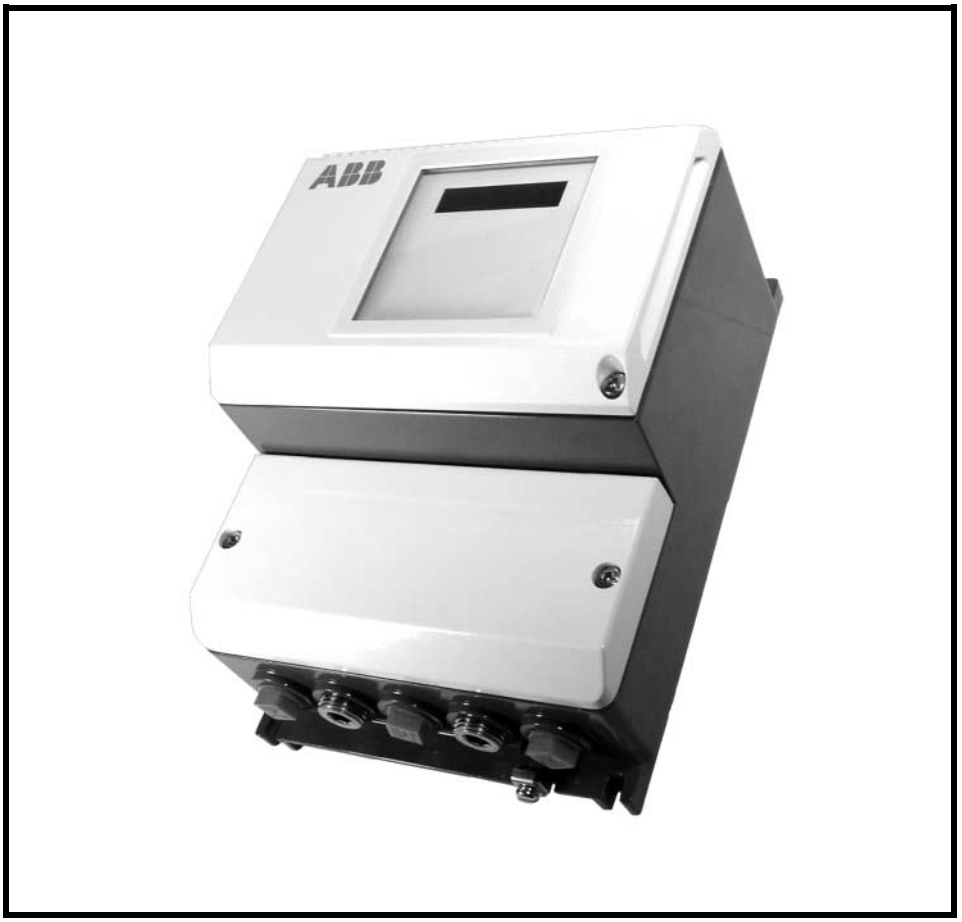
INSTRUCTION MANUAL

MAGNETIC FLOWMETERS
50XM1000 Design Levels D & N

MICROPROCESSOR-BASED SIGNAL CONVERTER



PN25041B

The following are registered trademarks of ABB Inc.: **MAG-X®**
MICRO-DCI™

The following is a registered trademark of Littelfuse Tracor Inc: **LITTELFUSE®**

The following is a registered trademark of the HART Communications Foundation: **HART®**

WARNING notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.

CAUTION notices apply to hazards or unsafe practices which could result in property damage.

NOTES highlight procedures and contain information which assist the operator in understanding the information contained in this manual.

WARNING

INSTRUCTION MANUALS
Do not install, maintain or operate this equipment without reading, understanding and following the proper ABB Inc. instructions and manuals, otherwise injury or damage may result.

POSSIBLE PROCESS UPSETS
Operation & maintenance must be performed only by qualified personnel and only after securing equipment controlled by this product. Adjusting or removing this product while it is in the system may upset the process being controlled. Some process upsets may cause injury or damage.

NOTICE

The information contained in this document is subject to change without notice. ABB Inc. reserves the right to make minor changes to this publication, such as company name & logos as well as other minor corrections, without necessarily changing the publication number.

ABB Inc., its affiliates, employees, and agents, and the authors of and contributors to this publication specifically disclaim all liabilities and warranties, express and implied (including warranties of merchantability and fitness for a particular purpose), for the accuracy, currency, completeness, and/or reliability of the information contained herein and/or for the fitness for any particular use and/or for the performance of any material and/or equipment selected in whole or part with the user of/or in reliance upon information contained herein. Selection of materials and/or equipment is at the sole risk of the user of this publication.

This document contains proprietary information of ABB Inc. and is issued in strict confidence. Its use, or reproduction for use, for the reverse engineering, development or manufacture of hardware or software described herein is prohibited. No part of this document may be photocopied or reproduced without the prior written consent of ABB Inc.

Model 50XM1000
Design Levels D & N
Magmeter Signal Converter

ADDENDUM

ADDENDUM TO MAGNETIC FLOWMETER
50XM1000D/N INSTRUCTION MANUAL

The purpose of this addendum is to revise the Model Number Breakdown section of the 50XM1000D/N Magnetic Flowmeter Signal Converter Instruction Manual

The information on the following pages supersedes the existing information in Section 1.2 (pages 1-6 & 1-7) of the Model 50XM1000 Design Levels D & N Instruction Manual (PN25041B). Only the "**Certifications**" section of the Model Number Breakdown on Page 1-6 has been revised, all other model number information is identical to that shown in the instruction manual.

PN25063

1.2. Model Number Breakdown

Refer to the data sheet or instrument tag on the signal converter for the model number of the signal converter. The details of a model number are defined as follows:

	50XM1	_	_	X	_	_	_	_	AA	_	_	2	_

Engineering Reference

Excitation Frequency

6.25 Hz (50 Hz)	1
12.5 Hz (50 Hz)	2
7.5 Hz (60 Hz)	3
15 Hz (60 Hz)	4
6.25 Hz (DC)	5
12.5 Hz (DC)	6
7.5 Hz (DC)	7
15 Hz (DC)	8

Design Level

Fixed Cover	N
Hinged Cover	D

Software Level X

Certification

None	A
FM Approved (**Design Level D**) - Remote mounted Signal Converter: Non-Incendive for Class I, Div 2, Gp A,B,C & D; Dust-Ignition Proof Class II & III, Div 1, Gp E,F & G; Outdoor Hazardous Locations, NEMA 4X. FM Approved (**Design Level N**) - Primary Flowmeter & Remote Signal Converter: Non-Incendive ClI, Div 2, Gp.A,B,C & D, Dust-Ignition Proof ClII, Div 1, Gp.E,F & G and suitable for ClIII, Div 1; Outdoor Hazardous Locations, NEMA 4X. Integral Signal Converter enclosure additionally approved: Dust-Ignition Proof ClII, Div 1, Gp.E,F & G and suitable for ClIII, Div 1; Accidental Submergence, 33ft H_2O/48 h (10 m H_2O/48 h)	K

Enclosure

NEMA 4X Field Housing w/ Window & Cable Seal Fittings	B
NEMA 4X Field Housing w/ Window & 1/2" NPT Fittings	D
19" Rack-Mount (Not currently available)	M
NEMA 4X Field Housing w/ Window & Cable Seal Fittings, Level 4 Protection, Tropical High-Moisture Protection	P
NEMA 4X Field Housing w/ Window & 1/2" NPT Fittings, Level 4 Protection, Tropical High-Moisture Protection	Q

Contact Outputs

Optocoupler	1
Relay	2

1.2 Model Number Breakdown (continued)

50XM1 _ _ X _ _ _ _	AA	_	_	2	_

Output Options

None	0
Active Scaled Pulse (Fwd. & Rev.)	1
Relay Contact Scaled Pulse, Fwd. & Rev.	2
Optocoupled Scaled Pulse, Fwd. & Rev.	3
RS485 Port	4
RS232C Port	5
RS485 Port w/ Opto Pulse Output Forward	6
RS232C Port w/ Opto Pulse Output Forward	7
RS485 Port w/ Relay Pulse Output Forward	8

Operation

Continuous Mode	AA

Additional Options

Empty Pipe Detector	A
No Empty Pipe Detector	B
Empty Pipe Detector & External Totalizer Reset	E
External Totalizer Reset	F
HART Protocol & Empty Pipe Detector	G
HART Protocol	H
HART Protocol, External Totalizer Reset & Empty Pipe Detector	J
HART Protocol & External Totalizer Reset	K

Electrical Requirements

220/230/240 VAC, 50/60 Hz	A
110/115/120 VAC, 50/60 Hz	C
48 VDC	G
24 VDC	H

Customer Language

English	2

Output Current

0-20 mA	1
4-20 mA	2

Table of Contents

Table List

Figure List

SAFETY SUMMARY

GENERAL WARNINGS

POSSIBLE PROCESS UPSETS

Maintenance must be performed only by qualified personnel and only after securing equipment controlled by this product. Adjusting or removing this product while it is in the system may upset the process being controlled. Some process upsets may cause injury or damage.

RETURN OF EQUIPMENT

All Flowmeters and/or Signal Converters being returned to the factory for repair must be free of any hazardous materials (acids, alkalis, solvents, etc.). A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact the factory for authorization prior to returning equipment.

INSTRUCTION MANUALS

Do not install, maintain or operate this equipment without reading, understanding and following the proper operating instructions and manuals, otherwise injury or damage may result.

ELECTRICAL SHOCK HAZARD

Equipment powered by AC line voltage presents a potential electric shock hazard to the user. Make certain that the system power is disconnected from the operating branch circuit before attempting electrical interconnections or service.

SPECIFIC WARNINGS

All flowmeters and/or signal converters being returned to the factory for repair must be free of any hazardous materials (acids, alkalis, solvents, etc). A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact the factory for authorization prior to returning equipment. (pg. V)

Equipment powered by an AC line service constitutes a potentially lethal electric shock hazard. Always de-energize system power before removing the housing cover. (pg. 6-2)

SPECIFIC CAUTIONS

Some of the shields in the interconnection cable contain active voltages, that is, the shields are not necessarily grounded. For this reason, shields should not be permitted to contact other shields, or the housing of the flowmeter or signal converter. Good wiring practice dictates that the insulated center conductor of shielded cables should be trimmed to 1½ inches and excessive amounts of cable should not be stuffed into the junction box. Failure to adhere to these requirements may result in the flowmeter/signal converter system being inoperative. (pg. 2-5)

Should an "Error 2 - Uref too low" error occur when the instrument is activated, remove power from the device as soon as possible, otherwise instrument damage may occur. (pg. 2-7, 3-2 & 6-4)

Do not power the unit with the terminals M1 and M3 connected without also connecting terminals 3 and 16. Fuse failure and possible converter damage will result. (pg. 3-12)

The sequence in which the range and pulse factor are selected is important. The range must be selected first and then the pulse factor. If the pulse factor is selected first or is not reset when a range change is made, the frequency to the totalizer could exceed the limits discussed below. (pg. 3-20)

Applying 120 V ac power to a converter assembly that is supplied for 24 V dc operation will result in destruction of the signal converter. (pg. 5-3)

When the dynamic test is to be made in the customer's instrument service shop, especially if the total volume processed is needed for inventory or billing purposes, the total volume should be logged before disrupting electrical interconnections. (pg. 5-5)

Only experienced electronic technicians should attempt to calibrate the signal converter. Erroneous calibration will result in unsatisfactory performance of the converter. (pg. 5-7)

Some of the IC devices used in the signal converter are static sensitive and may be damaged by improper handling. When adjusting or servicing the signal converter, use of a grounded wrist strap is recommended to prevent inadvertant damage to the integral solid state circuitry. (pg. 5-7)

GÉNÉRAUX AVERTISSEMENTS

PROBLÈMES POTENTIELS. La maintenance doit être réalisée par du personnel qualifié et seulement après avoir sécurisé les équipements contrôlés par ce produit. L'ajustement ou le démontage de ce produit lorsqu'il est lié au système peut entraîner des dysfonctionnements dans le procédé qu'il contrôle. Ces dysfonctionnements peuvent entraîner des blessures ou des dommages.

RETOUR D'ÉQUIPEMENT. Tout débitmètre et(ou) convertisseur retourné à the factory pour réparation doit être exempt de toute trace de produit dangereux (acide, base, solvant, …). Un certificat de sécurité matériel doit être joint pour tous les liquides utilisés dans le procédé. Contacter the factory pour autorisation avant renvoi du matériel.

MANUEL DE MISE EN ROUTE. Ne pas installer, maintenir ou utiliser cet équipement sans avoir lu, compris et suivi les instructions et manuels, dans le cas contraire il y a risque d'entraîner blessures ou dommages.

RISQUE DE CHOC ÉLECTRIQUE
Les équipements alimentés en courant alternatif constituent un risque de choc électrique potentiel pour l'utilisateur. Assurez-vous que les câbles d'alimentation amont sont déconnectés avant de procéder à des branchements, des essais ou tests.

SPÉCIFIQUES AVERTISSEMENTS

Tout débitmètre et(ou) convertisseur retourné à the factory pour réparation doit être exempt de toute trace de produit dangereux (acide, base, solvant, …). Un certificat de sécurité matériel doit être joint pour tous les liquides utilisés dans le procédé. Contacter the factory pour autorisation avant renvoi du matériel. (pg. V)

RISQUE DE CHOC ÉLECTRIQUE. Le matériel actionné par un service de ligne à C.A. constitue un risque potentiellement mortel de décharge électrique. Déactivez toujours la puissance de système avant de retirer la couverture de logement. (pg. 6-2)

SPÉCIFIQUES ATTENTIONS

Certains des boucliers dans le câble d'interconnexion contiennent des tensions actives, c.-à-d., les boucliers ne sont pas nécessairement fondus. Pour cette raison, des boucliers ne devraient pas être autorisés pour entrer en contact avec d'autres boucliers, ou le logement du convertisseur de débitmètre ou de signal. Bon câblage pratique dicter que isoler central conducteur protéger câble devoir équilibrer 1½ pouce et excessif quantité câble devoir non bourrer dans de jonction boîte. Le manque d'adhérer à ces conditions peut avoir comme conséquence le système de convertisseur de flowmeter/signal étant inopérant. (pg. 2-5)

N'actionnez pas l'unité avec les terminaux M1 et M3 relié sans terminaux se reliants également 3 et 16. Fondez la panne et les dommages possibles de convertisseur résulteront. (pg. 3-12)

L'ordre dans lequel le facteur d'intervalle et d'impulsion sont choisis est important. L'intervalle doit d'abord et puis être choisi le facteur d'impulsion. Si le facteur d'impulsion est choisi d'abord ou n'est pas remis à l'état initial quand un changement d'intervalle est fait, la fréquence au totalisateur pourrait dépasser les limites discutées ci-dessous. (pg. 3-20)

Appliquer le courant alternatif de 120 V à un convertisseur qui est fourni pour 24 Vdc aura comme conséquence la destruction du convertisseur de signal. (pg. 5-3)

Quand l'essai dynamique doit être fait dans le système de service de l'instrument du client, particulièrement si tout le volume traité est nécessaire pour des buts de inventaire ou de facturation, tout le volume devrait être enregistré avant des interconnexions électriques de perturbation. (pg. 5-5)

Seulement les techniciens électroniques expérimentés devraient essayer de calibrer le convertisseur de signal. L'étalonnage incorrect aura comme conséquence l'exécution insuffisante du convertisseur. (pg. 5-7)

Certains Circuits Intégrés utilisés dans le convertisseur sont sensibles à l'électricité statique et peuvent être endommagés par une mauvaise manipulation. Pendant l'ajustement ou la maintenance d'un convertisseur, l'utilisation d'un bracelet antistatique est recommandé pour éviter la destruction par inadvertance d'un circuit intégré. (pg. 5-7)

READ FIRST

WARNING

INSTRUCTION MANUALS
Do not install, maintain, or operate this equipment without reading, understanding and following the proper factory-supplied instructions and manuals, otherwise injury or damage may result.

RETURN OF EQUIPMENT
All Flowmeters and/or Signal Converters being returned to the factory for repair must be free of any hazardous materials (acids, alkalis, solvents, etc). A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact the factory for authorization prior to returning equipment.

Read these instructions before starting installation;
save these instructions for future reference.

Contacting the Factory. . .

Should assistance be required with any of the company's products, contact the following:

Telephone:

Automation Services Call Center
1-800-HELP-365

E-Mail:

ins.techsupport@us.abb.com

The NEMA 4X rating applies to the meter body and electronics enclosure only. The following accessories (if supplied) may not meet NEMA 4X unless specifically ordered as NEMA 4X:

- meter flanges
- meter installation hardware: studs, nuts, bolts
- enclosure mounting hardware for pipe or wall mounting
- conduit hardware

This product is painted with a high performance epoxy paint. The corrosion protection provided by this finish is only effective if the finish is unbroken. It is the users' responsibility to "touch-up" any damage that has occurred to the finish during shipping or installation of the product. Special attention must be given to: meter flange bolting, pipe mounting of electronics, conduit entries and covers that are removed to facilitate installation or repair. For continued corrosion protection throughout the product life, it is the users' responsibility to maintain the product finish. Incidental scratches and other finish damage must be repaired and promptly re-painted with approved touch-up paint. Provide the model number and size of your product to the nearest factory representative to obtain the correct touch-up paint.

1.0 INTRODUCTION

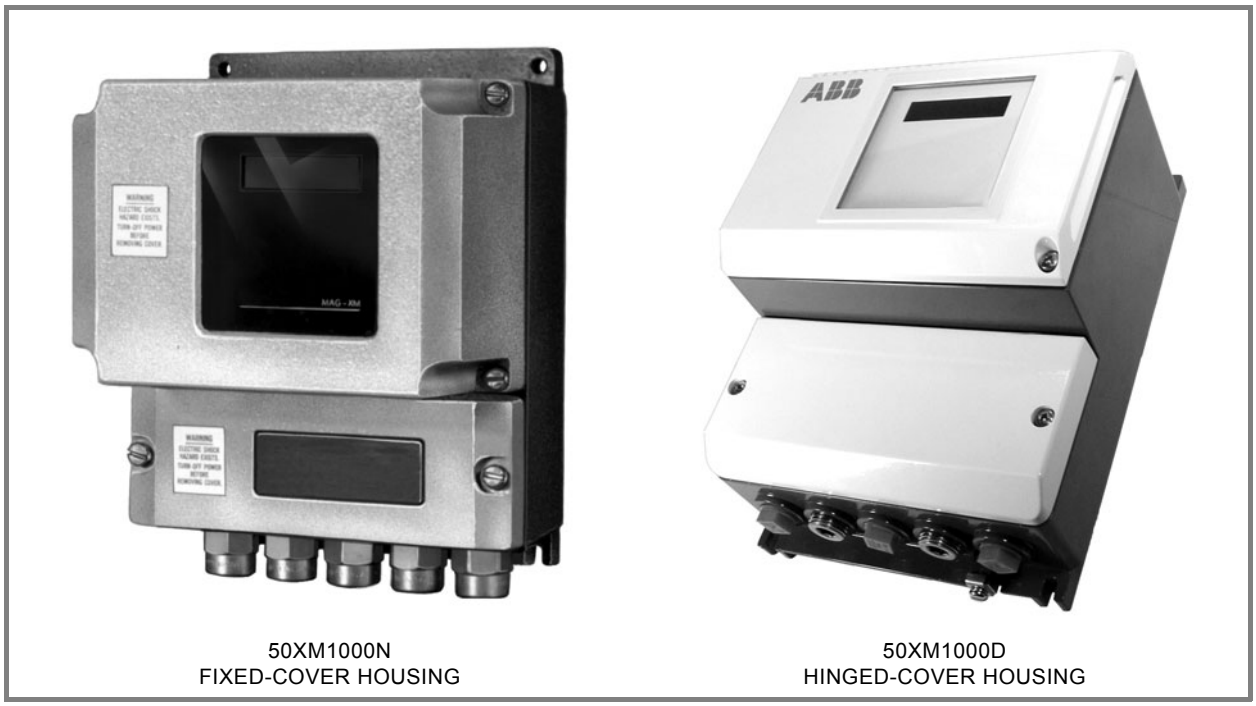
1.1 General Description

The 50XM1000 Microprocessor-based Signal Converter is of modular construction and uses the latest state-of-the-art electronic design (a mix of standard IC and surface mount technology). This design concept provides a compact, reliable, instrument. The 50XM1000 features firmware which has been developed especially for flow metering applications. This permits the respective flowmeter/signal converter combination to be easily customized for the particular process operating parameters.

The signal converter can be mounted as an integral part of the flowmeter or in a remote NEMA 4X rated enclosure. The remote enclosure may be supplied with a fixed-cover or with the newer hinged-cover (Refer to Figure 1-1 below) and is available with either 1/2" NPT connections or cable seal fittings. A remotely mounted signal converter is shown in Figures 1-2 and 1-3. The signal converter assembly (without the enclosure) is shown in Figures 1-4 and 1-5.

As signal converter operations are microprocessor-based, the converter has the capability to communicate via data link with other intelligent instruments such as the company's Series 53SU1000 SUPERVISOR, 53SU5000 SUPERVISOR-PC, or host computer. The signal converter will support ASCII protocol, permitting up to 32 instruments to be addressed via the data link.

The signal converter can be configured manually by use of the three pushbuttons located below the LCD display (see Figure 1-4) or remotely by means of the data link. During configuration, the converter remains on-line and data is updated continually. Zero is factory-set and no field zero adjustments are required.



50XM1000N
FIXED-COVER HOUSING

50XM1000D
HINGED-COVER HOUSING

FIGURE 1-1. 50XM1000 SIGNAL CONVERTER

Major features of the signal converter include:

1) All operating parameters are configurable, e.g., totalization units, flow rate range, calibration factor, etc. Parameter values can be changed via pushbuttons on the converter or via serial interface.
2) Microprocessor-based with digital signal processing.
3) Communication via terminal, computer or similar smart instrument using RS485, RS 232-C or current loop.
4) Direct reading data display without operator calculations. Displays forward and/or reverse flow.
5) Automatic self-monitoring with error diagnostics.

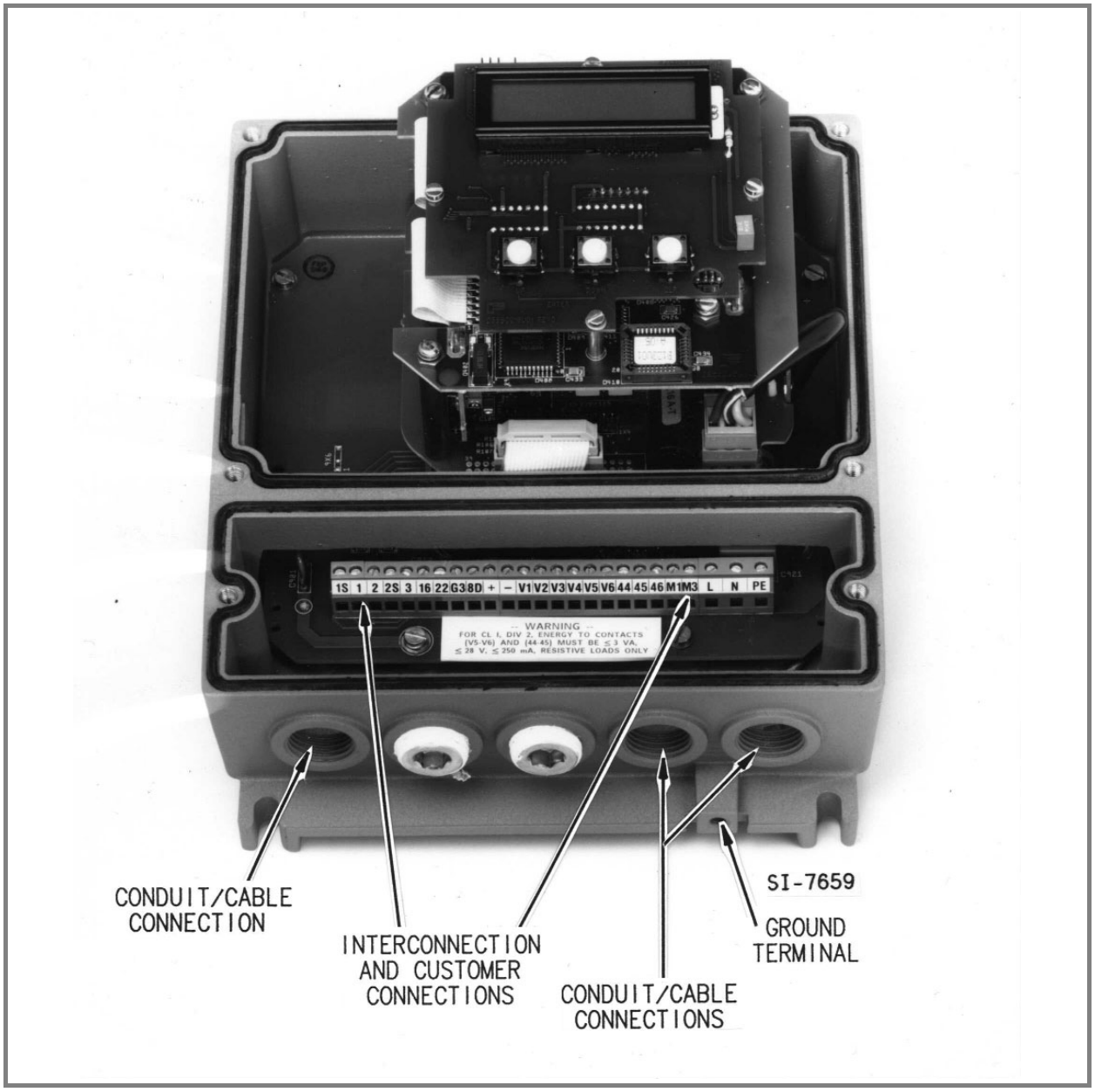


FIGURE 1-2. ENCLOSURE MOUNTED SIGNAL CONVERTER SHOWING TERMINAL CONNECTIONS AND ENTRANCES

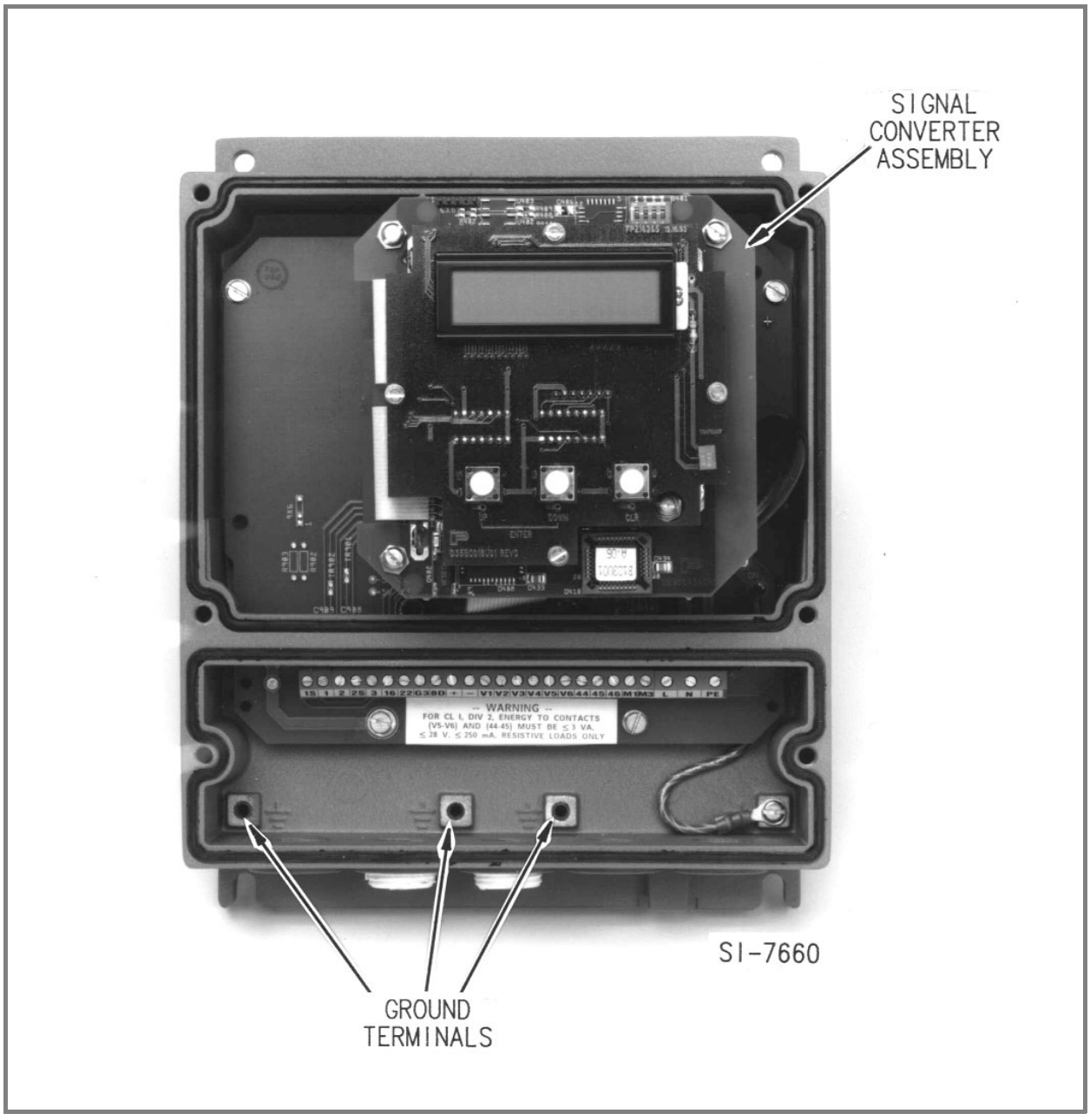


FIGURE 1-3. ENCLOSURE MOUNTED SIGNAL CONVERTER SHOWING SIGNAL CONVERTER AND GROUND TERMINALS

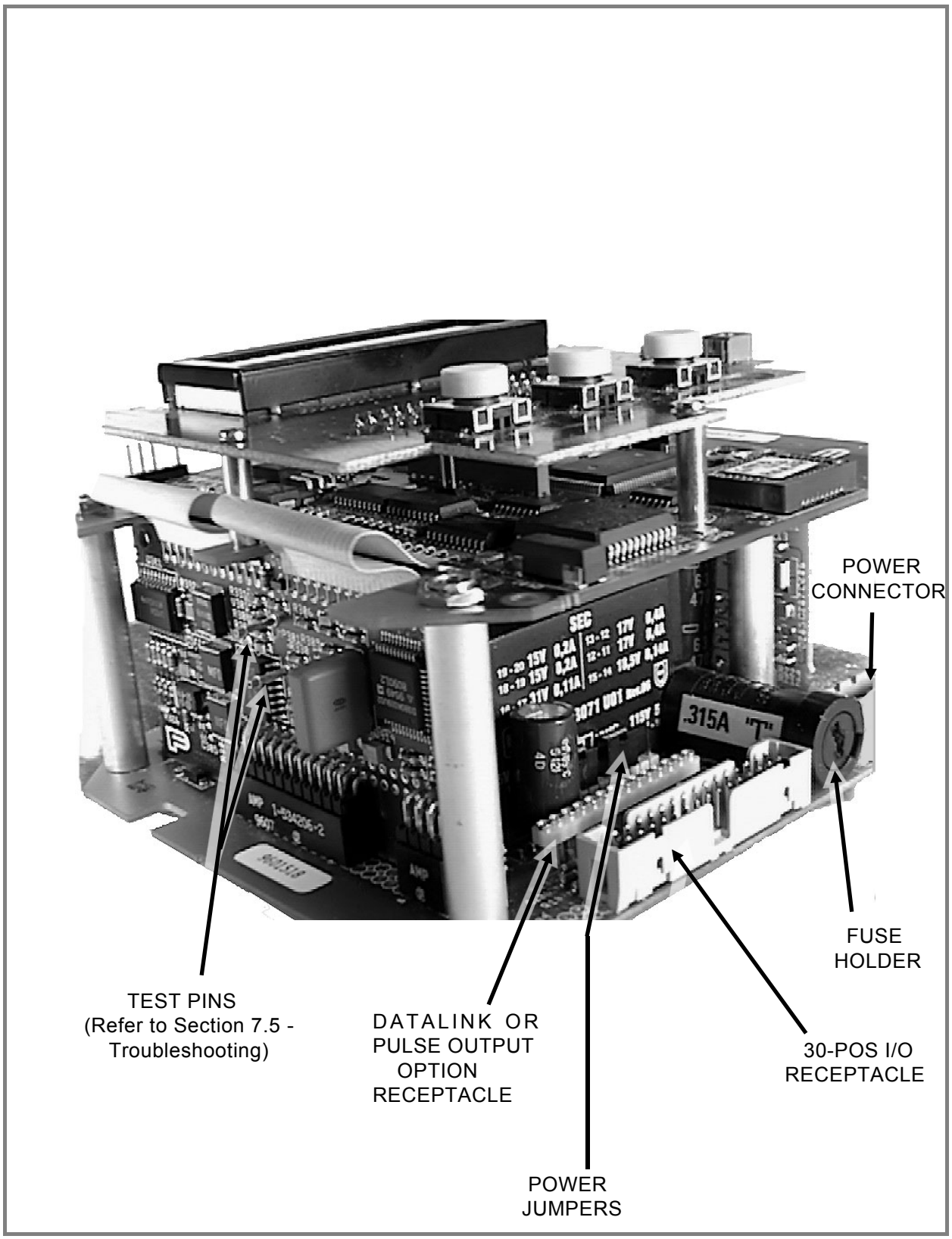


FIGURE 1-4. SIGNAL CONVERTER, SIDE VIEW

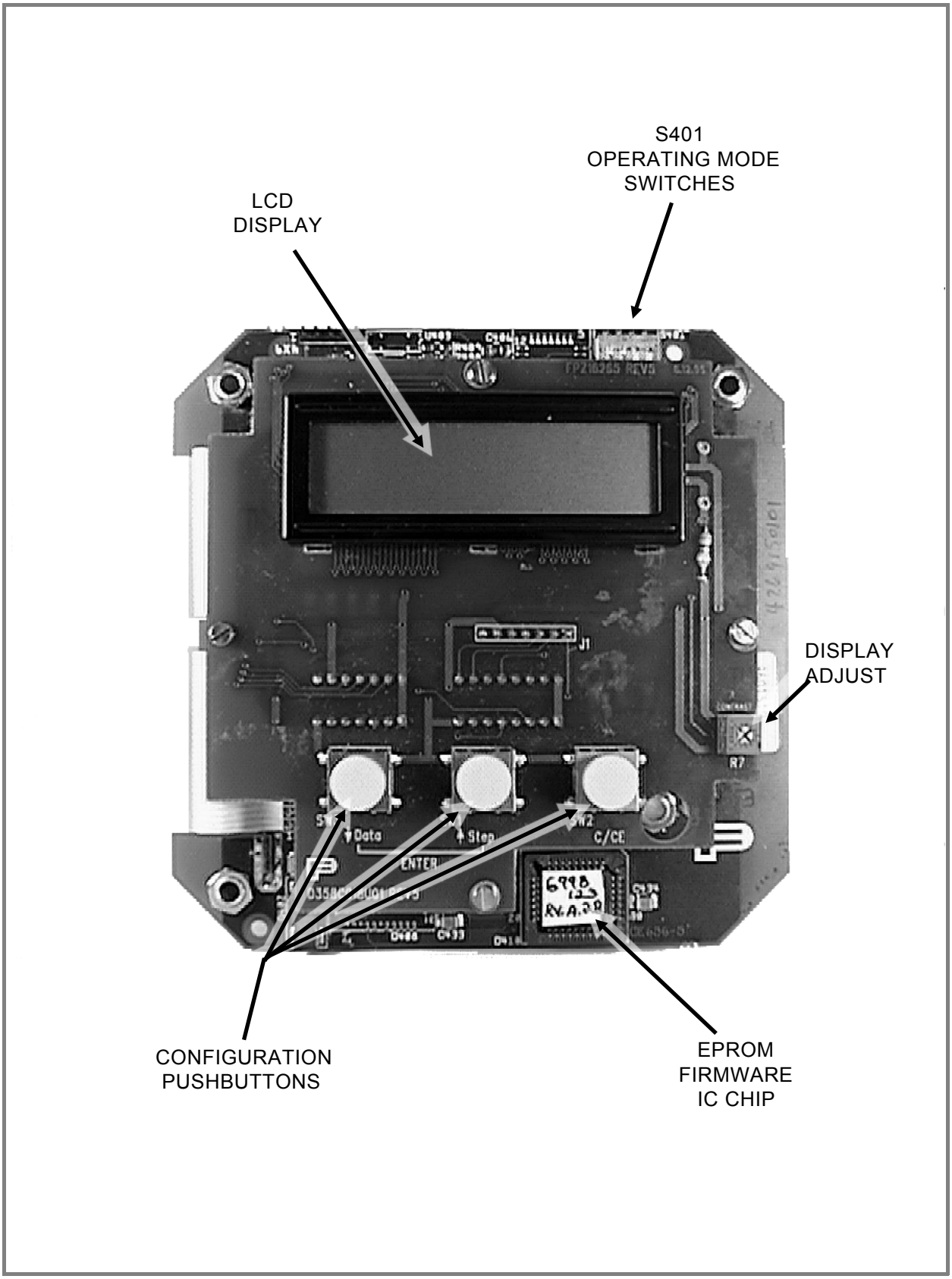


FIGURE 1-5. SIGNAL CONVERTER MODULE, TOP VIEW

1.2. Model Number Breakdown

Refer to the data sheet or instrument tag on the signal converter for the model number of the signal converter. The details of a model number are defined as follows:

