Instruction

MI 021-392
October 2009

I/A Series®
Magnetic Flowtube Simulator

FOXBORO™

Contents

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1. Introduction

The IMTSIM flowtube simulator (Figure 1) is a lightweight, dust, rain, and chemically resistant hand-held instrument designed to verify the calibration of IMT25 and IMT25L pulsed dc magflow transmitters in the field. The unit also meets applicable CE requirements. The IMTSIM produces an output signal of similar magnitude to that of a magnetic flowtube. The signal is used as the input to the flow transmitter under test and is translated by the transmitter to a corresponding flow rate.

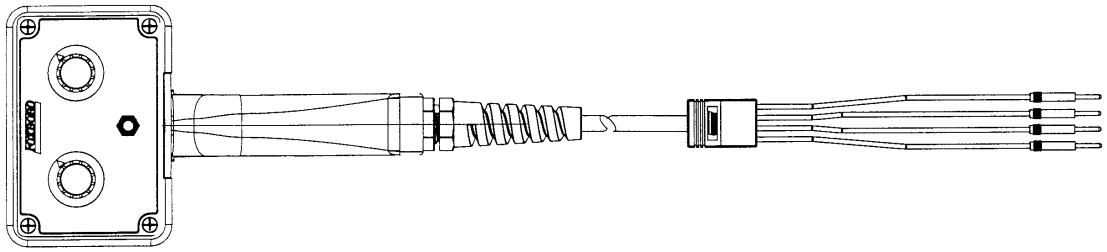

Figure 1. IMTSIM Simulator with Probes

The IMTSIM output signal is a voltage that is proportional to the current into the device. A rotary switch on the IMTSIM (Figure 2) selects one of seven simulated inputs in mV of signal per ampere of coil current. The accuracy of each setting is sufficient for functional testing the IMT25 and IMT25L. Settings of 2.0, 4.0, and 8.0 can be used to verify the calibration of the transmitter.

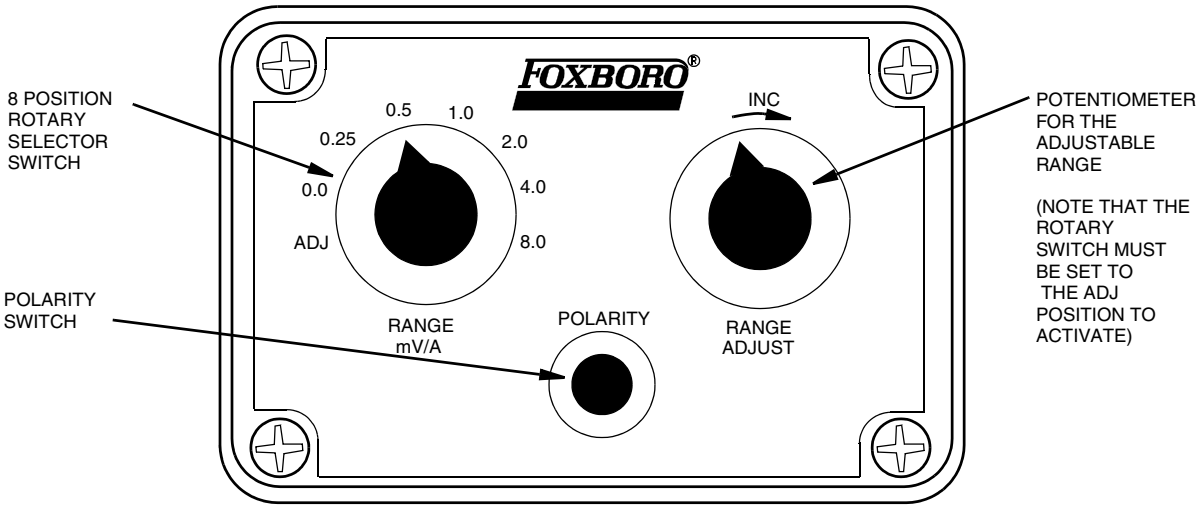

Figure 2. IMTSIM Control Panel

The first position on the rotary switch (Figure 2) selects an adjustable output/input ratio which may be used to simulate a wide range of flow signals. This adjustable range is intended to be used for general purpose troubleshooting of transmitter functions and should not be used to verify the calibration of a transmitter. The polarity switch toggles the sign of the IMTSIM output to simulate forward and reverse flows.

