

# Hand-Held Configuration Devices Mobility DHH810-MFT

## DHH810-MFT Modular Calibrator with HART® Communications



**WARNING** notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.

**CAUTION** notices apply to hazards or unsafe practices which could result in property damage.

**NOTES** highlight procedures and contain information which assist the operator in understanding the information contained in this manual.

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- When disposing of chemicals ensure that no two chemicals are mixed.

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## Read First

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## 1.0 Mobility DHH810-MFT Overview

The Mobility DHH810-MFT Multi-Function Tester (Mobility MFT) is a modular calibrator with three sensor bays accommodating up to three independent pressure, temperature or special function modules. The base Mobility MFT incorporates a voltage and current meter, several keys for user interface and will display up to four measurements simultaneously. The Mobility DHH810-MFT includes HART communication capability for greater flexibility and versatility in commissioning, reconfiguring, and maintaining HART field devices.

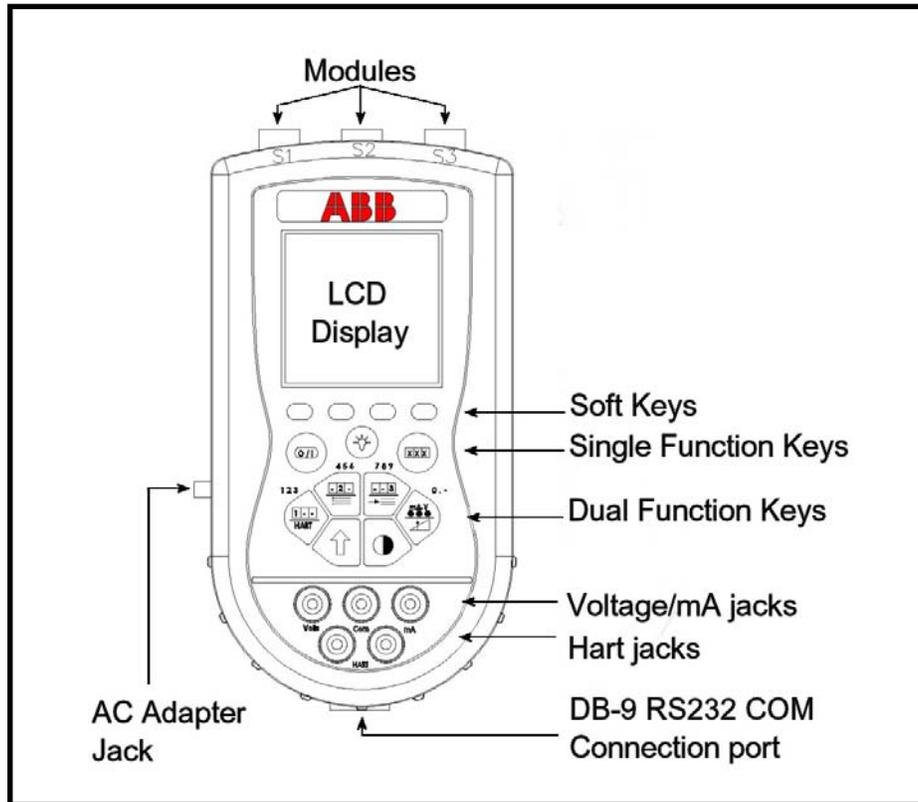


Figure 1.1 Front View

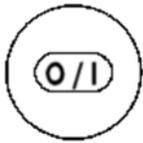
**Note:** For Intrinsically Safe Mobility MFT models, consult the Hazardous Area Use section of this manual for specific details on use of approved Mobility MFTs and applicable restrictions.



## 2.0 Key Pad Overview

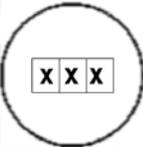
The following is an overview of the Mobility DHH810-MFT keypad operations. The Mobility MFT keypad has three basic key types (the functions of each are described below): Single function keys, dual-function keys, and soft keys. Single function keys control a dedicated Mobility MFT function. Dual-function 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.

### 2.1 Single Function Keys



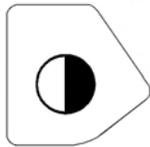
#### On/Off

Pressing the On/Off key powers up the Mobility 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 Mobility 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.

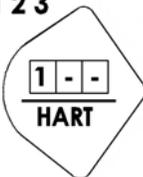


#### Shift

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.

### 2.2 Dual Function Keys

1 2 3



#### Units Sensor1

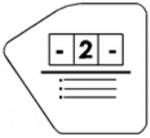
The Units Sensor1 key changes the engineering units for the module in sensor bay 1. The **Shift** key must be active before the units can be changed.

#### HART

The HART key puts the Mobility DHH810-MFT series calibrator into its HART Communications mode and initiates an attempt to establish communications via the HART connections at the bottom of the Mobility MFT.

**4 5 6 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.

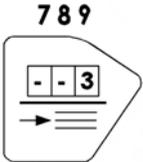


**Settings**

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

**7 8 9 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.

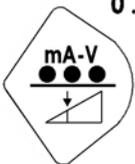


**Quick Menu**

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.

**0 . - 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. The **Shift** key must be active to toggle the display.



**Calibrate**

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

**2.3 Soft Keys**

**SOFT KEYS (unlabeled)**



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

**2.4 Alphanumeric Data Entry**

**Alphanumeric Entry:** For application of the Mobility MFT requiring alpha and numeric entry (examples: tagging or messaging), the Mobility 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. Mobility 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 Mobility MFT to service.

Character grids are provided for numeric, alpha, and symbol characters to permit complete editing of text fields. Each grid includes backspace (←), 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 Mobility 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
H	I	J	K
O	P	Q	R
V	W	X	Y
-->	<--	del	spc
PT-__			
Row	Col	Select	Done

Figure 2.1 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

Figure 2.2 Numeric entry grid

HART			
Tag No PT-3456			
@	[	\	]
”	#	\$	%
&	*	+	-
;	<	=	>
-->	<--	del	spc
PT-3456 OUTPUT < 50% @_			
Row	Col	Select	Done

Figure 2.3 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 Mobility MFT operations.

**Numeric Entry:** Many HART functions require only numeric entry. For these functions the Mobility MFT uses an **Increment** scheme to change the input field one place at a time. Press the **Inc** soft key to move through a scroll of -, ., 0, 1...9, and space until the desired value is displayed. Press the <- - soft key to move the cursor left and press the - -> to move the cursor right. Press the **Done** soft key to end the numeric entry session.

HART			
2600T-262/264: PT-3456			
Damp:			
_ 0.00 S			
<- -	- ->	Inc	Done

Figure 2.4 Numeric Only Entry Screen



### 3.0 Measure Mode

After the Mobility 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.

#### 3.1 Header-line Symbol Key

(see location at right)

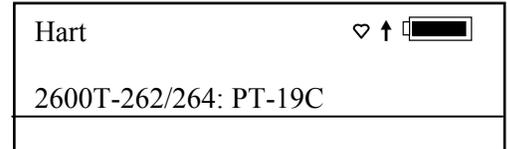
♡ heart symbol indicates active HART communication

↑ up arrow indicates SHIFT key is on

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

 electrical plug symbol indicates the AC adapter (P/N 3KXD311800L0036, barrel type or P/N3KXD311800L0034, pin type) is connected and powering the Mobility MFT

 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 operation

**NOTE:** Some early versions of the DHH810-MFT hardware used a pin style AC adapter connection.



## 4.0 Display Screen

The display screen displays measurements from modules installed in sensor bays S1, S2, and S3 and displays inputs to the Mobility 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

Figure 4.1 Measure Mode Main Screen



## 5.0 Soft Key Menu Options

On the bottom of the main menu screen in **Measure Mode** the following definitions are displayed just above the light blue soft keys. These definitions indicate the current function of each soft key.

Zero Mn/Max Damp More
-----------------------

### 5.1 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 Mobility MFT when performing this function. To prevent unintentional zeroing, a Zero command will be aborted if more than  $\pm 5\%$  of full scale signal is being measured by any Mobility 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.

### 5.2 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.

### 5.3 Damp

Pressing the Damp soft key initiates an exponential averaging function for the measurements over a selected time constant. This function smoothes 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.**

### 5.4 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
----------------------

### 5.5 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 Mobility MFT to normal **Measurement Mode**.

### 5.6 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 Mobility MFT itself.

The Mobility 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.

**5.7 Rcal**

Pressing the **Rcal** key enters the Mobility 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.**

**5.8 Tare**

Pressing the More soft key twice (if VMA module is not installed; with VMA module installed press three times) and select the TARE soft key. The Tare Setup display appears. Move arrow to the Sx of desired module and press the Select soft key. The measured value and units appears in upper right and an edit line appears at lower left. If the value shown is the desired Tare value, press the Select soft key and answer “Yes” to the “Save New Data?” question. Or edit the Tare value to the desired value and Select. Press the Back soft key to return to Measure Mode. The Sx position that has active Tare function will be marked. To remove Tare, press the Tare soft key from Measure Mode screen and use the Tare Setup screen to select Tare off.

<p>Measure <span style="float:right">▬</span></p> <p>S1: VMA <b>0.000</b> mA</p> <p>S2: DDN <b>5.000</b> inW20C</p> <p>S3: No Probe RIO</p> <p>IV: <b>0.000</b> mA</p>	<p>Tare</p> <p>Tare Setup:</p> <p>➔ S1: DDN</p> <p>S2: VMA</p> <p>S3: TIO</p> <p>S1 Tare off</p> <p>S2 Tare off</p> <p>S3 Tare off</p> <p>All Tare off</p>	<p>Tare</p> <p>Before Tare: 5.00</p> <p>➔ Units: inW20C</p> <p>Enter Tare Value:</p> <p><u>5.00</u></p>	<p>Measure <span style="float:right">▬</span></p> <p>S1: VMA <b>0.000</b> mA</p> <p>S2: DDN <b>0.000</b> Tare inW20C</p> <p>S3: No Probe RIO</p> <p>IV: <b>0.000</b> mA</p>
<p>Tare <span style="float:right">More</span></p>	<p>Up Down <b>Select</b> Back</p>	<p>Up Down <b>Select</b> Back</p>	<p>Zero Mn/Mx Damp More</p>

## 6.0 Settings

Press the **Settings** key to set the preferences on the Mobility 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 Mobility MFT model.** The **Settings** menu shows the current settings for the Mobility MFT and allows the user to make adjustments through the use of the soft keys:

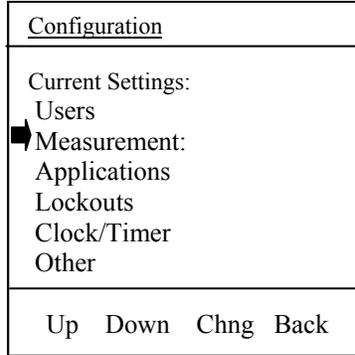


Figure 6.1 Settings

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 and make any changes.

### 6.1 Users

This feature is not currently used.

### 6.2 Measurement

Use the **Up** and **Down** soft keys to position the arrow at the parameter you want to change. Press the **Chng** soft key for the selected parameter and continue to press / release the **Chng** soft key to scroll through a list of selectable choices.

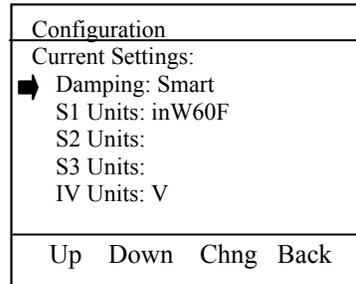


Figure 6.2 Settings Measurement Menu Screen

Damp is an exponential averaging function for measurements made over a selected time constant. This function provides a more stable display by smoothing the peaks and valleys of pulsating processes. To change the damp rate on the unit, position the arrow next to **Damp** and press **Chng**. Continue pressing **Chng** to the damp rate desired. Press **Save** to select the new value.

The damp rate can be set for Smart damping, disabled, or between 0.5 and 30 seconds. Factory default for the damp rate is 0.5 seconds.

### 6.3 Applications

Various applications are available here including Digital Poll (polling device addresses 0 – 15) and other user and factory applications.

## 6.4 Lockouts

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

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

Configuration	
Current Settings:	
➡ Lockout:	Disabled
PV Prompt:	Disabled
View Details	
Up Down Chng Back	

**Figure 6.3 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 Mobility MFT parameters that can be protected by lockout. These include All, Zero, Recalibration, Settings, Units, DOFs, Configurations, Firmware, and PV Prompt. 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 **Chng**. 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 **Chng**. This screen allows the user to choose which parameters to lockout. Use the **Up** and **Down** keys to scroll through the selections. Press **Chng** to choose the desired setting.

Press **Next** to save and switch back to the main lockout screen.

### 6.4.1 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 **Inc** and **Dec** soft keys to change the lockout code value and the **Next** 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.**

### 6.4.2 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 **View Details** and press **Chng**. This screen allows the user to choose which parameters to lockout. Use the **Up** and **Down** keys to scroll through the selections. Press **Chng** to choose the desired option. The screen will show the **enabled** or **disabled** lockout choice made for that function. Press **Back** to **Save**.

### 6.4.3 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.

## 6.5 Clock/Timer

The Clock/Timer allows changes to the MFT internal time / date, the selection of an automatic power off time of not user activity, and whether backlighting should be available.

### 6.5.1 Clock Edit

The Clock Edit option allows the user to change the date and time of the Mobility 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 **Chng** soft key.

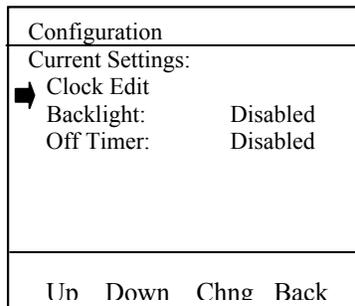


Figure 6.4 Settings Clock/Timer Menu Screen

Choose a clock or date option to adjust by scrolling **Up** or **Down**. Press **Chng** to choose that option. You will be prompted to make your changes by using the **Inc** and **Dec** soft keys to change the value and the **Next** 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 Mobility MFT clock.

To change the AM/PM option scroll **Down** to this option and press **Chng** which will toggle between the AM or PM option. Press **Back** to save the selection.

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. An internal, 10-year life back-up battery continuously powers date & time information. This battery is not serviceable by the user.**

### 6.5.2 Off Timer

To conserve battery life, the Mobility MFT 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 **Chng** to scroll **Up** or **Down** to the auto shut-off time desired. Press **Back** 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 3KXD311800L0036), regardless of the set value.**

## 6.6 Other

This menu item provides information about the handheld and allows selection of battery type, HART communication mode, and digital polling.

### 6.6.1 Model Info

This page shows the base manufacturing model number, the serial number, firmware revision ID, and when the handheld was last updated. It also shows the number of installed DOFs and configured devices with percentages of unused memory space.

### 6.6.2 Battery

Allows selection of alkaline, NiMH, or lithium.

### 6.6.3 HART

Allows selection of fast or compatible. Compatible needs to be used when the device is also connected to another HART master such as a PLC or DCS I/O card that can communicate via HART. Fast can be used when the device is not connected to another HART master such as a PLC or DCS I/O card that only communicates via 4-20 ma (or if the device is not connected to a PLC or DCS I/O card).

### 6.6.4 Enter PC Comm. Mode

When the Mobility MFT is connected to a PC for updates via DPC Manager (see DPC Manager section in this manual), a DB-9 serial cable is used. Occasionally a DB-9 Serial cable is encountered that does not have a DTR line. The DTR line is important to the update process because it is used to initiate and confirm communication between the two machines. If a DB-9 cable without a DTR line is used, the Mobility MFT must be manually placed in the **Enter PC Comm. Mode**. Go to the Mobility MFC Main display and select **Mobility MFT**. Scroll down to the **Enter PC Comm. Mode** menu option and press **Select**. Proceed with update and cycle Mobility MFT power when the update is complete. It is recommended to use fresh batteries or an AC adaptor during update procedures. This mode will automatically time-out after approx. 2 minutes of inactivity and return to the main display.

### 6.6.5 Polling Type

Select between Auto or Digital. This selection is maintained even after a power down. Auto tells the Mobility MFT to first look for a 0 address, and if found, to call it up. If not found, the handheld polls addresses 1 – 15 to find other devices and lists all found devices. Digital tells the Mobility MFT to always poll for devices starting with address 0 up through 15, and to list all found devices. The user can then select any device from the presented list.

## 7.0 General Operation

### 7.1 Sensor Installation/Removal

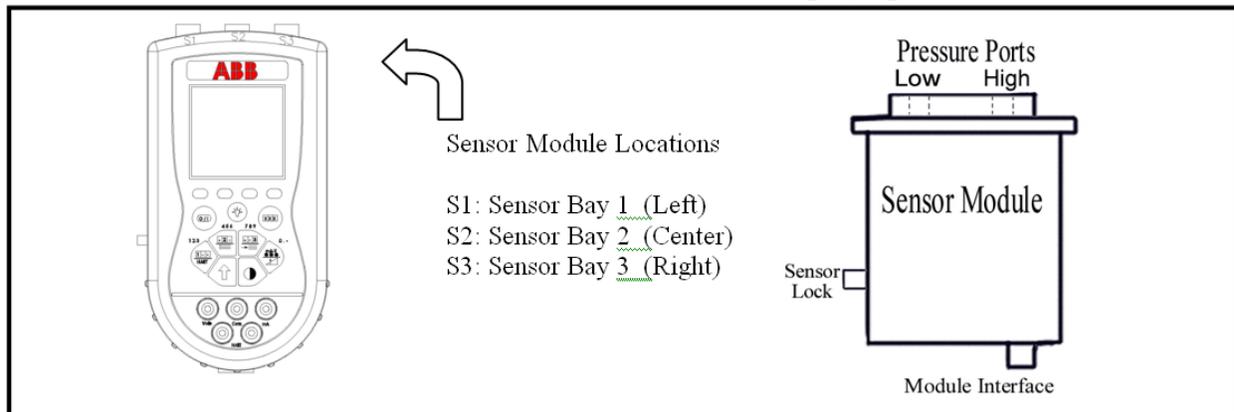
**To install** a new sensor module into a sensor bay, make sure the spring-loaded sensor lock is facing toward the rear of the Mobility MFT. Depress the sensor lock until the base of the sensor module passes into the sensor bay. Push module into bay until it locks into place.

Once installed, the Mobility 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 Mobility 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 Mobility 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.**



**Figure 7.1 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 Mobility MFT should be protected with dummy modules (P/N 3KXD311800L0260) to protect the electrical connector and avoid contamination of or damage to the sensor bays. Dummy modules are shipped as needed to fill Mobility MFT bays.**

## 7.2 Sensor Module Engineering Units

### Pressure

PSI  
 Inches of Water @ 20° Celsius  
 Inches of Water @ 60° Fahrenheit  
 Inches of Water @ 4° Celsius  
 KiloPascals  
 Kilograms/cm<sup>2</sup>  
 MilliBars  
 Bars  
 Centimeters of Water @ 20° Celsius  
 Inches of Mercury (Referenced @ 0° C)  
 Millimeters of Mercury (Referenced @ 0° C)  
 Ounces per square inch

### Temperature

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

## 7.3 Installation & Removal of Batteries – Non-hazardous use

To install or remove the batteries, turn the Mobility 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. Battery replacement is recommended when battery icon shows one segment; however, the Mobility MFT will function briefly after the battery icon is empty.**

## 7.4 Installation & Removal of Batteries – Intrinsically Safe

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

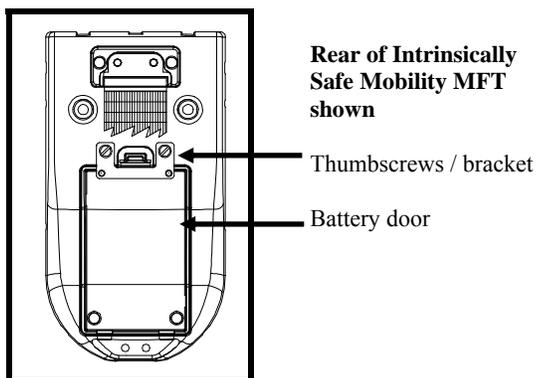


Figure 7.2 Battery Location

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

## 7.5 Over Pressurization - Pressure Modules

If a Mobility 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 Mobility 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.

3KXD311810L002x (Gauge Isolated) and 3KXD311810L004x (Absolute Isolated) Modules are capable of withstanding up to 2x the sensor range without sustaining damage.

3KXD311810L000x (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 3KXD311810L000x sensors have a 150 PSI pressure limit.

x is a place holder for the sensor module 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.**

## 7.6 Media Compatibility - Pressure Sensors

Gauge (3KXD311810L002x) and Absolute (3KXD311810L004x) pressure sensor modules are compatible with fluid and gas medias that are compatible with 316 stainless steel.

Differential (3KXD311810L000x) pressure sensors are for use with clean, dry, non-corrosive gases only.



## 8.0 Applications

### 8.1 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 3KXD311810L000x module, damage to the sensor can occur. To use a 3KXD311810L000x sensor, connect the pressure source to the high pressure port of the 3KXD311810L000x sensor and vent the low pressure port to atmosphere.

When calibrating a gauge pressure unit using a 3KXD311810L002x sensor, the connection is the same with the exception that the 3KXD311810L002x 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.