	50XM1	_	_	X	_	_	_	_	AA	_	_	2	_
Engineering Reference													
Excitation Frequency													
6.25 Hz (50 Hz)		**1**											
12.5 Hz (50 Hz)		**2**											
7.5 Hz (60 Hz)		**3**											
15 Hz (60 Hz)		**4**											
6.25 Hz (DC)		**5**											
12.5 Hz (DC)		**6**											
7.5 Hz (DC)		**7**											
15 Hz (DC)		**8**											
Design Level													
Fixed Cover			**N**										
Hinged Cover			**D**										
Software Level				**X**									
Certification													
None					**A**								
FM Approved - Primary Flowmeter & Remote Signal Converter: Non-Incendive Cl I, Div 2, Gp.A,B,C & D, Dust-Ignition Proof Cl II, Div 1, Gp.E,F & G and suitable for Cl III, Div 1; Outdoor Hazardous Locations, NEMA 4X. Integral Signal Converter enclosure additionally approved: Dust-Ignition Proof Cl II, Div 1, Gp.E,F & G and suitable for Cl III, Div 1; Accidental Submergence, 33ft H_2O/48 h (10 m H_2O/48 h)					**K**								
Enclosure													
NEMA 4X Field Housing w/ Window & Cable Seal Fittings						**B**							
NEMA 4X Field Housing w/ Window & 1/2" NPT Fittings						**D**							
19" Rack-Mount (Not currently available)						**M**							
NEMA 4X Field Housing w/ Window & Cable Seal Fittings, Level 4 Protection, Tropical High-Moisture Protection						**P**							
NEMA 4X Field Housing w/ Window & 1/2" NPT Fittings, Level 4 Protection, Tropical High-Moisture Protection						**Q**							
Contact Outputs													
Optocoupler							**1**						
Relay							**2**						

1.2 Model Number Breakdown (continued)

50XM1	_	_	X	_	_	_	_	AA	_	_	2	_
Output Options												
None							0					
Active Scaled Pulse (Fwd. & Rev.)							1					
Relay Contact Scaled Pulse, Fwd. & Rev.							2					
Optocoupled Scaled Pulse, Fwd. & Rev.							3					
RS485 Port							4					
RS232C Port							5					
RS485 Port w/ Opto Pulse Output Forward							6					
RS232C Port w/ Opto Pulse Output Forward							7					
RS485 Port w/ Relay Pulse Output Forward							8					
Operation												
Continuous Mode								AA				
Additional Options												
Empty Pipe Detector									A			
No Empty Pipe Detector									B			
Empty Pipe Detector & External Totalizer Reset									E			
External Totalizer Reset									F			
HART Protocol & Empty Pipe Detector									G			
HART Protocol									H			
HART Protocol, External Totalizer Reset & Empty Pipe Detector									J			
HART Protocol & External Totalizer Reset									K			
Electrical Requirements												
220/230/240 VAC, 50/60 Hz										A		
110/115/120 VAC, 50/60 Hz										C		
48 VDC										G		
24 VDC										H		
Customer Language												
English											2	
Output Current												
0-20 mA												1
4-20 mA												2

1.3. Specifications

Power Requirements

Power Input (as specified)	115/120 V ac, 50/60 Hz or 230/240 V ac, 50/60 Hz
Power Consumption	< 30 VA

Performance Characteristics

Flowmeter Model Number	refer to the data sheet or instrument tag on the body of the flowmeter
Meter Size, Cal Factor and Flow Range	refer to the flowmeter instruction bulletin
Minimum Liquid Conductivity	refer to flowmeter instruction bulletin for specifications
Bidirectional Flow	rate indication and totalization in both forward and reverse flow direction. (Flow direction for analog output is indicated by contact closure.)
Accuracy	0.5% of rate from 2% to 100% of meter Cal Factor; 0.01% of Cal Factor from 0% to 2% of Cal Factor
Response Time	.5 second, minimum
Damping	configurable, 1 to 100 seconds
Analog Output Current	4-20 mA into 0 to 750 ohm load (configurable to 0-20, 2-10, 0-5, 0-10, 0-10-20 or 4-12-20 mA)

Pulse Outputs

Scaled Pulse *	24 V dc, 150 ohm minimum load, 0-4 kHz maximum, pulse width configurable from 0.1 ms to 2000 ms
Unscaled Pulse	5 V dc (low-going TTL), 0-10 kHz maximum unscaled frequency, 0.032 mS pulse width [15 feet (5 m) maximum cable length]

* Scaled pulse output is also available with optically coupled output option when data link output option is specified.

Contact Outputs

Alarm Contact	denotes failure condition, with high or low analog output. Energy through contacts must not exceed 3 VA, 28 V or 250 mA.
Flow Direction	contact transfers when flow direction changes. Energy through contacts must not exceed 3 VA, 28 V or 250 mA.

Contact Inputs (optional)

Zero Return or Totalizer Reset	as specified by model number, remote contact closure needed to initiate action, as follows: Total Reset (forward and reverse), momentary closure. Zero return, maintains closure when pump or valve stops flow through meter.

Empty Pipe Detection	automatically drives the analog and digital output signals to zero when the meter electrodes become uncovered, or if < 20 μS conductivity for sizes <1/2 inch.

Physical Characteristics

Ambient Temperature Range (converter only)	-4^{o} F to 140^{o} F (–20^{o} C to +60^{o} C)
Relative Humidity	10% to 90% non-condensing
Vibration Limit	< .75 g continuous (10 to 150 Hz) < 1.5 g intermittent (10 to 150 Hz)
Enclosure Classification	NEMA 4X, IEC 529 IP65 (weather-tight and dust-tight)
Housing	Aluminum housing with fixed or hinged gasketed covers; panel or wall-mounting (refer to Figures 2-1 through 2-4).
Cable Entrance	five 1/2 inch NPT conduit or cable-seal connections in base as specified at time of order.

Certifications

FM Approved	Primary Flowmeter & Remote Signal Converter: Non-Incendive Cl I, Div 2, Gp.A,B,C & D, Dust-Ignition Proof Cl II, Div 1, Gp.E,F & G and suitable for Cl III, Div 1; Outdoor Hazardous Locations, NEMA 4X. Integral Signal Converter enclosure additionally approved: Dust-Ignition Proof Cl II, Div 1, Gp.E,F & G and suitable for Cl III, Div 1; Accidental Submergence, 33ft H_2O/48 h (10 m H_2O/48 h)

2.0 INSTALLATION

2.1 Inspection

The 50XM1000 signal converter is shipped in a heavy-duty protective container that is specially designed to provide adequate protection of the equipment during transit. The packaging is certified for air shipment by the Container Testing Laboratory. An itemized list of all items included in the shipment is attached to the shipping container.

The signal converter can be supplied as an integrally mounted assembly of the flowmeter, or in a separate wall or panel mounted enclosure. When the 50XM Converter is integrally mounted with the flowmeter, outline and mounting dimensions are provided in the instruction bulletin supplied with the flowmeter. Outline dimensions and clearance requirements for the remotely mounted signal converter are provided in Figures 2-1 through 2-4.

The equipment should be inspected immediately upon arrival for indications of damage that may have occurred during shipment. In most cases a careful visual inspection is all that is required to establish apparent damage.

All damage claims should be reported to the shipping agent involved before installing the equipment. In the event damage is such that faulty operation is likely to result, this damage should be brought to the attention of the our Service Department before installation. Always reference the complete instrument serial number and model number in all correspondence concerning the equipment supplied.

Following inspection of the shipment contents, it is suggested that all items be carefully replaced in the shipping container for storage and/or transit to the installation site. The use of normal care in the handling and installation of this equipment will contribute substantially toward satisfactory performance.

2.2 Location and Mounting

When the signal converter is integrally mounted, refer to the installation section of the instruction manual supplied with the flowmeter for location and mounting requirements.

The installation site for the remotely mounted signal converter should be clean, well lighted and adequately ventilated. The remote mounted enclosure is designed to meet NEMA 4X standards and is suitable for indoor or outdoor installation in an environment that is within the temperature, humidity and vibration limits as shown in Section 1.3. Mounting dimensions for the wall or panel mounted enclosures are provided in Figures 2-1 through 2-4. Mounting hardware is to be supplied by the user.

Also, consideration should be given to access requirements for repair and maintenance of the equipment.

The installation site must be provided with a power source that is compatible with the signal converter power requirements. Refer to the converter data tag for power requirements.

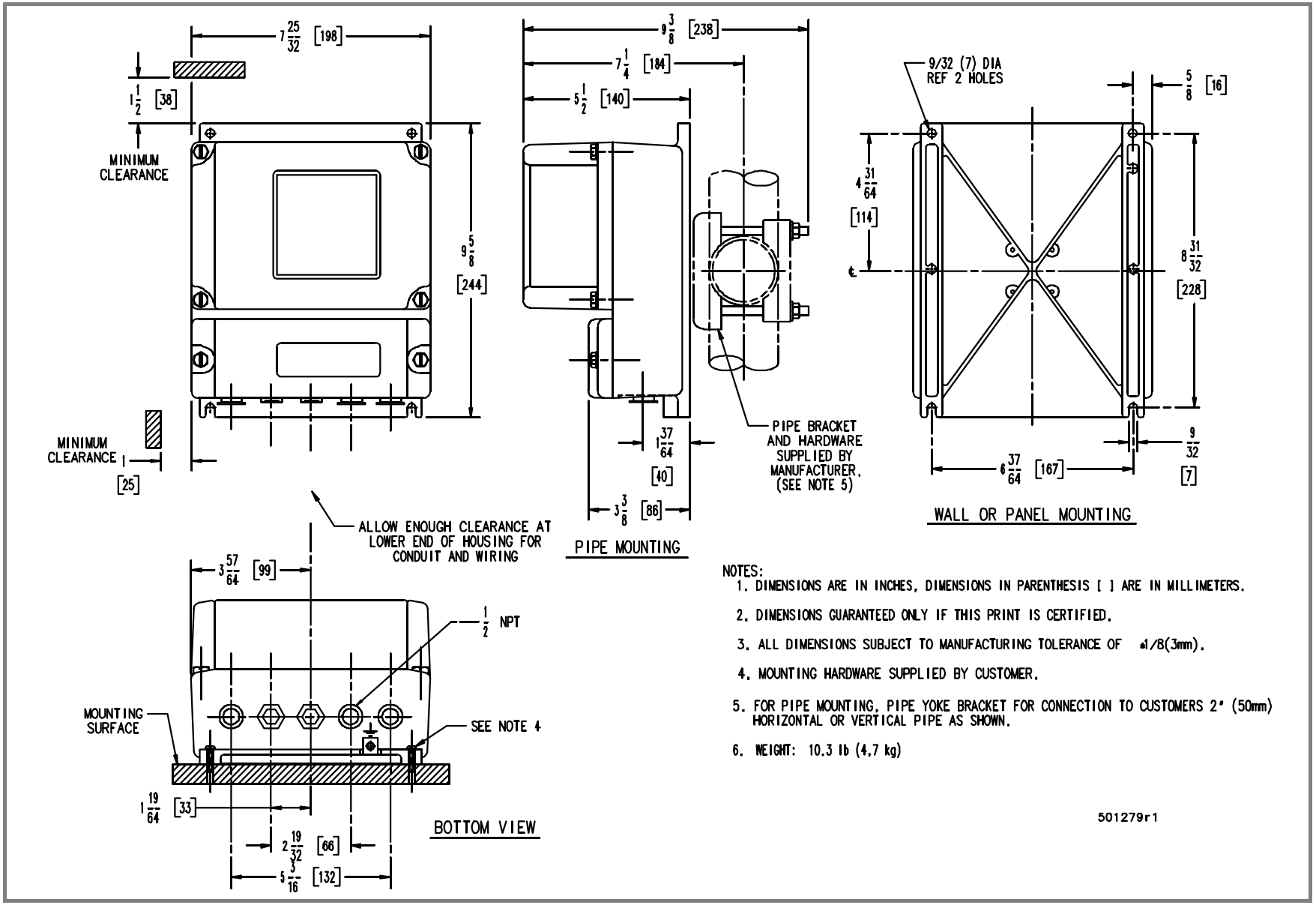
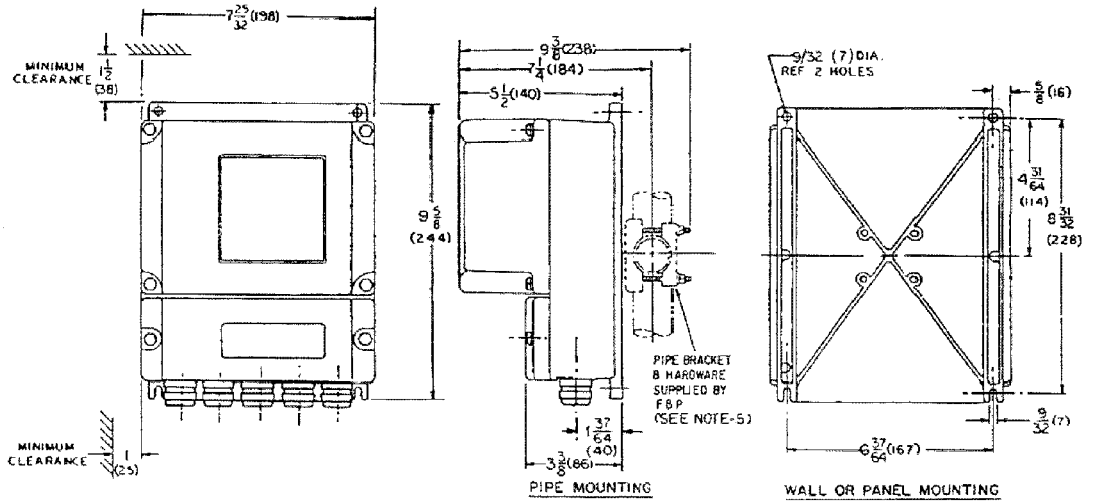
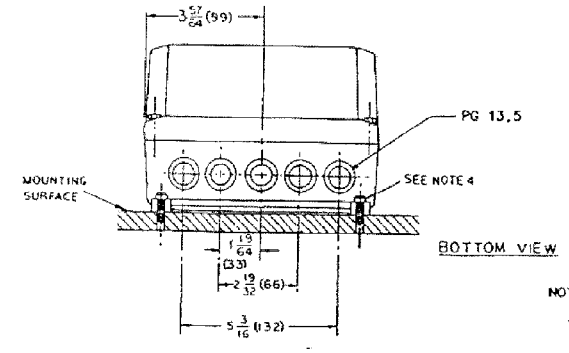


FIGURE 2-1. OUTLINE DIMENSIONS, REMOTELY MOUNTED 50XM1000N SIGNAL CONVERTER WITH FIXED-COVER & 1/2 INCH NPT CONNECTIONS





NOTES:

1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN PARENTHESES () ARE IN MILLIMETERS.
2. DIMENSIONS GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
3. ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE OF + – 1/8 (3mm).
4. MOUNTING HARDWARE TO BE SUPPLIED BY CUSTOMER.
5. FOR PIPE MOUNTING. PIPE YOKE BRACKET FOR CONNECTION TO CUSTOMER'S 2"(50mm) HORIZONTAL OR VERTICAL PIPE AS SHOWN.

FIGURE 2-2. OUTLINE DIMENSIONS, REMOTELY MOUNTED SIGNAL CONVERTER WITH FIXED-COVER & CABLE SEAL CONNECTIONS

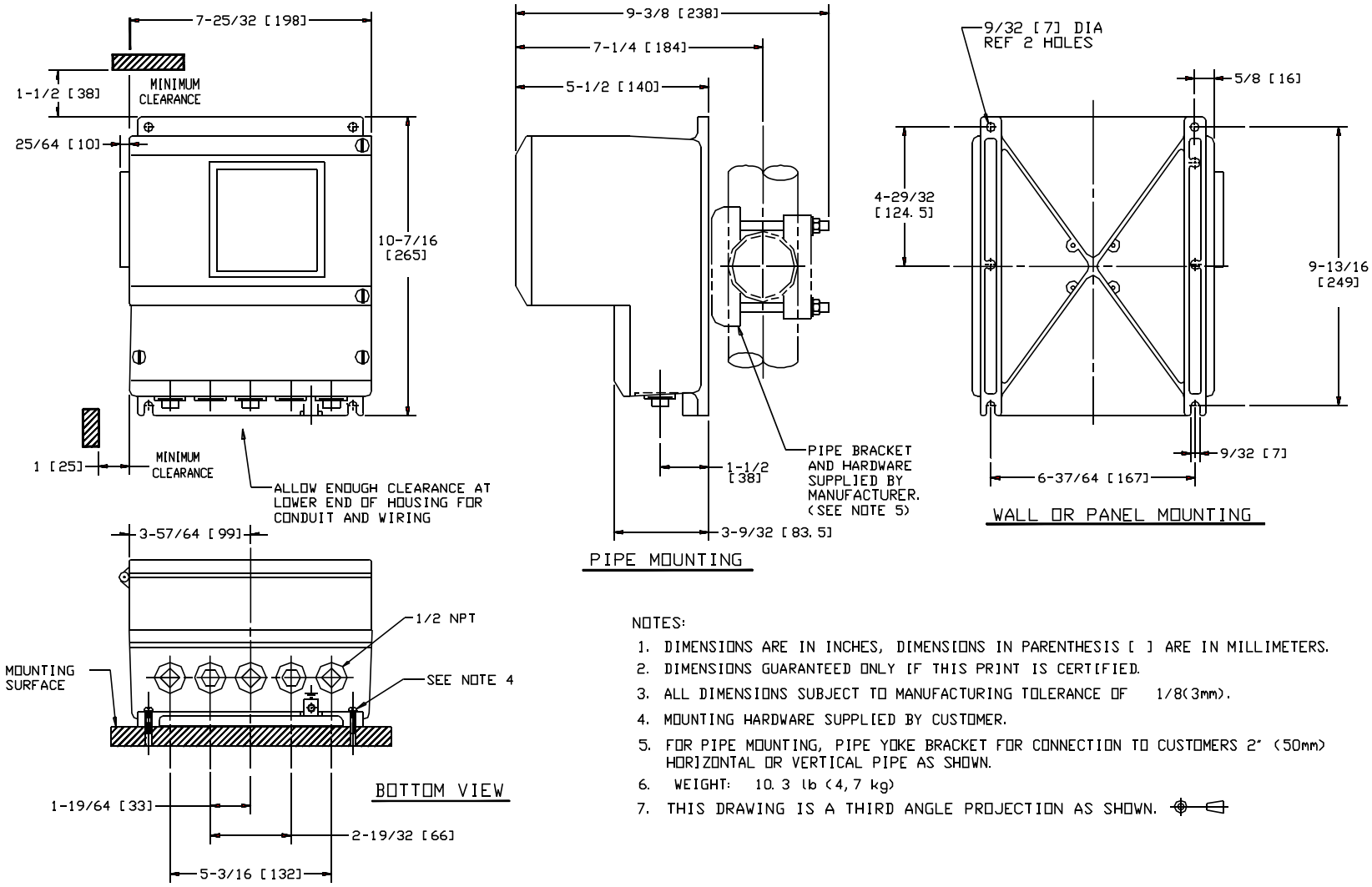


FIGURE 2-3. OUTLINE DIMENSIONS, REMOTELY MOUNTED 50XM1000D SIGNAL CONVERTER WITH HINGED COVER & 1/2 INCH NPT CONNECTIONS

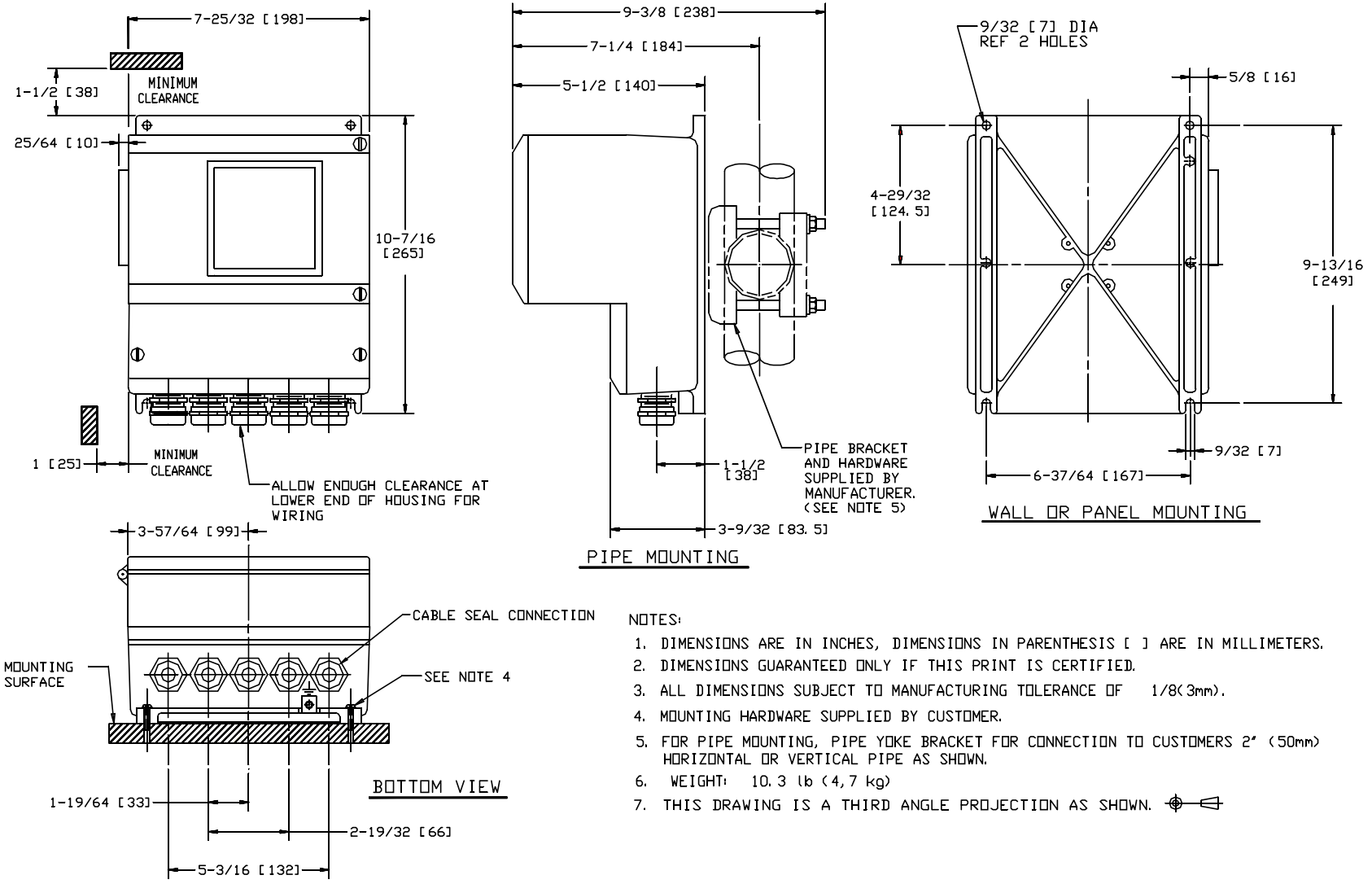


FIGURE 2-4. OUTLINE DIMENSIONS, REMOTELY MOUNTED 50XM1000D SIGNAL CONVERTER WITH HINGED COVER & CABLE SEAL CONNECTIONS

2.3 Electrical Interconnections

2.3.1 Typical Wiring Practice

Wiring for both Integral and Remote Converters should be prepared in a neat and workmanlike manner. Excess cable should be avoided so as not to clutter the wiring compartment. Typical wire preparation and wire-stripping procedures for shielded interconnection cable are shown in Figure 2-5. When stripping the outer jacket insulation from the coil-drive cable (M1 & M3 or M1 & MR), save the stripped piece of outer jacket for use as sleeving over the cable shield as shown in Figure 2-5.

CAUTION

Some of the shields in the interconnection cable contain active voltages, that is, the shields are not necessarily grounded. For this reason, shields should not be permitted to contact other shields, or the housing of the flowmeter or signal converter. Good wiring practice dictates that the insulated center conductor of shielded cables should be trimmed to 1½ inches and excessive amounts of cable should not be stuffed into the junction box. Failure to adhere to these requirements may result in the flowmeter/signal converter system being inoperative.

CAUTION

Should an "Error 2 - Uref too low" error occur when the instrument is activated, remove power from the device as soon as possible, otherwise instrument damage may occur. Refer to Section 7.3 of this manual for error-code troubleshooting information.

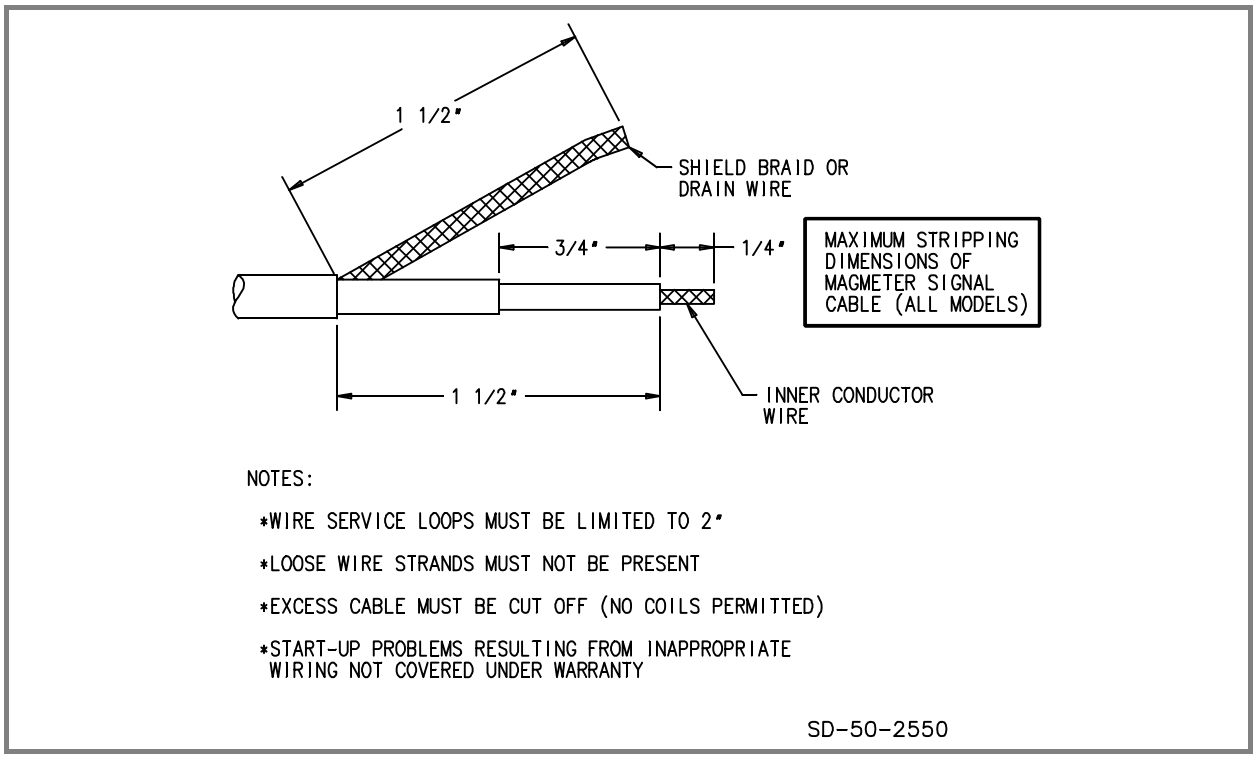


FIGURE 2-5. RECOMMENDED WIRE PREPARATION

Wiring in the customer connection compartment should be kept neat and as short as possible to allow for possible future accessibility and the addition of more wiring if required. Since Converters with "cage-clamp" terminals usually contain more wiring, the cage-clamp version is shown for illustrative purposes. Recommended wiring for the "barrier-block" version is similar.

Figure 2-6 shows a view of the interior of the customer connection box. The wiring shown in the figure is representative of "typical" wiring practices and is intended as a guide to illustrate how the completed wiring should look. It is not intended to be used as a "wiring interconnection' diagram.

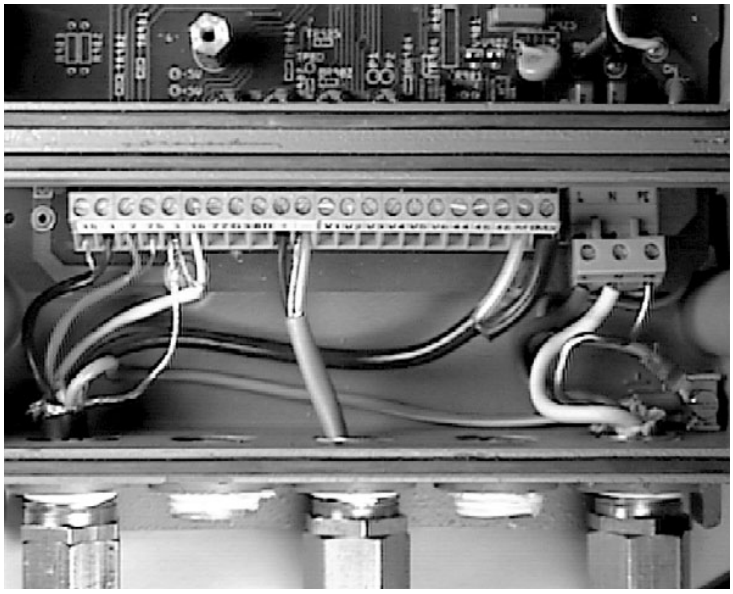


FIGURE 2-6. RECOMMENDED CUSTOMER CONNECTION BOX WIRING

Wiring for the coil-drive, input power and ground connections is shown in Figure 2-7. The AC power ground wire is connected to the "PE" terminal in the terminal block (if using the connection board with the cage-clamp terminals) or directly to the chassis ground lug on the converter housing (if using the connection board with the barrier-block terminals).