Included with the IMTSIM is a panel mounting bracket and hardware kit (Figure 3). The screws, lockwashers, and nuts contained in the kit may be substituted with a pair of #8 sheet metal screws for wall mounting.

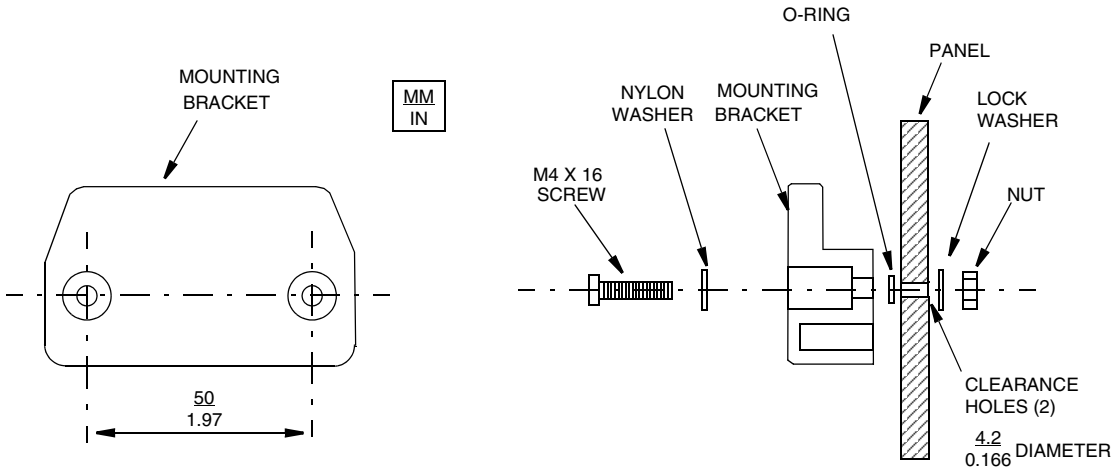

Figure 3. Installation of Panel Mounting Bracket

Reference Documents

Document	Description
MI 021-387	IMT25 I/A Series Magnetic Flow Transmitter — Installation
MI 021-390	IMT25 I/A Series Magnetic Flow Transmitter — Local Operation, Configuration, and Calibration
MI 021-391	IMT25 I/A Series Magnetic Flow Transmitter — System Maintenance
MI 020-495	PC20 Intelligent Field Device Configurator
MI 020-504	PC50 Intelligent Field Device Tool

IMTSIM Specifications

Input Signal (supplied by transmitter)	Bipolar current pulses, ±0.250 A normal, ±0.500 A maximum
Output Signal	The output of the IMTSIM is a voltage that is proportional to the current entering the input of the device. The output ranges are specified in units of millivolts per ampere (mV/A).
Power Requirements	The IMTSIM is completely powered by the IMT25/25L transmitter. No additional power is needed.
Temperature Limits	
Operating	0 to 60°C (32 to 140°F)
Storage	-40 to 70°C (-40 to 158°F)
Weight	0.6 kg (1.4 lb)

Accuracy (normal operating conditions)

Range Setting (mV/A)	IMTSIM Accuracy
ADJ	Not applicable
0.00	±0.00 mV/A ± Measurement Error
0.25	±0.25%
0.50	±0.10%
1.00	±0.08%
2.00	±0.08%
4.00	±0.08%
8.00	±0.08%

See Appendix A for the percentage bands of an IMTSIM/IMT25; /IMT25L combination.

2. Verification Procedures

The IMTSIM may be operated with any existing IMT25/25L transmitter in the Measurement Mode. Additionally, IMT25 transmitters with Version 2.0 software contain two special modes (Test Mode A and Test Mode B).

Test Mode A uses the existing configuration of the transmitter and compares a known input signal to flow rate. Test Mode B changes the configuration of the transmitter to equal 8 mV/A at 100% of the URV, and the rest of the settings to percentages of URV. Note that this change takes place only during the testing; the original configuration returns to normal after testing is complete. Both Test Modes A and B incorporate a special averaging algorithm to improve response time between changes in ranges on the IMTSIM.

Figure 4 is a diagram of a typical setup for field verification of an IMT25 flow transmitter.

