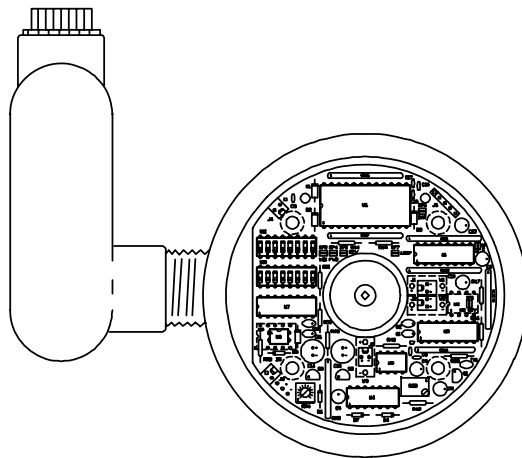


**INSTALLATION, OPERATION  
AND MAINTENANCE MANUAL**

**FOR**

**E7000, E7500, AND E8000**

**4 TO 20 mA ANALOG TRANSMITTERS**



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## I. GENERAL INFORMATION

### A. Unpacking and Inspection

Your **E7000/E7500/E8000** ANALOG TRANSMITTER is engineered to be a highly reliable, accurate system. It has been systematically assembled, inspected, tested and calibrated; then carefully packed or installed on your new McCrometer flowmeter before shipment. If not installed, unpack the transmitter **carefully** and inspect each assembly thoroughly for obvious shipping damage (Figure 1). Notify the freight carrier immediately upon discovery of any damage.

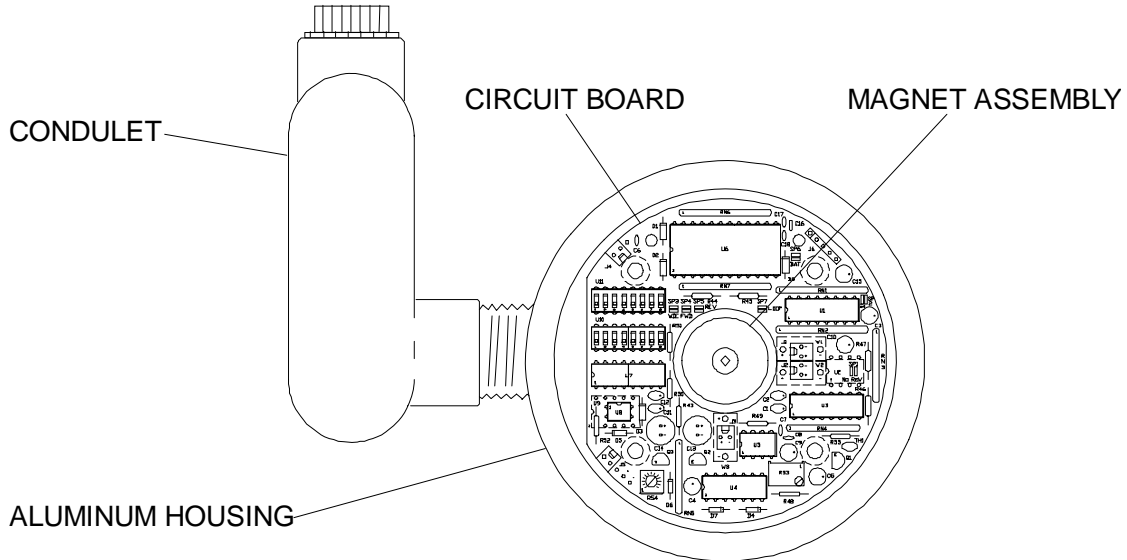


Figure 1. E7000 Transmitter shown

Make sure that all parts are included in the shipment listed below and shown in figure 2.

1. E7000/E7500/E8000 Analog Transmitter Assembly
2. EH222-10 Installation Kit:

EH221-00	Cable Extension	1 each
10142-20	Screw 10-32 x 3" Long w/ Seal Hole	1 each
10142-30	Screw 10-32 x 2-3/4" Long	5 each
10180-00	O-Ring 3-5/8" OD	1 each
10262	Gasket Flat	1 each
3. Specification Sheet

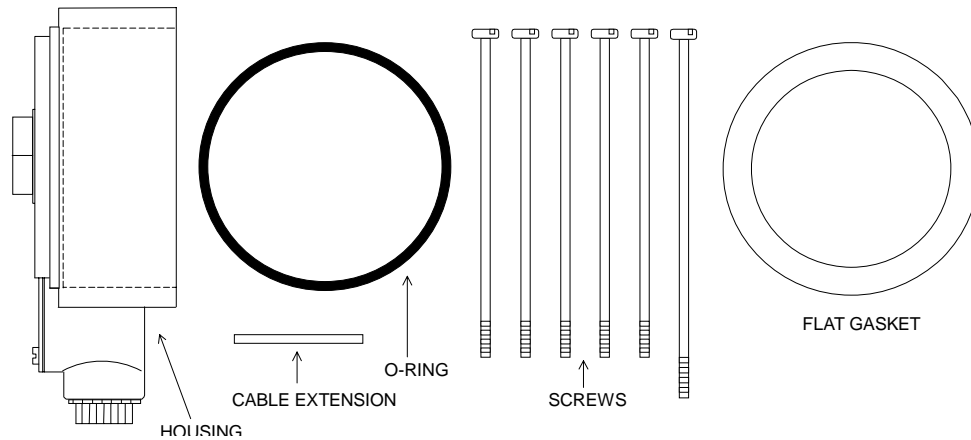


Figure 2. E7000/E7500/E8000 Retrofit Parts Kit

## B. Precautions

Avoid rough handling of the transmitter. The electronic circuits are of solid state technology but damage can result from shock in a fall. During unpacking and installation avoid dusty areas as much as possible. Fine dust or sand can cause erratic operation or failure of the circuitry. Once installed properly, the transmitter assembly is nearly impervious to environmental effects.

When connecting the cables and connectors, be sure that the screws are securely fastened and that the connectors are firmly pressed into place. Normally, you will not have to be concerned with the internal connections unless you are performing maintenance on the assembly.

Double check the installation, wiring, and power supply used to excite the transmitter to ensure that specifications are adhered to properly and precisely to avoid failure and violation of warranty.

