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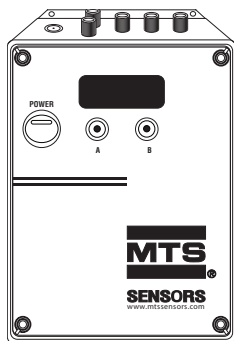
Magnetostrictive
Linear-Position Sensors



M-Series Analog / PWM
Tester

551132 A

User's Guide



M-Series Analog / PWM Tester

The M-Series Analog/PWM Tester supports analog, 0 - 20 mA and 0 - 10 Vdc, scaled Pulse Width Modulated (PWM), and PWM time of flight (tOF) sensor outputs. The M-Series tester is a battery powered device that is used in test bench and field applications to verify that the MTS Sensor is functioning properly and is producing the appropriate signal outputs.

FEATURES:

- Easy connection to MTS' M12 integrated connector system
- Easy to use push-button controls
- Supports voltage (0-10 Vdc) and current (0-20 mA) outputs
- Supports scaled PWM and time-of-flight PWM outputs
- Compact construction for use in field applications
- Provides both +5 Vdc and +1Vdc sensor power supply
- Sealed lead acid battery that provides up to 8 hours of operation per charge
- Battery level monitoring
- Automatic detection of PWM sensor frequency
- Carrying case

All specifications are subject to change. Contact MTS for specifications and engineering drawings that are critical to your application. Drawings contained in this document are for reference only. Go to www.mtssensors.com for the latest support documentation.

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Quote and Contract Terms & Conditions:

The parties expressly agree that the purchase and use of Material and/or Services from MTS Sensors Division are subject to MTS' Terms and Conditions, in effect as of the date of this document, which are located at http://www.mtssensors.com/fileadmin/media/pdfs/Terms_and_Conditions.pdf and are incorporated by reference into this and any ensuing contract. Printed Terms and Conditions can be provided upon request by emailing info@mtssensors.com or if you prefer, go to <http://www.mtssensors.com/index> and click the *Quote/Contract Terms and Conditions* link at the bottom of the page to download the PDF.

Related publications:

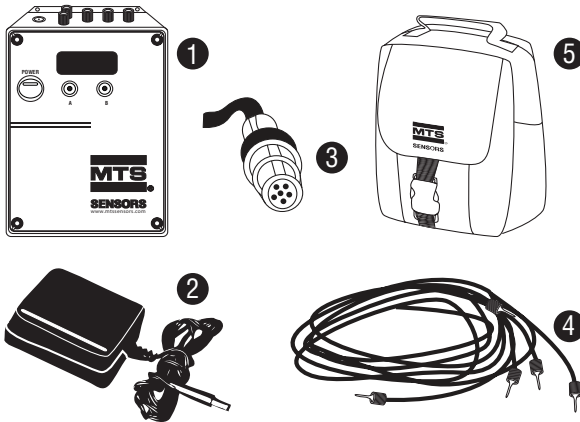
Product Specification, M-Series Analog / PWM Test Kit, Part no. 551139. Download the (PDF) <http://www.mtssensors.com>.

1.0 - The M-Series Analog / PWM Test Kit

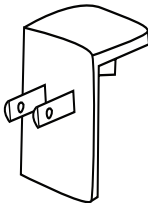
1.1 Contents and Accessories

The M-Series Analog / PWM Test Kit includes:

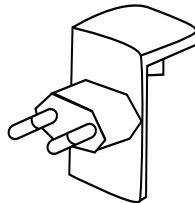
- 1 M-Series Analog / PWM Tester
- 2 12 Vdc Sealed Lead Acid (SLA) battery charger with adapter
- 3 Cable with MTS' M12 integrated connector system and banana plugs
- 4 Pigtailed cable with banana plugs
- 5 Carrying case
- 6 User's Guide (*part no. 551132* not pictured)
- 7 Wrist strap (not pictured)
- 8 Quick start instruction label (not pictured)



