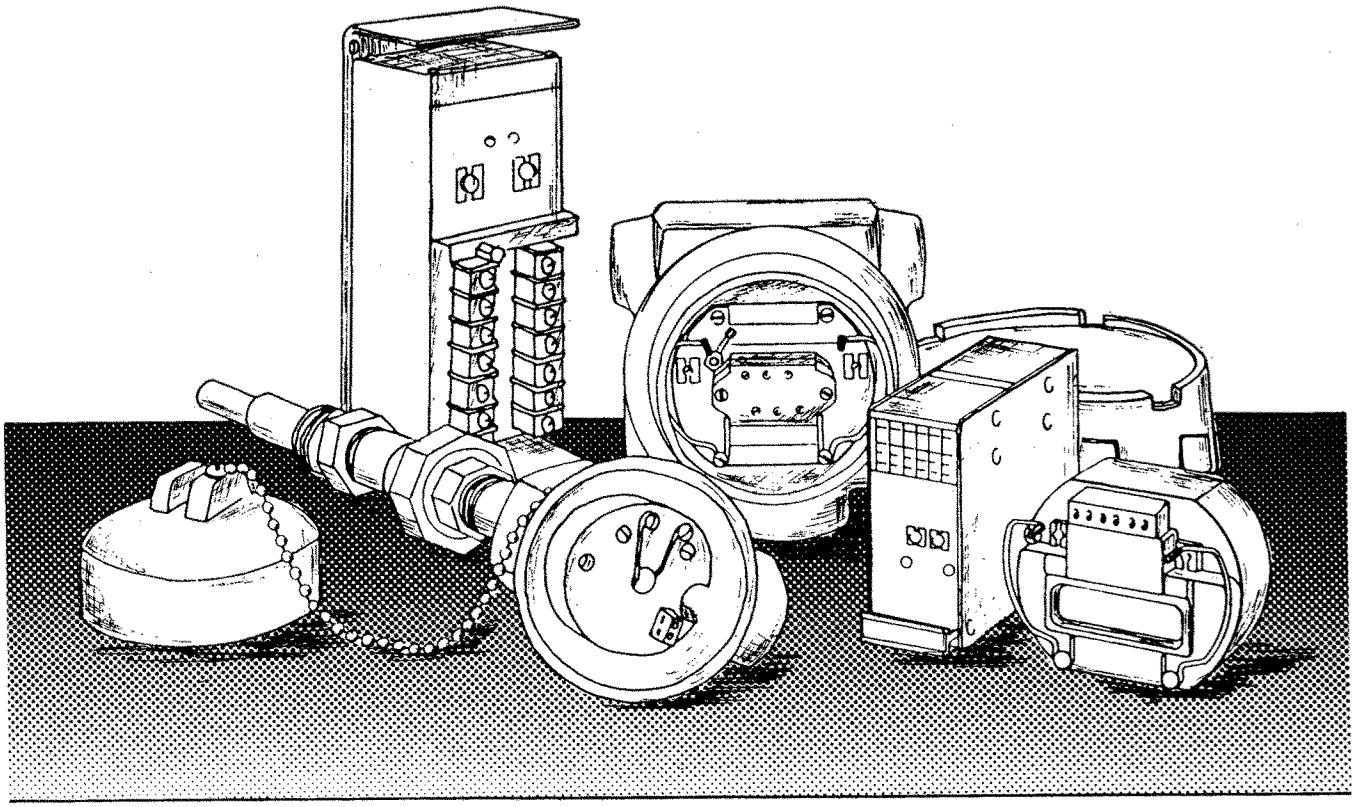
MOORE INDUSTRIES

INSTRUCTION MANUAL

EP-FDX

Extended Performance
Frequency-to-DC Transmitter

Form 165-724-00B
April 2016



Description

The EP-FDX is a 2-wire, extended performance transmitter that receives input from a turbine or from a positive displacement meter and provides a proportional 4-20mA or 10-50mA output. Input and output parameter range settings are jumper selectable in the field. Stability is provided by a unique quartz-crystal time-base design. RFI/EMI protection, that exceeds SAMA standards, is available as an option. SPAN and ZERO multiturn adjustment is provided. The EP-FDX is available in a variety of housing styles, including: "hockey puck" (HP) and rail-mount (DIN).

Installation

Introduction

This section of the manual provides installation information consisting of mechanical installation, electrical and power connections, and jumper placements.

Mechanical Installation

Figure 1 illustrates the physical outline of the EP-FDX unit in the DIN housing, Figure 2 shows the hockey puck housing dimensions and physical installation requirements. The units should be installed in a location protected from dust, moisture, and corrosive gas.

Electrical Connections

All electrical connections are made to the terminals on the front of the unit. Table 1 lists the connector designations. When installing units, use 14-30AWG wire for all signal lines. Terminating lugs are not required for electrical connections. Simply strip the insulation from the end of the wire, tin the end, insert the connector and tighten the screw. To remove a wire, loosen the clamp screw and pull the wire straight out. Remember to tag the wire for proper identification before removing.

Table 1. *Terminal Positions*

Terminal Designations	Housing	
	DIN	FL/HP
1	+IN	+IN
2	-IN	-IN
3		
4		
5	+PS	+PS
6	-PS	-PS

Power Connections

The EP-FDX requires an 11-42 Vdc power supply connected to a +PS and -PS terminals. Table 1 lists the power connector designations for the unit.

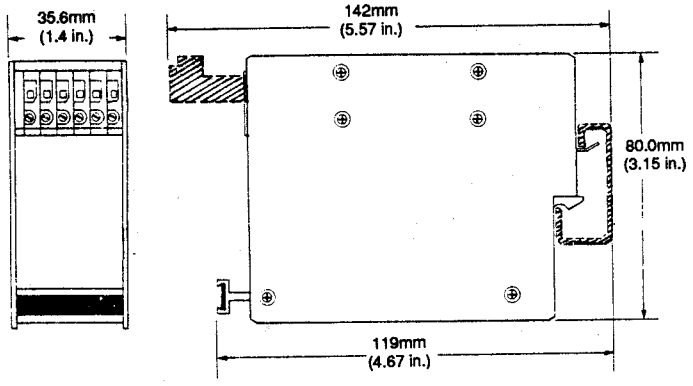


Figure 1. *Dimensions for the EP-FDX Transmitter Unit with DIN Housing.*

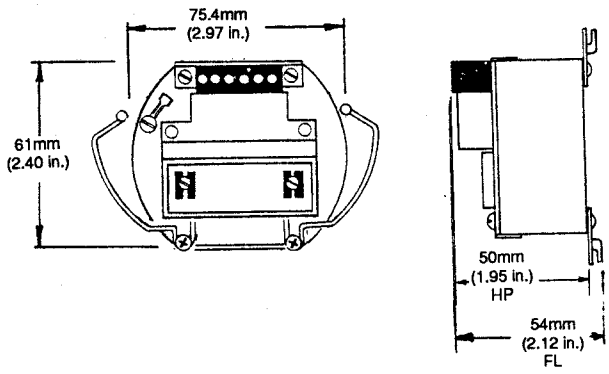


Figure 2. *Dimensions for the EP-FDX Transmitter Unit with HP Housing.*

Important Note: This document is complete as of printing date; however, subsequent product changes may be reflected in companion documents.