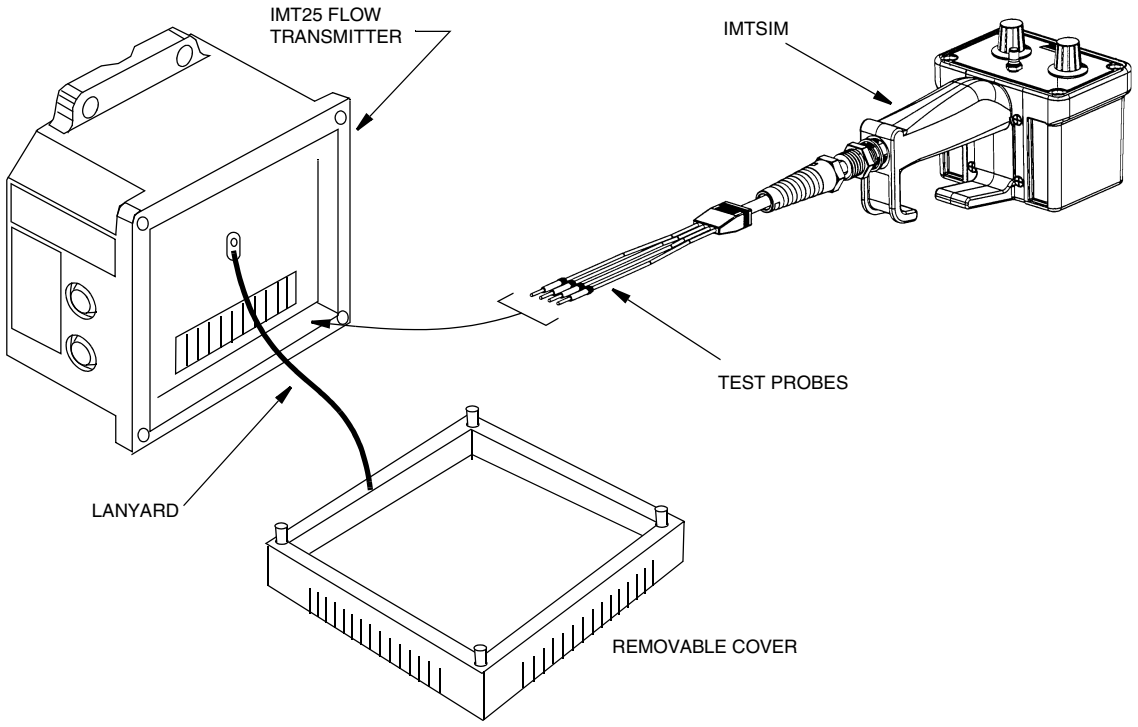

Figure 4. Typical System Setup

IMT25/25L Verification in Measurement Mode

1. Place loop in manual control.
2. Turn off power to the transmitter.

⚠ CAUTION

To prevent possible degradation of circuit calibration due to electrostatic discharge (ESD), discharge your body by touching a transmitter cover mounting screw before connecting the IMTSIM.

3. IMTSIM connections (refer to Figure 5 on page 7).

Red and Green Wires:

For configurations A, B, C, and D —

a. Remove main enclosure cover of IMT25 and locate terminal block labeled “coil”.
b. If flowtube wires are connected to “coil1” and “coil 2” terminals, remove them.
c. Connect red wire to “coil 1” terminal and green wire to “coil 2” terminal.

Black and White Wires:

For configurations A, B, and C —

a. Locate terminal block labeled “signal”.
b. If flowtube wires are connected, remove all wires connected to “signal terminal”.
c. Connect black wire to “signal B” terminal and white wire to “signal W” terminal.

For configuration D —

a. Remove cover of junction box and locate terminal block labeled “signal”.
b. If flowtube wires are connected, remove all wires connected to “signal terminal”.
c. Connect black wire to “signal B” terminal and white wire to “signal W” terminal.

NOTE

Radio frequency (RF) energy from intentional transmitters such as walkie-talkies within close proximity to an IMT25 with the cover removed, may affect accuracy.

4. Reconnect power to the transmitter.

NOTE

Record initial values.

