemount sensor and was not calibrated at the Rosemount factory, contact your Rosemount representative for assistance.

If your sensor is imprinted with an eight-digit number or a k-factor, check in the sensor wiring compartment for the sixteen-digit calibration number. If there is no serial number, contact the factory for a proper conversion.

PV Damping

Fast Keys	1, 3, 7
LOI Key	DAMPING

Adjustable between 0.0 and 256 seconds

PV 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.

Section 4 Operation

INTRODUCTION

This section contains information for advanced configuration parameters and diagnostics.

The software configuration settings for the Rosemount 8712 can be accessed through a HART-based communicator, Local Operator Interface (LOI), or through a control system. The software functions for the HART Communicator are described in detail in this section of the manual. It provides an overview and summary of communicator functions. For more complete instructions, see the communicator manual. Before operating the Rosemount 8712 in an actual installation, you should review all of the factory set configuration data to ensure that they reflect the current application.

DIAGNOSTICS

HART Comm.	1, 2

Diagnostics are used to verify that the transmitter is functioning properly, to assist in troubleshooting, to identify potential causes of error messages, and to verify the health of the transmitter and sensor. Diagnostic tests can be initiated through the use of a HART-based communications device, the Local Operator Interface, or through the control system.

Rosemount offers several different diagnostic suites providing various functionality.

Standard diagnostics included with every Rosemount 8712 transmitter are Empty Pipe detection, Electronics Temperature monitoring, Coil Fault detection, and various loop and transmitter tests.

Advanced diagnostics suite option one (DA1 option) contains advanced diagnostics for High Process Noise detection and Grounding and Wiring fault detection.

Advanced diagnostics suite option two (DA2 option) contains advanced diagnostics for the 8714i Meter Verification. This diagnostic is used to verify the accuracy and performance of the magnetic flowmeter installation.

Diagnostic Controls

HART Comm.	1, 2, 1
LOI Key	AUX. FUNCTION

The diagnostic controls menu provides a centralized location for enabling or disabling each of the diagnostics that are available. Note that for some diagnostics to be available, a diagnostics suite package is required.

Empty Pipe

HART Comm.	1, 2, 1, 1

Turn the empty pipe diagnostic on or off as required by the application. For more details on the empty pipe diagnostic, see Appendix C: "Diagnostics".

High Process Noise

HART Comm.	1, 2, 1, 2

Turn the high process noise diagnostic on or off as required by the application. For more details on the high process noise diagnostic, see Appendix C: "Diagnostics".

Grounding / Wiring

HART Comm.	1, 2, 1, 3

Turn the grounding / wiring diagnostic on or off as required by the application. For more details on the grounding / wiring diagnostic, see Appendix C: "Diagnostics".

Electronics Temperature

HART Comm.	1, 2, 1, 4

Turn the electronics temperature diagnostic on or off as required by the application. For more details on the electronics temperature diagnostic, see Appendix C: "Diagnostics".

Basic Diagnostics

HART Comm.	1, 2, 2

The basic diagnostics menu contains all of the standard diagnostics and tests that are available in the 8712 transmitter.

Self Test

HART Comm.	1, 2, 2, 1
LOI Key	AUX. FUNCTION

The transmitter test initiates a series of diagnostic tests that are not performed continuously during normal operation. It performs the following tests:

- Display Test
- RAM Test
- PROM Test

During the entire test, all outputs respond to flow signal. The test requires about ten seconds to complete.

AO Loop Test

HART Comm.	1, 2, 2, 2
LOI Key	AUX. FUNCTION

The AO Loop test allows you to drive the transmitter output to a desired electrical current output on terminals 1 and 2. The user then has the ability to independently measure the actual loop current against the desired level set by the transmitter. On the LOI, the test will end after five minutes if the transmitter is not returned to normal operation manually.

4 mA

HART Comm.	1, 2, 2, 2, 1

Fix the analog loop current at 4 mA.

20 mA

HART Comm.	1, 2, 2, 2, 2

Fix the analog loop current at 20 mA.

Simulate Alarm

HART Comm.	1, 2, 2, 2, 3

Send the analog output into an alarm mA value. Actual mA value depends on the alarm configuration.

- Rosemount Standard High Alarm – 22.6 mA
- Rosemount Standard Low Alarm – 3.75 mA
- Namur Compliant High Alarm – 22.6 mA
- Namur Compliant Low Alarm – 3.5 mA

Other

HART Comm.	1, 2, 2, 2, 4

Fix the analog loop current to some other mA value between 3.5 mA and 23.0 mA.

End

HART Comm.	1, 2, 2, 2, 5

This command cancels the analog loop test and returns the analog output back into normal operating mode.

Pulse Output Loop Test

HART Comm.	1, 2, 2, 3
LOI Key	AUX. FUNCTION

The Pulse Output Loop Test allows you to drive the frequency output at terminals 3 and 4 to a desired value. The user then has the ability to compare the pulse output value measured by auxiliary equipment to the desired pulse output level set by the transmitter. On the LOI the test will end after five minutes if the transmitter is not returned to normal operation manually.

Select Value

HART Comm.	1, 2, 2, 3, 1

Set the value of the pulse output for the test to a value between 1 pulse/day to 10,000 Hz.

End

HART Comm.	1, 2, 2, 3, 2

This command cancels the pulse output loop test and returns the pulse output back into normal operating mode.

Tune Empty Pipe

HART Comm.	1, 2, 2, 4
LOI Key	AUX. FUNCTION

Empty Pipe allows you to view the current value and configure the diagnostic parameters. For more detail on this parameter see Appendix C: "Diagnostics".

Empty Pipe Value

HART Comm.	1, 2, 2, 4, 1
LOI Key	AUX. FUNCTION

Read the current Empty Pipe Value. This number is a unitless number and is calculated based on multiple installation and process variables. For more detail on this parameter see Appendix C: "Diagnostics".

Empty Pipe Trigger Level

HART Comm.	1, 2, 2, 4, 2
LOI Key	AUX. FUNCTION

Limits: 3 to 2000

Configure the threshold limit that the empty pipe value must exceed before the diagnostic alert activates. Default from the factory is set to 100. For more detail on this parameter see Appendix C: "Diagnostics".

Empty Pipe Counts

HART Comm.	1, 2, 2, 4, 3
LOI Key	AUX. FUNCTION

Limits: 5 to 50

Configure the number of consecutive times that the empty pipe value must exceed the empty pipe trigger level before the diagnostic alert activates. Counts are taken at 1.5 second intervals. Default from the factory is set to 5. For more detail on this parameter see Appendix C: "Diagnostics".

Electronics Temperature

HART Comm.	1, 2, 2, 5
LOI Key	XMTR INFO

Electronics Temperature allows you to view the current value for the electronics temperature.

Flow Limit 1

HART Comm.	1, 2, 2, 6
LOI Key	AUX. FUNCTION

Configure the Parameters that will determine the criteria for activating 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), or if this functionality has been licensed in the field.

Control 1

HART Comm.	1, 2, 2, 6, 1

Turns the Flow Limit 1 ON or OFF.

ON – The transmitter will generate a HART alert when the defined conditions are met. If a digital output is configured for Flow Limit 1, the digital output will activate when the conditions for mode 1 are met.

OFF – The transmitter will not generate a HART alert for the Flow Limit 1.

Mode 1

HART Comm.	1, 2, 2, 6, 2

Mode that determines when the Flow Limit 1 HART Alert will activate.

> High Limit – The HART Alert will activate when the measured flow rate exceeds the High Limit 1 set point.

< Low Limit – The HART Alert will activate when the measured flow rate falls below the Low Limit 1 set point.

In Range – The HART Alert will activate when the measured flow rate is between the High Limit 1 and Low Limit 1 set points.

Out of Range – The HART Alert will activate when the measured flow rate exceeds the High Limit 1 set point or falls below the Low Limit 1 set point.

High Limit 1

HART Comm.	1, 2, 2, 6, 3

Set the flow rate value that corresponds to the high limit set point for the Flow Limit 1 alert.

Low Limit 1

HART Comm.	1, 2, 2, 6, 4

Set the flow rate value that corresponds to the low limit set point for the Flow Limit 1 alert.

Flow Limit Hysteresis

HART Comm.	1, 2, 2, 6, 5

Set the hysteresis band for the flow limit to determine how quickly the transmitter comes out of Alert status. This hysteresis value is used for both Flow Limit 1 and Flow Limit 2.

Flow Limit 2

HART Comm.	1, 2, 2, 7
LOI Key	AUX. FUNCTION

Configure the Parameters that will determine the criteria for activating 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), or if this functionality has been licensed in the field. If a digital output is configured for Flow Limit 1, the digital output will activate when the conditions for mode 1 are met.

Control 2

HART Comm.	1, 2, 2, 7, 1

Turns the Flow Limit 2 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 Flow Limit 2.

Mode 2

HART Comm.	1, 2, 2, 7, 2

Mode that determines when the Flow Limit 2 HART Alert will activate.

> High Limit – The HART Alert will activate when the measured flow rate exceeds the High Limit 2 set point.

< Low Limit – The HART Alert will activate when the measured flow rate falls below the Low Limit 2 set point.

In Range – The HART Alert will activate when the measured flow rate is between the High Limit 2 and Low Limit 2 set points.

Out of Range – The HART Alert will activate when the measured flow rate exceeds the High Limit 2 set point or falls below the Low Limit 2 set point.

High Limit 2

HART Comm.	1, 2, 2, 7, 3

Set the flow rate value that corresponds to the high limit set point for the Flow Limit 2 alert. If a digital output is configured for Flow Limit 1, the digital output will activate when the conditions for mode 1 are met.

Low Limit 2

HART Comm.	1, 2, 2, 7, 4

Set the flow rate value that corresponds to the low limit set point for the Flow Limit 2 alert.

Flow Limit Hysteresis

HART Comm.	1, 2, 2, 7, 5

Set the hysteresis band for the flow limit to determine how quickly the transmitter comes out of Alert status. This hysteresis value is used for both Flow Limit 1 and Flow Limit 2.

Total Limit

HART Comm.	1, 2, 2, 8

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 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), or if this functionality has been licensed in the field.

Total Control

HART Comm.	1, 2, 2, 8, 1

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

HART Comm.	1, 2, 2, 8, 2

Mode that determines when the Total Limit HART Alert will activate.

> High Limit – The HART Alert will activate when the measured net total exceeds the Total High Limit set point.

< Low Limit – The HART Alert will activate when the measured net total falls below the Total Low Limit set point.

In Range – The HART Alert will activate when the measured net total is between the Total High Limit and Total Low Limit set points.

Out of Range – The HART Alert will activate when the measured net total exceeds the Total High Limit set point or falls below the Total Low Limit set point.

Total High Limit

HART Comm.	1, 2, 2, 8, 3

Set the net total value that corresponds to the high limit set point for the Flow Limit 1 alert.

Total Low Limit

HART Comm.	1, 2, 2, 8, 4

Set the net total value that corresponds to the low limit set point for the Flow Limit 1 alert.

Total Limit Hysteresis

HART Comm.	1, 2, 2, 8, 5

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

Advanced Diagnostics

HART Comm.	1, 2, 3

The advanced diagnostics menu contains information on all of the additional diagnostics and tests that are available in the 8712 transmitter if one of the diagnostics suite packages was ordered.

Rosemount offers two advanced diagnostic suites. Functionality under this menu will depend on which of these suites are ordered.

Advanced diagnostics suite option one (DA1 option) contains advanced diagnostics for High Process Noise detection and Grounding and Wiring fault detection.

Advanced diagnostics suite option two (DA2 option) contains advanced diagnostics for the 8714i Meter Verification. This diagnostic is used to verify the accuracy and performance of the magnetic flowmeter installation.

8714i Meter Verification

HART Comm.	1, 2, 3, 1
LOI Key	AUX. FUNCTION

This diagnostic allows you to test and verify that the sensor, transmitter, or both are working within specifications. For more details on this diagnostic, see Appendix C: "Diagnostics".

Run 8714i

HART Comm.	1, 2, 3, 1, 1
LOI Key	AUX. FUNCTION

Run the meter verification test to check the transmitter, sensor, or entire installation.

Full Meter Verification

HART Comm.	1, 2, 3, 1, 1, 1

Run the internal meter verification to validate the entire installation, sensor and transmitter at the same time.

Transmitter Only

HART Comm.	1, 2, 3, 1, 1, 2

Run the internal meter verification to validate the transmitter only.

Sensor Only

HART Comm.	1, 2, 3, 1, 1, 3

Run the internal meter verification to validate the sensor only.

8714i Results

HART Comm.	1, 2, 3, 1, 2
LOI Key	XMTR INFO

Review the results of the most recently performed 8714i Meter Verification test. Information in this section details the measurements taken and if the meter passed the verification test. For more details on these results and what they mean, see Appendix C: "Diagnostics".

Test Condition

HART Comm.	1, 2, 3, 1, 2, 1

Displays the conditions that the 8714i Meter Verification test was performed under. For more details on this parameter see Appendix C: "Diagnostics".

Test Criteria

HART Comm.	1, 2, 3, 1, 2, 2

Displays the criteria that the 8714i Meter Verification test was performed against. For more details on this parameter see Appendix C: "Diagnostics".

8714i Test Result

HART Comm.	1, 2, 3, 1, 2, 3

Displays the results of the 8714i Meter Verification test as pass or fail. For more details on this parameter see Appendix C: "Diagnostics".

Simulated Velocity

HART Comm.	1, 2, 3, 1, 2, 4

Displays the test velocity used to verify transmitter calibration. For more details on this parameter see Appendix C: "Diagnostics".

Actual Velocity

HART Comm.	1, 2, 3, 1, 2, 5

Displays the velocity measured by the transmitter during the transmitter calibration verification test. For more details on this parameter see Appendix C: "Diagnostics".

Velocity Deviation

HART Comm.	1, 2, 3, 1, 2, 6

Displays the deviation of the transmitter calibration verification test. For more details on this parameter see Appendix C: "Diagnostics".

Transmitter Calibration Test Result

HART Comm.	1, 2, 3, 1, 2, 7

Displays the result of the transmitter calibration verification test as pass or fail. For more details on this parameter see Appendix C: "Diagnostics".

Sensor Calibration Deviation

HART Comm.	1, 2, 3, 1, 2, 8

Displays the deviation of the sensor calibration verification test. For more details on this parameter see Appendix C: "Diagnostics".

Sensor Calibration Test Result

HART Comm.	1, 2, 3, 1, 2, 9

Displays the result of the sensor calibration verification test as pass or fail. For more details on this parameter see Appendix C: "Diagnostics".

Coil Circuit Test Result

HART Comm.	1, 2, 3, 1, 2, 10

Displays the result of the coil circuit test as pass or fail. For more details on this parameter see Appendix C: "Diagnostics".

Electrode Circuit Test Result

HART Comm.	1, 2, 3, 1, 2, 11

Displays the result of the electrode circuit test as pass or fail. For more details on this parameter see Appendix C: "Diagnostics".

NOTE
To access the coil circuit test result and electrode circuit test result, you must scroll to this option in the HART Field Communicator.

Sensor Signature

HART Comm.	1, 2, 3, 1, 3
LOI Key	AUX. FUNCTION

The sensor signature describes the sensor characteristics to the transmitter and is an integral part of the sensor meter verification test. From this menu you can view the current stored signature, have the transmitter take and store the sensor signature, or re-call the last saved good values for the sensor signature. For more details on this parameter see Appendix C: "Diagnostics".

Signature Values

HART Comm.	1, 2, 3, 1, 3, 1
LOI Key	XMTR INFO

Review the current values stored for the sensor signature. For more details on this parameter see Appendix C: "Diagnostics".

Coil Resistance

HART Comm.	1, 2, 3, 1, 3, 1, 1

View the base line value for the coil resistance taken during the sensor signature process.

Coil Signature

HART Comm.	1, 2, 3, 1, 3, 1, 2

View the base line value for the coil signature taken during the sensor signature process.

Electrode Resistance

HART Comm.	1, 2, 3, 1, 3, 1, 3

View the base line value for the electrode resistance taken during the sensor signature process.

Re-Signature Meter

HART Comm.	1, 2, 3, 1, 3, 2
LOI Key	AUX. FUNCTION

Have the transmitter measure and store the sensor signature values. These values will then be used as the baseline for the meter verification test. Use this when connecting to older Rosemount or another manufacturers sensors, or installing the magnetic flowmeter system for the first time. For more details on this parameter see Appendix C: "Diagnostics".

Recall Last Saved Values

HART Comm.	1, 2, 3, 1, 3, 3
LOI Key	AUX. FUNCTION

Recalls the last saved "good" values for the sensor signature.

Set Pass/Fail Criteria

HART Comm.	1, 2, 3, 1, 4
LOI Key	AUX. FUNCTION

Set the maximum allowable deviation percentage test criteria for the 8714i Internal Meter Verification test. There are three tests that this criteria can be set for:

- Full Pipe; No Flow (Best test condition) – Default is 2%
- Full Pipe; Flowing – Default is 3%
- Empty Pipe – Default is 5%

NOTE
If the 8714i Meter Verification test is done with an empty pipe, the electrode circuit will NOT be tested.

No Flow Limit

HART Comm.	1, 2, 3, 1, 4, 1

1 to 10 percent

Set the pass/fail test criteria for the 8714i Meter Verification test at Full Pipe, No Flow conditions.

Flowing Limit

HART Comm.	1, 2, 3, 1, 4, 2

1 to 10 percent

Set the pass/fail test criteria for the 8714i Meter Verification test at Full Pipe, Flowing conditions.

Empty Pipe Limit

HART Comm.	1, 2, 3, 1, 4, 3

1 to 10 percent

Set the pass/fail test criteria for the 8714i Meter Verification test at Empty Pipe conditions.

Measurements

HART Comm.	1, 2, 3, 1, 5
LOI Key	XMTR INFO

View the measured values taken during the meter verification test. Values are shown for the Coil Resistance, Coil Signature, and Electrode Resistance.

Coil Resistance

HART Comm.	1, 2, 3, 1, 5, 1

View the measured value for the coil resistance taken during the 8714i meter verification test.

Coil Signature

HART Comm.	1, 2, 3, 1, 5, 2

View the measured value for the coil signature taken during the 8714i meter verification test.

Electrode Resistance

HART Comm.	1, 2, 3, 1, 5, 3

View the measured value for the electrode resistance taken during the 8714i meter verification test.

Licensing

HART Comm.	1, 2, 3, 2
LOI Key	AUX. FUNCTION

If a diagnostic suite or the auxiliary output option was not ordered initially, these features can be licensed in the field. Access the licensing information from this menu. For more details on licensing, see Appendix C: "Diagnostics".

License Status

HART Comm.	1, 2, 3, 2, 1

Determine what capabilities have been licensed, and are available for activation.

License Key

HART Comm.	1, 2, 3, 2, 2

A license key is required to activate features in the field if the desired functionality was not initially ordered. This menu allows for gathering of necessary data to generate a license key and also the ability to enter the license key once it has been received.

Device ID

HART Comm.	1, 2, 3, 2, 2, 1

This function displays the Device ID and Software Revision for the transmitter. Both of these pieces of information are required to generate a license key.

License Key

HART Comm.	1, 2, 3, 2, 2, 2

Allows you to enter a license key to activate the desired functionality.

Diagnostic Variable Values

HART Comm.	1, 2, 4
LOI Key	XMTR INFO

From this menu, all of the diagnostic variable values can be reviewed. This information can be used to get more information about the transmitter, sensor, and process, or to get more detail about an alert that may have activated.

Empty Pipe Value

HART Comm.	1, 2, 4, 1

Read the current value of the Empty Pipe parameter. This value will read zero if Empty Pipe is turned off.

Electronics Temperature

HART Comm.	1, 2, 4, 2

Read the current value of the Electronics Temperature.

Line Noise

HART Comm.	1, 2, 4, 3

Read the current value of the amplitude of AC line noise measured on the transmitter's electrode inputs. This value is used in the grounding / wiring diagnostic.

5 Hz Signal to Noise Ratio

HART Comm.	1, 2, 4, 4

Read the current value of the signal to noise ratio at 5 Hz. For optimum performance, a value greater than 50 is preferred. Values less than 25 will cause the High Process Noise alert to activate.

37 Hz Signal to Noise Ratio

HART Comm.	1, 2, 4, 5

Read the current value of the signal to noise ratio at 37.5 Hz. For optimum performance, a value greater than 50 is preferred. Values less than 25 will cause the High Process Noise alert to activate.

Signal Power

HART Comm.	1, 2, 4, 6

Read the current value of the velocity of the fluid through the sensor. Higher velocities result in greater signal power.

8714i Results

HART Comm.	1, 2, 4, 7

Review the results of the 8714i Meter Verification tests. For more details on these results and what they mean, see Appendix C: "Diagnostics".

Test Condition

HART Comm.	1, 2, 3, 7, 1

Displays the conditions that the 8714i Meter Verification test was performed under. For more details on this parameter see Appendix C: "Diagnostics".

Test Criteria

HART Comm.	1, 2, 3, 7, 2

Displays the criteria that the 8714i Meter Verification test was performed against. For more details on this parameter see Appendix C: "Diagnostics".

8714i Test Result

HART Comm.	1, 2, 3, 7, 3

Displays the results of the 8714i Meter Verification test as pass or fail. For more details on this parameter see Appendix C: "Diagnostics".

Simulated Velocity

HART Comm.	1, 2, 3, 7, 4

Displays the test velocity used to verify transmitter calibration. For more details on this parameter see Appendix C: "Diagnostics".

Actual Velocity

HART Comm.	1, 2, 3, 7, 5

Displays the velocity measured by the transmitter during the transmitter calibration verification test. For more details on this parameter see Appendix C: "Diagnostics".

Velocity Deviation

HART Comm.	1, 2, 3, 7, 6

Displays the deviation of the transmitter calibration verification test. For more details on this parameter see Appendix C: "Diagnostics".

Transmitter Verification Test Result

HART Comm.	1, 2, 3, 7, 7

Displays the result of the transmitter calibration verification test as pass or fail. For more details on this parameter see Appendix C: "Diagnostics".

Sensor Verification Deviation

HART Comm.	1, 2, 3, 7, 8

Displays the deviation of the sensor calibration verification test. For more details on this parameter see Appendix C: "Diagnostics".

Sensor Verification Result

HART Comm.	1, 2, 3, 7, 9

Displays the result of the sensor calibration verification test as pass or fail. For more details on this parameter see Appendix C: "Diagnostics".

Coil Circuit Test Result

HART Comm.	1, 2, 3, 7, 10

Displays the result of the coil circuit test as pass or fail. For more details on this parameter see Appendix C: "Diagnostics".

Electrode Circuit Test Result

HART Comm.	1, 2, 3, 7, 11

Displays the result of the electrode circuit test as pass or fail. For more details on this parameter see Appendix C: "Diagnostics".

NOTE
To access the coil circuit test result and electrode circuit test result, you must scroll to this option in the HART Field Communicator.

Trims

HART Comm.	1, 2, 5
LOI Key	AUX. FUNCTION

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.

D/A Trim

HART Comm.	1, 2, 5, 1
LOI Key	AUX. FUNCTION

The D/A Trim is used to calibrate the 4-20 mA 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 4–20 mA loop.
3. Initiate the D/A Trim function with the LOI or Handheld Communicator.
4. Enter the 4 mA meter value when prompted to do so.
5. Enter the 20 mA meter value when prompted to do so.
6. Return the loop to automatic control, if necessary.

The 4–20 mA trim is now complete. You may repeat the 4–20 mA trim to check the results, or use the analog output test.

Scaled D/A Trim

HART Comm.	1, 2, 5, 2
LOI Key	AUX. FUNCTION

Scaled D/A trim enables you to calibrate the flowmeter analog output using a different scale than the standard 4-20 mA 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 allows you to trim the flowmeter using a scale that may be more convenient based upon your method of measurement.

For example, it may be more convenient for you to make current measurements by direct voltage readings across the loop resistor. If your loop resistor is 500 ohms, and you want to calibrate the meter using voltage measurements made across this resistor, you could rescale your trim points from 4-20mA to 4-20mA x 500 ohm or 2-10 VDC. Once your scaled trim points have been entered as 2 and 10, you can calibrate your flowmeter by entering voltage measurements directly from the voltmeter.

Digital Trim

HART Comm.	1, 2, 5, 3
LOI Key	AUX. FUNCTION

Digital trim is the function by which the factory calibrates the transmitter. This procedure is rarely needed by users. It is only necessary if you suspect the Rosemount 8712 is 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. Digital trim must be performed only with the coil drive mode set to 5 Hz 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 power down the Rosemount 8712 to clear the message.

To simulate a nominal sensor with the Rosemount 8714D Calibration Standard, you must change the following four parameters in the Rosemount 8712:

1. Tube Calibration Number—1000015010000000
2. Units—ft/s
3. PV URV—20 mA = 30.00 ft/s
4. PV LRV—4 mA = 0 ft/s
5. Coil Drive Frequency—5 Hz

The instructions for changing the Sensor Calibration Number, Units, PV URV, and PV LRV are located in "Basic Setup" on page 3-8. Instructions for changing the Coil Drive Frequency can be found on page 4-16 in this section.

Set the loop to manual, if necessary, before you begin. 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 Calibration Standard 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 Handheld Communicator. The digital trim takes about 90 seconds to complete. No transmitter adjustments are required.

Auto Zero

HART Comm.	1, 2, 5, 4
LOI Key	AUX. FUNCTION

The auto zero function initializes the transmitter for use with the 37 Hz coil drive mode only. Run this function only with the transmitter and sensor installed in the process. The sensor must be filled with process fluid at zero flow. Before running the auto zero function, be sure the coil drive mode is set to 37 Hz (Auto Zero will not run with the coil drive frequency set at 5 Hz).

Set the loop to manual if necessary and begin the auto zero procedure. The transmitter completes the procedure automatically in about 90 seconds. A symbol appears in the lower right-hand corner of the display to indicate that the procedure is running.

Universal Trim

HART Comm.	1, 2, 5, 5
LOI Key	AUX. FUNCTION

The universal auto trim function enables the Rosemount 8712 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 your Rosemount sensor has a 16-digit calibration number, in-process calibration is not required. If it does not, or if your sensor is made by another manufacturer, complete the following steps for in-process calibration.

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.

Status

HART Comm.	1, 2, 6
LOI Key	XMTR INFO

Status displays a summary of the health of the transmitter. If there are any alerts or error messages that have activated, they will be listed here.

ADVANCED CONFIGURATION

In addition to the basic configuration options and the diagnostic information and controls, the 8712 has many advanced functions that can also be configured as required by the application.

DETAILED SETUP

HART Comm.	1, 4

The detailed setup function provides access to other parameters within the transmitter that can be configured such as coil drive frequency, output parameters, local display configuration, and other general information about the device.

Additional Parameters

HART Comm.	1, 4, 1

The additional parameters menu provides a means to configure optional parameters within the 8712 transmitter.

Coil Drive Frequency

HART Comm.	1, 4, 1, 1
LOI Key	AUX. FUNCTION

Coil drive frequency allows pulse-rate selection of the sensor 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 output, increase the coil drive frequency to 37 Hz. If the 37 Hz mode is selected, perform the auto zero function.

Density Value

HART Comm.	1, 4, 1, 2
LOI Key	AUX. FUNCTION

The density value is used to convert from a volumetric flow rate to a mass flow rate using the following equation:

$Q_m = Q_v$ 3 r

Where:

Q_m is the mass flow rate

Q_v is the volumetric flow rate, and

r is the fluid density

PV Upper Sensor Limit (USL)

HART Comm.	1, 4, 1, 3

The PV USL is the maximum value that the 20 mA value can be set to. This is the upper measuring limit of the transmitter and sensor.

PV Lower Sensor Limit (LSL)

HART Comm.	1, 4, 1, 4

The PV LSL is the minimum value that the 4 mA value can be set to. This is the lower measuring limit of the transmitter and sensor.

PV Minimum Span

HART Comm.	1, 4, 1, 5

The PV minimum span is the minimum flow range that must separate the 4 mA and 20 mA set point values.

Configure Outputs

HART Comm.	1, 4, 2

The configure outputs functionality contains functionality to configure the more advanced features that control the analog, pulse, auxiliary, and totalizer outputs of the transmitter.

Analog Output

HART Comm.	1, 4, 2, 1

Under this function the advanced features of the analog output can be configured.

PV Upper Range Value (URV)

HART Comm.	1, 4, 2, 1, 1
LOI Key	ANALOG OUTPUT RANGE

The upper range value (URV), or analog output range, is preset to 30 ft/s at the factory. The units that appear will be the same as those selected under the units parameter.

The URV (20 mA point) can be set for both forward or reverse flow rate. Flow in the forward direction is represented by positive values and flow in the reverse direction is represented by negative values. The URV can be any value from –39.3 ft/s to +39.3 ft/s (-12 m/s to +12 m/s), as long as it is at least 1 ft/s (0.3 m/s) from the lower range value (4 mA point). The URV can be set to a value less than the lower range value. This will cause the transmitter analog output to operate in reverse, with the current increasing for lower (or more negative) flow rates.

NOTE
Line size, special units, and density must be selected prior to configuration of URV and LRV.

PV Lower Range Value (LRV)

HART Comm.	1, 4, 2, 1, 2
LOI Key	AUX. FUNCTION

The lower range value (LRV) is preset to 0 ft/s at the factory. The units that appear will be the same as those selected under the units parameter.

Reset the lower range value (LRV), or analog output zero, to change the size of the range (or span) between the URV and LRV. Under normal circumstances, the LRV should be set to a value near the minimum expected flow rate to maximize resolution. The LRV must be between –39.3 ft/s to +39.3 ft/s (-12 m/s to +12 m/s).

NOTE
The LRV can be set to a value greater than the URV, which will cause the analog output to operate in reverse. In this mode, the analog output will increase with lower (more negative) flow rates.

Example

If the URV is greater than the LRV, the analog output will saturate at 3.9 mA when the flow rate falls below the selected 4 mA point. The minimum allowable span between the URV and LRV is 1 ft/s. Do not set the LRV within 1 ft/s (0.3 m/s) of the 20 mA point. For example, if the URV is set to 15.67 ft/s (4.8 m/s) and if the desired URV is greater than the LRV, then the highest allowable analog zero setting would be 14.67 ft/s (4.5 m/s). If the desired URV is less than the LRV, then the lowest allowable LRV would be 16.67 ft/s (5.1 m/s).

NOTE
Line size, special units, and density must be selected prior to configuration of URV and LRV.

PV Analog Output

HART Comm.	1, 4, 2, 1, 3

The PV analog output displays the current analog output value (mA) of the transmitter corresponding to the current measured flow rate.

Analog Output Alarm Type

HART Comm.	1, 4, 2, 1, 4

The analog output alarm type displays the alarm mode the 8712 is currently set for. This value is set by a switch on the electronics board. There are two available options for this setting:

- High
- Low

Loop Test

HART Comm.	1, 4, 2, 1, 5
LOI Key	AUX. FUNCTION

The loop test allows you to drive the transmitter output to a desired electrical current output on terminals 1 and 2. This capability allows you to check the entire current loop prior to start-up. On the LOI the test will end after five minutes if the transmitter is not returned to normal operation manually.

D/A Trim

HART Comm.	1, 4, 2, 1, 6
LOI Key	AUX. FUNCTION

The D/A Trim is used to calibrate the 4-20 mA 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 4–20 mA loop.
3. Initiate the Output Trim function with the LOI or Handheld Communicator.
4. Enter the 4 mA meter value when prompted to do so.
5. Enter the 20 mA meter value when prompted to do so.
6. Return the loop to automatic control, if necessary.

The 4–20 mA trim is now completed. You may repeat the 4–20 mA trim to check the results, or use the analog output test.

Scaled D/A Trim

HART Comm.	1, 4, 2, 1, 7
LOI Key	AUX. FUNCTION

Scaled D/A trim enables you to calibrate the flowmeter analog output using a different scale than the standard 4-20 mA 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 allows you to trim the flowmeter using a scale that may be more convenient based upon your method of measurement.

For example, it may be more convenient for you to make current measurements by direct voltage readings across the loop resistor. If your loop resistor is 500 ohms, and you want to calibrate the meter using voltage measurements made across this resistor, you could rescale your trim points from 4-20mA to 4-20mA x 500 ohm or 2-10 VDC. Once your scaled trim points have been entered as 2 and 10, you can calibrate your flowmeter by entering voltage measurements directly from the voltmeter.

Alarm Level

HART Comm.	**1, 4, 2, 1, 8**

The alarm level allows you to drive the transmitter to preset values if an alarm occurs. There are two options:

- Rosemount Alarm and Saturation Values
- NAMUR-Compliant Alarm and Saturation Levels

Table 4-1. Rosemount (Standard) Alarm and Saturation Values

Level	4-20 mA Saturation	4-20 mA Alarm
Low	3.9 mA	≤3.75 mA
High	20.8 mA	≥22.6 mA

Table 4-2. NAMUR-Compliant Alarm and Saturation Values

Level	4-20 mA Saturation	4-20 mA Alarm
Low	3.8 mA	≤3.5 mA
High	20.5 mA	≥22.6 mA

Pulse Output

HART Comm.	**1, 4, 2, 2**
LOI Key	**AUX. FUNCTION**

Under this function the pulse output of the 8712 can be configured.

Pulse Scaling

HART Comm.	**1, 4, 2, 2, 1**
LOI Key	**PULSE OUTPUT SCALING**

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 rate 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 10,000 Hz.

When selecting pulse output scaling, remember that the maximum pulse rate is 10,000 Hz. With the 110 percent overrange capability, the absolute limit is 11,000 Hz. For example, if you want the Rosemount 8712 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:

$$\frac{10,000\,\text{gal}}{1\,\text{min}} \times \frac{}{60\,\text{sec}} \times \frac{1\,\text{pulse}}{0.01\,\text{gal}} = \mathbf{16666.7\ Hz}$$

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 counter external frequency.

NOTE
For totalizing on the LOI, ten digits are available.

Pulse Width

HART Comm.	1, 4, 2, 2, 2
LOI Key	AUX. FUNCTION

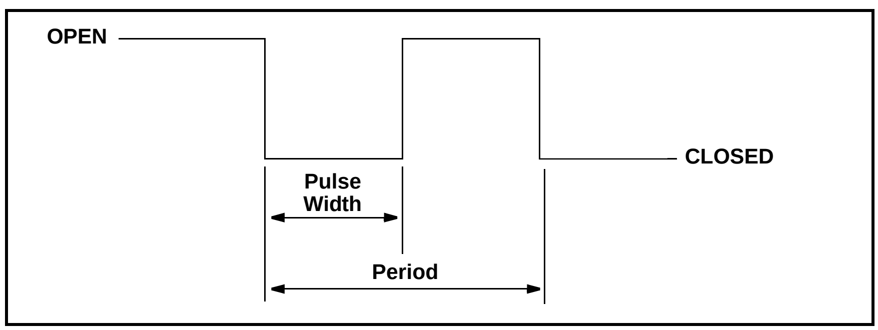
The factory default pulse width is 0.5 ms.

The width, or duration, of the pulse width can be adjusted to match the requirements of different counters or controllers (see Figure 4-1 on page 4-21). 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.

If the pulse width is set too wide (more than 1/2 the period of the pulse) the transmitter will automatically default to a pulse width of 50% duty cycle.

Figure 4-1. 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 percent 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 10,000 Hz at 10,000 gpm.

$$\text{Pulse Scaling} = \frac{\text{Flow Rate (gpm)}}{(60\text{ s/min})(\text{Frequency})}$$

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

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

$$1\text{ Pulse} = 0.0167\text{ gallon}$$

NOTE
Changes to pulse width are only required when there is a minimum pulse width required for external counters, relays, etc. If frequency generated by the transmitter requires a smaller pulse width than the pulse width selected, the transmitter will automatically go to 50% duty cycle.

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 5.833 Hz.

$$\text{Frequency} = \frac{\text{Flow Rate (gpm)}}{(60\text{ s/min})(\text{Pulse Scaling gal/pulse})}$$

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

$$\text{Frequency} = 5.833\text{ Hz}$$

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.

$$\text{Pulse Scaling} = \frac{\text{Flow Rate (gpm)}}{(60\text{ s/min})(\text{Frequency})}$$

$$= \frac{3000\text{ gpm}}{(60\text{ s/min})(10{,}000\text{Hz})}$$

$$= 0.005\text{ gal/pulse}$$

$$1\text{ Pulse} = 0.005\text{ gallon}$$

Pulse Output Loop Test

HART Comm.	1, 4, 2, 2, 3
LOI Key	AUX. FUNCTION

The Pulse Output Loop Test allows you to drive the frequency output at terminals 3 and 4 to a desired value. This capability allows you to check auxiliary equipment prior to start-up. On the LOI the test will end after five minutes if the transmitter is not returned to normal operation manually.

Digital Input / Digital Output

HART Comm.	1, 4, 2, 3
LOI Key	AUX. FUNCTION

This menu is used to configure the optional digital input and digital output parameters of the 8712 transmitter. Note that this configuration option is only active if the auxiliary output suite (option code AX) was ordered or licensed in the field.

DI/DO 1

HART Comm.	1, 4, 2, 3, 1

Configure the auxiliary output channel 1. This controls the auxiliary channel 1 of the transmitter on terminals 9(+) and 10(-). Note that the transmitter must have been ordered with the auxiliary output option (Model Code AX) or have been licensed in the field in order to have access to this functionality.

Configure I/O 1

HART Comm.	1, 4, 2, 3, 1, 1

Configure channel 1 for either an Input or an Output.

Input – Channel 1 will be configured as a discrete input. Options are:

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.

Output – Channel 1 will be configured as a discrete output. Options are:

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.

DIO 1 Control

HART Comm.	1, 4, 2, 3, 1, 2

Displays the configuration for Channel 1 as either a discrete Input or Output.

Digital Input 1

HART Comm.	1, 4, 2, 3, 1, 3

Displays what digital input Channel 1 will be set to when the Control for Channel 1 is set to Input.

Digital Output 1

HART Comm.	1, 4, 2, 3, 1, 4

Displays what digital output Channel 1 will be set to when the Control for Channel 1 is set to Output.

DO 2

HART Comm.	1, 4, 2, 3, 2

Configure the digital output value here. This controls the digital output from the transmitter on terminals 16(+) and 20(-). There are four options that the digital output can be configured for:

- 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.

Flow Limit 1

HART Comm.	1, 4, 2, 3, 3
LOI Key	AUX. FUNCTION

Configure the Parameters that will determine the criteria for activating 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), or if this functionality has been licensed in the field.

Control 1

HART Comm.	1, 4, 2, 3, 3, 1

Turns the Flow Limit 1 HART Alert ON or OFF.

ON – The transmitter will generate a HART alert when the defined conditions are met. If a digital output is configured for Flow Limit 1, the digital output will activate when the conditions for mode 1 are met.

OFF – The transmitter will not generate a HART alert for the Flow Limit 1.

Mode 1

HART Comm.	1, 4, 2, 3, 3, 2

Mode that determines when the Flow Limit 1 HART Alert will activate.

> High Limit – The HART Alert will activate when the measured flow rate exceeds the High Limit 1 set point.

< Low Limit – The HART Alert will activate when the measured flow rate falls below the Low Limit 1 set point.

In Range – The HART Alert will activate when the measured flow rate is between the High Limit 1 and Low Limit 1 set points.

Out of Range – The HART Alert will activate when the measured flow rate exceeds the High Limit 1 set point or falls below the Low Limit 1 set point.

High Limit 1

HART Comm.	1, 4, 2, 3, 3, 3

Set the flow rate value that corresponds to the high limit set point for the Flow Limit 1 alert.

Low Limit 1

HART Comm.	1, 4, 2, 3, 3, 4

Set the flow rate value that corresponds to the low limit set point for the Flow Limit 1 alert.

Flow Limit Hysteresis

HART Comm.	1, 4, 2, 3, 3, 5

Set the hysteresis band for the flow limit to determine how quickly the transmitter comes out of Alert status. This hysteresis value is used for both Flow Limit 1 and Flow Limit 2.

Flow Limit 2

HART Comm.	1, 4, 2, 3, 4
LOI Key	AUX. FUNCTION

Configure the Parameters that will determine the criteria for activating 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), or if this functionality has been licensed in the field. If a digital output is configured for Flow Limit 1, the digital output will activate when the conditions for mode 1 are met.

Control 2

HART Comm.	1, 4, 2, 3, 4, 1

Turns the Flow Limit 2 HART Alert ON or OFF.

ON – The transmitter will generate a HART alert when the defined conditions are met. If a digital output is configured for Flow Limit 1, the digital output will activate when the conditions for mode 1 are met.

OFF – The transmitter will not generate a HART alert for the Flow Limit 2.

Mode 2

HART Comm.	1, 4, 2, 3, 4, 2

Mode that determines when the Flow Limit 2 HART Alert will activate.

> High Limit – The HART Alert will activate when the measured flow rate exceeds the High Limit 2 set point.

< Low Limit – The HART Alert will activate when the measured flow rate falls below the Low Limit 2 set point.

In Range – The HART Alert will activate when the measured flow rate is between the High Limit 2 and Low Limit 2 set points.

Out of Range – The HART Alert will activate when the measured flow rate exceeds the High Limit 2 set point or falls below the Low Limit 2 set point.

High Limit 2

HART Comm.	1, 4, 2, 3, 4, 3

Set the flow rate value that corresponds to the high limit set point for the Flow Limit 2 alert.

Low Limit 2

HART Comm.	1, 4, 2, 3, 4, 4

Set the flow rate value that corresponds to the low limit set point for the Flow Limit 2 alert.

Flow Limit Hysteresis

HART Comm.	1, 4, 2, 3, 4, 5

Set the hysteresis band for the flow limit to determine how quickly the transmitter comes out of Alert status. This hysteresis value is used for both Flow Limit 1 and Flow Limit 2.

Total Limit

HART Comm.	1, 4, 2, 3, 5
LOI Key	AUX. FUNCTION

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 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), or if this functionality has been licensed in the field.

Total Control

HART Comm.	1, 4, 2, 3, 5, 1

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

HART Comm.	1, 4, 2, 3, 5, 2

Mode that determines when the Total Limit HART Alert will activate.

> High Limit – The HART Alert will activate when the measured net total exceeds the Total High Limit set point.

< Low Limit – The HART Alert will activate when the measured net total falls below the Total Low Limit set point.

In Range – The HART Alert will activate when the measured net total is between the Total High Limit and Total Low Limit set points.

Out of Range – The HART Alert will activate when the measured net total exceeds the Total High Limit set point or falls below the Total Low Limit set point.

Total High Limit

HART Comm.	1, 4, 2, 3, 5, 3

Set the net total value that corresponds to the high limit set point for the Flow Limit 1 alert.

Total Low Limit

HART Comm.	1, 4, 2, 3, 5, 4

Set the net total value that corresponds to the low limit set point for the Flow Limit 1 alert.

Total Limit Hysteresis

HART Comm.	1, 4, 2, 3, 5, 5

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

Diagnostic Status Alert

HART Comm.	1, 4, 2, 3, 6
LOI Key	AUX. FUNCTION

Turn ON / 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.

Reverse Flow

HART Comm.	1, 4, 2, 4
LOI Key	AUX. FUNCTION

Enable or disable the transmitter’s ability to read reverse flow.

Reverse Flow allows the transmitter to read negative flow. This may occur when flow in the pipe is going the negative direction, or when either electrode wires or coil wires are reversed. This also enables the totalizer to count in the reverse direction.

Totalizer Setup

HART Comm.	1, 4, 2, 5
LOI Key	AUX. FUNCTION

The totalizer setup menu allows for the viewing and configuration of the totalizer parameters.

Totalizer Units

HART Comm.	1, 4, 2, 5, 1
LOI Key	AUX. FUNCTION

Totalizer units allow for the configuration of the units that the totalized value will be displayed as. These units are independent of the flow units.

Measured Gross Total

HART Comm.	1, 4, 2, 5, 2
LOI Key	TOTALIZE

Measured gross total provides the output reading of the totalizer. This value is the amount of process fluid that has passed through the flowmeter since the totalizer was last reset.

To reset the gross total value, you must change the line size. See “Line Size” on page 3-10 for details on how to change the line size.

Measured Net Total

HART Comm.	1, 4, 2, 5, 3
LOI Key	TOTALIZE

Measured net total provides the output reading of the totalizer. This value is the amount of process fluid that has passed through the flowmeter since the totalizer was last reset. When reverse flow is enabled, the net total represents the difference between the total flow in the forward direction less the total flow in the reverse direction.

Measured Reverse Total

HART Comm.	1, 4, 2, 5, 4
LOI Key	TOTALIZE

Measured reverse total provides the output reading of the totalizer. This value is the amount of process fluid that has passed through the flowmeter in the reverse direction since the totalizer was last reset. This value is only totalized when reverse flow is enabled.

Start Totalizer

HART Comm.	1, 4, 2, 5, 5
LOI Key	START/STOP

Start totalizer starts the totalizer counting from its current value.

Stop Totalizer

HART Comm.	1, 4, 2, 5, 6
LOI Key	START/STOP

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

HART Comm.	1, 4, 2, 5, 7
LOI Key	READ/RESET

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

NOTE
The totalizer value is saved in the Non-Volatile memory of the electronics every three seconds. Should power to the transmitter be interrupted, the totalizer value will start at the last saved value when power is re-applied.

Alarm Level

HART Comm.	**1, 4, 2, 6**

The alarm level allows you to drive the transmitter to preset values if an alarm occurs. There are two options:

- Rosemount Alarm and Saturation Values
- NAMUR-Complaint Alarm and Saturation Levels

Table 4-3. Rosemount (Standard) Alarm and Saturation Values

Level	4-20 mA Saturation	4-20 mA Alarm
Low	3.9 mA	≤3.75 mA
High	20.8 mA	≥22.6 mA

Table 4-4. NAMUR-Compliant Alarm and Saturation Values

Level	4-20 mA Saturation	4-20 mA Alarm
Low	3.8 mA	≤3.5 mA
High	20.5 mA	≥22.6 mA

HART Output

HART Comm.	**1, 4, 2, 7**

Multidrop configuration refers to the connection of several flowmeters to a single communications transmission line. Communication occurs digitally between a HART-based communicator or control system and the flowmeters. Multidrop mode automatically deactivates the analog output of the flowmeters. Using the HART communications protocol, up to 15 transmitters can be connected on a single twisted pair of wires or over leased phone lines. The use of a multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Multidrop installations are not recommended where intrinsic safety is a requirement. Communication with the transmitters can be accomplished with commercially available Bell 202 modems and a host implementing the HART protocol. Each transmitter is identified by a unique address (1-15) and responds to the commands defined in the HART protocol.

Variable Mapping

HART Comm.	**1, 4, 2, 7, 1**

Variable mapping allows you to configure the variables that are mapped to the tertiary and quaternary variables. The primary and secondary variables are fixed and cannot be configured.

- PV is configured for flow
- SV is configured for pulse

Tertiary Variable

HART Comm.	**1, 4, 2, 7, 1, 1**

The tertiary variable maps the third variable of the transmitter. This variable is a HART only variable and can be read off of 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 are:

- Forward Gross
- Forward Net
- Reverse Gross
- Electronics Temp

Quaternary Variable

HART Comm.	1, 4, 2, 7, 1, 2

The quaternary variable maps the fourth variable of the transmitter. This variable is a HART only variable and can be read off of 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 are:

- Forward Gross
- Forward Net
- Reverse Gross
- Electronics Temp

Polling Address

HART Comm.	1, 4, 2, 7, 2

Poll Address enables you to set the poll address for a multi- dropped meter. The poll address is used to identify each meter on the multi-drop line. Follow the on-screen instructions to set the address at a number from 1 to 15. To set or change the flowmeter address, establish communication with the selected Rosemount 8712 in the loop.

NOTE
The Rosemount 8712 is set to poll address zero at the factory, allowing it to operate in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, the transmitter poll address must be changed to a number between 1 and 15. This change deactivates the 4–20 mA analog output, setting it to 4 mA, and disables the failure mode alarm signal.

Number of Request Preambles

HART Comm.	1, 4, 2, 7, 3

This is the number of preambles required by the 8712 for HART communications.

Number of Response Preambles

HART Comm.	1, 4, 2, 7, 4

This is the number of preambles sent by the 8712 in response to any host request.

Burst Mode

HART Comm.	1, 4, 2, 7, 5

Burst Mode Configuration

The Rosemount 8712 includes a burst mode function that broadcasts the primary variable or all dynamic variables approximately three to four times a second. The burst mode is a specialized function used in very specific applications. The burst mode function enables you to select the variables to broadcast while in the burst mode and to select the burst mode option.

The Burst Mode variable enables you to set the Burst Mode to the needs of your application. Options for the Burst Mode setting include:

- Off–Turns off the Burst Mode so that no data are broadcast on the loop.
- On–Turns Burst Mode on so that the 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 8712.

Burst Option

HART Comm.	1, 4, 2, 7, 6

Burst option enables you to select the variables to broadcast over the transmitter burst. Choose one of the following options:

- PV–Selects the process variable for broadcast over the transmitter burst.
- Percent Range/Current–Selects the process variable as percent of range and analog output variables for broadcast over the transmitter burst.
- Process vars/crnt–Selects the process variables and analog output variables for broadcast over the transmitter burst.
- Dynamic Vars–Burst all dynamic variables in the transmitter.

LOI Configuration

HART Comm.	1, 4, 3

The LOI (local operator interface) configuration contains functionality to configure the LOI outputs of the transmitter.

Flowrate Display

HART Comm.	1, 4, 3, 2

This allows you to configure the items that the LOI will display when at the flowrate screen. There are five options available:

- Flow rate and % Span
- % Span and Net Total
- Flowrate and Net Total
- % Span and Gross Total
- Flowrate and Gross Total

Totalizer Display

HART Comm.	1, 4, 3, 3

This allows you to configure the items that the LOI will display when in the totalizer screen. There are two options available:

- Forward Total and Reverse Total
- Net Total and Gross Total

Signal Processing

HART Comm.	1, 4, 4
LOI Key	AUX. FUNCTION

The 8712 contains several advanced functions that can be used to stabilize erratic outputs caused by process noise. The signal processing menu contains this functionality.

Operating Mode

HART Comm.	1, 4, 4, 1

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.

Manually Configure Digital Signal Processing (DSP)

HART Comm.	1, 4, 4, 2

The 8712 transmitter includes digital signal processing capabilities that can be used to condition the output from the transmitter by enabling noise rejection. See Appendix D: "Digital Signal Processing" for a more information on the DSP functionality.

Enable/Disable DSP

HART Comm.	1, 4, 4, 2, 1

When ON is selected, the Rosemount 8712 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. 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 37Hz. The three parameters that make up signal processing (number of samples, maximum percent limit, and time limit) are described below.

Samples

HART Comm.	1, 4, 4, 2, 2

0 to 125 Samples

The number of samples function sets the amount of time that inputs are collected and used to calculate the average value. Each second is divided into tenths (1/10) with the number of samples equaling the number of 1/10 second increments used to calculate the average.

For example, a value of:

1 averages the inputs over the past 1/10 second

10 averages the inputs over the past 1 second

100 averages the inputs over the past 10 seconds

125 averages the inputs over the past 12.5 seconds

% Limit

HART Comm.	1, 4, 4, 2, 3

0 to 100 Percent

The maximum percent limit is a tolerance band set up on either side of the running average. The percentage value refers to deviation from the running average. For example, if the running average is 100 gal/min, and a 2 percent maximum limit is selected, then the acceptable range is from 98 to 102 gal/min.

Values within the limit are accepted while values outside the limit are analyzed to determine if they are a noise spike or an actual flow change.

Time Limit

HART Comm.	1, 4, 4, 2, 4

0 to 256 Seconds

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 8712 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. The selected signal processing configuration may be turned ON or OFF to suit your needs.

Coil Drive Frequency

HART Comm.	1, 4, 4, 3
LOI Key	AUX. FUNCTION

Coil drive frequency allows pulse-rate selection of the sensor 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 output, increase the coil drive frequency to 37 Hz. If the 37 Hz mode is selected, perform the auto zero function with no flow and a full sensor.

Low Flow Cutoff

HART Comm.	1, 4, 4, 4
LOI Key	AUX. FUNCTION

Low flow cutoff allows you to specify the flow rate, between 0.01 and 38.37 f/s, below which the outputs are driven to zero flow. The units format for low flow cutoff cannot be changed. It is always displayed as feet per second regardless of the PV Units format selected. The low flow cutoff value applies to both forward and reverse flows.

Primary Variable Damping

HART Comm.	1, 4, 4, 5
LOI Key	DAMPING

0 to 256 Seconds

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.

Universal Auto Trim

HART Comm.	1, 4, 5
LOI Key	AUX. FUNCTION

The universal auto trim function enables the Rosemount 8712 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 your Rosemount sensor has a 16-digit calibration number, in-process calibration is not required. If it does not, or if your sensor is made by another manufacturer, complete the following steps for in-process calibration.

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.

Device Info

HART Comm.	1, 4, 6
LOI Key	XMTR INFO

Information variables are used for identification of Flowmeters in the field and to store information that may be useful in service situations. Information variables have no effect on flowmeter output or process variables.

Manufacturer

HART Comm.	1, 4, 6, 1
LOI Key	XMTR INFO

Manufacturer is an informational variable provided by the factory. For the Rosemount 8712, the Manufacturer is Rosemount.

Tag

HART Comm.	1, 4, 6, 2
LOI Key	XMTR INFO

Tag is the quickest variable to identify and distinguish between flowmeters. Flowmeters can be tagged according to the requirements of your application. The tag may be up to eight characters long.

Descriptor

HART Comm.	1, 4, 6, 3
LOI Key	XMTR INFO

Descriptor is a longer user-defined variable to assist with more specific identification of the particular flowmeter. It is usually used in multi-flowmeter environments and provides 16 characters.

Message

HART Comm.	1, 4, 6, 4
LOI Key	XMTR INFO

The message variable provides an even longer user-defined variable for identification and other purposes. It provides 32 characters of information and is stored with the other configuration data.

Date

HART Comm.	1, 4, 6, 5
LOI Key	XMTR INFO

Date is a user-defined variable that provides a place to save a date, typically used to store the last date that the transmitter configuration was changed.

Device ID

HART Comm.	1, 4, 6, 6
LOI Key	AUX. FUNCTION

This function displays the Device ID of the transmitter. This is one piece of information required to generate a license code to enable diagnostics in the field.

Sensor Serial Number

HART Comm.	1, 4, 6, 7

The PV sensor serial number is the serial number of the sensor connected to the transmitter and can be stored in the transmitter configuration for future reference. The number provides easy identification if the sensor needs servicing or for other purposes.

Sensor Tag

HART Comm.	1, 4, 6, 8

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

Write Protect

HART Comm.	1, 4, 6, 9

Write protect is a read-only informational variable that reflects the setting of the hardware security switch. If write protect is ON, configuration data is protected and cannot be changed from a HART-based communicator, the LOI, or control system. If write protect is OFF, configuration data may be changed using the communicator, LOI, or control system.

Revision Numbers

HART Comm.	1, 4, 6, 10

Revisions numbers are fixed informational variables that provide the revision number for different elements of your HART Communicator and Rosemount 8712. These revision numbers may be required when calling the factory for support. Revision numbers can only be changed at the factory and are provided for the following elements:

NOTE
To access these features, you must scroll to this option in the HART Field Communicator.

Universal Revision Number

HART Comm.	1, 4, 6, 10, 1

Universal revision number – Designates the HART Universal Command specification to which the transmitter is designed to conform.

Field Device Revision Number

HART Comm.	1, 4, 6, 10, 2

Field device revision number – Designates the revision for the Rosemount 8712 specific command identification for HART compatibility.

Software Revision Number

HART Comm.	1, 4, 6, 10, 3

This function displays the software revision number of the transmitter. This is one piece of information required to generate a license code to enable diagnostics in the field.

Final Assembly Number

HART Comm.	1, 4, 6, 10, 4
LOI Key	XMTR INFO

Final Assembly Number – Factory set number that refers to the electronics of your flowmeter. The number is configured into the flowmeter for later reference.

Construction Materials

HART Comm.	1, 4, 6, 11
LOI Key	XMTR INFO

Construction materials contain information about the sensor that is connected to the transmitter. This information is configured into the transmitter for later reference. This information can be helpful when calling the factory for support.

NOTE
To access these features, you must scroll to this option in the HART Field Communicator.

Flange Type

HART Comm.	1, 4, 6, 11, 1
LOI Key	XMTR INFO

Flange type enables you to select the flange type for your magnetic transmitter system. This variable only needs to be changed if you have changed your sensor. Options for this value are:

- 150# ANSI
- 300# ANSI
- 600# ANSI
- 900# ANSI
- 1500# ANSI
- 2500# ANSI
- PN 01
- PN 61
- PN 52
- PN 04
- PN 46
- Wafer
- Other

Flange Material

HART Comm.	1, 4, 6, 11, 2
LOI Key	XMTR INFO

Flange material enables you to select the flange material for your magnetic transmitter system. This variable only needs to be changed if you have changed your sensor. Options for this value are:

- Carbon Steel
- 304 Stainless Steel
- 316 Stainless Steel
- Wafer
- Other

Electrode Type

HART Comm.	1, 4, 6, 11, 3
LOI Key	XMTR INFO

Electrode type enables you to select the electrode type for your magnetic transmitter system. This variable only needs to be changed if you have replaced electrodes or if you have replaced your sensor. Options for this value are:

- Standard
- Std & Ground
- Bullet
- Other

Electrode Material

HART Comm.	1, 4, 6, 11, 4
LOI Key	XMTR INFO

Electrode Material enables you to select the electrode material for your magnetic transmitter system. This variable only needs to be changed if you have replaced electrodes or if you have replaced your sensor. Options for this value are:

- 316L SST
- Nickel Alloy 276 (UNS N10276)
- Tantalum
- Titanium
- 80% Platinum – 20% Iridium
- Alloy 20
- Other

Liner Material

HART Comm.	1, 4, 6, 11, 5
LOI Key	XMTR INFO

Liner material enables you to select the liner material for the attached sensor. This variable only needs to be changed if you have replaced your sensor. Options for this value are:

- PTFE
- ETFE
- PFA
- Polyurethane
- Linatex
- Natural Rubber
- Neoprene
- Other

Figure 4-2. Field Communicator Menu Tree for the Rosemount 8712

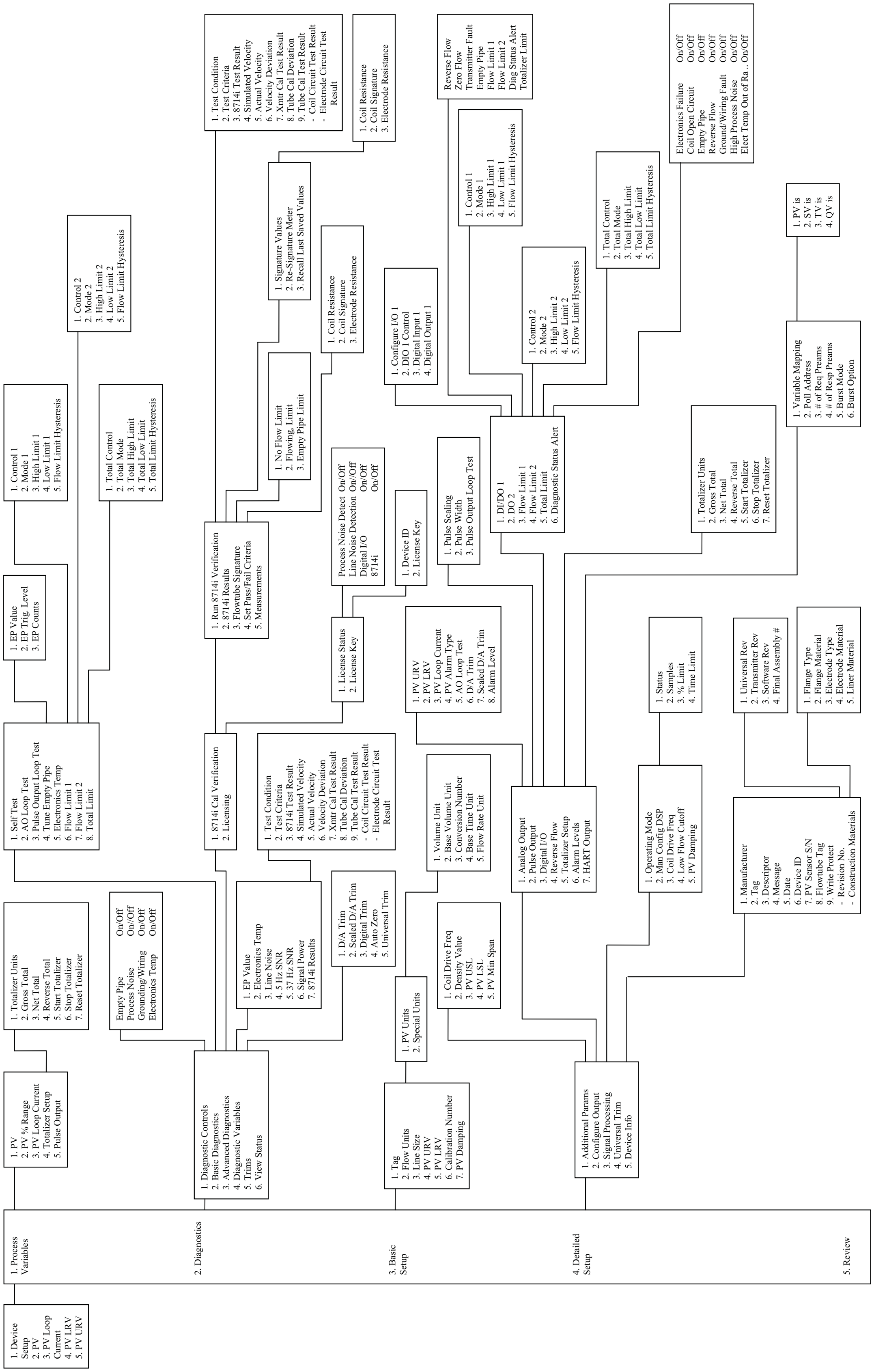


Figure 4-3. HART Fast Key

Function	HART Fast Keys
Process Variables (PV)	**1,1**
Primary Variable Value	1,1,1
Primary Variable %	1,1,2
PV Loop Current	1,1,3
Totalizer Set-Up	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**
Diagnostic Controls	1,2,1
Basic Diagnostics	1,2,2
Self Test	1,2,2,1
AO Loop Test	1,2,2,2
Pulse Output Loop Test	1,2,2,3
Tune Empty Pipe	1,2,2,4
EP Value	1,2,2,4,1
EP Trigger 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
8714i Meter Verification	1,2,3,1
Run 8714i	1,2,3,1,1
8714i Results	1,2,3,1,2
Test Condition	1,2,3,1,2,1
Test Criteria	1,2,3,1,2,2
8714i Test Result	1,2,3,1,2,3
Simulated Velocity	1,2,3,1,2,4
Actual Velocity	1,2,3,1,2,5
Velocity Deviation	1,2,3,1,2,6
Xmtr Cal Test Result	1,2,3,1,2,7
Sensor Cal Deviation	1,2,3,1,2,8

Function	HART Fast Keys
Sensor Cal Test Result	1,2,3,1,2,9
Coil Circuit Test Result	1,2,3,1,2,x
Electrode Circuit Test Result	1,2,3,1,2,x
Sensor Signature	1,2,3,1,3
Signature Values	1,2,3,1,3,1
Coil Resistance	1,2,3,1,3,1,1
Coil Signature	1,2,3,1,3,1,2
Electrode Resistance	1,2,3,1,3,1,3
Re-Signature Meter	1,2,3,1,3,2
Recall Last Saved Values	1,2,3,1,3,3
Set Pass/Fail Criteria	1,2,3,1,4
No Flow Limit	1,2,3,1,4,1
Flowing Limit	1,2,3,1,4,2
Empty Pipe Limit	1,2,3,1,4,3
Measurements	1,2,3,1,5
Coil Resistance	1,2,3,1,5,1
Coil Signature	1,2,3,1,5,2
Electrode Resistance	1,2,3,1,5,3
Licensing	1,2,3,2
License Status	1,2,3,2,1
License Key	1,2,3,2,2
Device ID	1,2,3,2,2,1
License Key	1,2,3,2,2,2
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 Signal to Noise Ratio (SNR)	1,2,4,4
37 Hz SNR	1,2,4,5
Signal Power	1,2,4,6
8714i results	1,2,4,7
Test Condition	1,2,4,7,1
Test Criteria	1,2,4,7,2
8714i Test Result	1,2,4,7,3
Simulated Velocity	1,2,4,7,4
Actual Velocity	1,2,4,7,5
Velocity Deviation	1,2,4,7,6
Xmtr Cal Test Result	1,2,4,7,7
Sensor Cal Deviation	1,2,4,7,8
Sensor Cal Test Result	1,2,4,7,9
Coil Circuit Test Result	1,2,4,7,x
Electrode Circuit Test Result	1,2,4,7,x
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
PV Units	1,3,2,1
Special Units	1,3,2,2
Volume Unit	1,3,2,2,1

Function	HART Fast Keys
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 Params	1,4,1
Coil Drive Freq	1,4,1,1
Density Value	1,4,1,2
PV USL	1,4,1,3
PV LSL	1,4,1,4
PV Min 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
PV Alarm Type	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
Pulse Output	1,4,2,2
Pulse Scaling	1,4,2,2,1
Pulse Width	1,4,2,2,2
Pulse Output Loop Test	1,4,2,2,3
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
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
Total Low Limit	1,4,2,3,5,4
Total Limit Hysteresis	1,4,2,3,5,5

Function	HART Fast Keys
Diagnostic Status Alert	1,4,2,3,6
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	1,4,2,5,5
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 Level	1,4,2,6
HART Output	1,4,2,7
Variable Mapping	1,4,2,7,1
TV is	1,4,2,7,1,1
QV is	1,4,2,7,1,2
Poll Address	1,4,2,7,2
# of Req Preams	1,4,2,7,3
# Resp Preams	1,4,2,7,4
Burst Mode	1,4,2,7,5
Burst Option	1,4,2,7,6
Signal Processing	1,4,3
Operating Mode	1,4,3,1
Man Config DSP	1,4,3,2
Status	1,4,3,2,1
Samples	1,4,3,2,2
% Limit	1,4,3,2,3
Time Limit	1,4,3,2,4
Coil Drive Freq	1,4,3,3
Low Flow Cutoff	1,4,3,4
PV Damping	1,4,3,5
Universal Trim	1,4,4
Device Info	1,4,5
Manufacturer	1,4,5,1
Tag	1,4,5,2
Descriptor	1,4,5,3
Message	1,4,5,4
Date	1,4,5,5
Device ID	1,4,5,6
PV Sensor S/N	1,4,5,7
PV Sensor Tag	1,4,5,8
Write Protect	1,4,5,9
Revision No.	1,4,5,x
Universal Rev	1,4,5,x,1
Transmitter Rev	1,4,5,x,2
Software Rev	1,4,5,x,3
Final Assembly #	1,4,5,x,4
Construction Materials	1,4,5,x
Flange Type	1,4,5,x,1
Flange Material	1,4,5,x,2
Electrode Type	1,4,5,x,3
Electrode Material	1,4,5,x,4
Liner Material	1,4,5,x,5
Review	**1,5**

Figure 4-4. Local Operator Interface (LOI) Data Entry Keys for the Rosemount 8712

Data Entry Keys	Function Performed
Shift	• Moves the blinking cursor on the display one character to the right • Scrolls through available values
Increment	• Increments the character over the cursor by one • Steps through all the digits, letters, and symbols that are applicable to the present operation • Scrolls through available values
Enter	Stores the displayed value previously selected with the SHIFT and INCR. keys
Display Control Keys	Function Performed
Flow Rate	Displays the user-selected parameters for flow indication
Totalize	Displays the present totalized output of the transmitter, and activates the Totalizer group of keys The choices, **Forward** and **Reverse** totals or **Net** and **Gross** totals, are selected in Auxiliary Functions
Start/Stop	Starts the totalizing display if it is stopped, and stops the display if it is running
Read/Reset	Resets the net totalizing display to zero if it is stopped, and halts the display if the display is running
Transmitter Parameters Keys	Function Performed
Tube Cal No.	Identifies the calibration number when using Rosemount sensors, or other manufacturers' sensors calibrated at the Rosemount factory
Tube Size	Specifies the sensor size and identifies the corresponding maximum flow (0.1 - through 80-inch line sizes)
Units	Specifies the desired units: Gal/Min Liters/Min ImpGal/Min CuMeter/Hr Ft/Sec Meters/Sec Special (user defined) For a complete list of available units, see Table 3-3 on page 3-9

Auxiliary Functions	Function	Options
	Run 8714i	Runs the meter verification diagnostic
	Operating Mode	Normal or Filter
	Coil Pulse Mode	5 or 37 Hz
	Flow rate Display	Flow–% Span, Flow–Totalize, %Span–Totalize
	Totalizer Display	Forward–Reverse or Net–Gross
	Totalizer Units	Configure the totalizer units of measure
	Configure Signal Processing	On/Off
	Special Units	Volume units, base volume units, conversion, time base, rate units
	Process Density	Required for units of mass flow
	DI/DO 1 Config	Configure Auxiliary Channel 1
	Digital Output 2	Configure Auxiliary Channel 2
	Flow Limit 1	Configure Flow Limit 1 Alert
	Flow Limit 2	Configure Flow Limit 2 Alert
	Totalizer Limit	Configure Totalizer Limit Alert
	Diagnostic Status Alert	Configure Diagnostic Status Alert
	Reverse Flow Enable	On/Off
	Licensed Options	Displays Licensed Options
	License Key	Field license advanced functionality
	Diagnostics Enable	Turn diagnostics On/Off
	8714i Setup	Configure test criteria parameters
	Re-signature Sensor	Base line sensor characteristics
	Recall Last Signature	Recall previous signature values
	Empty Pipe	Configure empty pipe diagnostic parameters
	Universal Auto Trim	In-process Sensor Calibration
	Low Flow Cutoff	0.01 ft/s to 1 ft/s
	Pulse Width	Pulse Width
	Analog Output Zero	4 mA Value
	Analog Output Test	Analog Output Loop Test
	Pulse Output Test	Pulse Output Loop Test
	Transmitter Test	Test the Transmitter
	4–20 mA Output Trim	Adjust the 4–20 mA Output
	Auto Zero	Zero Sensor for 37 Hz Coil Drive Operation
	Electronics Trim	Transmitter Calibration
Analog Output Range	Sets the desired 20 mA point – **must set the sensor size first**	
Pulse Output Scaling	Sets one pulse to a selectable number of volume units – **must set the sensor size first**	
Damping	Sets response time (single pole time constant), in seconds, to a step change in flow rate	
Transmitter Information	Allows you to view and change useful information about the transmitter and sensor	
Empty Pipe Tuning	Allowable range 3.0 - 2000.0	

Section 5 Sensor Installation

This section covers the steps required to physically install the magnetic sensor. For electrical connections and cabling see Section 2: "Installation". Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Please refer to the following safety messages before performing any operation in this section.

SAFETY MESSAGES

⚠ This symbol is used throughout this manual to indicate that special attention to warning information is required.

⚠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 that the operating environment of the sensor and transmitter is consistent with the appropriate hazardous area approval.

Do not connect a Rosemount 8712 to a non-Rosemount sensor that is located in an explosive atmosphere.

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 8712 reference manual for any restrictions associated with a safe installation.

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.

Electrical shock can result in death or serious injury

Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

⚠WARNING

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.

To avoid possible damage to the sensor liner ends, do not use metallic or spiral-wound gaskets. If frequent removal is anticipated, take precautions to protect the liner ends. Short spool pieces attached to the sensor ends are often used for protection.

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 limits. Failure to observe these instructions could result in severe damage to the sensor lining and possible sensor replacement.

Emerson Process Management can supply lining protectors to prevent liner damage during removal, installation, and excessive bolt torquing.

SENSOR HANDLING

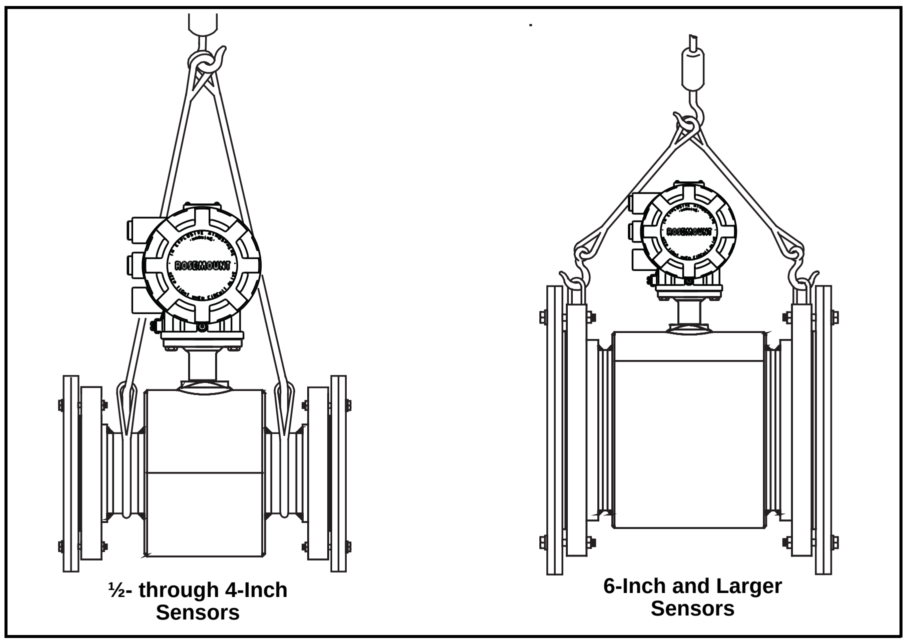
Handle all parts carefully to prevent damage. Whenever possible, transport the system to the installation site in the original shipping containers. PTFE-lined sensors are shipped with end covers that protect it from both mechanical damage and normal unrestrained distortion. Remove the end covers just before installation.

Flanged 6- through 36-inch sensors come with a lifting lug on each flange. The lifting lugs make the sensor easier to handle when it is transported and lowered into place at the installation site.

Flanged ½- to 4-inch sensors do not have lugs. They must be supported with a lifting sling on each side of the housing.

Figure 5-1 shows sensors correctly supported for handling and installation. Notice the plywood end pieces are still in place to protect the sensor liner during transportation.

Figure 5-1. Rosemount 8705 Sensor Support for Handling



See "Safety Messages" on pages 5-1 and 5-2 for complete warning information.

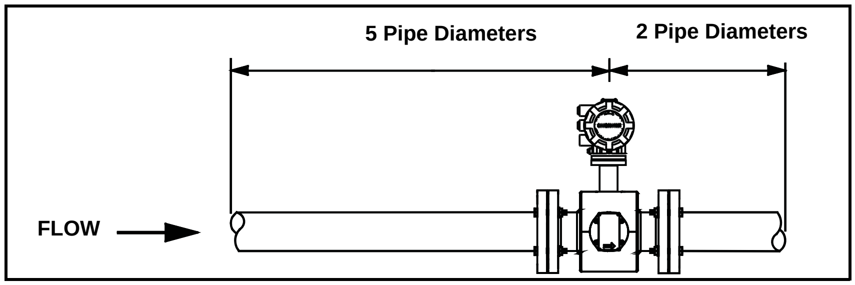
SENSOR MOUNTING

Physical mounting of a sensor is similar to installing a typical section of pipe. Conventional tools, equipment, and accessories (bolts, gaskets, and grounding hardware) are required.

Upstream/Downstream Piping

To ensure specification accuracy over widely varying process conditions, install the sensor a minimum of five straight pipe diameters upstream and two pipe diameters downstream from the electrode plane (see Figure 5-2).

Figure 5-2. Upstream and Downstream Straight Pipe Diameters



Sensor Orientation

The sensor should be installed in a position that ensures the sensor remains full during operation. Figures 5-3, 5-4, and 5-5 show the proper sensor orientation for the most common installations. The following orientations ensure that the electrodes are in the optimum plane to minimize the effects of entrapped gas.

Vertical installation allows upward process fluid flow and is generally preferred. Upward flow keeps the cross-sectional area full, regardless of flow rate. Orientation of the electrode plane is unimportant in vertical installations. As illustrated in Figures 5-3 and 5-4, avoid *downward* flows where back pressure does not ensure that the sensor remains full at all times.

Installations with reduced straight runs from 0 to five pipe diameters are possible. In reduced straight pipe run installations, performance will shift to as much as 0.5% of rate. Reported flow rates will still be highly repeatable.

Figure 5-3. Vertical Sensor Orientation

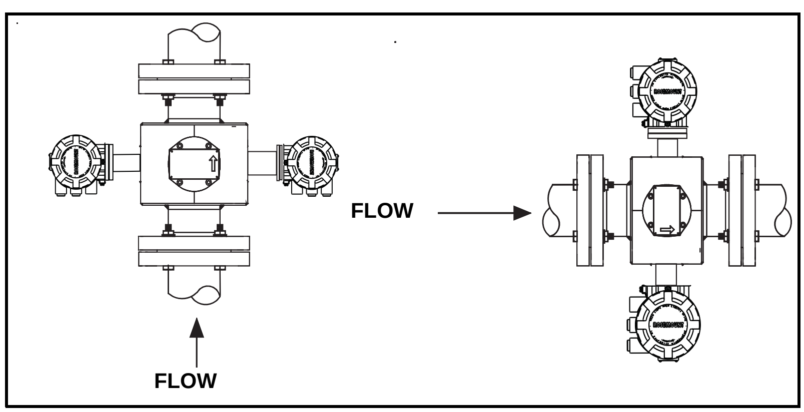
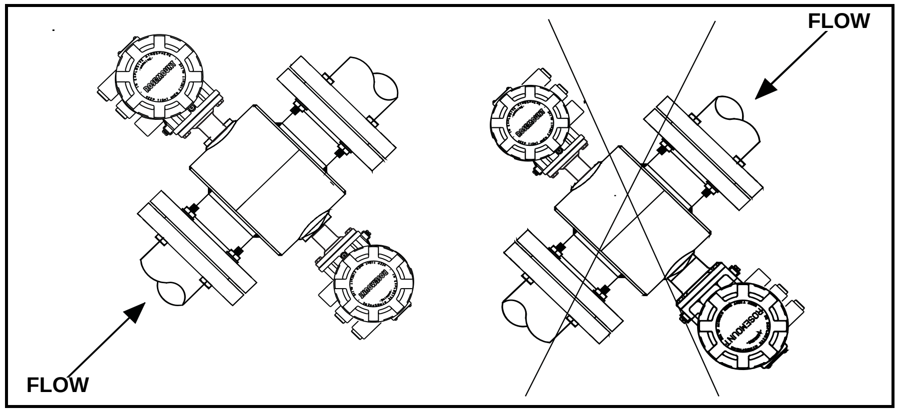
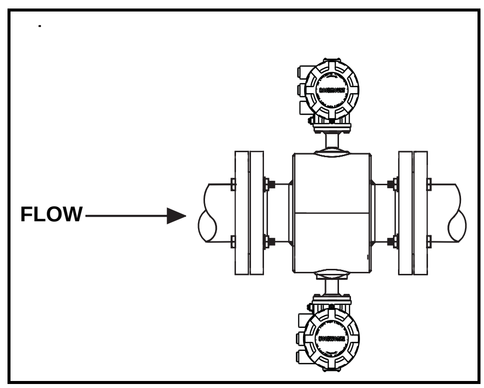


Figure 5-4. Incline or Decline Orientation



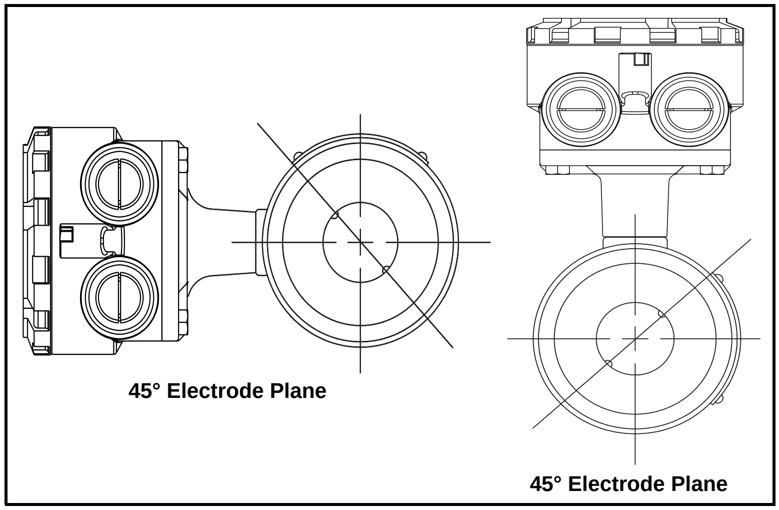
Horizontal installation should be restricted to low piping sections that are normally full. Orient the electrode plane to within 45 degrees of horizontal in horizontal installations. A deviation of more than 45 degrees of horizontal would place an electrode at or near the top of the sensor thereby making it more susceptible to insulation by air or entrapped gas at the top of the sensor.

Figure 5-5. Horizontal Sensor Orientation



The electrodes in the Rosemount 8711 are properly oriented when the top of the sensor is either vertical or horizontal, as shown in Figure 5-6. Avoid any mounting orientation that positions the top of the sensor at 45 degrees from the vertical or horizontal position.

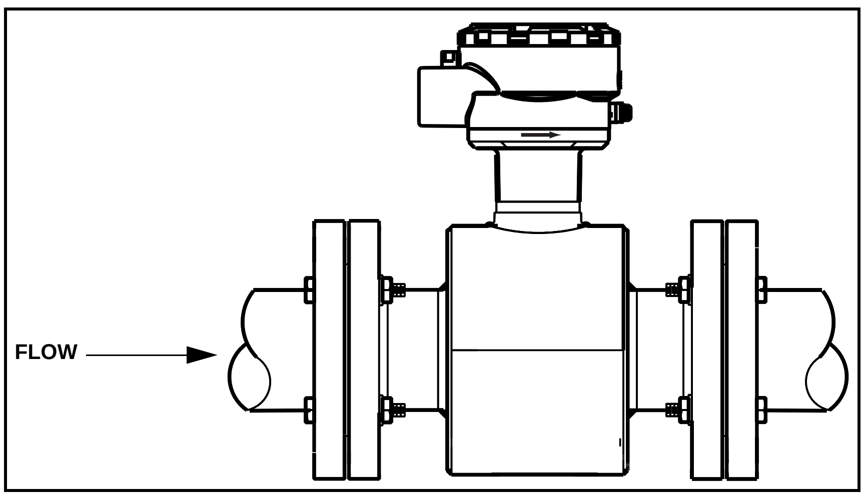
Figure 5-6. Rosemount 8711 Mounting Position



Flow Direction

The sensor should be mounted so that the FORWARD end of the flow arrow, shown on the sensor identification tag, points in the direction of flow through the tube (see Figure 5-7).

Figure 5-7. Flow Direction



INSTALLATION (FLANGED SENSOR)

The following section should be used as a guide in the installation of the flange-type Rosemount 8705 and Rosemount 8707 High-Signal Sensors. Refer to page 5-10 for installation of the wafer-type Rosemount 8711 Sensor.

Gaskets

⚠ The sensor requires a gasket at each of its connections to adjacent devices or piping. The gasket material selected must be compatible with the process fluid and operating conditions. **Metallic or spiral-wound gaskets can damage the liner.** If the gaskets will be removed frequently, protect the liner ends. All other applications (including sensors with lining protectors or a grounding electrode) require only one gasket on each end connection, as shown in Figure 5-8. If grounding rings are used, gaskets are required on each side of the grounding ring, as shown in Figure 5-9.

Figure 5-8. Gasket Placement

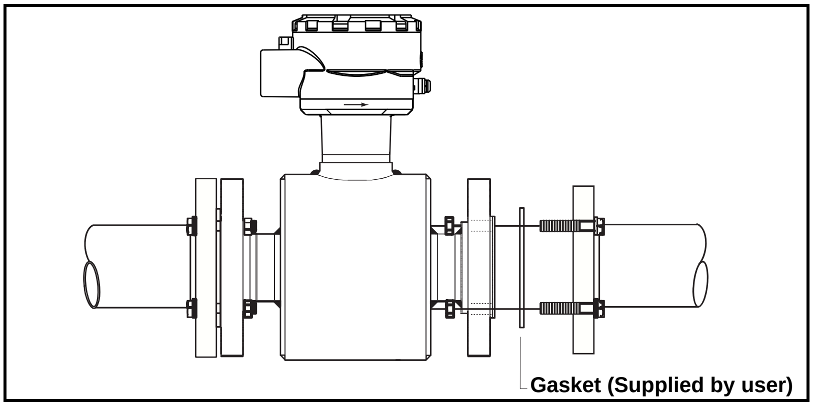
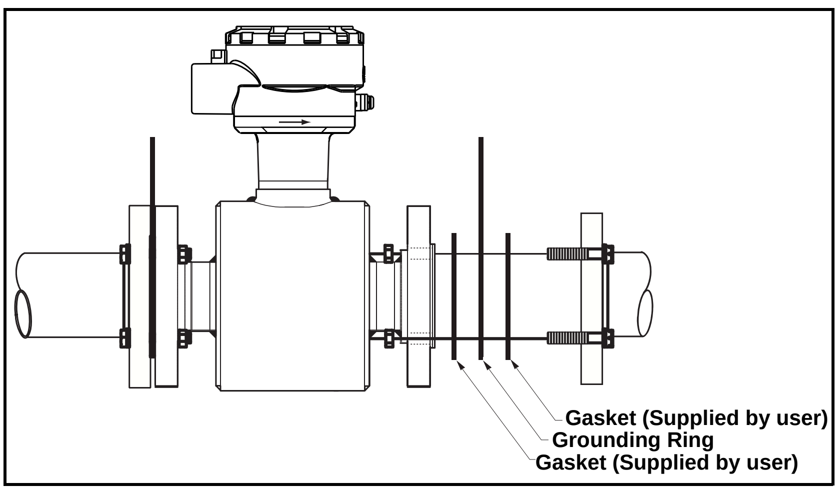


Figure 5-9. Gasket Placement with Non-attached Grounding Rings



Flange Bolts

Suggested torque values by sensor line size and liner type are listed in Table 5-1 on page 5-8 for ASME B16.5 (ANSI) flanges and Table 5-2 and Table 5-3 for DIN flanges. Consult the factory for other flange ratings. Tighten flange bolts in the incremental sequence as shown in Figure 5-10. See Table 5-1 and Table 5-2 for bolt sizes and hole diameters.

⚠ See "Safety Messages" on pages 5-1 and 5-2 for complete warning information.

NOTE
Do not bolt one side at a time. Tighten each side simultaneously. Example:
1. Snug left
2. Snug right
3. Tighten left
4. Tighten right

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.

⚠ Always check for leaks at the flanges after tightening the flange bolts. Failure to use the correct flange bolt tightening methods can result in severe damage. All sensors require a second torquing 24 hours after initial flange bolt tightening.

Table 5-1. Flange Bolt Torque Specifications for Rosemount 8705 and 8707 High-Signal Sensors

		PTFE/ETFE liner		Polyurethane liner	
Size Code	Line Size	Class 150 (pound-feet)	Class 300 (pound-feet)	Class 150 (pound-feet)	Class 300 (pound-feet)
005	1/2-inch (15 mm)	8	8	—	—
010	1 inch (25 mm)	8	12	—	—
015	1 1/2 inch (40 mm)	13	25	7	18
020	2 inch (50 mm)	19	17	14	11
030	3 inch (80 mm)	34	35	23	23
040	4 inch (100 mm)	26	50	17	32
060	6 inch (150mm)	45	50	30	37
080	8 inch (200 mm)	60	82	42	55
100	10 inch (250 mm)	55	80	40	70
120	12 inch (300 mm)	65	125	55	105
140	14 inch (350 mm)	85	110	70	95
160	16 inch (400 mm)	85	160	65	140
180	18 inch (450 mm)	120	170	95	150
200	20 inch (500 mm)	110	175	90	150
240	24 inch (600 mm)	165	280	140	250
300	30 inch (750 mm)	195	415	165	375
360	36 inch (900 mm)	280	575	245	525

⚠ See "Safety Messages" on pages 5-1 and 5-2 for complete warning information.

