

**ANALOG SIGNAL CONVERTER**



**SI-7313**

The following is a registered trademark of E. I. DuPont de Nemours & Company:

TEFLON

**The code contained in all memory devices in this product is copyright  
by Fischer & Porter Company 1992.**

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

**NOTICE**

**The instructions given herein cover generally the description,  
installation, operation and maintenance of subject equipment. Fischer &  
Porter reserves the right to make engineering refinements that may not  
be reflected in this bulletin. Should any questions arise which may not  
be answered specifically by these instructions, the questions should be  
directed to Fischer & Porter for further detailed information and  
technical assistance. The material in this manual is for informational  
purposes and is subject to change without notice. Fischer & Porter  
Company assumes no responsibility for any errors that may appear in  
this manual.**

Copyright 1992 Fischer & Porter Company. [March 1992]



ADDENDUM TO  
MAGNETIC FLOWMETER  
INSTRUCTION BULLETINS 50XM1000 AND 50XO1000

**ADDENDUM TO MAGNETIC FLOWMETER  
INSTRUCTION BULLETINS 50XM1000 AND 50XO1000**

The purpose of this addendum is to supply additional information when using the 50XM1000 and 50XO1000 Signal Converters with the 10DX2112 Flowmeter.

When the 50XM1000 Signal Converter is supplied with the 10DX2112 Flowmeter the applicable interconnection diagram to use is Figure 2-5 in the 50XM1000 Instruction Bulletin.

When the 50XO1000 Signal Converter is supplied with the 10DX2112 Flowmeter the applicable interconnection diagram to use is Figure 2-3 in the 50XO1000 Instruction Bulletin.

PN 24618

[Supplements PN 24584 and PN 24422A]

Copyright 1993 Fischer & Porter Company. [December 1993]

---

## Table of Contents

---

<b>READ FIRST</b>	<b>I</b>
<b>1.0 INTRODUCTION</b>	<b>1-1</b>
1.1 General Description	1-1
1.2 Model Number Breakdown	1-6
1.3 Specifications	1-7
<b>2.0 INSTALLATION</b>	<b>2-1</b>
2.1 Inspection	2-1
2.2 Location and Mounting	2-1
2.3 Electrical Interconnections	2-4
2.3.1 General	2-4
2.3.2 Integrally Mounted Signal Converter	2-4
2.3.3 Remotely Mounted Signal Converter	2-5
<b>3.0 START-UP AND OPERATION</b>	<b>3-1</b>
3.1 General	3-1
3.1.1 Introduction	3-1
3.1.2 Placing System On Line	3-4
3.2 Changing Flow Range	3-5
3.3 Changing Signal Converter Output	3-6
3.4 Data Conversion	3-6
3.4.1 Current Output	3-6
3.4.2 Integral Scaler	3-7
3.4.2.1 General Discussion	3-7
3.4.2.2 Scaler Programming	3-7
3.4.2.2.1 Scaling Factor	3-7
3.4.2.2.2 Scaler Preset Procedure	3-8
3.4.3 Unscaled Pulse Output	3-9
<b>4.0 PERFORMANCE VERIFICATION</b>	<b>4-1</b>
4.1 Calibration	4-1
4.2 Performance Verification	4-1
<b>5.0 MAINTENANCE</b>	<b>5-1</b>
5.1 General	5-1
5.2 System Troubleshooting	5-2
5.3 Signal Converter Voltage Check	5-5
5.4 Signal Converter Servicing	5-5
5.5 Parts List	5-6

## Figure List

FIGURE 1-1. METER HOUSING WITH FLOWMETER BOARD .....	1-2
FIGURE 1-2. METER HOUSING WITH INTEGRAL CONVERTER .....	1-3
FIGURE 1-3. REMOTE HOUSING WITH INTERCONNECTION BOARD .....	1-4
FIGURE 1-4. REMOTE HOUSING WITH SIGNAL CONVERTER .....	1-5
FIGURE 2-1. OUTLINE DIMENSIONS, REMOTE MOUNTED SIGNAL CONVERTER .....	2-3
FIGURE 2-2. INTERCONNECTION DIAGRAM FOR INTEGRALLY MOUNTED SIGNAL CONVERTER .....	2-7
FIGURE 2-3. INTERCONNECTION DIAGRAM FOR REMOTELY MOUNTED SIGNAL CONVERTER .....	2-8
FIGURE 2-4. INTERCONNECTION CABLE AND CONDUIT SEAL .....	2-9
FIGURE 3-1. TYPICAL SIGNAL CONVERTER TAG .....	3-1
FIGURE 3-2. OUTPUT BOARD .....	3-2
FIGURE 3-3. POWER SUPPLY BOARD .....	3-3
FIGURE 4-1. TEST WIRING USING SIGNAL SIMULATOR D55XC2000 .....	4-3
FIGURE 5-1. OUTPUT BOARD .....	5-3
FIGURE 5-2. POWER SUPPLY BOARD .....	5-4
FIGURE 5-3. DRIVER MODULE WAVEFORM DIAGRAM .....	5-4

## Table List

TABLE 3-1. SCALER SWITCH SETTINGS .....	3-9
---	-----

# READ FIRST

## WARNING

All Flowmeters and/or Signal Converters being returned to Fischer & Porter 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 F&P for authorization prior to returning equipment.

## NEMA 4X, Corrosion Resistant Finish

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 Fischer & Porter representative to obtain the correct touch-up paint.

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

# 1.0 INTRODUCTION

---

## 1.1 General Description

The F&P 50XO1000 Analog Signal Converter is designed to be compatible with the F&P 10DX3000 Series Pulse DC Flowmeter. The Signal Converter can be integrally mounted with the Flowmeter or remotely mounted in its own enclosure. The Signal Converter uses surface mounted technology to achieve high reliability and compactness.

The Signal Converter supplies a pulsed dc current to the flowmeter magnet coils in order to establish a magnetic field. The magnet driver unit used to power the flowmeter magnet coils is contained in the Signal Converter. The Signal Converter can be supplied with a driver frequency of 7.5 Hz or 15.0 Hz, and current output of 4 - 20 mA or 0 - 20 mA. Additional features of the Converter include switch selectable range setting, integral scaler with active pulse output, zero return input contact and switch selectable damping.

Remote mounting of the Signal Converter is recommended for any or all of the following conditions:

- if the summation of ambient and process temperature is greater than 120° C
- vibration limit of 1.5g from 14 to 200 Hz is exceeded

If a remotely mounted Signal Converter is required, it should be specified at time of purchase. A Flowmeter with a integrally mounted Signal Converter must be returned to F&P for conversion to remote mounting.

Flowmeter/Signal Converter options are illustrated in Figures 1-1 through 1-4.

For information concerning the Flowmeter, refer to the Instruction Bulletin supplied with the Flowmeter.