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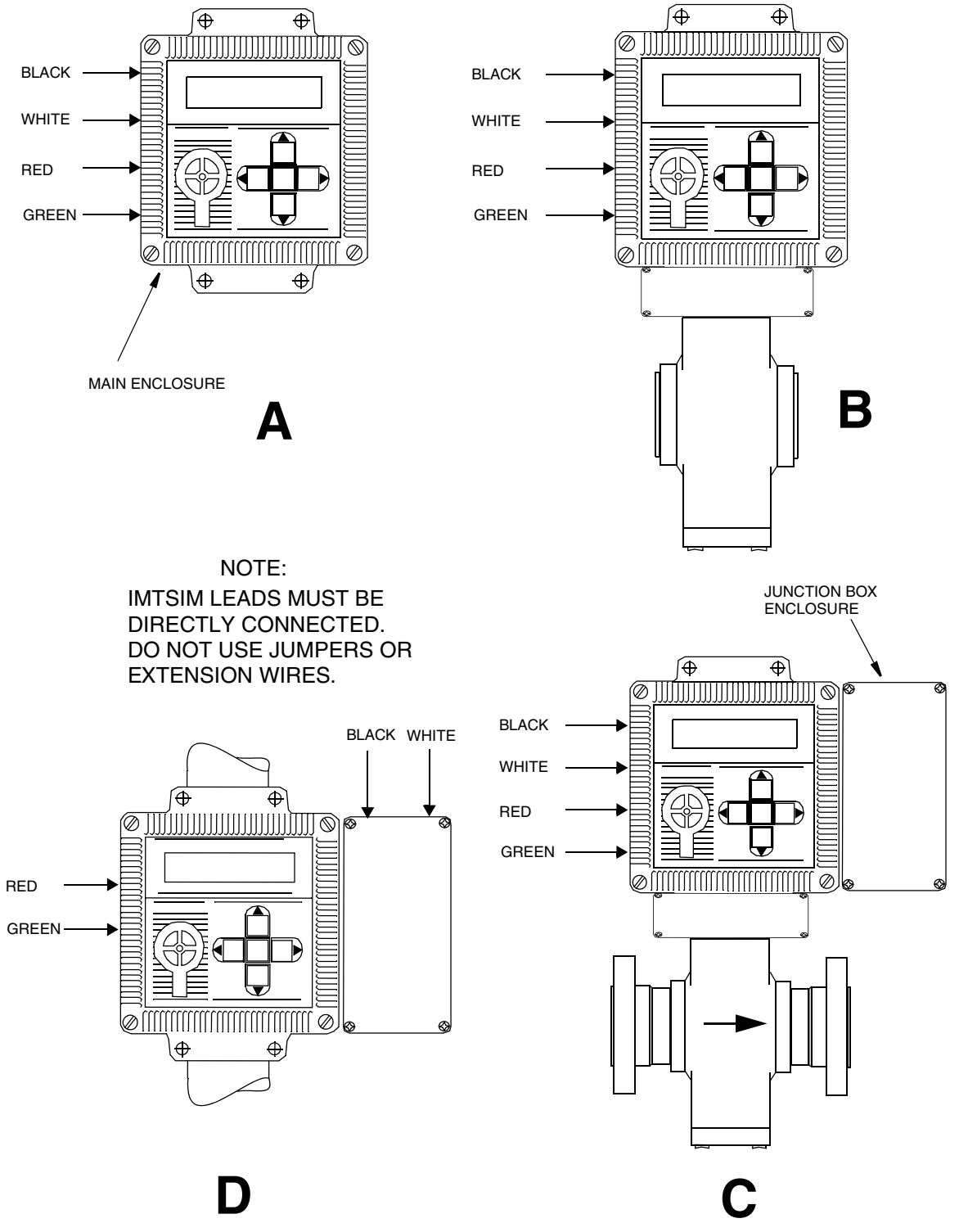


Figure 5. Connecting the IMTSIM to an IMT25 Transmitter

5. Reconfigure IMT25 per MI 021-390 or IMT25L per MI 020-495 (using PC20) or MI 020-504 (using PC50):
   - Noise Reduction OFF.
   - Empty Pipe Detector OFF.
   - If analog (4 to 20 mA) or Pulse Rate is used, set the Rate Out Damping to 15 seconds.
   - If local display is used (IMT25), set Rate Display Damping to 15 seconds.
6. If local keypad and display are available, use the Up/Down arrow keys to set display to "Rate" in engineering units.
7. Calculate the expected flow rate by using the following equation:

$$Flow\_rate = \frac{318.9}{meter\_factor} \times range\_setting \times units\_slope$$

where

meter_factor = calibration factor of flowtube as configured in IMT25/25L

range_setting = setting in mV/A of the IMTSIM

units_slope = the number of selected EGUs that equals one GPM (e.g., 3.7853 liters/minute [LPM] = 1 GPM)