Table 5-2. Flange Bolt Torque and Bolt Load Specifications for Rosemount 8705

		PTFE/ETFE liner							
		PN10		PN 16		PN 25		PN 40	
Size Code	Line Size	(Newton-meter)	(Newton)	(Newton-meter)	(Newton)	(Newton-meter)	(Newton)	(Newton-meter)	(Newton)
005	1/2-inch (15 mm)	7	3209	7	3809	7	3809	7	4173
010	1 inch (25 mm)	13	6983	13	6983	13	6983	13	8816
015	1 1/2 inch (40 mm)	24	9983	24	9983	24	9983	24	13010
020	2 inch (50 mm)	25	10420	25	10420	25	10420	25	14457
030	3 inch (80 mm)	14	5935	14	5935	18	7612	18	12264
040	4 inch (100 mm)	17	7038	17	7038	30	9944	30	16021
060	6 inch (150mm)	23	7522	32	10587	60	16571	60	26698
080	8 inch (200 mm)	35	11516	35	11694	66	18304	66	36263
100	10 inch (250 mm)	31	10406	59	16506	105	25835	105	48041
120	12 inch (300 mm)	43	14439	82	22903	109	26886	109	51614
140	14 inch (350 mm)	42	13927	80	22091	156	34578	156	73825
160	16 inch (400 mm)	65	18189	117	28851	224	45158	224	99501
180	18 inch (450 mm)	56	15431	99	24477	—	—	—	67953
200	20 inch (500 mm)	66	18342	131	29094	225	45538	225	73367
240	24 inch (600 mm)	104	25754	202	40850	345	63940	345	103014

Figure 5-10. Flange Bolt Torquing Sequence

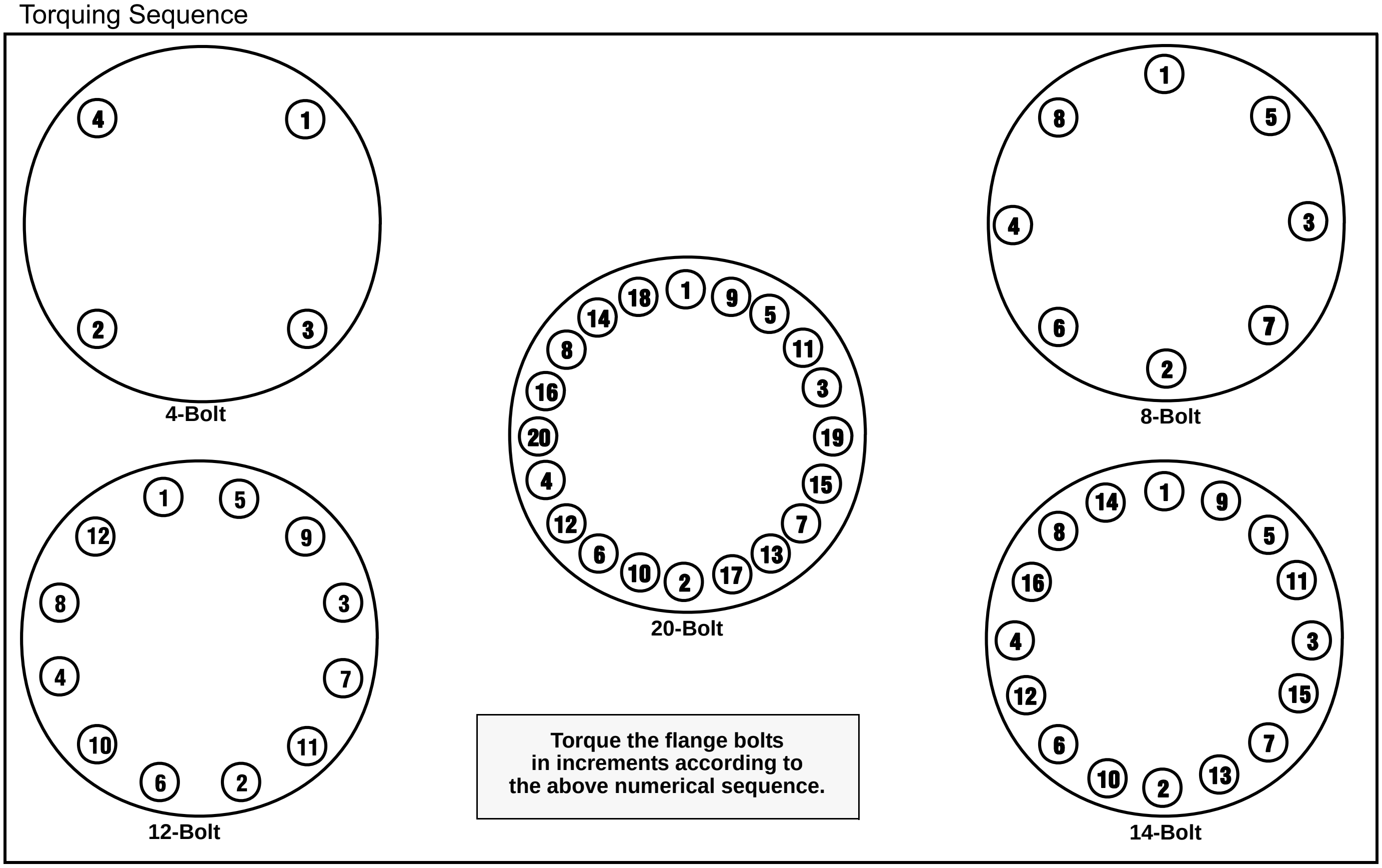


Table 5-3. Flange Bolt Torque and Bolt Load Specifications for Rosemount 8705

		Polyurethane Liner							
		PN 10		PN 16		PN 25		PN 40	
Size Code	Line Size	(Newton-meter)	(Newton)	(Newton-meter)	(Newton)	(Newton-meter)	(Newton)	(Newton-meter)	(Newton)
005	1/2-inch (15 mm)	1	521	1	826	2	1293	6	3333
010	1 inch (25 mm)	2	1191	3	1890	5	2958	10	5555
015	1 1/2 inch (40 mm)	5	1960	7	3109	12	4867	20	8332
020	2 inch (50 mm)	6	2535	10	4021	15	6294	26	10831
030	3 inch (80 mm)	5	2246	9	3563	13	5577	24	19998
040	4 inch (100 mm)	7	3033	12	4812	23	7531	35	11665
060	6 inch (150mm)	16	5311	25	8425	47	13186	75	20829
080	8 inch (200 mm)	27	8971	28	9487	53	14849	100	24687
100	10 inch (250 mm)	26	8637	49	13700	87	21443	155	34547
120	12 inch (300 mm)	36	12117	69	19220	91	22563	165	36660
140	14 inch (350 mm)	35	11693	67	18547	131	29030	235	47466
160	16 inch (400 mm)	55	15393	99	24417	189	38218	335	62026
200	20 inch (500 mm)	58	15989	114	25361	197	39696	375	64091
240	24 inch (600 mm)	92	22699	178	36006	304	56357	615	91094

INSTALLATION (WAFER SENSOR)

The following section should be used as a guide in the installation of the Rosemount 8711 Sensor. Refer to page 5-7 for installation of the flange-type Rosemount 8705 and 8707 High-Signal sensor.

Gaskets

The sensor requires a gasket at each of its connections to adjacent devices or piping. The gasket material selected must be compatible with the process fluid and operating conditions. **Metallic or spiral-wound gaskets can damage the liner.** If the gaskets will be removed frequently, protect the liner ends. If grounding rings are used, a gasket is required on each side of the grounding ring.

Alignment and Bolting

1. On 1 1/2 - through 8-inch (40 through 200 mm) line sizes, place centering rings over each end of the sensor. The smaller line sizes, 0.15- through 1-inch (4 through 25 mm), do not require centering rings.
2. Insert studs for the bottom side of the sensor between the pipe flanges. Stud specifications are listed in Table 5-4. **Using carbon steel bolts on smaller line sizes, 0.15- through 1-inch (4 through 25 mm), rather than the required stainless steel bolts, will degrade performance.**

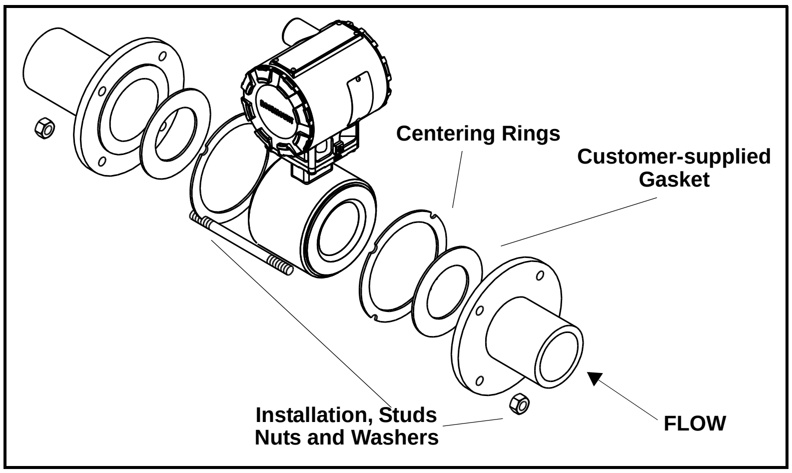
Table 5-4. Stud Specifications

Nominal Sensor Size	Stud Specifications
0.15 – 1 inch (4 – 25 mm)	316 SST ASTM A193, Grade B8M Class 1 threaded mounted studs
$1^1/2$ – 8 inch (40 – 200 mm)	CS, ASTM A193, Grade B7, threaded mounting studs

3. Place the sensor between the flanges. Make sure that the centering rings are properly placed in the studs. The studs should be aligned with the markings on the rings that correspond to the flange you are using.
4. Insert the remaining studs, washers, and nuts.
5. Tighten to the torque specifications shown in Table 5-5. Do not overtighten the bolts or the liner may be damaged.

NOTE
On the 4- and 6- inch PN 10-16, insert the sensor with rings first and then insert the studs. The slots on this ring scenario are located on the inside of the ring.

Figure 5-11. Gasket Placement with Centering Rings



Flange Bolts

Sensor sizes and torque values for both Class 150 and Class 300 flanges are listed in Table 5-5. Tighten flange bolts in the incremental sequence, shown in Figure 5-10.

NOTE
Do not bolt one side at a time. Tighten each side simultaneously. Example:
1. Snug left
2. Snug right
3. Tighten left
4. Tighten right

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.

⚠ Always check for leaks at the flanges after tightening the flange bolts. All sensors require a second torquing 24 hours after initial flange bolt tightening.

Table 5-5. Flange bolt Torque Specifications of Rosemount 8711 Sensors

Size Code	Line Size	Pound-feet	Newton-meter
15F	0.15 inch (4 mm)	5	6.8
30F	0.30 inch (8 mm)	5	6.8
005	1/2-inch (15 mm)	5	6.8
010	1 inch (25 mm)	10	13.6
015	1 1/2 inch (40 mm)	15	20.5
020	2 inch (50 mm)	25	34.1
030	3 inch (80 mm)	40	54.6
040	4 inch (100 mm)	30	40.1
060	6 inch (150 mm)	50	68.2
080	8 inch (200 mm)	70	81.9

INSTALLATION (SANITARY SENSOR)

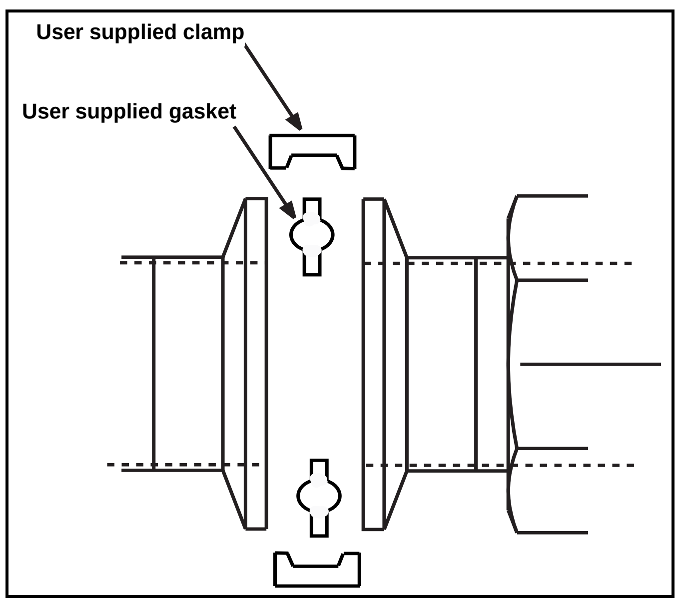
Gaskets

The sensor requires a gasket at each of its connections to adjacent devices or piping. The gasket material selected must be compatible with the process fluid and operating conditions. Gaskets are supplied with all Rosemount 8721 Sanitary sensors except when the process connection is an IDF sanitary screw type.

Alignment and Bolting

Standard plant practices should be followed when installing a magmeter with sanitary fittings. Unique torque values and bolting techniques are not required.

Figure 5-12. Rosemount 8721 Sanitary Installation



GROUNDING

Process grounding the sensor is one the most important details of sensor installation. Proper process grounding ensures that the transmitter amplifier is referenced to the process. This creates the lowest noise environment for the transmitter to make a stable reading. Use Table 5-6 to determine which grounding option to follow for proper installation.

NOTE
Consult factory for installations requiring cathodic protection or situations where there are high currents or high potential in the process.

The sensor case should always be earth grounded in accordance with national and local electrical codes. Failure to do so may impair the protection provided by the equipment. The most effective grounding method is direct connection from the sensor to earth ground with minimal impedance.

The Internal Ground Connection (Protective Ground Connection) located in side the junction box is the Internal Ground Connection screw. This screw is identified by the ground symbol: ⏚

Table 5-6. Grounding Installation

	Grounding Options			
Type of Pipe	**No Grounding Options**	**Grounding Rings**	**Grounding Electrodes**	**Lining Protectors**
Conductive Unlined Pipe	See Figure 5-13	Not Required	Not Required	See Figure 5-14
Conductive Lined Pipe	Insufficient Grounding	See Figure 5-14	See Figure 5-13	See Figure 5-14
Non-Conductive Pipe	Insufficient Grounding	See Figure 5-15	See Figure 5-16	See Figure 5-15

Figure 5-13. No Grounding Options or Grounding Electrode in Lined Pipe

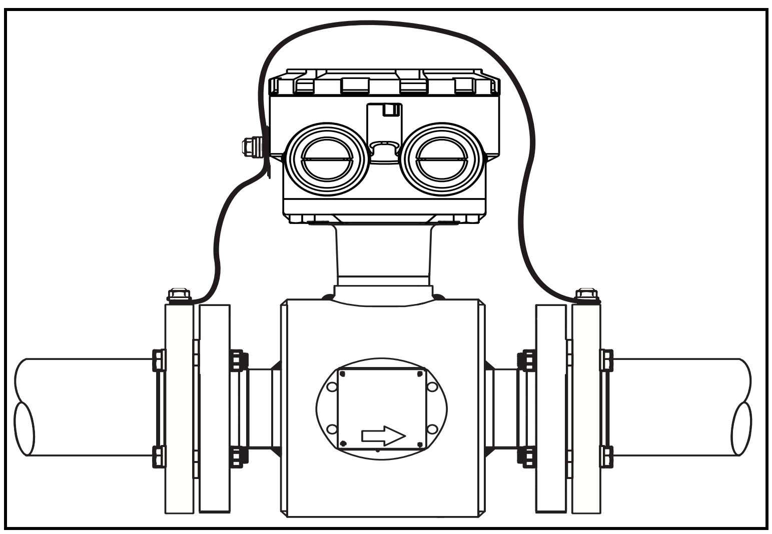


Figure 5-14. Grounding with Grounding Rings or Lining Protectors

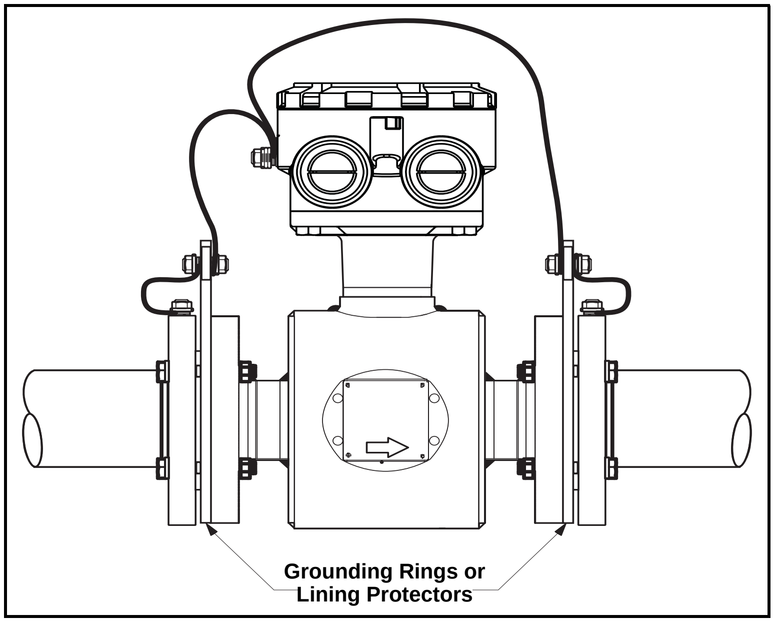


Figure 5-15. Grounding with Grounding Rings or Lining Protectors

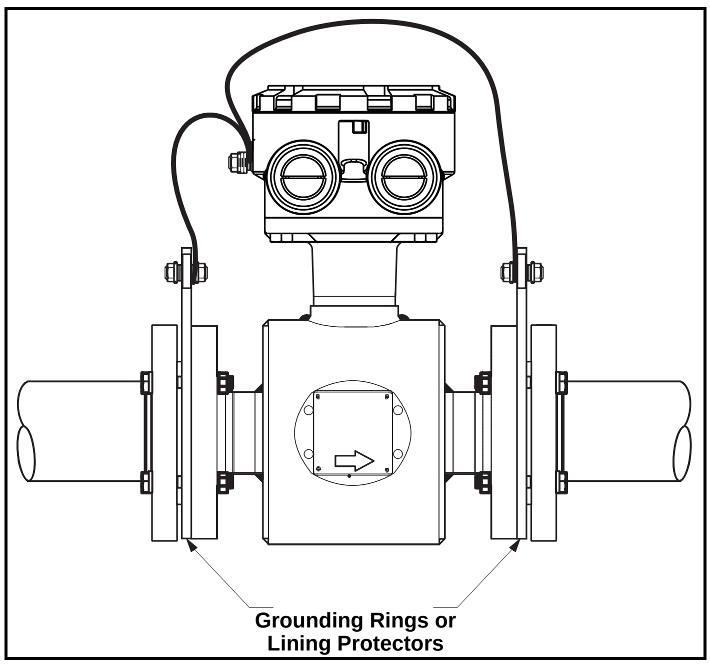
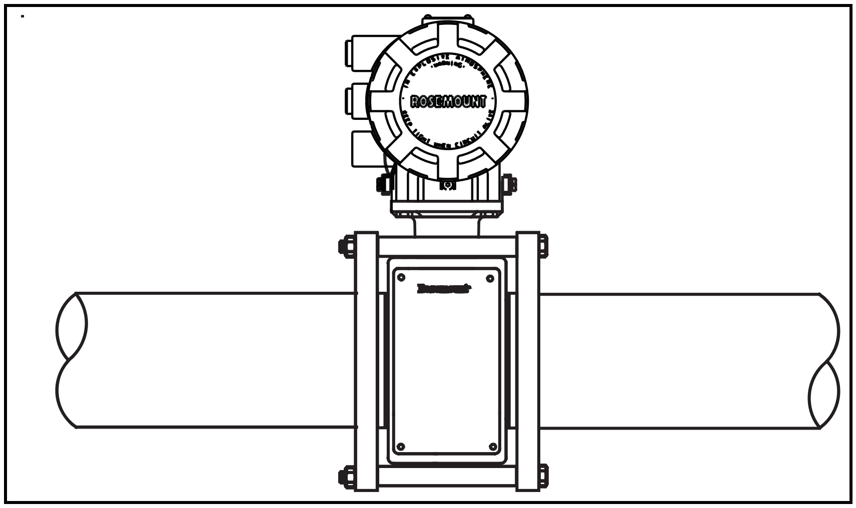


Figure 5-16. Grounding with Grounding Electrodes



PROCESS LEAK PROTECTION (OPTIONAL)

The Rosemount 8705 and 8707 High-Signal Sensor housing is fabricated from carbon steel to perform two separate functions. First, it provides shielding for the sensor magnetics so that external disturbances cannot interfere with the magnetic field and thus affect the flow measurement. Second, it provides the physical protection to the coils and other internal components from contamination and physical damage that might occur in an industrial environment. The housing is completely welded and gasket-free.

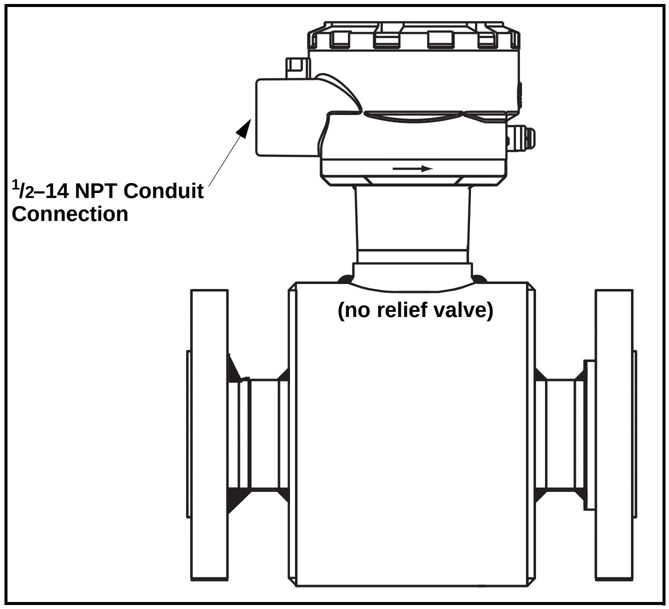
The three housing configurations are identified by the W0, W1, or W3 in the model number option code when ordering. Below are brief descriptions of each housing configuration, which are followed by a more detailed overview.

- **Code W0** — sealed, welded coil housing (standard configuration)
- **Code W1** — sealed, welded coil housing with a relief valve capable of venting fugitive emissions to a safe location (additional plumbing from the sensor to a safe area, installed by the user, is required to vent properly)
- **Code W3** — sealed, welded coil housing with separate electrode compartments capable of venting fugitive emissions (additional plumbing from the sensor to a safe area, installed by the user, is required to vent properly)

Standard Housing Configuration

The standard housing configuration is identified by a code W0 in the model number. This configuration does not provide separate electrode compartments with external electrode access. In the event of a process leak, these models will not protect the coils or other sensitive areas around the sensor from exposure to the pressure fluid (Figure 5-17).

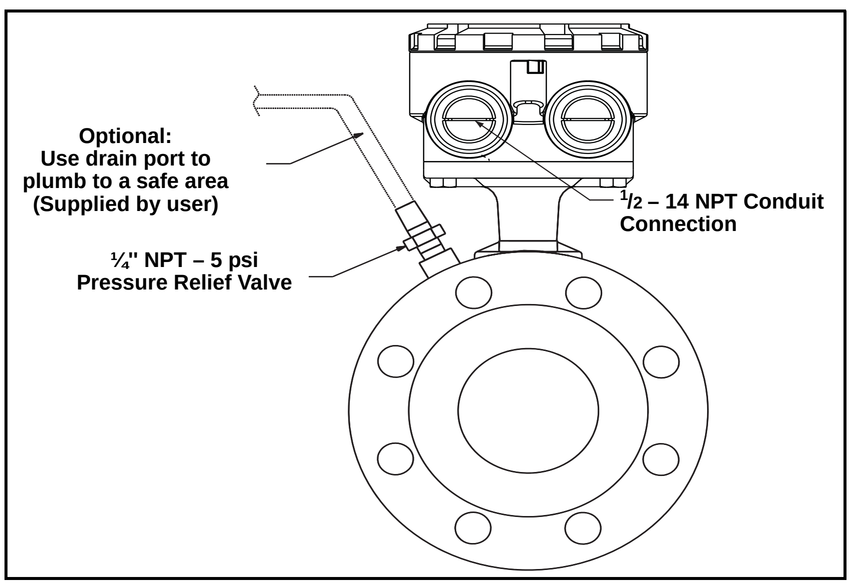
Figure 5-17. Standard Housing Configuration — Sealed Welded Housing (Option Code W0)



Relief Valves

The first optional configuration, identified by the W1 in the model number option code, uses a completely welded coil housing. This configuration does not provide separate electrode compartments with external electrode access. This optional housing configuration provides a relief valve in the housing to prevent possible overpressuring caused by damage to the lining or other situations that might allow process pressure to enter the housing. The relief valve will vent when the pressure inside the sensor housing exceeds 5 psi. Additional piping (provided by the user) may be connected to this relief valve to drain any process leakage to safe containment (see Figure 5-18).

Figure 5-18. Coil-Housing Configuration — Standard Welded Housing With Relief Valve (Option Code W1)



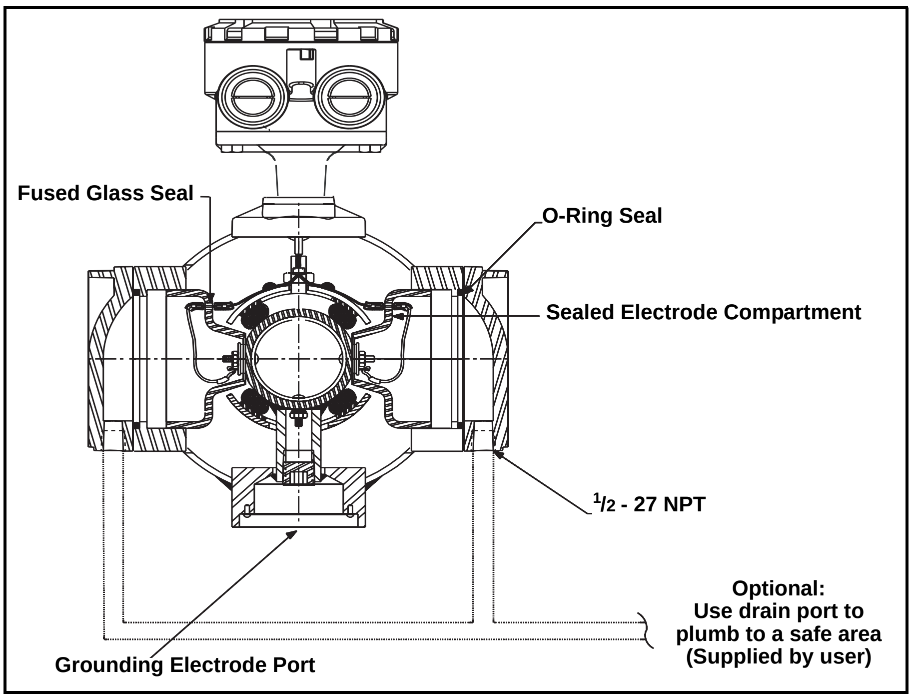
Process Leak Containment

The second optional configuration, identified as option code W3 in the model number, divides the coil housing into three compartments: one for each electrode and one for the coils. Should a damaged liner or electrode fault allow process fluid to migrate behind the electrode seals, the fluid is contained in the electrode compartment. The sealed electrode compartment prevents the process fluid from entering the coil compartment where it would damage the coils and other internal components.

The electrode compartments are designed to contain the process fluid at full line pressure. An o-ring sealed cover provides access to each of the electrode compartments from outside the sensor; drainports are provided in each cover for the removal of fluid.

NOTE
The electrode compartment could contain full line pressure and it must be depressurized before the cover is removed.

Figure 5-19. Housing Configuration — Sealed Electrode Compartment (Option Code W3)



If necessary, capture any process fluid leakage, connect the appropriate piping to the drainports, and provide for proper disposal (see Figure 5-19).

Section 6 Maintenance and Troubleshooting

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 your system. If the problem persists, consult your local Rosemount representative to determine if the material should be returned to the factory. Emerson Process Management 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. Please read the following safety messages before performing any operation described in this section. Refer to these warnings when appropriate throughout this section.

SAFETY INFORMATION

⚠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 that the operating environment of the sensor and transmitter is consistent with the appropriate FM or CSA approval.

Do not connect a Rosemount 8712 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 (MSDA) for each hazardous substance identified must be included with the returned goods.

The 8712 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 pin point the problem and make the appropriate adjustments.

If there are problems with a new magmeter installation, see “Installation Check and Guide” on page 6-2 for a quick guide to solve the most common installation problems. For existing magmeter installations, Table 6-5 lists the most common magmeter problems and corrective actions.

INSTALLATION CHECK AND GUIDE

Use this guide to check new installations of Rosemount magnetic flowmeter systems that appear to malfunction.

Before You Begin

Transmitter

Apply power to your system before making the following transmitter checks.

1. Verify that the correct sensor calibration number is entered in the transmitter. The calibration number is listed on the sensor nameplate.
2. Verify that the correct sensor line size is entered in the transmitter. The line size value is listed on the sensor nameplate.
3. Verify that the analog range of the transmitter matches the analog range in the control system.
4. Verify that the forced analog output and forced pulse output of the transmitter produces the correct output at the control system.

Sensor

Be sure that power to your system is removed before beginning sensor checks.

1. **For horizontal flow installations**, ensure that the electrodes remain covered by process fluid.

   For vertical or inclined installations, ensure that the process fluid is flowing up into the sensor to keep the electrodes covered by process fluid.
2. Ensure that the grounding straps on the sensor are connected to grounding rings, lining protectors, or the adjacent pipe flanges. Improper grounding will cause erratic operation of the system.

Wiring

1. The signal wire and coil drive wire must be twisted shielded cable. Emerson Process Management, Rosemount division. recommends 20 AWG twisted shielded cable for the electrodes and 14 AWG twisted shielded cable for the coils.
2. The cable shield must be connected at both ends of the electrode and coil drive cables. Connection of the signal wire shield at both ends is necessary for proper operation. It is recommended that the coil drive wire shield also be connected at both ends for maximum flowmeter performance
3. The signal and coil drive wires must be separate cables, unless Emerson Process Management specified combo cable is used. See Table 2-3 on page 2-14.
4. The single conduit that houses both the signal and coil drive cables should not contain any other wires.

Process Fluid

1. The process fluid conductivity should be 5 microsiemens (5 micro mhos) per centimeter minimum.
2. The process fluid must be free of air and gasses.
3. The sensor should be full of process fluid.

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 your system.

Table 6-1. Rosemount 8712 Basic Diagnostic Messages

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 - see Appendix E: Universal Sensor Wiring Diagrams
	Electrode Error	Perform sensor tests C and D (see Table 6-6 on page 6-9)
	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
"Coil Open Circuit"	Improper wiring	Check coil drive wiring and sensor coils Perform sensor test A - Sensor Coil
	Other manufacturer's sensor	Change coil current to 75 mA Perform a Universal Auto Trim to select the proper coil current
	Circuit Board Failure	Replace Rosemount 8712 Electronics
	Verify the transmitter is not a Rosemount 8712H	Replace Rosemount 8712H with Rosemount 8712C/U/H/D
	Coil Circuit OPEN Fuse	Return to factory for fuse replacement
"Auto Zero Failure"	Flow is not set to zero	Force flow to zero, perform autozero
	Unshielded cable in use	Change wire to shielded cable
	Moisture problems	See moisture problems in "Accuracy Section"
"Auto-Trim Failure"	No flow in pipe while performing Universal Auto Trim	Establish a known flow in tube, and perform Universal Auto-Trim calibration
	Wiring error	Check that wiring matches appropriate wiring diagrams - see "Universal Sensor Wiring Diagrams" on page E-1
	Flow rate is changing in pipe while performing Universal Auto-Trim routine	Establish a constant flow in tube, and perform Universal Auto-Trim calibration
	Flow rate through sensor is significantly different than value entered during Universal Auto-Trim routine	Verify flow in tube and perform Universal Auto-Trim calibration
	Incorrect calibration number entered into transmitter for Universal Auto-Trim routine	Replace sensor calibration number with 1000005010000001
	Wrong tube size selected	Correct tube size setting - See "Line Size" on page 3-10
	Sensor failure	Perform sensor tests C and D (see Table 6-6 on page 6-9)
"Electronics Failure"	Electronics self check failure	Replace Electronics
"Electronics Temp Fail"	Ambient temperature exceeded the electronics temperature limits	Move transmitter to a location with an ambient temperature range of -40 to 165 °F (-40 to 74 °C)
"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	Re-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 11,000 Hz	Increase pulse scaling to prevent pulse output going above 11,000 Hz Verify the sensor calibration number is 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 is correctly entered in the electronics

Table 6-1. Rosemount 8712 Basic Diagnostic Messages

Message	Potential Cause	Corrective Action
"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 test A - Sensor Coil (see Table 6-6 on page 6-9)
"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 1000005010000001
	Calibrator is not set to 30 FPS	Change calibrator setting to 30 FPS
	Bad calibrator	Replace calibrator

Table 6-2. Rosemount 8712 Advanced Diagnostic Messages (Suite 1 - Option Code DA1)

Message	Potential Cause	Corrective Action
Grounding/Wiring Fault	Improper installation of wiring	See "Sensor to Remote Mount Transmitter Connections" on page 2-15
	Coil/Electrode shield not connected	See "Flowtube Sensor Connections" on page 2-17
	Improper process grounding	See "Grounding" on page 5-12
	Faulty ground connection	Check wiring for corrosion, moisture in the terminal block, and refer to "Grounding" on page 5-12
	Sensor not full	Verify sensor is full
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 "Step 2: Process Noise" on page 6-8
	Chemical additives upstream of the sensor	Move injection point downstream of the sensor, or move the sensor Complete the possible solutions listed under "Step 2: Process Noise" on page 6-8
	Electrode not compatible with the process fluid	Refer to the Rosemount Magnetic Flowmeter Material Selection Guide (00816-0100-3033)
	Air in line	Move the sensor to another location in the process line to ensure that it is full under all conditions
	Electrode coating	Use bulletnose electrodes Downsize sensor to increases flow rate above 3 ft/s (1 m/s) Periodically clean sensor
	Styrofoam or other insulating particles	Complete the possible solutions listed under "Step 2: Process Noise" on page 6-8 Consult factory
	Low conductivity fluids (below 10 microsiemens/cm)	Trim electrode and coil wires - refer to "Installation" on page 2-1

Table 6-3. Rosemount 8712 Advanced Diagnostic Messages (Suite 2 - Option Code DA2)

Message	Potential Cause	Corrective Action
8714i Failed	Transmitter Calibration Verification test failed	Verify pass/fail criteria Rerun 8714i Meter Verification under no flow conditions Verify calibration using 8714D Calibration Standard Perform digital trim Replace electronics board
	Sensor Calibration test failed	Verify pass/fail criteria Perform sensor test - see Table 6-6 on page 6-9
	Sensor Coil Circuit test failed	Verify pass/fail criteria Perform sensor test - see Table 6-6 on page 6-9
	Sensor Electrode Circuit test failed	Verify pass/fail criteria Perform sensor test - see Table 6-6 on page 6-9

Table 6-4. Basic Troubleshooting–Rosemount 8712

Symptom	Potential Cause	Corrective Action
Output at 0 mA	No power to transmitter	Check power source and connections to the transmitter
	Blown fuse	Check the fuse and replace with an appropriately rated fuse, if necessary
	Electronics failure	Verify transmitter operation with an 8714 Calibration Standard or replace the electronic board
	Analog output improperly configured	Check the analog power switch position
Output at 4 mA	Open coil drive circuit	Check coil drive circuit connections at the sensor and at the transmitter
	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 8714 Calibration Standard or replace the electronic board
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
Output at 20.8 mA	Transmitter not ranged properly	Reset the transmitter range values – see "PV URV (Upper Range Value)" on page 3-11; Check tube size setting in transmitter and make sure it matches your actual tube size – see "Line Size" on page 3-10
Output at alarm level	Electronics failure	Cycle power. If alarm is still present, verify transmitter operation with an 8714 Calibration Standard or replace the electronic board
Pulse output at zero, regardless of flow	Wiring error	Check pulse output wiring at terminals 3 and 4. Refer to wiring diagram for your sensor and pulse output
	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 your sensor and pulse output Power the transmitter
	Reverse flow	Enable Reverse Flow function
	Electronics failure	Verify transmitter operation with an 8714 Calibration Standard or replace the electronic board
	Pulse output incorrectly configured	Review configuration and correct as necessary
Communication problems with the Handheld Communicator	4–20 mA output configuration	Check analog power switch (internal/external). The Handheld Communicator requires a 4–20 mA output to function
	Communication interface wiring problems	Incorrect load resistance (250 Ω minimum, 600 ohm maximum); Check appropriate wiring diagram
	Low batteries in the Handheld Communicator	Replace the batteries in the Handheld Communicator – see the communicator manual for instructions
	Old revision of software in the Handheld Communicator	Consult your local sales office about updating to the latest revision of software
Error Messages on LOI or Handheld Communicator	Many possible causes depending upon the message	See the Figure 3-1 on page 3-3 for the LOI or Handheld Communicator messages.
Digital input does not register	Input signal does not provide enough counts	Verify that the digital input provided meets the requirements of Figure 2-13 on page 2-15

TRANSMITTER TROUBLESHOOTING

Table 6-5. Advanced Troubleshooting–Rosemount 8712

Symptom	Potential Cause	Corrective Action
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 – see “Quick Troubleshooting” on page 6-8
	Electrode Coating	Use bulletnose electrodes; Downsize sensor to increase flow rate above 3 ft/s; Periodically clean sensor
	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 A, B, C, and D (see Table 6-6 on page 6-9)
	Improper wiring	If electrode shield and signal wires are switched, flow indication will be about half of what is expected. Check wiring diagrams for your application.
	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 C and D (see Table 6-6 on page 6-9)
	Sensor failure–Shorted or open coil	Perform the sensor Tests A and B (see Table 6-6 on page 6-9)
	Transmitter failure	Verify transmitter operation with an 8714 Calibration Standard or replace the electronic board
Noisy Process	Chemical additives upstream of magnetic flowmeter	Complete the Noisy Process Basic procedure. 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	Complete the Noisy Process Basic procedure; Consult factory
	Electrode coating	Use replaceable electrodes in Rosemount 8705. Use a smaller sensor to increase flow rate above 3 ft/s. Periodically clean sensor.
	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 “Conduit Cables” on page 2-6 • Keep flow rate below 3 FPS • Integral mount transmitter • Use 8712-0752-1,3 cable • Use N0 approval sensor

Advanced Troubleshooting continued on next page

Table 6-5. Advanced Troubleshooting–Rosemount 8712

Symptom	Potential Cause	Corrective Action
Meter output is unstable	Medium to low conductivity fluids (10–25 microsiemens/cm) combined with cable vibration or 60 Hz interference	Eliminate cable vibration: • Integral mount • Move cable to lower vibration run • Tie down cable mechanically • Trim electrode and coil wires • See "Conduit Cables" on page 2-6 • Route cable line away from other equipment powered by 60 Hz • Use 8712-0752-1,3 cable
	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 "Mount the Transmitter" on page 2-3 for wiring and grounding procedures
	High local magnetic or electric fields	Move magnetic flowmeter (20–25 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 A, B, C, and D (See Table 6-6 on page 6-9)
	Analog output loop problem	Check that the 4 to 20 mA loop matches the digital value. Perform analog output test.
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
	Electrode coating	Use bulletnose electrodes in the Rosemount 8705 Sensor. Downsize the sensor to increase the flow rate above 3 ft/s. Periodically clean the sensor
	Air in line	Move the sensor to another location in the process line to ensure that it is full under all conditions
	Flow rate is below 1 ft/s (specification issue)	See the accuracy specification for specific transmitter and sensor
	Insufficient upstream/downstream pipe diameter	Move sensor to location where 5 pipe diameters upstream and 2 pipe diameters downstream is possible
	Cables for multiple magmeters run through same conduit	Run only one conduit cable between each sensor and transmitter
	Auto zero was not performed when the coil drive frequency was changed from 5 Hz to 37.5 Hz	Perform the auto zero function with full pipe and no flow
	Sensor failure—shorted electrode	See Table 6-6 on page 6-9
	Sensor failure—shorted or open coil	See Table 6-6 on page 6-9
	Transmitter failure	Replace the electronics board
	Transmitter wired to correct sensor	Check wiring

QUICK TROUBLESHOOTING

Step 1: Wiring Errors

The most common magmeter problem is wiring between the sensor and the transmitter in remote mount installations. The signal wire and coil drive wire must be twisted shielded cable: 20 AWG twisted shielded cable for the electrodes and 14 AWG twisted shielded cable for the coils. Ensure that the cable shield is connected at both ends of the electrode and coil drive cables. Signal and coil drive wires must have their own cables. The single conduit that houses both the signal and coil drive cables should not contain any other wires. For more information on proper wiring practices, refer to “Transmitter to Flowtube Sensor Wiring” on page 2-17.

Step 2: Process Noise

In some circumstances, process conditions rather than the magmeter can cause the meter output to be unstable. Possible solutions for addressing a noisy process situation are given below. When the output attains the desired stability, no further steps are required.

Use the Auto Zero function to initialize the transmitter for use with the 37.5 Hz coil drive mode only. Run this function only with the transmitter and sensor installed in the process. The sensor must be filled with process fluid with zero flow rate. Before running the auto zero function, be sure the coil drive mode is set to 37.5 Hz.

Set the loop to manual if necessary and begin the auto zero procedure. The transmitter completes the procedure automatically in about 90 seconds. A symbol appears in the lower right-hand corner of the display to indicate that the procedure is running.

1. Change the coil drive to 37.5 Hz. Complete the Auto Zero function, if possible (see “Coil Drive Frequency” on page 4-16).
2. Turn on Digital Signal Processing (see “Signal Processing” on page 4-31)
3. Increase the damping (see “PV Damping” on page 3-12).

If the preceding steps fail to resolve the process noise symptoms, consult your Rosemount sales representative about using a high-signal magnetic flowmeter system.

Step 3: Installed Sensor Tests

If a problem with an installed sensor is identified, Table 6-6 can assist in troubleshooting the sensor. Before performing any of the sensor tests, disconnect or turn off power to the transmitter. To interpret the results, the hazardous location certification for the sensor must be known. Applicable codes for the Rosemount 8705 are N0, N5, and KD. Applicable codes for the Rosemount 8707 are N0 and N5. Applicable codes for the Rosemount 8711 are N0, N5, E5, and CD. Always check the operation of test equipment before each test.

If possible, take all readings from inside the sensor junction box. If the sensor junction box is inaccessible, take measurements as close as possible. Readings taken at the terminals of remote-mount transmitters that are more than 100 feet away from the sensor may provide incorrect or inconclusive information and should be avoided. A sensor circuit diagram is provided in Figure 6-1 on page 6-10.

Table 6-6. Sensor Test

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	$2\Omega \le R \le 18\Omega$	• Open or Shorted Coil	• Remove and replace sensor
B. Shields to Case	Installed or Uninstalled	Multimeter	17 and ⏚ ⏚ and case ground 17 and case ground	$< 0.2\Omega$	• Moisture in terminal block • Leaky electrode • Process behind liner	• Clean terminal block • Remove sensor
C. Coil Shield to Coil	Installed or Uninstalled	Multimeter	1 and ⏚ 2 and ⏚	$\infty\Omega$ (< 1nS) $\infty\Omega$ (< 1nS)	• Process behind liner • Leaky electrode • Moisture in terminal block	• Remove sensor and dry • Clean terminal block • Confirm with sensor coil test
D. Electrode Shield to Electrode	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 NO: $\lvert R_1 - R_2 \rvert \le 300\Omega$ N5, E5, CD, ED: $\lvert R_1 \ \ R_2 \rvert \le 1500\Omega$	• Unstable R_1 or R_2 values confirm coated electrode • Shorted electrode • Electrode not in contact with process • Empty Pipe • Low conductivity • Leaky electrode	• Remove coating from sensor wall • Use bulletnose electrodes • Repeat measurement • Pull tube, complete test in Table 6-7 and Table 6-8 on page 6-11 out of line.

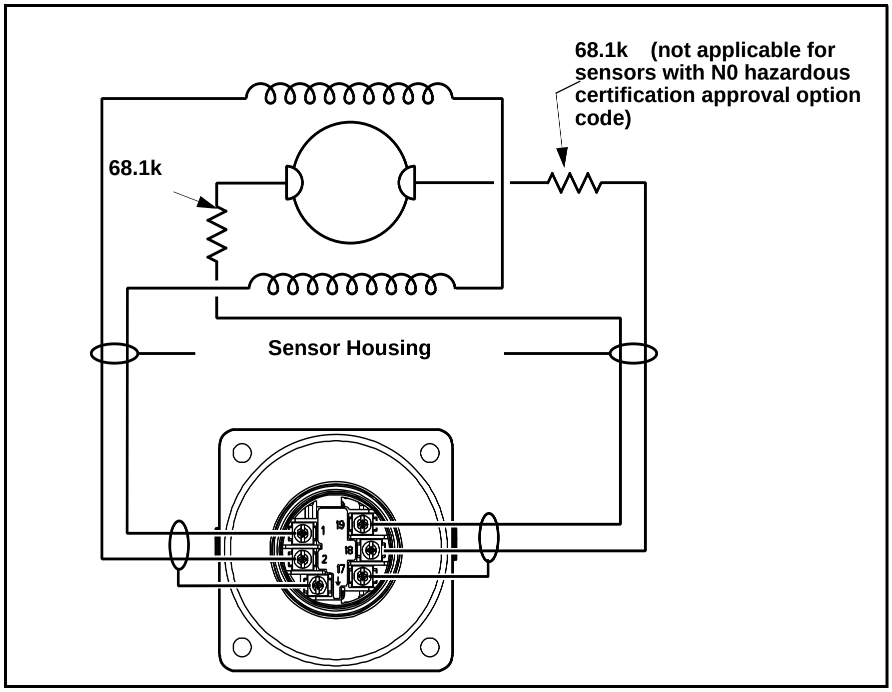
To test the sensor, a multimeter capable of measuring conductance in nanosiemens is preferred. Nanosiemens is the reciprocal of resistance.

$$1 \text{ nanosiemens} = \frac{1}{1 \text{ gigaohm}}$$

or

$$1 \text{ nanosiemens} = \frac{1}{1 \times 10^9 \text{ ohm}}$$

Figure 6-1. Sensor Circuit Diagram



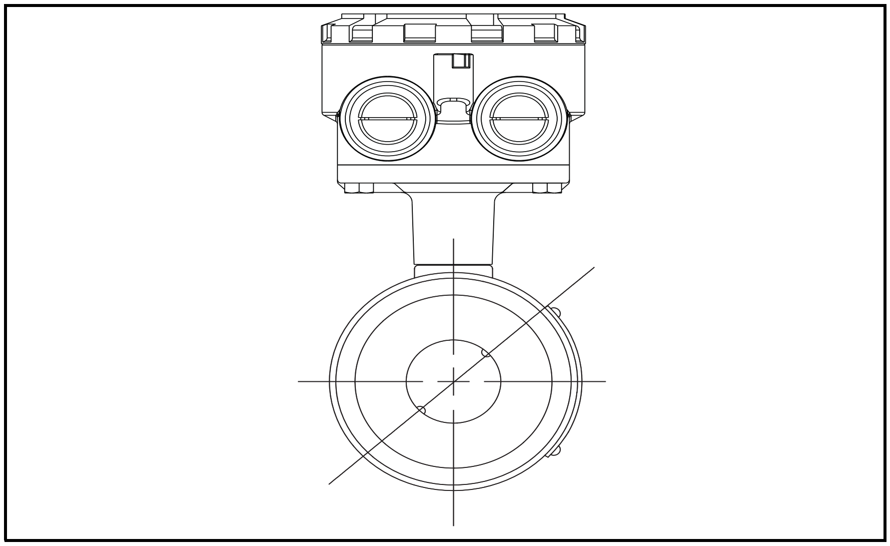
Step 4: Uninstalled Sensor Tests

An uninstalled sensor can also be used for sensor troubleshooting. To interpret the results, the hazardous location certification for the sensor must be known. Applicable codes for the Rosemount 8705 are N0, N5, and KD. Applicable codes for the Rosemount 8707 are N0 and N5. Applicable codes for the Rosemount 8711 are N0, N5, E5, and CD.

A sensor circuit diagram is provided in Figure 6-1. Take measurements from the terminal block and on the electrode head inside the sensor. The measurement electrodes, 18 and 19, are on opposite sides in the inside diameter. If applicable, the third grounding electrode is in between the other two electrodes. On Rosemount 8711 sensors, electrode 18 is near the sensor junction box and electrode 19 is near the bottom of the sensor (Figure 6-2). The different sensor models will have slightly different resistance readings. Flanged sensor resistance readings are in Table 6-7 while wafer sensor resistance readings are in Table 6-8.

See “Safety Information” on page 6-1 for complete warning information.

Figure 6-2. 45° Electrode Plane



To insure accuracy of resistance readings, zero out multimeter by shorting and touching the leads together.

Table 6-7. Uninstalled Rosemount 8705 / 8707 Flanged Sensor Tests

	Hazardous Location Certifications	
Measuring at Connections	**N0**	**N5, KD**
18 and Electrode(1)	$\leq 275\Omega$	$61k\Omega \leq R \leq 75k\Omega$
19 and Electrode(1)	$\leq 275\Omega$	$61k\Omega \leq R \leq 75k\Omega$
17 and Grounding Electrode	$\leq 0.3\Omega$	$\leq 0.3\Omega$
17 and Ground Symbol	$\leq 0.3\Omega$	$\leq 0.3\Omega$
17 and 18	Open	Open
17 and 19	Open	Open
17 and 1	Open	Open

(1) *It is difficult to tell from visual inspection alone which electrode is wired to which number terminal in the terminal block. Measure both electrodes. One electrode should result in an open reading, while the other electrode should be less than 275Ω.*

Table 6-8. Uninstalled Rosemount 8711 Wafer Sensor Tests

	Hazardous Location Certification	
Measuring at Connections	**N0**	**N5, E5, CD**
18 and Electrode(1)	$\leq 0.3\Omega$	$61k\Omega \leq R \leq 75k\Omega$
19 and Electrode(2)	$\leq 275\Omega$	$61k\Omega \leq R \leq 75k\Omega$
17 and Grounding Electrode	$\leq 0.3\Omega$	$\leq 0.3\Omega$
17 and Grounding Symbol	$\leq 0.3\Omega$	$\leq 0.3\Omega$
17 and 18	Open	Open
17 and 19	Open	Open
17 and 1	Open	Open

(1) *Measure the electrode closest to the junction box*
(2) *Measure the electrode farthest away from the junction box.*

Appendix A Reference Data

NOTE
Detailed information for all Rosemount Magnetic Flowmeter Products can be found in the latest revision of the 8700 Series Product Data Sheet (p/n 00813-0100-4727).

FUNCTIONAL SPECIFICATIONS

Sensor Compatibility

Compatible with Rosemount 8705, 8711, 8721, and 570TM sensors.
Compatible with Rosemount 8707 sensor with D2 Dual calibration option.
Compatible with AC and DC powered sensors of other manufacturers.

Sensor Coil Resistance

350 Ω maximum

Transmitter Coil Drive Current

500 mA

Flow Rate Range

Capable of processing signals from fluids that are traveling between 0.01 and 39 ft/s (0 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 for Rosemount 8712E. Excludes the effect of interconnecting cable length in remote mount transmitter installations.

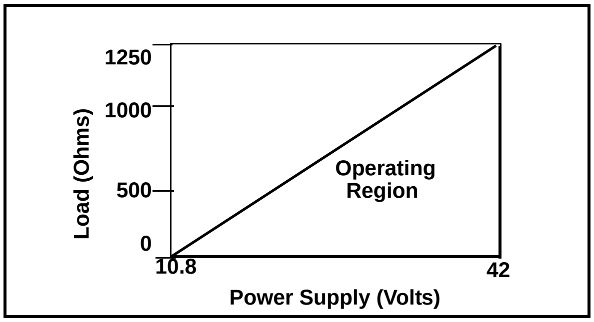
Power Supply

90-250 V AC, 50–60 Hz or 12–42 V DC

DC Load Limitations (Analog Output)

Maximum loop resistance is determined by the voltage level of the external power supply, as described by:

FIGURE 1. DC Load Limitations



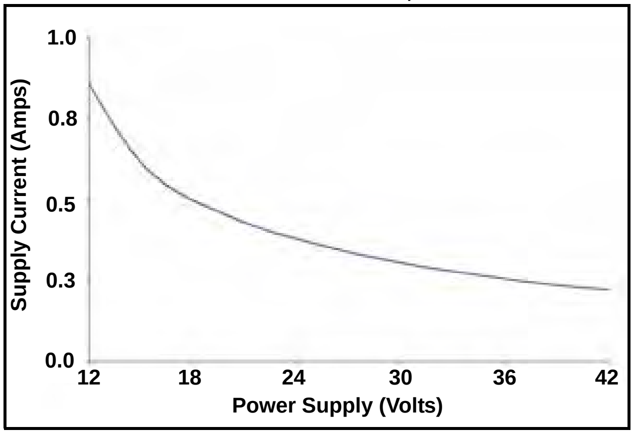
R_{max} =	$41.7(V_{ps} - 10.8)$
V_{ps} =	Power Supply Voltage (Volts)
R_{max} =	Maximum Loop Resistance (Ohms)

NOTE
HART Communication requires a minimum loop resistance of 250 ohms.

Supply Current Requirements

Units powered by 12-42 V DC power supply may draw up to 1 amp of current steady state.

FIGURE 2. DC Current Requirements



Power Consumption

10 watts maximum

Ambient Temperature Limits

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

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

Storage
–40 to 176 °F (–40 to 80 °C)

Humidity Limits

0–100% RH to 120 °F (49 °C), decreases linearly to 10% RH at 130 °F (54 °C)

Enclosure Rating

Type 4X, IP66

Output Signals

Analog Output Adjustment(1)
4–20 mA, switch-selectable as internally or externally powered 5 to 24 V DC; 0 to 1000 Ω load.

Engineering units—lower and upper range values are user-selectable.

Output 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, digital flow signal, superimposed on 4–20 mA signal, available for control system interface. 250 Ω required for HART communications.

Scalable Frequency Adjustment(1)
0-10,000 Hz, switch-selectable as internally or externally powered 5 to 24 V DC, transistor switch closure up to 2 W for frequencies up to 4,000 Hz and 5 V DC at 0.1 W at maximum frequency of 10,000 Hz. Pulse value can be set to equal desired volume in selected engineering units. Pulse width adjustable from 1.5 to 500 msec, below 1.5 msec pulse width automatically switches to 50% duty cycle. Local operator interface automatically calculates and displays maximum allowable output frequency.

Totalizer
Non-volatile totalizer for net, gross, forward and reverse totals.

Optional Digital Output Function (AX option)

Externally powered at 5 to 24 V DC, transistor switch closure up to 3 W to indicate either:

Reverse Flow:
Activates switch closure output when reverse flow is detected. The reverse flow rate is displayed.

Zero Flow:
Activates switch closure output when flow goes to 0 ft/s.

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.

(1) For transmitters with intrinsically safe outputs, power must be supplied externally.

Flow Limits (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 Digital Input Function (AX option)

Externally powered at 5 to 24 V DC, transistor switch closure up to 3 W 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. Activated by applying a contact closure.

Security Lockout

Security lockout jumper 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.

Output Testing

Analog Output Test
Transmitter may be commanded to supply a specified current between 3.75 and 23.25 mA

Pulse Output Test
Transmitter may be commanded to supply a specified frequency between 1 pulse/ day and 10,000 Hz

Turn-on Time

5 minutes to rated accuracy from power up, 5 seconds from power interruption

Start-up Time

0.2 seconds from zero flow

Low Flow Cutoff

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. The signal output will remain constant above these values. Out of range message displayed on LOI and the HART Communicator.

Damping

Adjustable between 0.0 and 256 seconds

Sensor Compensation

Rosemount sensors are flow-calibrated and assigned a calibration factor at the factory. The calibration factor is entered into the transmitter, enabling interchangeability of sensors without calculations or a compromise in accuracy.

8712E 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 00809-0100-4664.

Diagnostics

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

Advanced (DA1 Suite)
Ground/wiring fault
High process noise

Advanced (DA2 Suite)
8714i Meter Verification

PERFORMANCE SPECIFICATIONS

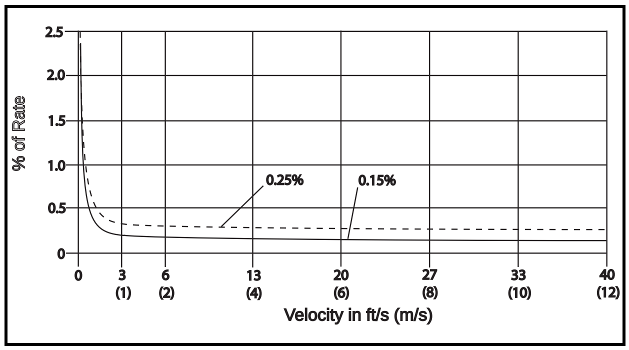
(System specifications are given using the frequency output and with the unit at referenced conditions.)

Accuracy

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

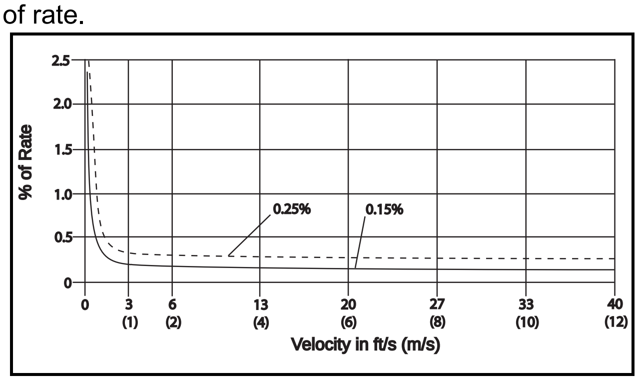
Rosemount 8712E with 8705/8707 Sensor:
Standard system accuracy is ±0.25% of rate ±1.0 mm/sec from 0.04 to 6 ft/s (0.01 to 2 m/s); above 6 ft/s (2 m/s), the system has an accuracy of ±0.25% of rate ±1.5 mm/sec.

Optional high accuracy is ±0.15% of rate ±1.0 mm/sec from 0.04 to 13 ft/s (0.01 to 4 m/s); above 13 ft/s (4 m/s), the system has an accuracy of ±0.18% of rate.(1)



Rosemount 8712E with 8711 Sensor:
Standard system accuracy is ±0.25% of rate ±2.0 mm/sec from 0.04 to 39 ft/s (0.01 to 12 m/s).

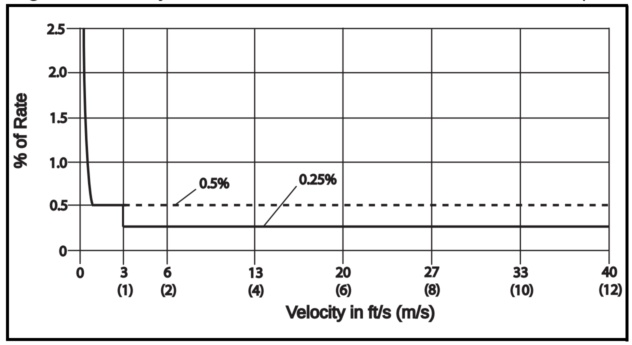
Optional high accuracy is ±0.15% of rate ±1.0 mm/sec from 0.04 to 13 ft/s (0.01 to 4 m/s); above 13 ft/s (4 m/s), the system has an accuracy of ±0.18% of rate.



Rosemount 8712E with 8721 Sensor:
Standard system accuracy is ±0.5% of rate from 1 to 39 ft/s (0.3 to 12 m/s); between 0.04 and 1.0 ft/s (0.01 and 0.3 m/s), the system has an accuracy of ±0.005 ft/s (0.0015 m/s).

(1) *For sensor sizes greater than 12 in. (300 mm) the high accuracy is ±0.25% of rate from 3 to 40 ft/sec (1 to 12 m/sec).*

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



Rosemount 8712E with Legacy 8705 Sensors:
Standard system accuracy is ±0.5% of rate from 1 to 39 ft/s (0.3 to 12 m/s); between 0.04 and 1.0 ft/s (0.01 and 0.3 m/s), the system has an accuracy of ±0.005 ft/s (0.0015 m/s).

Rosemount 8712E with Legacy 8711 Sensors:
Standard system accuracy is ±0.5% of rate from 3 to 39 ft/s (1 to 12 m/s); between 0.04 and 3.0 ft/s (0.01 and 1 m/s), the system has an accuracy of ±0.015 ft/s (0.005 m/s).

Rosemount 8712E with 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.

Analog Output Effect

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

Vibration Effect

±0.1% of span per SAMA PMC 31.1, Level 2

Repeatability

±0.1% of reading

Response Time

0.2 seconds maximum response to step change in input

Stability

±0.1% of rate over six months

Ambient Temperature Effect

0.25% over operating temperature range

EMC Compliance

EN61326-1 : 2006 (Industrial) electromagnetic compatibility (EMC) for process and laboratory apparatus.

PHYSICAL SPECIFICATIONS

Materials of Construction

Housing
Low-copper aluminum, Type 4X and IEC 60529 IP66

Paint
Polyurethane

Cover Gasket
Rubber

Electrical Connections

Four $^{1}/_{2}$–14 NPT connections provided on the base of the transmitter. Screw terminals provided for all of the connections. Power wiring connected to the transmitter only. Remote mounted transmitters require only a single conduit connection to the sensor.

NOTE
If $^{3}/_{4}$ - 14 NPT connections are required, $^{1}/_{2}$ to $^{3}/_{4}$ in. adapter kits are available for order.

Line Power Fuses

90–250 V ac systems
2 amp, Quick-acting Bussman AGCI or equivalent

12–42 V DC systems
3 amp, Quick-acting Bussman AGCI or equivalent

Transmitter Weight

Transmitter approximately 9 lb (4 kg). Add 1 lb (0.5 kg) for local operator interface.

ROSEMOUNT 8712E ORDERING INFORMATION

Model	Product Description
8712E	Remote Magnetic Flowmeter Transmitter
Code	**Transmitter Style**
S	Standard
Code	**Transmitter Mount**
R	Remote Mount for 2 in. pipe or panel (includes CS mounting bolts and 316L SST bracket)
Code	**Transmitter Power Supply**
1	AC Power Supply (90 to 250 V AC, 50-60Hz)
2	DC Power Supply (12 to 42 V DC)
Code	**Outputs**
A	4-20 mA Digital Electronics (HART Protocol)
Code	**Conduit Entry**
1	$^1/_2$ - 14 NPT, 4 Conduit Entries
2	CM20, 4 Conduit Entries(1)
3	PG 13.5, 4 Conduit Entries(2)
Code	**Safety Approvals(2)**
NA	CE Marking, no hazardous location approval
	FM & CSA
N0	FM Class 1 Div 2 for non-flammable: CSA Class 1 Div 2
N5	FM Class 1 Div 2 for flammable fluids
	ATEX
N1	ATEX Type n Ex nA nL IIC and ATEX Dust Approval(3)
ND	ATEX Dust Approval
	IECEx
N7	IECEx Type n Ex nA nL IIC and IECEx Dust Approval(3)
NF	IECEx Dust Approval
Code	**Options**
	PlantWeb Product/Process Diagnostics
DA1	Magmeter HART Diagnostic Suite 1: Includes High Process Noise and Ground/Wiring Fault Detection
DA2	Magmeter HART Diagnostic Suite 2: Includes 8714i Meter Verification
	Other Options
C1	Custom Configuration (CDS Required)
D1	High Accuracy Calibration (0.15% of rate for matched sensor and transmitter)(4)
DT	Heavy Duty Tagging
M4	Local Operator Interface
B6	316L Stainless Steel 4-bolt Kit for 2-in. Remote Pipe Mount
GE	M12, 4-Pin, Male Connector (Eurofast)
GM	A Size Mini, 4-Pin, Male Connector (Minifast)

	QIG Language
YA	Danish
YD	Dutch
YF	French
YG	German
YH	Finnish
YI	Italian
YN	Norwegian
YP	Portuguese
YS	Spanish
YR	Russian
YW	Swedish
Typical Model Number: 8712E S R 1 A 1 N0 DA1 DA2 M4	

(1) Adapter are used for this conduit entry type
(2) All product, ordered with or without Safety approvals, is compliant with local CE Marking and C-tick requirements unless specifically noted as a special
(3) For DC Transmitter Power Supply (Code = 2) Only
(4) D1 Option Code must be ordered with sensor and transmitter

Appendix B Approval Information

PRODUCT CERTIFICATIONS

APPROVED MANUFACTURING LOCATIONS

Rosemount Inc. — Eden Prairie, Minnesota, USA

Fisher-Rosemount Technologias de Flujo, S.A. de C.V. — Chihuahua Mexico

Emerson Process Management Flow — Ede, The Netherlands

Asia Flow Technology Center — Nanjing, China

European Directive Information

The EC declaration of conformity can be found in document number 00825-0100-4664. The most recent revision can be found at www.rosemount.com.

Type n protection type in accordance with EN 50021, EN 60079-15

- Closing of entries in the device must be carried out using the appropriate EEx e or EEx n metal cable gland and metal blanking plug or any appropriate ATEX approved cable gland and blanking plug with IP66 rating certified by an EU approved certification body.

CE *CE Marking*

C-Tick Marking

Hazardous Locations Certifications

North American Certifications

FM Approvals

N0 Non-incendive for Class I, Division 2, Groups A, B, C, and D non-flammable fluids (T4 at 40 °C), and Dust-ignition proof Class II/III, Division 1, Groups E, F, and G (T4 at 40 °C) Hazardous locations; Enclosure Type 4X

N5 Non-incendive for Class I, Division 2, Groups A, B, C, and D flammable fluids (T4 at 40 °C), and Dust-ignition proof Class II/III, Division 1, Groups E, F, and G (T4 at 40 °C) Hazardous locations; Enclosure Type 4X
Requires sensors with N5 Approval

Canadian Standards Association (CSA)

N0 Non-incendive for Class I, Division 2, Groups A, B, C, and D non-flammable fluids (T4 at 40 °C), and Dust-ignition proof Class II/III, Division 1, Groups E, F, and G (T4 at 40 °C) Hazardous locations; Enclosure Type 4X

European Certifications

N1 ATEX Type n
ATEX Certificate No: BASEEFA 05ATEX0170X
EEx nA nL IIC T4 (Ta = -40 °C to + 60 °C)
V_{max} = 42 V DC
CE 0575

Special Conditions for Safe Use (x)

The apparatus is not capable of withstanding the 500V insulation test required by Clause 8.1of EN 60079-15: 2003. This must be taken into account when installing the apparatus.

International Certifications

IECEx

N7 IECEx Type n
Certificate No: IECEx BAS 07.0036X
Ex nA nL IIC T4 (Ta = -40 °C to + 60 °C)
V_{max} = 42 V DC

Special Conditions for Safe Use (x)

The apparatus is not capable of withstanding the 500V insulation test required by Clause 6.8.1of IEC 60079-15: 2005. This must be taken into account when installing the apparatus.

Sensor Approval Information

Approval Codes	Rosemount 8705 Sensor		Rosemount 8707 Sensor		Rosemount 8711 Sensor		Rosemount 8721 Sensors
	For Non-flammable Fluids	For Flammable Fluids	For Non-flammable Fluids	For Flammable Fluids	For Non-flammable Fluids	For Flammable Fluids	For Non-flammable Fluids
NA	•						•
N0	•		•		•		
ND	•	•			•	•	
N1	•	•			•	•	
N5	•	•	•	•	•	•	
N7	•	•			•	•	
ND	•	•			•	•	
NF	•	•			•	•	
E1	•	•			•	•	
E5(1)	•	•			•	•	
KD(2)	•	•			•	•	

(1) *Available in line sizes up to 8 in. (200 mm) only.*
(2) *Refer to Table B-2 on page B-4 for relation between ambient temperature, process temperature, and temperature class.*

North American Certifications

Factory Mutual (FM)

N0 Non-incendive for Class I, Division 2, Groups A, B, C, and D non-flammable fluids (8705/8711 T5 at 60 °C; 8707 T3C at 60 °C), and Dust-ignition proof Class II/III, Division 1, Groups E, F, and G (8705/8711 T6 at 60 °C; 8707 T3C at 60 °C) Hazardous locations; Enclosure Type 4X

N0 8721 Hygienic Sensor
Factory Mutual (FM) Ordinary Location;
CE Marking; 3-A Symbol Authorization #1222;
EHEDG Type EL

N5 Non-incendive for Class I, Division 2, Groups A, B, C, and D; with intrinsically safe electrodes for use on flammable fluids (8705/8711 T5 at 60 °C; 8707 T3C at 60 °C), and Dust-ignition proof Class II/III, Division 1, Groups E, F, and G (8705/8711 T6 at 60 °C; 8707 T3C at 60 °C) Hazardous locations; Enclosure Type 4X

E5 Explosion proof for Class I, Division 1, Groups C and D (8705/8711 T6 at 60 °C), and Dust-ignition proof Class II/III, Division 1, Groups E, F, and G (8705/8711 T6 at 60 °C), and non-incendive for Class I, Division 2, Groups A, B, C, and D flammable fluids (8705/8711 T5 at 60 °C) Hazardous locations; Enclosure Type 4X

Canadian Standards Association (CSA)

N0 Non-incendive for Class I, Division 2, Groups A, B, C, and D non-flammable fluids (8705/8711 T5 at 60 °C; 8707 T3C at 60 °C), and Dust-ignition proof Class II/III, Division 1, Groups E, F, and G (8705/8711 T6 at 60 °C; 8707 T3C at 60 °C) Hazardous locations; Enclosure Type 4X

N0 8721 Hygienic Sensor
Canadian Standards Association (CSA) Ordinary Location;
CE Marking; 3-A Symbol Authorization #1222;
EHEDG Type EL

European Certifications

ND ATEX Dust Certificate No.: KEMA 06ATEX0006
Ex II 1D max. DT = 40 K IP66
Amb. Temp. Limits: (-20 °C = Ta = +65 °C)
CE 0575

Installation Instructions

The cable and conduit entry devices and blanking elements shall be of a certified IP66 type, suitable for the conditions of use and correctly installed.
At maximum ambient temperatures, or at process temperatures above 60 °C, heat resistant cables with a temperature rating of at least 90 °C shall be used.

N1 ATEX Non-Sparking/Non-incendive
Certificate No: KEMA02ATEX1302X
Ex II 3G EEx nA [L] IIC T3... T6
Ambient Temperature Limits -20 to 65 °C

SPECIAL CONDITIONS FOR SAFE USE (X):

The relation between ambient temperature, process temperature and temperature class is to be taken from Table B-3 on page B-5. The electrical data is to be taken from Table B-1 on page B-4.

KD, E1

ATEX Zone 1 Increased Safety with IS Electrodes
Certificate No. KEMA 03ATEX2052X
Ex II 1/2G EEx e ia IIC T3...T6
Ambient Temperature Limits -20 to 65 °C (See Table B-2)
CE 0575
V_{max} = 40 V

SPECIAL CONDITIONS FOR SAFE USE (X):

The relation between ambient temperature, process temperature and temperature class is to be taken from Table B-3 on page B-5. The electrical data is to be taken from Table B-1 on page B-4.

Installation Instructions

At ambient temperatures above 50 °C, heat resistant cables with a temperature rating of at least 90 °C shall be used.
A fuse with a rating of maximum 0,7 A according to IEC 60127-1 shall be included in the coil excitation circuit if the sensors are used with other flow transmitters.

Table B-1. Electrical Data

Rosemount 8705 and 8711 Sensors	
Coil excitation circuit:	40 V, 0,5 A, 20 W maximum
Electrode circuit:	in type of explosion protection intrinsic safety EEx ia IIC, U_i = 5 V, I_i = 0.2 mA, P_i = 1 mW, U_m = 250 V

Table B-2. Relation between ambient temperature, process temperature, and temperature class(1)

Meter Size (Inches)	Maximum Ambient Temperature	Maximum Process Temperature	Temperature Class
1/2	115°F (65°C)	239°F (115°C)	T3
1	149°F (65°C)	248°F (120°C)	T3
1	95°F (35°C)	95°F (35°C)	T4
1 1/2	149°F (65°C)	257°F (125°C)	T3
1 1/2	122°F (50°C)	148°F (60°C)	T4
2	149°F (65°C)	257°F (125°C)	T3
2	149°F (65°C)	167°F (75°C)	T4
2	104°F (40°C)	104°F (40°C)	T5
3 - 36	149°F (65°C)	266°F (130°C)	T3
3 - 36	149°F (65°C)	194°F (90°C)	T4
3 - 36	131°F (55°C)	131°F (55°C)	T5
3 - 36	104°F (40°C)	104°F (40°C)	T6
6	115°F (65°C)	275°F(135°C)	T3
6	115°F (65°C)	230°F (110°C)	T4
6	115°F (65°C)	167°F (75°C)	T5
6	140°F (60°C)	140°F (60°C)	T6
8-60	115°F (65°C)	284°F (140°C)	T3
8-60	115°F (65°C)	239°F (115°C)	T4
8-60	115°F (65°C)	176°F (80°C)	T5
8-60	115°F (65°C)	156°F (69°C)	T6

(1) This table is applicable for KD approval codes only.

Table B-3. Relation between the maximum ambient temperature, the maximum process temperature, and the temperature class(1)

Maximum Ambient Temperature	Maximum process temperature °F (°C) per temperature class			
	T3	T4	T5	T6
0.5 in. sensor size				
149°F (65°C)	297°F (147°C)	138°F (59°C)	54°F (12°C)	18°F (-8°C)
140°F (60°C)	309°F (154°C)	151°F (66°C)	66°F (19°C)	28°F (-2°C)
131°F (55°C)	322°F (161°C)	163°F (73°C)	79°F (26°C)	41°F (5°C)
122°F (50°C)	334°F (168°C)	176°F (80°C)	90°F (32°C)	54°F (12°C)
113°F (45°C)	347°F (175°C)	189°F (87°C)	102°F (39°C)	66°F (19°C)
104°F (40°C)	351°F (177°C)	199°F (93°C)	115°F (46°C)	79°F (26°C)
95°F (35°C)	351°F (177°C)	212°F (100°C)	127°F (53°C)	90°F (32°C)
86°F (30°C)	351°F (177°C)	225°F (107°C)	138°F (59°C)	102°F (39°C)
77°F (25°C)	351°F (177°C)	237°F (114°C)	151°F (66°C)	115°F (46°C)
68°F (20°C)	351°F (177°C)	248°F (120°C)	163°F (73°C)	127°F (53°C)
1.0 in. sensor size				
149°F (65°C)	318°F (159°C)	158°F (70°C)	72°F (22°C)	34°F (1°C)
140°F (60°C)	331°F (166°C)	171°F (77°C)	84°F (29°C)	46°F (8°C)
131°F (55°C)	343°F (173°C)	183°F (84°C)	97°F (36°C)	59°F (15°C)
122°F (50°C)	351°F (177°C)	196°F (91°C)	109°F (43°C)	72°F (22°C)
113°F (45°C)	351°F (177°C)	207°F (97°C)	122°F (50°C)	84°F (29°C)
104°F (40°C)	351°F (177°C)	219°F (104°C)	135°F (57°C)	97°F (36°C)
95°F (35°C)	351°F (177°C)	232°F (111°C)	145°F (63°C)	109°F (43°C)
86°F (30°C)	351°F (177°C)	244°F (118°C)	158°F (70°C)	122°F (50°C)
77°F (25°C)	351°F (177°C)	257°F (125°C)	171°F (77°C)	135°F (57°C)
68°F (20°C)	351°F (177°C)	270°F (132°C)	183°F (84°C)	145°F (63°C)
1.5 in. sensor size				
149°F (65°C)	297°F (147°C)	160°F (71°C)	88°F (31°C)	55°F (13°C)
140°F (60°C)	307°F (153°C)	171°F (77°C)	97°F (36°C)	66°F (19°C)
131°F (55°C)	318°F (159°C)	181°F (83°C)	108°F (42°C)	77°F (25°C)
122°F (50°C)	329°F (165°C)	192°F (89°C)	118°F (48°C)	88°F (31°C)
113°F (45°C)	340°F (171°C)	203°F (95°C)	129°F (54°C)	97°F (36°C)
104°F (40°C)	351°F (177°C)	214°F (101°C)	140°F (60°C)	108°F (42°C)
95°F (35°C)	351°F (177°C)	223°F (106°C)	151°F (66°C)	118°F (48°C)
86°F (30°C)	351°F (177°C)	234°F (112°C)	160°F (71°C)	129°F (54°C)
77°F (25°C)	351°F (177°C)	244°F (118°C)	171°F (77°C)	140°F (60°C)
68°F (20°C)	351°F (177°C)	255°F (124°C)	181°F (83°C)	151°F (66°C)

Continued on Next Page

Table B-3. Relation between the maximum ambient temperature, the maximum process temperature, and the temperature class[1]

Maximum Ambient Temperature	Maximum process temperature °F (°C) per temperature class			
	T3	T4	T5	T6
2.0 in. sensor size				
149°F (65°C)	289°F (143°C)	163°F (73°C)	95°F (35°C)	66°F (19°C)
140°F (60°C)	300°F (149°C)	172°F 78(°C)	104°F (40°C)	75°F (24°C)
131°F (55°C)	309°F (154°C)	183°F (84°C)	115°F (46°C)	84°F (29°C)
122°F (50°C)	318°F (159°C)	192°F (89°C)	124°F (51°C)	95°F (35°C)
113°F (45°C)	329°F (165°C)	201°F (94°C)	135°F (57°C)	104°F (40°C)
104°F (40°C)	338°F (170°C)	212°F (100°C)	144°F (62°C)	115°F (46°C)
95°F (35°C)	349°F (176°C)	221°F (105°C)	153°F (67°C)	124°F (51°C)
86°F (30°C)	351°F (177°C)	232°F (111°C)	163°F (73°C)	135°F (57°C)
77°F (25°C)	351°F (177°C)	241°F (116°C)	172°F (78°C)	144°F (62°C)
68°F (20°C)	351°F (177°C)	252°F (122°C)	183°F (84°C)	153°F (67°C)
3 to 60 in. sensor size				
149°F (65°C)	351°F (177°C)	210°F (99°C)	117°F (47°C)	75°F (24°C)
140°F (60°C)	351°F (177°C)	223°F (106°C)	129°F (54°C)	90°F (32°C)
131°F (55°C)	351°F (177°C)	237°F (114°C)	144°F (62°C)	102°F (39°C)
122°F (50°C)	351°F (177°C)	250°F (121°C)	156°F (69°C)	117°F (47°C)
113°F (45°C)	351°F (177°C)	264°F (129°C)	171°F (77°C)	129°F (54°C)
104°F (40°C)	351°F (177°C)	266°F (130°C)	183°F (84°C)	144°F (62°C)
95°F (35°C)	351°F (177°C)	266°F (130°C)	198°F (92°C)	156°F (69°C)
86°F (30°C)	351°F (177°C)	266°F (130°C)	203°F (95°C)	171°F (77°C)
77°F (25°C)	351°F (177°C)	266°F (130°C)	203°F (95°C)	176°F (80°C)
68°F (20°C)	351°F (177°C)	266°F (130°C)	203°F (95°C)	176°F (80°C)

(1) *This table is applicable for N1 option codes only.*

Appendix C Diagnostics

DIAGNOSTIC AVAILABILITY

Rosemount Magmeters provide device diagnostics that powers PlantWeb and informs the user of abnormal situations throughout the life of the meter - from installation to maintenance and meter verification. With Rosemount Magmeter diagnostics enabled, users can change their practices to improve plant availability and output, and reduce costs through simplified installation, maintenance and troubleshooting.

Diagnostics	Mag User Practice	8712 HART
Basic		
Empty Pipe	Process Management	•
Electronics Temperature	Maintenance	•
Coil Fault	Maintenance	•
Transmitter Faults	Maintenance	•
Reverse Flow	Process Management	•
Advanced (Suite 1)		DA1 Option
High Process Noise	Process Management	•
Grounding/Wiring Fault	Installation	•
Advanced (Suite 2)		DA2 Option
8714i Meter Verification	Calibration Verification	•

Options for Accessing Diagnostics

Rosemount magmeter diagnostics can be accessed through the Local Operator Interface (LOI), the 375 Handheld Communicator, and AMS Device Manager.

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 Intelligent Device Manager for the Ultimate Value

The value of the Diagnostics increases significantly when AMS is used. Now the user gets a simplified screen flow and procedures for how to respond to the Diagnostic messages.

LICENSING AND ENABLING

All non-basic diagnostics must be 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. To obtain a license key, contact your local Rosemount Representative. Each transmitter has a unique license key specific to the diagnostic option code. See the detailed procedures below for entering the license key and enabling the advanced diagnostics.

Licensing the 8712 Diagnostics

For licensing the advanced diagnostics, follow the steps below.

1. Power-up the 8712 transmitter
2. Verify that you have 5.3.1 software or later

HART Fast Keys	1, 4, 6, 10, 3
LOI Key	AUX. FUNCTION
AMS Tab	License

3. Determine the Device ID

HART Fast Keys	1, 4, 6, 6
LOI Key	AUX. FUNCTION
AMS Tab	License

4. Obtain a License Key from your local Rosemount Representative.
5. Enter License Key

HART Fast Keys	1, 2, 3, 5, 2, 2
LOI Key	AUX. FUNCTION
AMS Tab	License

6. Enable Advanced Diagnostics

HART Fast Keys	1, 2, 1
LOI Key	AUX. FUNCTION
AMS Tab	Diagnostics

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 0, and deliver a PlantWeb alert.

Turning Empty Pipe On/Off

HART Fast Keys	1, 2, 1, 1
LOI Key	AUX. FUNCTION
AMS Tab	Diagnostics

The Empty Pipe diagnostic can be turned on or off as required by the application. If the advanced diagnostics suite 1 (DA1 Option) was ordered, then the Empty Pipe diagnostic will be turned on. If DA1 was not ordered, the default setting is off.

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 Value

HART Fast Keys	1, 2, 2, 4, 1
LOI Key	XMTR INFO
AMS Tab	Diagnostics

Reads the current Empty Pipe Value. This is a read-only value. This number is a unitless 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 Trigger Level

HART Fast Keys	1, 2, 2, 4, 2
LOI Key	AUX. FUNCTION
AMS Tab	Diagnostics

Limits: 3 to 2000

This value configures 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 Counts

HART Fast Keys	1, 2, 2, 4, 3
LOI Key	AUX. FUNCTION
AMS Tab	Diagnostics

Limits: 5 to 50

This value configures the number of consecutive updates that the Empty Pipe Value must exceed the Empty Pipe Trigger Level before the Empty Pipe diagnostic alert activates. The default setting from the factory is 5.

Optimizing Tunable Empty Pipe

The Tunable Empty Pipe diagnostic is set at the factory to properly diagnose most applications. If this diagnostic unexpectedly activates, the following procedure can be followed to optimize the Empty Pipe diagnostic for the application.

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

Troubleshooting Empty Pipe

The following actions can be taken if Empty Pipe detection is unexpected.

1. Verify the sensor is full.
2. Verify that 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 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 5-50, with 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. Confirm the resistance reading between coil ground (ground symbol) and coil (1 and 2) is infinity, or open. Confirm the resistance reading between electrode ground (17) and an electrode (18 or 19) is greater than 2 kohms and rises. For more detailed information, consult Table 6-6 on page 6-9.

GROUND/WIRING FAULT DETECTION

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 a PlantWeb alert. This diagnostic can also detect if the grounding is lost over-time due to corrosion or another root cause.

Turning Ground/Wiring Fault On/Off

HART Fast Keys	1, 2, 1, 3
LOI Key	AUX. FUNCTION
AMS Tab	Diagnostics

The Ground/Wiring Fault 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 diagnostic will be turned on. If DA1 was not ordered or licensed, this diagnostic is not available.

Ground/Wiring Fault Parameters

The Ground/Wiring Fault diagnostic has one read-only parameter. It does not have any configurable parameters.

Line Noise

HART Fast Keys	1, 2, 4, 3
LOI Key	XMTR INFO
AMS Tab	Diagnostics

Reads the current 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.

Troubleshooting Ground/Wiring Fault

The transmitter detected high levels of 50/60 Hz noise caused by improper wiring or poor process grounding.

1. Verify that the transmitter is earth grounded.
2. Connect ground rings, grounding electrode, lining protector, or grounding straps. Grounding diagrams can be found in “Grounding” on page 5-12.
3. Verify sensor is full.
4. Verify wiring between sensor and transmitter is prepared properly. Shielding should be stripped back less than 1 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.

Ground/Wiring Fault Functionality

The transmitter continuously monitors signal amplitudes over a wide range of frequencies. For the Ground/Wiring Fault 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.

HIGH PROCESS NOISE DETECTION

The High Process Noise diagnostic detects if there is a process condition causing unstable or noisy readings, but the noise is not real flow variation. One 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 variation is seen, this diagnostic will activate and deliver a PlantWeb alert. If this situation exists and is left without remedy, it will add additional uncertainty and noise to the flow reading.

Turning High Process Noise On/Off

HART Fast Keys	1, 2, 1, 2
LOI Key	AUX. FUNCTION
AMS Tab	Diagnostics

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.

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 > 1 ft/s.

5 Hz Signal to Noise Ratio

HART Fast Keys	1, 2, 4, 4
LOI Key	XMTR INFO
AMS Tab	Diagnostics

Reads the current 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

HART Fast Keys	1, 2, 4, 5
LOI Key	XMTR INFO
AMS Tab	Diagnostics

Reads 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.

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 (refer to “Coil Drive Frequency” on page 4-16) and, if possible, perform Auto Zero function (refer to “Auto Zero” on page 4-15).
2. Verify sensor is electrically connected to the process with grounding 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 (refer to Appendix D: 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 3-12). This will add dead-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.

High Process Noise Functionality

The High Process Noise diagnostic is useful for detecting situations where the process fluid may be causing electrical noise resulting in a poor measurement from the magnetic flowmeter. There are three basic types of process noise that can affect the performance of the magnetic flowmeter system.

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 the general background noise of the plant.

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.

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.

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.

8714I METER VERIFICATION

The 8714i Meter Verification diagnostic provides a means of verifying the flowmeter is within calibration without removing the sensor from the process. This is a manually initiated diagnostic test that provides a review of the transmitter and sensors critical parameters as a means to document verification of calibration. The results of running this diagnostic provide the deviation amount from expected values and a pass/fail summary against user-defined criteria for the application and conditions.

Initiating 8714i Meter Verification

HART Fast Keys	1, 2, 3, 3, 1
LOI Key	AUX. FUNCTION
AMS Tab	Context Menu, Diagnostics and Tests, 8714i Meter Verification

The 8714i Meter Verification diagnostic can be initiated as required by the application. If the advanced diagnostic suite (DA2) was ordered, then the 8714i Meter Verification diagnostic will be available. If DA2 was not ordered or licensed, this diagnostic will not be available.

Sensor Signature Parameters

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.

Establishing the baseline sensor signature

The first step in running the 8714i 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.

HART Fast Keys	1, 2, 3, 3, 3, 2
LOI Key	AUX. FUNCTION
AMS Tab	Context Menu, Diagnostics and Tests,

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 signature measurements. 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.

8714i Meter Verification Test Parameters

The 8714i has a multitude of parameters that set the test criteria, test conditions, and scope of the calibration verification test.

Test Conditions for the 8714i Meter Verification

There are three possible test conditions that the 8714i Meter Verification test can be initiated under. This parameter is set at the time that the Sensor Signature or 8714i Meter Verification test is initiated.

No Flow

Run the 8714i Meter Verification test with a full pipe and no flow in the line. Running the 8714i Meter Verification test under this condition provides the most accurate results and the best indication of magnetic flowmeter health.

Flowing, Full

Run the 8714i Meter Verification test with a full pipe and flow in the line. Running the 8714i Meter Verification test under this condition provides the ability to verify the magnetic flowmeter health without shutting down the process flow in applications where a shutdown is not possible. Running the calibration verification under flowing conditions can cause false fails if the flow rate is not at a steady flow, or if there is process noise present.

Empty Pipe

Run the 8714i Meter Verification test with an empty pipe. Running the 8714i Meter Verification test under this condition provides the ability to verify the magnetic flowmeter health with an empty pipe. Running the calibration verification under empty pipe conditions will not check the electrode circuit health.