Calibration

Introduction

This section of the manual provides information needed to calibrate the EP-FDX. Each unit is adjusted and checked at the factory for proper performance before it is shipped.

Control Description and Location

ZERO and SPAN controls are located on the front panel of the unit. The SPAN potentiometer adjusts for any span within the jumper-selected range. The ZERO potentiometer provides adjustability about 0 to ±10% of span. The external controls are adjustable with a flat-blade screwdriver. The screwdriver blade must be no more than 0.1 inch (2.54 mm) wide. A wider blade may permanently damage the potentiometer mounting. The potentiometers are equipped with a slip clutch at each end. This prevents damage if the controls are turned beyond the wiper stop. Turning the controls clockwise will result in an increasing output, and turning the controls counterclockwise will result in a decreasing output.

Test Equipment and Tools

Test equipment and tools that are needed to calibrate the EP-FDX are shown in Table 2. The listed tools and equipment are not supplied with the unit and must be provided by the user.

Preliminary Procedures

To change calibration for the values that are preset at the factory, it is necessary to gain access to the programming jumpers. For the DIN-type housing this is accomplished by removing the cover on the side of the unit. For the Hockey-Puck (HP) unit, the four top screws must be removed and the electronics assembly must be extracted from the housing. It is not necessary to dismantle the circuit card assembly any further since all jumpers are accessible at the edges of the two cards.

Calibration

Calibration consists of simulating the operative input signal and adjusting the unit to obtain the specified output. The results are tabulated as a convenient correction chart for future measurements when the unit is permanently installed. Before calibrating the EP-FDX, read all of the procedures carefully. Jumpers are installed in each unit prior to shipment. It is important to verify that each operating mode is correct before calibration procedures begin. See figures 9 and 10 for DIN jumper locations and figures 6 and 7 for HP jumper locations.

***Table 2.** Test Equipment and Tools Required*

Equipment or Tool	Characteristic	Purpose
Screwdriver (blade)	Blade not wider than 0.1 inch (2.54 mm)	Front panel control adjustment
AC Signal Source	Must be frequency stable to within ±0.05% or better	Simulates input
DC Voltmeter	Must be accurate to within ±0.05% or better	Output signal monitoring (across series output resistor)
DC Miliammeter	Must be accurate to within ±0.05%	Output signal monitoring
Frequency Counter	Must be capable of measuring output of AC signal source to within 0.05% or better	Measure frequency of AC signal source

Specifications

Characteristics

Front Panel Adjustments
Span: Multiturn potentiometer provides full adjustability over the selected input range.
Zero: Multiturn potentiometer provides adjustability about 0 to ±10% of span

Performance
Calibration Capability: ±0.05% of span.
Temperature Effect: ±0.01% of span / °F
Loop Load Effect: ±0.002% of span for 100 ohm change in loop resistance
Line Voltage Effect: ±0.002% of span/volt change

Operating Temperature
Range: -29°C to +82°C (-20°F to +180°F)

***Input Impedance**
10K ohms, ±20% for all units not equipped with the -RF option.

***Input Isolation**
500Vrms, for all units not equipped with the -RF option.

Input Amplitude
10mV P/P to 30V P/P

Common Mode Rejection
54db, minimum, up to 120Hz

Output Noise
≤ 10mV, P/P (dc to 10KHz)
≤ 100mV, P/P (above 10KHz)

Weight
141.5 grams (5oz), without explosion-proof enclosure, 1.36 kilograms (3lb), approximate, with explosion-proof enclosure

Ordering Specifications

Unit
EPFDX

Input
Range: see table below

Output
Current:
4-20MA 4-20mA (30mA limit, maximum)
10-50MA 10-50mA (65mA limit, maximum)

Options
-CC Contact Closure
-RF RFI/EMI protection (as defined by SAMA standard 33.1)
Sensitivity:
-S10 10mV, P/P
-S30 30mV, P/P
-S100 100mV, P/P
(If no sensitivity option is specified, 300mV P/P is provided as standard)

Power
12-42DC 12-42VDC

Housings
DIN DIN-style rail-mount housing
FL Aluminum case (HP) with mounting flanges for relay-track or surface mounting
HP Standard aluminum case with spring clips for mounting in explosion-proof enclosures
HPD Aluminum case with clip assembly
OTH Oil tight, NEMA, 12 enclosure
WTH Water tight, NEMA, 4 enclosure
2HG Explosion-proof, high glass dome, 2 hub
2HS Explosion-proof, 2 hub, solid cover, 2" pipe mounting assy.
2LS Explosion-proof, 2 hub, solid cover
3HG Explosion-proof, high glass dome, 3 hub
3HS Explosion-proof, solid cover, 3 hub
3LS Explosion-proof, 3 hub, solid cover

P (suffix) 2" pipe mounting

* Because RF filtering adds shunt capacitance to each terminal, consult the factory for performance specifications of units equipped with the -RF option.

When ordering specify:
Unit/Input Range - Input Sensitivity/Output/Power/Options [Housing]

Model number example:
EPFDX/A/4-20MA/12-42DC/-CC [HP]

Input Frequency Range

Code	Range (Hz)	Code	Range (Hz)	Code	Range (Hz)	Code	Range (Hz)
A	3.12 - 4.68	G	25.00 - 37.50	N	200 - 300	U	1600 - 2400
B	4.68 - 6.25	H	37.50 - 50.00	P	300 - 400	V	2400 - 3200
C	6.25 - 9.37	J	50.00 - 75.00	Q	400 - 600	W	3200 - 4800
D	9.37 - 12.50	K	75.00 - 100.00	R	600 - 800	X	4800 - 6400
E	12.50 - 18.75	L	100.00 - 150.00	S	800 - 1200		
F	18.75 - 25.00	M	150.00 - 200.00	T	1200 - 1600		

The following section of the EP-FDX manual consists of a step-by-step procedural guide for calibrating a unit:

1. Connect the EP-FDX to the test equipment with the signal generator temporarily disconnected and the input terminals of the unit short circuited.

2. Apply power input to the unit.

3. With the input terminals of the unit shorted, adjust the ZERO potentiometer to 4mA.

4. Remove the short circuit from the input terminals of the unit and connect the signal generator to these terminals. Adjust the signal generator to the maximum frequency that will be applied to the unit when it is installed, and adjust the output of the signal generator to a value greater than 300 millivolts RMS but not more than 10 volts RMS.

5. Adjust the SPAN potentiometer to obtain 100% output with the input applied as above.

6. Repeat the above steps until no further adjustment of either the ZERO or SPAN potentiometer is required.

7. Successively apply frequencies of 25%, 50%, and 75% of the frequency used in step 4 to the unit and check that the output is linearly proportional (within ±0.1% of the output span) to the applied frequency.

