

MFT 4000 Calibrator
MFT 4010 Calibrator with HART®
MFT 4020 Calibrator w/Loop Power Supply

**OPERATOR
INSTRUCTION MANUAL**



MFT 4000 SERIES OPERATOR INSTRUCTION MANUAL

Models

MFT 400X Modular Calibrator

MFT 401X Modular Calibrator / HART® Communicator

MFT 402X Modular Calibrator / Loop Supply

IMPORTANT NOTICE

Important information on the product is contained in this manual. Read this manual carefully and completely before operation the product. For the safety of the operator and the system, a thorough understanding of this manual is necessary before commissioning, using or maintaining the product.

ASSISTANCE

For customer assistance please contact the local Meriam Representative or Meriam Process Technologies directly. For a geographic listing of Representatives and their contact information, visit our web site at www.meriam.com and click on the “Representatives” button. Contact Meriam Process Technologies directly by phone at (216) 281-1100 or by e-mail at meriam@meriam.com. Direct all assistance inquiries to Technical Services.

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MFT 4000/4010/4020 OPERATING INSTRUCTIONS

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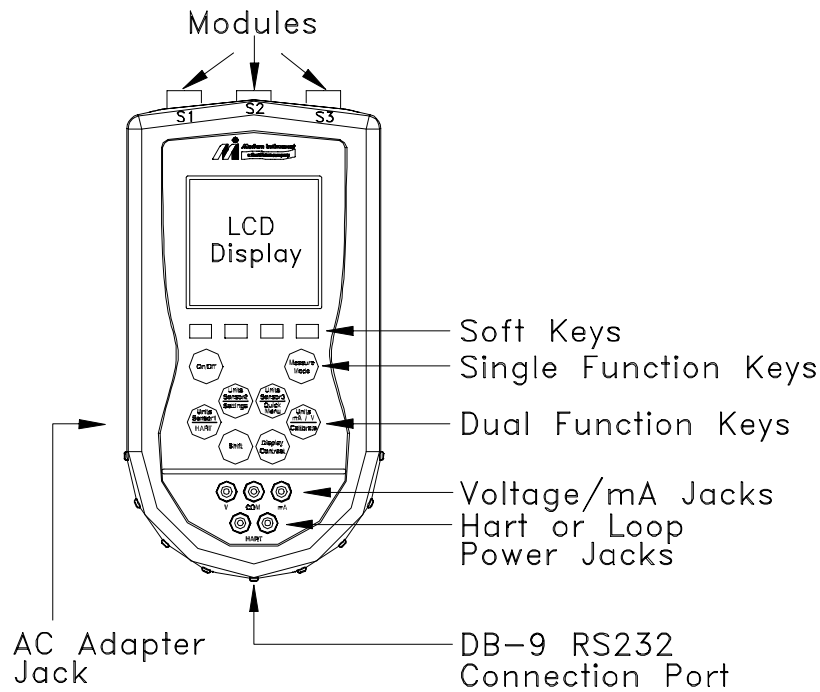
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MFT 4000 SERIES OVERVIEW



The MFT 4000 Multi-Function Tester (MFT) is a modular calibrator with three sensor bays accommodating up to three independent pressure, temperature or special function modules. The base MFT incorporates a voltage and current meter, several keys for user interface and will display up to four measurements simultaneously. The MFT 4010 adds HART communication capability to the same handheld base unit for greater flexibility and versatility in commissioning, reconfiguring, and maintaining HART field devices. The MFT 4020 is a calibrator with integral 24Vdc loop power supply. This feature provides loop power directly from the MFT.

Note: For Intrinsically Safe MFT models, consult the Hazardous Area Use section of this manual for specific details on use of approved MFTs and applicable restrictions.

KEY PAD OVERVIEW

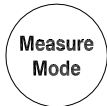
The following is an overview of the MFT 4000 series keypad operations. The MFT keypad has three basic key types (the functions of each are described below): Single function keys, dual-function keys, and soft keys. Single function keys control a dedicated MFT function. Dual-function keys, through the use of the Shift key, control two separate functions. Soft key functions change depending on the operating mode. Their definitions are displayed at the bottom of the LCD, just above each white soft key.

Single Function Keys

On/Off

On/Off

Pressing the On/Off key powers up the MFT. As the unit powers up, it performs an internal diagnostic check of its systems. Any abnormalities are posted on the display. The unit will briefly display the MFT model number and the installed sensor module ranges and bay locations (S1, S2, or S3) before the unit enters the **Measure Mode**.



Measure Mode

Pressing the Measure Mode button will instantly return the unit to measure mode from any menu or sub-menu. **Measure** will appear on the upper left of the display.



Display Contrast

This key allows the user to adjust the contrast of the LCD display for user conditions or preferences. Pressing and holding this key will cycle through all available contrast settings. If the display is faded or blacked out, simply depress the key until the display returns to an acceptable level. After adjusting Contrast, wait at least five (5) seconds before turning unit off to insure storage of new contrast setting.



Shift

The Shift key must be pressed to access the functions labeled in blue on the dual-function keys. Pressing the Shift key will allow the user to access and/or alter the corresponding properties. Shift remains on until it is depressed again. When the Shift key is active, an up arrow ↑ will appear at the top of the display left of the battery power or AC wall plug icon.

Dual Function Keys



Units Sensor1

The Units Sensor1 key changes the engineering units for the module in sensor bay 1. The **Shift** key must be active before the units can be changed.

HART *Active only with MFT 4010*

The HART key puts the MFT 4010 series calibrator into its HART Communications mode and initiates an attempt to establish communications via the HART connections at the bottom of the MFT.



Units Sensor2

The Units Sensor2 key changes the engineering units for the module in sensor bay 2. The **Shift** key must be active before the units can be changed.

Settings

Provides access to the settings menu. This menu shows the current unit settings and allows the user to customize MFT settings. See **Settings** section for more details.

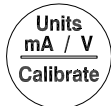


Units Sensor3

The Units Sensor3 key changes the engineering units for the module in sensor bay 3. The **Shift** key must be active before the units can be changed.

Quick Menu *Active only with MFT 4010*

This key provides the user with a list of frequently used HART configuration and maintenance function menus. User can quickly scroll to any desired menu.



Units mA / V

Toggles between voltage, current (mA), and off display for the integral voltage and current meter. This measurement is designated by “V/I” on the display.

Calibrate *Active only with MFT 4010*

This key enters the MFT into calibration mode for HART device calibrations.

Soft Keys



The four white keys located below the display are soft keys. The specific functions of these keys change depending on the operating mode of the MFT. Current definitions are displayed at the bottom of the LCD display.

Alphanumeric Data Entry

Alphanumeric Entry: For application of the MFT requiring alpha and numeric entry (examples: tagging or messaging), the MFT uses three display grids, the **SHIFT** key to change from one grid to another, and four soft keys used for cursor movement and selection of characters and text. MFT and HART communication functions that require alpha and numeric entry automatically call up the appropriate grid and make the other grids accessible using the **SHIFT** key. **Row** and **Column** soft keys are used to move the flashing cursor through the displayed grid. The **Select** soft key enters the indicated character in the text line and the **Done** soft key accepts the displayed text line and returns the MFT to service.

Character grids are provided for numeric, alpha, and symbol characters to permit complete editing of text fields. Each grid includes back space (←), forward space (→), delete (del) and space (spc) operators to accommodate text editing needs.

User Interface

The displays shown below illustrate the alphanumeric entry grids and soft key functions. Pressing the MFT’s **SHIFT** key changes the display from one grid to another allowing text messages to be developed using all three grids when needed.

HART						
Tag No PT-3456						
<u>A</u>	B	C	D	E	F	G
H	I	J	K	L	M	N
O	P	Q	R	S	T	U
V	W	X	Y	Z	-	.
→	←		del		spc	
PT-__						
Row	Col	Select	Done			

Alpha entry grid

HART						
Tag No PT-3456						
1	2	3				
4	5	<u>6</u>				
7	8	9				
.	0	+	-			
→	←		del		spc	
PT-3456_						
Row	Col	Select	Done			

Numeric entry grid

HART						
Tag No PT-3456						
@	[\]	^	_	“
”	#	\$	%	()	’
&	*	+	-	.	/	:
;	<	=	>	?	,	!
→	←		del		spc	
PT-3456 OUTPUT < 50% @_						
Row	Col	Select	Done			

Symbol grid

When using any character grid, pressing **Row** or **Col** and releasing the respective soft key moves the flashing cursor one character across or down the grid. Pressing and holding the **Row** or **Col** key causes the cursor to advance down or across, respectively, at a regular rate. Releasing the key when the cursor is under the desired character stops the cursor movement and allows the selection of the character using the **Select** key. Press the **Done** soft key when the character string is completed to enter the string and continue MFT operations.

Numeric Entry: Many HART functions require only numeric entry. For these functions the MFT uses an **Increment** and **Decrement** scheme to change the input field one place at a time. Press the **Inc / Dec** soft keys to move through a scroll of -, ., 0, 1...9, and space until the desired value is displayed. Press the **Next** soft key to enter that value and advance to the next place in the input field. Repeat as necessary. Press the **Done** soft key to end the numeric entry session.

HART			
3051: PT-3456			
Output:			
6.5_ mA			
Inc	Dec	Next	Done

Numeric Only Entry Screen

MEASURE MODE

After the MFT performs its power up diagnostics and displays the model number and sensor data, it defaults to the **Measure Mode**. The word *Measure* appears on the upper left of the display, confirming this mode is active. The soft key definitions in this mode are directed toward measurement and information functions.

Header-line Symbol Key (see location at right)

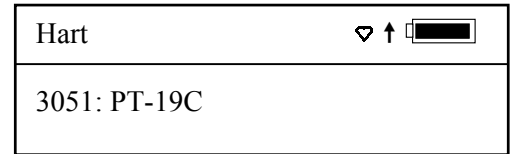
♥ heart symbol indicates active HART communication

↑ up arrow indicates SHIFT key is on

- battery symbol indicates MFT under battery power; filled portion indicates remaining battery

⏻ electrical plug symbol indicates the AC adapter (P/N A36742) is connecting and powering the MFT

BUSY BUSY text box replaces either power symbol when the microprocessor is busy executing requested tasks



NOTE: Power icons may temporarily disappear during certain HART Communication operations

DISPLAY SCREEN

The display screen displays measurements from modules installed in sensor bays S1, S2, and S3 and displays inputs to the MFTs voltage or current jacks. Only installed and active sensors are shown. Measurements are identified on the display by lines with “S1”, “S2”, and “S3” designators for sensor modules and by “V/I” for analog measurements. The measured values are shown with the corresponding unit of measure.

Measure		
S1:	0.00	inW20C
S2:	0.0000	PSI
S3:	0.00	inHg
V/I:	0.000	mA
Zero Mn/Mx Damp More		

Measure Mode Main Screen

SOFT KEY MENU OPTIONS

On the bottom of the main menu screen in **Measure Mode** the following definitions are displayed just above the white soft keys.

These definitions indicate the current function of each soft key.

Zero Mn/Max Damp More

Zero

Pressing the soft key corresponding to Zero will zero the installed sensor modules and integral mA/Volts meter. The LCD will display “Zero in Progress” as this function is carried out. The sensors should be zeroed prior to making measurements to provide an accurate zero reference. Make sure that no physical signal is applied to the MFT when performing this function. To prevent unintentional zeroing, a Zero command will be aborted if more than ±5% of full scale signal is being measured by any MFT sensor. Absolute pressure modules cannot be zeroed until the applied pressure is less than 5% of full scale. This prevents the accidental corruption of the absolute zero reference essential to absolute pressure module performance.

Mn/Max

The Mn/Max key allows the user to display the minimum and maximum measured value each sensor has measured since this function was activated. The min/max values are displayed below the normal pressure or V/mA reading. To reset the Mn/Max function, toggle the Mn/Max key off, and then press it again to turn it on.

Damp

Pressing the Damp soft key initiates an exponential averaging function for the measurements over a selected time constant. This function smooths over the peaks and valleys of pulsating measurements for a more stable display. The factory default setting for **Damp** is 0.5 second. A **D** symbol appears in the top of the LCD display when this feature is active. *To change the damp rate refer to the Settings section.*

More

This option takes the user to more soft key menu options.

After pressing More from the menu options above, the following soft key options are made available:

Hold Sensr Rcal More

Hold

Pressing the **Hold** button freezes the measurements on the display to allow convenient reading or transcription of data. An **H** symbol appears on the top of the LCD display when this feature is active. Pressing **Hold** again returns the MFT to normal **Measurement Mode**.

Sensr

Pressing the **Sensr** key provides detailed information about the installed modules. The first screen provides information pertaining to the sensor in module bay 1, including the sensor model, serial number, and the date the unit was last calibrated.

Pressing **Next** consecutively scrolls through the remaining installed sensors, then the electrical inputs, and finally the MFT itself.

The MFT information provides the model number of the unit, the serial number, firmware revision, and the Flash information used to determine the date the firmware was installed.

Pressing **Next** after scrolling through all available information returns the user to the **Measure mode** screen.

Rcal

Pressing the **Rcal** key enters the MFT into the **Field Recalibration** mode. This allows the unit's sensors and modules to be recalibrated in the field to maintain optimal accuracy. *See section on Field Recalibration for details.*

SETTINGS

Press the **Settings** key to set the preferences on the MFT for lockout options, damp rates, auto shutoff time, or clock edit. This will display the **Settings** menu. *Note: Not all options will be active on every MFT model.* The **Settings** menu shows the current settings for the MFT and allows the user to make adjustments through the use of the soft keys:

Settings	
Current Settings:	
➡ Lockout:	Disabled
Damp Rate	0.5 Sec
Off Timer	Disabled
Clock Edit	
Up Down Select Back	

Settings Main Menu Screen

Pressing the **Back** soft key at this point will take you to the previous screen. Pressing the **Back** soft key when in any of the **Settings** sub-menus will take you to the previous screen *without* making any changes.

Lockout Feature

To enable the lockout feature, make sure the selection cursor ➡ is pointed at **Lockout**. If not, scroll the arrow **Up** using the soft keys. Choose the **Lockout** selection by pressing the **Select** soft key.

After selecting lockout, the MFT will enter the lockout settings menu. The current status is shown and three choices are provided:

Settings	
Lockout:	Disabled
➡ Disabled	
Enabled	
View Details	
Up Down Select Back	

Lockout Main Screen

Disabled: All lockout features are disabled and all options on the menu are accessible for reconfiguration.

Enabled: Enables the lockout selections that are set in the **View details** screen.

View Details: This option takes the user to a screen listing all MFT parameters that can be protected by lockout. These include All, Zero, Recalibration, Settings, Units, DOFs and Configurations. Individual functions can be locked or, if preferred, the lockout can be set to deny unauthorized access to all parameters.

To enable the lockout option, select **Enabled** by scrolling **Down** and press **Select**. The screen will switch back to the original **Settings** screen that now shows the lockout status as Enabled.

Select **Lockout** again, scroll **Down** to **View Details**, and press **Select**. This screen allows the user to choose which parameters to lockout. Use the **Up** and **Down** keys to scroll through the selections. Press **Select** to choose the desired setting.

The screen will change and prompt you to **enable** or **disable** lockout for that function. Scroll **Down** to **enable** and press **Save**.

Lockout Code

At this point the user will be prompted to enter a 3-digit lockout code. This code will be required to gain access and change any parameter previously locked out. Use the Number Grid and soft keys to change the lockout code value and the **Select** soft key to move to the next digit.

When you are satisfied with the choice for the lockout code, press **Store**. ***IMPORTANT: After the code is entered, the user must cycle the power to activate the lockout mechanism.***

BE SURE TO SAVE THIS CODE IN A SAFE PLACE IN THE EVENT YOU FORGET THE NUMBER. ACCESS TO LOCKED-OUT FEATURES WILL BE DENIED WITHOUT THE PROPER CODE.

To select more than one option to lockout, simply complete your first selection, enter the Lockout code as instructed above, and cycle through **View Details** until all the desired lockout options are enabled. ***Note: Be sure to cycle power to activate the lockout feature.***

To Disable Lockout

When you wish to edit a parameter protected by the lockout code, enter the three digit code when prompted and press **Save**. You will now be able to edit the settings as described below. Entering an incorrect code will display the message “Invalid Code.”

From the **Settings** menu Select **Lockout** and press **Select**. This screen allows the user to choose which parameters to lockout. Use the **Up** and **Down** keys to scroll through the selections. Press **Select** to choose the desired option. The screen will change and prompt you to **enable** or **disable** lockout for that function. Scroll **Down** to **Disabled** and press **Save**.

Changing the Lockout Code

To change the lockout code, disable the lockout function for all the parameters selected, shut the unit off, and follow the procedures outlined above.

Damp Rate

Damp is an exponential averaging function for measurements made over a selected time constant. This function smooths the peaks and valleys of pulsating processes for a more stable display. To change the damp rate on the unit, scroll **Down** to **Damp** and press **Select**. Scroll **Up** or **Down** to the damp rate desired. Press **Save** to select the new value.

The damp rate can be set between 0.5 and 30 seconds. Once set, the damp rate feature can be activated or deactivated from the **Measure Mode** by pressing the Damp soft key. Factory default for the damp rate is 0.5 seconds.

Off Timer

To conserve battery life, the MFT 4000 series allows the user to set the unit to shut off after a certain period of keypad inactivity. To change the off timer on the unit, scroll **Down** to **Off Timer** and press **Select**. Scroll **Up** or **Down** to the auto shut-off time desired. Press **Save** to select the new value.

The shutoff timer can be disabled or set to shut off after time periods of from 1 minute up to 2 hours.

NOTE: The Off Timer is disabled whenever the unit is powered by the optional AC Adapter (P/N A36742) regardless of the set value.

Clock Edit

The Clock Edit option allows the user to change the date and time of the MFT's internal clock. To select the **Clock Edit** feature, make sure the pointer arrow is pointed to this selection. If not, scroll the arrow **Down** using the soft keys. Choose **Clock Edit** by pressing the **Select** soft key.

Choose a clock or date option to adjust by scrolling **Up** or **Down**. Press **Select** to choose that option. You will be prompted to make your changes by the Numeric Grid and underscore (_). Use the Numeric Grid and soft keys to change the value and the **Select** soft key to move to the next digit. When complete, press **Done**. You will be asked if you wish to save the new data. Press **Yes** to accept the new value. Pressing **No** will take you back to the **Clock Edit** without making any changes to the MFT clock.

To change the AM/PM option scroll **Down** to this option and press **Select**. Choose the AM or PM option by scrolling up or down and press **Save**.

To go back to the **Settings** main menu press **Back**. To enter **Measure Mode** press the **Back** soft key again, or simply press the **Measure Mode** key.

NOTE: When replacing the batteries, the date and time will remain active. Date & time information is continuously powered by an internal, 10-year life back-up battery. This battery is not serviceable by the user.

GENERAL OPERATION

Sensor Installation/Removal

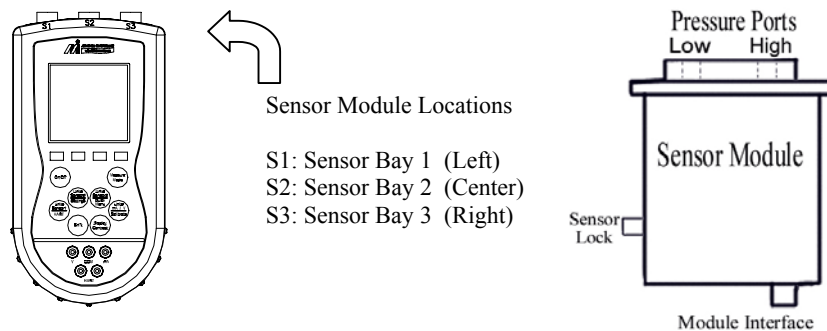
To install a new sensor module into a sensor bay, make sure the spring-loaded sensor lock is facing toward the rear of the MFT. Depress the sensor lock until the base of the sensor module passes into the sensor bay. Push module into bay until it locks into place.

Once installed, the MFT will immediately read the data from the sensor and load it into the system. The display will briefly show what sensor has been installed. The engineering units that were previously assigned to that sensor module will automatically be displayed. *Sensor modules may be installed in any sensor bay.*

To remove a sensor module from a sensor bay, depress the spring-loaded sensor lock corresponding to the module you wish to remove. The sensor lock needs to be depressed so that it clears the MFT housing. While pressing down on the sensor lock, simultaneously pull upward on the module. A pen or small screwdriver may be used to depress the sensor lock far enough to clear the housing.

Once a sensor module is removed from a bay, the display will clear that sensor's information from the display screen.

Note: Modules may be “hot swapped” or changed while the MFT is on or off. For intrinsically safe versions, however, installation, removal or hot swapping must be done in a non-hazardous environment only. See Hazardous Area Use section for more details.



Changing Units / Removing & Restoring Sensors on Display

Specific sensors can be turned on and off individually if they are not required. To turn off a specific sensor, press the **Shift** key and select the corresponding **Units Sensor** key for the sensor you wish to remove from the display. Repeatedly pressing the **Units Sensor** key will cycle through the available engineering units. Before the unit cycle repeats, the sensor display will go blank. The sensor is now off. Press the **Shift** key again to return to normal operation.

To reactivate a sensor that has been removed from the display, press the **Shift** key then press the corresponding **Units Sensor** key. Continue to cycle through the engineering units by pressing the **Units Sensor** key until the desired unit appears on the display. Press the **Shift** key to accept the engineering unit and return to normal **Measure Mode**.

Note: Open sensor bays on the MFT should be protected with dummy modules (P/N A36741) to protect the electrical connector and avoid contamination of or damage to the sensor bays. Dummy modules are shipped as needed to fill MFT bays.

Sensor Module Engineering Units

Pressure

PSI
Inches of Water @ 20° Celsius
Inches of Water @ 60° Fahrenheit
Inches of Water @ 4° Celsius
KiloPascals
Kilograms/cm²
MilliBars
Bars
Centimeters of Water @ 20° Celsius
Inches of Mercury (Referenced @ 0° C)
Millimeters of Mercury (Referenced @ 0° C)

Temperature

° Fahrenheit
° Celsius
° Rankin
° Kelvin
Ohms
milli-Volts

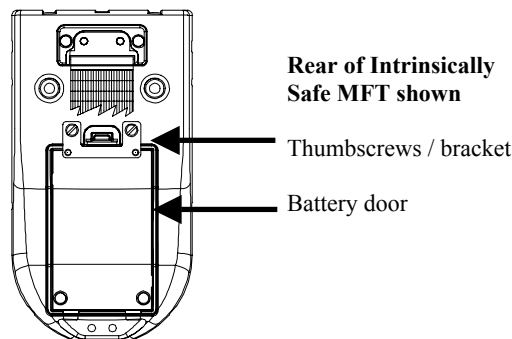
Installation & Removal of Batteries – standard MFTs

To install or remove the batteries, turn the MFT face down and pull down on the loose end of the Velcro strap to separate it from the opposite side, then pull the strap through the lower metal strap guide. Use a finger to push down and pull back on the battery cover latch to remove the cover. Be sure to follow the polarity diagram shown on the bottom of the battery holders when installing the batteries. Make sure all batteries are firmly secured. Replace cover, reinsert strap through metal strap guide, and re-secure the Velcro.

Note: Replace all six (6) AA batteries at once with alkaline or NiMH cells. Do not mix alkaline or NiMH batteries with each other or with other battery types. Batteries replacement is recommended when battery icon shows one segment; however, the MFT will function briefly after the battery icon is empty.

Installation & Removal of Batteries – Intrinsically Safe MFTs

Intrinsically Safe rated MFTs have a battery compartment door fitted with two captive thumbscrews and metallic bracket to mechanically secure the door to the MFT case. To install or remove batteries, follow the above instruction and unscrew the two thumbscrews to remove door. After batteries maintenance is complete, replace door and tighten thumbscrews re-secure.



Note: For Intrinsically Safe MFT models, replace batteries only with approved types. See the MFT Intrinsic Safety Control Document in the Appendix for approved battery details.

Over Pressurization - Pressure Modules

If an MFT pressure sensor is over pressurized above its full scale pressure range, an “Overrange” warning appears on the LCD above the engineering units of the affected sensor. If the applied pressure exceeds 20%

of the sensor's full scale range, the affected pressure measurement is replaced by an "Overrange" warning. If this occurs, immediately release the pressure until the MFT displays a normal reading. Although pressures are displayed up to 20% over full scale range, specified accuracy is guaranteed for full scale range only.

xGI (Gauge Isolated) and xAI (Absolute Isolated) Modules are capable of withstanding up to 2x the sensor range without sustaining damage.

xDN (Differential Non-Isolated) Modules are capable of withstanding up to 2x the sensor range when pressurized on *the high side only*. When pressure is applied to *both* the high and low side *simultaneously*, all xDN sensors have a 150 PSI pressure limit.

x is a place holder for the sensor module accuracy designator. *See information in the Appendix for additional sensor module information.*

Note: Subjecting pressure sensor modules to pressure limits beyond those listed above may damage the sensors and void the warranty.