8714i Meter Verification Test Criteria

The 8714i Meter Verification diagnostic provides the ability for the user to define the test criteria that the verification must test to. The test criteria can be set for each of the flow conditions discussed above.

HART Fast Keys	1, 2, 3, 3, 4
LOI Key	AUX. FUNCTION
AMS Tab	8714i

No Flow

Set the test criteria for the No Flow condition. The factory default for this value is set to two percent with limits configurable between one and ten percent.

HART Fast Keys	1, 2, 3, 3, 4, 1
AMS Tab	8714i

Flowing, Full

Set the test criteria for the Flowing, Full condition. The factory default for this value is set to three percent with limits configurable between one and ten percent.

HART Fast Keys	1, 2, 3, 3, 4, 2
AMS Tab	8714i

Empty Pipe

Set the test criteria for the Empty Pipe condition. The factory default for this value is set to three percent with limits configurable between one and ten percent.

HART Fast Keys	1, 2, 3, 3, 4, 3
AMS Tab	8714i

8714i Meter Verification Test Scope

The 8714i Meter Verification 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 8714i Meter Verification test is initiated.

All

Run the 8714i Meter Verification test and verify the entire flowmeter installation. This parameter results in the calibration verification performing the transmitter calibration verification, tube calibration verification, coil health check, and electrode health check. Transmitter calibration and tube calibration are verified to the percentage associated with the test condition selected when the test was initiated.

HART Fast Keys	1, 2, 3, 3, 1, 1
AMS	Context Menu, Diagnostics and Tests, 8714i Meter Verification

Transmitter

Run the 8714i 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 8714i Meter Verification test was initiated.

HART Fast Keys	1, 2, 3, 3, 1, 2
AMS	Context Menu, Diagnostics and Tests, 8714i Meter Verification

Sensor

Run the 8714i 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 8714i Meter Verification test was initiated, verifying the coil circuit health, and the electrode circuit health.

HART Fast Keys	1, 2, 3, 3, 1, 3
AMS	Context Menu, Diagnostics and Tests, 8714i Meter Verification

8714i Meter Verification Test Results Parameters

Once the 8714i Meter Verification test is initiated, the transmitter will make several measurements to verify the transmitter calibration, tube calibration, coil circuit health, and electrode circuit health. The results of these tests can be reviewed and recorded on the calibration verification report found on page C-16. This report can be used to validate that the meter is within the required calibration limits to comply with governmental regulatory agencies such as the Environmental Protection Agency or Food and Drug Administration.

Viewing the 8714i Meter Verification Results

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 the calibration report is populated with the necessary data eliminating the need to manually complete the report found on page C-16.

NOTE
When using AMS there are two possible methods that can be used to print the report.

Method one involves taking a PrntScrn picture of the 8714i Report tab on the status screen and pasting it into a word processing program. The PrntScrn button will capture all items on the screen so the image will need to be cropped and resized in order to get only the report.

Method two involves using the print feature within AMS 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 following order:

Test Condition

Review the test condition that the 8714i Meter Verification test was performed under.

HART Fast Keys	1, 2, 3, 3, 2, 1
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

Test Criteria

Review the test criteria used to determine the results of the calibration verification tests.

HART Fast Keys	1, 2, 3, 3, 2, 2
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

8714i Result

Displays the overall result of the 8714i Meter Verification test as either a Pass or Fail.

HART Fast Keys	1,2,3,3,2,3
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

Simulated Velocity

Displays the simulated velocity used to verify the transmitter calibration.

HART Fast Keys	1,2,3,3,2,4
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

Actual Velocity

Displays the velocity measured by the transmitter during the transmitter calibration verification process.

HART Fast Keys	1,2,3,3,2,5
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

Velocity Deviation

Displays the deviation in the actual velocity compared to the simulated velocity in terms of a percentage. This percentage is then compared to the test criteria to determine if the transmitter is within calibration limits.

HART Fast Keys	1,2,3,3,2,5
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

Transmitter Calibration Verification

Displays the results of the transmitter calibration verification test as either a Pass or Fail.

HART Fast Keys	1,2,3,3,2,6
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

Sensor Calibration Deviation

Displays the deviation in the sensor calibration. This value tells how much the sensor calibration has shifted from the original baseline signature. This percentage is compared to the test criteria to determine if the sensor is within calibration limits.

HART Fast Keys	1,2,3,3,2,7
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

Sensor Calibration Verification

Displays the results of the sensor calibration verification test as either a Pass or Fail.

HART Fast Keys	1,2,3,3,2,8
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

Coil Circuit Verification

Displays the results of the coil circuit health check as either a Pass or Fail.

HART Fast Keys	1,2,3,3,2,9
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

Electrode Circuit Verification

Displays the results of the electrode circuit health check as either a Pass or Fail.

HART Fast Keys	1,2,3,3,2,10 (To get to this value, the down arrow must be used to scroll through the menu list)
LOI Key	XMTR INFO
AMS	Context Menu, Device Diagnostics, 8714i Report

Optimizing the 8714i Meter Verification

The 8714i 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 every year to comply with Environmental Protection Agency and Pollution Control Agency standards. These governmental agencies require that the meter be certified to five percent accuracy.

Since this is an effluent meter, shutting down the process may not be viable. In this instance the 8714i 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, but plant requirements require a calibration record be kept on-hand. Meter calibration on this process must meet one 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 8714i Meter Verification test can be run under no flow conditions, set the test criteria for No Flow to one 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 8714i 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.

Troubleshooting the 8714i Meter Verification Test

In the event that the 8714i Meter Verification test fails, the following steps can be used to determine the appropriate course of action. Begin by reviewing the 8714i results to determine the specific test that failed.

Figure C-1. Troubleshooting the 8714i Meter Verification Test Table

Test	Potential Causes of Failure	Steps to Correct
Transmitter Calibration Verification Test Failed	• Unstable flow rate during the verification test • Noise in the process • Transmitter drift • Faulty electronics	• Perform the test with no flow in the pipe • Check calibration with an external standard like the 8714D • Perform a digital trim • Replace the electronics
Sensor Calibration Verification Failed	• Moisture in the terminal block of the sensor • Calibration shift caused by heat cycling or vibration	• Remove the sensor and send back for recalibration.
Coil Circuit Health Failed	• Moisture in the terminal block of the sensor • Shorted Coil	• Perform the sensor checks detailed on page C-16.
Electrode Circuit Health Failed	• Moisture in the terminal block of the sensor • Coated Electrodes • Shorted Electrodes	• Perform the sensor checks detailed on page C-16.

8714i Meter Verification Functionality

The 8714i Meter Verification diagnostic functions by taking a baseline sensor signature and then comparing measurements taken during the verification test to these baseline results.

Sensor Signature Values

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

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 when the 8714i Meter Verification diagnostic is initiated.

HART Fast Keys	1,2,3,3,3,1,1
LOI Key	XMTR INFO
AMS Tab	Config/Setup, 8714i

Coil Signature

The Coil Signature is a measurement of the magnetic field strength. This value is used as a baseline to determine if a sensor calibration shift has occurred when the 8714i Meter Verification diagnostic is initiated.

HART Fast Keys	1,2,3,3,3,1,2
LOI Key	XMTR INFO
AMS Tab	Config/Setup, 8714i

Electrode Circuit Resistance

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 when the 8714i Meter Verification diagnostic is initiated.

HART Fast Keys	1,2,3,3,3,1,3
LOI Key	XMTR INFO
AMS Tab	Config/Setup, 8714i

8714i Meter Verification Measurements

The 8714i 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

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.

HART Fast Keys	1,2,3,3,5,1
LOI Key	XMTR INFO
AMS Tab	Config/Setup, 8714i

Coil Signature

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 tube calibration deviation.

HART Fast Keys	1,2,3,3,5,2
LOI Key	XMTR INFO
AMS Tab	Config/Setup, 8714i

Electrode Circuit Resistance

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.

HART Fast Keys	1,2,3,3,5,3
LOI Key	XMTR INFO
AMS Tab	Config/Setup, 8714i

ROSEMOUNT MAGNETIC FLOWMETER CALIBRATION VERIFICATION REPORT

Calibration Verification Report Parameters

User Name: ____

Calibration Conditions: ☐ Internal ☐ External

Tag #:____

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

Simulated Velocity:______________________________

Actual Velocity:_________________________________

Deviation %:____________________________________

Transmitter: PASS / FAIL / NOT TESTED

Sensor Calibration Verification Results

Sensor Deviation %:______________________________

Sensor: PASS / FAIL / NOT TESTED

Coil Circuit Test: 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:____

Appendix D Digital Signal Processing

SAFETY MESSAGES

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Please read the following safety messages before performing any operation described in this section.

Warnings

⚠WARNING

Explosions could result in death or serious injury:

- Verify that the operating atmosphere of the sensor and transmitter is consistent with the appropriate hazardous locations certifications.
- Do not remove the 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.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

⚠WARNING

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:

- The electrode compartment may contain line pressure; it must be depressurized before the cover is removed.

⚠WARNING

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

- Avoid contact with leads and terminals.

PROCEDURES

If the output of your Rosemount 8712 is unstable, first check the wiring and grounding associated with the magnetic flowmeter system. Ensure that the following conditions are met:

- Ground straps are attached to the adjacent flange or ground ring?
- Grounding rings, lining protectors, or grounding electrodes are being used in lined or nonconductive piping?
- Both of the shields attached at both ends?

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 8712 coil drive mode is selectable between the standard 5 Hz and the noise-reducing 37 Hz. See "Coil Drive Frequency" on page 4-33 for instructions on how to change the coil drive mode to 37 Hz.

Auto Zero

To ensure optimum accuracy when using 37 Hz coil drive mode, there is an auto zero function that must be initiated during start-up. The auto zero operation is also discussed in the start-up and configuration sections. 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.

Signal Processing

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 8712 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 8712 microprocessor can actually scrutinize each input based on three user-defined parameters to reject the noise specific to the application.

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:

1. Number of samples: The number of samples function sets the amount of time that inputs are collected and used to calculate the average value. Each second is divided into tenths ($^1/_{10}$) with the number of samples equaling the number of $^1/_{10}$ second increments used to calculate the average. Factory Preset Value = 90 samples.

   For example, a value of:

   1 averages the inputs over the past $^1/_{10}$ second

   10 averages the inputs over the past 1 second

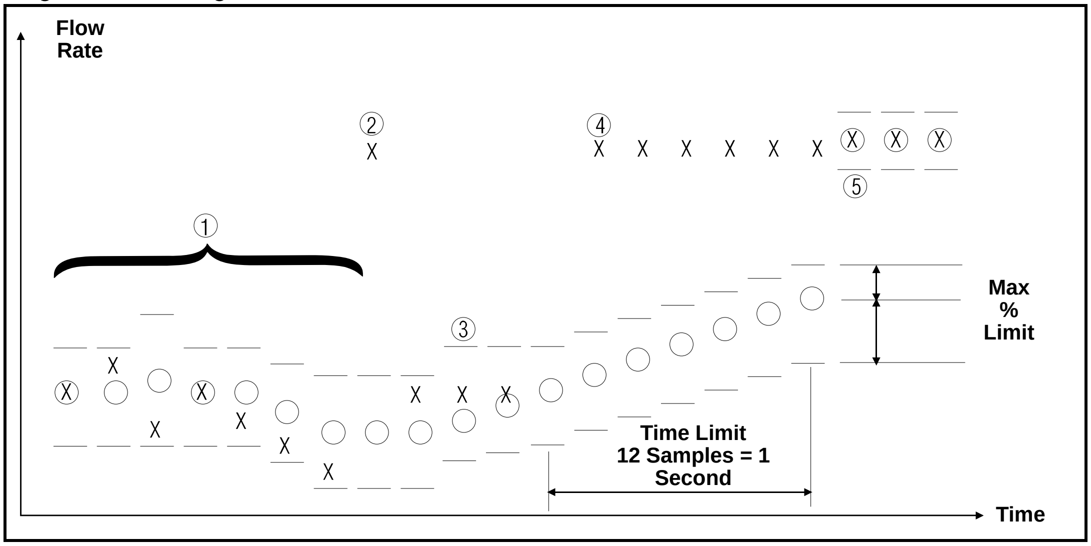
   100 averages the inputs over the past 10 seconds

   125 averages the inputs over the past 12.5 seconds
2. Maximum Percent Limit: The tolerance band set up 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. Factory Preset Value = 2 percent.
3. Time Limit: Forces the output and running average values to the new value of an actual flow rate change that is outside the percent limit boundaries, thereby limiting response time to real flow changes to the time limit value rather than the length of the running average. Factory Preset Value = 2 seconds.

How Does It Really Work?

The best way to explain this is with the help of an example, plotting flow rate versus time

Figure D-1. Signal Processing



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, a shortcut 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.

When Should Signal Processing Be Used?

The Rosemount 8712 offers three separate functions that can be used in series for improving a noisy output. The first step is to toggle the coil drive to the 37 Hz mode and initialize with an auto zero. If the output is still noisy at this stage, signal processing should be actuated and, if necessary, tuned to match the specific application. Finally, if the signal is still too unstable, the traditional damping function can be used.

NOTE
Failure to complete an Auto Zero will result in a small (<1%) error in the output. While the output level will be offset by the error, the repeatability will not be affected.

Appendix E Universal Sensor Wiring Diagrams

The wiring diagrams in this section illustrate the proper connections between the Rosemount 8712 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 manufacturers' sensors is provided. If the manufacturer for your sensor is not included, see the drawing for generic connections.

Any trademarks used herein regarding sensors not manufactured by Rosemount are owned by the particular manufacturer of the sensor.

Rosemount Transmitter	Sensor Manufacturer	Page Number
Rosemount		
Rosemount 8712	Rosemount 8705, 8707, 8711, 8721	page E-3
Rosemount 8712	Rosemount 8701	page E-4
Brooks		
Rosemount 8712	Model 5000	page E-9
Rosemount 8712	Model 7400	page E-10
Endress and Hauser		page E-6
Rosemount 8712	Generic Wiring for Sensor	page E-11
Fischer and Porter		page E-15
Rosemount 8712	Model 10D1418	page E-15
Rosemount 8712	Model 10D1419	page E-16
Rosemount 8712	Model 10D1430 (Remote)	page E-17
Rosemount 8712	Model 10D1430	page E-18
Rosemount 8712	Model 10D1465, 10D1475 (Integral)	page E-20
Rosemount 8712	Generic Wiring for Sensors	page E-21
Foxboro		
Rosemount 8712	Series 1800	page E-22
Rosemount 8712	Series 1800 (Version 2)	page E-23
Rosemount 8712	Series 2800	page E-24
Rosemount 8712	Generic Wiring for Sensors	page E-27
Kent		
Rosemount 8712	Veriflux VTC	page E-28
Rosemount 8712	Generic Wiring for Sensors	page E-39
Krohne		
Rosemount 8712	Generic Wiring for Sensors	page E-30
Taylor		
Rosemount 8712	Series 1100	page E-35
Rosemount 8712	Generic Wiring for Sensors	page E-35
Yamatake Honeywell		
Rosemount 8712	Generic Wiring for Sensors	page E-36
Yokogawa		
Rosemount 8712	Generic Wiring for Sensors	page E-38
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Rosemount 8712	Generic Wiring for Sensors	page E-39

ROSEMOUNT SENSORS

Rosemount 8705/8707/8711/8721 Sensors to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure .

Figure E-1. Wiring Diagram to a Rosemount 8712 Transmitter

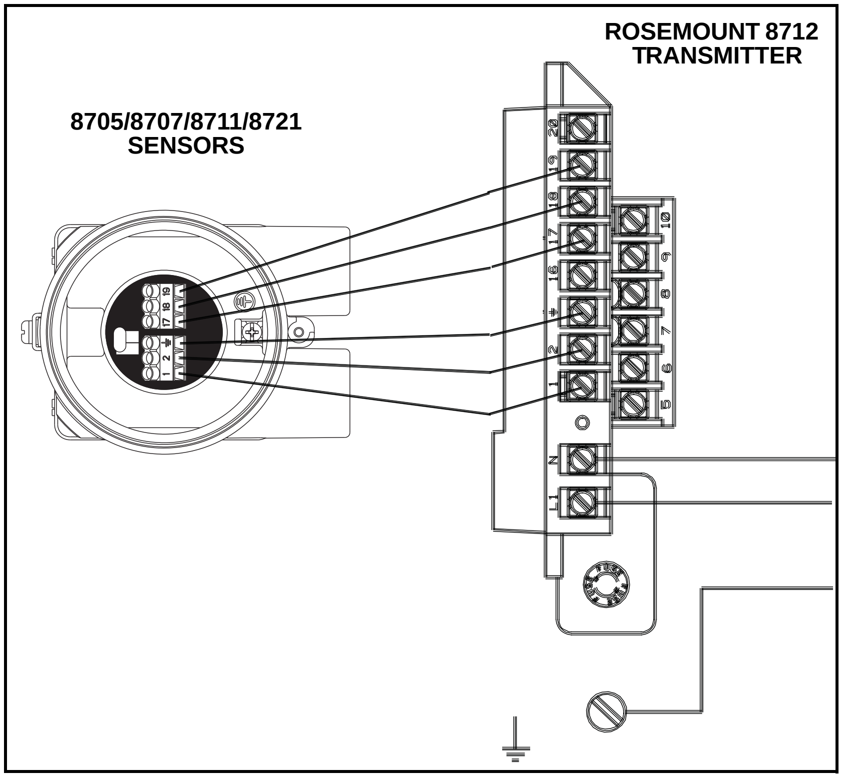
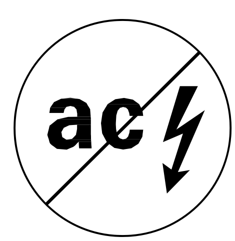


Table E-1. Rosemount 8705/8707/8711/8721 Sensor Wiring Connections

Rosemount 8712 Transmitters	Rosemount 8705/8707/8711/8721 Sensors
1	1
2	2
⏚	⏚
17	17
18	18
19	19

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Rosemount 8701 Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-2 on page E-4.

Figure E-2. Wiring Diagram for Rosemount 8701 Sensor and Rosemount 8712 Transmitter

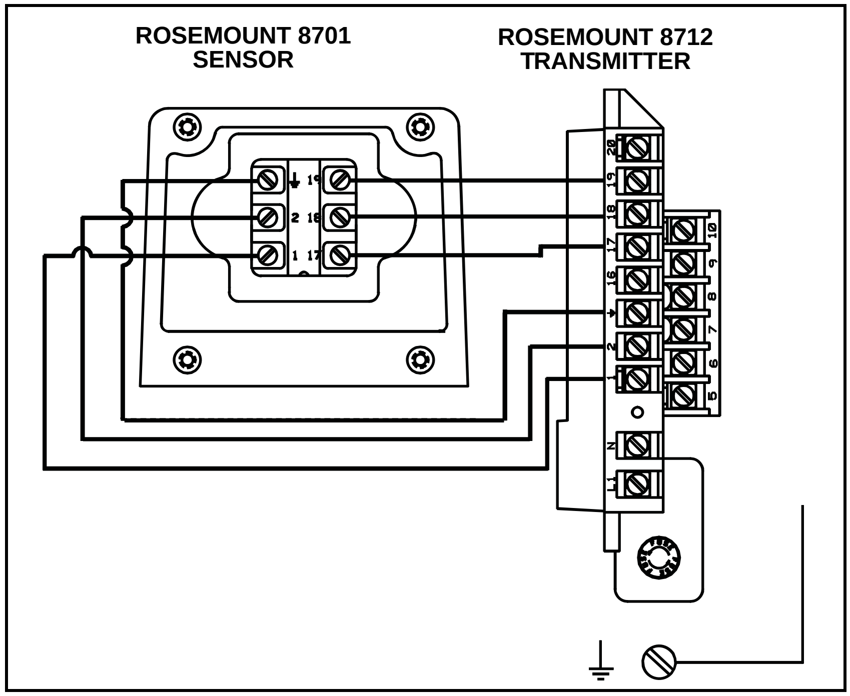
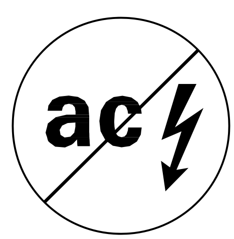


Figure E-3. Rosemount 8701 Sensor Wiring Connections

Rosemount 8712	Rosemount 8701 Sensors
1	1
2	2
⏚	⏚
17	17
18	18
19	19

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Rosemount 8711 Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-4.

Figure E-4. Wiring Diagram for Rosemount 8711 Sensor and Rosemount 8712 Transmitter

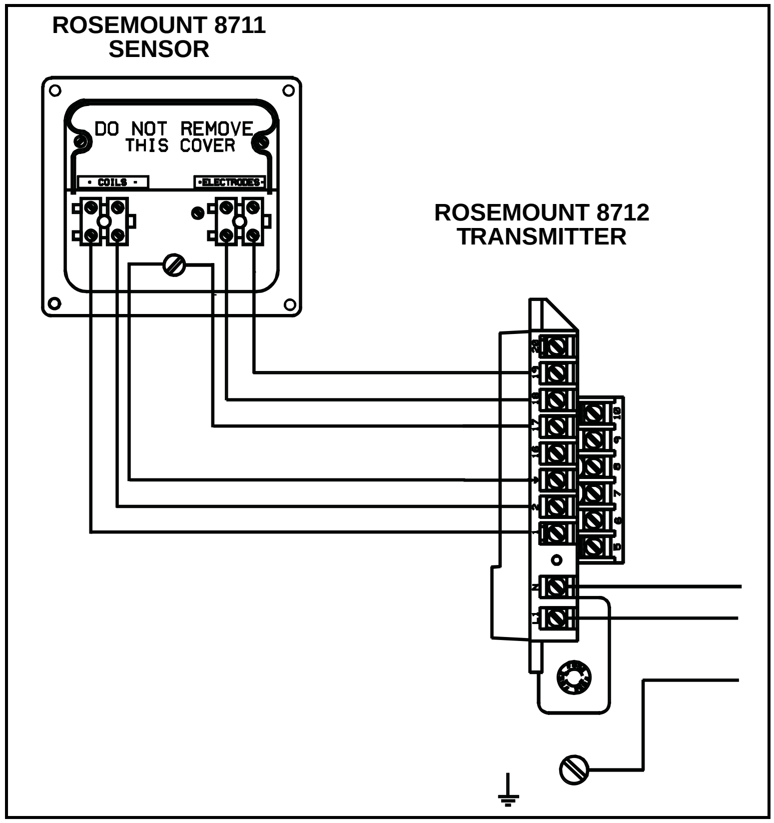
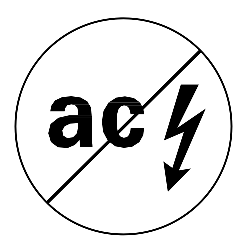


Table E-2. Rosemount 8711 Sensor Wiring Connections

Rosemount 8712	Rosemount 8711 Sensors
1	Coils +
2	Coils –
⏚	⏚
17	Shield
18	Electrode +
19	Electrode –

⚠CAUTION

This is a pulsed dc magnetic flowmeter. **Do not connect ac power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Connecting Sensors of Other Manufacturers

Before connecting another manufacturer's sensor to the Rosemount 8712 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 that 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 "Mount the Transmitter" on page 2-3.
6. Verify that 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 220V operation are typically wired in parallel and must be rewired in series.)
7. Verify that the sensor is in good working condition. Use the manufacturer's recommended test procedure for verification of sensor condition. Perform the basic checks:
    a. Check the coils for shorts or open circuits.
    b. Check the sensor liner for wear or damage.
    c. Check the electrodes for shorts, leaks, or damage.
8. Connect the sensor to the transmitter in accordance with reference wiring diagrams. See Appendix E: Universal Sensor Wiring Diagrams for specific drawings.
9. Connect and verify all connections between the sensor and the transmitter, then apply power to the transmitter.
10. Perform the Universal Auto Trim function.

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.

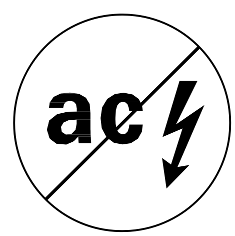


ABB SENSORS

Connect coil drive and electrode cables as shown in Figure E-7.

ABB Magmaster MFE and MFF Sensors (Old Version) to Rosemount 8712 Transmitter

Figure E-5. Wiring Diagram for ABB Magmaster MFE and MFF Sensors (Old Version) and Rosemount 8712

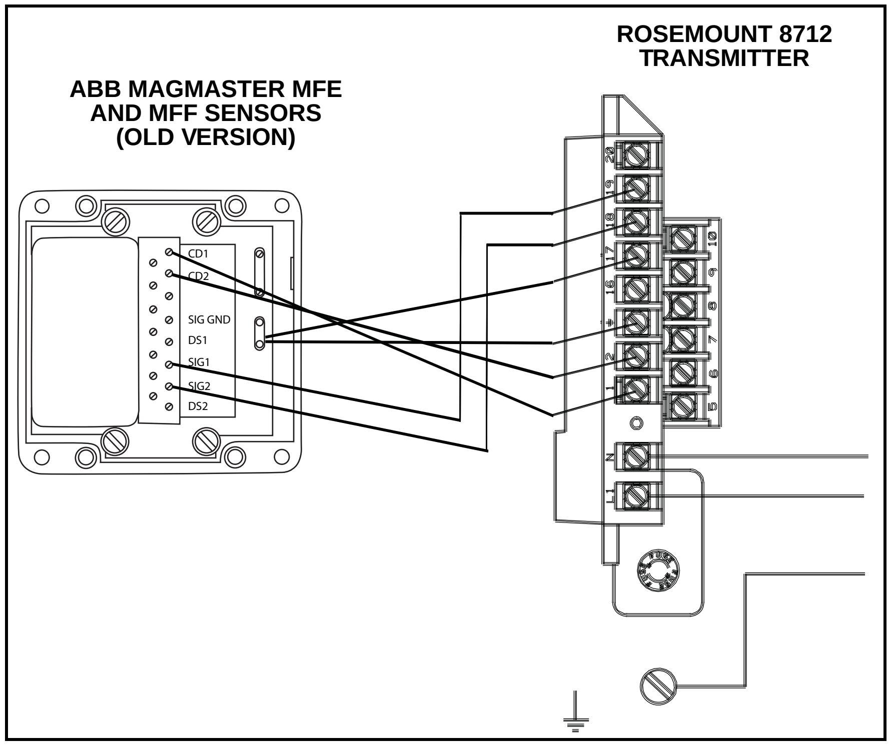


Table E-3. ABB Magmaster MFE and MFF Sensors (Old Version) Wiring Connections

Rosemount 8712	ABB Magmaster MFE and MFF Sensors (Old Version)
1	CD1
2	CD2
⏚	⏚
17	⏚
18	SIG2
19	SIG1

⚠CAUTION

This is a pulsed dc magnetic flowmeter. **Do not connect ac power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.

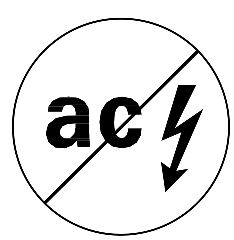


ABB Magmaster MFE and MFF Sensors (New Version) to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-7.

Figure E-6. Wiring Diagram for ABB Magmaster MFE and MFF Sensors (New Version) and Rosemount 8712

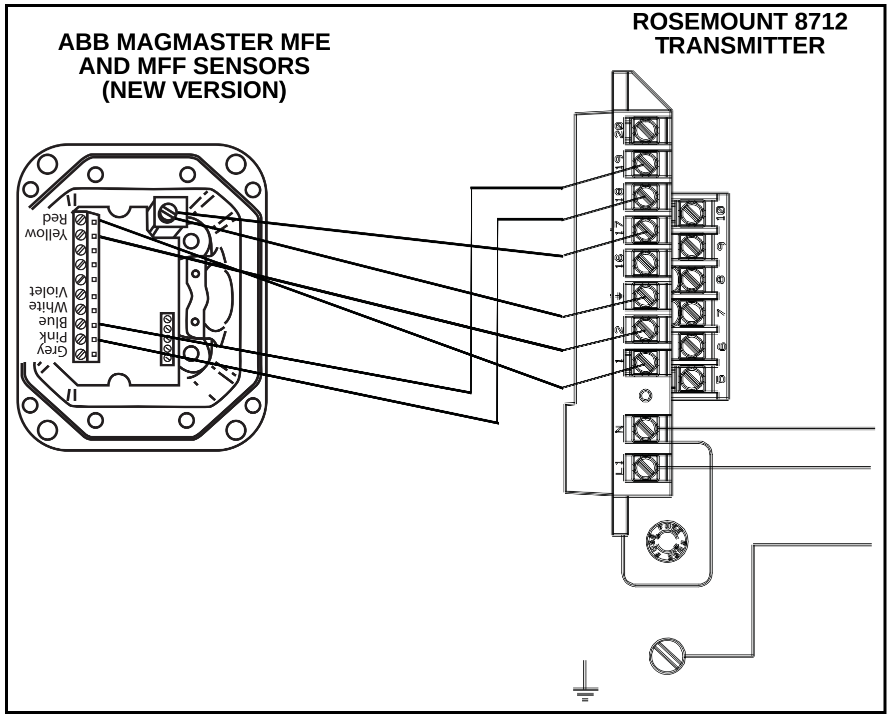
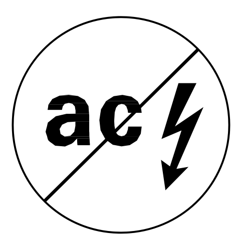


Table E-4. ABB Magmaster MFE and MFF Sensors (New Version) Wiring Connections

Rosemount 8712	ABB Magmaster MFE and MFF Sensors (New Version)
1	Red
2	Yellow
⏚	⏚
17	⏚
18	Pink
19	Blue

⚠CAUTION

This is a pulsed dc magnetic flowmeter. **Do not connect ac power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



BROOKS SENSORS

Model 5000 Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-7.

Figure E-7. Wiring Diagram for Brooks Sensor Model 5000 and Rosemount 8712

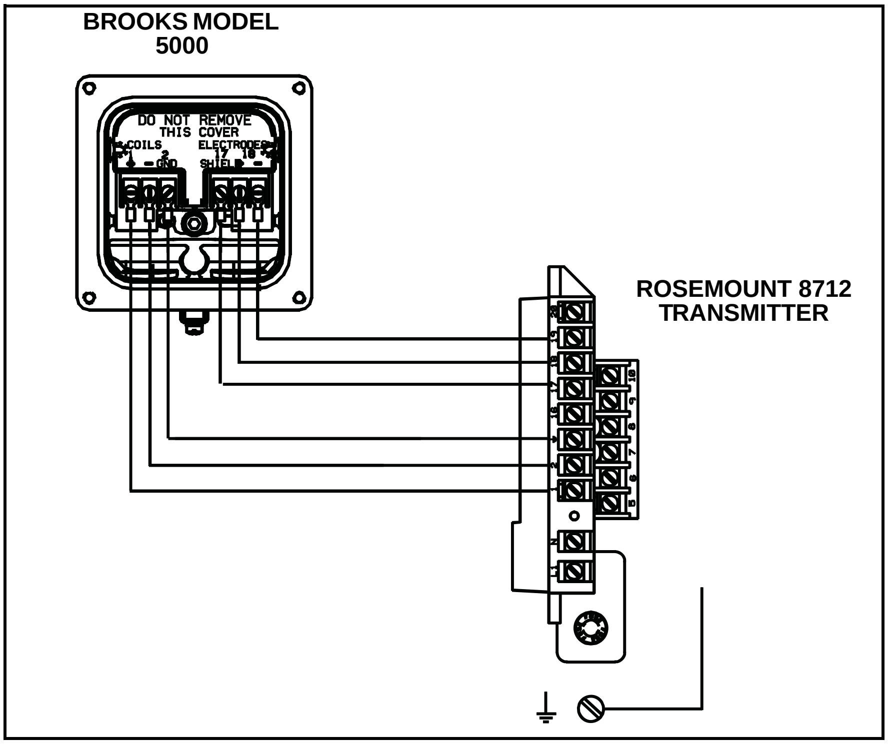
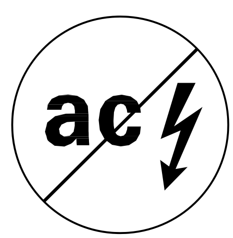


Table E-5. Brooks Model 5000 Sensor Wiring Connections

Rosemount 8712	Brooks Model 5000 Sensors
1	1
2	2
⏚	⏚
17	17
18	18
19	19

⚠CAUTION	
This is a pulsed dc magnetic flowmeter. **Do not connect ac power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.	

Model 7400 Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-8.

Figure E-8. Wiring Diagram for Brooks Sensor Model 7400 and Rosemount 8712

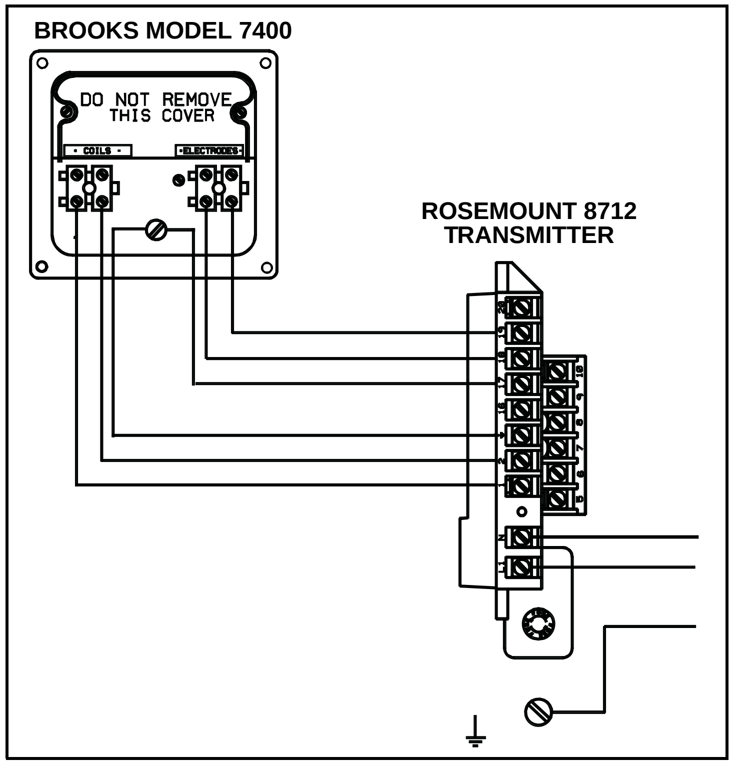
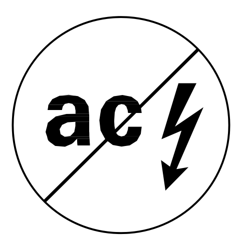


Table E-6. Brooks Model 7400 Sensor Wiring Connections

Rosemount 8712	Brooks Model 7400 Sensors
1	Coils +
2	Coils –
⏚	⏚
17	Shield
18	Electrode +
19	Electrode –

⚠CAUTION	
This is a pulsed dc magnetic flowmeter. **Do not connect ac power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.	

ENDRESS AND HAUSER SENSORS

Connect coil drive and electrode cables as shown in Figure E-12.

Endress and Hauser Promag 10/50/53/55 H/P/WS Sensors

Figure E-9. Wiring Diagram for Endress and Hauser Sensors and Rosemount 8712

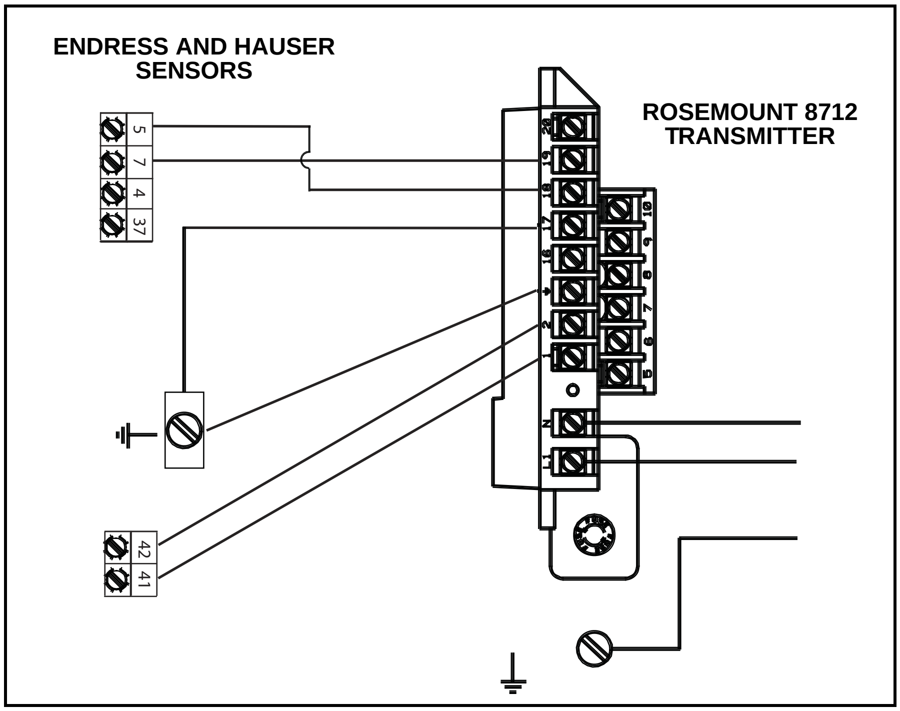
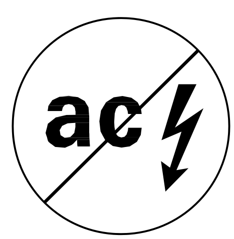


Table E-7. Endress and Hauser Sensor Wiring Connections

Rosemount 8712	Endress and Hauser Sensors
1	41
2	42
17	⏚
18	5
19	7

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Endress and Hauser Promag 30/33/39 D/H/F Sensors (FS Versions)

Connect coil drive and electrode cables as shown in Figure E-12.

Figure E-10. Wiring Diagram for Endress and Hauser Sensors and Rosemount 8712

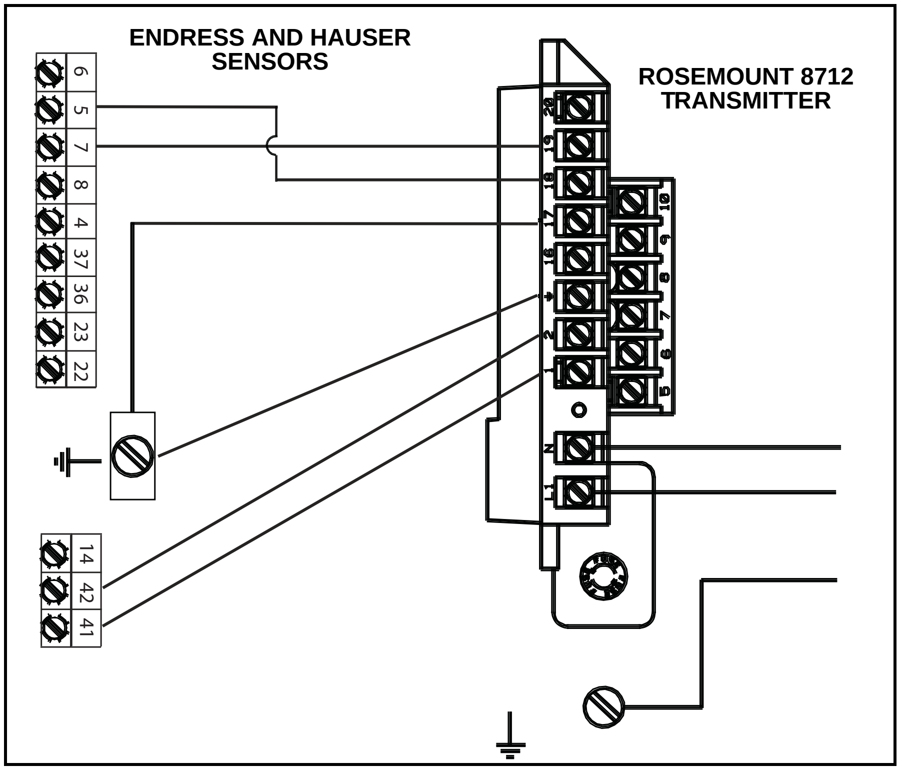
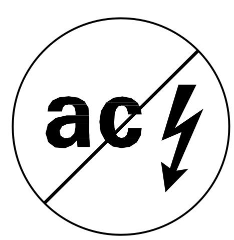


Table E-8. Endress and Hauser Promag 30/33/39 D/H/F Sensors (FS Versions) Wiring Connections

Rosemount 8712	Endress and Hauser Promag 30/33/39 D/H/F Sensors (FS Versions)
1	41
2	42
17	⏚
18	5
19	7

⚠CAUTION	
This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.	

Endress and Hauser Promag 30/33/39 A Sensors (FS Versions)

Connect coil drive and electrode cables as shown in Figure E-12.

Figure E-11. Wiring Diagram for Endress and Hauser Sensors and Rosemount 8712

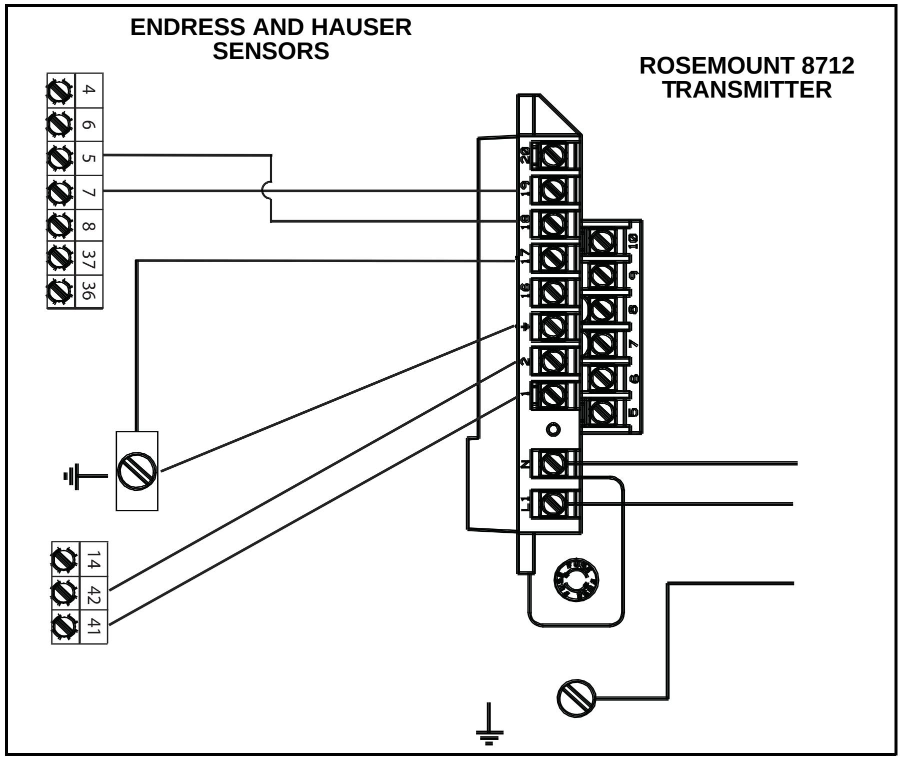
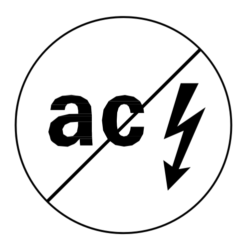


Table E-9. Endress and Hauser Promag 30/33/39 A Sensor (FS Versions) Wiring Connections

Rosemount 8712	Endress and Hauser Promag 30/33/39 A Sensors (FS Versions)
1	41
2	42
17	⏚
18	5
19	7

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Endress and Hauser Generic Sensor to Rosemount 8712 Transmitter

Figure E-12. Wiring Diagram for Endress and Hauser Sensors and Rosemount 8712

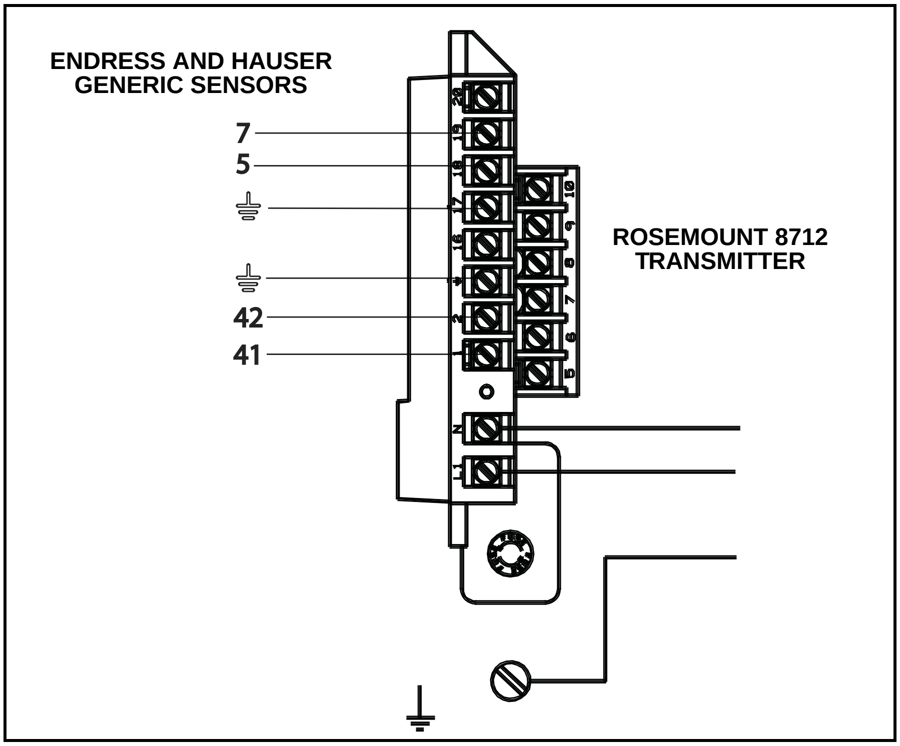
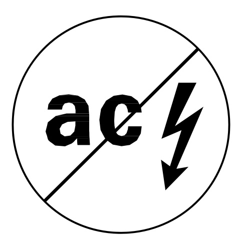


Table E-10. Endress and Hauser Generic Sensor Wiring Connections

Rosemount 8712	Endress and Hauser Generic Sensors
1	41
2	42
⏚	14
17	4
18	5
19	7

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



FISCHER AND PORTER SENSORS

Connect coil drive and electrode cables as shown in Figure E-13.

Model 10D1418 Sensor to Rosemount 8712 Transmitter

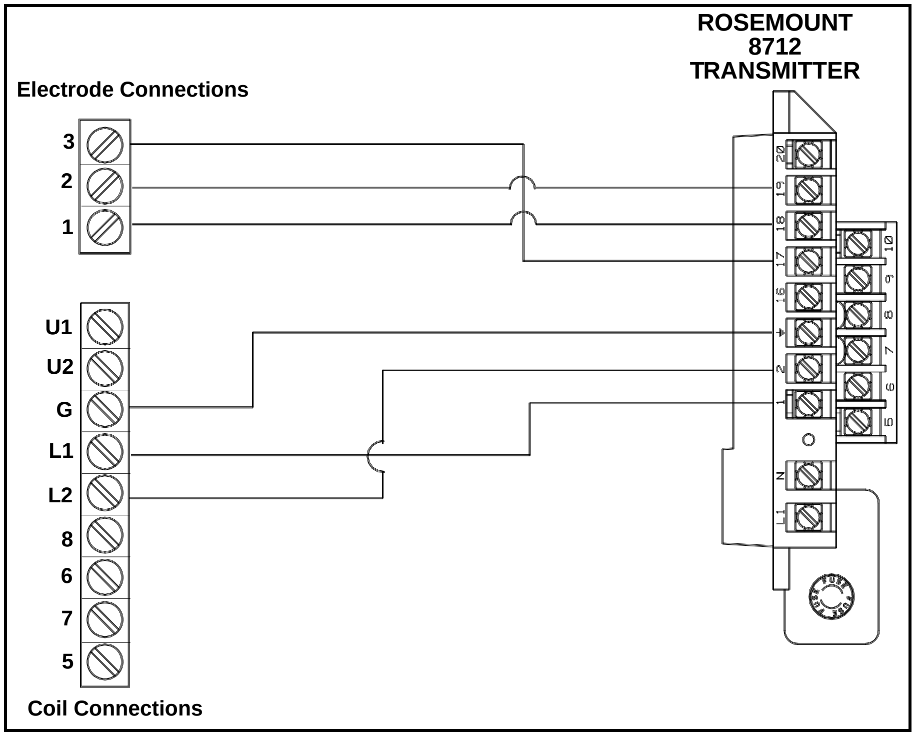
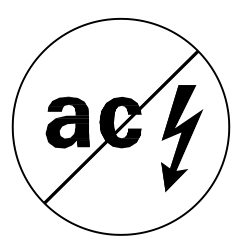


Figure E-13. Wiring Diagram for Fischer and Porter Sensor Model 10D1418 and Rosemount 8712

Table E-11. Fischer and Porter Model 10D1418 Sensor Wiring Connections

Rosemount 8712	Fischer and Porter Model 10D1418 Sensors
1	L1
2	L2
⏚	Chassis Ground
17	3
18	1
19	2

⚠CAUTION	
This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.	

Model 10D1419 Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-14.

Figure E-14. Wiring Diagram for Fischer and Porter Sensor Model 10D1419 and Rosemount 8712

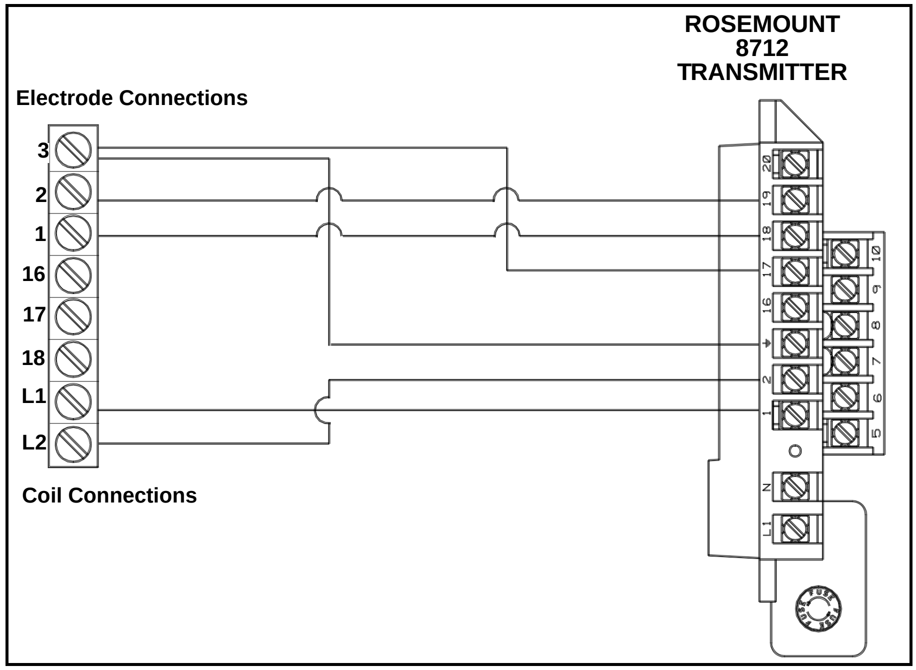
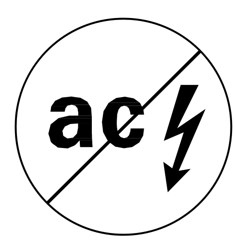


Table E-12. Fischer and Porter Model 10D1419 Sensor Wiring Connections

Rosemount 8712	Fischer and Porter Model 10D1419 Sensors
1	L1
2	L2
⏚	3
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Model 10D1430 Sensor (Remote) to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-15.

Figure E-15. Wiring Diagram for Fischer and Porter Sensor Model 10D1430 (Remote) and Rosemount 87 12

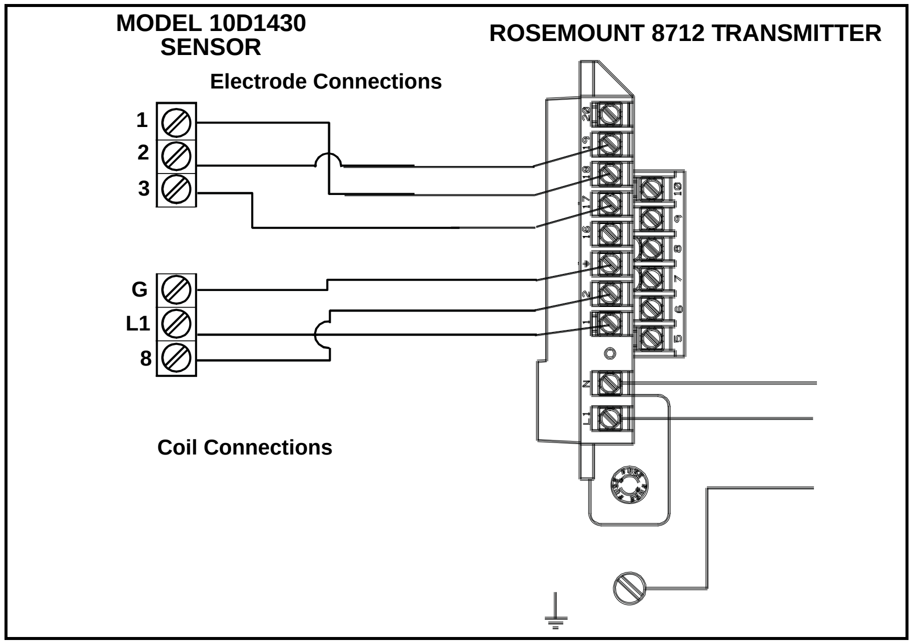
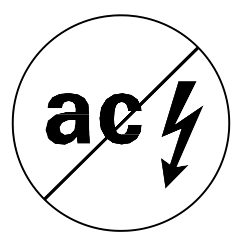


Table E-13. Fischer and Porter Model 10D1430 (Remote) Sensor Wiring Connections

Rosemount 8712	Fischer and Porter Model 10D1430 (Remote) Sensors
1	L1
2	8
⏚	G
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Model 10D1430 Sensor (Integral) to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-16.

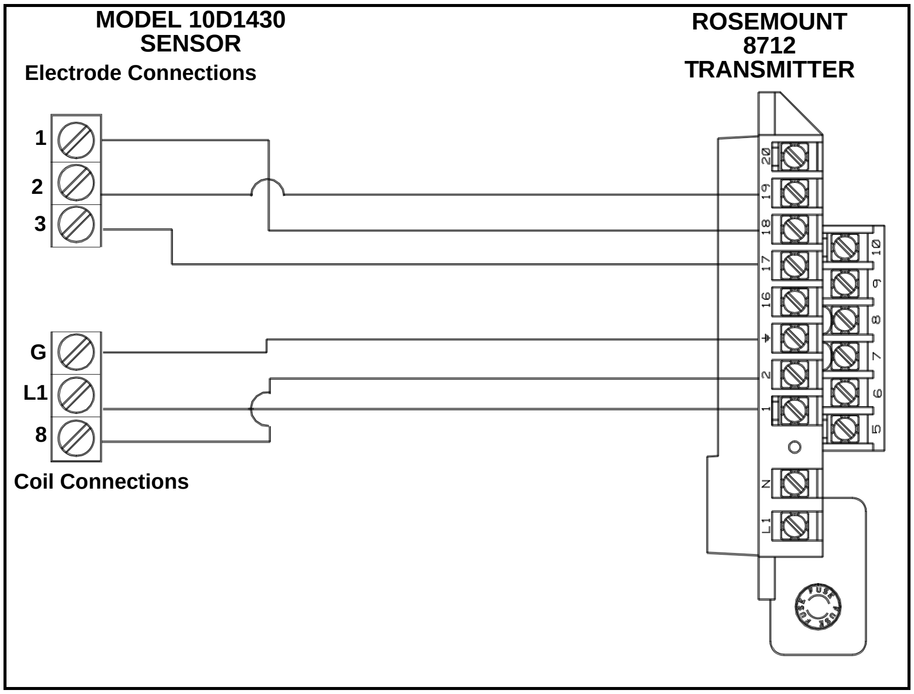


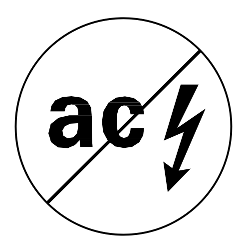
Figure E-16. Wiring Diagram for Fischer and Porter Sensor Model 10D1430 (Integral) and Rosemount 8712

Table E-14. Fischer and Porter Model 10D1430 (Integral) Sensor Wiring Connections

Rosemount 8712	Fischer and Porter Model 10D1430 (Integral) Sensors
1	L1
2	L2
⏚	G
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Model 10D1435 Sensor (Integral) to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-16.

Figure E-17. Wiring Diagram for Fischer and Porter Sensor Model 10D1430 (Integral) and Rosemount 8712

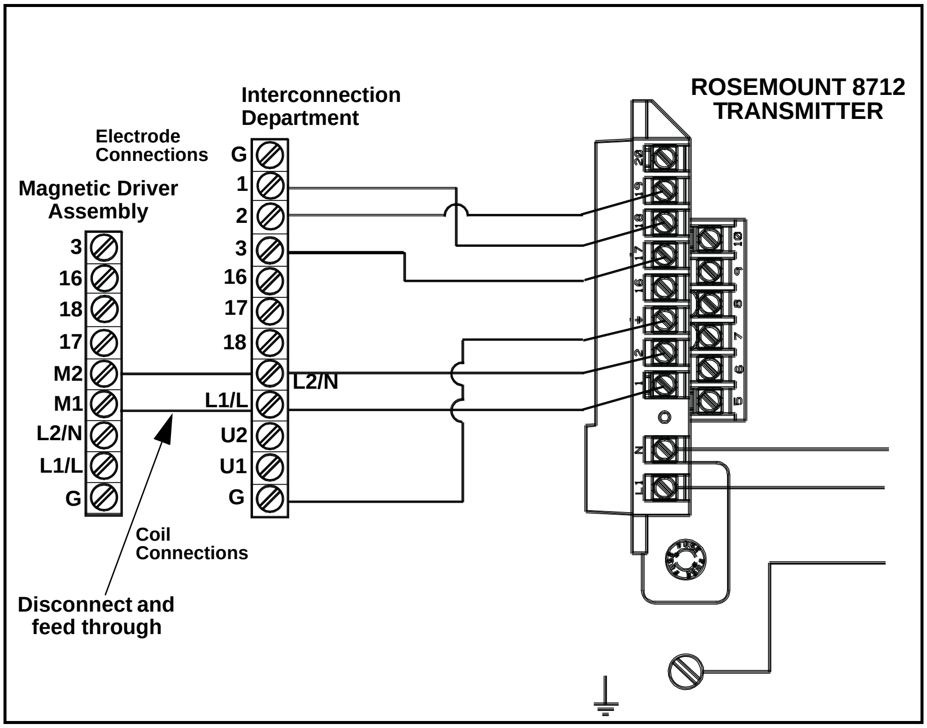
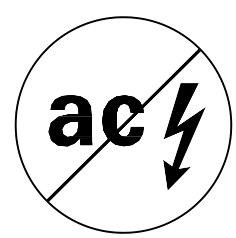


Table E-15. Fischer and Porter Model 10D1435 Sensor (Integral) Wiring Connections

Rosemount 8712	Fischer and Porter Model 10D1435 Sensors (Integral)
1	M1
2	M2
⏚	G
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Model 10D1465 and Model 10D1475 Sensors (Integral) to 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-18.

Figure E-18. Wiring Diagram for Fischer and Porter Sensor Model 10D1465 and Model 10D1475 (Integral) and Rosemount 8712

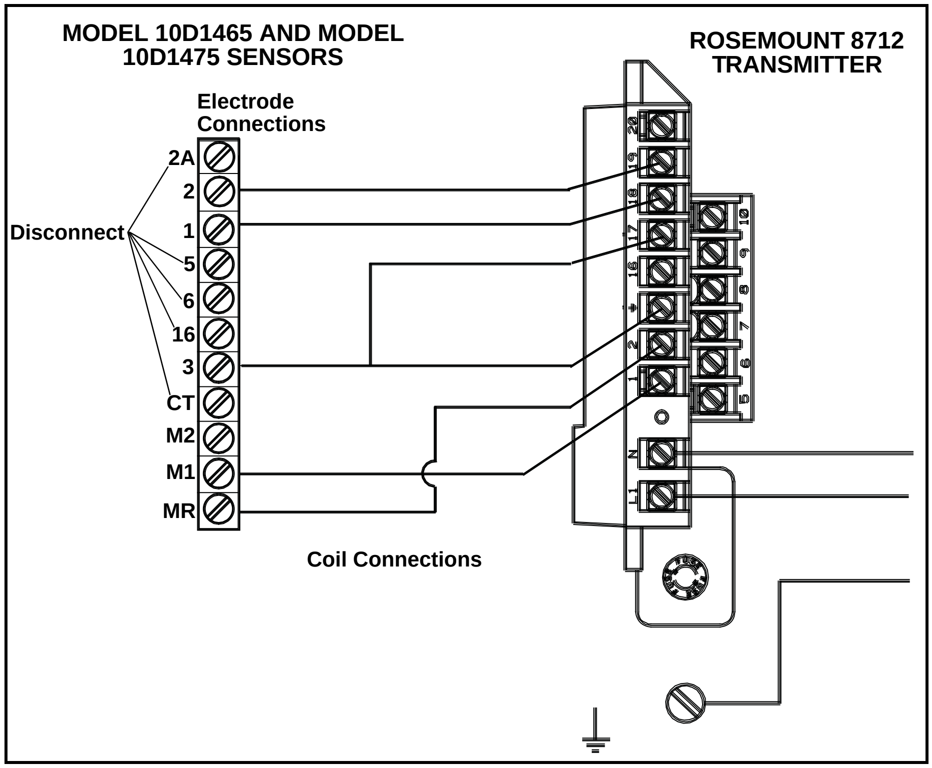
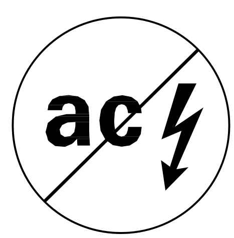


Table E-16. Fischer and Porter Model 10D1465 and 10D1475 Sensor Wiring Connections

Rosemount 8712	Fischer and Porter Model 10D1465 and 10D1475 Sensors
1	MR
2	M1
⏚	3
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Fischer and Porter Generic Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-19.

Figure E-19. Generic Wiring Diagram for Fischer and Porter Sensors and Rosemount 8712

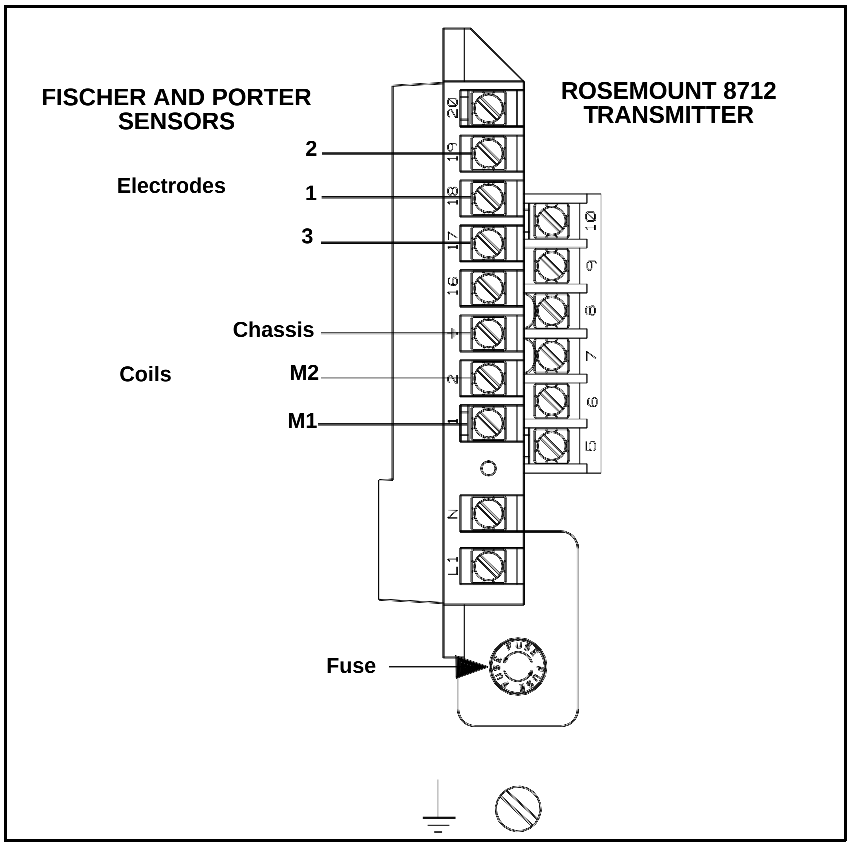
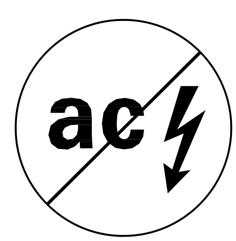


Table E-17. Fischer and Porter Generic Sensor Wiring Connections

Rosemount 8712	Fischer and Porter Generic Sensors
1	M1
2	M2
⏚	Chassis Ground
17	3
18	1
19	2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



FOXBORO SENSORS

Series 1800 Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-20.

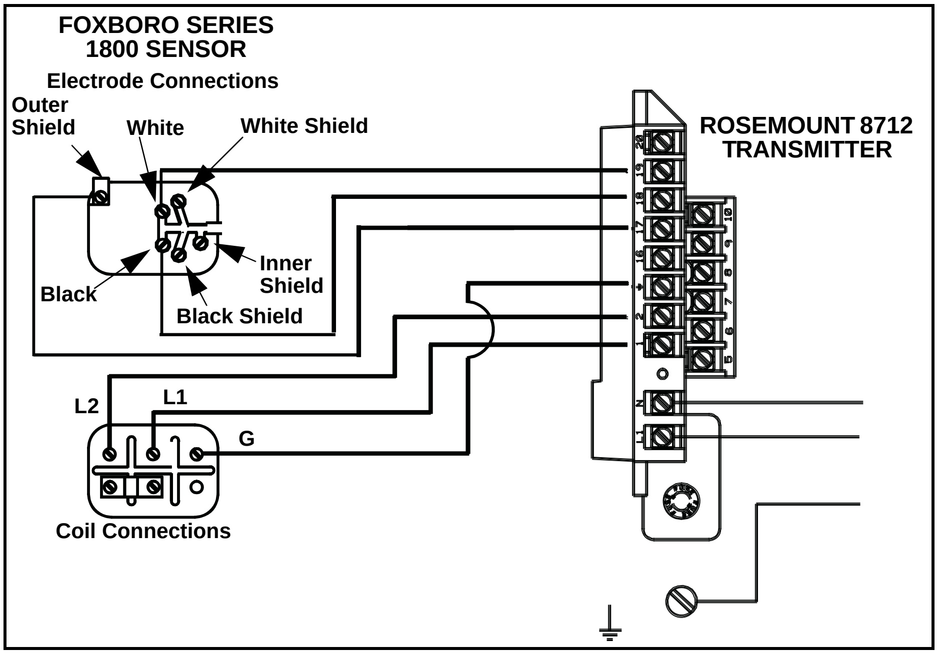
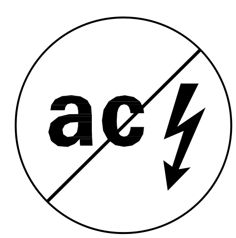


Figure E-20. Wiring Diagram for Foxboro Series 1800 and Rosemount 8712

Table E-18. Foxboro Series 1800 Sensor Wiring Connections

Rosemount 8712	Foxboro Series 1800 Sensors
1	L1
2	L2
⏚	Chassis Ground
17	Any Shield
18	Black
19	White

⚠CAUTION	
This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.	

Series 1800 (Version 2) Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-21.

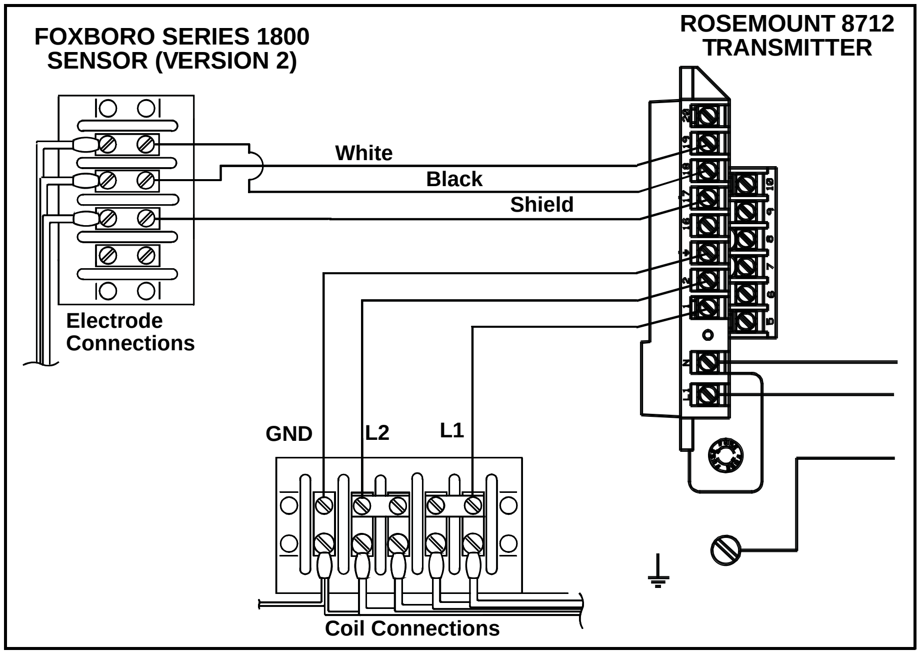


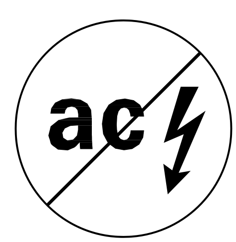
Figure E-21. Wiring Diagram for Foxboro Series 1800 (Version 2) and Rosemount 8712

Table E-19. Foxboro 1800 Version 2 Sensor Wiring Connections

Rosemount 8712	Foxboro Series 1800 Version 2 Sensors
1	L1
2	L2
⏚	Chassis Ground
17	Any Shield
18	Black
19	White

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Series 2800/8300 Sensor to 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-22.

Figure E-22. Wiring Diagram for Foxboro Series 2800 and Rosemount 87 12

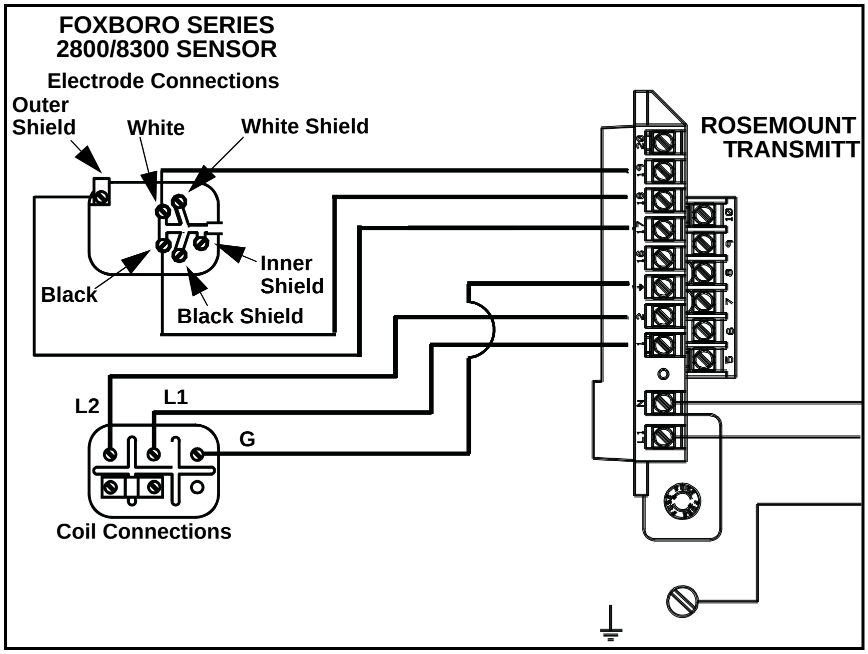
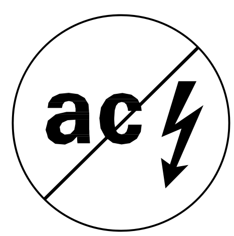


Table E-20. Foxboro Series 2800/8300 Sensor Wiring Connections

Rosemount 8712	Foxboro Series 2800/8300 Sensors
1	1
2	2
⏚	Chassis Ground
17	Any Shield
18	Black
19	White

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Series 8000A/9300A Sensor to 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-22.

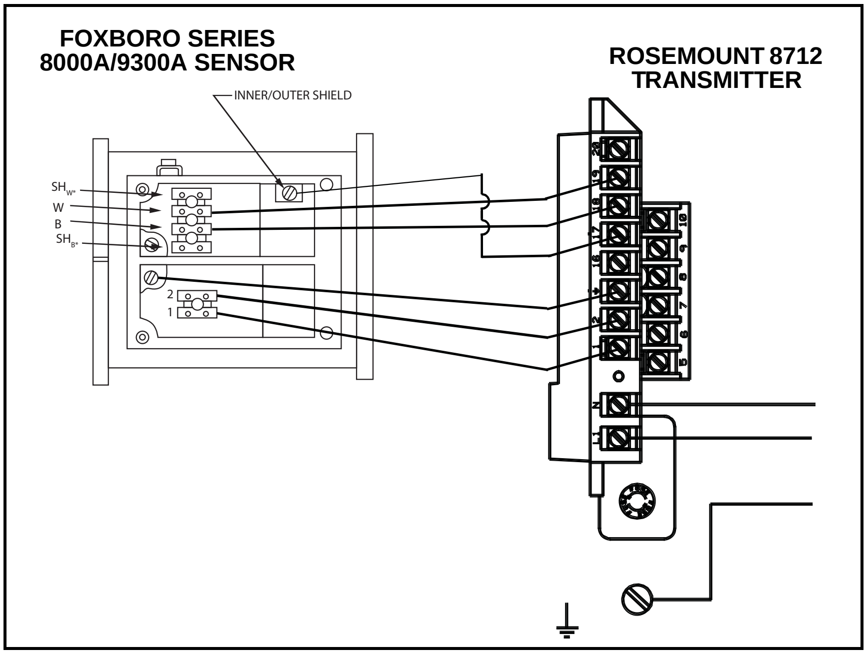
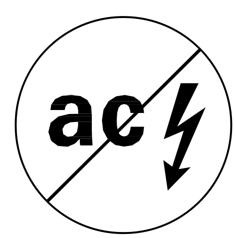


Figure E-23. Wiring Diagram for Foxboro Series 2800 and Rosemount 87 12

Table E-21. Foxboro Series 8000A/9300A Sensor Wiring Connections

Rosemount 8712	Foxboro Series 8000A/9300A Sensors
1	1
2	2
⏚	Chassis Ground
17	Any Shield
18	Black
19	White

⚠CAUTION	
This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.	

Series 9100A/9200A Sensors to 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-22.

Figure E-24. Wiring Diagram for Foxboro Series 9100A/9200A and Rosemount 8712

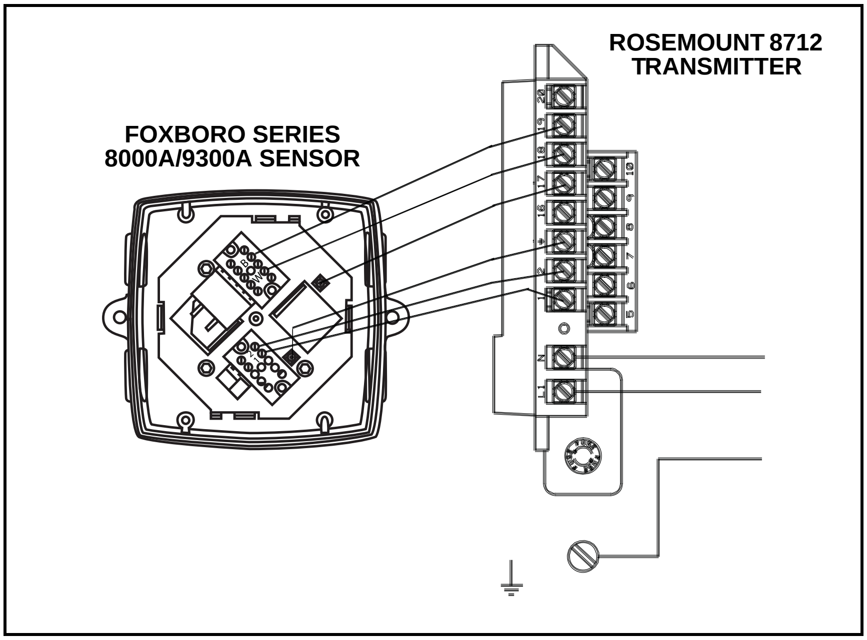
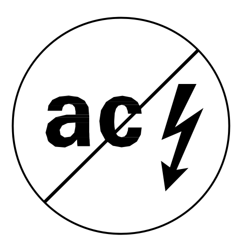


Table E-22. Foxboro Series 9100A/9200A Sensor Wiring Connections

Rosemount 8712	Foxboro Series 9100A/9200A Sensors
1	1
2	2
⏚	Chassis Ground
17	Chassis Ground
18	White (W)
19	Black (B)

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Foxboro Generic Sensor to 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-25.

Figure E-25. Generic Wiring Diagram for Foxboro Sensors and Rosemount 8712

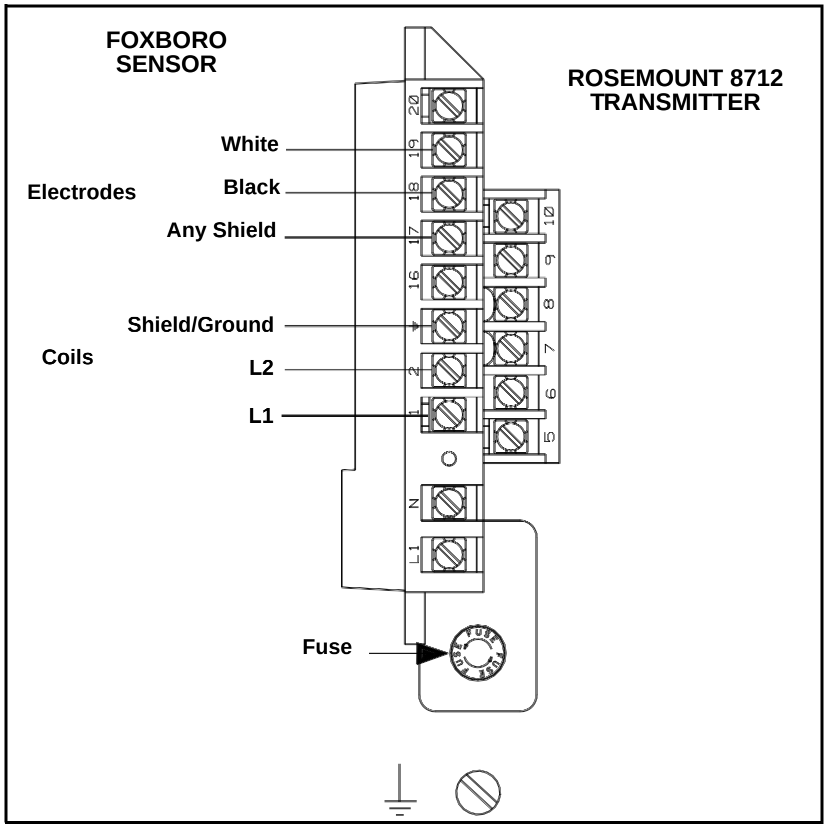
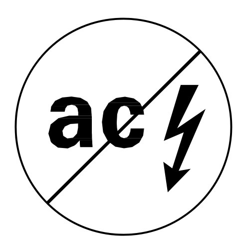


Table E-23. Foxboro Generic Sensor Wiring Connections

Rosemount 8712	Foxboro Generic Sensors
1	L1
2	L2
⏚	Chassis Ground
17	Any Shield
18	Black
19	White

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



KENT SENSORS

Connect coil drive and electrode cables as shown in Figure E-26.

Veriflux VTC Sensor to 8712 Transmitter

Figure E-26. Wiring Diagram for Kent Veriflux VTC Sensor and Rosemount 8712

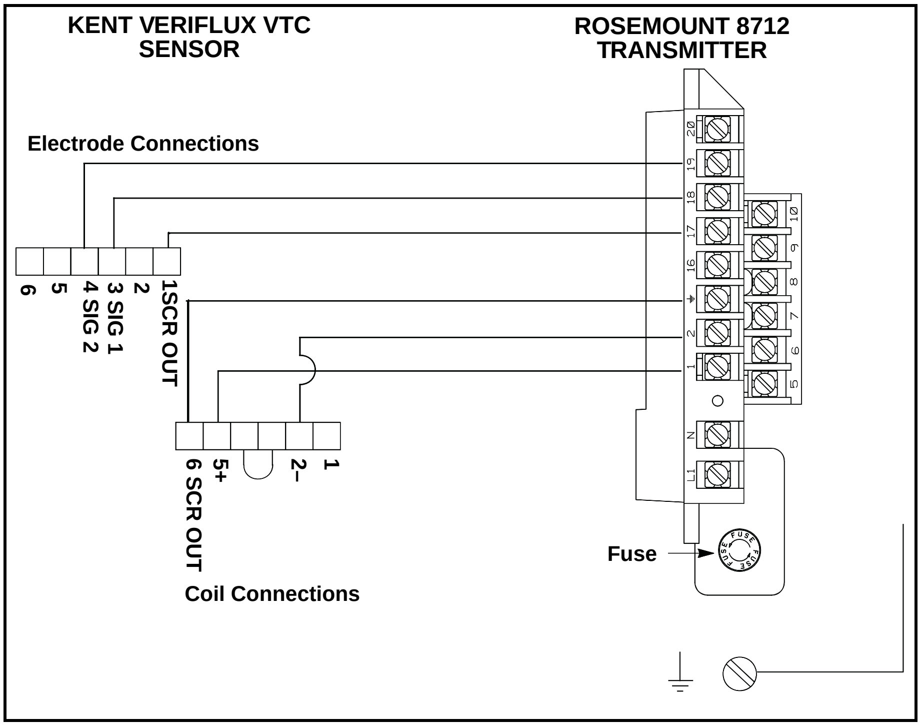
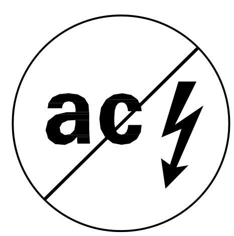


Table E-24. Kent Veriflux VTC Sensor Wiring Connections

Rosemount 8712	Kent Veriflux VTC Sensors
1	5
2	2
⏚	SCR OUT
17	SCR OUT
18	SIG1
19	SIG2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Kent Generic Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-27.

Figure E-27. Generic Wiring Diagram for Kent Sensors and Rosemount 8712

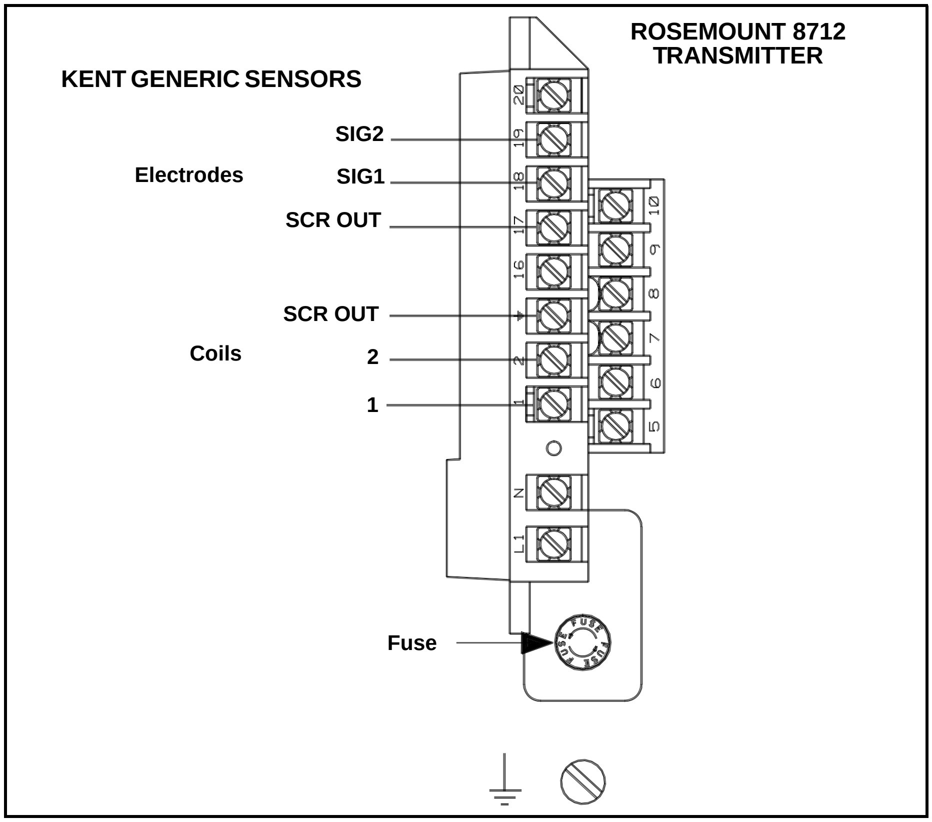
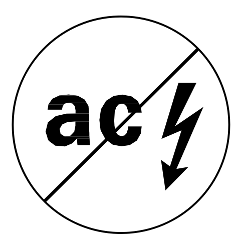


Table E-25. Kent Generic Sensor Wiring Connections

Rosemount 8712	Kent Generic Sensors
1	5
2	2
⏚	SCR OUT
17	SCR OUT
18	SIG1
19	SIG2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



KROHNE SENSORS

Krohne Autoflux Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-28.

Figure E-28. Wiring Diagram for Krohne Autoflux Sensors and Rosemount 8712

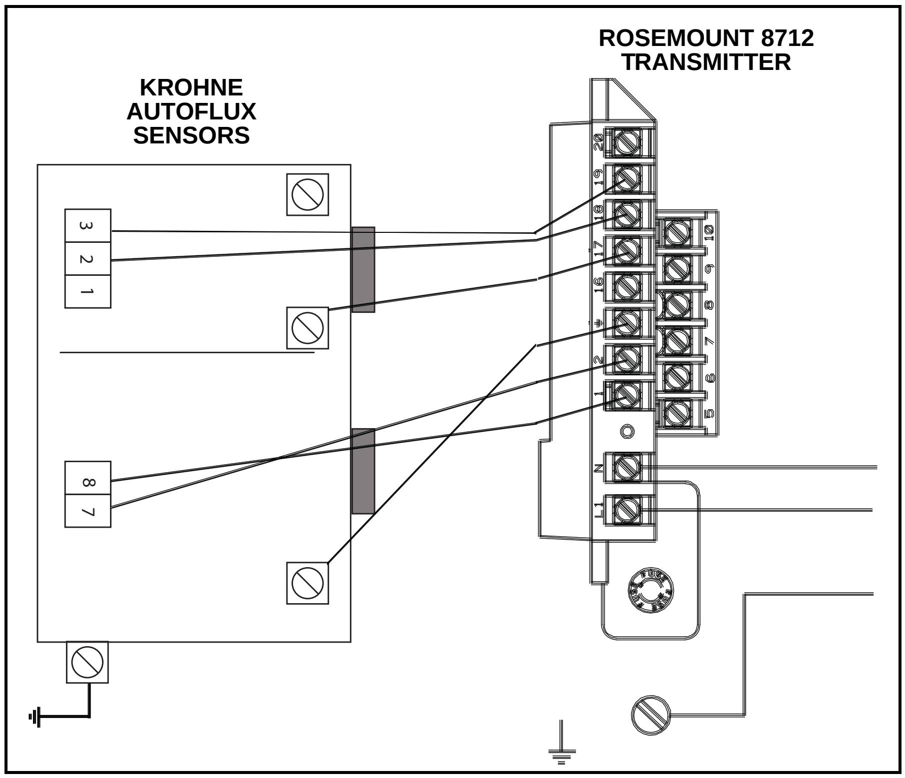
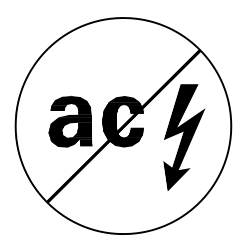


Table E-26. Krohne Autoflux Sensor Wiring Connections

Rosemount 8712	Krohne Autoflux Sensors
1	8
2	7
⏚	Coil Shield
17	Electrode Shield
18	2
19	3

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Krohne Optiflux Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-28.