Example 1:

An IMT25 transmitter is configured for an upper range value (URV) of 500 LPM and flowmeter calibration factor of 12. The transmitter should read the following when a range_setting of 2.0 mV/A is used:

$$Flow\_rate = \frac{318.9}{12} \times 2.0 \times 3.7853$$

$$= 201.19 \text{ LPM}$$

And for rate outputs:

$$\%\ of\ Output = \frac{201.19}{500} = 40.24\%$$

Values for all settings of IMTSIM are:

IMTSIM Range Setting (mV/A)	Flow Rate (LPM)	% of Output
0.25	25.2	5.03
0.50	50.3	10.06
1.00	100.6	20.12
2.00	201.2	40.24
4.00	402.4	80.48
8.00	804.8	161.95

Example 2:

An IMT25 transmitter is configured for an upper range value (URV) of 500 GPM and flowmeter calibration factor of 4.1. The following responses are expected from the transmitter when the IMTSIM is connected:

$$Flow\_rate = \frac{318.9}{4.1} \times range\_setting \times 1$$

IMTSIM Range Setting (mV/A)	Flow Rate (GPM)	% of Output
0.25	19.5	3.88
0.50	38.9	7.78
1.00	77.8	15.56
2.00	155.6	31.11
4.00	311.1	62.22
8.00	622.2	124.45

8. Set the IMTSIM to a desired range. Use the polarity switch to toggle between positive and negative flow. Depending on the meter_factor and URV, it is possible that more than one setting may be used to verify operation of the transmitter. Note that the settings which produce a reading of greater than the URV are out of the configured range of the transmitter rate outputs. To use these settings, the URV must be reconfigured. Reconfigure IMT25 per MI 021-390 or IMT25L per MI 020-495 (using PC20) or MI 020-504 (using PC50).
9. Compare the expected response to the actual response of the transmitter. The deviation should be less than or equal to the percentage bands in Appendix A.
10. Disconnect power to the transmitter and disconnect IMTSIM leads. Reattach flowtube leads as before and replace IMT25/25L cover(s). Reconnect power to the transmitter. Return damping, noise reduction, empty pipe detector, and URV settings to their original values.
11. Verify proper operation and then put the loop back on automatic control.

IMT25 Verification, Version 2.0 Software, Test Mode A

This procedure applies only to IMT25 transmitters with Version 2.0 software equipped with local keypad and display. To determine the software version, scroll through the top level menu of the IMT25 to "Identity". Use the right arrow key to enter the Identity menu structure. Use the Up/Down arrow keys to scroll through the Identity menu to Software Ver.".

1. Place loop in manual control.
2. Place the transmitter into Test Mode A (see IMT25 MI 021-391, System Maintenance). Before proceeding, complete the configuration of Test Mode and answer YES to the prompt "Go Online Test?"

— NOTE

If power is accidentally cycled before completing Step 2, use the arrow keys to exit Test Mode and repeat Step 2.

3. Turn off power to the transmitter.

—⚠ CAUTION

To prevent possible degradation of circuit calibration due to electrostatic discharge (ESD), discharge your body by touching a transmitter cover mounting screw before connecting the IMTSIM.

4. IMTSIM connection (refer to Figure 5 on page 7):

Red and Green Wires:

For configurations A, B, C, and D —

a. Remove main enclosure cover of IMT25 and locate terminal block labeled "coil".
b. If flowtube wires are connected to "coil 1" and "coil 2" terminals, remove them.
c. Connect red wire to "coil 1" terminal and green wire to "coil 2" terminal.

Black and White Wires:

For configurations A, B, and C —

a. Locate terminal block labeled "signal".
b. If flowtube wires are connected, remove all wires connected to "signal terminal".
c. Connect black wire to "signal B" terminal and white wire to "signal W" terminal.