## C. Description

### 1. General

The transmitter is a single assembly mounted on the flowmeter beneath the register assembly. It is contained in an aluminum housing 4.25" in diameter and approximately 2" high. It comes equipped with a standard 1/2" electrical LL19 conduit attached by a brass 1/2" close nipple.

The transmitter uses the mechanical rotation of the flexible drive shaft to turn a magnet assembly generating an electric pulse. The pulse is generated by a rotating magnet assembly that has four or eight magnets placed evenly around the assembly.

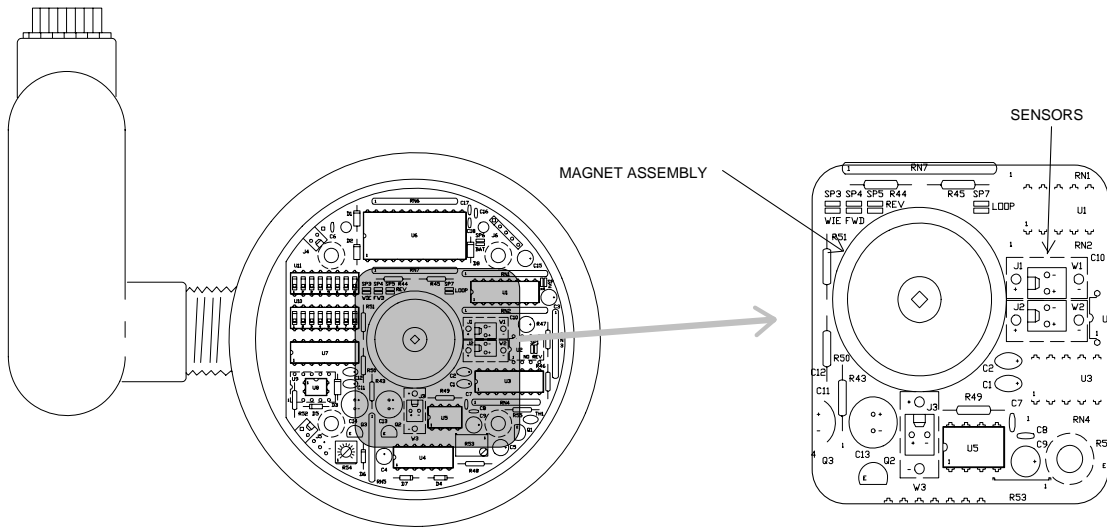


Figure 3. Location of Magnets and Sensors

The magnets pass by the sensor (Figure 3) or sensors depending on whether you have the standard E7000 (one sensor), the anti-reverse E7500 (two sensors), or the forward/reverse E8000 transmitter, and in doing so the magnet generates a pulse output that either goes to a digital-to-analog converter circuitry (standard), or to the quadrature IC (for anti-reverse) and then to the digital-to-analog converter circuitry.

## 2. Totalizer Output Circuit

With the E7000/E7500 there are **two** totalizer output options. These options must be ordered when the transmitter is manufactured.

1. The DRY CONTACT output.  
This is an internal relay rated at .5 Amps. resistive, 125 VAC, 1 Amp 30 VDC.
2. The optically isolated NPN transistor output.  
The end user supplies the power (up to 40 VDC) and ground to the open collector output.

NOTE: The E8000 provides forward and reverse 4-20 mA output, but pulse output in one direction only (specified at time order).

The pulse output from the Totalizer varies with different pipe sizes. When using the RELAY option the transmitter is limited to under 10 pulses per minute, when using the OPEN COLLECTOR output you can achieve a much greater pulse rate, up to 700 pulses per minute.

## 3. Switch Selected Scale Output

The totalizer output can be reprogrammed in the field. What this means is that the amount of fluid that passes through the meter before one totalizer pulse can be changed by simply changing the switch settings on the board shown in Figure 4. Contact McCrometer if the totalizer scaled pulses will be set to a different value.