Figure E-29. Wiring Diagram for Krohne Optiflux Sensors and Rosemount 8712

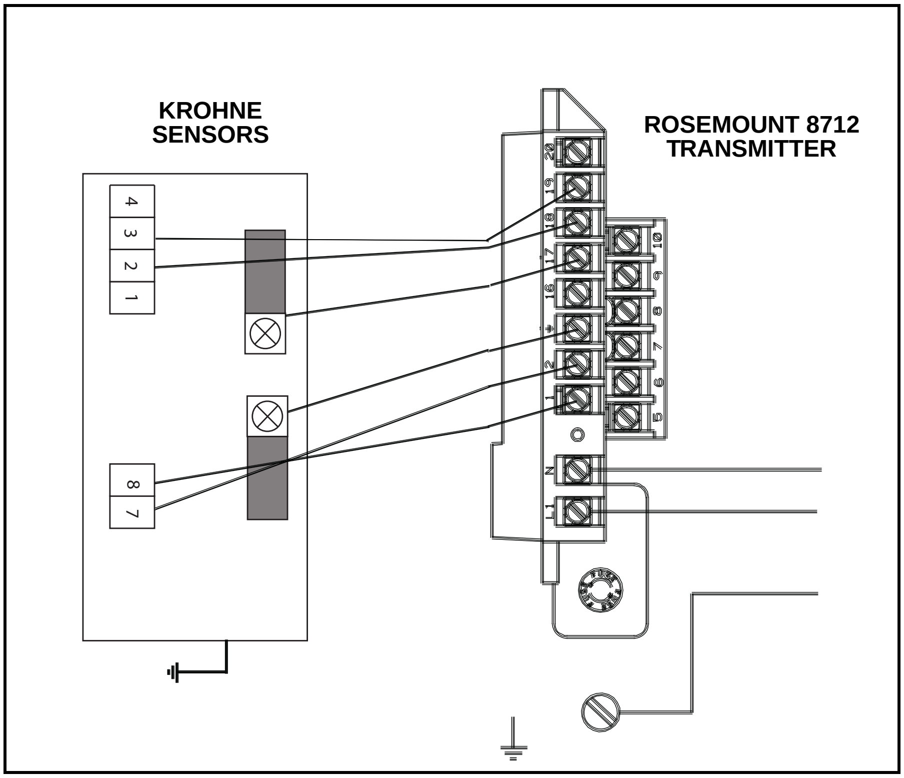
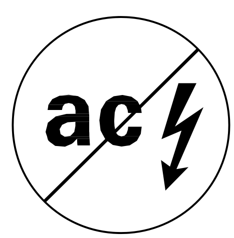


Table E-27. Krohne Optiflux Sensor Wiring Connections

Rosemount 8712	Krohne Optiflux Sensor Sensors
1	8
2	7
⏚	Coil Shield
17	Electrode Shield
18	2
19	3

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Krohne Generic Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-28.

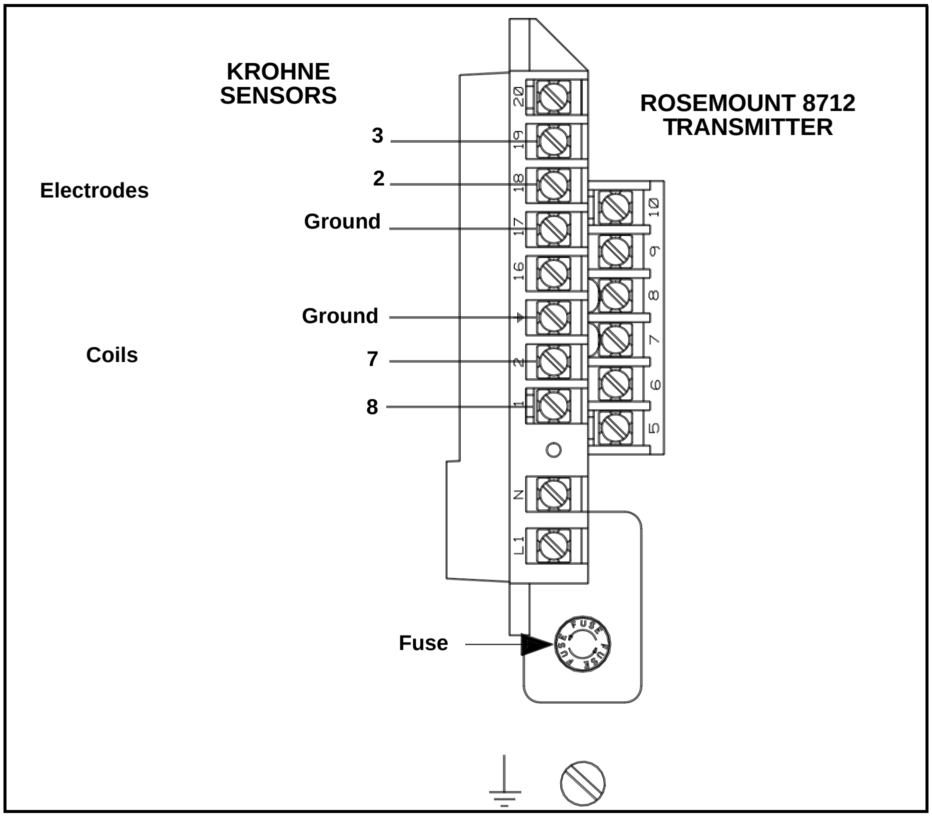


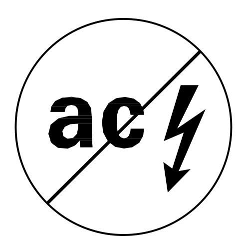
Figure E-30. Generic Wiring Diagram for Krohne Sensors and Rosemount 8712

Table E-28. Krohne Generic Sensor Wiring Connections

Rosemount 8712	Krohne Generic Sensors
1	8
2	7
⏚	Coil Shield
17	Electrode Shield
18	2
19	3

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



SIEMENS SENSORS

Siemens Sitrans F M Mag 3100/5100 Sensors to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-31.

Figure E-31. Wiring Diagram for Siemens Sitrans F M Mag 3100/5100 Sensors and Rosemount 87 12

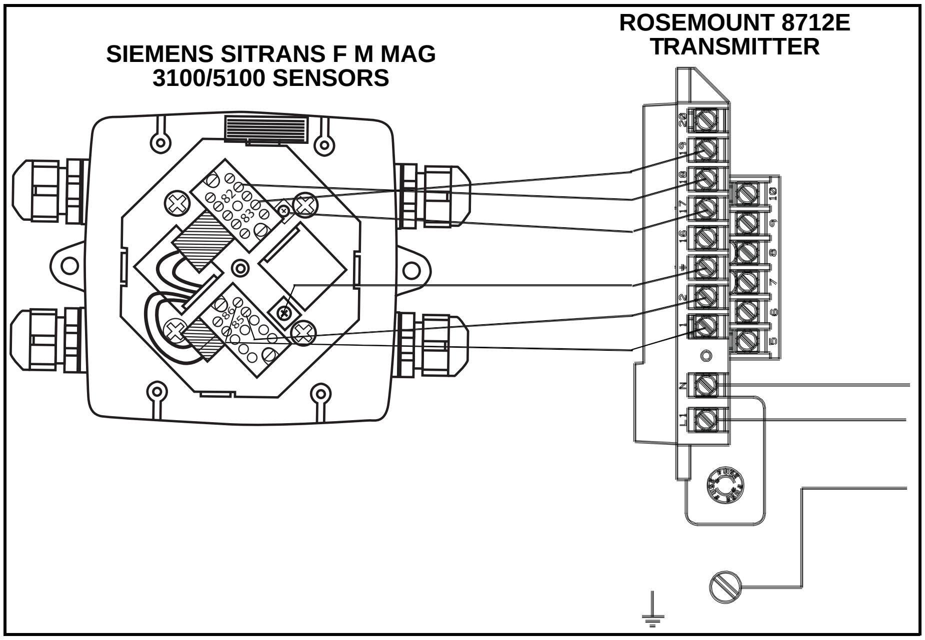
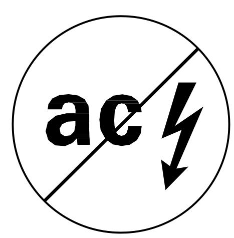


Table E-29. Siemens Sitrans F M Mag 3100/5100 Sensors Wiring Connections

Rosemount 8712	Siemens Sitrans F M Mag 3100/5100 Sensors
1	86
2	85
⏚	⏚
17	⏚
18	82
19	83

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



TAYLOR SENSORS

Series 1100 Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-31.

Figure E-32. Wiring Diagram for Taylor Series 1100 Sensors and Rosemount 87 12

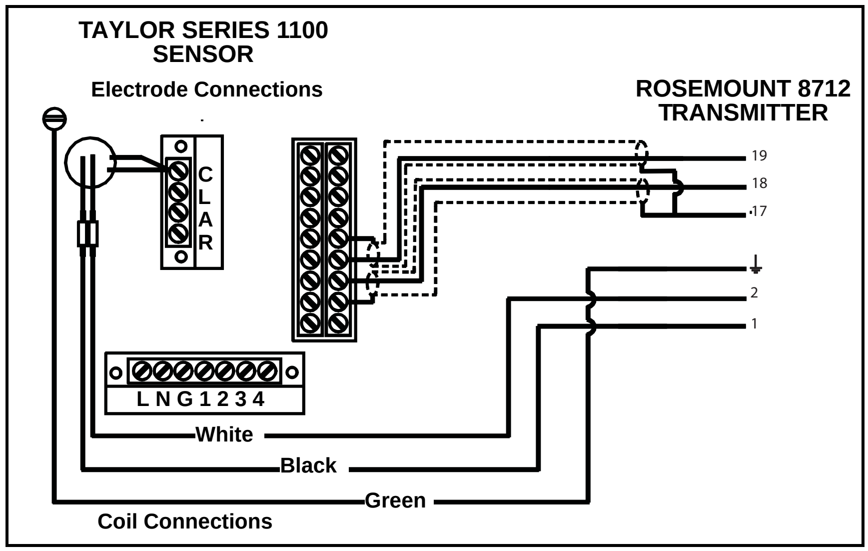
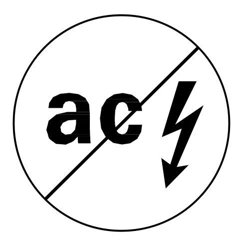


Table E-30. Taylor Series 1100 Sensor Wiring Connections

Rosemount 8712	Taylor Series 1100 Sensors
1	Black
2	White
⏚	Green
17	S1 and S2
18	E1
19	E2

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Taylor Generic Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-33.

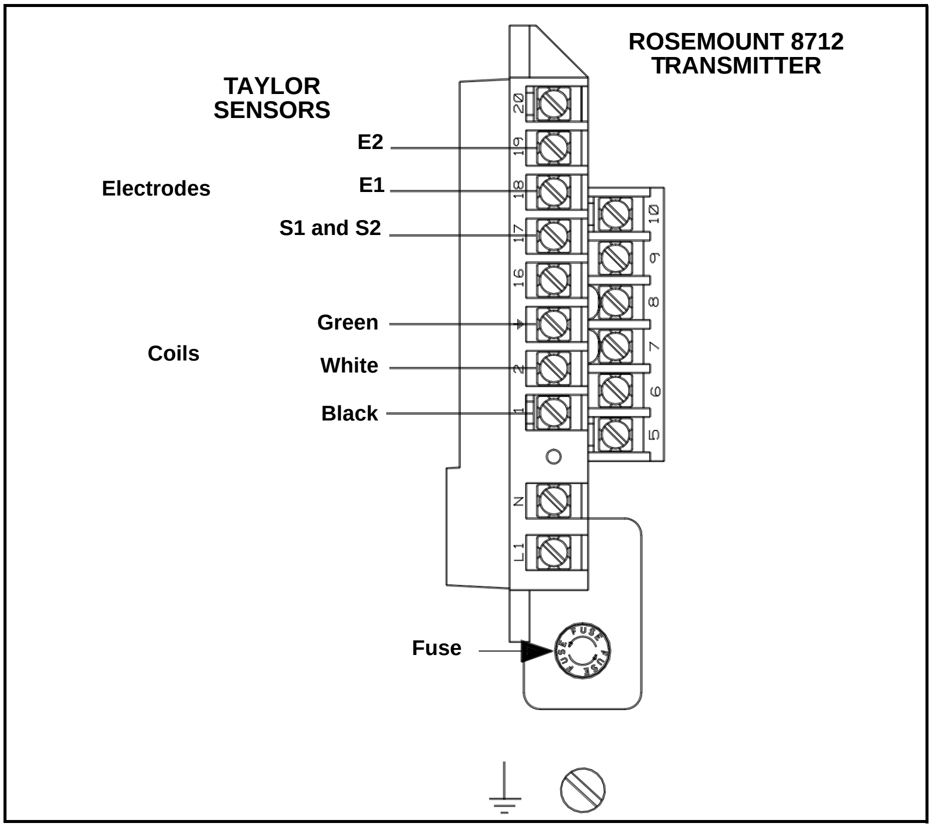


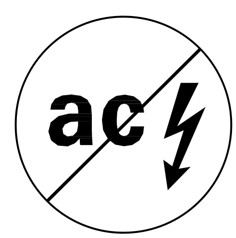
Figure E-33. Generic Wiring Diagram for Taylor Sensors and Rosemount 8712

Table E-31. Taylor Generic Sensor Wiring Connections

Rosemount 8712	Taylor Generic Sensors
1	Black
2	White
⏚	Green
17	S1 and S2
18	E1
19	E2

⚠CAUTION

This is a pulsed DCDC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



TOSHIBA SENSORS

Connect coil drive and electrode cables as shown in Figure E-34.

Toshiba LF430 and LF434 Sensor to Rosemount 8712 Transmitter

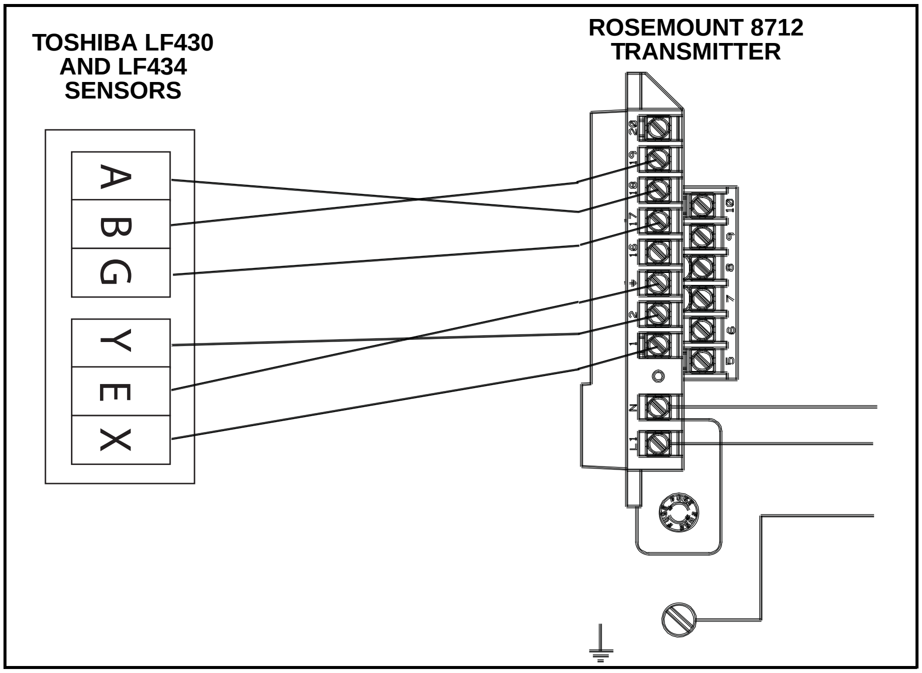


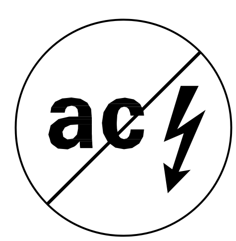
Figure E-34. Generic Wiring Diagram for Toshiba LF430 and LF434 Sensor and Rosemount 8712

Table E-32. Toshiba LF430 and LF434 Sensor Wiring Connections

Rosemount 8712	Toshiba LF430 and LF434 Sensors
1	X
2	Y
⏚	E
17	G
18	A
19	B

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



YAMATAKE HONEYWELL SENSORS

Connect coil drive and electrode cables as shown in Figure E-34.

Yamatake Honeywell Sensor to Rosemount 8712 Transmitter

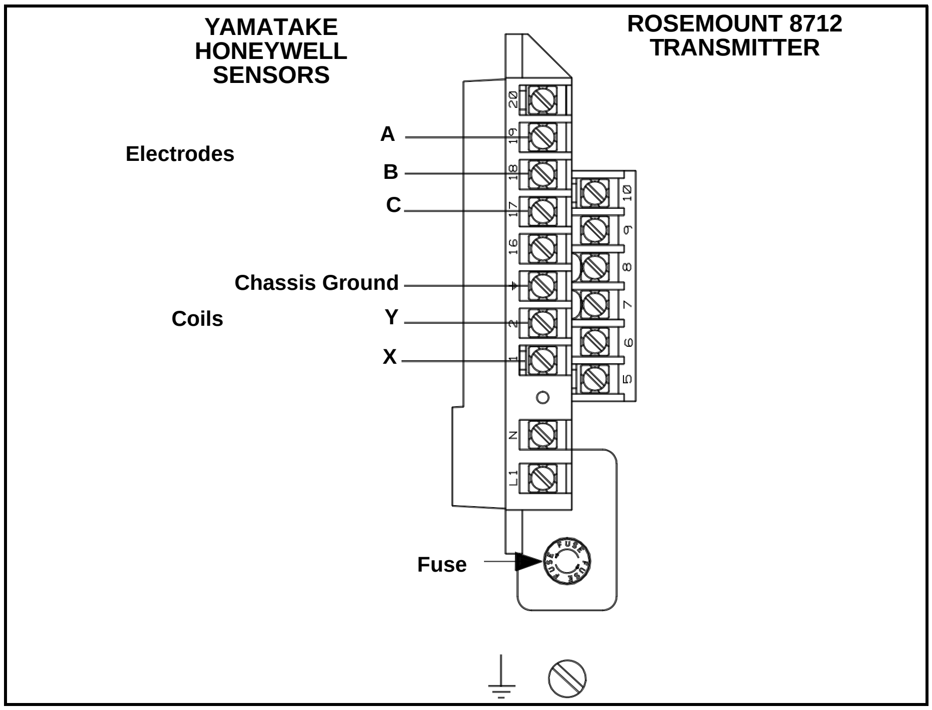


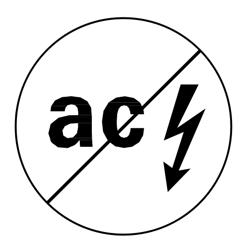
Figure E-35. Generic Wiring Diagram for Yamatake Honeywell Sensors and Rosemount 8712

Table E-33. Yamatake Honeywell Sensor Wiring Connections

Rosemount 8712	Yamatake Honeywell Sensors
1	X
2	Y
⏚	Chassis Ground
17	C
18	B
19	A

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



YOKOGAWA SENSORS

Yokogawa Sensor to Rosemount 8712 Transmitter

Connect coil drive and electrode cables as shown in Figure E-36.

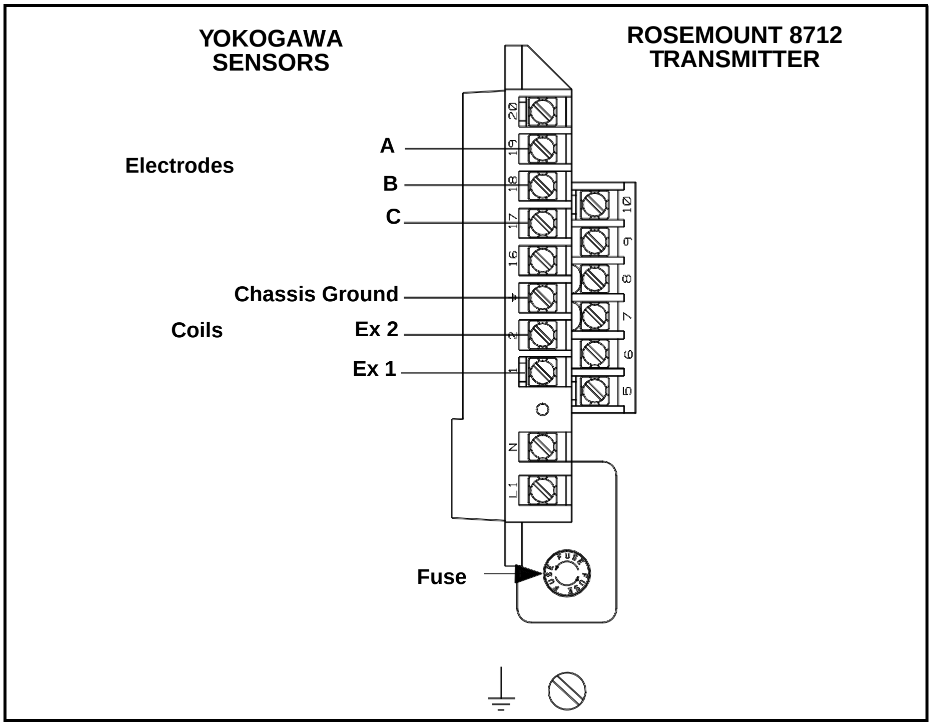


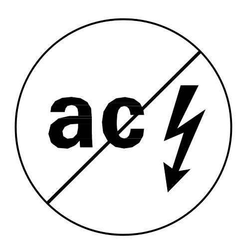
Figure E-36. Generic Wiring Diagram for Yokogawa Sensors and Rosemount 8712

Table E-34. Yokogawa Sensor Wiring Connections

Rosemount 8712	Yokogawa Sensors
1	EX1
2	EX2
⏚	Chassis Ground
17	C
18	B
19	A

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



GENERIC MANUFACTURER SENSORS

Generic Manufacturer Sensor to Rosemount 8712 Transmitter

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, if the sensor is empty. With a full sensor, the electrode terminals will have a resistance of approximately 1000 ohms.

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.

Wiring Connections

Connect the electrode terminals to Rosemount 8712 terminals 18 and 19. The electrode shield should be connected to terminal 17.

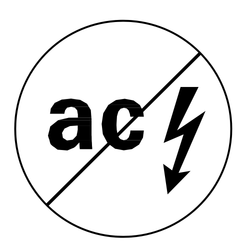
Connect the coil terminals to Rosemount 8712 terminals 1, 2, and ⏚.

If the Rosemount 8712 Transmitter indicates a reverse flow condition, switch the electrode wires connected to terminals 8 and 19.

Generic Sensor	Rosemount 8712E/8732E
Coil Circuit Connections	
Coil Positive	1
Coil Negative	2
Case Ground	⏚
Electrode Circuit Connections	
Electrode Positive	18
Electrode Negative	19
Case Ground	17

⚠CAUTION

This is a pulsed DC magnetic flowmeter. **Do not connect AC power to the sensor or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.



Appendix F HART Field Communicator Operation

HANDHELD COMMUNICATOR

NOTE
Please refer to the Handheld Communicator manual for detailed instructions on the use, features, and full capabilities of the Handheld Communicator.

⚠WARNING

Explosions can result in death or serious injury.

Do not make connections to the serial port or NiCad recharger jack in an explosive atmosphere.

Before connecting the Handheld 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.

CONNECTIONS AND HARDWARE

The HART Field Communicator exchanges information with the transmitter from the control room, the instrument site, or any wiring termination point in the loop. Be sure to install the instruments in the loop in accordance with intrinsically safe or non-incendive field wiring practices. Explosions can result if connections to the serial port or NiCad recharger jack are made in an explosive situation. The Handheld Communicator should be connected in parallel with the transmitter. Use the loop connection ports on the rear panel of the Handheld Communicator (see Figure F-1). The connections are non-polarized.

Figure F-1. Rear Connection Panel

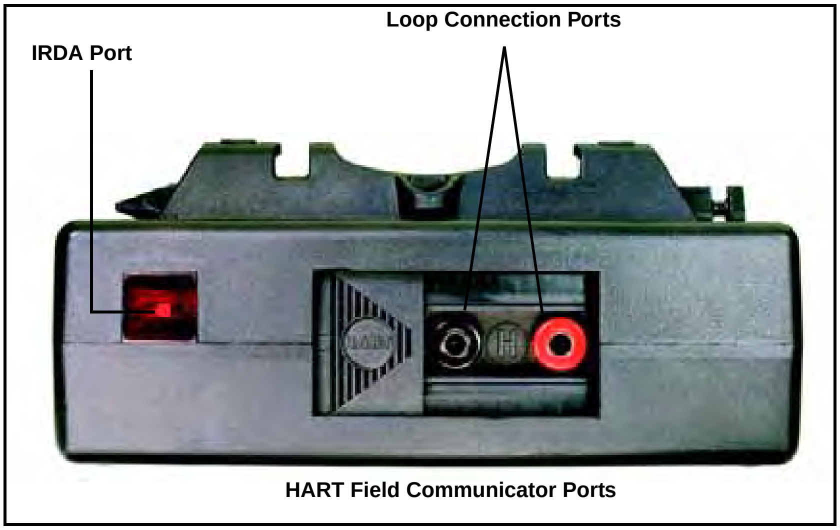
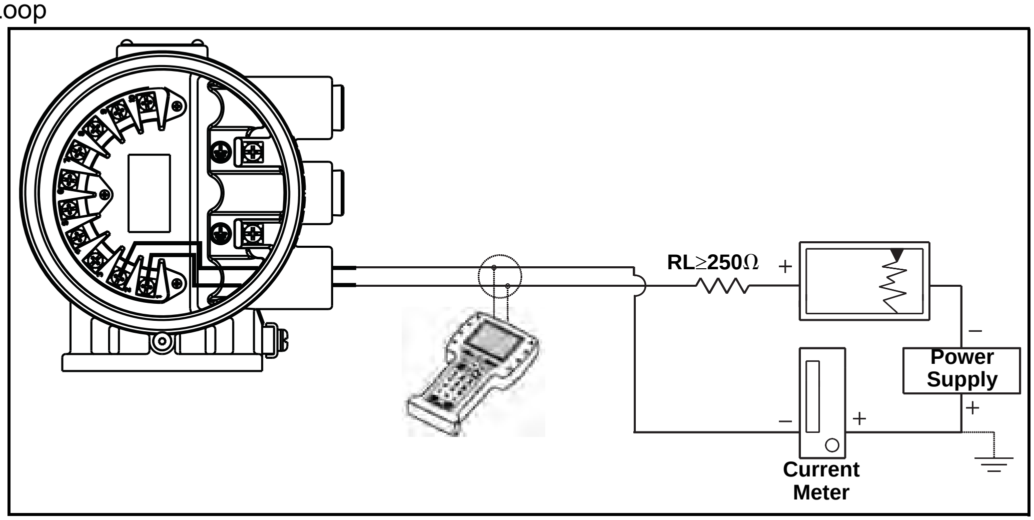
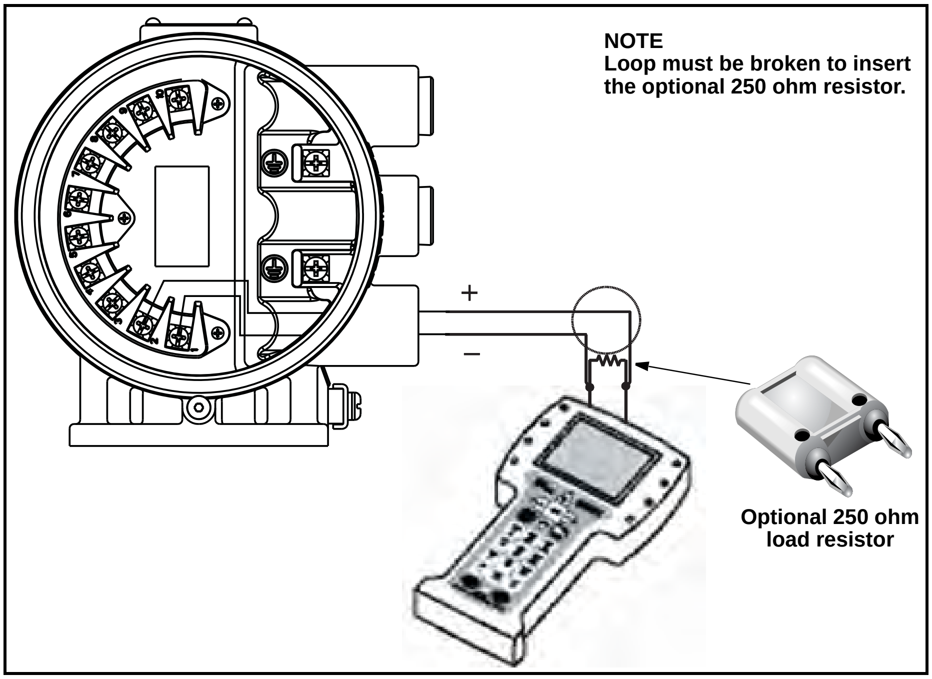


Figure F-2. Connecting the Handheld Communicator to a Transmitter Loop



NOTE
The Handheld Communicator needs a minimum of 250 ohms resistance in the loop to function properly. The Handheld Communicator does not measure loop current directly.

Figure F-3. Connecting the HART Field Communicator with the Optional Load Resistor



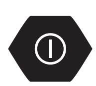
BASIC FEATURES

The basic features of the Handheld Communicator include Action Keys, Function Keys, and Alphanumeric and Shift Keys.

Figure F-4. The Handheld Communicator

Action Keys

The Action Keys
As shown in Figure F-4, the action keys are the six blue, white, and black keys located above the alphanumeric keys. The function of each key is described as follows:

ON/OFF Key 
Use this key to power the Handheld Communicator. When the communicator is turned on, it searches for a transmitter on the 4–20 mA loop. If a device is not found, the communicator displays the message, “No Device Found at Address O. Poll? YES NO.”

Select “YES” to poll for devices at other address (1-16).

Select “NO” to go to the Main Menu.

If a HART-compatible device is found, the communicator displays the Online Menu with device ID (8712) and tag (TRANSMITTER).

Directional Keys 

Use these keys to move the cursor up, down, left, or right. The right arrow key also selects menu options, and the left arrow key returns to the previous menu.

Tab Key 

Use this key to quickly access important, user-defined options when connected to a HART-compatible device. Pressing the Hot Key turns the Handheld Communicator on and displays the Hot Key Menu. See Customizing the Hot Key Menu in the Handheld Communicator manual for more information.

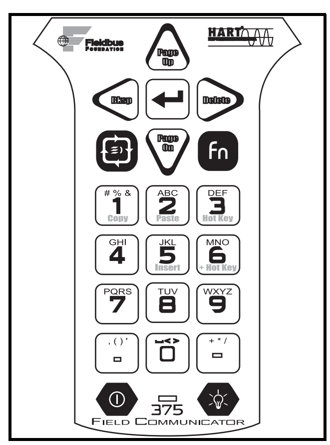
Function Key 

Use the four software-defined function keys, located below the LCD, to perform software functions. On any given menu, the label appearing above a function key indicates the function of that key for the current menu. As you move among menus, different function key labels appear over the four keys. For example, in menus providing access to on-line help, the HELP label may appear above the F1 key. In menus providing access to the Home Menu, the HOME label may appear above the F3 key. Simply press the key to activate the function. See your Handheld Communicator manual for details on specific Function Key definitions.

Alphanumeric and Shift Keys

The Alphanumeric keys perform two functions: the fast selection of menu options and data entry.

Figure F-5. Handheld Communicator Alphanumeric and Shift Keys



Data Entry

Some menus require data entry. Use the Alphanumeric and Shift keys to enter all alphanumeric information into the Handheld Communicator. If you press an Alphanumeric key alone from within an edit menu, the bold character in the center of the key appears. These large characters include the numbers zero through nine, the decimal point (.), and the dash symbol (—).

To enter an alphabetic character, first press the Shift key that corresponds to the position of the letter you want on the alphanumeric key. Then press the alphanumeric key. For example, to enter the letter R, first press the right Shift key, then the “6” key (see Figure F-5 on page F-4). Do not press these keys simultaneously, but one after the other.

Fast Key Feature

The Fast Key feature provides quick on-line access to transmitter variables and functions. Instead of stepping your way through the menu structure using the Action Keys, you can press a Fast Key Sequence to move from the Online Menu to the desired variable or function. On-screen instructions guide you through the rest of the screens.

Fast Key Example

The Fast Key sequences are made up of the series of numbers corresponding to the individual options in each step of the menu structure. For example, from the Online Menu you can change the **Date**. Following the menu structure, press 1 to reach **Device Setup**, press 4 for **Detailed Setup**, press 5 for **Device Info**, press 5 for **Date**. The corresponding Fast Key sequence is 1,4,5,5.

Fast Keys are operational only from the Online Menu. If you use them consistently, you will need to return to the Online Menu by pressing HOME (F3) when it is available. If you do not start at the Online Menu, the Fast Keys will not function properly.

Table F-2, is a listing of every on-line function with the corresponding Fast Keys. These codes are applicable only to the transmitter and the Handheld Communicator.

MENUS AND FUNCTIONS

The Handheld Communicator is a menu driven system. Each screen provides a menu of options that can be selected as outlined above, or provides direction for input of data, warnings, messages, or other instructions.

Main Menu

The Main Menu provides the following options:

- *Offline* - The Offline option provides access to offline configuration data and simulation functions.
- *Online* - The Online option checks for a device and if it finds one, brings up the Online Menu.
- *Transfer* - The Transfer option provides access to options for transferring data either from the Handheld Communicator (Memory) to the transmitter (Device) or vice versa. Transfer is used to move off-line data from the Handheld Communicator to the flowmeter, or to retrieve data from a flowmeter for off-line revision.

NOTE
Online communication with the flowmeter automatically loads the current flowmeter data to the Handheld Communicator. Changes in on-line data are made active by pressing SEND (F2). The transfer function is used only for off-line data retrieval and sending.

- *Frequency Device* - The Frequency Device option displays the frequency output and corresponding flow output of flow transmitters.
- *Utility* - The Utility option provides access to the contrast control for the Handheld Communicator LCD screen and to the autopoll setting used in multidrop applications.

Once selecting a Main Menu option, the Handheld Communicator provides the information you need to complete the operation. If further details are required, consult the Handheld Communicator manual.

Online Menu

The Online Menu can be selected from the Main Menu as outlined above, or it may appear automatically if the Handheld Communicator is connected to an active loop and can detect an operating flowmeter.

NOTE
The Main Menu can be accessed from the Online Menu. Press the left arrow action key to deactivate the on-line communication with the flowmeter and to activate the Main Menu options.

When configuration variables are reset in the on-line mode, the new settings are not activated until the data are sent to the flowmeter.
Press SEND (F2) to update the process variables of the flowmeter.

On-line mode is used for direct evaluation of a particular meter, re-configuration, changing parameters, maintenance, and other functions.

Diagnostic Messages

The following is a list of messages used by the Handheld Communicator (HC) and their corresponding descriptions.

Variable parameters within the text of a message are indicated with <*variable parameter*>.

Reference to the name of another message is identified by *[another message]*.

Table F-1. Handheld Communicator Diagnostic Messages

Message	Description
Add item for ALL device types or only for this ONE device type	Asks the user whether the hot key item being added should be added for all device types or only for the type of device that is connected.
Command Not Implemented	The connected device does not support this function.
Communication Error	Either a device sends back a response indicating that the message it received was unintelligible or the HC cannot understand the response from the device.
Configuration memory not compatible with connected device	The configuration stored in memory is incompatible with the device to which a transfer has been requested.
Device Busy	The connected device is busy performing another task.
Device Disconnected	Device fails to respond to a command
Device write protected	Device is in write-protect mode Data can not be written
Device write protected – do you still want to shut off?	Device is in write-protect mode – press YES to turn the HC off and lose the unsent data.
Display value of variable on hot key menu?	Asks whether the value of the variable should be displayed adjacent to its label on the hot key menu if the item being added to the hot key menu is a variable.
Download data from configuration memory to device	Prompts user to press SEND softkey to initiate a memory to device transfer.
Exceed field width	Indicates that the field width for the current arithmetic variable exceeds the device- specified description edit format
Exceed precision	Indicates that the precision for the current arithmetic variable exceeds the device- specified description edit form
Ignore next 50 occurrences of status?	Asked after displaying device status – softkey answer determines whether next 50 occurrences of device status will be ignored or displayed
Illegal character	An invalid character for the variable type was entered.
Illegal date	The day portion of the date is invalid.
Illegal month	The month portion of the date is invalid.
Illegal year	The year portion of the date is invalid.
Incomplete exponent	The exponent of a scientific notation floating point variable is incomplete.
Incomplete field	The value entered is not complete for the variable type.
Looking for a device	Polling for multidropped devices at addresses 1–15
Mark as read only variable on hot key menu?	Asks whether the user should be allowed to edit the variable from the hot key menu if the item being added to the hot key menu is a variable
No device configuration in configuration memory	There is no configuration saved in memory available to re-configure off-line or transfer to a device.
No Device Found	Poll of address zero fails to find a device, or poll of all addresses fails to find a device if auto-poll is enabled
No hot key menu available for this device	There is no menu named “hot key” defined in the device description for this device.
No off-line devices available	There are no device descriptions available to be used to configure a device off-line.
No simulation devices available	There are no device descriptions available to simulate a device.
No UPLOAD_VARIABLES in ddl for this device	There is no menu named “upload_variables” defined in the device description for this device – this menu is required for off-line configuration.

Table F-1. Handheld Communicator Diagnostic Messages

Message	Description
No Valid Items	The selected menu or edit display contains no valid items.
OFF KEY DISABLED	Appears when the user attempts to turn the HC off before sending modified data or before completing a method
On-line device disconnected with unsent data – RETRY or OK to lose data	There is unsent data for a previously connected device. Press RETRY to send data, or press OK to disconnect and lose unsent data.
Out of memory for hot key configuration – delete unnecessary items	There is no more memory available to store additional hot key items. Unnecessary items should be deleted to make space available.
Overwrite existing configuration memory	Requests permission to overwrite existing configuration either by a device-to-memory transfer or by an off-line configuration; user answers using the softkeys
Press OK...	Press the OK softkey – this message usually appears after an error message from the application or as a result of hart communications.
Restore device value?	The edited value that was sent to a device was not properly implemented. Restoring the device value returns the variable to its original value.
Save data from device to configuration memory	Prompts user to press SAVE softkey to initiate a device-to-memory transfer
Saving data to configuration memory	Data is being transferred from a device to configuration memory.
Sending data to device	Data is being transferred from configuration memory to a device.
There are write only variables which have not been edited. Please edit them.	There are write-only variables which have not been set by the user. These variables should be set or invalid values may be sent to the device.
There is unsent data. Send it before shutting off?	Press YES to send unsent data and turn the HC off. Press NO to turn the HC off and lose the unsent data.
Too few data bytes received	Command returns fewer data bytes than expected as determined by the device description
Transmitter Fault	Device returns a command response indicating a fault with the connected device
Units for <variable label> has changed – unit must be sent before editing, or invalid data will be sent	The engineering units for this variable have been edited. Send engineering units to the device before editing this variable.
Unsent data to on-line device – SEND or LOSE data	There is unsent data for a previously connected device which must be sent or thrown away before connecting to another device.
Use up/down arrows to change contrast. Press DONE when done.	Gives direction to change the contrast of the HC display
Value out of range	The user-entered value is either not within the range for the given type and size of variable or not within the min/max specified by the device.
<message> occurred reading/writing <variable label>	Either a read/write command indicates too few data bytes received, transmitter fault, invalid response code, invalid response command, invalid reply data field, or failed pre- or post-read method; or a response code of any class other than SUCCESS is returned reading a particular variable.
<variable label> has an unknown value – unit must be sent before editing, or invalid data will be sent	A variable related to this variable has been edited. Send related variable to the device before editing this variable.

Table F-2. Handheld Fast Keys (HART Handheld Communicator) and LOI Keys

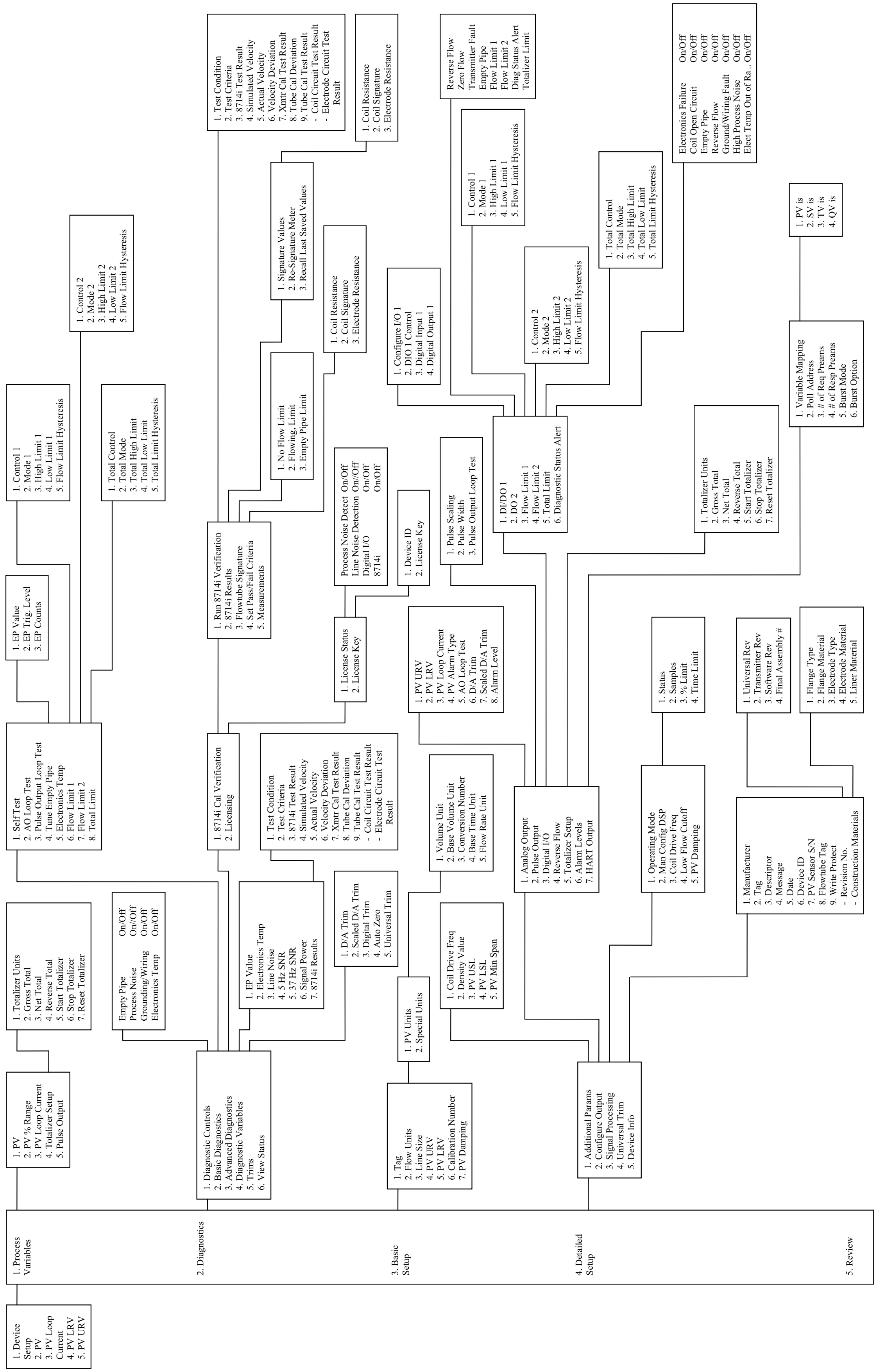
Function	HART Fast Keys
Process Variables	**1, 1**
Primary Variable (PV)	1, 1, 1
PV Percent of Range	1, 1,2
PV Analog Output (AO)	1, 1, 3
Totalizer Set-Up	1, 1, 4
Totalizer Units	1, 1, 4, 1
Gross Total	1,1,4,2
Net Total	1,1,4,3
Reverse Total	1,1,4,4
Start Totalizer	1,1,4,5
Stop Totalizer	1,1,4,6
Reset Totalizer	1,1,4,7
Pulse Output	1,1,5
Diagnostics	**1,2**
Diagnostic Controls	1,2,1
Basic Diagnostics	1,2,2
Self Test	1,2,2,1
AO Loop Test	1,2,2,2
Pulse Output Loop Test	1,2,2,3
Empty Pipe Limits	1,2,2,4
Empty Pipe (EP) Value	1,2,2,4,1
EP Trigger Level	1,2,2,4,2
EP Counts	1,2,2,4,3
Electronics Temp	1,2,2,5
Advanced Diagnostics	1,2,3
8714i Meter Verification	1,2,3,1
Run 8714i Verification	1,2,3,1,1
8714i Results	1,2,3,1,2
Test Condition	1,2,3,1,2,1
Test Criteria	1,2,3,1,2,2
8714i Test Result	1,2,3,1,2,3
Simulated Velocity	1,2,3,1,2,4
Actual Velocity	1,2,3,1,2,5
Velocity Deviation	1,2,3,1,2,6
Transmitter Calibration Test Result	1,2,3,1,2,7
Tube Calibration Deviation	1,2,3,1,2,8
Tube Calibration Test Result	1,2,3,1,2,9
Coil Circuit Test Result*	1,2,3,1,2,10
Electrode Circuit Test Result*	1,2,3,1,2,11
Sensor Signature	1,2,3,1,3
Signature Values	1,2,3,1,3,1
Re-Signature Meter	1,2,3,1,3,2

Function	HART Fast Keys
Recall Last Saved Values	1,2,3,1,3,3
Set Pass/Fail Criteria	1,2,3,1,4
No Flow Limit	1,2,3,1,4,1
Flowing Limit	1,2,3,1,4,2
Empty Pipe Limit	1,2,3,1,4,3
Measurements	1,2,3,1,5
4-20 mA Verify	1,2,3,2
4-20 mA Verification	1,2,3,2,1
4-20 mA Verify Result	1,2,3,2,2
Licensing	1,2,3,3
License Status	1,2,3,3,1
License Key	1,2,3,3,2
Device ID	1,2,3,3,2,1
License Key	1,2,3,3,2,2
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 Signal to Noise Ratio (SNR)	1,2,4,4
37 Hz SNR	1,2,4,5
Signal Power	1,2,4,6
8714i results	1,2,4,7
Test Condition	1,2,4,7,1
Test Criteria	1,2,4,7,2
8714i Test Result	1,2,4,7,3
Simulated Velocity	1,2,4,7,4
Actual Velocity	1,2,4,7,5
Velocity Deviation	1,2,4,7,6
Transmitter Calibration Test Result	1,2,4,7,7
Tube Calibration Deviation	1,2,4,7,8
Tube Calibration Test Result	1,2,4,7,9
Coil Circuit Test Result*	1,2,4,7,--
Electrode Circuit Test Result*	1,2,4,7,--
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
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 Upper Range Value (URV)	1,3,4
PV Lower Range Value (LRV)	1,3,5
Calibration Number	1,3,6
PV Damping	1,3,7

Function	HART Fast Keys
Detailed Setup	**1,4**
Additional Parameters	1,4,1
Coil Drive Frequency	1,4,1,1
Density Value	1,4,1,2
PV Upper Sensor Limit (USL)	1,4,1,3
PV Lower Sensor Limit (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 AO	1,4,2,1,3
AO Alarm Type	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
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 Output Loop Test	1,4,2,2,4
DI/DO Output	1,4,2,3
Digital Input 1	1,4,2,3,1
Digital Output 2	1,4,2,3,2
Reverse Flow	1,4,2,4
Totalizer Set-Up	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 Level	1,4,2,6
HART Output	1,4,2,7
Variable Mapping	1,4,2,7,1
TV is	1,4,2,7,1,1
4V is	1,4,2,7,1,2
Poll Address	1,4,2,7,2
# of Req Preams	1,4,2,7,3
# of Resp Preams	1,4,2,7,4
Burst Mode	1,4,2,7,5
Burst Option	1,4,2,7,6
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
Signal Processing	1,4,4
Operating Mode	1,4,4,1
Manual Configure DSP	1,4,4,2
Status	1,4,4,2,1
Samples	1,4,4,2,2
% Limit	1,4,4,2,3

Function	HART Fast Keys
Time Limit	1,4,4,2,4
Coil Drive Frequency	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 Serial Number	1,4,6,7
Sensor Tag	1,4,6,8
Write Protect	1,4,6,9
Revision No.*	1,4,6,10
Universal Rev	1,4,6,10,1
Transmitter Rev	1,4,6,10,2
Software Rev	1,4,6,10,3
Final Assembly #	1,4,6,10,4
Construction Materials*	1,4,6,11
Flange Type	1,4,6,11,1
Flange Material	1,4,6,11,2
Electrode Type	1,4,6,11,3
Electrode Material	1,4,6,11,4
Liner Material	1,4,6,11,5
Review	**1,5**

Figure F-6. Field Communicator Menu Tree for the Rosemount 8712



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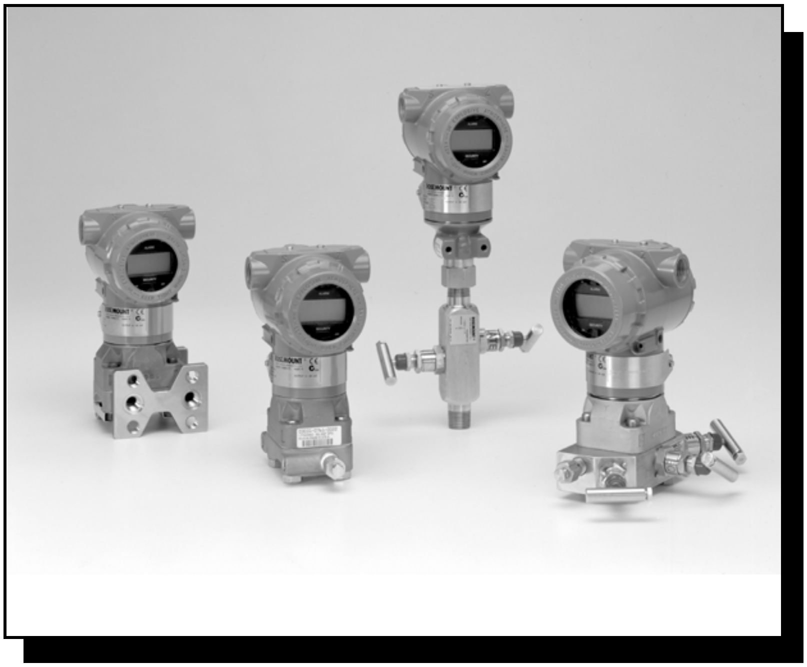
Reference Manual
00809-0100-4001, Rev HA
November 2009

Rosemount 3051 Pressure Transmitter

with HART® Protocol



HART COMMUNICATION PROTOCOL

ROSEMOUNT®

EMERSON Process Management

www.rosemount.com

Rosemount 3051 Pressure Transmitter

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.

For technical assistance, contacts are listed below:

Customer Central
Technical support, quoting, and order-related questions.

United States - 1-800-999-9307 (7:00 am to 7:00 pm CST)

Asia Pacific- 65 777 8211

Europe/ Middle East/ Africa - 49 (8153) 9390

North American Response Center
Equipment service needs.

1-800-654-7768 (24 hours—includes Canada)

Outside of these areas, contact your local Emerson Process Management representative.

⚠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.

Table of Contents

SECTION 3 Configuration

SECTION 4 Operation and Maintenance

SECTION 5 Troubleshooting

APPENDIX A Specifications and Reference Data

APPENDIX B Product Certifications

Section 1 Introduction

USING THIS MANUAL

The sections in this manual provide information on installing, operating, and maintaining the Rosemount 3051. The sections are organized as follows:

Section 2: Installation contains mechanical and electrical installation instructions, and field upgrade options.

Section 3: Configuration provides instruction on commissioning and operating Rosemount 3051 transmitters. Information on software functions, configuration parameters, and online variables is also included.

Section 4: Operation and Maintenance contains operation and maintenance techniques.

Section 5: Troubleshooting provides troubleshooting techniques for the most common operating problems.

Appendix A: Specifications and Reference Data supplies reference and specification data, as well as ordering information.

Appendix B: Product Certifications contains intrinsic safety approval information, European ATEX directive information, and approval drawings.

SERVICE SUPPORT

To expedite the return process outside of the United States, contact the nearest Emerson Process Management representative.

Within the United States, call the Emerson Process Management Instrument and Valve Response Center using the 1-800-654-RSMT (7768) toll-free number. This 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 process material to which the product was last exposed.

⚠CAUTION

Individuals who handle products exposed to a hazardous substance can avoid injury if they are informed of and understand the hazard. The product being returned will require a copy of the required Material Safety Data Sheet (MSDS) for each substance must be included with the returned goods.

Emerson Process Management Instrument and Valve Response Center representatives will explain the additional information and procedures necessary to return goods exposed to hazardous substances.

MODELS COVERED

The following Rosemount 3051 Pressure Transmitters are covered by this manual:

Rosemount 3051C Coplanar Pressure Transmitter

Rosemount 3051CD Differential Pressure Transmitter
Measures differential pressure up to 2000 psi (137,9 bar).

Rosemount 3051CG Gage Pressure Transmitter
Measures gage pressure up to 2000 psi (137,9 bar).

Rosemount 3051CA Absolute Pressure Transmitter
Measures absolute pressure up to 4000 psia (275,8 bar).

Rosemount 3051T In-Line Pressure Transmitter

Rosemount 3051T Gage and Absolute Pressure Transmitter
Measures gage pressure up to 10000 psi (689,5 bar).

Rosemount 3051L Liquid Level Transmitter

Provides precise level and specific gravity measurements up to 300 psi (20,7 bar) for a wide variety of tank configurations.

Rosemount 3051H High Process Temperature Pressure Transmitter

Provides high process temperature capability to 375 °F (191 °C) for measuring differential or gage pressure without use of remote diaphragm seals or capillaries.

NOTE
For Rosemount 3051 with FOUNDATION™ fieldbus, see Rosemount Product Manual 00809-0100-4774. For Rosemount 3051 with Profibus PA, see Rosemount Product Manual 00809-0100-4797.

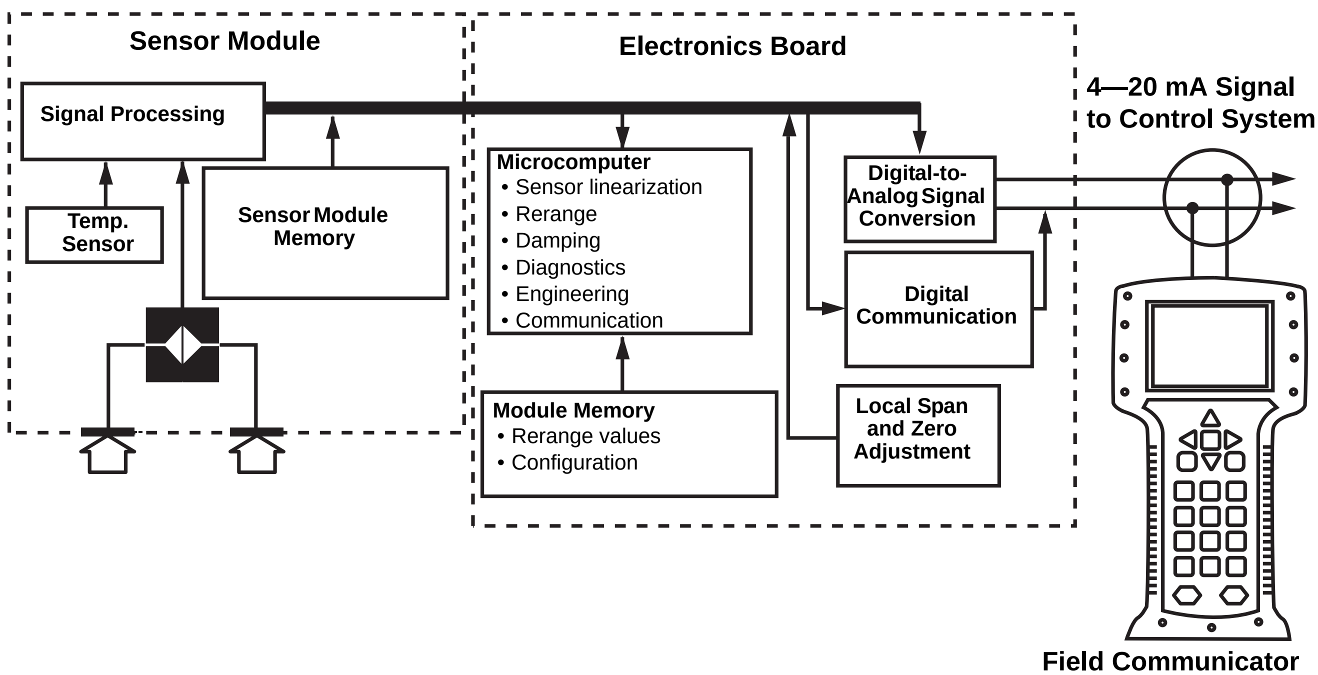
TRANSMITTER OVERVIEW

The Rosemount 3051C Coplanar™ design is offered for Differential Pressure (DP), Gage Pressure (GP) and Absolute Pressure (AP) measurements. The Rosemount 3051C utilizes Emerson Process Management capacitance sensor technology for DP and GP measurements. Piezoresistive sensor technology is utilized in the Rosemount 3051T and 3051CA measurements.

The major components of the Rosemount 3051 are the sensor module and the electronics housing. The sensor module contains the oil filled sensor system (isolating diaphragms, oil fill system, and sensor) and the sensor electronics. The sensor electronics are installed within the sensor module and include a temperature sensor (RTD), a memory module, and the capacitance to digital signal converter (C/D converter). The electrical signals from the sensor module are transmitted to the output electronics in the electronics housing. The electronics housing contains the output electronics board, the local zero and span buttons, and the terminal block. The basic block diagram of the Rosemount 3051CD is illustrated in Figure 1-1.

For the Rosemount 3051C design pressure is applied to the isolating diaphragms, the oil deflects the center diaphragm, which then changes the capacitance. This capacitance signal is then changed to a digital signal in the C/D converter. The microprocessor then takes the signals from the RTD and C/D converter calculates the correct output of the transmitter. This signal is then sent to the D/A converter, which converts the signal back to an analog signal and superimposes the HART signal on the 4-20 mA output.

Figure 1-1. Block diagram of operation



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 Installation

OVERVIEW

The information in this section covers installation considerations for the Rosemount 3051 with HART protocols. A Quick Installation Guide for HART protocol (document number 00825-0100-4001) is shipped with every transmitter to describe basic pipe-fitting and wiring procedures for initial installation. Dimensional drawings for each 3051 variation and mounting configuration are included on page 2-8.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operation. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

Warnings

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 3051 reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

⚠WARNING

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals.

Process leaks could result in death or serious injury.

- Install and tighten all four flange bolts before applying pressure.
- Do not attempt to loosen or remove flange bolts while the transmitter is in service.

Replacement equipment or spare parts not approved by Emerson Process Management for use as spare parts could reduce the pressure retaining capabilities of the transmitter and may render the instrument dangerous.

- Use only bolts supplied or sold by Emerson Process Management as spare parts.
- Refer to page A-42 for a complete list of spare parts.

Improper assembly of manifolds to traditional flange can damage sensor module.

- For safe assembly of manifold to traditional flange, bolts must break back plane of flange web (i.e., bolt hole) but must not contact sensor module housing.

GENERAL CONSIDERATIONS

Measurement accuracy depends upon proper installation of the transmitter and impulse piping. Mount the transmitter close to the process and use a minimum of piping to achieve best accuracy. Keep in mind the need for easy access, personnel safety, practical field calibration, and a suitable transmitter environment. Install the transmitter to minimize vibration, shock, and temperature fluctuation.

IMPORTANT
Install the enclosed pipe plug (found in the box) in unused conduit opening with a minimum of five threads engaged to comply with explosion-proof requirements.

For material compatibility considerations, see document number 00816-0100-3045 on www.emersonprocess.com/rosemount.

MECHANICAL CONSIDERATIONS

NOTE
For steam service or for applications with process temperatures greater than the limits of the transmitter, do not blow down impulse piping through the transmitter. Flush lines with the blocking valves closed and refill lines with water before resuming measurement.

NOTE
When the transmitter is mounted on its side, position the Coplanar flange to ensure proper venting or draining. Mount the flange as shown in Figure 2-9 on page 2-11, keeping drain/vent connections on the bottom for gas service and on the top for liquid service.

DRAFT RANGE CONSIDERATIONS

Installation

For the Rosemount 3051CD0 draft range pressure transmitter, it is best to mount the transmitter with the isolators parallel to the ground. Installing the transmitter in this way reduces oil head effect and provides for optimal temperature performance.

Be sure the transmitter is securely mounted. Tilting of the transmitter may cause a zero shift in the transmitter output.

Reducing Process Noise

There are two recommended methods of reducing process noise: output damping and, in gage applications, reference side filtering.

Output Damping

The output damping for the Rosemount 3051CD0 is factory set to 3.2 seconds as a default. If the transmitter output is still noisy, increase the damping time. If faster response is needed, decrease the damping time. Damping adjustment information is available on page 3-13.

Reference Side Filtering

In gage applications it is important to minimize fluctuations in atmospheric pressure to which the low side isolator is exposed.

One method of reducing fluctuations in atmospheric pressure is to attach a length of tubing to the reference side of the transmitter to act as a pressure buffer.

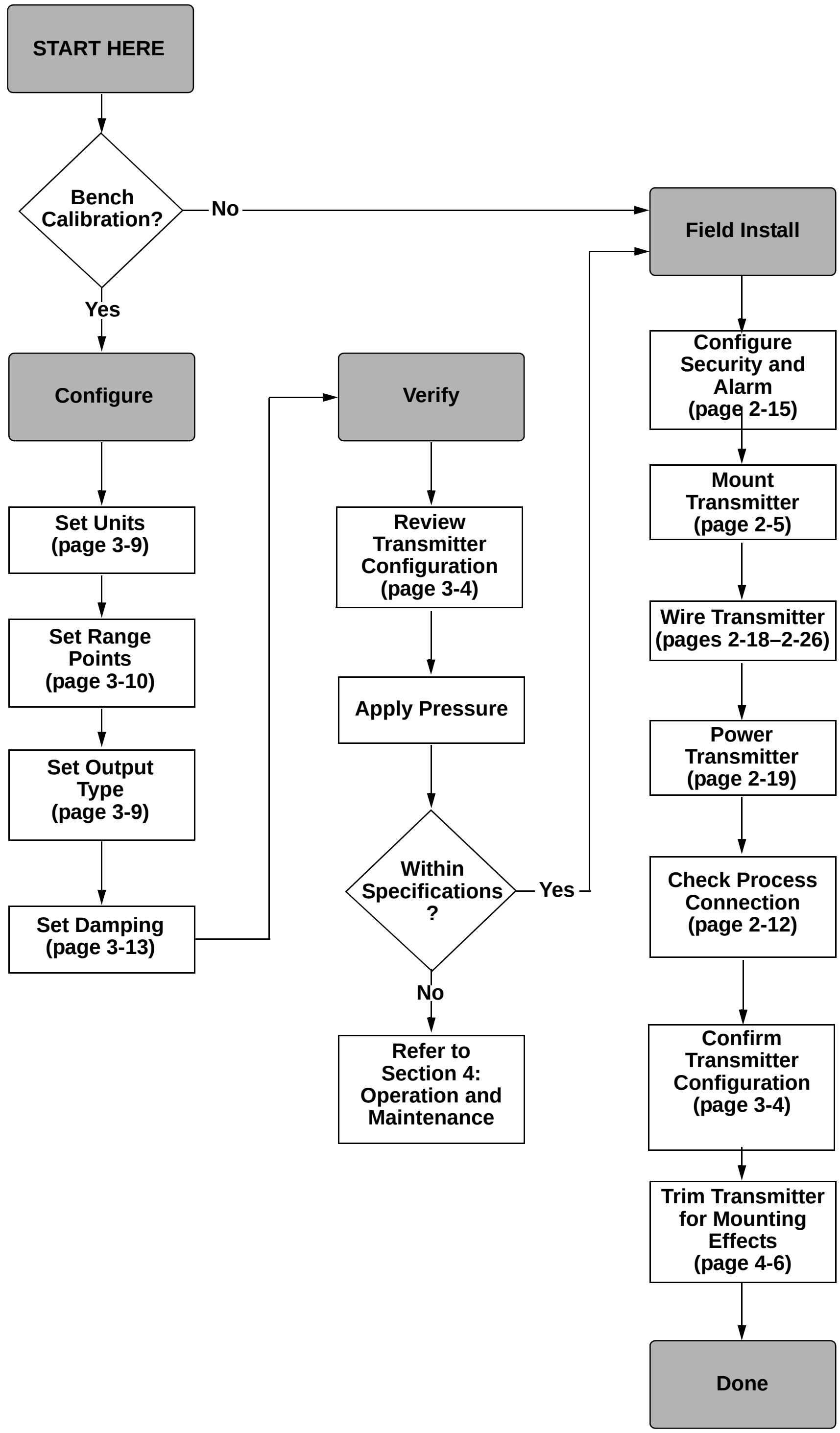
Another method is to plumb the reference side to a chamber that has a small vent to atmosphere. If multiple draft transmitters are being used in an application, the reference side of each device can be plumbed to a chamber to achieve a common gage reference.

ENVIRONMENTAL CONSIDERATIONS

Best practice is to mount the transmitter in an environment that has minimal ambient temperature change. The transmitter electronics temperature operating limits are –40 to 185 °F (–40 to 85 °C). Refer to Appendix A: Specifications and Reference Data that lists the sensing element operating limits. Mount the transmitter so that it is not susceptible to vibration and mechanical shock and does not have external contact with corrosive materials.

HART INSTALLATION FLOWCHART

Figure 2-1. HART Installation Flowchart



INSTALLATION PROCEDURES

Mount the Transmitter

For dimensional drawing information refer to Appendix A: Specifications and Reference Data on page A-13.

Process Flange Orientation

Mount the process flanges with sufficient clearance for process connections. For safety reasons, place the drain/vent valves so the process fluid is directed away from possible human contact when the vents are used. In addition, consider the need for a testing or calibration input.

NOTE
Most transmitters are calibrated in the horizontal position. Mounting the transmitter in any other position will shift the zero point to the equivalent amount of liquid head pressure caused by the varied mounting position. To reset zero point, refer to "Sensor Trim" on page 4-10.

Housing Rotation

See "Housing Rotation" on page 2-14.

Terminal Side of Electronics Housing

Mount the transmitter so the terminal side is accessible. Clearance of 0.75 in. (19 mm) is required for cover removal. Use a conduit plug in the unused conduit opening.

Circuit Side of Electronics Housing

Provide 0.75 in. (19 mm) of clearance for units with out an LCD display. Three inches of clearance is required for cover removal if a meter is installed.

Cover Installation

Always ensure a proper seal by installing the electronics housing cover(s) so that metal contacts metal. Use Rosemount O-rings.

Conduit Entry Threads

For NEMA 4X, IP66, and IP68 requirements, use thread seal (PTFE) tape or paste on male threads to provide a watertight seal.

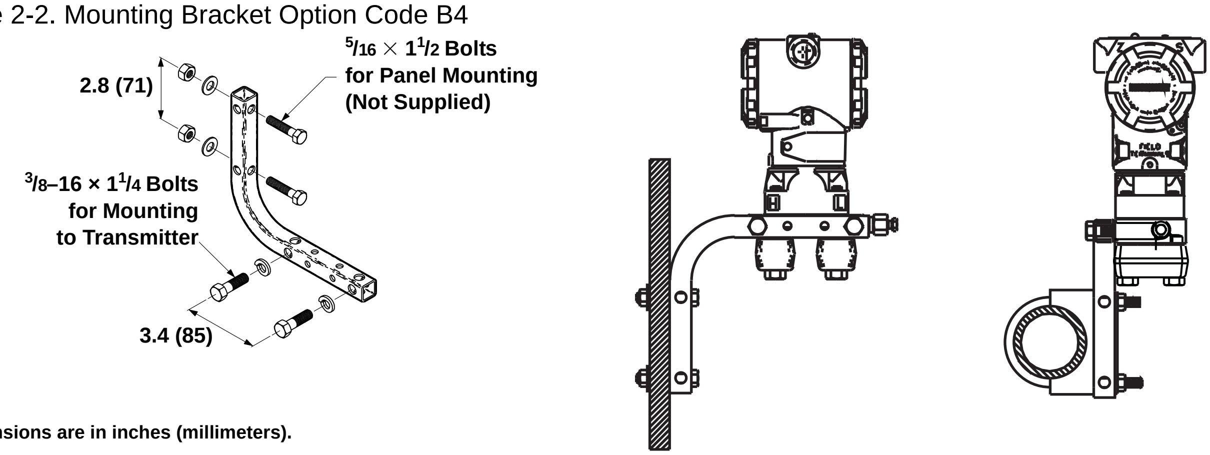
Mounting Brackets

Rosemount 3051 Transmitters may be panel-mounted or pipe-mounted through an optional mounting bracket. Refer to Table 2-1 for the complete offering and see Figure 2-2 through Figure 2-6 on pages 2-6 and 2-7 for dimensions and mounting configurations.

Table 2-1. Mounting Brackets

3051 Brackets										
	Process Connections			Mounting			Materials			
Option Code	Coplanar	In-Line	Traditional	Pipe Mount	Panel Mount	Flat Panel Mount	CS Bracket	SST Bracket	CS Bolts	SST Bolts
B4	X	X		X	X	X		X		X
B1			X	X			X		X	
B2			X		X		X		X	
B3			X			X	X		X	
B7			X	X			X			X
B8			X		X		X			X
B9			X			X	X			X
BA			X	X				X		X
BC			X			X		X		X

Figure 2-2. Mounting Bracket Option Code B4



NOTE
Dimensions are in inches (millimeters).

Figure 2-3. Mounting Bracket Option Codes B1, B7, and BA

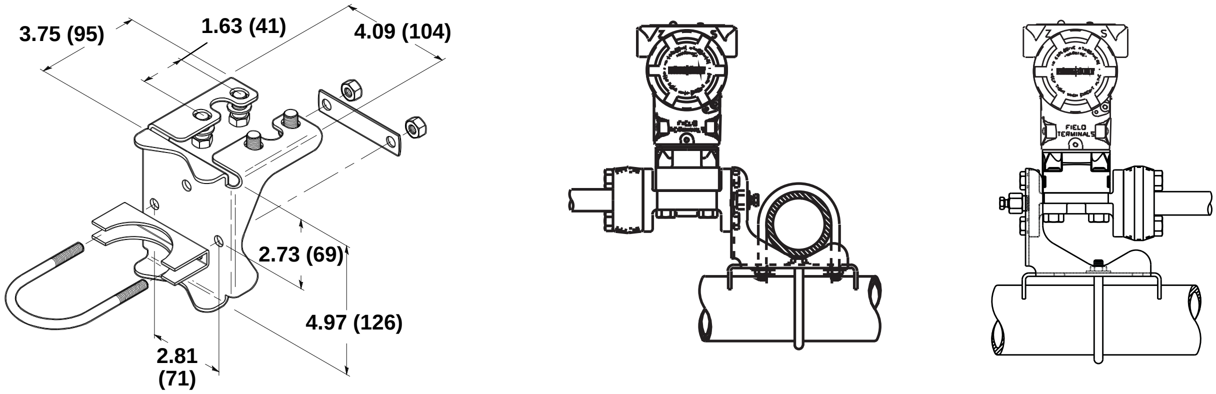


Figure 2-5. Panel Mounting Bracket Option Codes B2 and B8

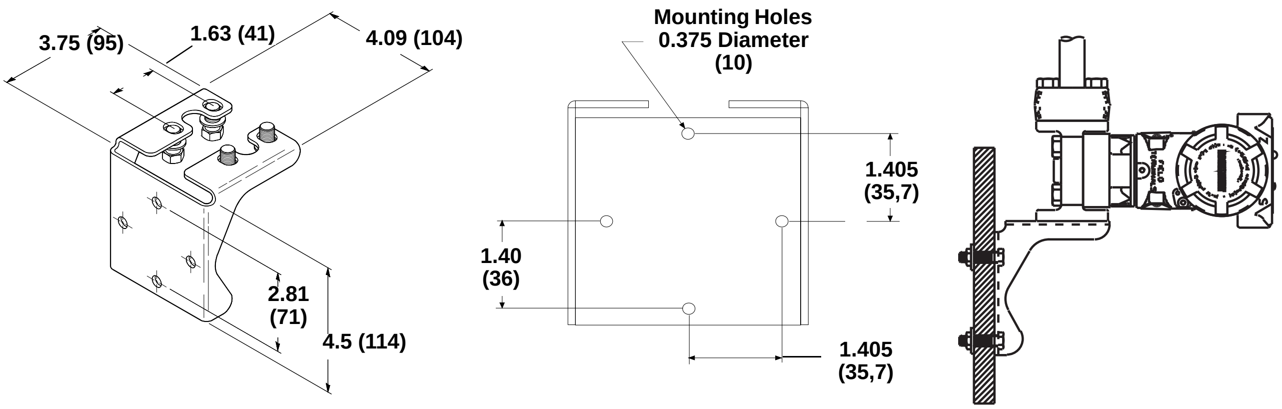
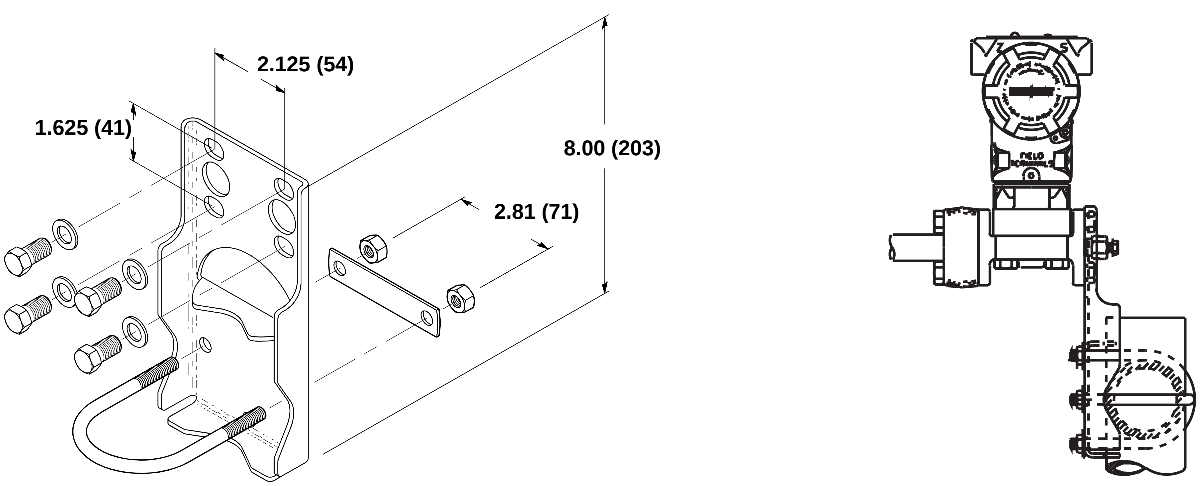


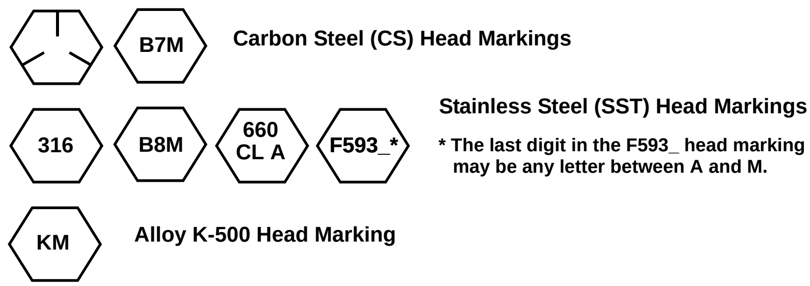
Figure 2-6. Flat Mounting Bracket Option Codes B3 and BC



NOTE
Dimensions are in inches (millimeters).

Flange Bolts

The 3051 can be shipped with a Coplanar flange or a Traditional flange installed with four 1.75-inch flange bolts. Mounting bolts and bolting configurations for the Coplanar and Traditional flanges can be found on page 2-9. Stainless steel bolts supplied by Emerson Process Management are coated with a lubricant to ease installation. Carbon steel bolts do not require lubrication. No additional lubricant should be applied when installing either type of bolt. Bolts supplied by Emerson Process Management are identified by their head markings:



Bolt Installation

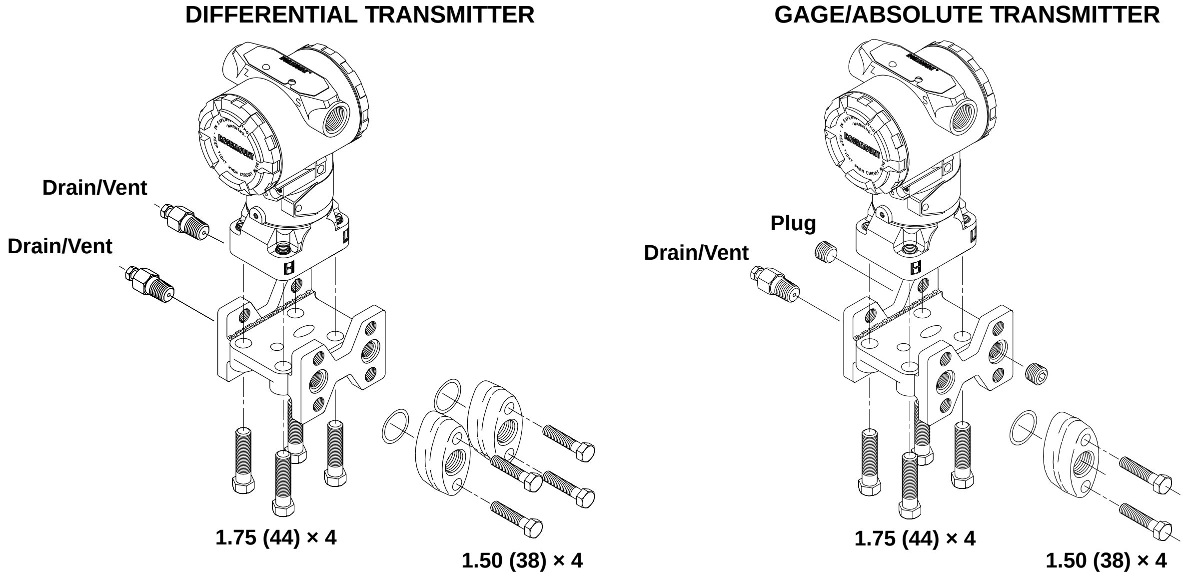
⚠ Only use bolts supplied with the Rosemount 3051 or sold by Emerson Process Management as spare parts for the Rosemount 3051 transmitter. Use the following bolt installation procedure:

1. Finger-tighten the bolts.
2. Torque the bolts to the initial torque value using a crossing pattern (see Table 2-2 for torque values).
3. Torque the bolts to the final torque value using the same crossing pattern.

Table 2-2. Bolt Installation Torque Values

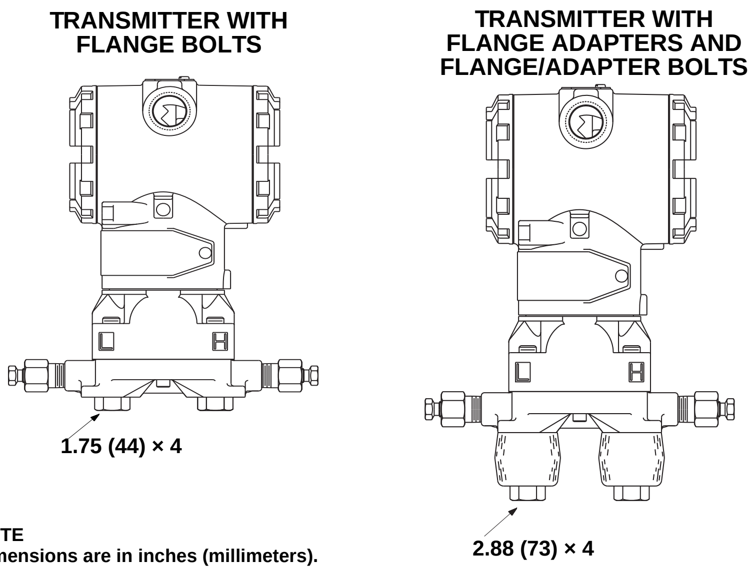
Bolt Material	Initial Torque Value	Final Torque Value
CS-ASTM-A445 Standard	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
316 SST—Option L4	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)
ASTM-A-193-B7M—Option L5	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
Alloy 400—Option L6	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)

Figure 2-7. Traditional Flange Bolt Configurations



NOTE
Dimensions are in inches (millimeters).

Figure 2-8. Mounting Bolts and Bolt Configurations for Coplanar Flange



NOTE
Dimensions are in inches (millimeters).

Description	Qty	Size in. (mm)
Differential Pressure		
Flange Bolts	4	1.75 (44)
Flange/Adapter Bolts	4	2.88 (73)
Gage/Absolute Pressure (1)		
Flange Bolts	4	1.75 (44)
Flange/Adapter Bolts	2	2.88 (73)

(1) Rosemount 3051T transmitters are direct mount and do not require bolts for process connection.

Impulse Piping

The piping between the process and the transmitter must accurately transfer the pressure to obtain accurate measurements. There are five possible sources of error: pressure transfer, leaks, friction loss (particularly if purging is used), trapped gas in a liquid line, liquid in a gas line, and density variations between the legs.

The best location for the transmitter in relation to the process pipe is dependent on the process. Use the following guidelines to determine transmitter location and placement of impulse piping:

- Keep impulse piping as short as possible.
- For liquid service, slope the impulse piping at least 1 in./foot (8 cm/m) upward from the transmitter toward the process connection.
- For gas service, slope the impulse piping at least 1 in./foot (8 cm/m) downward from the transmitter toward the process connection.
- Avoid high points in liquid lines and low points in gas lines.
- Make sure both impulse legs are the same temperature.
- Use impulse piping large enough to avoid friction effects and blockage.
- Vent all gas from liquid piping legs.
- When using a sealing fluid, fill both piping legs to the same level.
- When purging, make the purge connection close to the process taps and purge through equal lengths of the same size pipe. Avoid purging through the transmitter.
- Keep corrosive or hot (above 250 °F [121 °C]) process material out of direct contact with the sensor module and flanges.
- Prevent sediment deposits in the impulse piping.
- Maintain equal leg of head pressure on both legs of the impulse piping.
- Avoid conditions that might allow process fluid to freeze within the process flange.

Mounting Requirements

Impulse piping configurations depend on specific measurement conditions. Refer to Figure 2-9 for examples of the following mounting configurations:

Liquid Flow Measurement

- Place taps to the side of the line to prevent sediment deposits on the transmitter’s process isolators.
- Mount the transmitter beside or below the taps so gases can vent into the process line.
- Mount drain/vent valve upward to allow gases to vent.

Gas Flow Measurement

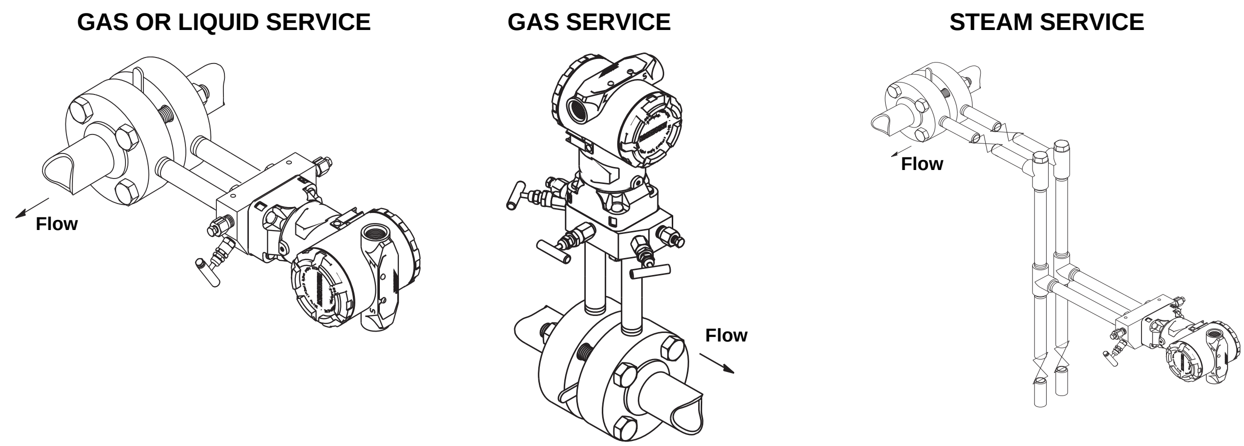
- Place taps in the top or side of the line.
- Mount the transmitter beside or above the taps so liquid will drain into the process line.

Steam Flow Measurement

- Place taps to the side of the line.
- Mount the transmitter below the taps to ensure that the impulse piping will stay filled with condensate.
- In steam service above 250 °F (121 °C), fill impulse lines with water to prevent steam from contacting the transmitter directly and to ensure accurate measurement start-up.

NOTE
For steam or other elevated temperature services, it is important that temperatures at the process connection do not exceed the transmitter's process temperature limits.

Figure 2-9. Installation Examples



Process Connections

Coplanar or Traditional Process Connection

⚠ Install and tighten all four flange bolts before applying pressure, or process leakage will result. When properly installed, the flange bolts will protrude through the top of the sensor module housing. Do not attempt to loosen or remove the flange bolts while the transmitter is in service.

⚠ **Flange Adaptors:**

Rosemount 3051DP and GP process connections on the transmitter flanges are $^1/_4$–18 NPT. Flange adapters are available with standard $^1/_2$–14 NPT Class 2 connections. The flange adapters allow users to disconnect from the process by removing the flange adapter bolts. Use plant-approved lubricant or sealant when making the process connections. Refer to Dimensional Drawings on page A-13 for the distance between pressure connections. This distance may be varied ±$^1/_8$ in. (3.2 mm) by rotating one or both of the flange adapters.

To install adapters to a Coplanar flange, perform the following procedure:

1. Remove the flange bolts.
2. Leaving the flange in place, move the adapters into position with the o-ring installed.
3. Clamp the adapters and the Coplanar flange to the transmitter sensor module using the larger of the bolts supplied.
4. Tighten the bolts. Refer to “Flange Bolts” on page 2-8 for torque specifications.

Whenever you remove flanges or adapters, visually inspect the PTFE o-rings. Replace with o-ring designed for Rosemount transmitter if there are any signs of damage, such as nicks or cuts. Undamaged o-rings may be reused. If you replace the o-rings, retorque the flange bolts after installation to compensate for cold flow. Refer to the process sensor body reassembly procedure in Section 5: Troubleshooting.

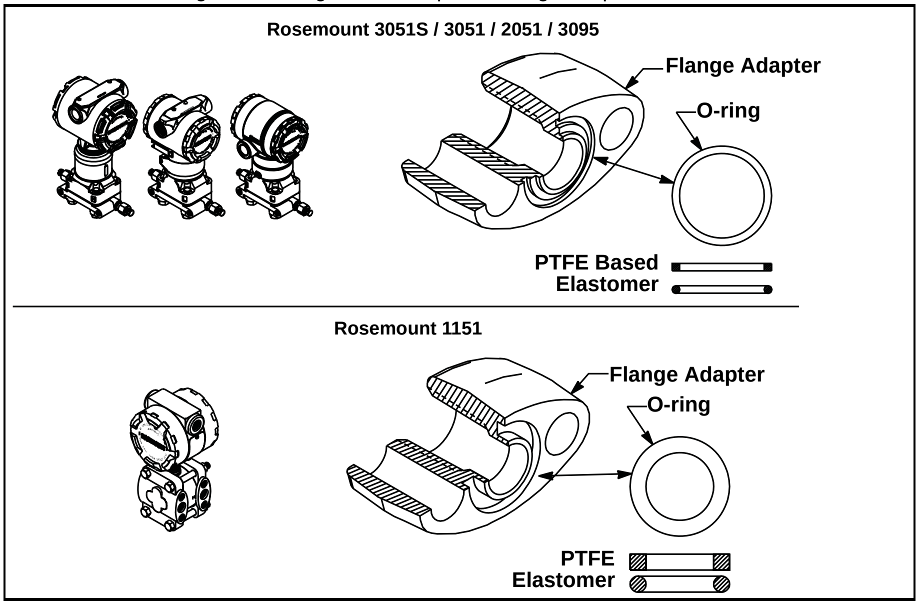
O-rings:

The two styles of Rosemount flange adapters (Rosemount 1151 and Rosemount 3051S/3051/2051/3095) each require a unique O-ring (see Figure 2-10). Use only the O-ring designed for the corresponding flange adaptor.