Media Compatibility - Pressure Sensors

Gauge (xGI) and Absolute (xAI) pressure sensor modules are compatible with fluid and gas medias that are compatible with 316 stainless steel.

Differential (xDN) pressure sensors are for use with clean, dry, non-corrosive gases only.

APPLICATIONS

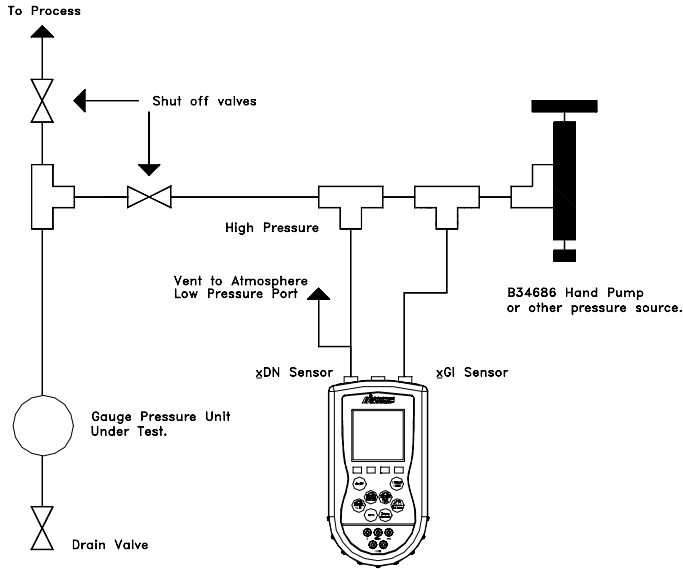
Gauge Pressure Calibration

The diagram below shows two typical set-ups for calibrating a gauge pressure unit under test. If the process is a liquid, it is vital that the gauge under test be isolated and drained. If liquid enters a xDN module, damage to the sensor can occur. To use a xDN sensor, connect the pressure source to the high pressure port of the xDN sensor vent the low pressure port to atmosphere.

When calibrating a gauge pressure unit using a xGI sensor, the connection is the same with the exception that the xGI sensor does not have an external vent to atmosphere.

In some cases the actual process may be used as the pressure source for calibration. If you choose to use the process to perform the calibration, make sure the process is compatible with the sensor used, and that it provides a stable pressure. If your process has a fluctuating or pulsating pressure, use of an external pressure

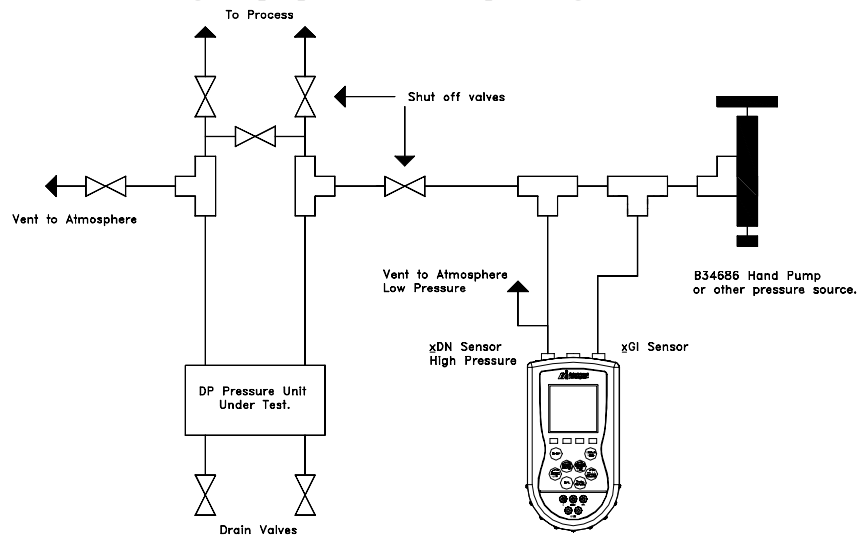
source is recommended to ensure the accuracy of your measurements and calibration.



Differential Pressure Calibration

Differential pressure gauges and transmitters can be calibrated using \bar{x} DN or \bar{x} GI sensor modules. The following drawing depicts a typical calibration set-up. The units under test should be isolated from the process and drained of liquids if necessary. The low pressure port of the DP unit under test is vented to atmosphere. Do not connect the low pressure port of a \bar{x} DN sensor to the low pressure port of the DP unit under test. Such a dead end connection can cause errors due to the expansion or contraction of trapped gas as a function of temperature change.

Meriam does not recommend using process pressure as the pressure source for DP pressure device calibration. Errors in measurement and calibration can easily creep in if the pressure source is unstable. In addition, \bar{x} DN sensors have a maximum overpressure limit of 150 PSI when a three valve equalizing manifold is used properly. Sensor damage can occur if more than 15 PSI is applied to the high or low side of a \bar{x} DN0020 or \bar{x} DN0200 sensor through improper use of the equalizing manifold.



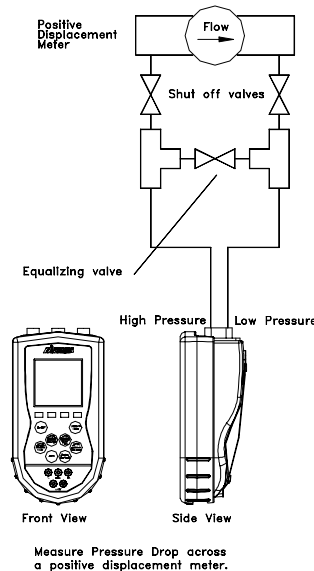
Additional DP Application Information

In addition to reading gauge pressures, the MFT can also be used to measure the pressure drop across a device in a pressurized pipe. Examples include measuring the differential pressure across positive displacement meters, filters, orifice plates or valves. Process compatibility and pressure ranges of the sensor modules need to be considered for each application.

A three valve equalizing manifold or push-to-read equalizing valve should be used to avoid damaging \bar{x} DN sensors. Follow the specific operating procedure for each type of valve manifold.

3-Valve Manifold: Make sure all shut-off valves are closed. Connecting to the process. Slowly open the equalizing valve. Slowly open the high pressure valve and then the low pressure valve. Close the equalizing valve and take the measurement. Reverse the process to disconnect.

Push-to-read valve: Connect to the process. Open shut off valves. Push the push-to-read plunger to take the reading.

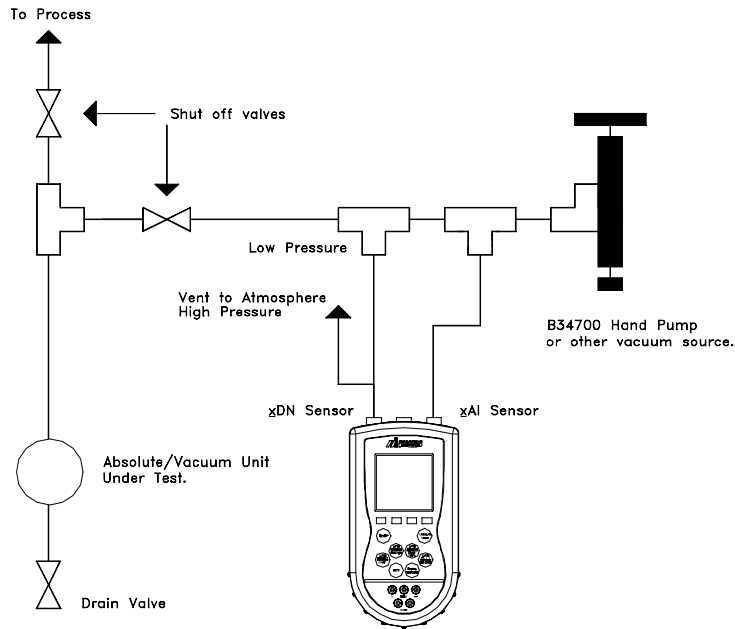


Vacuum and Absolute Pressure Calibration

Vacuum calibrations can be performed with a \bar{x} DN sensor module by venting the high pressure connection to atmosphere and applying the vacuum to the low pressure connection. Atmospheric pressure is the reference pressure for all vacuum measurements.

Absolute pressure calibrations use a \bar{x} AI sensor module. These sensor modules have an internal absolute zero reference. Simply connect the pressure (or vacuum) source to the single port on the module.

The following diagram shows the connection for both a vacuum and an absolute pressure measurement. If the process maintains a stable pressure, it can be used as the pressure source in some calibrations. Process compatibility and pressure ranges of the sensor modules need to be considered for each application.



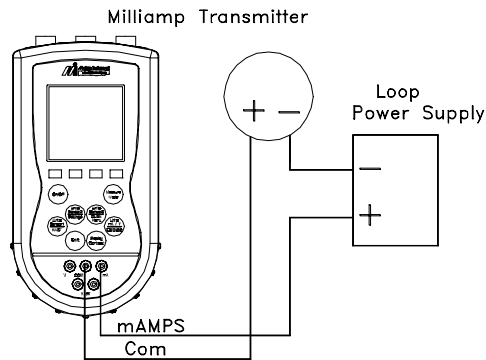
Absolute Pressure and Vacuum Calibration.

ELECTRICAL CONNECTIONS – See Hazardous Area Use Section of this manual for Intrinsically Safe guidelines / restrictions

MILLIAMP TRANSMITTER

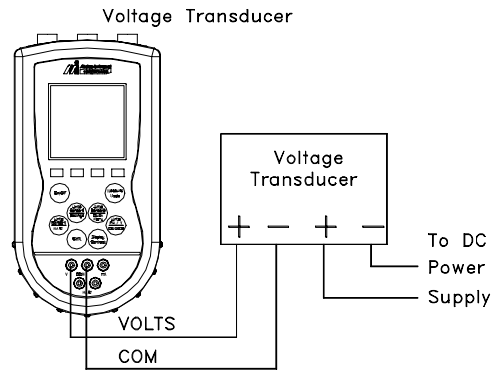
The diagram below depicts the proper connection for measuring the current output from a transmitter. The MFT is connected in series with the loop using standard banana jacks.

Important: Use the transmitter’s working terminals to measure mA, not the TEST terminals found on some transmitters. Do not use digital communication terminals found on smart transmitters. These terminals will give incorrect current reading.



VOLTAGE TRANSDUCER

The following diagram depicts the correct set-up for transducer calibrations.



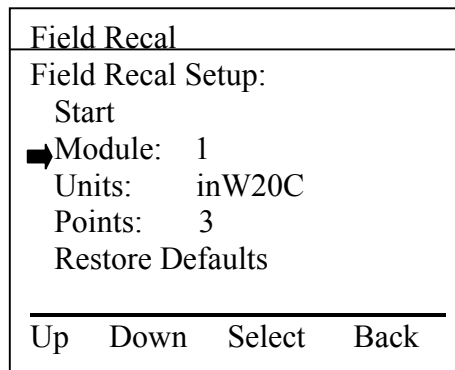
FIELD RECALIBRATION

The sensor modules and mA/V meter can be recalibrated in the field for zero, span, and linearity. The proper primary standards must be available prior to calibrating the MFT or modules. These standards should meet the accuracy requirements for your company or industry. Meriam Process Technologies follows the guidelines established by ANSI / NCSL Z540-1-1994 which requires that the primary standard be 4 times more accurate than the unit under test.

For sensors up to 200 PSI, Meriam recommends a $\pm 0.0015\%$ of reading deadweight tester for optimal accuracy. For sensors 200 PSI and above, a $\pm 0.0030\%$ of reading deadweight tester is recommended. If calibrating using inches of water units, be sure to match the reference temperature of water in both devices.

To enter **Field Recalibration** mode from the **Measure Mode** display, press the **More** soft key, then press the **Rcal** soft key.

This will access the **Field Recal Setup** screen.



Field Recalibration Setup Screen

Module: Select this option to choose which sensor module (S₁, S₂, S₃) or mA/V (I or V) meter to calibrate.

Units: Allows the user to choose the engineering units to calibrate in. Meriam recommends the calibration be performed in the default units of the subject sensor. For example: a \underline{x} DN0200 sensor with a range of 0-200" of water referenced to 20° Celsius should be calibrated using a deadweight tester with the same units

and temperature reference. Other engineering units or reference temperatures may be used but great care in units and temperature reference conversion must be used to achieve accurate calibration results.

Points: This option allows the user to select the number of calibration points desired. The example above would use 3 calibration points; 0%, 50%, and 100% of the full range of the sensor. The user may select 3, 5, or 9 point calibrations.

Start: Begins the recalibration process.

Recalibration Set-Up Menu

Select the parameters desired and the sensor module to be calibrated using the options provided. Press the **Up** or **Down** soft keys to scroll to the desired parameter. Press the **Select** soft key to choose that parameter. A sub-menu opens showing the options for the selected parameter. Use the **Up** or **Down** soft keys to scroll to the desired option. Use the **Save** soft key to choose that option. The display will then return to the main recalibration set-up menu. If you choose not to make any changes to a selected parameter, the **Back** soft key returns the display to the main recalibration set-up menu without making any changes.

Repeat this procedure for each parameter that needs to be changed.

Procedure - Field Recalibration

Once all of the desired parameters and options have been set, scroll **Down** to **Start** on the main recalibration menu and press the **Select** soft key. This takes you into the recalibration display.

Field Recal			
Cal Point: 0%			
Apply: 0.00			
S1:	0.00	inW20C	
Error:	0.000	%	
Adj	Abort	Next	Back

Sample Field Recalibration Screen (xDN Pressure Module)

The recalibration screen shown above provides the following information:

Cal Point: This is the target calibration point expressed as a percentage of the sensor module full scale pressure.

The next line shows the sensor bay location or analog sensor being calibrated (S1, S2, S3, V, or mA). The pressure applied by the user is also shown in the engineering units previously selected.

Error: Is the percentage error between the applied calibration pressure and the recalibration target pressure for the recalibration point (Apply value). + and – indicates whether the error is above or below the recalibration target pressure (Apply value).

Apply: This is the recalibration target pressure the MFT assigns based on the number of calibration points set in the **recalibration set-up** menu.

Make sure your pressure source and calibration standard are properly connected to the sensor module under test. Connections must be leak free. The first recalibration target pressure is normally zero, so the first point should have all zeros. (As shown in example above—See section **Adj** for other options). Adjust the pressure source until the pressure you are applying matches the **Apply** pressure & the **Error** percentage goes to zero.

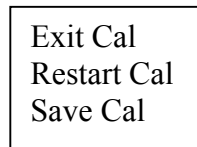
If the error percentage is not zero, attempt to adjust the applied pressure until the unit reads zero. If zero error can't be achieved a small error percentage within the accuracy of the unit under test or within company accuracy guidelines may be acceptable.

When the error % is within acceptable limits, press the **Next** soft key. This moves the unit to the next calibration point. Repeat the procedure outlined above. When completing the final recalibration point is set, press **Next** to store the data.

After completion of the calibration process for 3, 5, or 9 points, the MFT will inquire if the cal data should be saved. Select **Yes** to accept the recalibration data or **No** for other options.

If Yes was selected, the screen will verify the new calibration by displaying the date and module position number. Press the **OK** soft key. The MFT then returns to the **Measure Mode**.

Choosing **No** opens the **Cal Not Saved** screen with options:



Exit Cal: Does not save any new calibration data and returns the user to the **Measure Mode**.

Restart Cal: Takes the user back to the **Recalibration set up** screen to begin a new recalibration procedure.

Save Cal: Gives the user a second opportunity to accept the recalibration data.

The user can verify sensor module or mA/V calibration status by pressing the **Sensr** soft key from the **Measure Mode** display. The calibration data will show the sensor ID information and the most recent calibration date.

Other Recalibration Keys and Functions

Adj: Used at the start of the recalibration cycle, this option allows the user to redefine the recalibration target points. For example: if the first calibration point is a value other than zero, press **Adj** and enter the desired target pressure using the Numeric Grid and soft keys. Press **Select** to go to the next digit. Once you are satisfied with the new target pressure press **Done**. The MFT will prompt the user to save this value. Pressing **Yes** will change the calibration pressure value for that point. Begin recalibration with the new point designated on the **Apply** line. Perform this adjustment on any calibration point you wish to customize.

Abort: Pressing the **Abort** key will immediately cancel all calibration value changes made to that point, retain the previous calibration, and return to the **Measure Mode**.

Next: Takes the user to the next calibration point.

Back: In this mode, **Back** aborts the calibration procedure and returns the user to the **recalibration set-up** screen. The previous calibration data is retained. It does not return the user to the previous screen in the calibration procedure.

DB-9 CONNECTION PORT

All MFT models are equipped with a standard DB-9 connection for RS-232C communications. The DB-9 provides the hardware interface to facilitate download / upload operations from a host PC. This connection port facilitates download of MFT firmware improvements, HART[®] Device Object Files (DOFs) and documenting operations (Documenting option pending). All MFT upgrades are available via the Meriam Process Technologies Download Site accessible from www.meriam.com. The MFT will not need to be returned to Meriam for firmware updates for addition of DOFs.

Note: Do not use the DB-9 connection port in Hazardous Areas. Use in non-hazardous areas only. See Intrinsic Safety Control Document in the Appendix for more details on I. S. MFT units.

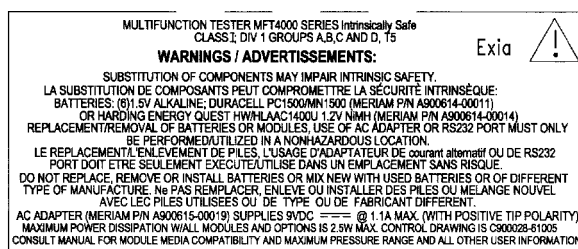
HAZARDOUS AREA USE

The MFT 40XX Series Calibrator / Communicator is available with Intrinsically Safe Certification for use in Class I, Div I, Groups A, B, C and D Hazardous Areas. Refer to the Intrinsic Safety Control Document in the Appendix for more details. CAN /CSA-22.2 No.1010.1-92 & UL913, Fifth Edition Rev 2/21/97 .

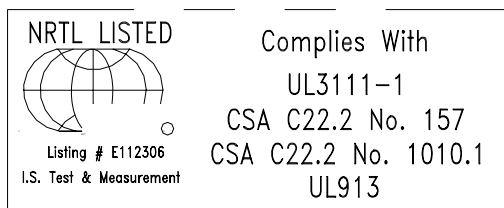
The following table identifies MFT model numbers and Areas of acceptable use.

Model Number	Non-hazardous Area	Hazardous Area
MFT 4000	√	NO
MFT 4001	√	√
MFT 4002	√	NO
MFT 4003	√	√
MFT 4010	√	NO
MFT 4011	√	√
MFT 4012	√	NO
MFT 4013	√	√
MFT 4020	√	NO
MFT 4022	√	NO

Intrinsically Safe MFTs can be identified by model number (see table above or Appendix), by special Intrinsically Safe Certification label and by WARNING label affixed to the MFT case. See the label samples below.



WARNING label for Intrinsically Safe MFT Units



Intrinsically Safe Certification Label

Intrinsically Safe MFTs have special battery door hardware to prevent the accidental ejection of batteries. This hardware consists of threaded inserts in the MFT case plus a bracket and captive thumbscrews on the battery door. See the Installation and Removal of Batteries section of this manual for more details.

WARNING: Serious injury or death may result from explosions. Do not make connection to the DB – 9 connection port or to the AC adapter jack in a hazardous area

WARNING: Serious injury or death may result from explosions. Before making electrical connections to an Intrinsically Safe MFT at the V/Com/mA jacks or at the HART jacks, verify the instruments in the loop are installed in accordance with intrinsically safe field wiring practices.

Note: Restrictions apply to the use of Intrinsically Safe MFT units in hazardous areas. Refer to the Intrinsically Safe Control Document in the Appendix for exact details. Meriam Process Technologies reserves the right to revise the Control Document without notice. Contact Meriam Process Technologies for the current Intrinsically Safe Control Document.

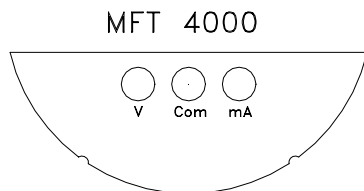
Note: Intrinsically Safe module RTD1000 requires the connection with Meriam RTDs, with RTD connectors and with RTD general-purpose connectors be made in non-hazardous areas only. Refer to the Intrinsically Safe Control Document in the Appendix for details.

MFT 4000 SERIES

MODEL SPECIFIC FEATURES: MFT 4000, MFT 4010, MFT 4020

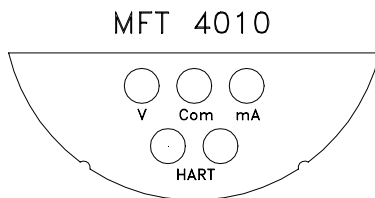
Previous sections of this manual have covered specifications and instructions that are common to all models of the MFT. The following sections address model specific instructions.

ELECTRICAL CONNECTIONS by MFT Model



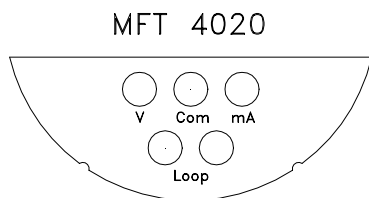
MFT 4000 Calibrator

Electrical connections are shrouded standard banana jacks (3/4" center) for ± 50 mA/volts measurements.



MFT 4010 with HART®

Electrical connections are shrouded standard banana jacks (3/4" center) for ± 50 mA/volts measurements. HART® loop connections are also standard banana jacks.



MFT 4020 with Loop Power

Electrical connections are shrouded standard banana jacks (3/4" center) for ± 50 mA/volts measurements. Loop power jacks are also shrouded standard banana style to supply 24Vdc to an unpowered field device.

For Intrinsically Safe MFT models, consult the Hazardous Area Use section of this manual for restrictions and special instructions for use and electrical connections.

MFT 4010 with HART® Communications

Overview

The MFT 4010 includes HART communication functions that allow the user to poll, configure and maintain supported HART field device. The MFT 4010 uses a combination of Universal, Common Practice and Device Specific commands to facilitate communication with a field device. Combining HART ability with the modular calibrator means that technicians can use one device to perform device analog output trim adjustments (4 and 20 mA), trim the sensor, re-configure the field device, or poll a device for basic information.

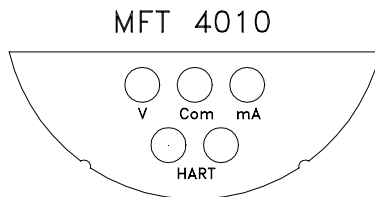
The MFT 4010 will communicate with any HART device through Universal and Common Practice Commands using the standard Generic DOF (Device Object File) but must have the DOF for a specific HART device installed before it can execute Device Specific Commands. Consult the list of available DOFs at www.meriam.com for an up to date list of HART devices. The list is found under "Available DOFs" button on the home page.

HART Commands

Three HART command types are used by the MFT 4010 to communicate with HART field devices. First, *Universal Commands* are primarily used to identify a field device by its model number and tag number and to read process data from the device. This communication is often referred to as “polling”. The MFT 4010 can poll any Hart Device. Second, *Common Practice Commands* are used for calibration and maintenance functions that are common to many devices. An example of this would be to trim or adjust the analog output. Third, *Device Specific Commands* are used to handle functions that are unique to a particular device or manufacturer. Examples of these commands include sensor zero, sensor trim, calibration curve characterization, density inputs required for calculations made by the HART device or other configuration functions unique to the specific device.

HART Connections

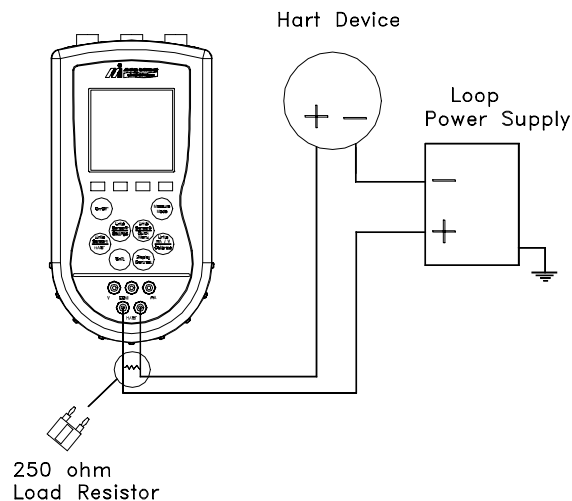
HART connections are made using the two standard banana jacks (3/4” center) located at the bottom of the MFT 4010. Refer to the following diagram. Polarity is not a concern for HART connections so both jack collars are black. Meriam supplies a test lead kit (P/N A36744) complete with standard connector for each model MFT 4010.