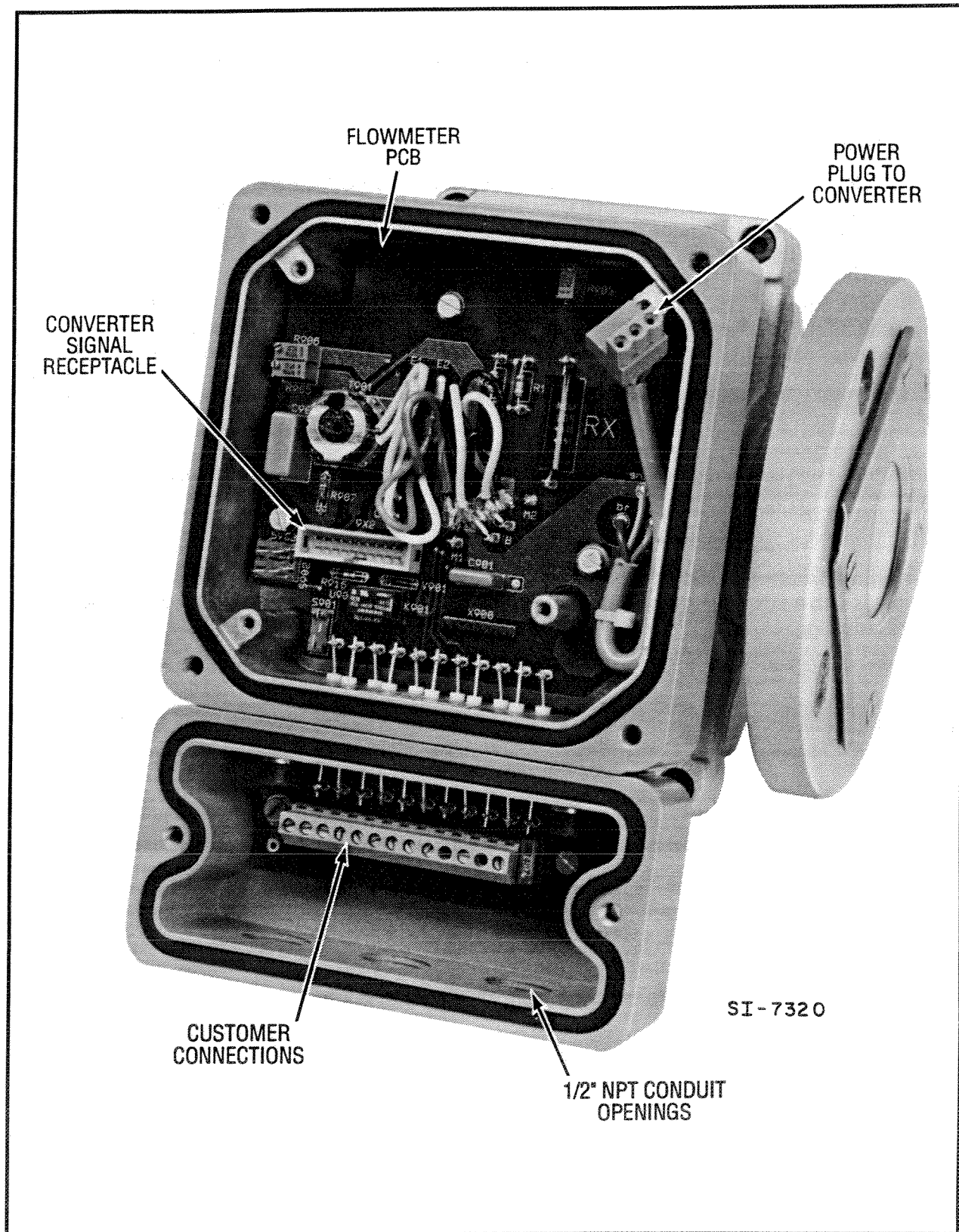


FIGURE 1-1. METER HOUSING WITH FLOWMETER BOARD



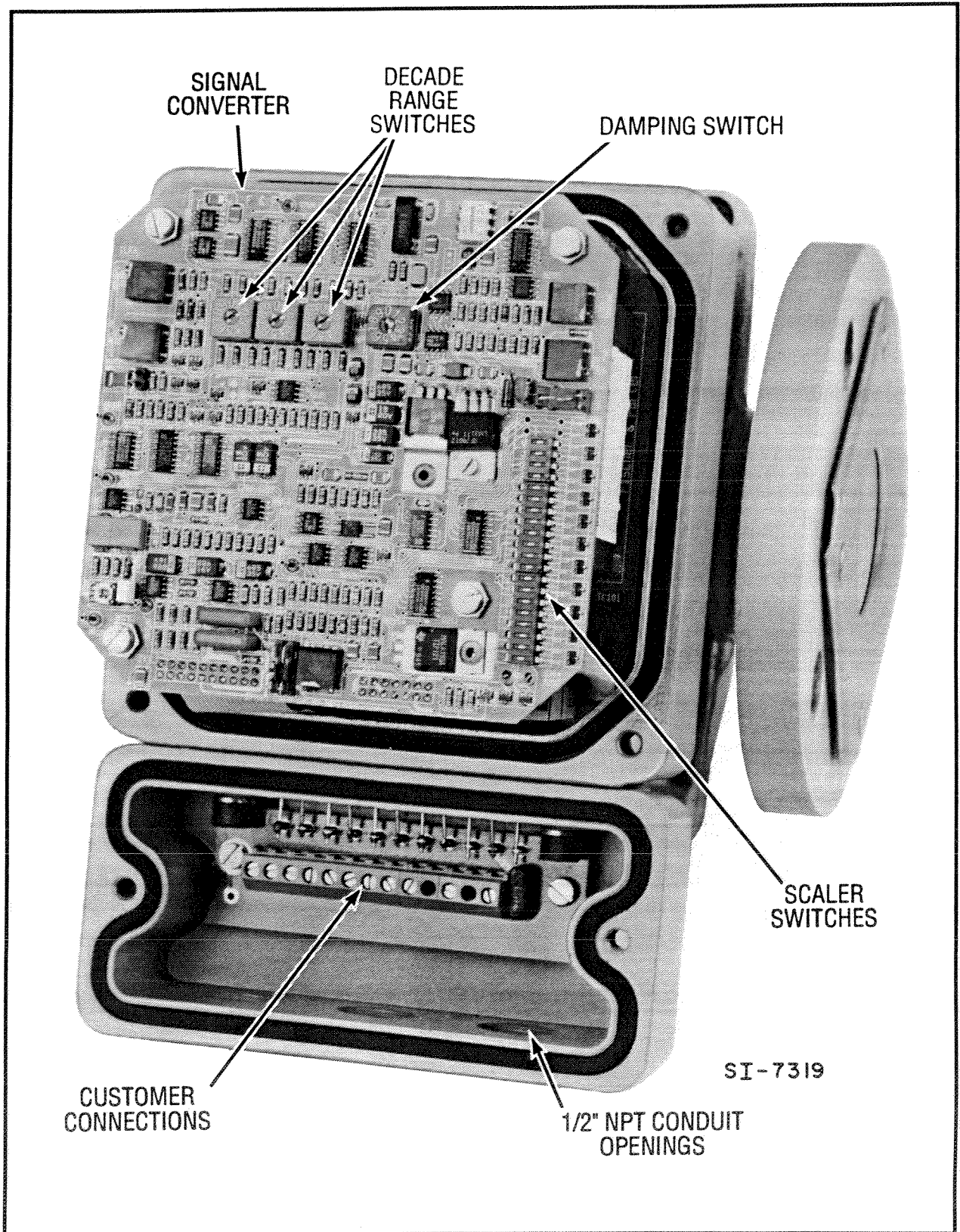


FIGURE 1-2. METER HOUSING WITH INTEGRAL CONVERTER

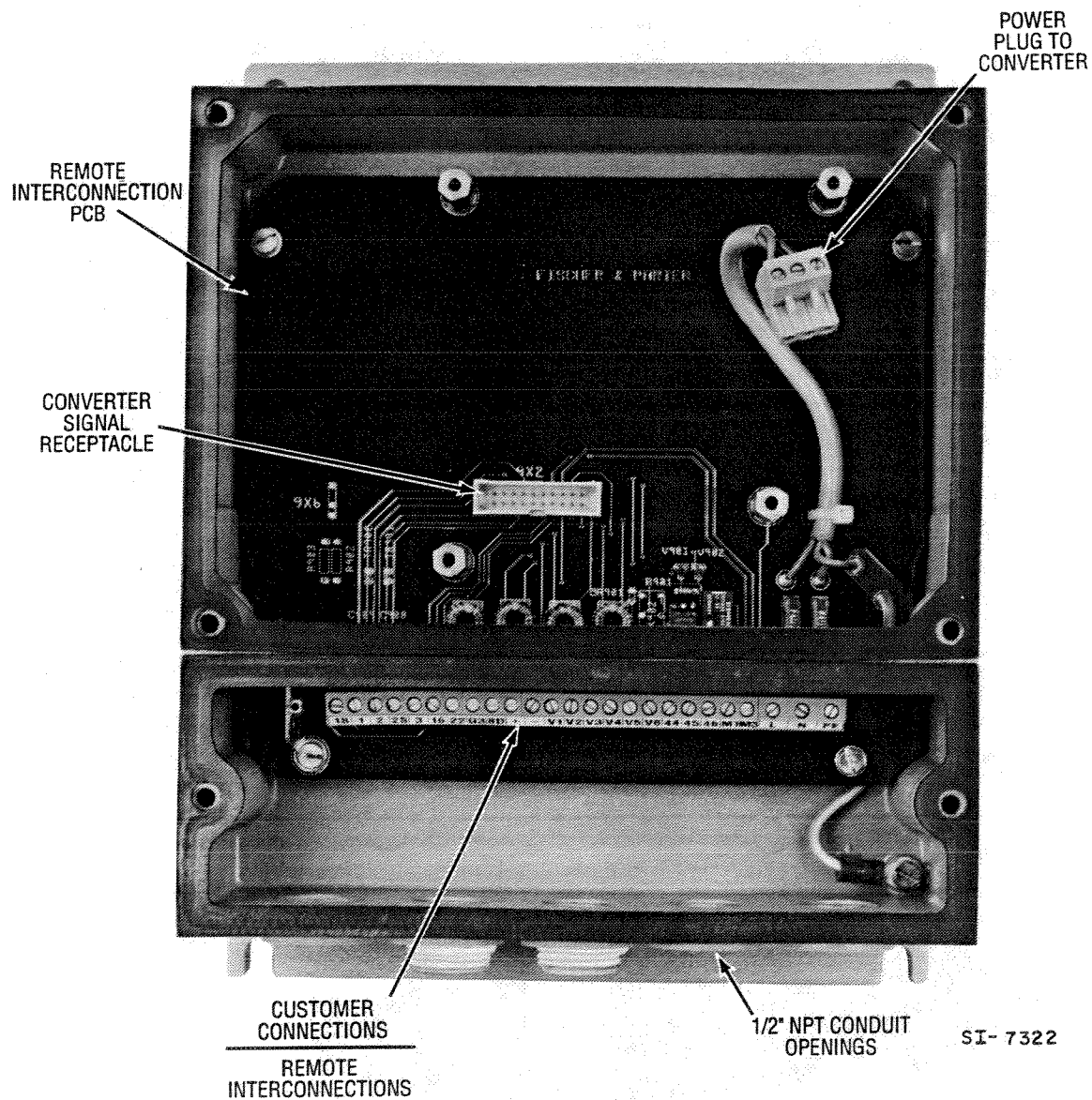


FIGURE 1-3. REMOTE HOUSING WITH INTERCONNECTION BOARD

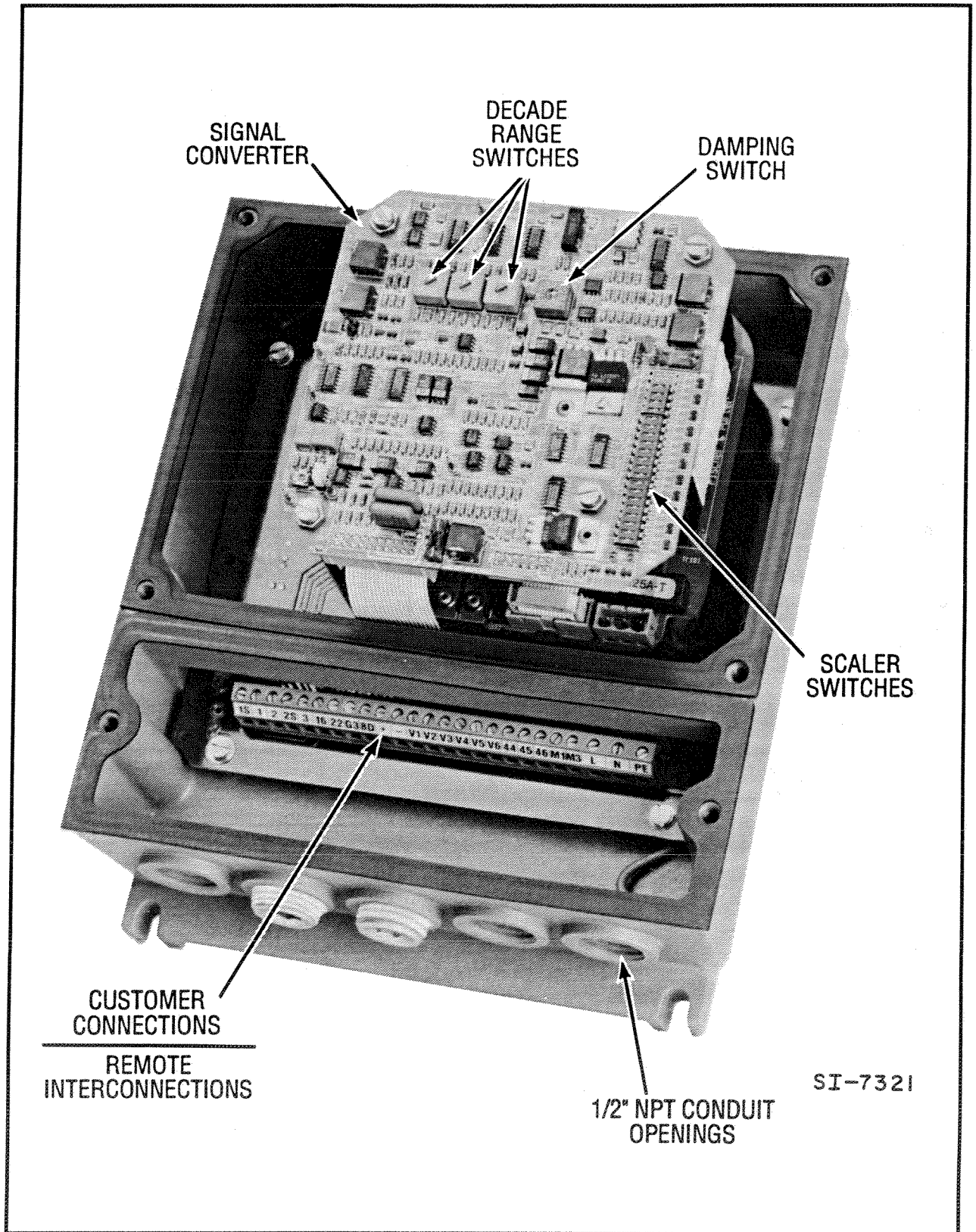


FIGURE 1-4. REMOTE HOUSING WITH SIGNAL CONVERTER

## 1.2 Model Number Breakdown

Refer to the F&P data sheet or the instrument tag on the Converter for the model number of the Converter furnished. The details of a specific model number are defined as follows:

	50XO1		2	A	A		A		2	A
<b>Exciter Frequency</b>										
7.5 Hz (60 Hz)	3									
15 Hz (60 Hz)	4									
<b>Analog Output</b>										
4-20 mA	1									
0-20 mA	2									
<b>Pulse Output</b>										
Active, 24 V, 50 ms	2									
<b>Design Level</b>				A						
<b>Range Selection</b>					A					
0.5 - 9.99 m/s (1.6 - 32.8 ft/s)										
<b>Enclosure (remote)</b>										
NEMA 4X (IEC 529 IP65)						C				
Other						Z				
<b>Options</b>										
None						A				
<b>Power Requirements</b>										
230 V ac, 50/60 Hz							B			
115 V ac, 50/60 Hz							D			
<b>Language</b>										
English								2		
<b>Certification</b>										
None										A

## 1.3 Specifications

### Power Requirements

Voltage	115 V ac $\pm 15\%$ or 230 V ac $\pm 15\%$
Line Frequency	56 - 64 Hz or 47 - 53 Hz
Power Consumption	< 23 VA including flowmeter

### Input Signals

Flow Signal	Approximately 0.4 mV/m/s flow velocity Input impedance at electrode terminals > 1000 Gigohms
External zero return (Terminals G3, 22)	Via contact closure, effective for current and pulse output