Figure 2-10. O-Rings.

⚠WARNING

Failure to install proper flange adapter O-rings may cause process leaks, which can result in death or serious injury. The two flange adapters are distinguished by unique O-ring grooves. Only use the O-ring that is designed for its specific flange adapter, as shown below.



⚠ When compressed, PTFE O-rings tend to “cold flow,” which aids in their sealing capabilities.

NOTE
PTFE O-rings should be replaced if the flange adapter is removed.

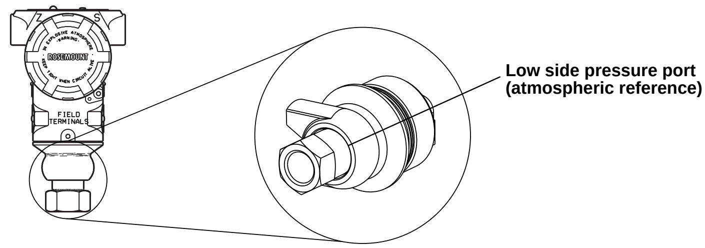
Inline Process Connection

Inline Gage Transmitter Orientation

The low side pressure port on the inline gage transmitter is located in the neck of the transmitter, behind the housing. The vent path is 360 degrees around the transmitter between the housing and sensor (See Figure 2-11).

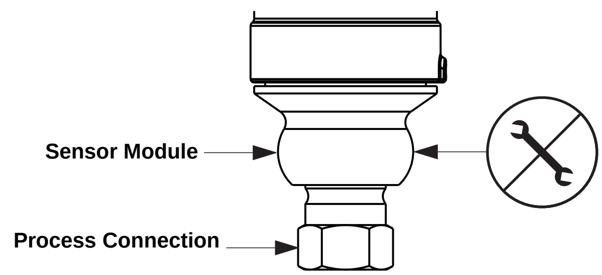
Keep the vent path free of any obstruction, such as paint, dust, and lubrication by mounting the transmitter so that the process can drain away.

Figure 2-11. Inline Gage Low Side Pressure Port



⚠WARNING

Do not apply torque directly to the sensor module. Rotation between the sensor module and the process connection can damage the electronics. To avoid damage, apply torque only to the hex-shaped process connection.

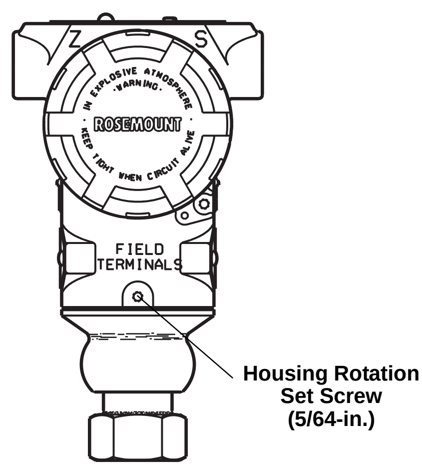


Housing Rotation

The electronics housing can be rotated up to 180 degrees in either direction to improve field access, or to better view the optional LCD display. To rotate the housing, perform the following procedure:

1. Loosen the housing rotation set screw using a $\frac{5}{64}$-in. hex wrench.
2. Turn the housing left or right up to 180° from its original position. Over rotating will damage the transmitter.
3. Retighten the housing rotation set screw.

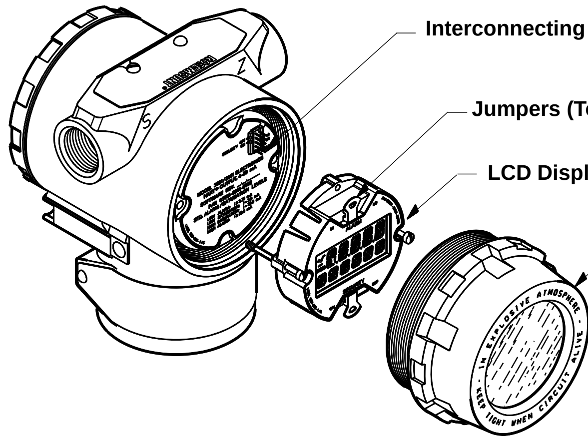
Figure 2-12. Housing Rotation



LCD Display

Transmitters ordered with the LCD option are shipped with the display installed. Installing the display on an existing 3051 transmitter requires a small instrument screwdriver.

Figure 2-13. LCD Display



Configure Security and Alarm

Security (Write Protect)

There are three security methods with the Rosemount 3051 transmitter:

1. Security Jumper: prevents all writes to transmitter configuration.
2. Local Keys (Local Zero and Span) Software Lock Out: prevents changes to transmitter range points via local zero and span adjustment keys. With local keys security enabled, changes to configuration are possible via HART.
3. Physical Removal of Local Keys (Local Zero and Span) Magnetic Buttons: removes ability to use local keys to make transmitter range point adjustments. With local keys security enabled, changes to configuration are possible via HART.

You can prevent changes to the transmitter configuration data with the write protection jumper. Security is controlled by the security (write protect) jumper located on the electronics board or LCD display. Position the jumper on the transmitter circuit board in the “ON” position to prevent accidental or deliberate change of configuration data.

If the transmitter write protection jumper is in the “ON” position, the transmitter will not accept any “writes” to its memory. Configuration changes, such as digital trim and reranging, cannot take place when the transmitter security is on.

NOTE
If the security jumper is not installed, the transmitter will continue to operate in the security OFF configuration.

Configuring Transmitter Security and Alarm Jumper Procedure

To reposition the jumpers, follow the procedure described below.

1. Do not remove the transmitter covers in explosive atmospheres when the circuit is live. If the transmitter is live, set the loop to manual and remove power.
2. ⚠ Remove the housing cover opposite the field terminal side. Do not remove the transmitter covers in explosive atmospheres when the circuit is live.
3. Reposition the jumpers as desired.
   - Figure 2-14 shows the jumper positions for the 4-20 mA HART Transmitter.
   - Figure 2-15 shows the jumper positions for the 1-5 HART Vdc Low Power Transmitter.
4. ⚠ Reattach the transmitter cover. Always ensure a proper seal by installing the electronics housing covers so that metal contacts metal to meet explosion-proof requirements.

Figure 2-14. Electronics Board

4-20 mA HART	
Without LCD Meter	With LCD Display

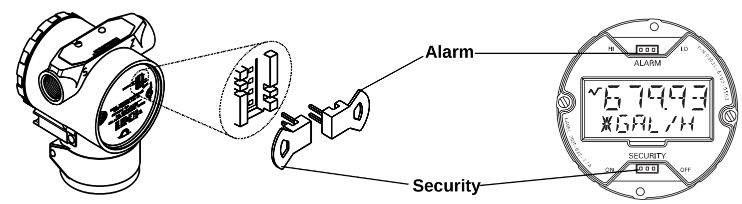
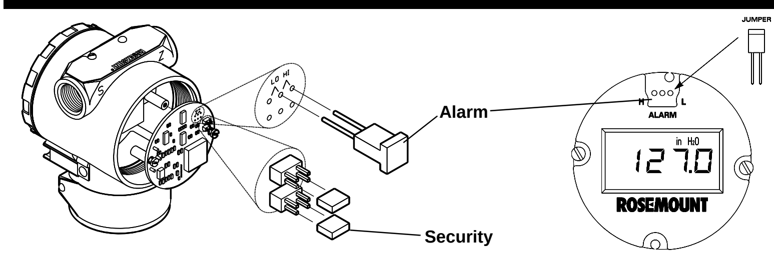
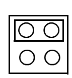


Figure 2-15. Low Power Transmitter Electronics Boards

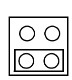
1-5 Vdc HART Low Power	
Without LCD Meter	With LCD Display



TRANSMITTER SECURITY JUMPER POSITIONS



Write Protect ON



Write Protect OFF

NOTE
Security jumper not installed = Not Write Protected
Alarm jumper not installed = High Alarm

ELECTRICAL CONSIDERATIONS

NOTE
Make sure all electrical installation is in accordance with national and local code requirements.

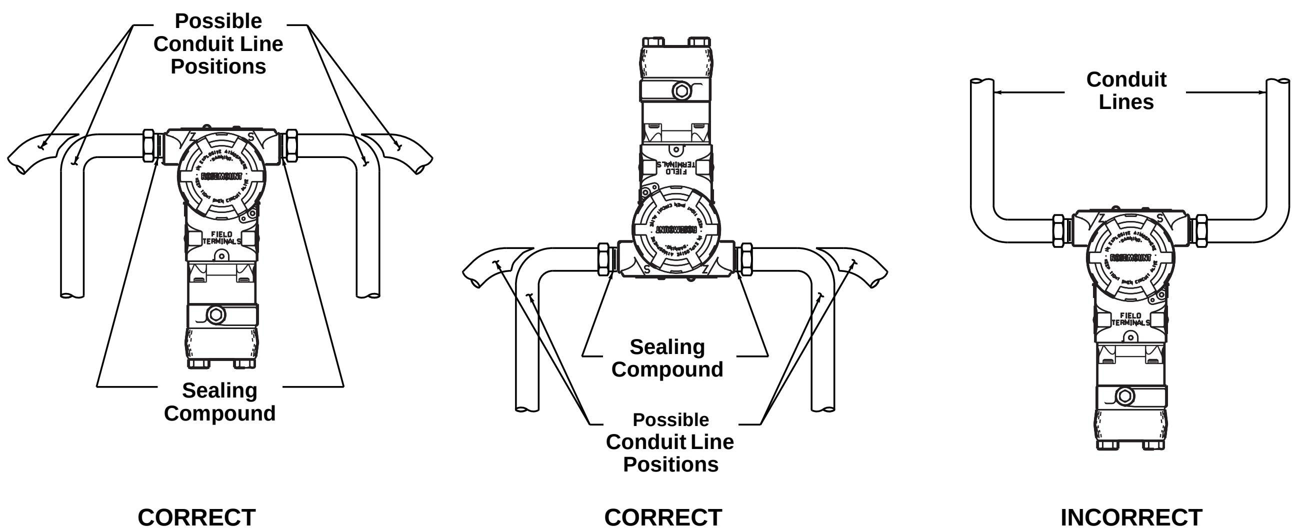
Conduit Installation

⚠CAUTION

If all connections are not sealed, excess moisture accumulation can damage the transmitter. Make sure to mount the transmitter with the electrical housing positioned downward for drainage. To avoid moisture accumulation in the housing, install wiring with a drip loop, and ensure the bottom of the drip loop is mounted lower than the conduit connections or the transmitter housing.

Recommended conduit connections are shown in Figure 2-16.

Figure 2-16. Conduit Installation Diagrams.



Wiring

⚠CAUTION

Do not connect the power signal wiring to the test terminals. Voltage may burn out the reverse-polarity protection diode in the test connection.

NOTE
Use shielded twisted pairs to yield best results. To ensure proper communication, use 24 AWG or larger wire, and do not exceed 5000 feet (1500 meters).

Figure 2-17. 4-20 mA HART wiring

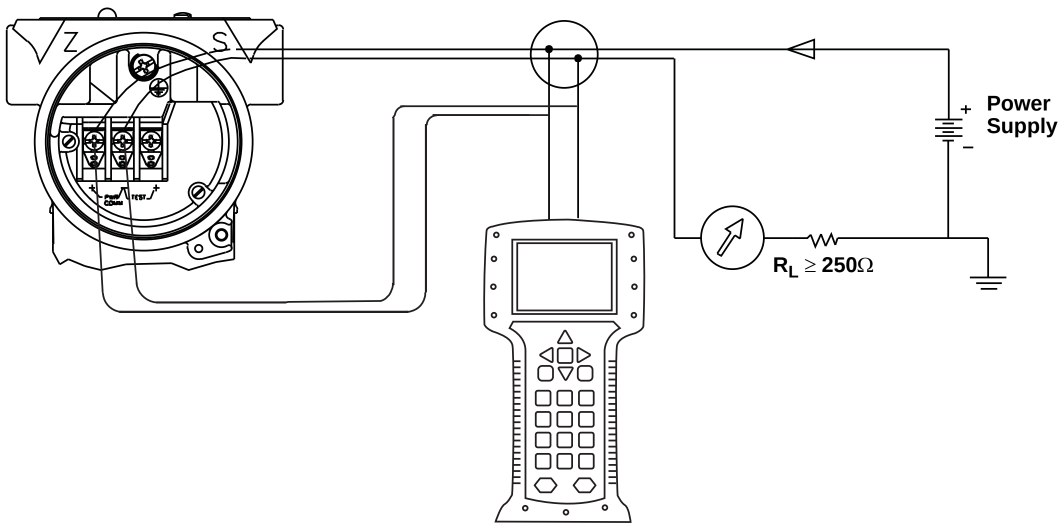
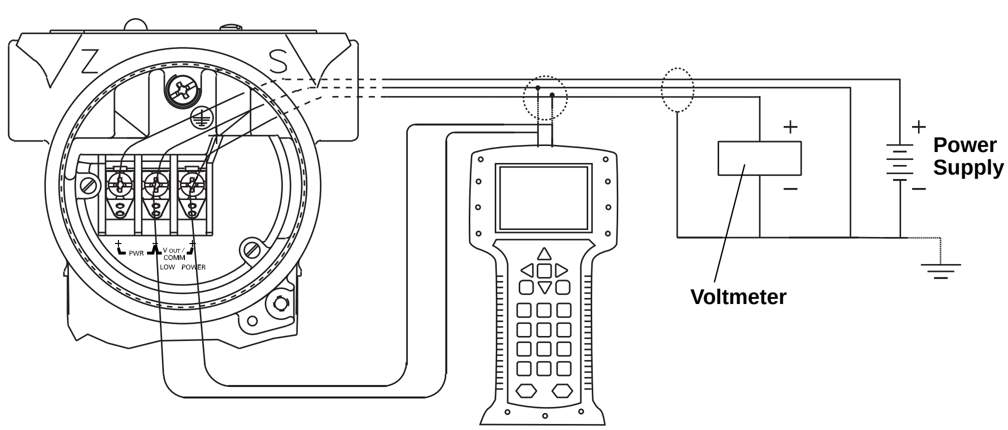


Figure 2-18. 1-5 Vdc Low Power wiring



Perform the following procedure to make wiring connections:

1. Remove the housing cover on terminal compartment side. Do not remove the cover in explosive atmospheres when the circuit is live. Signal wiring supplies all power to the transmitter.
2. a. For 4-20 mA HART output, connect the positive lead to the terminal marked (+) and the negative lead to the terminal marked (pwr/comm -). Do not connect powered signal wiring to the test terminals. Power could damage the test diode.
   b. For 1-5 Vdc HART Low Power output, connect the positive lead to the terminal marked (+ pwr) and the negative lead to the terminal marked (pwr -). Connect signal lead to V_{out} / comm +.
3. Plug and seal unused conduit connection on the transmitter housing to avoid moisture accumulation in the terminal side. Install wiring with a drip loop. Arrange the drip loop so the bottom is lower than the conduit connections and the transmitter housing.

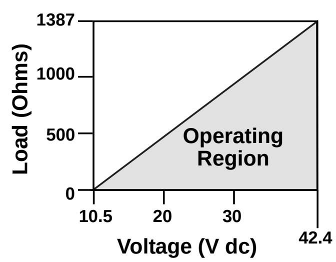
Power Supply for 4-20 mA HART

Transmitter operates on 10.5 - 42.4 Vdc. The dc power supply should provide power with less than two percent ripple.

NOTE
A minimum loop resistance of 250 ohms is required to communicate with a Field Communicator. If a single power supply is used to power more than one 3051 transmitter, the power supply used, and circuitry common to the transmitters, should not have more than 20 ohms of impedance at 1200 Hz.

Figure 2-19. Load Limitation

Maximum Loop Resistance = 43.5 * (Power Supply Voltage – 10.5)



The Field Communicator requires a minimum loop resistance of 250Ω for communication.

The total resistance load is the sum of the resistance of the signal leads and the load resistance of the controller, indicator, and related pieces. Note that the resistance of intrinsic safety barriers, if used, must be included.

Power Supply for 1-5 Vdc HART Low Power

Low power transmitters operate on 6-14 Vdc. The dc power supply should provide power with less than two percent ripple. The V_{out} load should be 100 kΩ or greater.

Transient Protection Terminal Block

The transmitter will withstand electrical transients of the energy level usually encountered in static discharges or induced switching transients. However, high-energy transients, such as those induced in wiring from nearby lightning strikes, can damage the transmitter.

The transient protection terminal block can be ordered as an installed option (Option Code T1 in the transmitter model number) or as a spare part to retrofit existing 3051 transmitters in the field. See "Parts List" on page A-42 for spare part numbers. The lightning bolt symbol shown in Figure 2-20 and Figure 2-21 identifies the transient protection terminal block.

Figure 2-20. 4-20 mA HART wiring with transient protection

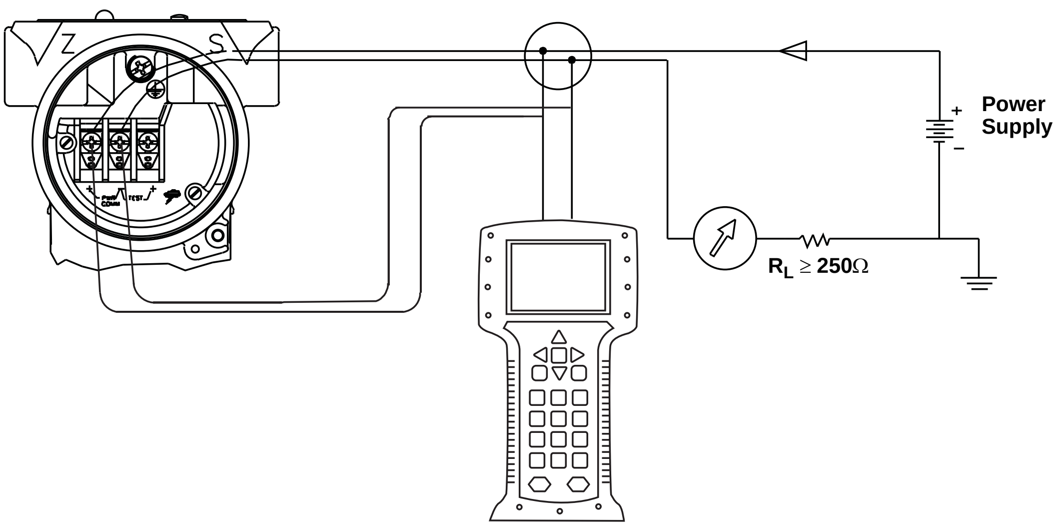


Figure 2-21. 1-5 Vdc Low Power wiring with transient protection

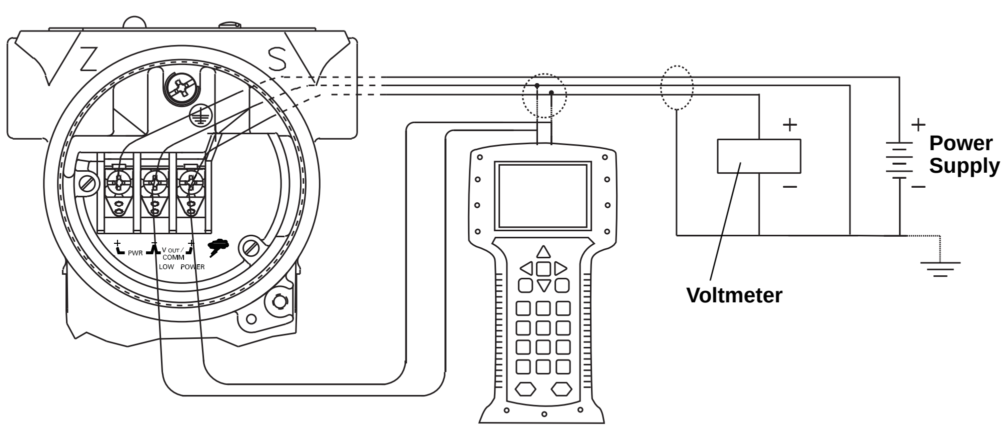
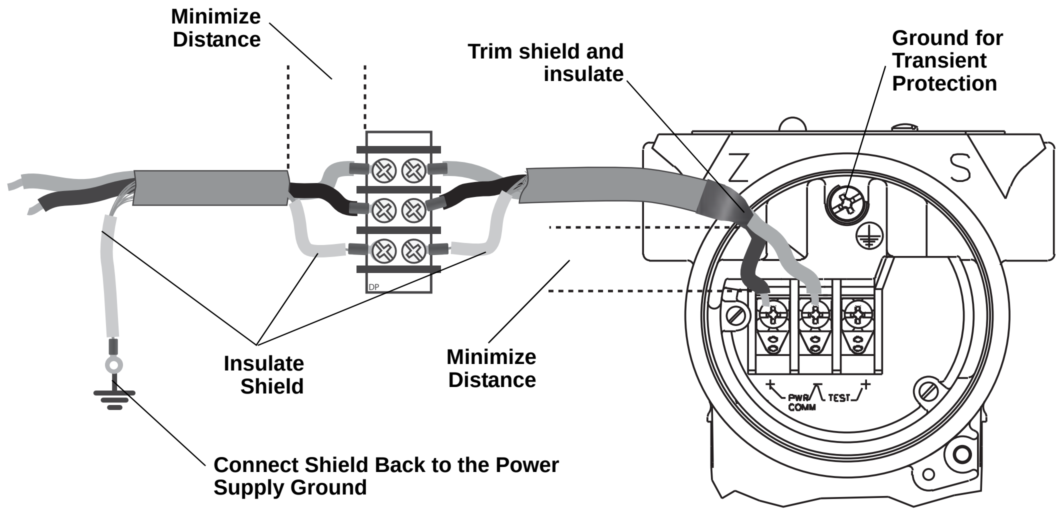


Figure 2-22. Wiring Pair and Ground



NOTE
The transient protection terminal block does not provide transient protection unless the transmitter case is properly grounded. Use the guidelines to ground the transmitter case. Refer to page 2-21.

Do not run the transient protection ground wire with signal wiring as the ground wire may carry excessive current if a lightning strike occurs.

Grounding

⚠ Use the following techniques to properly ground the transmitter signal wiring and case:

Signal Wiring

Do not run signal wiring in conduit or open trays with power wiring or near heavy electrical equipment. It is important that the instrument cable shield be:

- Trimmed close and insulated from touching the transmitter housing
- Connected to the next shield if cable is routed through a junction box
- Connected to a good earth ground at the power supply end

For 4-20 mA HART output, the signal wiring may be grounded at any one point on the signal loop or may be left ungrounded. The negative terminal of the power supply is a recommended grounding point.

For 1-5 Vdc HART Low Power output, the power wires may be grounded at only one point or left ungrounded. The negative terminal of the power supply is a recommended grounding point.

Transmitter Case

Always ground the transmitter case in accordance with national and local electrical codes. The most effective transmitter case grounding method is a direct connection to earth ground with minimal impedance. Methods for grounding the transmitter case include:

- **Internal Ground Connection**: The Internal Ground Connection screw is inside the FIELD TERMINALS side of the electronics housing. This screw is identified by a ground symbol (⏚). The ground connection screw is standard on all Rosemount 3051 transmitters. Refer to Figure 2-23.
- **External Ground Assembly**: This assembly is included with the optional transient protection terminal block (Option Code T1), and it is included with various hazardous location certifications. The External Ground Assembly can also be ordered with the transmitter (Option Code V5), or as a spare part. See “Parts List” on page A-42. Refer to Figure 2-24 for location of the External Ground Screw.

Figure 2-23. Internal Ground Screw

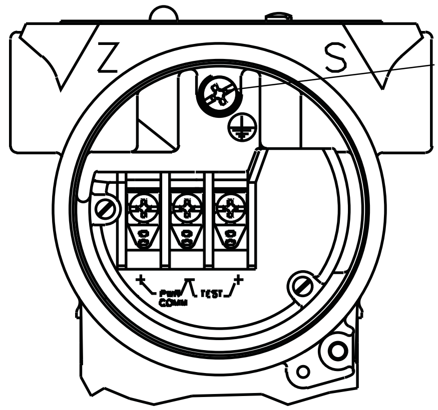
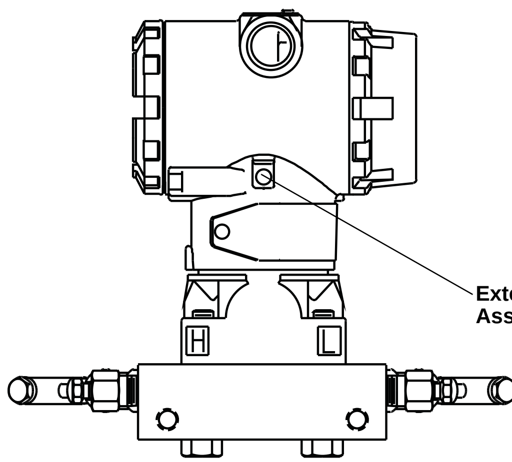


Figure 2-24. External Ground Assembly



NOTE
Grounding the transmitter case via threaded conduit connection may not provide sufficient ground continuity.

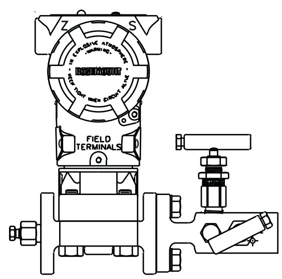
HAZARDOUS LOCATIONS CERTIFICATIONS

⚠ Individual transmitters are clearly marked with a tag indicating the approvals they carry. Transmitters must be installed in accordance with all applicable codes and standards to maintain these certified ratings. Refer to “Hazardous Locations Certifications” on page B-2 for information on these approvals.

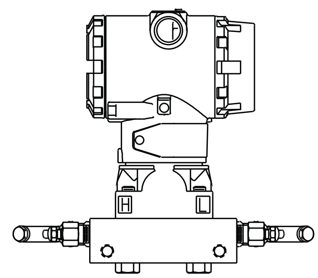
ROSEMOUNT 305, 306 AND 304 MANIFOLDS

The 305 Integral Manifold is available in two designs: Traditional and Coplanar. The traditional 305 Integral Manifold can be mounted to most primary elements with mounting adapters in the market today. The 306 Integral Manifold is used with the 3051T in-line transmitters to provide block-and-bleed valve capabilities of up to 10000 psi (690 bar).

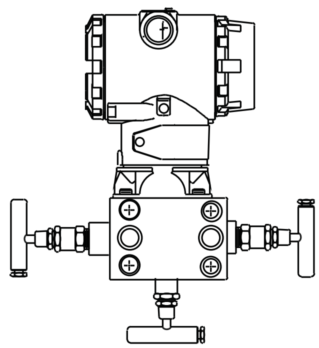
Figure 2-25. Manifolds



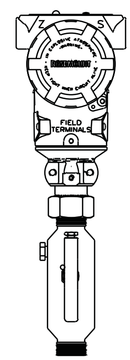
3051C AND 304
CONVENTIONAL



3051C AND 305
INTEGRAL COPLANAR



3051C AND 305
INTEGRAL TRADITIONAL



3051T AND 306
IN-LINE

Rosemount 305 Integral Manifold Installation Procedure

To install a 305 Integral Manifold to a 3051 transmitter:

1. Inspect the PTFE sensor module o-rings. Undamaged o-rings may be reused. If the o-rings are damaged (if they have nicks or cuts, for example), replace with o-rings designed for Rosemount transmitter.

IMPORTANT
If replacing the o-rings, take care not to scratch or deface the o-ring grooves or the surface of the isolating diaphragm while you remove the damaged o-rings.

2. Install the Integral Manifold on the sensor module. Use the four 2.25-in. manifold bolts for alignment. Finger tighten the bolts, then tighten the bolts incrementally in a cross pattern to final torque value. See "Flange Bolts" on page 2-8 for complete bolt installation information and torque values. When fully tightened, the bolts should extend through the top of the sensor module housing.
3. If the PTFE sensor module o-rings have been replaced, the flange bolts should be re-tightened after installation to compensate for cold flow of the o-rings.

NOTE
Always perform a zero trim on the transmitter/manifold assembly after installation to eliminate mounting effects.

Rosemount 306 Integral Manifold Installation Procedure

The 306 Manifold is for use only with a 3051T In-line transmitter.

Assemble the 306 Manifold to the 3051T In-line transmitter with a thread sealant.

Rosemount 304 Conventional Manifold Installation Procedure

To install a 304 Conventional Manifold to a 3051 transmitter:

1. Align the Conventional Manifold with the transmitter flange. Use the four manifold bolts for alignment.
2. Finger tighten the bolts, then tighten the bolts incrementally in a cross pattern to final torque value. See "Flange Bolts" on page 2-6 for complete bolt installation information and torque values. When fully tightened, the bolts should extend through the top of the sensor module housing.
3. Leak-check assembly to maximum pressure range of transmitter.

See "Safety Messages" on page 2-1 for complete warning information.

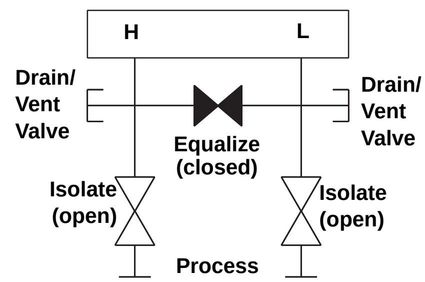
Manifold Operation

⚠ Improper installation or operation of manifolds may result in process leaks, which may cause death or serious injury.

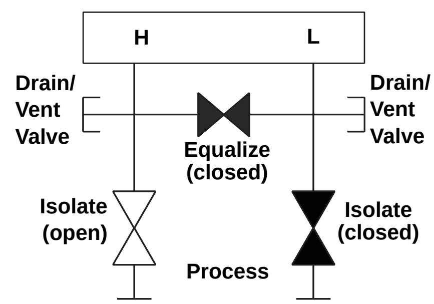
Always perform a zero trim on the transmitter/manifold assembly after installation to eliminate any shift due to mounting effects. See "Sensor Trim Overview" on page 4-10.

Three and five-valve configurations shown:

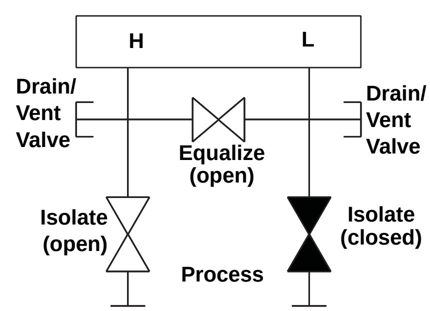
In normal operation the two block valves between the process and instrument ports will be open and the equalizing valve will be closed.



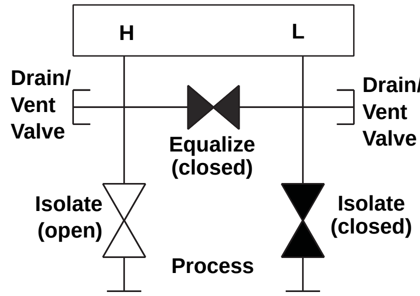
1. To zero the 3051, close the block valve to the low pressure (downstream) side of the transmitter first.



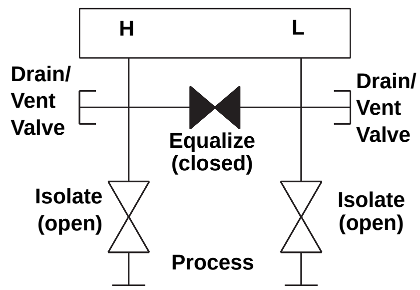
2. Open the center (equalize) valve to equalize the pressure on both sides of the transmitter. The manifold valves are now in the proper configuration for zeroing the transmitter.



3. After zeroing the transmitter, close the equalizing valve.

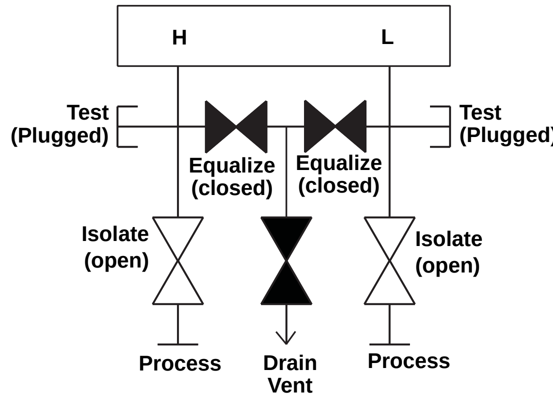


4. Open the block valve on the low pressure side of the transmitter to return the transmitter to service.

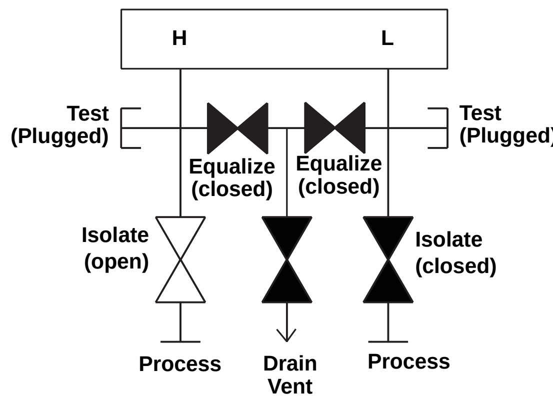


Five-valve Natural Gas configurations shown:

In normal operation, the two block valves between the process and instrument ports will be open, and the equalizing valves will be closed.

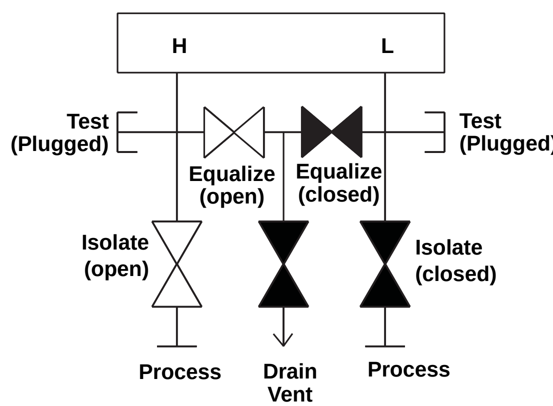


1. To zero the 3051, first close the block valve on the low pressure (downstream) side of the transmitter.

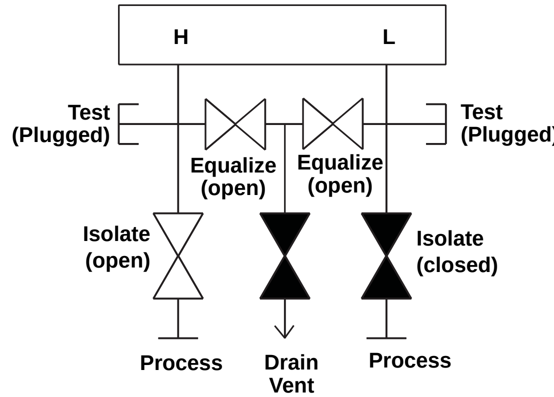


NOTE
Do not open the low side equalize valve before the high side equalize valve. Doing so will overpressure the transmitter.

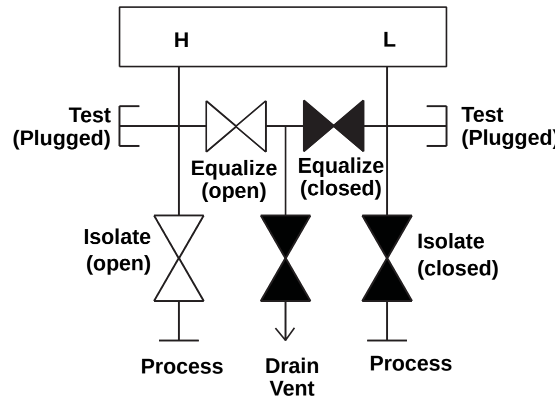
2. Open the equalize valve on the high pressure (upstream) side of the transmitter.



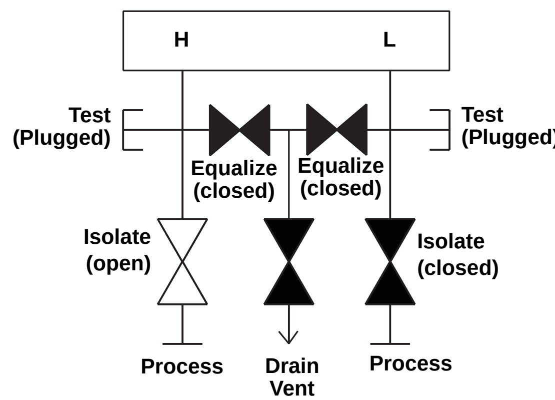
3. Open the equalize valve on the low pressure (downstream) side of the transmitter. The manifold is now in the proper configuration for zeroing the transmitter.



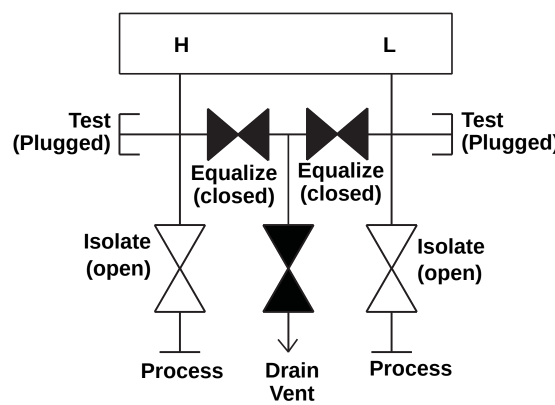
4. After zeroing the transmitter, close the equalize valve on the low pressure (downstream) side of the transmitter.



5. Close the equalize valve on the high pressure (upstream) side.



6. Finally, to return the transmitter to service, open the low side isolation valve.



LIQUID LEVEL MEASUREMENT

Differential pressure transmitters used for liquid level applications measure hydrostatic pressure head. Liquid level and specific gravity of a liquid are factors in determining pressure head. This pressure is equal to the liquid height above the tap multiplied by the specific gravity of the liquid. Pressure head is independent of volume or vessel shape.

Open Vessels

A pressure transmitter mounted near a tank bottom measures the pressure of the liquid above.

Make a connection to the high pressure side of the transmitter, and vent the low pressure side to the atmosphere. Pressure head equals the liquid's specific gravity multiplied by the liquid height above the tap.

Zero range suppression is required if the transmitter lies below the zero point of the desired level range. Figure 2-26 shows a liquid level measurement example.

Closed Vessels

Pressure above a liquid affects the pressure measured at the bottom of a closed vessel. The liquid specific gravity multiplied by the liquid height plus the vessel pressure equals the pressure at the bottom of the vessel.

To measure true level, the vessel pressure must be subtracted from the vessel bottom pressure. To do this, make a pressure tap at the top of the vessel and connect this to the low side of the transmitter. Vessel pressure is then equally applied to both the high and low sides of the transmitter. The resulting differential pressure is proportional to liquid height multiplied by the liquid specific gravity.

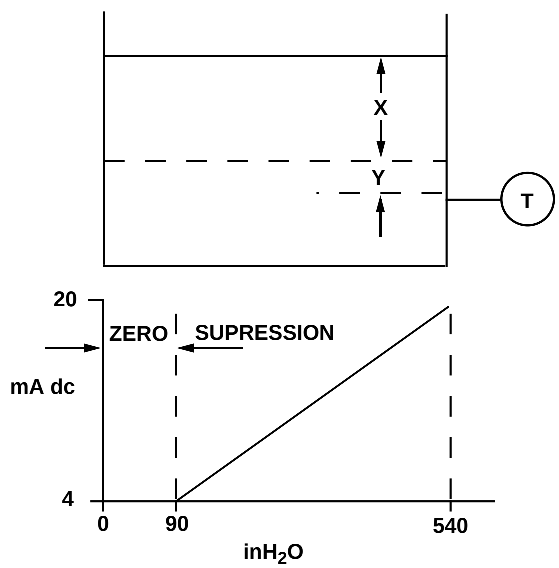
Dry Leg Condition

Low-side transmitter piping will remain empty if gas above the liquid does not condense. This is a dry leg condition. Range determination calculations are the same as those described for bottom-mounted transmitters in open vessels, as shown in Figure 2-26.

Figure 2-26. Liquid Level Measurement Example.

Let **X** equal the vertical distance between the minimum and maximum measurable levels (500 in.).
Let **Y** equal the vertical distance between the transmitter datum line and the minimum measurable level (100 in.).
Let **SG** equal the specific gravity of the fluid (0.9).
Let **h** equal the maximum head pressure to be measured in inches of water.
Let **e** equal head pressure produced by **Y** expressed in inches of water.
Let **Range** equal **e** to **e** + **h**.

Then h = (**X**)(**SG**)
= 500 x 0.9
= 450 inH_2O
e = (**Y**)(**SG**)
= 100 x 0.9
= 90 inH_2O
Range = 90 to 540 inH_2O

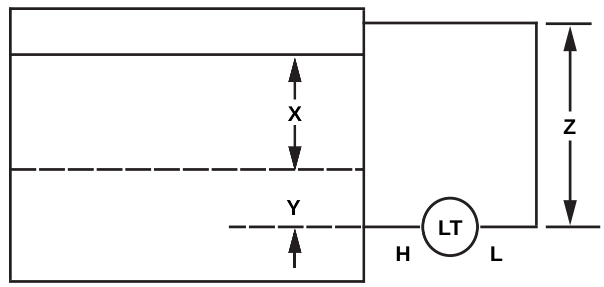


Wet Leg Condition

Condensation of the gas above the liquid slowly causes the low side of the transmitter piping to fill with liquid. The pipe is purposely filled with a convenient reference fluid to eliminate this potential error. This is a wet leg condition.

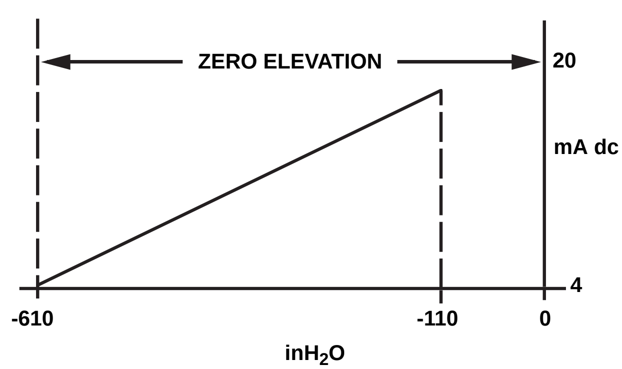
The reference fluid will exert a head pressure on the low side of the transmitter. Zero elevation of the range must then be made. See Figure 2-27

Figure 2-27. Wet Leg Example.



Let **X** equal the vertical distance between the minimum and maximum measurable levels (500 in.).
Let **Y** equal the vertical distance between the transmitter datum line and the minimum measurable level (50 in.).
Let **z** equal the vertical distance between the top of the liquid in the wet leg and the transmitter datum line (600 in.).
Let **SG_1** equal the specific gravity of the fluid (1.0).
Let **SG_2** equal the specific gravity of the fluid in the wet leg (1.1).
Let **h** equal the maximum head pressure to be measured in inches of water.
Let **e** equal the head pressure produced by **Y** expressed in inches of water.
Let **s** equal head pressure produced by **z** expressed in inches of water.
Let **Range** equal **e** – **s** to **h** + **e** – **s**.

Then h = **$(X)(SG_1)$**
= 500 x 1.0
= 500 in H_2O
e = **$(Y)(SG_1)$**
= 50 x 1.0
= 50 inH_2O
s = **$(z)(SG_2)$**
= 600 x 1.1
= 660 inH_20
Range = **e – s** to **h + e – s**.
= 50 – 660 to 500 + 50 – 660
= –610 to –110 inH_20

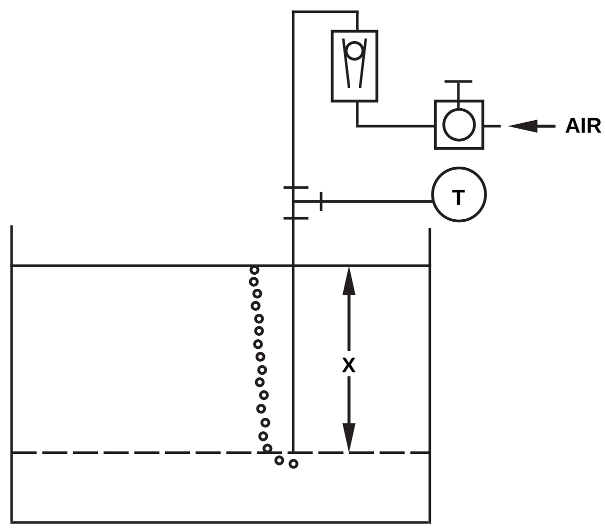


Bubbler System in Open Vessel

A bubbler system that has a top-mounted pressure transmitter can be used in open vessels. This system consists of an air supply, pressure regulator, constant flow meter, pressure transmitter, and a tube that extends down into the vessel.

Bubble air through the tube at a constant flow rate. The pressure required to maintain flow equals the liquid's specific gravity multiplied by the vertical height of the liquid above the tube opening. Figure 2-28 shows a bubbler liquid level measurement example.

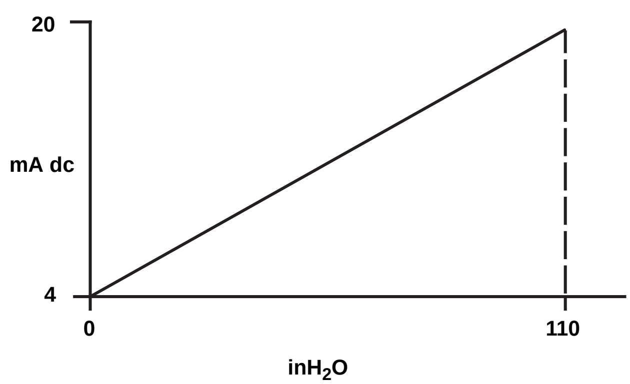
Figure 2-28. Bubbler Liquid Level Measurement Example.



Let **X** equal the vertical distance between the minimum and maximum measurable levels (100 in.).
Let **SG** equal the specific gravity of the fluid (1.1).
Let **h** equal the maximum head pressure to be measured in inches of water.
Let **Range** equal **zero** to **h**.

Then **h** = **(X)(SG)**
= 100 x 1.1
= 110 inH_2O

Range = 0 to 110 inH_2O



Section 3 Configuration

OVERVIEW

This section contains information on commissioning and tasks that should be performed on the bench prior to installation.

Field Communicator and AMS Device Manager instructions are given to perform configuration functions. For convenience, Field Communicator fast key sequences are labeled “Fast Keys” for each software function below the appropriate headings.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

Warnings

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 3051 reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an explosion-proof/flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

COMMISSIONING

Commissioning consists of testing the transmitter and verifying transmitter configuration data. The 3051 transmitters can be commissioned either before or after installation. Commissioning the transmitter on the bench before installation using a Field Communicator or AMS Device Manager ensures that all transmitter components are in working order.

⚠ To commission on the bench, required equipment includes a power supply, a milliamp meter, and a Field Communicator or AMS Device Manager. Wire equipment as shown in Figure 3-1 and Figure 3-2. To ensure successful communication, a resistance of at least 250 ohms must be present between the Field Communicator loop connection and the power supply. Connect the Field Communicator leads to the terminals labeled “COMM” on the terminal block.

Set all transmitter hardware adjustments during commissioning to avoid exposing the transmitter electronics to the plant environment after installation.

When using a Field Communicator, any configuration changes made must be sent to the transmitter by using the **Send** key. AMS Device Manager configuration changes are implemented when the **Apply** button is clicked.

Setting the Loop to Manual

Whenever sending or requesting data that would disrupt the loop or change the output of the transmitter, set the process application loop to manual. The Field Communicator or AMS Device Manager will prompt you to set the loop to manual when necessary. Acknowledging this prompt does not set the loop to manual. The prompt is only a reminder; set the loop to manual as a separate operation.

Wiring Diagrams

Connect the equipment as shown in Figure 3-1 for 4-20 mA HART or Figure 3-2 for 1-5 Vdc HART Low Power. To ensure successful communication, a resistance of at least 250 ohms must be present between the Field Communicator loop connection and the power supply. The Field Communicator or AMS Device Manager may be connected at “COMM” on the transmitter terminal block or across the load resistor. Connecting across the “TEST” terminals will prevent successful communication for 4-20 mA HART output.

Turn on the Field Communicator by pressing the ON/OFF key or log into AMS Device Manager. The Field Communicator or AMS Device Manager will search for a HART-compatible device and indicate when the connection is made. If the Field Communicator or AMS Device Manager fail to connect, it indicates that no device was found. If this occurs, refer to Section 5: Troubleshooting.

Figure 3-1. Wiring (4–20 mA)

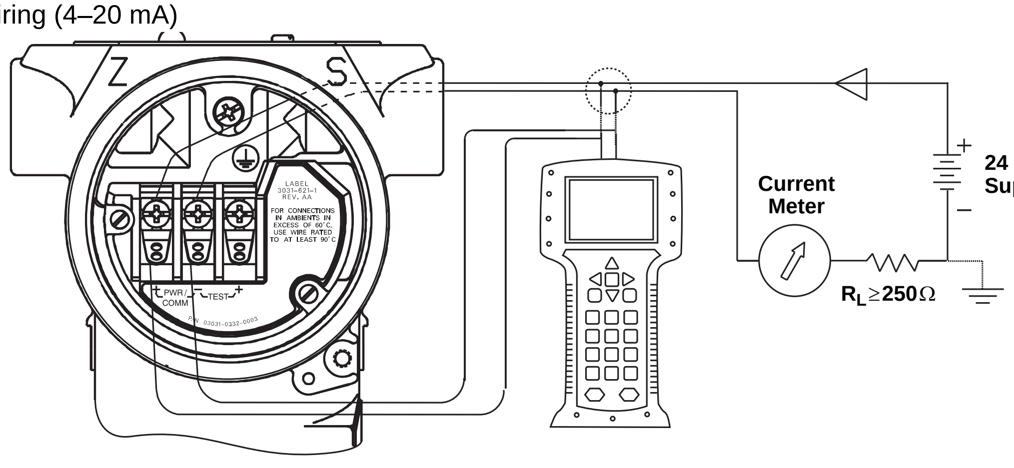
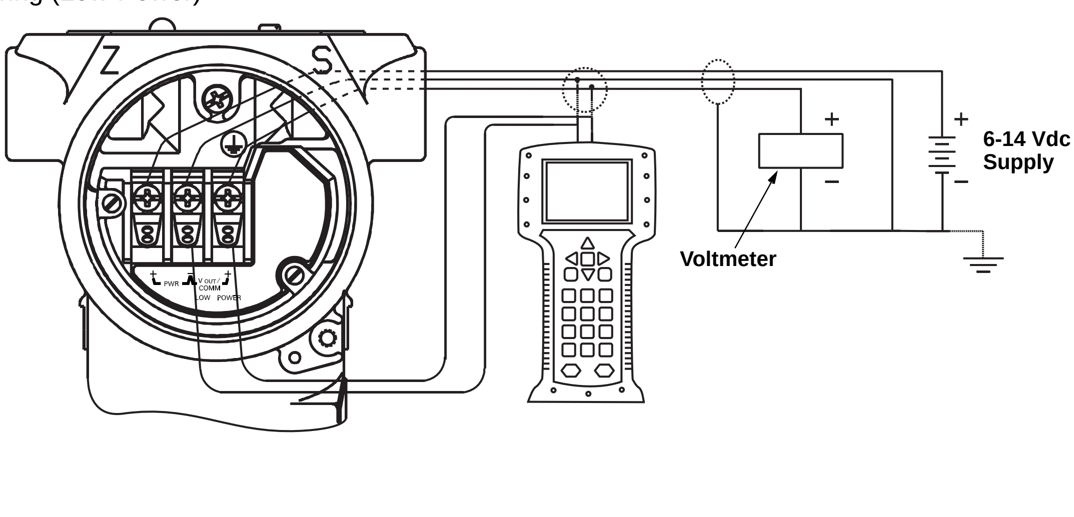


Figure 3-2. Wiring (Low-Power)



CONFIGURATION DATA REVIEW

NOTE
Information and procedures in this section that make use of Field Communicator fast key sequences and AMS Device Manager assume that the transmitter and communication equipment are connected, powered, and operating correctly.

The following is a list of factory default configurations. These can be reviewed by using the Field Communicator or AMS Device Manager.

Field Communicator

4-20 mA Fast Keys	1, 5
1-5 Vdc Fast Keys	1, 5

Enter the fast key sequence to view the configuration data.

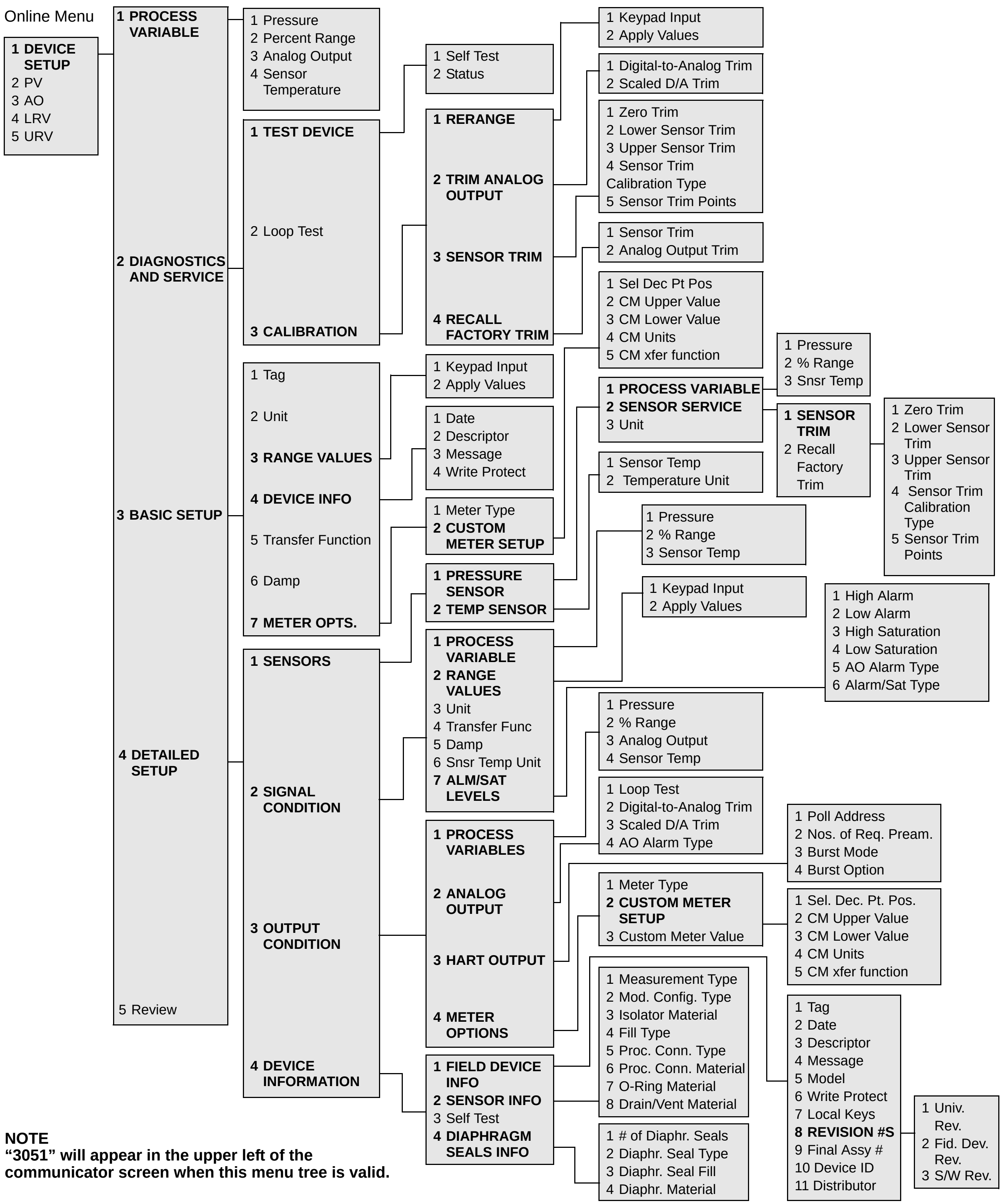
Transmitter Model	Type
Tag	Range
Date	Descriptor
Message	Minimum and Maximum Sensor Limits
Minimum Span	Units
4 and 20 mA points	Output (linear or sq. root)
Damping	Alarm Setting (high, low)
Security Setting (on, off)	Local Zero/Span Keys (enabled, disabled)
Integral Display	Sensor Fill
Isolator Material	Flange (type, material)
O-Ring Material	Drain/Vent
Remote Seal (type, fill fluid, isolator material, number)	Transmitter S/N
Address	Sensor S/N

AMS Device Manager

Right click on the device and select **Configuration Properties** from the menu. Select the tabs to review the transmitter configuration data.

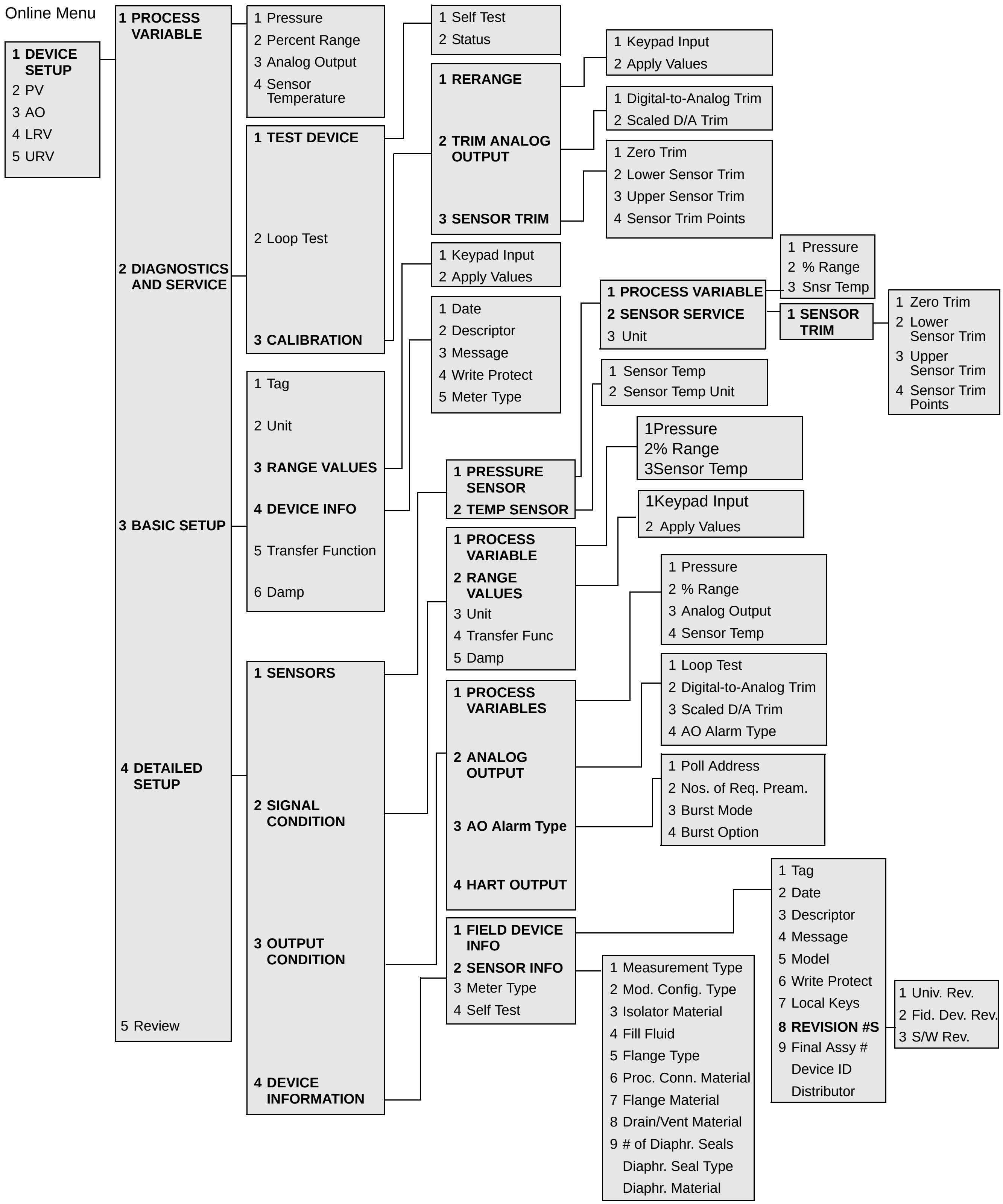
FIELD COMMUNICATOR MENU TREES

Rosemount 3051 HART menu tree for 4-20 mA HART output



NOTE
“3051” will appear in the upper left of the communicator screen when this menu tree is valid.

Rosemount 3051 HART Menu Tree for 1-5 Vdc Low Power



FAST KEY SEQUENCE

A check (✓) indicates the basic configuration parameters. At minimum, these parameters should be verified as part of the configuration and startup procedure.

Table 3-1. 3051 Fast Key Sequence

	Function	4-20 mA HART	1-5 Vdc HART Low Power
✓	Alarm and Saturation Levels	1, 4, 2, 7	N/A
	Analog Output Alarm Type	1, 4, 3, 2, 4	1, 4, 3, 2, 4
	Burst Mode Control	1, 4, 3, 3, 3	1, 4, 3, 3, 3
	Burst Operation	1, 4, 3, 3, 4	1, 4, 3, 3, 4
	Custom Meter Configuration	1, 3, 7, 2	N/A
	Custom Meter Value	1, 4, 3, 4, 3	N/A
✓	Damping	1, 3, 6	1, 3, 6
	Date	1, 3, 4, 1	1, 3, 4, 1
	Descriptor	1, 3, 4, 2	1, 3, 4, 2
	Digital To Analog Trim (4-20 mA Output)	1, 2, 3, 2, 1	1, 2, 3, 2, 1
	Disable Local Span/Zero Adjustment	1, 4, 4, 1, 7	1, 4, 4, 1, 7
	Field Device Information	1, 4, 4, 1	1, 4, 4, 1
	Full Trim	1, 2, 3, 3	1, 2, 3, 3
	Keypad Input – Rerange	1, 2, 3, 1, 1	1, 2, 3, 1, 1
	Local Zero and Span Control	1, 4, 4, 1, 7	1, 4, 4, 1, 7
	Loop Test	1, 2, 2	1, 2, 2
	Lower Sensor Trim	1, 2, 3, 3, 2	1, 2, 3, 3, 2
	Message	1, 3, 4, 3	1, 3, 4, 3
	Meter Options	1, 4, 3, 4	N/A
	Number of Requested Preambles	1, 4, 3, 3, 2	1, 4, 3, 3, 2
	Poll Address	1, 4, 3, 3, 1	1, 4, 3, 3, 1
	Poll a Multidropped Transmitter	Left Arrow, 4, 1, 1	Left Arrow, 4, 1, 1
✓	Range Values	1, 3, 3	1, 3, 3
	Rerange	1, 2, 3, 1	1, 2, 3, 1
	Scaled D/A Trim (4–20 mA Output)	1, 2, 3, 2, 2	1, 2, 3, 2, 2
	Self Test (Transmitter)	1, 2, 1, 1	1, 2, 1, 1
	Sensor Info	1, 4, 4, 2	1, 4, 4, 2
	Sensor Temperature	1, 1, 4	1, 1, 4
	Sensor Trim Points	1, 2, 3, 3, 4	1, 2, 3, 3, 4
	Status	1, 2, 1, 2	1, 2, 1, 2
✓	Tag	1, 3, 1	1, 3, 1
✓	Transfer Function (Setting Output Type)	1, 3, 5	1, 3, 5
	Transmitter Security (Write Protect)	1, 3, 4, 4	1, 3, 4, 4
	Trim Analog Output	1, 2, 3, 2	1, 2, 3, 2
✓	Units (Process Variable)	1, 3, 2	1, 3, 2
	Upper Sensor Trim	1, 2, 3, 3, 3	1, 2, 3, 3, 3
	Zero Trim	1, 2, 3, 3, 1	1, 2, 3, 3, 1

CHECK OUTPUT

Before performing other transmitter on-line operations, review the digital output parameters to ensure that the transmitter is operating properly and is configured to the appropriate process variables.

Process Variables

The process variables for the 3051 provide transmitter output, and are continuously updated. The pressure reading in both engineering units and percent of range will continue to track with pressures outside of the defined range from the lower to the upper range limit of the sensor module.

Field Communicator

4-20 mA Fast Keys	1, 1
1-5 Vdc Fast Keys	1, 1

The process variable menu displays the following process variables:

- Pressure
- Percent of range
- Analog output

AMS Device Manager

Right click on the device and select **Process Variables...** from the menu.The *Process Variable* screen displays the following process variables:

- Pressure
- Percent of range
- Analog output

Sensor Temperature

The 3051 contains a temperature sensor near the pressure sensor in the sensor module. When reading this temperature, keep in mind the sensor is not a process temperature reading.

Field Communicator

4-20 mA Fast Keys	1, 1, 4
1-5 Vdc Fast Keys	1, 1, 4

Enter the fast key sequence “Sensor Temperature” to view the sensor temperature reading.

AMS Device Manager

Right click on the device and select **Process Variables...** from the menu. “Snsr Temp” is the sensor temperature reading.

BASIC SETUP

Set Process Variable Units

The PV Unit command sets the process variable units to allow you to monitor your process using the appropriate units of measure.

Field Communicator

4-20 mA Fast Keys	1, 3, 2
1-5 Vdc Fast Keys	1, 3, 2

Enter the fast key sequence "Set Process Variable Units." Select from the following engineering units:

- inH_2O
- inHg
- ftH_2O
- mmH_2O
- mmHg
- psi
- bar
- mbar
- g/cm^2
- kg/cm^2
- Pa
- kPa
- torr
- atm
- inH_2O at 4 °C
- mmH_2O at 4 °C

AMS Device Manager

Right click on the device and select **Configure** from the menu. In the *Basic Setup* tab, select **Unit** from the drop down menu to select units.

Set Output (Transfer function)

The 3051 has two output settings: Linear and Square Root. Activate the square root output option to make analog output proportional to flow. As input approaches zero, the 3051 automatically switches to linear output in order to ensure a more smooth, stable output near zero (see Figure 3-3).

For 4-20 mA HART output, the slope of the curve is unity (y = x) from 0 to 0.6 percent of the ranged pressure input. This allows accurate calibration near zero. Greater slopes would cause large changes in output (for small changes at input). From 0.6 percent to 0.8 percent, curve slope equals 42 (y = 42x) to achieve continuous transition from linear to square root at the transition point.

Field Communicator

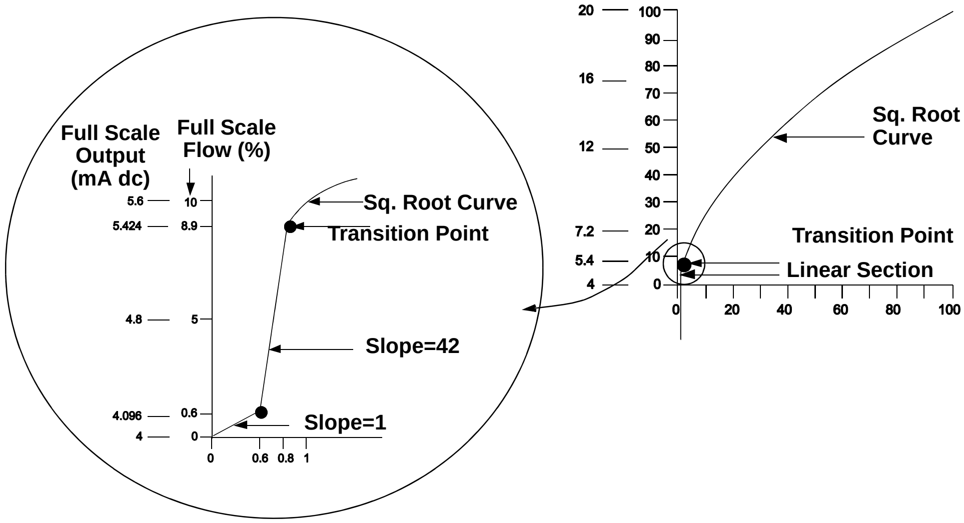
4-20 mA Fast Keys	1, 3, 5
1-5 Vdc Fast Keys	1, 3, 5

AMS Device Manager

Right click on the device and select **Configure** from the menu.

1. In the *Basic Setup* tab, use **Xfer fnctn** drop down menu to select output, click **Apply**.
2. After carefully reading the warning provided, select **yes**.

Figure 3-3. 4-20 mA HART Square Root Output Transition Point



NOTE
For a flow turndown of greater than 10:1 it is not recommended to perform a square root extraction in the transmitter. Instead, perform the square root extraction in the system.

Rerange

The Range Values command sets each of the lower and upper range analog values (4 and 20 mA points and 1 and 5 Vdc points) to a pressure. The lower range point represents 0% of range and the upper range point represents 100% of range. In practice, the transmitter range values may be changed as often as necessary to reflect changing process requirements. For a complete listing of Range & Sensor limits, refer to “Range and Sensor Limits” on page A-4.

NOTE
Transmitters are shipped from Emerson Process Management fully calibrated per request or by the factory default of full scale (zero to upper range limit).

NOTE
Regardless of the range points, the 3051 will measure and report all readings within the digital limits of the sensor. For example, if the 4 and 20 mA points are set to 0 and 10 inH_2O, and the transmitter detects a pressure of 25 inH_2O, it digitally outputs the 25 inH_2O reading and a 250% of range reading.

Select from one of the methods below to rerange the transmitter. Each method is unique; examine all options closely before deciding which method works best for your process.

- Rerange with a Field Communicator or AMS Device Manager only.
- Rerange with a pressure input source and a Field Communicator or AMS Device Manager.
- Rerange with a pressure input source and the local zero and span buttons (option D4).

NOTE
If the transmitter security switch is **ON,** adjustments to the zero and span will not be able to be made. Refer to "Configure Security and Alarm" on page 2-16 for security information.

Rerange with a Field Communicator or AMS Device Manager Only

The easiest and most popular way to rerange is to use the Field Communicator only. This method changes the range values of the analog 4 and 20 mA points (1 and 5 Vdc points) independently without a pressure input. This means that when you change either the 4 or 20 mA setting, you also change the span.

An example for the 4-20 mA HART output:

If the transmitter is ranged so that

4 mA = 0 inH_2O, and
20 mA = 100 inH_2O,

and you change the 4 mA setting to 50 inH_2O using the communicator only, the new settings are:
4 mA = 50 inH_2O, and
20 mA = 100 inH_2O.

Note that the span was also changed from 100 inH_2O to 50 inH_2O, while the 20 mA setpoint remained at 100 inH_2O.

To obtain reverse output, simply set the 4 mA point at a greater numerical value than the 20 mA point. Using the above example, setting the 4 mA point at 100 inH_2O and the 20 mA point at 0 inH_2O will result in reverse output.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 1
1-5 Vdc Fast Keys	1, 2, 3, 1

From the *HOME* screen, enter the fast key sequence "Rerange with a Communicator Only."

AMS Device Manager

Right click on the device and select **Configure** from the menu. In the *Basic Setup* tab, locate the Analog Output box and perform the following procedure:

1. Enter the lower range value (LRV) and the upper range value (URV) in the fields provided. Click **Apply**.
2. After carefully reading the warning provided, select **yes**.

Rerange with a Pressure Input Source and a Field Communicator or AMS Device Manager

Reranging using the Field Communicator and applied pressure is a way of reranging the transmitter when specific 4 and 20 mA points (1 and 5 Vdc points) are not calculated.

NOTE
The span is maintained when the 4 mA point (1 Vdc point) is set. The span changes when the 20 mA point (5 Vdc point) is set. If the lower range point is set to a value that causes the upper range point to exceed the sensor limit, the upper range point is automatically set to the sensor limit, and the span is adjusted accordingly.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 1, 2
1-5 Vdc Fast Keys	1, 2, 3, 1, 2

From the *HOME* screen, enter the fast key sequence "Rerange with a Pressure Input Source and a Field Communicator or AMS Device Manager".

AMS Device Manager

Right click on the device, select **Calibrate**, then **Apply values** from the menu.

1. Select **Next** after the control loop is set to manual.
2. From the *Apply Values* menu, follow the on-line instructions to configure lower and upper range values.
3. Select **Exit** to leave the *Apply Values* screen.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

Rerange with a Pressure Input Source and the Local Zero and Span buttons (option D4)

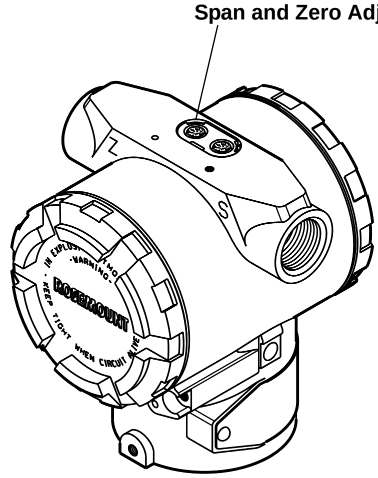
Reranging using the local zero and span adjustments (see Figure 3-4 on page 3-13) and a pressure source is a way of reranging the transmitter when specific 4 and 20 mA (1 and 5 Vdc) points are not known and a communicator is not available.

NOTE
When you set the 4 mA (1 Vdc) point the span is maintained; when you set the 20 mA (5 Vdc) point the span changes. If you set the lower range point to a value that causes the upper range point to exceed the sensor limit, the upper range point is automatically set to the sensor limit, and the span is adjusted accordingly.

To rerange the transmitter using the span and zero buttons, perform the following procedure:

1. Loosen the screw holding the certifications label on the top of the transmitter housing. Slide the label to expose the zero and span buttons. See Figure 3-4.
2. Apply the desired 4 mA (1 Vdc) pressure value to the transmitter. Push and hold the zero adjustment button for at least two seconds but no longer than ten seconds.
3. Apply the desired 20 mA (5 Vdc) pressure value to the transmitter. Push and hold the span adjustment button for at least two seconds but no longer than ten seconds.

Figure 3-4. Zero and Span buttons



NOTE
The span is maintained when the 4 mA point (1 Vdc point) is set. The span changes when the 20 mA point (5 Vdc point) is set. If the lower range point is set to a value that causes the upper range point to exceed the sensor limit, the upper range point is automatically set to the sensor limit, and the span is adjusted accordingly.

Damping

The “Damp” command introduces a delay in the micro-processing which increases the response time of the transmitter; smoothing variations in output readings caused by rapid input changes. Determine the appropriate damping setting based on the necessary response time, signal stability, and other requirements of the loop dynamics within your system. The default damping value is 0.4 seconds and it can be set to any of ten pre-configured damping values between 0 and 25.6 seconds. See list below.

- 0.00 seconds
- 0.05 seconds
- 0.10 seconds
- 0.20 seconds
- 0.40 seconds
- 0.80 seconds
- 1.60 seconds
- 3.20 seconds
- 6.40 seconds
- 12.8 seconds
- 25.6 seconds

The current damping value can be determined by executing the Field Communicator fast keys or going to “Configure” in AMS Device Manager.

Field Communicator

4-20 mA Fast Keys	1, 3, 6
1-5 Vdc Fast Keys	1, 3, 6

AMS Device Manager

Right click on the device and select **Configure** from the menu.

1. In the *Basic Setup* tab, enter the damping value in the *Damp* field, click **Apply**.
2. After carefully reading the warning provided, select **yes**.

LCD DISPLAY

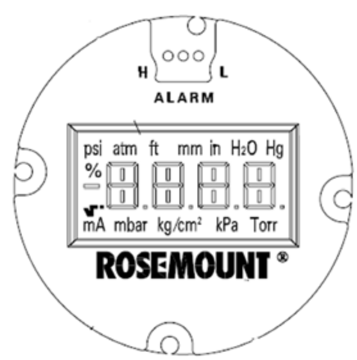
The LCD display connects directly to the interface board which maintains direct access to the signal terminals. The display indicates output and abbreviated diagnostic messages. A display cover is provided to accommodate the display.

For 4-20 mA HART output, the LCD display features a two-line display. The first line of five characters displays the actual measured value, the second line of six characters displays the engineering units. The LCD can also display diagnostic messages. Refer to Figure 3-5.

For 1-5 Vdc HART Low Power output, the LCD display features a single-line display with four characters that display the actual value. The LCD can also display diagnostic messages. Refer to Figure 3-5.

Figure 3-5.

4-20 mA HART | **1-5 Vdc HART Low Power**



LCD Display Configuration for 4-20 mA HART only

The factory default alternates are between Engineering Units and % of Range. The LCD Display Configuration command allows customization of the LCD display to suit application requirements. The LCD display will alternate between the selected items:

- Eng. Units only
- % of Range only
- Custom Display only
- Alternate Eng. Units & % of Range
- Alternate Eng. Units & Custom Display
- Alternate % of Range & Custom Display

Field Communicator

4-20 mA Fast Keys	1, 3, 7

To change the standard default to one of the above options, follow these steps:

1. From the communicators main menu select (1) Device Setup (3) Basic Setup, (7) Meter Options.
2. Select (1) Meter Type. Using the up or down arrows scroll up or down until the desired display has been highlighted. Press ENTER, SEND, and HOME.

AMS

Right click on the device and select **Configuration Properties** from the menu.

1. In the *Local Display* tab, locate the *Meter Type* area. Select the desired options to suit your application needs, click **Apply**.
2. An *Apply Parameter Modification* screen appears, enter desired information and click **OK**.
3. After carefully reading the warning provided, select **OK**.

Custom Display Configuration 4-20 mA HART only

The user-configurable scale is a feature that enables the LCD display to display flow, level, or custom pressure units. With this feature you can define the decimal point position, the upper range value, the lower range value, the engineering units, and the transfer function.The display can be configured using a Field Communicator or AMS.

The user-configurable scale feature can define:

- decimal point position
- upper range values
- lower range values
- engineering units
- transfer function

To configure the display with a Field Communicator, perform the following procedure:

1. Change the Meter Type to "Custom Meter" by using the Fast Key sequence under "LCD Display Configuration for 4-20 mA HART only" on page 3-15.
2. Next from the *ONLINE* screen, Select **1 Device Setup, 3 Basic Setup, 7 Meter Options, 2 Meter Options, 2 Custom Meter Setup**.
3. To specify decimal point position:
   a. Select **1 Sel dec pt pos**. Choose the decimal point representation that will provide the most accurate output for your application. For example, when outputting between 0 and 75 GPM, choose *XX.XXX* or use the decimal point examples below:

      XXXXX
      XXXX.X
      XXX.XX
      XX.XXX
      X.XXXX

NOTE:
Make sure the selection has been sent and the decimal point has changed before proceeding to the next step.

   b. SEND
4. To specify a custom upper range value:
   a. Select *2 CM Upper Value*. Type the value that you want the transmitter to read at the 20 mA point.
   b. SEND
5. To specify a custom lower range value:
   a. Select *3 CM Lower Value*. Type the value that you want the transmitter to read at the 4 mA point.
   b. SEND
6. To define custom units:
   a. Select *4 CM Units*. Enter the custom units (five characters maximum) that you want the display to display.
   b. SEND
7. To choose the transmitter transfer function for the display:
   a. Select *5 CM xfer fnct*. Enter the transmitter transfer function for the display. Select *sq root* to display flow units. The custom meter transfer function is independent of the analog output transfer function.
8. Select **SEND** to upload the configuration to the transmitter.

DETAILED SETUP

Failure Mode Alarm and Saturation

The 3051 transmitters automatically and continuously perform self-diagnostic routines. If the self-diagnostic routines detect a failure, the transmitter drives its output outside of the normal saturation values. The transmitter will drive its output low or high based on the position of the failure mode alarm jumper. See Table 3-2, Table 3-3, and Table 3-4 for failure mode and saturation output levels. To select alarm position, see “Configure Security and Alarm” on page 2-16.

Table 3-2. 4-20 mA HART Alarm and Saturation Values

Level	4–20 mA Saturation	4–20 mA Alarm
Low	3.9 mA	≤ 3.75 mA
High	20.8 mA	≥ 21.75 mA

Table 3-3. NAMUR-Compliant Alarm and Saturation Values

Level	4–20 mA Saturation	4–20 mA Alarm
Low	3.8 mA	≤ 3.6 mA
High	20.5 mA	≥ 22.5 mA

Table 3-4. 1-5 Vdc HART Low-Power Alarm and Saturation Values

Level	1–5 V Saturation	1–5 V Alarm
Low	0.97 V	≤ 0.95 V
High	5.20 V	≥ 5.4 V

CAUTION
Alarm level values will be affected by analog trim. Refer to “Analog Output Trim” on page 4-7.

NOTE
When a transmitter is in an alarm condition, the Field Communicator indicates the analog output the transmitter would drive if the alarm condition did not exist. The transmitter will alarm high in the event of failure if the alarm jumper is removed.

Alarm and Saturation Levels for Burst Mode

Transmitters set to burst mode handle saturation and alarm conditions differently.

Alarm Conditions:

- Analog output switches to alarm value
- Primary variable is burst with a status bit set
- Percent of range follows primary variable
- Temperature is burst with a status bit set

Saturation:

- Analog output switches to saturation value
- Primary variable is burst normally
- Temperature is burst normally

Alarm and Saturation Values for Multidrop Mode

Transmitters set to multidrop mode handle saturation and alarm conditions differently.

Alarm Conditions:

- Primary variable is sent with a status bit set
- Percent of range follows primary variable
- Temperature is sent with a status bit set

Saturation:

- Primary variable is sent normally
- Temperature is sent normally

Alarm Level Verification

If the transmitter electronics board, sensor module, or LCD display is repaired or replaced, verify the transmitter alarm level before returning the transmitter to service. This feature is also useful in testing the reaction of the control system to a transmitter in an alarm state. To verify the transmitter alarm values, perform a loop test and set the transmitter output to the alarm value (see Tables 3-2, 3-3, and 3-4 on page 3-17, and “Loop Test” on page 3-19).

DIAGNOSTICS AND SERVICE

Diagnostics and service functions listed below are primarily for use after field installation. The Transmitter Test feature is designed to verify that the transmitter is operating properly, and the Loop Test feature is designed to verify proper loop wiring and transmitter output.

Transmitter Test

The Transmitter Test command initiates a more extensive diagnostics routine than that performed continuously by the transmitter. The test routine can quickly identify potential electronics problems. If the test detects a problem, messages to indicate the source of the problem are displayed on the *Field Communicator* screen.

Field Communicator

4-20 mA Fast Keys	1, 2, 1, 1
1-5 Vdc Fast Keys	1, 2, 1, 1

AMS Device Manager

Right click on the device and select **Diagnostics and Test**, then **Self Test** from the menu.

1. Click **Next** to acknowledge test results.
2. Select **Finish** to acknowledge the method is complete.

Loop Test

The Loop Test command verifies the output of the transmitter, the integrity of the loop, and the operations of any recorders or similar devices installed in the loop.

Field Communicator

4-20 mA Fast Keys	1, 2, 2
1-5 Vdc Fast Keys	1, 2, 2

To initiate a loop test, perform the following procedure:

1. a. For 4-20 mA HART output, connect a reference meter to the transmitter by either connecting the meter to the test terminals on the terminal block, or shunting transmitter power through the meter at some point in the loop.
   b. For 1-5 Vdc Low Power HART output, connect a reference meter to the V_{out} terminal.
2. From the *HOME* screen, enter the fast key sequence “Loop Test” to verify the output of the transmitter.
3. Select **OK** after the control loop is set to manual (see “Setting the Loop to Manual” on page 3-2).
4. Select a discrete milliamp level for the transmitter to output. At the **CHOOSE ANALOG OUTPUT** prompt select 1: 4mA (1 Vdc), select 2: 20mA (5 Vdc), or select 3: “Other” to manually input a value.
   a. If you are performing a loop test to verify the output of a transmitter, enter a value between 4 and 20 mA (1 and 5 Vdc).
   b. If you are performing a loop test to verify alarm levels, enter the value representing an alarm state (see Tables 3-2, 3-3, and 3-4 on page 3-17).
5. Check that the reference meter displays the commanded output value.
   a. If the values match, the transmitter and the loop are configured and functioning properly.
   b. If the values do not match, the meter may be attached to the wrong loop, there may be a fault in the wiring or power supply, the transmitter may require an output trim, or the reference meter may be malfunctioning.

After completing the test procedure, the display returns to the *Loop Test* screen to choose another output value or to end loop testing.

AMS Device Manager

Right click on the device and select **Diagnostics and Test**, then **Loop Test** from the menu.

1. a. For 4-20 mA HART output, connect a reference meter to the transmitter by either connecting the meter to the test terminals on the terminal block, or shunting transmitter power through the meter at some point in the loop.
   b. For 1-5 Vdc Low Power HART output, connect a reference meter to the V_{out} terminal.
2. Click **Next** after setting the control loop to manual.
3. Select desired analog output level. Click **Next**.
4. Click **Next** to acknowledge output being set to desired level.
5. Check that the reference meter displays the commanded output value.
   a. If the values match, the transmitter and the loop are configured and functioning properly.
   b. If the values do not match, the meter may be attached to the wrong loop, there may be a fault in the wiring or power supply, the transmitter may require an output trim, or the reference meter may be malfunctioning.

After completing the test procedure, the display returns to the *Loop Test* screen to choose another output value or to end loop testing.

6. Select **End** and click **Next** to end loop testing.
7. Select **Next** to acknowledge the loop can be returned to automatic control.
8. Select **Finish** to acknowledge the method is complete.

ADVANCED FUNCTIONS

Saving, Recalling, and Cloning Configuration Data

Use the cloning feature of the Field Communicator or the AMS Device Manager “User Configuration” feature to configure several 3051 transmitters similarly. Cloning involves configuring a transmitter, saving the configuration data, then sending a copy of the data to a separate transmitter. Several possible procedures exist when saving, recalling, and cloning configuration data. For complete instructions refer to the Field Communicator manual (publication no. 00809-0100-4276) or AMS Device Manager on-line guides. One common method is as follows:

Field Communicator

4-20 mA Fast Keys	left arrow, 1, 2
1-5 Vdc Fast Keys	left arrow, 1, 2

1. Completely configure the first transmitter.

2. Save the configuration data:
   a. Select **SAVE** from the Field Communicator *HOME/ONLINE* screen.
   b. Ensure that the location to which the data will be saved is set to **MODULE**. If it is not, select 1: Location to set the save location to **MODULE**.
   c. Select 2: Name, to name the configuration data. The default is the transmitter tag number.
   d. Ensure that the data type is set to **STANDARD**. If the data type is NOT **STANDARD**, select 3: Data Type to set the data type to **STANDARD**.
   e. Select **SAVE**.
3. Connect and power the receiving transmitter and Field Communicator.
4. Select the back arrow from the *HOME/ONLINE* screen. The Field Communicator menu appears.
5. Select 1: Offline, 2: Saved Configuration, 1: Module Contents to reach the *MODULE CONTENTS* menu.
6. Use the **DOWN ARROW** to scroll through the list of configurations in the memory module, and use the **RIGHT ARROW** to select and retrieve the required configuration.
7. Select 1: Edit.
8. Select 1: Mark All.
9. Select **SAVE**.
10. Use the **DOWN ARROW** to scroll through the list of configurations in the memory module, and use the **RIGHT ARROW** to select the configuration again.
11. Select **3: Send** to download the configuration to the transmitter.
12. Select **OK** after the control loop is set to manual.
13. After the configuration has been sent, select **OK** to acknowledge that the loop can be returned to automatic control.

When finished, the Field Communicator informs you of the status. Repeat Steps 3 through 13 to configure another transmitter.