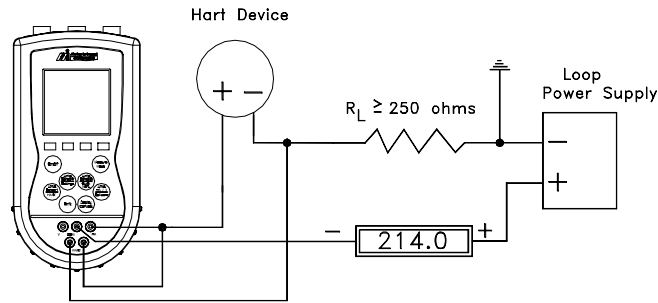
MFT 4010 with HART®

Electrical connections are shrouded standard banana jacks (3/4” center) for ± 50 mA/volts measurements. HART® loop connections are also standard banana jacks. Since HART is polarity independent, the HART jacks both have black collars.

For low load loops (less than 250 ohm), a 250 ohm resistor will need to be added to insure reliable HART communications. Meriam supplies a 250 ohm load resistor in the form of a standard adaptor (P/N A36821). Refer to the following diagram for details on connecting the adapter. This method requires the loop be opened in order to make the necessary connections.

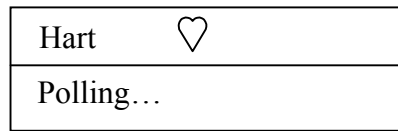


When connecting the MFT 4010 to a loop with a resistive load greater than 250 ohms, the HART jacks may be connected across the loop + and – or to the HART device terminals. Refer to the following diagram for connecting across the loop + and -. Notice the 250 ohm adapter is not needed here.



HART[®] Communications

Pressing the MFT’s **HART** dual-function key initiates the HART communication mode. The MFT automatically searches for a HART device at address 0. The ♥ symbol will appear on the top display line as the MFT searches and “Polling” appears on line two to indicate activity in progress.



When Polling is complete, there are two possibilities; 1) a HART device is found and the MFT launches into **Hart Device Online** communications mode (see details in **Hart Device Online Screen** section) or 2) no HART device is found.

No Device Found Notification

If no device is found, the MFT will display the message:

“No device found at address 0, perform multidrop poll?”

This indicates that no HART device was located at the default address 0. Press the **Yes** soft key to perform a **Multidrop Polling** of all remaining available addresses (1 – 15). Press the **No** soft key to work in the **Hart Offline** mode. See the **Hart Offline Mode** section below for details on this useful offline configuration tool.

Communication Trouble Shooting

If a HART device is connected to the MFT but the “No device found” notification is received, the **Multidrop Polling** option should be selected to determine if the device has a non-zero address. If the “No device found” notification is received again, then the loop connections to the MFT should be checked.

Make sure all connections are correct and secure. Check for shorts, open circuits and multiple grounds.

Determine if the loop resistance is greater than 250Ω and less than 1100 ohms. If less than 250Ω then use the supplied 250Ω load resistor in series with the loop (see diagram above) or add resistance to the loop.

Multidrop Polling

When multidrop polling is selected the MFT will search for the remaining 15 address locations. Each address poll requires up to 4 seconds to complete.

If you wish to discontinue the multidrop polling process, press either the **Stop** or **Abort** soft key options and the MFT will enter the **Hart Offline** screen.

When the MFT locates multiple devices on the loop, their addresses will be displayed on the screen. Mark the address of interest by scrolling **Up** or **Down** through the list. Press the **Select** soft key to choose the indicated address. The MFT will then enter the **Hart Device Online** screen.

HART OFFLINE MODE

If communications with a HART device are not established, and **Multidrop Polling** was declined, stopped, or aborted, the following screen will appear:

Hart Offline			
Utilities:			
▀	List/Show DOFs		
	List/Edit Configs		
	Create Configs		
	Delete All Configs		
DOFs Installed: 86			
Configs Stored: 12			
Back	Up	Down	Select

Hart Offline Main Menu Screen


List / Show DOFs:

Provides a list of installed DOFs (Device Object Files) used by the MFT to communicate with HART devices. Lists can be view by Manufacturer, by Device Name or by stepping through all Devices one at a time. Use the soft key controls to move through the list. Pressing the SHIFT key changes soft key definitions **Down** and **Up** to **PgUp** and **PgDn**. To quickly advance to the next page of a list, press **SHIFT** and then the **PgDn** soft key. To retreat to the prior page, press **SHIFT** and then **PgUp**. Once engaged, the **PgUp** and **PgDn** soft keys remain active until the **Up** or **Down** soft keys or **SHIFT** is pressed again.

List / Edit Configs:

Lists all stored HART configurations by Tag Number, date, and origin code. Once a desired tag is located with the cursor, pressing the **Select** soft key displays header information to help the user confirm the identity and origin of the configuration. Pressing **Select** again opens the configuration for review and editing as needed. Any configuration in the list can be sent to another HART device of the same manufacture and model number. This feature enables fast commissioning of replacement devices, cloning of existing systems, or re-configuring for changes in process conditions or batch runs.

New entries to this list are loaded to the bottom of the list as indicated by at right. If multiple entries for one device are shown, the most recently saved configuration is always listed last.

Offline			
List/Edit Configs			
▀	PT-105A	02/21/03	C
	PT-105B	02/21/03	D
	DPT-201C	02/23/03	C
	TT-312 A	02/24/03	E
	TT-312 A	02/24/03	C
	FE-201	03/01/03	P
	FE-201	03/01/03	S
	PT-6174	03/04/03	C
Up	Down	Select	Back

Offline List / Edit Configs Screen

Entries in this list may have been saved directly from a connected HART device, created in the MFT using the **Create Configs** function, copied from another configuration and renamed, or created by editing an existing file. MFT with Documentation option (MFT 4011, MFT 4013) will also list configurations downloaded from the separately available Meriam Device Management System software (see www.meriam.com/dm_solns.htm for more information). Tag numbers, date of storage, and a code indicating the origin of the configuration file are displayed under **List/Edit Configs**. The following codes may be given:

- D** = created by MFT in Offline mode, **D**efault config
- C** = saved from connected device in Online mode, **C**omplete config
- E** = created by editing an existing file, either D, C, P or S, **E**edited config
- P** = for multivariable devices, **P**rimary configuration (Primary Variable)
- S** = for multivariable devices, **S**ub-configuration (other variable[s])

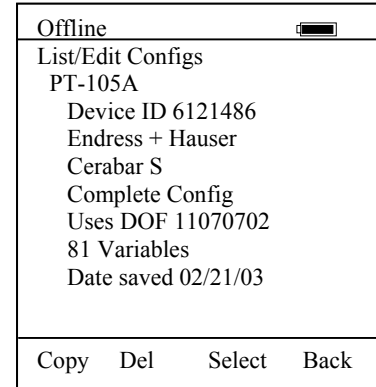
Create Configs:

The **Create Configs** function allows the user to configure a HART device file in Offline Mode for sending to the intended device later when connected in the Online Mode. Use the soft key controls to move through the list and select the device model number required. The menus prompt the user to make the necessary configuration selections, tag the file for later retrieval and use, and edit configuration lines as required. This function can be locked out. See the Lockout Section of this manual for more information.

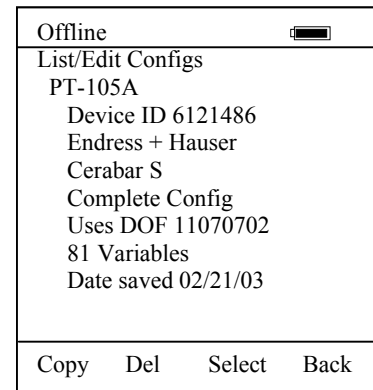
Delete Configs / Clearing Configuration Memory:

Individual stored Configurations may be deleted with MFT **Del** soft key functions (see example at right). A delete confirmation screen is provided to prevent unintended deletions. The **Del** key only hides the record from the MFT screen; it does not clear memory space.

To clear **all** configurations from memory (including active and hidden configs), enter the **HART Offline Menu Screen** and select the **Delete All Configs** option. The MFT will ask “Delete ALL Configs... ARE YOU SURE???” Select **Yes** to clear **all** stored configurations from memory.



**Offline List / Edit
Config Detail Screen**



Delete All Stored Configurations

HART ONLINE MODE

Once a HART device is located, the MFT enters the **Hart Device Online Screen** as shown below. The word “Hart” appears in the top left of LCD. The ♥ symbol will “flash” when HART communications have been established.

Note: The screen below illustrates a Rosemount 1151 rev. 5 DP HART display. Screen configuration may vary depending on the HART device connected. For more information, please refer to the owner’s manual for the HART device under test.

Hart	♥		
1151: Pump 8			
▀ Device Config			
PV: 0.000 InH2O			
AO: 4.000 mA			
LRV: 0.000 InH2O			
URV: 104.8 InH2O			
% of Range: 0.000%			
AO Fixed			
Up	Down	Select	Back

Hart Device Online Screen

1151: Pump 8: Line 1 displays the model and tag number or service description of the device connected to the MFT. The model of the device is fixed and cannot be changed by the user.

Device Config: Line 2 is dedicated to accessing the HART configuration menus. See the Device Setup section below for further information.

PV: Displays the current primary variable’s value as reported by the digital side of the HART device.

AO: Displays the current analog output value as reported by the digital side of the HART device.

LRV: Displays the Lower Range Value of the transmitter corresponding with a 4 mA analog output.

URV: Displays the Upper Range Value of the transmitter corresponding with a 20 mA analog output.

% of Range: Reflects the primary variable reported as a percent of full-scale range.

AO Fixed: Line 9 is a message line used to display general messages including but not limited to the state of HART device output, errors, or warnings. *This line will be blank if no messages or warnings are active.*

Device Configuration

From the **HART Device Online Screen** move the cursor to **Device Config** and press the **Select** soft key. The menu screen below allows the user to select a number of tasks. These include changing editable parameters, re-ranging the device, calibration, and device diagnostics.

Hart	♡
1151: Pump 8	
▀ Process Variables	
Sensor	
Analog Trim	
Basic Info	
Hart Output	
Diagnostics	
Save/Send	
Review/ Edit	
Up	Down
Select	Back

Device Config Screen

Process Variables

The **Process Variables** option allows the user to review information concerning the process variables (such as pressure, current, etc...) as reported by the transmitter.

To enter the **Process Variables** option, use the **Up** or **Down** soft key to move the selection arrow to **Process Variables**, and then press the **Select** soft key. The MFT will then display the process variables being sent by the HART device.

Press **Back** to return to the **Device Config** screen.

Sensor

This option allows the user to manage and configure sensor range and perform trim functions. From the **Device Config** screen scroll the cursor to **Sensor** and press the **Select** soft key.

The following screen will appear:

Hart	
1151: Pump 8	
▀ Rerange	
Signal Conditioning	
Pressure Trim	
Up	Down
Select	Back

Rerange: Allows the user to re-range the settings for Lower and Upper Range Value, set 4-20 mA values, and view Lower and Upper Span Limits.

Move cursor to **Rerange** and press the **Select** soft key.

The following screen will appear showing the current values for LRV, URV, LSL, and USL:

Hart			
1151: Pump 8			
▀ LRV: 0.00 InH20			
URV: 150.00 InH20			
Set 4mA Range			
Set 20mA Range			
LSL: -150.00 InH20			
USL: 150.00 InH20			
Up	Down	Select	Back

Rerange Main Menu Screen

Pressing the **Back** soft key while in the **Rerange** main menu returns the MFT to the **Device Config** main menu.

LRV: Lower Range Value. Allows the user to adjust the lower pressure range that the HART device will measure. This value typically corresponds to the 4 mA analog output. The values entered must be within the span limits of the device.

Move the cursor to **LRV** and press the **Select** soft key.

Hart			
1151: Pump 8			
Lower Range Value			
_0.00 in H20			
Inc	Dec	Next	Done

Use the **Inc** / **Dec** soft keys to make changes. Use the **Next** soft key to move to the next character. Press the **Done** soft key when the changes are complete. A prompt will appear: **Save new data?** Press the **Yes** soft key to accept the changes.

Pressing the **No** soft key will delete the changes and keep the previous settings. The MFT will return to the **Rerange** main menu.

URV: Upper Range Value. Allows the user to adjust the upper pressure range that the HART device will measure. Typically, this value corresponds to the 20 mA output. The values entered must be within the span limits of the device.

Move the cursor to **URV** and press the **Select** soft key.

Hart			
1151: Pump 8 Upper Range Value			
_150.00 InH20			
Inc	Dec	Next	Done

Use the **Inc** / **Dec** soft keys to make changes. Use the **Next** soft key to move to the next character. Press the **Done** soft key when the changes are complete. A prompt will appear: **Save new data?** Press the **Yes** soft key to accept the changes. Pressing the **No** soft key will delete the changes and keep the previous settings. The MFT will now return to the **Rerange** main menu.

Set 4mA Range: This option allows the user to configure the pressure value at which the HART device will read 4 mA.

Move the cursor to **Set 4mA** and press the **Select** soft key.

The screen will prompt: **Take Loop offline.** This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Rerange** main menu screen.

After pressing **OK**, the screen will prompt: **Apply new 4ma input.** This screen prompts the user to apply the pressure that will become the lower range value. Press the **OK** soft key to continue and the following screen will appear. Press **Back** to escape.

Hart		♥	
1151: Pump 8			
■ Set 4ma			
PV: 0.00 InH20			
Up	Down	Select	Back

With pressure connections teed to the MFT and the HART device, apply the desired pressure and press the **Select** soft key. The MFT will then configure the pressure applied to equal 4 mA. To set 4 mA to correspond to zero pressure, make sure HART device is vented to atmosphere.

The screen will display the prompt: **Put Loop back online.** This notice reminds the user to return the device to service. Press the **OK** soft key to continue. The MFT returns to the **Rerange** main menu screen.

Press the **Back** soft key to return to the **Sensor** main menu screen. Pressing **Back** again will return the MFT to the **Device Config** screen.

Set 20mA Range: This option allows the user to configure the pressure value at which the HART device will read 20 mA.

Move the cursor to **Set 20mA** and press the **Select** soft key.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Rerange** main menu screen.

After pressing **OK**, the screen will prompt: **Apply new 20ma input**. This screen prompts the user to apply the pressure that will become the upper range value. Press the **OK** soft key to continue. The following screen will appear. Press **Back** to escape.

Hart	♥
1151: Pump 8	
▀ Set 20ma	
PV: 0.00 InH2O	
Up	Down
Select	Back

With pressure connections teed with to MFT and the HART device, apply the desired pressure and press the **Select** soft key. The MFT will then configure the pressure applied to equal 20 mA.

The screen will display the prompt: **Put Loop back online**. This notice reminds the user to return the device to service. Press the

OK soft key to continue. The MFT returns to the **Rerange** main menu screen.

Press the **Back** soft key to return to the **Sensor** main menu screen. Pressing **Back** again will return the MFT to the **Device Config** screen.

LSL: Lower Span Limit. This display is informational only and cannot be edited. It is the lowest output value available with the device.

USL: Upper Span Limit. This display is informational only and cannot be edited. It is the highest output value available with the device.

Signal Conditioning

Signal Conditioning allows the MFT to configure how the HART device will process the sensor data. This includes pressure units, damping values, alarm settings, and transfer functions.

Move the cursor to **Signal Conditioning** and press the **Select** soft key.

The following screen will appear:

Hart			
1151: Pump 8			
▀ Transfer Function			
Damping Value			
Units			
Analog Alarm			
Up	Down	Select	Back

Signal Conditioning Screen

Transfer Function: This option allows the user to choose how the HART device processes the primary variable. Typical options include linear and square root functions.

Move the cursor to **Transfer Function** and press the **Select** soft key.

The MFT will enter the **Transfer Function** screen. Use the **Edit** soft key to make changes. Press **Back** to return to the **Signal Conditioning** main menu screen.

After pressing **Edit**, the screen will show the current setting for the **Transfer Function**. Use the **Increase** and **Decrease** soft keys to scroll through the available options. Press **Done** to accept the changes. The MFT will then return to the **Signal Conditioning** main menu.

Damping Value: This option allows the MFT to configure the Damp rate for the HART device.

Move the cursor to **Damping Value** and press the **Select** soft key.

The screen will display the current Damping value. Press the **Edit** soft key to change the current value, or press **Back** to return to the **Signal Conditioning** main menu.

After pressing **Edit**, the following screen will appear:

Hart			
1151: Pump 8			
Damping Value:			
_0.25			
Inc	Dec	Next	Done

The underscore will prompt the user for changes (_). Use the **Inc / Dec** soft keys to change the value and the **Next** soft key to move to the next digit. When complete, press **Done**. A prompt will appear: **Save new data?** Pressing **No** will return the MFT to the **Signal Conditioning** main screen without making any changes. Press **Yes** to accept the new value. The MFT will return to the **Signal Conditioning** main screen.

Units: This option allows the user to configure the engineering units for the connected HART device. Move the cursor to **Units** and press the **Select** soft key. The screen will display the current units being used. Press the **Edit** soft key to change the current unit, or press **Back** to return to the **Signal Conditioning** main menu.

Use the **Increase** and **Decrease** soft keys to scroll through the available engineering units. Press **Done** to select the new engineering unit. The MFT will send the update to the HART device and return to the **Signal Conditioning** main menu.

Analog Alarm: This option allows the user to configure the analog alarm properties for the HART device. Move the cursor to **Analog Alarm** and press the **Select** soft key.

The MFT will enter the **Analog Alarm** screen. Use the **Edit** soft key to make changes. Press **Back** to return to the **Signal Conditioning** main menu screen.

After pressing **Edit**, the screen will show the current setting for the **Analog Alarm**. Use the **Increase** and **Decrease** soft keys to scroll through the available options. Press **Done** to accept the changes. The MFT returns to the **Signal Conditioning** main menu.

Pressure Trim

This option allows the user to trim various primary variable settings. Move the cursor to **Pressure Trim** and press the **Select** soft key. The following menu screen will appear:

Hart
1151: Pump 8
➡ Zero Trim
Lower Trim
Upper Trim
Low Sensor Trim Pt
Up Sensor Trim Pt
Up Down Select Back

Pressure Trim Main Menu Screen

Zero Trim: This option allows the user to trim the zero pressure reported by the HART device sensor.

Use the **Up** or **Down** soft key to move the selection arrow to **Zero Trim**, then press the **Select** soft key.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Pressure Trim** main menu screen without making changes, or taking the device offline.

The MFT will prompt: **Apply zero to Sensor**. Make sure that the HART device has no pressure applied. Press the **OK** soft key to continue. The MFT will then prompt the user: **Wait until stable**. All pressure must be vented, and the display stabilized, before accepting a zero pressure value. Press the **OK** soft key to continue.

Hart	♥		
1151: Pump 8	◆ PV: 0.00 InH2O		
Up	Down	Select	Back

Once the display is stabilized, press the **Select** soft key to set the displayed value.

Press **Back** to exit this screen without performing a zero trim. The screen will display the prompt: **Put Loop back online**. This notice reminds the user to reconnect the device under test to the receiving device. Press the **OK** soft key to continue to the **Pressure Trim** main menu screen. Pressing **Back** again will return the MFT to the **Sensor** main menu screen.

Lower Trim: This option allows the user to trim the low pressure at a specific reference point. This value becomes the low sensor trim point.

Use the **Up** or **Down** soft key to move the selection arrow to **Lower Trim**, then press the **Select** soft key.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Pressure Trim** main menu screen without making changes, or taking the device offline.

The MFT will prompt: **Apply Low Pressure**. Press the **OK** soft key to continue. The MFT will then prompt the user: **Wait until stable**. This notice reminds the user to wait for the pressure displayed to stabilize before accepting a pressure value. Press the **OK** soft key to continue.

Apply a low pressure value to the HART device and allow it to stabilize. Press the **Select** soft key to accept the value.

When the **Select** soft key is pressed, the MFT will prompt for changes with the Numeric entry grid and underscore (_). Use the Number Grid and soft keys to change the value and the **Select** soft key to move to the next digit.

When complete, press **Done**. A prompt will appear: **Save new data?** Press the **Yes** soft key to accept the changes. Pressing **No** returns the MFT to the **Pressure Trim** main menu screen without saving changes.

The screen will display the prompt: **Remove Pressure**. This notice reminds the user to release the pressure applied. Press **OK** to continue. The screen will display the prompt: **Put Loop back online**. This notice reminds the user to reconnect the device under test to the receiving device. Press the **OK** soft key to continue to the **Pressure Trim** main screen.

Upper Trim: This option allows the user to trim the high pressure at a specific reference point. This value becomes the high sensor trim point.

Use the **Up** or **Down** soft key to move the selection arrow to **Upper Trim**, then press the **Select** soft key.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Pressure Trim** main menu screen without making changes, or taking the device offline.

The MFT will prompt: **Apply High Pressure**. Press the **OK** soft key to continue. The MFT will then prompt the user: **Wait until stable**. This notice reminds the user to wait for the pressure displayed to stabilize before accepting a pressure value. Press the **OK** soft key to continue.

Apply a high pressure value to the HART device and allow it to stabilize. Press the **Select** soft key to accept the value.

When the **Select** soft key is pressed, the MFT will prompt for changes with the Numeric entry grid and underscore (_). Use the Numeric Grid and soft keys to change the value and the **Select** soft key to move to the next digit.

When complete, press **Done**. A prompt will appear: **Save new data?** Press the **Yes** soft key to accept the changes. Pressing **No** returns the MFT to the **AnalogTrim** main menu screen without saving changes.

The screen will display the prompt: **Remove Pressure**. This notice reminds the user to release the pressure applied. Press **OK** to continue. The screen will display the prompt: **Put Loop back online**. This notice reminds the user to reconnect the device under test to the receiving device. Press the **OK** soft key to continue to the **Analog Trim** main screen.

Low Sensor Trim Pt: Allows the user to view the pressure value where the last Low Sensor Trim Point was referenced. See the **Lower Trim** section for more information.

Use the **Up** or **Down** soft key to move the selection arrow to **Low Sensor Trim Pt**, then press the **Select** soft key. Use the **Back** key to return to the **Pressure Trim** main menu.

Up Sensor Trim Pt: Allows the user to view the pressure value where the last Upper Sensor Trim Point was referenced. See the **Upper Trim** section for more information.

Use the **Up** or **Down** soft key to move the selection arrow to **High Sensor Trim Pt**, then press the **Select** soft key. Use the **Back** key to return to the **Pressure Trim** main menu.

Analog Trim

The **Analog Trim** option allows the user to trim the analog output of the connected HART device. To enter the **Analog Trim** option, use the **Up** or **Down** soft key to move the selection arrow to **Analog Trim**, then press the **Select** soft key. The following screen will appear:

Hart
1151: Pump 8
▀ 4 mA Analog Trim
20 mA Analog Trim
Loop Test
Up Down Select Back

Analog Trim Main Menu Screen

4 mA Analog Trim: This option allows the user to trim the 4 mA analog output of the connected HART device. A multimeter will be needed to use this trim feature operating out of the HART communications mode.

Note: For best convenience on Trim operations, the MFT's mA/V meter should be used. See the Calibrate section of this manual and review the Analog Trim instructions for more information on this feature.

To initiate the **4 mA Analog Trim**, use the **Up** or **Down** soft key to move the selection arrow to **4 mA Analog Trim**, then press the **Select** soft key.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue.

Press the **Back** soft key to return to the **Pressure Trim** main menu screen without making changes, or taking the device offline.

Hart	♥
1151: Pump 8	
▀ AO: 4.000 mA	
AO Fixed	
Up Down Select Back	

The MFT will send commands to set the HART device output to 4.000 mA and display the message "AO Fixed." Verify the output of 4.000 mA using a reliable external multimeter. If the multimeter confirms the value, no trim is needed and the **Back** soft key can be used to escape the trim function. If the multimeter measurement does not confirm the "AO Fixed" value, press the **Select** soft key to enter the trim value at the underscore (_) prompt. Use the Numeric Grid and soft keys to manually enter the value measured by the external multimeter. Use the **Select** soft key to move to the next digit. Press **Done** when complete. A

prompt will appear: **Save new data?** Press the **Yes** soft key to accept the changes and implement the 4 mA trim. Pressing **No** will take you back to the **Analog Trim** main menu screen without saving changes.

Press the **Back** soft key. The MFT will prompt: **Put Loop back online**. This is to remind the user to return the HART device back into service. Press the **OK** soft key to return to the **Analog Trim** main menu screen.

The screen will display the prompt: **Put Loop back online**. This notice reminds the user to reconnect the device under test to the receiving device. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Analog Trim** main screen. Pressing **Back** again will return the MFT to the **Device Config** screen.