8. After step 7 has been successfully completed, remove the signal input to the unit and then turn off the power input to the unit.

Changing Input Range

The EP-FDX is capable of accepting frequency input from 0-3.12 to 0-6400 Hz in twenty-two different ranges. Changing from one input range to another requires the selection of an appropriate combination of eight solderless jumpers. The following section of the EP-FDX manual consists of a step-by-step procedural guide for changing the input range of a unit:

1. The input signal should be a zero crossing signal.

2. With no signal applied, the input should have a noise level of less than 1 millivolt, peak to peak.

3. Place the EP-FDX transmitter no more than three feet from the signal source.

4. Avoid RFI.

5. Use twisted, shielded input wire and ground it at the signal end.

6. The power supply for the loop current should be low capacity to the ac power line.

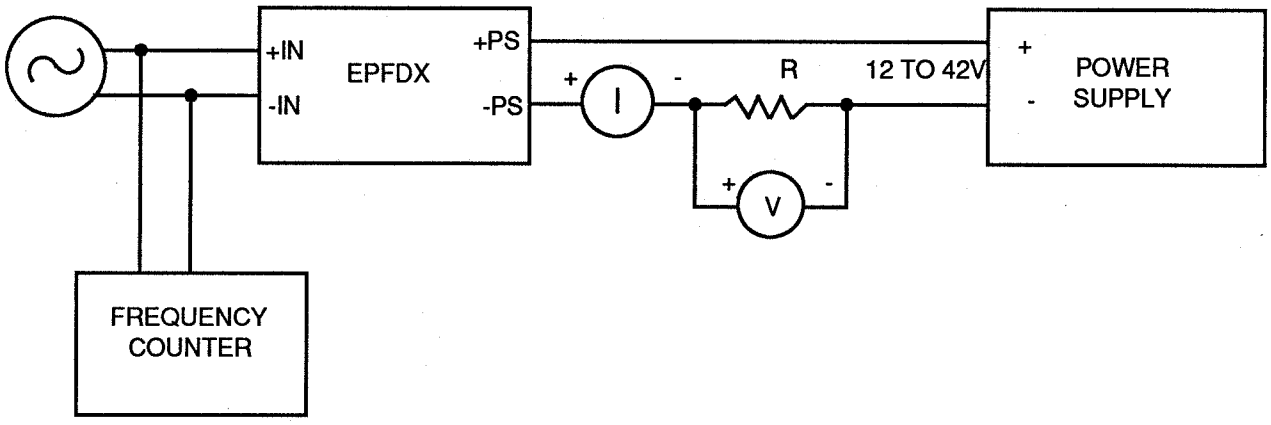


Figure 3. Test Equipment Set-Up For Calibration of Unit

7. The signal-to-signal noise ratio should be at least 4 to 1 (12dB) at the input.

8. Ground the HP case or DIN rail to a water pipe ground.

9. Ensure that the electromagnetic pick-up is not located near electromagnetic disturbance.

Refer to Table 4 (EP-FDX Jumper Programming) for the minimum signal necessary to activate the transmitter. The EP-FDX is available in four levels of input sensitivity: -S10 (10mV), -S30 (30mV), -S100 (100mV), and 300 mV p-p, which is supplied (pre-programmed) if an input sensitivity level is not specified. When the Contact Closure (-CC) option is selected, the -S100 sensitivity level option must also be selected.

Theory Of Operation

Introduction

This section of the manual briefly describes the operation of the EP-FDX. A simplified block diagram of the unit is provided to help explain the circuit description. Figure 4 shows the EP-FDX block diagram. Detailed schematics and assembly drawings can be found in figures 5 through 10.

Operation

The incoming signal is amplified by a gain-programmable, D.C. coupled preamp and is processed by a level discriminator. An output one-shot multi-vibrator drives the isolating photo-coupler which transfers a digital pulse train at the input signal frequency to the pulse processing section. This section outputs a pulse of precision height, the width of which is controlled by a jumper-plug-programmable counter. A quartz crystal time base ensures a precise pulse width output for each signal input pulse. This train of pulses is integrated by the active low-pass filter to achieve a voltage output that is proportional to input signal frequency. The output driver converts this control voltage to a 4 to 20 mA loop current. Power for the isolated input section is provided by a transformer-coupled inverter circuit. This, in conjunction with the photo coupler, results in both power and signal isolation.

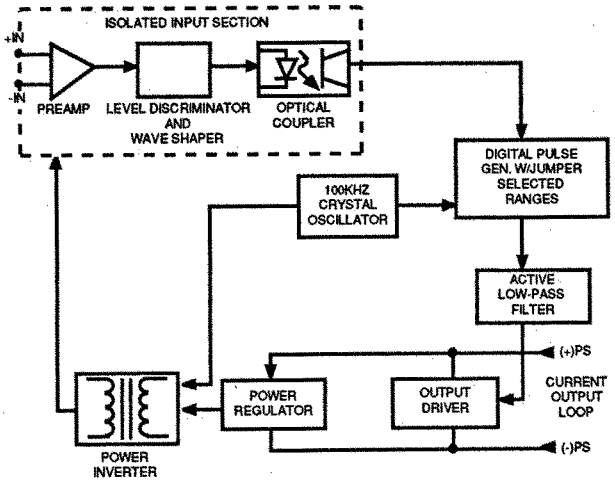


Figure 4. Block Diagram

Maintenance

This section of the manual contains maintenance and minor troubleshooting information as well as unit documentation data. The design of the EP-FDX limits maintenance to basically keeping the input and output terminals and conductors clean and tightly fitted to maintain a good heat conduction path to a suitable sink. A complete cleaining of the terminal block requires total disassembly and should be done only at the factory. It is recommended that the user check the termination leads periodically (every six months) to verify that they are tightly fitted and free from oxidation.

Troubleshooting

Troubleshooting is carried out by tracing the signal with an oscilloscope and referring to the schematic diagrams to determine which component or device might be causing an abnormal indication. If the original problem was a "complete failure of the unit to operate," the component or components that are most likely to be malfunctioning are those associated with the power supply. If the unit is producing an incorrect (but not zero) output, check the outputs from the input circuit and trace the resulting signal through the unit.

Table 4. EP-FDX Jumper Programming

1. INPUT FREQUENCY RANGE. An input frequency range is selected by the installation of the appropriate jumpers as shown below. Jumpers that are not installed are stored on a single unused pin.