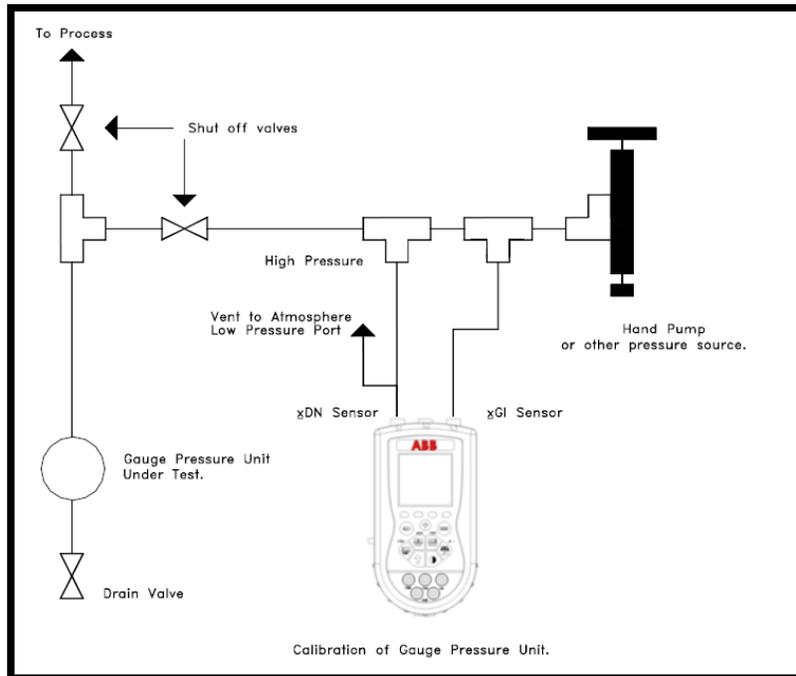


Figure 8.1 Gauge Pressure Connection

### 8.2 Differential Pressure Calibration

Differential pressure gauges and transmitters can be calibrated using 3KXD311810L000x or 3KXD311810L002x 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 3KXD311810L000x 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.

ABB 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, 3KXD311810L000x 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 3KXD311800L0002 or 3KXD311800L0004 sensor through improper use of the equalizing manifold.

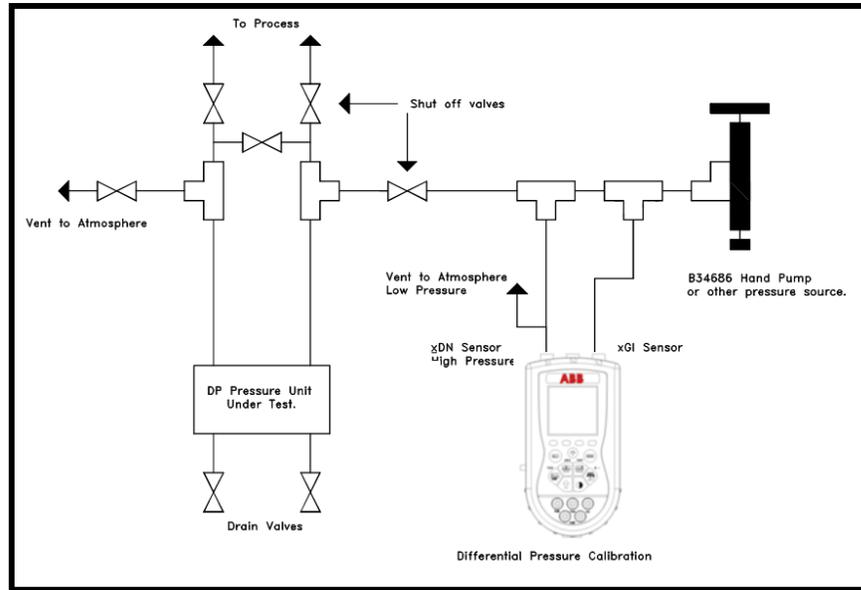


Figure 8.2 Differential Pressure Connection

### 8.3 Additional DP Application Information

In addition to reading gauge pressures, the Mobility 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 3KXD311810L000X sensors. Follow the specific operating procedure for each type of valve manifold.

**3-Valve Manifold:** Make sure all shut-off valves are closed. Connect 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.

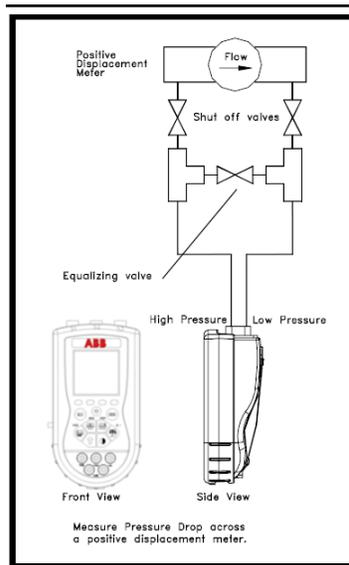


Figure 8.3 3-Valve Manifold Connection

### 8.4 Vacuum and Absolute Pressure Calibration

Vacuum calibrations can be performed with a 3KXD311810L000x 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 3KXD311810L004x 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.

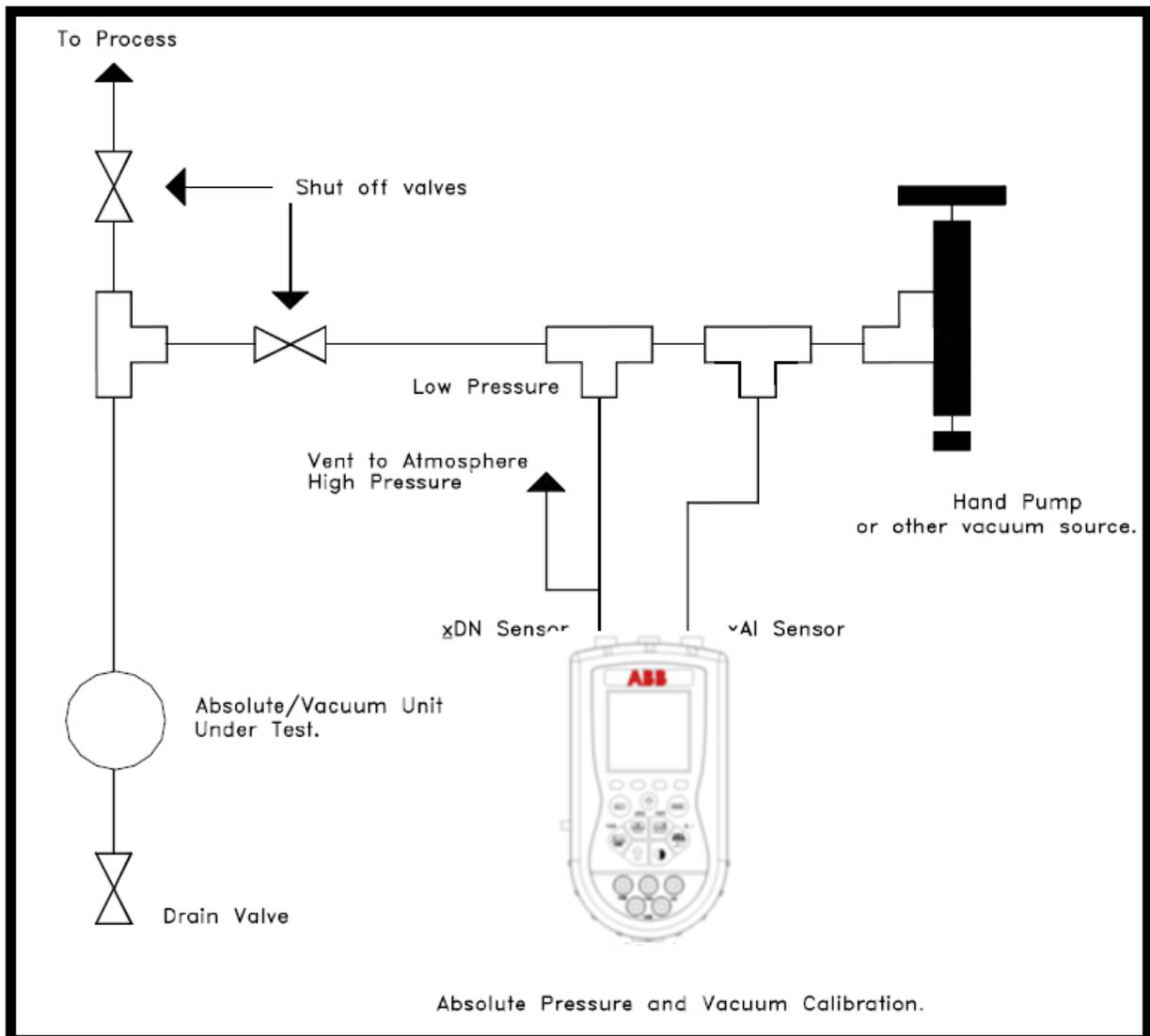


Figure 8.4 Absolute and Vacuum Connection



## 9.0 Milliamp Transmitter

The diagram below depicts the proper connection for measuring the current output from a transmitter. The Mobility 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.

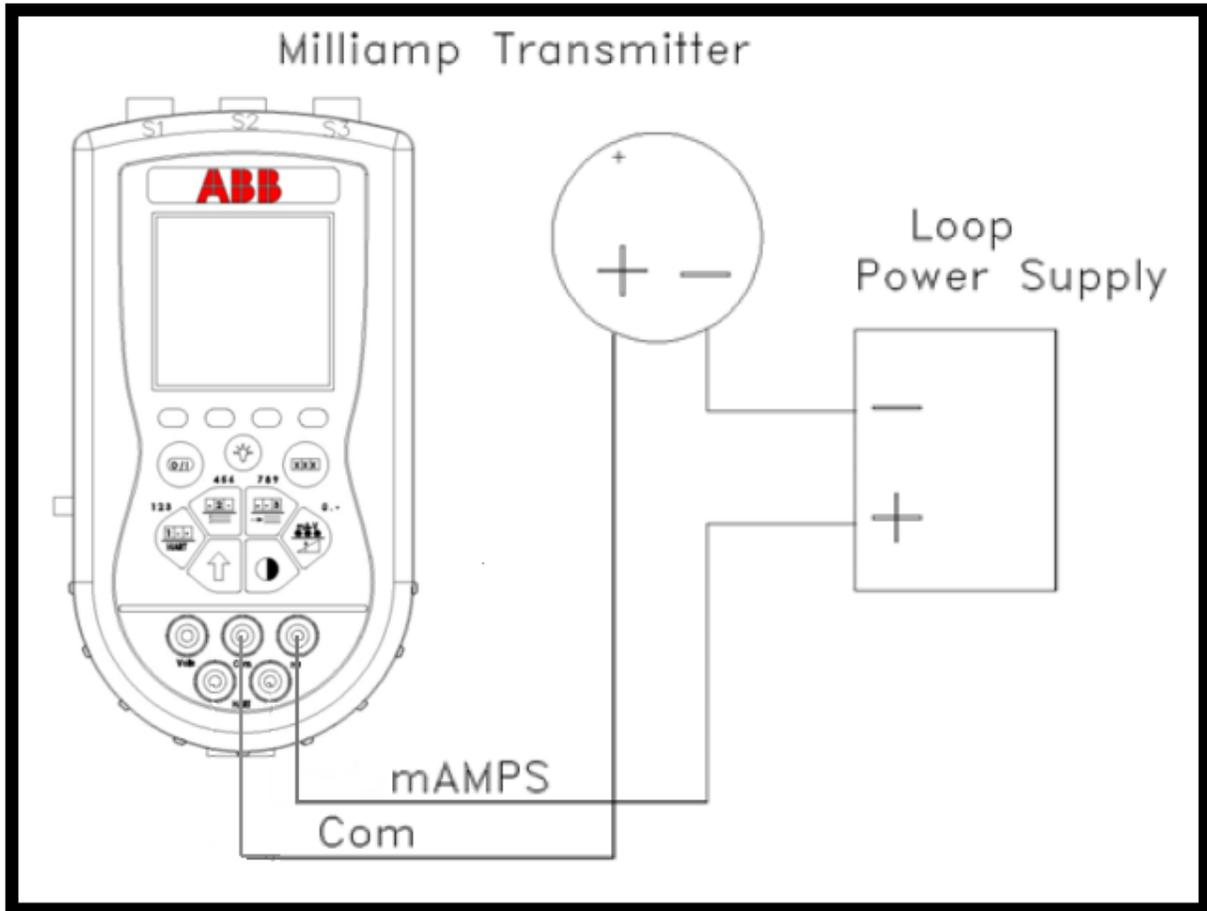


Figure 9.1 Current Transmitter Connection



## 10.0 Voltage Transducer

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

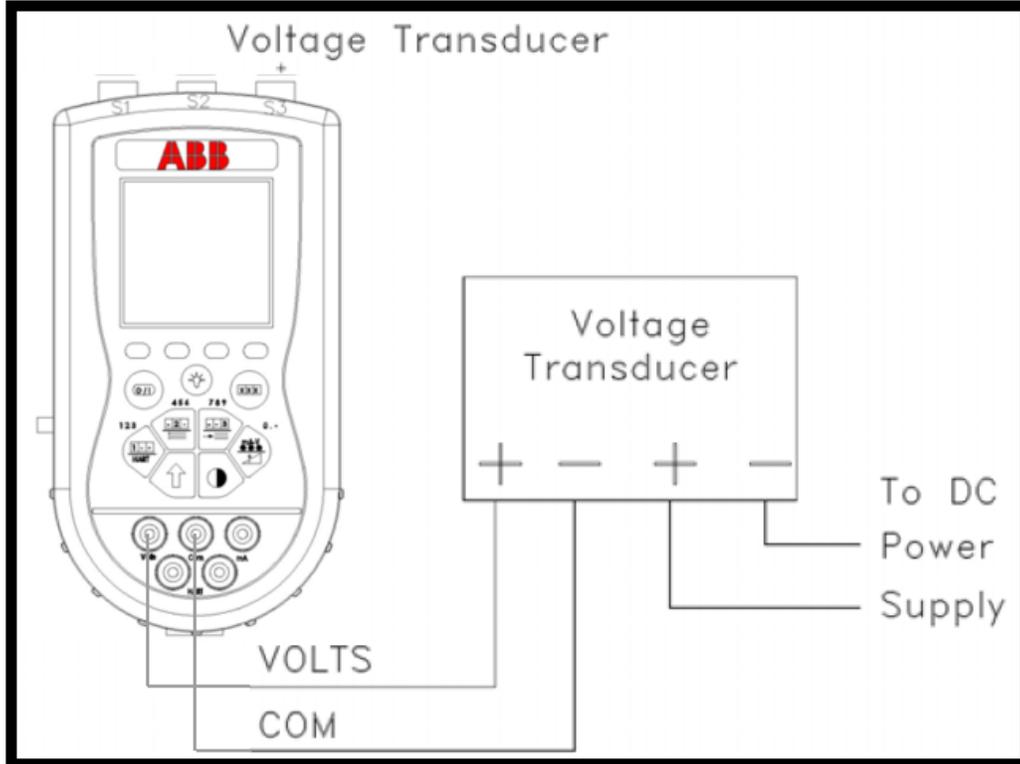


Figure 10.1 Voltage Transducer Connection



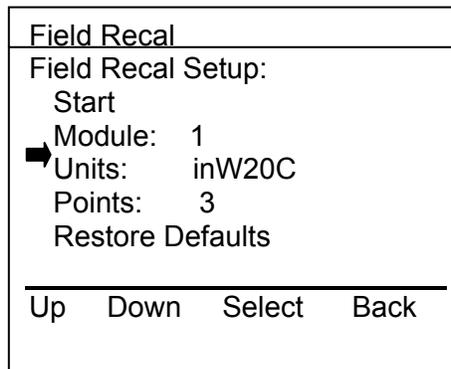
## 11.0 Field Recalibration

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 Mobility MFT or modules. These standards should meet the accuracy requirements for your company or industry. ABB 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, ABB 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.



**Figure 11.1 Field Recalibration Setup Screen**

**Module:** Select this option to choose which sensor module (S<sub>1</sub>, S<sub>2</sub>, S<sub>3</sub>) or mA/V (I or V) meter to calibrate.

**Units:** Allows the user to choose the engineering units to calibrate in. ABB recommends the calibration be performed in the default units of the subject sensor. For example: a 3KXD311810L0004 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.

### 11.1 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.

### 11.2 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	inW20C	
S1:	0.00	inW20C	
Error:	0.000	%	
Adi	Abort	Next	Back

**Figure 11.2 Sample Field Recalibration Screen (3KXD311810L000x 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.

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

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).

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 Mobility 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 Mobility 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.

### 11.3 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 **Inc** and **Dec** soft keys. Press **Next** to go to the next digit. Once you are satisfied with the new target pressure press **Done**. The Mobility 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.



## 12.0 DB-9 Connection Port

All Mobility 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 Mobility MFT firmware improvements, HART<sup>®</sup> Device Object Files (DOFs) and documenting operations. All Mobility MFT upgrades are available via the DPC Manager Download Site (refer to the DOF/Firmware Download Site section in this manual). The Mobility MFT will not need to be returned to ABB 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. Mobility MFT units.***



### 13.0 Hazardous Area Use

The Mobility DHH810-MFT 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 Mobility MFT model numbers and Areas of acceptable use.

Model Number	Non-hazardous Area	Hazardous Area
Mobility DHH810-MFT-xxx-00	√	NO
Mobility DHH810-MFT-xxx-01	√	√

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



Complies With UL3111-1  
CSA C22.2 No.1010.1&157

**MULTIFUNCTION TESTER DHH810-MFTX2X01 Series Intrinsically Safe  
CLASS I; DIV 1 GROUPS A,B,C AND D T5**

**WARNINGS / ADVERTISSEMENTS.**



**Exia**

**SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.**  
**LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SECURITE INTRINSEQUE.**  
**BATTERIES: REFER TO CONTROL DRAWING FOR REPLACEMENT.**  
**FOR REPLACEMENT / REMOVAL OF BATTERIES OR MODULES, USE OF AC ADAPTER OR RS232 PORT MUST ONLY BE PERFORMED / UTILIZED IN NON-HAZARDOUS LOCATION.**  
**LE REMPLACEMENT/L'ENLEVEMENT DE PILES, L'USAGE D'ADAPTATEUR DE courant alternatif OU DE RS232 PORT DOIT ETRE SEULEMENT EXECUTE/UTILISE DANS UN EMPLACEMENT SANS RISQUE.**  
**DO NOT REPLACE, REMOVE OR INSTALL BATTERIES OR MIX NEW WITH USED BATTERIES OR OF DIFFERENT TYPE OF MANUFACTURE.**  
**Ne PAS REMPLACER, ENLEVE OU INSTALLER DES PILES OU MELANGE NOUVEL AVEC LEC PILES UTILISEES OU DE TYPE OU DE FABRICANT DIFFERENT.**  
**MAXIMUM POWER DISSIPATION W/ALL MODULES AND OPTIONS IS 2.5W MAX.**  
**CONSULT MANUAL FOR MODULE MEDIA COMPATIBILITY AND MAXIMUM PRESSURE RANGE AND ALL OTHER USER INFORMATION. CONTROL DRAWING: ID-53-1622**

9P000015PN04

**WARNING label for Intrinsically Safe Mobility MFT Units**

<p>NRTL LISTED</p>  <p style="font-size: x-small;">Listing # E112306 I.S. Test &amp; Measurement</p>	<p>Complies With</p> <p>UL3111-1 CSA C22.2 No. 157 CSA C22.2 No. 1010.1 UL913</p>
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**Intrinsically Safe Certification Label**

Intrinsically Safe Mobility MFTs have special battery door hardware to prevent the accidental ejection of batteries. This hardware consists of threaded inserts in the Mobility 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 Mobility 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 Mobility MFT units in hazardous areas. Refer to the Intrinsically Safe Control Document in the Appendix for exact details. ABB reserves the right to revise the Control Document without notice. Contact ABB for the current Intrinsically Safe Control Document.*

**Note:** *Intrinsically Safe module RIO4000 requires the connection with 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.*

## 14.0 Mobility DHH810-MFT12 with HART® Communications

### 14.1 Overview

The Mobility DHH810-MFT12 includes HART communication functions that allow the user to poll, configure and maintain supported HART field device. The Mobility DHH810-MFT12 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.

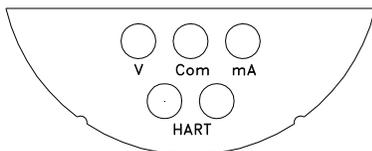
The Mobility DHH810-MFT12 communicates with any HART device through Universal and Common Practice Commands using the standard Generic DOF (Device Object File) but must have the DOF for a specific HART device installed before it can execute Device Specific Commands. Consult the list of available DOFs for an up to date list of HART devices. Refer to the Available DOF Website section of this document for information on accessing this list.

### 14.2 HART Commands

Three HART command types are used by the Mobility DHH810-MFT12 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 Mobility DHH810-MFT12 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.

### 14.3 HART Connections

HART connections are made using the two standard banana jacks (3/4” (1.9 cm) center) located at the bottom of the Mobility DHH810-MFT. Refer to the following diagram. Polarity is not a concern for HART connections so both jack collars are black. ABB supplies a test lead kit (P/N 3KXD311800L0011) complete with standard connector for each model Mobility DHH810-MFT.



#### Mobility DHH810-MFT12 with HART®

Electrical connections are shrouded standard banana jacks (3/4” (1.9 cm) center) for  $\pm 50$  mA/volts measurements. HART® loop connections are also standard banana jacks. Since HART is polarity independent, the HART jacks both have black collars.

Figure 14.1 Connections

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

For low load loops (less than 250 ohm), a 250-ohm resistor will need to be added to insure reliable HART communications. ABB supplies a 250-ohm load resistor in the form of a standard adaptor (P/N 3KXD311800L0012). Refer to the following diagram for details on connecting the adaptor. This method requires the loop be opened in order to make the necessary connections.