### Output Signals

Current Output (Terminals + and -)	4-20 mA or 0-20 mA load resistance 0-750 ohms Isolated from the signal Input and pulse output
Unscaled Pulse Output (Terminals 8D, G3)	0-10 kHz active, 12 V, $R_L > 1$ kohm 5 meters (16.5 feet) maximum cable length
Scaled Pulse Output (Terminals 11, 9) Adjustment range	0-10 kHz input divisible by integers between 1000 and 1,048,575
Pulse width	50 ms
Pulse amplitude	24 V, load > 150 ohms Isolated from the current output and signal input
Range of primary nominal line sizes	1 to 600 mm (.040 to 24 inch)
Reference Voltage	$\pm 70$ mV
Conductivity	> 5 $\mu\text{S/cm}$
Reproducibility	0.2% of measured value or .002 m/s (.006 feet/sec.)
Minimum Response Time	1 second
Switching frequency for exciting the magnetic field	7.5 Hz (6.25 Hz); 15 Hz (12.5 Hz), switch selectable at 60Hz(50Hz) line frequency

**Maximum Excitation Current**       $\pm 0.5$  A

**Maximum Excitation Voltage**      44 V

**Maximum cable length  
between flowmeter and  
signal converter**                      91 meters (300 feet)

**Minimum-maximum range  
setting**                                      0.5 - 9.99 m/s (1.6 - 32.8 ft/s)

**System Zero Setting**                      Factory set in flowmeter

**Damping Settings**                        Decade switch adjustable

<b>Damping Setting</b>	<b>Response Time</b>
0	1 s
1	2.5 s
2 (std.)	4 s
3	5 s
4	7 s
5	9 s
6	10 s
7	12 s
8	14 s
9	15 s

**Low Signal Drop Out**                      Approximately 1% of range  
(effective for scaled pulse output)

**Common Mode Rejection**                      > 80 dB

**Environmental Characteristics**

**Ambient Temperature**                      -25° C to +60° C (-13° F to +140° F)

**Relative humidity**                              10% to 90% non-condensing

**Storage Temperature**                      -40° C to +70° C (-40° F to +158° F)

**Physical Characteristics**

**Enclosure (remote)**

Rating	NEMA 4X (IEC 529 IP65)
Wiring	Five 1/2" NPT openings for conduit in base
Weight	4.2 Kg (9.3 lbs.)
Outline dimensions	Refer to Figure 2-1

**Accuracy at reference conditions**

Pulse/Frequency	0.1% of range or 0.002 m/s (0 to 10% of range) 1% of rate or 0.002 m/s (10 to 100% of range)
Analog output	add an additional 0.2% of rate, + 0.1% of range to the above

## 2.0 INSTALLATION

---

### 2.1 Inspection

The Signal Converter may be supplied as an integrally mounted part of the Magnetic Flowmeter, or in a remotely mounted enclosure such as that shown in the outline dimension diagram of Figure 2-1. When the Signal Converter is supplied as an integral part of the Flowmeter, refer to the Installation Section of the Instruction Bulletin supplied with the Flowmeter for location and mounting requirements.

The Magnetic Flowmeter and Analog Signal Converter are shipped in a heavy-duty container 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 the items included in the shipment is attached to the shipping container.

The equipment should be inspected immediately upon arrival for indications of damage that may have occurred during shipment. All claims of damage should be reported to the shipping agent involved for equipment shipped F.O.B. Warminster, PA, or to Fischer & Porter Company for equipment shipped F.O.B. job site before installation is attempted. In the event damage is such that faulty operation is likely to result, this damage should be brought to the attention of Fischer & Porter Service Department before installation is attempted. 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 recommended that all items be replaced in the shipping container for storage and/or transit to the installation site.

### 2.2 Location and Mounting

#### NOTE

It is the responsibility of the user to provide a water-tight conduit system. The warranty is voided if condensation is permitted to enter the Flowmeter and/or the Signal Converter housings.

The installation site for the remote mounted Signal Converter should be clean, well lighted and adequately ventilated. Also, consideration should be given to access requirements for repair and maintenance of the equipment. The remotely mounted enclosure is designed to meet NEMA 4X standards, and is suitable for indoor and outdoor installation in an environment that is within the temperature, humidity and vibration limits given in Section 1.3.

Mounting dimensions for the wall (flat vertical surface) mounted enclosure are provided in Figure 2-1. The remote housing should be mounted in a vertical position with the 1/2" NPT conduit openings on the bottom. **All conduit entrances must be equipped with cable seals and unused entrances must have pipe plugs installed.** This is required to maintain the NEMA 4X rating. Mounting hardware for wall mounting is supplied by the user.



An alternative mounting option permits the remote Converter housing to be mounted to a 2-inch horizontal or vertical pipe. The pipe clamping brackets and mounting hardware are supplied by F&P. Insert the two 5/16-18 x 3-3/4" long bolts into the holes provided in the pipe mounting bracket. Orient the bracket as required for vertical or horizontal pipe. As shown in Figure 2-1, this pipe mounting bracket must be attached to the rear of the Converter enclosure. Four 1/4-20 x 1/2" long selftapping screws are supplied with the pipe mounting kit for attaching the bracket. To mount the Converter, place the housing with the attached bracket against the mounting pipe with the pipe between the two 3-3/4" long bolts. While supporting the housing, install the pipe clamping bracket, flat washers and hex nuts. Tighten the nuts alternately to maintain even pressure distribution across the clamping bracket. Check that the Converter housing is plumb before securing.

The housing covers are removable to facilitate access for installation and maintenance. For installation remove the covers from the housings by loosening the screws on the covers. Replace the covers when the installation has been completed.

**WARNING**

**Equipment powered by ac line voltage constitutes a potentially lethal electric shock hazard. Installation and servicing of the Signal Converter should only be attempted by a qualified technician.**

**Make certain that the power input leads are disconnected from the operating branch circuit before attempting electrical connections.**

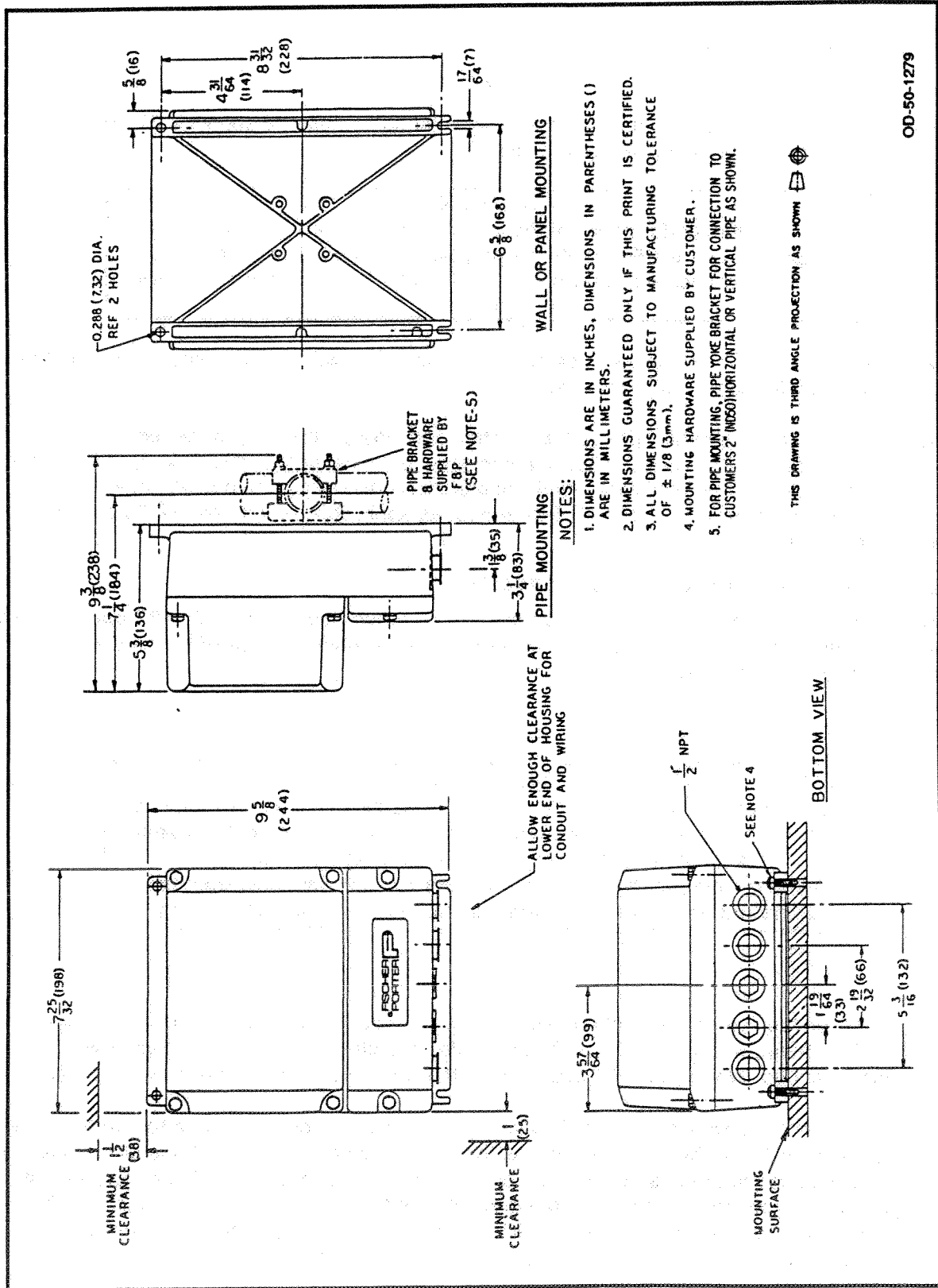


FIGURE 2-1. OUTLINE DIMENSIONS, REMOTE MOUNTED SIGNAL CONVERTER

## 2.3 Electrical Interconnections

### 2.3.1 General

The interconnection diagrams for the Magnetic Flowmetering System are shown in Figures 2-2 and 2-3, which supplement the following discussion.

#### CAUTION

For optimum performance of the Magnetic Flowmetering System it is important that the Flowmeter be properly grounded. The appropriate grounding procedure is discussed in the Instruction Bulletin provided with the Flowmeter.

Verify that the installation site has a source of power compatible with the instrument. Refer to the instrument data tag for power requirements.

The use of metal conduit provides physical protection and aids significantly in the reduction of induced RFI signals. For FM approved instruments used in nonhazardous locations, all wiring shall comply with the national electrical code and local electrical code requirements. All boxes, fittings and seals are to comply with Articles 501, 502 or 503, as applicable, of ANSI/NFPA 70 and local electrical code requirements.

### 2.3.2 Integrally Mounted Signal Converter

Interconnection wiring enters the junction box on the Flowmeter housing via 1/2" NPT openings. All external interconnection wiring is to be enclosed within metal conduit (supplied by the user). Recommended procedure follows.

#### WARNING

Equipment powered by ac line voltage constitutes a potentially lethal electric shock hazard. Installation and servicing of the Signal Converter should only be attempted by a qualified technician. Make certain that the power input leads are disconnected from the operating branch circuit before attempting electrical connections.

1) Loosen the two screws and remove the instrument's junction box cover. The terminals accept a bared wire which enters the hole below the clamp screws; solid copper wire is recommended. When stranded wire is used, the wire end should be tinned with solder.

2) Connect the power supply (refer to voltage specified on the meter data tag) to terminals L/L1 and N/L2. For the ac power supply, the black wire should be the phase side of the line and connected to terminal (L/L1); the neutral or white wire to terminal (N/L2). Equipment grounding is affected by connecting a green colored wire to the ground terminal cast into the junction box; the other end of this wire is connected to the protective ground at the power source. Refer to the Flowmeter Instruction Bulletin for additional information.

**CAUTION**

For servicing and protection of the equipment, the customer should install a disconnect switch, and suitably sized fuse or a suitably sized circuit breaker in the incoming power line; maximum power consumption is 23 VA.