20 mA Analog Trim: This option allows the user to trim the 20 mA analog output of the connected HART device. An external multimeter will be needed to use this trim feature operating out of the HART communications mode.

Note: For best convenience on Trim operations, the MFT's mA/V meter should be used. See the Calibrate section of this manual and review the Analog Trim instructions for more information on this feature.

To initiate the **20 mA Analog Trim**, use the **Up** or **Down** soft key to move the selection arrow to **20 mA Analog Trim**, then press the **Select** soft key.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Analog Trim** main menu screen.

Hart	♥		
1151: Pump 8	■ AO: 20.00 mA		
AO Fixed			
Up	Down	Select	Back

The MFT will send commands to set the HART device output to 20.000 mA and display the message “AO Fixed.” Verify the output of 20.000 mA using a reliable multimeter. If the multimeter confirms the value, no trim is needed and the **Back** soft key can be used to escape the trim function. If the multimeter measurement does not confirm the “AO Fixed” value, press the **Select** soft key to enter the trim value at the underscore (_) prompt. Use the Numeric Grid and soft keys to manually enter the value measured by the external multimeter. Use the **Select** soft key to move to the next digit. Press **Done** when complete.

A prompt will appear: **Save new data?** Press the **Yes** soft key to accept the changes and implement the 20 mA trim. Pressing **No** will take you back to the **Analog Trim** main menu screen without saving changes.

Press the **Back** soft key. The MFT will prompt: **Put Loop back online**. This is to remind the user to return the HART device back into service. Press the **OK** soft key to return to the **Analog Trim** main menu screen.

The screen will display the prompt: **Put Loop back online**. This notice reminds the user to reconnect the device under test to the receiving device. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Analog Trim** main screen. Pressing **Back** again will return the MFT to the **Device Config** screen.

LOOP TEST

Loop Test: This option allows the user to send HART commands to the device under test to “fix” its analog output to any desired value between 4 and 20 mA, regardless of process variable value.

This test is useful in determining the ability of a loop to deliver accurate analog signals by providing a specific current output to a receiving device.

Use the **Down** soft key to scroll to **Loop Test** and press the **Select** soft key to select. The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Analog Trim** main screen.

The MFT will execute the selected analog output assignment to the connected HART device and display the results.

Hart	♥		
1151: Pump 8			
◆ AO: 3.999 mA			
(message area)			
Up	Down	Select	Back

Messages relevant to Loop Test will appear in the message area shown above. This area will be blank if no messages are issued by the HART device.

To manually change the fixed analog output value from the HART device, press the **Select** soft key. The following screen will appear.

Hart			
1151: Pump 8			
AO:			
_3.999 mA			
Inc	Dec	Next	Done

An underscore will prompt the user for changes (_). Use the **Inc** / **Dec** soft keys to change the value and the **Next** soft key to move to the next digit. When complete, press **Done**. A prompt will appear: **Save new data?** Pressing **No** will take you back to the **Loop Test** main screen without making any changes. Press **Yes** to accept the new value. The MFT returns to the Loop Test main screen. The message line will indicate: “AO Fixed.”

Press the **Back** soft key to exit this screen. The screen will display the prompt: **Put Loop back online**. This notice reminds the user to return the device to service. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Analog Trim** main menu screen. Pressing **Back** from the **Analog Trim** screen will return the MFT to the **Device Config** screen.

Scaled D/A Trim

Scaled D/A Trim is a feature that allows HART® communications users to trim a smart transmitter’s 4-20 mA output using a different analog scale to measure the loop current. For example, an I/O resistor is commonly placed in series with the two wire 4-20 mA loop to convert the current signal into a voltage signal for use by the DCS. By measuring the voltage across the I/O resistor, the loop current value can be obtained by dividing the voltage by the resistor value. **Scaled D/A Trim** allows the user to enter this voltage directly instead of having to convert it into the actual current value. During the trim function, the transmitter output is set to a fixed output (first 4 mA and then 20 mA). The user is prompted to enter the meter reading using the analog scale selected by the user. The transmitter D/A calibration trim is then adjusted to obtain the correct meter reading. The resulting calibrated loop delivers a precision voltage signal to the DCS.

To use Scaled D/A Trim, first make connections to the HART transmitter of interest and press the **HART** key. Once communication is established, select the **Device Configuration** option on the first display, then **Diagnostics**, then **Calibrate**, then **Analog Trim** and finally **Scaled D/A Trim** (these menu paths and titles may vary with HART device). The screen will prompt: “Loop should be removed from automatic control.” This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Use the **Select** soft key to accept **OK**. Press the **Abrt** (Abort) soft key to return to the previous screen without making changes and without taking the device offline.

If **OK** is selected, the following display will appear.

HART			
3144 Temp: DOF TEST			
Select Trim Scale:			
1.0 to 5.0 volts			
■	1.2 to 6.0 volts		
2.0 to 10.0 volts			
User Defined			
Up	Down	Select	Abrt

Select Scaled D/A Trim Display

Scale Options & Corresponding I/O Resistor Values

- 1.0 to 5.0 volts corresponds to 250 ohm I/O resistor
- 1.2 to 6.0 volts corresponds to 300 ohm I/O resistor
- 2.0 to 10.0 volts corresponds to 500 ohm I/O resistor

Use the **Up** or **Down** key to indicate the desired Trim scale. Use the **Select** key to select the desired scale. Selecting **1.2 to 6.0 volts** will automatically set the “Scaling Lo value:” to 1.2 and the “Scaling Hi value:” to 6.0 and a message will be displayed to “connect reference meter.” An accurate reference multimeter should be connected across the I/O resistor at this point. **Select** the OK menu option once this is done. The message “Setting field device output to 4 mA” will be displayed. **Selecting** the OK menu option causes the MFT to

send the AO fixed command for device output of 4 mA . The next display asks the user to “Enter meter value” as read from the multimeter display. Use the Numeric Grid and soft keys to enter this value. Press **Done** when finished and the following screen is displayed.

HART			
3144 Temp: DOF TEST			
Scaled output :1.20000 equal to readout device?			
<input checked="" type="radio"/> -Yes <input type="radio"/> - No			
Up	Down	Select	Abt

If the meter now reads the correct scale value for 4 mA output, **Select** Yes to continue on to “Setting field device output to 20mA.” Otherwise, select No and you will be prompted to enter the new meter reading. At the “Setting field device output to 20mA,” **Select** the OK option and the MFT sets the HART device output to 20.00 mA. The next display asks the user to “Enter meter value” read from the multimeter display. Use the Numeric Grid and soft keys to enter this value. Press **Done** when finished. **Select** No if the meter does not read the correct scale value for 20 mA output. **Selecting** Yes completes the trim operation and the display changes to “Data is being made permanent, please wait...” then to “Returning field device to original output” and finally to “Note- Loop may be returned to automatic control”. **Select** OK here to complete the Scaled D/A Trim.

This feature also allows custom scaling by entering values for “Scaling Lo value” and “Scaling Hi value”. Selecting the **User Defined** menu option on the “Select Trim Scale” display provides the Numeric Grid display to allow input of the Scaling Lo and Hi values. Once this is complete, the following display is shown.

HART			
3144 Temp: DOF TEST			
Trim will be scaled from :1.400 to :8.000			
<input checked="" type="radio"/> -Apply above scale <input type="radio"/> - Change scale			
Up	Down	Select	Abt

Selecting “Change scale” gives the user a chance to further adjust the desired scale. Once “Apply above scale” is selected, the remaining procedure is identical to the **1.2 to 6.0 volts** example given above. Complete the procedure as prompted by the MFT displays using the custom scale for the D/A trim.

Basic Info

This function provides basic but valuable HART device information to the user.

Use the **Up** or **Down** soft key to move the selection arrow until it points to **Basic Info**, then press the **Select** soft key.

The following screen will appear:

Hart
1151: Pump 8 ➡ Tag Date Descriptor Message Private Label Revisions Construction Matls
Up Down Select Back

Basic Info Main Screen

All of the options listed on this screen are accessed by scrolling the cursor **Up** or **Down** to the desired parameter and pressing **Select** to enter that option's edit screen.

Non-editable screens provide information only. The **Back** soft key will be the only soft key shown for these screens. For options that can be edited, press the **Edit** soft key to change current settings. Use the Alphanumeric Grids options (see Alphanumeric Entry Section in this manual) and soft keys to select desired characters. Press the **Select** key to enter alphanumeric information. Press **Done** to save the information. The MFT will send the update to the HART device and return to the **Basic Info** main menu.

Tag: Allows the user to program a tag number/name for the HART device. Up to 8 characters, including spaces, may be used.

Date: Allows the user to set the date.

Descriptor: Allows the user to provide a brief custom description of the HART device. Examples: "Pipe 7E" or "DP xmtr". Up to 15 characters, including spaces, may be used.

Message: Allows the user to enter a short message, similar to the **Descriptor** option above. Up to 20 characters, including spaces, may be used.

Model: Provides information on the specific model of the connected HART device. This option is non-editable.

Private Label: Provides the device manufacturer's name. This option is non-editable.

Revisions: After selecting **Revisions** the screen will change and provide a menu of HART related items. Press **Select** to choose the item of interest.

Hart
1151: Pump 8 ➡ Hart Revision Device Revision Software Revision Final Assembly Number
Up Down Select Back

Revisions Main Screen

Most items on this screen are non-editable, and are for informational purposes only.

Final Assembly Number: This is the only user editable selection. Use the **Down** soft key to select **Final Assembly Number**, then press the **Select** soft key.

The screen will display the current final assembly number. To change the value, press the **Edit** soft key.

Use the Number Grid and soft keys to adjust the value, and **Select** to edit the next character. This option allows numeric values only. Press **Done** to select the information.

Construction Mats: This option takes the user to a screen dedicated to construction information about the HART device.

Some options can be edited to allow entry of physical details.

Hart Output

This option allows the user to configure the HART communications protocol options. It also provides information about the HART device ID and Burst Com number.

To enter the **Hart Output** option, use the **Up** or **Down** soft key to move the selection arrow to **Hart Output**, then press the **Select** soft key. The MFT screen provides the options shown below:

Hart
1151: Pump 8 ➡ Polling Address Burst Mode Select Burst Com Number Device ID Preambles
Up Down Select Back

Hart Output Main Menu

Polling Address: This option allows the user to configure the address of the HART device. See the **HART Communications** section for more details on HART device addresses.

Move the cursor to **Polling Address** and press the **Select** soft key. The screen will display the current Polling address. Press the **Edit** soft key to change the current value, or press **Back** to return to the **Hart Output** main menu.

After pressing **Edit**, the following screen will appear:

Hart			
1151: Pump 8			
Polling Address:			
_15			
Row	Col	Select	Done

The underscore will prompt the user for changes (_). Use the **Inc / Dec** soft keys to change the value and the **Next** soft key to move to the next digit.

Note: Acceptable polling addresses are 0 through 15. Care must be taken to insure that the new address is not already assigned to a device on the loop. Failure to do so will result in a loss of communications.

When complete, press **Done**. A prompt will appear: **Save new data?** Pressing **No** returns to the **Hart Output** main screen without making any changes. Press **Yes** to accept the new value. The MFT will return to the **Hart Output** main screen.

Burst Mode Select: Burst mode is a communications option that allows a HART device to continuously broadcast pre-selected information to a host device. The MFT does not use burst mode for its interface with HART devices. Burst information is often used within a plant's information technology framework. The MFT can be used to set a device's burst mode information and to initiate or terminate the **Burst Mode Select** function. It does not display the burst mode variable.

To enter the **Burst Mode Select** option, use the **Up** or **Down** soft key to move the selection arrow to **Burst Mode Select**, then press the **Select** soft key.

Press the **Edit** soft key, and use the **Increase** and **Decrease** soft keys to toggle the burst mode on or off. Press **Done** when the desired option is displayed. The MFT will query if the new data should be saved. Pressing **Yes** puts the MFT into the selected burst mode, and returns the MFT to the **Hart Output** main menu screen. Selecting **No** leaves the device in the original "As found" burst mode and returns the MFT to the **Hart Output** main menu screen.

Burst Mode communications are differentiated from normal HART communications with the filled heart ♥ symbol displayed when communicating.

Burst Com Number: This register is used to select the information that will be continuously broadcast. The selection will differ from device to device.

To enter the **Burst Com Number** option, use the **Up** or **Down** soft key to move the selection arrow to **Burst Com Number**, then press the **Select** soft key.

The screen will display the currently selected output setting for the device. Press **Back** to return to the **Hart Output** main menu screen if you do not wish to edit the settings.

To edit the current settings, press the **Edit** soft key. Use the **Increase** and **Decrease** soft keys to scroll through the selections for that specific device.

Press **Done** when the desired selection is displayed. A prompt will appear: **Save new data?** Press the **Yes** soft key to accept the new **Burst Com Number** changes. Pressing **No** returns the MFT to the **Hart Output** main menu screen without saving changes to the device.

Diagnostics

To enter the **Diagnostics** option, use the **Up** or **Down** soft key to move the selection arrow to **Diagnostics**, then press the **Select** soft key.

The MFT screen provides two test options as shown below:

Hart			
1151: Pump 8			
▣ Self Test			
Loop Test			
Up	Down	Select	Back

Diagnostics Main Menu Screen

Self Test: Provides an overall diagnostic test of the selected HART Device. Press the **Select** soft key to choose the **Self Test** option.

The screen changes as shown below. Press the **Select** soft key to perform a diagnostic test of the HART device.

Hart			
1151: Pump 8			
▣ Perform Test			
Test Results			
Up	Down	Select	Back

The ♥ symbol will appear and flash briefly, indicating the test is being performed. Scroll **Down** to **Test Results** and press **Select** to scroll through the status of the various parameters tested.

Press the **Next** soft key to scroll through diagnostic results and finally return to the **Diagnostics** main menu. The **Back** soft key will return to the previous screen at any point in the diagnostics review.

Loop Test: Refer to **Loop Test** under **Analog Trim** section for more information. When using the Loop Test here, pressing the **Back** and **OK** soft keys will return the MFT to the **Diagnostics** main menu screen.

Save: Allows the MFT to save the HART configuration from a connected device to memory.

Send: Allows the MFT to send (download) a HART configuration to an identical HART device. Once a suitable configuration for one unit is created, it can be shared with identical units requiring the same parameters.

Review/Edit

This function allows the user to bypass the menu system to view and/or edit variables directly from the configuration information.

To enter the **Review/Edit** option, use the **Down** soft key to move the selection arrow to **Review/Edit**, then press the **Select** soft key.

The **Edit** soft key is active only for editable parameters. To edit the displayed parameter, press the **Edit** soft key. The MFT will then switch to that variable's edit screen. Use the Alphanumeric Grids options (see Alphanumeric Entry Section in this manual) and soft keys to select desired characters. Press the **Select** key to move on to the next character. Use the **Increase** and **Decrease** soft keys to make selections from editable menus. Use the **Next** soft key to move to the next selection. Press the **Done** soft key when the changes are complete. A prompt will appear: **Save new data?** Press the **Yes** soft key to accept the changes. Pressing the **No** soft key will keep the previous settings with out saving any changes. In both cases, the MFT display will remain the same. Press the **Next** soft key to move on to the next variable, the **Back** soft key to go back one variable, or the **Done** soft key to exit **Review/Edit** and return to the **Device Config** screen.

Quick Menu

The **Quick Menu** key allows the user to go directly to a specific HART menu. This is a time saving feature that allows the user to skip entire blocks of standard HART menus and jump directly to a frequently used function. **Quick Menu** titles are the same as HART menu titles for ease of recognition. Press the **Quick Menu** dual function key and the following screen will appear:

Quick Menu			
Select Menu Title:			
■	Main Menu		
	Config Menu		
	Rerange Menu		
	Diagnostic Menu		
	Basic Info		
	Construction Matls		
	Sensor Menu		
	Signal Conditioning		
Up	Down	Select	Back

Quick Menu Screen

Main Menu: Refer to **Hart Device Online Screen** section.

Config Menu: Refer to **Device Config** section for more information.

Rerange Menu: Refer to **Rerange** section for more information.

Diagnostic Menu: Refer to **Diagnostic** section for more information.

Basic Info: Provides quick access to basic information about the connected HART device, including tag number, manufacturer and software information.

Construction Matls: Provides quick access to construction material information for the connected HART device

Sensor Menu: Refer to **Sensors** section for further information.

Signal Conditioning: See **Signal Conditioning** section for more information.

Calibrate Key

Pressing the **Calibrate** key allows the user to setup the MFT to calibrate HART or non-HART devices. In MFTs that do not have the HART or Documentation options (MFT 4000, MFT 4002, MFT 4020), this key has no value. However, for MFTs with HART and / or Documentation (MFT 40x1 or MFT 40x3) the **Calibrate** key provides access to powerful calibration tools.

After pressing the **Calibrate** key the following screen will appear:

Cal
Cal: Pump 8
■ Begin Calibration
Hart: Yes
Procedure: Manual
Sensor : S1
Quick Cal
Smart Trim
View Results
Clear Cal Memory
Up Down Select Back

Calibrate Key Main Menu Screen

Begin Calibration: Select to perform a calibration. (see **Documenting Calibration Results** for more information)

Hart: This option allows the user to select between the calibration of a HART device or a non-HART device. To select, make sure the selection arrow points to **Hart** and press **Select**.

Cal
Hart: Yes
■ No
Yes
Up Down Save Back

The screen will change, giving the user the option to select **No** if a calibration procedure is to be performed on a non-Hart device, or **Yes**, if the HART calibration features are desired. Use the **Up** or **Down** soft key to scroll to the desired option and press **Save** to make the change.

Press the **Back** soft key if you choose not to make any changes. The MFT will then return to the **Calibrate** key main menu screen.

Procedure: This option allows the user to select a Manual calibration where the user defines the procedure as he calibrates the device under test or Stored calibration procedure where the procedure has previously been stored in the MFT memory for later use in the field. The options require the MFT Documentation option and Device Management System from Meriam).

To choose this option, make sure the selection arrow points to **Procedure** and press **Select**.

The following screen will appear:

Cal
Procedure: Manual
▀ Manual
Stored
Up Down Save Back

Use the **Up** or **Down** soft key to scroll to the desired option and press **Save** to make the change.

Press the **Back** soft key if you choose not to make any changes. The MFT will then return to the **Calibrate** key main menu screen.

Sensor: This option allows the user to select which MFT sensor to use to perform the calibration: None, S1, S2, or S3.

To change the selected sensor, make sure the selection arrow points to **Sensor** and press the **Select** soft key.

The following screen will be displayed:

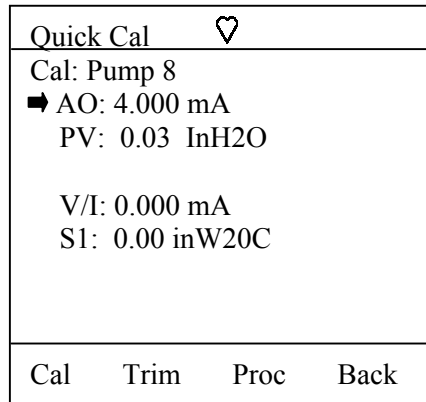
Cal
Sensor: S1
None
▀ S1
S2
S3
Up Down Save Back

Use the **Up** or **Down** soft key to scroll to the desired sensor module location and press **Save**. Selecting **None** will allow the user to perform calibration using the MFT's mA/V meter only.

Press the **Back** soft key if you choose not to make any changes. The MFT will then return to the **Calibrate** key main menu screen.

Quick Cal: The Quick Cal feature for MFT 401x models displays the PV and AO from the HART signal along with the corresponding values measured by the MFTs NIST traceable standards. The user can determine at a glance whether or not an analog trim or sensor trim is needed. Direct access to trim commands (see Smart Trim above) from this screen provides convenience and enhances productivity when trimming HART devices. Documenting versions of MFT 401x (MFT 4011 and MFT 4013) will also document the As found and As left calibration points of the device.

From **Measure Mode** screen, press the **Calibrate** key and move the selection arrow to **Quick Cal** menu option. Press the **Select** soft key. The following screen will appear:



Quick Cal Main Screen

Comparison of AO to the MFTs V/I measurement of loop current and of PV to the MFTs S1 measurement of applied pressure provides the user with unique and convenient way to determine what trim function(s) is needed to bring the HART device back into calibration. Pressing the **Trim** soft key takes the MFT to the **Smart Trim** main menu screen which typically includes trim options for 4 mA, 20 mA, Sensor Zero, Sensor Lower Trim and Sensor Upper Trim. These options can vary by HART device. For more information, see the section on **Smart Trim** section below.

Pressing the **Cal** soft key initiates a manual calibration documentation for MFT models MFT 4011 and MFT 4013. AO, PV, V/I and Sx information will be stored in memory after the user applies a pressure and presses a Save soft key. See the **Documentation** section of this manual for more information on manual calibrations.

Pressing the **Proc** soft key initiates a search for stored calibration procedures in MFT memory. Utilizing stored calibration procedures does require the Meriam Device Management System (DMS) software. Procedures can be designed for transmitter categories, assigned to device tag numbers and downloaded into MFT memory for use in field calibrations. The MFT documents the As found calibration results, facilitates analog and sensor trims, documents As left results and uploads data back to DMS. For more information on these MFT features see the Documentation section of this manual. For more information on Meriam DMS go to www.meriam.com or call us at (216) 281-1100.

Pressing the **Back** soft key will return the MFT to the **Measure Mode** screen. Refer to the **Calibrate** section for more information.

Smart Trim: The MFT 401x multi-function calibrator / HART communicator provides all measurement and communication features needed to trim / calibrate HART transmitters. No other handheld device is needed. **Smart Trim** enables this by providing direct access to the five common HART trim commands from one MFT screen.

To perform a trim on a HART transmitter, move the selection arrow in the **Calibrate** key main menu to **Smart Trim** and press **Select**. The following screen will appear:

Cal Menu			
Cal: Pump 8			
▀	4mA Analog Trim		
	20mA Analog Trim		
	Zero Trim		
	Lower Sensor Trim		
	Upper Sensor Trim		
Up	Down	Select	Back

Hart Smart Trim Screen

4 mA Analog Trim: MFT 401x executes 4 mA trim on HART device
For **4mA Trim** function, make sure the selection arrow points to **4 mA Analog Trim** and press **Select**.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue (or press the **Abort** soft key to return to the Hart Smart Trim Screen). The following screen will appear:

Trim 4ma ♥			
Cal: Pump 8			
▀	AO: 4.000 mA		
MFT Analog Data			
V/I: 4.002 mA			
AO Fixed			
Up	Down	Select	Back

4 mA Analog Trim Screen

This screen shows the analog output (AO) value being transmitted by the HART signal and the loop value measured by the MFT.

The “AO Fixed” message indicates that the device’s output current has been fixed or set to 4 mA.

To perform a 4 mA Trim. Press the **Select** soft key. The screen will clear and report “Trim Successful”. Press **OK**. Press **OK** again at the “Put Loop back online” notice. The MFT returns to the Hart Smart Trim Menu Screen. AO should now match the MFT’s measured V/I value. Pressing **Back** will return the MFT to the **Calibrate** key main menu screen.

20 mA Analog Trim: MFT 401x executes 20 mA trim on HART device

To perform the 4mA Trim, make sure the selection arrow points to **20 mA Analog Trim** and press **Select**.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue (or press the **Abort** soft key to return to the Hart Smart Trim Screen). The following screen will appear:

Trim 20 ma	♥		
Cal: Pump 8			
▀ AO: 20.000 mA			
MFT Analog Data			
V/I: 20.002 mA			
AO Fixed			
Up	Down	Select	Back

20 mA Analog Trim Screen

This screen shows the analog output (AO) value being transmitted by the HART signal and the analog value measured by the MFT.

The “AO Fixed” message indicates that the device’s output current has been fixed or set to 20 mA.

To perform a 20 mA Trim. Press the **Select** soft key. The screen will clear and report “Trim Successful”. Press **OK**. Press **OK** again at the “Put Loop back online” notice. The MFT returns to the Hart Smart Trim Menu Screen. AO should now match the MFT’s measured V/I value. Press the **Back** soft key to return to the **Calibrate** key main menu screen.

Zero Trim: MFT 401x executes Zero trim on HART device

Use the **Up** or **Down** soft key to move the selection arrow to **Zero Trim**, then press the **Select** soft key.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue (or press the **Abort** soft key to return to the Hart Smart Trim Screen).

The MFT will now prompt: **Apply zero to Sensor**. Make sure that no pressure is applied to the HART device or MFT. Press the **OK** soft key to continue. The MFT will then prompt the user: **Wait until stable**. This notice reminds the user to wait for all pressure to be vented before continuing. Press the **OK** soft key to continue.