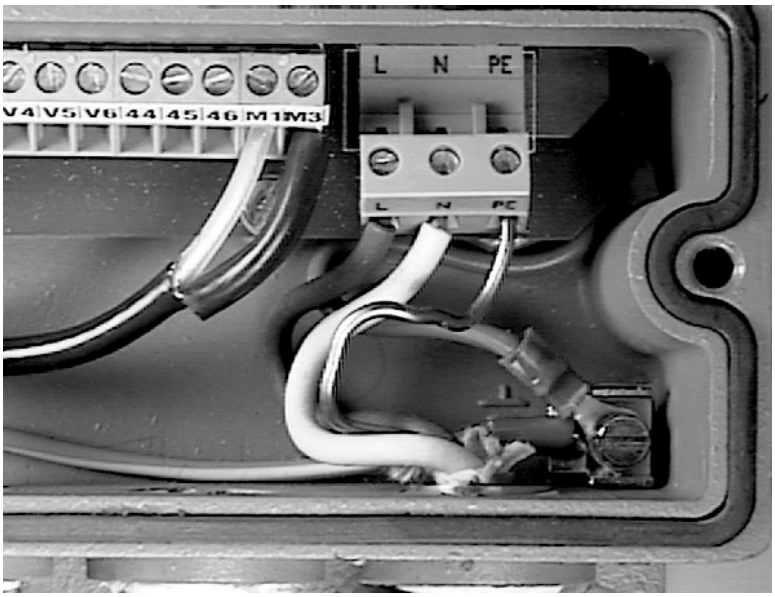


FIGURE 2-7. POWER CABLE WIRING

Figure 2-8 shows wiring for the reference and electrode-signal cables as well as the 4-20 mA output cable. Note that the outer shield for the cable connects to terminal 3 of the terminal block.

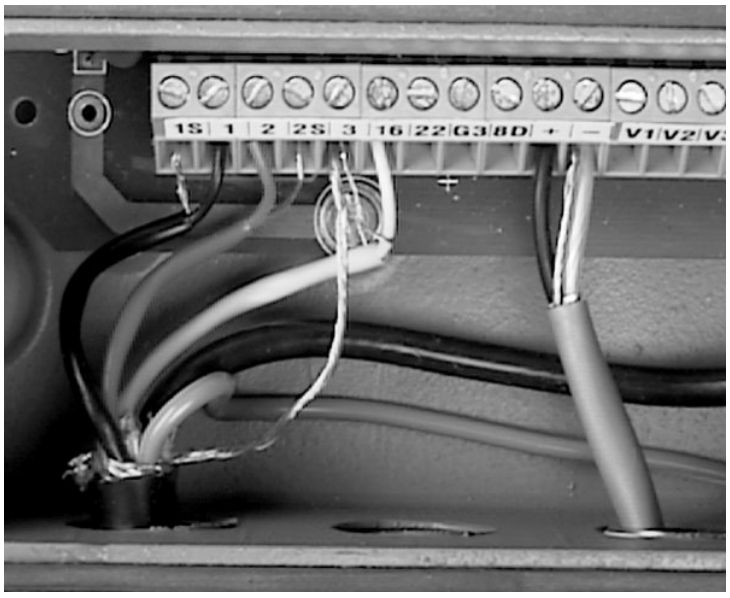
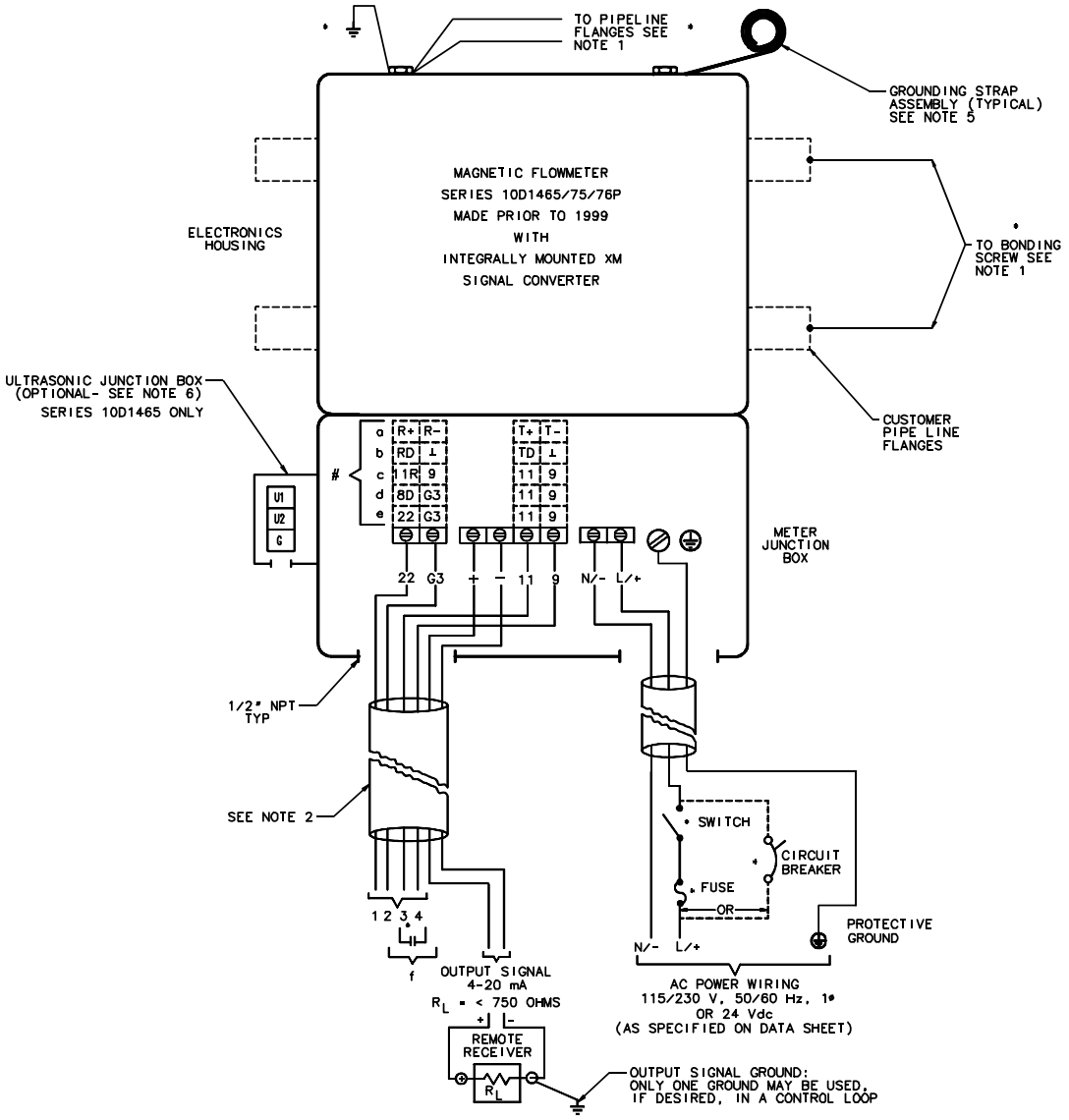


FIGURE 2-8. SIGNAL CABLE WIRING

2.3.2 Integrally Mounted Signal Converter

Signal and power interconnection wiring enters the customer connection box on the flowmeter housing via three conduit connections. Any unused opening(s) must be sealed by installing pipe plug(s) in the unused opening(s). All wiring is to be enclosed within metal conduit, supplied by the user. Interconnection wiring is terminated to a 10-point terminal block located within the customer connection box. Terminal assignment will vary according to the options specified, as defined by the instrument model number. Interconnections for the integrally mounted 50XM1000 converter are identified in Figures 2-9 and 2-10. If the integrally mounted converter is used for bidirectional flow, flow direction will not be indicated for the analog output. The display will show flow direction for both totalization and flowrate. Additional options are available with the remote converter.



#TERMINAL ASSIGNMENT TABLE, (DETERMINED BY MODEL NUMBER)
(SEE OUTPUT AND INPUT OPTIONS)

a) DATA LINK RS 485

b) DATA LINK RS 232C

c) SCALED PULSE OUTPUT, ACTIVE, 24 Vdc, LOAD > 150 OHMS
11R/9 - REVERSE FLOW
11/9 - FOWARD FLOW

d) SCALED PULSE OUTPUT, ACTIVE, 24 Vdc LOAD > 150 OHMS &
10 KHz UNSCALED PULSE
8D/G3 - 10 KHz UNSCALED PULSE
11/9 - FOWARD FLOW

e) SCALED PULSE OUTPUT, ACTIVE, 24 Vdc, LOAD > 150 OHMS
& ZERO RETURN
22/G3 - ZERO RETURN FEATURE
11/9 - FORWARD FLOW

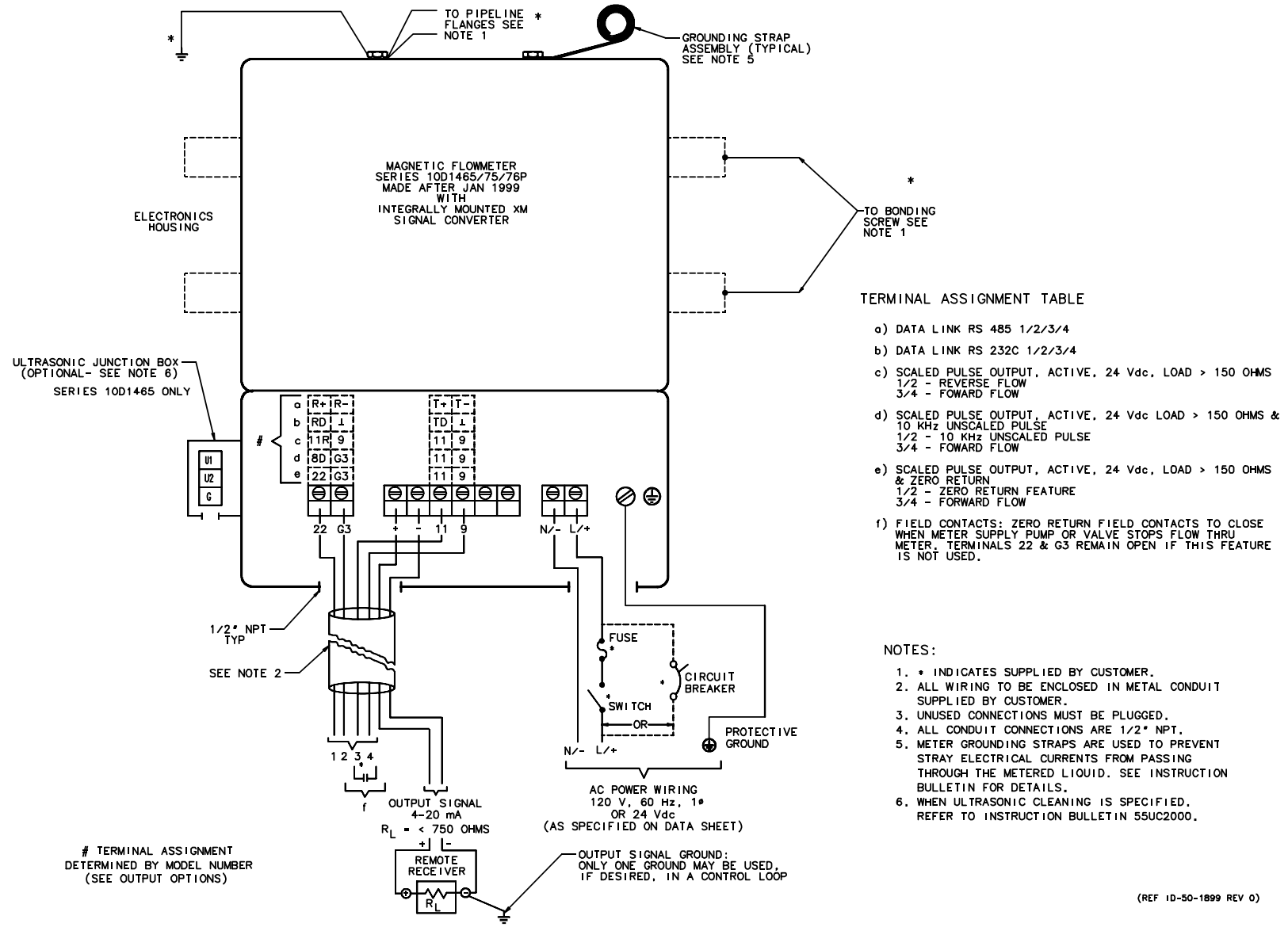
f) FIELD CONTACTS: ZERO RETURN FIELD CONTACTS TO CLOSE WHEN METER SUPPLY PUMP OR VALVE STOPS FLOW THRU METER. TERMINALS 22 & G3 REMAIN OPEN IF THIS FEATURE IS NOT USED.

NOTES:

1. * INDICATES SUPPLIED BY CUSTOMER.
2. ALL WIRING TO BE ENCLOSED IN METAL CONDUIT SUPPLIED BY CUSTOMER.
3. UNUSED CONNECTIONS MUST BE PLUGGED.
4. ALL CONDUIT CONNECTIONS ARE 1/2" NPT.
5. METER GROUNDING STRAPS ARE USED TO PREVENT STRAY ELECTRICAL CURRENTS FROM PASSING THROUGH THE METERED LIQUID. SEE INSTRUCTION BULLETIN FOR DETAILS.
6. WHEN ULTRASONIC CLEANING IS SPECIFIED, REFER TO INSTRUCTION BULLETIN 55UC2000.

(REF ID-50-1794-3)

FIGURE 2-9a. INTERCONNECTION WIRING FOR MODELS 10D1465, 10D1475 & 10D1476 w/INTEGRAL 50XM1000 CONVERTER PRIOR TO JANUARY 1999 [Refer also to Table 2-1]



TERMINAL ASSIGNMENT TABLE

a) DATA LINK RS 485 1/2/3/4

b) DATA LINK RS 232C 1/2/3/4

c) SCALED PULSE OUTPUT, ACTIVE, 24 Vdc, LOAD > 150 OHMS
1/2 - REVERSE FLOW
3/4 - FOWARD FLOW

d) SCALED PULSE OUTPUT, ACTIVE, 24 Vdc LOAD > 150 OHMS & 10 KHz UNSCALED PULSE
1/2 - 10 KHz UNSCALED PULSE
3/4 - FOWARD FLOW

e) SCALED PULSE OUTPUT, ACTIVE, 24 Vdc, LOAD > 150 OHMS & ZERO RETURN
1/2 - ZERO RETURN FEATURE
3/4 - FORWARD FLOW

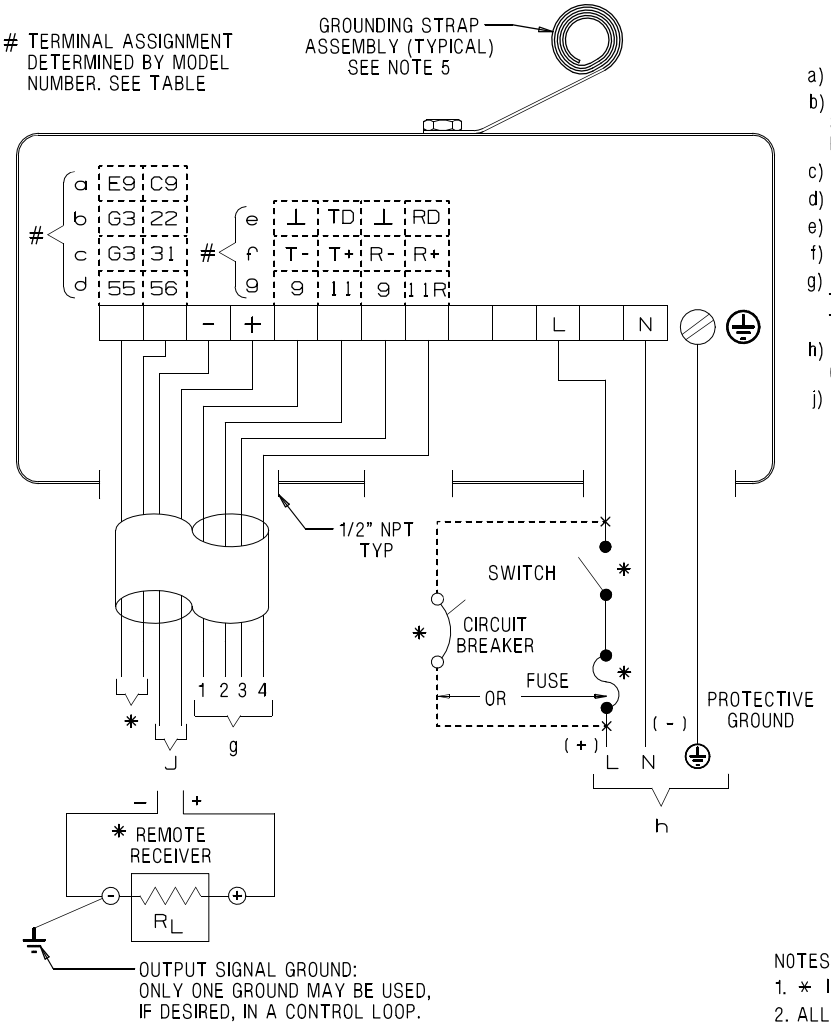
f) FIELD CONTACTS: ZERO RETURN FIELD CONTACTS TO CLOSE WHEN METER SUPPLY PUMP OR VALVE STOPS FLOW THRU METER. TERMINALS 22 & G3 REMAIN OPEN IF THIS FEATURE IS NOT USED.

NOTES:

1. * INDICATES SUPPLIED BY CUSTOMER.
2. ALL WIRING TO BE ENCLOSED IN METAL CONDUIT SUPPLIED BY CUSTOMER.
3. UNUSED CONNECTIONS MUST BE PLUGGED.
4. ALL CONDUIT CONNECTIONS ARE 1/2" NPT.
5. METER GROUNDING STRAPS ARE USED TO PREVENT STRAY ELECTRICAL CURRENTS FROM PASSING THROUGH THE METERED LIQUID. SEE INSTRUCTION BULLETIN FOR DETAILS.
6. WHEN ULTRASONIC CLEANING IS SPECIFIED, REFER TO INSTRUCTION BULLETIN 55UC2000.

(REF ID-50-1899 REV 0)

FIGURE 2-9b. INTERCONNECTION WIRING FOR MODELS 10D1475 & 10D1476 w/INTEGRAL 50XM1000 CONVERTER AFTER JANUARY 1999 [Refer also to Table 2-1]



REF: ID-50-1801 REV 2

TERMINAL ASSIGNMENT TABLE

a) SOLID STATE STATUS ALARM OUTPUT; COLLECTOR (C9) AND EMITTER (E9)

b) FIELD CONTACTS, ZERO RETURN FIELD CONTACTS TO CLOSE WHEN METER SUPPLY PUMP OR VALVE STOPS FLOW THROUGH METER. TERMINALS 22 & G3 REMAIN OPEN IF THIS FEATURE IS NOT USED.

c) TOTALIZER RESET INPUT VIA ISOLATED CUSTOMER CONTACT

d) SOLID STATE SCALED PULSE OUTPUT FORWARD; COLLECTOR (55) AND EMITTER (56)

e) DATA LINK RS 232C

f) DATA LINK RS 485

g) SCALED PULSE OUTPUT, ACTIVE, 24 Vdc, LOAD >150 OHMS
TERMINALS 9 & 11, FORWARD FLOW (1 & 2)
TERMINALS 9 & 11R, REVERSE FLOW (3 & 4)

h) POWER SUPPLY: 120 Vac, 60 Hz, 1Ø; OR 24 Vdc (AS SPECIFIED ON DATA TAG).

j) OUTPUT SIGNAL = 4-20 mA
CURRENT OUTPUT R_L = <750 OHMS

FM APPROVED

220/240 V INSTRUMENTS NOT INCLUDED

NONINCENDIVE FOR CL I,DIV 2,GP A,B,C & D

DUST-IGNITIONPROOF FOR CL II,DIV 1,GP E,F & G

SUITABLE FOR CL III,DIV 1, OUTDOOR HAZARDOUS LOCATIONS, NEMA 4X

INSTALLATION REQUIREMENTS

NON-HAZARDOUS LOCATIONS: WIRING SHALL COMPLY WITH NATIONAL ELECTRICAL CODE AND LOCAL ELECTRICAL CODE REQUIREMENTS.

HAZARDOUS LOCATIONS: WIRING TO BE IN CONDUIT. BOXES, FITTINGS AND SEALS TO COMPLY WITH ARTICLES 501, 502 OR 503 AS APPLICABLE, OF ANSI/NFPA 70 AND LOCAL ELECTRICAL CODE REQUIREMENTS.

EQUIPMENT NOT BY F&P (*) TO BE IN NON-HAZARDOUS AREA UNLESS APPROVED FOR DIV 1 OR 2.

NOTES:

1. * INDICATES INTERFACE SUPPLIED BY CUSTOMER.
2. ALL WIRING TO BE ENCLOSED IN METAL CONDUIT SUPPLIED BY CUSTOMER.
3. UNUSED CONNECTIONS MUST BE PLUGGED.
4. ALL CONDUIT CONNECTIONS ARE 1/2" NPT.
5. METER GROUNDING STRAPS ARE USED TO PREVENT STRAY ELECTRICAL CURRENTS FROM PASSING THROUGH THE METERED LIQUID. SEE INSTRUCTION BULLETIN FOR DETAILS.

FIGURE 2-10. INTERCONNECTION WIRING FOR INTEGRALLY MOUNTED SIGNAL CONVERTER FOR MODEL 10DX3300

2.3.2 Remotely Mounted Signal Converter

The signal converter customer connection box is supplied with five openings for 1/2 inch NPT conduit fittings or cable-seal cable fittings as specified at time of purchase. Any unused opening(s) must be sealed by installing an applicable plug(s) in the unused opening(s). This is required to maintain the NEMA 4X rating of the enclosure. All interconnection wiring in North America is to be enclosed within metal conduit supplied by user.

The signal converter signal and power interconnection cables are to be terminated to the 25 point terminal block located in the remote customer connection box. Certain terminal assignments vary in accordance with the model number as defined in the terminal assignment table in Figures 2-11 through 2-14. Note that the terminals labeled V1 through V4 are used for the active pulse output as well as the data link. Consequently, only one of these can be selected as an option. If a pulse output is required as well as the data link, the output pulse must be optocoupled, and is available on terminals 55 and 56 (V5 and V6). When this combination is selected, the alarm contact on terminals V5 and V6 (39 and 40) is not available.

Unless otherwise specified, thirty feet (10 m) of signal and ground cable is supplied for connecting the flowmeter process signal (1 and 2), reference signal (16 and 3-shield) and magnet coil drive (M1 and M3-shield) to the remotely mounted signal converter. The flowmeter housing ground terminal is connected to the signal converter housing ground terminal, which is connected to an external earth ground. Refer to the flowmeter grounding procedure given in the instruction bulletin provided with the flowmeter.

2.3.2.1 Customer Connections

The following descriptions are for a converter in a remote mounted enclosure. Converters which are integrally mounted use subsets of these, and their application and availability varies with the model number. Verify the applicable features by checking the model number.

Terminals 1S, 1, 2, and 2S
These are the measuring electrodes of the flowmeter, along with their shields. The shield of each electrode is driven at the same potential as that electrode so as to minimize the effects of signal cable length.

Terminals 3 and 16
Terminal 3 is the circuit common of the magmeter measuring system, and is connected by the customer to a quality earth ground at the flowmeter. Terminal 16 is referred to as reference voltage and is proportional to the excitation current used for the primary. This voltage is regulated to ± 70 mV by the converter electronics. The wiring between the flowmeter and converter places 16 inside a cable shielded by terminal 3.

Terminal 22
This terminal is referred to as X1 in the firmware, and can be configured for positive zero return or totalizer reset. An isolated contact closure capable of passing 5 mA DC is required for activation of the selected function.

Terminal G3
This is the circuit common for all digital functions, which include the terminal 8D 10 kHz unscaled pulse and terminal 22. It is electrically connected to terminal 3 but should only be used for interface with terminals 8D and 22.

Terminal 8D
This is an unscaled 0 to 10 kHz unscaled logic pulse representing zero to full scale (range value) flow of the converter. The pulses are fixed at 30 μsec width and make a logic transition from 5 volts to zero volts. A maximum cable length of 15 feet (5 m) should be used when measuring this output.

Terminals + and -
These terminals are the process current output. This is an active current output which can be configured by firmware to various levels and operating modes. The converter can source 20 mA into a maximum of 750 ohms load resistance.

Terminals V1 - V4
The exact nomenclature of these terminals is determined by the option card selected for the converter. Designations 9/11 (V1/V2) and 9/11R (V3/V4) denote a scaled pulse output. This may be either opto coupled or active, with 11 being active for forward flow and 11R for reverse. Terminals 9 are common for both flow directions.
When an RS323C data link option is specified, V1 and V3 are common, while the converter transmits data out terminal V2 and receives it into V4.
When the RS485 data link is specified, the converter will transmit data out V1 and V2, (V2 normally high) and will receive data into V3 and V4, with the logic signal at V4 normally high going low.

Terminals V5 and V6
These terminals are used for alarm indication from the converter, and may be either a pair of relay contacts or the collector (V6) and emitter (V5) of an opto coupler. These contacts are closed during normal operation and will open during any alarm condition shown on the converter display.

Terminals 44, 45 and 46
These terminals constitute the contacts of a form "C" relay which connects terminals 44 and 45 of an unpowered converter and connects 45 and 46 when the relay is energized by the converter. The firmware refers to these terminals as P1/P2, with an "on" or closed condition being one which will energize the relay. The status of a P1/P2 connection may be considered analogous to that of terminals 45 and 46.

Terminals M1 and M3
These terminals are intended to energize the magnet coils of the flowmeter. A shielded cable is used for this purpose, with M1 being the inner conductor and M3 having a relatively low millivoltage.

Terminals L, N, and Ground
These are the terminals used to power the system, with L being the voltage supply and N being neutral. If the converter is purchased with DC power, then L is the positive connection. The ground terminal is for the converter enclosure and must be connected to ground at the local electrical service.

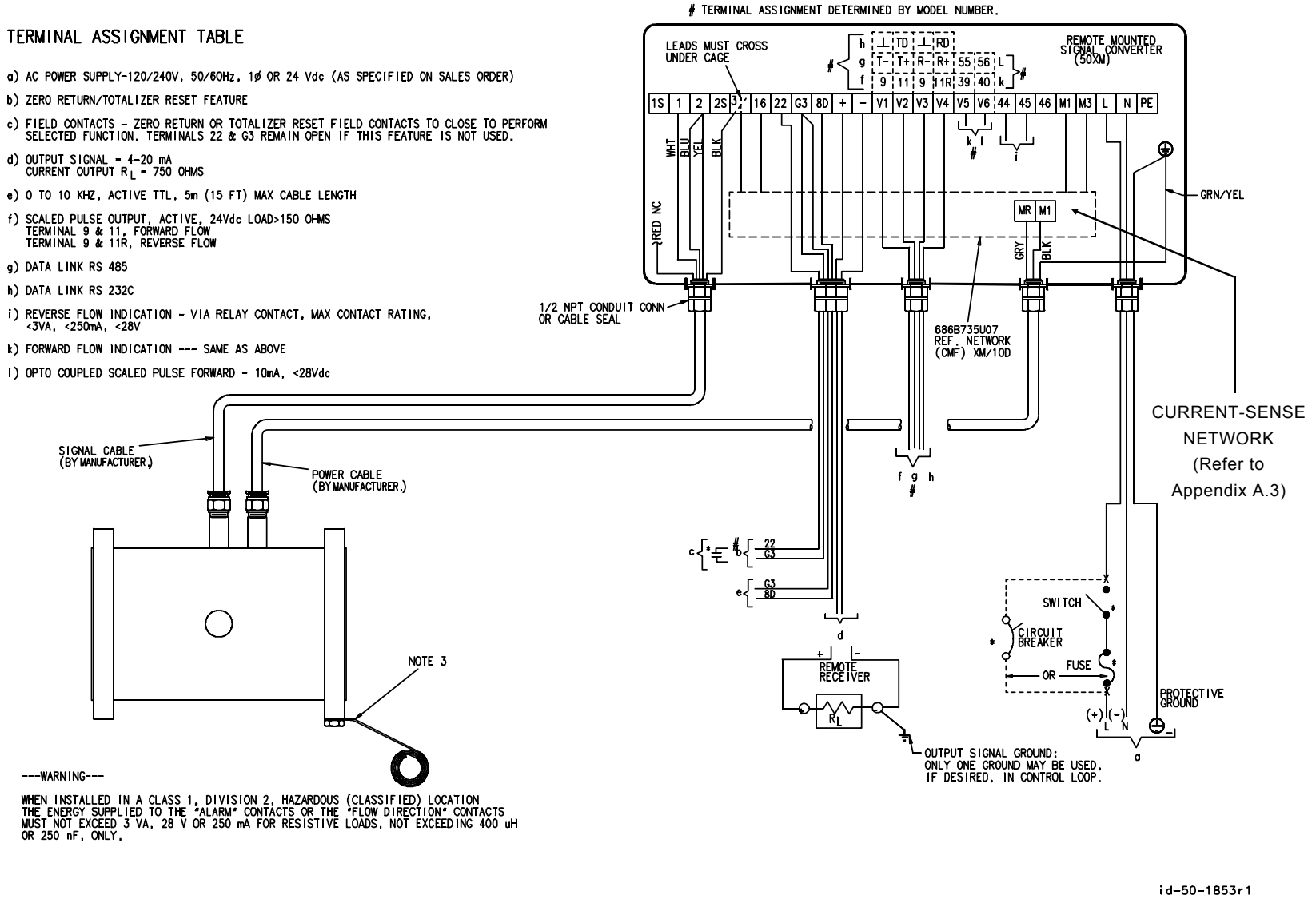


FIGURE 2-11. INTERCONNECTION WIRING FOR REMOTELY MOUNTED SIGNAL CONVERTER MODEL 10DX3111 WITH CONTINUOUS SUBMERGENCE FLOWMETER, SIZES 14 THROUGH 24 INCH

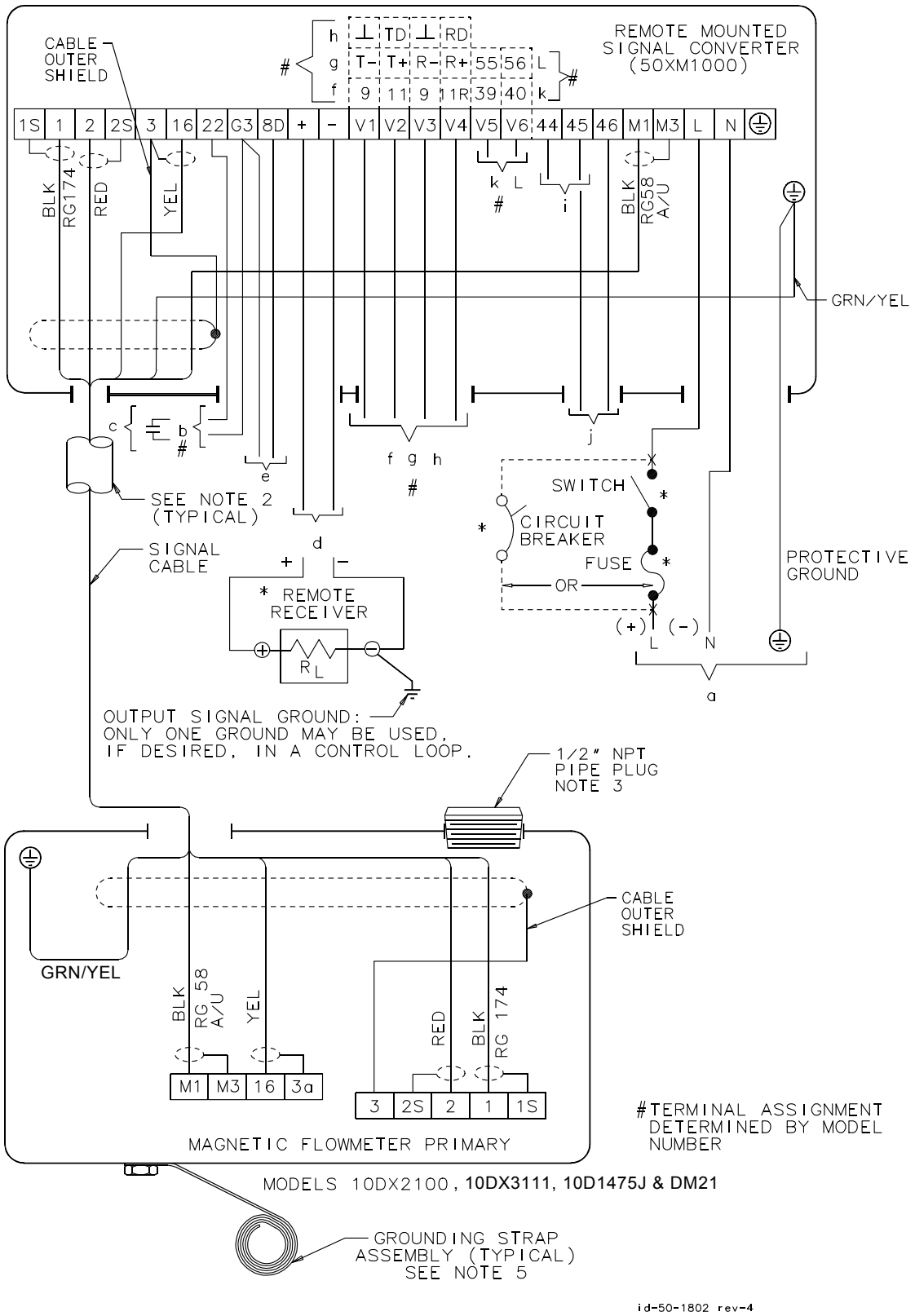


FIGURE 2-12. INTERCONNECTION WIRING FOR MODELS DM21, 10DX2100, 10DX3111 & 10D1475J WITH REMOTELY MOUNTED SIGNAL CONVERTER (Refer to the following page for applicable text.)