- 3) The analog current output signal lines are the plus (+) and minus (-) terminals. Connect these terminals to like terminals on the receiving equipment; i.e., plus to plus and minus to minus. Only one signal ground should be used. The output load must be within the range of values given on the interconnection diagram (Figure 2-2).
- 4) If the zero return feature is to be used, connect terminals 22/Z1 and G3/Z2 to a pair of non-powered field contacts. This contact pair shall close to indicate a no flow condition; e.g., the auxiliary contacts in the process supply pump motor starter close when the pump is shut off, or the limit switch contacts close when the supply valve is closed.
- 5) For the scaler pulse output, connect terminals 9 (-) and 11 (+).
- 6) When the installation is complete, replace all electrical box covers. **All conduit entrances must be equipped with cable seals and unused entrances must have pipe plugs installed.**

### 2.3.3 Remotely Mounted Signal Converter

Wiring between the Flowmeter and the remotely mounted Signal Converter is by an interconnection cable furnished by Fischer & Porter Company; a 30 foot cable is standard. This wiring must be installed in a metal conduit. For distances less than this, the cable can be shortened. Do not cut the cable too short; allow at least 4-6 inches of wire in the meter's junction box and the remote Converter box. Refer to interconnection diagram shown in Figure 2-3.

**WARNING**

**Equipment powered by ac line voltage constitutes a potentially lethal electric shock hazard. Installation and servicing of the Signal Converter should only be attempted by a qualified technician.**  
**Make certain that the power input leads are disconnected from the operating branch circuit before attempting electrical connections.**

- 1) At the flowmeter location, loosen the two corner captive screws and remove the junction box cover. Observe the terminal barrier strips and markers. These terminals will accept the bared conductor wire and shield of the interconnection cables. The wire enters the hole below the clamp screw on the terminal strip. Attach the interconnection cable to the junction box using the conduit seal indicated in Figure 2-4.
- 2) The interconnection cable consists of four coaxial cables and a ground wire. Note that the (M1 & M2/M3) wires use the larger cable designated 'A' (in the illustration) and is a type RG-58A/U coaxial cable; no cable substitution is allowable. The other three wires designated B, C, & D are type RG 174/U coaxial cable. Cable D attaches to terminal 16 and its shield to 3. Cables B & C attach to terminals 1 and 2 respectively; the shields terminate and are not attached at the flowmeter end of the cable.
- 3) Replace the junction box cover to complete the wiring at the flowmeter location.

- 4) At the remote mounted Signal Converter location, remove the junction box cover of the Converter by loosening the two screws. Two 1/2" NPT pipe plugs are supplied in the base of the enclosure. Unused openings must be plugged to maintain the NEMA 4X rating.
- 5) Feed the end of the interconnection cable through the conduit connector and attach the ends to the appropriate terminals. Cables designated 'B and C' connect to terminals 1 and 2, with there corresponding shields to connections 1S and 2S.
- 6) Connect the power supply (voltage specified on the meter data tag) to terminals L/L1 and N/L2. For the **ac power supply**, the black wire should be the phase side of the line and be connected to terminal (L/L1); the neutral or white wire to terminal (N/L2). Equipment ground is affected by connecting a protective ground wire to the ground terminal cast into the enclosure; the other end of this wire is connected to the protective ground at the power source.

**CAUTION**

For servicing and protection of the equipment, the customer should install a disconnect switch and suitably sized fuse or a suitably sized circuit breaker in the incoming power line; maximum power consumption is 23 VA.

- 7) The analog output signal lines are the plus (+) and minus (-) terminals. Connect these terminals to like terminals on the receiving equipment; i.e., plus to plus and minus to minus. Only one signal ground should be used. The output load should be within the value given under Specifications and on the Interconnection Diagram.
- 8) If the zero return feature is to be used, connect terminals 22/Z1 and G3/Z2 to a pair of non-powered field contacts. This contact pair shall close to indicate a no flow condition; e.g., the auxiliary contacts in the process supply pump motor starter close when the pump is shut off or the limit switch contacts close when the supply valve is closed.
- 9) For the scaler pulse output, connect terminals 9 (-) and 11 (+).
- 10) When the installation is complete, replace all electrical box covers. **All conduit entrances must be equipped with cable seals and unused entrances must have pipe plugs installed.**

## TERMINAL ASSIGNMENT TABLE

a) FIELD CONTACTS. ZERO RETURN FIELD CONTACTS TO CLOSE WHEN METER SUPPLY PUMP OR VALVE STOPS FLOW THROUGH METER. TERMINALS 22 & 63 REMAIN OPEN IF THIS FEATURE IS NOT USED.

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

c) SCALED PULSE OUTPUT, ACTIVE, 24 Vdc,  
LOAD  $>150$  OHMS

d) POWER SUPPLY - 120 Vac, 60 Hz, 10; OR  
24 Vdc (AS SPECIFIED ON DATA TAG)

## 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.

FM

APPROVED

220/240 V INSTRUMENTS NOT INCLUDED

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

DUST-IGNITIONPROOF FOR CL II, DIV 1, GP E, F &amp; 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.

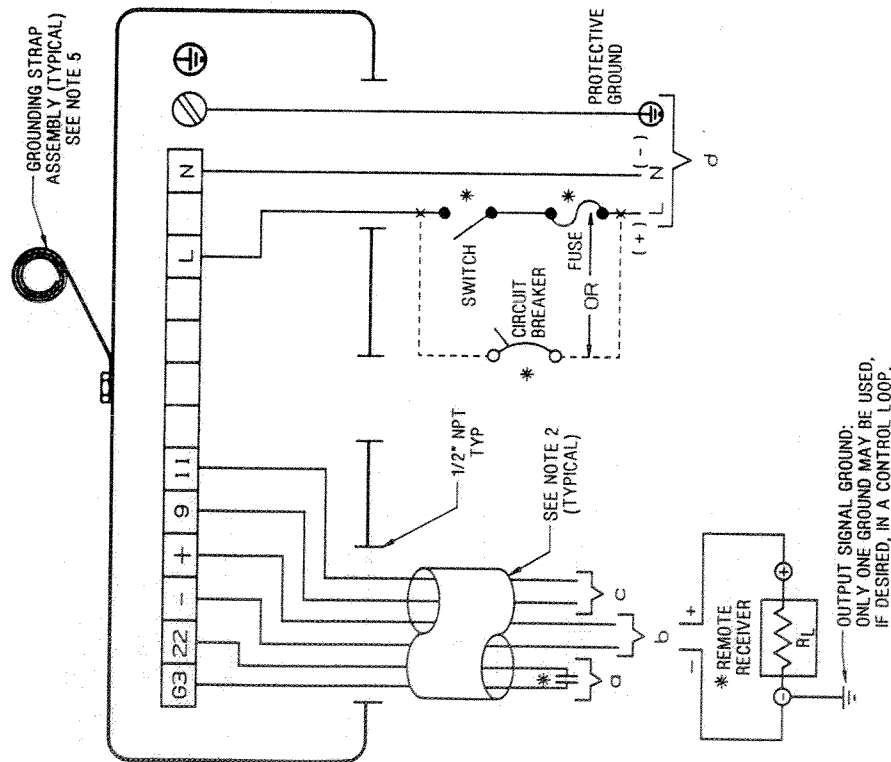
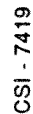
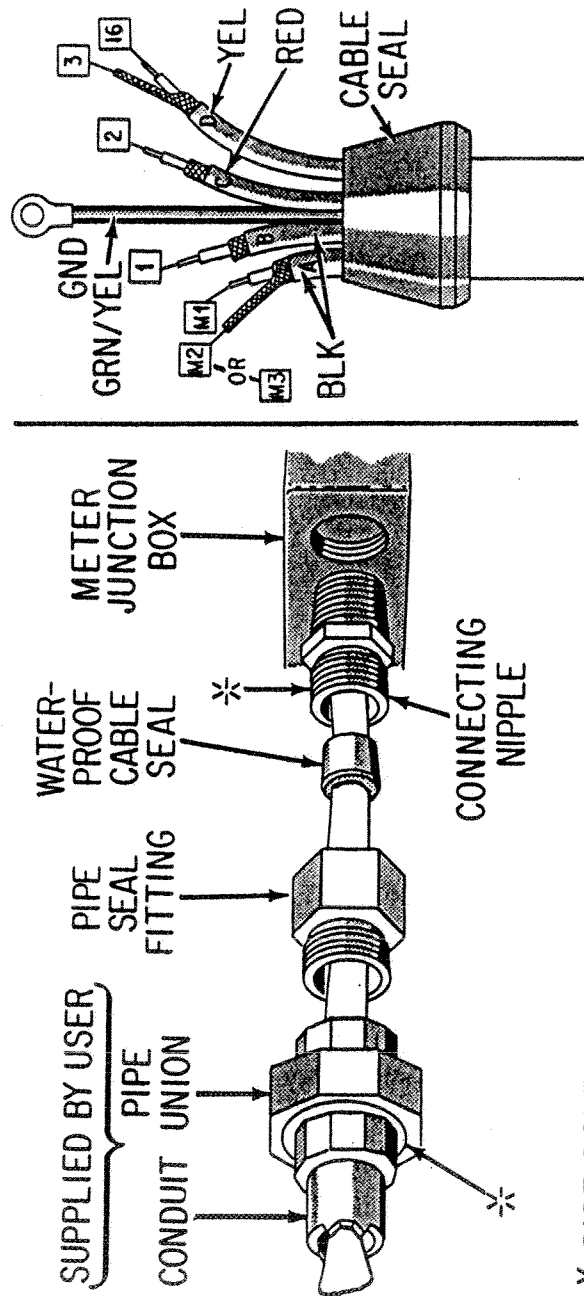


FIGURE 2-2. INTERCONNECTION DIAGRAM FOR INTEGRALLY MOUNTED SIGNAL CONVERTER



**FIGURE 2-3. INTERCONNECTION DIAGRAM FOR REMOTELY MOUNTED SIGNAL CONVERTER**

### USED WITH REMOTE MOUNTED CONVERTER ONLY



\* PIPE DOPE OR TEFLON TAPE TO BE USED ON ALL EXCEPT THESE STRAIGHT THREADS.

NOTE: TO FACILITATE CABLE TERMINATION, IDENTIFY EACH CABLE BEFORE INSTALLATION.

338D350U01

FIGURE 2-4. INTERCONNECTION CABLE AND CONDUIT SEAL



## 3.0 START-UP AND OPERATION

### 3.1 General

#### 3.1.1 Introduction

The F&P Magnetic Flowmetering System (which includes the integral or remote Signal Converter) is precision calibrated at the factory for the values stated on the instrument tag. If specific values were not specified at the time of order, the meter is calibrated at a maximum flow rate corresponding to approximately 10 feet/second liquid velocity and for a 4-20 mA current output span. In either case, the calibration data is noted on the Converter data tag (refer to Figure 3-1).

There are no operating controls that require field adjustment unless the full scale range setting was not specified. If a change in the full scale range setting is required, refer to paragraph 3.2. If no change is required, the equipment is ready for operation as received.

Prior to initial system start up, verify that the meter is properly installed; check flow direction and wiring interconnection as discussed in the Section 2.0. Particular attention should be paid to the meter grounding procedures; improper grounding will result in unsatisfactory performance. Refer to the Instruction Bulletin supplied with the Magnetic Flowmeter for the correct magmeter grounding procedure.

Verify that the shorting block on the output board is in the correct frequency location:  
BR201 = 15Hz, BR202 = 7.5 Hz (refer to Figure 3-2).

Verify that switch S102 is in the normal operating (closed) position and switch S101 is in the applicable 7.5 or 15 Hz position (refer to Figure 3-3).

Frequency settings must agree with the frequency stated on the Converter data tag. Incorrect frequency settings may result in calibration errors.