CODE	INPUT FREQUENCY RANGE SPAN (Hz)	MINIMUM USABLE FREQUENCY*	JUMPERS USED FOR INPUT FREQUENCY RANGE SELECTION	
			INPUT RANGE	FILTER
A	3.12 - 4.68	0.3	J3, 13, 14, 17, 19	J2, 6, 7
B	4.68 - 6.25	0.3	J4, 13, 14, 17, 19	J2, 6, 7
C	6.25 - 9.37	0.3	J3, 13, 14, 17, 18	J2, 6, 7
D	9.37 - 12.50	0.3	J4, 13, 14, 17, 18	J2, 6, 7
E	12.5 - 18.75	0.6	J3, 13, 14, 16, 19	J2, 6, 7
F	18.75 - 25	0.6	J4, 14, 14, 16, 19	J2, 6, 7
G	25 - 37.5	1	J3, 13, 14, 16, 18	J2, 6, 7
H	37.5 - 50	1	J4, 13, 14, 16, 18	J2, 6, 7
J	50 - 75	1	J3, 12, 15, 17, 19	J2, 6, 7
K	75 - 100	1	J4, 12, 15, 17, 19	J2, 6, 7
L	100 - 150	2	J3, 12, 15, 17, 18	J6
M	150 - 200	2	J4, 12, 15, 17, 18	J6
N	200 - 300	2	J3, 12, 15, 16, 19	J6
P	300 - 400	2	J4, 12, 15, 16, 19	J6
Q	400 - 600	4	J3, 12, 15, 16, 18	
R	600 - 800	4	J4, 12, 15, 16, 18	
S	800 - 1200	8	J3, 12, 14, 17, 19	
T	1200 - 1600	8	J4, 12, 14, 17, 19	
U	1600 - 2400	16	J3, 12, 14, 17, 18	
V	2400 - 3200	16	J4, 12, 14, 17, 18	
W	3200 - 4800	32	J3, 12, 14, 16, 19	
X	4800 - 6400	32	J4, 12, 14, 16, 19	

*Output goes to Zero (e.g. 4.0 mA) with no input. These numbers represent minimum useable frequencies with a ripple component of less than 10 mV p-p.

2. INPUT SENSITIVITY (±20%). To implement a specified input sensitivity, one or two of the three input sensitivity jumpers must be installed as shown below.

mV, p-p	JUMPERS
10	J8, 11
30	J8
100	J9, 11
300	J9

3. OUTPUT RANGE SELECTION is implemented by either the installation or storing of jumpers J1 and 5.

OUTPUT RANGE	JUMPERS
4 to 20 ma.	(jumpers are stored, not used)
10 to 50 ma.	J1, 5

4. CONTACT CLOSURE MODE is implemented by the selection of the following jumpers: J9, 10, 11. (100 mV Input Sensitivity [J9 & 11] must be selected when CONTACT CLOSURE MODE is used.) This mode can be used for Input Ranges A through M only.

Be sure to review each of the four categories in Table 4 and install only those jumpers indicated for the desired operational setup.