TERMINAL ASSIGNMENT TABLE

a) POWER SUPPLY - 120/240 V, 50/60 HZ, SINGLE PHASE
OR 24 V dc, (AS SPECIFIED ON NAME PLATE)
NOTE: 240 V SUPPLY NOT FM APPROVED.

b) MAY FUNCTION AS EITHER ZERO RETURN OR TOTALIZER RESET, AS SPECIFIED BY MODEL NUMBER.

c) FIELD CONTACTS-IF USED AS ZERO RETURN FIELD CONTACTS TO CLOSE WHEN METER SUPPLY PUMP OR VALVE STOPS FLOW THRU METER. WHEN USED FOR TOTALIZER RESET, CONTACTS TO MOMENTARILY CLOSE TO INITIATE. TERMINALS 22 & G3 REMAIN OPEN IF NOT USED.

d) OUTPUT SIGNAL = 4-20 mA
CURRENT OUTPUT R_L = <750 OHMS

e) 0 TO 10 K Hz, ACTIVE TTL, 5m (15 FT) MAX CABLE LENGTH

f) SCALED PULSE OUTPUT, ACTIVE, 24Vdc LOAD >150 OHMS
TERMINAL 9 & 11, FORWARD FLOW
TERMINAL 9 & 11R, REVERSE FLOW

g) DATA LINK RS 485

h) DATA LINK RS 232C

i) REVERSE FLOW INDICATION - VIA RELAY CONTACT * *

j) FORWARD FLOW INDICATION ----SAME AS ABOVE

k) ALARM CONTACT * *

L) OPTO COUPLED SCALED PULSE FORWARD - <10mA, <28Vdc.

NOTES:

1. * INDICATES SUPPLIED BY CUSTOMER.
2. ALL WIRING TO BE ENCLOSED IN METAL CONDUIT SUPPLIED BY CUSTOMER
3. UNUSED CONNECTIONS MUST BE PLUGGED TO MAINTAIN NEMA 4 RATING
4. ALL CONDUIT CONNECTIONS ARE 1/2" NPT.
5. METER GROUND BONDING STRAPS ARE USED TO PREVENT STRAY ELECTRICAL CURRENTS FROM PASSING THROUGH THE METERED LIQUID. SEE INSTRUCTION BULLETIN FOR DETAILS.
6. FOR HIGH TEMPERATURE APPLICATIONS (ABOVE 250° F) ENTIRE EXTERIOR OF METER BODY MUST BE INSULATED (EXCLUDING ELECTRONICS BOX MOUNTED ON EXTENSION NECK).

INSTALLATION REQUIREMENTS

FM
APPROVED

THIS IS NONINCENDIVE EQUIPMENT WHICH IS SUITABLE FOR INSTALLATION IN CLASS I, DIVISION 2, GROUP A, B, C & D, HAZARDOUS (CLASSIFIED) LOCATIONS.

WARNING

DO NOT DISCONNECT WIRING, REMOVE OR REPLACE COMPONENTS OR ASSEMBLIES WHILE CIRCUITS ARE ALIVE, UNLESS AREA IS KNOWN TO BE NONHAZARDOUS.

NON-HAZARDOUS LOCATION WIRING SHALL COMPLY WITH ANSI/NFPA 70, NATIONAL ELECTRICAL CODE, AND LOCAL CODE REQUIREMENTS.

CLASS I, DIVISION 2 EQUIPMENT AND WIRING SHALL BE INSTALLED IN ACCORDANCE WITH ANSI/NFPA 70, ARTICLE 501.

THIS EQUIPMENT HAS "NONINCENDIVE CIRCUIT FIELD WIRING" CONNECTIONS IN ACCORDANCE WITH ANSI/ISA S12.12, FOR USE IN CLASS I AND II, HAZARDOUS (CLASSIFIED) LOCATIONS, ALLOWING ORDINARY LOCATION WIRING PER ANSI/NFPA 70, ARTICLES 501-4(b) EXCEPTION.

DEFINITIONS:

EQUIPMENT SUPPLYING ENERGY TO NONINCENDIVE CIRCUIT(S).

Voc = MAXIMUM OUTPUT VOLTAGE
Isc = MAXIMUM OUTPUT CURRENT
Ca = MAXIMUM ALLOWABLE CAPACITANCE
La = MAXIMUM ALLOWABLE INDUCTANCE

EQUIPMENT RECEIVING ENERGY FROM NONINCENDIVE CIRCUIT(S).

Vmax = MAXIMUM INPUT VOLTAGE
Imax = MAXIMUM INTPUT CURRENT
Ci = MAXIMUM INTERNAL CAPACITANCE
Li = MAXIMUM INTERNAL INDUCTANCE

INTERCONNECTING FIELD WIRING.

Ccable = TOTAL CABLE CAPACITANCE
Lcable = TOTAL CABLE INDUCTANCE

NONINCENDIVE CIRCUIT FIELD WIRING PARAMETERS:

NOTE: NONINCENDIVE CIRCUIT FIELD WIRING PARAMETERS ONLY APPLY TO CIRCUIT TERMINALS IDENTIFIED BY A DOUBLE ASTERISK (* *).

** CONTACT TERMINALS: Vmax = 32.0 Vdc Imax = 110 mA
Ci = 0 La = 0

EQUIPMENT SUPPLYING THESE CONTACTS SHALL BE FACTORY MUTUAL RESEARCH APPROVED, AND DESIGNATED AS "AIS" (ASSOCIATED INTRINSICALLY SAFE APPARATUS), OR "ANI" (ASSOCIATED NONINCENDIVE EQUIPMENT), AND SHALL HAVE:

Voc < Vmax, Isc < Imax, Ca > Ccable, AND La > Lcable

WHEN CABLE PARAMETERS ARE UNKNOWN, THE FOLLOWING VALUES MAY BE USED:

CAPACITANCE (Ccable): 60 pF/ft (200 pF/m)
INDUCTANCE (Lcable): 0.20 uH/ft (0.66uH/m)

IT IS THE USERS RESPONSIBILITY TO VERIFY THE SUITABILITY OF ALL EQUIPMENT AND WIRING FOR USE IN A CLASS I, DIVISION 2, HAZARDOUS (CLASSIFIED) LOCATION.

FIGURE 2-12. INTERCONNECTION WIRING FOR MODELS DM21, 10DX2100, 10DX3111 & 10D1475J WITH REMOTELY MOUNTED SIGNAL CONVERTER (Refer to the previous page for applicable diagram.)

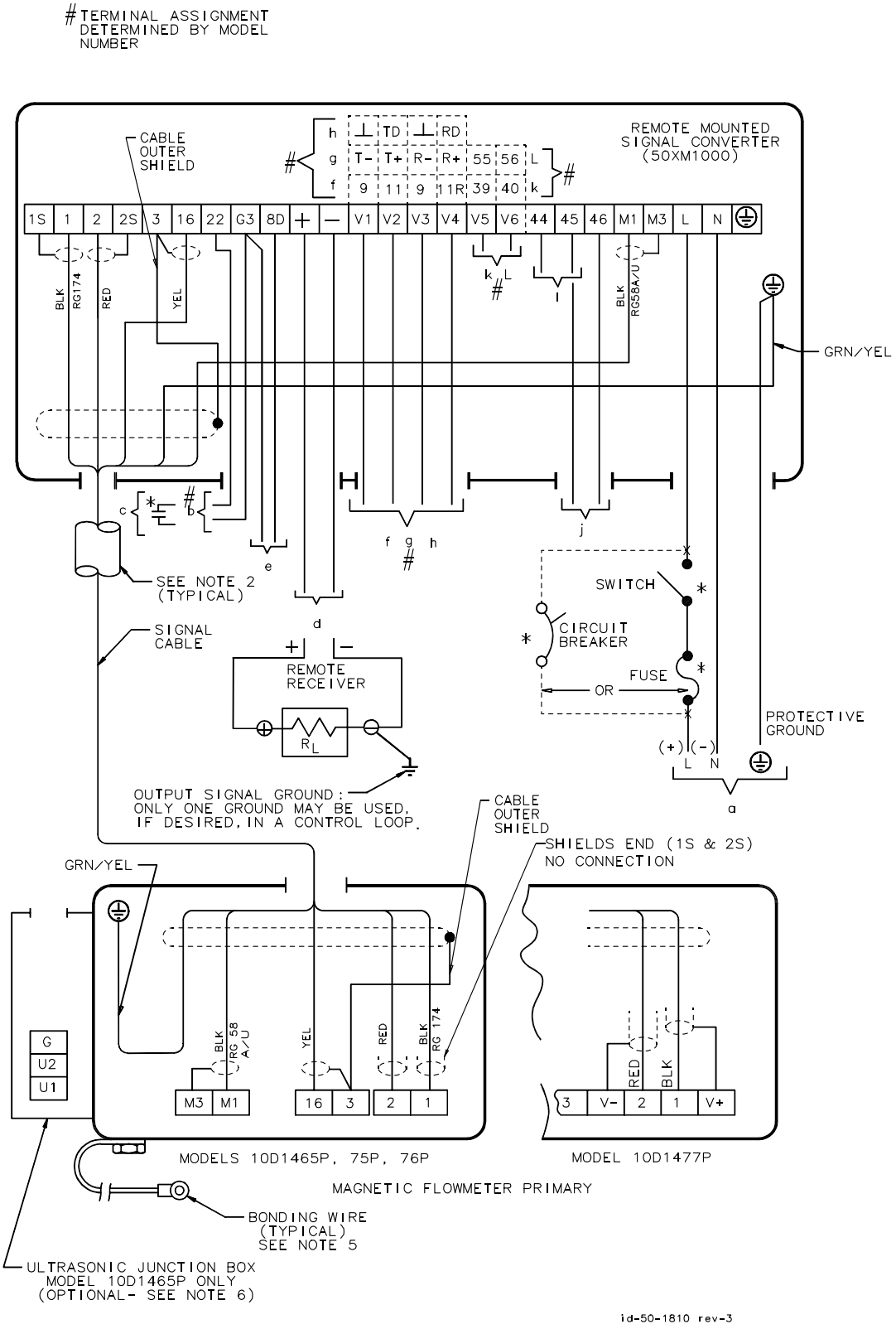


FIGURE 2-13. INTERCONNECTION WIRING FOR MODELS 10D1465P, 10D1475P/S, 10D1476P/1477P WITH REMOTELY MOUNTED CONVERTER (Refer to the following page for applicable text.)

TERMINAL ASSIGNMENT TABLE

a) POWER SUPPLY - 120/240 V, 50/60 HZ, SINGLE PHASE
OR 24 V dc, (AS SPECIFIED ON NAME PLATE)
NOTE: 240 V SUPPLY NOT FM APPROVED.

b) MAY FUNCTION AS EITHER ZERO RETURN OR TOTALIZER RESET, AS SPECIFIED BY MODEL NUMBER.

c) FIELD CONTACTS-IF USED AS ZERO RETURN FIELD CONTACTS TO CLOSE WHEN METER SUPPLY PUMP OR VALVE STOPS FLOW THRU METER. WHEN USED FOR TOTALIZER RESET, CONTACTS TO MOMENTARILY CLOSE TO INITIATE. TERMINALS 22 & G3 REMAIN OPEN IF NOT USED.

d) OUTPUT SIGNAL = 4-20 mA
CURRENT OUTPUT R_L = <750 OHMS

e) 0 TO 10 K Hz, ACTIVE TTL, 5m (15 FT) MAX CABLE LENGTH

f) SCALED PULSE OUTPUT, ACTIVE, 24Vdc LOAD >150 OHMS
TERMINAL 9 & 11, FORWARD FLOW
TERMINAL 9 & 11R, REVERSE FLOW

g) DATA LINK RS 485

h) DATA LINK RS 232C

i) REVERSE FLOW INDICATION - VIA RELAY CONTACT * *

j) FORWARD FLOW INDICATION ----SAME AS ABOVE

k) ALARM CONTACT* *

L) OPTO COUPLED SCALED PULSE FORWARD - <10mA, <28Vdc.

NOTES:

1.* INDICATES SUPPLIED BY CUSTOMER.
2. ALL WIRING TO BE ENCLOSED IN METAL CONDUIT SUPPLIED BY CUSTOMER
3. UNUSED CONNECTIONS MUST BE PLUGGED TO MAINTAIN NEMA 4 RATING
4. ALL CONDUIT CONNECTIONS ARE 1/2" NPT.
5. METER GROUND BONDING STRAPS ARE USED TO PREVENT STRAY ELECTRICAL CURRENTS FROM PASSING THROUGH THE METERED LIQUID. SEE INSTRUCTION BULLETIN FOR DETAILS.
6. WHEN ULTRASONIC CLEANING IS SPECIFIED, REFER TO I.B. 55UC2000.

INSTALLATION REQUIREMENTS

FM APPROVED

THIS IS NONINCENDIVE EQUIPMENT WHICH IS SUITABLE FOR INSTALLATION IN CLASS I DIVISION 2, GROUP A, B, C & D, HAZARDOUS (CLASSIFIED) LOCATIONS.

DO NOT DISCONNECT WIRING, REMOVE OR REPLACE COMPONENTS OR ASSEMBLIES WHILE CIRCUITS ARE ALIVE, UNLESS AREA IS KNOWN TO BE NONHAZARDOUS.

NON-HAZARDOUS LOCATION WIRING SHALL COMPLY WITH ANSI/NFPA 70, NATIONAL ELECTRICAL CODE, AND LOCAL CODE REQUIREMENTS.

CLASS I, DIVISION 2 EQUIPMENT AND WIRING SHALL BE INSTALLED IN ACCORDANCE WITH ANSI/NFPA 70, ARTICLE 501.

THIS EQUIPMENT HAS "NONINCENDIVE CIRCUIT FIELD WIRING" CONNECTIONS IN ACCORDANCE WITH ANSI/ISA S12.12, FOR USE IN CLASS AND , HAZARDOUS (CLASSIFIED) LOCATIONS, ALLOWING ORDINARY LOCATION WIRING PER ANSI/NFPA 70, ARTICLES 501-4(b) EXCEPTION.

DEFINITIONS:

EQUIPMENT SUPPLYING ENERGY TO NONINCENDIVE CIRCUIT(S).

Voc = MAXIMUM OUTPUT VOLTAGE
Isc = MAXIMUM OUTPUT CURRENT
Ca = MAXIMUM ALLOWABLE CAPACITANCE
La = MAXIMUM ALLOWABLE INDUCTANCE

EQUIPMENT RECEIVING ENERGY FROM NONINCENDIVE CIRCUIT(S).

Vmax = MAXIMUM INPUT VOLTAGE
Imax = MAXIMUM INTPUT CURRENT
Ci = MAXIMUM INTERNAL CAPACITANCE
Li = MAXIMUM INTERNAL INDUCTANCE

INTERCONNECTING FIELD WIRING.

Ccable = TOTAL CABLE CAPACITANCE
Lcable = TOTAL CABLE INDUCTANCE

NONINCENDIVE CIRCUIT FIELD WIRING PARAMETERS:

NOTE: NONINCENDIVE CIRCUIT FIELD WIRING PARAMETERS ONLY APPLY TO CIRCUIT TERMINALS IDENTIFIED BY A DOUBLE ASTERISK (**).

** CONTACT TERMINALS: Vmax = 32.0 Vdc Imax = 110 mA
Ci = 0 La = 0

EQUIPMENT SUPPLYING THESE CONTACTS SHALL BE FACTORY MUTUAL RESEARCH APPROVED, AND DESIGNATED AS "AIS" (ASSOCIATED INTRINSICALLY SAFE APPARATUS), OR "ANI" (ASSOCIATED NONINCENDIVE EQUIPMENT), AND SHALL HAVE:

$Voc < Vmax$, $Isc < Imax$, $Ca > Ccable$, AND $La > Lcable$

WHEN CABLE PARAMETERS ARE UNKNOWN, THE FOLLOWING VALUES MAY BE USED:

CAPACITANCE (Ccable): 60 pF/ft (200 pF/m)
INDUCTANCE (Lcable): 0.20 uH/ft (0.66uH/m)

IT IS THE USERS RESPONSIBILITY TO VERIFY THE SUITABILITY OF ALL EQUIPMENT AND WIRING FOR USE IN A CLASS I, DIVISION 2, HAZARDOUS (CLASSIFIED) LOCATION.

FIGURE 2-13. INTERCONNECTION WIRING FOR MODELS 10D1465P, 10D1475P/S, 10D1476P/1477P WITH REMOTELY MOUNTED CONVERTER (Refer to the previous page for applicable diagram.)

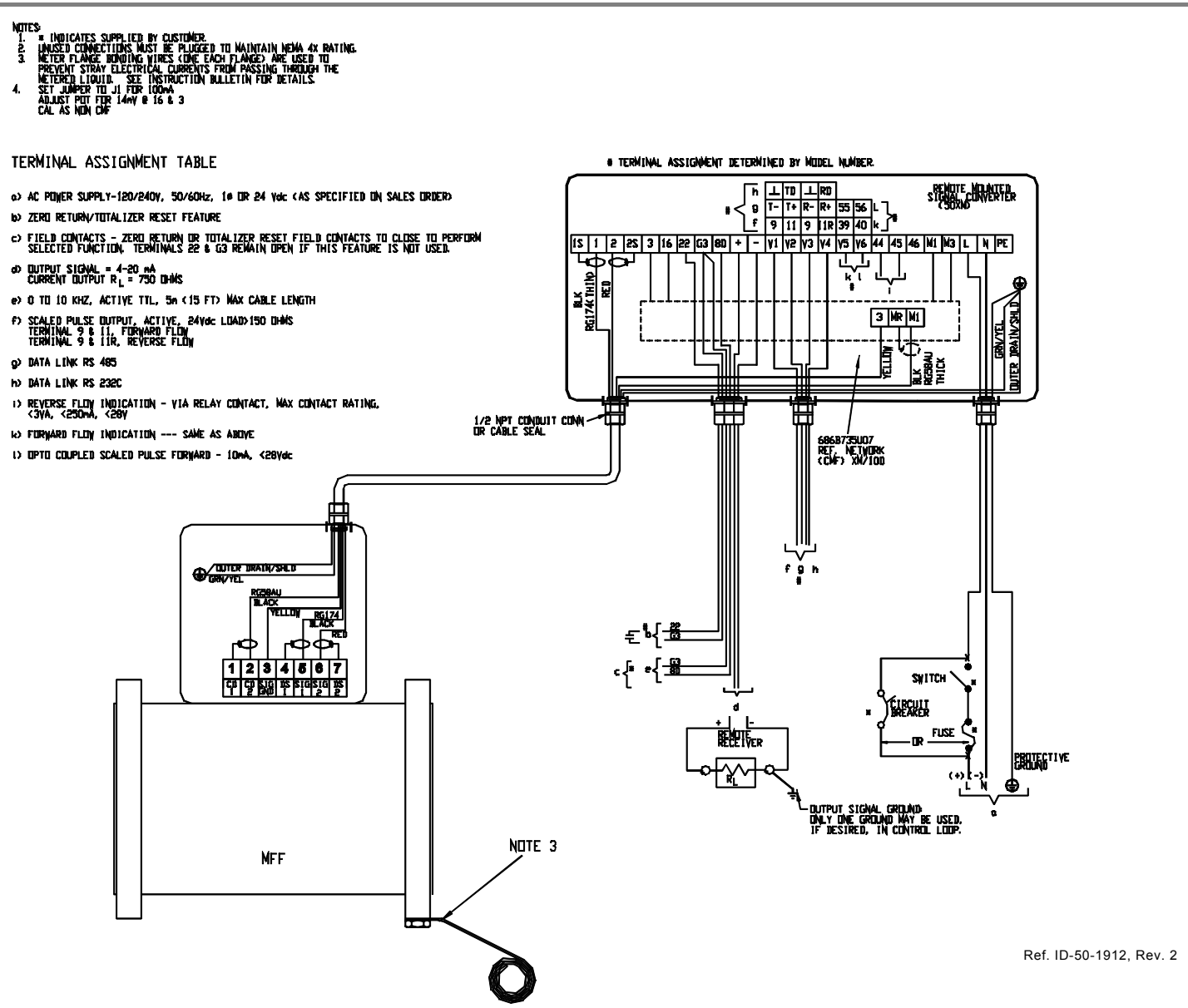


FIGURE 2-14. INTERCONNECTION WIRING FOR MODELS MFE & MFF WITH REMOTELY MOUNTED SIGNAL CONVERTER

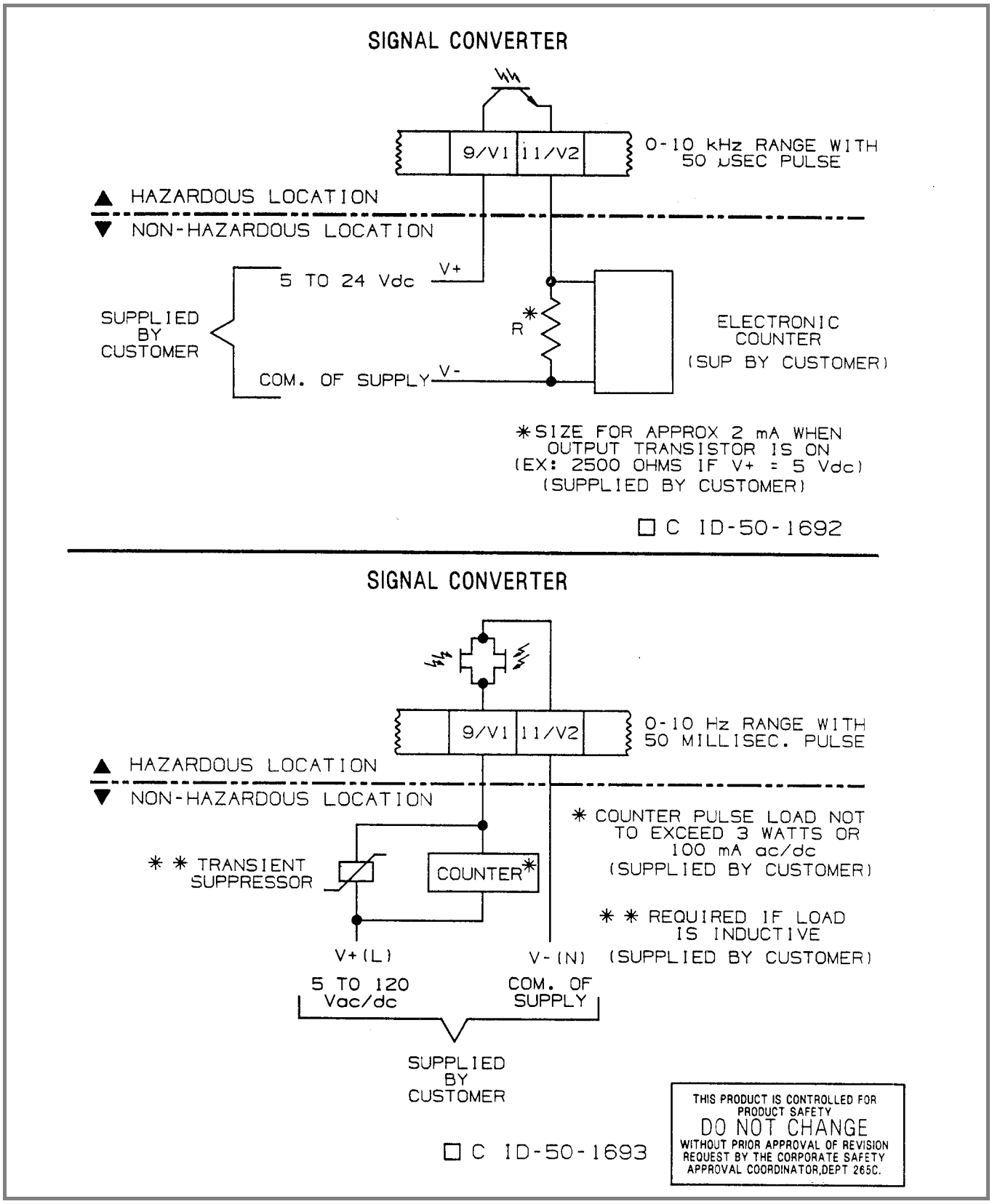


FIGURE 2-15. INTERCONNECTION WIRING DIAGRAM; SCALER ASSEMBLY

THE FOLLOWING INFORMATION SUPPLEMENTS OR SUPERSEDES INFORMATION CONTAINED IN THE FOLLOWING FIGURES SHOWN IN THIS INSTRUCTION MANUAL:

FIGURE 2-9
FIGURE 2-10
FIGURE 2-13

TABLE 2-1 below summarizes the terminal designations and function vs. model numbers.

TABLE 2-1. TERMINAL MARKINGS vs. MODEL NUMBER

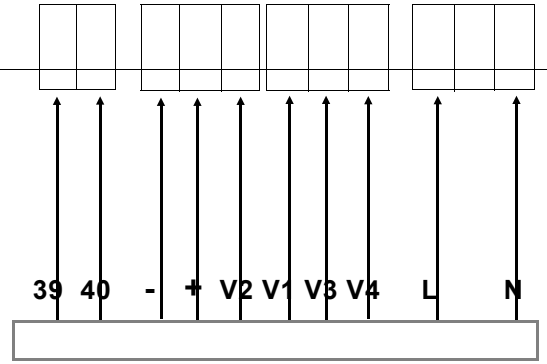
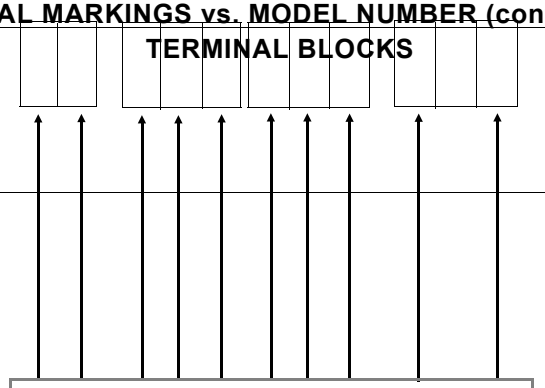
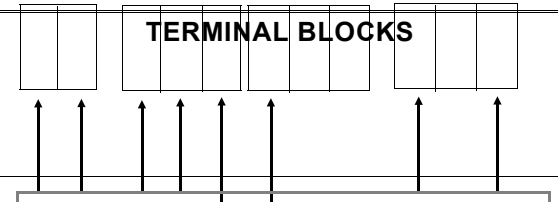
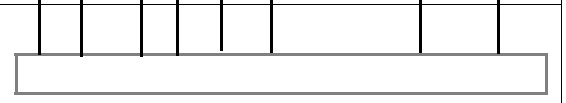
MODEL	TERMINAL BLOCKS	TERMINALS	TERMINAL FUNCTION
10DX3311E & S, 1/2 through 12 in. [Integral XM or M2 Converters]	 **MARKINGS (Supersedes information in FIGURE 2-4)**	**39/40**	a) Zero return or totalizer reset (software selectable) b) Solid-state status contact (39 = emitter) c) Forward flow scaled pulse output, open collector (39 = emitter)
		-/+	4-20 mA current output
		V2/V1	a) Forward scaled pulse output (V1 = negative) b) Data link transmit (V1 = negative)
		V3/V4	a) Reverse scaled pulse output (V3 = negative) b) Data link receive (V3 = negative)
		L/N	Signal converter power supply (N is negative or neutral)

TABLE 2-1. TERMINAL MARKINGS vs. MODEL NUMBER (cont.)

MODEL	TERMINAL BLOCKS	TERMINALS	TERMINAL FUNCTION
10D1475P & S 10D1476P & S [Integral XM Converters]	 **MARKINGS (Supersedes information in FIGURE 2-3)**	**22/G3** **+/-** **11/9** (optional) **L/N** or **(-)N/L(+)**	a) Zero return b) Reverse flow pulse output or data link receive c) 0 - 10 kHz unscaled pulse output a) 4-20 mA current output a) Active or passive scaled pulse output (9 = signal common) b) Data link transmit for XM converters Signal converter power input; either 24 VDC (polarity as marked) or 120/240 VAC depending on model
MODEL	**TERMINAL BLOCKS**	**TERMINALS**	TERMINAL FUNCTION
PRIMARIES FOR REMOTE-MOUNT CONVERTERS (EXCEPT 10D1477P & S)		**1/2** **3** **16**	Electrode terminals Signal common Reference Voltage
10D1477P & S w/ REMOTE CONVERTER	 **MARKINGS (Supersedes information in FIGURE 2-7)**	**M1** **M2/M3** **V+/V-**	"Active" coil terminal Coil "common" ± 12 VDC Preamplifier power supply voltage (10D1477P & S only)

3.0 START-UP AND OPERATION

3.1 Start-Up

3.1.1 Calibration Data

The flowmeter and its associated Model 50XM1000 Signal Converter function as a complete flow metering system and therefore the respective flowmeter/converter combination must be installed and operated as a dedicated unit. Each flow metering system is precisely calibrated at the factory in accordance with customer specified flow parameters. The data recorded at calibration is listed on the tags attached to the signal converter. Typical data and calibration tags are shown in Figures 3-1 and 3-2. The data tag is located on the converter housing and the calibration tag is located on the converter transformer.

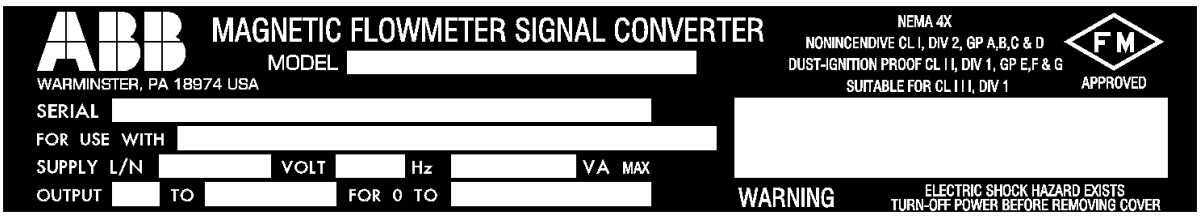


FIGURE 3-1. TYPICAL DATA TAG, REMOTE-MOUNTED CONVERTER

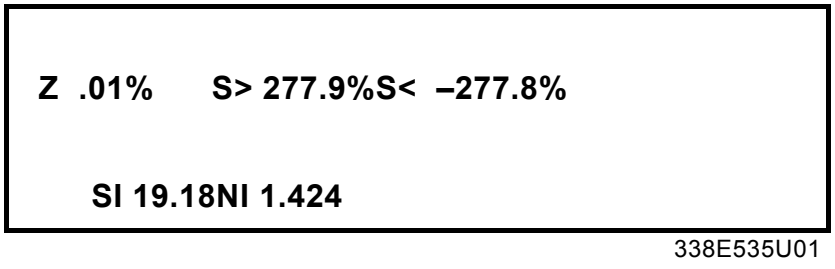


FIGURE 3-2. TYPICAL 50XM1000 CALIBRATION TAG

Typically, the flowmeter and its converter will have either the same or sequential serial numbers. For example, if the signal converter is integrally mounted with the meter, then both the meter and the converter would be assigned the same serial number such as 94W012345. However, if the converter is remote mounted, then the meter would be assigned 94W012345 and the converter 94W012346, with the designated serial numbers referenced on the converter data tag as shown in Figure 3-1.

Because the flow metering system is precalibrated, it is generally ready for on-line service as received. To place the flow metering system in operation, proceed as outlined in Sub-Section 3.1.2.

In the event that the specified system flow parameters or engineering units are to be changed, the signal converter must be reconfigured to agree with the revised flow values. The procedure is outlined in Sub-Section 3.2.

Should it be necessary to replace the signal converter assembly, the operator should record the operating parameters because these values must be entered in the replacement converter. The replacement converter will also be factory calibrated, eliminating field calibration requirements. Simply enter the noted operating parameters and the system can be returned to service.

3.1.2 Flow Measurement

To place the flow metering system on-line, proceed as follows:

1) Verify that the signal converter has been properly mounted and that system interconnection wiring has been completed correctly, as discussed in the Section 2. It will be necessary to remove the instrument housing covers temporarily to permit access for inspection of system wiring and to verify normal operation. Improper wiring may result in blown fuses and/or converter damage.

2) Check that the external power source connected to the signal converter is compatible with the power requirements of the signal converter. The converter power requirements are stated on the name tag affixed to the converter housing.

3) Apply power to the signal converter. Because the flowmeter is driven by the signal converter, the meter will be energized also.