Start flow through the process piping system that includes the meter. Allow flow through the pipeline for several minutes to purge entrapped air. The pipe line must be full for accurate flow measurement.

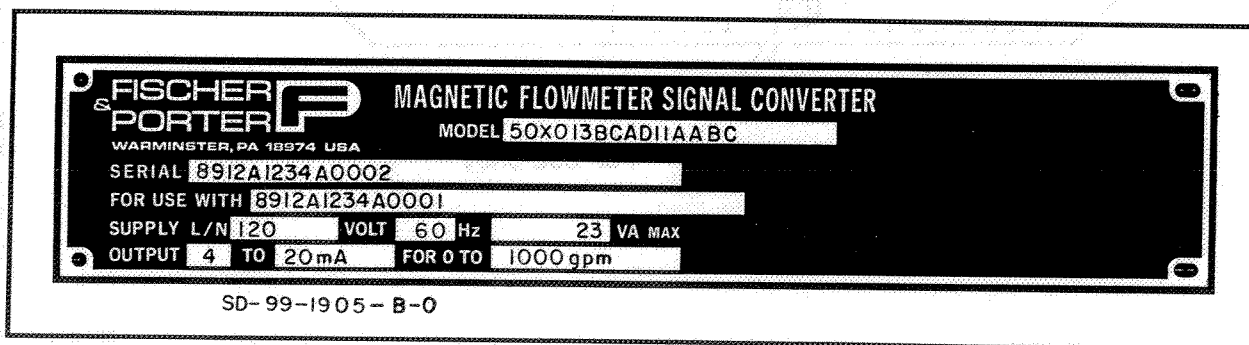


FIGURE 3-1. TYPICAL SIGNAL CONVERTER TAG

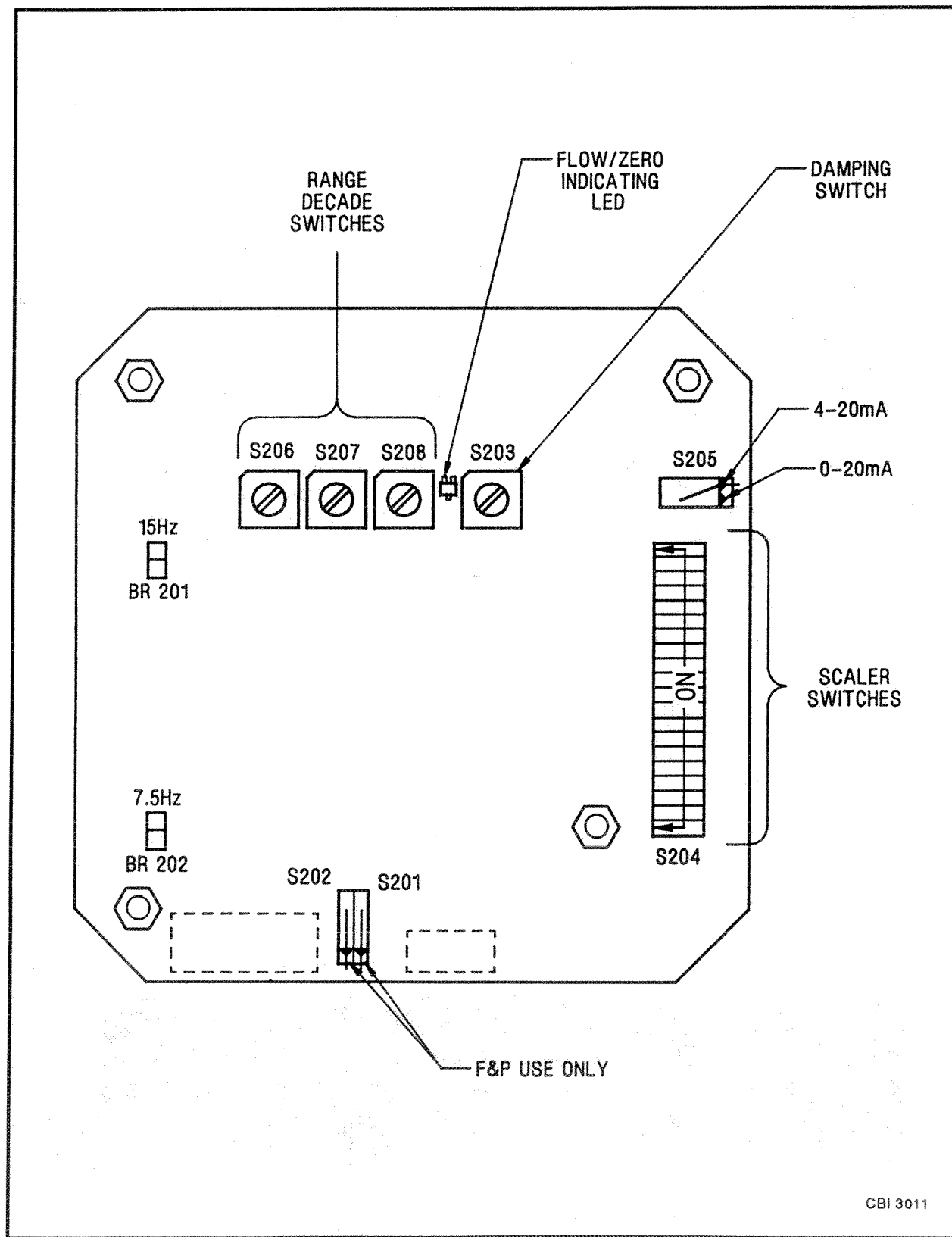


FIGURE 3-2. OUTPUT BOARD

CBI 3011

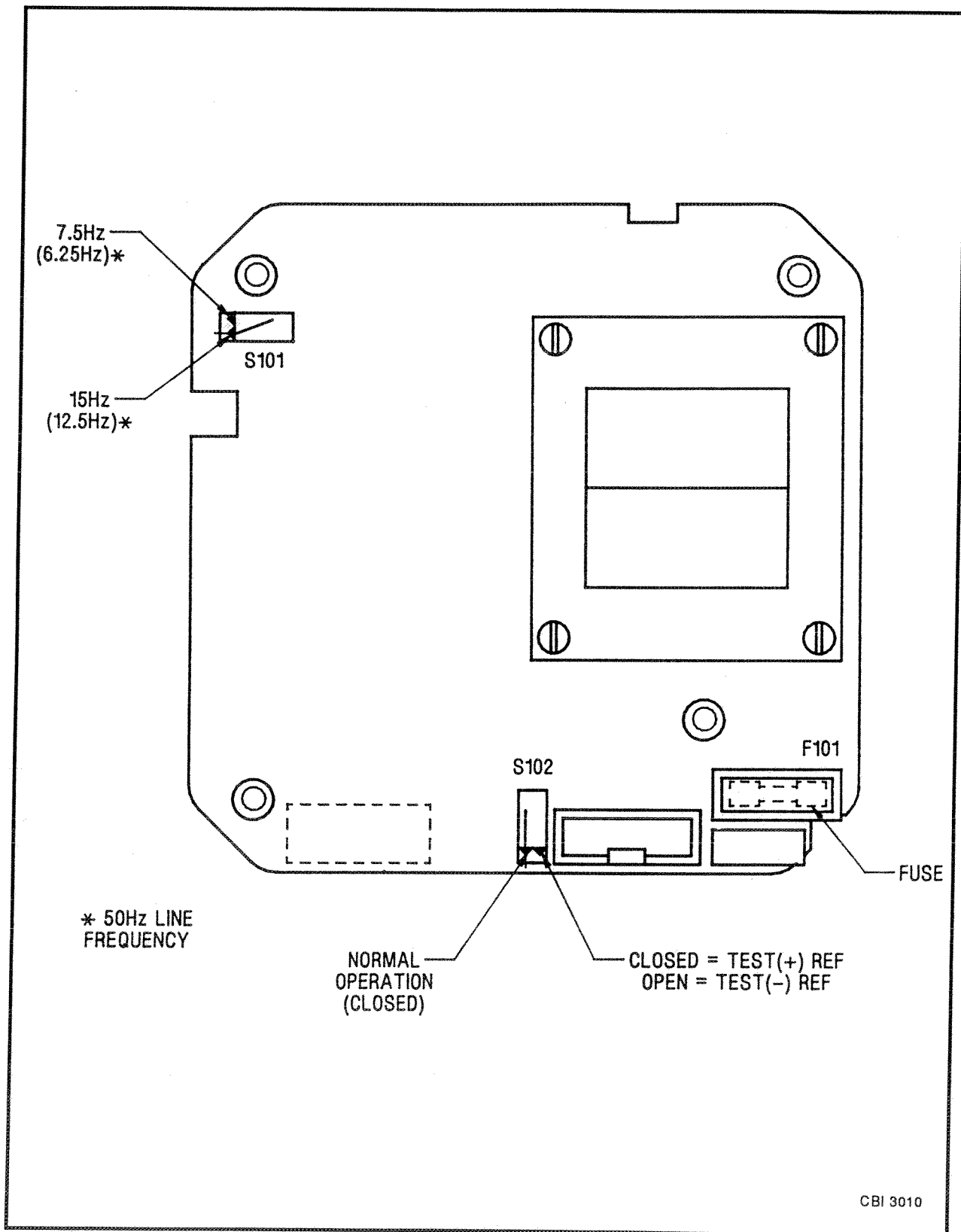


FIGURE 3-3. POWER SUPPLY BOARD

### 3.1.2 Placing System On Line

- 1) Apply the ac power to the Magnetic Flowmeter or remotely mounted Converter by closing the external switch or circuit breaker; there are no power switches inside of the equipment. Also energize any auxiliary equipment associated with the flow metering system such as remote analog recorders, controllers or rate indicators. Typical warm-up time for the Converter is approximately 30 minutes.
- 2) Start process flow through the pipeline. Flow measurement and concurrent output signal transmission will commence with flow through the meter.
- 3) The damping setting is factory set at position 2 (4 seconds), which is satisfactory for most operations. Additional damping settings are available via the damping switch located on the Signal Converter. Refer to Figure 3-2 for location of the Damping Switch. Damping settings and response times are shown below.

Damping Setting	Response Time
0	1 s
1	2.5 s
2 (std.)	4 s
3	5 s
4	7 s
5	9 s
6	10 s
7	12 s
8	14 s
9	15 s

- 4) The zero return feature is automatically operative if terminals Z1/22 and Z2/G3 are connected to a customer furnished field contact; if unconnected the feature is disabled. The zero return feature provides a positive zero output signal immediately following the shutdown of a pipeline. This feature should be used for any or all of the following reasons:

- forward and reverse surges exist in a pipeline, causing a pulsing output signal when there is no flow
- the pipeline empties causing the liquid to lose contact with the electrodes
- output signals are used for billing or other processes dependent upon actual total registry (if the above are present)

An empty pipeline causes an erratic output.

- 5) The Converter has a pulse dropout feature, which prevents the scaled pulse output from operating whenever the flow is below 1% of the range value. This prevents flow totalization when flows are not significant.

- 6) The Converter Output Board has an indicating LED which determines whether a flow or no-flow condition exists in the pipe line. For any flow above 0.2% of range, the LED will be on continuously. When a zero flow condition exists, the LED will flash several times per second. If the LED is off and there is a known flow, the electrode signal wires may be reversed or there may be reverse flow in the pipeline.

### 3.2 Changing Flow Range

The Converter data tag (see Figure 3-1) shows the full scale span setting for which the range adjustment was factory set. The procedure to change the range adjustment is given below.

**NOTE**

The flow rate and the meter capacity must be in the same flow measurement units.

Example:

A 150 mm (6") meter with a 4-20 mA current output, calibrated for a 0-1800 gpm flow span:

$$100\% \text{ full scale} = 20 \text{ mA} = 1800 \text{ gpm}$$

To change the full scale setting to some other flow rate, obtain the meter capacity from the factor tag attached to the electronic base of the magnetic flowmeter.