Trim Zero	♥		
Cal Setup:			
▀ PV: 0.00 InH2O			
S1: 0.00 inW20C			
Up	Down	Select	Back

Zero Trim Screen

PV displays the pressure being reported by the HART signal and S1 (or whichever sensor bay location is selected) displays the pressure being measured by the MFT's NIST traceable module.

When the S1 reads zero pressure, press the **Select** soft key. The sensor will automatically be trimmed, and the screen will display the prompt: **Put Loop back online**. This notice reminds the user to reconnect the device under test to the receiving device. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Hart Smart Trim Screen** main menu screen. Pressing **Back** again will return the MFT to the **Calibration** key main menu screen.

Lower Sensor Trim: MFT 401x executes Lower Sensor Trim on HART device

Use the **Up** or **Down** soft key to move the selection arrow to **Lower Sensor Trim**, then press the **Select** soft key.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue (or press the **Abort** soft key to return to the Hart Smart Trim Screen).

The MFT will now prompt: **Apply Low Pressure**. Press the **OK** soft key to continue. The MFT will then prompt the user: **Wait until stable**. This notice reminds the user to wait for the pressure to stabilize before accepting a pressure value. Press the **OK** soft key to continue.

The following screen will appear:

Trim Lower	♥		
Cal Setup:			
■ PV: 9.780 InH2O			
MFT Lower Sensor			
S1: 10.00 inW20C			
Up	Down	Select	Back

Lower Sensor Trim Screen

Apply a low pressure value to the HART device and allow it to stabilize. The actual value chosen for this low pressure point is at the operator's discretion. When the S1 sensor (or whichever sensor is selected) reads a steady low pressure value, press the **Select** soft key. The sensor will automatically be trimmed to match the MFT measured value, and the screen will display the prompt: **Remove Pressure**. This notice reminds the user to release the pressure applied. Press **OK** to continue. The screen will now prompt: **Put Loop back online**. This notice reminds the user to reconnect the device under test to the receiving device. Press the **OK** soft key to continue. Press the **Back** soft key to return to the **Hart Smart Trim Screen** main menu screen. Pressing **Back** again will return the MFT to the **Calibration** key main menu screen.

Upper Sensor Trim: MFT 401x executes Upper Sensor Trim on HART device

Use the **Up** or **Down** soft key to move the selection arrow to **Upper Sensor Trim**, then press the **Select** soft key.

The screen will prompt: **Take Loop offline**. This notice reminds the user that the device output will not be a measurement of the actual process, and to place the receiving device or control system (such as a

chart recorder, PLC, or DCS) in manual mode. Press the **OK** soft key to continue (or press the **Abort** soft key to return to the Hart Smart Trim Screen).

The MFT will now prompt: **Apply High Pressure**. Press the **OK** soft key to continue. The MFT will then prompt the user: **Wait until stable**. This notice reminds the user to wait for the pressure to stabilize before accepting a pressure value. Press the **OK** soft key to continue.

The following screen will appear:

Trim Upper	♥		
Cal: Pump 8			
➡ PV: 0.00 InH2O			
MFT Upper Sensor			
S1: 0.00 inW20C			
Up	Down	Select	Back

Upper Sensor Trim Screen

Apply a high pressure value to the HART device and allow it to stabilize. The actual value chosen for this pressure point is at the operator's discretion. When the S1 sensor (or whichever sensor is selected) reads a steady high pressure value, press the **Trim** soft key. The sensor will automatically be trimmed to match the MFT measured value, and the screen will display the prompt: **Remove Pressure**. This notice reminds the user to release the pressure applied. Press **OK** to continue. The screen will now prompt: **Put Loop back online**. This notice reminds the user to reconnect the device under test to the receiving device. Press the **OK** soft key to continue.

Press the **Back** soft key to return to the **Hart Smart Trim Screen** main menu screen. Pressing **Back** again will return the MFT to the **Calibration** key main menu screen.

View Results: Available on MFT 40x1 and MFT 40x3 model, **View Results** allows users to view saved calibration results. Selecting this menu option provides the user with a summary of saved calibration files, soft key functions used for viewing the information, and a delete file function.

Use the **Up** or **Down** soft key to move the selection arrow to **View Results**, then press the **Select** soft key. The following screen will appear.

Cal	♥		
Select Cal to view:			
PT-102			
➡ PT-307			
DPT-101			
DPT-106			
TT-621			
Up	Down	Select	Back

View Results Menu Screen

Move the selection arrow to the tag number desired and press the Select soft key. Point one of the saved calibration is displayed as shown below.

Cal	♥		
Results: PT-307 Single variable As found Point 1 of 6 In: 0.090 inW20C Out: 3.999 mA Error: -0.096 % Pass			
Del	Done	Next	Back

View Calibration Results Screen

Use the **Del** soft key to delete the entire calibration record. *Note: This **Del** key only removes the record from viewing by the MFT; it does not clear memory space. Connect the MFT to Meriam DMS or PC utility (pending) and use the clear MFT calibration data function to clear memory.*

Use the **Done** soft key to end the Viewing session

Use the **Next** soft key to move to the next saved point for the active tag number

Use the **Back** soft key to go back to the prior screen

Clear Cal Memory

To clear all calibration procedure / result files, **Select** the **Clear Cal Memory** menu option under the MFTs **Calibrate** key (see the Calibrate Key section of this manual for more details). A delete confirmation screen is provided to prevent unintended clearing of all documentation files.

More Status Message

HART device events (diagnostic flags) cause the MFT 401x to display a “More Status Message” at the bottom of the display. This message is a notice to the user that one or more diagnostic warnings are available in the Review Status menu option of the connected device. Upon receipt of this message, enter the **HART** mode and select Detailed Setup / Diagnostics – Service / Test – Status / View Status to retrieve the diagnostic information.

MFT 401x Device Specific & Generic HART® Communications

Meriam supports a growing number of Device Specific DOFs (Device Object Files). For a current listing of HART® devices with full Device Specific MFT communications support, go to www.meriam.com and click on the “Available DOFs” button.

To facilitate communications with HART devices that are not yet supported with Device Specific DOF files or that do not require DOF files, the MFT 401x includes Generic HART Communication capability. This capability allows the user to communicate with any HART device using Universal and Common Practice commands to poll, configure, and maintain HART devices. Specific functions supported include most polling, tagging, device configuration and trim operations for analog outputs. Generic communications do not support Device Specific commands for higher order HART functions (see the **HART® Commands** section of this manual or the instruction manual for the HART device of interest for more information on the three command levels).

Using Generic HART Communication

The MFT 401x’s Generic HART Communication mode starts automatically when the **HART** or **Calibrate** keys are pressed and no Device Specific DOF (device object file) is found to match the connected HART device name. When this occurs, line two of the display will indicate “Generic” and the device tag number.

In general, both Generic **HART** and Generic **Calibrate** modes will operate similarly to their device specific DOF counterparts (see HART Communication and Calibrate sections of this manual for more details). However, the MFT does not display Device Specific related communication menus or options when in the Generic communication mode. For example, the Zero and Sensor trim menu options (normally executed by Device Specific commands) are not displayed for pressure transmitters without DOF support. Please see the **Meriam Process Technologies Download Site** section of this manual for information on downloading the latest Device Specific DOF files to your MFT.

Download Site Information - DOFs, Firmware, Utilities

Overview

One of the unique features of the MFT 4000, MFT 4010 and MFT 4020 is the built in ability to have firmware upgrades installed by the user at his location. The Meriam Download Site is accessible over the Internet and provides for the convenient download of new or revised firmware, DOF’s (Device Object Files for HART communications), and MFx Installer utility. MFT units already in service in the field do not need to be returned to the factory for firmware upgrades or improvements released by Meriam. The user can simply download the files to a PC having Internet access and upgrade the MFT firmware using the MFx Installer PC utility. DOF’s are also available on this site for users of the MFT 401x with HART communications. The Download Site enables users to stay current as Meriam releases new DOF’s or updates of existing ones.

MFT users also using the Meriam Device Management System (DMS) software should always use the DOF update utility found within DMS to synchronize MFT DOFs with those in DMS. This is critical for downloading configuration files to an MFT for use in the field and for uploading saved device configurations from MFT memory to the DMS. For more information, see the DMS Instruction Manual.

Who may use the Download Site?

All MFT purchasers have unlimited access to the Download Site for six months from date of shipment. These customers may download any published file from the site to their MFT upon entry of the proper authenticating codes. After the initial six-month period, the Download Site is available with paid annual subscription fee. Contact Meriam Instrument at (216) 281-1100 or meriam@meriam.com for more information or to purchase an annual subscription.

PC Requirements for Download Operations

Meriam recommends IBM compatible Pentium I PCs or higher for download operations. The PC should have an available RS-232 port, minimum modem speed of 28K and access to Internet service.

Preparing the MFT

All MFT models come ready to connect to an IBM compatible PC using the DB-9 socket located at the bottom of the MFT enclosure. A six-foot male DB-9 to female DB-9 cable (P/N A90047-00052) is available from Meriam. Similar cables are acceptable. Connect the MFT to the PC and power up the MFT using internal batteries or the optional AC Adapter (P/N A36742). The MFT is ready for download operations.

Preparing to Download

Establish connection to the Download Site by going to the Meriam Process Technologies website at www.meriam.com. Click on the "Download Site" button on the home page navigation bar to access all download functions. A list of currently available DOF's for HART device communication can be viewed at the www.meriam.com website. Click the "Available DOFs" button on the home page navigation to view an up to date list of available DOF's.

Using the Download Site

The landing page of the Download Site requires the user to enter a valid User Name and Password to authenticate user identity and permit entry to the Site. These two codes are initially assigned by Meriam and can be found on a card inside the cover of the manual CD. Remove the card and place in a safe place for future reference.

Once a user is logged on to the Site, the **Latest Release Notes** screen appears listing and describing the most recent firmware releases posted the posting date. Also available on this screen are the navigation buttons for **Current Release Notes**, **File Download Area**, and **Subscriber Options**.

The **Current Release Notes** screen describes all firmware releases available. Five (5) columns are shown on this page: Posting Date, Title, Description, Manufacturer, and Model. These categories assist the user in finding the release descriptions of the DOF, MFx Installer or MFx Firmware release(s) of interest. Each column can be sorted to assist searches of the release database. Individual files can be downloaded by clicking on the file of interest, and then clicking on the file name that appears on the next screen. Also available on this screen are the navigation buttons for **Latest Release Notes**, **File Download Area**, and **Subscriber Options**.

The **File Download Area** screen is the actual download page. Select from a list of downloadable files (including MFx Installer Utility, MFx Firmware, MFx Documentation Firmware and DOF's) by locating the file name of interest with the PC mouse and clicking on the corresponding check box. Dialog boxes guide the user through the process. Multiple files can be downloaded using a Java applet that must first be loaded onto the host PC. Dialog boxes again guide the user through the process. Subsequent downloads of multiple files will be handled by the Java applet stored in the host PC memory. If all DOF files are desired, use the "Check All Files" button at the top of this page. Then review the list and un-check any undesired file types. Also available on this screen are the navigation buttons for **Latest Release Notes**, **Current Release Notes**, and **Subscriber Options**.

First time visitors to the Download Site will need to download the MFx Installer Utility to the host PC. MFx Installer can be found at the bottom of the **File Download Area** page. MFx Installer coordinates the download operations from the host PC to the MFx. Periodic improvements may be incorporated into this Utility. Meriam recommends periodic comparison of the MFx Installer version installed on the host PC to the latest available version on the Download Site to insure use of the most current version.

Subscriber Options

The **Subscriber Options** screen provides useful account information. User Name and Password for the account are listed as well as the subscription expiration date. In addition, this screen allows the user to customize the account Password to a personal preference. The user can also elect to provide an e-mail address that allows Meriam to provide notification of new firmware, DOF releases, and subscription expiration. Press the “Update Subscriber Options” button to save all **Subscriber Options** changes before leaving this page.

To report any difficulties with downloading operations, please contact Meriam Process Technologies at (216) 281-1100 or meriam@meriam.com.

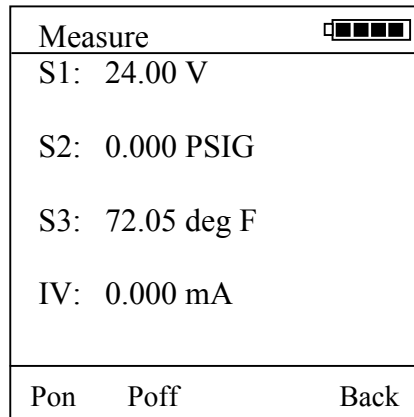
MFx Installer Utility

MFx Installer utility should be loaded onto the host PC from the instruction manual CD (included with MFT shipment) or from the Meriam Download Site where it can be found on the **File Download Area** page. MFx Installer coordinates the download operations from the host PC to the MFT. Periodic improvements may be incorporated into this Utility. Meriam recommends periodic comparison of the MFx Installer version installed on the host PC to the latest available version on the Download Site to insure use of the most up to date Utility tool.

MFT 402x with Loop Power

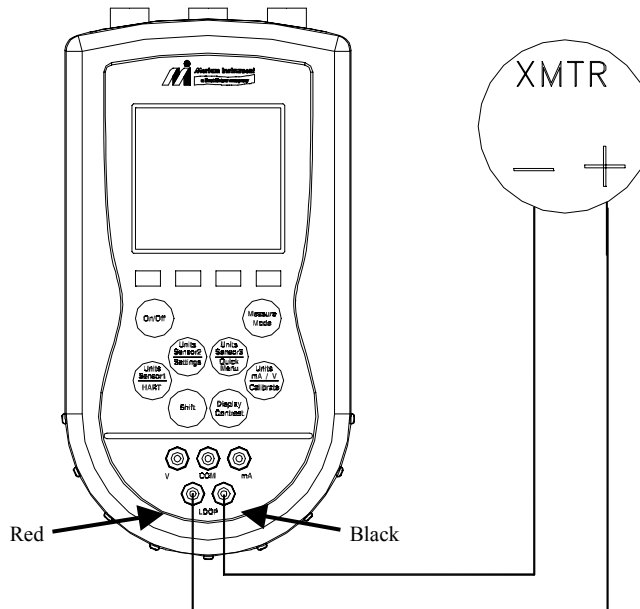
The MFT 402x is designed to simultaneously power a field device and display the applied calibration parameters and mA/volts output from the field device. Measure Mode and programming operations are exactly the same as the MFT 400x, however, the MFT 402x is also equipped with an internal 24Vdc power supply. Power is provided by the MFT's six (6) internal AA alkaline batteries. This feature provides the user with temporary, portable loop power and facilitates the calibration of unpowered transmitters in the field. Documentation option is available as the MFT 4021. MFT 402x models are not available for Hazardous Area service.

To turn the loop supply on, put the MFT in **Measure Mode**, press the **More** soft key and then the **Sensr** soft key. The following screen will appear.



Press the **Pon** soft key to turn loop power on. To manually turn off the loop power, press the **Poff** soft key. If the loop is disconnected when loop power is on, the loop jacks on the MFT remain live. If the MFT is turned off, the loop power is turned off. Loop power remains off when MFT is turned on until the **Pon** soft key is used.

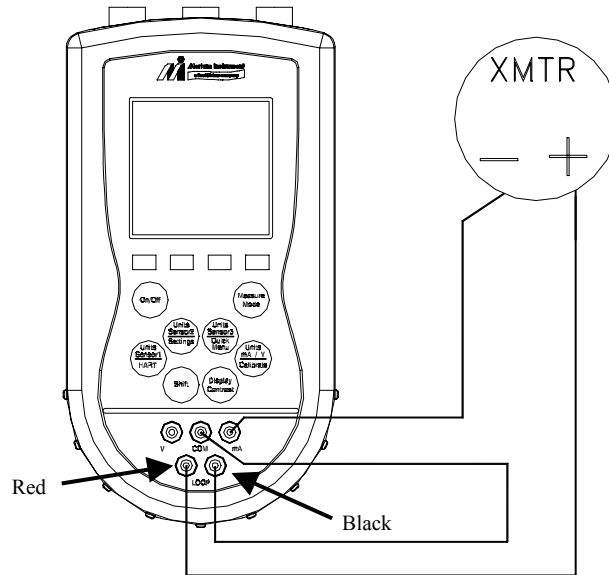
Connecting the MFT 4020 for Loop Power only:



To supply 24 Vdc to a field device, connect to the device as shown in the diagram. Observe loop polarity using the color coded standard banana jacks on the MFT. Red is positive (+) and Black is negative (-). Refer to previous sections in this manual for general MFT measurement and calibration information.

MFT 402x models are not available for Hazardous Area service.

Connecting the MFT 4020 Volt / Amp meter & Power Supply:



This diagram depicts the proper wiring arrangement to temporarily power a field device with the MFT 402x and use the same MFT to make 4-20 mA loop measurements.

From the MFT's positive (red) **Loop** banana jack, connect to the (+) terminal on the field device. From the negative (black) **Loop** banana jack, jumper to the MFT's **Common** (black) banana jack. Connect the MFT's **mA** (red) banana jack to the (-) terminal on the field device.

Refer to previous sections in this manual for general MFT measurement and calibration information using replaceable sensor modules.

MFT 402x models are not available for Hazardous Area service.

DOCUMENTING CALIBRATION RESULTS / HART CONFIGURATIONS

The MFT 40x1 or MFT 40x3 multi-function calibrators include documentation capability. The Documentation option enables the MFT to store calibration procedures for use with specific field devices, save As found and As left results of a stored calibration procedure, save the results of manual calibrations, view saved calibration results and upload saved results to Meriam's Device Management System (DMS). MFTs with both Documentation and HART options (MFT 4011 and MFT 4013) also have the ability to save configurations to memory and upload those configurations to DMS to provide a complete history on the field device. For more information on DMS, please go to www.meriam.com or contact Meriam at (216) 281-1100.



The MFT 40x1 and MFT 40x3 enable the user to document both **Manual Procedure Calibrations** and **Stored Procedure Calibrations**. (See the Applications section of this manual for typical calibration connection diagrams). Typically, manual and stored procedures require an As found calibration check, trimming operations to correct an out-of-calibration condition, and an As left calibration check. MFTs with the documentation option provide of this functionality

Manual Procedure Calibrations are performed by varying the input signal (e.g. pressure for a pressure transmitter), allowing the input to stabilize, and saving the measurements made by the MFT to memory. If the device under test is a HART device, the AO and PV obtained via HART communication will also be saved. The number of calibration points saved per manual calibration is up to the user (maximum of 255 per device).

Stored Procedure Calibrations prompt the user for each input signal according to the predefined procedure stored in the MFT memory. Stored procedures are set up in the Meriam DMS software and assigned to device tag numbers there. When calibrations become due, the DMS operator downloads the list of tag numbers and their associated procedures to the MFT. The technician then takes the MFT to the field, makes the needed connections to the device of interest, looks up the stored procedure for the UUT, and begins the calibration. The MFT guides the user through the complete procedure.

The dedicated MFT calibration data memory can save up to 100 calibration result files with up to 21 As found and 21 As left points with header information including Tag, S/N, LRV, URV, date and time.

Entering Calibration Documentation Mode

Press the **Calibrate** key to setup the MFT to calibrate HART or conventional devices. The following screen will appear (see the Calibrate Key section in this manual for more details):

Cal
Cal: Pump 8 ■ Begin Calibration Hart: Yes Procedure: Manual Sensor : S1 Quick Cal Smart Trim View Results Clear Cal Memory
Up Down Select Back

Calibrate Key Main Menu Screen

Begin Calibration: select to initiate a calibration documenting operation

Hart: Select to set up the MFT for calibration of a HART device or non-HART device. The following screen will appear:

Cal
Hart: Yes No ■ Yes
Up Down Save Back

Procedure: Select to set up the MFT for Manual Procedure Calibration or Stored Procedure Calibration. The following screen will appear:

Cal
Procedure: Manual ■ Manual Stored
Up Down Save Back

Sensor: This option allows the user to select which MFT sensor will be used to perform the calibration: None, S1, S2, or S3. The following screen will be displayed:

Cal
Sensor: S1 None ■ S1 S2 S3
Up Down Save Back

Manual Procedure Calibrations and Documentation

To start a **Manual Procedure Calibration**, press the MFTs **Calibrate** key, set up the MFT for **Manual Procedure** using the Procedure, HART, and Sensor menu options described above, and then **Select** the **Begin Calibration** option. The following screen will appear:

Cal			
Cal: DEFAULT			
Begin Calibration			
➔ Cal Type: Pressure			
Device Tag: DEFAULT			
Device SN: 00000			
LRV: 0.000 inW20C			
URV: 0.000 inW20C			
Units: inW20C			
Xfer Fn: Linear			
PV is:			
Up	Down	Select	Back

Manual Calibration Launch Screen

When a conventional device is connected to an MFT 40x1 or MFT 40x3, the above Cal screen is shown. Users input the Device Tag, URV, and other information they want the MFT to store with the calibration data by move the selection arrow Up or Down to the desired line and pressing Select. ***Be sure to specify the correct Cal Type for each calibration.*** This lets the MFT know which of its features will be of benefit during the calibration. The abbreviation PV above stands for Primary Variable of the device under test.

When a HART device is connected to an MFT 4011 or MFT 4013, the MFT will poll the device and fill in most of the information on the Cal screen shown above. ***Be sure to specify the correct Cal Type for each calibration.*** This lets the MFT know which of its features will be of benefit during the calibration.

Select **Begin Calibration** to proceed with the As found portion of a Manual Procedure Calibration. The following screen will appear:

Cal	
Device: DPT-1003	
S1: 0.00 inW20C	
IV: 4.006 mA	
0 Points Saved	
Save	Done

Manual Cal Screen for Conventional Devices

Cal	
Device: DPT-1003	
AO: 4.004 mA	
Pres: 0.07 inH2O	
IV: 3.991 mA	
S1: -0.00 inH2O	
0 Points Saved	
Save	Done

Manual Cal Screen for HART Devices

Apply the desired input signal to the MFT and device under test, wait for the value to stabilize and press the **Save** soft key to save the displayed data to memory. The MFT will provide “Saving Data Point...” feedback on the display, show “1 Points Saved,” and prepare to accept the next point.

Apply the next desired input signal and press the **Save** soft key when satisfied with the input signal. Repeat as needed to complete the calibration. Press the **Done** soft key to end the As found portion of the calibration. The following display will appear:

Cal			
As Fnd: DPT-1003			
Save As Fnd to AsLft			
Trim			
As left			
View Results			
Quick Cal			
Up	Down	Select	Abrt

Cal Options Screen for Conventional Devices

Cal			
As Fnd: DPT-1003			
Save As Fnd to AsLft			
Smart Trim			
As left			
View Results			
Quick Cal			
Up	Down	Select	Abrt

Cal Options Screen for HART Devices

Cal Options for Conventional Devices:

Save As Fnd to AsLft – accepts the first set of saved cal data (As found) to be the As left data.

Trim – Reminds user to perform the trim adjustments for zero and span

As left – Reactivates the documentation feature to save As left data

View Results – Allows user to view saved calibration results from As found or As left work. Returns to Cal Options Screen after all points are reviewed or **Back** soft key is pressed

Quick Cal – displays measured input and device output values to allow user see the impact of trims performed. Press Done to escape back to Cal Options screen.

Cal Options for HART Devices:

Save As Fnd to AsLft – accepts the first set of saved cal data (As found) to be the As left data.

Smart Trim – Provides immediate access to HART analog and sensor trim options. See Smart Trim section of manual for more details.

As left – Reactivates the documentation feature to save As left data

View Results – View saved calibration results from As found or As left work. Returns to Cal Options Screen when finished

Quick Cal – displays HART PV and AO along with MFTs measured values for at a glance determination of needed trims. Direct access to the Smart Trim function through **Trim** soft key. See Quick Cal section of this manual for more details.

Select the As left option to proceed with the As left portion of a Manual Procedure Calibration.

Data saved to the MFT using the Manual Procedure Calibration can be uploaded to Meriam DMS software or other compatible FCINTF software programs. The Field Calibrator Interface (FCINTF) specification has been implemented as the MFTs interface for transmitting calibration data. Compatible asset management software programs should be able to receive and process MFT calibration data. *Note: HART configuration data saved by the MFT cannot be passed by FCINTF. This data can only be uploaded to Meriam DMS.*

To view previously stored calibration results, select the **View Results** menu option under the MFTs **Calibrate** key. See the **Calibrate Key** section of this manual for more information.

Stored Procedure Calibrations and Documentation

The Stored procedure option is only available when the MFT is used in conjunction with Meriam DMS software or other compatible FCINTF software programs. The Field Calibrator Interface (FCINTF) specification has been implemented as the MFTs Interface for receiving and transmitting calibration data. Compatible asset management software programs should be able to transmit assigned calibration procedures to MFT 40x1 and MFT 40x3 models. They should also be able to receive calibration results back from the MFT.