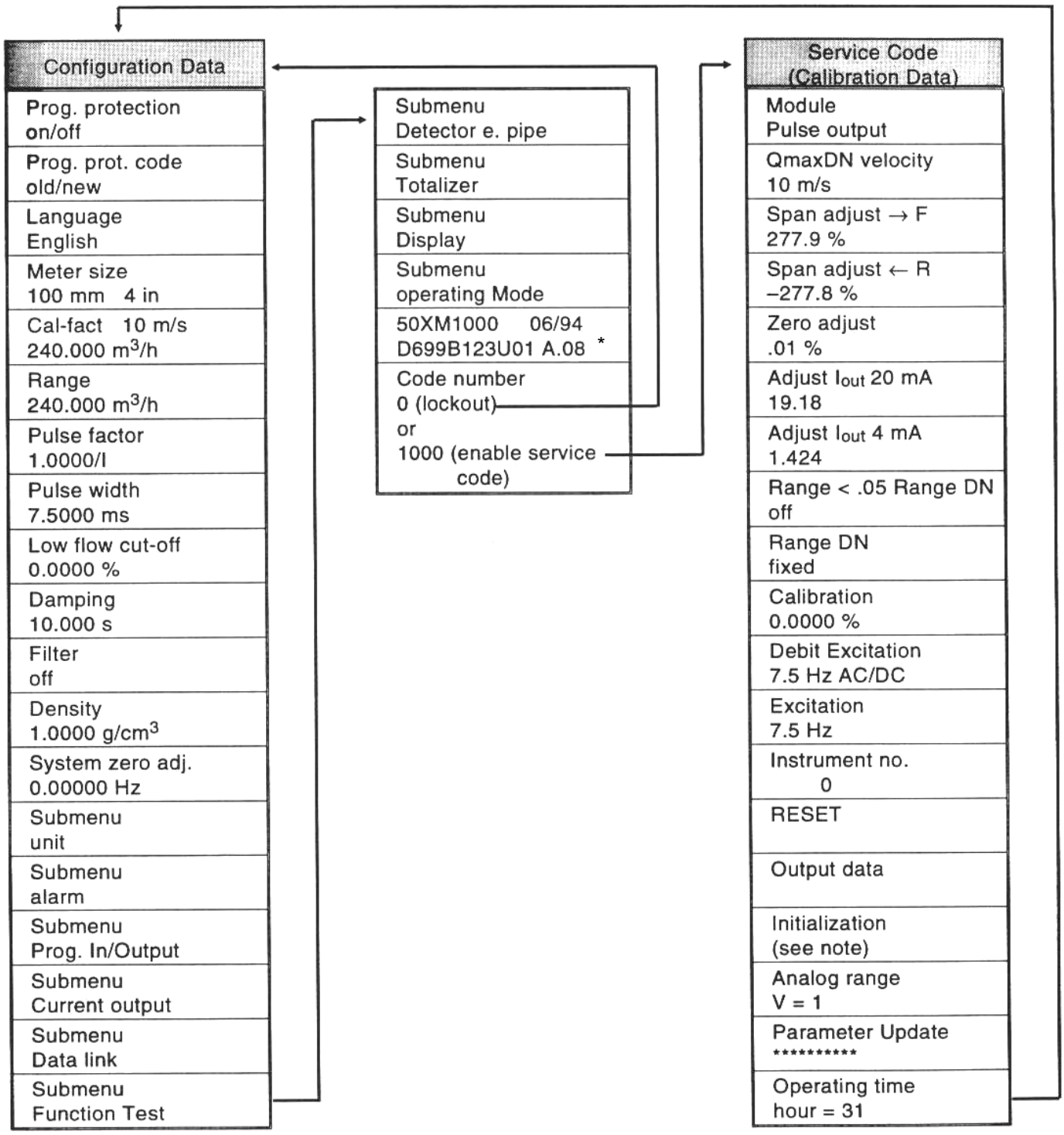
4) Using the Down, Up and CLR buttons on the front of the signal converter, verify that system operating parameters have been correctly entered. Use of the buttons is described in Sub-Section 3.2. This data can be verified with the signal converter operating in the monitor mode. Refer to the flow parameter values given on the manufacturing specification sheet (identified by serial number).

5) Initiate a minimal flow through the process pipeline for several minutes to purge entrapped air from the piping system. Flow rate indication should be displayed on the signal converter readout concurrent with flow start-up. Accurate measurement cannot be expected until all air has been purged from the process pipeline. If desired, after the pipeline has been purged of air, the flow totalizer can be reset to zero as described in Sub-Section 3.18.

6) When system operation appears normal, stop flow measurement and replace all housing covers. Log the flow total displayed on the LCD readout or reset flow totalizers. Process measurement will commence with the initiation of flow through the meter.

CAUTION

Should an "**Error 2 - Uref too low**" error occur when the instrument is activated, remove power from the device as soon as possible, otherwise instrument damage may occur. Refer to Section 7.3 of this manual for error-code troubleshooting information.



* Refer to Section 3.4 for supplemental information on newer version A.28 firmware. Other versions may show slightly different displays and options.

Note: Preset values or conditions noted in the above flowchart are typical values found in the database.

FIGURE 3-3. CONFIGURATION AND CALIBRATION FLOWCHART

3.1.3 Menu Sequence

The following list represents the display menu sequence when running firmware version A.08 and using the Up button to move through the menu items. The first message displayed the first time the CLR button is pressed after the converter is powered up is "Prog. Protection ON". Thereafter, pressing the CLR button while the converter is in monitoring mode will display the parameter on display when configuration or calibration mode was last exited. There is wraparound between the last and the first items on the menu.

The menu items beginning the list are configuration mode functions. Calibration mode items are those items on the list following "code number". These items are preceded with " * " on the list; these calibration mode functions are inhibited unless "code" is selected. Submenu lists (preceded with a "+") only appear if the associated upper level is selected.

Where an item has a few choices, the other choices are shown following a "//".

Prog. protection
off//on

Prot. code
old //new

Language
English

Meter size (available only for fixed range per size)
25 mm 1 in

Cal-fact 10m/s //33ft/s
53.6744 gpm

Range
25 gpm

Pulse factor
1.00000 / gal

Pulse width
30.000 ms

Low flow cut-off
1.0000 %

Damping
6.0000 s

Filter
on//off

Density
1.00000 g/cm3

System zero adj.
0.0000 Hz

+ Adjust
+ Manual//automatic

Submenu
unit
+ Range unit
gpm
+ Totalizer unit
gal
+ Unit factor
3785.40 Liter
+ Unit name
kgal/min
+ Prog unit
With//without density

Submenu
alarm
+ Max alarm
+ Min alarm
+ Error log

Submenu
Program Input/Output
+ Function P1/P2
No function
+ Function P1/P2
F/R-Signal
+ Function P1/P2
Empty pipe (closed//open)
+ Function P1/P2
General alarm (closed//open)
+ Function P1/P2
Max/Min alarm (open//closed)
+ Function P1/P2
Min alarm (open//closed)
+ Function P1/P2
Max alarm (open//closed)
+ Function X1
No function
+ Function X1
Totalizer reset
+ Function X1
Zero return

Current output
+ Current output
  4 - 20 mA
+ I_{out} at alarm
  0 % //130 % //3.8 mA
Submenu
Data link
+ Communication
+ Printer type
+ Printer time
+ Baudrate
  1200 bd
+ Instr. address
  000
Submenu
Function test
+ Function test
  I_{out}
+ Function test
  Multiplexer
+ Test Mode
  off//on
+ Simulation
  off//on
+ Function test
  function X1 off//on
+ Function test
  Display
+ Function test
  F_{out}
+ Function test
  Data link
+ Function test
  Switch S401
+ Function test
  function P1/P2
+ Function test
  Alarm contact
+ Function test
  External EEPROM
+ Function test
  EEPROM
+ Function test
  EPROM (Program)
+ Function test
  NVRAM
+ Function test
  RAM (ASIC)

Submenu
Detector e.pipe
+ Detector e.pipe
  on //off
+ Adjust
  Detector e.pipe
+ Threshold
  2300
+ Iout at empty pipe
+ 0%//130%//3.8 mA
+ alarm empty pipe
  off//on

Submenu
Totalizer
+ Totalizer →F
  reset
+ Totalizer ←R
  reset
+ Mains interrupt
  reset
+ Overflow →F
  000
+ Overflow ←R
  000
+ Totalizer function
  standard//differ. total

Submenu
Display
+ 1st line
  Q [mA]
  Q [unit]
  Q [%]
  Q [Bargraph]
  Tag number
  Totalizer ← R
  Totalizer → F
  Totalizer
+ 2nd line
  Q [mA]
  Q [unit]
  Q [%]
  Blanks
  Q [Bargraph]
  Tag number
  Totalizer ← R
  Totalizer → F
  Totalizer
+ 1st line Multiplex displ.
  off//on
+ 2nd line Multiplex displ.
  off//on

Submenu
  Operating mode
    standard//fast
    + Preset total (not applicable to 50XM1000)
    + Fast
    + 2 Range, auto. (not applicable to 50XM1000)
    + 2 Range, ext. (not applicable to 50XM1000)

    Flow indication
    + standard/ /opposite

    Flowdirection
    + forward/ /reverse

 Firmware Level
    50XM1000   06/94
    D699B123U01 A.08 *

* Refer to Section 3.4 for supplemental information on newer version A.28 firmware.
Other versions may show slightly different displays and options.

Code number (Service Code)
****

* Module
  Pulse output

* Q_{max}DN velocity
  10 m/s // 33.33 ft/s

* Span adjust → F
  277.9%

* Span adjust ← R
  –277.8%

* Zero adjust
  .01 %

* Adjust I_{out} 20 mA
  19.18

* Adjust I_{out} 4 mA
  1.424

* Range < .05 Range DN
  off//on

* Range DN
  fixed//programmable

* Calibration
  0.0000%

* Debit Excitation
  7.5 Hz AC/DC

* Excitation
  7.5 Hz

* Instrument no.
  0

* Reset

* Output data

* Initialization

* Analog range
  V = 1

* Parameter Update
  ****

* Operating time
  hour = 31

3.1.4 Engineering Units

Available flow units are listed below. Entries for volumetric units followed by a "/" may use any of the units of time following the "/". Entries preceded with a "^" permit use of a density entry other than 1.000.

l/s /min /h
hl/s /min /h
m^3/s /min /h
igp/s /m /h
gp/m /h
mgd
bbl/s /min /h
bls/day /min /h
^ kg/s /min /h
^ t/s /min /h where ton = 1000 kgm (not U.S. ton)
^ gram/s /m /h
ml/s /min /h
Mlt/min /h /day megaliters = million liters
^ lbs/s /min /h
^ uton/min /h /day U.S. ton = 2000 pounds
k/gal/s /m /h thousands of U.S. gallons

The following are totalization units available:

l
hl
m^3
igal
gal
mgal
bbl
bls
^ kg
^ t
^ gram
ml
Mlt
^ lbs
^ uton
kgal

NOTE
Engineering units may be selected via the display menu or from a remote terminal connected to the 50XM1000 data link. In the latter case, selection is made by use of a 3-digit code number as defined in Section 6.

3.2 Configuration Procedure

The unit has been pre-configured at the factory per the specifications given at the time the order was placed. However, parameters can be changed using the procedure described in this section. Note that the firmware version described in this bulletin is D699B123U01, A.08 (refer to Section 3.4 for supplemental information on newer versions A.28 Standard and X.21 HART Protocol firmware); other versions may show slightly different displays and options.

CAUTION
Do not power the unit with the terminals M1 and M3 connected without also connecting terminals 3 and 16. Fuse failure and possible converter damage will result.

NOTE
Replacement fuses must be the same as the original type supplied with the converter (i.e., 5x20 mm "T" type), LITTELFUSE type 218. Other type fuses may blow as power is applied.

NOTE
Additional configuration information and a typical Test Wiring Diagram are provided in Section 5.

All data base interrogations and changes are addressed through three pushbuttons. They are identified as "Up", "Down", and "CLR" (refer to Figure 3-3). To gain access to the data base, it is necessary to leave the normal "monitoring mode" and enter the "configuration mode". This is accomplished simply by pressing the pushbutton on the right which is identified as the "CLR" pushbutton. The various parameters of the data base can then be viewed by moving up or down through the menu by pressing one of the two buttons to the left of "CLR" identified as "Up" and "Down". Data is accessed and changes entered by pressing the "Up" and "Down" pushbuttons simultaneously. This simultaneous action constitutes the ENTER function. If no entries or changes are made within 70 seconds the unit will automatically revert to the monitoring mode.
When the "CLR" button is pressed while the unit is in the monitoring mode, the flowrate and totalization in the display will be replaced by a data base parameter. The name of the parameter will appear on the top line, and the changeable value on the bottom line.

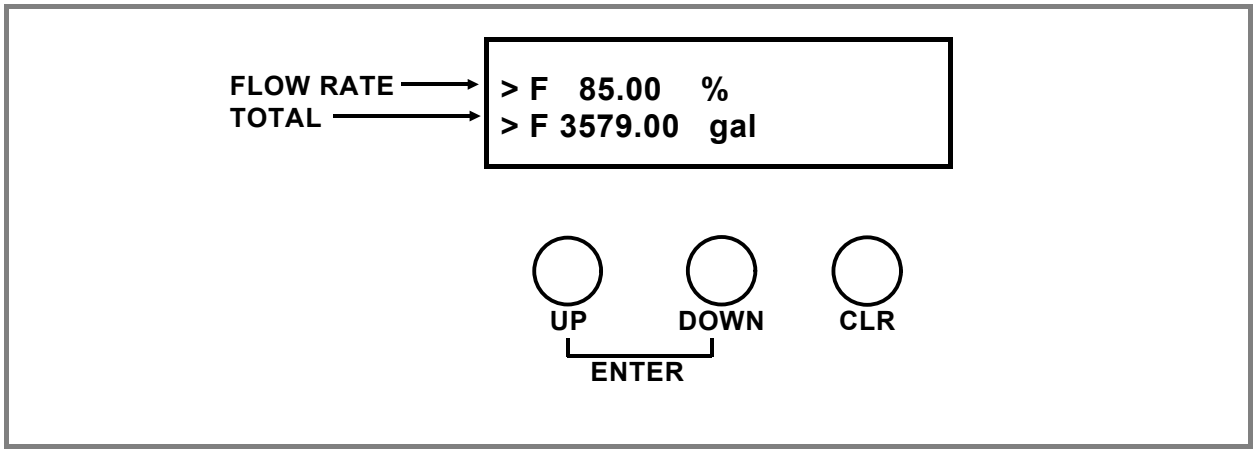


FIGURE 3-4. 50XM1000 DISPLAY AND PUSHBUTTONS

Program protection is a feature that allows the unit to be placed in the Configuration Mode so that all the parameters in the data base can be evaluated but cannot be changed. This protection is automatically enabled each time power is applied to the converter. The following message will appear in the display the first time the CLR button is pressed after power has been applied.

```
Prog. protection
on
```

To remove the PROGRAM PROTECTION press the ENTER buttons, and the message in the display will be changed to the following.

```
Prog. protection
off
```

It is now possible to step through the data base and make changes to it. It should be noted that if Prog. Protection is "on" and an attempt is made to change a parameter listed in the menu, the display will indicate:

```
* ERROR *
PROG. PROTECTION
```

If the program protection code is other than 0 it is requested when attempting to turn the program protection off. The program protection code is set to 0 by the factory.

To change a program protection code number first enter the old PP-code number and press ENTER. The default number is 0.

```
Old PP-code ?
_
```

Press enter. A new code number can be entered after entering the old number using the Up and Down buttons. A number up to 255 can be entered. Then press enter.

```
New PP-code ?
_
```

The new PP-code number is revealed when the service code number is entered as described in Section 5.6.1.

There are two ways to make changes to the data base. One is by entering numeric values, and the other is by making a selection from the menu. Numbers are entered by pressing the Up and Down buttons. The Up button is used to select numbers 0 through 9, decimal point, minus sign, or a blank space. The Down button is used to move to the next digit.

An overview of the menu sequence is provided in Sub-Secton 3.1.3 and Figure 3-3.

Access to the data base must be gained by pressing the Up and Down buttons simultaneously. When the ENTER buttons (Up and Down) are pressed, a cursor is added to the right of the data on the bottom line of the display if selection is to be made from the menu.

```
Meter size
25 mm     1 in          _
```

It is now possible to "step" through the menu by pressing the Up or Down button to go forward or backward to find the correct item in the menu. Once it is found, press the ENTER buttons again, and the item will be entered into memory.

When the parameter to be changed is a numerical value, the top line will again list the parameter name, and the bottom line will show the cursor on the left and the units on the right as shown.

```
Range  >F
 0  gpm
```

The number "0" over the cursor will now increase by one each time the Up button is pressed. If it is pressed when the number "nine" (9) is over the cursor a decimal point (.) will appear. If it is pressed again a minus sign (-) will appear, and if it is pressed one more time a space will appear ( ). The number can only be increased. If the desired number is passed it is not possible to back up. It is necessary to continue the cycle of advancing the number until the desired value appears again. When the desired number appears above the cursor, simply press the "Down" button once and the cursor will move one space to the right. A zero will again appear over the cursor, and the next desired digit can be selected. If an error is made in the selection of a number it can be corrected by pressing the CLR button. The entry will be cleared, and a new entry can be made.

When the desired value is reached, press the entry buttons and the value will be entered into memory. It will then be evaluated by the computer, and if it is not compatible with other selected parameters it will be rejected. An ERROR message will appear to indicate why the entry is not acceptable.

3.3 Changing Parameters

The following section is devoted to the configuration procedure for each changeable parameter. Some items are not accessible even though they appear in the menu. They are "locked out" and are indicated by a series of asterisks on the second line of the display. These locked parameters will be pointed out in the following discussion. Each parameter will be discussed briefly to promote an understanding of that function as well as the procedure for its configuration. The following parameters are presented in the order in which they appear in the menus.

3.3.1 Language

Messages and data can be shown in the display in nine different languages. Changing languages affects only the text that appears in the display. It does not affect any of the engineering units. The languages are selected by pressing the Up or Down button to step through the menu and enter the desired language. Languages available are: English, Danish, Dutch, Finnish, French, German, Italian, Spanish and Swedish.

Language English

3.3.2 Meter Size

All calibration factors for meters 1/10 through 16 inches are identical by size for Flowmeter Models 10D1465S, 10D1475S, 10D1476S, 10DX2100 and 10DX3000. The suffix letters denote design levels for which these models have constant calibration factors per size. For those meters, the meter size function may be used. For meters built to earlier design levels, the meter size function will be locked out, and a message will be displayed as shown below. When meter size is locked out, the cal factor or meter capacity stamped on the meter nameplate must be entered in the Cal Factor parameter.

Meter size ********

Typically, if the Meter size function is available the display will show the following for a size 10 inch flowmeter. A listing of available meter sizes is given in Table 3-3.

Meter size 250 mm 10 in.

Pressing the ENTER buttons will cause the cursor to appear on the lower line to the right of the size. Press either the Up or Down button to step through the menu of sizes. When the desired size is reached, press the ENTER buttons again. The size will be entered into memory. At this point, the computer will enter the calibration factor for the selected size as it is recorded in the EPROM. This value will also be entered as the range.

3.3.3 Cal Factor/Meter Capacity

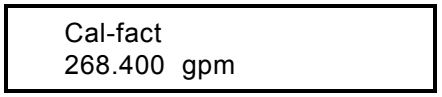
In order for the converter to produce the proper flow rate output(s), calibration information from the associated flowmeter must be known. This information has been determined at the factory and is entered in the converter non-volatile memory as "Cal-Factor". Depending on the flowmeter model number and size, the Cal-Factor is determined as the amount of flow necessary to produce a converter velocity signal of either 10 meters/second or 33.33 feet/second. In most cases, the flowmeter is factory calibrated so that the flow rate which produces this velocity is a fixed value ("constant meter factor per size") as a function of meter size as described in 3.3.2. This permits the converter to be set up by the user by simply entering the size of the flowmeter. The appropriate maximum velocity is factory set to 10 meters/second for Models DM21 and 10DX3000 Series Flowmeters and 33.33 feet/second for all other models (e.g., 10D1400 Series). In the case of the DM21 and 10DX3000 Flowmeters, the term "Meter Capacity" is used to mean "Cal-Factor".

The converter is configured to permit entry of a programmable calibration factor. When the calibration factor stamped on the flowmeter tag is different than the fixed value shown in the flowmeter instruction bulletin, the value on the flowmeter tag must be entered in the "Cal-Factor" parameter.

The capacity of the meter is expressed in units such as gpm, l/m, or mgd and is called the calibration factor. Some meters may have a meter factor recorded instead of the calibration factor. These can be converted to calibration factors in gpm (at 33.33 ft/s) by using the following equation:

$$\text{Cal Factor} = (\text{Meter Factor})^2 \times 81.6$$

The calibration factor is the base upon which the computer establishes maximum and minimum limits for range settings and outputs. A typical calibration factor for a size two-inch flowmeter might be 268.4 gpm. It will appear in the display as shown below.



If the units (gpm) are not the required units step through the menus to "Submenu Units" and enter the correct value under "Range Unit" (refer to Sub-Section 3.3.12). To enter a calibration factor, press the ENTER buttons. The number 268.400 will disappear and will be replaced by the cursor. The unit "gpm" will remain. Enter the cal factor value, as it appears on the flowmeter nameplate, and press the ENTER buttons. The new calibration factor will be entered into memory. This value will also be entered into the range setting. The pulse factor (to be discussed later) will be set to one pulse per engineering unit.

3.3.4 Range

There is a table of flow units in the EPROM from which the range units can be selected (see Sub-Section 3.3.12). A listing of available units is given in Table 3-1. Each unit is normally available in seconds, minutes, or hours. For example, L/s, L/min, or L/h. US gallons are available in minutes, hours, or in million gallons per day. (Units are added or deleted periodically as firmware is updated.)

To select the range unit from this menu, first enter the configuration mode by pressing the CLR button. Next, use the Up or Down button to move through the data base until "Submenu - Unit"

appears on the display (refer to 3.3.12), and then press the ENTER buttons. Use the Up or Down button again to go through the Submenu-Unit until "Range Unit" appears, press ENTER. Use the Down button to toggle through the menu until the desired range unit appears on the bottom line of the display. Press the ENTER buttons again and the selected unit is placed in memory. No further action is required. After about 70 seconds, the display will be automatically returned to the monitoring mode. Pressing the CLR button will return the display to the monitoring mode immediately.

Entering the cal factor automatically sets both the forward and reverse ranges equal to that value. Note that this is the flow value at 33.33 ft/s or 10 m/s (higher than what normal flows are in practical applications). Consequently, the range must be set to the actual maximum flowrate for the application. The value for the reverse direction will be the same as the value for the forward direction.

For the cal factor setting of 268.4 gpm, the display appears as follows:

```
Range
268.400 gpm
```

The actual range can now be set in the same manner as the cal factor. Any value can be set between 2% and 150% of the cal factor. If a higher or lower setting is attempted an error message will appear in the display, and the new value will be rejected. For example, 4 gpm is below 2% of 268.4 gpm. If an attempt is made to enter 4 gpm as the range setting the following message will appear in the display.

```
Error - 11
< 0.02 Range DN
```

Range DN is the Cal Factor. The Cal Factor times 0.02 is 2% of the value that can be entered. The message says that the value we attempted to enter is below 2% of the Cal Factor, and it will not be accepted. The procedure for entering the range for the reverse flow is the same as for the forward flow.

There is an additional error message related to range settings that applies to both forward and reverse ranges. That message is FLOW> 130%, and it appears when the actual process flow exceeds the maximum range setting by 130% for any reason. This could happen because the range was set too low for the actual flow or because a valve failed or was improperly positioned. The message would appear as shown below. Between 100% and 130%, the output signal will accurately reflect the flow rate.

```
Flow > 130%
> F 6359284 gal
```

TABLE 3-1 RANGE UNITS
l/s
l/min
l/h
hl/s
hl/min
hl/h
m^3/s
m^3/min
m^3/h
igps
igpm
igph
mgd
gpm
gph
bbl/s
bbl/min
bbl/h
bls/day
bls/min
bls/h
kg/s
kg/min
kg/h
t/s
t/min
t/h
gram/s
gram/mi
gram/h
ml/s
ml/min
ml/h
Ml/min
Ml/h
Ml/day
lb/s
lb/min
lb/h
uton/min
uton/h
uton/day
**kgal/s
**kgal/min
**kgal/h

TABLE 3-2 TOTALIZER UNITS
l (liter)
hl (hectoliter)
m^3 (cubic meter)
igal (imperial gallon)
gal (US gallon)
mgal (million US gallon)
bbl (barrel=31 gal)
bls (barrel=42 gal)
kg (kilogram)
t (metric ton)
gram (gram)
ml (milliliter)
Ml (megaliter)
lb (pound)
uton (US ton)
**kgal (US thousand gallons)

* = Not available in the US
** = Configurable unit-kgal is the default unit (refer to 3.3.12).

TABLE 3-3 METER SIZES	
mm	**inches**
1	1/25
* 1.5	1/17
2	1/12
3	1/10
4	5/32
* 5	3/16
6	1/4
* 8	5/16
10	3/8
15	1/2
* 20	3/4
25	1
* 32	1 1/4
40	1 1/2
50	2
* 65	2 1/2
80	3
100	4
* 125	5
150	6
200	8
250	10
300	12
350	14
400	16
450	18
500	20
600	24
* 700	28
750	30
* 800	32
900	36
* 1000	40
1100	42
1200	48
* 1300	51
1400	54
1500	60
* 1600	64
1700	66
1800	72
2000	78
* 2100	82
* 2200	86
* 2300	90
* 2400	94

3.3.5 Pulse Factor

The pulse factor is used to select the number of pulses per engineering unit for totalization purposes. It functions whether or not the pulse output option is selected and operates equally on the internal and the external totalizer. If the unit is set for unidirectional flow the totalizer in the reverse direction will be locked out. As an example, note what happens as the number of pulses per gallon is changed. Call up Pulse factor, and the display might look like the figure below.

Pulse factor 10.000 / gal

The internal totalizer display is always direct reading so that at one pulse per gallon the totalizer will add one count for each pulse applied to it. We can select a factor of ten pulses per gallon and there will be ten pulses arriving at the totalizer for each gallon. Keep in mind that these units can be gallons, barrels, liters or whatever is selected from the units menu. Each pulse now represents 1/10 of a gallon. The totalizer will still add a count for each arriving pulse, but a decimal will be added so that the display reads in gallons and tenths of a gallon.

If we select 100 pulses per gallon then each pulse represents 1/100 of a gallon, and the decimal will appear at the proper point to show totals in hundredths of a gallon. See below for units of 1/10 gallon.

> F 45.75% > F 34864.8 gal

NOTE
This is a seven digit counter, and as it fills up, the decimal will be continually moved to the right until only whole units are displayed.

Although selecting multiple pulses per engineering unit is practical for low flows, it creates readability problems at high flows. The higher flows could cause the totalizer to add counts so rapidly that the last digit or two would be unreadable. What is needed to slow down the totalizer is for each pulse arriving at the counter to represent more than one gallon. For example, at one pulse per ten gallons (select factor 0.1) the totalizer will receive a pulse every ten gallons, and the last digit on the right will always be a zero. The count will change every ten gallons (10, 20, 30, etc.). For one pulse equal to 100 gallons, (select factor 0.01), the last two digits will be zeroes, and the totalizer will change every 100 gallons.

3.3.5.1 Allowable Pulse Factors

Pulse factors can be selected for any value between 0.001 to 1000. Which factor to select is generally determined by the application requirements. However, there are two restrictions that must be considered.

First, the maximum pulse output frequency at 100% of the converter span is 4 kHz. The internal counter operates at this frequency independent of the pulse width selection for the external readout device. The following discussion applies to the internal counter as well as to an external high frequency counter. The suggested maximum count to these devices is limited to 4,000 pulses per second. Consider a maximum flow of 240,000 gpm (4,000 gal/s). With this flow, the highest pulse factor that could be used would be one pulse per gallon.

$$4{,}000 \text{ gal/s} \times 1 \text{ pulse/gal} = 4{,}000 \text{ pulse/s}$$

However, the converter will normally function properly up to 130% of the range setting. This means that for a range setting of 4,000 gal/s (and 4000 pulses/s at 100%) a proper output signal will be generated for flows up to 5,200 gal/s (4,000 X 1.3 = 5,200). The analog value at 130% of the range setting will be 24.8 mA dc. Although this condition is acceptable, it is not considered good practice.

Ideally, a pulse factor should be selected to keep the pulses to the counter within the 4,000 per second limit. For example, if we apply a pulse factor of 0.1 to the above example then each pulse will represent 10 gallons, and the pulses at the counter will be within 4,000 per second.

4,000 gal/s X 1.3 X 0.1 pulse/gal = 520 pulses/s

Second, electromechanical counters typically require a pulse width of 30 milliseconds or more and are limited to about 15 counts (pulses) per second. They require time between pulses to complete the mechanical operation of moving a wheel to its next count position. If there is not sufficient time between pulses to do this the counter will jam. A high pulse factor could create a condition where an external electromechanical counter would jam while the internal counter would continue to operate. Because the ERROR message is based upon 4 kHz (operating frequency of internal counter), there would be no alert to signal this condition.

A conservative approach would assume a 50 millisecond on time and 50 milliseconds between pulses at maximum flow. This gives 100 milliseconds total time for each pulse or ten pulses per second. Consider a flow of 750 gpm or 12.5 gal/s.

12.5 gal/s X 1 pulse/gal = 12.5 pulses/s

The converter can operate up to 130% of range setting!

12.5 gal/s X 1.3 X 1 pulse/sec = 16.25 pulses/s

This condition would not generate an ERROR message, but it could cause the electromechanical counter to jam. It would operate normally up to the maximum range setting, and as the flow approached 130% of the range setting, the counter could jam. The internal counter would continue to count.

3.3.5.2 Pulse Factor Summary

The important thing to remember about pulse factor selection is that the high frequency output is limited to 4,000 counts per second and the external electromechanical devices are limited to about 15 counts per second. Also, remember that the internal counter operates independently of the pulse width selection and the external counter. To select a pulse factor, convert flowrate to units per second. Then multiply by 1.3 to determine flowrate at 130% of range setting. This cannot exceed 5200 per second for high frequency devices or 15 counts per second for electromechanical counters. Select a pulse factor that will keep the counts within these limits.

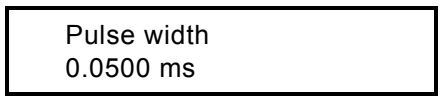
CAUTION
The sequence in which the range and pulse factor are selected are important. The range must be selected first and then the pulse factor. If the pulse factor is selected first or is not reset when a range change is made, the frequency to the totalizer could exceed the limits discussed above.

3.3.6 Pulse Width

If the pulse output option is selected the output pulse width can be adjusted between 0.032 and 2000 milliseconds. For driving an electromechanical counter, the pulse width should be about 50 milliseconds. For high speed electronic devices, a pulse width of about 50 microseconds (0.050 milliseconds) is typical.

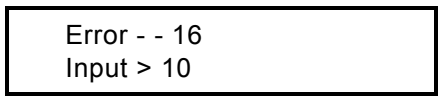
A pulse width that could produce a 100% "ON" time is automatically corrected.

Toggle through the menu until pulse width appears in the display. The present pulse width will be displayed. Press the ENTER buttons, and the value will be replaced by the cursor which will be at the left of the display. All values are in milliseconds. To enter a microsecond pulse width, place a decimal point three places to the left of the numerical value. For example, a 50 microsecond pulse width would be entered as 0.050 milliseconds, as follows:



3.3.7 Low Flow Cut-off

This feature allows for setting the low flow cut-off point in terms of percent of the full scale range setting. The cut-off causes the input signal to drop to a zero condition (4 mA dc for a 4-20 mA dc output) when the flow drops below the set value. This value can be set at 0 to 10% of the full scale range setting. Typical values are 1 or 2%. If a value greater than 10 is attempted it will be rejected, and an error message will appear as shown below.



3.3.8 Damping

Damping effectively controls the speed at which the signal converter responds to changes in flow. Without damping, it will show a 100% change in flow in about 1 second. By entering various values for damping, the full scale response can be slowed to as much as 99 seconds. This is not a linear function. Consequently, response will be faster in the first few seconds of the damping interval than during the last few seconds. Damping is sometimes used to smooth out pulsating flow signals that are caused by pumps and to reduce output oscillations that are created by process generated noise.

Damping is a numerical value entry, and it is changed in the same manner as the range and other numerical units. Values greater than 99.9999 seconds will prompt an ERROR message.

3.3.9 Filter

A digital filter is available in the firmware to provide a steady indication of flow and analog output for pulsating flows or noisy signals. With the filter switched on, damping settings can be reduced. Response time is minimally effected by activating this parameter.

Filter on/off

3.3.10 Density

If kg, tons, grams, US tons or pounds is selected for the range or totalizer units a density value can be entered. The density can be entered between the values of 0.01 and 5 g/cm^3. This is used as a factor against the range setting and the Cal Factor. For example, if the range setting is 250 kg/min a density setting of 2.00000 g/cm^3 will change the range setting to 500 kg/min. Therefore, the pulse factor must be based on 500 kg/min.

Density 1.00000 g/cm^3

Density is a numerical value. It is entered in the same manner as the range setting. If values entered are not within the limits listed above an ERROR message will result.

NOTE It is important to make changes to the parameters discussed up to this point in the order in which they have been presented. This will simplify the task and minimize the margin of error. From this point on, the order in which parameters are configured is less important.