NOTE
The transmitter receiving cloned data must have the same software version (or later) as the original transmitter.

AMS Device Manager creating a Reusable Copy

To create a reusable copy of a configuration perform the following procedure:

1. Completely configure the first transmitter.
2. Select **View** then **User Configuration View** from the menu bar (or click the toolbar button).
3. In the User Configuration window, right click and select **New** from the context menu.
4. In the *New* window, select a device from the list of templates shown, and click **OK**.
5. The template is copied into the User Configurations window, with the tag name highlighted; rename it as appropriate and press **Enter**.

NOTE
A device icon can also be copied by dragging and dropping a device template or any other device icon from AMS Device Manager Explorer or Device Connection View into the User Configurations window.

The “Compare Configurations” window appears, showing the Current values of the copied device on one side and mostly blank fields on the other (User Configuration) side.

6. Transfer values from the current configuration to the user configuration as appropriate or enter values by typing the values into the available fields.
7. Click **Apply** to apply the values, or click **OK** to apply the values and close the window.

AMS Device Manager Applying a User Configuration

Any amount of user configurations can be created for the application. They can also be saved, and applied to connected devices or to devices in the Device List or Plant Database.

NOTE
When using AMS Device Manager Revision 6.0 or later, the device to which the user configuration is applied, must be the same model type as the one created in the user configuration. When using AMS Device Manager Revision 5.0 or earlier, the same model type and revision number are required.

To apply a user configuration perform the following procedure:

1. Select the desired user configuration in the User Configurations window.
2. Drag the icon onto a like device in AMS Device Manager Explorer or Device Connection View. The Compare Configurations window opens, showing the parameters of the target device on one side and the parameters of the user configuration on the other.
3. Transfer parameters from the user configuration to the target device as desired, Click **OK** to apply the configuration and close the window.

Burst Mode

When configured for burst mode, the 3051 provides faster digital communication from the transmitter to the control system by eliminating the time required for the control system to request information from the transmitter. Burst mode is compatible with the analog signal. Because the HART protocol features simultaneous digital and analog data transmission, the analog value can drive other equipment in the loop while the control system is receiving the digital information. Burst mode applies only to the transmission of dynamic data (pressure and temperature in engineering units, pressure in percent of range, and/or analog output), and does not affect the way other transmitter data is accessed.

Access to information other than dynamic transmitter data is obtained through the normal poll/response method of HART communication. A Field Communicator, AMS Device Manager or the control system may request any of the information that is normally available while the transmitter is in burst mode. Between each message sent by the transmitter, a short pause allows the Field Communicator, AMS Device Manager or a control system to initiate a request. The transmitter will receive the request, process the response message, and then continue "bursting" the data approximately three times per second.

Field Communicator

4-20 mA Fast Keys	1, 4, 3, 3, 3
1-5 Vdc Fast Keys	1, 4, 3, 3, 3

AMS Device Manager

Right click on the device and select **Configure** from the menu.

1. In the *HART* tab, use the drop down menu to select "Burst Mode ON or OFF." For "Burst option" select the desired properties from the drop down menu. Burst options are as follows:
   - PV
   - % range/current
   - Process vars/crnt
   - Process variables
2. After selecting options click **Apply**.
3. After carefully reading the warning provided, select **yes**.

MULTIDROP COMMUNICATION

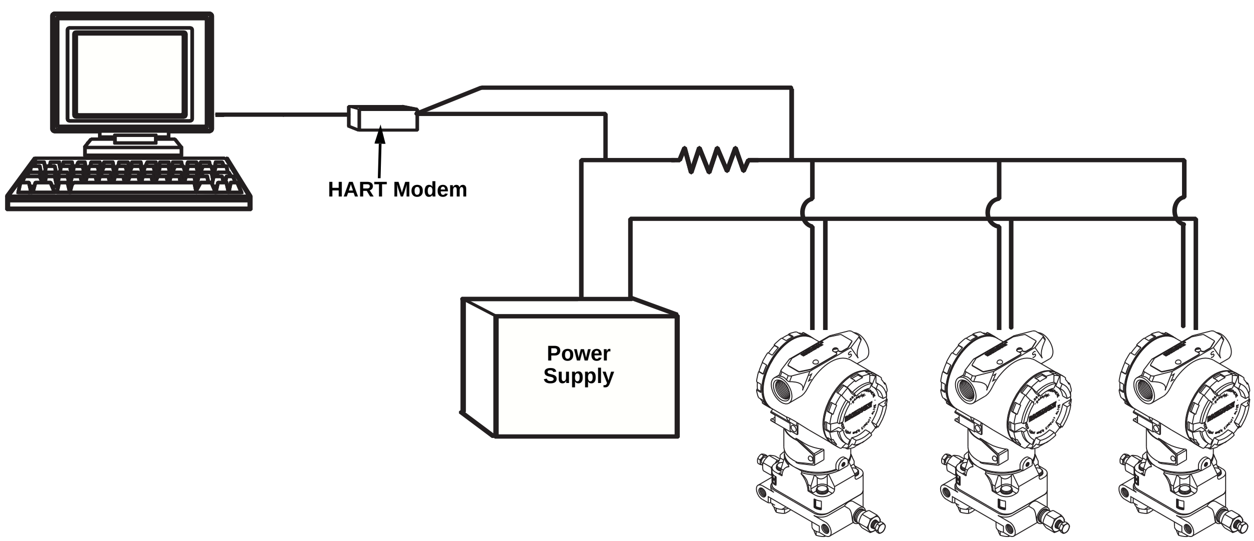
Multidropping transmitters refers to the connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated. With smart communications protocol, up to fifteen transmitters can be connected on a single twisted pair of wires, or over leased phone lines.

Multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Communication with transmitters can be accomplished with HART modems and a host implementing HART protocol. Each transmitter is identified by a unique address (1–15) and responds to the commands defined in the HART protocol. Field Communicators and AMS Device Manager can test, configure, and format a multidropped transmitter the same way as a transmitter in a standard point-to-point installation.

Figure 3-6 shows a typical multidrop network. This figure is not intended as an installation diagram.

NOTE
A transmitter in multidrop mode has the analog output fixed at 4 mA. If an LCD display is installed to a transmitter in multidrop mode, it will alternate the display between “current fixed” and the specified LCD display output(s).

Figure 3-6. Typical Multidrop Network



The 3051 is set to address zero (0) at the factory, which allows operation in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15. This change deactivates the 4–20 mA analog output, sending it to 4 mA. It also disables the failure mode alarm signal, which is controlled by the upscale/downscale switch position. Failure signals in multidropped transmitters are communicated through HART messages.

Changing a Transmitter Address

To activate multidrop communication, the transmitter poll address must be assigned a number from 1 to 15, and each transmitter in a multidropped loop must have a unique poll address.

Field Communicator

4-20 mA Fast Keys	1, 4, 3, 3, 1
1-5 Vdc Fast Keys	1, 4, 3, 3, 1

AMS Device Manager

Right click on the device and select **Configuration Properties** from the menu.

1. In the *HART* tab, in *the ID* box, enter poll address located in the *Poll addr* box, click **Apply**.
2. After carefully reading the warning provided, select **yes**.

Communicating with a Multidropped Transmitter

Field Communicator

4-20 mA Fast Keys	1, 4, 3, 3, 2
1-5 Vdc Fast Keys	1, 4, 3, 3, 2

To communicate with a multidropped transmitter, configure the Field Communicator to poll for a non-zero address.

1. From the *HOME* screen, enter the fast key sequence “Communicating with a Multidropped Transmitter.”
2. On the polling menu, scroll down and select “Digital Poll.” In this mode, the Field Communicator automatically polls for devices at addresses 0-15 upon start up.

AMS Device Manager

Click on the HART modem icon and select **Scan All Devices**.

Polling a Multidropped Transmitter

Polling a multidropped loop determines the model, address, and number of transmitters on the given loop.

Field Communicator

4-20 mA Fast Keys	Left arrow, 4, 1
1-5 Vdc Fast Keys	Left arrow, 4, 1

AMS Device Manager

Click on the HART modem icon and select **Scan All Devices**.

Section 4 Operation and Maintenance

OVERVIEW

This section contains information on calibrating and diagnostics messages on Rosemount 3051 Pressure Transmitters.

Field Communicator and AMS instructions are given to perform configuration functions. For convenience, Field Communicator fast key sequences are labeled "Fast Keys" for each software function below the appropriate headings.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

Warnings

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 3051 reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

CALIBRATION OVERVIEW

Calibration is defined as the process required to optimize transmitter accuracy over a specific range by adjusting the factory sensor characterization curve located in the microprocessor. Possible procedures are:

- Reranging: Setting the lower and upper range points (4 and 20 mA or 1 and 5 Vdc) points at required pressures. Reranging does not change the factory sensor characterization curve. Refer to page 3-10.
- Analog Output Trim: Adjusts the transmitter's analog characterization curve to match the plant standard of the control loop. There are two types of digital-to-analog output trims. Refer to page 4-7.
  - Digital-to-Analog Output Trim on 4-20 mA HART output (page 4-7)
  - Digital-to-Analog Output Trim on 4-20 mA HART output Using Other Scale (page 4-8)
- Sensor Trim: Adjusts the position of the factory sensor characterization curve due to a change in the sensor characteristics over time or a change in test equipment. Trimming has two steps, zero and sensor trims. Refer to page 4-11 and page 4-11.
  - Zero Trim (page 4-11)
  - Sensor Trim (page 4-11)

Figure 4-1 on page 4-3 illustrates 3051 transmitter data flow. Data flow can be summarized in four major steps:

1. A change in pressure is measured by a change in the sensor output (Sensor Signal).
2. The sensor signal is converted to a digital format that is understood by the microprocessor (Analog-to-Digital Signal Conversion). Sensor trim functions affect this value. Select these options to alter the digital signal on the LCD or Field Communicator.
3. Corrections are performed in the microprocessor to obtain a digital representation of the process input (Digital PV).
4. The Digital PV is converted to an analog value (Digital-to-Analog Signal Conversion). Rerange and Analog trim functions affect this value. Select these options to change the range points (4-20 mA or 1-5 Vdc).

For a summary of recommended calibration procedures, refer to Table 4-1 on page 4-3. Also, Figure 4-1 on page 4-3 identifies the approximate transmitter location for each calibration task. Data flows from left to right and a parameter change affects all values to the right of the changed parameter.

Figure 4-1. Transmitter Data Flow with Calibration Options

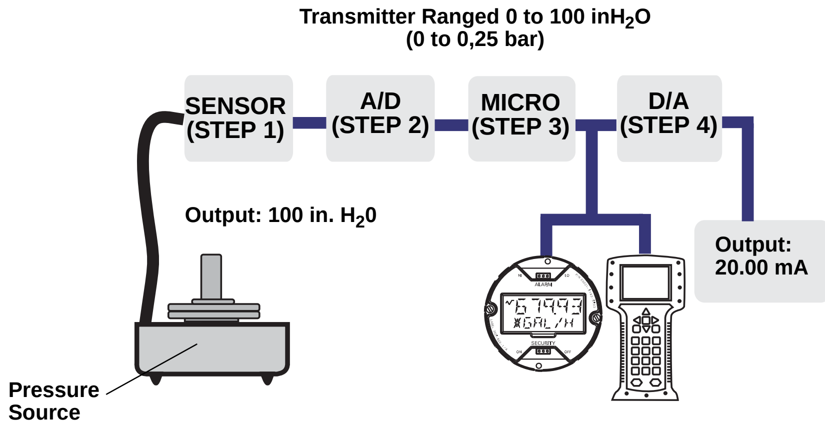


Table 4-1. Recommended Calibration Tasks

Transmitter	Bench Calibration Tasks	Field Calibration Tasks
3051CD 3051CG 3051L 3051TG, Range 1-4	1. Set output configuration parameters: a. Set the range points. b. Set the output units. c. Set the output type. d. Set the damping value. 2. *Optional*: Perform a sensor trim. (Accurate pressure source required.)	1. Reconfigure parameters if necessary. 2. Zero trim the transmitter to compensate for mounting effects or static pressure effects. 3. *Optional*: Perform an analog output trim. (Accurate multimeter required)
3051CA 3051TA 3051TG, Range 5	1. Set output configuration parameters: a. Set the range points. b. Set the output units. c. Set the output type. d. Set the damping value. 2. *Optional*: Perform a sensor trim if equipment available (accurate absolute pressure source required), otherwise perform the low trim value section of the sensor trim procedure.	1. Reconfigure parameters if necessary. 2. Perform low trim value section of the sensor trim procedure to correct for mounting position effects. 3. *Optional*: Perform an analog output trim (Accurate multimeter required)

NOTE
The 3051 has been carefully calibrated at the factory. Trimming adjusts the position of the factory characterization curve. It is possible to degrade performance of the transmitter if any trim is done improperly or with inaccurate equipment.

NOTE
A Field Communicator is required for all sensor and output trim procedures. Rosemount 3051C Range 4 and Range 5 transmitters require a special calibration procedure when used in differential pressure applications under high static line pressure (see“Select Finish to acknowledge the method is complete.” on page 4-13).

Determining Calibration Frequency

Calibration frequency can vary greatly depending on the application, performance requirements, and process conditions. Use the following procedure to determine calibration frequency that meets the needs of your application.

1. Determine the performance required for your application.
2. Determine the operating conditions.
3. Calculate the Total Probable Error (TPE).
4. Calculate the stability per month.
5. Calculate the calibration frequency.

Sample Calculation For A Standard 3051C

Step 1: Determine the performance required for your application.

Required Performance:	0.20% of span

Step 2: Determine the operating conditions.

Transmitter:	3051CD, Range 2 [URL=250 inH_2O(623 mbar)]
Calibrated Span:	150 inH_2O (374 mbar)
Ambient Temperature Change:	± 50 °F (28 °C)
Line Pressure:	500 psig (34,5 bar)

Step 3: Calculate total probable error (TPE).

$$\text{TPE} = \sqrt{(\text{ReferenceAccuracy})^2 + (\text{TemperatureEffect})^2 + (\text{StaticPressureEffect})^2} = 0.108\% \text{ of span}$$

Where:

Reference Accuracy = ± 0.065% of span

Ambient Temperature Effect =

$$\pm\left(\frac{0.0125 \quad \text{URL}}{\text{Span}} + 0.0625\right)\% \text{ per 50 °F} = \pm 0.070\% \text{ of span}$$

Span Static Pressure Effect(1) =

$$0.1\% \text{ reading per 1000 psi (69 bar)} = \pm 0.05\% \text{ of span at maximum span}$$

(1) *Zero static pressure effect removed by zero trimming at line pressure.*

Step 4: Calculate the stability per month.

$$\text{Stability} = \pm\left[\frac{(0.0125 \quad \text{URL})}{\text{Span}}\right]\% \text{ of span for 5 years} = \pm 0.00125\% \text{ of span per month}$$

Step 5: Calculate calibration frequency.

$$\text{Cal. Freq.} = \frac{(\text{Req. Performance} - \text{TPE})}{\text{Stability per Month}} = \frac{(0.2\% - 0.108\%)}{0.00125\%} = 73 \text{ months}$$

**Sample Calculation for 3051C with P8 option
(0.04% accuracy & 5-year stability)**

Step 1: Determine the performance required for your application.

Required Performance:	0.20% of span

Step 2: Determine the operating conditions.

Transmitter:	3051CD, Range 2 [URL=250 inH_2O(623 mbar)]
Calibrated Span:	150 inH_2O (374 mbar)
Ambient Temperature Change:	± 50 °F (28 °C)
Line Pressure:	500 psig (34,5 bar)

Step 3: Calculate total probable error (TPE).

$$\text{TPE} = \sqrt{(\text{ReferenceAccuracy})^2 + (\text{TemperatureEffect})^2 + (\text{StaticPressureEffect})^2} = 0.095\% \text{ of span}$$

Where:

Reference Accuracy = ± 0.04% of span

Ambient Temperature Effect =

$$\pm\left(\frac{0.0125\,\text{¥}\,\text{URL}}{\text{Span}} + 0.0625\right)\% \text{ per } 50\ °\text{F} = \pm 0.070\% \text{ of span}$$

Span Static Pressure Effect(1) =

$$0.1\% \text{ reading per } 1000 \text{ psi } (69 \text{ bar}) = \pm 0.05\% \text{ of span at maximum span}$$

(1) Zero static pressure effect removed by zero trimming at line pressure.

Step 4: Calculate the stability per month.

$$\text{Stability} = \pm\left[\frac{(0.0125\,\text{¥}\,\text{URL})}{\text{Span}}\right]\% \text{ of span for 5 years} = \pm 0.00125\% \text{ of span per month}$$

Step 5: Calculate calibration frequency.

$$\text{Cal. Freq.} = \frac{(\text{Req. Performance} - \text{TPE})}{\text{Stability per Month}} = \frac{(0.2\% - 0.095\%)}{0.00125\%} = 84 \text{ months}$$

Choosing a Trim Procedure

To decide which trim procedure to use, you must first determine whether the analog-to-digital section or the digital-to-analog section of the transmitter electronics need calibration. Refer to Figure 4-1 and perform the following procedure:

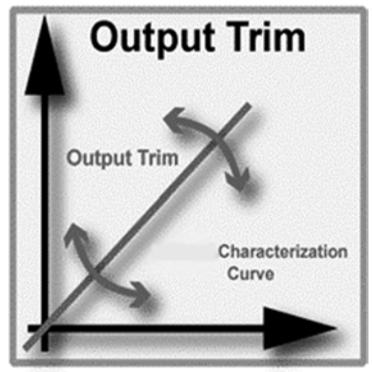
1. Connect a pressure source, a Field Communicator or AMS, and a digital readout device to the transmitter.
2. Establish communication between the transmitter and the Field Communicator.
3. Apply pressure equal to the upper range point pressure.
4. Compare the applied pressure to the pressure process variable valve on the Process Variables menu on the Field Communicator or the *Process Variables* screen in AMS. For instructions on how to access process variables, see page 3-7 of Section 3: Configuration.
    a. If the pressure reading does not match the applied pressure (with high-accuracy test equipment), perform a sensor trim. See “Sensor Trim Overview” on page 4-10 to determine which trim to perform.
5. Compare the Analog Output (AO) line, on the Field Communicator or AMS, to the digital readout device.

If the AO reading does not match the digital readout device (with high-accuracy test equipment), perform an analog output trim. See “Analog Output Trim” on page 4-7.

ANALOG OUTPUT TRIM

The Analog Output Trim commands allow you to adjust the transmitter's current output at the 4 and 20 mA (1 and 5 Vdc) points to match the plant standards. This command adjusts the digital to analog signal conversion.

Figure 4-2. Output Trim



Digital-to-Analog Trim

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 2, 1
1-5 Vdc Fast Keys	1, 2, 3, 2, 1

To perform a digital-to-analog trim with a Field Communicator, perform the following procedure.

1. From the *HOME* screen, enter the fast key sequence "Digital-to-Analog Trim." Select **OK** after setting the control loop to manual, see "Setting the Loop to Manual" on page 3-2.
2. a. For 4-20 mA HART output, connect a reference meter to the transmitter by either connecting the meter to the test terminals on the terminal block, or shunting transmitter power through the meter at some point in the loop.
   b. For 1-5 Vdc Low Power HART output, connect a reference meter to the V_{out} terminal.
3. Select **OK** after connecting the reference meter.
4. Select **OK** at the **SETTING FLD DEV OUTPUT TO 4 MA (1 Vdc)** prompt. The transmitter outputs 4.0 mA.
5. Record the actual value from the reference meter, and enter it at the **ENTER METER VALUE** prompt. The Field Communicator prompts you to verify whether or not the output value equals the value on the reference meter.
6. Select 1: Yes, if the reference meter value equals the transmitter output value, or 2: No if it does not.
   a. If 1 is selected: Yes, proceed to Step 7.
   b. If 2 is selected: No, repeat Step 5.
7. Select **OK** at the **SETTING FLD DEV OUTPUT TO 20 MA (5 Vdc)** prompt, and repeat Steps 5 and 6 until the reference meter value equals the transmitter output value.
8. Select **OK** after the control loop is returned to automatic control.

AMS

Right click on the device and select **Calibrate**, then **D/A Trim** from the menu.

1. Click **Next** after setting the control loop to manual.
2. Click **Next** after connecting the reference meter.
3. Click **Next** at the *Setting fld dev output to 4mA (1 Vdc)* screen.
4. Record the actual value from the reference meter, and enter it at the *Enter meter value* screen and click **Next**.
5. Select **Yes**, if the reference meter value equals the transmitter output value, or **No** if it does not. Click **Next**.
   a. If **Yes** is selected, proceed to Step 6.
   b. If **No** is selected, repeat Step 4.
6. Click **Next** at the *Setting fld dev output to 20mA (5 Vdc)* screen.
7. Repeat Step 4 - Step 5 until the reference meter equals the transmitter output value.
8. Select **Next** to acknowledge the loop can be returned to automatic control.
9. Select **Finish** to acknowledge the method is complete.

Digital-to-Analog Trim Using Other Scale

The Scaled D/A Trim command matches the 4 and 20 mA (1 and 5 Vdc) points to a user selectable reference scale other than 4 and 20 mA (for example, 2 to 10 volts if measuring across a 500 ohm load, or 0 to 100 percent if measuring from a Distributed Control System (DCS)). To perform a scaled D/A trim, connect an accurate reference meter to the transmitter and trim the output signal to scale, as outlined in the Output Trim procedure.

NOTE
Use a precision resistor for optimum accuracy. If you add a resistor to the loop, ensure that the power supply is sufficient to power the transmitter to a 20 mA output with additional loop resistance. Refer to "Power Supply for 4-20 mA HART" on page 2-21.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 2, 2
1-5 Vdc Fast Keys	1, 2, 3, 2, 2

AMS

Right click on the device and select **Calibrate**, then **Scaled D/A trim** from the menu.

1. Click **Next** after setting the control loop to manual.
2. Select **Change** to change scale, click **Next**.
3. Enter Set scale-Lo output value, click **Next**.
4. Enter Set scale-Hi output value, click **Next**.
5. Click **Next** to proceed with Trim.
6. Click **Next** after connecting the reference meter.
7. Click **Next** at the *Setting fld dev output to 4 mA* screen.
8. Record the actual value from the reference meter, and enter it at the *Enter meter value* screen and click **Next**.
9. Select **Yes**, if the reference meter value equals the transmitter output value, or **No** if it does not. Click **Next**.
   a. If **Yes** is selected, proceed to Step 10.
   b. If **No** is selected, repeat Step 8.
10. Click **Next** at the *Setting fld dev output to 20mA* screen.
11. Repeat Step 8 - Step 9 until the reference meter equals the transmitter output value.
12. Select **Next** to acknowledge the loop can be returned to automatic control.
13. Select **Finish** to acknowledge the method is complete.

Recall Factory Trim—Analog Output

The Recall Factory Trim—Analog Output command allows the restoration of the as-shipped factory settings of the analog output trim. This command can be useful for recovering from an inadvertent trim, incorrect Plant Standard or faulty meter. This command is only available with 4-20 mA output.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 4, 2

AMS

Right click on the device and select **Calibrate**, then **Recall Factory Trim** from the menu.

1. Click **Next** after setting the control loop to manual.
2. Select **Analog output trim** under *Trim to recall* and click **Next**.
3. Click **Next** to acknowledge restoration of trim values is complete.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

SENSOR TRIM

Sensor Trim Overview

Trim the sensor using either sensor or zero trim functions. Trim functions vary in complexity and are application-dependent. Both trim functions alter the transmitter's interpretation of the input signal.

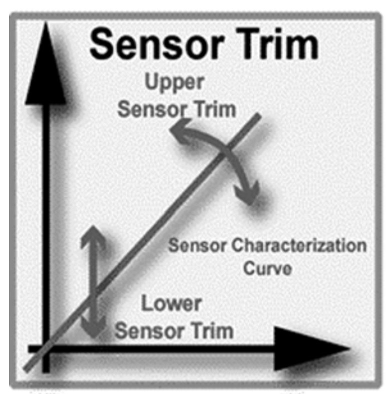
Zero trim is a single-point offset adjustment. It is useful for compensating for mounting position effects and is most effective when performed with the transmitter installed in its final mounting position. Since this correction maintains the slope of the characterization curve, it should not be used in place of a sensor trim over the full sensor range.

When performing a zero trim, ensure that the equalizing valve is open and all wet legs are filled to the correct levels.

NOTE
Do not perform a zero trim on Rosemount 3051T Absolute pressure transmitters. Zero trim is zero based, and absolute pressure transmitters reference absolute zero. To correct mounting position effects on a 3051T Absolute Pressure Transmitter, perform a low trim within the sensor trim function. The low trim function provides an offset correction similar to the zero trim function, but it does not require zero-based input.

Sensor trim is a two-point sensor calibration where two end-point pressures are applied, and all output is linearized between them. Always adjust the low trim value first to establish the correct offset. Adjustment of the high trim value provides a slope correction to the characterization curve based on the low trim value. The trim values allow you to optimize performance over your specified measuring range at the calibration temperature.

Figure 4-3. Sensor Trim



Zero Trim

NOTE
The transmitter PV at zero pressure must be within three percent of URL in order to calibrate using the zero trim function.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 3, 1
1-5 Vdc Fast Keys	1, 2, 3, 3, 1

Calibrate the sensor with a Field Communicator using the zero trim function as follows:

1. Vent the transmitter and attach a Field Communicator to the measurement loop.
2. From the *HOME* screen, follow the fast key sequence "Zero Trim."
3. Follow the commands provided by the Field Communicator to complete the zero trim adjustment.

AMS

Right click on the device and select **Calibrate,** then **Zero trim** from the menu.

1. Click **Next** after setting the control loop to manual.
2. Click **Next** to acknowledge warning.
3. Click **Next** after applying appropriate pressure to sensor.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

Sensor Trim

NOTE
Use a pressure input source that is at least four times more accurate than the transmitter, and allow the input pressure to stabilize for ten seconds before entering any values.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 3
1-5 Vdc Fast Keys	1, 2, 3, 3

To calibrate the sensor with a Field Communicator using the sensor trim function, perform the following procedure:

1. Assemble and power the entire calibration system including a transmitter, Field Communicator, power supply, pressure input source, and readout device.
2. From the *HOME* screen, enter the fast key sequence under "Sensor Trim."
3. Select 2: Lower sensor trim. The lower sensor trim value should be the sensor trim point that is closest to zero.

Examples:

Calibration: 0 to 100" H_2O - lower trim = 0, upper trim = 100

Calibration: -100 to 0” H_2O - lower trim = 0, upper trim = -100

Calibration: -100 to 100” H_2O - lower trim = -100 or 100,
upper trim = -100 or 100

NOTE
Select pressure input values so that lower and upper values are equal to or outside the 4 and 20 mA (1 and 5 Vdc) points. Do not attempt to obtain reverse output by reversing the high and low points. This can be done by going to “Rerange” on page 3-9 of Section 3: Configuration. The transmitter allows approximately five percent deviation.

4. Follow the commands provided by the Field Communicator to complete the adjustment of the lower value.
5. Repeat the procedure for the upper value, replacing 2: Lower sensor trim with 3: Upper sensor trim in Step 3.

AMS

Right click on the device and select **Calibrate**, then **Sensor trim**” from the menu.

1. Select **Lower sensor trim**. The lower sensor trim value should be the sensor trim point that is closest to zero.
2. Click **Next** after setting the control loop to manual.
3. Click **Next** after applying appropriate pressure to sensor.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.
6. Right click on the device and select **Calibrate**, select **Sensor trim** from the menu.
7. Select **Upper sensor trim** and repeat steps 2-5.

Recall Factory Trim—Sensor Trim

The Recall Factory Trim—Sensor Trim command allows the restoration of the as-shipped factory settings of the sensor trim. This command can be useful for recovering from an inadvertent zero trim of an absolute pressure unit or inaccurate pressure source. This command is only available with 4-20 mA output.

Field Communicator

4-20 mA Fast Keys	1, 2, 3, 4, 1

AMS

Right click on the device and select **Calibrate**, then **Recall Factory Trim** from the menu.

1. Click **Next** after setting the control loop to manual.
2. Select "**Sensor trim**" under *Trim to recall* and click **Next**.
3. Click **Next** to acknowledge restoration of trim values is complete.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

Line Pressure Effect (Range 2 and Range 3)

The following specifications show the static pressure effect for the Rosemount 3051 Range 2 and Range 3 pressure transmitters used in differential pressure applications where line pressure exceeds 2000 psi (138 bar).

Zero Effect
± 0.1% of the upper range limit plus an additional ± 0.1% of upper range limit error for each 1000 psi (69 bar) of line pressure above 2000 psi (138 bar).

Example: Line pressure is 3000 psi (207 bar) for Ultra performance transmitter. Zero effect error calculation:

± {0.05 + 0.1 x [3 kpsi - 2 kpsi]} = ± 0.15% of the upper range limit

Span Effect

Refer to "Line Pressure Effect" on page A-3.

Compensating for Line Pressure

Rosemount 3051 Range 4 and 5 pressure transmitters require a special calibration procedure when used in differential pressure applications. The purpose of this procedure is to optimize transmitter performance by reducing the effect of static line pressure in these applications. The 3051 differential pressure transmitters (Ranges 1, 2, and 3) do not require this procedure because optimization occurs in the sensor.

Applying high static pressure to 3051 Range 4 and Range 5 pressure transmitters causes a systematic shift in the output. This shift is linear with static pressure; correct it by performing the Sensor Trim procedure on page 4-11.

The following specifications show the static pressure effect for 3051 Range 4 and Range 5 transmitters used in differential pressure applications:

Zero Effect:
± 0.1% of the upper range limit per 1000 psi (69 bar) for line pressures from 0 to 2000 psi (0 to 138 bar)

For line pressures above 2000 psi (138 bar), the zero effect error is ± 0.2% of the upper range limit plus an additional ± 0.2% of upper range limit error for each 1000 psi (69 bar) of line pressure above 2000 psi (138 bar).

Example: Line pressure is 3000 psi (3 kpsi). Zero effect error calculation:

± {0.2 + 0.2 x [3 kpsi - 2 kpsi]} = ± 0.4% of the upper range limit

Span Effect:
Correctable to ±0.2% of reading per 1000 psi (69 bar) for line pressures from 0 to 3626 psi (0 to 250 bar)

The systematic span shift caused by the application of static line pressure is -1.00% of reading per 1000 psi (69 bar) for Range 4 transmitters, and -1.25% of reading per 1000 psi (69 bar) for Range 5 transmitters.

Use the following example to compute corrected input values.

Example
A Range 4 transmitter with model number 3051_CD4 will be used in a differential pressure application where the static line pressure is 1200 psi (83 bar). The transmitter output is ranged with 4 mA at 500 inH_2O (1,2 bar) and 20 mA at 1500 inH_2O (3,7 bar).

To correct for systematic error caused by high static line pressure, first use the following formulas to determine corrected values for the low trim and high trim.

Low Trim Value

LT = LRV - (S/100 x P/1000 x LRV)

Where:	LT =	Corrected Low Trim Value
	LRV =	Lower Range Value
	S =	Span shift per specification (as a percent of reading)
	P =	Static Line Pressure in psi

In this example:

LRV =	500 inH_2O (1.24 bar)
S =	-1.00%
P =	1200 psi
LT =	500 inH_2O - (-1%/100 x 1200 psi/1000 x 500 inH_2O)
LT =	506 inH_2O

High Trim Value

HT = (URV - (S/100 x P/1000 x URV)

Where:	HT =	Corrected High Trim Value
	URV =	Upper Range Value
	S =	Span shift per specification (as a percent of reading)
	P =	Static Line Pressure in psi

In this example:

URV =	1500 inH_2O (3.74 bar)
S =	-1.00%
P =	1200 psi
HT =	1500 - (-1%/100 x 1200 psi/1000 x 1500 inH_2O)
HT =	1518 inH_2O

Complete the Sensor Trim procedure as described on page 4-11. In the example above, at step 4, apply the nominal pressure value of 500 inH_2O. However, enter the calculated correct lower trim (LT) value of 506 inH_2O with the Field Communicator. Repeat the procedure for the upper value.

NOTE
The range values for the 4 and 20 mA (1 and 5 Vdc) points should be at the nominal URV and LRV. In the example above, the values are 1500 inH_2O and 500 inH_2O respectively. Confirm the values on the *HOME* screen on the Field Communicator. Modify, if needed, by following the steps in the Rerange section on page 3-10.

Section 5 Troubleshooting

OVERVIEW

Table 5-1 provides summarized maintenance and troubleshooting suggestions for the most common operating problems.

If you suspect malfunction despite the absence of any diagnostic messages on the Field Communicator display, consider using Table 5-1 on page 5-2 to identify any potential problem.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

Warnings (⚠)

⚠WARNING

Explosions could result in death or serious injury:
Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 3051 reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

Table 5-1. Rosemount 3051 Troubleshooting Table for 4-20 mA output

Symptom	Corrective Actions
Transmitter milliamp reading is zero	Verify power is applied to signal terminals Check power wires for reversed polarity Verify terminal voltage is 10.5 to 42.4 Vdc Check for open diode across test terminal
Transmitter Not Communicating with HART Communicator	Verify the output is between 4 and 20 mA or saturation levels Verify terminal voltage is 10.5 to 42.4 Vdc Verify clean DC Power to transmitter (Max AC noise 0.2 volts peak to peak) Check loop resistance, 250 Ω minimum (PS voltage -transmitter voltage/loop current) Have Field Communicator poll for all addresses
Transmitter milliamp reading is low or high	Verify applied pressure Verify 4 and 20 mA range points Verify output is not in alarm condition Verify if 4 – 20 mA output trim is required
Transmitter will not respond to changes in applied pressure	Check test equipment Check impulse piping or manifold for blockage Verify the transmitter is not in multidrop mode Verify applied pressure is between the 4 and 20 mA set points Verify output is not in alarm condition Verify transmitter is not in Loop Test mode
Digital Pressure Variable reading is low or high	Check test equipment (verify accuracy) Check impulse piping for blockage or low fill in wet leg Verify transmitter is calibrated properly Verify pressure calculations for application
Digital Pressure Variable reading is erratic	Check application for faulty equipment in pressure line Verify transmitter is not reacting directly to equipment turning on/off Verify damping is set properly for application
Milliamp reading is erratic	Verify power source to transmitter has adequate voltage and current Check for external electrical interference Verify transmitter is properly grounded Verify shield for twisted pair is only grounded at one end

DIAGNOSTIC MESSAGES

In addition to the output, the LCD meter displays abbreviated operation, error, and warning messages for troubleshooting the transmitter. Messages appear according to their priority, with normal operating messages appearing last. To determine the cause of a message, use a Field Communicator or AMS to further interrogate the transmitter. A description of each LCD diagnostic message follows.

Error

Error messages appear on the LCD display to inform you of serious problems affecting the operation of the transmitter. The LCD displays an error message until the error condition is corrected, and the analog output is driven to the specified alarm level. No other transmitter information is displayed during an alarm condition.

FAIL
The transmitter CPU board and the sensor module are incompatible. See “Disassembly Procedures” on page 5-8.

Fail Module
The sensor module is disconnected or is malfunctioning. Verify that the sensor module ribbon cable is connected to the back of the electronics board. If the ribbon cable is properly connected, there is a problem within the sensor module. Possible sources of problems include:

- Pressure or temperature updates are not being received in the sensor module.
- A non-volatile memory fault that will effect transmitter operation has been detected in the module by the memory verification routine.

Some non-volatile memory faults are user-repairable. Use a Field Communicator to diagnose the error and determine if it is repairable. Any error message that ends in “FACTORY” is not repairable. In cases of non user-repairable errors, you must replace the transmitter.

Fail Elect
The transmitter electronics board is malfunctioning due to an internal fault. Some of the FAIL ELECT errors are user-repairable. Use a 275 Field Communicator to diagnose the error and determine if it is repairable. Any error message that ends in “FACTORY” is not repairable. In cases of non user-repairable errors, you must replace the electronics board. See “Disassembly Procedures” on page 5-3.

Fail Config
A memory fault has been detected in a location that could effect transmitter operation, and is user-accessible. To correct this problem, use a Field Communicator to interrogate and reconfigure the appropriate portion of the transmitter memory.

Warnings

Warnings appear on the LCD display to alert you of user-repairable problems with the transmitter, or current transmitter operations. Warnings appear alternately with other transmitter information until the warning condition is corrected or the transmitter completes the operation that warrants the warning message.

Press Limit
The process variable read by the transmitter is outside of the transmitter's range.

Temp Limit
The secondary temperature variable read by the transmitter is outside of the transmitter's range.

Curr Fixed
The transmitter is in multidrop mode. The analog output is not tracking pressure changes.

Curr Saturd
The pressure read by the module is outside of the specified range, and the analog output has been driven to saturation levels.

Loop Test
A loop test is in progress. During a loop test or 4–20 mA trim, the analog output is set to a fixed value. The meter display alternates between the current selected in milliamps and "LOOP TEST."

Xmtr Info
A non-volatile memory fault has been detected in the transmitter memory by the memory verification routine. The memory fault is in a location containing transmitter information. To correct this problem, use a Field Communicator to interrogate and reconfigure the appropriate portion of the transmitter memory. This warning does not effect the transmitter operation.

Operation

Normal operation messages appear on the LCD meter to confirm actions or inform you of transmitter status. Operation messages are displayed with other transmitter information, and warrant no action to correct or alter the transmitter settings.

Zero Pass
The zero value, set with the local zero adjustment button, has been accepted by the transmitter, and the output should change to 4 mA (1 Vdc).

Zero Fail
The zero value, set with the local zero adjustment button, exceeds the maximum rangedown allowed for a particular range, or the pressure sensed by the transmitter exceeds the sensor limits.

Span Pass
The span value, set with the local span adjustment button, has been accepted by the transmitter, and the output should change to 20 mA (5 Vdc).

Span Fail
The span value, set with the local span adjustment button, exceeds the maximum rangedown allowed for a particular range, or the pressure sensed by the transmitter exceeds the sensor limits.

LOCAL DSBLD
This message appears during reranging with the integral zero and span buttons and indicates that the transmitter local zero and span adjustments have been disabled. The adjustments may have been disabled by the transmitter security jumper on the transmitter circuit board or through software commands from the Field Communicator. See "Security (Write Protect)" on page 2-14 for information on the position of the security jumper and information on software lockout.

Write Protect
This message appears if you attempt to change the transmitter configuration data while the security jumper is in the ON position. See "Security (Write Protect)" on page 2-14 for more information about the security jumper.

Field Communicator Diagnostics

Table 5-2 is a list of messages used by the Field Communicator (HC) and their corresponding descriptions.

Variable parameters within the text of a message are indicated with <*variable parameter*>.

Reference to the name of another message is identified by *[another message]*.

Table 5-2. Field Communicator Messages

Message	Description
1k snsr EEPROM error-factory ON	Replace the transmitter
1k snsr EEPROM error-user-no out ON	Use the Field Communicator to reset the following parameters: remote seal isolator, remote seal fill fluid, flange material, o-ring material, transmitter type, remote seal type, flange type, meter type, number of remote seals.
1k snsr EEPROM error-user ON	Perform a full trim to recalibrate the transmitter.
4k micro EEPROM error-factory ON	Replace the electronics board.
4k micro EEPROM error-user-no out ON	Use the Field Communicator to reset the message field.
4k micro EEPROM error-user ON	Use the Field Communicator to reset the following parameters: units, range values, damping, analog output, transfer function, tag, scaled meter values. Perform a D/A trim to ensure that the error is corrected.
4k snsr EEPROM error-factory ON	Replace the transmitter.
4k snsr EEPROM error-user ON	Use the Field Communicator to reset the temperature units and the calibration type.
Add item for ALL device types or only for this ONE device type.	Asks the user whether the hot key item being added should be added for all device types or only for the type of device that is connected.
Command Not Implemented	The connected device does not support this function.
Communication Error	The communicator and the device are not communicating correctly. Check all connections between the Field Communicator and the device and resend the information.

Message	Description
Configuration memory not compatible with connected device	The configuration stored in memory is incompatible with the device to which a transfer has been requested.
CPU board not initialized ON	The electronics board is not initialized. Replace the electronics board.
CPU EEPROM write failure ON	Message sent to electronics board from HART signal failed. Replace the electronics board.
Device Busy	The connected device is busy performing another task.
Device Disconnected	The device failed to respond to a command. Check all connections between the Field Communicator and the device and resend the command.
Device write protected	Device is in write-protect mode. Data can not be written.
Device write protected. Do you still want to shut off?	Device is in write-protect mode. Press YES to turn the Field Communicator off and lose the unsent data.
Display value of variable on hotkey menu?	Asks whether the value of the variable should be displayed adjacent to its label on the hotkey menu if the item being added to the hotkey menu is a variable.
Download data from configuration memory to device	Press the SEND softkey to transfer information from the communicator memory to the device.
Exceed field width	Indicates that the field width for the current arithmetic variable exceeds the device-specified description edit format.
Exceed precision	Indicates that the precision for the current arithmetic variable exceeds the device-specified description edit format.
Ignore next 50 occurrences of status?	Select YES to ignore the next 50 occurrences of device status, or select no to display every occurrence.
Illegal character	An invalid character for the variable type was entered.
Illegal date	The day portion of the date is invalid.
Illegal month	The month portion of the date is invalid.
Illegal year	The year portion of the date is invalid.
Incompatible CPU board and module ON	Upgrade the electronics board or the sensor module to the current revision.
Incomplete exponent	The exponent of a scientific notation floating point variable is incomplete.
Incomplete field	The value entered is not complete for the variable type.
Looking for a device	Polling for multidropped devices at addresses 1–15.
Local buttons operator error ON	Illegal pressure applied during zero or span operation. Repeat the process after verifying the correct pressures.
Mark as read only variable on hotkey menu?	Asks whether the user should be allowed to edit the variable from the hotkey menu if the item being added to the hotkey menu is a variable.
Module EEPROM write failure ON	Message sent to the module from the HART signal failed. Replace the transmitter.
No device configuration in configuration memory	There is no configuration saved in memory available to re-configure off-line or transfer to a device.
No Device Found	Poll of address zero fails to find a device, or poll of all addresses fails to find a device if auto-poll is enabled.
No hotkey menu available for this device.	There is no menu named “hotkey” defined in the device description for this device.
No pressure updates ON	No pressure updates being received from the sensor module. Verify that the sensor module ribbon cable is attached correctly. Or replace the transmitter.
No offline devices available.	There are no device descriptions available to be used to configure a device offline.
No simulation devices available.	There are no device descriptions available to simulate a device.

Message	Description
No temperature updates ON	No temperature updates being received from the sensor module. Verify that the sensor module ribbon cable is attached correctly. Or replace the transmitter.
No UPLOAD_VARIABLES in ddl for this device	There is no menu named “upload_variables” defined in the device description for this device. This menu is required for offline configuration.
No Valid Items	The selected menu or edit display contains no valid items.
OFF KEY DISABLED	Appears when the user attempts to turn the HC off before sending modified data or before completing a method.
Online device disconnected with unsent data. RETRY or OK to lose data.	There is unsent data for a previously connected device. Press RETRY to send data, or press OK to disconnect and lose unsent data.
Out of memory for hotkey configuration. Delete unnecessary items.	There is no more memory available to store additional hotkey items. Unnecessary items should be deleted to make space available.
Overwrite existing configuration memory	Requests permission to overwrite existing configuration either by a device-to-memory transfer or by an offline configuration. User answers using the softkeys.
Press OK...	Press the OK softkey. This message usually appears after an error message from the application or as a result of HART communications.
Restore device value?	The edited value that was sent to a device was not properly implemented. Restoring the device value returns the variable to its original value.
ROM checksum error ON	Checksum of transmitter software has detected a fault. Replace the electronics board.
Save data from device to configuration memory	Prompts user to press SAVE softkey to initiate a device-to-memory transfer.
Saving data to configuration memory.	Data is being transferred from a device to configuration memory.
Sending data to device.	Data is being transferred from configuration memory to a device.
Sensor board not initialized ON	The sensor module electronics board is not initialized. Replace the transmitter.
There are write only variables which have not been edited. Please edit them.	There are write-only variables which have not been set by the user. These variables should be set or invalid values may be sent to the device.
There is unsent data. Send it before shutting off?	Press YES to send unsent data and turn the HC off. Press NO to turn the HC off and lose the unsent data.
Too few data bytes received	Command returns fewer data bytes than expected as determined by the device description.
Transmitter Fault	Device returns a command response indicating a fault with the connected device.
Units for <variable label> has changed. Unit must be sent before editing, or invalid data will be sent.	The engineering units for this variable have been edited. Send engineering units to the device before editing this variable.
Unsent data to online device. SEND or LOSE data	There is unsent data for a previously connected device which must be sent or thrown away before connecting to another device.
Upgrade 275 software to access XMTR function. Continue with old description?	The communicator does not contain the most recent 3051 Device Descriptors (DDs). Select YES to communicate using the existing DDs. Select NO to abort communication.
Use up/down arrows to change contrast. Press DONE when done.	Gives direction to change the contrast of the HC display.

Message	Description
Value out of range	The user-entered value is either not within the range for the given type and size of variable or not within the min/max specified by the device.
<message> occurred reading/writing <variable label>	Either a read/write command indicates too few data bytes received, transmitter fault, invalid response code, invalid response command, invalid reply data field, or failed pre- or post-read method; or a response code of any class other than SUCCESS is returned reading a particular variable.
<variable label> has an unknown value. Unit must be sent before editing, or invalid data will be sent.	A variable related to this variable has been edited. Send related variable to the device before editing this variable.

DISASSEMBLY PROCEDURES

⚠ Do not remove the instrument cover in explosive atmospheres when the circuit is live.

Remove from Service

Follow these steps:

- Follow all plant safety rules and procedures.
- Isolate and vent the process from the transmitter before removing the transmitter from service.
- Remove all electrical leads and disconnect conduit.
- Remove the transmitter from the process connection.
  - The Rosemount 3051C transmitter is attached to the process connection by four bolts and two cap screws. Remove the bolts and separate the transmitter from the process connection. Leave the process connection in place and ready for re-installation.
  - The Rosemount 3051T transmitter is attached to the process by a single hex nut process connection. Loosen the hex nut to separate the transmitter from the process. Do not wrench on neck of transmitter.
- Do not scratch, puncture, or depress the isolating diaphragms.
- Clean isolating diaphragms with a soft rag and a mild cleaning solution, and rinse with clear water.
- For the 3051C, whenever you remove the process flange or flange adapters, visually inspect the PTFE o-rings. Replace the o-rings if they show any signs of damage, such as nicks or cuts. Undamaged o-rings may be reused.

Remove Terminal Block

Electrical connections are located on the terminal block in the compartment labeled “FIELD TERMINALS.”

1. Remove the housing cover from the field terminal side.
2. Loosen the two small screws located on the assembly in the 9 o’clock and 5 o’clock positions.
3. Pull the entire terminal block out to remove it.

⚠ See “Safety Messages” on page 5-1 for complete warning information.

Remove the Electronics Board

The transmitter electronics board is located in the compartment opposite the terminal side. To remove the electronics board perform the following procedure:

1. Remove the housing cover opposite the field terminal side.
2. If you are disassembling a transmitter with a LCD display, loosen the two captive screws that are visible on the right and left side of the meter display.
3. Loosen the two captive screws that anchor the board to the housing. The electronics board is electrostatically sensitive; observe handling precautions for static-sensitive components. Use caution when removing the LCD as there is an electronic pin connector that interfaces between the LCD and electronics board. The two screws anchor the LCD display to the electronics board and the electronics board to the housing.
4. Using the two captive screws, slowly pull the electronics board out of the housing. The sensor module ribbon cable holds the electronics board to the housing. Disengage the ribbon cable by pushing the connector release.

Remove the Sensor Module from the Electronics Housing

1. Remove the electronics board. Refer to “Remove the Electronics Board” on page 5-9.

IMPORTANT
To prevent damage to the sensor module ribbon cable, disconnect it from the electronics board before you remove the sensor module from the electrical housing.

2. Carefully tuck the cable connector completely inside of the internal black cap.

NOTE
Do not remove the housing until after you tuck the cable connector completely inside of the internal black cap. The black cap protects the ribbon cable from damage that can occur when you rotate the housing.

3. Loosen the housing rotation set screw with a $^5/_{64}$-inch hex wrench, and loosen one full turn.
4. Unscrew the module from the housing, making sure the black cap and sensor cable do not catch on the housing.

REASSEMBLY PROCEDURES

1. Inspect all cover and housing (non-process wetted) O-rings and replace if necessary. Lightly grease with silicone lubricant to ensure a good seal.
2. Carefully tuck the cable connector completely inside the internal black cap. To do so, turn the black cap and cable counterclockwise one rotation to tighten the cable.
3. Lower the electronics housing onto the module. Guide the internal black cap and cable through the housing and into the external black cap.
4. Turn the module clockwise into the housing.

IMPORTANT
Make sure the sensor ribbon cable and internal black cap remain completely free of the housing as you rotate it. Damage can occur to the cable if the internal black cap and ribbon cable become hung up and rotate with the housing.

5. Thread the housing completely onto the sensor module. The housing must be no more than one full turn from flush with the sensor module to comply with explosion proof requirements.
6. Tighten the housing rotation set screw using a $^{5}/_{64}$-inch hex wrench.

Attach the Electronics Board

1. Remove the cable connector from its position inside of the internal black cap and attach it to the electronics board.
2. Using the two captive screws as handles, insert the electronics board into the housing. Make sure the posts from the electronics housing properly engage the receptacles on the electronics board. Do not force. The electronics board should slide gently on the connections.
3. Tighten the captive mounting screws.
4. Replace the electronics housing cover. The transmitter covers must be engaged metal-to-metal to ensure a proper seal and to meet Explosion-Proof requirements.

Install the Terminal Block

1. Gently slide the terminal block into place, making sure the two posts from the electronics housing properly engage the receptacles on the terminal block.
2. Tighten the captive screws.
3. Replace the electronics housing cover. The transmitter covers must be fully engaged to meet Explosion-Proof requirements.

Reassemble the 3051C Process Flange

1. Inspect the sensor module PTFE o-rings. Undamaged o-rings may be reused. Replace o-rings that show any signs of damage, such as nicks, cuts, or general wear.

NOTE
If you are replacing the o-rings, be careful not to scratch the o-ring grooves or the surface of the isolating diaphragm when removing the damaged o-rings.

See “Safety Messages” on page 5-1 for complete warning information.

2. Install the process connection. Possible options include:
   a. Coplanar Process Flange:
   - Hold the process flange in place by installing the two alignment screws to finger tightness (screws are not pressure retaining). Do not overtighten as this will affect module-to-flange alignment.
   - Install the four 1.75-in. flange bolts by finger tightening them to the flange.

   b. Coplanar Process Flange with Flange Adapters:
   - Hold the process flange in place by installing the two alignment screws to finger tightness (screws are not pressure retaining). Do not overtighten as this will affect module-to-flange alignment.
   - Hold the flange adapters and adapter o-rings in place while installing the four configurations, use four 2.88-in. bolts. For gage pressure configurations, use two 2.88-in. bolts and two 1.75-in. bolts.

   c. Manifold:
   - Contact the manifold manufacturer for the appropriate bolts and procedures.
3. Tighten the bolts to the initial torque value using a crossed pattern. See Table 5-3 for appropriate torque values.

Table 5-3. Bolt Installation Torque Values

Bolt Material	Initial Torque Value	Final Torque Value
CS-ASTM-A445 Standard	300 in-lb. (34 N-m)	650 in-lb. (73 N-m)
316 SST—Option L4	150 in-lb. (17 N-m)	300 in-lb. (34 N-m)
ASTM-A-193-B7M—Option L5	300 in-lb. (34 N-m)	650 in-lb. (73 N-m)
ASTM-A-193 Class 2, Grade B8M—Option L8	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)

NOTE
If you replaced the PTFE sensor module o-rings, re-torque the flange bolts after installation to compensate for cold flow.

NOTE
After replacing o-rings on Range 1 transmitters and re-installing the process flange, expose the transmitter to a temperature of 185 °F (85 °C) for two hours. Then re-tighten the flange bolts in a cross pattern, and again expose the transmitter to a temperature of 185 °F (85 °C) for two hours before calibration.

Install the Drain/Vent Valve

1. Apply sealing tape to the threads on the seat. Starting at the base of the valve with the threaded end pointing toward the installer, apply two clockwise turns of sealing tape.
2. Tighten the drain/vent valve to 250 in-lb. (28.25 N-m).
3. Take care to place the opening on the valve so that process fluid will drain toward the ground and away from human contact when the valve is opened.

Appendix A Specifications and Reference Data

PERFORMANCE SPECIFICATIONS

This product data sheet covers both HART and fieldbus protocols unless specified.

Conformance To Specification (±3σ (Sigma))

Technology leadership, advanced manufacturing techniques and statistical process control ensure specification conformance to at least ±3σ.

Reference Accuracy[1]

Models	Standard	High Accuracy Option
3051CD, 3051CG		
Range 0 (CD)	±0.10% of span For spans less than 2:1, accuracy = ±0.05% of URL	
Range 1	±0.10% of span For spans less than 15:1, accuracy = $\pm\left[0.025 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span	
Ranges 2-5	±0.065% of span For spans less than 10:1, accuracy = $\pm\left[0.015 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span	Ranges 2-4 High Accuracy Option, P8 ±0.04% of span For spans less than 5:1, accuracy = $\pm\left[0.015 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span
3051T		
Ranges 1-4	±0.065% of span For spans less than 10:1, accuracy = $\pm\left[0.0075\left(\frac{URL}{Span}\right)\right]$% of Span	Ranges 1-4 High Accuracy Option, P8 ±0.04% of span For spans less than 5:1, accuracy = $\pm\left[0.0075\left(\frac{URL}{Span}\right)\right]$% of Span
Range 5	±0.075% of span	
3051CA		
Ranges 1-4	±0.065% of span For spans less than 10:1, accuracy = $\pm\left[0.0075\left(\frac{URL}{Span}\right)\right]$% of Span	Ranges 2-4 High Accuracy Option, P8 ±0.04% of span For spans less than 5:1, accuracy = $\pm\left[0.0075\left(\frac{URL}{Span}\right)\right]$% of Span
3051H/3051L		
All Ranges	±0.075% of span For spans less than 10:1, accuracy = $\pm\left[0.025 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span	

(1) *Total performance is determined by performing a root sum square calculation on reference accuracy, ambient temperature effect, and line pressure effect errors. For FOUNDATION fieldbus transmitters, use calibrated range in place of span. For zero based spans, reference conditions, silicone oil fill, SST materials, Coplanar flange (3051C) or 1/2 in. - 18 NPT (3051T) process connections, digital trim values set to equal range points.*

Total Performance

For ±50 °F (28 °C) temperature changes, up to 1000 psi (6,9 MPa) line pressure (CD only), from 1:1 to 5:1 rangedown.

Models		Total Performance
3051C		
	Ranges 2-5	±0.15% of span
3051T		
	Ranges 1-4	±0.15% of span

Long Term Stability

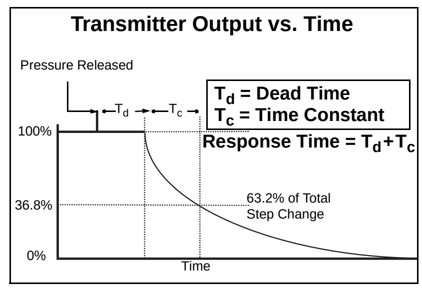
Models	Long Term Stability
3051C	
Ranges 2-5	±0.125% of URL for 5 years ±50 °F (28 °C) temperature changes, and up to 1000 psi (6,9 MPa) line pressure.
3051CD Low/Draft Range	
Ranges 0-1	±0.2% of URL for 1 year
3051T	
Ranges 1-4	±0.125% of URL for 5 years ±50 °F (28 °C) temperature changes, and up to 1000 psi (6,9 MPa) line pressure.
Rosemount 3051H	
Ranges 2-3	±0.1% of URL for 1 year
Ranges 4-5	±0.2% of URL for 1 year

Dynamic Performance

	4 - 20 mA (*HART* protocol)[1]	Fieldbus protocol[3]
Total Response Time (T_d + T_c)[2]:		
3051C, Ranges 2-5:	100 ms	152 ms
Range 1:	255 ms	307 ms
Range 0:	700 ms	752 ms
3051T:	100 ms	152 ms
3051H/L:	Consult factory	Consult factory
Dead Time (Td)	45 ms (nominal)	97 ms
Update Rate	22 times per second	22 times per second

(1) Dead time and update rate apply to all models and ranges; analog output only
(2) Nominal total response time at 75 °F (24 °C) reference conditions.
(3) Transmitter fieldbus output only, segment macro-cycle not included.

Typical HART Transmitter Response Time



Line Pressure Effect per 1000 psi (6,9 MPa)[1]

Models	Line Pressure Effect
3051CD	Zero Error[2]
Range 0	±0.125% of URL/100 psi (6,89 bar)
Range 1	±0.25% of URL/1000 psi (68,9 bar)
Ranges 2-3	±0.05% of URL/1000 psi (68,9 bar) for line pressures from 0 to 2000 psi (0 to 13,7 MPa)
	Span Error
Range 0	±0.15% of reading/100 psi (6,89 bar)
Range 1	±0.4% of reading/1000 psi (68,9 bar)
Ranges 2-3	±0.1% of reading/1000 psi (68,9 bar)
3051HD	Zero Error[1]
All Ranges	±0.1% of URL/1000 psi (68,9 bar) for line pressures from 0 to 2000 psi (0 to 13,7 MPa)
	Span Error
All Ranges	±0.1% of reading/1000 psi (68,9 bar)

(1) For zero error specifications for line pressures above 2000 psi (137,9 bar) or line pressure effect specifications for DP Ranges 4-5, see “Compensating for Line Pressure” on page 4-13.
(2) Can be calibrated out at line pressure.

Ambient Temperature Effect per 50°F (28°C)

Models		Ambient Temperature Effect
3051CD/CG		
	Range 0	±(0.25% URL + 0.05% span)
	Range 1	±(0.1% URL + 0.25% span)
	Ranges 2-5	±(0.0125% URL + 0.0625% span) from 1:1 to 5:1 ±(0.025% URL + 0.125% span) from 5:1 to 100:1
3051T		
	Range 1	±(0.025% URL + 0.125% span) from 1:1 to 10:1 ±(0.05% URL + 0.125% span) from 10:1 to 100:1
	Range 2-4	±(0.025% URL + 0.125% span) from 1:1 to 30:1 ±(0.035% URL + 0.125% span) from 30:1 to 100:1
	Range 5	±(0.1% URL + 0.15% span)
3051CA		
	All Ranges	±(0.025% URL + 0.125% span) from 1:1 to 30:1 ±(0.035% URL + 0.125% span) from 30:1 to 100:1
3051H		
	All Ranges	±(0.025% URL + 0.125% span + 0.35 inH_2O) from 1:1 to 30:1 ±(0.035% URL + 0.125% span + 0.35 inH_2O) from 1:1 to 30:1
3051L		See Rosemount Inc. Instrument Toolkit® software.

Mounting Position Effects

Models	Mounting Position Effects
3051C	Zero shifts up to ±1.25 inH_2O (3,11 mbar), which can be calibrated out. No span effect.
3051H	Zero shifts up to ±5 inH_2O (12,43 mbar), which can be calibrated out. No span effect.
3051L	With liquid level diaphragm in vertical plane, zero shift of up to 1 inH_2O (2,49 mbar). With diaphragm in horizontal plane, zero shift of up to 5 inH_2O (12,43 mbar) plus extension length on extended units. All zero shifts can be calibrated out. No span effect.
3051T/CA	Zero shifts up to 2.5 inH_2O (6,22 mbar), which can be calibrated out. No span effect.

Vibration Effect

Less than ±0.1% of URL when tested per the requirements of IEC60770-1 field or pipeline with high vibration level (10-60 Hz 0.21mm displacement peak amplitude / 60-2000 Hz 3g).

Power Supply Effect

Less than ±0.005% of calibrated span per volt.

Electromagnetic Compatibility (EMC)

Meets all relevant requirements of EN 61326 and NAMUR NE-21.

Transient Protection (Option Code T1)

Meets IEEE C62.41, Category Location B

6 kV crest (0.5 μs - 100 kHz)
3 kV crest (8 × 20 microseconds)
6 kV crest (1.2 × 50 microseconds)

FUNCTIONAL SPECIFICATIONS

Range and Sensor Limits

Table A-1. 3051CD, 3051CG, 3051L, and 3051H Range and Sensor Limits

Range	Minimum Span	Range and Sensor Limits						
			Lower (LRL)					
	3051CD[(1)], CG, L, H	Upper (URL)	3051C Differential	3051C/ Gage	3051L Differential	3051L Gage	3051H Differential	3051H Gage
0	0.1 inH_2O (0,25 mbar)	3.0 inH_2O (7,47 mbar)	–3.0 inH_2O (-7,47 mbar)	NA	NA	NA	NA	NA
1	0.5 inH_2O (1,2 mbar)	25 inH_2O (62,3 mbar)	–25 inH_2O (–62,1 mbar)	–25 inH_2O (–62,1 mbar)	NA	NA	NA	NA
2	2.5 inH_2O (6,2 mbar)	250 inH_2O (0,62 bar)	–250 inH_2O (–0,62 bar)	–250 inH_2O (–0,62 bar)	–250 inH_2O (–0,62 bar)	–250 inH_2O (–0,62 bar)	–250 inH_2O (–0,62 bar)	–250 inH_2O (–0,62 bar)
3	10 inH_2O (24,9 mbar)	1000 inH_2O (2,49 bar)	–1000 inH_2O (–2,49 bar)	0.5 psia (34,5 mbar abs)	–1000 inH_2O (–2,49 bar)	0.5 psia (34,5 mbar abs)	–1000 inH_2O (–2,49 bar)	0.5 psia (34,5 mbar abs)
4	3 psi (0,20 bar)	300 psi (20,6 bar)	–300 psi (–20,6 bar)	0.5 psia (34,5 mbar abs)	–300 psi (–20,6 bar)	0.5 psia (34,5 mbar abs)	–300 psi (–20,6 bar)	0.5 psia (34,5 mbar abs)
5	20 psi (1,38 bar)	2000 psi (137,9 bar)	– 2000 psi (–137,9 bar)	0.5 psia (34,5 mbar abs)	NA	NA	– 2000 psi (–137,9 bar)	0.5 psia (34,5 mbar abs)

(1) Range 0 only available with 3051CD. Range 1 only available with 3051CD or 3051CG.

Table A-2. Range and Sensor Limits

3051CA			
Range	Range and Sensor Limits		
	Minimum Span	Upper (URL)	Lower (LRL)
1	0.3 psia (20,6 mbar)	30 psia (2,07 bar)	0 psia (0 bar)
2	1.5 psia (0,103 bar)	150 psia (10,3 bar)	0 psia (0 bar)
3	8 psia (0,55 bar)	800 psia (55,2 bar)	0 psia (0 bar)
4	40 psia (2,76 bar)	4000 psia (275,8 bar)	0 psia (0 bar)

3051T				
Range	Range and Sensor Limits			
	Minimum Span	Upper (URL)	Lower (LRL)	Lower(1) (LRL) (Gage)
1	0.3 psi (20,6 mbar)	30 psi (2,07 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)
2	1.5 psi (0,103 bar)	150 psi (10,3 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)
3	8 psi (0,55 bar)	800 psi (55,2 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)
4	40 psi (2,76 bar)	4000 psi (275,8 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)
5	2000 psi (137,9 bar)	10000 psi (689,4 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)

(1) Assumes atmospheric pressure of 14.7 psig.

Zero and Span Adjustment Requirements (*HART* and Low Power)

Zero and span values can be set anywhere within the range limits stated in Table A-1 and Table A-2.

Span must be greater than or equal to the minimum span stated in Table A-1 and Table A-2.

Service

Liquid, gas, and vapor applications

4–20 mA (Output Code A)

Output

Two-wire 4–20 mA, user-selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to the *HART* protocol.

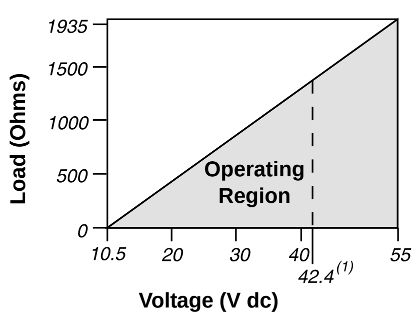
Power Supply

External power supply required. Standard transmitter (4–20 mA) operates on 10.5 to 55 V dc with no load.

Load Limitations

Maximum loop resistance is determined by the voltage level of the external power supply, as described by:

Max. Loop Resistance = 43.5 (Power Supply Voltage – 10.5)



Communication requires a minimum loop resistance of 250 ohms.

(1) For CSA approval, power supply must not exceed 42.4 V.

FOUNDATION fieldbus (output code F) and Profibus (output code W)

Power Supply

External power supply required; transmitters operate on 9.0 to 32.0 V dc transmitter terminal voltage.

Current Draw

17.5 mA for all configurations (including LCD display option)

FOUNDATION fieldbus Function Block Execution Times

Block	Execution Time
Resource	-
Transducer	-
LCD Block	-
Analog Input 1, 2	30 milliseconds
PID	45 milliseconds
Input Selector	30 milliseconds
Arithmetic	35 milliseconds
Signal Characterizer	40 milliseconds
Integrator	35 milliseconds

FOUNDATION fieldbus Parameters

Schedule Entries	7 (max.)
Links	20 (max.)
Virtual Communications Relationships (VCR)	12 (max.)

Standard Function Blocks

Resource Block

Contains hardware, electronics, and diagnostic information.

Transducer Block

Contains actual sensor measurement data including the sensor diagnostics and the ability to trim the pressure sensor or recall factory defaults.

LCD Block

Configures the local display.

2 Analog Input Blocks

Processes the measurements for input into other function blocks. The output value is in engineering units or custom and contains a status indicating measurement quality.

PID Block

Contains all logic to perform PID control in the field including cascade and feedforward.

Backup Link Active Scheduler (LAS)

The transmitter can function as a Link Active Scheduler if the current link master device fails or is removed from the segment.

Advanced Control Function Block Suite (Option Code A01)

Input Selector Block

Selects between inputs and generates an output using specific selection strategies such as minimum, maximum, midpoint, average or first “good.”

Arithmetic Block

Provides pre-defined application-based equations including flow with partial density compensation, electronic remote seals, hydrostatic tank gauging, ratio control and others.

Signal Characterizer Block

Characterizes or approximates any function that defines an input/output relationship by configuring up to twenty X, Y coordinates. The block interpolates an output value for a given input value using the curve defined by the configured coordinates.

Integrator Block

Compares the integrated or accumulated value from one or two variables to pre-trip and trip limits and generates discrete output signals when the limits are reached. This block is useful for calculating total flow, total mass, or volume over time.

FOUNDATION fieldbus Diagnostics Suite (Option Code D01)

The 3051C FOUNDATION fieldbus Diagnostics provide Abnormal Situation Prevention (ASP) indictation. The integral statistical process monitoring (SPM) technology calculates the mean and standard deviation of the process variable 22 times per second. The 3051C ASP algorithm uses these values and highly flexible configuration options for customization to many user-defined or application specific abnormal situations. The detection of plugged impulse lines is the first available predefined application.

Low Power (Output Code M)

Output

Three wire 1–5 V dc or 0.8–3.2 V dc (Option Code C2) user-selectable output. Also user selectable for linear or square root output configuration. Digital process variable superimposed on voltage signal, available to any host conforming to the *HART* protocol. Low-power transmitter operates on 6–14 V dc with no load.

Power Consumption

3.0 mA, 18–36 mW

Minimum Load Impedance

100 kΩ (V_{out} wiring)

Indication

Optional 5-digit LCD display

Overpressure Limits

Rosemount 3051CD/CG

- Range 0: 750 psi (51,7 bar)
- Range 1: 2000 psig (137,9 bar)
- Ranges 2–5: 3626 psig (250 bar)
  4500 psig (310,3 bar) for option code P9

Rosemount 3051CA

- Range 1: 750 psia (51,7 bar)
- Range 2: 1500 psia (103,4 bar)
- Range 3: 1600 psia (110,3 bar)
- Range 4: 6000 psia (413,7 bar)

Rosemount 3051H

- All Ranges: 3626 psig (25 MPa)

Rosemount 3051TG/TA

- Range 1: 750 psi (51,7 bar)
- Range 2: 1500 psi (103,4 bar)
- Range 3: 1600 psi (110,3 bar)
- Range 4: 6000 psi (413,7 bar)
- Range 5: 15000 psi (1034,2 bar)

For 3051L or Level Flange Option Codes FA, FB, FC, FD, FP, and FQ, limit is 0 psia to the flange rating or sensor rating, whichever is lower.

Table A-3. 3051L and Level Flange Rating Limits

Standard	Type	CS Rating	SST Rating
ANSI/ASME	Class 150	285 psig	275 psig
ANSI/ASME	Class 300	740 psig	720 psig
ANSI/ASME	Class 600	1480 psig	1440 psig
At 100 °F (38 °C), the rating decreases with increasing temperature.			
DIN	PN 10–40	40 bar	40 bar
DIN	PN 10/16	16 bar	16 bar
DIN	PN 25/40	40 bar	40 bar
At 248 °F (120 °C), the rating decreases with increasing temperature.			

Static Pressure Limit

Rosemount 3051CD Only

Operates within specifications between static line pressures of 0.5 psia and 3626 psig (4500 psig (310, 3 bar) for
Option Code P9).

Range 0: 0.5 psia and 750 psig (3, 4 bar and 51, 7 bar)

Range 1: 0.5 psia and 2000 psig (3, 4 bar and 137, 9 bar)

Burst Pressure Limits

Burst pressure on Coplanar, traditional, or 3051H process flange is 10000 psig (69 MPa).

Burst pressure for the 3051T is

Ranges 1–4: 11000 psi (75,8 MPa)

Range 5: 26000 psig (179 MPa)

Failure Mode Alarm

Output Code A

If self-diagnostics detect a gross transmitter failure, the analog signal will be driven either below 3.75 mA or to 21.75 mA to alert the user. NAMUR-compliant values are available, option code C4. High or low alarm signal is user-selectable by internal jumper.

Output Code M

If self-diagnostics detect a gross transmitter failure, the analog signal will be driven either below 0.94 V or above 5.4 V to alert the user (below 0.75 V or above 4.4 V for Option C2). High or low alarm signal is user-selectable by internal jumper.

Output Code F and W

If self-diagnostics detect a gross transmitter failure, that information gets passed as a status along with the process variable.

Temperature Limits

Ambient

–40 to 185 °F (–40 to 85 °C)

With LCD display[1]: –40 to 175 °F (–40 to 80 °C)

Storage

–50 to 230 °F (–46 to 110 °C)

With LCD display: –40 to 185 °F (–40 to 85 °C)

Process

At atmospheric pressures and above. See Table A-4

(1) LCD display may not be readable and LCD updates will be slower at temperatures below -4 °F (-20 °C).

Table A-4. 3051 Process Temperature Limits

3051CD, 3051CG, 3051CA	
Silicone Fill Sensor(1)	
with Coplanar Flange	–40 to 250 °F (–40 to 121 °C)(2)
with Traditional Flange	–40 to 300 °F (–40 to 149 °C)(2)(3)
with Level Flange	–40 to 300 °F (–40 to 149 °C)(2)
with 305 Integral Manifold	–40 to 300 °F (–40 to 149 °C)(2)
Inert Fill Sensor(1)	-40 to 185 °F (–40 to 85 °C)(4)(5)
3051H (Process Fill Fluid)	
D.C.® Silicone 200(1)	–40 to 375 °F (–40 to 191 °C)
Inert(1)	–50 to 350 °F (–45 to 177 °C)
Neobee M-20®(1)	0 to 375 °F (–18 to 191 °C)
3051T (Process Fill Fluid)	
Silicone Fill Sensor(1)	–40 to 250 °F (–40 to 121 °C)(2)
Inert Fill Sensor(1)	–22 to 250 °F (–30 to 121 °C)(2)
3051L Low-Side Temperature Limits	
Silicone Fill Sensor(1)	–40 to 250 °F (–40 to 121 °C)(2)
Inert Fill Sensor(1)	0 to 185 °F (–18 to 85 °C)(2)
3051L High-Side Temperature Limits (Process Fill Fluid)	
Syltherm® XLT	–100 to 300 °F (–73 to 149 °C)
D.C. Silicone 704®	32 to 400 °F (0 to 205 °C)
D.C. Silicone 200	–40 to 400 °F (–40 to 205 °C)
Inert	–50 to 350 °F (–45 to 177 °C)
Glycerin and Water	0 to 200 °F (–18 to 93 °C)
Neobee M-20	0 to 400 °F (–18 to 205 °C)
Propylene Glycol and Water	0 to 200 °F (–18 to 93 °C)

(1) Process temperatures above 185 °F (85 °C) require derating the ambient limits by a 1.5:1 ratio (0.6:1 ratio for the 3051H).
(2) 220 °F (104 °C) limit in vacuum service; 130 °F (54 °C) for pressures below 0.5 psia.
(3) 3051CD0 process temperature limits are –40 to 212 °F (–45 to 100 °C)
(4) 160 °F (71 °C) limit in vacuum service.
(5) Not available for 3051CA.

Humidity Limits

0–100% relative humidity

Turn-On Time

Performance within specifications less than 2.0 seconds (10.0 s for Profibus protocol) after power is applied to the transmitter

Volumetric Displacement

Less than 0.005 in^3 (0,08 cm^3)

Damping

Analog output response to a step input change is user-selectable from 0 to 36 seconds for one time constant. This software damping is in addition to sensor module response time.

PHYSICAL SPECIFICATIONS

Electrical Connections

$^1/_2$–14 NPT, G$^1/_2$, and M20 × 1.5 (CM20) conduit. HART interface connections fixed to terminal block.

Process Connections

All Models except 3051L and 3051T

$^1/_4$–18 NPT on 2$^1/_8$-in. centers

$^1/_2$–14 NPT on 2-, 2$^1/_8$-, or 2$^1/_4$-in. centers

Rosemount 3051L

High pressure side: 2-, 3-, or 4-in., ASME B 16.5 (ANSI) Class 150, 300 or 600 flange; 50, 80 or 100 mm, PN 40 or 10/16 flange

Low pressure side: $^1/_4$–18 NPT on flange $^1/_2$–14 NPT on adapter

Rosemount 3051T

$^1/_2$–14 NPT female. A DIN 16288 Male (available in SST for Range 1–4 transmitters only), or Autoclave type F-250-C (Pressure relieved $^9/_{16}$–18 gland thread; $^1/_4$ OD high pressure tube 60° cone; available in SST for Range 5 transmitters only).

Process-Wetted Parts

Drain/Vent Valves

316 SST, Alloy C-276, or Alloy 400/K-500(1) material
(Drain vent seat: Alloy 400, Drain vent stem: Alloy K-500)

(1) Alloy 400/K-500 is not available with 3051L or 3051H.

Process Flanges and Adapters

Plated carbon steel
SST: CF-8M (Cast 316 SST) per ASTM A743
Cast C-276: CW-12MW per ASTM A494
Cast Alloy 400: M-30C per ASTM A494

Wetted O-rings

Glass-filled PTFE or Graphite-filled PTFE

Process Isolating Diaphragms

Isolating Diaphragm Material	3051CD/CG	3051T	3051CA	3051H
316L SST	•	•	•	•
Alloy C-276	•	•	•	•
Alloy 400	•		•	
Tantalum	•			•
Gold-plated Alloy 400	•		•	
Gold-plated SST	•		•	

Rosemount 3051L Process Wetted Parts

Flanged Process Connection (Transmitter High Side)

Process Diaphragms, Including Process Gasket Surface

- 316L SST, Alloy C-276, or Tantalum

Extension

- CF-3M (Cast version of 316L SST, material per ASTM-A743), or Alloy C-276. Fits schedule 40 and 80 pipe.

Mounting Flange

- Zinc-cobalt plated CS or SST

Reference Process Connection (Transmitter Low Side)

Isolating Diaphragms

- 316L SST or Alloy C-276

Reference Flange and Adapter

- CF-8M (Cast version of 316 SST, material per ASTM-A743)

Non-Wetted Parts

Electronics Housing

Low copper aluminum or SST: CF-3M or CF-8M (Cast version of 316L or 316 SST, material per ASTM-A743). NEMA 4X, IP 65, IP 66

Coplanar Sensor Module Housing

CF-3M (Cast version of 316L SST, material per ASTM-A743)

Bolts

ASTM A449, Type 1 (zinc-cobalt plated carbon steel)
ASTM F593G, Condition CW1 (Austenitic 316 SST)
ASTM A193, Grade B7M (zinc plated alloy steel)
Alloy 400

Sensor Module Fill Fluid

Silicone oil (D.C. 200) or Fluorocarbon oil (Halocarbon or Fluorinert® FC-43 for 3051T)

Process Fill Fluid (3051L and 3051H only)

3051L: Syltherm XLT, D.C. Silicone 704,
D.C. Silicone 200, inert, glycerin and water, Neobee M-20 or propylene glycol and water

3051H: inert, Neobee M-20, or D.C. Silicone 200

Paint

Polyurethane

Cover O-rings

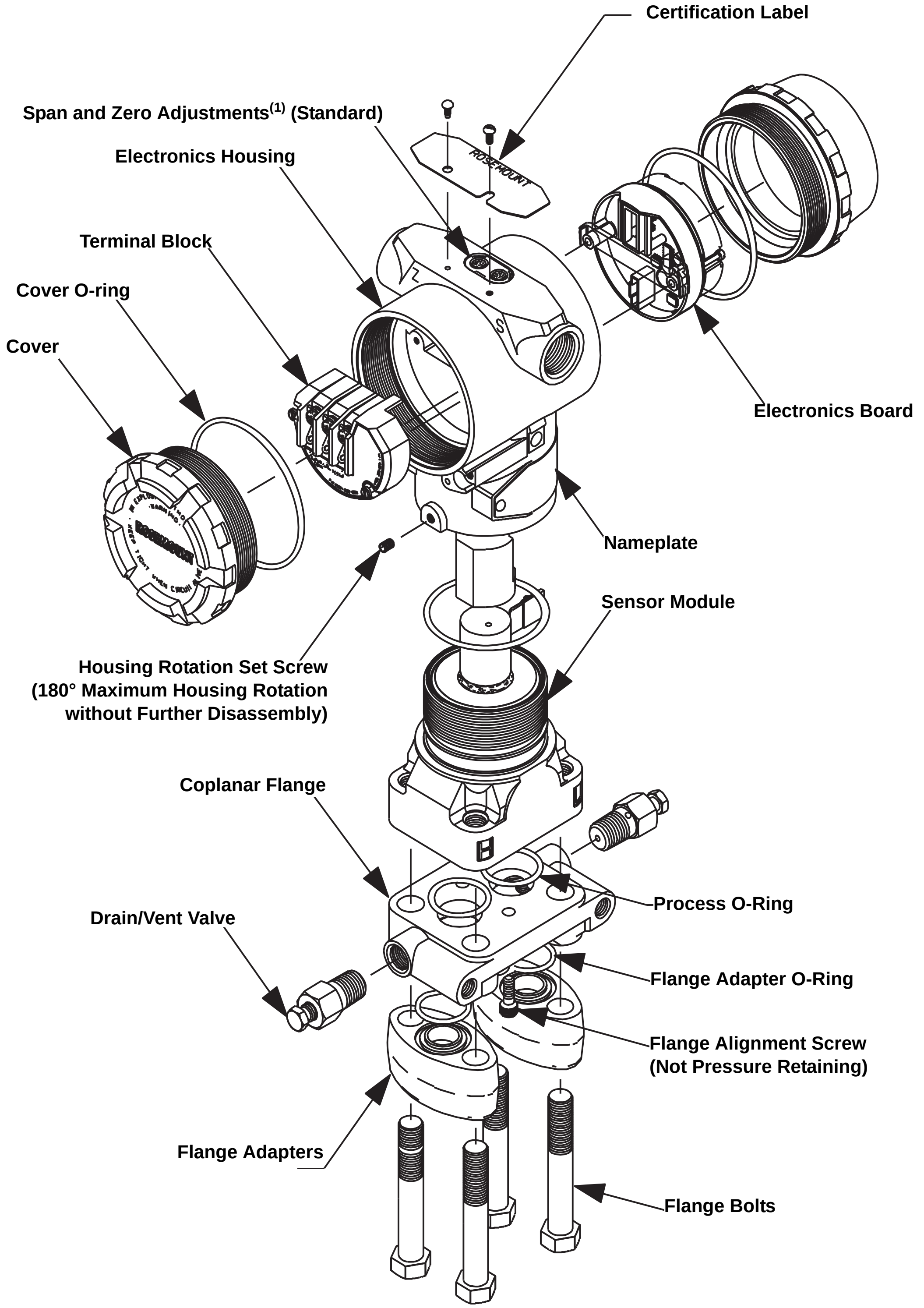
Buna-N

Shipping Weights

Refer to “Shipping Weights” on page A-39.

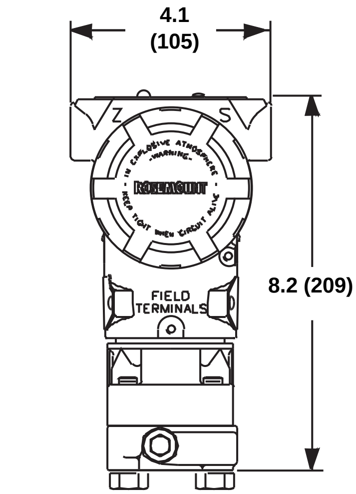
DIMENSIONAL DRAWINGS

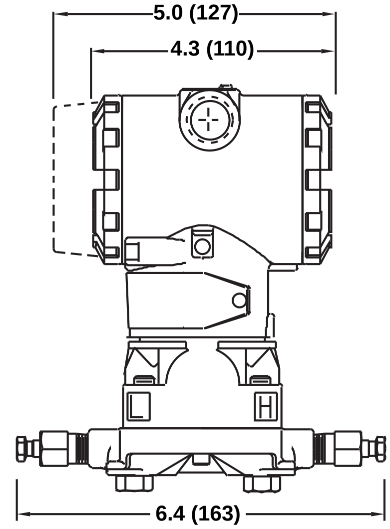
3051 Exploded View



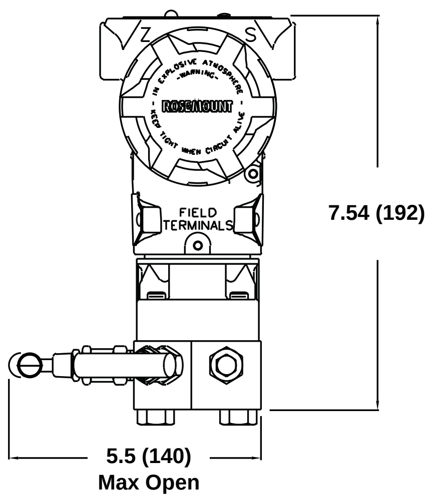
1) Span and Zero Adjustments are not available with fieldbus or profibus protocols.