Stored procedures are developed and assigned to a tag number in the DMS software. Then they can be downloaded into MFT memory for later use in the field. The downloaded information includes tag number, LRV, URV, units, transfer function, serial number, calibration procedure, allowable test point error percentage, maximum allowable error percentage and adjust-to error percentage. All information is then available to the MFT user in the field for calibrate activities. See the DMS Instruction Manual for more details.

To start a **Stored Procedure Calibration**, press the MFTs **Calibrate** key, set up the MFT for **Stored Procedure** using the Procedure, HART, and Sensor menu options described above, and then **Select** the **Begin Calibration** option. The following screen will appear allowing the user to select the tag number of interest.

Cal			
Cal Setup:			
PT30511/3/03			
PT11510 1/3/03			
PT11512 1/3/03			
DPT1001 1/3/03			
➡ DPT1003 1/3/03			
FT30041/3/03			
Up	Down	Select	Back

Stored Procedure List by Tag Number

Arrow to and **Select** the desired tag number.

When the MFT has been set up for “HART – Yes” calibration, the MFT will poll the connected device and confirm the tag number match between the device and the stored procedure. If a tag number mismatch is detected, the MFT display will advise “Device mismatch, continue with this device?” Pressing the **No** soft key aborts the procedure. Pressing the **Yes** soft key enables the use of the stored procedure with the mismatched device tag and saves the calibration data under the connected device’s tag number (this information is obtained over the HART connection).

Once a tag number match is confirmed, or the user directs the MFT to use the mismatched procedure, the following screen will appear.

Cal	
Cal: DPT1003 Single Var Device Cal Type: Pressure Device SN: 649201 LRV: 0.000 inW20C URV: 200.00 inW20C Xfer Fn: Linear Cal Points: 5 Max Err: 0.25%	
OK	Back

Press **OK** soft key to continue with **Stored Procedure Calibration** & documentation (or the **Back** soft key to return to the stored procedure list). The next screen provides Setup Instructions that may have been associated with the tag during setup in the DMS software. Typically these would be start up instructions for the technician using the MFT. Press the **OK** soft key to continue. The following screen will appear:

Quick Cal		
Device: PT-1003		
Apply 0.000 in W20C	←	Apply line prompts user to apply procedure-defined input values. Auto advances to next test value upon "Save" of current data.
AO: 4.004 mA	}	← Analog Output and Present Variable value from HART link with device under test
Pres: 0.07 inH2O		
IV: 3.991 mA	}	← Analog output and input values as measured by NIST traceable MFT sensors
S1: -0.00 inH2O		
X Error 0.981 %	←	% Error between HART and measured data
0 Points of 6	←	Indicator for number of points saved out of total number of test procedure points
Save	Abt	

Stored Procedure Calibration Documentation Screen

Note the **Apply** value called for by the **Stored** procedure and input that signal with a source device. Monitor the **Sx** (S1 in the example above) to verify the correct input signal value and wait until stable. Press the **Save** soft key to save the displayed data to memory.

The MFT will provide "Saving Data Point..." feedback on the display, show "1 Points Saved," and prepare to accept the next point. If a message "Applied too high" or "Applied too low" is received, adjust the applied input signal as indicated by **Sx** to more closely agree with the **Apply** value shown. The MFT will not save a set of data if the **Sx** value varies from the **Apply** value by more than the percentage selected in the DMS software.

Apply the next input signal indicated by the **Apply** value and press the **Save** soft key when satisfied. Repeat as needed to complete the calibration. Press the **Done** soft key to end the As found portion of the calibration. The following display will appear:

Cal			
As Fnd: DPT-1003 FAIL			
Save As Fnd to AsLft			
Smart Trim			
As left			
View Results			
Quick Cal			
Up	Down	Select	Abrt

Calibration Options Screen for Stored Procedures

Save As Fnd to AsLft – accept the first set of saved cal data (As found) to be the As left data. The **Pass** indicator on this screen indicates this option is acceptable. The **Fail** indicator lets the user know if trim operations and subsequent As left documentation are needed.

Quick Cal – displays HART PV and AO along with MFTs measured values for at-a-glance determination of trim needs. Direct access to the Smart Trim function (see below) is provided through the **Trim** soft key. See Quick Cal section of this manual for more details.

Smart Trim – Provides immediate access to HART analog and sensor trim options. See Smart Trim section of this manual for more details.

As left – Reactivates the Stored Procedure Documentation feature to save As left data

View Results – View saved calibration results from As found work. Returns to Cal Options Screen when finished

Select the **As left** calibration option from the **Cal Options Screen** to document the As left condition of the device under test (after trim operations are complete). The **Stored Procedure Calibration Documentation Screen** appears again to guide the user through the necessary procedure points as before. Press the **Save** soft key after the **Sx** value matches the **Apply** value and is stable. Repeat this process for each **Apply** value until all procedure test points are complete and the following screen appears.

Cal			
As left: DPT-1003 Pass			
Enter Cal Note			
Smart Trim			
View Results			
Up	Down	Select	Done

Store Procedure Ending Screen

Pass / Fail notice – Provides user with notification of the Pass / Fail status of the As left calibration documentation.

Enter Cal Note – User may enter a calibration note into MFT memory for the procedure just completed; uses the MFTs alphanumeric entry features.

Smart Trim – Provides immediate access to HART analog and sensor trim options. These could be used if a Fail notice was received on this screen. See Smart Trim section of this manual for more details.

View Results – View saved calibration results from As left work. Returns to Cal Options Screen when finished

Press the **Done** soft key to end the Stored Procedure Calibration documentation session.

NOTE: Stored procedures downloaded to the MFT provide data allow allowing the MFT to evaluate if a calibration point is in or out of calibration. MFT tracks the **Pass** or **Fail** of each point in the procedure and marks the overall **As found** results and **As left** results as either **Pass** or **Fail** as appropriate. See the Meriam DMS Instruction Manual for more details on Pass / Fail and the tag data entered in DMS to support this feature.

The equation used to calculate the X Error displayed on the MFT Stored Procedure Calibration screens is shown below:

$$\text{Error} = \frac{AO_{\text{meas}} - AO_{\text{calc}}}{\text{Output Range}}$$

Where:

$$AO_{\text{meas}} = \frac{AO_{\text{MFT}} - 4}{16}$$

$$AO_{\text{calc}} = \frac{\text{MFT}_{\text{meas}} - \text{LRV}}{\text{URV} - \text{LRV}}$$

$$\text{Output Range} = 16 \text{ mA}$$

Stored Procedure Status Indicators

The MFT provides indicators to help the user identify the status of stored procedures at a glance. The screen shown below is an example of the status indicators used.

Cal			
Cal Setup:			
PT30511/3/03			
➔	PT11510	1/3/03	P
	PT11512	1/3/03	
	DPT1001	1/3/03	M
	DPT1003	1/3/03	C
FT30041/3/03			
Un	Down	Select	Back

Stored Procedure List by Tag Number With Status Indicator

- <Blank> – blank space indicates no work done on stored procedure
- P** – Partially complete procedure with As found data saved (see below)
- C** – Complete procedure was performed and saved
- M** – Manual calibration procedure was performed and saved

A **P**artial procedure is saved if all As found test points were saved before the procedure was interrupted. Trim operations may or may not have been completed before interruption. A Partial can be reopened and completed. Move the selection arrow up or down to the procedure tag marked with the **P** indicator and press the **Select** soft key. The following screen will appear.

Cal	
PT11510	P
As Fnd complete. Do you want to continue?	
Yes	No

Re-entering a Partially Complete Procedure

Select **Yes** to re-open the procedure and complete it. The MFT will guide the user through the remaining procedure options and As left calibration documentation. Selecting **No** will restart the stored procedure at the beginning of the As found test points.

Deleting Files and Clearing Documentation Memory

Deleting Files Documentation Files: Individual calibration procedure / result files can be deleted from the MFT using the **Del** soft key found on the View Calibration Results Screen. This screen is accessed by pressing the MFT's **Calibrate** key (see the Calibrate Key section of this manual for more details). The **Del** key removes the record from viewing by the MFT but it does not clear memory space.

Clearing Documentation Memory: To clear all calibration procedure / result files, **Select** the **Clear Cal Memory** menu option under the MFT's **Calibrate** key (see the Calibrate Key section of this manual for more details). A delete confirmation screen is provided to prevent unintended clearing of all documentation files.

An alternate way to clear documentation memory is to connect the MFT to Meriam DMS and use the Clear MFT Calibration Data function. See the DMS Instruction Manual for more details.

DOCUMENTING HART CONFIGURATIONS

All MFT 401x models are able to save and send HART device configuration files. The MFT 4011 and MFT 4013 with Documentation option are also able to uploading saved configurations to the Meriam DMS software. The information joins the corresponding tag number history once DMS receives the data.

Within DMS users can review configuration data, compare the most recent configuration to past configurations, and revise configurations for subsequent download to the intended device. See the DMS Instruction Manual for more information.

All saved configurations can be deleted from MFT memory using the “Delete All Configs” option in the HART offline mode. However, “Delete All Configs” only removes the record(s) from viewing by the MFT; it does not clear memory space. To clear the configuration documentation memory of the MFT 401x, connect the MFT to Meriam DMS or PC Utility (pending) and use the Clear MFT Configurations function. See the DMS Instruction Manual for more details.

RETURNING THE MFT FOR REPAIR

In the event that a MFT requires service and must be returned to the factory for repair, please contact your local Meriam Process Technologies Representative (see list and contact information at www.meriam.com) or the factory direct at the numbers listed below.

Please do not send any unit in for repair without first contacting Meriam Process Technologies or Representative for a Return Material Authorization (RMA) number. This number will be provided by the Meriam Repair Department when you call, fax or e-mail your information. All incoming packages must be accompanied by an RMA number to insure efficient processing and repair work.

To assist us with processing your repair request, please have the Model & Serial Number of the unit available when you call. This information is located on the MFT label and on all sensor module labels. This information can also be obtained directly from the MFT display by pressing the **Sensr** soft key while in **Measure Mode**. See the *Measure Mode* section in this manual for more details.

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APPENDIX

PRODUCT SPECIFICATIONS OVERVIEW

BASE UNIT: 9" L x 4.7" W x 3.2"D ABS plastic case with shock absorbing boot, 28 ozs. Three bays for measurement modules

DISPLAY: 128 x 128 pixel graphic display, 2.6" x 2.6" viewable area, 5-digit resolution

POWER: 6 AA alkaline batteries (1.5 V), 6 AA NiMH batteries (1.2 V) or optional 100 – 240 Vac power adapter (P/N A36742)

TEMPERATURE SPECIFICATIONS:

Storage: -40° F to 140° F (-40° C to 60° C)

Operating: 23° F to 122° F (-5° C to 50° C)

CONNECTIONS:

Pressure: 1/8" FNPT, 316ss

Electrical: Standard banana jacks (3/4" center)

HART & Loop: Standard banana jacks (3/4" center)

Data transfer: DB-9

MODULES – select from a variety of positive-lock measurement modules and special function modules for excellent versatility. Most modules can be “hot swapped” – remove or install measurement modules at any time (restrictions for Intrinsic Safety and VMA0055 models apply).

AVAILABLE UNITS –Pressure: PSI, inches H₂O and cm H₂O (inches H₂O with 4° C, 20° C, and 60° F ref. temp.), kg/cm², kPa, mBars, Bars, mm Hg, inches Hg (inches Hg with 0° C ref. temp), oz/in². Temperature: °F, °C, °R, °K. Others based on module option.

CONFIGURABLE DISPLAY – user configured for one to four measurements.

AUTO SHUT-OFF - occurs after user-selected period of keypad inactivity or can be disabled

DAMPING - exponential damping is user selectable from 0.5 to 30 seconds to damp pulsation and stabilize the display.

DIAGNOSTICS – MFT 4000 self-tests upon power up and upon installation of sensor modules. Advisories are posted on the display.

NIST TRACEABLE ACCURACY:

Pressure: ± 0.025% to ± 0.10% of F.S including all effects of linearity, repeatability, and hysteresis and temperature over the range 23° F to 122° F.

Current / Voltage: ± 0.025% of F.S. ± 0.001% of F.S. per ° F (reference temperature is 70° F)

APPROVALS: Optional Intrinsic Safety for Class I, Div I, Groups A, B, C, D certified by MET Laboratories, Inc per UL3111-1, CAN/CSA-22.2 No. 157, CAN/CSA-22.2 No. 1010.1-92 and UL913, Fifth Edition, Rev. 2/21/97

PRESSURE MODULE LIMITS / COMPATIBLE MEDIAS:

GI / AI modules: 2X F.S. range / Medias compatible with 316ss

DN modules: 2X F.S. range when pressurized on high side only,
150 PSI when applied simultaneously to high and low
sides / Medias are clean, dry gases only.

ELECTRICAL MEASUREMENTS

Current: ± 50.00 mA $\pm 0.025\%$ FS

Voltage: ± 50.00 VDC $\pm 0.025\%$ FS

MODULES: 2.3”L x 1.3”W x 2.6”D, 8.3 ozs. Positive-lock with spring-loaded sensor lock. Depress lock to release.

MIN/MAX - minimum and maximum measured values are captured. Capture speed equal to current damping rate setting.

HOLD - toggle function freezes display.

ZERO – simultaneous re-zeroing of all installed modules

CONTRAST – direct adjustment of display contrast

FIELD RECERTIFICATION – sensor modules and integral mA / Volts can be recalibrated for zero, span and linearity through the base unit using appropriate standards at 1, 3, 5, or 9 points

SECURITY LOCKOUT – MFT 4000 Settings can be locked out entirely or by specific feature.

CE CE compliance

MODELS

MFT 400X Multi-Function Tester – Base unit for use with up to three (3) sensor modules.

MFT 401X Multi-Function Tester with HART® - Base unit for use with sensor modules plus HART communication capability.

MFT 402X Multi-Function Tester / Loop Supply – Base unit for use with sensor modules plus integral loop supply to power field devices. HART is not available on Loop Supply version.

OPTIONS

DOCUMENTING – Documenting capabilities. (DB-9 connector for RS-232C data transfer is standard)

INTRINSIC SAFETY– MFT 400X and MFT 401X only. I.S. certified by MET Laboratories per testing to UL3111-1 First Edition Rev. 6/30/94, CAN/CSA-22.2 No. 157, CAN/CSA-22.2 No. 1010.1-92 and UL913 Fifth Edition. All modules listed on the Intrinsic Safety Control Drawing (see Appendix) are also certified Intrinsically Safe to the same standards.

ORDERING INFORMATION

BASE UNIT MODEL No & DESCRIPTION:

MFT 400X Multi-Function Tester–base unit for modules

MFT 401X Multi-Function Tester with HART Communicator

MFT 402X Multi-Function Tester with 24Vdc Loop Supply

BASE UNIT OPTIONS (replace “X” above with desired code)

- 0 No additional base unit options
- 1 Documentation
- 2 Intrinsic Safety – MFT 400X, 401X only
- 3 Documentation & Intrinsic Safety –MFT 400X and 401X only

SENSOR MODULES

Module	Pressure range / type
FDN0010	0-10" H ₂ O Differential
FDN0020	0-20" H ₂ O Differential
<u>x</u> DN0100	0-100" H ₂ O Differential
<u>x</u> DN0200	0-200" H ₂ O Differential
<u>x</u> DN0400	0-400" H ₂ O Differential
<u>x</u> DN2000	0-2000" H ₂ O Differential
<u>x</u> GI0020	0-20 PSI Gauge
<u>x</u> GI0200	0-200 PSI Gauge
<u>x</u> GI0500	0-500 PSI Gauge
<u>x</u> GI1000	0-1000 PSI Gauge
<u>x</u> GI1500	0-1500 PSI Gauge
<u>x</u> GI2000	0-2000 PSI Gauge
GGI3000	0-3000 PSI Gauge
<u>x</u> AI0900	0-900 mm Hg Absolute
<u>x</u> AI2000	0-2000 mm Hg Absolute
<u>x</u> AI5200	0-2000 mm Hg Absolute
RTD1000	RTD temperature module
TIO0110	T/C meas & sim module
RIO4000*	RTD meas & sim module
VMA0055	V / mA meas & sim module

*Release pending

where x is replaced with letter code:

D for $\pm 0.025\%$ FS with full temperature compensation from 23° F to 122° F

E for $\pm 0.025\%$ FS $\pm 0.004\%$ FS per °F (reference temperature is 70° F) other accuracy codes:

F for $\pm 0.10\%$ FS with full temperature compensation from 23° F to 122° F

G for $\pm 0.05\%$ FS with full temperature compensation from 23° F to 122° F

Most of the Sensor Modules above are certified for Intrinsic Safety. For a precise list of certified modules, please refer to the Intrinsic Safety Control Drawing in the Appendix of this manual.

ACCESSORIES

Sensor Modules – see list on previous page

P/N A36741 Protection module for open sensor bays

P/N A36742 Power adapter for 100 - 240 Vac with US plug

P/N A36755 International plug adapter kit for A36742

P/N A36800 6-pack AA alkaline batteries (1.5V), also approved for Intrinsic Safety (Duracell PC 1500)

P/N A36843 6-pack AA NiMH batteries (1.2V), also approved for Intrinsic Safety (Harding Energy Quest HWAAC1400U)

P/N A36844 NiMH battery charger, 8 cells, 8 hours, 120 VAC 60 Hz

P/N A36821 250 ohm shunt required for HART® communication on low resistance loops (included with MFT 401X)

P/N A900529-00014† HART test lead kit (inc'd with MFT 401X)

P/N A900529-00011† Standard banana jack test lead kit

P/N B34686† Pressure pump with variator, 145 PSI max.

P/N B34700† Vacuum pump with variator, -600 mm Hg max.

P/N A34386† low pressure fittings and tubing kit – vacuum to 150 PSI; connectors, tees, NPT adapters

P/N A900020-90502 high pressure fittings and hose – up to 9000 PSI; 3' hose w/ 1/8" & 1/4" MNPT x quick connect fittings

P/N A900028-90201 Class A, 100Ω platinum RTD probe, ¼" OD, 10" length, 304SS sheath, 5 foot coiled cable with connector for use with RTD1000 RTD measurement module

P/N A900028-90202, 1000Ω platinum RTD probe, ¼" OD, 10" length, 304SS sheath, 5 foot coiled cable with connector for use with RTD1000 RTD measurement module

P/N A36749 Soft carrying case with shoulder strap for base unit, modules, pump and test leads

P/N A36750[†] Hard carrying case with handle – foam insert for base unit with 3 installed modules, 4 additional modules, test leads, hand pump, RTD temperature probe, fittings and tubing

Kit Options - Standard kit includes A36750 hard carrying case, pneumatic pump choice, A34386 low pressure connection kit and A36744 test lead kit.

P/N A36785 Standard kit with B34686 pressure pump

P/N A36786 Standard kit with B34700 vacuum pump

P/N A36787 Standard kit with B34686 pressure pump and A900028-90201 100 ohm RTD

P/N A36788 Standard kit with B34700 vacuum pump and A900028-90201 100 ohm RTD

[†] Designates Kit item

RTD1000 Measurement Module

Safety Notice: *Intrinsically Safe RTD1000 modules require the MFT 40X2 or 40X3 Intrinsically Safe base MFT units. The RTD1000 module must be installed or removed in a safe area. RTDs or RTD connectors must be connected to the RTD1000 module in a non-hazardous area. For more information on Intrinsically Safe operation, see the MFT instruction manual section on this topic and see the Intrinsic Safety Control Document in the appendix.*

RTD Temperature Measurement Module

The RTD1000 is an RTD measurement module for use with the Meriam MFT 4000 Series multi-function tester. The module is used to accurately measure the resistance from any of 22 different RTD sensor types with nominal resistance up to 1000 ohms. RTD material may be platinum, copper, nickel and iron and several alpha coefficients are supported. The MFT converts the measured resistance to a corresponding temperature value and displays the value in the user's selected temperature unit (°F, °C, °R or °K). The resistance in ohms can also be displayed. RTDs available from Meriam (Pt 100 and Pt 1000) are 4-wire, DIN Class A probes complete with handle, connector, and 5' coiled cable. The RTD1000 can be used with the user's 2-, 3-, or 4-wire RTDs by wiring them to an accessory connector.

When used with a dedicated DIN Class A RTD, the RTD1000 makes an excellent temperature reference standard for comparison with RTDs installed in process applications. The module can also be used to make temperature measurements on any 2-, 3-, or 4-wire RTD by using an accessory connector/cable with alligator clip terminations. Actual resistances up to 4000 ohms may be measured within the accuracy rating of the module.

RTD1000 modules certified for Intrinsic Safety by MET Laboratories per testing to UL3111-1 First Edition Rev. 6/30/94, CAN/CSA-22.2 No. 1010.1-92 and UL913 Fifth Edition. See the Intrinsically Safe Control Document in the Appendix. Connection of Meriam RTDs, connectors or general-purpose connectors must be made in a non-hazardous area.

MFT Interface

The MFT's interface with the RTD1000 has been designed for user convenience. For RTDs dedicated for use with the RTD1000 as reference standards, a unique probe ID resistor can be wired into the connector. The ID resistor allows the MFT to automatically identify the RTD type connected. This technique is used on the Meriam Pt 100 and Pt 1000 accessory probes. The ID resistor technique can be used on any of the 22 RTD types that the RTD1000 supports. See the Table 1 below for RTD Type and Probe ID Resistor information. If the connector is to be used for multiple RTD types, the unique ID resistor can be replaced with a wire short. When the MFT reads the short, an RTD menu is displayed that prompts the user to enter the necessary probe information (material, nominal resistance and α) from the MFT menus.

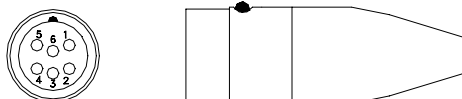
Table 1: RTD type verses Probe ID Resistor

Material	R0	ALPHA	Rs (Probe ID)	Temp Range (deg C)
Platinum	100	0.00385	100	
Platinum	1000	0.00385	1000	
Platinum	100	0.00392	46.4	
Platinum	100	0.00391	56.2	
Platinum	25.5	0.00392	17.8	
Platinum	200	0.00385	178	
Platinum	470	0.00392	261	
Platinum	500	0.00392	316	
Platinum	500	0.00391	383	

Platinum	500	0.00385	464	
Platinum	1000	0.00375	1210	
Platinum	100	0.00393	68.1	-200 to +962° C
Platinum	100	0.00393	82.5	-200 to +630° C
Platinum	98.129	0.00392	21.5	
Platinum	200	0.00392	215	
Copper	9.035	0.00427	12.1	
Copper	100	0.00427	121	
Nickel	100	0.00618	31.6	
Nickel	120	0.00672	147	
Iron	604	0.00518	562	
Iron	908.4	0.00527	681	
Iron	1816.81	0.00527	1470	

Note: Rs (above) is a ¼ Watt, 1%, metal film resistor

Connector Option 1 – For Reference Temperature Probes



P/N A900442-00026 connector is used to connect an RTD to the RTD1000 module. See the Table 2 below for connector pin-outs.

Table 2: Connector Pin-Outs

PINS	Functions
1, 2	Rs – Probe ID Resistor (see Table above)
3, 4	One side of RTD
5, 6	Other side of RTD

Note: Pins 3 – 6 must be connected. See RTD wiring styles below for further information

RTD wiring styles for Connector Option 1

IMPORTANT: Pins 3 – 6 on the custom connector must all be connected to something for readings to take place!

2-wire RTDs

Connect pin 3 and pin 4 to one wire/terminal of the RTD. Connect pin 5 and pin 6 to the other wire/terminal.

3-wire RTDs

3-wire RTDs have two wires/terminals that are the same color. Connect pin 3 to one of these wires/terminals and connect pin 4 to the other wire/terminal of the same color. Connect both pin 5 and pin 6 to the remaining, different color wire/terminal.

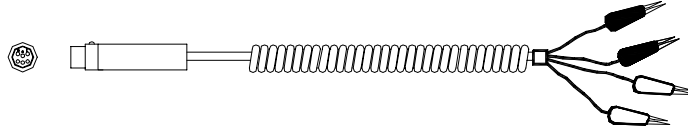
4-wire RTDs

4-wire RTDs have two wires/terminals of one color and two of another color. Connect pin 3 and pin 4 to each of two wires/terminals of the same color. Connect pin 5 and pin 6 to each of two wires/terminals of the other color.

Notes on RTD wiring

1. For maximum accuracy use 3-wire or 4-wire configurations with DIN Class A RTDs.
2. When using a 2-wire RTD, keep the lead length between the alligator clips of the general-purpose connector and the RTD element as short as possible.
3. In 3-wire and 4-wire configurations, the wire size and length should be identical for all leads.