3.3.11 System Zero Adjustment

This adjustment is required for older flowmeters that are converted for use with a 50XM1000 Signal Converter. To make the adjustment, the flowmeter must be set up in a full pipe, no flow condition. Then call up the System zero adj. feature which should appear as shown below.

System zero adj. 0.0000 Hz

To access the zero adjustment, press the ENTER buttons, and the display will show:

Adjust ? yes-----> Enter

Press ENTER and the option to adjust manually or automatically will be offered.

Adjust Automatic?

Select automatic, and press ENTER again. The zero will be adjusted. During the adjustment procedure, the display will show a count down twice from 255 to 0. At the end of the count down, a frequency value will appear. If the value exceeds 50 Hz an ERROR message will appear, and an adjustment to the flowmeter or converter may be required. Record the value. If the converter is changed, this value can be entered into the new converter manually. It will not be necessary to set up a "full pipe no-flow" condition for this situation.

If it becomes necessary to replace the converter assembly, the meter zero value must be entered in the replacement converter. On some meters, this value is noted on a sticker attached to the inside of the converter junction box (behind the terminal block). To adjust zero manually, select Manual operating mode and press ENTER. Next, encode the applicable zero value (as given on the sticker in the junction box) and press ENTER to complete the procedure.

Note that 100 Hz is equal to 1% of the Cal Factor.

3.3.12 Submenu - Unit

Functions associated with selection of rate and totalizer units appear in this submenu.

Submenu Unit

Press ENTER and the following will appear.

Range Unit

Range unit gpm

A listing of available units is given in Table 3-1. To select a range unit from Table 3-1, enter the configuration mode by pressing the CLR button. Next, use the Up or Down button to move through the parameters until "Range unit" appears on the top line of the display and press the ENTER buttons. Use the Up or Down button to move through the menu until the required unit appears on the bottom line of the display. Press ENTER and the selected unit is entered in memory. Selection of this submenu also allows the user to construct and enter any flow unit not available from the normal menu selection. This unit may be used for range selection in conjunction with time units of seconds, minutes or hours. The default unit is "kgal" (thousands of US gallons). The "kgal" unit may also be selected for the totalizer, and can be used in preventing frequent totalizer overflow on large size meters.
Configuration of a flow unit (not in the menu) requires entry of the text of the unit description and a conversion factor indicating how many liters the unit contains.
Pressing CLR twice will return the display to monitor mode. Press the Down button and the following will appear.

Totalizer unit

Totalizer unit gal

A listing of available units is given in Table 3-2. The totalizer units available are the same as those for the range units except they do not include units of time. Selecting the totalizer units is the same procedure as for selecting range units. Press the Down button and the following will appear.

Unit Factor

unit factor 3785.4 liter

This parameter is used to enter the numeric value representing the number of liters contained in the configured flow unit. Refer to the example given in Unit Name. Press the Down button and the following will appear.

Unit Name

Unit name kgal /s/min/hr

This parameter is used to configure the text representative of a unit not listed in the menu.
For example, to enter a unit for US ounces and designate it as "oz". The conversion factor may be calculated as: 3.785 liters (1 gallon) are equal to 128 oz (1 gallon). Press ENTER and using the Up and Down buttons, the letters of the alphabet in lower case and upper case are sequentially displayed. To enter "oz" , press ENTER and then use the Up button to move to "o". Then press the Down button to move the cursor to the right. Press the Up button until "z" appears. Press ENTER to complete the entry. Next, press the Up button and Unit factor will appear.

Enter the numeric value 0.02957 (3.785 ÷ 128). This unit may also use a density other than 1.00 g/cm^3 by selecting "with density" in the following parameter Program Unit. Press the Down button and the following will appear.

Program Unit

Prog. unit without density/with density

This parameter allows a density to be entered if required. To enter a density select "with density". Refer to the density submenu described in Sub-Section 3.3.10 to enter a density value.

3.3.13 Submenu - Alarm

This Submenu provides for indication and configuration of the converter's response to various types of alarm conditions. Press ENTER and the following will appear.

3.3.13.1 Maximum Alarm

Max alarm > 130%

Maximum alarm can be set between 0 - 130% of range. Values can only be entered in whole numbers. If the flow rate exceeds the alarm setting, a message will appear on the display. A form C (normally open/normally closed) alarm contact may be configured at terminals 44, 45 and 46 indicated as P1/P2 in the display of a remotely mounted enclosure. The percentage of range required to activate the alarm is entered in this parameter. When the flow exceeds the entered value, a flashing upward pointing arrow will appear to the right of the flow direction symbol. Press the Down button and the following will appear.

3.3.13.2 Minimum Alarm

Min alarm < 0%

Minimum alarm can be set between 0 - 130%. Values can only be entered in whole numbers. If the flow rate falls below the alarm setting, a message will appear on the display. A form C (normally open/normally closed) alarm contact is available at terminals 44, 45 and 46 of a remotely mounted enclosure. The percentage of range required to activate the alarm is entered in this parameter. When the flow is less than the entered value, a flashing downward pointing arrow will appear to the right of the flow direction symbol. Press the Down button and the following will appear.

3.3.13.3 Error Log

Error log

The Error Log records the code number of any alarm conditions as they occur. For example, if the flow exceeds 130% of the range setting, the error code is the number 3. This number would appear in the error register along with the code numbers of any other alarms that have occurred. Toggling the UP button will display the error number(s). The numbers are cleared from the error register by pressing the ENTER buttons.

Error No.	Display	Cause
0	Empty Pipe	Empty Flowmeter
1	A/DC saturated	A/DC converter over ranged
2	U_{ref} too small	Pos or Neg ref voltage too low
3	Flow > 130%	Flow is greater than 130%
4	Zero return	Zero Return activated
5	RAM data	Error in RAM data
6	Totalizer	Error of Totalizer Value
7	U_{refp} too Large	Positive reference voltage too large
8	U_{refn} too Large	Negative reference voltage too large
9	Excitation	Coil excitation has stopped
A	MAX alarm	Maximum alarm setting exceeded
B	MIN alarm	Minimum alarm setting exceeded
Errors 10 - 80, below, result from attempts made to enter values which are above or below preset converter limits. The new entry will be rejected and replaced with the previous value. These error messages will appear only during configuration and do not remain in the converter's error log.		
10, 11 & 12	Range Max	Range setting outside the limits of 5 to 150% of Cal Factor attempted.
16 & 17	low flow cutoff	Low flow cutoff setting <0 or >10% of range attempted
20 & 21	damping	Setting of damping value <.5 sec or >99 sec attempted
38 & 39	pulse factor	Pulse factor setting of <.001 or >1000 attempted
40 & 41	Maximum pulse rate	Maximum pulse rate <.00016 Hz or >5K Hz
42 & 43	Pulse width	Pulse width setting less than .064 msec or >2000 msec attempted
44 & 45	Density	Density setting of <.01 g/cm3or >5 g/cm3 attempted
46	Entry too large	Generalized error message an entry is to large
54	system zero	System zero adjust >50 Hz (0.5% of Cal Factor) required
56	empty pipethreshold	Threshold value setting of >3000 was attempted
58		Factory-only parameter whose value limits have been exceeded
74 & 76	alarm limits	Setting the high or low flow alarms outside the limits of 0 to 130% of range has been attempted
80		Converter has calculated a new pulse width
91	EEPROM	Data in the device internal EEPROM is defective
96		Internal EEPROM does not agree with the actual device version

NOTE
Errors 92 through 95 only apply to M2 (50XM2000) and 50XE4000 converters.

3.3.14 Submenu - Program Input/Output

Press the CLR button and then the Up button and the following will appear.

Submenu Prog. In/Output

Various alarm functions can activate contacts P1 and P2. For converters that are remotely mounted, terminals 45 and 46 represent P1 and P2 and opposite contact conditions occur between terminals 44 and 45. If the converter is integrally mounted, terminals E9 and C9 represent P1 and P2. Press ENTER and the following will appear.

No Function

Function P1/P2 No function

The P1 and P2 contacts are not activated by any condition.

Press ENTER and the following will appear.

F/R- Signal

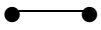
Function P1/P2 F/R- Signal

This is a default parameter. Forward flow direction closes contacts 45 and 46. Reverse flow closes contacts 44 and 45. Press the Down button and the following will appear.

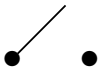
*The following parameters can be configured as either **normally open** or **normally closed** contacts. Note, the contact position shown in the displays shows the contact positions after the contacts have been activated, e.g., normally open contacts are shown in the closed position.*
Press ENTER to make a selection.

Empty Pipe

normally open =

Function P1/P2 Empty pipe 

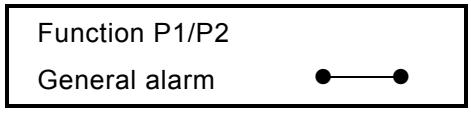
normally closed =

Function P1/P2 Empty pipe 

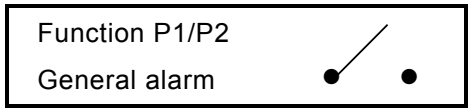
Contact operation indicates an empty pipe condition when this option is activated.
Press the Down button and the following will appear.

General Alarm

normally open =



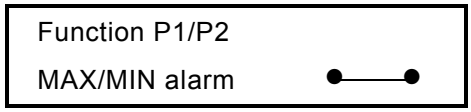
normally closed =



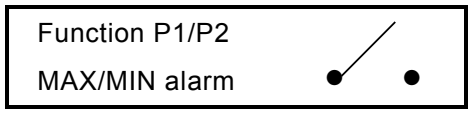
General alarm is any alarm condition that places a message on the 1st line of the display and creates an error log entry. Alarm contacts will activate if an error log condition occurs. Refer to Sub-Section 3.3.13.3. Press the Down button and the following will appear.

Maximum/Minimum Alarm

normally open =



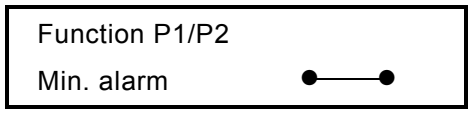
normally closed =



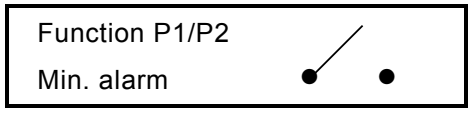
Contacts P1 and P2 will close when flow is above the maximum or below the minimum value. Refer to Sub-Sections 3.3.13.1 and 3.3.13.2. Press the Down button and the following will appear.

Minimum Alarm

normally open =



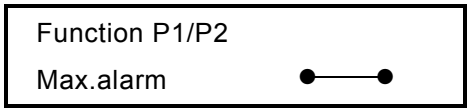
normally closed =



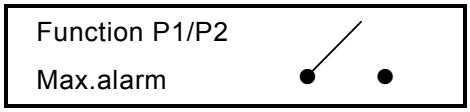
Selecting this parameter will activate contacts P1 and P2 under a minimum alarm condition. Refer to Sub-Section 3.3.13.2. Press the Down button and the following will appear.

Maximum Alarm

normally open =



normally closed =



Selecting this parameter will activate contacts P1 and P2 under a maximum alarm condition. Refer to Sub-Section 3.3.13.1. Press the Down button and the following will appear.

Press clear and the Down button and the following will appear.

The following parameters allows terminals 22 and G3 to be configured to function as either a zero return, a totalizer reset or no function.

Press the Down button to toggle through the following parameters. Press ENTER to make a selection.

Contact closure required to initiate reset.

When a contact closure is maintained all outputs will go to zero. This feature is useful when the liquid in the meter empties after the flow rate ceases.

3.3.15 Submenu-Current Output

The current output range is selectable. In addition to the 4-20 mA dc which is the normal output, 0-20, 0-10, 2-10, 0-5, 0-10-20 and 4-12-20 mA are available and selectable from the menu. In addition, the current output during an alarm condition can be set to 0%, 130% or 3.8 mA. The display for these options appears initially as shown below. If 4-12-20 mA is selected, the 12-20 mA span indicates forward flow and 12-4 indicates reverse flow (12 is a "live" zero). If 0-10-20 mA is selected the 10-20 mA span indicates forward flow and 10-0 indicates reverse flow (10 is a "live" zero).
Bi-directional operating mode must be selected for 0-10 and 12-20 outputs. Press the Up button and the following will appear.

Submenu Current output

Press the ENTER buttons, and the current output menu will be accessible. Move back and forth between the submenu items of current output and I_{out} at alarm using the Up and Down buttons. Select either by pressing the ENTER buttons. Again, step through the submenu to select the appropriate current output or alarm output.

Current output 4-20 mA

Manual exit from any submenu is done in two steps. Pressing the CLR button from either I_{out} at alarm or current output will step the menu up to Submenu. Press the Up or Down button to continue in the configuring mode or press the CLR button again to exit from the configuration mode. The unit will return to the monitoring mode in two steps taking about 2 minutes between each step.

I_{out} at alarm sets the analog output to a low or high value as selected. In case of an operational failure, the computer activates an alarm, an error message is sent to the display, and the current output goes to the selected value. The selected value can be set to 0% or 130% of the range setting or 3.8 mA. Setting this parameter to 3.8 mA allows the user to distinguish an alarm condition from a no flow condition. Press the Down button to toggle through the following parameters.
Press ENTER to make a selection.
The I_{out} at alarm menus appear as shown below:

I_{out} at alarm 0%

I_{out} at alarm 130%

I_{out} at alarm 3.8 mA

3.3.16 Submenu-Data link

If the Data link option has been installed it is configured by calling up the data link submenu which appears in the display as shown below. If the Data Link option has not been installed a "NOT AVAILABLE" message will appear. Press the Up button and the following will appear.

Submenu Data link

If the Data link option is available, press the ENTER buttons, and the Communications menu will appear as shown below.

Communications ASCII

Press the ENTER buttons again, and select ASCII. Print5 charge, Print6 continuous or μDCI Binary are not available in the US.

Parameters Printer type and Printer time cannot be used without an optional document printer (consult the factory).

Printer type standard

Printer time

Press the Down button, and the menu will change to the Baudrate menu as shown below.

Baudrate 2400 Bd

Press the ENTER buttons, and select one of the following baud rates: 110, 300, 600, 1200, 2400, 4800, 9600, 14400, 28800. Baud rates above 9600 are blocked with the RS232C data link.

Press the Down button, and the menu will change to the instrument address as shown below.

Instr. address 0

Each converter included in the data link must be identified by a unique numeric address. These are limited to the numbers 000 to 031. An attempt to enter a number higher than 031 will result in an ERROR message. Refer to Section 6.

3.3.17 Submenu-Function Test

A number of function test routines are built into the converter. Some of these are firmware driven checks and some are performed with a combination of firmware and continuity checks. This submenu is used for checking new installations and in the event of a problem.
Press the Up button and the following will appear.

NOTE
The converter is not "on line" during Function Test. This is a maintenance procedure, and data is not updated while the converter is in this mode.

```
Submenu
Function test
```

Press ENTER and the following should appear in the display.

```
Function test
Iout
```

Press ENTER again, and I_{out} will disappear and mA will appear on the right in the bottom line. An output can now be entered, and the analog output will go to that value. To exit the I_{out} test and any other function test, press CLR.

```
Iout
     mA
```

Press the Down button. **The following display will not appear unless the Service Code (Code Number) parameter is enabled** (Refer to Sub-Section 5.4.1).

```
Function test
Multiplexer
```

Press the Down button, and the following should appear.

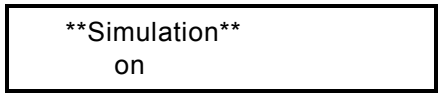
```
Test Mode
off/on
```

The Test Mode parameter is not applicable to the 50XM1000 Converter.

Press the Down button, and the following should appear.

```
**Simulation**
off/on
```

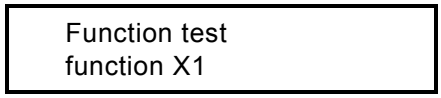
Press ENTER to turn Simulation ON.



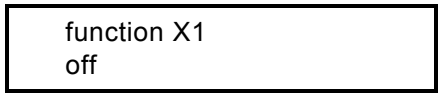
Press the CLR button twice and the following will appear.

The second line of the display will alternate between the totalizer value and "Simulation". The data on the first line of the display can be increased by 1% each time the Up button is pressed. Conversely, pressing the Down button will decrease the displayed data by 1% each time the Down button is pressed. All converter outputs will assume the displayed value. Press the CLR button to return to the Function Test display. Press ENTER, and using the Up or Down key, step through the displays until Simulation appears. Press ENTER to turn Simulation OFF. Note, Simulation must be turned OFF before exiting Function Test.

Press the Down button, and the following should appear.

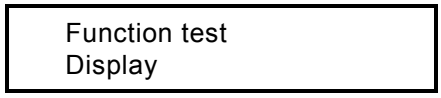


Press ENTER and the following will appear.



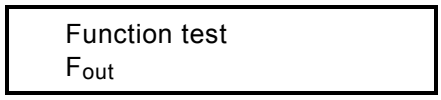
Place a jumper across terminals 22 and G3, and the display will change to "on".

Press the Down button, and the following should appear.



Press ENTER, and the display will fill up with the numbers 1 through 0 and the letters A through F to show that the display is functional.

Press the Down button, and the following should appear.



Note that 10,000 Hz represents the full scale range setting of the instrument.

A function test of the frequency output will test the 0 to 10KHz unscaled output, and the optional scaled pulse output if it is present in the converter.

Negative frequencies can be entered for testing reverse flow totalizers.

Press the Down button, and the following should appear.

Function test Data link

The Data Link check requires that jumpers be installed in the wiring so that the converter can transmit and receive its own signal. For the RS 232 link, place the jumper between terminals TD and RD. For the RS 485 link, place a jumper between terminals T- and R- and another between T+ and R+. These terminals are located in the converter customer connection box.

Press ENTER. The computer will output 1000 characters of ASCII code 31 Hex ("1") and check the received characters. In the display, the output data count appears on the left, and the error data count appears on the right. After 1000 characters are sent, the computer ends the check on the received data and continues to transmit the value 31 Hex until the CLR button is pressed.

Press the Down button, and the following should appear.

Function test Switch S401

The Switch S401 test is for factory use only

Function test function P1/P2

This parameter exercises contacts 44, 45 and 46, also identified as P1/P2.

Press the Down button, and the following should appear.

Function test Alarm contact

This test checks the alarm contacts 39 and 40 (V5 and V6).

Press ENTER, and the display will show "Alarm contact" on the top line, and either Off or On on the bottom line. Press the Up button to switch from On to Off. Continuity should be present when the menu reads On.

Function test External EEPROM

The external EEPROM test is not applicable to 50XM1000 Converters.

Press the Down button and the EEPROM test should appear as shown below.

Function test EEPROM

Press the Down button, and the following should appear.

Function test EPROM (Program)

Press ENTER and an EPROM OK or an ERROR message will appear in the display.

Press the Down button and the NVRAM check should appear as shown below.

Function test NVRAM

Press ENTER and an NVRAM OK or an ERROR message will appear in the display.

Press the Down button and the RAM check should appear as shown below.

Function test RAM (ASIC)

3.3.18 Submenu-Detector Empty Pipe

This feature is standard on all units. It is designed to sense when the liquid in the flowmeter has dropped below the level of the electrodes. When this happens, the outputs can be locked at zero flow (4 mA dc and 0 Hz typically), 130% of range setting or 3.8 mA depending upon which of these values has been selected for the "I_{out} at alarm" condition. This feature cannot be used with meters <1/2 inch and/or with low conductivity process liquids.

This function is either ON or OFF. It is activated or deactivated by finding it in the menu and pressing the Enter buttons. Next, press the Up or Down button to change from ON to OFF or vice versa. Press the Enter buttons to enter the selection.

In order to use this feature, certain adjustments must be made with the flowmeter installed in the pipeline under both full pipe and empty pipe conditions. First, call up the Empty Pipe Menu. Press the Up button and the following will appear.

```
Submenu
Detector e. Pipe
```

```
Detector e. Pipe
off/on
```

Select ON and press the Down button to continue

```
Adjust
1725.0 Hz                201
```

This is the frequency of the empty pipe oscillator when "looking" at the electrodes of a full flowmeter. Using the Up or Down button, place the Hz value to between 1700 and 1800. When the desired value has been attained, press enter and note the Hz reading. The numeric value to the right side of the second display line is sent from the CPU memory to the oscillator control of the empty pipe circuit, and can range from 0 to 255, with a typical adjust value being near 200.

At this point, drain the liquid from the pipe and note the value in the "Adjust" window.

Press the Down button until Threshold appears in the display as shown below:

```
Threshold
2350.0 Hz
```

Threshold = [Adjust empty + Adjust full]/2

Example:

Full pipe adjust value is 1725 Hz and the empty pipe adjust value is 2975 Hz. The Threshold should be set as follows:

Threshold = [2975 + 1725]/2 = 2350 Hz

Press ENTER and change the numerical value that appears on the second line of the display to the value calculated above.

Press the Down button, and the following should appear.

I_{out} at empty pi(pe) %

This parameter can be set at 0%, 130% or 3.8 mA, as desired.

Press the Down button, and the following should appear.

alarm empty pipe off/on

This parameter determines whether an empty pipe will cause an alarm at contacts V5 and V6.

3.3.19 Submenu-Totalizer

The totalizer is reset and overflows cleared using this submenu. Totalizer "Standard" separates the totalizer into forward and reverse flow. Totalizer "differ. total" (differential totalizer) displays the difference between forward and reverse flow.

Press the Up button and the following will appear.

Submenu totalizer

Press ENTER and the following will appear.

Totalizer reset

The Forward and Reverse totalizers can be reset to zero individually. Toggle through the menu until the Totalizer> F reset message appears in the display. Forward or reverse flow will be indicated by "> F" and "< R". Press the ENTER buttons, and the appropriate counter will be reset to zero. Press the Down button and the following will appear.

Mains interrupt reset

The converter may be configured for Custody Transfer (Billing) applications using Switch S401 (location of switch is shown in Figure 1-4). In this mode, a power interruption will create a flashing asterisk to the right of the flow rate indicator. Pressing ENTER under this submenu clears that asterisk.

Press the Down button and the following will appear.

Overflow →F

Overflow ←R

When the totalizer reaches its maximum count (9,999,999,) it "rolls over" and starts to count again at zero. When this occurs, the direction indicator (> F or < R) at the left of the register and the units (i.e., gal) at the right of the register will blink, and an overflow register will record the overflow. The cumulative total can be determined by multiplying the number in the overflow register times 10,000,000 and adding the value in the totals register. The overflow message is removed by toggling through the menu using the Up or Down button. At this time, pressing the ENTER buttons will reset the overflow register, and the blinking will stop.

Press the Down button and the following will appear.

Totalizer funct standard/differ. total

Press the ENTER buttons and the cursor will appear to the right of "standard". Press the Up or Down button and the indication will toggle between "standard" and "differ. total".

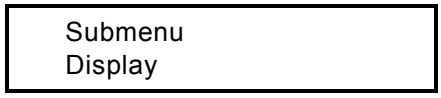
"Differ. total" subtracts reverse flow from forward flow. Indication shows net direction and value.

3.3.20 Submenu-Display

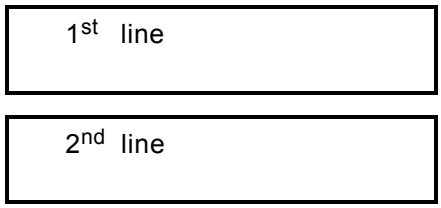
The Submenu Display parameters can be configured by selecting the appropriate parameters listed below and entering the desired information. Some parameters are only available (as indicted) when the Code Number (Service Code) is activated (refer to 5.4.1). The display may be configured so that any available information may be placed on either first or second line of the display.

In addition, a **multiplex feature** is available which can alternate any of two sets of parameters on either line of the display. This feature can be activated by turning ON the line(s) of the display desired for multiplexing and then selecting the parameter to be shown. The display will alternate between the display value and the multiplex value approximately every 7 seconds.

Press the Up button and the following will appear.



Press ENTER and the following will appear



Press the Down button and the following parameters will appear on the display.

Q [%] - flow rate as a percentage of range setting

Q [Bargraph] - left to right graphic of flow rate as a percentage of range, with numeric percentage to the right of the bar graph

TAG number - not available for the 50XM1000

Totalizer - ←R totalized flow for reverse direction only

Totalizer - →F totalized flow for forward direction only

Totalizer - totalized flow for the direction currently indicated on the flow rate display

Q [mA] - flow rate expressed as the number of mA present at the + and – analog output terminals

Q [unit] - flow rate in actual selected units

The second display line can also be chosen as blank

The Code Number (Service Code), see 5.4.1, must be enabled to display the following parameters that are included in the Display Submenu.

Detector e.p.

Reference p/n

Signal p/n

Refer to Sub Section 7.3.

3.3.21 Submenu-Operating Mode

Press the Up button and the following menu will appear.

Operating mode standard

Press ENTER and the Down button to display the following menu.

Operating mode * Fast

* Consult the factory for applications assistance before selecting the Fast mode. This mode is used to specifically characterize converter response.

Flow Indication

This feature makes it possible to reverse the forward and reverse flow signals. If the flowmeter is installed so that flow through the meter is in the direction opposite to that in which it is wired and calibrated, the flow indication will be reversed. Forward flow will read as reverse flow and vice versa. This can be corrected by reversing the wires on terminals 1 and 2 of either the flowmeter or the signal converter. This change can be made through the firmware by selecting the flow indication feature.

Press the Down button and the following will appear.

Flow indication standard/opposite

Press the ENTER buttons and the cursor will appear to the right of "standard". Press the Up or Down button and the indication will toggle between standard and opposite. Select opposite, press ENTER, and the flowrate and totalizer indications will display in the forward direction even though the flowmeter has been installed so that the actual flow enters from the reverse direction. The purpose of this parameter is to compensate for the incorrect installation of the meter. **Note that the flow arrow on the meter points in the opposite direction of actual flow.**

Flowdirection

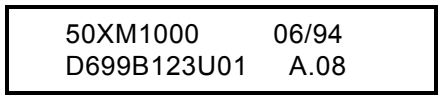
The converter offers bidirectional and forward only flow measurement. If the converter is in the forward mode, the parameters Range R, Pulse Factor R and Multiplex Display are not available.

Press ENTER and the Down button to display the following menu. Press ENTER to enter a selection.

Flowdirection forward/reverse

3.3.22 Firmware Level

The firmware level and the converter model number are shown in the display with the model number and firmware release date on the top line and the EPROM identification and firmware level on the bottom line. **Changes to the firmware can only be made by replacing the EPROM.** This procedure has been prepared for use with Firmware Version D699B123U01 A.08. Other versions may be similar but not identical and may have features different from those discussed in this instruction bulletin.

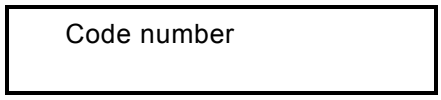


Refer to Section 3.4 for supplemental information on newer version A.28 firmware. Other versions may show slightly different displays and options.

Refer to Appendix A to configure the signal converter for 50XM2000.

3.3.23 Code Number (Service Code)

The code number is used to gain access to internal checks and adjustments that are not normally performed by operating personnel. These are reserved for factory and maintenance personnel. Instructions for these procedures are contained in Section 5.4.1. The code number display appears as shown below.



3.4 Supplemental Information

3.4.1 Purpose

The following section supplements information in this instruction bulletin and provides the following new information:

- new replacement Converter part numbers
- adds version A.28 Standard firmware upgrade information
- adds version X.21 HART Protocol firmware information

3.4.2 Converter Replacement Modules

The following table shows which 50XM1000 Converter modules should be ordered to replace modules in the 50XM1000B or 50XM1000D/N Converters. The replacement kits include all necessary interconnecting ribbon cables as well as user instructions for setting the proper operating mode.

PART NUMBER	CONVERTER DESCRIPTION
698B273U01	115V 50XM1000 Replacement Converter
698B273U02	115V 50XM1000 Replacement Converter w/ HART
698B273U03	230V 50XM1000 Replacement Converter
698B273U04	230V 50XM1000 Replacement Converter w/ HART
698B273U05	24VDC 50XM1000B/XM1000N Replacement Converter
698B273U06	24VDC 50 XM1000B/XM1000N Replacement Converter w/ HART

3.4.3 Firmware

Two new versions of 50XM1000 Signal Converter firmware (system operating software) have become available since earlier releases of this instrument. As a result of these improvements, several new features have been added and product reliability has been increased.

3.4.3.1 Version A.28 Standard Firmware

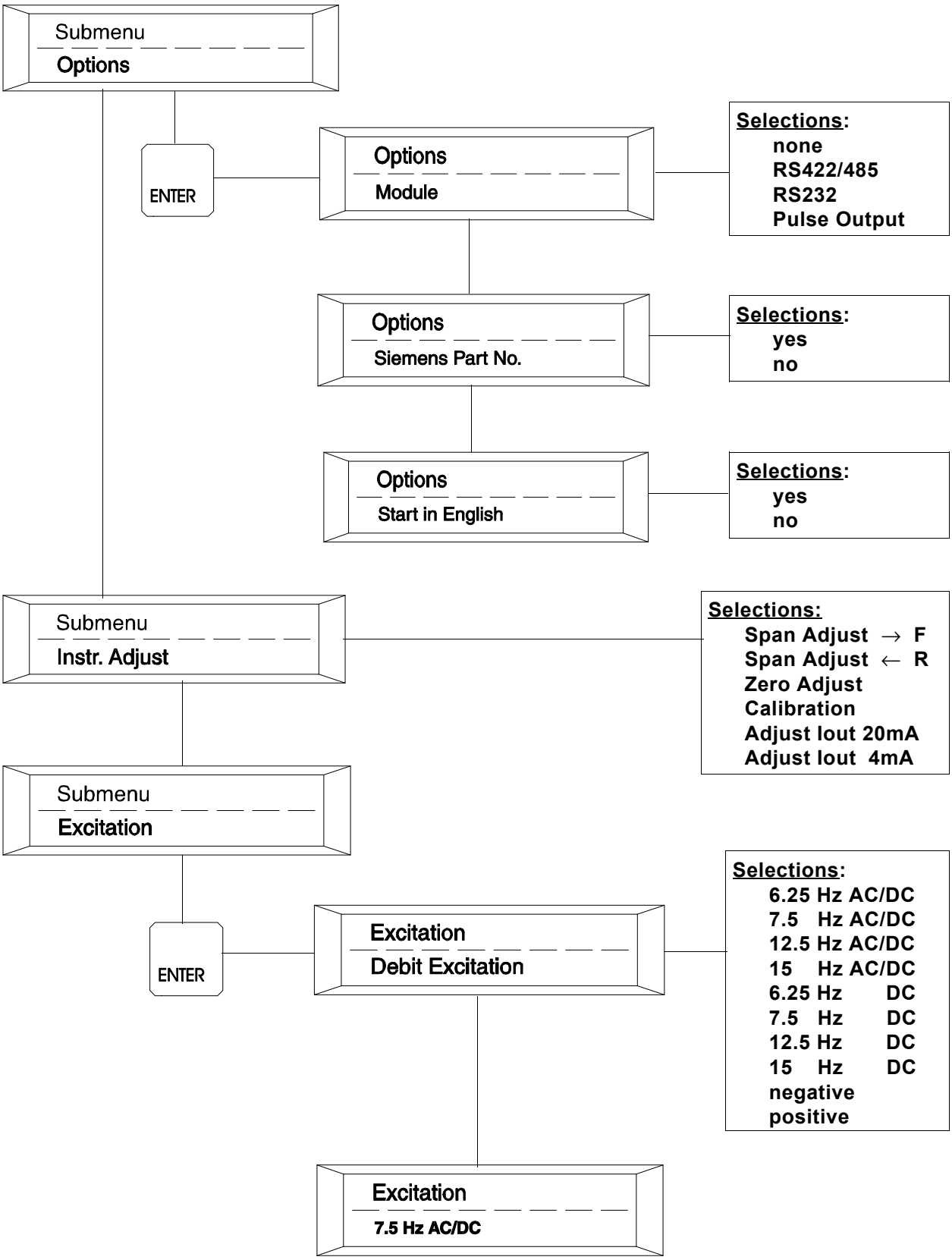
This firmware version (P/N CD699B123U01) adds several new menu configurations. These are summarized below and are shown graphically later in this section.

- Dual range or batch totalization options may be configured in the series “1000” operating mode. These features previously required configuring to the series “2000” operating mode before their menu selections were revealed.
- The coil excitation frequency is now selected from a submenu which is revealed when the Service Code is entered. The selections are the same as those previously available and **should not be changed from those set by the factory**.
- An “Instr. Adjust” submenu has been created and becomes available when the Service Code is entered. It contains constants for adjustment of the unscaled frequency and analog outputs.

- An “Options” submenu has been created and appears after the Service Code is entered. It defines the startup mode of the instrument (Language, etc.) and the type of circuit card plugged into the option socket (data link, pulse).
- "System Zero" has been limited to a maximum ± 0.5% of meter capacity (± 50Hz). This may present some problems when using the new converters with older primaries, many of which require more than this limited amount of zero offset.

If using version A.28 firmware in conjunction with an older Primary causes an error message to be displayed when attempting to perform a system zero, contact Tech Support or Product Management. This may indicate that A.28 firmware is not compatible with the older Primary.

The corresponding menus for the items described above for the A.28 firmware are shown on the next page.