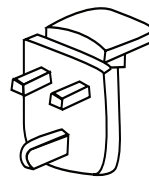
Accessories



**Power Plug Adapter,
North America**
Part no. 370573



**Power Plug Adapter,
European Union**
Part no. 370572



**Power Plug Adapter,
United Kingdom**
Part no. 370574

1.2 Familiarizing yourself with the M-Series Tester

1.2.1 Front panel

① LCD panel

Tester LCD panel displays sensor output, settings, and battery level

② Power switch

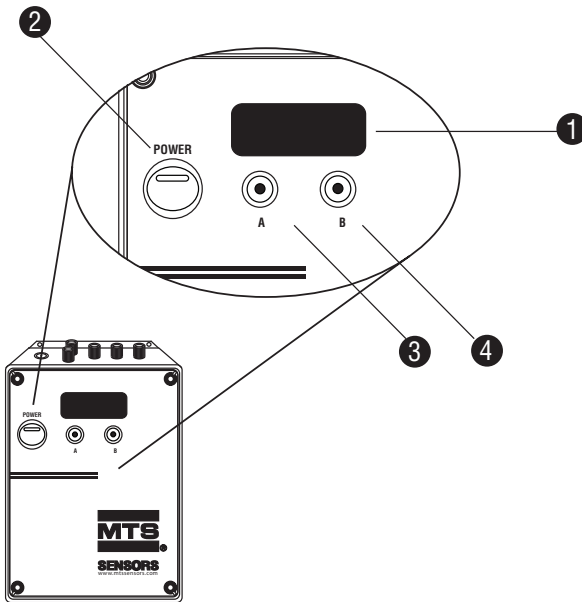
Toggle to turn the M-Series Tester 'ON' and 'OFF'

③ Mode button 'A'

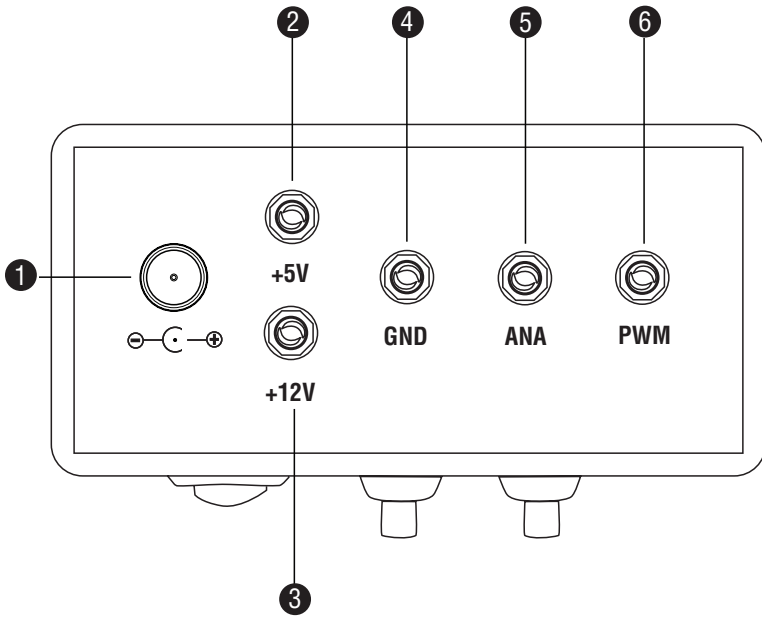
Press to change transducer modes and to reset system

④ Special function button 'B'

Press to change recirculation values in PWM / 'tOF' mode and to reset system



1.2.2 Top panel



1 Charger port

Port used to charge the internal SLA battery

2 +5 Vdc port

Sensor 5 volt supply connection (Not an input port)

3 +12 Vdc port

Sensor 12 volt supply connection (Not an input port)

4 GND

Sensor ground connection

5 Analog port

0-10 Vdc or 0-20 mA sensor output connection

6 PWM port

Scaled PWM or PWM (tOF) sensor output connection

2.0 Installation

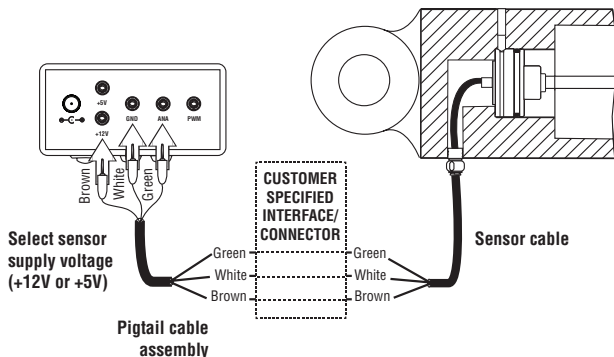
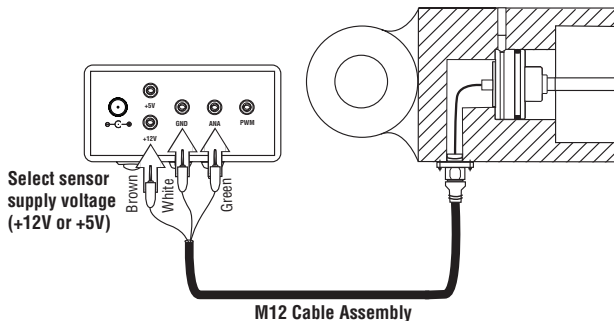
2.1 Connecting an analog sensor