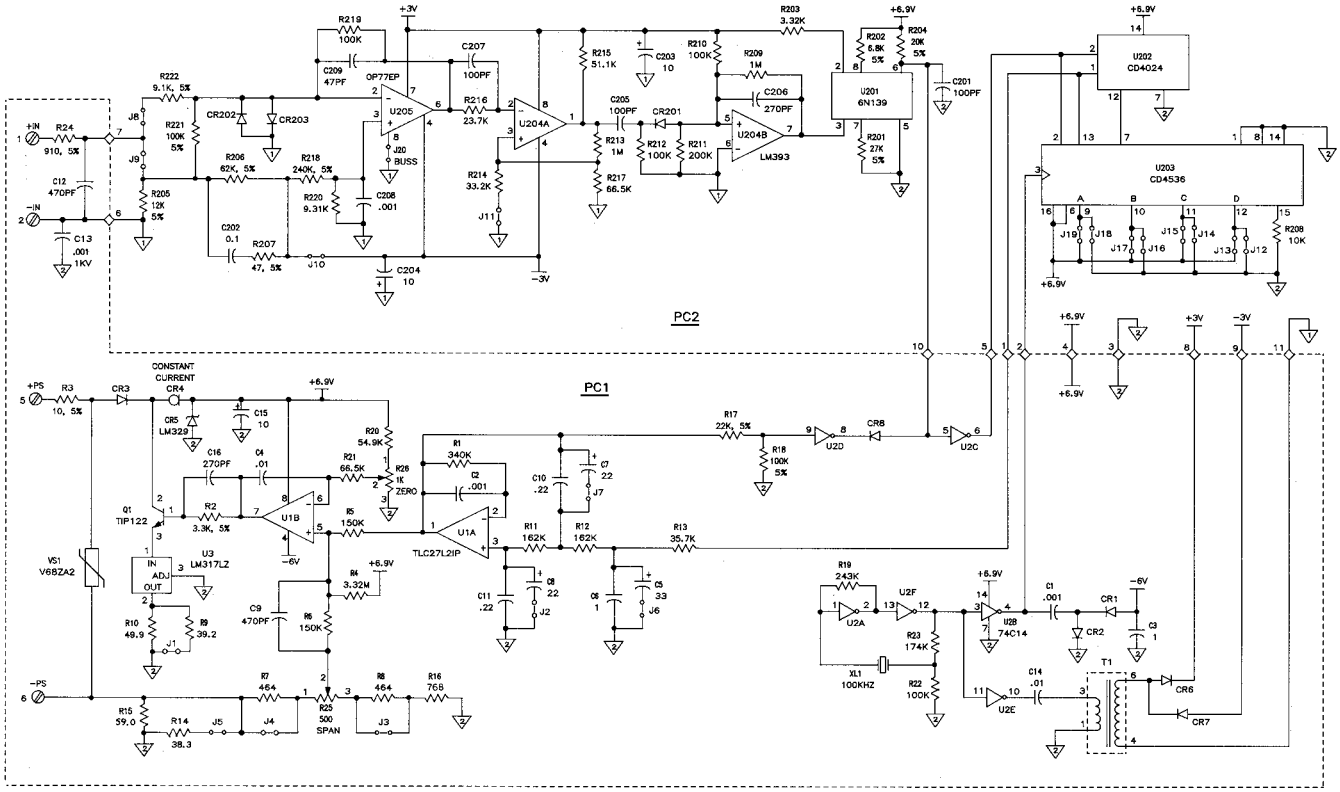


Figure 5. Schematic Diagram for the EP-FDX Transmitter with HP Housing

165-424-00

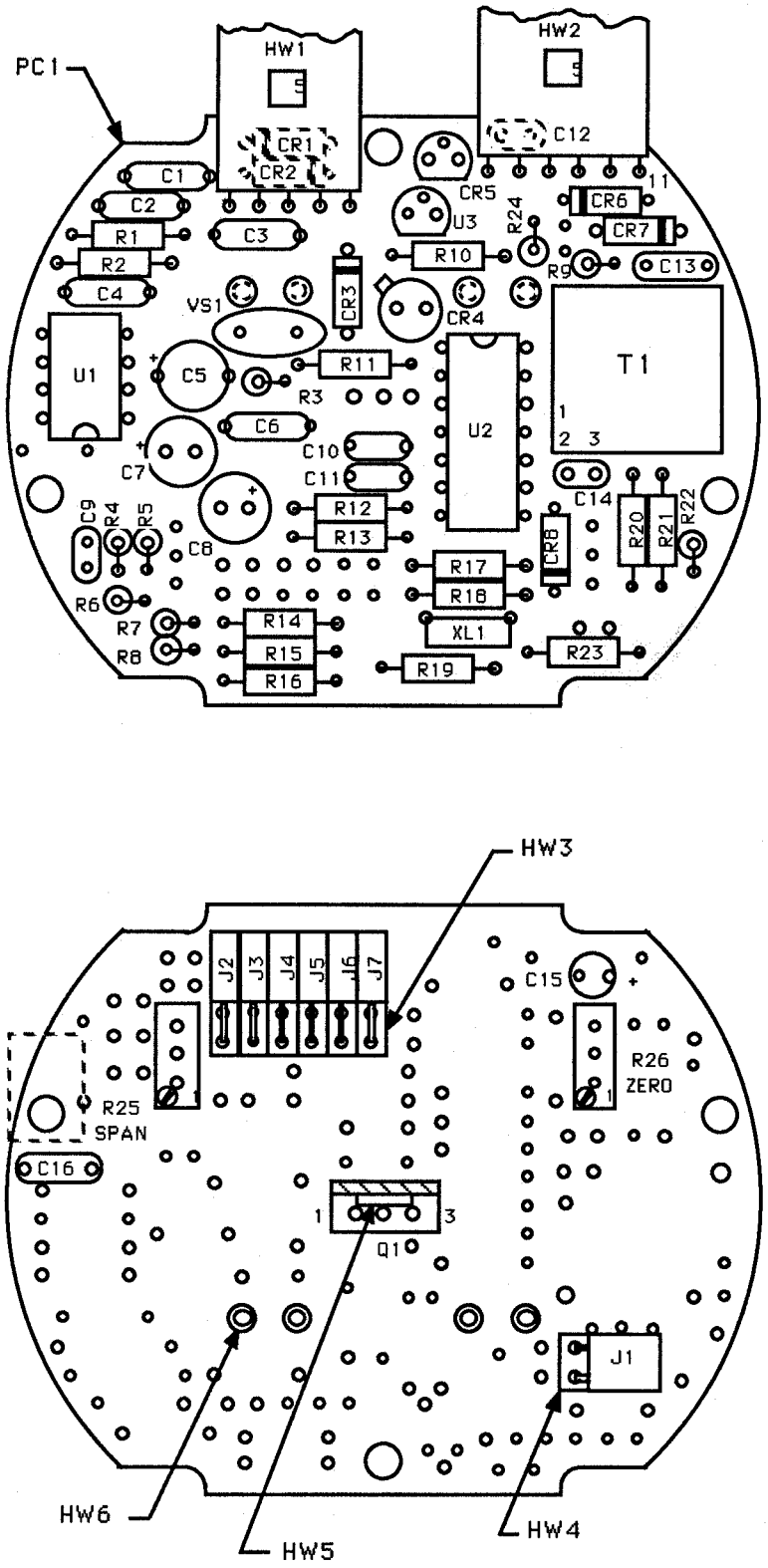


Figure 6. Printed Circuit Board Assembly 1 for the EP-FDX Transmitter with HP Housing

165-524-00

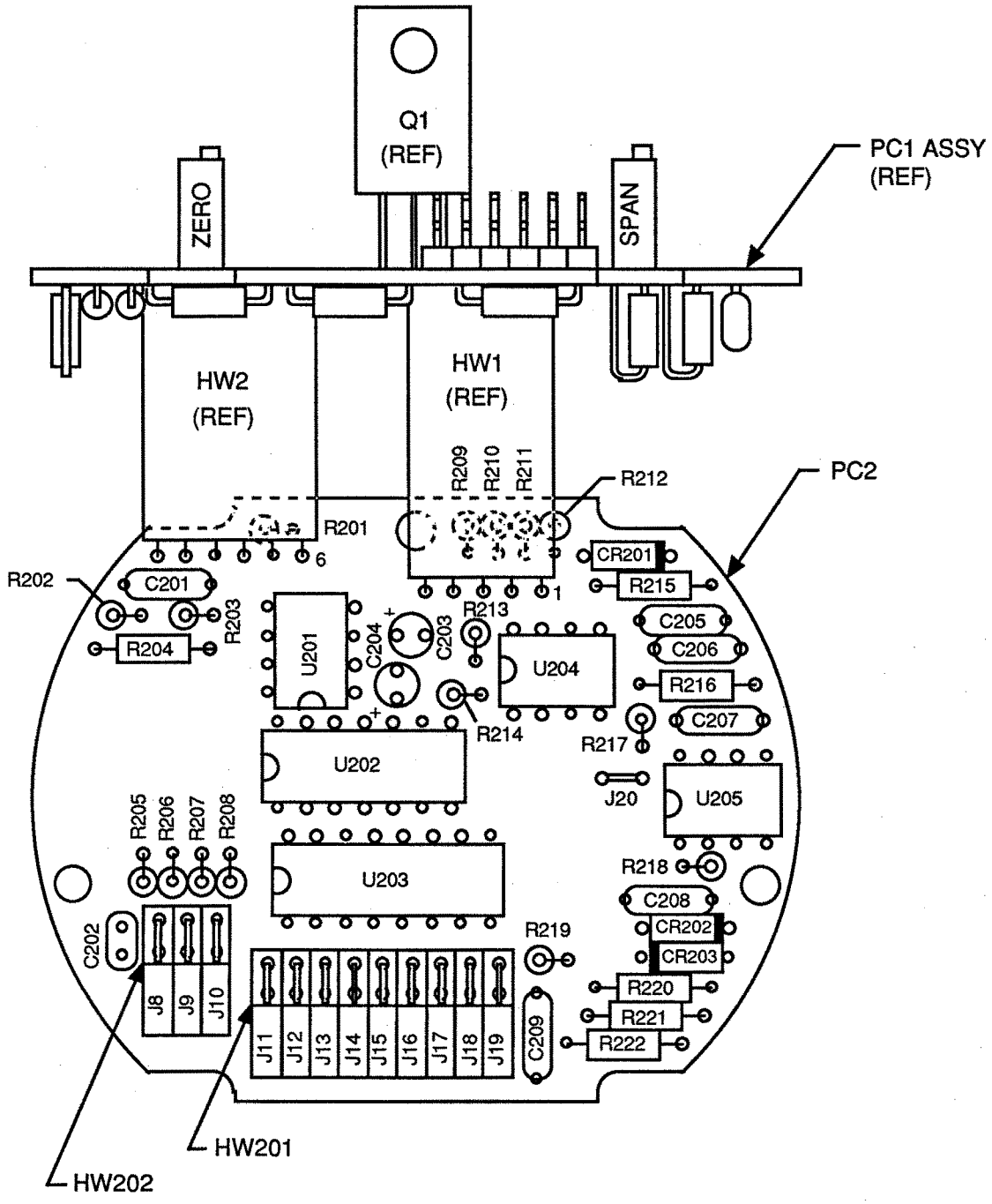


Figure 7. *Printed Circuit Board Assembly 2 for the EP-FDX Transmitter with HP Housing*