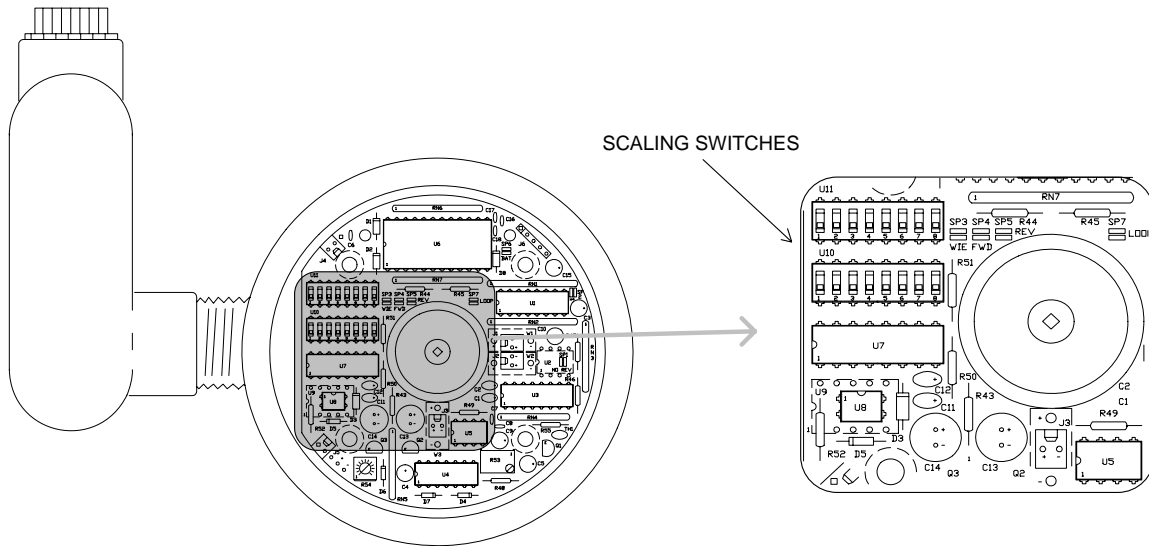


Figure 4. Location of Scaling Switches

## II SPECIFICATIONS

### A. Overall Systems Specifications

Accuracy: 0.5% over entire range

Linearity: 0.1%

Operation Temperature: 25 to 130 ° F

Supply Voltage: 16 to 40 VDC, Nominal 24 VDC, Minimum 25mA

Maximum Resistive Load = 1200 Ohms

(Power Supply Voltage - 16 VDC)/20 mA

Example: (40 VDC - 16 VDC)/20 mA = 1200 Ohms

Temperature Coefficient: +/- 1% Over Entire Temperature Range

Option 1, Dry Contact Relay

Maximum Contact Closures per Minute:10

Contact Closure Duration: 20 milliseconds

Rated Load: 0.5 A at 125 VAC, 1 A at 30 VDC

Maximum Operating Voltage: 125 VAC, 110 VDC

Maximum Switched Power: 30W, 62.5 VA

Option 2, Optically Isolated Transistor

Output Type: NPN Darlington, Optically Isolated

Isolation Voltage: 5000 Vac

Totalizing Pulse Duration: 20 Milliseconds

Collector to Emitter Voltage: 40 VDC Maximum

Collector Current: 200 mA Maximum

Maximum Pulses per Minute: 350

**III. INSTALLATION**

**A. Disassembly**

It is necessary to remove the existing canopy and register. The analog transmitter mounts between the register and the register mounting plate already installed on top of the pipe protruding from the top of the meter.

\* Note: If your meter has the old style plastic canopy and gasket you must replace both the canopy and the base plate with new aluminum ones (Order Canopy Kit RO143-00).

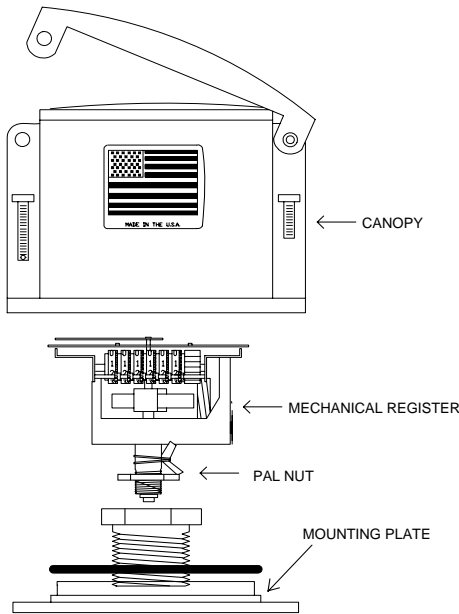


Figure 5. Canopy, Register Removal

THE FLOWMETER CAN BE IN FULL OPERATION DURING THIS PROCEDURE

**1. Canopy Removal**

Remove the six (6) screws holding the Canopy to the mounting plate and discard, Figure 5. One of the screws has a seal attached, remove it prior to removing that screw. Lift off the canopy carefully to prevent damage to the register.

**2. Register Removal**

Loosen the pal nut located on the threaded shaft of the register. Carefully unscrew the register counter clockwise and lift it from the bushing.

**CAUTION:**

Protect the Register from dust while it is outside of the Canopy.

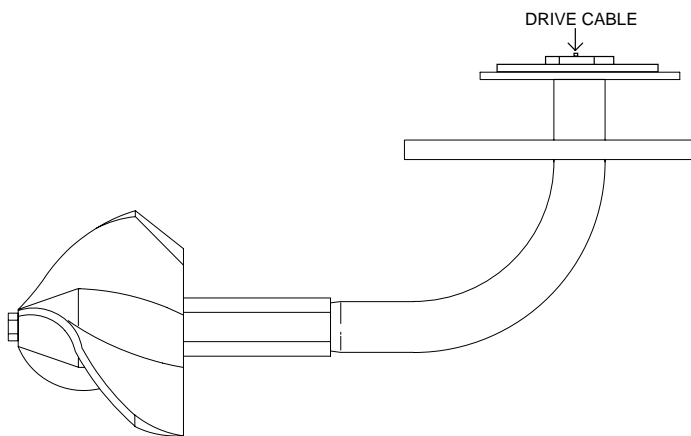


Figure 6. Location of The Drive Cable

You can now see the open end of the ELL with the drive cable, Figure 6. If the flowmeter is in operation the cable will be rotating. If the flowmeter is not installed turn the propeller by hand to check that the bearing and cable rotate freely with no excess play.

## B. Re-assembly

### 1. Analog Transmitter Installation

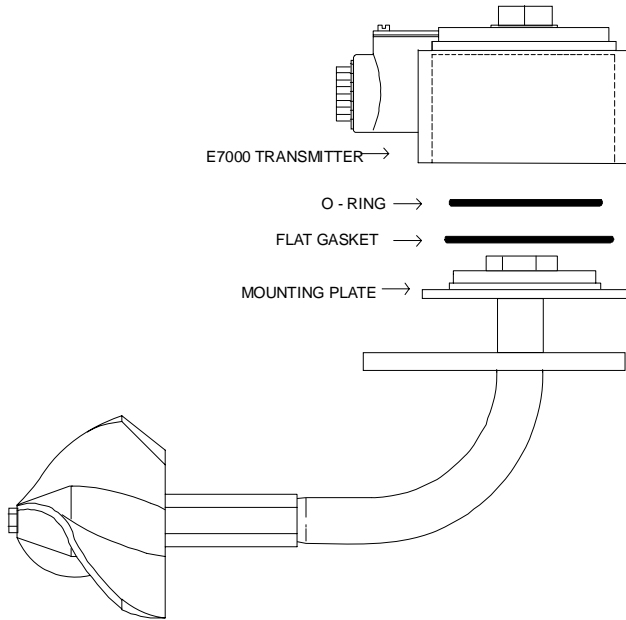


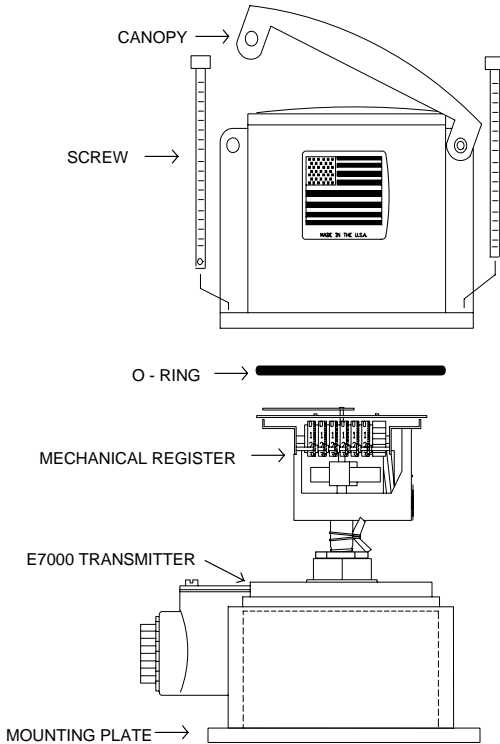
Figure 7. Installation Of The Transmitter