To connect an Analog sensor *equipped* with MTS' M12 integrated connector system to the M-Series Tester use the following procedure:

1. Use the provided cabling fitted with the M12 connector and connect the M12 cable to the MTS M12 integrated connector system on the sensor or cylinder. (*continue with step 3 below*) OR

To connect an Analog Sensor *not equipped* with MTS' M12 integrated connector system:

1. Use the Pigtailed cable that is included in the test kit to connect the ends without banana plugs to the customer's specified interface/connector that mates to the M-Series Sensor or cylinder.
2. Ensure that the wire colors of the cable correspond with the wire colors of the output wires from the sensor.
3. Plug the brown banana plug into the +12 Vdc or +5 Vdc (depending on voltage required by the sensor) terminal on the top of the tester.
4. Plug the white banana plug into the DC GND terminal on the top of the tester.
5. Plug the green banana plug into the analog terminal at the top of the tester.



2.0 Installation (continued)

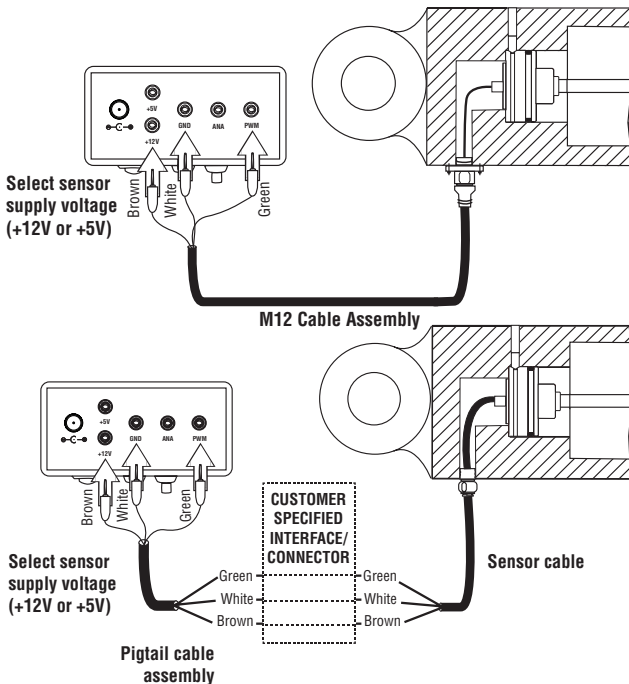
2.2 Connecting PWM Sensors

To connect a PWM sensor *equipped* with MTS' M12 integrated connector system to the M-Series Tester use the following procedure:

1. Use the provided cabling fitted with the M12 connector and connect the M12 cable to the MTS M12 integrated connector system on the sensor or cylinder. (continue with step 3 below) OR

To connect a PWM Sensor *not equipped* with MTS' M12 integrated connector system:

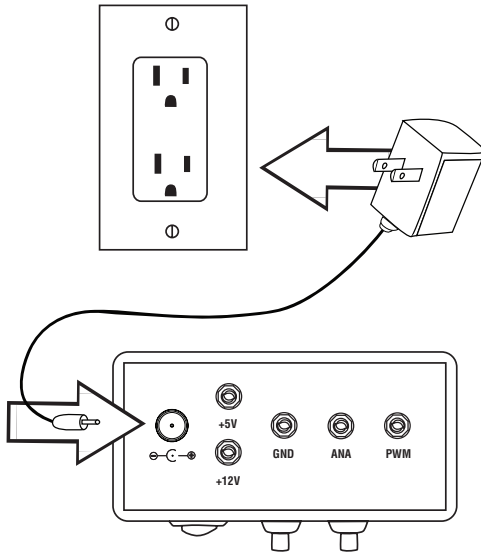
1. Use the Pigtailed cable that is included in the test kit to connect the ends without banana plugs to the customer's specified interface/connector that mates to the M-Series Sensor or cylinder.
2. Ensure that the wire colors of the cable correspond with the wire colors of the output wires from the sensor.
3. Plug the brown banana plug into the +12 Vdc or +5 Vdc (depending on voltage required by the sensor) terminal on the top of the tester.
4. Plug the white banana plug into the DC GND terminal on the top of the tester.
5. Plug the green banana plug into the PWM terminal at the top of the tester.