165-525-00

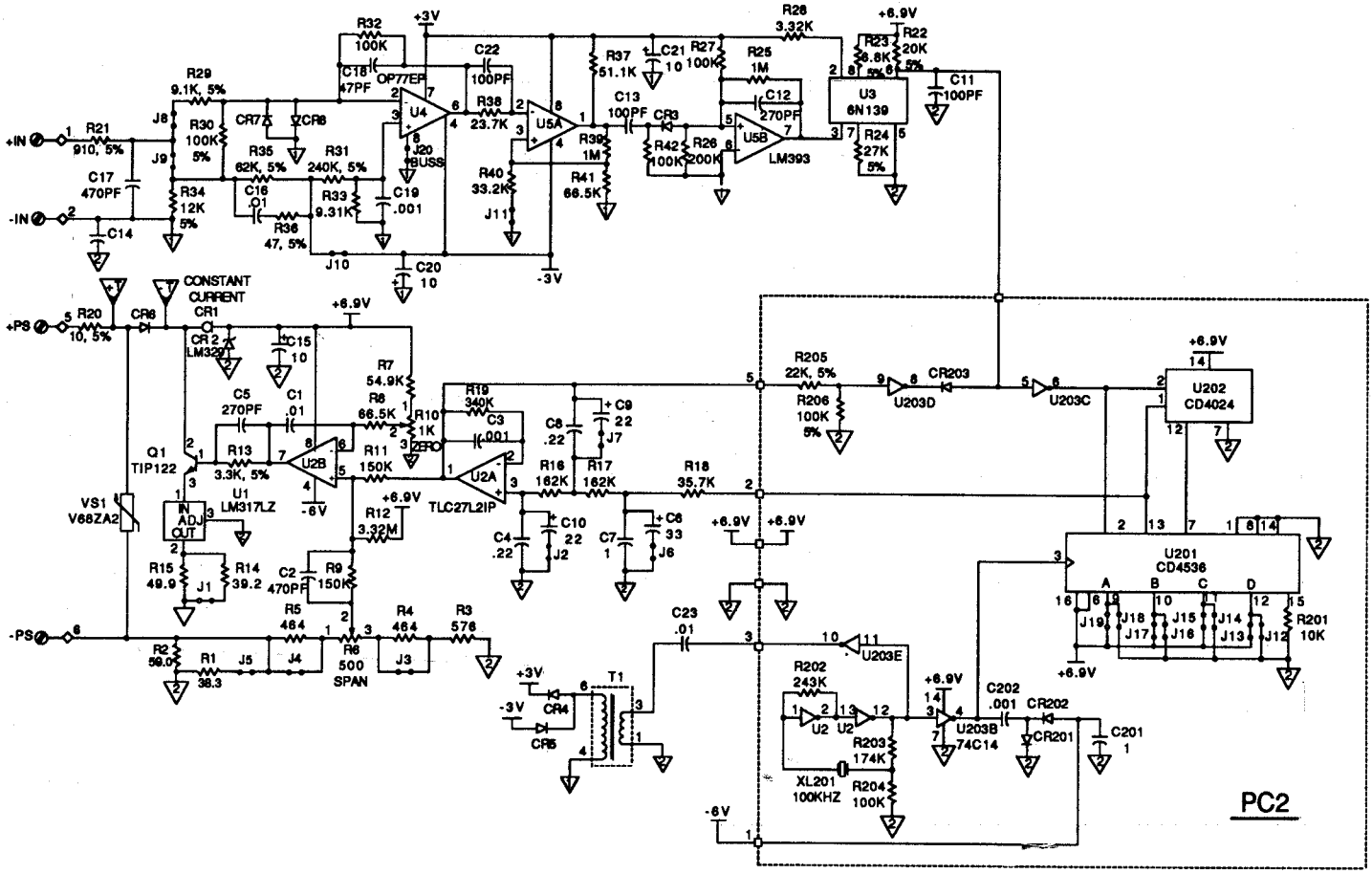
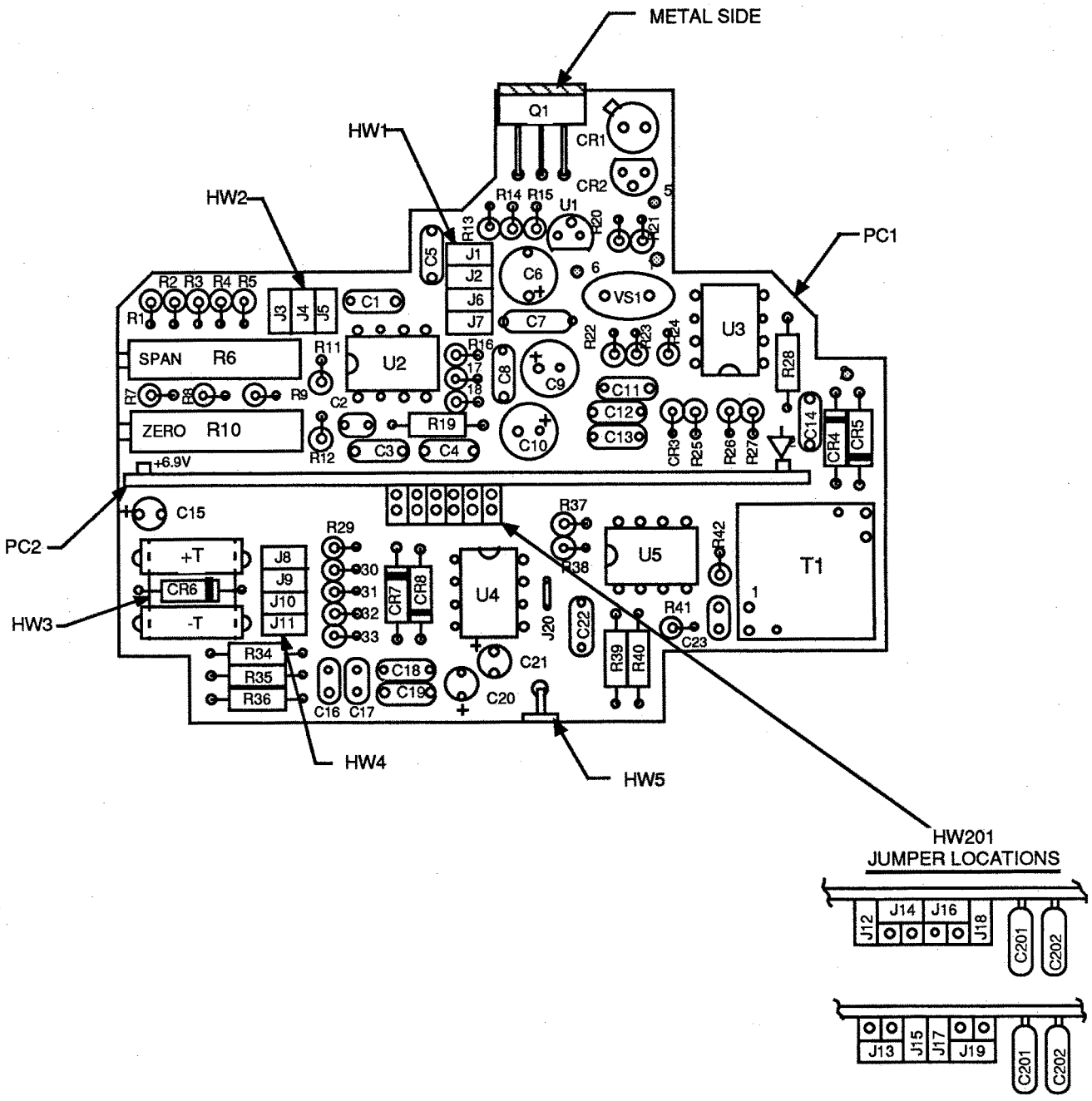