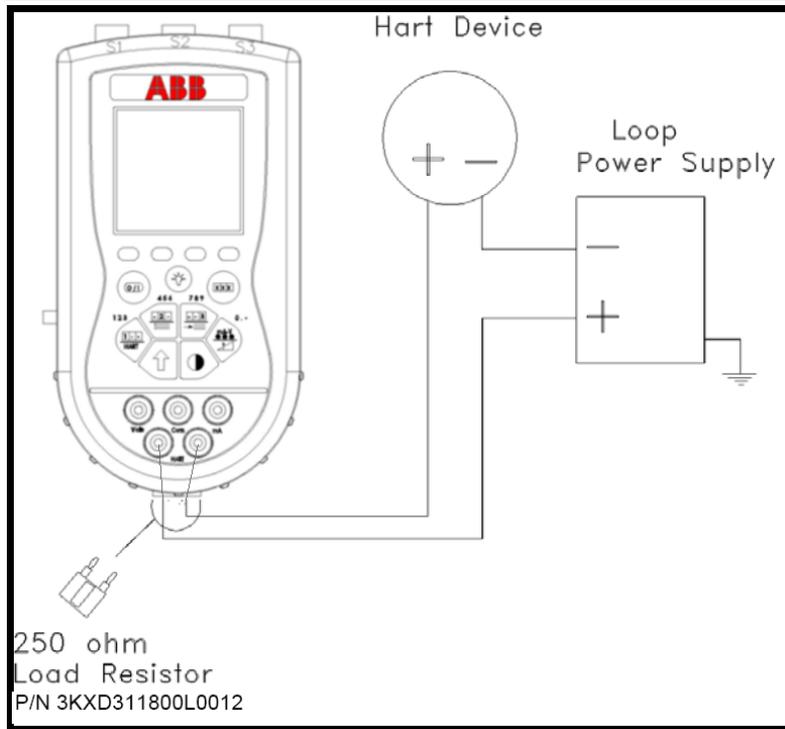


Figure 14.2 Adding a Resistor

When connecting the Mobility DHH810-MFT12 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.

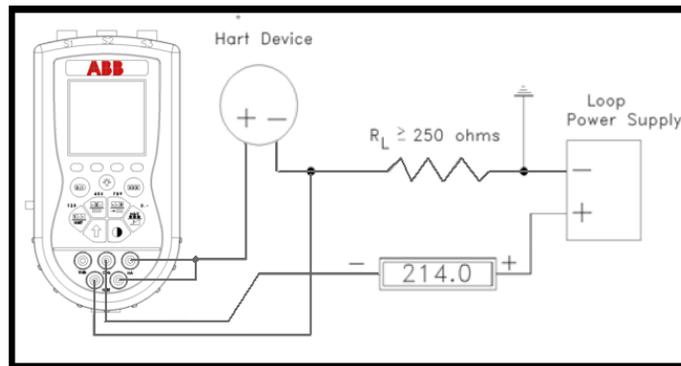


Figure 14.3 Resistor in Loop

#### 14.4 HART Communications

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



Figure 14.4 HART Polling

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

### 14.5 No Device Found Notification

If no device is found, the Mobility 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 **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.

#### 14.5.1 Communication Trouble Shooting

If a HART device is connected to the Mobility 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 Mobility 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.

#### 14.5.2 Multidrop Polling

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

To discontinue the multidrop polling process, press either the **Stop** or **Abort** soft key options and the Mobility MFT will enter the **Hart Offline** screen.

When the Mobility 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 Mobility MFT will then enter the **Hart Device Online** screen.

### 14.6 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:
<ul style="list-style-type: none"> <li>▀ List/Show DOFs</li> <li>  List/Edit Configs</li> <li>  Create Configs</li> <li>  Delete All Configs</li> </ul>
DOFs Installed: 200
Configs Stored: 12
Back    Up    Down    Select

Figure 14.5 Hart Offline Main Menu Screen

**14.6.1 List / Show DOFs:**

Provides a list of installed DOFs (Device Object Files) used by the Mobility 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.

**14.6.2 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 at right. If multiple entries for one device are shown, the most recently saved configuration is always listed last.

Entries in this list may have been saved directly from a connected HART device, created in the Mobility MFT using the **Create Configs** function, copied from another configuration and renamed, or created by editing an existing file. Mobility MFT will also list configurations downloaded from the separately available ABB Device Management System software. 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 Mobility MFT in Offline mode, **Default** config
- C** = saved from connected device in Online mode, **Complete** config
- E** = created by editing an existing file, either D, C, P or S, **Edited** config
- P** = for multivariable devices, **Primary** configuration (Primary Variable)
- S** = for multivariable devices, **Sub**-configuration (other variable[s])

**14.6.3 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.

Offline <span style="float: right;"># </span>		
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

**Figure 14.6 Offline List / Edit**

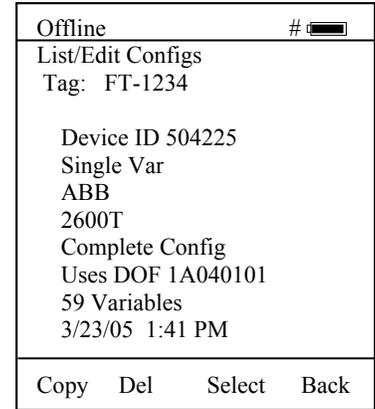
Offline <span style="float: right;"># </span>	
List/Edit Configs	
Tag: FT-1234	
Device ID 504225	
Single Var	
ABB	
2600T	
Complete Config	
Uses DOF 1A040101	
59 Variables	
3/23/05 1:41 PM	
Copy	Del Select Back

**Figure 14.7 Offline List / Edit Configs Detail Screen**

**14.6.4 Delete Configs / Clearing Configuration Memory:**

Individual stored Configurations may be deleted with Mobility 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 Mobility MFT screen; it does not clear memory space.

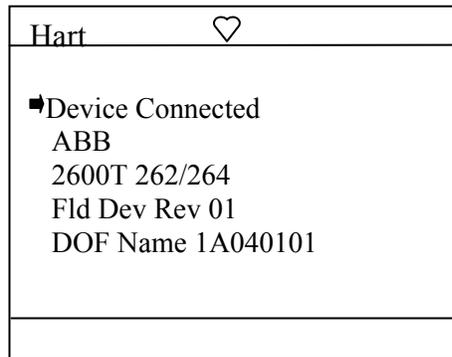
To clear **all** configurations from memory (including active and hidden configurations), enter the **HART Offline Menu Screen** and select the **Delete All Configs** option. The Mobility MFT will ask “Delete ALL Configs... ARE YOU SURE???” Select **Yes** to clear **all** stored configurations from memory.



**Figure 14.8 Offline List / Edit Configs Detail Screen**

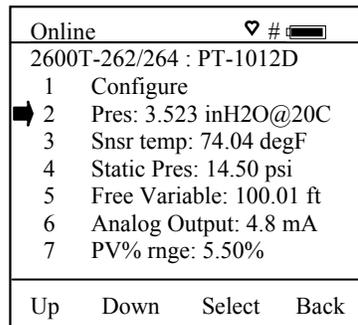
**14.7 HART Online Mode**

Once a HART device is located, the Mobility MFT briefly shows a **Hart Device Initialization Screen** and then 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.



**Figure 14.9 Hart Device Initialization Screen**

**Note:** The screen below illustrates an **ABB 2600T-262/264 rev. 1** pressure transmitter 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.



**Figure 14.10 Online**

**2600T-262/264: PT-1012D:** Line 1 displays the model and tag number or service description of the device connected to the Mobility MFT. The model of the device is fixed and cannot be changed by the user.

**Configure** (or **Device Setup** for some devices): Line 2 is dedicated to accessing the HART configuration menus. See the Device Configuration section below for further information.

**Pres:** Displays the current primary variable value as reported by the digital side of the HART device.

**Snsr temp:** Displays the current secondary variable value as reported by the digital side of the HART device.

**Static Pres:** Displays the current static pressure value as reported by the digital side of the HART device.

**Free variable:** Displays the current free variable value as reported by the digital side of the HART device.

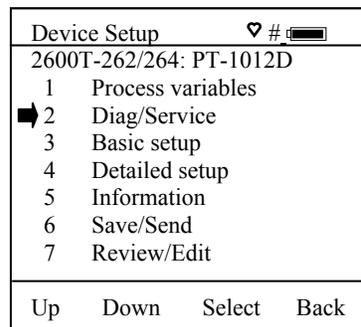
**Analog Output:** Displays the current analog output value as reported by the digital side of the HART device.

**PV % 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.***

### 14.8 Device Configuration

From the **HART Device Online Screen** move the cursor to **Configure** (or **Device Setup**) 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.



**Figure 14.11 Online Device Configuration Screen**

#### Process Variables

This option allows the user to review information concerning the process variables (such as pressure, current, etc...) as reported by the transmitter. For the ABB 2600T-262/264 rev. 1 pressure transmitter, the following can be monitored:

- Sensor Pressure
- Sensor Temperature
- Static Pressure
- Free Variable
- Analog Out
- Process Variable Percent

### Diag/Service

This option allows the user to perform trim functions. For the ABB 2600T-262/264 rev. 1 pressure transmitter, the following can be monitored and / or adjusted:

- Zero Span / Calibration parameters / functions:
  - Zero adjustment
  - Lower Range Value
  - Upper Range Value
  - Pressure Unit
  - Lower Sensor Limit
  - Upper Sensor Limit
  - Rerange 4-20 mA
  - Minimum Span Pressure
  - Maximum Working Pressure
  
- Test Device parameters / functions:
  - EEPROM 1 and 2 Error Status
  - Static Pressure ool Status
  - Sensor Temperature ool Status
  - Electronic Temperature ool Status
  - Sensor Failed Status
  - ASIC Controller ool
  - Cyclic Redundancy Check Start Failed Status
  - Static Pressure oopl Status
  - Sensor Temperature oopl Status
  - Electronic Temperature oopl Status
  - D/A Controller Value oopl Status
  - Different Block Startup Status
  - Over Pressure Minus Status
  - Over Pressure Plus Status
  - Differential Match Number Status
  - ASIC Sensor Fail Status
  - ASIC Overflow Status
  - ASIC Read Timed Out Status
  - T1 Out Physical Limit
  - T2 Out Physical Limit
  - Output Saturated Low Status
  - Output Saturated High Status
  - Analog Output Fixed Status
  - Sensor Database Invalid Status
  - Self Test
  
- Output Trim parameters / functions:
  - Loop Test
  - Scaled D/A Trim (comparison requires external volt meter)
  - D/A Trim (comparison requires external current meter)
  - Factory Trim

- Pressure Sensor Trim parameters / functions:
  - Zero Trim
  - Full Trim
  - Static Trim
  - Factory Trim
  - Pressure Value
  - Lower Sensor Trim Point
  - Upper Sensor Trim Point
  - Lower Sensor Limit
  - Upper Sensor Limit

### Basic setup

This option allows the user to set the tag name, the range values, sensor limits, engineering units, damping values, linearity, and non-linear polynomial and double polynomial coefficients. For the ABB 2600T-262/264 rev. 1 pressure transmitter, the following can be monitored and / or adjusted:

- Tag / Range Value parameters:
  - Tag Name
  - Lower Range Value
  - Upper Range Value
  - Pressure Unit
  - Lower Sensor Limit
  - Upper Sensor Limit
- Transfer Function parameters:
  - Linear
  - Square Root
  - Square Root to 3<sup>rd</sup> Power
  - Square Root to 5<sup>th</sup> Power
  - 5<sup>th</sup> Order Polynomial
  - Double Polynomial
- Characterization parameters:
  - Damping Time
  - Cut Linear Percent
  - Polynomial Coefficients (A0 thru A5)
  - Double Polynomial Coefficients (a0 thru a2, b0 thru b2)
  - Double Polynomial Coefficient Limit Percent

### Detailed setup

This option allows the user to monitor and adjust sensor parameters, to monitor and adjust output and input conditioning values, to adjust analog and HART output parameters such as the polling address, and to review device information such as model number, manufacturer, serial number, and construction materials. For the ABB 2600T-262/264 rev. 1 pressure transmitter, the following can be monitored and / or adjusted:

- Pressure sensor parameters:
  - Zero Trim
  - Pressure Value
  - Pressure Unit
  - Module Type
  - Lower Sensor Limit
  - Upper Sensor Limit
  - Minimum Sensor Span
  - Maximum Working Pressure
  - Maximum Sensor Temperature
  - Minimum Sensor Temperature
  - Full Trim
  - Static Trim
  - Factory Trim
  - Lower Sensor Trim Point
  - Upper Sensor Trim Point
  - Lower Sensor Limit
  - Upper Sensor Limit
  
- Temperature sensor parameters:
  - Sensor Temperature Value
  - Sensor Temperature Unit
  
- Static pressure sensor parameters:
  - Static Pressure Value
  - Static Pressure Unit
  
- Output conditioning parameters:
  - PV Percent Range
  - Lower Range Value
  - Upper Ranger Value
  - Transfer function
  - Damping
  - Cut Linear Percent
  - Polynomial Coefficients (A0 thru A5)
  - Double Polynomial Coefficients (a0 thru a2, b0 thru b2)
  - Double Polynomial Coefficient Limit Percent
  - Set Output Percent Low
  - Set Output Percent High
  - Set Free Variable Unit
  - Set Free Variable High Limit
  - Set Free Variable Low Limit

- Input conditioning parameters:
  - PV Bias Reset
  - Set PV Zero
  - Set PV Value
  - Upper Range Value
  - Lower Range Value
  
- Output adjustment parameters:
  - Meter Type
  - Analog Output Value
  - Loop Test
  - Scaled D/A Trim (comparison requires external volt meter)
  - D/A Trim (comparison requires external current meter)
  - Factory Trim
  - HART Polling Address
  - HART Number of Preambles
  - HART Local Key Mode
  - HART LCD Display Mode
  - HART LCD Transfer Function
  - HART LCD Variable Units
  - HART LCD Variable High Limit
  - HART LCD Variable Low Limit
  
- Device information parameters:
  - Manufacturer
  - Model
  - Device ID
  - Tag
  - Date
  - Write Protect Enable / Disable
  - Descriptor
  - Message
  - Final Assembly Number
  - PV Sensor Serial Number
  - Flange Type
  - Flange Material
  - O-ring Material
  - Drain Vent Material
  - Meter Type
  - Universal Revision Number
  - Field Device Revision Number
  - Software Revision Number
  - Hardware Revision Number

### Information

This option allows the user to monitor and/or adjust PV output parameters, field device parameters, material information parameters, revision number parameters, and miscellaneous parameters. For the ABB 2600T-262/264 rev. 1 pressure transmitter, the following can be monitored and / or adjusted:

- PV output parameters:

- Pressure Units
- Lower Range Value
- Upper Ranger Value
- Transfer function
- Damping
- Cut Linear Percent
- Polynomial Coefficients
- Double Polynomial Coefficients
- Minimum span
- Upper Sensor Limit
- Lower Sensor Limit
- PV Bias Units
- PV Bias Values
- Maximum Working Pressure
- Maximum Sensor Temperature
- Up-Down Scale Mode

- Field device parameters:

- Model
- Manufacturer
- Tag
- Descriptor
- Message
- Date
- Device ID
- Write Protect Enable / Disable

- Material information parameters:

- Flange type
- Flange material
- O-ring Material
- Drain vent material
- Number of Remote Seals
- Remote Seal Type
- Remote Seal Fill Material
- Remote Seal Isolator Material
- Fill Fluid Material
- Isolator Material
- Module Type

- Revision number parameters:

- Universal Rev Number
- Fluid Device Rev Number
- Software Rev Number
- Hardware Rev Number

- Miscellaneous parameters:

- Final Assembly Number
- PV Sensor Serial Number
- Write Protect Enable / Disable
- Meter Type
- Calibration Type
- Procedure Type
- Local Keys Mode
- LCD Display Mode

When navigating menus in the online mode, certain commands will require that the device be taken out of online operation. Whenever this occurs, the screen will prompt: **WARN – Loop should be removed from automatic control → - OK**. 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 **Select** soft key to confirm the action and to continue. Press the **Abrt** soft key to cancel the action and to return to the previous menu screen. After the command is performed, the device will need to be returned to online operation. Whenever this occurs, the screen will return with: **NOTE – Loop may be returned to automatic control → - OK**. Press the **Select** soft key to confirm the action and to return to the previous menu screen.

## 15.0 Device Specific & Generic HART® Communications

ABB supports a growing number of Device Specific DOFs (Device Object Files). Refer to the **Available DOF Website** section of this document for accessing a current listing of HART® devices with full Device Specific communication support. Information found there can be sorted by manufacturer name or model number.

To facilitate communications with HART devices that are not yet supported with Device Specific DOF files or that do not require DOF files, the Mobility DHH810-MFT 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 User's manual for the HART device of interest for more information on the three command levels).

### 15.1 Using Generic HART Communication

The Mobility DHH810-MFT'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 Mobility 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 **Updating the Mobility DHH810-MFT Firmware and DOFs** section of this manual for information on downloading the latest Device Specific DOF files to your Mobility MFT.



## 16.0 RIO4000 Module Instructions

For RTD (Resistance Temperature Detector) Measurement and Simulation when used with the DHH810-MFT Multifunction Calibrator / HART Communicator.

**SPECIAL NOTICE:** New features have been added to the RIO4000 Measure/Simulate module. **The calibrator firmware must be Version 3.42 or later** in order for the RIO4000 module to operate properly.

**Safety Notice:** RIO4000 modules require Intrinsically Safe MFT base units in order to be Intrinsically Safe themselves. The RIO module must only be installed or removed in a safe area. Similarly, RTDs and User Cables must only be connected to or removed from the RIO4000 module in a safe area. For more information on Intrinsically Safe operation, see the MFT instruction manual section on this topic.

### RTD Types Supported for Measure and Simulate

The RIO4000 Module measures and simulates temperature for twenty-two (22) RTD types and accommodates 2-, 3-, and 4-wire configurations for measure and 2-wire configurations for simulate. To enter any of the modes of operation for the RIO module, select the **More** softkey, then select the **Sensr** softkey and the following screen will appear.

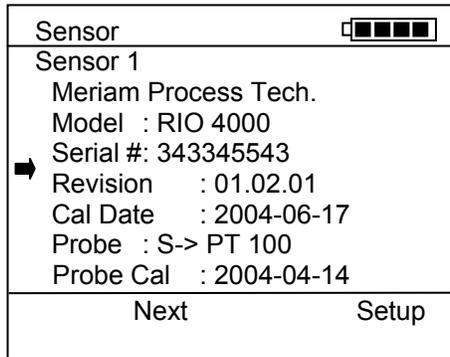


Figure 16.1

Information for the module in the 1<sup>st</sup> bay location will appear as in this example where the RIO module is installed in Bay 1. Otherwise select **Next** softkey to select the correct bay location.

From this window, select the **Setup** softkey to start the user interface for:

- simulation mode
- measure mode
- Rcal Mode

## 16.1 Simulation Mode

## 16.2 Connectors and Wiring Configurations

A Simulation Cable (by manufacturer) must be used for simulation applications. When the simulation cable is plugged into the RIO module, it will automatically be detected and will not allow any measure mode operations. The RIO module can simulate to conventional and smart transmitters.

**Special Note:** In order to maintain the RIO module's accuracy statement, some Pulsed transmitters (Rosemount 644) must be placed in "Active Calibration" mode or a similar continuous mode prior to simulating RTD Type resistance to the transmitter sensor input circuitry. RIO4000 modules meet published accuracy specifications except for the specific use case of PT1000 simulation to Rosemont 3144 temperature transmitters.

## 16.3 Simulation Mode User Interface

Plug the Simulate Cable into a RIO module that has already been inserted into an MFT Bay.

To setup a simulation from the RIO Setup Menu, select **Simulate Mode** from the RIO Setup.

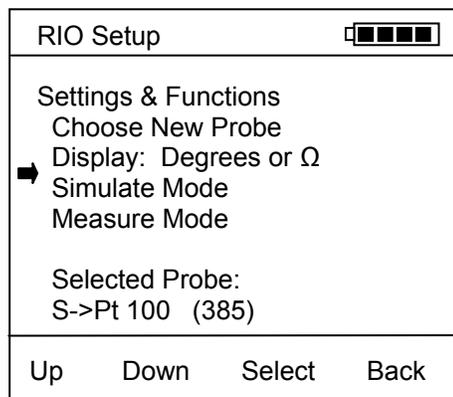


Figure 16.2

The user will be prompted:

**“Short the Sim. Cable Leads (clip together)”**

Clip the alligator clips together and then Select the **OK** soft key. The RIO4000 will perform a self calibration and then the user will be prompted:

**“Connect Sim. Cable Leads to the device”**

Below is an example of 2, 3, and 4-Wire RTD Configurations for an RTD Sensor to a given manufacturer's Temperature Transmitter. There can be different configurations, however these examples illustrate the corresponding RIO4000 connection required to perform RTD Simulation for 2, 3 and 4 Wire RTD's.