Cleanliness is vital for the operation of the transmitter and the register. Check the threaded area and the mounting plate, Figure 7, they should be free of grease, dust, or any other foreign materials. Place the o-ring and flat gasket over the lip on the mounting plate. Use a small amount of oil to lubricate the o-ring. Rotate the transmitter to align and locate the condulet to the desired position. Lower the transmitter to insert the cable into the center shaft of the transmitter. Continue to lower the unit until it touches the o-ring on the Plate. Work the transmitter carefully down over the o-ring, seat it firmly into place. Avoid unnecessary movement to prevent damage to the o-ring.

Find the short cable extension in the installation kit and insert it into the center of the bearing on top of the transmitter. Place the register with the Pal nut still in place on this cable extension and rotate it clockwise three (3) or four (4) turns. Stop when the register is positioned as it was prior to its' removal and snug up the pal nut. If the flowmeter is operating turn register in until there is a slight binding of the cable in the Register and back out approximately two (2) turns and then tighten the Pal nut; this should give you smooth operation and be correctly positioned.



## 2. Canopy Installation



The canopy can now be installed. Check the transmitter housing and the canopy for cleanliness and clean if needed, Figure 8. Orient the canopy and lower it carefully over the lubricated o-ring and seat it firmly onto the Transmitter Housing. Again, be careful so that the o-ring on the transmitter housing is not damaged.

Locate the long screws; insert the screws through the canopy, transmitter housing, and the Plate. Tighten them using the crisscross method. Use caution when tightening the screws to prevent thread damage. The o-ring will seal the transmitter and mechanical register from environmental contaminants.

Figure 8. Canopy Installation

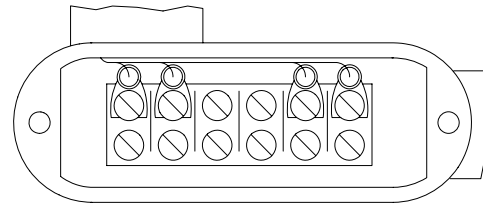


Figure 9. Condulet Wiring

## C. Electrical Specifications

1. The Electrical Requirements are:

- a. 16-40 VDC
- b. 20 mAdc minimum per 4-20 mA loop

2. Remove the cover from the condulet and observe the wires connected to the terminal strip, Figure 9.

The color codes are as follows:

- a. Black = RETURN positive 4-20 mA out
- b. Red = Positive (+) 16-40 VDC from external power
- c. Orange = Positive collector (collector output), or relay contact (normally open)
- d. Blue = Negative emitter (collector output), or relay contact (common)

3. Connect the external power and loads to the terminals in the conduit as follows:
  - a. Connect the positive (+) lead from the external power supply to the terminal with the RED wire connected inside the conduit, and the negative (-) side of the power supply to the negative side of the LOAD, then connect a wire from the Positive side of the LOAD to the BLACK wire inside the conduit as shown in Figure 10.

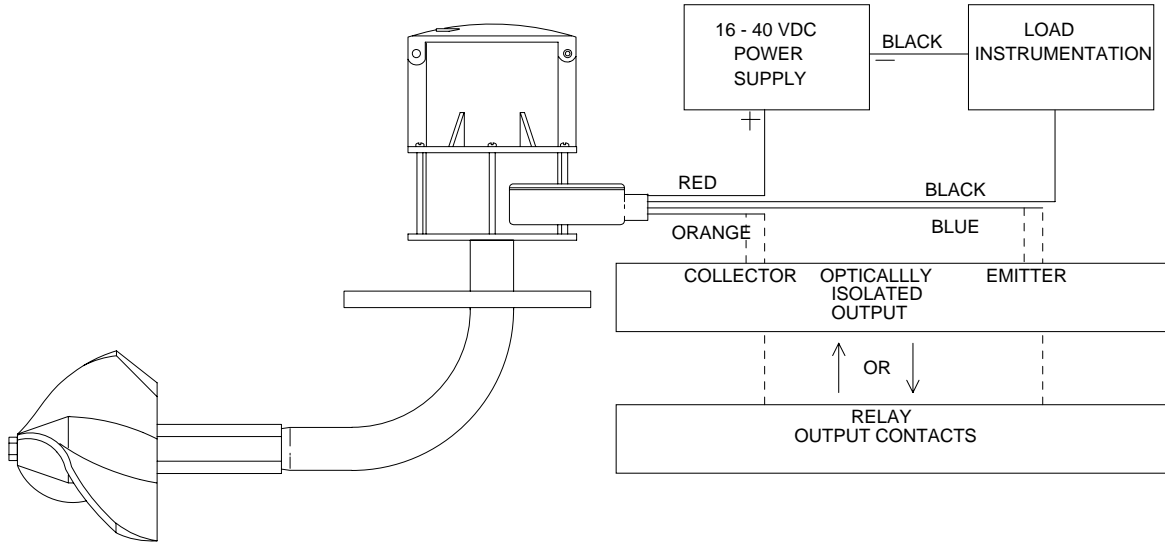


Figure 10. Electrical Connections

- b. For scaled pulse output (e.g. 1P=100 gal) use the ORANGE and BLUE wires, depending on what option that you ordered. The ORANGE wire will be either the Collector output or the Normally Open output. And the BLUE wire will be either the Emitter or the Common output.