For configuration D —

a. Remove cover of junction box and locate terminal block labeled "signal".
b. If flowtube wires are connected, remove all wires connected to "signal terminal".
c. Connect black wire to "signal B" terminal and white wire to "signal W" terminal.

— NOTE

Radio Frequency (RF) energy from intentional transmitters such as walkie-talkies within close proximity to an IMT25 with the cover removed, may affect accuracy.

5. Reconnect power to the transmitter.

NOTE

When the transmitter is initially powered up in Test Mode, the local display reads TESTING until the reading is stable. Thereafter, when the setting of IMTSIM is changed, the bottom line of the display flashes until the reading is stable.

6. Set the display to read either in mV/A or Rate in engineering units, depending on your preference. (See IMT25 MI 021-391.)
7. If you are only using the display for verification, it is easiest to simply compare the mV/A readout from the IMT25 to the setting on the IMTSIM. Otherwise, refer to Steps 7 and 8 of "IMT25/25L Verification in Measurement Mode" on page 6 to calculate expected flow rate using the IMTSIM.
8. Compare the expected response to the actual response of the transmitter. The deviation should be less than or equal to the percentage bands in Appendix A.
9. Disconnect power to the transmitter and disconnect the IMTSIM leads. Reattach the flowtube leads as before and replace the IMT25 cover(s). Reconnect power to the transmitter. Return the URV setting back to the original value if it was changed. Set Test Mode OFF and answer YES to "Go Online?".
10. Verify proper operation and then put the loop back on automatic control.

IMT25 Verification, Version 2.0 Software, Test Mode B

This procedure applies only to IMT25 transmitters equipped with local keypad and display and supplied with Version 2.0 software. To determine the software version, scroll through the top level menu of the IMT25 to “Identity”. use the right arrow key to enter the Identity menu structure. use the Up/Down arrow keys to scroll through the Identity menu to “Software Ver.”.

1. Place loop in manual control.
2. Place the transmitter into Test Mode B (see IMT25 MI 021-391, System Maintenance). Before proceeding, complete the configuration of Test Mode and answer YES to the prompt “Go Online Test?”.

— NOTE

If power is accidentally cycled before completing Step 2, use the arrow keys to exit Test Mode and repeat Step 2.

3. Turn off power to the transmitter.

—⚠ CAUTION

To prevent possible degradation of circuit calibration due to electrostatic discharge (ESD), discharge your body by touching a transmitter cover mounting screw before you connect the IMTSIM.

4. IMTSIM connections (refer to Figure 5 on page 7):

Red and Green Wires

For configurations A, B, C, and D —

a. Remove main enclosure cover on IMT25 and locate terminal block labeled “coil”.
b. If flowtube wires are connected to “coil 1” and coil 2” terminals, remove them.
c. Connect red wire to “coil 1” terminal and green wire to “coil 2” terminal.

Black and White Wires

For configurations A, B, and C —

a. Locate terminal block labeled “signal”.
b. If flowtube wires are connected, remove all wires connected to “signal terminal”.
c. Connect black wire to “signal B” terminal and white wire to “signal W” terminal.

For configuration D —

a. Remove cover of junction box and locate terminal block labeled “signal”.
b. If flowtube wires are connected, remove all wires connected to “signal terminal”.
c. Connect black wire to “signal B” terminal and white wire to “signal W” terminal.

— NOTE

Radio frequency (RF) energy from intentional transmitters such as walkie-talkies within close proximity to an IMT25 with the cover removed, may affect accuracy.

5. Reconnect power to the transmitter.

NOTE

When the transmitter is initially powered up in Test Mode, the local display reads TESTING until the reading is stable. Thereafter, when the setting of the IMTSIM is changed, the bottom line of the display flashes until the reading is stable.

6. Set the display to read either in mV/A or Rate in engineering units, depending on your preference. (See IMT25 MI 021-391.)
7. The transmitter indicate 100% URV when the IMTSIM is set to 8 mV/A. Note that this URV change is temporary and that the transmitter reverts to the original URV when it is returned to the normal operating mode.