Submenu
Options
ENTER
Options
Module
Selections:
none
RS422/485
RS232
Pulse Output
Options
Siemens Part No.
Selections:
yes
no
Options
Start in English
Selections:
yes
no
Submenu
Instr. Adjust
Selections:
Span Adjust → F
Span Adjust ← R
Zero Adjust
Calibration
Adjust Iout 20mA
Adjust Iout 4mA
Submenu
Excitation
ENTER
Excitation
Debit Excitation
Selections:
6.25 Hz AC/DC
7.5 Hz AC/DC
12.5 Hz AC/DC
15 Hz AC/DC
6.25 Hz DC
7.5 Hz DC
12.5 Hz DC
15 Hz DC
negative
positive
Excitation
7.5 Hz AC/DC

3.4.3.2 Version X.21 HART® Protocol Firmware

The optional HART®protocol firmware (P/N CD699B138U01), when supplied, permits simultaneous 4-20 mA and digital signal transmission on the same 2-wire cable. With this protocol, process parameters such as instantaneous flow rate and cumulative total flow, or operating conditions such as alarm values, can be monitored or altered by an external "smart " device, e.g., a host computer. This interface allows the 50XM1000 data base to be uploaded into the host computer. Operating parameters which would only be changeable at the 50XM1000 Converter can be scanned and remotely reconfigured.

Software and hardware are optionally available to implement a HART Protocol information exchange between the converter and a HART® Protocol master device. This data link permits continuous monitoring of process variable and totalized flows and provides for configuration of the following:

- Values and units for range
- Pulse factor and units for totalizers as well as reset capability
- Damping, noise reduction, low flow cutoff value
- Empty pipe detector setup
- Alarm fail safe condition
- Converter tag name and record information
- Calibration of the analog (4 - 20 mA) output

The following parameters may be displayed but not configured:

- Meter size and calibration factor
- Instrument type (50XM1000) and manufacturer
- Totalizer overflow values

When implementing the HART® protocol, the control computer is the master and the field transmitter the slave. In addition to this primary master a second master (such as the Model 275 Hand-Held Communicator) can become active. Data is transmitted at 1200 baud, with the serial information being encoded and detected as outlined in the Bell 202 standard.

The Rosemount Model 275 Hand-Held Communicator is recommended for HART® communication. Refer to the HART® Model 275 Communicator Instruction Bulletin for detailed information regarding application of HART® Protocol.

The following standard firmware features are **not available** with the HART® Protocol firmware version:

- Selected Range and Totalizer units (Refer to **Tables 4-1 & 4-2** where "♦" indicates "available")
- Batching option
- ASCII RS232C or RS485 data link
- Analog outputs other than 4-20 mA DC

Special HART® features are now available which were previously not available, these include:

- A function test for the modem which superimposes either 2200 Hz or 1200 Hz signals on the analog output
- A function test that displays the HART® command received from a master device
- A menu structure behind the "Service Code" identical to that of the Standard A.22/A.28 firmware

TABLE 4-1. RANGE UNITS

Unit Abbreviation / Description	Time Units *				with HART
	/S	/M	/H	/D	
l, liter	♦	♦	♦		♦
ml, milliliter, .001 liters	♦	♦	♦		
hl, hectoliter, 100 liters	♦	♦	♦		
Ml, megaliters, 1,000,000 l		♦	♦	♦	
m^3, cubic meters	♦	♦	♦	♦	♦
igal, imperial gallon	♦	♦	♦	♦	♦
gal, US gallon		♦	♦		♦
mgal, million US gallons				♦	
bbl, brewery barrel, 31 gal.	♦	♦	♦		♦
bls, petroleum barrel, 42 gal		♦	♦	♦	
gram	♦	♦	♦		♦
kg, kilogram, 1000 grams	♦	♦	♦		♦
t, metric ton, 2000 kg		♦	♦	♦	♦
lb, US pound	♦	♦	♦		♦
uton, US ton, 2000 pounds		♦	♦	♦	
configurable unit **	♦	♦	♦	♦	♦

TABLE 4-2. TOTALIZER UNITS

Unit Abbreviation / Description	with HART
l, liter	♦
ml, milliliter, .001 liters	
hl, hectoliter, 100 liters	
Ml, megaliters, 1,000,000 l	
m^3, cubic meters	♦
igal, imperial gallon	♦
gal, US gallon	♦
mgal, million US gallons	
bbl, brewery barrel, 31 gal.	♦
bls, petroleum barrel, 42 gal	
gram	♦
kg, kilogram, 1000 grams	♦
t, metric ton, 2000 kg	♦
lb, US pound	♦
uton, US ton, 2000 pounds	
configurable unit **	♦

* Where: /S = per second
/M = per minute
/H = per hour
/D = per day

** Name & volume may be configured by the user. Volume can be 0.001 to 4,999,999 liters. Default unit is "kgal", 1000 US gallons.

4.0 FUNCTIONAL DESCRIPTION

4.1 Basic Functions

The signal converter is of the pulsed dc type, i.e., it supplies a pulsed constant current dc signal to the magnet coils of the flowmeter to establish the magnetic field. Also it receives the electrode flow signal from the flowmeter, and converts it into analog and digital output signals. Zero is factory set, and no field zero adjustments are required.

Two field selectable coil operating frequencies are incorporated in this design. They are 7.5 Hz and 15 Hz for 60 Hz power and 6.25 and 12.5 Hz for 50 Hz power. The standard coil drive frequency is 7.5 Hz. The 15 Hz, when used with the digital filter feature, is only recommended for applications in which the process generates noise signals that interfere with the flow signal.

4.2 Design Features

4.2.1 Micro-Processor Controlled

The converter is micro-processor controlled with nonvolatile memory. All operating parameters are configurable via three pushbuttons on the converter or via an optional data link. During configuration, the converter remains on line, and data is updated continually. The data base is updated at the time the ENTER buttons are pressed to enter a parameter change.

4.2.2 Display

The liquid crystal display (LCD) is back lit and contains two lines of 16 alphameric (5 X 7 dot matrix) characters. The display is used to show flow rate on the top line in either percent of flow or in direct engineering units and totalization in direct engineering units on the bottom line (see Figure 3-4). In addition, the display is used to show configuring data or error messages in English language (or the selected language). Both the rate indicator and the seven digit totalizer are included in every converter as standard.

4.2.3 Rangeability

Any flow rate from 0 to 100% can be measured provided the full scale value is between 49 ft/s (15 m/s) and 0.66 ft/s (0.2 m/s).

4.2.4 Bi-Directional Flow

The converter can be either unidirectional or bidirectional. Selection of the directional mode is made through firmware. The standard mode is unidirectional. This can easily be changed at the factory or in the field. Instructions for this firmware change are contained in Section 3.3.21. In the bidirectional mode, the converter will automatically display rate and totalization in forward and reverse directions. A pulse output option for each direction is available for retransmission to an external totalizer. A flow direction contact is included in the converter to indicate flow direction for the one analog output.

4.2.5 Flow Direction

The flow direction is indicated at the left side of the display as "F" for forward flow and "R" for reverse flow. Totalization is also shown in this manner. The totalizer can be switched manually from forward to reverse or vice versa by pressing the Up or Down button located below the display. The totalizer can also be switched automatically every 7 seconds by selecting MULTIPLEX DISPLAY from the configuring menu.

A separate external totalizer for each flow direction can be driven by the 24 V dc scaled pulse if the scaled pulse option has been selected.

There is one analog output available. Flow in the reverse direction is indicated by the same analog signal as the forward. To make the distinction between forward and reverse flow, contact closures are provided in the converter. In a two pen recorder, for example, one pen could be used to record flow while the second pen could rest at zero with the contact open and could be elevated to some positive value when the contact closes. Therefore, the position of the second pen would indicate the direction of flow. If the analog signal goes to a computer or other intelligent instrument the contact closure condition is easily recognized as an indication of flow direction. Also (alternatively) the zero center analog outputs may be selected (see 3.3.15).

4.2.6 Output Signals

4.2.6.1 Analog Output

A 4-20 mA dc output signal into 0-750 ohms is standard and is always available regardless of which output options are selected.

4.2.6.2 Incremental Pulse

This is a 5 volt, 0-10 kHz unscaled frequency which is normally used during calibration. It can be adapted for use as an output in special applications. This output is also provided regardless of output options.

4.2.6.3 Optional Outputs

Either a scaled pulse output or a data link can be selected.

4.2.6.4 Scaled Pulse

This is a 24 V dc pulse that operates a load of 150 ohms or more. It can be used to drive an electromechanical counter at 0-10 Hz with a 50 millisecond pulse width or a high speed electronic device at 0-4 kHz with a 50 microsecond pulse width. The pulse width can be adjusted as a part of the data base and does not require a hardware change.

4.2.7 Data Link

The data link is the hardware and firmware by which the data base may be examined. The data base is a collection of elements in the converter memory which may be either altered or examined through firmware. In addition, the data base represents the information the instrument is working with in the course of its normal computations. A few of the parameters included in the data base are calibration factor, range setting, damping value and pulse width. The data link consists of two transmitting and two receiving wires which pass serial data at 110 bits per second up to 28,800 bits per second (110 Baud to 28.8 kBaud). It does not carry the analog output signal from the con-verter. The analog signal is carried over its own wires directly to the receiving device (recorder, controller, indicator, computer, etc.) in the normal manner. There are two industry standard hardware arrangements for the data link option. They are RS232C and RS485.

The RS232C interface is probably the most common serial data link in use today. It permits communication between two devices normally within 50 feet (15 m) of each other at baud rates up to about 9600. Devices are available to convert from RS232C to RS485 to allow connection of more than one converter to a single computer and to transmit well beyond 50 feet.The RS485 interface is a high speed link used by intelligent instruments. It permits any transmitter to be shut off or 'tri-stated' when not in use. For instruments such as the company's **SUPERVISOR™**, it means that up to 32 instruments may 'talk' over one data link. This link can send data at 28.8 kBaud over lines up to 4000 feet (1200 m). ASCII is the only key pad selectable communication mode available.

4.2.7.1 ASCII

In the ASCII mode, a sequence of ASCII characters is sent back and forth.

4.2.8 Power

Refer to the converter data tag for power requirements.

5.0 CALIBRATION

5.1 General Discussion

NOTE
The signal converter should never require recalibration, unless a hardware failure has occurred. If the non-volatile memory data proves defective, calibration data must be re-entered. In the event of component failure, existing calibration data may no longer be valid.

One notable feature of the converter is that it can be configured independent of any particular flowmeter, as long as the flowmeters are of the same size and use the constant meter factor/size design concept. The design of the microprocessor-based converter permits configuration and calibration of the converter prior to its installation.

Each converter is configured and precisely calibrated at the factory in accordance with customer specified flow parameters.

Since the flow metering system is precalibrated, it is generally ready for on-line service as received. In the event that the specified system flow parameters or engineering units are to be changed, the converter must be reconfigured to agree with the revised flow values.

Signal converter performance can be verified periodically using the procedure described in Section 5.3. If problems are experienced which may be originating with the signal processor, use the performance verification procedure first. Recalibration should be done only when it has been determined that it is actually required. If calibration is necessary, it can be done using the procedure described in Section 5.4.

Performance verification and calibration of the converter require the use of the Model 55XC2000 or 55XC4000 Signal Simulator. The signal simulator is supplied with an interface adaptor which includes test cables that mate with receptacles provided on the converter assembly.

Essential calibration data is recorded and listed on a data tag that is attached to the side of the transformer in the signal converter assembly. The calibration data provided can be used to restore the signal converter to a calibrated condition when data held in the non-volatile memory data has been corrupted. RAM corruption can result from a lightning strike or severe electrical disturbance near the installation site. In this event, all of the calibration data can be re-entered manually. However, if the signal converter has malfunctioned and a defective component must be replaced, the calibration data is no longer valid; the unit must then be recalibrated as described in this section.

5.2 Test Equipment Requirements

5.2.1 Equipment

Test equipment needed for signal converter calibration includes the following:

1) Series 55XC2000 or 55XC4000 Signal Simulator
2) Electronic Totalizer/Frequency Counter (0-10 kHz)
3) Digital Voltmeter (typically, 0-10 V dc)
4) Electromechanical Counter or Electronic Totalizer (as applicable for 0-15 Hz* max, or 0-4 kHz)
5) 250 ohm ±0.05%, 1/2 W, precision resistor

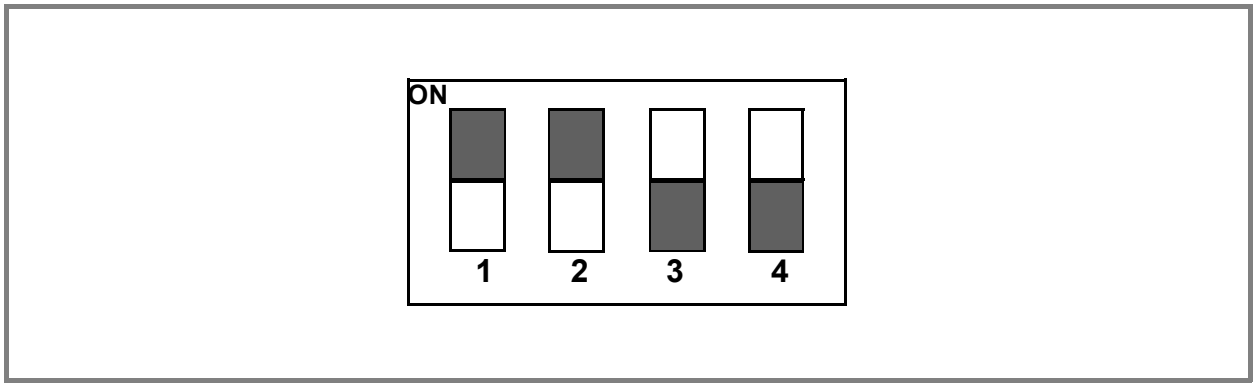
*assumed maximum count rate of electromechanical counter

Typical test wiring is shown in Figures 5-2 and 5-3. Interconnection wiring diagrams for the converter are included in Section 2.0 and should be used to supplement this discussion.

Use of a Model 53SU1000 SUPERVISOR, 53SU5000 SUPERVISOR-PC, or similar intelligent data handling equipment will be needed for interfacing with the RS232C or RS485 I/O signals, when supplied. Signal wiring is shown on the applicable system interconnecting diagram.

When using the 55XC2000 or 55XC4000 Simulator, make sure that the S401 DIP switches on the new Converter module are set to the 50XM1000 operating mode as per the following procedure. Locate DIP-Switch S401 on the Digital circuit board directly under the upper right hand corner of the display (Refer to Figure 1-4). Switches 1 & 2 of S401 DIP switch must be in the "on" or "closed" position. Positions 3 & 4 of S401 must be "off" or "open" for all operating modes. Switch settings should appear as shown below.

FIGURE 5-1. S401 SHOWN IN "XM1000" MODE



5.2.2 55XC2000 Signal Simulator

The 55XC2000 signal simulator provides an adjustable process variable flow signal suitable for on-site performance and accuracy tests of the Converter.

The signal simulator is supplied with an interface adaptor that includes some test cables that mate with receptacles provided on the signal Converter assembly. **A 30 to 20-pin adapter ribbon cable is required when using the 55XC2000 Signal Simulator to test the 50XM1000 Converter. This cable must be ordered separately and is available as Part Number 677B962U02.**

Typically, when these test cables are connected, power for operation of the Converter is supplied by the signal simulator.

Attachment of the test cables from the 55XC2000 signal simulator to the signal Converter is shown in Figure 5-2. The verification procedure is described in Section 5.3.

CAUTION
Applying 120 V ac power to a converter assembly that is supplied for 24 V dc operation will result in destruction of the signal converter.

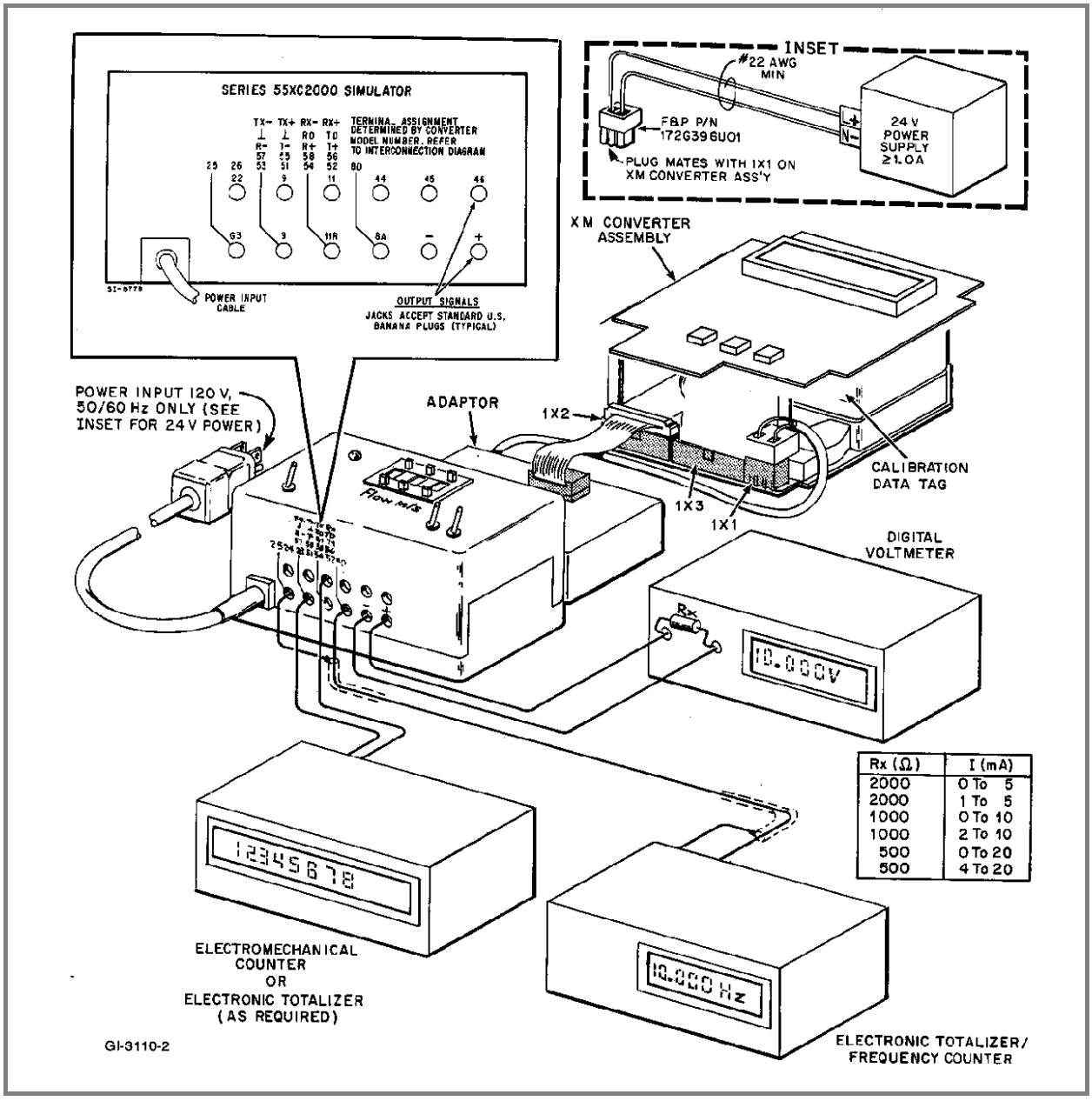


FIGURE 5-2. TEST WIRING FOR 50XM1000

5.2.3 55XC4000 Signal Simulator

The 55XC4000 signal simulator provides an adjustable process variable flow signal suitable for on-site performance and accuracy tests of the converter.

The signal simulator is supplied with an interface adaptor that includes test cables that mate with receptacles provided on the signal converter assembly.Typically, when the test cables are connected, power for operation of the Converter is supplied by the signal simulator.

Attachment of the test cables from the 55XC4000 signal simulator to the Signal Converter is shown in Figure 5-3. The verification procedure is described in Section 5.3.

The simulator signal range can be preset via 3 decade type (0-9) digital switches. These preset switches permit precise setting of the simulated flow signal over a range of 0.00 to 9.99 m/s in 0.01 m/s increments.

The Converter power supply should correspond to Simulator power supply. The AC line plug (mains plug) should be connected so that the "Phase" lamp is energized. If power supply is DC, take care to observe the proper polarity as indicated in Figure 5-3.

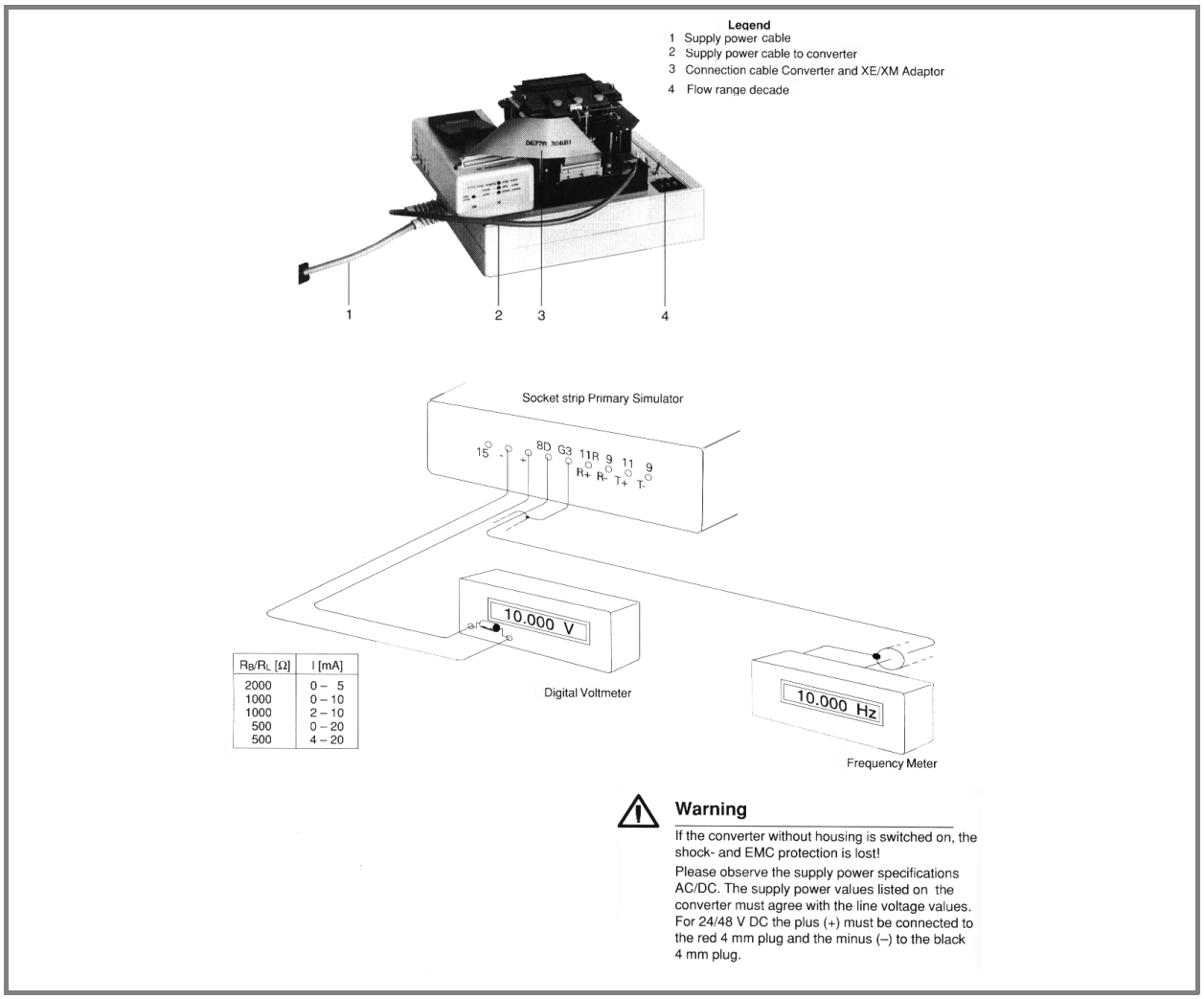


FIGURE 5-3. TEST WIRING USING 55XC4000 SIGNAL SIMULATOR

5.3 Performance Verification

To verify calibration of the converter, connect the simulator as shown in Figure 5-1.

CAUTION
When the dynamic test is to be made in the user's instrument service shop, especially if the total volume processed is needed for inventory or billing purposes, the total volume should be logged before disrupting electrical interconnections.

Enter a range value on the 3-digit range selector and read the output on the converter assembly liquid crystal display or metering devices connected to the simulator output(s).

For = Q_{max} DN velocity = 33.33 ft/s

The indicator reading can be calculated as follows:

$$\% \text{ Indicator Display} = \frac{\text{m/s}}{10.159} \times \frac{\text{Range DN}}{\text{Range}} \times 100$$

where, m/s = Simulator velocity setting
Range DN = meter Cal factor (automatically corrected by the computer for either 33.33 ft/s or 10.0 m/s)

Alternatively, if the converter is set up for maximum flow velocity (Q_{max}DN) = 10 m/s, then the % Indicator Display calculation would be as follows:

$$\% \text{ Indicator Display} = \frac{\text{m/s}}{10.00} \times \frac{\text{Range DN}}{\text{Range}} \times 100$$

For example, assume the flowmeter is a 2 inch size meter with a Cal Factor of 268.372 gpm at 33.33 ft/s, that the signal simulator is set for 5.00 m/s, and Range is preset for 250 gpm maximum, then:

$$\% = \frac{5.00}{10.159} \times \frac{268.372}{250} \times 100$$

$$\% = 52.8$$

If the current output is preset for 0-20 mA and the load resistor (Rx) is 250 ohm (refer to Figure 5-1 Test Wiring), then the voltage reading displayed by the DVM should be:

$$E = \left(Imax \ x \frac{indicator\ \%}{100} \right) (Rx)$$

$$E = \left(0.020 \, x \frac{52.8}{100.0} \right) (250)$$

$$E = 2.64 \, V \, dc$$

The flow velocity in ft/s at the operating flow rate can be calculated as shown below.

$$\text{ft/s} = \frac{\text{OPER(gpm) x 33.33}}{\text{CALFACTOR(gpm)}}$$

Using values given in the above example,

$$\text{ft/s} = \frac{250 \ x \ 33.33}{268.372} = 31.0$$

To convert velocity in ft/s to m/s,

$$\text{m/s} = \frac{ft/s}{3.2808}$$

typically,

$$\text{m/s} = \frac{31.0}{3.2808} = 9.45$$

When satisfactory performance has been demonstrated, select the desired current output span (4-20, 0-20, 4-12-20, 0-10-20, 0-5, 2-10 or 0-10 mA) before returning the converter to service. Standard output is 4-20 mA.

5.4 Calibration Procedure

NOTE
The signal converter should not require recalibration in its lifetime, unless a hardware failure has occurred. If the non-volatile memory data proves defective, calibration data must be reentered. In the event of component failure, existing calibration data may no longer be valid.

The converter firmware includes some configuring routines whose use permits special entries specific to the calibration of the device to be set. When the calibration mode has been invoked, it is possible to access parameters normally blocked because they are either linked to options not installed or because they are not compatible with other parametric settings.

For example, the firmware includes an automatic module identification for the RS485 and RS232 serial interface modules. When configuring the converter, the parameters "Instr. address", "Baudrate" and "Communication" in the "Data link" submenu are programmable only if a serial interface module has been installed. The absence of such a module is indicated by "ERROR-NOT AVAILABLE" on the display whenever an attempt is made to call up that parameter. However, in the calibration mode, any of these menu items may be accessed and changed if the proper module has been installed.

NOTE
This procedure has been prepared for use with firmware version 699B123, A.08 of the 50XM1000 Signal Converter. Other versions will be similar but not necessarily identical, and may have features different from those discussed in this section.

CAUTION
Only experienced electronic technicians should attempt to calibrate the signal converter. Erroneous calibration will result in unsatisfactory performance of the converter.

CAUTION
Some of the surface mounted IC devices used in the signal converter are static sensitive and may be damaged by improper handling. When adjusting or servicing the signal converter, use of a grounded wrist strap is recommended to prevent inadvertent damage to the integral solid state circuitry.

5.4.1 Quick-Check Procedure

1. Calculate input value for 100% using the formula below:

m/sec = Range x 10.159/Cal Factor (Cal Factor in ft/sec) or

m/sec = Range x 10.0/Cal Factor (Cal Factor in m/sec)

2. Disconnect the converter from the primary and connect the signal simulator.

3. Set the simulator to the calculated m/s value.

4. The converter should display the 100% range of the converter and read a 20mA output on the simulator.

5. If this is not the case, perform the extensive calibration procedure in Section 5.4.2.

5.4.2 Comprehensive Procedure

1. Disconnect the converter from the primary and connect a 55XC2000 or 55XC4000 flow simulator to the converter. Refer to Figure 5-1 for proper test wiring configuration.

2. Enter Code Number (Service Code). Access to special functions including calibration parameters is achieved by entering the proper code number. In order to enter the factory calibration mode it is necessary to enter the number **1000**. The calibration mode is locked out with the entry of a number other than 1000 or after a power-on reset. To provide security for this mode, each digit is over-written by an asterisk (*) when the next digit is selected.

4. Scroll to the appropriate menus and record the **Cal Factor rate (33.33ft/sec or 10m/sec)**, **Range**, **Low Flow cut off**, **System Zero adj.**, **Detector e.pipe** settings (M/T pipe) and **Operating Mode Flow Direction** settings (forward / reverse).

5. Scroll to the **Range DN** or **QmaxDN Velocity** menu selection and set the converter to 10m/sec.

This parameter is used to select either 10 m/s or 33.33 ft/s as the velocity corresponding to Cal Factor. Span calibration adjustments of both frequency and current outputs are to be made with this parameter set to 10 m/s and the Span Adjust display set to indicate flow in "%" (See Step 7).

6. Scroll to **Submenu - Operating Mode** and set Operating Mode Flow Direction to forward/reverse.

7. Scroll to **Submenu - Display** and set the bottom line of the display to indicate percent (%).

8. Scroll to **Submenu - Detector e. pipe** and turn off the empty pipe detector.

9. Set the **Low Flow cut off** to zero percent.

10. Set the forward and reverse **Range** to equal the **Cal Factor**.

NOTE
Older meters used a Cal Factor value of 33.33ft/sec. If Cal Factor reading in step 4 was 33.33ft/sec it should be changed to the new 10m/s for calibration purposes.

11. Set **System zero adj.** to zero.

12. Adjust the flow simulator to 9.99 m/s Forward and connect a mA meter to the simulator. If a mA meter is not available, the resulting output may be read across a precision 250 ohm, 0.1% resistor with a voltmeter.

If the resistor method is used, the output current is calculated as follows:

$$I_{out} = V_{out} / 0.250$$

where V_{out} is the voltage measured across the 250 ohm resistor. This observed value of current should be entered as the 20 mA Adjust parameter.

Once the simulator is set to 9.99 m/s Forward,

- o The converter should read 99.9%
- o The meter flow rate should read 99.9% of cal factor
- o The mA meter should read 19.984mA.

For example: if the cal factor is 2077.72 the meter should read 2075.64. (Cal factor x 0.999)

If this is **not correct**, the converter will need to have the span adjusted. Go to next step.

If the reading is **correct**, restore the converter back to its original configuration by restoring the converter settings recorded in Step 4. Recheck calibration after all original data is reloaded.

13. Set simulator to **9.99 Forward**

14. Select **Span adj.>F** and press **enter**.This parameter determines the calibration of both the display and the 10 kHz unscaled pulse output (on some converters this may be found in the **instr. Adj.** menu). Select **auto**. Press **enter** and the adjustment progresses. The display will count down from "001 255" to "000 001".

After approximately 20 seconds, the adjustment is completed and the converter will return to monitoring mode; the display reading will be 99.9% (± 0.1%).

15. Set simulator to **9.99 Reverse**

16. Select **Span adj.<R** and press **enter**. Select **auto**. Press **enter** and converter will count down.

17. Set simulator to **0.00 Forward**

18. Select **Zero adj.** and press **enter**. Select **auto**. Press enter and converter will count down.

19. Set simulator to **9.99 Forward**

20. Select **Adjust Iout 20mA** and press enter. Record the mA output current from simulator and enter this mA reading into the "Adjust Iout 20mA" parameter.

21. Set simulator to **0.00**

22. Select **Adjust Iout 4mA** and press **enter**. Record the mA output current from simulator and enter this mA reading into the "Adjust Iout 4mA" parameter.

23. Set simulator to **0.00** and check the display and mA output current. The converter should read 0%. The simulator should have a 4 mA output. Check the unit's span using Step 12.

24. Restore the converter back to its original configuration by restoring the converter settings recorded in Step 4. Recheck calibration after all original data is reloaded.

5.4.3 < .05 Range DN

Selecting "ON" permits ranges to 2% of Cal Factor.
Selecting "OFF" permits ranges to 5% of Cal Factor.

```
Qmax > = .02 max DN
 on/off
```

5.4.4 Range DN

Range DN - fixed/programmable

```
Range DN
 fixed
```

The range DN can be entered either through meter size selection (fixed) or by direct entry (programmable). In the programmable mode a further choice regarding the velocity at the cal factor (33.33 ft/s) or meter capacity (10 m/s) can be made. Refer to 5.4.3.

If the "Fixed" mode has been chosen, Range DN is automatically configured upon selection of meter size. Attempts to configure these parameters will be ignored as long as "Fixed" mode is active.

5.4.5 Calibration

For factory use only.

```
Calibration
 0%
```

5.4.6 Debit Excitation

This is the excitation mode and frequency which will be invoked each time the unit is powered up. Those entries indicated as DC are applicable to units with DC power supplies. Those entries indicated as AC/DC are applicable to units with line power. Frequencies 25 and 30 Hz are not to be used without factory approval. Modes positiv and negativ are used for testing excitation at a DC constant current level (excitation does not reverse).