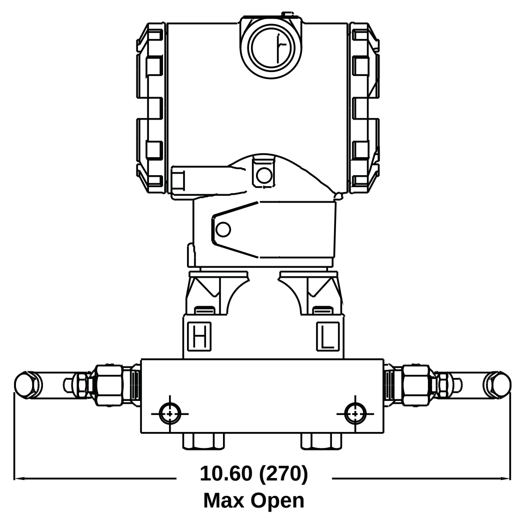
3051C Coplanar Flange



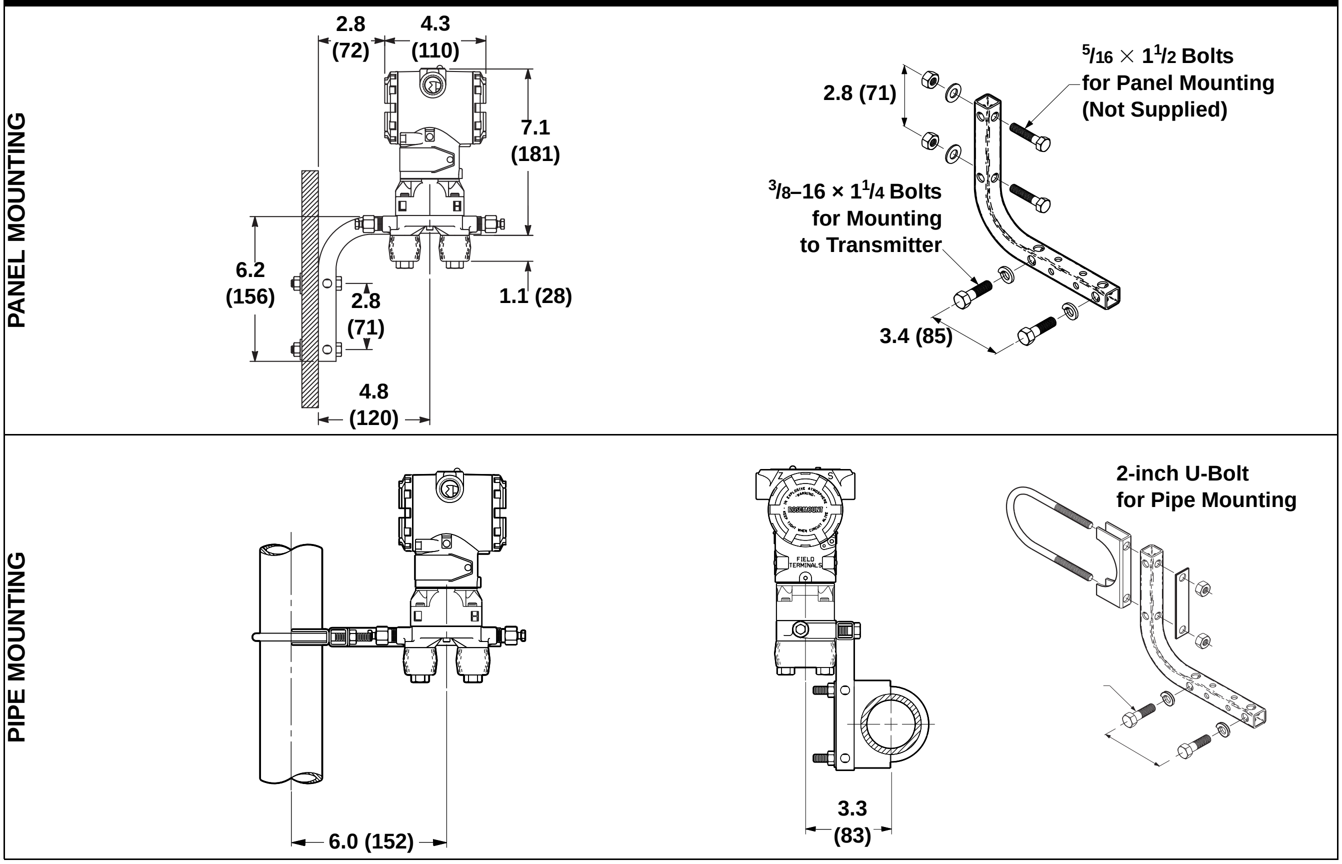


3051C Coplanar Flange with Rosemount 305 Coplanar Integral Manifold



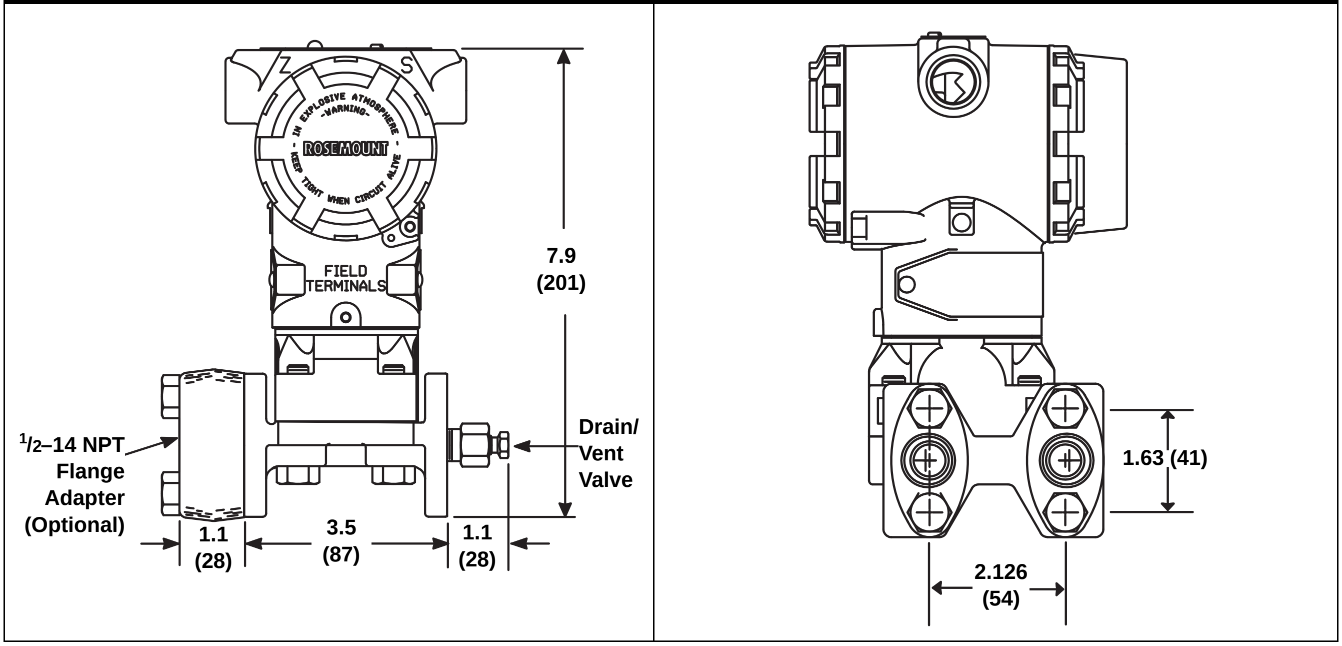


Coplanar Flange Mounting Configurations with Optional Bracket (B4) for 2-in. Pipe or Panel Mounting



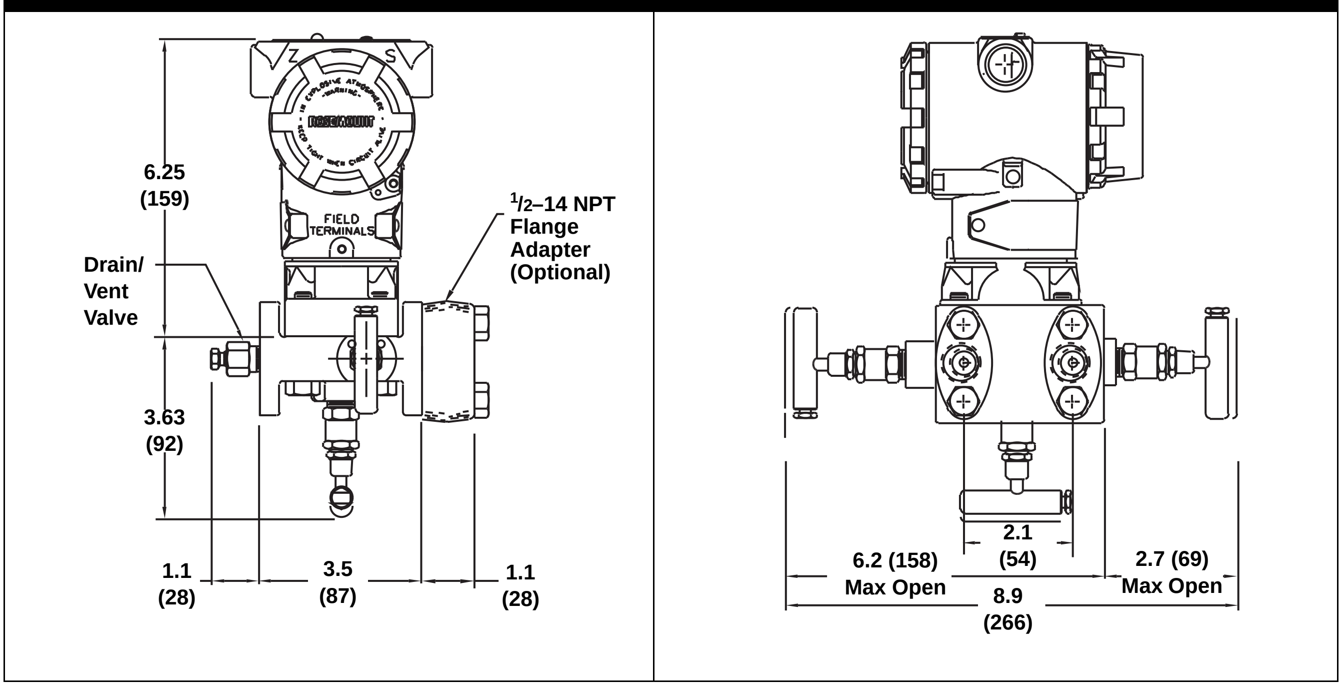
Dimensions are in inches (millimeters)

3051C Coplanar with Traditional Flange



Dimensions are in inches (millimeters)

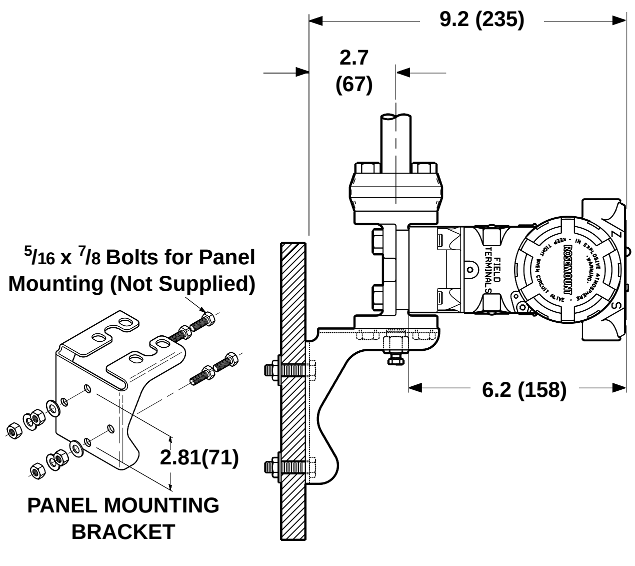
3051C Coplanar with Rosemount 305 Traditional Integral Manifold



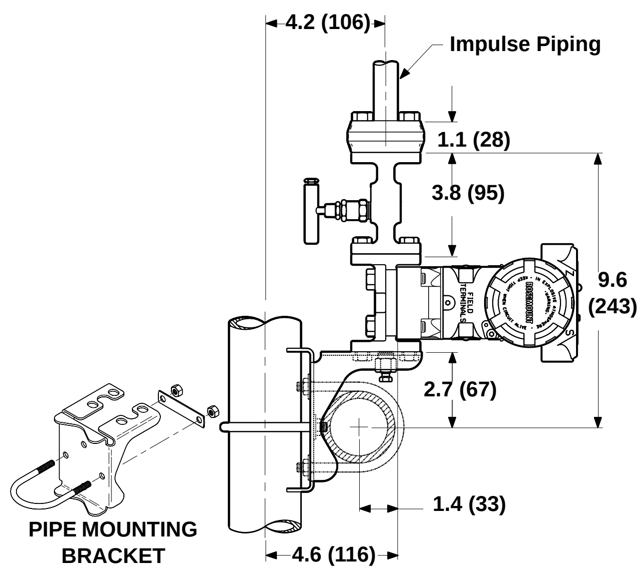
Dimensions are in inches (millimeters)

Traditional Flange Mounting Configurations with Optional Brackets for 2-in. Pipe or Panel Mounting

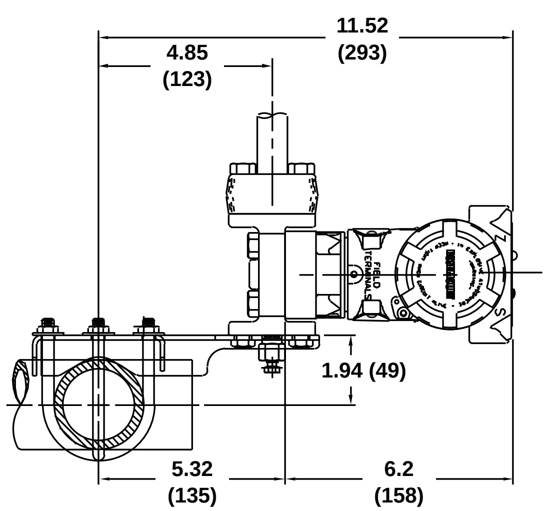
Panel Mounting Bracket (option B2/B8)



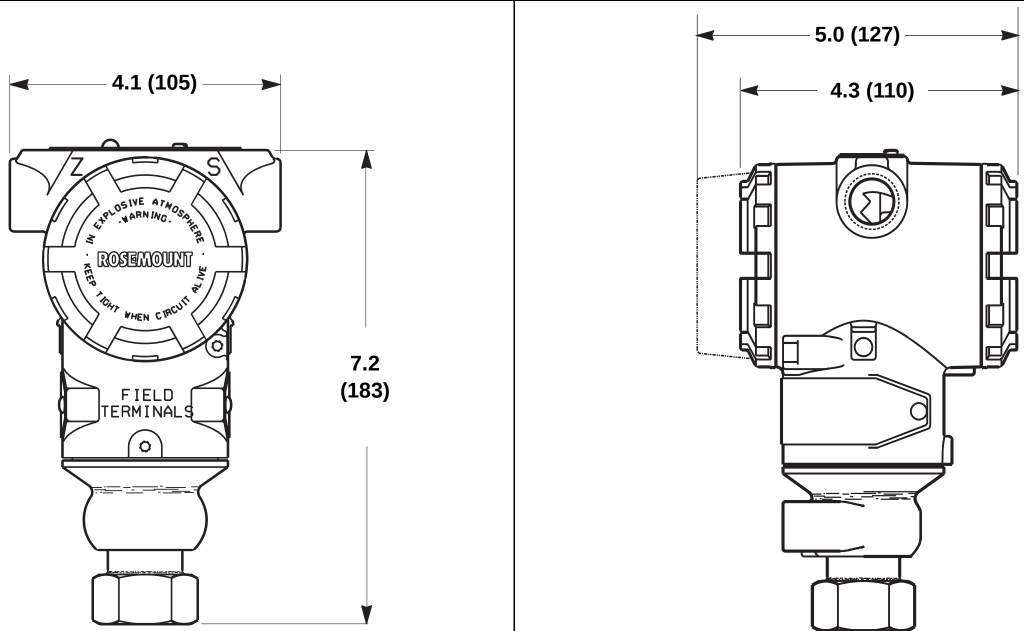
2-in. Pipe Mounting Bracket (option B1/B7/BA)



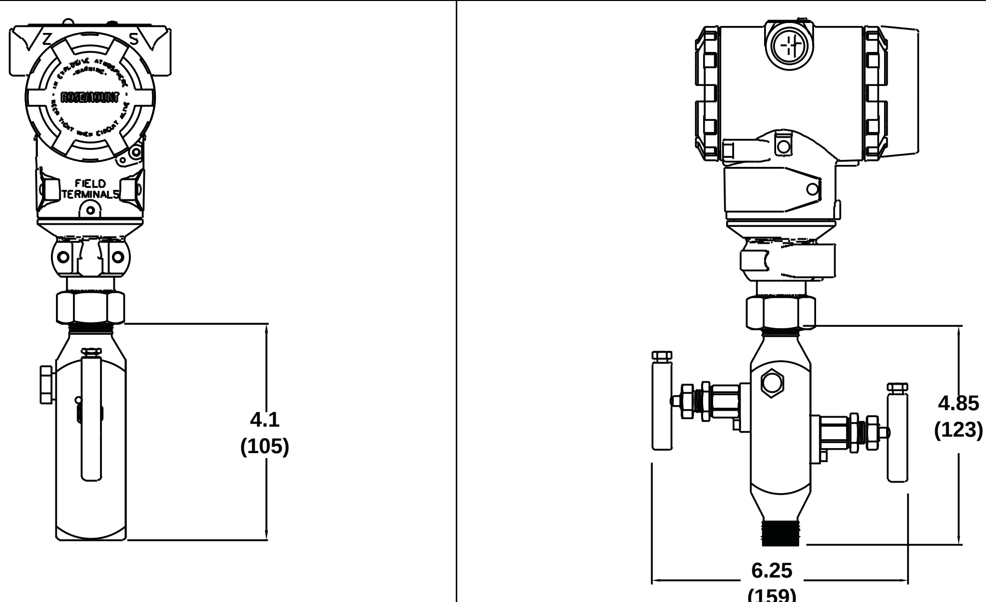
2-in. Pipe Mounting Bracket (option B3/B9/BC)



3051T Dimensional Drawings

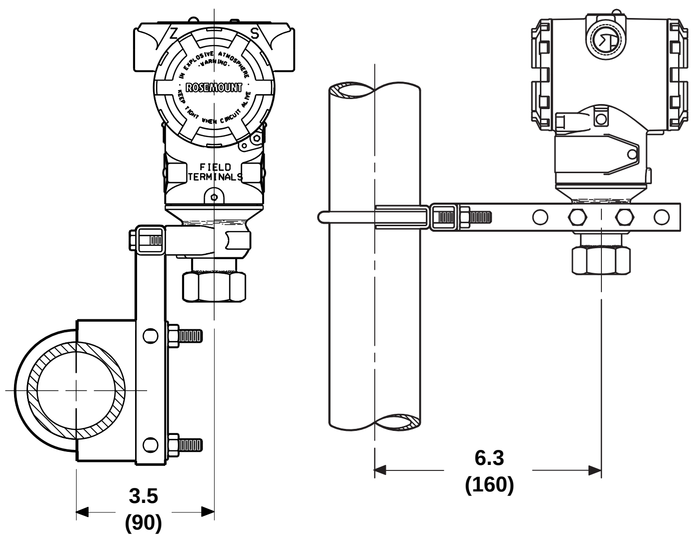


3051T with Rosemount 306 Integral Manifold

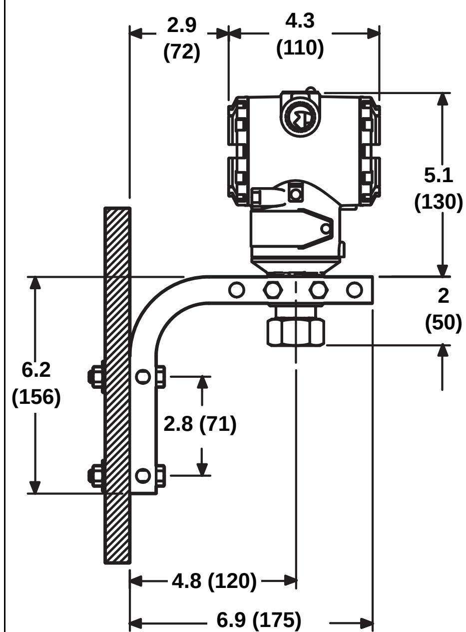


3051T Typical Mounting Configurations with Optional Mounting Bracket

Pipe Mounting



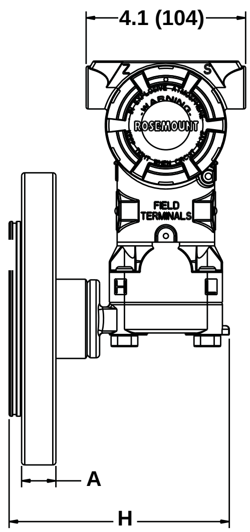
Panel Mounting



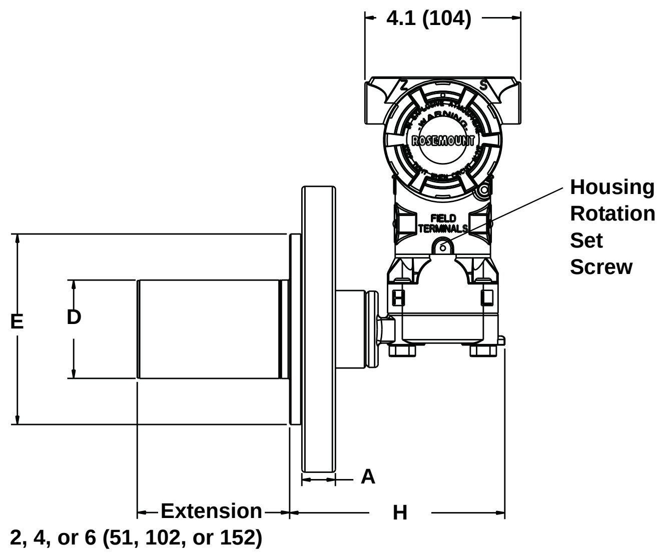
Dimensions are in inches (millimeters)

3051L Dimensional Drawings

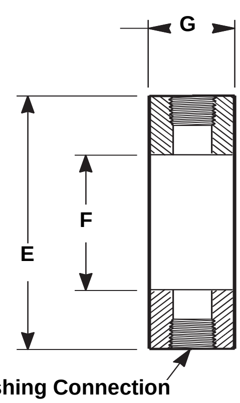
2-in. Flange Configuring (Flush Mount Only)



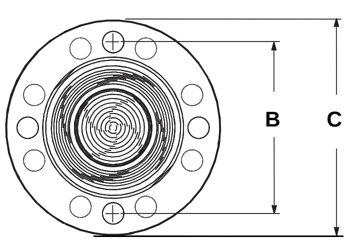
3- and 4-in. Flange Configuration

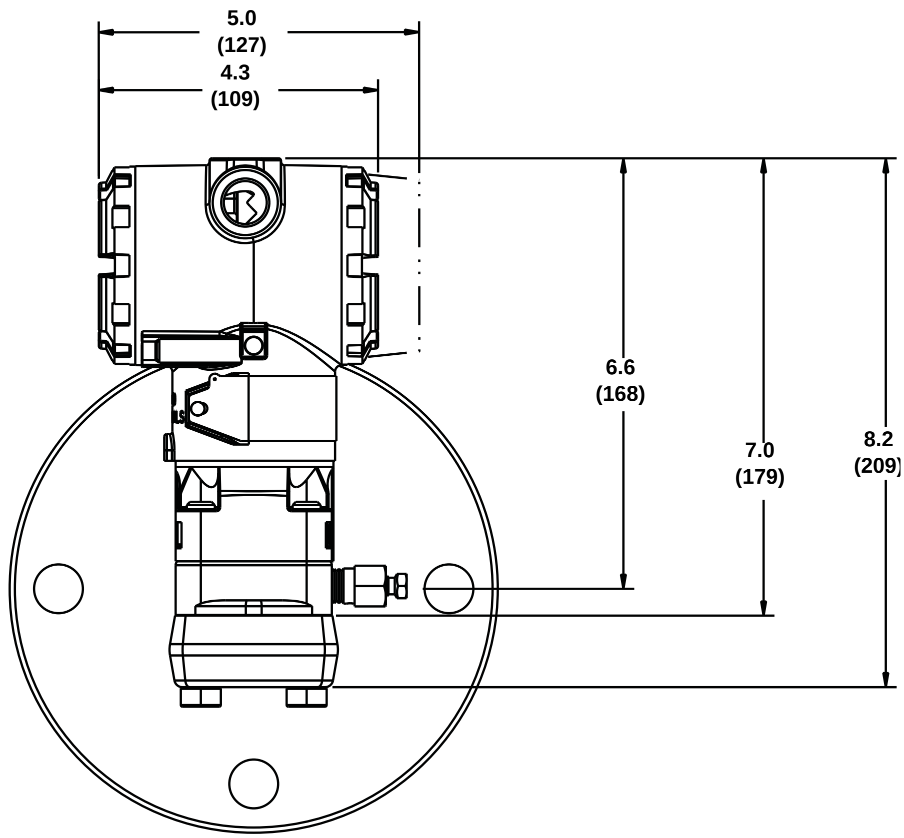


Optional Flushing Connection Ring (Lower Housing)



Diaphragm Assembly and Mounting Flange





Dimensions are in inches (millimeters)

TABLE 1. 3051L Dimensional Specifications

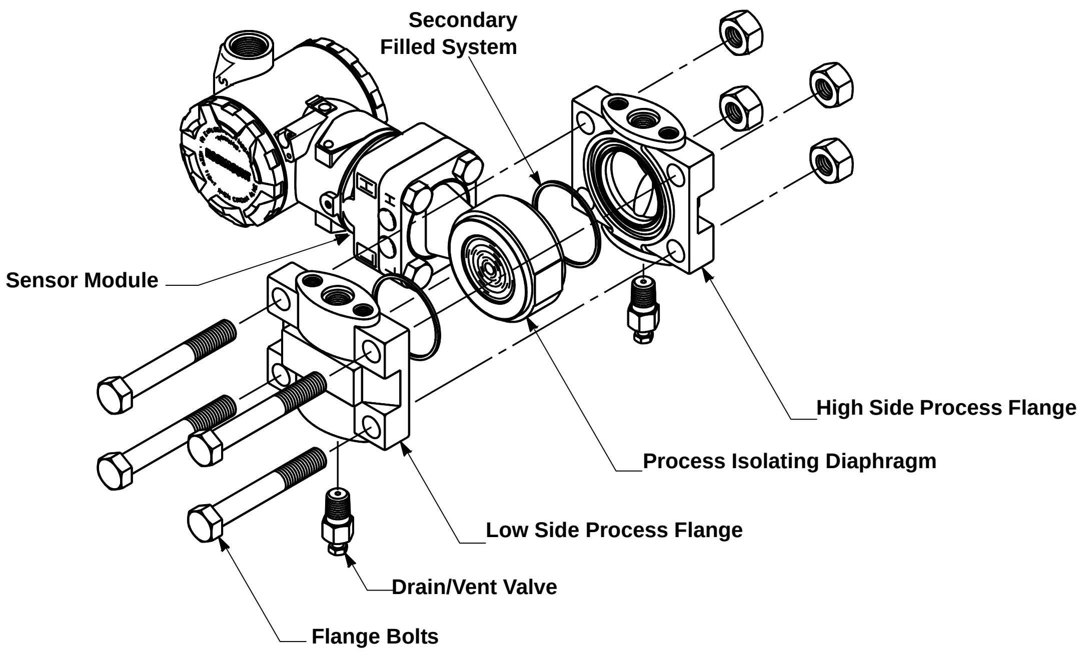
Except where indicated, dimensions are in inches (millimeters).

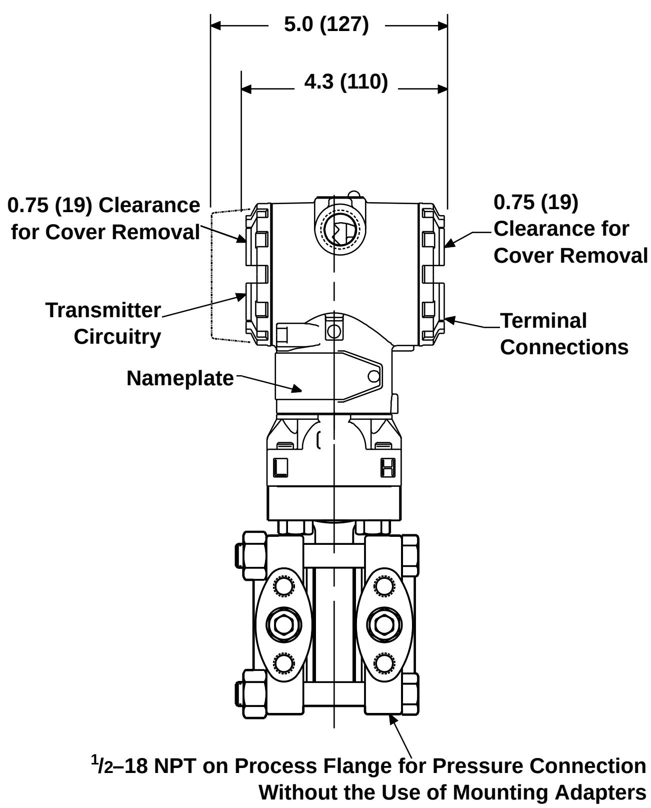
Class	Pipe Size	Flange Thickness A	Bolt Circle Diameter B	Outside Diameter C	No. of Bolts	Bolt Hole Diameter	Extension Diameter(1) D	O.D. Gasket Surface E
ASME B16.5 (ANSI) 150	2 (51)	0.69 (18)	4.75 (121)	6.0 (152)	4	0.75 (19)	NA	3.6 (92)
	3 (76)	0.88 (22)	6.0 (152)	7.5 (191)	4	0.75 (19)	2.58 (66)	5.0 (127)
	4 (102)	0.88 (22)	7.5 (191)	9.0 (229)	8	0.75 (19)	3.5 (89)	6.2 (158)
ASME B16.5 (ANSI) 300	2 (51)	0.82 (21)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6 (92)
	3 (76)	1.06 (27)	6.62 (168)	8.25 (210)	8	0.88 (22)	2.58 (66)	5.0 (127)
	4 (102)	1.19 (30)	7.88 (200)	10.0 (254)	8	0.88 (22)	3.5 (89)	6.2 (158)
ASME B16.5 (ANSI) 600	2 (51)	1.00 (25)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6 (92)
	3 (76)	1.25 (32)	6.62 (168)	8.25 (210)	8	0.88 (22)	2.58 (66)	5.0 (127)
DIN 2501 PN 10–40	DN 50	20 mm	125 mm	165 mm	4	18 mm	NA	4.0 (102)
DIN 2501 PN 25/40	DN 80	24 mm	160 mm	200 mm	8	18 mm	66 mm	5.4 (138)
	DN 100	24 mm	190 mm	235 mm	8	22 mm	89 mm	6.2 (158)
DIN 2501 PN 10/16	DN 100	20 mm	180 mm	220 mm	8	18 mm	89 mm	6.2 (158)

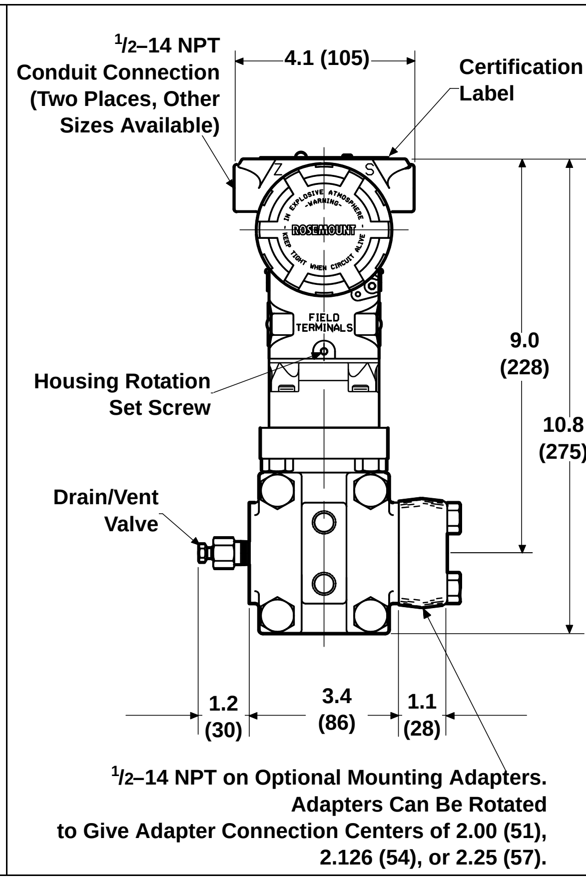
Class	Pipe Size	Process Side F	Lower Housing G		H
			1/4 NPT	1/2 NPT	
ASME B16.5 (ANSI) 150	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	5.65 (143)
	3 (76)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	4 (102)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
ASME B16.5 (ANSI) 300	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	5.65 (143)
	3 (76)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	4 (102)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
ASME B16.5 (ANSI) 600	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	7.65 (194)
	3 (76)	3.6 (91)	0.97 (25)	1.31 (33)	7.65 (194)
DIN 2501 PN 10–40	DN 50	2.4 (61)	0.97 (25)	1.31 (33)	5.65 (143)
DIN 2501 PN 25/40	DN 80	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	DN 100	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
DIN 2501 PN 10/16	DN 100	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)

(1) Tolerances are 0.040 (1,02), –0.020 (0,51).

3051H Pressure Transmitter Exploded View and Dimensional Drawings



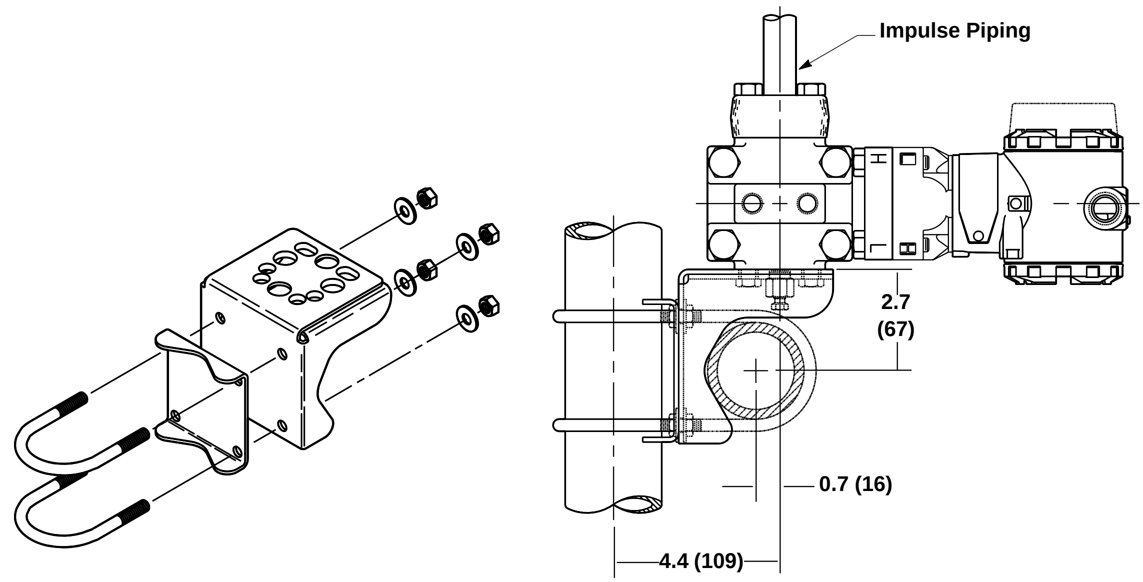




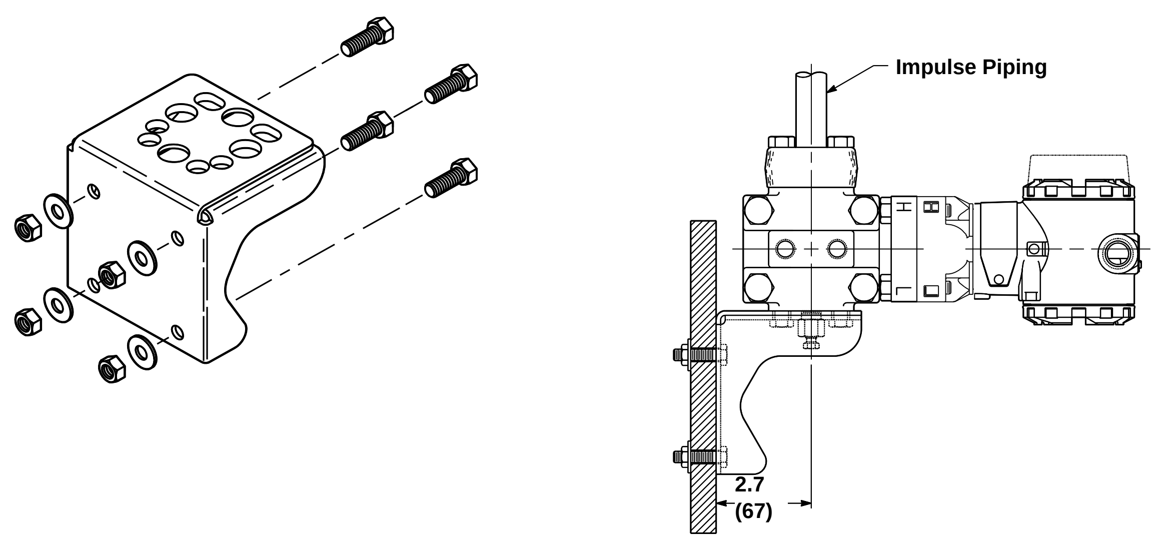
Dimensions are in inches (millimeters)

3051H Mounting Brackets for 2-in. Pipe and Panel Mount (Option Code B5/B6)

PIPE MOUNTING CONFIGURATION



PANEL MOUNTING CONFIGURATION
$^{7}/_{16}$–20×$^{3}/_{4}$ Bolts Supplied for Attaching Bracket to Transmitter



Dimensions are in inches (millimeters)

ORDERING INFORMATION

TABLE 2. 3051C Differential, Gage, and Absolute Pressure Transmitters — = Not Applicable

Model	Transmitter Type (Select One)			CD	CG	CA
3051CD	Differential Pressure Transmitter			•	—	—
3051CG	Gage Pressure Transmitter			—	•	—
3051CA	Absolute Pressure Transmitter			—	—	•
Code	**Pressure Ranges (Range/Min. Span)**			**CD**	**CG**	**CA**
	3051CD	**3051CG**[1]	**3051CA**			
0[2]	–3 to 3 inH_2O/0.1 inH_2O (–7,5 to 7,5 mbar/0,25 mbar)	Not Applicable	Not Applicable	•	—	—
1	–25 to 25 inH_2O/0.5 inH_2O (–62,2 to 62,2 mbar/1,2 mbar)	–25 to 25 inH_2O/0.5 inH_2O (–62,1 to 62,2 mbar/1,2 mbar)	0 to 30 psia/0.3 psia (0 to 2,1 bar/20,7 mbar)	•	•	•
2	–250 to 250 inH2O/2.5 inH_2O (–623 to 623 mbar/6,2 mbar)	–250 to 250 inH_2O/2.5 inH_2O (–621 to 623 mbar/6,2 mbar)	0 to 150 psia/1.5 psia (0 to 10,3 bar/0,1 bar)	•	•	•
3	–1000 to 1000 inH_2O/10 inH_2O (–2,5 to 2,5 bar/25 mbar)	–393 to 1000 inH_2O/10in H_2O (–0,98 to 2,5 bar/25 mbar)	0 to 800 psia/8 psia (0 to 55,2 bar/0,55 bar)	•	•	•
4	–300 to 300 psi/3 psi (–20,7 to 20,7 bar/0,2 bar)	–14.2 to 300 psi/3 psi (–0,98 to 20,7 bar/0,2 bar)	0 to 4000 psia/40 psia (0 to 275,8 bar/2,8 bar)	•	•	•
5	–2000 to 2000 psi/20 psi (–137,9 to137,9 bar/1,4 bar)	–14.2 to 2000 psi/20 psi (–0,98 to 137,9 bar/1,4 bar)	Not Applicable	•	•	—
Code	**Output**			**CD**	**CG**	**CA**
A	4–20 mA with Digital Signal Based on *HART* Protocol			•	•	•
M[3]	Low-Power, 1–5 V dc with Digital Signal Based on HART Protocol			•	•	•
F	FOUNDATION fieldbus Protocol			•	•	•
W	Profibus — PA			•	•	•
Code	**Materials of Construction**			**CD**	**CG**	**CA**
	Process Flange Type	**Flange Material**	**Drain/Vent**	•	•	•
2	Coplanar	SST	SST	•	•	•
3[4]	Coplanar	Cast C-276	Alloy C-276	•	•	•
4	Coplanar	Cast Alloy 400	Alloy 400	•	•	•
5	Coplanar	Plated CS	SST	•	•	•
7[4]	Coplanar	SST	Alloy C-276	•	•	•
8[4]	Coplanar	Plated CS	Alloy C-276	•	•	•
0	Alternate Flange—See Options on page A-25			•	•	•
Code	**Isolating Diaphragm**			**CD**	**CG**	**CA**
2[4]	316L SST			•	•	•
3[4]	Alloy C-276			•	•	•
4	Alloy 400			•	•	•
5	Tantalum *(Available on 3051CD and CG, Ranges 2–5 only. Not available on 3051CA)*			•	•	—
6	Gold-plated Alloy 400 *(Use in combination with O-ring Option Code B.)*			•	•	•
7	Gold-plated SST			•	•	•
Code	**O-ring**					
A	Glass-filled PTFE			•	•	•
B	Graphite-filled PTFE			•	•	•
Code	**Fill Fluid**			**CD**	**CG**	**CA**
1	Silicone			•	•	•
2	Inert fill (Halocarbon)			•	•	—

TABLE 2. 3051C Differential, Gage, and Absolute Pressure Transmitters — = Not Applicable

Code	Housing Material	Conduit Entry Size	CD	CG	CA
A	Polyurethane-covered Aluminum	½–14 NPT	•	•	•
B	Polyurethane-covered Aluminum	M20 × 1.5 (CM20)	•	•	•
D	Polyurethane-covered Aluminum	G½	•	•	•
J	SST	½–14 NPT	•	•	•
K	SST	M20 × 1.5 (CM20)	•	•	•
M	SST	G½	•	•	•
Code	**PlantWeb Functionality (Optional)**		**CD**	**CG**	**CA**
A01	Advanced Control Function Block Suite		•	•	•
D01	FOUNDATION fieldbus Diagnostics Suite		•	•	•
Code	**Alternate Process Connection: Flange**		**CD**	**CG**	**CA**
H2	Traditional Flange, 316 SST, SST Drain/Vent		•	•	•
H3(4)	Traditional Flange, Cast C-276 Alloy C-276 Drain/Vent		•	•	•
H4	Traditional Flange, Cast Alloy 400, Alloy 400/K-500 Drain/Vent		•	•	•
H7(4)	Traditional Flange, 316 SST, Alloy C-276 Drain/Vent		•	•	•
HJ	DIN Compliant Traditional Flange, SST, 1/16 in. Adapter/Manifold Bolting		•	•	•
HK	DIN Compliant Traditional Flange, SST, 10 mm Adapter/Manifold Bolting		•	•	•
HL	DIN Compliant Traditional Flange, SST, 12mm Adapter/Manifold Bolting *(Not available on 3051CD0)*		•	•	•
FA	Level Flange, SST, 2 in., ANSI Class 150, Vertical Mount		•	•	•
FB	Level Flange, SST, 2 in., ANSI Class 300, Vertical Mount		•	•	•
FC	Level Flange, SST, 3 in., ANSI Class 150, Vertical Mount		•	•	•
FD	Level Flange, SST, 3 in., ANSI Class 300, Vertical Mount		•	•	•
FP	DIN Level Flange, SST, DN 50, PN 40, Vertical Mount		•	•	•
FQ	DIN Level Flange, SST, DN 80, PN 40, Vertical Mount		•	•	•
Code	**Alternate Process Connection: Manifold**		**CD**	**CG**	**CA**
S5(5)	Assemble to Rosemount 305 Integral Manifold		•	•	•
S6(5)	Assemble to Rosemount 304 Manifold or Connection System		•	•	•
Code	**Alternate Process Connection: Primary Element**		**CD**	**CG**	**CA**
S4(5)	Assemble to Rosemount Annubar or Rosemount 1195 Integral Orifice		•	—	—
S3(5)	Assemble to Rosemount 405 Compact Orifice Plate		•	—	—
Code	**Diaphragm Seal Assemblies**		**CD**	**CG**	**CA**
S1(5)	Assemble to one Rosemount 1199 diaphragm seal		•	•	•
S2(5)	Assemble to two Rosemount 1199 diaphragm seals		•	—	—
Code	**All Welded Diaphragm Seal Systems (for high vacuum applications)**		**CD**	**CG**	**CA**
S7(5)	One Diaphragm Seal, All-Welded System (Capillary Connection Type)		•	•	•
S8(5)	Two Diaphragm Seals, All-Welded System (Capillary Connection Type)		•	—	—
S0(5)	One Diaphragm Seal, All-Welded System (Direct Mount Connection Type)		•	•	•
S9(5)	Two Diaphragm Seals, All-Welded System (One Direct Mount and One Capillary Connection Type)		•	—	—
Code	**Mounting Brackets**		**CD**	**CG**	**CA**
B4	Coplanar Flange Bracket for 2-in. Pipe or Panel Mounting, all SST		•	•	•
B1	Traditional Flange Bracket for 2-in. Pipe Mounting, CS Bolts		•	•	•
B2	Traditional Flange Bracket for Panel Mounting, CS Bolts		•	•	•
B3	Traditional Flange Flat Bracket for 2-in. Pipe Mounting, CS Bolts		•	•	•
B7	B1 Bracket with Series 300 SST Bolts		•	•	•
B8	B2 Bracket with Series 300 SST Bolts		•	•	•
B9	B3 Bracket with Series 300 SST Bolts		•	•	•
BA	SST B1 Bracket with Series 300 SST Bolts		•	•	•
BC	SST B3 Bracket with Series 300 SST Bolts		•	•	•

TABLE 2. 3051C Differential, Gage, and Absolute Pressure Transmitters — = Not Applicable

Code	Product Certifications	CD	CG	CA
E5	FM Explosion-proof, Dust Ignition-proof	•	•	•
I5	FM Intrinsically Safe, Division 2	•	•	•
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2	•	•	•
IE	FM FISCO Intrinsically Safe	•	•	•
I1(6)	ATEX Intrinsic Safety and Dust	•	•	•
IA	ATEX FISCO Intrinsic Safety	•	•	•
N1(7)	ATEX Type n and Dust	•	•	•
E8	ATEX Flameproof and Dust Certification	•	•	•
K8(7)	ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E8, I1 and N1)	•	•	•
E4(7)	TIIS Flameproof	•	•	•
C5(7)	Measurement Canada Accuracy Approval to the Electricity and Gas Inspection Act for the purchase and sale of natural gas	•	•	•
C6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2	•	•	•
K6(7)	CSA and ATEX Explosion-proof, Intrinsically Safe, and Division 2 (combination of C6 and K8)	•	•	•
KB	FM and CSA Explosion-proof, Dust Ignition-Proof, Intrinsically Safe, and Division 2 (combination of K5 and C6)	•	•	•
K7	SAA Flameproof, Dust Ignition-proof, Intrinsic Safety, and Type n (combination of I7, N7, and E7)	•	•	•
KD(7)	CSA, FM, and ATEX Explosion-proof and Intrinsically Safe (combination of K5, C6, I1, and E8)	•	•	•
I7	SAA Intrinsic Safety	•	•	•
E7	SAA Flameproof, Dust Ignition-proof	•	•	•
N7	SAA Type n Certification	•	•	•
E2	INMETRO Flameproof	•	•	•
I2	INMETRO Intrinsic Safety	•	•	•
K2	INMETRO Flameproof, Intrinsic Safety	•	•	•
E3	China Flameproof	•	•	•
I3	China Intrinsic Safety	•	•	•
DW	NSF drinking water approval	•	•	•
Code	**Bolting Options**	**CD**	**CG**	**CA**
L4	Austenitic 316 SST Bolts	•	•	•
L5	ASTM A 193, Grade B7M Bolts	•	•	•
L6	Alloy K-500 Bolts	•	•	•
Code	**Display Options**	**CD**	**CG**	**CA**
M5	LCD display for Aluminum Housing (Housing Codes A, B, C, and D only)	•	•	•
M6	LCD display for SST Housing (Housing Codes J, K, L, and M only)	•	•	•

TABLE 2. 3051C Differential, Gage, and Absolute Pressure Transmitters — = Not Applicable

Code	Other Options	CD	CG	CA
Q4	Calibration Certificate	•	•	•
QG	Calibration Certificate and GOST Verification Certificate	•	•	•
Q8	Material Traceability Certification per EN 10204 3.1.B	•	•	•
Q16	Surface finish certification for sanitary remote seals	•	•	•
QZ	Remote Seal System Performance Calculation Report	•	•	•
QP	Calibration certification and tamper evident seal	•	•	•
QS	Certificate of FMEDA Data	•	•	•
J1(7)(8)	Local Zero Adjustment Only	•	•	•
J3(7)(8)	No Local Zero or Span Adjustment	•	•	•
T1	Transient Protection Terminal Block	•	•	•
C1(7)	Custom Software Configuration (Completed CDS 00806-0100-4001 required with order)	•	•	•
C2(7)	0.8–3.2 V dc Output with Digital Signal Based on *HART* Protocol (Output Code M only)	•	•	•
C3	Gage Calibration (3051CA4 only)	—	—	•
C4(7)(9)	Analog Output Levels Compliant with NAMUR Recommendation NE 43	•	•	•
CN(7)(9)	Analog Output Levels Compliant with NAMUR Recommendation NE 43 Alarm Configuration–Low	•	•	•
P1	Hydrostatic Testing with Certificate	•	•	•
P2	Cleaning for Special Service	•	•	•
P3	Cleaning for <1 PPM Chlorine/Fluorine	•	•	•
P4	Calibrate at line pressure *(Specify Q48 on order for corresponding certificate)*	•	•	•
DF	$^1/_2$ -14 NPT flange adapter(s)— Material determined by flange material	•	•	•
D7	Coplanar Flange Without Drain/Vent Ports	•	•	•
D8	Ceramic Ball Drain/Vents	•	•	•
D9	JIS Process Connection—RC ¼ Flange with RC ½ Flange Adapter	•	•	•
P8	0.04% accuracy to 5:1 turndown (Range 2-4)	•	•	•
P9	4500 psig Static Pressure Limit (3051CD Ranges 2–5 only)	•	—	—
V5(10)	External Ground Screw Assembly	•	•	•
DO	316 SST Conduit Plug	•	•	•
Typical Model Number:	**3051CD 2 A 2 2 A 1 A B4**			

(1) 3051CG lower range limit varies with atmospheric pressure.
(2) 3051CD0 is available only with Output Code A, Process Flange Code 0 (Alternate Flange H2, H7, HJ, or HK), Isolating Diaphragm Code 2, O-ring Code A, and Bolting Option L4.
(3) Not available with hazardous locations certification Options Codes I1, N1, E4, K6 and K8.
(4) Materials of Construction comply with recommendations per NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
(5) "Assemble-to" items are specified separately and require a completed model number.
(6) Not available with Low Power code M.
(7) Not available with Fieldbus (output code F) or Profibus (output code W).
(8) Local zero and span adjustments are standard unless Option Code J1 or J3 is specified
(9) NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
(10) The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.

Table A-5. 3051T Gage and Absolute Pressure Transmitter

Model	Transmitter Type	
3051T	Pressure Transmitter	
Code	**Pressure Type**	
G	Gage	
A	Absolute	
Code	**Pressure Ranges (Range/Min. Span)** **3051TG(1)**	**3051TA**
1	–14.7 to 30 psi/0.3 psi (–1,01 to 2,1 bar/20,7 mbar)	0 to 30 psia/0.3 psia (0 to 2,1 bar/20,7 mbar)
2	–14.7 to 150 psi/1.5 psi (–1,01 to 10,3 bar/103,4 mbar)	0 to 150 psia/1.5 psia (0 to 10,3 bar/103,4 mbar)
3	–14.7 to 800 psi/8 psi (–1,01 to 55,2 bar/0,55 bar)	0 to 800 psia/8 psia (0 to 55,2 bar/0,55 bar)
4	–14.7 to 4000 psi/40 psi (–1,01 to 275,8 bar/2,8 bar)	0 to 4000 psia/40 psia (0 to 275,8 bar/2,8 bar)
5	–14.7 to 10000 psi/2000 psi (–1,01 to 689,5 bar/138 bar)	0 to 10000 psia/2000 psia (0 to 689,5 bar/138 bar)
Code	**Output**	
A	4–20 mA with Digital Signal Based on *HART* Protocol	
M(2)	Low-Power 1–5 V dc with Digital Signal Based on *HART* Protocol	
F	FOUNDATION fieldbus Protocol	
W	Profibus — PA	
Code	**Process Connection Style**	
2A	1/4–18 NPT Female	
2B	1/2–14 NPT Female	
2C	G½ A DIN 16288 Male (Available in SST for Range 1–4 only)	
2F	Coned and Threaded, Compatible with Autoclave Type F-250-C *(Only available in SST for Range 5)*	
61	Non-threaded Instrument flange (Range 1-4 only)	
Code	**Isolating Diaphragm**	**Process Connection Wetted Parts Material**
2(3)	316L SST	316L SST
3(3)	Alloy C-276	Alloy C-276
Code	**Fill Fluid**	
1	Silicone	
2	Inert (Fluorinert® FC-43)	
Code	**Housing Material**	**Conduit Entry Size**
A	Polyurethane-covered Aluminum	½–14 NPT
B	Polyurethane-covered Aluminum	M20 × 1.5 (CM20)
D	Polyurethane-covered Aluminum	G½
J	SST	½–14 NPT
K	SST	M20 × 1.5 (CM20)
M	SST	G½
Code	***PlantWeb* Functionality (Optional)**	
A01	Advanced Control Function Block Suite	
D01	FOUNDATION fieldbus Diagnostics Suite	
Code	**Integral Mount Manifold (Optional)**	
S5(4)	Assemble to Rosemount 306 Integral Manifold	
Code	**Remote Diaphragm Seals Assemblies (Optional)**	
S1(4)	One remote diaphragm seal	
Code	**Mounting Brackets (Optional)**	
B4	Bracket for 2-in. Pipe or Panel Mounting, All SST	

Code	Product Certifications (Optional)			
E5	FM Explosion-proof, Dust Ignition-proof	•	•	•
I5	FM Intrinsically Safe, Division 2	•	•	•
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2	•	•	•
IE	FM FISCO Intrinsically Safe	•	•	•
I1(5)	ATEX Intrinsic Safety and Dust	•	•	•
IA	ATEX FISCO Intrinsic Safety	•	•	•

Table A-5. 3051T Gage and Absolute Pressure Transmitter

N1[(6)]	ATEX Type n and Dust	•	•	•
E8	ATEX Flameproof and Dust Certification	•	•	•
K8[(6)]	ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E8, I1 and N1)	•	•	•
E4[(6)]	TIIS Flameproof	•	•	•
C5[(6)]	Measurement Canada Accuracy Approval to the Electricity and Gas Inspection Act for the purchase and sale of natural gas	•	•	•
C6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2	•	•	•
K6[(6)]	CSA and ATEX Explosion-proof, Intrinsically Safe, and Division 2 (combination of C6 and K8)	•	•	•
KB	FM and CSA Explosion-proof, Dust Ignition-Proof, Intrinsically Safe, and Division 2 (combination of K5 and C6)	•	•	•
K7	SAA Flameproof, Dust Ignition-proof, Intrinsic Safety, and Type n (combination of I7, N7, and E7)	•	•	•
KD[(6)]	CSA, FM, and ATEX Explosion-proof and Intrinsically Safe (combination of K5, C6, I1, and E8)	•	•	•
I7	SAA Intrinsic Safety	•	•	•
E7	SAA Flameproof, Dust Ignition-proof	•	•	•
N7	SAA Type n Certification	•	•	•
E2	INMETRO Flameproof	•	•	•
I2	INMETRO Intrinsic Safety	•	•	•
K2	INMETRO Flameproof, Intrinsic Safety	•	•	•
E3	China Flameproof	•	•	•
I3	China Intrinsic Safety	•	•	•
DW	NSF drinking water approval	•	•	•
Code	**Other Options**			
Q4	Calibration Certificate			
QG	Calibration Certificate and GOST Verification Certificate			
QP	Calibration certification and tamper evident seal			
Q8	Material Traceability Certification per EN 10204 3.1.B *NOTE: This option applies to the process connection only.*			
QS	Certificate of FMEDA Data			
QT	Safety certified to IEC 61508 with Certificate of FMEDA data			
D1	Hardware adjustments (zero, span, alarm, security)			
J1[(6)(7)]	Local Zero Adjustment Only			
J3[(6)(7)]	No Local Zero or Span Adjustment			
M5	LCD display for Aluminum Housing (Housing Codes A, B, C, and D only)			
M6	LCD display for SST Housing (Housing Codes J, K, L and M only)			
DO	316 SST Conduit Plug			
T1	Transient Protection Terminal Block			
C1[(6)]	Custom Software Configuration (Completed CDS 00806-0100-4001 required with order)			
C2[(6)]	0.8–3.2 V dc Output with Digital Signal Based on *HART* Protocol (Output Code M only)			
C4[(6)(8)]	Analog Output Levels Compliant with NAMUR Recommendation NE 43, 27-June-1996.			
CN[(6)(8)]	Analog Output Levels Compliant with NAMUR Recommendation NE 43: Low Alarm Configuration			
CR	Custom alarm and saturation signal levels, high alarm			
CS	Custom alarm and saturation signal levels, low alarm 4			
CT	Low alarm (standard Rosemount alarm and saturation levels)			
P1	Hydrostatic Testing with Certificate			
P2	Cleaning for Special Service			
P3	Cleaning for <1 PPM Chlorine/Fluorine			
P8	0.04% accuracy to 5:1 turndown (Range 1-4)			
V5[(9)]	External Ground Screw Assembly			
Q16	Surface finish certification for sanitary remote seals			
QZ	Remote Seal System Performance Calculation Report			
Typical Model Number: 3051T G 5 F 2A 2 1 A B4				

(1) 3051TG lower range limit varies with atmospheric pressure.
(2) Not available with hazardous certification Option Codes I1, N1, E4, K6 or K8.
(3) Materials of Construction comply with recommendations per NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
(4) "Assemble-to" items are specified separately and require a completed model number. Process Connection Style code 2B is required.
(5) Not available with Low Power code M.
(6) Not available with fieldbus (output code F) or Profibus protocols (output code W).
(7) Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.
(8) NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
(9) The V5 option is not needed with T1 option; external ground screw assembly is included with the T1 option.

Table A-6. 3051L Flange-Mounted Liquid Level Transmitter

Model	Transmitter Type		
3051L	Flange-Mounted Liquid Level Transmitter		
Code	**Pressure Ranges (Range/Min. Span)**		
2	–250 to 250 inH_2O/2.5 inH_2O (–0,6 to 0,6 bar/6,2 mbar)		
3	–1000 to 1000 inH_2O/10 inH_2O (–2,5 to 2,5 bar/25 mbar)		
4	–300 to 300 psi/3 psi (–20,7 to 20,7 bar/0,2 bar)		
Code	**Output**		
A	4–20 mA with Digital Signal Based on *HART* Protocol		
M(1)	Low-Power 1–5 V dc with Digital Signal Based on *HART* Protocol		
F	FOUNDATION fieldbus Protocol		
W	Profibus – PA		
High Pressure Side			
Code	**Diaphragm Size**	**Material**	**Extension Length**
G0	2 in./DN 50	316L SST	Flush Mount Only
H0	2 in./DN 50	Alloy C-276	Flush Mount Only
J0	2 in./DN 50	Tantalum	Flush Mount Only
A0	3 in./DN 80	316L SST	Flush Mount
A2	3 in./DN 80	316L SST	2 in./50 mm
A4	3 in./DN 80	316L SST	4 in./100 mm
A6	3 in./DN 80	316L SST	6 in./150 mm
B0	4 in./DN 100	316L SST	Flush Mount
B2	4 in./DN 100	316L SST	2 in./50 mm
B4	4 in./DN 100	316L SST	4 in./100 mm
B6	4 in./DN 100	316L SST	6 in./150 mm
C0	3 in./DN 80	Alloy C-276	Flush Mount
C2	3 in./DN 80	Alloy C-276	2 in./50 mm
C4	3 in./DN 80	Alloy C-276	4 in./100 mm
C6	3 in./DN 80	Alloy C-276	6 in./150 mm
D0	4 in./DN 100	Alloy C-276	Flush Mount
D2	4 in./DN 100	Alloy C-276	2 in./50 mm
D4	4 in./DN 100	Alloy C-276	4 in./100 mm
D6	4 in./DN 100	Alloy C-276	6 in./150 mm
E0	3 in./DN 80	Tantalum	Flush Mount Only
F0	4 in./DN 100	Tantalum	Flush Mount Only
Code	**Mounting Flange**		
	Size	**ASME B 16.5 (ANSI) or DIN Flange Rating**	**Material**
1	JIS 10K	JIS	CS
2	JIS 20K	JIS	CS
3	JIS 40K	JIS	CS
4	JIS 10K	JIS	316 SST
5	JIS 20K	JIS	316 SST
6	JIS 40K	JIS	316 SST
7	4 in.	ANSI Class 600	SST

Table A-6. 3051L Flange-Mounted Liquid Level Transmitter

M	2 in.	Class 150	CS	
A	3 in.	Class 150	CS	
B	4 in.	Class 150	CS	
N	2 in.	Class 300	CS	
C	3 in.	Class 300	CS	
D	4 in.	Class 300	CS	
P	2 in.	Class 600	CS	
E	3 in.	Class 600	CS	
X	2 in.	Class 150	SST	
F	3 in.	Class 150	SST	
G	4 in.	Class 150	SST	
Y	2 in.	Class 300	SST	
H	3 in.	Class 300	SST	
J	4 in.	Class 300	SST	
Z	2 in.	Class 600	SST	
L	3 in.	Class 600	SST	
Q	DN 50	PN 10-40	CS	
R	DN 80	PN 40	CS	
S	DN 100	PN 40	CS	
V	DN 100	PN 10/16	CS	
K	DN 50	PN 10-40	SST	
T	DN 80	PN 40	SST	
U	DN 100	PN 40	SST	
W	DN 100	PN 10/16	SST	
Code	**Process Fill-High Pressure Side**		**Temperature Limits**	
A	Syltherm XLT		–100 to 300 °F (–73 to 135 °C)	
C	D. C. Silicone 704		60 to 400 °F (15 to 205 °C)	
D	D. C. Silicone 200		–40 to 400 °F (–40 to 205 °C)	
H	Inert (Halocarbon)		–50 to 350 °F (–45 to 177 °C)	
G	Glycerine and Water		0 to 200 °F (–17 to 93 °C)	
N	Neobee M-20		0 to 400 °F (–17 to 205 °C)	
P	Propylene Glycol and Water		0 to 200 °F (–17 to 93 °C)	
Low Pressure Side				
Code	**Configuration**	**Flange Adapter**	**Diaphragm Material**	**Sensor Fill Fluid**
11	Gage	SST	316L SST	Silicone
21	Differential	SST	316L SST	Silicone
22	Differential	SST	Alloy C-276	Silicone
2A	Differential	SST	316L SST	Inert (Halocarbon)
2B	Differential	SST	Alloy C-276	Inert (Halocarbon)
31	Remote Seal	SST	316L SST	Silicone (Requires Option Code S1)
Code	**O-ring Material**			
A	Glass-filled PTFE			

Table A-6. 3051L Flange-Mounted Liquid Level Transmitter

Code	Housing Material	Conduit Entry Size
A	Polyurethane-covered Aluminum	½–14 NPT
B	Polyurethane-covered Aluminum	M20 × 1.5 (CM20)
D	Polyurethane-covered Aluminum	G½
J	SST	½–14 NPT
K	SST	M20 × 1.5 (CM20)
M	SST	G½

Code	PlantWeb Functionality (Optional)
A01	Advanced Control Function Block Suite
D01	FOUNDATION fieldbus Diagnostics Suite

Code	Diaphragm Seal Assemblies (Optional)
S1[2]	One Diaphragm Seal *(requires low pressure side Option Code 31 capillary connection type)*

Code	Product Certification (Optional)			
E5	FM Explosion-proof, Dust Ignition-proof	•	•	•
I5	FM Intrinsically Safe, Division 2	•	•	•
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2	•	•	•
IE	FM FISCO Intrinsically Safe	•	•	•
I1[3]	ATEX Intrinsic Safety and Dust	•	•	•
IA	ATEX FISCO Intrinsic Safety	•	•	•
N1[4]	ATEX Type n and Dust	•	•	•
E8	ATEX Flameproof and Dust Certification	•	•	•
K8[4]	ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E8, I1 and N1)	•	•	•
E4[4]	TIIS Flameproof	•	•	•
C6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2	•	•	•
K6[4]	CSA and ATEX Explosion-proof, Intrinsically Safe, and Division 2 (combination of C6 and K8)	•	•	•
KB	FM and CSA Explosion-proof, Dust Ignition-Proof, Intrinsically Safe, and Division 2 (combination of K5 and C6)	•	•	•
K7	SAA Flameproof, Dust Ignition-proof, Intrinsic Safety, and Type n (combination of I7, N7, and E7)	•	•	•
KD[4]	CSA, FM, and ATEX Explosion-proof and Intrinsically Safe (combination of K5, C6, I1, and E8)	•	•	•
I7	SAA Intrinsic Safety	•	•	•
E7	SAA Flameproof, Dust Ignition-proof	•	•	•
N7	SAA Type n Certification	•	•	•
E2	INMETRO Flameproof	•	•	•
I2	INMETRO Intrinsic Safety	•	•	•
K2	INMETRO Flameproof, Intrinsic Safety	•	•	•
E3	China Flameproof	•	•	•
I3	China Intrinsic Safety	•	•	•
DW	NSF drinking water approval	•	•	•

Code	Bolting Options
L5	ASTM A 193, Grade B7M Bolts

Code	Display Options
M5	LCD display for Aluminum Housing *(Available with Housing codes A, B, C, and D only)*
M6	LCD display for SST Housing *(Available with Housing codes J, K, L, and M only)*

Table A-6. 3051L Flange-Mounted Liquid Level Transmitter

Code	Other Options					
Q4	Calibration Certificate					
QG	Calibration Certificate and GOST Verification Certificate					
Q8	Material Traceability Certification per EN 10204 3.1.B (*Available with the diaphragm, upper housing, Coplanar flange, adapter, sensor module housing, lower housing/flushing connection, and extension)*					
QS	Prior-use certificate of FMEDA data					
QT	Safety certified to IEC 61508 with Certificate of FMEDA data					
QZ	Remote Seal System Performance Calculation Report					
QP	Calibration certification and tamper evident seal					
D1	Hardware adjustments (zero, span, alarm, security)					
J1(4)(5)	Local Zero Adjustment Only					
J3(4)(5)	No Local Zero or Span Adjustment					
T1	Transient Protection Terminal Block					
C1(4)	Custom Software Configuration (*Completed CDS 00806-0100-4001 required with order)*					
C2(4)	0.8–3.2 V dc Output with Digital Signal Based on *HART* Protocol *(Available with Output code M only)*					
C4(4)(6)	Analog Output Levels Compliant with NAMUR Recommendation NE 43					
CN(4)(6)	Analog Output Levels Compliant with NAMUR Recommendation NE 43: Alarm Configuration–Low					
CR	Custom alarm and saturation signal levels, high alarm					
CS	Custom alarm and saturation signal levels, low alarm					
CT	Low alarm (standard Rosemount alarm and saturation levels)					
D8	Ceramic Ball Drain/Vents					
DO	316 SST Conduit Plug					
V5(7)	External Ground Screw Assembly					
P1	Hydrostatic testing with certificate					
Code	**Lower Housing Flushing Connections Options**					
	Ring Material	**Number**	**Size**	**2 in.**	**3 in.**	**4 in.**
F1	SST	1	1/4	•	•	•
F2	SST	2	1/4	•	•	•
F3(8)	Cast C-276	1	1/4	•	•	•
F4(8)	Cast C-276	2	1/4	•	•	•
F7	SST	1	1/2	•	•	•
F8	SST	2	1/2	•	•	•
F9	Cast C-276	1	1/2	•	•	•
F0	Cast C-276	2	1/2	•	•	•
Typical Model Number: 3051L 2 A A0 D 21 A A F1						

(1) Not available with hazardous certification Option Codes I1, N1, E4, K6, and K8.
(2) "Assemble-to" items are specified separately and require a completed model number.
(3) Not available with Low Power code M.
(4) Not available with fieldbus (output code F) or profibus protocols (output code W).
(5) Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.
(6) NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
(7) The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
(8) Not available with Option Codes A0, B0, and G0.

Table A-7. 3051H Pressure Transmitter for High-Temperature Processes — = Not Applicable

Model	Transmitter Type (Select One)		HD	HG
3051HD	Differential Pressure Transmitter for High-Temperature Processes		•	—
3051HG	Gage Pressure Transmitter for High-Temperature Processes		—	•
Code	**Pressure Ranges (Range/ Min. Span)**			
	3051HD	**3051HG**		
2	–250 to 250 inH_2O/2.5 inH_2O (–0,62 to 0,62 bar/6,2 mbar)	–250 to 250 inH_2O/2.5 inH_2O (–0,62 to 0,62 bar/6,2 mbar)		
3	–1000 to 1000 inH_2O/10 inH_2O (–2,5 to 2,5 bar/25 mbar)	–407 to 1000 inH_2O/10in H_2O (–1,01 to 2,5 bar/25 mbar)		
4	–300 to 300 inH_2O/3 psi (–747 to 747 mbar/0,2 bar)	–14.7 to 300 psi/3 psi (–1,01 to 20,7 bar/0,2 bar)		
5	–2000 to 2000 psi/20 psi (–138 to 138 bar/1,4 bar)	–14.7 to 2000 psi/20 psi (–1,01 to 138 bar/1,4 bar)		
NOTE: 3051HG lower range limit varies with atmospheric pressure.				
Code	**Output**		**HD**	**HG**
A	4–20 mA with Digital Signal Based on *HART* Protocol		•	•
M(1)	Low-Power 1–5 V dc with Digital Signal Based on *HART* Protocol		•	•
F	FOUNDATION fieldbus Protocol		•	•
W	Profibus – PA		•	•
Code	**Process Connection**		**HD**	**HG**
	Process Flange Material	**Drain/Vent**		
2	SST	SST	•	•
7(2)	SST	Alloy C-276	•	•
Code	**Process Isolating Diaphragm**		**HD**	**HG**
2	316L SST		•	•
3(2)	Alloy C-276		•	•
5	Tantalum		•	•
Code	**O-ring Material**		**HD**	**HG**
A	Glass-Filled PTFE		•	•
Code	**Process Fill Fluid**		**HD**	**HG**
D	*D.C. 200* Silicone		•	•
H	Inert		•	•
N	*Neobee M-20*		•	•
Code	**Sensor Module Isolator Material**		**HD**	**HG**
2	SST		•	•
Code	**Sensor Module Fill Fluid**		**HD**	**HG**
1	Silicone		•	•
2	Inert (Halocarbon)		•	•
Code	**Housing Material**	**Conduit Entry Size**	**HD**	**HG**
A	Polyurethane-covered Aluminum	½–14 NPT	•	•
B	Polyurethane-covered Aluminum	M20 × 1.5 (CM20)	•	
D	Polyurethane-covered Aluminum	G½	•	
J	SST	½–14 NPT	•	•
K	SST	M20 × 1.5 (CM20)	•	
M	SST	G½	•	•
Code	***PlantWeb* Functionality (Optional)**			
A01	Advanced Control Function Block Suite			
D01	FOUNDATION fieldbus Diagnostics Suite			
Code	**Integral Mount Primary Elements (Optional)**		**HD**	**HG**
S4(3)	Assemble to Rosemount Annubar or Rosemount 1195 Integral Orifice		•	—
Code	**Mounting Bracket Options**		**HD**	**HG**
B5	Universal Mounting Bracket for 2-in. Pipe or Panel Mount, CS Bolts		•	•
B6	Universal Mounting Bracket for 2-in. Pipe or Panel Mount, SST Bolts		•	•

Table A-7. 3051H Pressure Transmitter for High-Temperature Processes — = Not Applicable

Code	Product Certifications (Optional)		HD	HG
E5	FM Explosion-proof, Dust Ignition-proof	•	•	•
I5	FM Intrinsically Safe, Division 2	•	•	•
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2	•	•	•
IE	FM FISCO Intrinsically Safe	•	•	•
I1(4)	ATEX Intrinsic Safety and Dust	•	•	•
IA	ATEX FISCO Intrinsic Safety	•	•	•
N1(5)	ATEX Type n and Dust	•	•	•
E8	ATEX Flameproof and Dust Certification	•	•	•
K8(5)	ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E8, I1 and N1)	•	•	•
E4(5)	TIIS Flameproof	•	•	•
C6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2	•	•	•
K6(5)	CSA and ATEX Explosion-proof, Intrinsically Safe, and Division 2 (combination of C6 and K8)	•	•	•
KB	FM and CSA Explosion-proof, Dust Ignition-Proof, Intrinsically Safe, and Division 2 (combination of K5 and C6)	•	•	•
K7	SAA Flameproof, Dust Ignition-proof, Intrinsic Safety, and Type n (combination of I7, N7, and E7)	•	•	•
KD(5)	CSA, FM, and ATEX Explosion-proof and Intrinsically Safe (combination of K5, C6, I1, and E8)	•	•	•
I7	SAA Intrinsic Safety	•	•	•
E7	SAA Flameproof, Dust Ignition-proof	•	•	•
N7	SAA Type n Certification	•	•	•
E2	INMETRO Flameproof	•	•	•
I2	INMETRO Intrinsic Safety	•	•	•
K2	INMETRO Flameproof, Intrinsic Safety	•	•	•
E3	China Flameproof	•	•	•
I3	China Intrinsic Safety	•	•	•
DW	NSF drinking water approval	•	•	•
Code	**Bolting Options**		**HD**	**HG**
L4	Austenitic 316 SST Bolts		•	•
Code	**Display Options**		**HD**	**HG**
M5	LCD display for Aluminum Housing *(Available with Housing codes A, B, C, and D only)*		•	•
M6	LCD display for SST Housing *(Available with Housing codes J, K, L, and M only)*		•	•
Code	**Other Options**		**HD**	**HG**
Q4	Calibration Certificate		•	•
QG	Calibration Certificate and GOST Verification Certificate		•	•
Q8	Material traceability certification per EN 10204 3.1.B		•	•
QP	Calibration certification and tamper evident seal		•	•
J1(5)(6)	Local Zero Adjustment Only		•	•
J3(5)(6)	No Local Zero or Span Adjustment		•	•
T1	Transient Protection Terminal Block		•	•
C1(5)	Custom Software Configuration (Completed CDS 00806-0100-4001 required with order)		•	•
C2(5)	0.8–3.2 V dc Output with Digital Signal Based on *HART* Protocol *(Output Code M only)*		•	•
C4(5)(7)	Analog Output Levels Compliant with NAMUR Recommendation NE 43		•	•
CN(5)(7)	Analog Output Levels Compliant with NAMUR Recommendation NE 43: Alarm Configuration–Low		•	•
P1	Hydrostatic Testing with Certificate		•	•
P2	Cleaning for Special Service		•	•
DF	$^{1}/_{2}$–14 NPT flange adapters—SST		•	•
D8	Ceramic Ball Drain/Vents		•	•
V5(8)	External Ground Screw Assembly		•	•
Typical Model Number: 3051HG 2 A 2 2 A H 2 1 A B5				

(1) Not available with hazardous certification Option Codes I1, N1, E4, K6, and K8.
(2) Materials of Construction comply with recommendations per NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
(3) "Assemble-to" items are specified separately and require a completed model number.
(4) Not available with Low Power code M.
(5) Not available with fieldbus (output code F) or profibus protocols (output code W).
(6) Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.
(7) NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
(8) The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.

OPTIONS

Standard Configuration

Unless otherwise specified, transmitter is shipped as follows:

ENGINEERING UNITS	
***Differential/Gage*:**	inH_2O (Range 0, 1, 2, and 3) psi (Range 4 and 5)
***Absolute/3051T*:**	psi (all ranges)
4 mA (1 V dc)[(1)]:	0 (engineering units above)
20 mA (5 V dc):	Upper range limit
Output:	Linear
Flange type:	Specified model code option
Flange material:	Specified model code option
O-ring material:	Specified model code option
Drain/vent:	Specified model code option
Integral meter:	Installed or none
Alarm[(1)]:	Upscale
Software tag:	(Blank)

(1) Not applicable to fieldbus.

Custom Configuration HART protocol only[(1)]

If Option Code C1 is ordered, the customer may specify the following data in addition to the standard configuration parameters.

- Output Information
- Transmitter Information
- LCD display Configuration
- Hardware Selectable Information
- Signal Selection

Refer to the “HART Protocol C1 Option Configuration Data Sheet” document number 00806-0100-4001.

Tagging (3 options available)

- Standard SST hardware tag is wired to the transmitter. Tag character height is 0.125 in. (3,18 mm), 56 characters maximum.
- Tag may be permanently stamped on transmitter nameplate upon request, 56 characters maximum.
- Tag may be stored in transmitter memory (30 characters maximum). Software tag is left blank unless specified.

Commissioning tag (fieldbus only)

A temporary commissioning tag is attached to all transmitters. The tag indicates the device ID and allows an area for writing the location.

Optional Rosemount 304, 305 or 306 Integral Manifolds

Factory assembled to 3051C and 3051T transmitters. Refer to the following Product Data Sheet (document number 00813-0100-4839 for Rosemount 304 and 00813-0100-4733 for Rosemount 305 and 306) for additional information.

Optional Diaphragm and Sanitary Seals

Refer to Product Data Sheet 00813-0100-4016 or 00813-0201-4016. for additional information.

(1) Not applicable to fieldbus.

Output Information[1]

Output range points must be the same unit of measure. Available units of measure include:

inH2O	inH2O@4 °C[1]	psi	Pa
inHg	ftH2O	bar	kPa
mmH2O	mmH2O@4 °C[1]	mbar	torr
mmHg	g/cm2	kg/cm2	atm

(1) Not available on low power or previous versions.

LCD display

M5 Digital Display, 5-Digit, 2-Line LCD

- Direct reading of digital data for higher accuracy
- Displays user-defined flow, level, volume, or pressure units
- Displays diagnostic messages for local troubleshooting
- 90-degree rotation capability for easy viewing

M6 Digital Display with 316 Stainless Steel Cover

- For use with stainless steel housing option (housing codes J, K, and L)

Local Span and Zero Adjustment[1]

Transmitters ship with local span and zero adjustments standard unless otherwise specified.

- Non-interactive external zero and span adjustments ease calibration
- Magnetic switches replace standard potentiometer adjustments to optimize performance

J1 Local Zero Adjustment Only[1]

J3 No Local Zero or Span Adjustment[1]

Bolts for Flanges and Adapters

- Options permit bolts for flanges and adapters to be obtained in various materials
- Standard material is plated carbon steel per ASTM A449, Type 1

L4 Austenitic 316 Stainless Steel Bolts

L5 ASTM A 193, Grade B7M Bolts

L6 Alloy K-500 Bolts

Rosemount 3051C Coplanar Flange and 3051T Bracket Option

B4 Bracket for 2-in. Pipe or Panel Mounting

- For use with the standard Coplanar flange configuration
- Bracket for mounting of transmitter on 2-in. pipe or panel
- Stainless steel construction with stainless steel bolts

(1) Not applicable to fieldbus.

Rosemount 3051H Bracket Options

B5 Bracket for 2-in. Pipe or Panel Mounting

- For use with the 3051H Pressure Transmitter for high process temperatures
- Carbon steel construction with carbon steel bolts

B6 B5 Bracket with SST Bolts

- Same bracket as the B5 option with Series 300 stainless steel bolts.

Traditional Flange Bracket Options

B1 Bracket for 2-in. Pipe Mounting

- For use with the traditional flange option
- Bracket for mounting on 2-in. pipe
- Carbon steel construction with carbon steel bolts
- Coated with polyurethane paint

B2 Bracket for Panel Mounting

- For use with the traditional flange option
- Bracket for mounting transmitter on wall or panel
- Carbon steel construction with carbon steel bolts
- Coated with polyurethane paint

B3 Flat Bracket for 2-in. Pipe Mounting

- For use with the traditional flange option
- Bracket for vertical mounting of transmitter on 2-in. pipe
- Carbon steel construction with carbon steel bolts
- Coated with polyurethane paint

B7 B1 Bracket with SST Bolts

- Same bracket as the B1 option with Series 300 stainless steel bolts

B8 B2 Bracket with SST Bolts

- Same bracket as the B2 option with Series 300 stainless steel bolts

B9 B3 Bracket with SST Bolts

- Same bracket as the B3 option with Series 300 stainless steel bolts

BA Stainless Steel B1 Bracket with SST Bolts

- B1 bracket in stainless steel with Series 300 stainless steel bolts

BC Stainless Steel B3 Bracket with SST Bolts

- B3 bracket in stainless steel with Series 300 stainless steel bolts

Shipping Weights

Table A-8. Transmitter Weights without Options

Transmitter	Add Weight In lb (kg)
3051C	6.0 (2,7)
3051L	Table A-9
3051H	13.6 (6,2)
3051T	3.0 (1,4)

Table A-9. 3051L Weights without Options

Flange	Flush lb. (kg)	2-in. Ext. lb (kg)	4-in. Ext. lb (kg)	6-in. Ext. lb (kg)
2-in., 150	12.5 (5,7)	—	—	—
3-in., 150	17.5 (7,9)	19.5 (8,8)	20.5 (9,3)	21.5 (9,7)
4-in., 150	23.5 (10,7)	26.5 (12,0)	28.5 (12,9)	30.5 (13,8)
2-in., 300	17.5 (7,9)	—	—	—
3-in., 300	22.5 (10,2)	24.5 (11,1)	25.5 (11,6)	26.5 (12,0)
4-in., 300	32.5 (14,7)	35.5 (16,1)	37.5 (17,0)	39.5 (17,9)
2-in., 600	15.3 (6,9)	—	—	—
3-in., 600	25.2 (11,4)	27.2 (12,3)	28.2 (12,8)	29.2 (13,2)
DN 50/PN 40	13.8 (6,2)	—	—	—
DN 80/PN 40	19.5 (8,8)	21.5 (9,7)	22.5 (10,2)	23.5 (10,6)
DN 100/ PN 10/16	17.8 (8,1)	19.8 (9,0)	20.8 (9,5)	21.8 (9,9)
DN 100/ PN 40	23.2 (10,5)	25.2 (11,5)	26.2 (11,9)	27.2 (12,3)

Table A-10. Transmitter Options Weights

Code	Option	Add lb (kg)
J, K, L, M	Stainless Steel Housing(T)	3.9 (1,8)
J, K, L, M	Stainless Steel Housing (C, L, H, P)	3.1 (1,4)
M5	LCD display for Aluminum Housing	0.5 (0,2)
M6	LCD display for SST Housing	1.25 (0,6)
B4	SST Mounting Bracket for Coplanar Flange	1.0 (0,5)
B1 B2 B3	Mounting Bracket for Traditional Flange	2.3 (1,0)
B7 B8 B9	Mounting Bracket for Traditional Flange	2.3 (1,0)
BA, BC	SST Bracket for Traditional Flange	2.3 (1,0)
B5 B6	Mounting Bracket for 3051H	2.9 (1,3)
H2	Traditional Flange	2.4 (1,1)
H3	Traditional Flange	2.7 (1,2)
H4	Traditional Flange	2.6 (1,2)
H7	Traditional Flange	2.5 (1,1)
FC	Level Flange—3 in., 150	10.8 (4,9)
FD	Level Flange—3 in., 300	14.3 (6,5)
FA	Level Flange—2 in., 150	10.7 (4,8)
FB	Level Flange—2 in., 300	14.0 (6,3)
FP	DIN Level Flange, SST, DN 50, PN 40	8.3 (3,8)
FQ	DIN Level Flange, SST, DN 80, PN 40	13.7 (6,2)

Table A-11. 3051C Differential/Gage Pressure Transmitter Range Limits

	Range 1 Span		Range 2 Span		Range 3 Span		Range 4 Span		Range 5 Span	
Units	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
inH_2O	0.5	25	2.5	250	10	1000	83.040	8304	553.60	55360
inHg	0.03678	1.8389	0.18389	18.389	0.73559	73.559	6.1081	610.81	40.720	4072.04
ftH_2O	0.04167	2.08333	0.20833	20.8333	0.83333	83.3333	6.9198	691.997	46.13	4613.31
mmH_2O	12.7	635.5	63.553	6355	254	25421	2110.95	211095	14073	1407301
mmHg	0.93416	46.7082	4.67082	467.082	18.6833	1868.33	155.145	15514.5	1034.3	103430
psi	0.01806	0.903	0.0902	9.03183	0.36127	36.127	3	300	20	2000
bar	0.00125	0.06227	0.00623	0.62272	0.02491	2.491	0.20684	20.6843	1.37895	137.895
mbar	1.2454	62.2723	6.22723	622.723	24.9089	2490.89	206.843	20684.3	1378.95	137895
g/cm^2	1.26775	63.3875	6.33875	633.875	25.355	2535.45	210.547	21054.7	1406.14	140614
kg/cm^2	0.00127	0.0635	0.00635	0.635	0.0254	2.54	0.21092	21.0921	1.40614	140.614
Pa	124.545	6227.23	622.723	62160.6	2490.89	249089	20684.3	2068430	137895	13789500
kPa	0.12545	6.2272	0.62272	62.2723	2.49089	249.089	20.6843	2068.43	137.895	13789.5
torr	0.93416	46.7082	4.67082	467.082	18.6833	1868.33	155.145	15514.5	1034.3	103430
atm	0.00123	0.06146	0.00615	0.61460	0.02458	2.458	0.20414	20.4138	1.36092	136.092

When using a Field Communicator, ±5% adjustment is allowed on the sensor limit to allow for unit conversions.

Table A-12. 3051L/3051H Pressure Transmitter Range Limits

	Range 2 Span		Range 3 Span		Range 4 Span		Range 5 Span	
Units	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
inH_2O	2.5	250	10	1000	83.040	8304	553.60	55360
inHg	0.18389	18.389	0.73559	73.559	6.1081	610.81	40.720	4072.04
ftH_2O	0.20833	20.8333	0.83333	83.3333	6.9198	691.997	46.13	4613.31
mmH_2O	63.553	6355	254	25421	2110.95	211095	14073	1407301
mmHg	4.67082	467.082	18.6833	1868.33	155.145	15514.5	1034.3	103430
psi	0.0902	9.03183	0.36127	36.127	3	300	20	2000
bar	0.00623	0.62272	0.02491	2.491	0.20684	20.6843	1.37895	137.895
mbar	6.22723	622.723	24.9089	2490.89	206.843	20684.3	1378.95	137895
g/cm^2	6.33875	633.875	25.355	2535.45	210.547	21054.7	1406.14	140614
kg/cm^2	0.00635	0.635	0.0254	2.54	0.21092	21.0921	1.40614	140.614
Pa	622.723	62160.6	2490.89	249089	20684.3	2068430	137895	13789500
kPa	0.62272	62.2723	2.49089	249.089	20.6843	2068.43	137.895	13789.5
torr	4.67082	467.082	18.6833	1868.33	155.145	15514.5	1034.3	103430
atm	0.00615	0.61460	0.02458	2.458	0.20414	20.4138	1.36092	136.092

When using a Field Communicator, ±5% adjustment is allowed on the sensor limit to allow for unit conversions.

Table A-13. 3051T Gage and Absolute Pressure Transmitter Range Limits

	Range 1 Span		Range 2 Span		Range 3 Span		Range 4 Span		Range 5 Span	
Units	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
inH_2O	8.30397	831.889	41.5198	4159.45	221.439	22143.9	1107.2	110720	55360	276799
inHg	0.61081	61.0807	3.05403	305.403	16.2882	1628.82	81.441	8144.098	4072.04	20360.2
ftH_2O	0.69199	69.3241	3.45998	345.998	18.4533	1845.33	92.2663	9226.63	4613.31	23066.6
mmH_2O	211.10	21130	1054.60	105460.3	5634.66	563466	28146.1	2814613	1407301	7036507
mmHg	15.5145	1551.45	77.5723	7757.23	413.72	41372	2068.6	206860.0	103430	517151
psi	0.3	30	1.5	150	8	800	40	4000	2000	10000
bar	0.02068	2.06843	0.10342	10.3421	0.55158	55.1581	2.75791	275.7905	137.895	689.476
mbar	20.6843	2068.43	103.421	10342.11	551.581	55158.1	2757.91	275790.5	137895	689476
g/cm^2	21.0921	2109.21	105.461	10546.1	561.459	56145.9	2807.31	280730.6	140614	703067
kg/cm^2	0.02109	2.10921	0.10546	10.5461	0.56246	56.2456	2.81228	281.228	140.614	701.82
Pa	2068.43	206843	10342.1	1034212	55158.1	5515811	275791	27579054	13789500	68947600
kPa	2.06843	206.843	10.3421	1034.21	55.1581	5515.81	275.791	27579.05	13789.5	68947.6
torr	15.5145	1551.45	77.5726	7757.26	413.721	413721	2068.6	206859.7	103430	517151
atm	0.02041	2.04138	0.10207	10.2069	0.54437	54.4368	2.72184	272.1841	136.092	680.46

When using a Field Communicator, ±5% adjustment is allowed on the sensor limit to allow for unit conversions.

Table A-14. 3051C Absolute Pressure Transmitter Range Limits

	Range 1 Span		Range 2 Span		Range 3 Span		Range 4 Span	
Units	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
inH_2O	8.30397	831.889	41.5198	4151.98	221.439	22143.9	1107.2	110720
inHg	0.61081	61.0807	3.05403	305.403	16.2882	1628.82	81.441	8144.098
ftH_2O	0.69199	69.3241	3.45998	345.998	18.4533	1845.33	92.2663	9226.63
mmH_2O	211.10	21130	6.35308	635.308	5634.66	563466	28146.1	2814613
mmHg	15.5145	1551.45	1055.47	105547	413.72	41372	2068.6	206860.0
psi	0.3	30	1.5	150	8	800	40	4000
bar	0.02068	2.06843	0.10342	10.342	0.55158	55.1581	2.75791	275.7905
mbar	20.6843	2068.43	103.421	10342.1	551.581	55158.1	2757.91	275790.5
g/cm^2	21.0921	2109.21	105.27	105.27	561.459	56145.9	2807.31	280730.6
kg/cm^2	0.02109	2.10921	0.10546	10.546	0.56246	56.2456	2.81228	281.228
Pa	2068.43	206843	10342.1	1034210	55158.1	5515811	275791	27579054
kPa	2.06843	206.843	10.3421	1034.21	55.1581	5515.81	275.791	27579.05
torr	15.5145	1551.45	77.5726	7757.26	413.721	413721	2068.6	206859.7
atm	0.02041	2.04138	0.10207	10.207	0.54437	54.4368	2.72184	272.1841

When using a Field Communicator, ±5% adjustment is allowed on the sensor limit to allow for unit conversions.