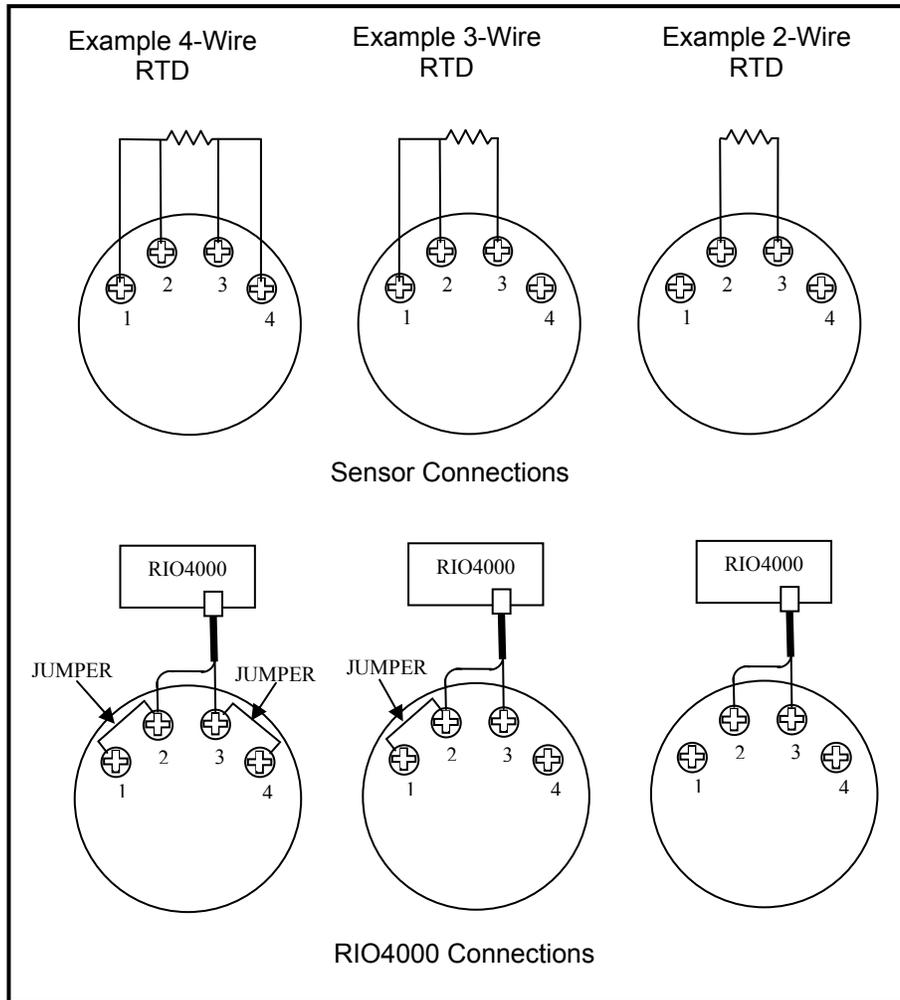


Figure 16.3

Connect the leads and any necessary jumpers to the transmitter RTD sensor terminals and select the **OK** soft key. The RIO Simulation screen shown below will be displayed. From this screen the user can select simulation units, start a simple simulation, assign a step value change, or setup and execute automated step or ramping test procedures.

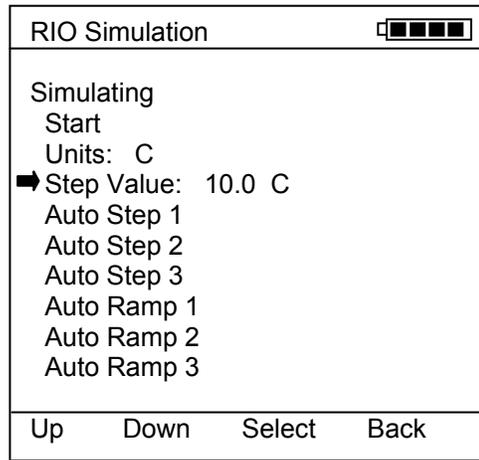


Figure 16.4

Start begins an RTD (resistance) simulation. When Start is selected with the Select soft key, a numeric entry screen appears to facilitate the entry of the desired simulation value (degree or ohm value as selected at Units line). Once a value has been entered and saved, the MFT will use the RTD type and alpha coefficient previously specified to both determine and output the corresponding ohm value through the User Cable.

Units is used to select the temperature unit for the simulation. °C, °F, °K, and °R are the available. The user can also select ohms if desired.

Step Value is a user entered value that can be used to increment or decrement the simulation value after the simulation is started.

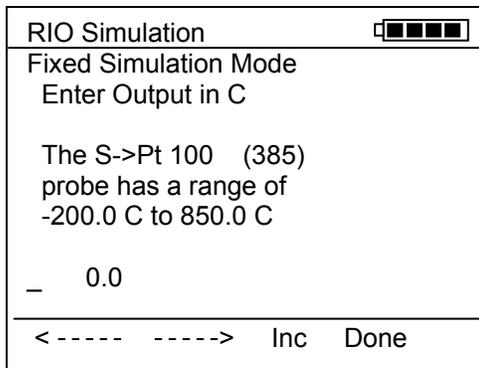


Figure 16.5 Fixed Simulation Value Entry Screen

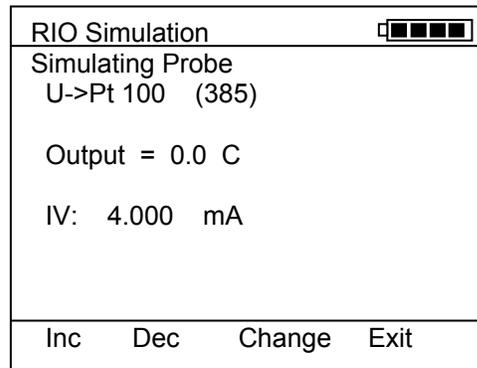


Figure 16.6 Simulation with mA/V

Auto Step 1-3 menu options enable pre-programmed Simulations to be set up and executed automatically. Auto-Steps settings are remembered and stored for future use.

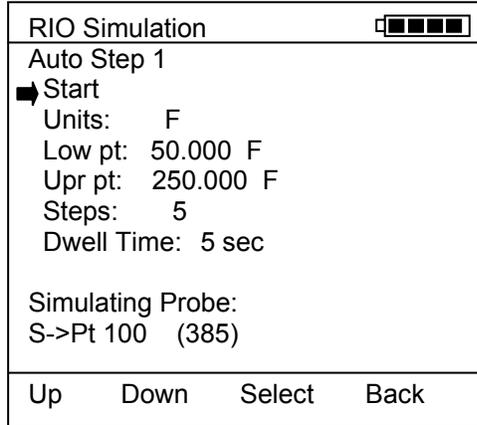


Figure 16.7

Select Start menu option to begin the indicated Auto Step number.  
 Select Units to change the Auto Step x simulation units.  
 Select Low pt to enter the beginning test point value.  
 Select Upr pt to enter the ending test point value.  
 Select Steps to enter the number of test points in the procedure including the Upr pt. The Low pt to Upr pt range will be evenly divide according to the number of steps selected.  
 Select Dwell Time to choose the duration of each simulated point or choose Manual for the manual advance option.

Auto Ramp 1-3 menu options allow pre-programmed Simulations to be set up and executed automatically for those applications requiring an automatic incremental advance from Low pt to Upr pt and down again. User selects a start delay time, a ramp cycle time, direction (up scale, up scale/down scale). Up to three (3) Auto-Ramp settings are remembered and stored for future use.

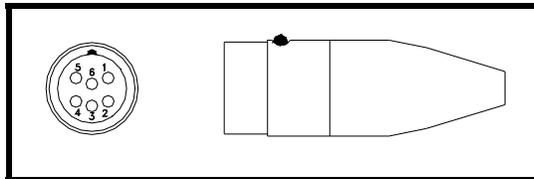
**16.4 Measure Mode**

**16.5 Connectors and Wiring Configurations**

The module has a 6 pin male connector that plugs into a 6 pin female connector of the Measure cable (by manufacturer).

Pt 100 RTDs are available from ABB complete with plug connector, Rs resistor, and 5 foot (152 cm) coiled cable.

**RIO4000 Plug Connector**



The connector is wired to RTDs for measurement applications using a dedicated RTD probe. P/N 3KXD311810L0241 as shown above is the "connector only" and can be used to create a customized RTD connection to the RIO4000 module.

**MOBILITY DHH810-MFT CALIBRATOR/CONFIGURATOR INSTRUCTION MANUAL**

Pins 1 and 2 of the 6 pin connector are utilized for identification of RTD Types. A resistor value (Rs) has been assigned to each of the twenty-two (22) RTD Types supported (see Table 1 below for Rs values).

The connector pin-outs are as follows:

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

Pins 3 and 6 must be connected. See RTD wiring configuration options later in this document for more detail.

**Table 1: Supported RTD Materials / Rs Sensor Resistor No.**

Material	R0	ALPHA	Rs (Probe ID)	Temp Range (deg C)	Recommended Calib Resistor
Platinum	100	0.00385	100	-200 to +850° C	100 Ω
Platinum	1000	0.00385	1000	-200 to +630° C	1000 Ω
Platinum	100	0.00392	46.4	-200 to +630° C	100 Ω
Platinum	100	0.00391	56.2	-200 to +630° C	100 Ω
Platinum	25.5	0.00392	17.8	-200 to +630° C	100 Ω
Platinum	200	0.00385	178	-200 to +630° C	100 Ω
Platinum	470	0.00392	261	-200 to +630° C	1000 Ω
Platinum	500	0.00392	316	-200 to +630° C	1000 Ω
Platinum	500	0.00391	383	-200 to +630° C	1000 Ω
Platinum	500	0.00385	464	-200 to +630° C	1000 Ω
Platinum	1000	0.00375	1210	-50 to +500° C	1000 Ω
Platinum	100	0.00393	68.1	-200 to +962° C	100 Ω
Platinum	100	0.00389	82.5	-200 to +630° C	100 Ω
Platinum	98.129	0.00392	21.5	-200 to +600° C	100 Ω
Platinum	200	0.00392	215	-200 to +630° C	100 Ω
Copper	9.035	0.00427	12.1	-100 to +260° C	10 Ω
Copper	100	0.00427	121	-100 to +260° C	100 Ω
Nickel	100	0.00618	31.6	-60 to +160° C	100 Ω
Nickel	120	0.00672	147	-80 to +260° C	100 Ω
Iron	604	0.00518	562	-100 to +200° C	1000 Ω
Iron	908.4	0.00527	681	-100 to +200° C	1000 Ω
Iron	1816.81	0.00527	1470	-100 to +200° C	1000 Ω
10 Ω resistor	na	na	14.7	Precision cal resistor	Na
100 Ω resistor	na	na	26.1	Precision cal resistor	Na
1000 Ω resistor	na	na	825	Precision cal resistor	Na

Based on the Rs value connected between pins 1 and 2, the corresponding RTD Type look up table is utilized.

Plug connectors are available for customers that want to make up their own RTD Type standards. If no Rs resistor is installed between pins 1 and 2, a copper wire (Rs = 0) must be wired between pins 1 and 2. When Rs = 0 is detected, the RTD Type setting will be defaulted to the last RTD Types setting used. This setting will display briefly at the bottom of the MFT display when the cable is attached to the RIO module.

**Option 1: RTD wiring styles for User Wired RTD Type with Manufacturer's Plug**

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

**2-wire RTDs**

Connect pins 3 and 4 to one wire/terminal of the RTD. Connect pins 5 and 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 pins 5 and 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 pins 3 and 4 to each of two wires/terminals of the same color. Connect pins 5 and 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.

**Option 2: RTD Measure Cable**



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

**RIO Measure Cable**

P/N 3KXD311810L0242 general-purpose connector is used for connecting to RTD wires or terminals to obtain temperature measurements directly from an RTD devices. One pair of white and one pair of red Alligator clips are suitable for connecting to 2-, 3-, or 4-wire RTDs.

**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.

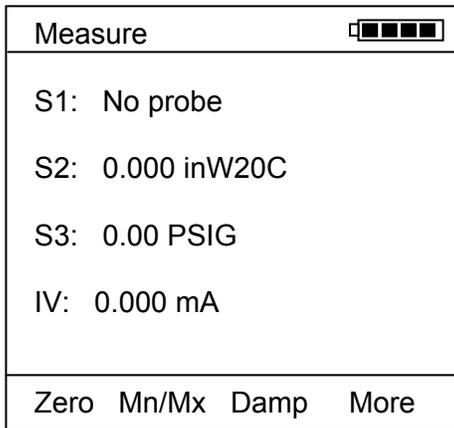
4-wire RTDs

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.

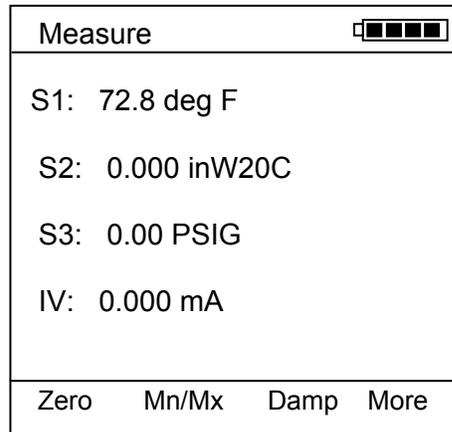
**Note: Restrictions apply for use of Intrinsically Safe RIO4000 modules / MFT units in Hazardous Areas. RTDs and / or RIO4000 modules must only be removed or replaced in non-hazardous areas. RTDs, P/N 3KXD311810L0241 connectors and P/N 3KXD311810L0242 User Cable must only be connected to the RIO4000 in a non-hazardous area. See the Intrinsically Safe Control Document in the Appendix for more details.**

**16.6 Measure Mode User Interface**

Install the RIO4000 module in one of the MFT bays and turn on the MFT. If no RTD is connected to the RIO module, the corresponding Sx line on the display will indicate “No Probe.” Be sure the RTD type is correct - if not correct, go to the RTD Sensor Module Setup display to change the type.



**Figure 16.8 MFT Measure Mode Display showing open RTD**



**Figure 16.9 MFT Measure Mode Display showing temperature**

If an RTD type is connected (depending on the Rs value), the MFT displays the measured temperature. Units can be changed by pressing the MFT Shift key (and letting go) and then the appropriate Units Sensor X key. The various temperature units will display after each button push. Press the Shift key again to return the MFT to standard Measure Mode.

When the MFT is in Measure Mode and the User Measure Cable is connected to the RIO4000 (Rs = 0 ) the MFT will default to the last user setting for RTD Type and display the measured temperature and/or Ohm reading.

**Note:** The last user setting for RTD Type is briefly displayed at the bottom of the LCD.

To Select a New RTD Type, Select the More soft key, then the Sensor soft key and choose the correct "Sensor X" location that corresponds with the module bay that the RIO module and select the Setup softkey. The following will be displayed:

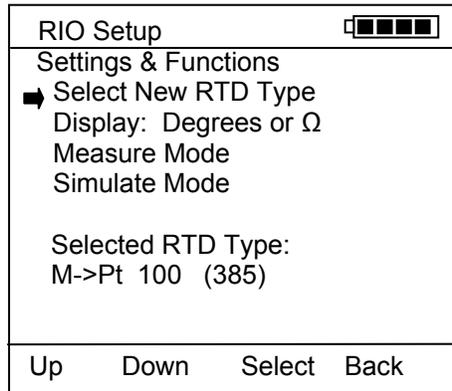


Figure 16.10

Move the right arrow to the "Select New RTD Type" option and press the Select softkey. The following will be displayed.

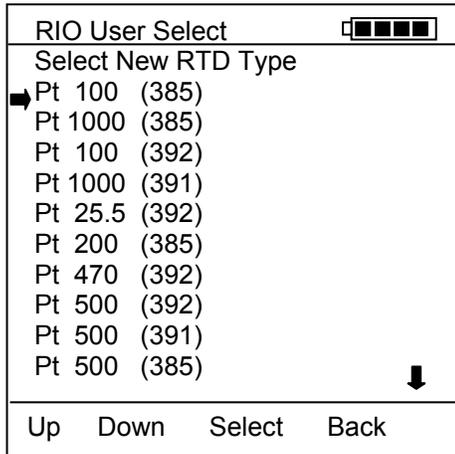


Figure 16.11 RIO User Select Screen 1

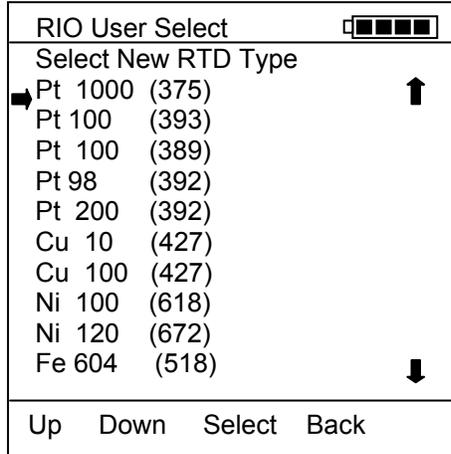


Figure 16.12 RIO User Select Screen 2

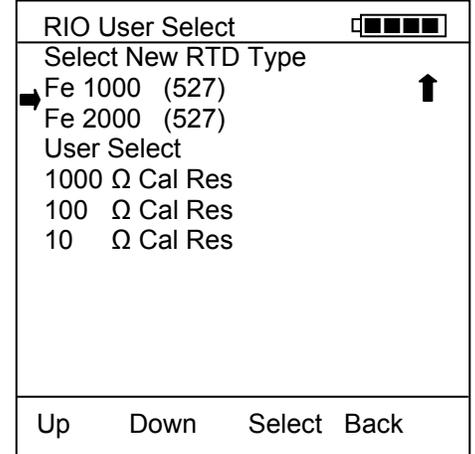
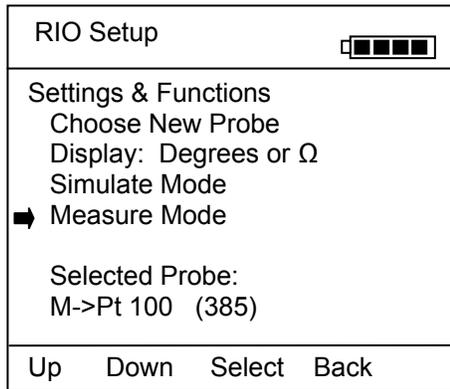


Figure 16.13 RIO User Select Screen 3

Push the Up and Down soft keys to move the cursor to the desired RTD / alpha coefficient combination. Press the Select soft key to accept the selection and continue.

**Helpful Hint:** To move page by page, press the **Shift** key to change the soft key row to "**Up Down PgUp PgDn**." Subsequent press of the **Up** or **Down** key will return the **Select** and **Back** soft key options to the display.

After selecting the RTD Type, the RIO Setup screen will appear as shown below. Use the Up and Down soft keys to move the cursor to the desired setting or function and press Select.



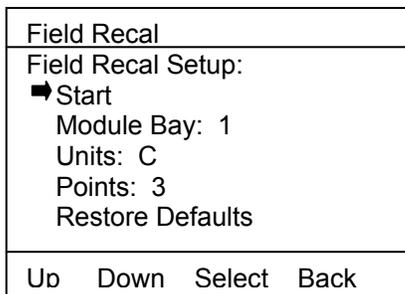
**Figure 16.14**

- Choose New Probe:** returns to RIO User Select screen
- Display:** set display for:
  - Degrees or Ω (1 Line)**
  - Degrees and Ω (2 Lines)**
- Simulate Mode:** Simulation setup screen, see below
- Measure Mode:** Returns to Measure Mode
- Selected Probe:** shows current RTD Type selection

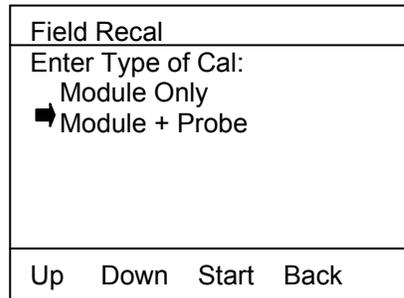
To display a temperature reading the user can also press the Back soft key or press Measure Mode key.

### 16.7 Rcal – Field Recalibration

The RIO4000 module can be recalibrated / re-certified using appropriate local standards and the MFT's Rcal feature. Two recalibration methods are available. See the FIELD RECALIBRATION Section of this MFT Operator Instruction Manual for general information on the Rcal feature and initial setup. Once pertinent parameters and options have been entered, move cursor arrow to the Start option on the main Rcal menu and press the Select soft key. This initiates the recalibration type selection display shown below.



**Figure 16.15 Rcal Feature Main Setup Menu**



**Figure 16.16 Calibration Type Selection Menu**

**Module Only** method makes use of external precision resistors to calibrate the module’s resistance measurement. The module is set up to allow calibration using precision 10 Ω, 100 Ω, or 1000 Ω resistors rated for a total tolerance of 10 PPM. The user selects the best resistor value for the types of RTDs the RIO4000 will be used to calibrate.

One ABB connector (P/N 3KXD311810L0241) is needed for each precision resistor used. A 10 Ω, 100 Ω, or 1000 Ω precision resistor is connected to pins 3 & 4 and 5 & 6 as though a 4-wire RTD were being connected (many precision resistor are available in a 4-wire configuration). In addition, an Rs resistor corresponding to 10, 100, or 1000 Ω should be connected across pins 1 and 2 of the connector. The Rs resistor allows the MFT to automatically determine which precision calibration resistor is connected. For 10 Ω the Rs value is 14.7 Ω, for 100 Ω the Rs value is 26.1 Ω and for 1000 Ω the Rs value is 825 Ω. Make sure the external precision resistor is securely engaged in the RIO4000 connector. Wiring between the connector and the precision resistor 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 at most to replicate the original factory accuracy.

Selecting the Module Only option and connecting a 100 Ω precision resistor causes the following display to appear.

RTD Calibrate	
Standard: 100 Ω Cal R	
Edit Cal Res Value	
Calibrate	
Cal Res	= 100.000
Old Ref	= 100.165
New Ref	= 100.164
Adjusted	= 99.999
Up	Down Select Back



**Figure 16.17 Module Only Recalibration Screen**

**Cal Res** is the actual value of the connected calibration resistor. Edit this value by selecting “Edit Cal Res Value” menu option. **Old Ref** is the resistance value from the RIO4000 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 **Cal Res** to determine the new calibration coefficient. Press the **Save** soft key to store the new calibration point. Repeat the process by alternately connecting a 1000 Ω precision resistor and a 10 Ω precision resistor to calibrate the full RIO4000 range.