The typical factor tag for a 6 inch meter will have a meter capacity of 2641 gpm. Using this information and the 100% full scale flow rate value in the following example, the new setting for the decade range switches on the Converter may be calculated.

Use the example below as a guide to obtain a new setting:

Example: To change the full scale span from 0-1800 gpm to 0-2000 gpm.

1) Calculate the required range setting as follows:

$$\begin{aligned} \text{Range setting} &= \frac{1000 \times \text{flow at 100\%}}{\text{meter capacity}} \\ &= \frac{1000 \times 2000 \text{ gpm}}{2641} \\ &= 757.289 \end{aligned}$$

2) Round this number to the nearest integer (757).

3) **With the metering system de-energized**, remove the Signal Converter cover and set the three decade range switches to the calculated value. Figure 3-2 shows the location of the decade range switches. Replace the Signal Converter cover.

The flow metering system is now preset for the new full scale flow rate value. No recalibration of the analog current or frequency output signal is required.

**NOTE**

Signal Converters are directly interchangeable between meters. However, it is necessary to preset the range switches for the full scale span setting.

### 3.3 Changing Signal Converter Output

The output signal of the Signal Converter may be either 4-20 mA or 0-20 mA. Changing the output is possible by changing the position of switch S205 on the Signal Converter as shown in Figure 3-2.

#### NOTE

When interchanging Signal Converters for servicing, verify that S205 switch selection is compatible with the required output signal.

### 3.4 Data Conversion

#### 3.4.1 Current Output

The analog current output signal (4-20 mA or 0-20 mA) is a linear function that varies in direct proportion to the volumetric flow rate through the meter. The maximum output current of 20 mA corresponds to the 100% full scale span setting and the minimum output (typically 4 mA) corresponds to 0% scale value.

The output signal at any metered output can be calculated as follows:

$$I_{out} = [ (I_{max} - I_{bias}) \times \% \text{ scale} ] + I_{bias}$$

Example: Assume a metered flow of 80% scale - calculate the output signal for a 4-20 mA range output.

$$I_{out} = [ (20 \text{ mA} - 4 \text{ mA}) \times 0.80 ] + 4 \text{ mA}$$

$$I_{out} = (16 \text{ mA} \times 0.80) + 4 \text{ mA} = 16.8 \text{ mA}$$

The analog output signal can be converted to a voltage signal by selection of the appropriate range resistor by use of Ohm's law

$$E = I \times R$$

Example: A recorder requires a 1-5 V input signal (span = 4 V dc) that is being received from the flowmeter as a 4-20 mA signal. Calculate the resistor value required for this conversion.

$$R = \frac{\text{Instrument Voltage Span (1-5 V dc)}}{\text{Signal Current Range (0.004 - 0.020 A)}}$$

$$R = \frac{4 \text{ V dc}}{0.016 \text{ A}} = 250 \Omega$$

A precision resistor,  $\pm 0.1\%$ , 0.5 W may be used.

Using the previous examples, the voltage output for a 1-5 V signal range at 80% scale would be:

$$E = 0.0168 \text{ A} \times 250 \Omega = 4.2 \text{ V dc}$$

### 3.4.2 Integral Scaler

#### 3.4.2.1 General Discussion

The integral Scaler can provide a 0-10 Hz scaled output in the form of a 24 V pulse. The Scaler assembly is driven by the 0-10 kHz signal applied to the Opto coupler, U202, on the Output Board. Therefore, the analog signal output can be used in conjunction with the scaled frequency output. Use of the scaler permits conversion of the flow information to a direct reading signal in the measurement unit desired. Refer to Figure 3-2 for location of scaler switches.

The 0-10 Hz, 24 Volt output with 50 ms pulse duration is generally used to drive remote electromechanical registers, predetermining counters, etc. To obtain a scaled pulse output, connect the receiving instrument to terminals V1/9 (common) and V2/11 (+).

#### 3.4.2.2 Scaler Programming

##### 3.4.2.2.1 Scaling Factor (SF)

When the actual flow rate range and the desired measurement unit desired for the scaled output are supplied to F&P at time of order, the Scaler can be factory programmed. In this case, the Scaler will not require programming in the field unless one of the following conditions occurs:

- When it is desired to change the engineering measurement unit previously specified to some other volumetric or gravimetric unit, e.g., U.S. Gallons to Imperial Gallons, etc.
- When the specified maximum flow rate is to be changed, thereby changing the relationship between maximum flow rate and frequency at 100% span.

To establish the Scaling Factor (SF) proceed as follows:

$$SF = \frac{f_{\max} \times C_t \times M}{Q_{\max}}$$

where:

$f_{\max}$  = 10,000 Hz (regardless of full scale range setting)

$Q_{\max}$  = full scale flow rate in engineering units per unit of time

$C_t$  = time constant is the number of seconds in the time unit of the engineering measurement unit. For example, when measuring in GPM, the time constant is 60 seconds (number of seconds in a minute). When measuring in GPH the time constant is 3600 seconds (number of seconds in an hour).

$M$  = multiplier; e.g., gallons/pulse (X1, X10, X1000)

Typically, assuming maximum flow rate is 400 gpm and the scaled frequency is to represent 1 gallon flow increments, then:

$$SF = \frac{10,000 \times 60 \times 1}{400} = 1500$$

When using the 0-10 Hz output verify that the output frequency will not exceed the maximum counting rate of the electromechanical counter (10 Hz typical). The maximum scaled output frequency can be computed as follows:

$$\begin{aligned} f_{out} &= \frac{f_{\max \text{ unscaled}}}{SF} \\ &= \frac{10,000}{1500} \\ &= 6.6 \text{ Hz} \end{aligned}$$

The multiplier selected must be compatible with both the scaled output frequency and the required readout resolution. For example, with smaller size meters it is possible to display in gallon or 0.1 gallon flow increments, whereas larger size meters may require readout in 10's or 100's of gallons. Note that only whole numbers (integers) can be preset in the binary "weighted" scaling switches and the practice of rounding off numbers will result in a proportional cumulative error.

For example: SF = 1213.6

The recommended Scaler preset value for 0.1% accuracy would be 1214.

#### 3.4.2.2.2 Scaler Preset Procedure

Obtain the scaling factor(SF) preset value for the particular application as discussed above. The Scaler uses 20 individual switches that are assigned "weighted" values in accordance with powers of the "base 2". Setting a switch ON causes its "weight" to be subtracted from the previous value. Setting several switches performs successive subtraction. These are slide type switches that can be preset (ON or OFF) by use of a test probe. Only those switches required for the particular scaling factor should be in the ON position (all others OFF). The binary-decimal weighted values for each switch are given in Table 3-1. Assuming a SF of "1519", the applicable switch program is as follows:

Successive Subtraction	Switch Program
1519	
<u>-1024</u>	M on
495	
<u>-256</u>	K on
239	
<u>-128</u>	J on
111	
<u>-64</u>	H on
47	
<u>-32</u>	F on
15	
<u>-8</u>	D on
7	
<u>-4</u>	C on
3	
<u>-2</u>	B on
1	
<u>-1</u>	A on



**TABLE 3-1. SCALER SWITCH SETTINGS**

Scaling Switches	$2^n$	Binary-Decimal Switch Weight
X	$2^{19}$	524,288
W	$2^{18}$	262,144
V	$2^{17}$	131,072
U	$2^{16}$	65,536
T	$2^{15}$	32,768
S	$2^{14}$	16,384
R	$2^{13}$	8,192
P	$2^{12}$	4,096
N	$2^{11}$	2,048
M	$2^{10}$	1,024
L	$2^9$	512
K	$2^8$	256
J	$2^7$	128
H	$2^6$	64
F	$2^5$	32
E	$2^4$	16
D	$2^3$	8
C	$2^2$	4
B	$2^1$	2
A	$2^0$	1

### 3.4.3 Unscaled Pulse Output

A 0 to 10 kHz output representing 0 to 100% of the Converter range setting is available at terminals 8D and G3 (common). The 30  $\mu$ s logic pulse has an amplitude of 12 volts and will drive a 1000 ohm minimum load over a maximum distance of 15 feet. The pulse output may be used in conjunction with an electronic frequency counter.

## 4.0 PERFORMANCE VERIFICATION

### 4.1 Calibration

Calibration of the 50XO1000 should not be required during the normal service life of the Converter. Periodic performance verification of accuracy may be required. Should the Converter experience a failure, the Converter must be returned to F&P for repair and calibration.

#### WARNING

Equipment powered by an ac line voltage presents a potentially lethal electric shock hazard. Installation and servicing of the Magnetic Flowmeter and Signal Converter should only be attempted by a qualified electronics technician.

Make certain that the power input leads are disconnected from the operating circuit before attempting electrical connections.

### 4.2 Performance Verification

Converter accuracy can be verified on a periodic basis by connecting it to a 55XC2000 flow simulator, as shown in Figure 4-1. An electronic frequency counter, precision load resistor and digital voltmeter are required for this procedure.

With the simulator and adaptor connected as shown in Figure 4-1, calculate the flow signal corresponding to 100% of the flow range as follows:

$$\text{Simulator Setting} = 10 \times \text{Flow Rate/Meter Capacity}$$

For example, to simulate a 1200 gpm flow rate in a 6 inch meter with a capacity of 2641 gpm, set the simulator push button decade switches as follows:

$$\text{Simulator Setting} = 10 \times 1200/2641 = 4.544 \text{ (round to 4.54)}$$

The actual converter outputs observed will depend on both the range and the simulator settings. For a given simulator setting, the converter outputs measured by the test instruments may be computed as follows:

$$F_{\text{out}} = 10,000 \times \text{Flow Rate/Range Value (in Hz)}$$

$$V_{\text{out}} = (4 \times \text{Flow Rate/Range Value}) + 1 \text{ (in Volts)}$$

For the above 6 inch meter with a range of 2000 gpm, it is desired to simulate a flow rate of 400 gpm. The simulator setting will be:

$$\text{Simulator Setting} = 10 \times 400/2641 = 1.514 \text{ (round to 1.51)}$$

The resulting outputs will be:

$$F_{out} = 10,000 \times 400/2000 = 2,000 \text{ Hz}$$

$$V_{out} = (4 \times 400/2000) + 1 = 1.800 \text{ V}$$

The numbers computed here and for other cases will not be exact because of the rounding of the simulator and possibly the range value to the nearest available setting. The percentage of converter full scale output may be calculated exactly as follows:

$$\text{Exact \% full scale} = 10,000 \times \text{Simulator Setting}/\text{Range Setting}$$

$$F_{out \text{ exact}} = 10,000 \times \text{Exact \% Full Scale}/100 \text{ (Hz)}$$

$$V_{out \text{ exact}} = (4 \times \text{Exact \% Full Scale}/100) + 1 \text{ (volts)}$$

As an example, a 6 inch primary with a range of 2000 gpm required a range setting of 757. A nominal flow simulation of 400 gpm required a simulator setting of 1.51. The exact percentage of full scale will be:

$$\text{Exact \% full scale} = 10,000 \times 1.51/757 = 19.95\%$$

$$F_{out \text{ exact}} = 10,000 \times 19.95/100 = 1995 \text{ Hz}$$

$$V_{out \text{ exact}} = (4 \times 19.95/100) + 1 = 1.798 \text{ volts}$$

In a similar manner, the scaled pulse output rate at a given simulator setting may be verified by calculating the interval as follows:

$Q_{max}$  = full scale flow rate in engineering units per unit of time

$C_t$  = time constant is the number of seconds in the time unit of the engineering measurement unit. For example, when measuring in GPM, the time constant is 60 seconds (number of seconds in a minute). When measuring in GPH the time constant is 3600 seconds (number of seconds in an hour).