   The range settings of the IMTSIM correspond to the URV as follows:

IMTSIM Range Setting (mV/A)	% of URV
0.25	3.125
0.50	6.25
1.00	12.50
2.00	25.00
4.00	50.00
8.00	100.00

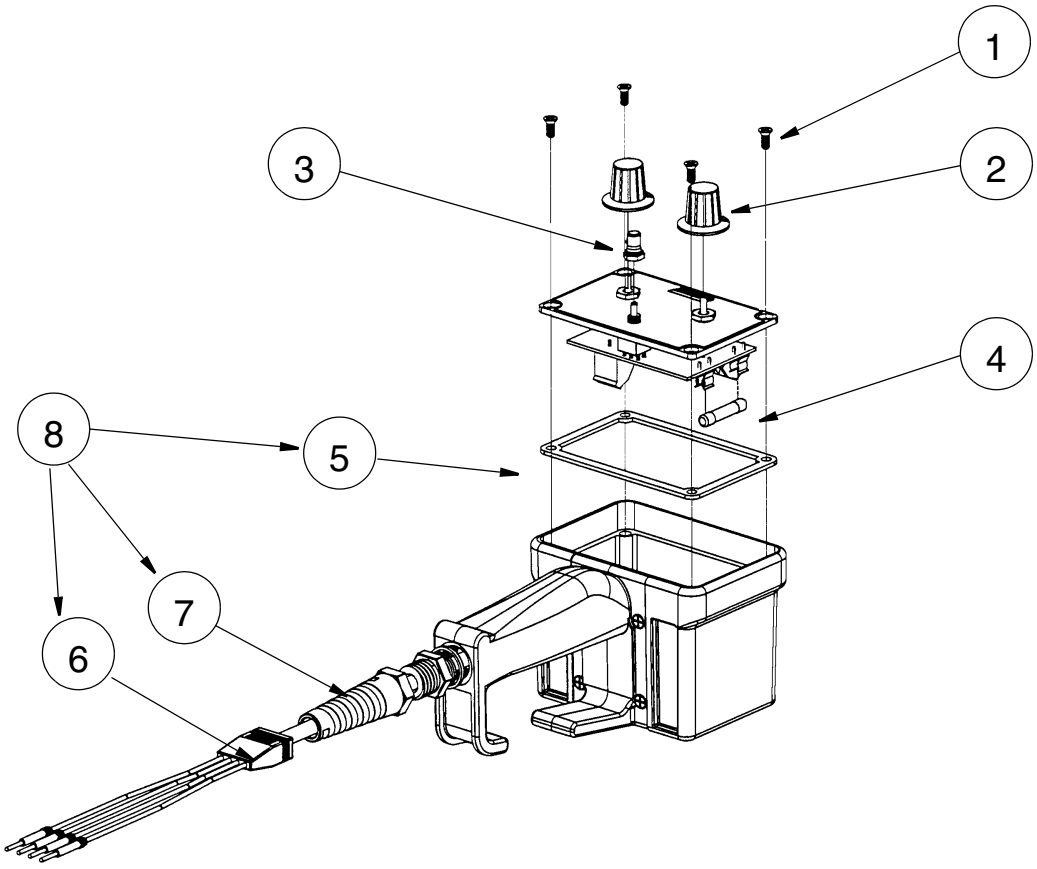
   Example:

   An IMT25 transmitter has been configured for flowrates of 0 to 125 GPM. The response of the transmitter when in Test Mode B is as follows:

IMTSIM range Setting (mV/A)	% of URV	Flow Rate Response (GPM)
0.25	3.125	3.91
0.50	6.25	7.81
1.00	12.50	15.63
2.00	25.00	31.25
4.00	50.00	62.50
8.00	100.00	125.00

8. Compare the expected response to the actual response of the transmitter. The deviation should be less than or equal to the percentage bands in Appendix A.
9. Disconnect power to the transmitter and disconnect the IMTSIM leads. Reattach flowtube leads as before and replace the IMT25 cover(s). Reconnect power to the transmitter. Set Test Mode OFF and answer YES to “Go Online?”.
10. Verify proper operation and then put the loop back on automatic control.

3. Replacement Parts



Item	Part No.	Qty	Description
1	X0173XY	4	M4x10 Screws
2	P0150KZ	2	Knob
3	P0150LX	1	Seal, Toggle, Boot
4	C3510KB	1	Fuse, 3 AG 0.750A F. B.
5*	D0158MH	1	Gasket
6*	D0177BC	1	Cable Assembly
7*	D0158KK	1	Cable Grip/Strain Relief
8	D0158KL	1	Cable Assembly Kit
9	A0158KF	1	Bracket, Panel Mounting**

*Included in Item 8.
**Refer to Figure 3.