Connector Option 2 – For General Purpose Temperature Measurement



P/N A900028-90500 general-purpose connector is used for connecting to RTD wires or terminals to obtain temperature measurements directly from RTD devices. One pair of white and one pair of red Alligator clips are suitable for connecting to 2-, 3-, or 4-wire RTDs.

RTD wiring styles for Connector/Cable Option 2

IMPORTANT: Alligator clips on the connector/cable assembly must all be connected to something for readings to take place!

2-wire RTDs

Connect the two Red clips to one wire/terminal of the RTD. Connect the two White clips to the other wire/terminal.

3-wire RTDs

3-wire RTDs have two wires/terminals that are the same color. Connect the two Red clips to the wires/terminals of the same color. Connect the two White clips to the remaining wire/terminal.

4-wire RTDs

4-wire RTDs have two wires/terminals of one color and two of another color. Connect the Red clips to each of two wires/terminals of the same color. Connect the White clips to each of two wires/terminals that are the other color.

Note: *Restrictions apply for use of RTD1000 modules / MFT units in Hazardous Areas. RTDs, removed or replaced in non-hazardous areas. RTDs, P/N A900442-00026 connectors and P/N A900028-90500 general-purpose connectors must only be connected to the RTD1000 in a non-hazardous area. See the Intrinsicly Safe Control Document in the Appendix for more details.*

How to Use the Module – Refer to MFT Operator Instruction Manual F/N 4000:440; GENERAL OPERATION Section

Installation – See Sensor Install/Removal Section

Changing Units – See Changing Units/Removing Sensors on Display. Available units for the RTD1000 are °F, °C, °R, °K, ohms, off

Real – Field Recalibration

The RTD1000 module can be recalibrated / re-certified using appropriate local standards and the MFT’s **Real** feature. Two recalibration methods are available. See the FIELD RECALIBRATION Section of this MFT Operator Instruction Manual for general information on the **Real** feature and initial setup. Once pertinent parameters and options have been entered, move cursor arrow to the **Start** option on the main **Real** menu and press the **Select** soft key. This initiates the recalibration type selection display shown below.

Field Recal
Field Recal Setup: ■ Start Module Bay: 1 Units: C Points: 3 Restore Defaults
Up Down Select Back

Real Feature Main Setup Menu

Field Recal
Enter Type of Cal: ■ Module Only Module + Probe
Up Down Start Back

Calibration Type Selection Menu

The **Module Only** method makes use of external precision resistors to calibrate the module’s resistance measurement. Precision 100 Ω and 1000 Ω resistors rated at a total tolerance of 10 PPM are connected in turn to the RTD1000 module as directed by the Real menu. One Meriam connector accessory P/N A900442-00026 is needed for each precision resistor. The 100 Ω precision resistor is connected to pins 3 & 5 and 4 & 6 as though a 4-wire RTD were being connected (many precision resistor are available in a 4-wire configuration). In addition, an ID resistor with value 26.1 Ω must be connected across pins 1 and 2 of one connector (the ID resistor allows the MFT to automatically determine which resistor is connected). Similarly, the 1000 Ω precision resistor is connected to pins 3 & 5 and 4 & 6, plus an ID resistor with value 825 Ω is connected across pins 1 and 2, of a second connector. Make sure the external precision resistor is securely engaged in the RTD1000 connector. Wiring should be of the same size and of the same length. Field calibrations performed using the **Module Only** method should use precision resistors rated for 10 ppm total tolerance to maintain the original factory accuracy. Selecting the **Module Only** option and connecting a 100 Ω precision resistor causes the following display to appear.

RTD Cal	
Old Ref	= 100.226
New Ref	= 100.239
Save	Exit

Module Only Recalibration Screen

Old Ref is the resistance value from the RTD1000 module memory that was used in the previous calibration. **New Ref** is the present resistance measured by the module with the precision resistor connected. The MFT uses the ratio between **New Ref** and 100.000 Ω to determine the new calibration coefficient. Press the **Save** soft key to store the new calibration point. Repeat the process by connecting a 1000 Ω precision resistor, as directed by the MFT display, to calibrate the full RTD1000 range.

The **Module + Probe** method is an alternative for users who need a reference standard calibrated as a “matched set”; that is, using a specific RTD1000 module with a dedicated RTD probe and cable to achieve the best possible displayed accuracy (this method also permits the use of a precision RTD simulator for

multipoint calibrations). This method allows adjustments to be made to the Module + Probe calibration by using an external temperature bath, dry block, or a temperature simulation standard. The user can select 1-, 3-, 5- or 9-point calibration options. When calibrating using a temperature bath or dry block, a DIN Class A RTDs should be used for best possible “matched set” accuracy.

Please note that 1) all calibrations are executed in °C units and 2) adjustment made to calibration points within a multipoint calibration procedure are temporarily saved point-by-point but not permanently saved for use until the entire procedure is completed. To erase Rcal data, simple select the “Restore Defaults” option from the Rcal Feature Main Setup Menu shown above.

Selecting the **Module + Probe** option with an RTD connected will cause the following display to appear on the MFT.

Field Recal			
Cal Point:	0%		
Applied:	-20.00 C		
S1:	-19.54	C	
Error:	0.46	C	
Adj	Abort	Next	Back

Probe Only Recalibration Screen

The **Module + Probe** recalibration screen shown above provides the following information:

Cal Point: target calibration temperature expressed in percent of the specified range. The default Calibration Range is -20° C to +80° C (see the following section “Other Recalibration Keys and Functions” information on changing the range or any point within the range).

Applied: the target recalibration temperature calculated by the MFT based on the number of calibration points selected in the **Rcal** set-up menu for the default or specified range.

S1/S2/S3: this line shows measured temperature in the sensor bay location of the RTD1000 module. The temperature applied by the user standard is displayed in °C.

Error: the algebraic difference between the applied temperature and the temperature measured by the “matched set” (RTD1000 module and connected RTD or RTD simulator) expressed in °C.

Adjust the temperature source until the temperature applied matches the **Applied** value displayed. If the “matched set” is accurate, the **Error** value will be very close to zero. If the **Error** value indicated exceeds your requirements, press the **Adj** soft key and enter actually applied temperature value as indicated by your standard. Press the **Done** soft key and then select **Yes** to save the new data point. This process adjusts that particular point on the calibration curve. Confirm the **Error** value is now within specification (see below).

Field Recal			
Cal Point:	0%		
Applied:	-20.00 C		
S1:	-20.01	C	
Error:	-0.01	C	
Adj	Abort	Next	Back

When the **Error** value is within acceptable limits, press the **Next** soft key. This moves the calibration procedure to the next calibration point. Repeat the procedure outlined above until all points are complete; when the final recalibration point is acceptable, press **Next** to store the data.

After completion of the calibration process for 1, 3, 5, or 9 points, the MFT will inquire if the cal data should be saved. Select **Yes** to accept the recalibration data or **No** for other options.

If **Yes** was selected, the screen will verify the new calibration by displaying the date and module position number. Press the **OK** soft key. The MFT then returns to the **Measure Mode**. The active calibration is indicated to the right of the measured temperature value.

Choosing **No** opens the **Cal Not Saved** screen. Three options are available:



Exit Cal: Does not save any calibration data, reverts to the previous calibration in memory, and returns the user to the **Measure Mode**.

Restart Cal: Takes the user back to the **Rcal** set-up screen to begin a new recalibration procedure.

Save Cal: Gives the user a second opportunity to accept the recalibration data.

The user can verify sensor module calibration status by pressing the **Sensr** soft key from the **Measure Mode** display. The calibration data will show the sensor ID information and the most recent calibration date.

Other Recalibration Keys and Functions used on the Module + Probe recalibration type:

Adj: allows the user to redefine the recalibration target points. For example: if the first desired calibration point is a value other than -20° C, apply the desired first temperature with temperature bath, dry block, or RTD simulator and let it stabilize. Press **Adj** and enter the actually applied temperature value (using the **Inc** and **Dec** soft keys; press **Next** to go to the next digit) and press the **Done** soft key. The MFT will prompt the user to save this value. Save the value by selecting **Yes** and then confirm the **Applied** line value matches the **S1** value (Error line is close to zero). When satisfied with the indicated **Error**, pressing **Next** soft key. This **will** change the calibration temperature value for point of interest and calibrate the module at the point as well. Perform this adjustment on any calibration point you wish to customize. The customized procedure will be saved in module memory when the procedure is completed.

Abort: Pressing the **Abort** key will immediately cancel all calibration value changes made to that point, reinstate the previous calibration, and return to the **Measure Mode**.

Next: Takes the user to the next calibration point.

Back: In the **Rcal** mode, **Back** aborts the calibration procedure and returns the user to the **Rcal** set-up screen. The previous calibration data is retained. It does not return the user to the previous screen in the calibration procedure.

Specifications for RTD1000 module

Accuracy: 50 ppm + 10 ppm/° C (Ref. Temp. = 22° C)

Temperature: Storage: -40° F to 140° F (-40° C to 60° C)

Operating: 23° F to 122° F (-5° C to 50° C)

Mating Connector: Switchcraft #TA6FL

Power: supplied from MFT

Units: °F, °C, °R, °K, ohms

Weight: 0.20 lbs

Approvals

Intrinsically Safe by MET Laboratories, Inc per CAN/CSA-C22.2 No. 157, CAN/CSA-C22.2 No. 1010.1-92 & UL 913 Fifth Edition, Rev 2/21/97 for Class I, Division I, Groups A, B, C & D Hazardous Areas. ***Restrictions apply – see the Intrinsically Safe Control Document in Appendix for more details.***

CE mark

Accessories/Options for RTD1000 module

P/N A900442-00026 connector is used to permanently connect a customer's RTD to the RTD1000 module

P/N A900028-90500 general-purpose connector used to temporarily connect the RTD1000 to RTD wires or terminals, 4-wire with alligator clips, 5 ft coiled cable

P/N A900028-90201 Pt 100 RTD, DIN Class "A", 0.00385 alpha, 4 leads, 1/4" O.D., SS probe, 10" probe length, 3.5" handle and 5 ft coiled cable with connector for RTD1000 temperature module

P/N A900028-90202 Pt 1000 RTD, DIN Class "A", 0.00385 alpha, 4 leads, 1/4" O.D., SS probe, 10" probe length, 3.5" handle and 5 ft coiled cable with connector for RTD1000 temperature module

TIO0110 Module Quick Instructions

For Thermocouple and milli-Volt Measurement and Simulation

Safety Notice: *Intrinsically Safe TIO0110 modules require the MFT 40X2 or 40X3 Intrinsically Safe base MFT units. The TIO module must be installed or removed in a safe area. T/C connectors must be connected to the TIO0110 module in a non-hazardous area. For more information on Intrinsically Safe operation, see the MFT instruction manual section on this topic and see the Intrinsic Safety Control Document in the appendix.*

The TIO0110 Module will measure any of twelve (12) thermocouple types, measure milli-Volts, or simulate the milli-Volt output the twelve (12) t/c types. Connections for measurement applications are made using mini-t/c connectors with appropriate t/c wire. Connections for simulation applications are made using mini-t/c connectors with wire cable and alligator clip ends (see Accessories section for the Meriam wire-kit part numbers).

Measure

- T/C types E, J, K, N, T
- T/C types B, K, R
- T/C types C, D, S, M, P
- ± 110.000 mV dc

Simulate

- ± 110.000 mV dc output for the same t/c types

1.0 Measurement Mode

- 1.1 Install the TIO0110 module in any MFT bay location and turn on the MFT. If no t/c is connected to the MFT, the Sx line will indicate "T/C open." If a t/c is connected a temperature will be shown on the display. Be sure the t/c type is correct - if not go to the TC Setup display to change the type.

Measure ▣▣▣▣▣			
S1:	T/C open		
S2:	0.000 inW20C		
S3:	0.00 PSIG		
IV:	0.000 mA		
Zero	Mn/Mx	Damp	More

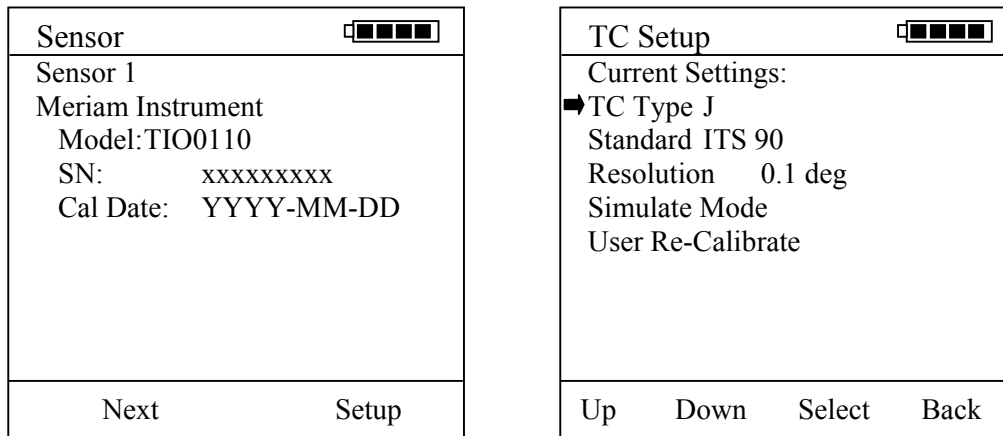
MFT Measure Mode Display showing open T/C

Measure ▣▣▣▣▣			
S1:	72.8 deg F		
S2:	0.000 inW20C		
S3:	0.00 PSIG		
IV:	0.000 mA		
Zero	Mn/Mx	Damp	More

MFT Measure Mode Display showing temperature

- 1.2 To access the setup menu for the TIO0110 module, press the **More** soft key from the **Measure Mode** of the MFT and then the **Sensr** soft key to view the S1 sensor bay module information. If the TIO module information is shown, press the **Setup** soft key to arrive at the TC Setup display shown below. Otherwise, press the **Next** soft

key until the TIO module is displayed.



1.3 At the TC Setup display the user can select the desired t/c from the TC Type list, select the mV to temperature conversion standard, set the temperature display resolution, select Simulate Mode or enter the User Re-Calibrate Mode. Arrow Up or Down to the desired menu option and press the Select soft key.

1.3.1 **TC Type** – select from T/C types E, J, K, N, T, B, R, C, D, S, M, or P. Use the Up and Down soft keys and Save key to set type.

1.3.2 **Standard** – choose from NIST 175 (default), ITS 90 or ITS 68 standards. Use the Up and Down soft keys and Save key to set.

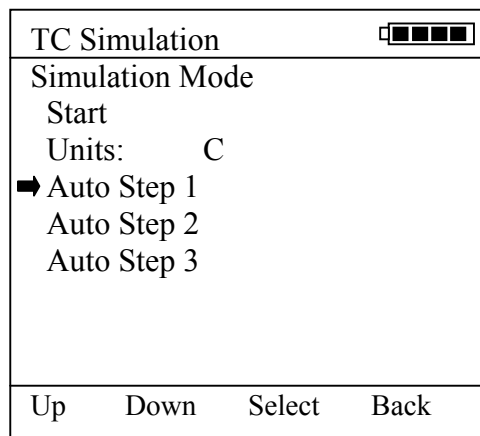
1.3.3 **Resolution** – use to select temperature display resolution of 1° or 0.1°. Use the Up and Down soft keys and Save key to set.

1.3.4 **Simulate Mode** – select simulate mode to simulate a t/c mV output to a receiving device. See details below.

1.3.5 **User Re-Calibration** – select this menu option to calibrate the TIO0110 module with appropriate local standards. See details below.

2.0 Simulate Mode

Select **Simulate Mode** from the TC Setup screen to access the TC simulation display. From this display the user can select simulation units, start a simple simulation or setup and execute an automated test procedure.



- 2.1 The **Start** menu begins a TC or mV simulation. When Start is selected with the Select soft key, a numeric entry screen appears to facilitate the entry of the desired simulation temperature value (or mV value). Once the value has been entered, the MFT will use the previously selected conversion standard to determine the corresponding mV value and output that value through the TIO mini-t/c connector.
- 2.2 The **Units** menu line is used to select the temperature units for the simulation. °C, °F, °K, or °R are the available temperature units. The user can also select mV units for the simulation if desired.
- 2.3 **Auto-Step x** menu options allow pre-programmed simulations to be set up and executed automatically by the MFT / TIO. Auto-Steps are automatically stored for future use.

TC Setup ▢▢▢▢▢			
Auto-Step x			
Start			
Units:	mV		
Low pt:	0.000 mV		
▀ Upr pt:	110.000 mV		
Steps:	5		
Dwell Time:	5 sec		
Up	Down	Select	Back

- 2.3.1 Select **Start** menu option to begin the indicated Auto-Step number.
- 2.3.2 Select **Units** to change the Auto-Step x simulation units.
- 2.3.3 Select **Low pt** to enter the beginning test point value.
- 2.3.4 Select **Upr pt** to enter the ending test point value.
- 2.3.5 Select **Steps** to enter the number of test points in the procedure including the Upr pt.
- 2.3.6 Select **Dwell Time** to choose the duration of each simulated point or chose Manual for the manual advance option.

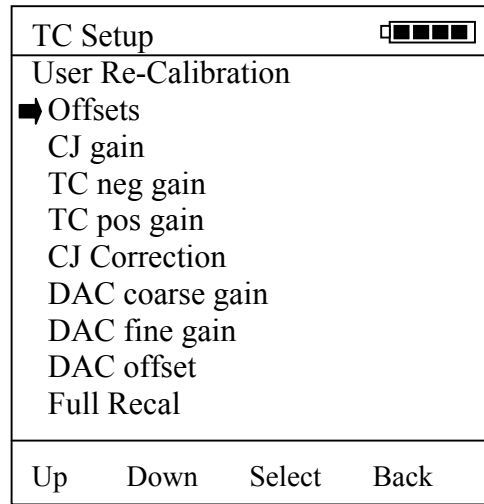
3.0 User Re-Calibrate

This menu option accesses the controls used for re-calibration of the TIO0110 module using local standards.

This calibration requires a highly accurate DMM, a stable, programmable DC voltage source and a standard type TT thermocouple probe in a stable ice bath. Required equipment is as follows:

DMM	Fluke 8508A, HP3458A or equivalent
DC Voltage Source	EDC 52X or equivalent
Thermocouple	Omega TRCIII ice point with TRP-T thermocouple probe or equivalent

Each selection on the TC Setup screen enables a mode to measure and capture calibration data. The values are stored in non-volatile memory in the sensor module. Refer to the MFT TIO0110 Calibration Manual for details of the re-calibration process.



- 3.1 **Offsets** – Input offsets
- 3.2 **CJ gain** – Gain of cold-junction compensation
- 3.3 **TC neg gain** – Thermocouple negative-gain slope
- 3.4 **TC pos gain** – Thermocouple positive-gain slope
- 3.5 **CJ Correction** – Offset of cold-junction compensation
- 3.6 **DAC coarse gain** – Coarse output DAC gain slope
- 3.7 **DAC fine gain** – Fine output DAC gain slope
- 3.8 **DAC offset** – DAC offset constant
- 3.9 **Full Recal** – Sequences from step 3.1 to step 3.8 and stores all calibration constants.

4.0 Specifications

Input impedance: > 10 megohms
 Warm-up time: ≤ 1 Minute to full rated accuracy
 mV Accuracy : ± 0.025% R + 0.005% FS
 Temperature Effect: ≤ 2uV/°C
 T/C Accuracy: ± 0.3°C for E, J, K, N & T types
 T/C Accuracy: ± 1.0°C for B, R & S types
 T/C Accuracy: ±0.5°C for C, D, M & P types
 Cold junction effect: ± 0.5°C max
 Resolution: ± 0.1° or ± 1° for T/Cs, ± 0.001 mV
 Voltage range: ± 110.000 mV dc

Temperature: Storage: -40° F to 140° F (-40° C to 60° C)

Operating: 23° F to 122° F (-5° C to 50° C)

Connector – Measure & Simulate T: standard mini-t/c connector with t/c wire

- Source mV: standard mini-t/c connector with cable and two alligator clips

Power: supplied from MFT (simulate / source mode only)

Units: °F, °C, °R, °K, milli-Volts

Weight: 3 ozs

5.0 Approvals

5.1 Intrinsically Safe by MET Laboratories, Inc per CAN/CSA-C22.2 No. 157, CAN/CSA-C22.2 No. 1010.1-92 & UL 913 Fifth Edition, Rev 2/21/97 for Class I, Division I, Groups A, B, C & D Hazardous Areas. ***Restrictions apply – see the Intrinsically Safe Control Document in Appendix for more details.***

5.2 CE mark

6.0 Accessories for TIO0110

P/N A36857	T/C Wire Kit 1 for types E, J, K, N, T - mini t/c connector, 1 m cable, wire ends
P/N A36858	T/C Wire Kit 2 for types B, K, R - mini t/c connector, 1 m cable, wire ends
P/N A36881	mV simulation cable assembly; mini t/c connector, 3.5 ft. copper cable, alligator clips

VMA0055 Module Quick Instructions

For mA / V measurement, Xmitter Simulation, mA Source and V Source

Notices:

- 1) The VMA 0055 module is **not hot-swappable**. To install the module, turn the MFT base unit OFF, install the VMA 0055 in any bay and turn the MFT back ON. Attempting to install the VMA module with MFT power ON will cause the MFT to shut down. **Damage could occur** to the MFT or module.
- 2) *Intrinsically Safe VMA 0055 modules require the MFT 40X2 or 40X3 Intrinsically Safe base MFT units. The VMA module must be installed or removed in a safe area. For more information on Intrinsically Safe operation, see the MFT instruction manual section on this topic and see the Intrinsic Safety Control Document in the appendix.*

The VMA Module has two measurement functions and four source/simulate functions:

Measure

- ± 55.000 V dc
- ± 100.000 mA dc

Source / Simulate

- 24 VDC Loop Power
- Xmitter Sim
- mA Source
- V Source

1.0 Measurement Applications

The VMA module will measure voltage and current to upper values that exceed the MFT base unit's metering capabilities.

1.1 Use "Volts" and "Com" jacks on the VMA module to measure voltage from upper range values of ± 500.000 milli-volts to ± 55.000 volts. The "V Range" should be set to the appropriate range for best accuracy. This is done from the MFT **Measure Mode** by pressing the **More** soft key twice and then the **Vrng** soft key. The following display appears for selection of the desired Voltage measurement range.

Vma Setup ▢▢▢▢▢	
V Range	+/-55
➡ +/-55	
	+/-30
	+/-15
	+/-8
	+/-4
	+/-2
	+/-1
	+/-0.5
Up	Down Save Back

Voltage range selection display

The top line of the V Range display indicates the range presently in use. To select a more suitable range for the application at hand, simply arrow **Up** or **Down** to the desired range and press the **Save** soft key. Press **Back** when satisfied with the range selection.

1.2 For current measurements up to ± 100 mA, use the VMA module's "mAmp" and "Com" jacks as you would with a standard meter. ± 100.000 mA can be measured without any range selection for current.

2.0 Loop Power Application

The VMA will provide 24VDC Loop Power for transmitter loop circuits. The recommended wiring is depicted in the diagram below:

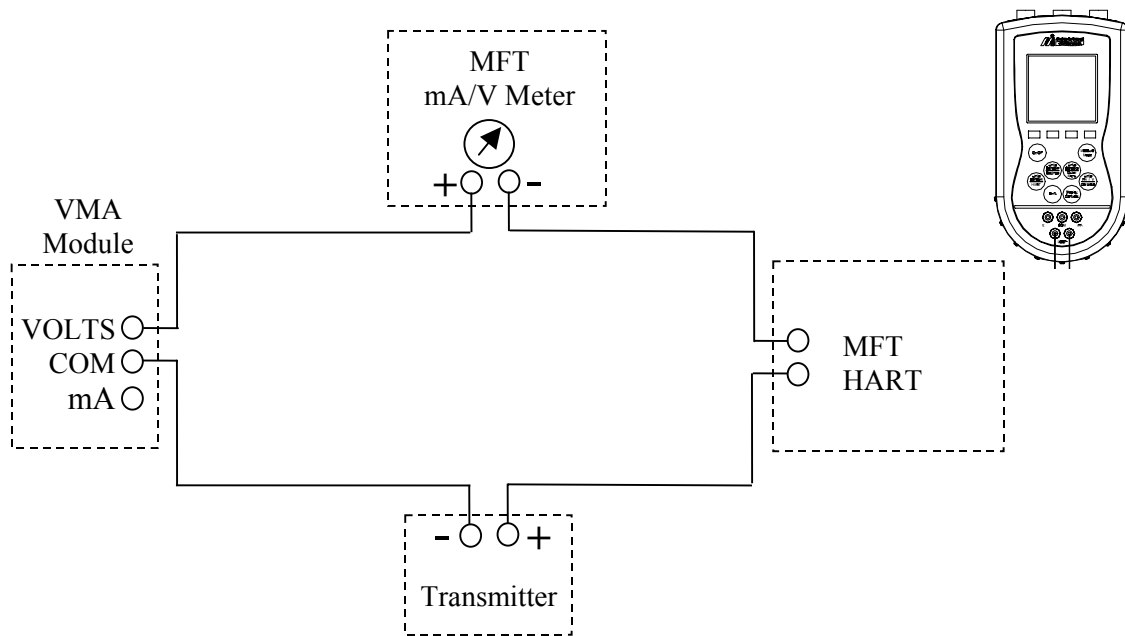


Diagram 2.1 – Loop Power Connection Diagram for simple low load loop

Connect the test circuit according to the Diagram 2.1.