$M$  = multiplier; e.g., gallons/pulse (X1, X10, X1000)

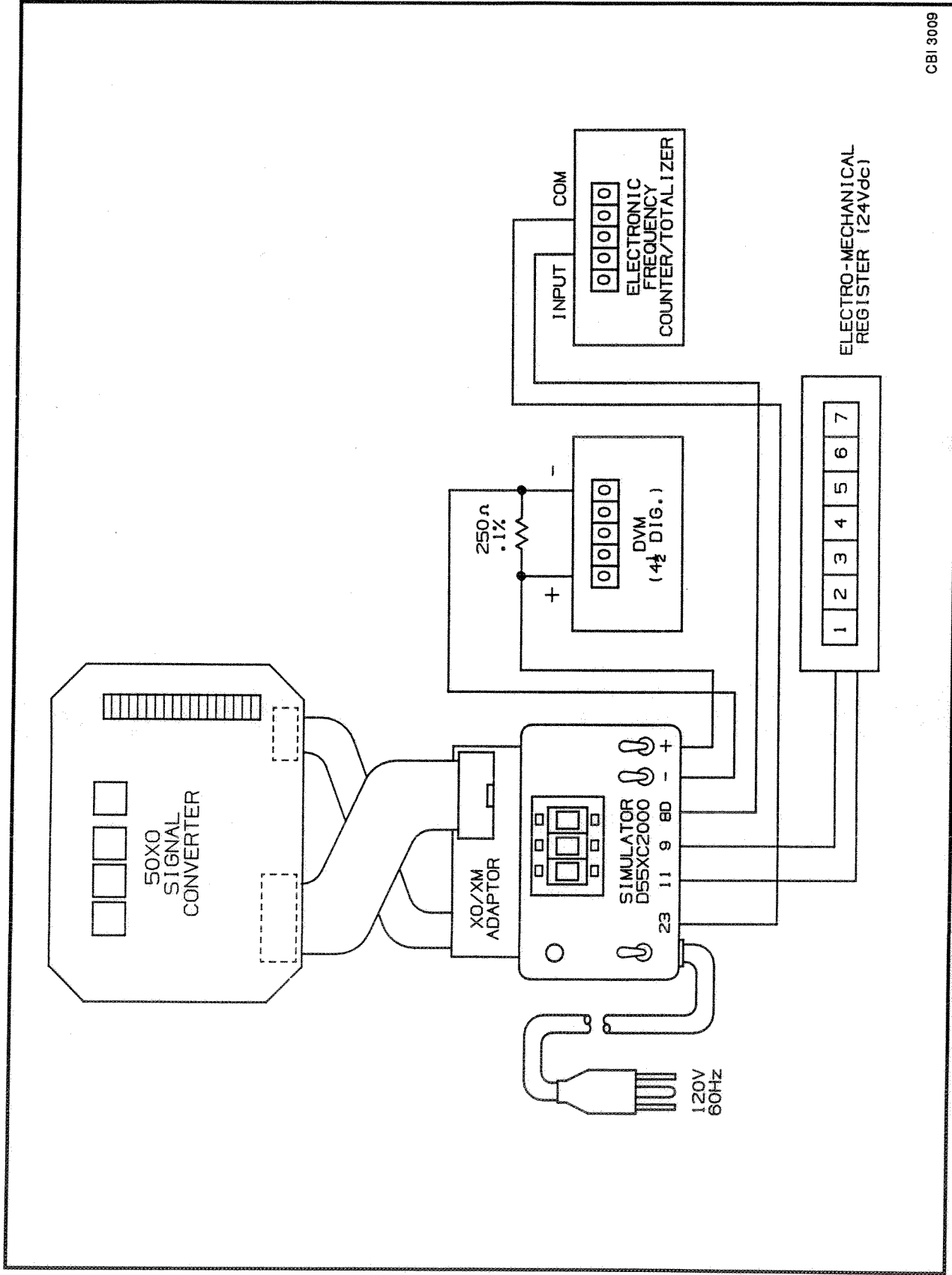
$$\text{Pulse interval (in seconds)} = (\text{range set}/\text{sim. set}) \times (\text{scale fact}/1,000,000)$$

By example, to obtain 1 pulse per 100 gallons of flow for a 6 inch meter operating at a range of 2000 gpm, the scale factor would be:

$$SF = \frac{10,000 \times C_t \times M}{Q_{max}} = \frac{10,000 \times 60 \times 100}{2000} = 30,000$$

If the simulator were set for 400 gpm (1.51), the pulse interval would then be:

$$\text{Pulse interval} = (757/1.51) \times (30,000/1,000,000) = 15.04 \text{ seconds}$$



CBI 3009

FIGURE 4-1. TEST WIRING USING SIGNAL SIMULATOR D55XC2000

## 5.0 MAINTENANCE

---

### 5.1 General

**WARNING**

Equipment powered by an ac line voltage presents a potentially lethal electric shock hazard. Installation and servicing of the Magnetic Flowmeter and Signal Converter should only be attempted by a qualified electronics technician.

Make certain that the power input leads are disconnected from the operating circuit before attempting electrical connections.

Except for an occasional performance verification check, there is no routine maintenance for the Signal Converter. When the Signal Converter is integrally mounted with the Magnetic Flowmeter, refer to the Instruction Bulletin provided with the Flowmeter for additional information.

The Signal Converter uses both IC and LSI components. Generally, due to the complexity of troubleshooting integrated circuit devices, maintenance beyond the Converter assembly level is not recommended. Also, caution must be used when connecting test probes, as a momentary accidental short circuit may damage or destroy an integrated circuit device.

In the event of a malfunction in the Signal Converter, a replacement assembly can be quickly substituted for the defective assembly, thereby minimizing system down time. Servicing by substitution with spare assemblies is generally more economical than stocking a large variety of IC chips, transistors, diodes, etc. Also, test equipment requirements and the level of technical expertise necessary for servicing are minimized. Should a question arise regarding the proper procedure for solving a problem, contact the nearest F&P service facility for technical assistance.

**WARNING**

All Flowmeters and/or Signal Converters being returned to Fischer & Porter 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 F&P for authorization prior to returning equipment.

When communicating with F&P in regard to replacement of a Signal Converter, it is important to reference the complete instrument model number and serial number to assure that the correct replacement will be supplied.

The model number and serial number are provided on the manufacturing specification sheet supplied with the Magnetic Flowmeter, and on the Converter data tag.

## 5.2 System Troubleshooting

If faulty operation of the Magnetic Flowmeter System is evident, the following procedure can be used as a guide to isolate the malfunction to either the Flowmeter or the Signal Converter. A standard multimeter is suitable for making most of the test measurements. These measurements can be made at the customer connections of the Signal Converter.

1. If meter operation is suspected, proceed as follows:

- a) Remove access covers from the junction box and the Converter housing (remote or integral).
- b) Inspect for evidence of water entry in the junction box and Converter housing.

If water is present, de-energize system at power source. Inspect conduit seals and cover gaskets for possible source of water entry. Replace the seals and/or gaskets as required. Allow interior of junction box and Converter housing to dry completely before restoring system power

2. To verify the zero flow feature, connect a jumper wire between the Flowmeter input terminals 1 and 2 (signal), and 3 (common). This will simulate a zero flow condition. For integrally mounted Signal Converters, the Converter assembly must be moved aside to a insulated surface to gain access to the lugs on the Flowmeter base board. Refer to the Flowmeter Instruction Bulletin for additional information.

The output of the Converter must now represent the base line (zero flow) condition. For example, if 4-20 mA output is specified, the current output must be 4 mA. Scaler output must be off (no pulse output).

3. If the Converter output is other than given in step 2, check the reference signal (Flowmeter terminal 16 or test point MP201 shown in Figure 5-1). If there is no reference signal, check to verify that the magnet driver signal (terminal M1 of the remote Converter) is present. Normal signals for reference (16) and driver (M1) appear in Figure 5-3.

When the driver signal is present at terminal M1 but there is no reference signal, check for an open magnet coil, loose or defective coil wiring, etc. Refer to the Instruction Bulletin supplied with the Magnetic Flowmeter for additional information.

If the driver signal is not present at terminal M1, check the fuse on the Signal Converter. If the fuse is okay, the Signal Converter is probably defective.

It is possible to check the Converter's magnet driving system using a dc voltmeter. Connect the voltmeter to MP207 and MP201 of the output board (refer to Figure 5-1). Switch S102 on the power supply board must be in the open position (refer to Figure 5-2). A reference voltage of -70 mV ( $\pm 5$  mV) should be measured. Moving switch S102 to the closed test position should indicate a reference voltage of +70 mV ( $\pm 5$  mV). If this test is successful, return switch S102 to the normal operating (closed) position.

If reference and driver signals appear normal, proceed to step 4.

## 4. Zero point elevate test:

When a zero flow condition exists, it is possible to establish a "live" zero point which will verify proper operation of the Converter's circuitry. With a short circuit placed across terminals 1, 2 and 3 from the flowmeter, attach a 100,000 ohm metal film resistor (1% tolerance) between MP206 and MP207 of the output board (refer to Figure 5-1). The output should be 36.8% of range ( $\pm 3\%$ ). If the Converter functions as indicated, it can be assumed that the Converter is operating properly.

5. Remove the shorting jumpers between input terminals 1, 2 and 3. If the Converter output now appears normal, the initial erroneous output may have been caused by **coating or oxide plating** of the electrodes. If this is the case, the meter may fail again shortly. The electrodes should be cleaned.

6. The Converter Output Board has an indicating LED which determines whether a flow or no-flow condition exists in the pipe line. For any flow above 0.2% of range, the LED will be on continuously. When a zero flow condition exists, the LED will flash several times per second. If the LED is off and there is a known flow, the electrode signal wires may be reversed or there may be reverse flow in the pipeline.

## 7. Other possible causes of erroneous flow rate indication are:

- incorrect grounding
- excessive noise due to a slurry or non-homogeneous process liquid
- loose wiring
- non-full or empty pipe
- excess air entrained in process liquid