Figure 6. IMTSIM Assembly

4. Maintenance

Preventive Maintenance

The IMTSIM simulator does not require any periodic preventive maintenance or calibration.

Fuse Replacement

NOTE

Replace fuse only with Foxboro Part No. C3510KB or equivalent. (Refer to Parts List.)

1. Remove screws from front plate of the IMTSIM.
2. Carefully lift the front plate from the enclosure, and using a suitable tool, remove the fuse from the fuse holder located on the rear of the circuit board (Figure 6).
3. Insert the replacement fuse in the fuse holder and reinstall the front plate.

⚠ CAUTION

Tighten screws evenly to lightly compress the gasket. Excessive tightening of screws will cause permanent distortion of the front plate.

Cable Assembly Replacement

The cable assembly kit consists of:

- 1 Cable Assembly
- 1 Cable grip/Strain Relief with Sealing Washer
- 1 Gasket

1. Remove screws from front plate of the IMTSIM.
2. Carefully lift the front plate and disconnect the cable assembly wiring from the terminal blocks located on the rear of the circuit board.
3. Unscrew the cable grip from the enclosure and remove the old cable assembly.
4. Carefully remove the old gasket material, clean the contact surface, and install the new gasket.
5. Install the new strain relief bushing and washer on the enclosure handle with an appropriate tool.
6. Insert the cable assembly through the strain relief pigtail, bushing, and enclosure. Connect the leads to the proper terminals of the circuit board (Figure 7).
7. Withdraw the cable assembly into the handle of the enclosure, exposing leads only, and secure by tightening the pigtail with an appropriate tool. Reattach the front plate to the enclosure.

⚠ CAUTION

Tighten screws evenly to lightly compress the gasket. Excessive tightening of screws will cause permanent distortion of the front plate.

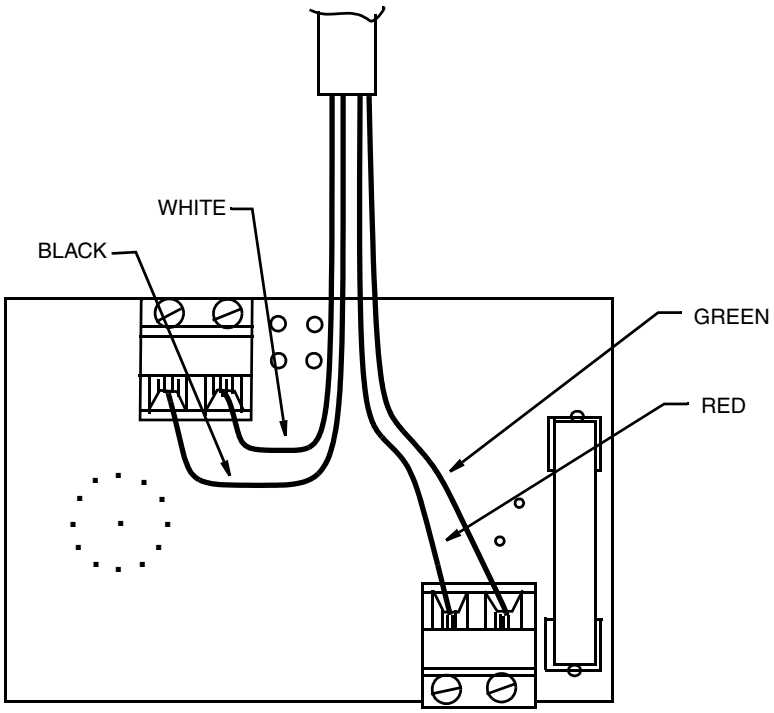


Figure 7. Cable Assembly Terminals

Appendix A. Percentage Bands of IMTSIM with the IMT25/25L

Setting	±Percent of Reading*
0.0	n/a
0.25	1.5
0.5	0.75
1.0	0.38
2.0	0.25
4.0	0.25
8.0	0.25

* For the 4 to 20 mA output, add ±0.03% of span, which equates to 0.0048 mA. For ambient temperatures above or below 23±2°C, increase the bands for the current output only, an additional 0.01% of span/°C (0.0016 mA/°C).

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