Include 250-ohm resistor for low load loops.

The loop power is turned on from the MFT **Measure Mode** by pressing the following keys:

Press the **More** Soft Key two times

Press the **Pon** Soft Key to turn VMA power supply on

Measure ▢▢▢▢▢			
S1: 24.00 V			
S2: 0.000 PSIG			
S3: 72.05 deg F			
IV: 4.000 mA			
Pon	Poff	Vrng	More

The SX sensor location (depending which bay the VMA is located in) should read approximately 24.00 VDC. The MFT's IV value will read the loop current.

To establish HART communications with the test device, press the MFT's **HART** key.

3.0 Manual Source and Simulation Operations–

3.1 Wire the test circuit as shown in Diagram 3.1 and 3.2 depending on the desired application:

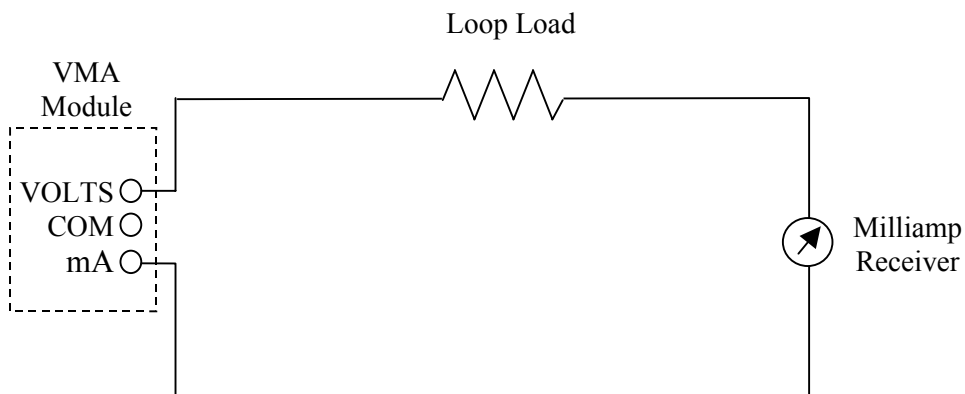


Diagram 3.1 – mA Source & V Source Connection Diagram

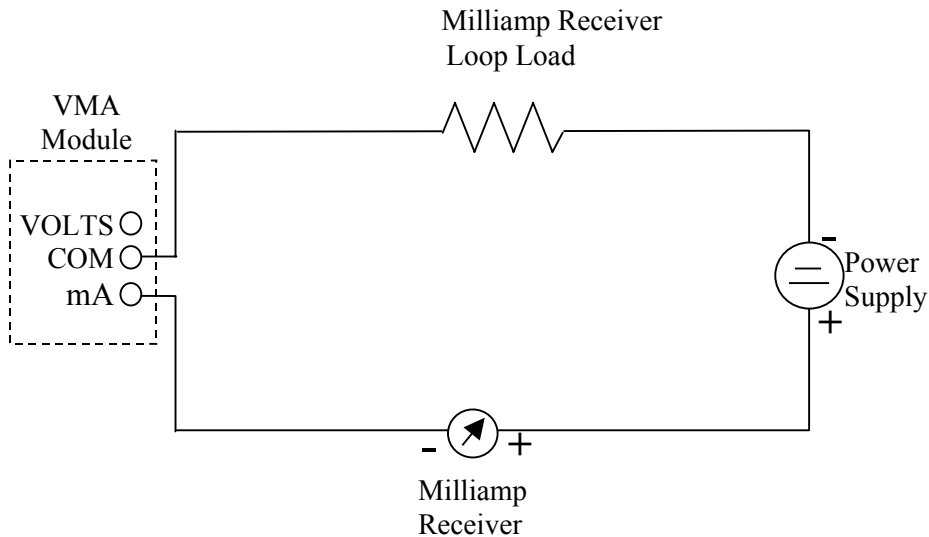
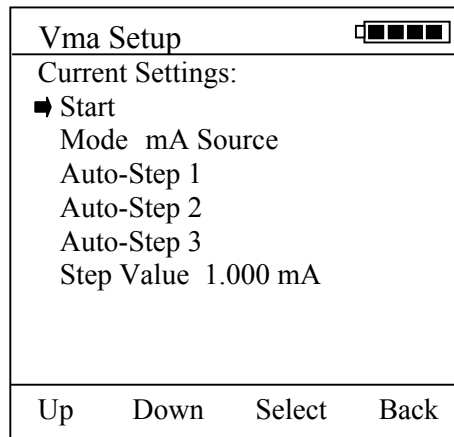


Diagram 3.2 – Transmitter Simulation Connection Diagram

- 3.2 From MFT **Measure Mode**, press the **More** soft key
- 3.3 Press the **Sensr** soft key and then **Next** until the VMA module information is displayed (MFT bay S1 module information is displayed first, then Next changes to bay S2, etc...)
- 3.4 Press the **Setup** soft key option for the VMA module to display the VMA Main Setup Display



VMA Main Setup Display

- 3.5 Select the **Mode** option to select from **Xmitter Sim**, **mA Source** or **V Source** options. Use the soft keys to move cursor **Up** or **Down**, to **Select** the desired option and to go **Back** to the VMA Main Setup Display.
- 3.6 From the VMA Main Setup Screen, select **Start**
- 3.7 The user will be prompted to enter the starting value with the following screen. Use the soft keys to enter the desired value.

Vma Settings ▣▣▣▣▣			
Current Settings Enter Output Value			
_ 0.000			
Inc	Dec	Next	Done

- Inc** – Increases the value shown above the cursor
- Dec** – Decreases the value shown above the cursor
- Next** – moves cursor to the right; eventually wraps back to left position
- Done** – Ends data entry session and proceeds with the selected operation

3.8 Once the value is entered, press the **Done** soft key to initiate the selected operation.

The operation depicted below is for mA Source. Use the soft keys to change the output value as desired. Note that the MFT base unit’s IV (current/voltage) meter reading is shown on this display for use in applications requiring both sourcing and measurement. The IV line can be changed at this display from V to mA to off by using the MFTs “Shift” and “Units mA / V” keys as usual (see the MFT instruction manual section on Changing Units for more information).

mA Source ▣▣▣▣▣			
Output = 16.000 mA			
IV = 16.015 mA			
Inc	Dec	Chng	Exit

- Inc** – Increases the current value by the Step Value (entered in the VMA Main Setup Display).
- Dec** – Decreases the current value by the Step Value (entered in the VMA Main Setup Display).
- Chng** – Allows the user to enter another value.
- Exit** – Ends simulation mode, returns to the VMA Main Setup Display.

4.0 Automated Operation – Source and Simulation

The VMA has features that allow step functions that can be utilized in the source/simulation options. The standard steps programmed by the user are stored for future recall and use.

- 4.1 Refer to Diagrams 3.1 and 3.2 and make connections for the desired application.
- 4.2 From the VMA Main Setup Menu, arrow down and select **Auto-Step X**.

Vma Setup ▢ ■ ■ ■ ■	
Auto-Step 1:	
➤ Start	
Mode: mA Source	
Low pt: 4.000 mA	
Upr pt: 20.000 mA	
Steps: 5	
Auto-Step 3	
Dwell Time: Manual	
Up	Down Select Back

Auto-Step Setup Display

Start – Begins the desired simulation mode with the stepping parameters selected.

Mode – Displays the current selected simulation mode. Select **Mode** to change.

Low pt – Displays the starting source or simulation value. Select to enter a value.

Upr pt – Displays the ending source or simulation value. Select to enter a value.

Steps – Displays the number of steps to take (including the “Upr pt”). Select to change the number of steps.

Dwell Time – Displays the time delay in seconds at each step. “Manual” can be selected to enable user to manually advance to next programmed step.

6.0 Resolution, Range, Accuracy for VMA0055 Module

mA dc	mA Measure Mode	mA Source Mode
Resolution	.001 mA	.001 mA
Range	±100.000 mA (55 Vdc compliance)	0 - 24.000 mA
Accuracy	± (0.01% of reading + 0.015% FS)	± (0.01% of reading + 0.015% FS)
Open Circuit Voltage		24 VDC
Output Drive		15 VDC minimum @ 24 mA, Resistive load

Volts dc	V dc Measure Mode	V dc Source (Regulated) Mode
Resolution	1/100,000 counts: .001 mV; .001 V	1 / 1,000,000
Ranges	500 mV; 1, 2, 4, 8, 15, 30, 55 V	± 1000 mV, 0 - 24.000 VDC
Accuracy	± (0.01% of reading + 0.05% FS)	± (0.01% of reading + 0.05% FS)
Open Circuit Voltage		24 VDC
Output Drive		15 VDC minimum @ 24 mA, Resistive load

2-wire Transmitter Simulate	mA Simulation
Resolution	.001 mA
Range	0 - 24.000 mA
Accuracy	± (0.01% of reading + 0.015% FS)
Loop Voltage Limits	1 VDC min., 55 VDC max.

Regulated Loop Power		Regulated Power
Resolution		na
Range		24V dc
Accuracy		± (0.01% of reading + 0.015% FS)
Open Circuit Voltage		24 VDC
Output Drive		15 VDC minimum @ 24 mA, Resistive load

- Notes: 1. Nominal resistance at VMA current terminal is 10 – 15 Ω
2. Output load line is linear

7.0 Approvals

7.1 Intrinsically Safe by MET Laboratories, Inc per CAN/CSA-C22.2 No. 157, CAN/CSA-C22.2 No. 1010.1-92 & UL 913 Fifth Edition, Rev 2/21/97 for Class I, Division I, Groups A, B, C & D Hazardous Areas. ***Restrictions apply – see the Intrinsically Safe Control Document in Appendix for more details.***

7.2 CE mark

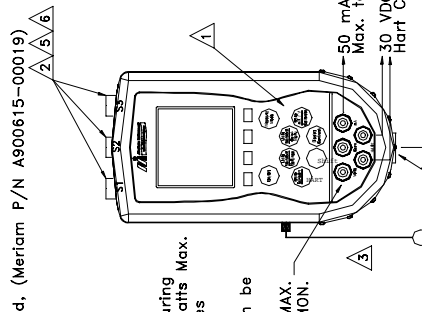
Intrinsic Safety Control Document

Multifunction Tester MFT 4XXX Series

Multifunction Tester MFT 4XXX Series

NON-HAZARDOUS LOCATION

- ⚠ Batteries: (6) 1.5 VDC \equiv Alkaline or NiMH, battery replacement, (removal/replacement), shall only be performed in a non-hazardous area. Do not mix new with used batteries or of different type or manufacture.
- ⚠ Modules may be removed or replaced.
- ⚠ AC/DC adapter may be used, (Meriam P/N A900615-00019)
- ⚠ RS232 port may be used.
- ⚠ RTD/Temperature probes may be used.
- ⚠ Max. power dissipation with all modules is 600 mW, during normal use, 1.35W max; during DOP downloading, and 2.5Watts Max. with use of any (2) modules and (1) VMA module.



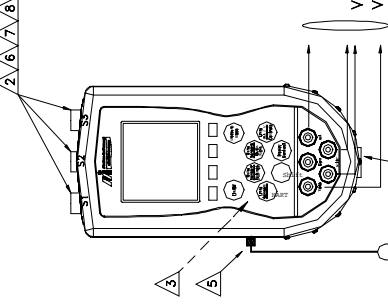
Note: Only (1) VMA module can be used in any given unit.

HAZARDOUS LOCATION

Intrinsically Safe/Securité Intrinseque Class I; Div 1; Groups A, B, C, D; T5

Exia

- ⚠ Substituting of Components may impair Intrinsic Safety!
LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SÉCURITÉ INTRINSEQUE;
- ⚠ Modules must not be installed, removed or replaced.
- ⚠ Do not replace, remove or install batteries or mix new with used batteries or of different type or manufacture.



Note: Capacitance and Inductance values connected to the intrinsically safe circuit are not to exceed the values specified by the entity parameters.

WARNINGS/AVERTISSEMENTS:

- ⚠ Substituting of Components may impair Intrinsic Safety!
LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SÉCURITÉ INTRINSEQUE;
- ⚠ Modules must not be installed, removed or replaced.
- ⚠ Do not replace, remove or install batteries or mix new with used batteries or of different type or manufacture.

Ne PAS REMPLACER, ENLEVER OU INSTALLER DES PILES OU MELANGE NOUVEL AVEC LES PILES UTILISEES OU DE TYPE OU DE FABRICANT DIFFERENT.

- ⚠ RS232 comm. port must not be used.
- ⚠ AC/DC Adapter must not be used.
- ⚠ Consult manual for media compatibility, max. Pressure or Temperature Range and for additional information regarding Hazardous location use.
- ⚠ RTD/Temperature probes must not be installed, removed or replaced.

Vmax=50VDC \equiv Imax=50mA Ci=0.1uF Li=0
Vmax=30VDC \equiv Imax=100mA Ci=1.24uF Li=0
Vmax=50VDC \equiv Imax=50uA Ci=0.1uF Li=0

Connect to Certified Intrinsically Safe circuit only.

⚠ To prevent ignition of hazardous atmospheres, batteries must only be changed in an area known to be non-hazardous.

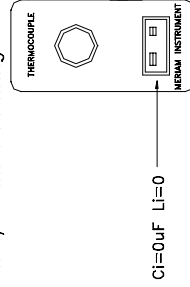
AFIN DE PREVENIR, INFLAMMATION D'ATMOSPHERES DANGEREUSES, NE CHANGER LES BATTERIES QUE DANS DES EMBLEMENTS DESIGNES NON DANGEREUX.

Batteries approved for intrinsic safe location use are:

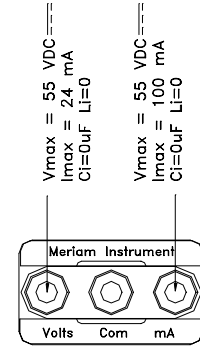
- (6) 1.5VDC \equiv Alkaline; Duracell PC1500/MN1500 (Meriam P/N A900614-00011) or (Meriam P/N A900614-00011)
- (6) 1.5VDC \equiv NiMH; Harding Energy Quest HW/HLAAC1400U (Meriam P/N A900614-00014)

10. Pi max (Hazardous Location Use) = 2.5 Watts

MFT 4XXX Series Intrinsic Safety Control Drawing

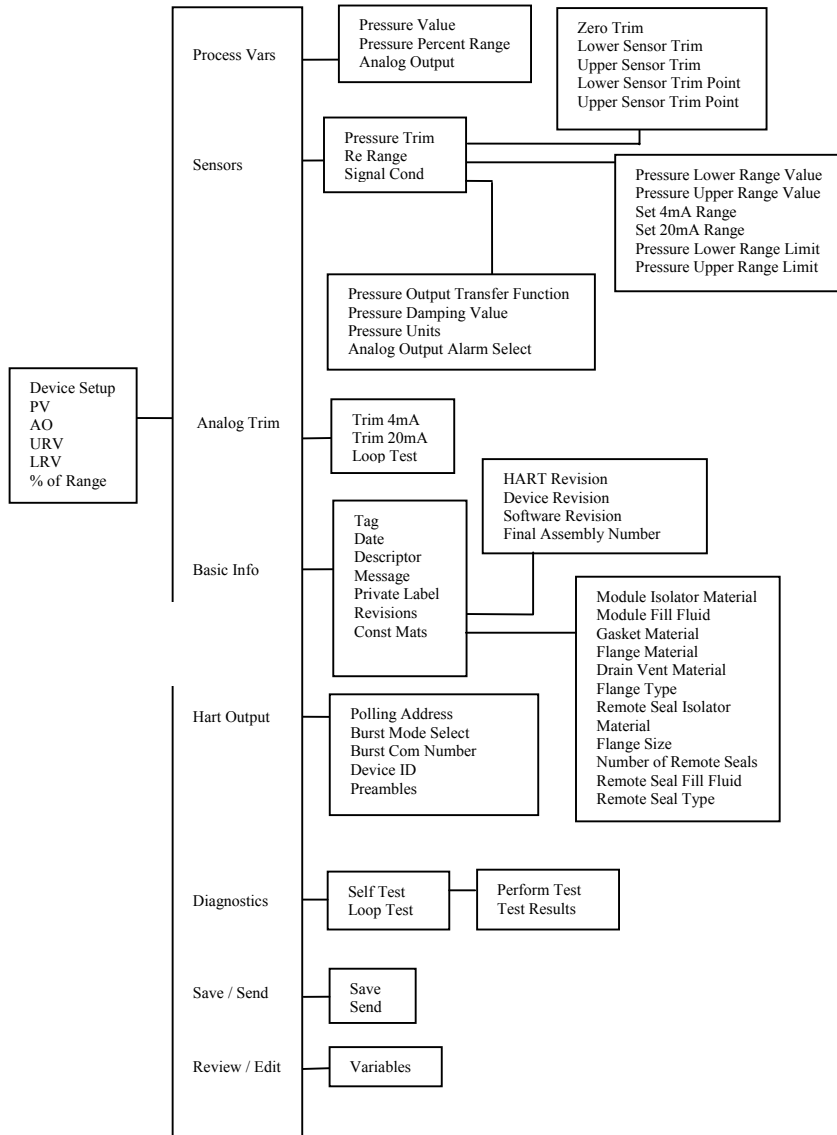


Vmax = 55 VDC \equiv
Imax = 24 mA
Ci=0uF Li=0

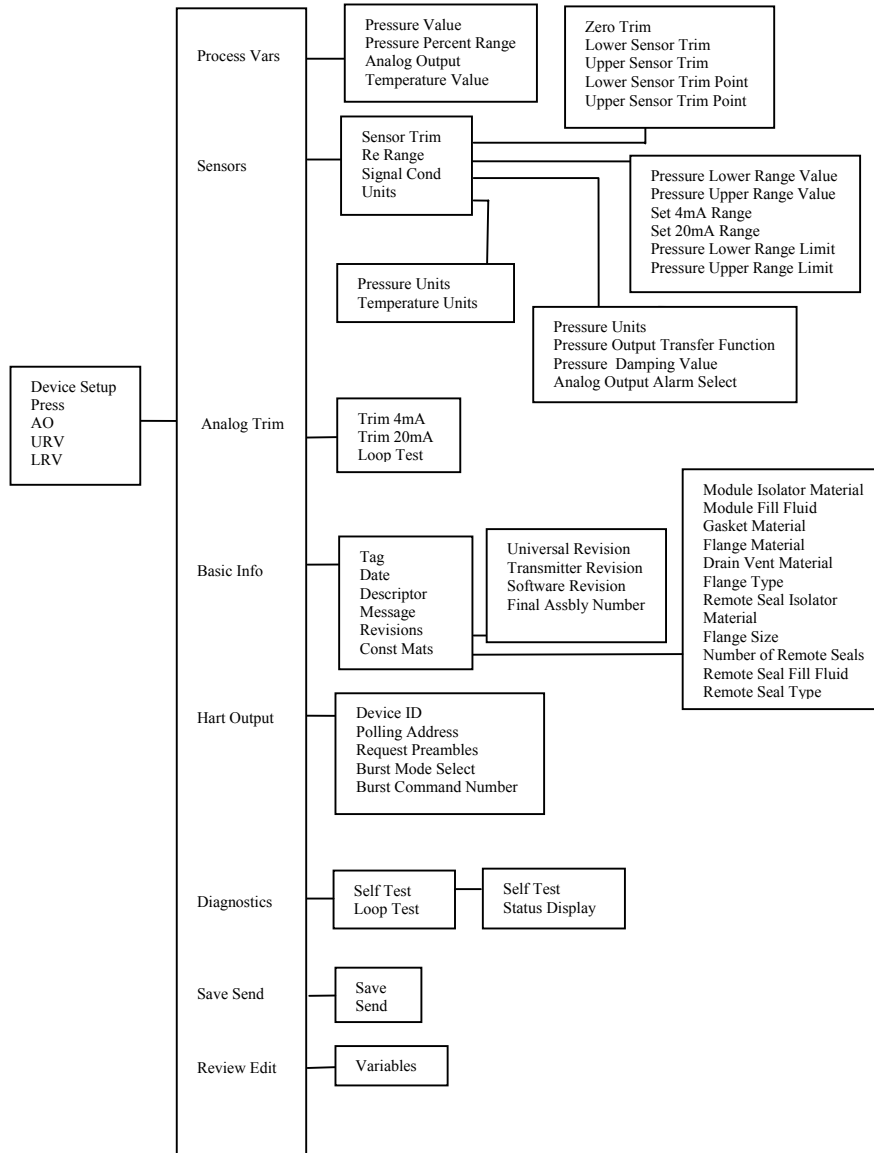


VMA0055 MODULE

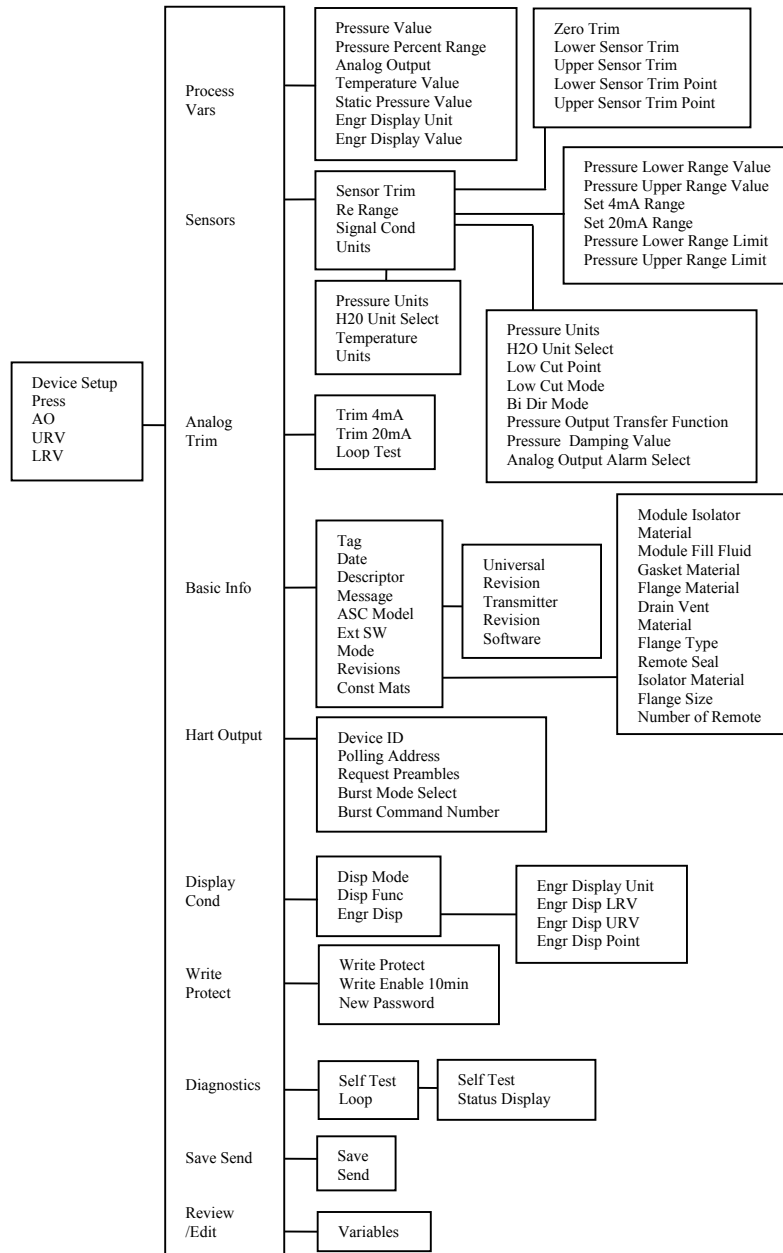
1151 Rev. 5 Menu Tree



3051C Rev. 2 Menu Tree



EJA Rev. 2 Menu Tree



EJA Rev. 1 Menu Tree