If the Cal Res value does not need to be edited, the user may move the cursor down to the **Calibrate** option on the **Module Only Recalibration Screen** and press **Select**. The calibration is completed and the following display is shown as confirmation.

RTD Calibrate
Calibration complete Date: 2004-05-20  Remove Cal Resistor
OK

**Figure 16.18 Module Only Calibration Confirmation**

**Module Only** cal can also be performed using a User Cable (P/N 3KXD311810L0242) and a precision resistor. When the User Cable is connected to the RIO4000, the RIO User Select Screen is displayed. The user can select the 10 Ω, 100 Ω, or 1000 Ω precision resistor options from the list and proceed as above.

Module + Probe method is an alternative for users who need a module and probe reference standard calibrated as a “matched set;” that is, using a specific RIO4000 module with a dedicated RTD probe and cable to achieve the best possible displayed accuracy. This method allows adjustments to be made to the Module + Probe calibration by using an external temperature bath, dry block, Ice Point Calibration Reference Chamber, or other temperature 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 RTD 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 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

**Figure 16.19 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 (-4° F to +176° F) (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 RIO4000 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” (RIO4000 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 the actual 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

**Figure 16.20**

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:

Field Recal			
Cal Not Saved:			
Exit Cal			
Restart Cal			
Save Cal Data			
Up	Down	Select	Back

**Figure 16.21**

**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, press the Next soft key. This will change the calibration temperature value for the 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 as directed by the user 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.

## 16.8 Specifications

Input impedance: > 10 megohm

Warm-up time: ≤ 30 Seconds to full rated accuracy

Ohm Measurement Accuracy :

Temperature Effect: ≤ 0.001 ohm / °C

RTD Measurement Accuracy: See RIO Accuracies Table

RTD Simulation Accuracy: See RIO Accuracies Table

Resolution: ± 0.1° or ± 1° for RTDs

Resistance range: 0 – 4000 ohms

Temperature:

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

Operating: 14° F to 122° F (-10° C to 50° C)

Connectors – Measure temperature: standard connector for reference RTD or Measure Cable for general purpose measurements on installed RTDs

Simulate resistance: User Cable with connector and two alligator clips

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

Units: °F, °C, °R, °K, ohms

Weight: 3 ozs (85 g)

**RIO4000 Accuracy Table**

Ambient temperature limits: -10 °C to +50 °C (14 to 122°F)

Accuracy statements are for ambient temperatures of 18° C to 28° C. (64 to 82°F)

Apply the Temperature Coefficient for ambient temperatures below 18° C (64°F) and above 28° C (82°F)

RTD Type	(α)	T Range (°C)	Operating Temperature 18<T<28 °C *	
			Measure (2, 3, 4 Wire)	Simulate (2 Wire**)
Pt 100	385	-200 to 0	0.3	0.3
		0 to 400	0.4	0.4
		400 to 800	0.5	0.6
Pt 100	391	-200 to 0	0.3	0.4
		0 to 630	0.4	0.6
	392	-200 to 0	0.4	0.4
		0 to 630	0.5	0.6
Pt 100	393	-200 to 0	0.5	0.4
		0 to 400	0.4	0.5
		400 to 962	0.6	0.6
Pt 200	385, 392	-200 to 0	0.2	0.5
		0 to 400	0.6	0.4
		400 to 630	0.8	0.6
Pt 500	385, 392	-200 to 0	0.2	0.4
		0 to 400	0.3	0.5
		400 to 630	0.4	0.6
Pt 500	391	-200 to 0	0.2	0.5
		0 to 400	0.4	0.4
		400 to 630	0.5	0.6
Pt 1000	385	-200 to 0	0.2	0.5
		0 to 400	0.3	0.4
		400 to 630	0.4	0.6
Pt 1000	375	-50 to 0	0.3	0.4
		0 to 500	0.3	0.5
Cu 10	4274	-100 to 0	2	2
		0 to 260	2	2
Cu 100	4274	-100 to 0	1	1
		0 to 260	1	1
Ni 100	618	-60 to 160	0.2	0.4
Ni 120	672	-80 to 260	0.2	0.4
Fe 604	518	-100 to 200	0.3	0.5
Fe 908	527	-100 to 200	0.3	0.5
Fe 1816	527	-100 to 200	0.2	0.5

\*Temperature Coefficient = 0.02 °C/°C

\*\* For 2-Wire Simulation, Manufacturer's 2 Wire Connector/Cable is Required.

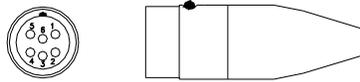
## 16.9 Accessories for RIO4000

### PART NUMBER

P/N 3KXD311810L0186 Simulation Cable for RTD 2-Wire simulation.



P/N 3KXD311810L0241 Mating plug connector for use with customer's dedicated RTD



P/N 3KXD311810L0242 Measure cable assembly; RTD connector, 5 ft. (1.52 m) copper cable, four (4) alligator clips



P/N 3KXD311810L0240 Pt 100 RTD, DIN Class "A", 0.00385 alpha, 4 leads, 1/4" (0.635 cm) O.D., SS probe, 10" probe length, 3.5" (8.9 cm) handle and 5 ft (1.52 m) coiled cable with connector for RIO4000 temperature module



## 17.0 TIO0110 Module Quick Instructions

### For Thermocouple and milli-Volt Measurement and Simulation

**Safety Notice:** TIO1000 modules require Intrinsically Safe MFT base units in order to be Intrinsically Safe themselves. 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 Mobility 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 for 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 ABB 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
- $\pm 110.000$  mV dc

#### Simulate

- $\pm 110.000$  mV dc output for the same t/c types

### 17.1 Measurement Mode

Install the TIO0110 module in any Mobility MFT bay location and turn on the Mobility MFT. If no t/c is connected to the Mobility 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 <span style="float: right;">▣▣▣▣▣</span>	
S1:	T/C open
S2:	0.000 inW20C
S3:	0.00 PSIG
IV:	0.000 mA
Zero Mn/Mx Damp More	

Figure 17.1 Mobility MFT Measure Mode Display showing open T/C

Measure <span style="float: right;">▣▣▣▣▣</span>	
S1:	72.8 deg F
S2:	0.000 inW20C
S3:	0.00 PSIG
IV:	0.000 mA
Zero Mn/Mx Damp More	

Figure 17.2 Mobility MFT Measure Mode Display showing temperature

To access the setup menu for the TIO0110 module, press the **More** soft key from the **Measure Mode** of the Mobility 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.

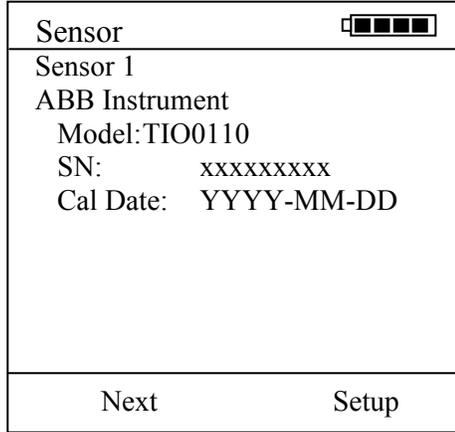


Figure 17.3

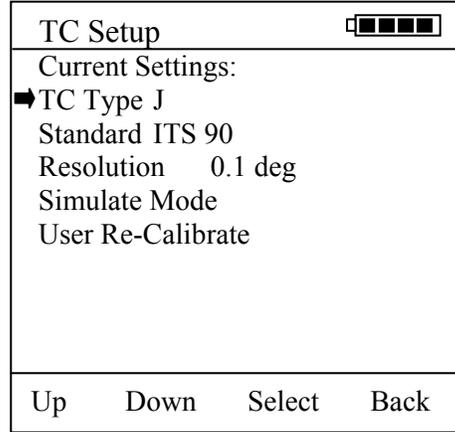


Figure 17.4

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.

**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.

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

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

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

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

## 17.2 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.

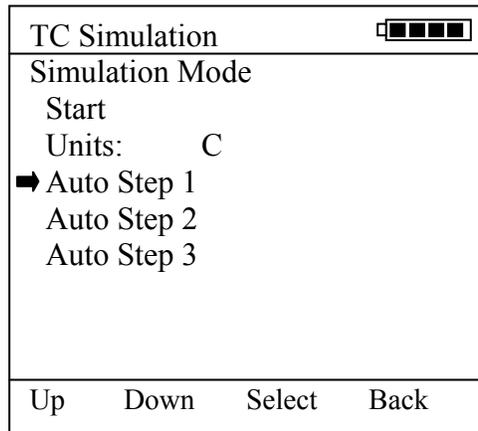


Figure 17.5

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 Mobility 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.

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.

**Auto-Step x** menu options allow pre-programmed simulations to be set up and executed automatically by the Mobility MFT / TIO. Auto-Steps are automatically stored for future use.

TC Setup <span style="float: right;">▣▣▣▣▣</span>			
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

Figure 17.6

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

### 17.3 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 Digital Multi-Meter (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

Figure 17.7

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 Mobility MFT Calibration Manual for details of the re-calibration process.

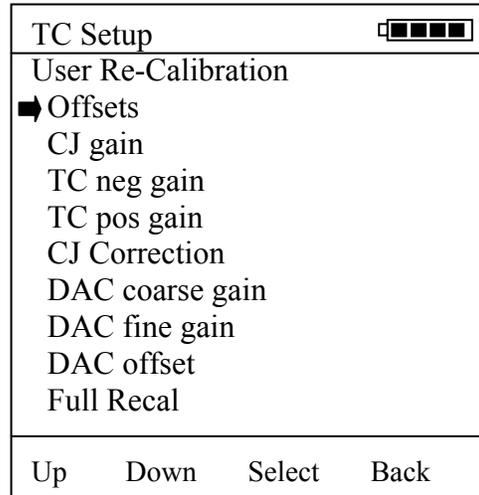


Figure 17.8

- Offsets** – Input offsets
- CJ gain** – Gain of cold-junction compensation
- TC neg gain** – Thermocouple negative-gain slope
- TC pos gain** – Thermocouple positive-gain slope
- CJ Correction** – Offset of cold-junction compensation
- DAC coarse gain** – Coarse output DAC gain slope
- DAC fine gain** – Fine output DAC gain slope
- DAC offset** – DAC offset constant
- Full Recal** – Sequences above steps and stores all calibration constants.

## 17.4 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 Mobility MFT (simulate / source mode only)
- Units: °F, °C, °R, °K, milli-Volts
- Weight: 3 ozs (85 g)

## 17.5 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.**

All Mobility Hand-Helds are CE marked.

## 17.6 Accessories for TIO0110

P/N 3KXD311810L0243	T/C Wire Kit 1 for types E, J, K, N, T - mini t/c connector, 1 m (3.3 ft.) cable, wire ends
P/N 3KXD311810L0244	T/C Wire Kit 2 for types B, K, R - mini t/c connector, 1 m (3.3 ft.) cable, wire ends
P/N 3KXD311810L0245	mV simulation cable assembly; mini t/c connector, 1 m (3.3 ft.) copper cable, alligator clips



## 18.0 VMA0055 Module Quick Instructions

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

#### Notices:

- 1) The VMA0055 module is **not hot-swappable**. To install the module, turn the Mobility MFT base unit OFF, install the VMA 0055 in any bay and turn the Mobility MFT back ON. Attempting to install the VMA module with Mobility MFT power ON will cause the Mobility MFT to shut down. **Damage could occur** to the Mobility MFT or module.
- 2) VMA0055 modules require Intrinsically Safe MFT base units in order to be Intrinsically Safe themselves. The VMA module must be installed or removed in a safe area. For more information on Intrinsically Safe operation, see the Mobility 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

- $\pm 55.000$  V dc
- $\pm 100.000$  mA dc

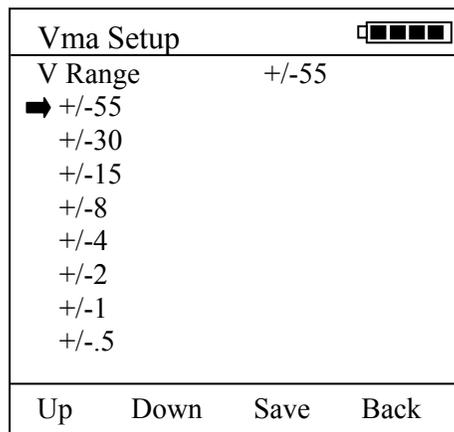
#### Source / Simulate

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

### 18.2 Measurement Applications

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

Use "Volts" and "Com" jacks on the VMA module to measure voltage from upper range values of  $\pm 500.000$  milli-volts to  $\pm 55.000$  volts. The "V Range" should be set to the appropriate range for best accuracy. This is done from the Mobility 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.



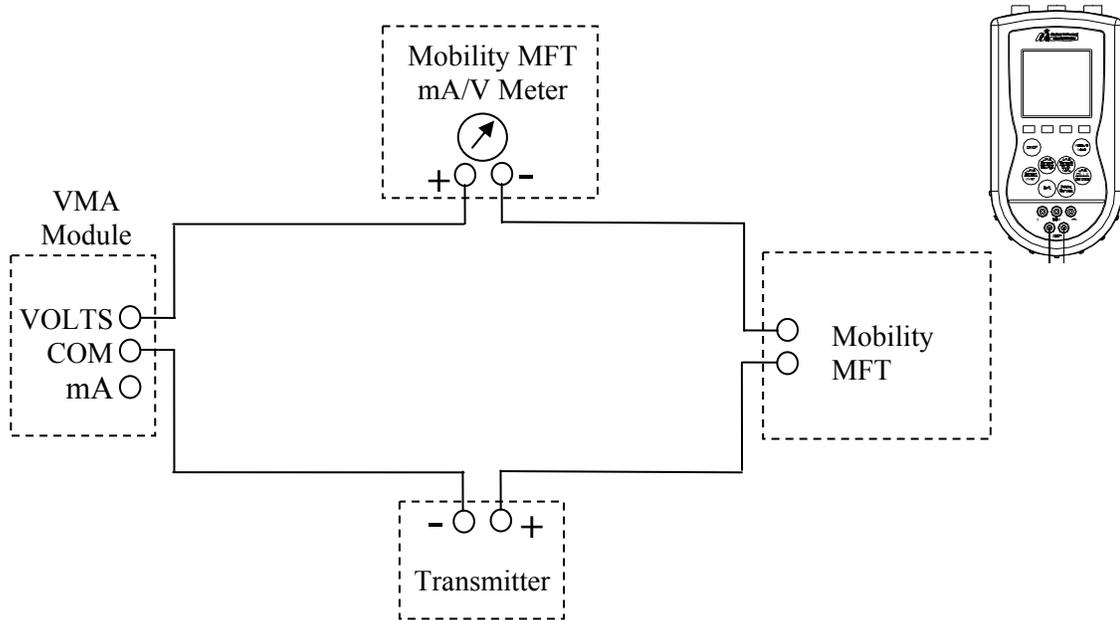
**Figure 18.1 Voltage range selection display**

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.

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

### 18.3 Loop Power Application

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



**Diagram 18.1 – Loop Power Connection Diagram for simple low load loop**

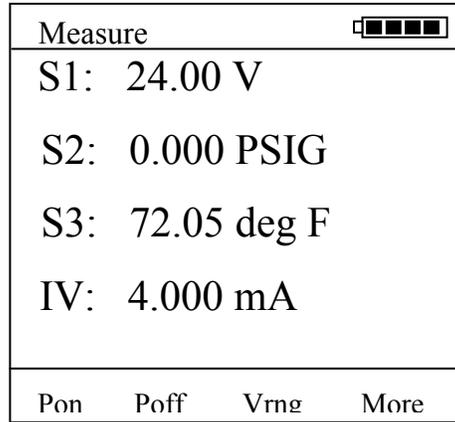
Connect the test circuit according to the Diagram 26.1.

Include 250-ohm resistor for low load loops.

The loop power is turned on from the Mobility 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



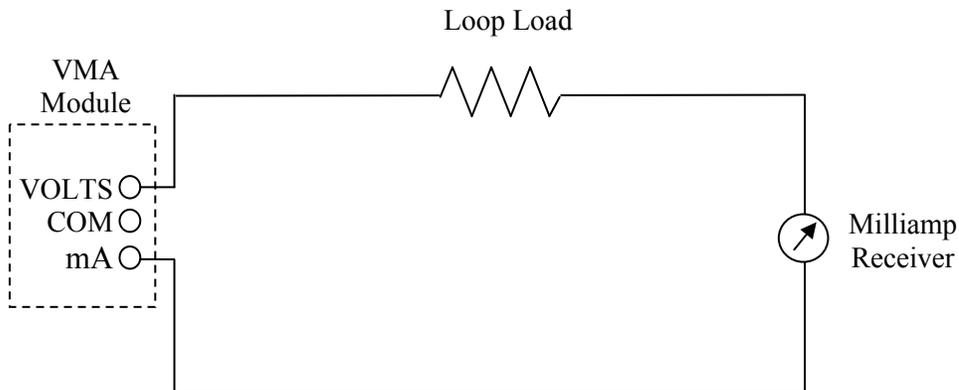
**Figure 18.2**

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

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

### 18.4 Manual Source and Simulation Operations—

Wire the test circuit as shown in Diagram 26.2 and 26.3 depending on the desired application:



**Diagram 18.2 - mA Source & V Source Connection Diagram**

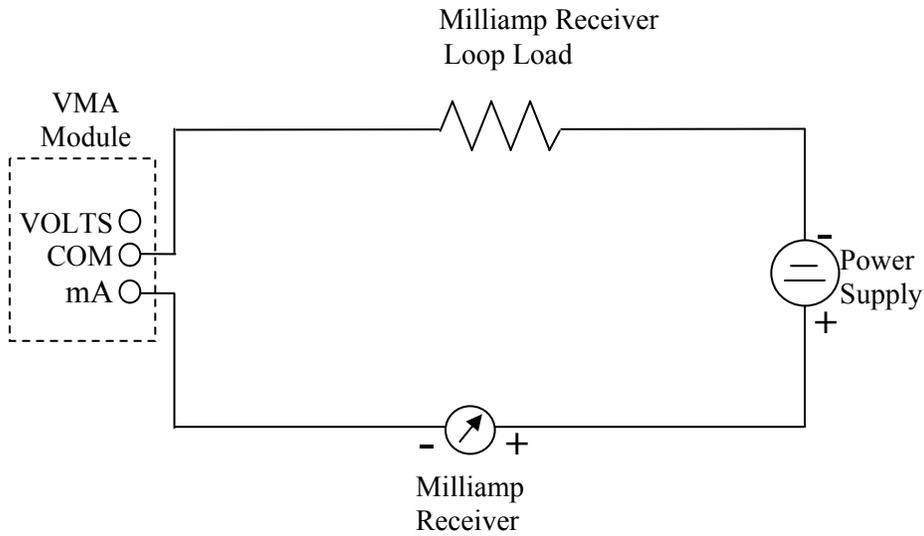


Diagram 18.3 - Transmitter Simulation Connection Diagram

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

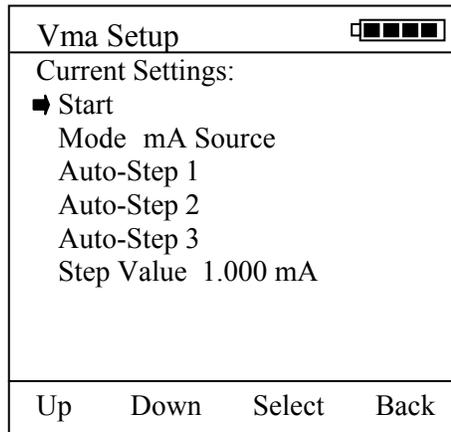
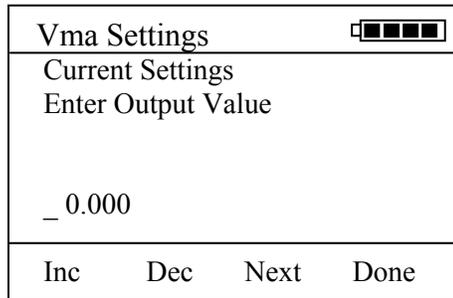


Figure 18.3 VMA Main Setup Display

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. From the VMA Main Setup Screen, select **Start**. The user will be prompted to enter the starting value with the following screen. Use the soft keys to enter the desired value.

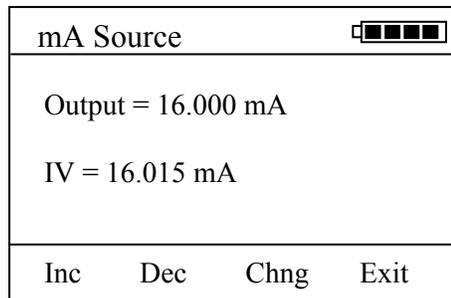


**Figure 18.4**

- 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

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

The operation depicted below is for a mA Source. Use the soft keys to change the output value as desired. Note that the Mobility 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 Mobility MFTs "Shift" and "Units mA / V" keys as usual (see the Mobility MFT instruction manual section on Changing Units for more information).



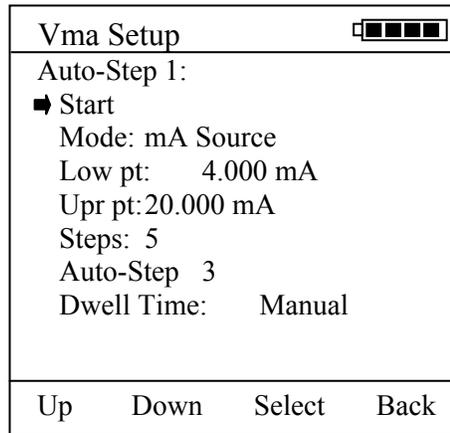
**Figure 18.5**

- 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.