2.0 Installation (continued)

2.3 SLA battery charger setup

The M-Series tester will also run off of AC power supplied by the charger included in the Test Kit. To run the box off of AC power or to charge the internal SLA battery plug the charger barrel plug into the charger port on the top of the Test Box and connect the charger to an AC outlet.



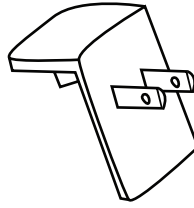
2.4 AC power plug adapter connection / replacement

The kits SLA Battery charger rating is based on a nominal input of 90-264 Vac/47-63 Hz and can be used on both 110 Vdc and 240 Vdc systems. For this reason, additional AC power plug adapters can be purchased (*see Accessories*).

Use the following steps to change the power plug adapter:

1. Unplug the AC adapter from the wall and from the M-Series Tester. Firmly hold the AC adapter in one hand with the plug facing you.
2. With the other hand, press down on the plug adapter and slide upwards away from you.

2.0 Installation (continued)



To replace the AC power plug adapter:

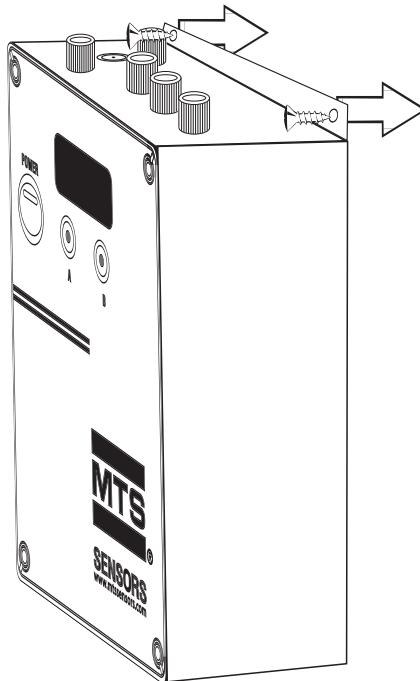
1. Hold the AC adapter in one hand
2. With the other hand slide the adapter plug against the adapter
(There are grooves along the channel for the adapter plug)
3. Slide the adapter plug down until it snaps into place.

Notes:

There is an arrow on the adapter to denote the way to slide the plug during removal.

2.5 Bench mounting the tester

The M-Series Tester has a flange connection that will allow for bench mounting of the unit. To attach the M-Series Tester to your bench use the existing through holes in the flange at the top of the device and secure to the bench with appropriate sized screws.



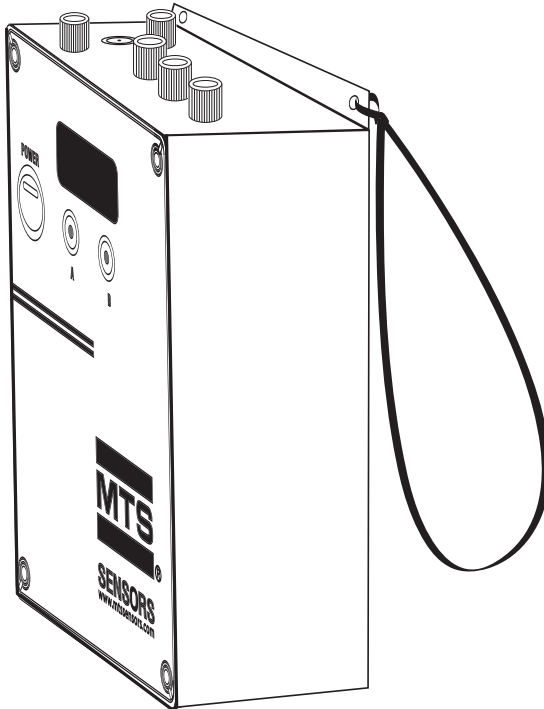
2.0 Installation *(continued)*

2.6 Flange connection for field testing applications

The M-Series Tester has a flange connection at the top of device that will allow for attaching the wrist strap included in the Test Kit to one of the flange holes. Attaching and using the wrist strap with the M-Series Tester will reduce the likelihood that the device will be dropped and damaged during field testing applications.