Press Enter and then the Down key to toggle through the selections. When the appropriate selection appears, press Enter.

```
Debit Excitation
 6.25 Hz DC
 7.5 Hz DC
 12.5 Hz DC
 15 Hz DC
 25 Hz DC
 30 Hz DC
Positiv
Negativ
 6.25 Hz AC/DC
 7.5 Hz AC/DC
 12.5 Hz AC/DC
 15 Hz AC/DC
 25 Hz AC/DC
 30 Hz AC/DC
```

5.4.7 Excitation

Indicates the actual frequency of the coil excitation.

```
Excitation
 7-1/2 Hz
```

5.4.8 Instrument Number

```
Instrument no.
    0
```

All converters have a factory installed sequential number, reflecting their relative time of manufacture.

5.4.9 Reset

```
* *  RESET * *
```

This function executes a "warm" CPU hardware reset, after which switch positions, hardware options, etc. are polled. This function is normally completed whenever power is applied to the converter. The power line interrupt counter is not incremented and the code number is not cleared when "RESET" is invoked.

5.4.10 Output Data

This function outputs all the converter's configured data in plain ASCII text to both the converter display and the data link simultaneously. This can be useful in establishing data link protocol or saving all device parameters.

5.4.11 Initialization

If initialization is selected all parameters are set to the default values, replacing the factory installed settings. Therefore, **extreme caution** should be exercised in using initialization. In general, initialization need only be performed if there has been a loss of data in non-volatile memory. If a record of the calibration data is available from the tag, the data should be re-entered following the initialization. Otherwise, the unit must be calibrated again to place it back to within specified accuracy. The user will be prompted (yes → ENTER) for assurance that initialization is desired.

5.4.12 Analog Range

Indicates the relative amplitude of the electrode signal as required by the internal automatic gain changing circuitry. These are normally either "1" or "2", but may sometimes be at "4" or "8" (highest gain available).

Analog Range:

```
V = 1
V = 2
V = 4
V = 8
```

5.4.13 Parameter Update

```
Parameter Update
************
```

Not applicable to the 50XM1000 Converter.

5.4.14 Operating Time

```
Operating Time
hour = 31
```

Indicates the hours the instrument has been powered.

6.0 MAINTENANCE

6.1 General Discussion

The 50XM1000 Signal Converter is a microprocessor-based instrument. All computations, data manipulation and sequencing operations are software controlled. Display of flow rate and the cumulative total flow are performed automatically concurrent with flow through the associated flowmeter. As the flowmeter has no moving parts that are subject to mechanical wear and the signal converter has no operating controls that require field adjustment, there are no recommended periodic tests to be performed. As a result, routine system maintenance is not required.

Due to the complexity of troubleshooting microprocessor-based instruments, maintenance beyond the assembly level is not recommended. If troubleshooting of the signal converter assembly is attempted, it should be noted that many of the CMOS type IC chips used in this assembly are static sensitive devices that can be internally damaged if not handled properly. Also, caution must be used when connecting test probes, as even a momentary accidental short may damage or destroy an integrated circuit. Further, although protection is provided against electro-static effects by built-in circuitry, the following precautions should be taken if it is necessary to handle the Converter printed circuit assembly:

1) Ground all test equipment.

2) Technicians should use grounding-type wrist straps.

3) The surface of the service bench should be grounded to preclude static electric build-up.

4) All CMOS devices should be stored or transported in materials that are anti-static. (Do not use ordinary plastic wraps or bags). Typically, protection of the converter assembly can be effected by first covering the printed circuit assembly with aluminum foil and then providing an outer wrap of heavy paper.

When a system malfunction is evident, the first step is to determine whether the problem is hardware or software related. If the signal converter appears to respond normally to functional operations such as those expected to occur during the course of parameter monitoring, self test procedures, etc., and system constants can be verified as correct, but the displayed process values are wrong, then proper operation of the flowmeter should be verified.

When the signal converter exhibits total failure (no display can be obtained on the LCD), then possible loss of the external power source or an internal hardware malfunction could be the cause. A simple volt-ohm analysis will quickly indicate whether the problem is external or internal. Use of a conventional V-O-M type multimeter is considered adequate for voltage and resistance analysis. An electronic frequency counter and oscilloscope will also be useful for verifying the output frequency rate, signal tracing, etc. Should any doubt arise regarding the proper procedure for solving a service problem, it is suggested that users contact their local factory-service facility for technical assistance.

When communicating with the factory regarding a replacement converter assembly, it is important to refer to the complete instrument serial number and model number to assure that the correct replacement assembly will be provided. The serial number and model number are given on the manufacturing specification sheet and on the instrument nameplate (attached to the housing base).

6.2 Removing the Signal Converter

Should it be necessary to disassemble the signal converter for calibration, troubleshooting, or replacement of a defective assembly, proceed as outlined below.

WARNING
Equipment powered by an ac line service constitutes a potentially lethal electric shock hazard. Always de-energize system power before removing the housing cover.

1) To remove the converter housing cover, unscrew the four hex head mounting screws located in the corners of the cover. These are captive-type screws and should not be removed from the housing cover. Store the housing cover for re-assembly.

2) On top of the digital printed circuit board (see Figure 6-1), unscrew the four screws that pass through the 1-7/8 inch standoffs located near the corners of the converter module. Support the converter module while removing the last of the 4 mounting screws. This will prevent excessive strain on interconnection cables. Save this mounting hardware.

3) Disconnect the 30-pin ribbon-type signal cable from the I/O receptacle (refer to Figure 1-3). Disconnect the 3-pin power plug from the power receptacle (refer to Figure 1-3).

The converter module is now disconnected and can be removed from the housing.

6.3 Troubleshooting

A series of simple tests may be performed on the signal converter module to determine problem areas. If proper converter operation cannot be achieved when these steps are completed, then it should be assumed that the converter has a failed component, most of which are not field replaceable. It is assumed that persons following this procedure are thoroughly familiar with operation of the device and that the entire flowmeter system has previously operated correctly. **Servicing of the signal converter should only be attempted by a qualified electronics technician.**

6.3.1 Procedure

Typical problems with causes and/or correction procedures are outlined in the following sections.

1. No characters present on display:

* Check display contrast adjustment on the display pc board.

2. Error messages appear on display instead of the normal flow rate and totalization information:

> Note
> Errors 0 through C will be "chained" together on the converter display if more than one occurs. Thus it might be possible to have a display with error "1237C", for example.

* Attempt to determine the source of any error message (some are detailed further on in this procedure). Error code numbers are also defined in Section 3.3.13 of this manual.

* Check system interconnection wiring for loose connections, open or shorted cable(s), etc.

Error Indication	Cause
Error 0 - empty pipe	This error is present when the empty pipe detector has been activated ("on") and the adjust frequency of the detector circuit exceeds the threshold value. In short, the converter believes the pipe to be empty based on parameter settings and measurements. Refer to Section 3.3.18 for Empty Pipe Detector adjustment and operation.
Error 1 - A/DC saturated	The analog to digital converter device(A/DC) in the electrode signal measurement circuit has been overloaded by excessive signal or noise. This is often the result of poor grounding of the liquid flowing in the meter or extreme process noise from certain slurries. This message may also result when the pipe is empty and the converter is picking up random open circuit noise. The message frequently occurs during system start-up and will disappear when normal flow conditions have been established. Check for incorrect range, non-full pipe, excessive flow noise, incorrect reference, improper grounding, excessive dc voltage on meter electrodes. Apply a short circuit between flowmeter terminals 1, 2, and 3 (except on model 10D1477). The current output should drop to less than 1% of calibration factor (Range DN).
Error 2 - U ref too low	The converter provides pulsed constant current to the coils of the primary, using the measured "reference voltage" as the feedback means for setting coil current. Reference voltage is present between converter terminals 16 and 3 (com). Nominal voltage is 70 millivolts, and the tolerance band is +/-10%. Therefore, error 2 will result if the converter measures a reference voltage of less than 64 millivolts. In some instances, voltages greater than 100 millivolts will also result in the low ref. message. If error 2 occurs after the converter has operated properly over a sustained time interval, then there has been either a failure of the coil drive circuit or loss of a connection to 3, 16, M1, or M3.

Check for proper reference voltage (±65 to ±75 mV). Use Excitation positive or negative to place reference voltage into a dc condition. Always return settings to previous condition when complete.

Check magnet coil wiring (in flowmeter) for proper circuit resistance.

Cycle converter power off and on.

CAUTION
Should an "**Error 2 - Uref too low**" error occur when the instrument is activated, remove power from the device as soon as possible, otherwise instrument damage may occur.

Error 3 - Flow > 130%

The measured flow rate is more than 30% greater than the value of the converter's range. This message may also result when the pipe is empty and the converter is picking up random open circuit noise.

Error 4 - Zero return

The external zero return contact has been activated, causing all converter outputs to go to their zero flow state. Totalization will cease.

Error 5 - EEPROM or NVRAM Defect

All the converter's non-volatile data is stored in either an EEPROM or NVRAM type of device. A checksum of the data is placed in the last byte, and the error message will appear when the data and checksum are in disagreement. This is a "fatal" error and can generally only be corrected via re-initialization of the converter data base. New entries of all flow and calibration parameters will then be required.

Log all process parameters (range, damping, totalizer factors, etc.) and enter the "code 1000" mode. Step to the "INITIALIZE" menu and press "ENTER". Manually load all calibration parameters back into converter as they appear on the attached tags.

NOTE
If the initialize routine is invoked, the converter must be recalibrated. Refer to Section 5.0.

If the error occurs again following a power interruption, then the memory chip is defective and the converter requires factory repair.

Error 6 - Totalizer

The small non-volatile device retaining the totalizer value upon power failure has a bad checksum. Verify this by noting the totalizer value and turning power off. The last value observed should be retained after power is again applied.

Error 7 and Error 8 - Uref P or N too large	**Refer to error 2 for additional information**. In this case, the converter's measured reference voltage of either the positive or negative part of the pulse exceeds 66 millivolts. The display of error "78" means both values are excessive. In some rare cases the coil drive becomes unstable with certain primary coil types and then tends to run high. **Trouble shoot in the same manner as for error 2**. Check for proper reference voltage (±65 to ±75 mV). Use Excitation positive or negative to place reference voltage into a dc condition. Always return settings to previous condition when complete. Check magnet coil wiring (in flowmeter) for proper circuit resistance. Cycle converter power off and on.
Error 9 - Excitation	The logic signal which results in coil pulsation and signal measurement/processing is not present. This is a fatal error. Verify that the debit excitation parameter has not been left at the "positive" or "negative" setting. If cycling of the instrument power does not clear the message, the converter must be sent to the factory for repair.
Error A and Error B - Max and Min Alarm	The converter output is either greater than the Maximum alarm value or less than the Minimum alarm value as a percentage of the converter's range value.

The following errors 10 through 80 are indicative of attempts made to enter values which are above or below preset converter limits. The new entry will be rejected and replaced with the previous value. These error messages will appear only during configuration and will not remain in the converter's error log.

Error Indication	**Cause**
Errors 10, 11, and 12 - Range Max	Range setting outside the limits of 5 to 150% of Cal Factor attempted.
Errors 16 and 17 - low flow cutoff	Low flow cutoff setting <0 or >10% of range attempted
Errors 20 and 21 - damping	Setting of damping value <.5 sec or >99 sec attempted
Errors 38 and 39 - pulse factor	Pulse factor setting of <.001 or >1000 attempted
Errors 40 and 41	Maximum pulse rate <.00016 Hz or >5K Hz

Errors 42 and 43	pulse width setting less than .064 msec or >2000 msec attempted
Errors 44 and 45	Density setting of <.01 g/cm3or >5 g/cm3 attempted
Error 46	Generalized error message an entry is to large
Error 54 - system zero error	System zero adjust >50 Hz (0.5% of Cal Factor) required. This error is generally indicative of installation problems which cause excessive zero offset. Check for proper grounding of meter body and the liquid, be certain the pipe is completely full, and be certain that flow is completely stopped. This error may also be encountered when fitting a new 50XM on an older style meter. Consult the factory for further advice if this last situation occurs.
Error 56 - empty pipe threshold	Threshold value setting of >3000 was attempted. If a value of greater than 3000 seems to be required, first check to be certain that the primary does not contain a buffer electrode amplifier or that more than 50 ft of interconnecting signal cable is in use. Consult the factory for further advice.
Error 58	This is a factory-only parameter whose value limits have been exceeded
Errors 74 and 76 - alarm limits	At attempt has been made to set the value of the high or low flow alarms outside the limits of 0 to 130% of range.
Error 80	The converter has calculated a new and more narrow pulse width as a result of pulse unit or pulse factor changes. This new pulse width will now be utilized.
Error 91	The data in the device internal EEPROM is defective. This is a fatal error. See error 5 for corrective action.
Error 96	The firmware version in the internal EERPOM does not agree with the actual device version. The converter will perform the "parameter update" function to clear this message.

NOTE

Errors 92 through 95 pertain to the External EEPROM device used in the M2 (50XM2000) and 50XE4000 converters only

3. Garbled information or missing characters appear on the display:

* Execute the display function-test. Assuming no other problems exist, the converter can operate without a display, except that no data can be changed.

4. Converter output does not appear to be correct but display information seems OK:

* Move to the "FUNCTION-TEST" menu and execute the I_{out} and F_{out} functions. The Frequency self-test will also produce both a 10 kHz and an active pulse output.

5. Check signals under function test.

The Code Number (Service Code) must be activated to display the following parameters, either in a continuous or a multiplex fashion (refer to Section 5.4.1).

*** Detector e. p.**

This display is the actual frequency, in real time, at which the empty pipe oscillator is running. It is a function of not only whether the pipe of full or empty, but also fluid conductivity with a full pipe. Refer to Sub Section 3.3.17 for additional information regarding this item.

*** Reference p/n**

A typical display line of this type might appear as:

Rpn10490. -10520 where "Rpn" = Ref: positive/negative

These numbers represent the last digitized values of the positive and negative reference voltages respectively, which are proportional to coil excitation current. Their values are nominally 10,500 (±10%) and should be matched to 2%. The magmeter coil system and its wiring should be checked if any significant differences from these norms is noted. The reference voltage is measured every 17 seconds in the standard operating mode and every 2 minutes in the Fast operating mode.

NOTE
Firmware versions later than A.20 display the reference voltage directly in millivolts

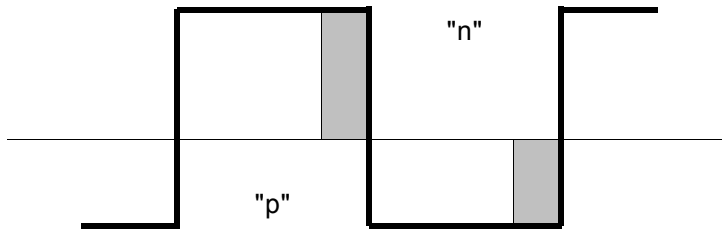
*** Signal p/n**

This parameter represents the magnitude of the flow rate signal being digitized by the analog to digital converter (A/D). A typical display at a liquid velocity of 3 m/s (10 ft/sec) might appear as:

V8p11891.n-5581.0

Measurement of flow rate is effected by digitizing the square wave flow signal during the last 25% of each half excitation cycle.

Typical waveform example:



"p" = positive
"n" = negative
= digitized signal
= zero volts (base line for A/D)

Note the wave form is not perfectly centered about the zero volt reference. This is typically due to DC voltages present at the electrodes and the fact that their influence on signal cannot be completely eliminated.

The flow signal calculated from the waveform above is equal to the "p" value minus the "n" value divided by the gain factor (1, 2, 4, or 8). The significance of the "p" is that this is the portion of the signal which is coincident with positive excitation (reference) voltage. Conversely, "n" values of signal occur during negative excitation. For the example shown numerically and graphically, flow will be:

[11891 - (-5581)]/8 = 2184

Keep in mind that numbers observed while using a flow simulator will be much more stable and repeatable that those seen during actual flow. In fact, the magnitude of the variation is indicative of the amount of process noise (from slurries, etc.) and can assist in determining how much damping to apply and whether to use the digital filter. Instability of these readings observed in the last two or even three places should not be considered a problem, as a substantial amount of signal averaging is used to produce the actual output signal.

The gain factor will automatically change as required by signal conditions. The highest reading that can be made is approximately 16000 counts, while the gain will increase when both readings are below 4500 counts. Also, when the reference is measured every 17 seconds, the readings will display zero for one measurement. For flows in the reverse direction, the outcome of the signal calculation will be a negative number. A flow of 10 m/s (33 ft/sec) will produce approximately 7200 counts.

A second group of displays of real time data as previously described may also be found under Submenu Function Test 3.3.17 Multiplexer. In order to view this item, the Service Code must be active. The items available are Signal, Int. GND, Int. Reference, Analog 2, Analog 1, and Reference. Analog 1, Analog 2, and Int. GND (internal circuit common) should be less than 10 counts positive or negative.

Briefly explained, the others are:

Signal - similar to that described previously, except that the gain factor last used for flow measurement continues to be applied. It is suggested that if signal is to be carefully examined, the parameter under Submenu Display be used.

Int. Reference - this is the value of a precision DC reference voltage source incorporated in the analog ASIC, and typically will read –10,500 counts (±5%).

Reference - this is the digitized reference voltage derived from coil excitation current, and it typically reads 10,500 and –10,500 (±10%).

NOTE
When in the Function Test Submenu, **the converter is off line and will not make an accurate process measurement**. The operator must clear out of this submenu manually.

6. Converter does not appear to be in calibration:

* Using the 55XC2000 or 55XC4000 Flow Simulator, apply input signals representing various points within the range. If the converter checks out properly, the problem may be in the flowmeter, or system interconnection wiring may be defective.

* Re-verify set-up of empty pipe detector

The following problems can only occur if the referenced options are present:

7. "Empty Pipe" message appears on display when pipe is known to be full or does not respond when pipe empties:

Refer to #2 Error-Indications in this section and to Section 3.3.18 for Empty Pipe Detector adjustment and operation.

8. Data link communication does not take place properly:

* Invoke the data link function-test after connecting the converter receive line(s) to the transmit line(s). This is a temporary connection for test purposes.
For the RS485 link, place a jumper between terminals T- and R-,
and another jumper between T+ and R+.
For the RS232-C link, place a jumper between terminals TD and RD.

NOTE
If the action in response to a given problem does not result in correct converter operation, it may be assumed that the converter module is defective and should be replaced.

NOTE
Replacement fuses must be the same as the original type supplied with the converter (i.e., 5x20 mm "T" type), LITTELFUSE type 218. Other type fuses may blow as power is applied.

6.4 Parts List

Reference the converter serial number and model number when ordering the following parts.

6.4.1 Signal Converter Assemblies

Part Number	Power
698B273U01	110/115/120 VAC
698B273U02	110/115/120 VAC w/ HART
698B273U03	220/230/240 VAC
698B273U04	220/230/240 VAC w/ HART
698B273U05	24 VDC
698B273U06	24 VDC w/ HART

6.4.2 Converter Modules

Part Number	Description
D685A606U02	Opto Pulse Output Module
686B742U01	Active Pulse Output Module
D358C018U01	Digital Display Module
686B735U07	Current-Sense Module

Refer to Figures 6-1 through 6-4 for module illustrations.

6.4.3 Fuses

Part Number	Description	Power
151A030U29	.315 A 5x20 mm Type T, LITTELFUSE Type 218	110/115/120 VAC
151A030U30	.160 A 5x20 mm Type T, LITTELFUSE Type 218	220/230/240 VAC
D151B001U16	1.25 A 5x20mm Slo-Blo	24 VDC

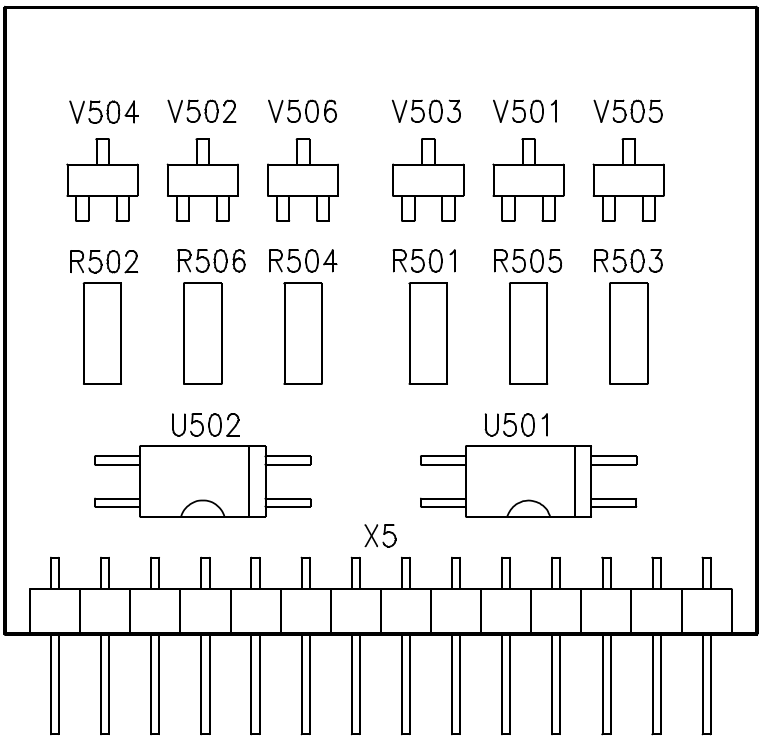


FIGURE 6-1. OPTO PULSE OUTPUT MODULE

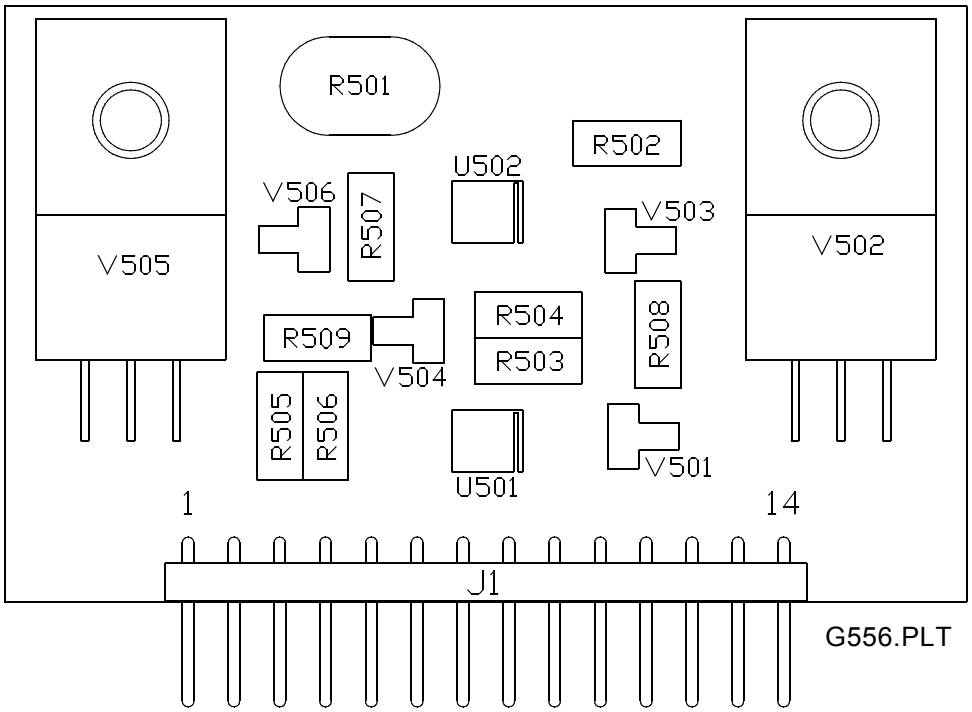


FIGURE 6-2. ACTIVE PULSE OUTPUT MODULE

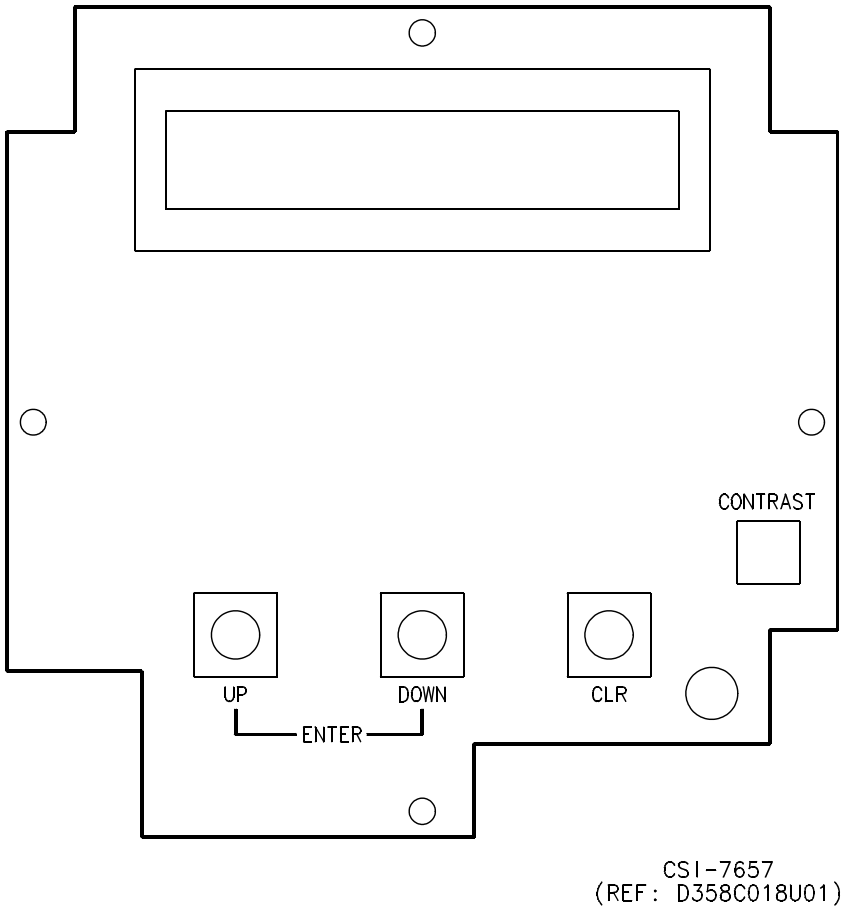


FIGURE 6-3. DIGITAL DISPLAY MODULE

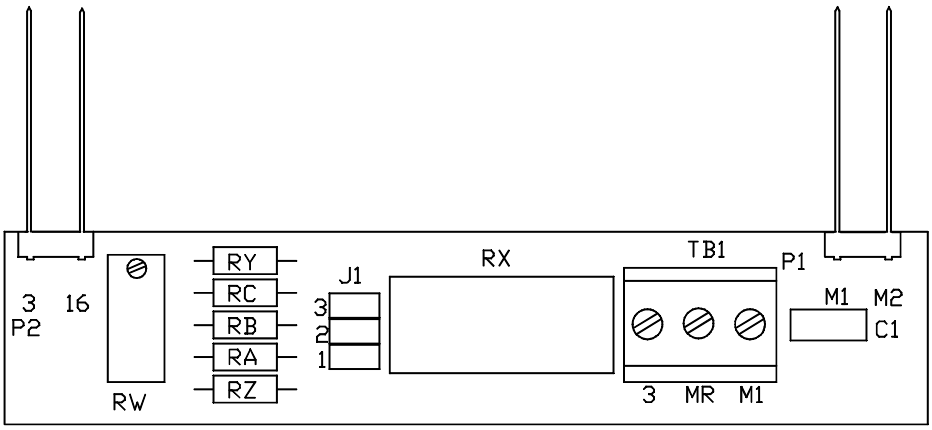


FIGURE 6-4. 686B735U07 CURRENT-SENSE MODULE

APPENDIX A

The 50XM1000 Signal Converter may be configured to have some of the software features of an M2 converter, by proper selection of Switch S401 located on the Digital Board (refer to Figure 1-4). The switch at position number 2 is to be placed into its open (off) position to select 50XM2000 operation. When the converter is powered up, its display will indicate the product name "50XM2000". The Code Number/Service Code entry required for the 50XM2000 is "2000" (See Section 5.4.1). The added features are described in the text which follows.

A.1. Preset Totalizer

This feature permits a desired batch quantity of fluid to be entered into a converter register. A user contact at X1 starts the addition of the batch quantity, and this will cause the converter to open the P1/P2 contact. The converter will in turn signal its completion by closing the P1/P2 contact. After the batch is complete, the totalizer display will continue to accumulate until the flow is either stopped or another batch is invoked.

While the batching feature is in use, the totalizer operates in a difference mode, with any reverse flow subtracting from the accumulated total.

After a batch has been initiated, the converter's totalizer line will display "Q E value_1" until the batch is complete, after which time it will display "Qg value_2", where value_1 is always less than value_2. Alternatively, the display may be configured to multiplex both "Q E" and "Qg" (see Section 3.3.20). It should be noted that whenever a batch is in progress, the "E" symbol will be present on any totalizer line. All totalizer values, both batch size and results, are limited to but permit the same 7 digits associated with other totalizer modes.

To use this feature, the Totalizer and Operating Mode Submenu parameters must first be set to "Preset total." The batch size must be entered into the menu item titled "Preset total", which immediately follows the Range parameter (3.3.4).

Press the Up or Down button to step through the menus.

Submenu Totalizer

Press ENTER and the Up button until the following appears. Then press ENTER.

totalizer funct. Preset total

Press the Up button until the following appears.

Submenu operating mode

Press ENTER and the Up button until the following appears. Then press ENTER.

operating mode Preset total.

Press the ENTER buttons and the displayed value will be replaced by the cursor. Use the Up and Down buttons to enter a batch size. Press ENTER.

Preset total. ----------

The batch process can be started or stopped using the buttons. Pressing ENTER starts or stops the process.

Preset total. start/stop

While the batch is in progress, a "snapshot" of **total** flow through the meter may be observed as "Qg" under Submenu Totalizer.

Press ENTER and the Up button until the following appears.

Totalizer Qg_____

Press CLR to return to the Submenu.

The preset totalizer feature may not be used in concert with the dual range mode described in Section A.2.

A.2. Dual Range Capability

The dual range capability allows greater accuracy in analog applications.

Also available in the 50XM2000 operating mode is a feature which permits the converter to operate in either of two ranges depending on the flow through the meter. Range selection may be accomplished by an external contact closure at terminal X1 or automatically by the converter.

This feature is selected in Submenu Operating Mode as either "2 range, auto.", or "2 Range,ext.". A second range may be selected immediately following the first range. The second range (Range 2) must always be less than the first range (Range 1).

Press the Up button until the following appears.

Submenu operating mode

Press ENTER and the Up button until the following appears. Then press ENTER.

operating mode Preset total.

Press ENTER and the Up button until the following displays appear.

operating mode 2 Range, auto.

operating mode 2 Range, ext.

To enter a selection press ENTER.

Press CLR to return to the Submenu.

Range setting are entered in the Range Parameter 3.3.4.

If the manual (ext.) mode of range change is selected, then the function of the X1 contact will be to activate Range 2 upon its closure. If the display is configured to display a percentage of range or milliampere output, then a numeral 1 or 2 will follow the flow direction indicator to indicate the active range.

When the automatic mode is selected, the converter will change to Range 1 as flow increases above 95% of Range 2 and will revert to Range 2 as flow decreases below 80% of Range 2. In addition, the P1/P2 contact will signal the fact that Range 2 is in operation. As described in the previous paragraph, the flow rate display will also indicate the selected range.

The dual range feature may not be used in concert with the preset totalizer mode described in Section A.1.

A.3. Current-Sense Network

Some Flowmeter systems used with the 50XM1000 remote Signal Converter do not have a coil current sensing circuit mounted inside their Primary housings. Most such primaries are designed for continuous submergence service. In these meters, instead of current sensing being done in the Primary, a small network is mounted within the remote Signal Converter housing. This network, part number 686B735U07, is interposed between the primary coil leads "M1" and "MR" and the converter terminals "3", "16", "M1", and "M2" (Refer to Figures 2-13 & 7-4). The network has been calibrated by the factory so that the system achieves the proper Cal Factor. **Do not make any adjustments to the Current-Sense module**.

Excitation currents between 80 and 550 mA may be set using the moveable jumper (J1) and potentiometer (RW) on the 686B735U07 module. Proper adjustment of a replacement assembly requires the use of a precision constant-current source and low level digital voltmeter. Replacement units ordered from the factory are preset if the system serial number is provided. Consult Tech Support if more information regarding this circuit is required.

ABB (www.abb.com) is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 105,000 people.

www.abb.com/instrumentation

The Company's policy is one of continuous product improvement and the right is reserved to modify the information contained herein without notice.

Printed in USA (January, 2005]

PN25041B

Germany

ABB Automation Products GmbH
Borsigstr. 2
63755 Alzenau
Tel: +49 (0) 6196 800 0
Fax: +49 (0) 6196 800 1849

UK

ABB Ltd
Oldends Lane, Stonehouse
Gloucestershire GL 10 3TA

Tel. +44 (0) 1453 826 661
FAX: +44 (0) 1453 829 671

Italy

ABB SACE S.p.A
Via Statale 113
20016 Lenno (CO)

Tel: +39 0344 58111
Fax: +39 0344 56278

USA

ABB Inc.
125 East County Line Road
Warminster, PA 18974-4995

Tel: +1 215 674 6000
FAX: +1 215 674 7183

China

ABB (China) Ltd
38th Floor Raffles City (Office Tower)
268 Xizang Zhong Lu
Shanghai 200001
Tel: +86 (0)21 61228888
FAX: +86 (0)21 61228892