## IV. TROUBLESHOOTING

### OPERATION

The transmitter was designed as a fully functional integrated system depending only on an external power source. It is composed of one circuit board with several different functions. The magnet drum rotates on the shaft, which passes by the sensor that produces a pulse which is then transformed into a square wave and goes to the directional sensor. Depending on what model you have, the directional sensor will either send the pulse to the correct digital-to-analog converter (E7000 or E8000) or only allow the forward pulses to advance to the digital-to-analog converter (E7500).

#### **A. Normal Conditions**

1. One of three (3) conditions could exist:
  1. Flowmeter with transmitter in line with flow.
  2. Flowmeter with transmitter in line without flow.
  3. Transmitter not installed on flowmeter

In any of the conditions above the outputs with the magnet rotating at a known speed (RPM) should be at a predicted level. The 4-20 mAdc output should be a steady level of current and the output should be as described on the calibration sheet which can be obtained on request from McCrometer.

#### **B. Troubles and Remedies**

1. Look for obvious physical damage such as cracks in the housing, loose circuit board, screws, magnet assembly, or conduit.
2. Rotate the magnet by hand and check for smooth rotation of the magnet assembly. Binding or rough operation may indicate that the bearing has been damaged.
3. Check the alignment of the conduit to the body of the housing, they should be parallel. A slight mis-alignment is acceptable but it should be tight. A loose conduit could allow moisture to enter the transmitter or terminal area of the conduit and cause failure. The conduit is attached by a 1/2" close nipple with thread lock on both ends. If the conduit was moved in shipment, the seal of the thread may have been broken.

Table 1 has a list of conditions, things to check, possible causes of the troubles, and what to do to correct the problems.

Table 1. Troubleshooting

CONDITION	CHECK	POSSIBLE CAUSE	REMEDY
No output	Power supply.	Wrong power supply. or faulty power supply	Replace power supply
	Check AC power at Source	Power supply not plugged in or no power to power supply	Plug in power supply to AC at Source
16 - 40 VDC to transmitter but no outputs	Wiring	Loose or disconnected Wire(s)	Fix Wire(s)
Incorrect Output	Load	Load Exceeds limit	Decrease Load Resistance (RL)
	Magnet	Magnet Assembly Set Screw Loose	Tighten Set Screw

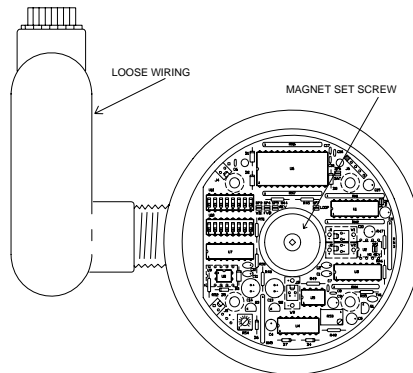


Figure 12 Troubleshooting

## V. CALIBRATION

**IMPORTANT:** Allow the mA output to stabilize for 1-2 minutes when the unit is first powered up before reading or changing output values.

It is necessary that you be able to rotate the magnet in the transmitter at a controlled rate and read the current output. The following list of equipment is meant as a reference only, but is the equipment we use in our electronics department at McCrometer. You may use any desired test equipment as long as it has the accuracy and you know the RPM-s applied. Your calibration is only as good as the equipment used and the skill and knowledge of the Technician. If you lack the necessary equipment to calibrate the transmitter, it can be sent to McCrometer for calibration.

1. Fluke 8060A Digital Multimeter  
Used to measure milliamps
2. A known controlled means of rotating the magnet.  
Minarik Electric (818) 507-6500 has quality equipment and a variety from which to choose. (MM21111A - DC Speed Control, 504-00-042 - Rae 1/50HP DC Motor)

### A. Preparation

1. Refer to Set Up drawing, Figure 13 and connect the equipment accordingly.
2. Calculate the required motor speed and the corresponding current reading.
3. Ensure that the motor turns the mechanical linkage clockwise when looking at the top of the transmitter.

### B. Calculations

Attached to each transmitter is a label showing a full scale propeller RPM. Set the motor at that speed to adjust the current output to 20 mAdc.

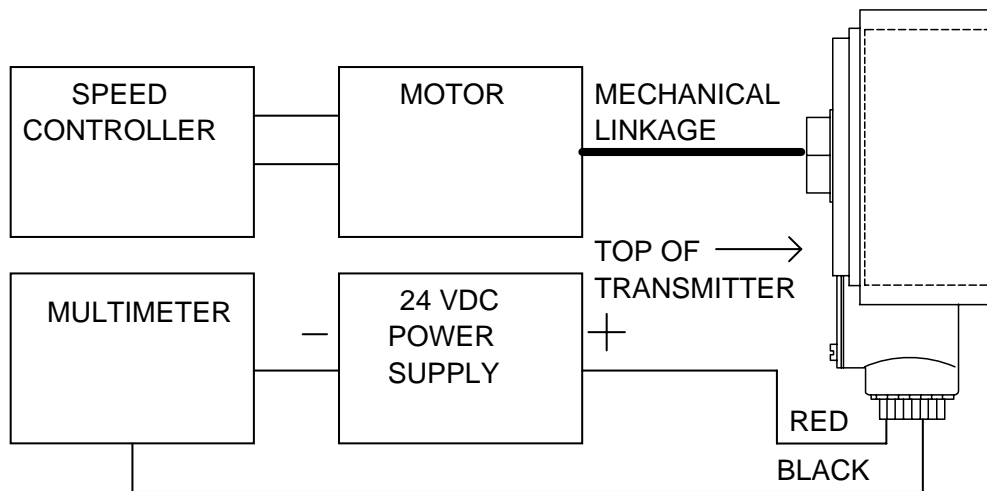


Figure 13 Block Diagram of Calibration Set Up

### C. Calibration

1. With the motor at zero RPM, adjust the potentiometer farthest to the left end of the E7000 circuit board to read 4.0 mAdc on the multimeter, see Figure 14.