## 18.5 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.

Refer to Diagrams 26.1 and 26.2 and make connections for the desired application. From the VMA Main Setup Menu, arrow down and select **Auto-Step X**.



**Figure 18.6 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.

### 18.6 Resolution, Range, Accuracy for VMA0055 Module

<b>mA dc</b>	<b>mA Measure Mode</b>	<b>mA Source Mode</b>
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

<b>Volts dc</b>	<b>V dc Measure Mode</b>	<b>V dc Source (Regulated) Mode</b>
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

<b>2-wire Transmitter Simulate</b>	<b>mA Simulation</b>
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.

<b>Regulated Loop Power</b>	<b>Regulated Power</b>
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

### 18.7 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.**

All Mobility Hand-Helds are CE marked



## 19.0 Updating the Mobility DHH810-MFT Firmware and DOFs

### 19.1 Overview

Firmware upgrades and new DOFs can be downloaded via the Internet in either of two ways. The first way is to use the DPC Manager utility (shipped with each Mobility MFT or downloaded from the DOF Download Site) on a PC with Internet access to download files from the DOF Download Site automatically and then update the MFT. The second way is to use the DOF Download Site to download the needed files to the host PC and then use the DPC Manager utility to coordinate the update of the Mobility MFT. The Download Site enables users to stay current as new DOF's or revisions of existing ones are posted. Automatic email notices of new DOF postings are sent to all users who have logged on to the Download Site and registered their email address under "Subscriber Options." Firmware updates are free of charge. DOFs are available by subscription.

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

Refer to the Available DOF Website section of this manual to access a list of currently available DOF's for HART device communication. Sort the list by clicking on any column header.

### 19.2 Who has access to the Download Site?

All Mobility MFT purchasers have unlimited access to the Download Site for three years from date of shipment. These customers may download all published files from the site to their Mobility MFT upon proper registration of the MFT using the DPC Manager software. After the initial three-year period, the Download Site is available with a paid three-year subscription fee. Contact an ABB representative for more information and to purchase the three-year subscription.

### 19.3 PC Requirements for Download Operations

ABB 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. USB ports can be used with USB to serial adapters as well. The RS-232 port must not be shared with other software applications during update operations.

### 19.4 Preparing the Mobility MFT

All Mobility MFT models come ready to connect to an IBM compatible PC using the DB-9 socket located at the bottom of the Mobility MFT enclosure. A six-foot male DB-9 to female DB-9 cable (P/N 3KXD311800L0013) included with every MFT. Similar cables are acceptable. For PCs that only have USB connections, a USB to DB-9 serial port adapter can be obtained (P/N 3KXD311800L0115). Connect the Mobility MFT to the PC and power up the Mobility MFT using fresh internal batteries or the optional AC Adapter (P/N 3KXD311800L0036). The Mobility MFT is ready for download operations.

### 19.5 Available DOF Website

After ensuring the PC has Internet access, establish a connection to the Available DOF website by going to [www.abb.com/instrumentation](http://www.abb.com/instrumentation) and making the following selections:

- "Device Management and Fieldbus" from the main page
- "Hand Held Configuration Tools" from the main page
- "DHH800-MFT" from the main page
- "Mobility Hand Held Supported Devices" under Links in the right hand column.

A list of currently available DOF's for HART device communication is presented as shown below:

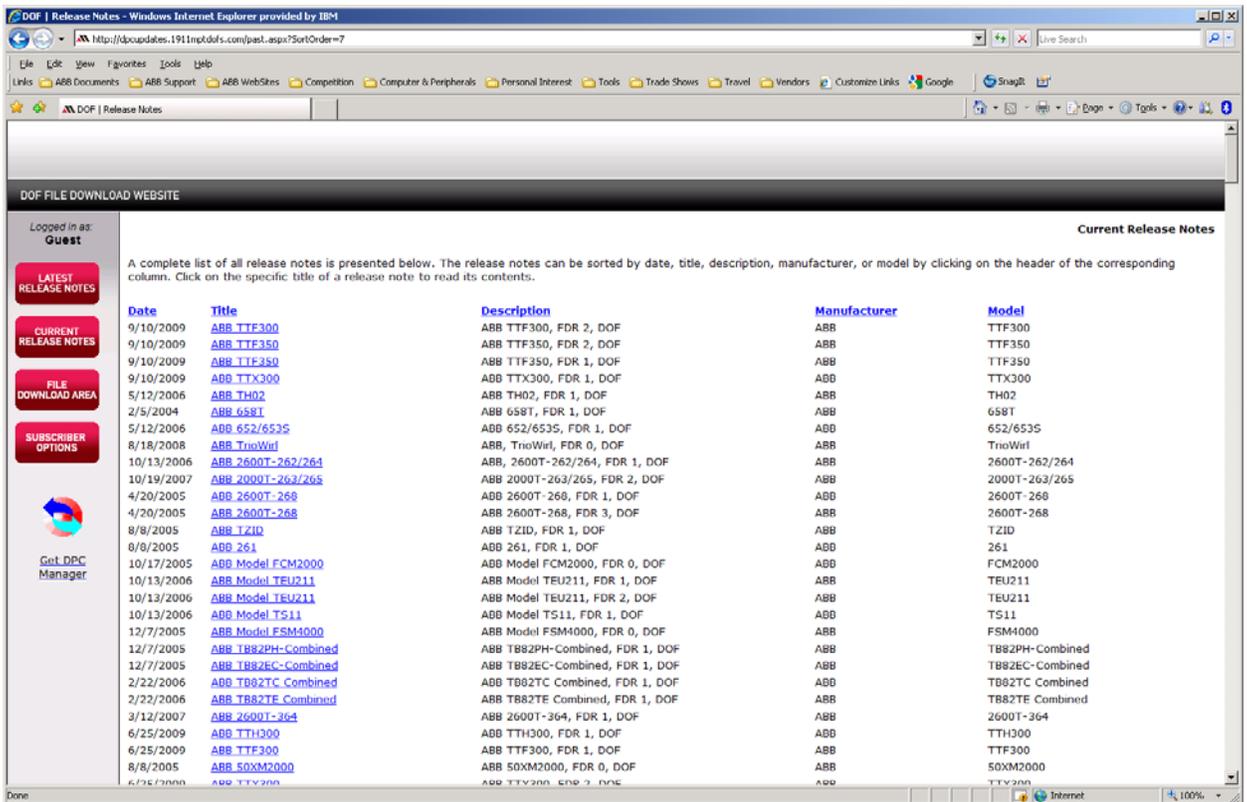


Figure 19.1 Mobility Handheld Supported Devices View

In addition to listing the Available DOFs, the website also provides access to the **Current Release Notes** screen that lists and describes the most recent firmware releases posted and the posting date. Individual files can be downloaded from the detailed description page of each DOF or firmware file listed. The screen describes the most recent firmware releases available and dates posted. Five (5) columns are shown on this page: Date, Title, Description, Manufacturer, and Model. These categories will assist the user in finding the release descriptions of the DOF, Mobility MFT Installer or Mobility MFT Firmware releases of interest. Each column can be sorted to assist searches of the release database.

**19.6 DOF Memory Maintenance**

DOF flash memory will become fragmented after many DOF download sessions to add new or update existing DOFs. Fragmentation reduces the total number of DOFs that can be saved in memory (500 DOFs is the nominal capacity of the flash memory). When fragmentation becomes extreme, the DHH810-MFT will not accept additional DOF downloads even though the number of DOFs stored is far less than 500. Periodic DOF memory maintenance will be needed to optimize DOF memory.

The Offline screen indicates the number of DOF files stored in memory and the percentage of free memory available for additional files. 320 DOFs ideally use about 64% of the available memory, so 36% of DOF memory should be free. The example at right indicates that only 25% of DOF memory is free. This indicates fragmentation.

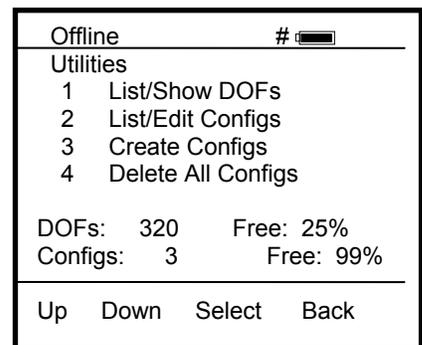


Figure 19.2 HART Offline Menu Screen

To optimize DOF flash memory, it is necessary to delete all DOFs and then reload them all in one session. Connect the DHH810-MFT to a host PC that has DPC Manager installed (see DPC Manager Utility in section 21.0 for more information). There are 2 methods for doing the re-installation.

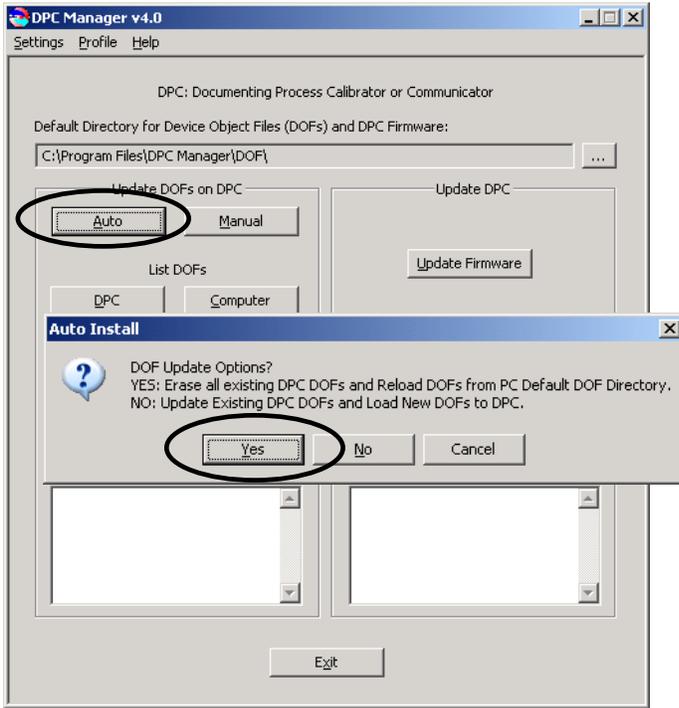


Figure 19.3 Download All DOFs from DPC Manager

Method 1 - This procedure works well for users that only download a select number of DOFs from the Internet onto the PC that are needed with instruments in their installation.

Launch DPC Manager and select the “Manage DPC Device Driver and Firmware Updates” option. Go to the Tool Bar and click on “Settings”, then click on the “Advanced” option. The screen to the left will appear.

Under “Update DOFs on DPC” section on left side, click on the “Auto” button. An Auto Install dialog box will appear.

Select the “Yes” response to the “DOF Update Options?” question to erase all existing DOFs and re-load DOFs from the default DOF directory.

Method 2 - This procedure is needed when all available DOFs are downloaded from the Internet onto the PC. The MFC will run out of memory if an attempt is made to download all stored DOFs (as is done in Method 1). To overcome this, a profile must be created and used for determining which DOFs to download onto the MFC. Refer to section 21.2.3 “Update Handhelds” for instructions to “Re-Install DOFs” to erase handheld memory and to install selected DOFs.



## 20.0 Upgrading DHH810-MFT22 to Support HART Device Configuration

To turn on a license that enables support for configuring HART devices permanently, proceed as follows:

Contact your ABB Manufacturers Representative or direct salesperson to obtain pricing and purchase the upgrade license with P/N 3KXD311810L0300. You will need to provide the serial number of your handheld to get the upgrade license.

The serial number of your handheld can be found by going to the following menu options:

Press the Settings key and go to Other/Model Info/Serial #.

After purchasing your upgrade license, you will be given a key code that is based on your handheld serial number. Once licensed, your handheld will permanently support HART device configuration. To enter the license key, press the Settings key, go to Applications/Upgrade Base Unit, enter the license key and press Done.



## 21.0 DPC Manager Utility

The DPC Manager software should be loaded onto the host PC from the Mobility Interface Software CD (included with Mobility MFT shipment). The DPC Manager coordinates the download operations from the host PC to the Mobility MFT. Periodic improvements may be incorporated into this software. Therefore, ABB recommends periodic comparison of the DPC Manager version installed on the host PC to the latest available version on the Available DOF Website to insure use of the up-to-date software. All instructions herein are based on use of version 4.0 which is the latest version available at the time this manual was written. Later versions of the DPC Manager can be obtained by purchase of a new Mobility Interface Software CD or it can be downloaded by making the following selections from [www.abb.com/Instrumentation](http://www.abb.com/Instrumentation)

- “Device Management and Fieldbus” from the main page
- “Hand Held Configuration Tools” from the main page
- “DHH810-MFT” from the main page
- “DHH800/810 Software Download DPC Manager, Version x.y” link from the right side column

Note that the DPC Manager software is >20 MB and phone modem downloads can be lengthy. After downloading the file, double click on the DPCsetup.exe self extracting zip file, type in a storage location, select all files, and press the Extract Items button. Go to the location where the extracted files were stored and run the setup file to install DPC Manager. Directions for using DPC Manager are found under the Help Tool Bar selection.

### 21.1 Running DPC Manager

The operating system firmware and device object files (DOFs) can be updated using flashing software that is part of the DPC Manager software. DPC Manager is shipped with your handheld and it also can be downloaded off the Internet.

#### 21.1.1 Prerequisites:

- A. DPC Manager is installed on a computer that has Internet Access.
- B. The latest version of DPC Manager is installed and the correct COM Port has been configured.
- C. A standard RS-232 Cable is connected to the DPC and the DPC is turned on. Note: The DPC cannot communicate HART while simultaneously communicating through the RS-232 connection.
- D. It is highly recommended that the power adapter be used while performing any RS-232 communications. This includes updating the DPC and uploading / downloading between DMS and the DPC.

#### 21.1.2 Launching DPC Manager

After double clicking on the desktop DPC Manager icon, the following will appear:

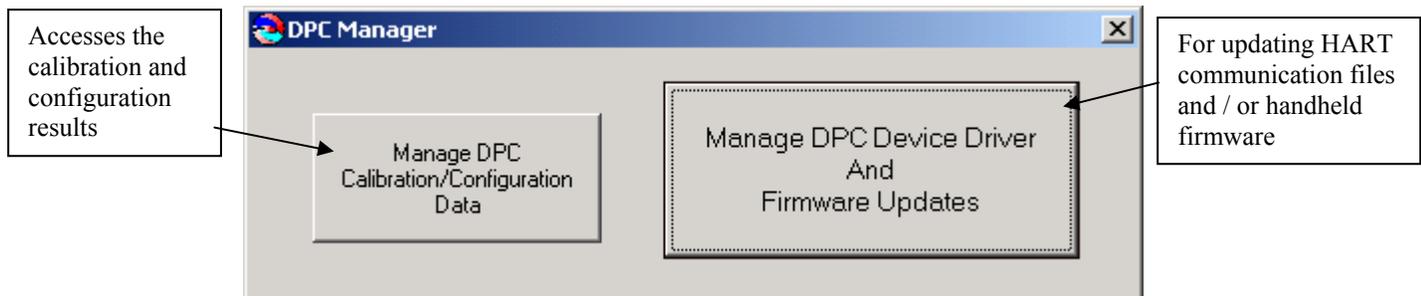
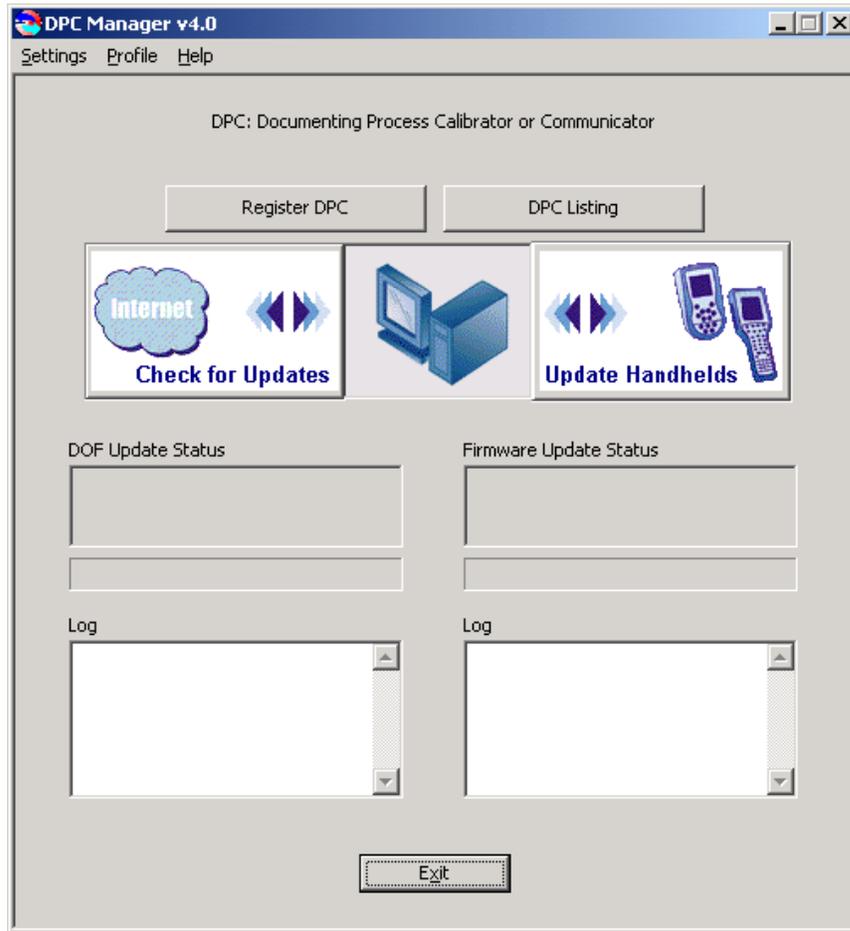


Figure 21.1 DPC Manager Option Selection

## 21.2 Using DPC Manager to Keep Your MFT Up to Date

Click on the right hand button “Manage DPC Device Driver And Firmware Updates” and the following should appear:



**Figure 21.2 DPC Manager  
Basic Update Method**

NOTE: If a different image appears, then select Settings>Advanced Settings to uncheck the Advanced Settings selection.

### 21.2.1 Check For Updates

Click on Check for Updates icon/button and DPC Manager will automatically update your computer from the Internet. The latest firmware and DOFs will be downloaded from the Internet onto your computer.

### 21.2.2 Register MFT

Launch DPC Manager and click on the Register DPC button. A screen will appear displaying the Model Number, Serial Number, Expiration Date and Firmware version of your MFT. If the expiration date and firmware version of your MFT is blank, then press Check Subscription. You will not be able to download DOFs to the handheld until the MFT is registered as indicated by a filled in expiration date and firmware version. This step must be performed after checking for updates. If the MFT registration date has expired, then a 3-year extension can be purchased for a single MFT with part number 3KXD311800L0051. Refer to section 27 Ordering Information for part numbers when multiple handhelds need 3-year extensions.

### 21.2.3 Update Handhelds

Click on the Update Handhelds icon/button to initiate an update session. The “DOF Update Status” box and “Log” box will update to show progress. This process takes a minute or so depending on the number of DOFs loaded on the connected handheld. Once all handheld DOFs are logged, a Tree View of those DOFs will appear.

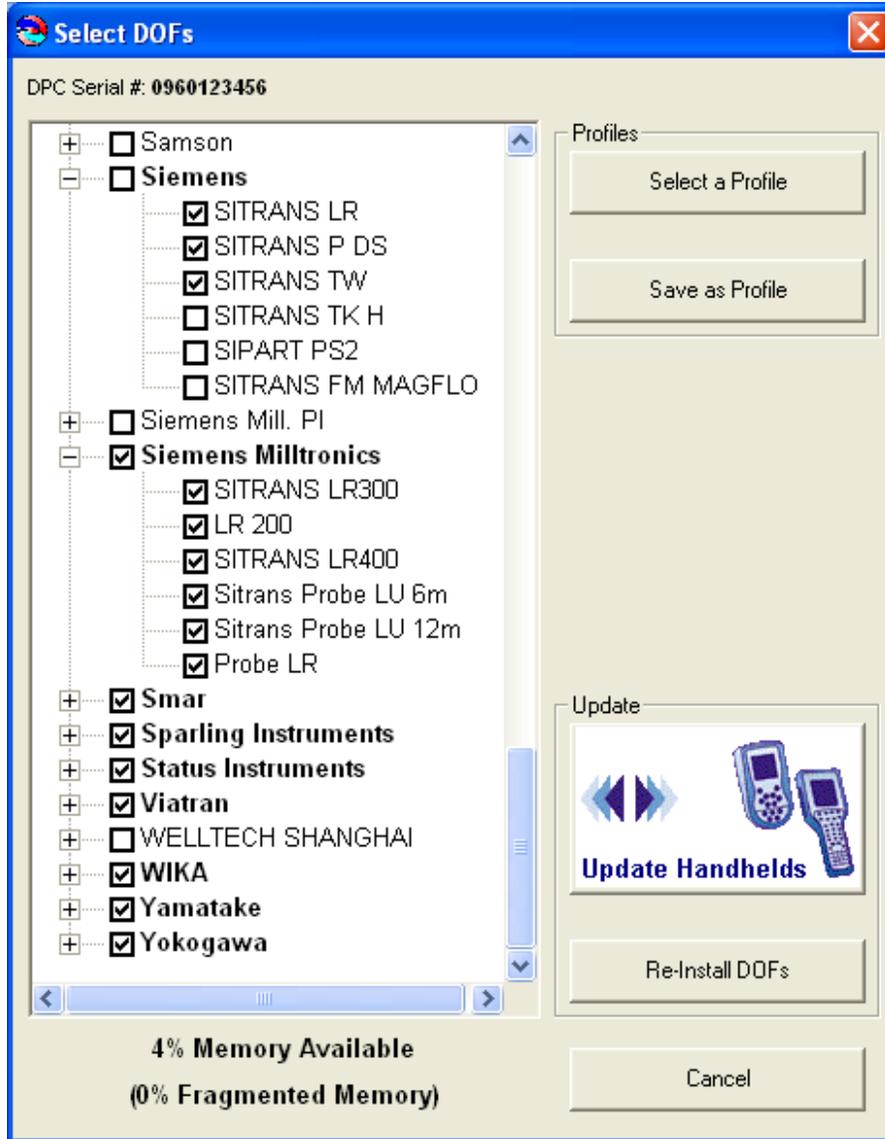


Figure 21.3 DPC Manager DOF Selection

The Tree View shows all DOFs installed on the connected handheld. Handheld serial number is shown at top. Checked boxes indicate DOFs that are on the handheld. A check in the manufacturer’s box with bold lettering means all their devices are loaded. An unchecked manufacturer’s box with bold lettering means some of their DOFs are loaded. An unchecked manufacturer’s box with standard lettering means none of their DOFs are loaded. % Memory Available and % Fragmented Memory are shown for the connected handheld at bottom of Tree View. A low or negative “% Memory Available” number and/or high “% Fragmented Memory” number indicates that the “Re-Install DOFs” button should be used to update the connected handheld. To make more memory available, uncheck all manufacturers that are not used in your plant. Uncheck unused devices within a manufacturer’s list to save further memory. Then select “Re-Install DOFs” button to erase handheld memory and re-install DOFs.