Figure 8. Schematic Diagram for the EP-FDX Transmitter with DIN Housing

165-426-00



165-526-00

Figure 9. *Printed Circuit Board Assembly 1 for the EP-FDX Transmitter with DIN Housing*

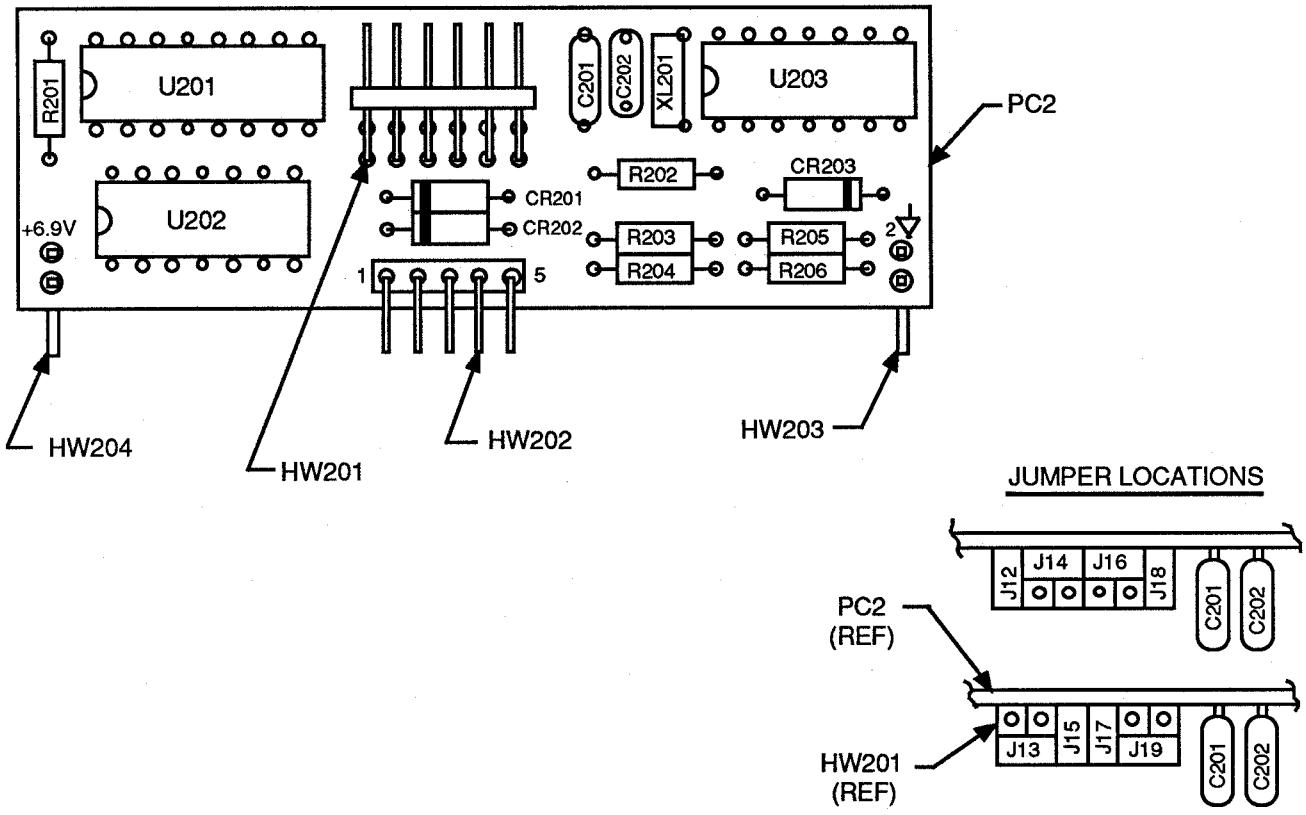


Figure 10. Printed Circuit Board Assembly 2 for the EP-FDX Transmitter with DIN Housing

165-527-00

MOORE INDUSTRIES

EP-FDX

Extended Performance
Frequency-to-DC Transmitter

SUPPLEMENT

September 1992

To Manual No. 165-724-00 A

Purpose

This supplement is intended for users of Moore Industries' EP-FDX. It contains additional information regarding jumper settings, which is not adequately covered in the current Instruction Manual (rev. A).

The information in this supplement will be incorporated in the manual during the next scheduled revision of that document.

The Input Coupling Jumper (J21)

The EP-FDX accepts either an ac or a dc type frequency input. To configure the unit to properly process the input, an internal, removable jumper is provided. Installation or removal of jumper J21 configures the unit for the required input type. Table 1s lists the jumper condition for the two input type options.

Table 1s. *Input Type Jumper Settings*

Input Type	J21 Setting
AC	Store
DC	Install

Figures 1s through 4s show the location of all the available jumpers for both the DIN- and HP-style EP-FDX's.

The Contact Closure Option

Units configured with the Contact Closure Option (CC) require jumpers J9, J10, J11, **and** J21 to be installed for the EP-FDX to repond properly to a contact closure input.