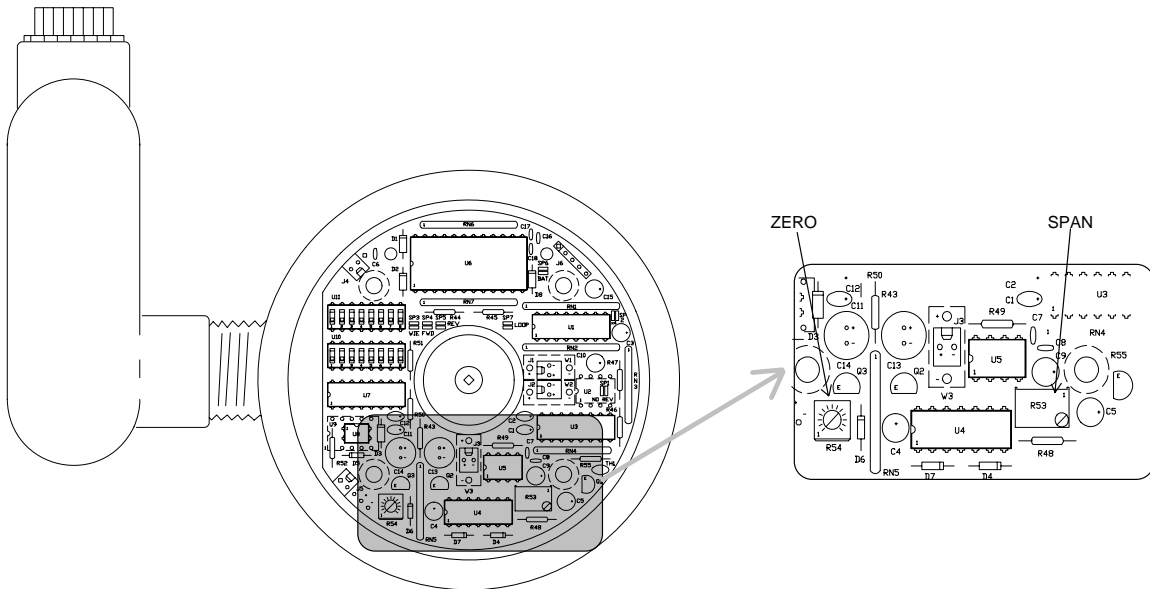


Figure 14 Calibration Of Zero and Span

2. Apply power to the speed control system that you are using and set for Full Scale RPM.
3. Adjust the pot on the right hand side for a reading of 20 mAdc on the multimeter.
4. Stop the rotation of the magnet and check the 4 mAdc reading. **It may take a minute or two to stabilize;** check and if necessary re-adjust the left potentiometer to obtain the 4 mAdc reading on the multimeter.
5. You may have to repeat the zero and span adjustments two or three times to be sure that the adjustments are stable.
6. Reverse the motor direction to verify function of the E7500 anti-reverse feature or to verify function of the E8000 reverse mA output.
7. Once you are satisfied that the transmitter is calibrated properly and within specifications the equipment can be disconnected from power and stored in a clean and temperature stable environment.
8. A suggestion at this point in your calibration is to put a drop of fingernail polish, or enamel on the adjustment end of the potentiometer to prevent them from turning due to vibration from the flow tubes.

Install the transmitter referring to the INSTALLATION Section.

**VI. WARRANTY**

This Warranty Shall apply to and be limited to the original purchaser consumer of any McCrometer product. Meters or instruments defective because of faulty material or workmanship will be repaired or replaced, at the option of McCrometer, free of charge, FOB the factory in Hemet, California, within a period of one (1) year from the date of delivery.

Repairs or modifications by others than McCrometer or their authorized representatives shall render this Warranty null and void in the event that factory examination reveals that such repair or modification was detrimental to the meter or instrument. Any deviations from the factory calibration require notification in writing to McCrometer of such recalibrations or this warranty shall be voided.

In case of a claim under this Warranty, the claimant is instructed to contact McCrometer, 3255 West Stetson Ave., Hemet, California 92545, and to provide an identification or description of the meter or instrument, the date of delivery, and the nature of the problem.

The Warranty provided above is the only warranty made by McCrometer with respect to its products or any parts thereof and is made expressly in lieu of any other warranties, by course of dealing, usages of trade or otherwise, expressed or implied, including but not limited to any implied warranties of fitness for any particular purpose or of merchantability under the uniform commercial code. It is agreed this warranty is in lieu of and buyer hereby waives all other warranties, guarantees or liabilities arising by law or otherwise. Seller shall not incur any other obligations or liabilities or be liable to buyer, or any customer of buyer for any anticipated or lost profits, incidental or consequential damages, or any other losses or expenses incurred by reason of the purchase, installation, repair, use or misuse by buyer or third parties of its products (including any parts repaired or replaced); and seller does not authorize any person to assume for seller any other liability in connection with the products or parts thereof. This Warranty cannot be extended, altered or varied except by a written instrument signed by seller and buyer.

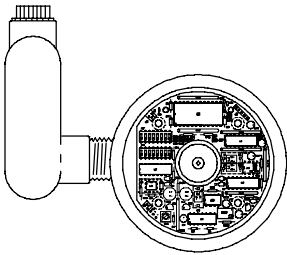
This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

McCrometer reserves the right to make improvements and repairs on product components which are beyond the warranty period at the manufacturer's option and expense, without obligation to renew the expired warranty on the components or on the entire unit. Due to the rapid advancement of meter design technology, McCrometer reserves the right to make improvements in design and material without prior notice to the trade.

All sales and all agreements in relation to sales shall be deemed made at the manufacturer's place of business in Hemet, California, and any dispute arising from any sale or agreement shall be interpreted under the laws of the State of California.