% Memory Available will update to reflect deletions or additions from the Tree View. If “% Memory Available” is high, then use the “Update Handhelds” button to add new or revised DOFs. Click “Update Handhelds” button to add newly checked device DOFs and new revisions of previously loaded DOFs as determined by the checks in the Tree View.

NOTE: “Update Handhelds” will not remove newly unchecked DOFs from the connected handheld. To remove unwanted DOFs, click the Re-Install DOFs button. This will erase all DOFs current in handheld memory and re-install only those DOFs checked on the Tree View. This takes longer the first time but makes more memory available for future use of the “Update Handheld” button.

### Using Profiles

Any Tree View can be saved as a Profile for later re-use by clicking on the “Save as Profile” button. Or, a Tree View can be created by clicking on the “Select a Profile” button and then selecting the “BlankProfile” from the default location. Save Profiles with descriptive names for easy identification at a later date.

Profiles can be re-used for updating additional handhelds, automatically update with new or revised DOFs from checked manufacturers, and automatically queues DOF revisions of all checked devices for future handheld updates. Just click on “Internet Check for Updates” and the select a saved Profile to Re-Install DOFs or Update Handhelds.

### Updating Firmware

After updating the HART® device DOFs, DPC Manager automatically checks the handheld’s firmware version against the latest downloaded firmware and initiates a firmware update if needed.

#### 21.2.4 MFT Listing

The DPC Listing is a list of all MFC’s and MFT’s that have been registered with the DPC Manager that is installed on the computer you are using.

To report any difficulties with downloading operations, please contact ABB (see page I, contacting ABB Instrumentation, for information on contacting ABB).

### 21.3 DPC Manager Option

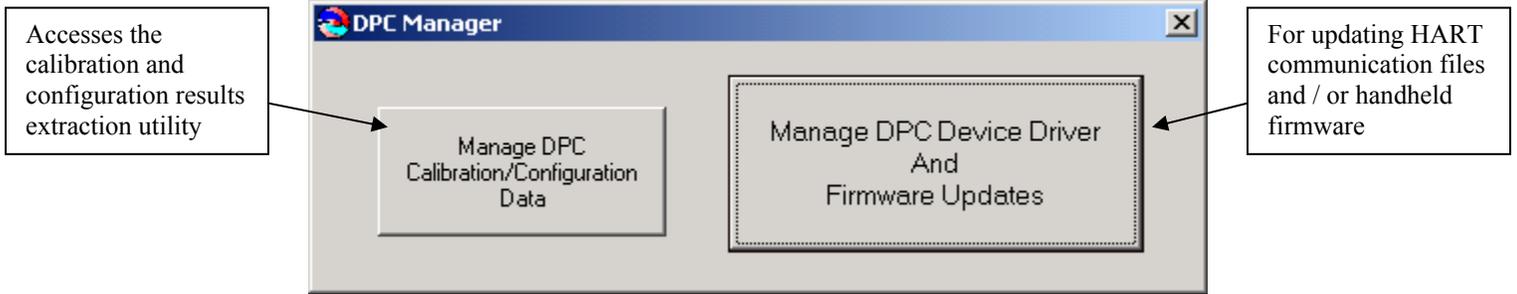
In addition to supporting Internet downloads of new DOFs, DPC Manager also provides a licensable option for storing, displaying, and printing configuration and/or calibration results uploaded from the DHH810-MFT handhelds. Contact your ABB Manufacturer’s Representative to obtain pricing and purchase the licensable option with P/N 3KXD311820L0001 (Configuration), 3KXD311820L0002 (Calibration), or 3KXD311820L0003 (Configuration and Calibration). These options add a powerful documenting function to the DPC Manager utility. Users can retrieve saved calibration results and / or HART configurations from the handhelds. The information is then saved in .csv format to spreadsheet applications such as MS Excel®.

The DHH800-MFT Calibrator can optionally save HART device configurations to memory to document as found and as left parameter values. The configurations can be uploaded to a host PC for viewing parameter lists or the lists can be printed for record purposes. The DHH810-MFT multifunction calibrator generates calibration procedures for pressure and temperature transmitters and saves the results to memory to document the as found and as left conditions. The results can be uploaded to a host PC, viewed in spreadsheet format, and printed in certificate format. Certificates are complete with approval signature line for filing and record purposes.

The DPC Manager Data Management feature is a one-way tool; results can be uploaded from the MFT or MFC handheld memory to a host PC. Data changed in the spreadsheet application cannot be returned to the handheld for use in the field. For two-way data management features (upload and download capabilities), consult ABB for information on our Mobility DHH820-DMS Device Management System software product.

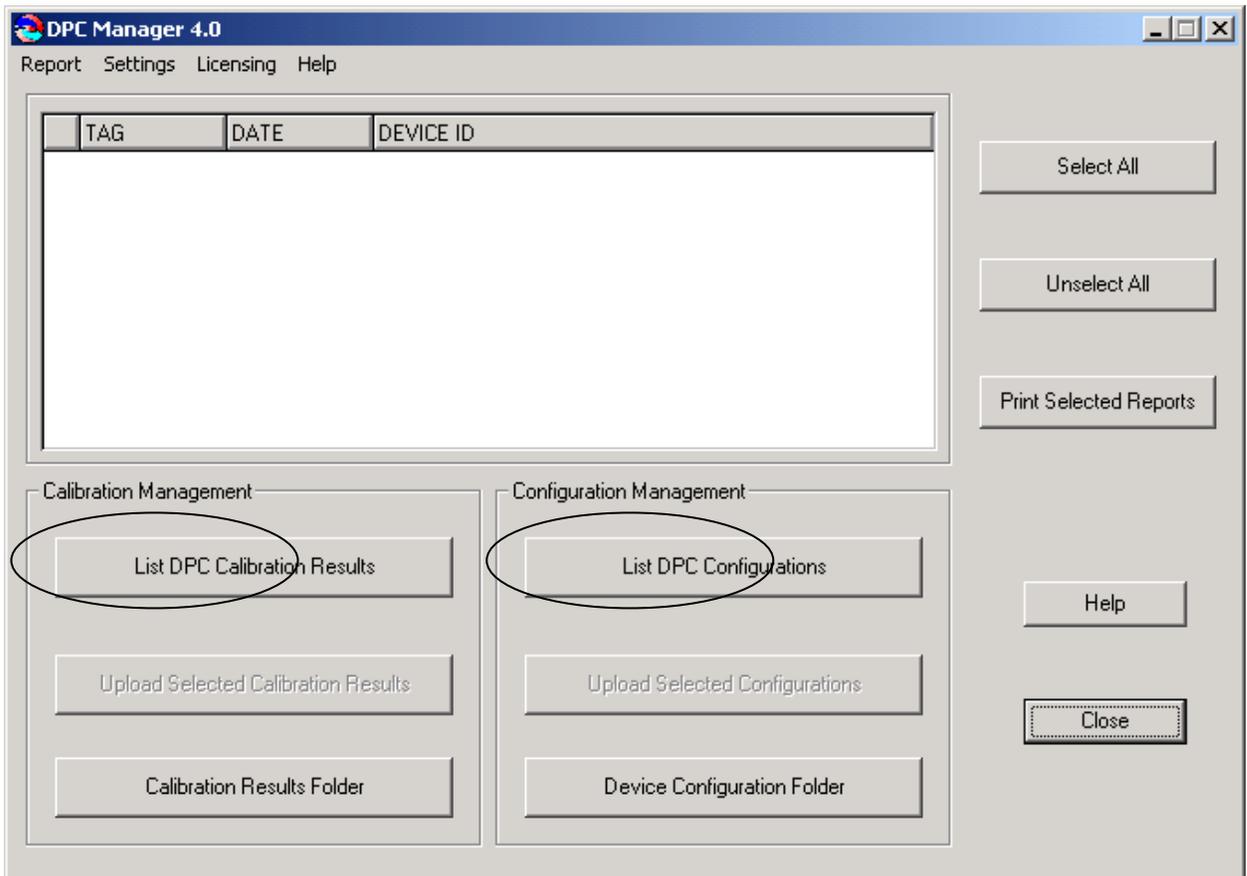
### 21.3.1 Managing Calibration and Configuration Data

1. After double clicking on the desktop DPC Manager icon, the following will appear:



**Figure 21.4 DPC Manager Option Selection**

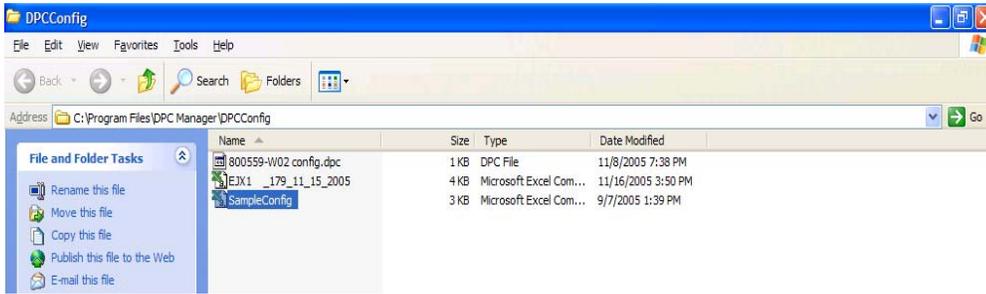
2. Click on the left hand button “Manage DPC Calibration/Configuration Data and the following will appear:



**Figure 21.5 DPC Manager Configuration / Calibration Management**

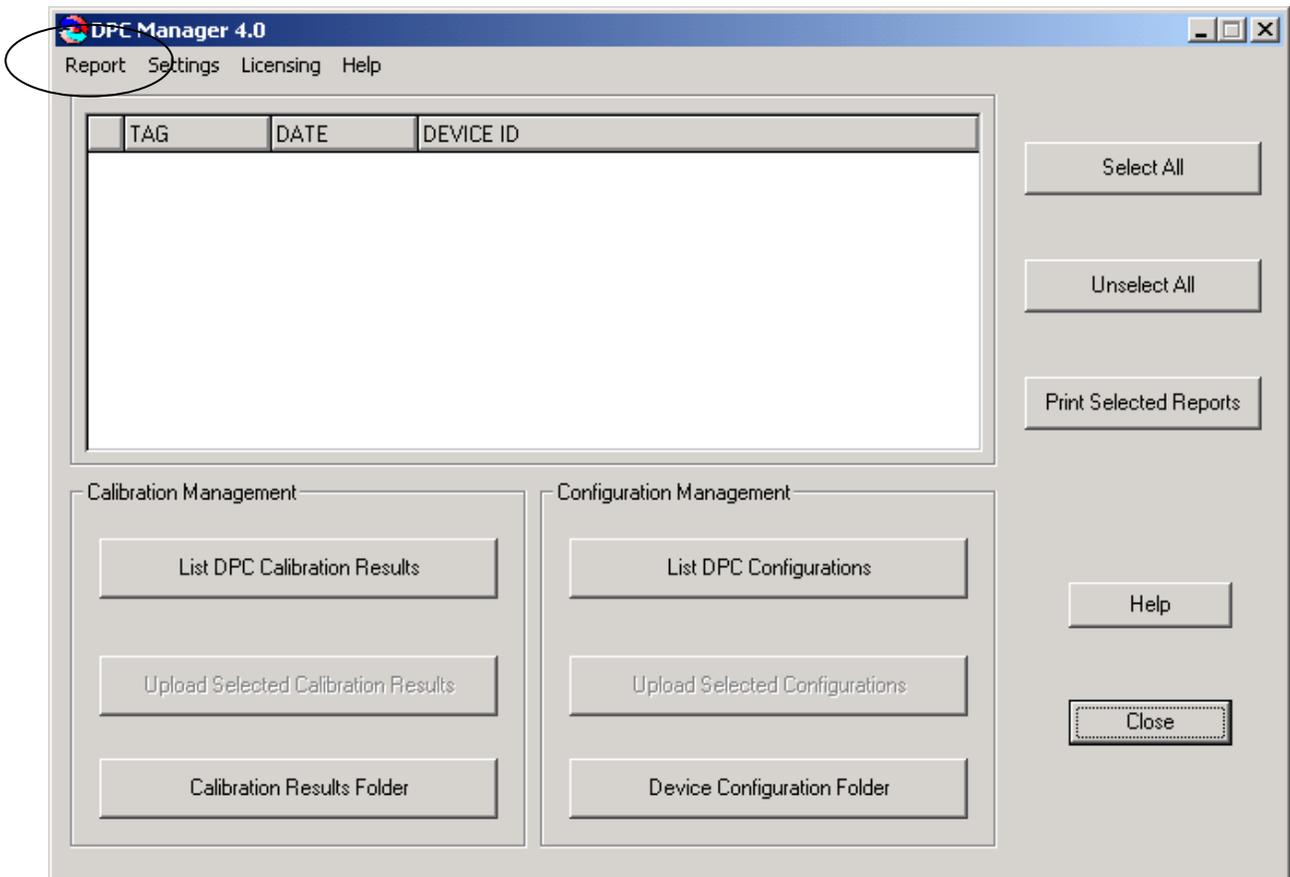
The utility is divided into a “Calibration Management” section and a “Configuration Management” section

3. Click on the “Device Configuration Folder” button and the following will be displayed. This is the default storage location on the computer’s hard drive. Double click on the “SampleConfig” file to see how HART configuration data is displayed in MS Excel

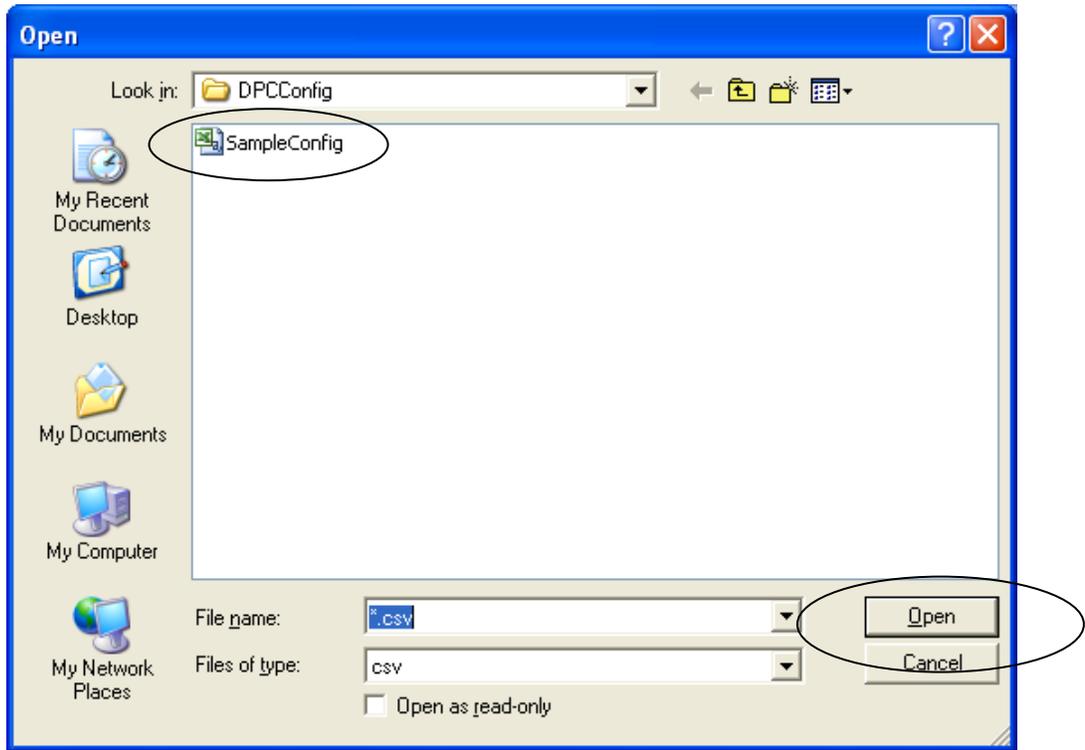


**Figure 21.6 DPC Manager  
Sample Device Configuration  
Selection**

4. To see a sample of the Report that can be generated from a HART configuration, click on “Report” in DPC Manager’s toolbar. Then select “Configuration” from the resulting drop down box.



5. Select "SampleConfig" from the next frame by double clicking on it or click once and then click "Open" button.



**Figure 21.8 DPC Manager  
Sample Device Configuration  
Report Selection**

6. DPC Manager will show the Configuration Report that can be printed.

### Device Configuration

3/24/2006

Tag: 1FSR5101  
 Device ID 11553  
 Single Var  
 Yokogawa

YTA70E  
 Complete Config  
 Uses DOF 370A0101  
 40 Variables  
 8/30/05 9:18 PM

PARAMETER	VALUE	PARAMETER	VALUE
Manufacturer:	Yokogawa	PV unit:	degC
Dev id:	11553	PV Damp:	2.000 S
Model:	YTA70-E	PV LRV:	-180.000 degC
Tag:	1FSR5101	PV URV:	1372.000 degC
Descriptor:	@@@@@@@@@@@@@@@@	Sensor Limits Units:	degC
Message:	@@@@@@@@@@@@@@@@	Snsr typ:	T/C Type K IEC 854
Date:	03-30-2005	Meas typ:	TC/V sgl int CJC
Write protect:	Not write protected	Meter typ:	Bad12
Snsr s/n:	0	system config.:	Not Used
LSL:	-180.000 degC	Number of wires:	2 wire
USL:	1372.000 degC	CJC type:	Internal
Min span:	50.000 degC	AO 100%:	0.000 mA
Xfer fnctn:	Linear	AO 0%:	0.000 mA
Final asmbly num:	0	AO up lim:	0.000 mA
Distributor:	Yokogawa	AO lo lim:	0.000 mA
Hardware rev:	7	Error detection:	No test performed
Software rev:	25	Sh sens:	20.500 mA
Universal rev:	5	Br sens:	3.800 mA
Fid dev rev:	1		

Figure 21.9 DPC Manager Sample Report

7. You can also view what the Calibration Results will look like by clicking on the “Calibration Results Folder” button and repeating steps 4 – 6 on the Calibration side of DPC Manager.