SPARE PARTS

Rosemount 3051C Gage and Differential Sensor Modules (Min. Span/Range)			Silicone Fill Part Number	Inert Fill Part Number
Note: One spare part is recommended for every 50 transmitters.				
Note: Listed by Range and Process Isolator Order Numbers.				
Range 1	**Gage Pressure Range –25 to 25 in H2O/0.5 in H2O**	**Differential Pressure Range –25 to 25 in H2O/0.5 in H2O**		
316L SST			03031-1045-0012	03031-1145-0012
Alloy C-276			03031-1045-0013	03031-1145-0013
Alloy 400			03031-1045-0014	03031-1145-0014
Gold-plated Alloy 400			03031-1045-0016	03031-1145-0016
Gold-plated 316 SST			03031-1045-0017	03031-1145-0017
Range 2	**–250 to 250 inH_2O/2.5 inH_2O**	**–250 to 250 inH_2O/2.5 inH_2O**		
316L SST			03031-1045-0022	03031-1145-0022
Alloy C-276			03031-1045-0023	03031-1145-0023
Alloy 400			03031-1045-0024	03031-1145-0024
Tantalum			03031-1045-0025	03031-1145-0025
Gold-plated Alloy 400			03031-1045-0026	03031-1145-0026
Gold-plated 316 SST			03031-1045-0027	03031-1145-0027
Range 3	**–407 to 1000 inH_2O/10 inH_2O**	**-1000 to 1000 inH_2O/10 inH_2O**		
316L SST			03031-1045-0032	03031-1145-0032
Alloy C-276			03031-1045-0033	03031-1145-0033
Alloy 400			03031-1045-0034	03031-1145-0034
Tantalum			03031-1045-0035	03031-1145-0035
Gold-plated Alloy 400			03031-1045-0036	03031-1145-0036
Gold-plated 316 SST			03031-1045-0037	03031-1145-0037
Range 4	**–14.2 to 300 psi/3 psi**	**-300 to 300 psi/3 psi**		
316L SST			03031-1045-2042	03031-1145-2042
Alloy C-276			03031-1045-2043	03031-1145-2043
Alloy 400			03031-1045-2044	03031-1145-2044
Tantalum			03031-1045-2045	03031-1145-2045
Gold-plated Alloy 400			03031-1045-2046	03031-1145-2046
Gold-plated 316 SST			03031-1045-2047	03031-1145-2047
Range 5	**–14.2 to 2000 psi/20 psi**	**-2000 to 2000psi/20 psi**		
316L SST			03031-1045-2052	03031-1145-2052
Alloy C-276			03031-1045-2053	03031-1145-2053
Alloy 400			03031-1045-2054	03031-1145-2054
Tantalum			03031-1045-2055	03031-1145-2055
Gold-plated Alloy 400			03031-1045-2056	03031-1145-2056
Gold-plated 316 SST			03031-1045-2057	03031-1145-2057

Rosemount 3051C Absolute Sensor Modules (Min. Span/Range)	Silicone Fill Part Number	Inert Fill Part Number
Note: One spare part is recommended for every 50 transmitters.		
Note: Listed by Range and Process Isolator Order Numbers.		
Range 1, 0 to 30 psia/0.3 psia		
316L SST	03031-2020-0012	—
Alloy C-276	03031-2020-0013	—
Alloy 400	03031-2020-0014	—
Gold-plated Alloy 400	03031-2020-0016	—
Gold-plated 316 SST	03031-2020-0017	—

Range 2, 0 to 150/1.5 psia		
316L SST	03031-2020-0022	—
Alloy C-276	03031-2020-0023	—
Alloy 400	03031-2020-0024	—
Gold-plated Alloy 400	03031-2020-0026	—
Gold-plated 316 SST	03031-2020-0027	—
Range 3, 0 to 800 psia/8 psia		
316L SST	03031-2020-0032	—
Alloy C-276	03031-2020-0033	—
Alloy 400	03031-2020-0034	—
Gold-plated Alloy 400	03031-2020-0036	—
Gold-plated 316 SST	03031-2020-0037	—
Range 4, 0 to 400 psia/40 psia		
316L SST	03031-2020-0042	—
Alloy C-276	03031-2020-0043	—
Alloy 400	03031-2020-0044	—
Gold-plated Alloy 400	03031-2020-0046	—
Gold-plated 316 SST	03031-2020-0047	—

Electronics Board Assemblies	Part Number
4-20 mA HART Standard	03031-0001-0002
4-20 mA HART NAMUR compliant	03031-0001-0003
1-5 Vdc HART Low Power	03031-0001-1001
FOUNDATION fieldbus	03031-0001-2001
PROFIBUS PA fieldbus	03031-0001-2101
LCD Display	**Part Number**
LCD Display Kits	
4-20 mA HART - Aluminum	03031-0193-0101
4-20 mA HART - 316 SST	03031-0193-0111
1-5 Vdc HART Low Power - Aluminum	03031-0193-0001
1-5 Vdc HART Low Power - 316 SST	03031-0193-0011
Fieldbus (FOUNDATION or PROFIBUS PA) - Aluminum	03031-0193-0104
Fieldbus (FOUNDATION or PROFIBUS PA) - 316 SST	03031-0193-0112
LCD Display Only	
4-20 mA HART	03031-0193-0103
1-5 Vdc HART Low Power	03031-0193-0003
Fieldbus (FOUNDATION or PROFIBUS PA)	03031-0193-0105
Terminal Block Assemblies	**Part Number**
4-20 mA HART Output	
Standard terminal block	03031-0332-0003
Transient terminal block (option T1)	03031-0332-0004
1-5 Vdc HART Low Power Output	
Standard terminal block	03031-0332-1001
Transient terminal block (option T1)	03031-0332-1002
Fieldbus (FOUNDATION or PROFIBUS PA)	
Standard terminal block	03031-0332-2001
Transient terminal block (option T1)	03031-0332-2002
FISCO terminal block	03031-0332-2005

Electrical Housings (without Terminal Block)	Part Number
Standard - Aluminum	
$^1/_2$ - 14 NPT conduit entry	03031-0635-0001
M20 conduit entry	03031-0635-0002
G$^1/_2$ conduit entry	03031-0635-0004
Standard - 316 SST	
$^1/_2$ - 14 NPT conduit entry	03031-0635-0041
M20 conduit entry	03031-0635-0042
1-5 Vdc HART Low Power - Aluminum	
$^1/_2$ - 14 NPT conduit entry	03031-0635-0101
1-5 Vdc HART Low Power - 316 SST	
$^1/_2$ - 14 NPT conduit entry	03031-0635-0141

Housing Conduit Plugs	Part Number
$^1/_2$ NPT Conduit plug	03031-0544-0003
M20 Conduit plug	03031-0544-0001
G$^1/_2$ Conduit plug	03031-0544-0004

Housing Covers (include o-ring)	Part Number
Field terminal cover - Aluminum	03031-0292-0001
Field terminal cover - 316 SST	03031-0292-0002
HART electronics cover - Aluminum	03031-0292-0001
HART electronics cover - 316 SST	03031-0292-0002
HART LCD Display cover - Aluminum	03031-0193-0002
HART LCD Display cover - 316 SST	03031-0193-0012
Fieldbus extended electronics cover - Aluminum	03031-0292-0003
Fieldbus extended electronics cover - 316 SST	03031-0292-0004
Fieldbus extended LCD Display cover - Aluminum	03031-0193-0007
Fieldbus extended LCD Display cover - 316 SST	03031-0193-0013

Miscellaneous Hardware	Part Number
Local Zero and Span Kit	03031-0293-0002
External ground screw assembly (option V5)	03031-0398-0001

Flanges	Part Number
Differential Coplanar Flange	
316 SST	03031-0388-0022
Cast C-276	03031-0388-0023
Cast Alloy 400	03031-0388-0024
Nickel-plated carbon steel	03031-0388-0025
Gage/Absolute Coplanar Flange	
316 SST	03031-0388-1022
Cast C-276	03031-0388-1023
Cast Alloy 40	03031-0388-1024
Nickel-plated carbon steel	03031-0388-1025
Coplanar flange alignment screw (package of 12)	03031-0309-0001
Traditional Flange	
316 SST	03031-0320-0002
Cast C-276	03031-0320-0003
Cast Alloy 400	03031-0320-0004
316 SST - DIN Compliant (Option Code HJ)	03031-1350-0012
Level Flange, Vertical Mount	
2 in., class 150, SST	03031-0393-0221
2 in., class 300, SST	03031-0393-0222
3 in., class 150, SST	03031-0393-0231
3 in., class 300, SST	03031-0393-0232
DIN, DN 50, PN 40	03031-0393-1002
DIN, DN 80, PN 40	03031-0393-1012

Flange Adapter Kits (each kit contains parts for one DP transmitter or two GP/AP transmitters)	Part Number
CS bolts, glass-filled PTFE O-Rings	
SST adapters	03031-1300-0002
Cast Alloy C-276 adapters	03031-1300-0003
Alloy 400 adapters	03031-1300-0004
Nickel-plated carbon steel adapters	03031-1300-0005
SST bolts, glass-filled PTFE O-Rings	
SST adapters	03031-1300-0012
Cast Alloy C-276 adapters	03031-1300-0013
Alloy 400 adapters	03031-1300-0014
Nickel-plated carbon steel adapters	03031-1300-0015
CS bolts, graphite-filled PTFE O-Rings	
SST adapters	03031-1300-0102
Cast Alloy C-276 adapters	03031-1300-0103
Alloy 400 adapters	03031-1300-0104
Nickel-plated carbon steel adapters	03031-1300-0105
SST bolts, graphite-filled PTFE O-Rings	
SST adapters	03031-1300-0112
Cast Alloy C-276 adapters	03031-1300-0113
Alloy 400 adapters	03031-1300-0114
Nickel-plated carbon steel adapters	03031-1300-0115

Flange Adapters	Part Number
$^1/_2$ - 14 NPT Adapters	
316 SST	02024-0069-0002
Cast C-276	02024-0069-0003
Cast Alloy 400	02024-0069-0004
Nickel-plated carbon steel	02024-0069-0005
Socket Weld Adapters	
316 SST	02024-0069-1002
Cast C-276	02024-0069-1003
Cast Alloy 400	02024-0069-1004

O-Ring Packages (package of 12)	Part Number
Electronics housing, cover	03031-0232-0001
Electronics housing, module	03031-0233-0001
Process flange, glass-filled PTFE (White)	03031-0234-0001
Process flange, graphite-filled PTFE (Black)	03031-0234-0002
Process flange for 3051H, PTFE (White)	02051-0167-0001
Flange adapter, glass-filled PTFE (Light Brown)	03031-0242-0001
Flange adapter, graphite-filled PTFE (Black)	03031-0242-0002

Bolt Kits	Part Number
COPLANAR FLANGE	
Flange Bolt Kit {44mm (1.75 in.)} (set of 4)	
Carbon steel	03031-0312-0001
316 SST	03031-0312-0002
ASTM A 193, Grade B7M	03031-0312-0003
Alloy K-500	03031-0312-0004
Flange/Adapter Bolt Kit {73mm (2.88 in.)} (set of 4)	
Carbon steel	03031-0306-0001
316 SST	03031-0306-0002
ASTM A 193, Grade B7M	03031-0306-0003
Alloy K-500	03031-0306-0004

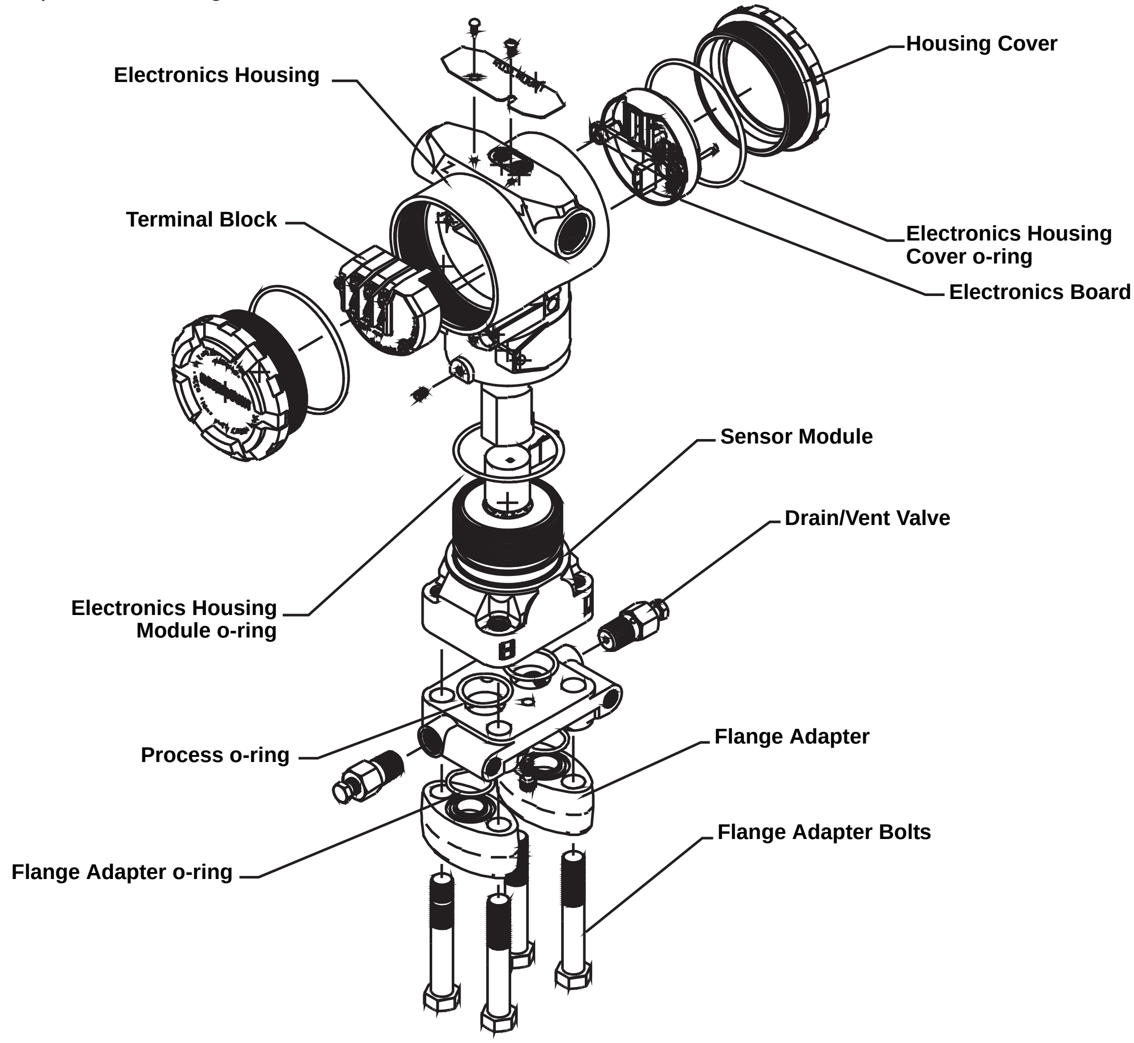
TRADITIONAL FLANGE	
Differential Flange/Adapter Bolt Kit {44mm (1.75 in.)} (set of 8)	
Carbon steel	03031-0307-0001
316 SST	03031-0307-0002
ASTM A 193, Grade B7M	03031-0307-0003
Alloy K-500	03031-0307-0004
Gage/Absolute Flange/Adapter Bolt Kit {44mm (1.75 in.)} (set of 6)	
Carbon steel	03031-0307-1001
316 SST	03031-0307-1002
ASTM A 193, Grade B7M	03031-0307-1003
Alloy K-500	03031-0307-1004
Conventional Manifold/Traditional Flange Bolts	
Carbon steel	Use bolts supplied with manifold
316 SST	Use bolts supplied with manifold
Level Flange, Vertical Mount Bolt Kit (Set of 4)	
Carbon steel	03031-0395-0001
316 SST	03031-0395-0002
3051H Process Flange Bolt Kit (Set of 4)	
Carbon Steel	02051-0164-0001
316 SST	02051-0164-0002

Drain/Vent Valve Kits (each kit contains parts for one transmitter)	Part Number
Differential Drain/Vent Kits	
316 SST stem and seat kit	01151-0028-0022
Alloy C-276 stem and seat kit	01151-0028-0023
Alloy K-500 stem and Alloy 400 seat kit	01151-0028-0024
316 SST ceramic ball drain/vent kit	03031-0378-0022
Alloy C-276 ceramic ball drain/vent kit	03031-0378-0023
Alloy 400/K-500 ceramic ball drain/vent kit	03031-0378-0024
Gage/Absolute Drain/Vent Kits	
316 SST stem and seat kit	01151-0028-0012
Alloy C-276 stem and seat kit	01151-0028-0013
Alloy K-500 stem and Alloy 400 seat kit	01151-0028-0014
316 SST ceramic ball drain/vent kit	03031-0378-0012
Alloy C-276 ceramic ball drain/vent kit	03031-0378-0013
Alloy 400/K-500 ceramic ball drain/vent kit	03031-0378-0014

Mounting Brackets	Part Number
3051C and 3051L Coplanar Flange Bracket kit	
B4 bracket, SST, 2-in. pipe mount, SST bolts	03031-0189-0003
3051T Inline Bracket Kit	
B4 bracket, SST, 2-in. pipe mount, SST bolts	03031-0189-0004
3051C Traditional Flange Bracket Kits	
B1 bracket, 2-in. pipe mount, CS bolts	03031-0313-0001
B2 bracket, panel mount, CS bolts	03031-0313-0002
B3 flat bracket, 2-in. pipe mount, CS bolts	03031-0313-0003
B7 (B1 bracket, SST bolts)	03031-0313-0007
B8 (B2 bracket, SST bolts)	03031-0313-0008
B9 (B3 bracket, SST bolts)	03031-0313-0009
BA (SST B1 bracket, SST bolts)	03031-0313-0011
BC (SST B3 bracket, SST bolts)	03031-0313-0013
3051H Bracket Kits	
B5 universal bracket, 2-in. pipe and panel mount, CS bolts	03051-1081-0001
B6 universal bracket, 2-in. pipe and panel mount, SST bolts	03051-1081-0002

FOUNDATION fieldbus Upgrade Kit	Part Number
Aluminum Housing	03031-0198-0001
316 SST Housing	03031-0198-0002

Figure A-1. Spare Parts Diagram



Appendix B Product Certifications

OVERVIEW

This Appendix contains information on Approved manufacturing locations, European directive information, Ordinary Location certification, Hazardous Locations Certifications and approval drawings for HART protocol.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

Warnings

⚠WARNING

Explosions could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review this section of the Model 3051 reference manual for any restrictions associated with a safe installation.

- 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.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

⚠WARNING

Cable gland and plug must comply with the requirements listed on the certificates.

APPROVED MANUFACTURING LOCATIONS

Emerson Process Management - Rosemount Inc. — Chanhassen, Minnesota, USA

Emerson Process Management — Wessling, Germany

Emerson Process Management Asia Pacific Private Limited — Singapore

Emerson Process Management — Beijing, China
Emerson Process Management — Daman, India

EUROPEAN DIRECTIVE INFORMATION

The most recent revision of the EC declaration of conformity can be found at www.emersonprocess.com.

Ordinary Location Certification for Factory Mutual

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

HAZARDOUS LOCATIONS CERTIFICATIONS

North American Certifications

FM Approvals

E5 Explosion-Proof for Class I, Division 1, Groups B, C, and D.
Dust-Ignition-Proof for Class II, Division 1, Groups E, F, and G.
Dust-Ignition-Proof for Class III, Division 1.
T5 (Ta = 85 °C), Factory Sealed, Enclosure Type 4x

I5 Intrinsically Safe for use in Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 when connected per Rosemount drawing 03031-1019 and 00375-1130 (When used with a Field Communicator); Non-incendive for Class I, Division 2, Groups A, B, C, and D.

Temperature Code:T4 (Ta = 40 °C), T3 (Ta = 85 °C), Enclosure Type 4x
For input parameters see control drawing 03031-1019.

Canadian Standards Association (CSA)

All CSA hazardous approved transmitters are certified per ANSI/ISA 12.27.02-2003.

E6 Explosion-Proof for Class I, Division 1, Groups B, C, and D. Dust-Ignition-Proof for Class II and Class III, Division 1, Groups E, F, and G. Suitable for Class I, Division 2 Groups A, B, C, and D for indoor and outdoor hazardous locations. Enclosure type 4X, factory sealed. Single Seal.

C6 Explosion-Proof and intrinsically safe approval. Intrinsically safe for Class I, Division 1, Groups A, B, C, and D when connected in accordance with Rosemount drawings 03031-1024. Temperature Code T3C.

Explosion-Proof for Class I, Division 1, Groups B, C, and D. Dust-Ignition-Proof for Class II and Class III, Division 1, Groups E, F, and G. Suitable for Class I, Division 2 Groups A, B, C, and D hazardous locations. Enclosure type 4X, factory sealed. Single Seal.

For input parameters see control drawing 03031-1024.

European Certifications

I1 ATEX Intrinsic Safety and Dust
Certification No.: BAS 97ATEX1089X ⟨Ex⟩ II 1 GD
Ex ia IIC T4 (–60 $\leq T_a \leq$ +70 °C)
Dust Rating: Ex tD A20 T80 °C (–20 $\leq T_a \leq$ 40 °C) IP66
CE 1180

Table B-1. Input Parameters

U_i = 30V
I_i = 200 mA
P_i = 0.9W
C_i = 0.012 µF

Special Conditions for Safe Use (X):

When the optional transient protection terminal block is installed, the apparatus is not capable of withstanding the 500V insulation test required by Clause 6.3.12 of EN60079-11. This must be taken into account when installing the apparatus.

N1 ATEX Type n and Dust
Certification No.: BAS 00ATEX3105X ⟨Ex⟩ II 3 GD
Ex nA nL IIC T5 (–40 $\leq T_a \leq$ 70 °C)
U_i = 55 Vdc max
Dust rating: Ex tD A22 T80 °C (–20 $\leq T_a \leq$ 40 °C) IP66

Special Conditions for Safe Use (X):

When the optional transient protection terminal block is installed, the apparatus is not capable of withstanding a 500V r.m.s. test to case. This must be taken into account on any installation in which it is used, for example by assuring that the supply to the apparatus is galvanically isolated.

E8 ATEX Flameproof and Dust
Certification No.: KEMA 00ATEX2013X Ex II 1/2 GD
Ex d IIC T6 (–50 $\leq$ T_a $\leq$ 65 °C)
Ex d IIC T5 (–50 $\leq$ T_a $\leq$ 80 °C)
Dust rating Ex tD A20/A21 T90 °C, IP66
CE 1180
Vmax = 55 V dc

Special Conditions for Safe Use (X):

This device contains a thin wall diaphragm. Installation, maintenance, and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
For more information on the dimensions of the flameproof joints, contact the manufacturer.

Japanese Certifications

E4 TIIS Flameproof
Ex d IIC T6

Certificate	Description
C15850	3051C/D/1 4–20 mA HART — no meter
C15851	3051C/D/1 4–20 mA HART — with meter
C15854	3051T/G/1 4–20 mA HART, SST, Silicon — no meter
C15855	3051T/G/1 4–20 mA HART, Alloy C-276, Silicon — no meter
C15856	3051T/G/1 4–20 mA HART, SST, Silicon — with meter
C15857	3051T/G/1 4–20 mA HART, Alloy C-276, Silicon — with meter

I4 TIIS Intrinsic Safety
Ex ia IIC T4

Certificate	Description
C16406	3051CD/CG

Australian Certifications

I7 SAA Intrinsic Safety
Certification No.: AUS EX 1249X
Ex ia IIC T4 (T_{amb} = 70 °C)
IP66
When connected per Rosemount drawing 03031-1026

The apparatus may only be used with a passive current limited power source Intrinsic Safety application. The power source must be such that Po ≤ (Uo * Io) / 4. Modules using transient protection in the terminal assembly (T1 transient protection models) the apparatus enclosure is to be electrically bonded to the protective earth. The conductor used for the connection shall be equivalent to a copper conductor of 4 mm2 minimum cross-sectional area.

Table B-2. Input Parameters

U_i = 30V
I_i = 200 mA
I_i = 160 mA (output code A with T1)
P_i = 0.9W
C_i = 0.01 µF
C_i = 0.042 µF (output code M)
L_i = 10 µH
L_i = 1.05 mH (output code A with T1)
L_i = 0.75 mH (output code M with T1)

E7 SAA Explosion-Proof (Flame-Proof)
Certification No.: AUS EX 1347X
Ex d IIC T6 (T_{amb} = 40 °C)
Ex d IIC T5 (T_{amb} = 80 °C)
DIP T6 (T_{amb} = 40 °C)
DIP T5 (T_{amb} = 80 °C)
IP65

Special Conditions for Safe Use (X):

It is a condition of safe use for transmitter enclosures having cable entry thread other than metric conduit thread that the equipment be utilized with an appropriate certified thread adaptor.

N7 SAA Type n (Non-sparking)
Certification No.: AUS EX 1249X
Ex n IIC T4 (T_{amb} = 70 °C)
IP66

Special Conditions for Safe Use (X):

Where the equipment is installed such that there is an unused conduit entry, it must be sealed with a suitable blanking plug to maintain the IP40 degree of protection. Any blanking plug used with the equipment shall be of a type which requires the use of a tool to effect its removal. Voltage source shall not exceed 35 Vdc.

Inmetro Certifications

E2 Flameproof
Certificate number (manufactured in Chanhassen, MN): Ex-073/971
Certificate number (manufactured in Brazil): Ex-1383/07X
BR-Ex d IIC T6/T5

I2 Intrinsic Safety
Certificate number (manufactured in Chanhassen, MN): Ex-073/971X
Certificate number (manufactured in Brazil): Ex-1412/07X
BR- Ex ia IIC T4

China (NEPSI) Certifications

E3 Flameproof
Certification No.: GYJ091065X
Ex d IIC T3~T5
DIP A21 T_A T90C IP66

I3 Intrinsic Safety
Certification No.: GYJ091066X
Ex ia IIC T4/T5
DIP A21 T_A T80C IP66

Table B-3. Input Parameters

U_i = 30V
I_i = 200 mA
P_i = 1W
C_i = 0.012 µF
L_i = 0

Combinations of Certifications

Stainless steel certification tag is provided when optional approval is specified. Once a device labeled with multiple approval types is installed, it should not be reinstalled using any other approval types. Permanently mark the approval label to distinguish it from unused approval types.

K5 **E5** and **I5** combination

KB **K5** and **C6** combination

KD **K5**, **C6**, **I1**, and **E8** combination

K6 **C6**, **I1**, and **E8** combination

K8 **E8** and **I1** combination

K7 **E7**, **I7**, and **N7** combination

K2 **E2** and **I2** combination

APPROVAL DRAWINGS

Factory Mutual
03031-1019

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AE	ADD 3Ø51G	RTC1Ø19922	J.G.	7/11/Ø5
AF	ADD FISCO DETAILS	RTC1Ø21913	N.J.H.	7/9/Ø6
AG	ADD FISCO ENTITY PARAMETERS TO SHT 12	RTC1Ø22876	N.J.H.	10/27/Ø6

ENTITY APPROVALS FOR

3Ø51C	3ØØ1C
3Ø51L	3ØØ1CL
3Ø51P	3ØØ1CH
3Ø51H	3ØØ1S
3Ø51CA	3ØØ1SL
3Ø51T	3ØØ1SH
3Ø51G	

OUTPUT CODE A (4-2Ø mA HART) I.S. SEE SHEETS 2-5
OUTPUT CODE M (LOW POWER) I.S. SEE SHEETS 6-7
OUTPUT CODE F/W (FIELDBUS) I.S. SEE SHEETS 8-12
ALL OUTPUT CODES NONINCENDIVE SEE SHEET 13

THE ROSEMOUNT TRANSMITTERS LISTED ABOVE ARE F.M. APPROVED AS INTRINSICALLY SAFE WHEN USED IN CIRCUIT WITH F.M. APPROVED BARRIERS WHICH MEET THE ENTITY PARAMETERS LISTED IN THE CLASS I, II, AND III, DIVISION 1 GROUPS INDICATED, TEMP CODE T4. ADDITIONALLY, THE ROSEMOUNT 751 FIELD SIGNAL INDICATOR IS F.M. APPROVED AS INTRINSICALLY SAFE WHEN CONNECTED IN CIRCUIT WITH ROSEMOUNT TRANSMITTERS (FROM ABOVE) AND F.M. APPROVED BARRIERS WHICH MEET THE ENTITY PARAMETERS LISTED FOR CLASS I, II, AND III, DIVISION 1, GROUPS INDICATED, TEMP CODE T4.

TO ASSURE AN INTRINSICALLY SAFE SYSTEM, THE TRANSMITTER AND BARRIER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE APPLICABLE CIRCUIT DIAGRAM.

CAD MAINTAINED (MicroStation)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

-TOLERANCE-
.X ± .1 [2.5]
.XX ± .02 [0.5]
.XXX ± .010 [0.25]
FRACTIONS ± 1/32
ANGLES ± 2°

DO NOT SCALE PRINT

Form Rev AC

CONTRACT NO.
DR. MIKE DOBE 03/21/89
CHK'D
APP'D. KELLY ORTH 03/22/89
APP'D. GOVT.

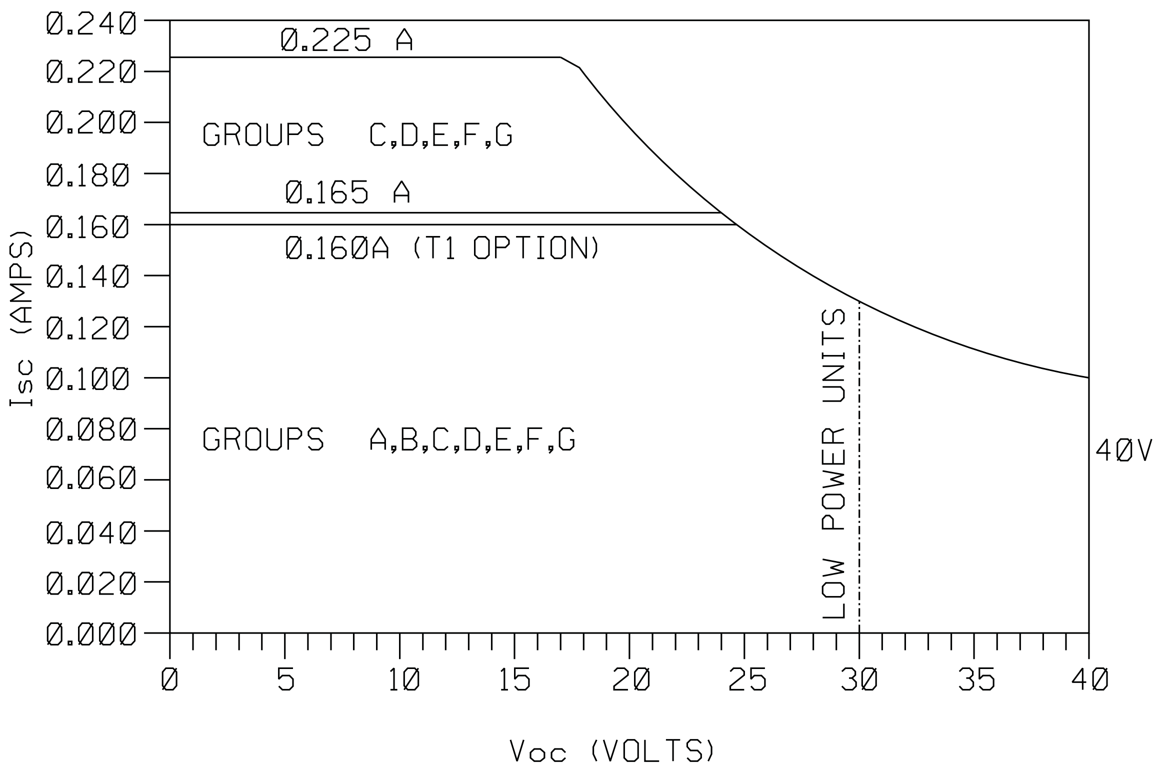
EMERSON. Process Management
ROSEMOUNT®
8200 Market Boulevard • Chanhassen, MN 55317 USA

TITLE: INDEX OF I.S. & NONINCENDIVE F.M. FOR 3Ø51C/L/P/H/T AND 3ØØ1C/S

SIZE A | FSCM NO | DWG NO. Ø3Ø31-1Ø19
SCALE N/A | WT. | SHEET 1 OF 13

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODES A & M)
Pmax = 1WATT

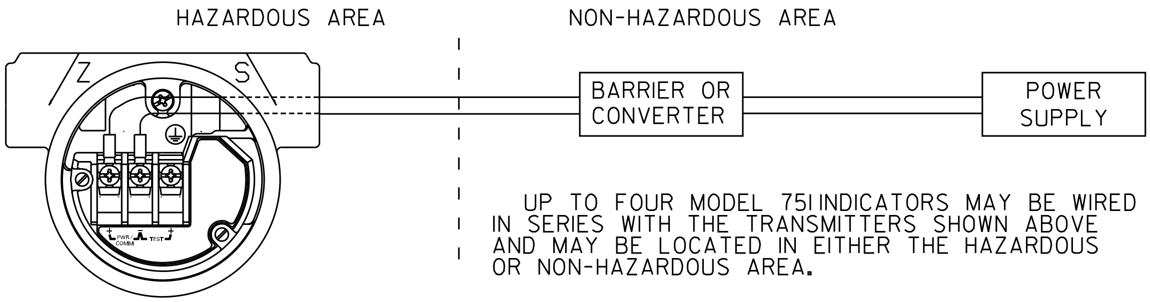


Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA	CAD MAINTAINED (MicroStation)		
DR. MIKE DOBE	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ————	SHEET 2 OF 13

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

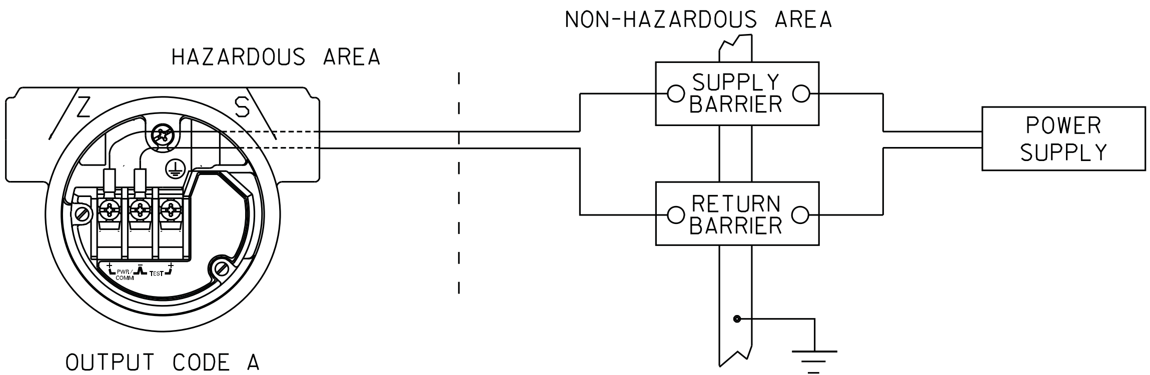
CIRCUIT DIAGRAM 1
ONE BARRIER OR CONVERTER:
SINGLE OR DUAL CHANNEL



UP TO FOUR MODEL 751 INDICATORS MAY BE WIRED IN SERIES WITH THE TRANSMITTERS SHOWN ABOVE AND MAY BE LOCATED IN EITHER THE HAZARDOUS OR NON-HAZARDOUS AREA.

OUTPUT CODE A
MODELS INCLUDED
3051C, L, P, H, T, CA, G
3001C, CL, CH, S, SL, SH

CIRCUIT DIAGRAM 2
SUPPLY AND RETURN BARRIERS
(ONLY FOR USE WITH BARRIERS APPROVED IN THIS CONFIGURATION)



OUTPUT CODE A
MODELS INCLUDED
3051C, L, P, H, T, CA, G
3001C, CL, CH, S, SL, SH

UP TO FOUR MODEL 751 INDICATORS MAY BE WIRED IN SERIES WITH THE TRANSMITTERS SHOWN ABOVE AND MAY BE LOCATED IN EITHER THE HAZARDOUS OR NON-HAZARDOUS AREA.

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. MIKE DOBE	SIZE A	FSCM NO	DWG NO. 03031-1019	
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 13	

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (Voc OR Vt) AND MAX. SHORT CIRCUIT CURRENT (Isc OR It) AND MAX.POWER (Voc X Isc/4) OR (Vt X It/4), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (Vmax), MAXIMUM SAFE INPUT CURRENT (Imax), AND MAXIMUM SAFE INPUT POWER (Pmax) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAX. ALLOWABLE CONNECTED CAPACITANCE (Ca) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (Ci) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (Li) OF THE INTRINSICALLY SAFE APPARATUS.

FOR OUTPUT CODE A

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

CLASS I, DIV. 1, GROUPS A AND B

V_{MAX} = 40V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 40V
I_{MAX} = 165mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 165mA
P_{MAX} = 1 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{oc} \times I_{sc}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .01μf	C_A IS GREATER THAN .01μf
L_I =10μH	L_A IS GREATER THAN 10μH

* FOR T1 OPTION:

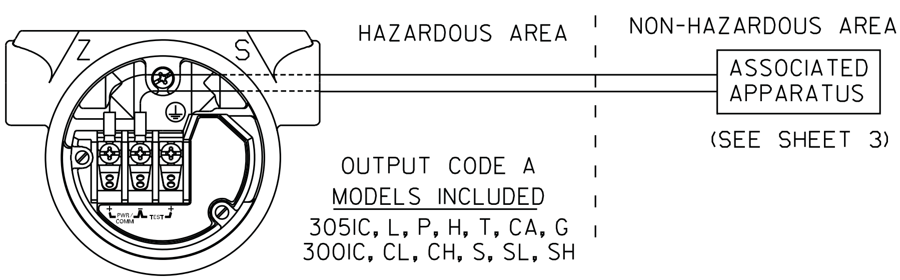
Imax = 160mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 160mA
L_I =1.05mH	L_A IS GREATER THAN 1.05mH

CLASS I, DIV. 1, GROUPS C AND D

V_{MAX} = 40V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 40V
I_{MAX} = 225mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 225mA
P_{MAX} = 1 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{oc} \times I_{sc}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .01μf	C_A IS GREATER THAN .01μf
L_I =10μH	L_A IS GREATER THAN 10μH

* FOR T1 OPTION:

L_I =1.05mH	L_A IS GREATER THAN 1.05mH



OUTPUT CODE A

MODELS INCLUDED

305IC, L, P, H, T, CA, G
300IC, CL, CH, S, SL, SH

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. MIKE DOBE	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ———	SHEET 4 OF 13

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

MODEL 3051G

FOR OUTPUT CODE A

CLASS I, DIV. 1, GROUPS A AND B

V_{MAX} = 30V	Vt or Voc IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 165mA	It or Isc IS LESS THAN OR EQUAL TO 165mA
P_{MAX} = 1 WATT	(Voc X Isc/4) or (Vt X It/4) IS LESS THAN OR EQUAL TO 1 WATT
C_I = 0.01 μF	C_A IS GREATER THAN 0.01 μF + C_{CABLE}
L_I = 10 μH	L_A IS GREATER THAN 10 μH + L_{CABLE}

FOR T1 OPTION:

I_{MAX} = 160mA	It or Isc IS LESS THAN OR EQUAL TO 145mA
L_I = 1.06 mH	L_A IS GREATER THAN 1.06 mH + L_{CABLE}

CLASS I, DIV. 1, GROUPS C AND D

V_{MAX} = 30V	Vt or Voc IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 225mA	It or Isc IS LESS THAN OR EQUAL TO 225mA
P_{MAX} = 1 WATT	(Voc X Isc/4) or (Vt X It/4) IS LESS THAN OR EQUAL TO 1 WATT
C_I = 0.01 μF	C_A IS GREATER THAN 0.01 μF + C_{CABLE}
L_I = 10 μH	L_A IS GREATER THAN 10 μH + L_{CABLE}

FOR T1 OPTION:

L_I = 1.06 mH	L_A IS GREATER THAN 1.06 mH + L_{CABLE}

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1019	
ISSUED	SCALE N/A	WT. ———	SHEET 5 OF 13	

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

FOR OUTPUT CODE M

CLASS I, DIV. 1, GROUPS A AND B

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 165mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 165mA
P_{MAX} = 1 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .042μf	C_A IS GREATER THAN .042μf
L_I =10μH	L_A IS GREATER THAN 10μH

* FOR T1 OPTION:

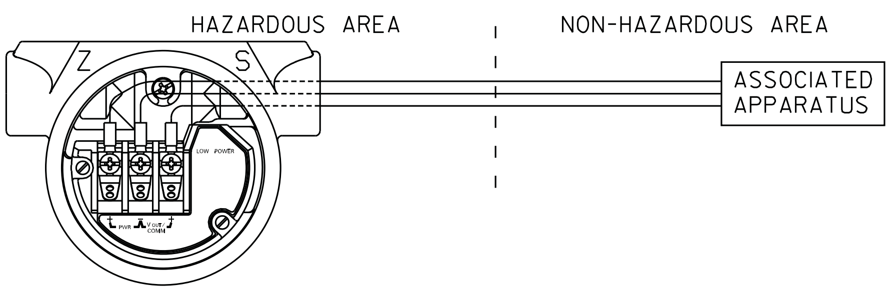
L_I =0.75mH	L_A IS GREATER THAN 0.75mH

CLASS I, DIV. 1, GROUPS C AND D

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 225mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 225mA
P_{MAX} = 1 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .042μf	C_A IS GREATER THAN .042μf
L_I =10μH	L_A IS GREATER THAN 10μH

* FOR T1 OPTION:

L_I =0.75mH	L_A IS GREATER THAN 0.75mH



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

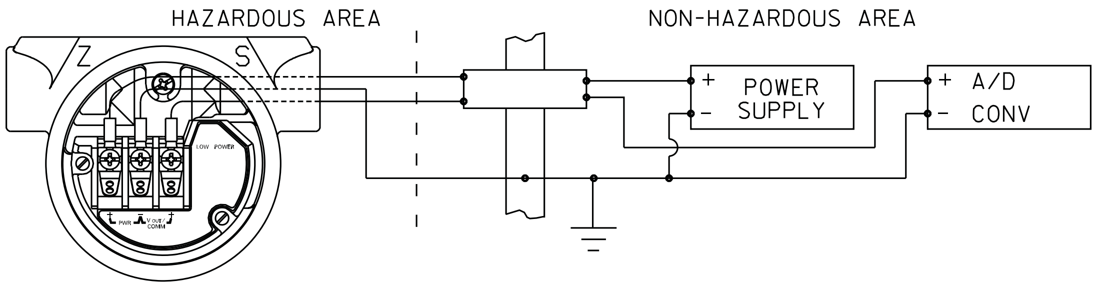
3051C	3051H
3051L	3051CA
3051P	3051T

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA	CAD MAINTAINED (MicroStation)		
DR. MIKE DOBE	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ———	SHEET 6 OF 13

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

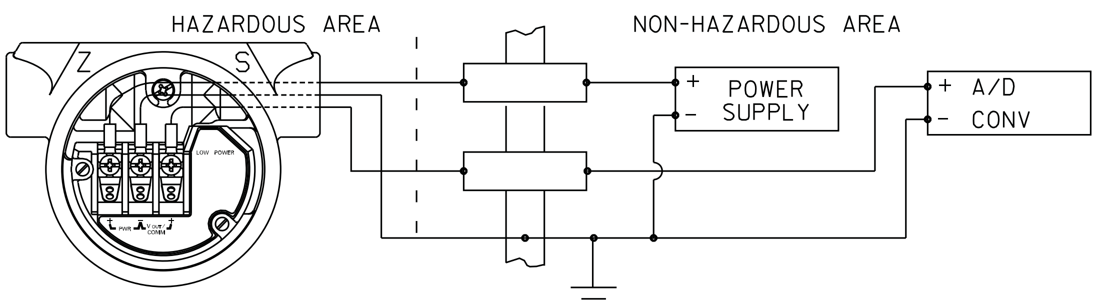
CIRCUIT DIAGRAM 3
ONE DUAL CHANNEL BARRIER



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

305IC	305IH
305IL	305ICA
305IP	305IT

CIRCUIT DIAGRAM 4
TWO SINGLE CHANNEL BARRIERS
(ONLY FOR USE WITH BARRIERS APPROVED
IN THIS CONFIGURATION)



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

305IC	305IH
305IL	305ICA
305IP	305IT

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. SANDI MANSON

ISSUED

SIZE A | FSCM NO | DWG NO. Ø3Ø31-1Ø19

SCALE N/A | WT. ———— | SHEET 7 OF 13

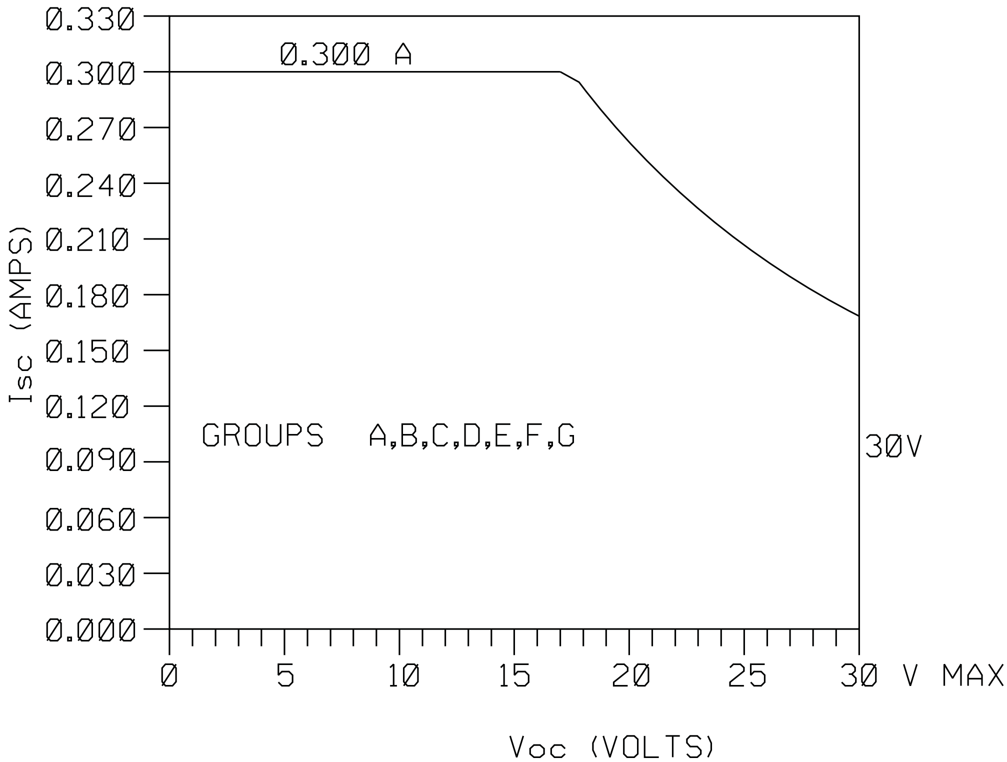
Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

3Ø51 WITH FOUNDATION FIELDBUS OR PROFIBUS.
(OUTPUT CODE F OR W)

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODE F OR W)

Pmax = 1.3 WATT

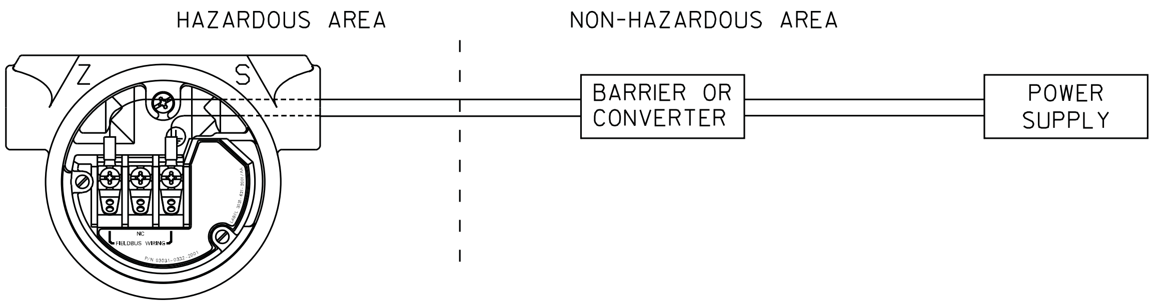


Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA	CAD MAINTAINED (MicroStation)			
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. Ø3Ø31-1Ø19	
ISSUED	SCALE N/A	WT. ————	SHEET 8 OF 13	

Form Rev AC

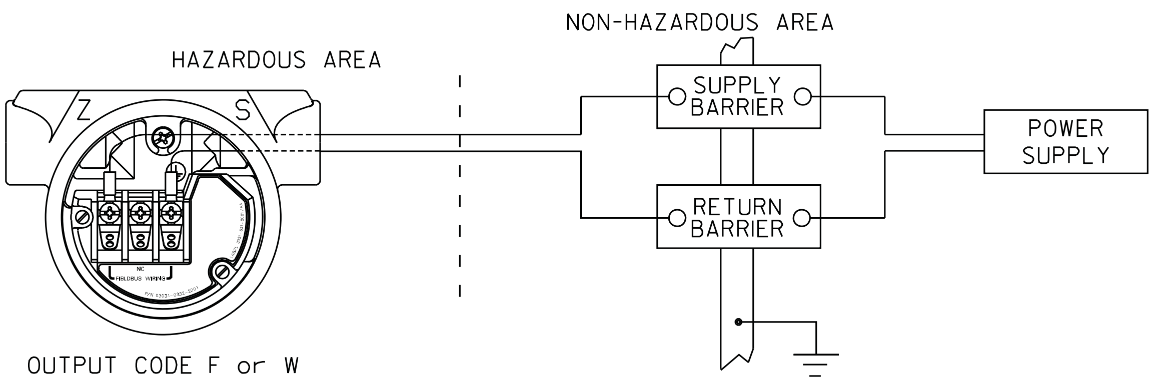
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

CIRCUIT DIAGRAM 1
ONE BARRIER OR CONVERTER:
SINGLE OR DUAL CHANNEL



OUTPUT CODE F or W
<u>MODELS INCLUDED</u>
3051C, L, P, H, T, CA
3001C, CL, CH

CIRCUIT DIAGRAM 2
SUPPLY AND RETURN BARRIERS
(ONLY FOR USE WITH BARRIERS APPROVED IN THIS CONFIGURATION)



OUTPUT CODE F or W
<u>MODELS INCLUDED</u>
3051C, L, P, H, T, CA
3001C, CL, CH

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO		DWG NO.	03031-1019
ISSUED	SCALE N/A	WT.		SHEET 9 OF 13	

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

ENTITY CONCEPT APPROVALS

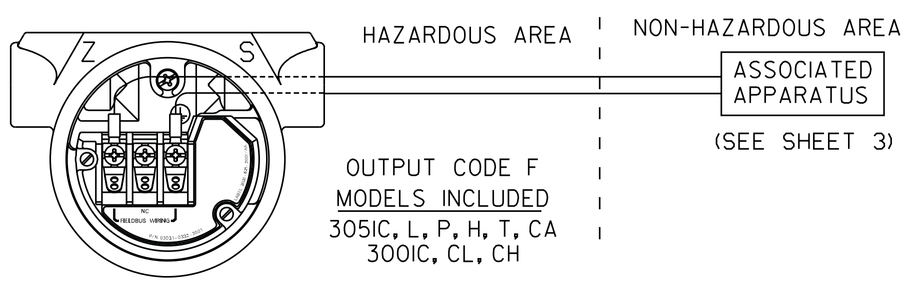
THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (Voc OR Vt) AND MAX. SHORT CIRCUIT CURRENT (Isc OR It) AND MAX.POWER (Voc X Isc/4) OR (Vt X It/4), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (Vmax), MAXIMUM SAFE INPUT CURRENT (Imax), AND MAXIMUM SAFE INPUT POWER (Pmax) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAX. ALLOWABLE CONNECTED CAPACITANCE (Ca) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (Ci) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (Li) OF THE INTRINSICALLY SAFE APPARATUS.

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

FOR OUTPUT CODE F or W

CLASS I, DIV. 1, GROUPS A, B, C AND D

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 300mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 300mA
P_{MAX} = 1.3 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1.3 WATT
C_I = 0 μf	C_A IS GREATER THAN 0 μf
L_I = 0 μH	L_A IS GREATER THAN 0 μH



Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA	CAD MAINTAINED (MicroStation)		
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ———	SHEET 10 OF 13

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

FISCO CONCEPT APPROVALS

THE FISCO CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIALLY EXAMINED IN SUCH COMBINATION. FOR THIS INTERCONNECTION TO BE VALID THE VOLTAGE (U_1 or V_{max}), THE CURRENT (I_1 or I_{max}), AND THE POWER (P_1 or P_{ma}) THAT INTRINSICALLY SAVE APPARATUS CAN RECEIVE AND REMAIN INTRINSICALY SAFE, INCLUDING FAULTS, MUST BE EQUAL OR GREATER THAN THE VOLTAGE (U_o, V_{oc}, or V_t), THE CURRENT (I_o, I_{sc}, or I_t), AND THE POWER (P_o or P_{max}) LEVELS WHICH CAN BE DELIVERED BY THE ASSOCIATED APPARATUS, CONSIDERING FAULTS AND APPLICABLE FACTORS. ALSO, THE MAXIMUM UNPROTECTED CAPACITANCE (C_1) AND THE INDUCTANCE (L_1) OF EACH APPARATUS (BESIDES THE TERMINATION) CONNECTED TO THE FIELDBUS MUST BE LESS THAN OR EQUAL TO 5nF AND 10μH RESPECTVELY.
ONLY ONE ACTIVE DEVICE IN EACH SECTION (USUALLY THE ASSOCIATED APPARATUS) IS ALLOWED TO CONTRIBUTE THE DESIRED ENERGY FOR THE FIELDBUS SYSTEM. THE ASSOCIATED APPARATUS' VOLTAGE U_o (or V_{oc} or V_t) IS LIMITED TO A RANGE OF 14V TO 24 V.D.C. ALL OTHER EQUIPENT COMBINED IN THE BUS CABLE MUST BE PASSIVE (THEY CANNOT PROVIDE ENERGY TO THE SYSTEM, EXCEPT A LEAKAGE CURRENT OF 50 μA FOR EACH CONNECTED DEVICE) SEPARATELY POWERED EQUIPMENT REQUIRES A GALVANIC ISOLATION TO AFFIRM THAT THE INTRINSICALLY SAFE FIELDBUS CIRCUIT WILL REMAIN PASSIVE. THE PARAMETER OF THE CABLE USED TO INTERCONNECT THE DEVICES MUST BE IN THE FOLLOWING RANGE:

LOOP RESISTANCE R':	15...150 OHM/km
INDUCTANCE PER UNIT LENGTH L':	0.4...1mH/KM
CAPACITANCE PER UNLIT LENGTH C':	80...200nF

C' = C' LINE/LINE +0.5C' LINE/SCREEN, IF BOTH LINES ARE FLOATING, OR
C' = C' LINE/LINE +C' LINE/SCREEN, IF THE SCREEN IS CONNECTED TO ONE LINE

TRUNK CABLE LENGTH:	≤1000 m
SPUR CABLE LENGTH:	≤30 m
SPLICE LENGTH:	≤1 m

AN APPROVED INFALLIBLE LINE TERMINATION TO EACH END OF THE TRUNK CABLE, WITH THE FOLLOWING PARAMETERS IS APPROPRIATE:

R = 90...100 OHMS C = 2.2μF

AN ALLOWED TERMINATION MIGHT ALREADY BE LINKED IN THE ASSOCIATED APPARATUS. DUE TO I.S. REASONS, THE NUMBER OF PASSIVE APPARATUS CONNECTED TO THE BUS SEGMENT IS NOT LIMITED. IF THE RULES ABOVE ARE FOLLOWED, UP TO A TOTAL LENGTH OF 1000 m (THE SUMMATION OF TRUNK AND ALL SPUR CABLES), THE INDUCTANCE AND THE CAPACITANCE OF THE CABLE WILL NOT DAMAGE THE INTRINSIC SAFETY OF THE SYSTEM.

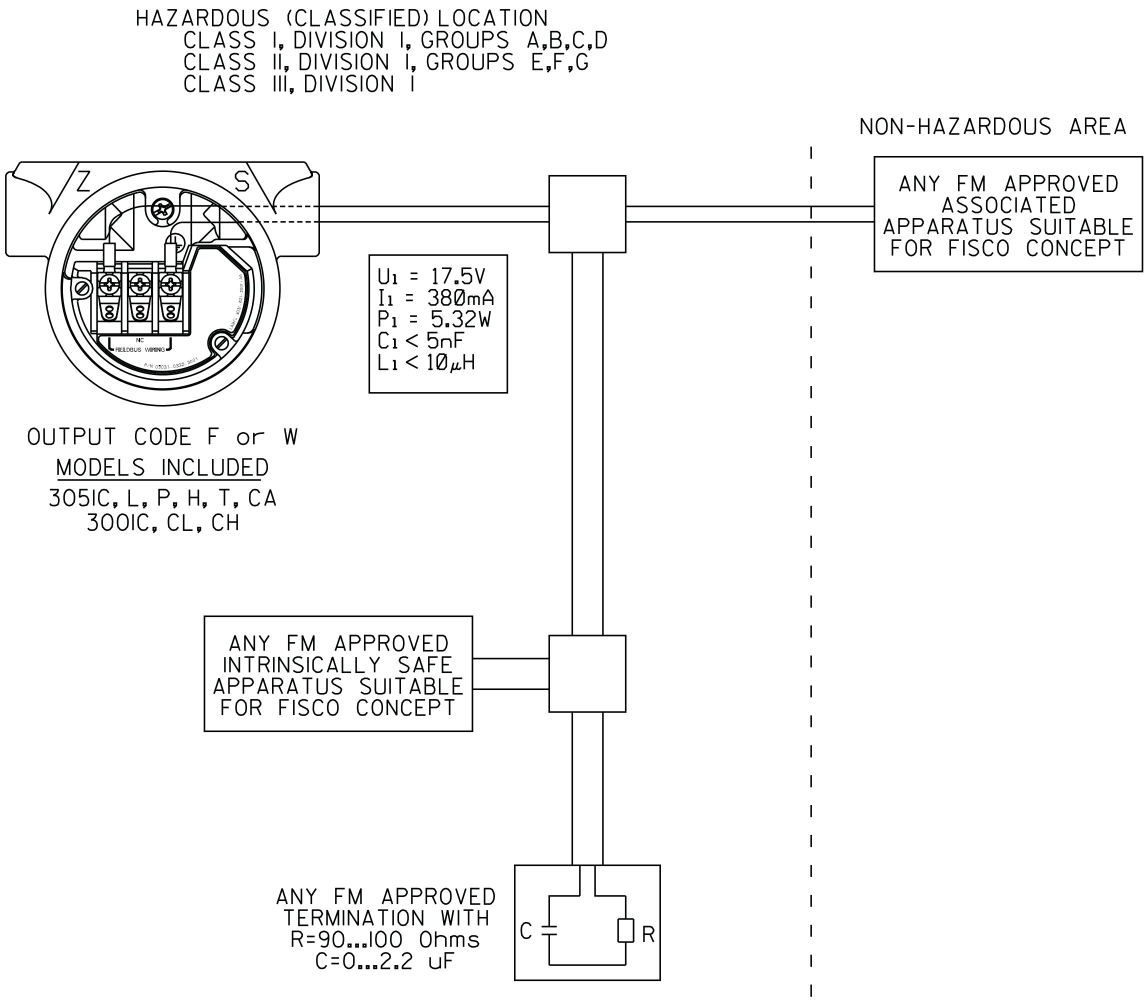
NOTES:
INTRINSICALLY SAFE CLASS I, DIV. 1, GROUPS A, B, C, D

1. THE MAXIMUM NON-HAZARDOUS AREA VOLTAGE MUST NOT EXCEED 250 V.
2. CAUTION: ONLY USE SUPPLY WIRES SUITABLE FOR 5°C ABOVE SURROUNDING TEMPERATURE.
3. WARNING: REPLACEMENT OF COMPONENTS MAY DAMAGE INTRINSIC SAFETY.

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA	CAD MAINTAINED (MicroStation)		
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT.	SHEET 11 OF 13

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				



Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

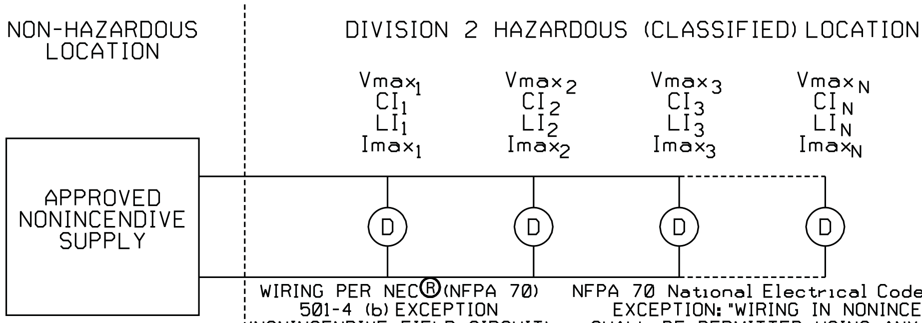
CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ————	SHEET 12 OF 13

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AG				

NONINCENDIVE FIELD CIRCUIT
CLASS I, DIV. 2 LOCATIONS



WIRING PER NEC® (NFPA 70) 501-4 (b) EXCEPTION (NONINCENDIVE FIELD CIRCUIT)

NFPA 70 National Electrical Code® ARTICLE 501-4(b) EXCEPTION: "WIRING IN NONINCENDIVE CIRCUITS SHALL BE PERMITTED USING ANY OF THE METHODS SUITABLE FOR WIRING IN ORDINARY LOCATIONS."

IN NORMAL OPERATION
DEVICES CONTROL THROUGH–CURRENT

PARAMETERS   DEVICE

$V_{oc} \leq$ Minimum of $(V_{max1}, V_{max2}, \ldots, V_{maxN})$

$I_{max1} \geq I_{q1} + I_{signal1}$

$I_{max2} \geq I_{q1} + I_{signal2}$

.
.
.

$I_{maxN} \geq I_{qN} + I_{signalN}$

$C_a \leq C_{i1} + C_{i2} + \ldots + C_{iN} + C_{cable}$

$L_a \leq L_{i1} + L_{i2} + \ldots + L_{iN} + L_{cable}$

ROSEMOUNT 3051/3001

	4-20mA / HART	FIELDBUS (F or W)
Vmax	40v	30v
Maximum normal operating current	22mA	27mA
Ca	.010uF	0uF
La	10uH	0uH

ROSEMOUNT 3051 TRANSMITTERS ARE CURRENT CONTROLLERS ON INDIVIDUAL PARALLEL BRANCHES WITH RESPECT TO THE POWER SUPPLY. IN NONINCENDIVE INSTALLATIONS THE Imax FOR EACH TRANSMITTER IS NOT RELATED TO THE MAXIMUM CURRENT OF THE POWER SUPPLY (Isc) IN THE SAME MANNER AS FOR TRANSMITTER INSTALLED PER I.S. REQUIREMENTS, BECAUSE NONINCENDIVE REQUIREMENTS INCLUDE ONLY NORMAL OPERATING CONDITIONS.

REFERENCE: APPENDIX A7.3 (FM3611)

Imax for an individual device = Iq + Isignal

Iq =Quiescent current through device
(Maximum quiescent current for the device)

Isignal =Signaling current through device
(Protocol may limit signaling to one device at a time)

Operating $I_{max} = I_{q1} + I_{q2} + \ldots + I_{qN} + I_{signal\,max}$

$I_{signal\,max}$ = Max. of $(I_{signal1}, I_{signal2}, \ldots, I_{signalN})$

CAD MAINTAINED (MicroStation)

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA				
DR. Jon Steffens	SIZE A	FSCM NO	DWG NO. 03031-1019	
ISSUED	SCALE N/A	WT. ————	SHEET 13 OF 13	

Form Rev AC

Canadian Standards Association (CSA) 03031-1024

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA	ADD FIELDBUS	RTC1004232	M.L.M.	5/28/98
AB	ADD PROFIBUS, ENTITY PARAMETERS	RTC1008326	P.C.S.	2/4/00
AC	REM It, Vt FROM ENTITY PARAMETERS	RTC1009279	W.C.R.	7/11/00
AD	ADD FISCO FIELDBUS	RTC1012624	J.P.W.	4/4/02

APPROVALS FOR

3051C	3001C
3051L	3001CL
3051P	3001CH
3051H	3001S
3051CA	3001SL
3051T	3001SH

OUTPUT CODE A (4-20 mA HART) I.S. SEE SHEETS 2-3
OUTPUT CODE M (LOW POWER) I.S. SEE SHEETS 3-4
OUTPUT CODE F/W (FIELDBUS) I.S. SEE SHEETS 5-7
OUTPUT CODES A,F,W I.S. ENTITY PARAMETERS SHEET 8-9

TO ASSURE AN INTRINSICALLY SAFE SYSTEM, THE TRANSMITTER AND BARRIER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE APPLICABLE CIRCUIT DIAGRAM.

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2.

CAD MAINTAINED (MicroStation)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

-TOLERANCE-
.X ± .1 [2,5]
.XX ± .02 [0,5]
.XXX ± .010 [0,25]
FRACTIONS ± 1/32
ANGLES ± 2°

DO NOT SCALE PRINT

CONTRACT NO.
DR. Mike Dobe 08/27/90
CHK'D
APP'D. GLEN MONZO 8/31/90
APP'D. GOVT.

EMERSON. Process Management
ROSEMOUNT®
8200 Market Boulevard • Chanhassen, MN 55317 USA

TITLE
INDEX OF I.S. CSA FOR 3051C/L/P/H/T & 3001C/S

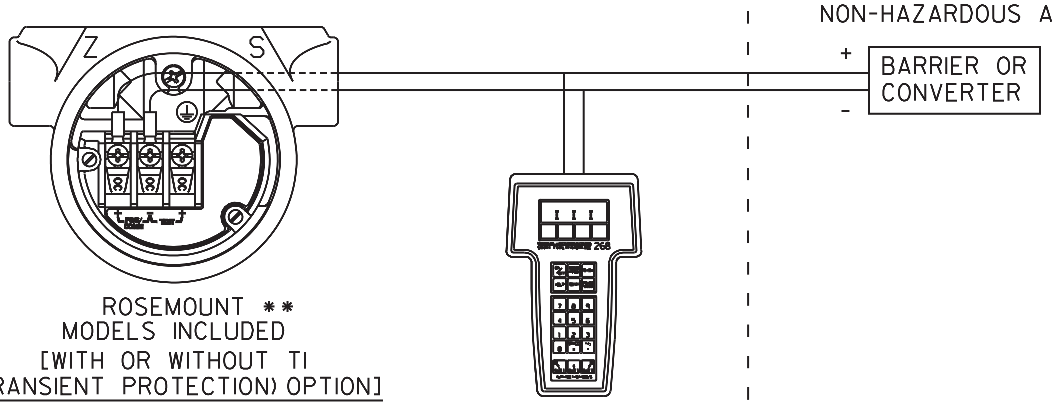
SIZE A | FSCM NO | DWG NO. 03031-1024
SCALE N/A | WT. | SHEET 1 OF 9

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

CSA INTRINSIC SAFETY APPROVALS
CIRCUIT CONNECTION WITH BARRIER OR CONVERTER
Ex ia
INTRINSICALLY SAFE/SECURITE INTRINSEQUE
4-20 mA, ("A" OUTPUT CODE)

HAZARDOUS AREA

NON-HAZARDOUS AREA



ROSEMOUNT **
MODELS INCLUDED
[WITH OR WITHOUT TI
(TRANSIENT PROTECTION) OPTION]
3051C, L, P, H, T, CA
3001C, CL, CH, S, SL, SH

ROSEMOUNT
MODEL 268 or 275 SMART
FAMILY INTERFACE

** FOR THE LOW POWER OPTION, SEE PAGE 4 FOR THE CIRCUIT CONNECTION WITH BARRIER OR CONVERTER. FOR FIELDBUS OPTIONS("F" or "W" OUTPUT CODE), SEE PAGE 5 FOR PARAMETERS AND CIRCIUT CONNECTION TO BARRIER.

Rosemount Inc. **8200 Market Boulevard** **Chanhassen, MN 55317 USA**	CAD MAINTAINED (MicroStation)			
DR. Mike Dobe 08/27/90	SIZE A	FSCM NO	DWG NO. 03031-1024	
ISSUED	SCALE N/A	WT.	SHEET 2 OF 9	

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

4-20 mA, ("A" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
CSA APPROVED SAFETY BARRIER	* 30 V OR LESS 330 OHMS OR MORE * 28 V OR LESS 300 OHMS OR MORE 25 V OR LESS 200 OHMS OR MORE * 22 V OR LESS 180 OHMS OR MORE	GROUPS A, B, C, D
FOXBORO CONVERTER 2AI-12V-CGB, 2AI-13V-CGB, 2AS-131-CGB, 3A2-12D-CGB, 3A2-13D-CGB, 3AD-131-CGB, 3A4-12D-CGB, 2AS-121-CGB, 3F4-12DA		GROUPS B, C, D
CSA APPROVED SAFETY BARRIER	30 V OR LESS 150 OHMS OR MORE	GROUPS C, D

LOW POWER, ("M" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
CSA APPROVED SAFETY BARRIER	Supply ≤ 28V, ≥300 Ω Return ≤ 10V, ≥47 Ω	GROUPS A, B, C, D
	Supply ≤ 30V, ≥150 Ω Return ≤ 10V, ≥47 Ω	GROUPS C, D

* MAY BE USED WITH ROSEMOUNT MODEL 268 or 275 SMART FAMILY INTERFACE.

Rosemount Inc. **8200 Market Boulevard** **Chanhassen, MN 55317 USA**	CAD MAINTAINED (MicroStation)				
DR. Mike Dobe	SIZE A	FSCM NO	DWG NO. 03031-1024		
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 9		

Form Rev AD

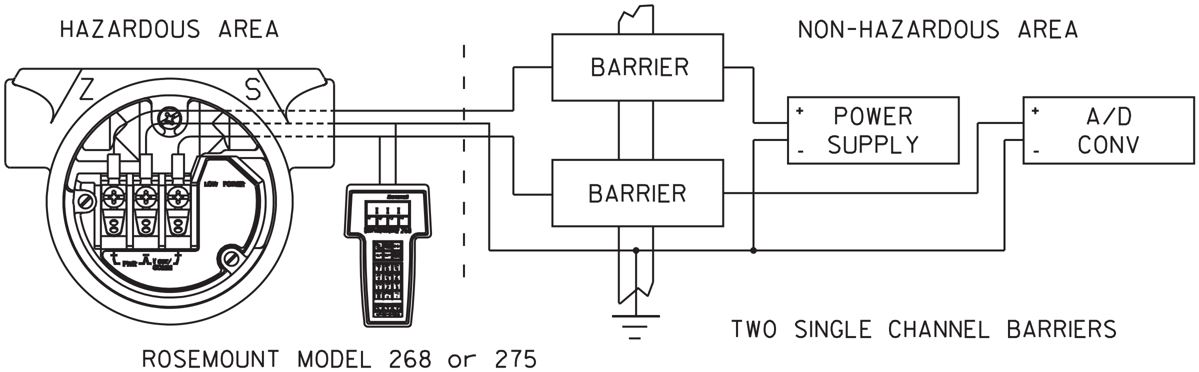
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

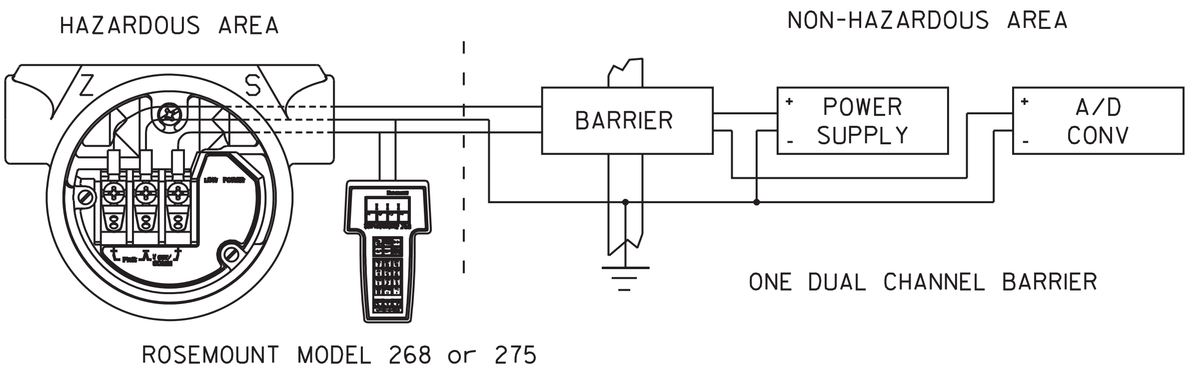
CSA INTRINSIC SAFETY APPROVALS

3051C LOW POWER CIRCUIT CONNECTION WITH INTRINSIC SAFETY BARRIERS

Ex ia

INTRINSICALLY SAFE/SECURITE INTRINSEQUE
LOWPOWER, ("M" OUTPUT CODE)





APPROVED FOR CLASS I, DIVISION I, GROUPS A,B,C,D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS, ONE WITH APPROVED SAFETY PARAMETERS OF 28 VOLTS OR LESS AND 300 OHMS OR MORE IN +PWR LINE, AND ONE WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN Vout LINE, OR ONE CSA APPROVED DUAL CHANNEL SAFETY BARRIER WITH IDENTICAL APPROVED SAFETY PARAMETERS CONNECTED IN LIKE MANNER, AS ABOVE.

APPROVED FOR CLASS I, DIVISION I, GROUPS C,D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS, ONE WITH APPROVED SAFETY PARAMETERS OF 30 VOLTS OR LESS AND 150 OHMS OR MORE IN +PWR LINE AND ONE WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN Vout LINE.

Rosemount Inc. **8200 Market Boulevard** **Chanhassen, MN 55317 USA**	CAD MAINTAINED (MicroStation)			
DR. SANDI MANSON	SIZE A	FSCM NO	DWG NO. 03031-1024	
ISSUED	SCALE N/A	WT. ————	SHEET 4 OF 9	

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

FIELDBUS, ("F" or "W" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
CSA APPROVED SAFETY BARRIER	30 V OR LESS 300 OHMS OR MORE 28 V OR LESS 235 OHMS OR MORE 25 V OR LESS 160 OHMS OR MORE 22 V OR LESS 100 OHMS OR MORE	GROUPS A, B, C, D

CSA INTRINSIC SAFETY APPROVALS

CIRCUIT CONNECTION WITH BARRIER OR CONVERTER

Ex ia

INTRINSICALLY SAFE/SECURITE INTRINSEQUE

FIELDBUS, ("F" or "W" OUTPUT CODE)

HAZARDOUS AREA

NON-HAZARDOUS AREA

ROSEMOUNT ** MODELS INCLUDED
[WITH OR WITHOUT TI (TRANSIENT PROTECTION) OPTION]

3051C, L, P, H, T, CA
3001C, CL, CH, S, SL, SH

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2.

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT. ————	SHEET 5 OF 9

Form Rev AD

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

FISCO CONCEPT APPROVALS

THE FISCO CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIALLY EXAMINED IN SUCH COMBINATION. FOR THIS INTERCONNECTION TO BE VALID THE VOLTAGE (U_i or V_{max}), THE CURRENT (I_i or I_{max}), AND THE POWER (P_i or P_{ma}) THAT INTRINSICALLY SAVE APPARATUS CAN RECEIVE AND REMAIN INTRINSICALY SAFE, INCLUDING FAULTS, MUST BE EQUAL OR GREATER THAN THE VOLTAGE (U_o, V_{oc}, or V_t), THE CURRENT (I_o, I_{sc}, or I_t), AND THE POWER (P_o or P_{max}) LEVELS WHICH CAN BE DELIVERED BY THE ASSOCIATED APPARATUS, CONSIDERING FAULTS AND APPLICABLE FACTORS. ALSO, THE MAXIMUM UNPROTECTED CAPACITANCE (C_i) AND THE INDUCTANCE (L_i) OF EACH APPARATUS (BESIDES THE TERMINATION) CONNECTED TO THE FIELDBUS MUST BE LESS THAN OR EQUAL TO 5nF AND 10µH RESPECTVELY.
ONLY ONE ACTIVE DEVICE IN EACH SECTION (USUALLY THE ASSOCIATED APPARATUS) IS ALLOWED TO CONTRIBUTE THE DESIRED ENERGY FOR THE FIELDBUS SYSTEM. THE ASSOCIATED APPARATUS' VOLTAGE U_o (or V_{oc} or V_t) IS LIMITED TO A RANGE OF 14V TO 24 V.D.C. ALL OTHER EQUIPENT COMBINED IN THE BUS CABLE MUST BE PASSIVE (THEY CANNOT PROVIDE ENERGY TO THE SYSTEM, EXCEPT A LEAKAGE CURRENT OF 50 µA FOR EACH CONNECTED DEVICE) SEPARATELY POWERED EQUIPMENT REQUIRES A GALVANIC ISOLATION TO AFFIRM THAT THE INTRINSICALLY SAFE FIELDBUS CIRCUIT WILL REMAIN PASSIVE. THE PARAMETER OF THE CABLE USED TO INTERCONNECT THE DEVICES MUST BE IN THE FOLLOWING RANGE:

LOOP RESISTANCE R':	15...150 OHM/km
INDUCTANCE PER UNIT LENGTH L':	0.4...1mH/KM
CAPACITANCE PER UNLIT LENGTH C':	80...200nF

C' = C' LINE/LINE +0.5C' LINE/SCREEN, IF BOTH LINES ARE FLOATING, OR
C' = C' LINE/LINE +C' LINE/SCREEN, IF THE SCREEN IS CONNECTED TO ONE LINE

TRUNK CABLE LENGTH:	≤ 1000 m
SPUR CABLE LENGTH:	≤ 30 m
SPLICE LENGTH:	≤ 1 m

AN APPROVED INFALLIBLE LINE TERMINATION TO EACH END OF THE TRUNK CABLE, WITH THE FOLLOWING PARAMETERS IS APPROPRIATE:

R = 90...100 OHMS C = 2.2µF

AN ALLOWED TERMINATION MIGHT ALREADY BE LINKED IN THE ASSOCIATED APPARATUS. DUE TO I.S. REASONS, THE NUMBER OF PASSIVE APPARATUS CONNECTED TO THE BUS SEGMENT IS NOT LIMITED. IF THE RULES ABOVE ARE FOLLOWED, UP TO A TOTAL LENGTH OF 1000 m (THE SUMMATION OF TRUNK AND ALL SPUR CABLES), THE INDUCTANCE AND THE CAPACITANCE OF THE CABLE WILL NOT DAMAGE THE INTRINSIC SAFETY OF THE SYSTEM.

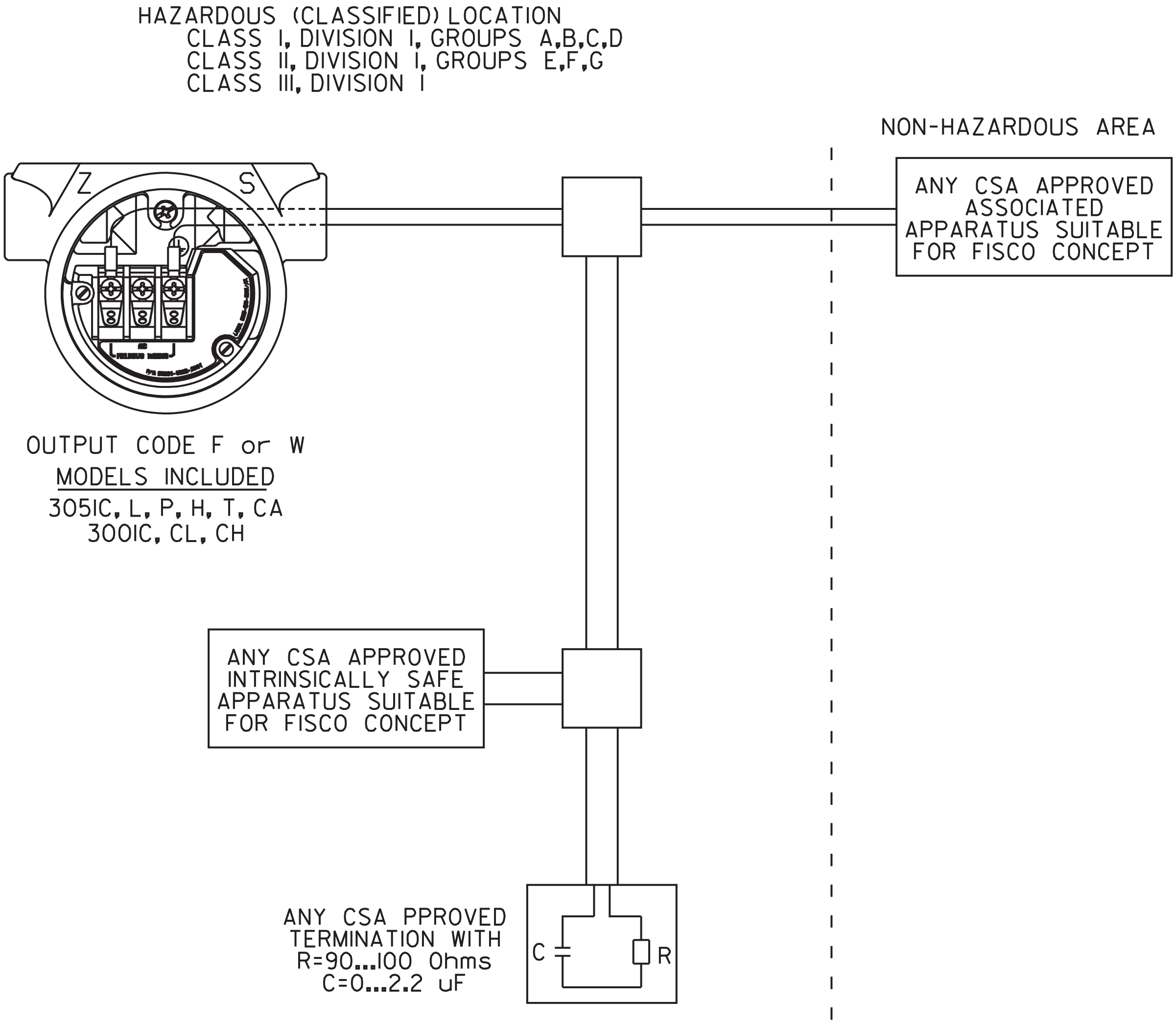
NOTES:
INTRINSICALLY SAFE CLASS I, DIV. 1, GROUPS A, B, C, D

1. THE MAXIMUM NON-HAZARDOUS AREA VOLTAGE MUST NOT EXCEED 250 V.
2. CAUTION: ONLY USE SUPPLY WIRES SUITABLE FOR 5°C ABOVE SURROUNDING TEMPERATURE.
3. WARNING: REPLACEMENT OF COMPONENTS MAY DAMAGE INTRINSIC SAFETY.

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA	CAD MAINTAINED (MicroStation)		
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT. ———	SHEET 6 OF 9

Form Rev AD

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				



Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

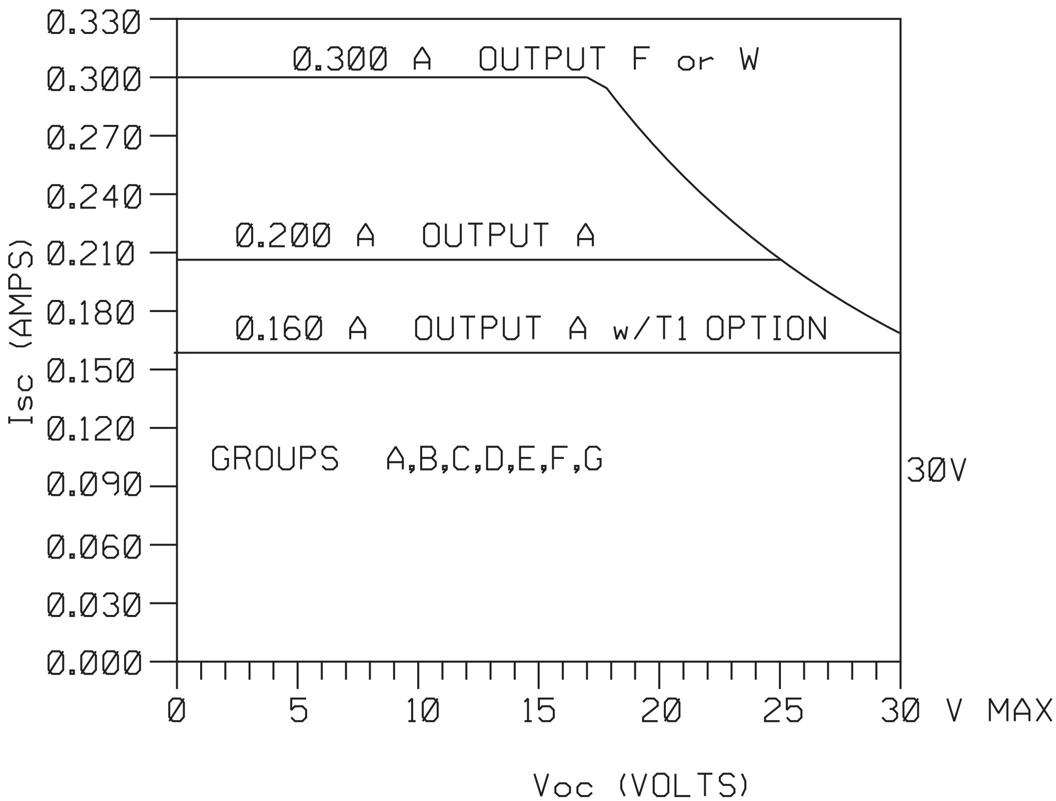
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO.	03031-1024
ISSUED	SCALE N/A	WT. ———	SHEET 7 OF 9	

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

3051 I.S. ENTITY PARAMETERS.
(OUTPUT CODE A,F, or W)

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODE A,F, or W)

Pmax = 1.3 WATT OUTPUT F or W
Pmax = 1.0 WATT OUTPUT A



Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA	CAD MAINTAINED (MicroStation)		
DR. JON STEFFENS	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT. ———	SHEET 8 OF 9

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (Voc) AND MAX. SHORT CIRCUIT CURRENT (Isc) AND MAX.POWER (Voc X Isc/4), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (Vmax), MAXIMUM SAFE INPUT CURRENT (Imax), AND MAXIMUM SAFE INPUT POWER (Pmax) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAX. ALLOWABLE CONNECTED CAPACITANCE (Ca) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (C_1) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (L_1) OF THE INTRINSICALLY SAFE APPARATUS.

FOR OUTPUT CODE A

CLASS I, DIV. 1, GROUPS A, B, C AND D

V_{MAX} = 30V	V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 200mA	I_{SC} IS LESS THAN OR EQUAL TO 200mA
P_{MAX} = 1 WATT	$(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .01µf	C_A IS GREATER THAN .01µf + C CABLE
L_I =10µH	L_A IS GREATER THAN 10µH + L CABLE

* FOR T1 OPTION:

Imax = 160mA	I_{SC} IS LESS THAN OR EQUAL TO 160mA
L_I =1.05mH	L_A IS GREATER THAN 1.05mH + L CABLE

FOR OUTPUT CODE F or W

CLASS I, DIV. 1, GROUPS A, B, C AND D

V_{MAX} = 30V	V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 300mA	I_{SC} IS LESS THAN OR EQUAL TO 300mA
P_{MAX} = 1.3 WATT	$(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1.3 WATT
C_I = 0µf	C_A IS GREATER THAN 0µf + C CABLE
L_I = 0µH	L_A IS GREATER THAN 0µH + L CABLE

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

Rosemount Inc. **8200 Market Boulevard** **Chanhassen, MN 55317 USA**	CAD MAINTAINED (MicroStation)			
DR. JON STEFFENS	SIZE A	FSCM NO	DWG NO. 03031-1024	
ISSUED	SCALE N/A	WT. ———	SHEET 9 OF 9	

Form Rev AB

Standards Association of Australia (SAA) 03031-1026

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY	REVISIONS				
	REV	DESCRIPTION	CHG. NO.	APP'D	DATE
	AA	UPDATE ENTITY PARAMETERS	RTC1002910	J.D.J.	12/2/97
	AB	ADD FIELDBUS AND PROFIBUS	RTC1006448	J.D.J.	4/26/99
	AC	ADD 2088 & 2090's	RTC1017572	K.J.K.	6/11/04

SAA ENTITY CONCEPT APPROVALS

3051C	3001C	2088
3051L	3001CL	2090P
3051P	3001CH	2090F
3051H	3001S	
3051CA		
3051T		

OUTPUT CODE A (4-20 mA HART) SEE SHEETS 2
OUTPUT CODE M (LOW POWER) SEE SHEETS 3
OUTPUT CODE F / W (FIELDBUS, PROFIBUS) SEE SHEETS 4

THE ROSEMOUNT PRESSURE TRANSMITTERS LISTED ABOVE ARE INTRINSICALLY SAFE WHEN USED IN THE CURCUIT WITH SAA APPROVED BARRIERS WHICH MEET THE LIST ENTITY PERAMETERS.

TO ASSURE AN INTRINSICALLY SAFE SYSTEM, THE TRANSMITTER AND BARRIER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE APPLICABLE CIRCUIT DIAGRAM.

CAD MAINTAINED (MicroStation)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125	CONTRACT NO.	EMERSON. Process Management — ROSEMOUNT® 8200 Market Boulevard • Chanhassen, MN 55317 USA
-TOLERANCE- .X ± .1 [2,5] .XX ± .02 [0,5] .XXX ± .010 [0,25]	DR. Mike Dobe 12/30/91	TITLE SAA I.S. INDEX FOR 2088, 2090, 3051 & 3001
FRACTIONS ± 1/32 ANGLES ± 2°	CHK'D	SIZE A / FSCM NO / DWG NO. 03031-1026
	APP'D. GLEN MONZO 5/8/92	
DO NOT SCALE PRINT	APP'D. GOVT.	SCALE N/A / WT. ——— / SHEET 1 OF 4

Form Rev AC