# Specification Sheet

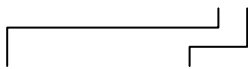
**Model:** E7000      **Description:** Two-Wire 4-20 mA Transmitter



**Features:**

- ◆ Industry standard 2-wire 4-20 mA output
- ◆ Output is linear with flowrate
- ◆ Compatible with all McCrometer propeller meters with a mechanical register
- ◆ Installation can be accomplished without meter removal from pipe
- ◆ For meter sizes up to 24"
- ◆ Signal can travel up to 5000 feet
- ◆ Additional pulse output and anti-reverse options

**E 7 0 0 0 - 0 x x**



**Anti-Reverse**

0 - No  
1 - Yes

**Pulse Output**

0 - None  
1 - Dry Contact  
2 - Open Collector

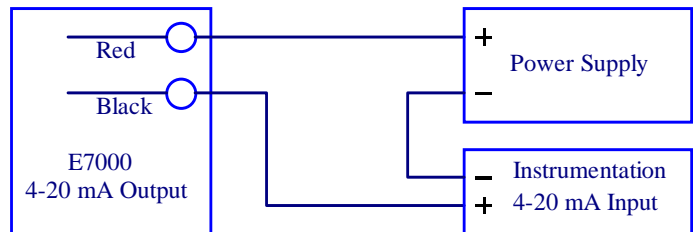
E7000 Model:	4-20 mA Output	Dry Contact	Open Collector	Anti-Reverse
E7000-000	•			
E7000-001	•	•		
E7000-002	•		•	
E7000-010	•			•
E7000-011	•	•		•
E7000-012	•		•	•

**Electrical Characteristics:**

**4-20 mA Output:**

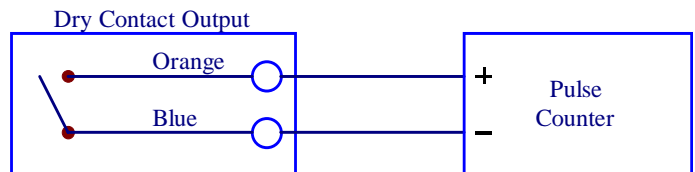
<b>Operating Temperature:</b>	+25 to +130 degrees F
<b>Supply Voltage:</b>	16 - 40 VDC
<b>Temperature Coefficient:</b>	±1.0%
<b>Linearity:</b>	0.1%
<b>Accuracy:</b>	0.5% over the entire range
<b>Maximum Resistive Load:</b>	Supply Voltage Dependent*
<b>Reverse Voltage Protection:</b>	-300V Maximum

**Typical Wiring Diagrams:**



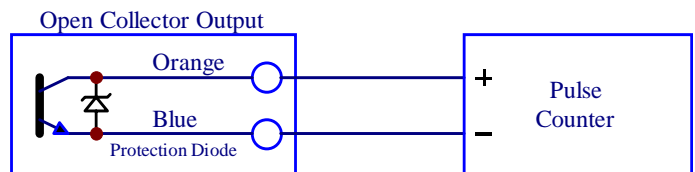
**Dry Contact Output\*\*:**

<b>Type:</b>	Relay Contact, Norm. Open
<b>Rated Load (AC):</b>	0.5 A at 125 VAC
<b>Rated Load (DC):</b>	1 A at 30 VDC
<b>Max. Operating Current:</b>	1 A
<b>Max. Switching Power:</b>	30 W, 62.5 VA
<b>Contact Closure Duration:</b>	20 milliseconds
<b>Max. Clicks per Minute:</b>	10



**Open Collector Output\*\*:**

<b>Type:</b>	NPN Darlington, Isolated
<b>Isolation Voltage:</b>	5000 VAC
<b>Collector to Emitter Voltage:</b>	40 VDC Maximum
<b>Collector Current:</b>	200 mA Maximum
<b>Pulse Output Duration:</b>	20 milliseconds
<b>Max. Pulses per Minute:</b>	350



\* - Use formula (Supply Voltage - 16) ÷ 0.02 = Maximum Load(Ω)

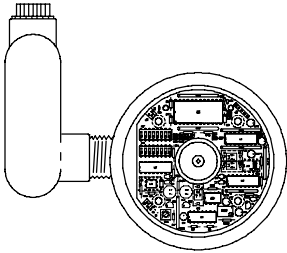
\*\* - Totalizer output operates only when power is applied to the 4-20 mA loop.

McCrometer reserves the right to change the Specification without notice.



# Specification Sheet

**Model:** E7500      **Description:** Two-Wire 4-20 mA Transmitter



**Features:**

- ◆ Industry standard 2-wire 4-20 mA output, Anti-Reverse
- ◆ Output is linear with flowrate
- ◆ Compatible with all McCrometer propeller meters with a mechanical register
- ◆ Installation can be accomplished without meter removal from pipe
- ◆ For meter sizes from 24" and above
- ◆ Signal can travel up to 5000 feet
- ◆ Additional pulse output options

**E 7 5 0 0 - 0 1 x**

**Pulse Output**

- 0 - None
- 1 - Dry Contact
- 2 - Open Collector

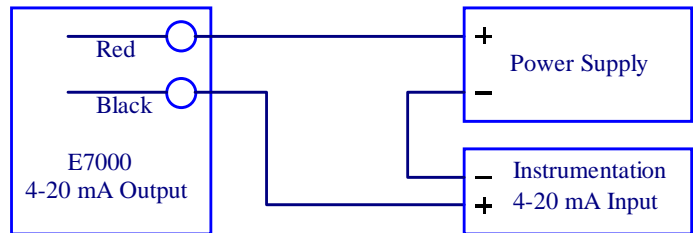
E7500 Model:	4-20 mA Output	Dry Contact	Open Collector	Anti-Reverse
E7500-010	•			•
E7500-011	•	•		•
E7500-012	•		•	•

**Electrical Characteristics:**

**4-20 mA Output:**

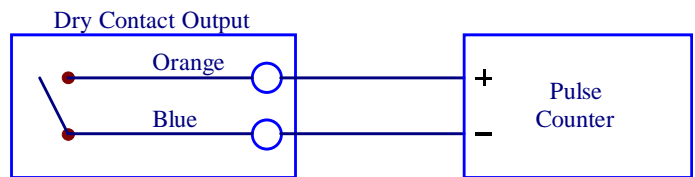
Operating Temperature:	+25 to +130 degrees F
Supply Voltage:	16 - 40 VDC
Temperature Coefficient:	±1.0%
Linearity:	0.1%
Accuracy:	0.5% over the entire range
Maximum Resistive Load:	Supply Voltage Dependent*
Reverse Voltage Protection:	-300V Maximum