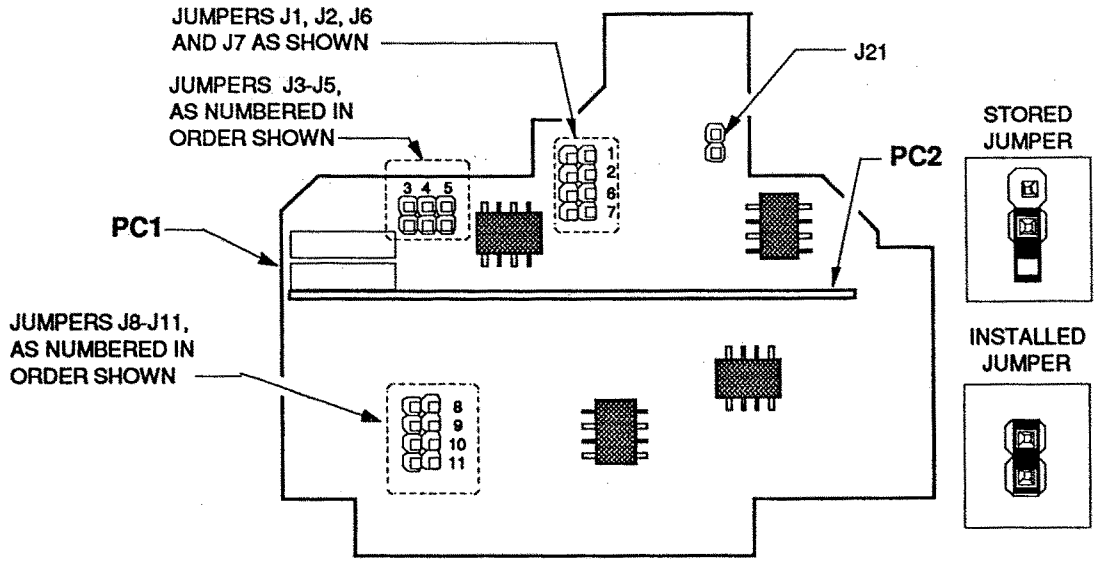


Figure 1s. *DIN-style PC1 Jumper Locations*

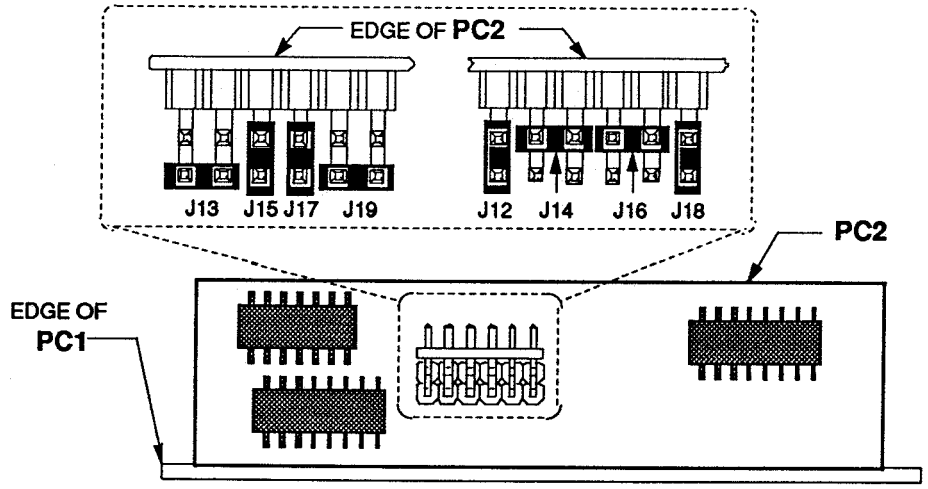


Figure 2s. *DIN-style PC2 Jumper Locations*

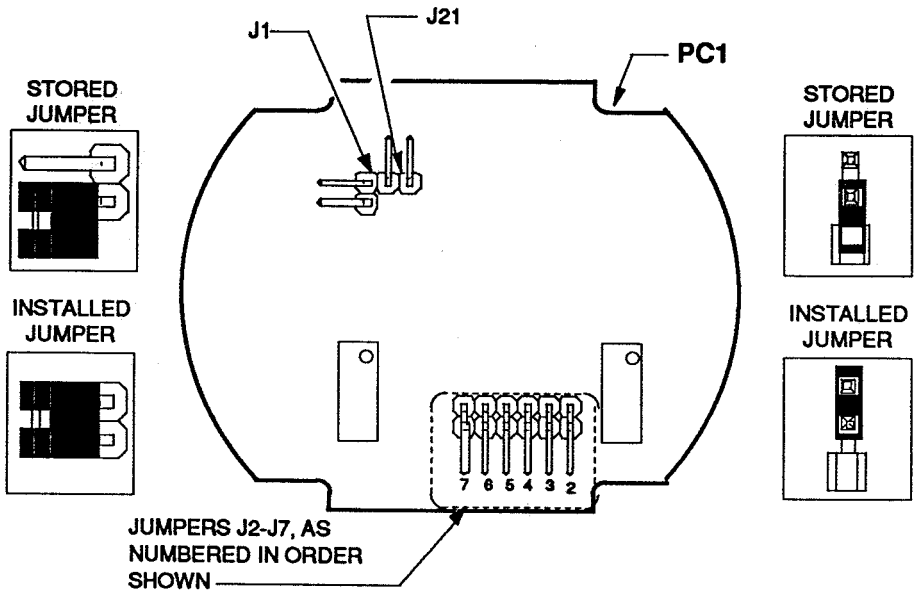


Figure 3s. *HP-style PC1 Jumper Locations*

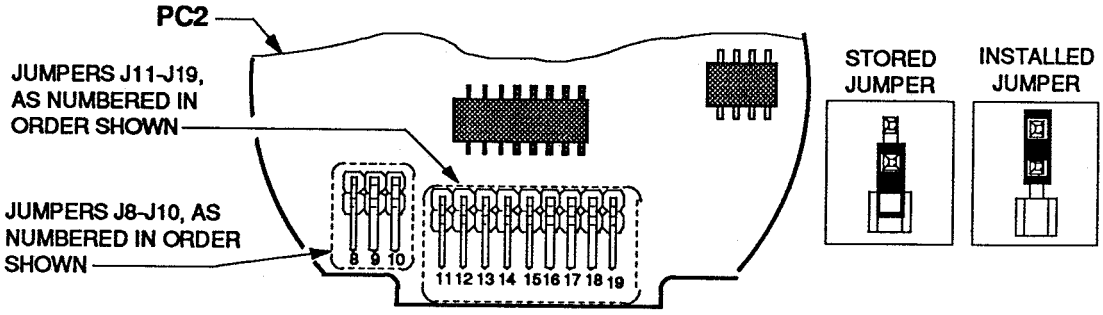


Figure 4s. *HP-style PC2 Jumper Locations*

RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

   Warranty Repair –
   If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

   Non-Warranty Repair –
   If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

MOORE INDUSTRIES

WORLDWIDE • www.miinet.com

United States • info@miinet.com
Tel: (818) 894-7111 • FAX: (818) 891-2816

Belgium • info@mooreind.be
Tel: 03/448.10.18 • FAX: 03/440.17.97

China • sales@mooreind.sh.cn
Tel: 86-21-62491499 • FAX: 86-21-62490635

Australia • sales@mooreind.com.au
Tel: (02) 8536-7200 • FAX: (02) 9525-7296

The Netherlands • sales@mooreind.nl
Tel: (0)344-617971 • FAX: (0)344-615920

United Kingdom • sales@mooreind.com
Tel: 01293 514488 • FAX: 01293 536852