To Connect the Wrist strap:

Connect wrist strap clip to one of the existing through holes in the M-Series Tester flange located at the top of the device.



2.7 Quick start instruction label

A quick start instruction label is included in the test kit. The label is designed to fit flush on either side of the M-Series Analog / PWM tester.

1. Remove the quick start label of choice based on language.
2. Align and apply the label smoothly either the left or right side of the tester and apply the label smoothly.

3.0 Operation

3.1 Startup

Notes

1. The tester switch is in the 'ON' position when the Red LED is lit.
2. If the LED on the power switch is not lit, the device might be in low power mode and the power supply needs to be connected to the charger port on the top of the tester.

Perform the following start-up procedure:

1. Turn the tester power switch to the '**ON**' position. The test box display will now cycle through the startup display sequence:
 - a. LED test for 1 second.
 - b. Software Data test for 1 second
 - c. Sensor type test for 5 seconds or until the '**A**' button is pressed.

The default mode setting is configured for voltage at the factory, but after its initial use, the tester will start up in the last mode the tester was set to.

2. If required, change the mode by pushing the '**A**' button. (*see 3.2 Mode Selections*)
3. Repeat *step 2* until the appropriate mode is selected and seen on the display.

3.2 Mode Selections

Mode	Display	Units
Voltage	Volt	Volts
Current	Curr	Milliamps (mA)
Battery	bAtt	Displays SLA battery voltage (Volts)
PWM	Puum	% of Displacement
TOF	tOF	Millimeters (mm)

3.2.1 Voltage (Volt)

The voltage range between 0 and 10 Vdc will be displayed for the M-Series sensor with voltage output. The voltage range shown will be dependent on the sensor model selected.

3.0 Operation (continued)

3.2.2 Current (Curr)

The current range between 0 and 20 mA will be displayed for the M-Series sensor with current output. The current range shown will be dependent on the sensor model selected.

3.2.3 Battery Level (Batt)

Notes:

1. See sensor model specification to determine what supply voltage is needed.
2. The LOBA (Low Battery) status alert will disrupt the output readings of the sensor every 60 seconds for 3 seconds until the power adapter is connected to the tester via the charger port.

The M-Series Tester utilizes a Sealed Lead Acid (SLA) battery to power both the tester and the sensor. The M-Series Tester contains circuitry that continually measures the device battery level to ensure that the necessary voltage is available to power the sensor. If the battery level drops below 9 volts, the tester will not have enough power to energize most M-Series sensors. Some M-Series model sensors only require a 5 volt supply and for these transducers test box battery voltage levels lower than 5 volts will interrupt sensor output.

Low battery (LOBA)

If 'LOBA' (Low Battery) displays, connect the 12 volt power adapter to the charger port. Whenever the internal SLA battery is allowed to discharge below 1.8 volts, the device will enter *low power* mode. In the event the device enters low power mode, connect the supply voltage to the charger port and cycle the power. When the battery level drops below 1.8 volts there is not enough voltage to drive the internal circuitry of the M-Series Tester.

3.2.4 Battery Charging

WARNING

Only use the supplied 12 volt adapter to charge the M-Series Tester. Using an off the shelf AC adapter without smart charging capabilities can result in overcharging the internal Sealed Lead Acid (SLA) batteries. Overcharging the batteries could lead to overheating and damage to the battery cells.

To recharge the internal batteries of the M-Series Tester, connect the supplied AC power plug adapter to the charger port on the top of the device. The LED

3.0 Operation *(continued)*

indicator on the charger will indicate the state of the charging process. The smart charger that is included in the M-Series Tester Kit will give the SLA battery a quick charge first and then apply a constant float charge to maintain battery level.

3.24 Scaled PWM (PWM)

Configuring the M-Series Tester to PWM mode will allow for the output of a scaled PWM sensor to be displayed.

The M-Series Tester will initially show the frequency of the attached scaled PWM sensor output. This will be displayed for 2 seconds before switching the display to the sensor output range.