**Typical Wiring Diagrams:**



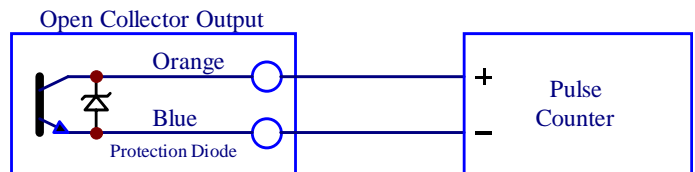
**Dry Contact Output\*\*:**

Type:	Relay Contact, Norm. Open
Rated Load (AC):	0.5 A at 125 VAC
Rated Load (DC):	1 A at 30 VDC
Max. Operating Current:	1 A
Max. Switching Power:	30 W, 62.5 VA
Contact Closure Duration:	20 milliseconds
Max. Clicks per Minute:	10



**Open Collector Output\*\*:**

Type:	NPN Darlington, Isolated
Isolation Voltage:	5000 VAC
Collector to Emitter Voltage:	40 VDC Maximum
Collector Current:	200 mA Maximum
Pulse Output Duration:	20 milliseconds
Max. Pulses per Minute:	350

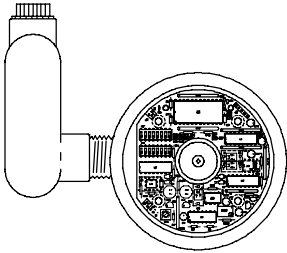


\* - Use formula (Supply Voltage - 16) ÷ 0.02 = Maximum Load(Ω)  
 \*\* - Totalizer output operates only when power is applied to the 4-20 mA loop.

McCrometer reserves the right to change the Specification without notice.

# Specification Sheet

**Model:** E8000      **Description:** Two-Wire 4-20 mA Transmitter



**Features:**

- ◆ Industry standard 2-wire dual 4-20 mA Forward-Reverse output
- ◆ Output is linear with flowrate
- ◆ Compatible with all McCrometer propeller meters with a mechanical register
- ◆ Installation can be accomplished without meter removal from pipe
- ◆ Compatible with all meter sizes
- ◆ Signal can travel up to 5000 feet
- ◆ Additional pulse output options

**E 8 0 0 0 - 0 0 x**

**Pulse Output**

- 0 - None
- 1 - Dry Contact
- 2 - Open Collector

E8000 Model:	4-20 mA Output (Forward/Reverse)	Dry Contact (Forward***)	Open Collector (Forward***)
E8000-000	•		
E8000-001	•	•	
E8000-002	•		•

**Electrical Characteristics:**

**4-20 mA Dual Outputs:**

<b>Operating Temperature:</b>	+25 to +130 degrees F
<b>Supply Voltage:</b>	16 - 40 VDC
<b>Temperature Coefficient:</b>	±1.0%
<b>Linearity:</b>	0.1%
<b>Accuracy:</b>	0.5% over the entire range
<b>Maximum Resistive Load:</b>	Supply Voltage Dependent*
<b>Reverse Voltage Protection:</b>	-300V Maximum

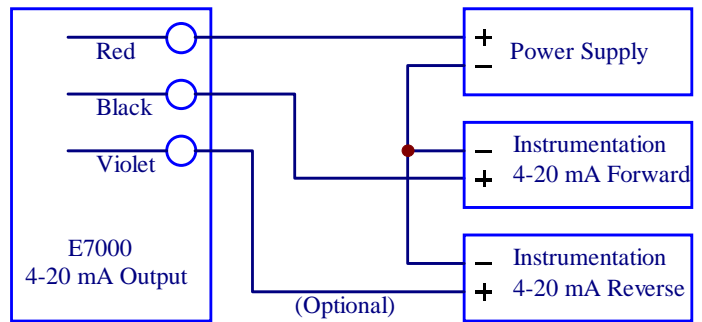
**Dry Contact Output\*\*:**

<b>Type:</b>	Relay Contact, Norm. Open
<b>Rated Load (AC):</b>	0.5 A at 125 VAC
<b>Rated Load (DC):</b>	1 A at 30 VDC
<b>Max. Operating Current:</b>	1 A
<b>Max. Switching Power:</b>	30 W, 62.5 VA
<b>Contact Closure Duration:</b>	20 milliseconds
<b>Max. Clicks per Minute:</b>	10

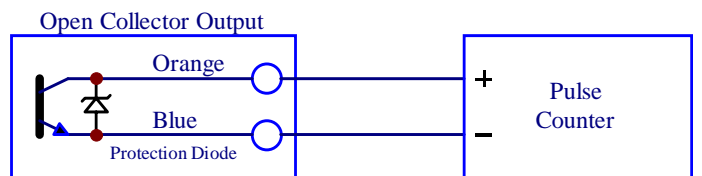
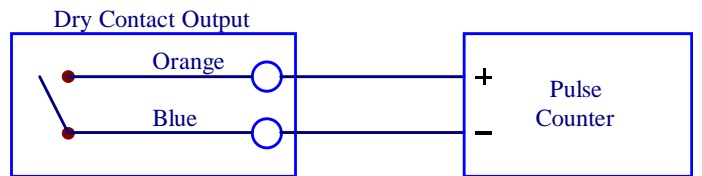
**Open Collector Output\*\*:**

<b>Type:</b>	NPN Darlington, Isolated
<b>Isolation Voltage:</b>	5000 VAC
<b>Collector to Emitter Voltage:</b>	40 VDC Maximum
<b>Collector Current:</b>	200 mA Maximum
<b>Pulse Output Duration:</b>	20 milliseconds
<b>Max. Pulses per Minute:</b>	350

**Typical Wiring Diagrams:**



*Note:* The Forward loop must be connected at all times for the transmitter to operate. Reverse loop can be left unconnected.



\* - Use formula (Supply Voltage - 16) ÷ 0.02 = Maximum Load(Ω)  
 \*\* - Totalizer output operates only when power is applied to the Forward 4-20 mA loop.  
 \*\*\* - Totalizer output operates only in forward direction unless ordered otherwise.

McCrometer reserves the right to change the Specification without notice.

## OTHER McCROMETER PRODUCTS INCLUDE:



Magnetic Flowmeters



Propeller Flowmeters



Propeller Flowmeters



Differential Pressure Flowmeters

*The Space Saver Solution*



Differential Pressure Flowmeters



Differential Pressure Flowmeters



Variable Area Flowmeters

Electronic Instrumentation for Remote Display and Control

FOR MORE INFORMATION CONTACT:

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