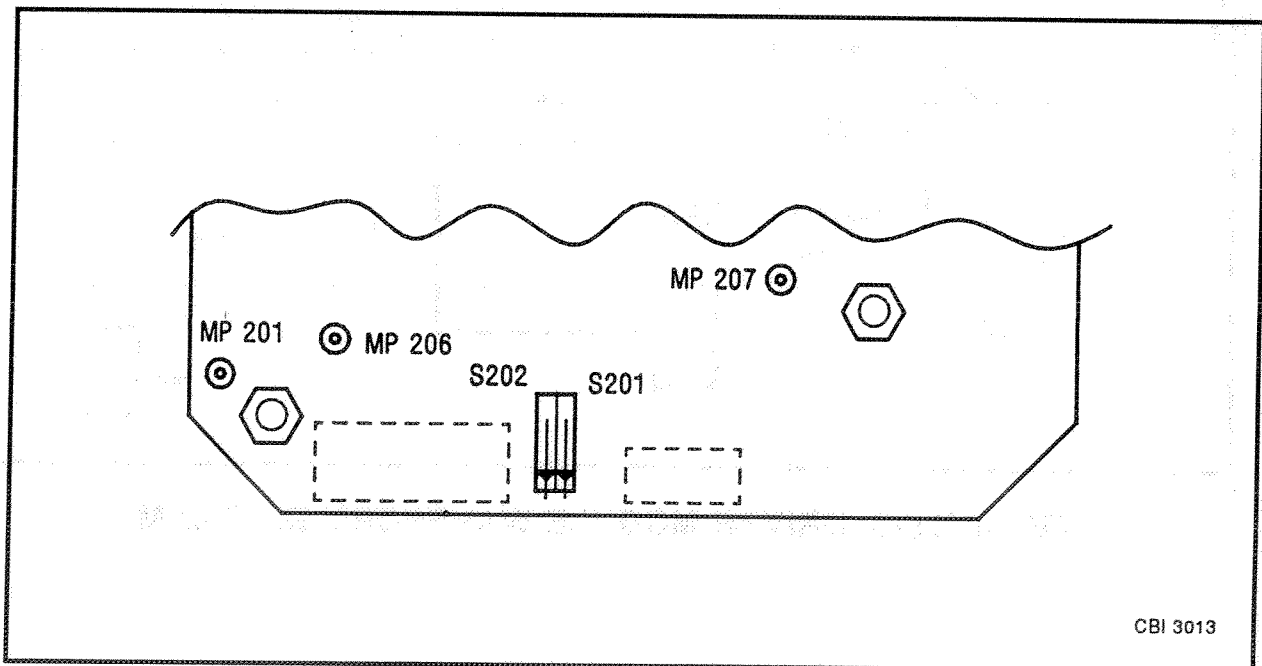


FIGURE 5-1. OUTPUT BOARD

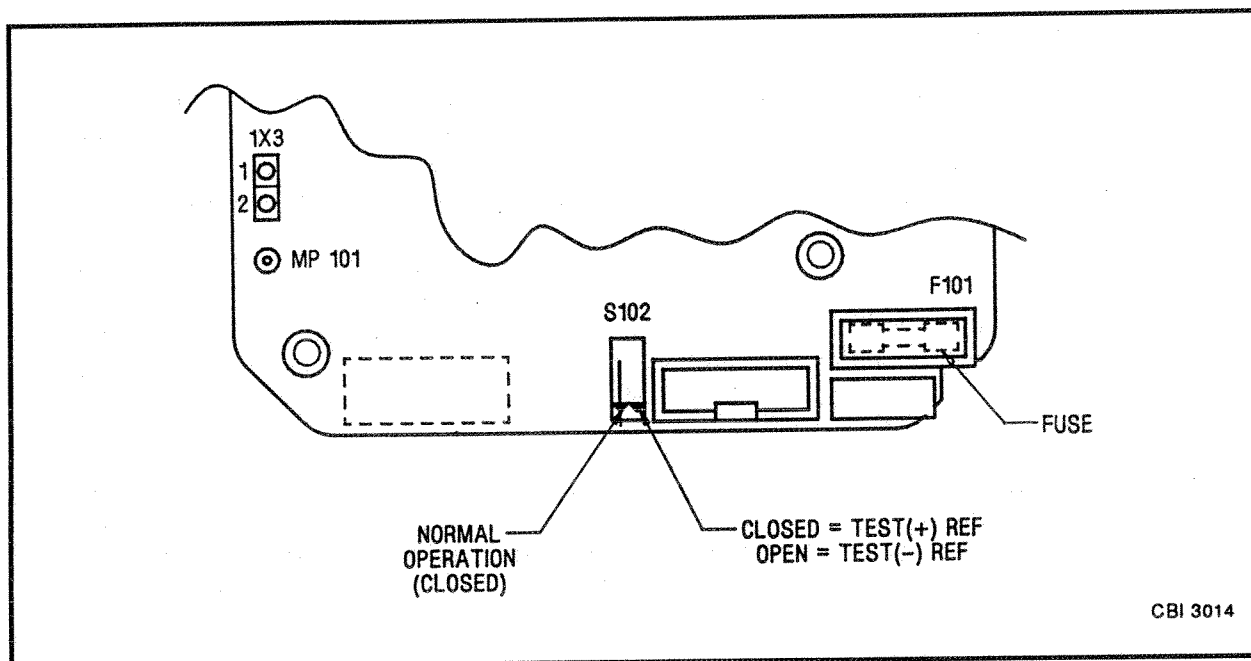


FIGURE 5-2. POWER SUPPLY BOARD

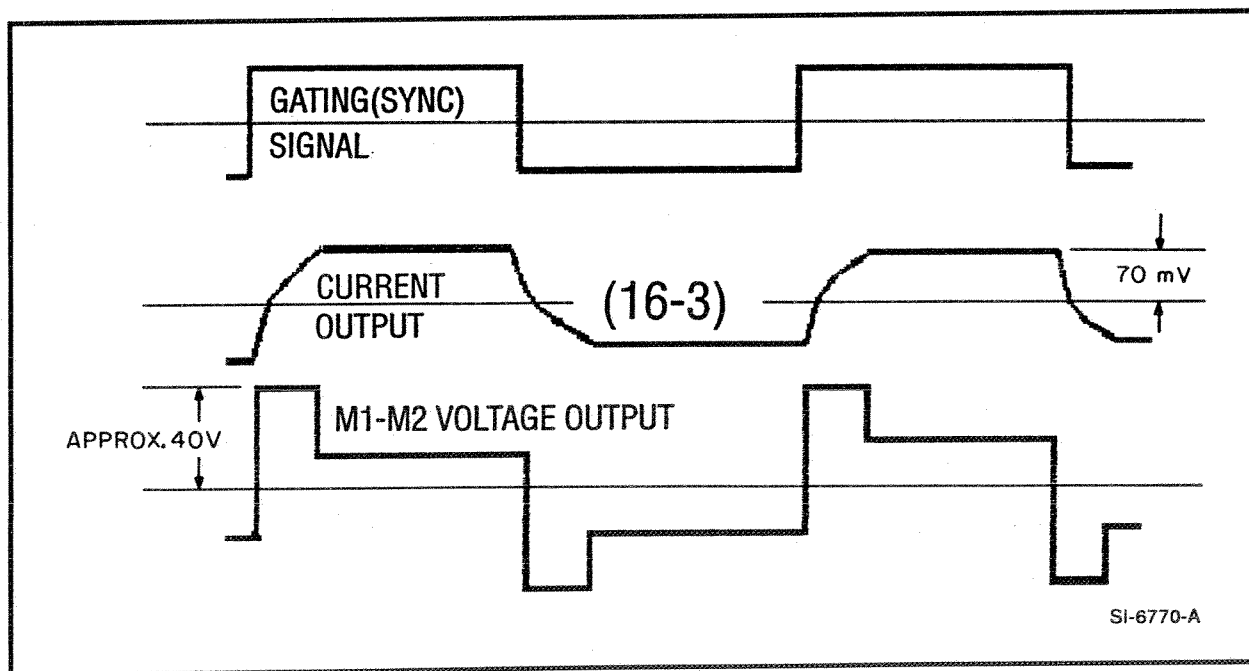


FIGURE 5-3. DRIVER MODULE WAVEFORM DIAGRAM



### 5.3 Signal Converter Voltage Check

The following voltage measurement can be made without removing the Signal Converter from the housing and with the proper source of ac line power applied to the flow metering system. A standard multimeter can be used to confirm normal power supply operation.

1. Set the multimeter for ac voltage measurement (250 V range, typical).

**NOTE**

Refer to the power requirements noted on the instrument data tag. The line voltage must be as specified on the instrument tag and within the tolerances given below.

2. With line power applied, place the voltmeter test leads across the power input lines by connecting the respective test probes to terminals L/L1 and N/L2 on the power supply. Depending on the Converter supplied, the voltmeter reading should be:

115 V ac  $\pm 15\%$   
or  
230 V ac  $\pm 15\%$

If no voltage can be measured, check system interconnection wiring, remote circuit breaker (or fuse), and check for a defective or open power switch, etc. Restore system power as required.

3. If ac power is present at the Converter, but the Converter is inoperative, a dc voltmeter may be connected to connector 1X3 on the power supply board (refer to Figure 5-2). Using test point MP101 as common, +12 V dc should be present at pin 1 and -12 V dc should be present at pin 2. If these voltages are not present, check the Converter fuse. If the fuse is okay, the Converter is defective and must be replaced.

### 5.4 Signal Converter Servicing

The recommended method of servicing a Signal Converter is by substituting a defective Converter with a replacement Converter.

When communicating with F&P in regard to replacement of a Signal Converter, it is important to refer to the complete instrument model number and serial number to assure that the correct replacement will be supplied. The model number and serial number are provided on the manufacturing specification sheet supplied with the Flowmeter, and on the instrument data tag.

## 5.5 Parts List

When communicating with F&P in regard to replacement of a Signal Converter, it is important to refer to the complete instrument model number and serial number to assure that the correct replacement will be supplied. The model number and serial number are provided on the manufacturing specification sheet supplied with the Magnetic Flowmeter, and on the instrument data tag.

### Signal Converters:

Part Number	Description
698B199U01	115 V, 50/60 Hz
698B199U02	230 V, 50/60 Hz

### Fuses:

Part Number	Description
151A030U18	1/8 A, 250 V, medium time lag 5mm X 20mm cartridge type
151A030U19	1/4 A, 250 V, slow blow 5mm X 20mm cartridge type

### Gaskets:

Part Number	Description
333F027U01	Signal Converter housing
333F027U02	Interconnection junction box

# DOCUMENTATION QUESTIONNAIRE

Your answers to the questions below and other comments assist us in publishing better documentation. If an answer requires explanation please use space provided. All comments and suggestions become the property of Fischer & Porter Co.

1. Title of Document? Instruction Bulletin 50XO1000A PN 24422A
2. Does this document meet your needs? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
3. Is the information: \_\_\_\_\_  
Easily understandable? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Properly organized? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Complete? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Sufficiently illustrated? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## OTHER COMMENTS

(Please include page and/or figure number.)

---

---

---

---

---

---

---

---

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

No postage necessary  
if mailed in U.S.A.

If F&P employee, please include  
department number.

FOLD 1



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

**BUSINESS REPLY MAIL**

FIRST CLASS

PERMIT NO 86

WARMINSTER, PA

POSTAGE WILL BE PAID BY ADDRESSEE:

FISCHER & PORTER COMPANY  
DEPT. 265  
125 E. COUNTY LINE ROAD  
WARMINSTER, PA 18974



FOLD 2

STAPLE  
HERE

**Worldwide Sales & Service\***
**AUSTRALIA**

Fischer & Porter Pty. Ltd.  
474-478 Princes Highway  
Noble Park, Victoria 3174  
Australia  
(03) 795-0255

**AUSTRIA**

Fischer & Porter Ges.m.b.H.  
Wiener Strasse 17  
A-2351 Wiener Neudorf  
Austria  
(02236) 88761

**BELGIUM**

Fischer & Porter N.V.  
Elektronikalaan 12/14  
B-2610 Wilrijk  
Belgium  
(03) 828 0511

**CANADA**

Fischer & Porter (Canada) Limited  
134 Norlinch Drive  
City of North York  
Ontario, Canada, M3N 1X7  
(416) 667-9800

**ENGLAND**

Fischer & Porter Ltd.  
Salterbeck Trading Estate  
Workington, Cumbria CA14 5DS  
England  
(0946) 830611

**FINLAND**

Fischer & Porter Oy  
Kuunkehra 2  
02210 Espoo 21  
Finland  
(0) 803 6066

**FRANCE**

Otic-Fischer & Porter  
151 bis, Avenue de la Liberation  
63000 Clermont-Ferrand  
France  
(73) 93 84 10

**GERMANY**

Fischer & Porter GmbH  
Postfach 1843  
D-3400 Goettingen  
Germany  
(0551) 905-0

**ITALY**

Fischer & Porter Italiana, S.p.A.  
P.O. Box 44, Via Gorizia 16  
20063 Cernusco sul/Naviglio  
Milan, Italy  
(02) 92771

**MEXICO**

FISPO, S.A.  
Apdo Postal M-9397  
Mexico 1, D.F., Mexico  
(5) 576-1033

**NETHERLANDS**

Fischer & Porter B.V.  
Avelingen West 3  
4202 MS Gorinchem  
Netherlands  
(01830) 34811

**SPAIN**

Fischer & Porter Iberica, S.A.  
Sanchez Pacheco, 79  
Madrid 28002  
Spain  
(91) 415-2200

**SWEDEN**

Fischer & Porter AB  
Malmgardsvagen 16-18  
Box 11124  
S-100 61 Stockholm 11  
Sweden  
(08) 23 42 15

**UNITED STATES**

Fischer & Porter Company  
125 E. County Line Rd.  
Warminster, PA 18974  
U.S.A.  
(215) 674-6000

\*Contact any of our companies for the name  
of our representative in your area.