The scaled PWM sensor output will display the sensor position as a % of the output frequency. At the zero position the z% for the attached sensor will be displayed. At the full stroke position the fs% for the attached sensor will be displayed. The sensor output for each position in between the zero position and the full stroke position will be displayed as a percentage of stroke over the available range of z% to fs%.

Example Readings for Various Sensor Types:

PWM Sensor Type	% at Zero Position (z%)	% at 1/4 stroke	% at 1/2 stroke	% at 3/4 stroke	% at full stroke (fs%)
5% - 95%	5%	27.5%	50%	72.5%	95%
10% - 90%	10%	30%	50%	70%	90%
15% - 85%	15%	32.5%	50%	67.5%	85%
20% - 80%	20%	35%	50%	65%	80%
25% - 75%	25%	37.5%	50%	62.5%	75%

To view the frequency of the scaled PWM sensor:

1. Press the 'B' button once
2. Frequency will display for 2 seconds
3. Repeat as needed

3.0 Operation (continued)

3.2.5 PWM TOF (tOF)

PWM, time of flight Sensor

Time of Flight mode allows for the M-Series Tester to display the output of a PWM, TOF sensor. In a TOF sensor the displacement amount is determined by the time between the creation of the interrogation pulse and the detection of the return pulse in the sensing element. This TOF calculation is dependent on the velocity of the return pulse, sensor length, and the number of recirculations performed by the sensor. In TOF mode the position output is displayed in millimeters.

Note:

In order to display millimeters a fixed value has been used for the location of the null with respect to the sensing element. The M-Series Tester is setup for the standard offset in the Model MH and MS sensors. For all other models there may be a shift in the output reading due to mechanical differences from the MH and MS models. Please check with the factory for the offset on other M-Series sensor models.

Recirculations

When the MH tester is in TOF mode, the tOF name on the display is followed by a character (Hex Value: *0-F*) which indicates the number of recirculations expected from the attached sensor. The default recirculation character for the mode is 0. The number of recirculation can be changed to accommodate the attached sensor output.

Perform the steps below to reset the number of recirculations:

1. When 'tOF' displays on the screen, press and hold the 'B' button for 2 seconds
2. The recirculation character (*0-F*) will begin to blink.
3. When the character is blinking:
Press the 'B' button to change the value. Repeat the procedure until the appropriate value displays. Then, press the 'A' button to return to 'tOF' measurement mode.

Note:

Once the 'A' button is pressed the desired recirculation value is saved in the memory.

3.0 Operation *(continued)*

Display Value	Recirculations
t0F0	0
t0F1	1
t0F2	2
t0F3	3
t0F4	4
t0F5	5
t0F6	6
t0F7	7
t0F8	8
t0F9	9
t0FA	10
t0Fb	11
t0FC	12
t0Fd	13
t0FE	14
t0FF	15

Notes:

1. 't0F0' denotes that there are no recirculations only the initial interrogation pulse.
2. In the PWM TOF mode if the reported displacement is longer than 4 digits the display will blink and only the most significant digits will be displayed.

3.0 Operation *(continued)*

3.3 Verification

Verify the sensor is reading the displacement of the magnet by moving the magnet in a bench test of the attached sensor or by stroking the cylinder. Observe the change in output reading.

Note:

The M-series Tester is not a calibrated device and should only be used for indication purposes only. The M-series Tester is designed to be used to verify that the sensor is functional after cylinder assembly and as a field troubleshooting device. For field troubleshooting the tester is designed to isolate the sensor from the rest of the vehicle in order to independently verify sensor functionality.

3.4 Troubleshooting

No Power

1. Confirm that Power switch is in “ON” position
2. M-Series Tester may be in Low Power Mode
3. Plug in AC power adapter and check the battery level

The sensor readings aren’t showing on the display

1. Is the M-Series Tester in the correct mode?
2. Is the M-Series battery level above 9 Vdc?
3. Is the sensor connected to the appropriate terminals.

Error Message “[--]” is seen in PWM or TOF Mode

1. Make sure the correct plug is in the PWM port at the top of the M-Series Tester
2. If in tOF mode, make sure the correct number or recirculations is selected
3. Check battery level to ensure the unit is providing a minimum of 9 Vdc to sensor.

3.0 Notes

Notes:

Notes:



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Part Number: 10-08 551132 Revision A

MTS and Temposonics, and are registered trademarks of MTS Systems Corporation.

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All Temposonics sensors are covered by US patent number 5,545,984. Additional patents are pending.

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