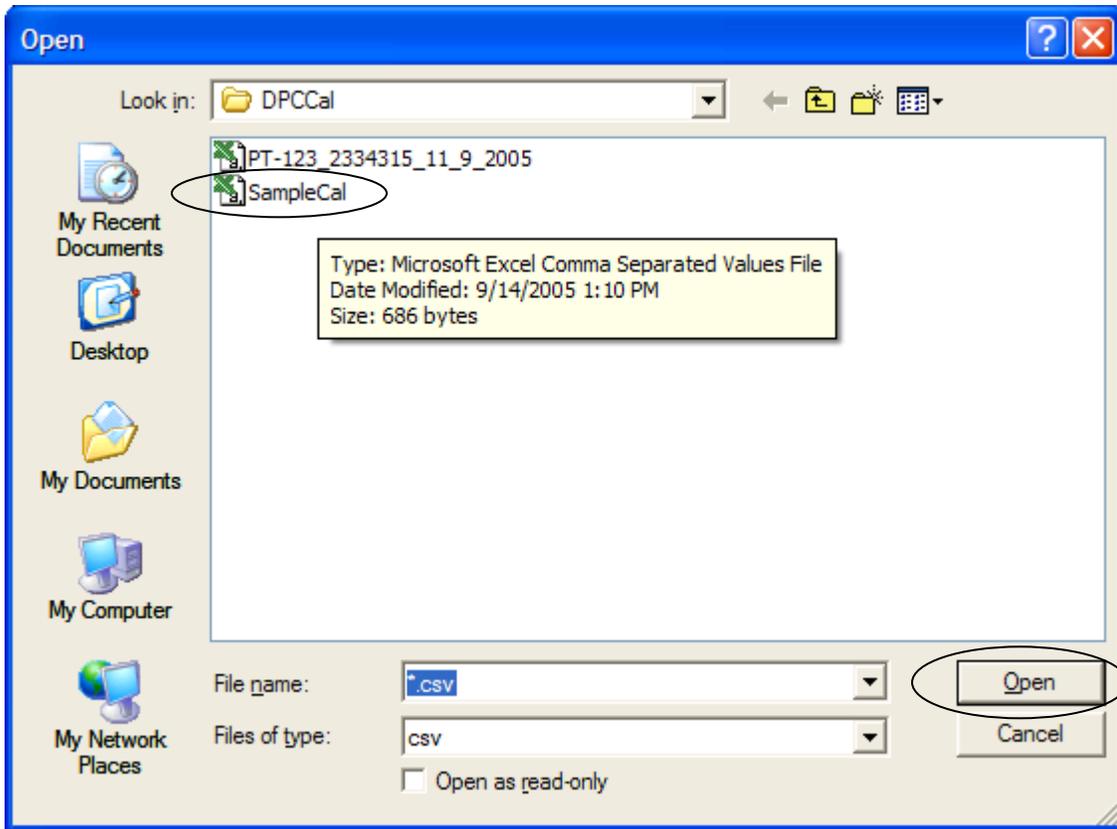
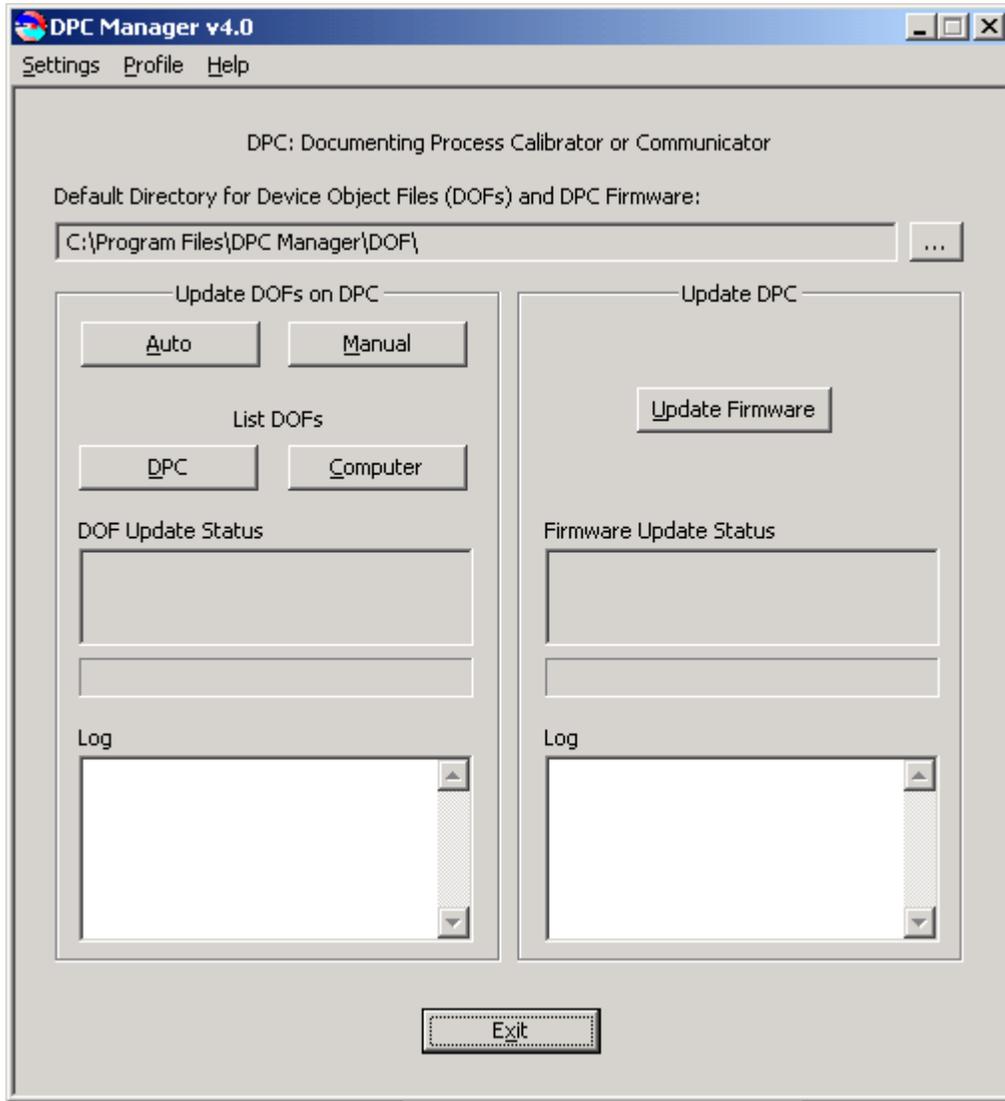


Figure 21.10 DPC Manager Sample Calibration Report Selection





**Figure 21.12 DPC Manager  
Advanced Settings View**

3. Write down the "Default Directory for Device Object Files (DOFs) and DPC Firmware" (typically C:\Program Files\DPC Manager\DOF\)
4. Minimize DPC Manager
5. Open Internet Explorer by going to [www.abb.com/instrumentation](http://www.abb.com/instrumentation) and make the following selections:
  - "Device Management and Fieldbus" from the main page
  - "Hand Held Configuration Tools" from the main page
  - "DHH800-MFT" from the main page

6. Select the Mobility Handheld Supported Devices link

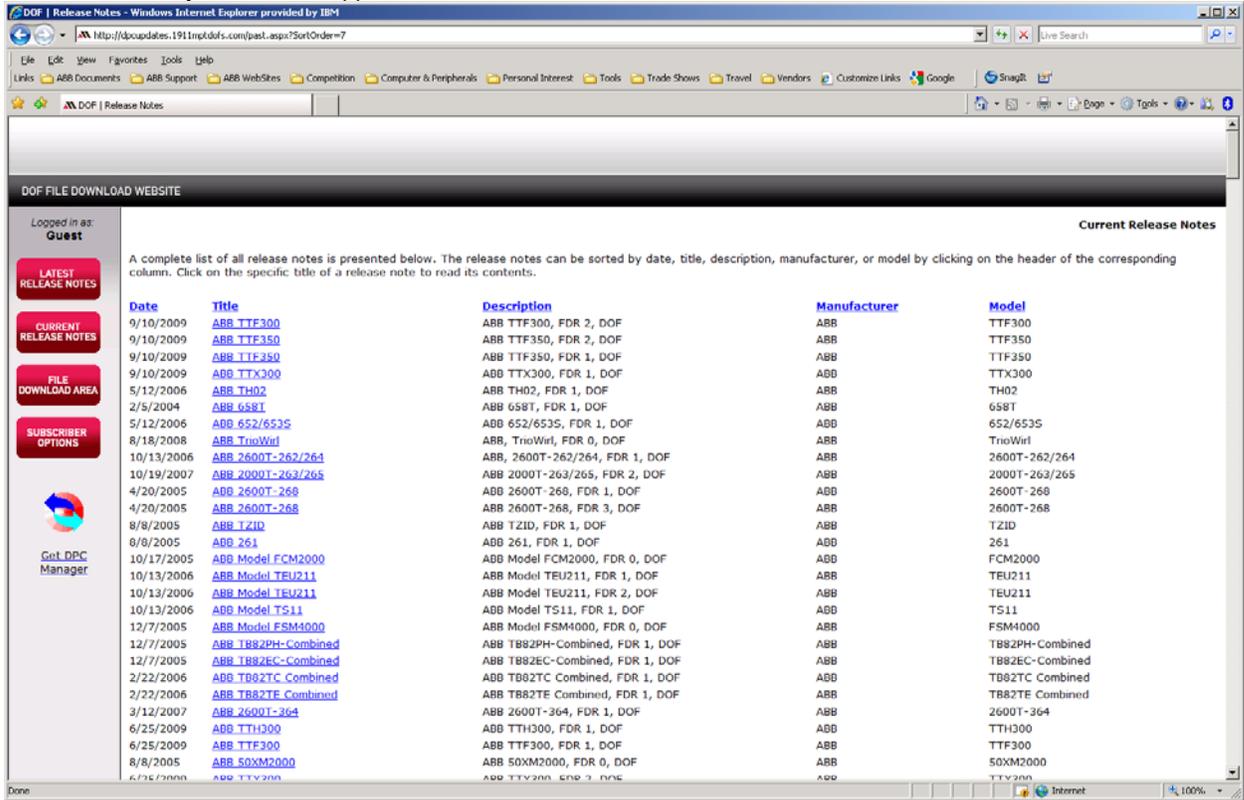


Figure 21.13 Mobility Handheld Supported Devices View

7. Select Subscriber Options (red box)
8. Enter the full serial number as the user name
9. Enter the first 6 digits of the serial number as the password (we recommend you change this password in the next step)
10. The user needs to fill in requested information and submit it
11. Select File Download Area (red box)
12. For first time users, select "Check All Files", scroll to bottom of page, and select "Download Selected Files"
13. For repeat users, select "Download All New Files".
14. Specify hard drive location to store downloaded files (recommend C:\Program Files\DPC Manager\Temp\)
15. Open the zip file at the storage location, select all files for extraction, and specify the storage location to be the same as the "Default Download Directory" (line 2 above)
16. Maximize DPC Manager
17. Connect Handheld to the PC (if not already done)
18. Select "Update Firmware"
19. Select "Auto" for DOF Updates, and select No for erase and replace all DOFs

This manual procedure downloads the files over the Internet to the PC (steps 1 through 15) and then downloads these files to the handheld (steps 16 through 19).

## 22.0 Documenting Calibration Results / HART Configurations

The Mobility DHH810-MFT multi-function calibrator enables the user to document both Manual Procedure Calibrations and Stored Procedure Calibrations. The Documentation capability of the Device Management System (DMS) software along with the MFT provides the ability to store calibration procedures for use with specific field devices, to save As found and As left results of a stored calibration procedure, to save the results of manual calibrations, to view saved calibration results and to upload saved results to DMS. Mobility DHH810-MFT also has 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 contact ABB (see page I, Contacting ABB Instrumentation, for contact information).



Figure 22.1 Pressure Calibration

**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 Mobility 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 Mobility MFT memory. Stored procedures are set up in the ABB 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 Mobility MFT. The technician then takes the Mobility 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 Mobility MFT guides the user through the complete procedure.

The dedicated Mobility 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.

### 22.1 Entering Calibration Documentation Mode

Press the **Calibrate** key to setup the Mobility 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: PT-1012D
■ Begin Calibration
Output: HART (mA)
Procedure: Manual
Sensor : S1
Quick Cal
Smart Trim
View Results
Clear Cal Memory
Up Down Select Back

Figure 22.2 Calibrate Key Main Menu Screen

**Begin Calibration:** select to initiate a calibration documenting operation

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

Cal			
Output:	HART (mA)		
	Conv (mA)		
	Conv (V)		
	HART (mA)		
	▀ HART (PV)		
	Fieldbus		
	Use Proc. Setting		
Up	Down	Save	Back

**Figure 22.3 Calibration Device Type Selection**

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

Cal			
Procedure:	Manual		
	▀ Manual		
	Stored		
Up	Down	Save	Back

**Figure 22.4 Calibration Procedure Type Selection**

**Sensor:** This option allows the user to select which Mobility 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

**Figure 22.5 Calibration Sensor Module Selection**

## 22.2 Manual Procedure Calibrations and Documentation

To start a **Manual Procedure Calibration**, press the Mobility MFTs **Calibrate** key, set up the Mobility 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 (More)
Up Down Select Back

Figure 22.6 .Manual Calibration Launch Screen

When a conventional device is connected to a Mobility DHH810-MFT, the above Cal screen is shown. Users input the Device Tag, URV, and other information they want the Mobility MFT to store with the calibration data by moving 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 Mobility 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 a Mobility DHH810-MFT, the Mobility 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 Mobility 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
Manual Cal Proc ➔ Manual Cal Create Procedure
Up Down Select Back

Figure 22.7 Manual Calibration Selection

Select **Manual Cal** to run through the calibration procedure. Select **Create Procedure** to create the manual procedure. When Manual Cal is selected, the following screen will appear depending on the type of device connection being used:

Cal	
Manual Calibration	
S1: 0.00 inW20C IV: 4.006 mA	
0 Points Saved	
Save	Done

**Figure 22.8 Manual Cal Screen for Conventional Devices**

Cal	
Manual Calibration	
AO: 4.004 mA Pres: 0.07 inH2O	
IV: 3.991 mA S1: -0.00 inH2O	
0 Points Saved	
Save	Done

**Figure 22.9 Manual Cal Screen for HART Devices**

Apply the desired input signal to the Mobility 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 Mobility 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

**Figure 22.10 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

**Figure 22.11 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 Mobility 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 Mobility MFT using the Manual Procedure Calibration can be uploaded to ABB DMS software or other compatible FCINTF software programs. The Field Calibrator Interface (FCINTF) specification has been implemented as the Mobility MFTs interface for transmitting calibration data. Compatible asset management software programs should be able to receive and process Mobility MFT calibration data. *Note: HART configuration data saved by the Mobility MFT cannot be passed by FCINTF. This data can only be uploaded to ABB DMS.*

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

### **22.3 Stored Procedure Calibrations and Documentation**

The Stored procedure option is only available when the Mobility MFT is used in conjunction with ABB DMS software or other compatible FCINTF software programs. The Field Calibrator Interface (FCINTF) specification has been implemented as the Mobility MFTs interface for receiving and transmitting calibration data. Compatible asset management software programs should be able to transmit assigned calibration procedures to the Mobility DHH810-MFT. They should also be able to receive calibration results back from the Mobility MFT.

Stored procedures are developed and assigned to a tag number in the DMS software. Then they can be downloaded into Mobility 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 Mobility MFT user in the field for calibrate activities. See the DMS Instruction Manual for more details.

To start a **Stored Procedure Calibration**, press the Mobility MFTs **Calibrate** key, set up the Mobility 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

**Figure 22.12 Stored Procedure List by Tag Number**

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

When the Mobility MFT has been set up for “HART (PV)” calibration, the Mobility 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 Mobility 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 Mobility MFT to use the mismatched procedure, the following screen will appear.

Cal		
Procedure Summary		
Tag		
DPT1003		
Date/Time:		
5/6/05		
Status:		
Incomplete		
Output: HART (PV)		
OK	Detail	Back

**Figure 22.13 Calibration Device Selected**

Pressing Detail results in the following screen display:

Cal : DPT1003	
Cal Type: Pressure	
PV:	
SN: 500504	
LRV: 0.002 PSI	
URV: 100.002 PSI	
Xfer Fn: Linear	
Cal Points 6	
Max Err: 0.50 %	
OK	Back

Figure 22.14 Calibration Device Details

Press the **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 Mobility MFT. Press the **OK** soft key to continue. The following screen will appear:

Quick Cal		
Device: DPT1003		
Apply 0.000 PSI	←	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 PSI		
IV: 3.991 mA	}	← Analog output and input values as measured by NIST traceable Mobility MFT sensors
S1: -0.00 PSI		
X Error 0.981 %	←	% Error between HART and measured data
Point 1 of 6	←	Indicator for number of points saved out of total number of test procedure points
Save	Abrt	

Figure 22.15 Stored Procedure Calibration Documentation Screen

Input the **Apply** value called for by the **Stored** procedure 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 Mobility 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 Mobility 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 <b>FAIL</b>			
Save As Fnd to AsLft			
Smart Trim			
As left			
View Results			
Quick Cal			
Up	Down	Select	Abt

**Figure 22.16 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 Mobility 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: DPT1003		<b>Pass</b>	
Enter Cal Note			
Smart Trim			
View Results			
Up	Down	Select	Done

**Figure 22.17 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 Mobility MFT memory for the procedure just completed; uses the Mobility 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 Mobility MFT provide data allowing the Mobility MFT to evaluate if a calibration point is in or out of calibration. Mobility 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 ABB 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 Mobility MFT Stored Procedure Calibration screens is shown below:

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

Where:

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

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

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

## 22.4 Stored Procedure Status Indicators

The Mobility 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			
Up	Down	Select	Back

**Figure 22.18 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	<b>P</b>
As Fnd complete. Do you want to continue?	
Yes	No

**Figure 22.19 Re-entering a Partially Complete Procedure**

Select **Yes** to re-open the procedure and complete it. The Mobility 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.

## 22.5 Deleting Files and Clearing Documentation Memory

**Deleting Files:** Individual calibration procedure / result files can be deleted from the Mobility MFT using the **Del** soft key found on the View Calibration Results Screen. This screen is accessed by pressing the Mobility 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 Mobility 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 Mobility 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.

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



## 23.0 Documenting HART Configurations

The Mobility DHH810-MFT12 is able to save and send HART device configuration files and is also able to upload saved configurations to the ABB DMS software. The information joins the corresponding tag 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 Mobility 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 Mobility MFT; it does not clear memory space. To clear the configuration documentation memory of the Mobility DHH810-MFT, connect the Mobility MFT to ABB DMS and use the Clear Mobility MFT Configurations function. See the DMS Instruction Manual for more details



## 24.0 Handheld Registration

Every Mobility MFT is shipped with a card that identifies a user name and password. Only registered handhelds with valid download subscription coverage are able to receive new DOF downloads. To register your handheld, establish a connection to the Internet and follow the instructions in the Available DOF Website section of this manual to get to the Mobility Hand Held Supported Devices web link. A list of currently available DOF's for HART device communication is presented as shown in Figure 19-1.

From this link, select the "Subscriber Options" button (red box) where a login page comes up where you are prompted to enter a user name and password. Enter the text from the card and press Go. Then fill out the requested information. This will also enable you to receive e-mail notices of new firmware and DOF availability.



## 25.0 Returning the Mobility MFT for Repair

In the event that a Mobility MFT requires service and must be returned to the factory for repair, please contact your local ABB Representative (see page I, Contacting ABB Instrumentation, for information on contacting ABB).

**Please do not send any unit in for repair without first contacting an ABB Representative or the ABB Factory for a Return Material Authorization (RMA) number.** This number will be provided by the ABB Repair Department when you call, fax or e-mail your information. An RMA number must accompany all incoming packages to insure proper tracking, 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 Mobility MFT label and on all sensor module labels. This information can also be obtained directly from the Mobility MFT display by pressing the **Sensr** soft key while in **Measure Mode**. See the **Measure Mode** section in this manual for more details.



## 26.0 Appendix

### 26.1 Product Specification

**BASE UNIT:** 9" (22.86 cm) L x 4.7" (11.94 cm) W x 3.6" (9.09 cm) D ABS plastic case with shock absorbing boot, 28 ozs. (794 g) Three bays for measurement modules

**DISPLAY:** 128 x 128 pixel graphic display, 2.6" (6.6 cm) x 2.6" (6.6 cm) 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 3KXD311800L0036)

#### 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" (0.318 cm) FNPT, 316ss

Electrical: Standard banana jacks (3/4" (1.9 cm) center)

HART & Loop: Standard banana jacks (3/4" (1.9 cm) 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 H<sub>2</sub>O and cm H<sub>2</sub>O (inches H<sub>2</sub>O with 4° C, 20° C, and 60° F ref. temp.), kg/cm<sup>2</sup>, kPa, mBars, Bars, mm Hg, inches Hg (inches Hg with 0° C ref. temp), oz/in<sup>2</sup>. 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** – Mobility DHH810-MFT 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 (-5°C to 50°C).

Current / Voltage: ± 0.025% of F.S., ± 0.001% of F.S. per ° F (reference temperature is 70° F (21.1°C))

**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 (10.35 bar) when applied simultaneously to high and low  
sides / Medias are clean, dry gases only.

**ELECTRICAL MEASUREMENTS**

Current:  $\pm 50.00\text{mA}$   $\pm 0.025\%FS$

Voltage:  $\pm 50.00\text{VDC}$   $\pm 0.025\%FS$

**MODULES:** 2.3" (5.84 cm) L x 1.3" (3.3 cm) W x 2.6" (6.6 cm) D, 8.3 ozs.(235 g) 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** – Mobility MFT Settings can be locked out entirely or by specific feature.

**CE** CE compliance

**INTRINSIC SAFETY** – 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, provide Certification for units that are intrinsically safe. All modules listed on the Intrinsic Safety Control Drawing (see Appendix) are also certified Intrinsically Safe to the same standards.

**MEMORY** – separate, dedicated, non-volatile flash memory for Mobility MFT firmware, DOFs, and Configurations / Calibrations

**DOF Memory:** 500 HART devices (based on average DOF size)

**Configuration / Calibration Memory:** A mix of 100 HART device configurations (based on average configuration size) + calibration results (based on average calibration procedure and results)

## 27.0 Ordering Information

Ordering information		Variant digit No.	1 - 7	8 - 10	11	12	13	14	15	16	17	18	19	20	21
<b>Mobility DHH810-MFT Modular Calibrator</b>	Catalog No.	<b>DHH810-</b>													
<b>Mobility DHH810-MFT Modular Calibrator with HART<sup>®</sup> Communications</b> - Includes CE Mark, Test Lead Kit, RS-232 Serial Cable, Paper User's Manual, NIST Traceability Certificate standard for modules & base unit, and 3-year download subscription		<b>MFT</b>													
<b>Model Type</b> Calibration and Configuration - All Supported HART devices (ABB and non-ABB) Calibration Only - HART and Conventional devices			1	2											
<b>Documenting Options</b> Standard - As-found & as-left function requires DHH820-DMS database software sold separately						1									
<b>Certification</b> CE Mark (Standard on all units) CE Mark, Intrinsic Safety certification by MET Laboratories per CSA C22.2 No. 1010.1-92, C22.2 No. 157, and UL913, Fifth Edition Rev. 2/21/97 for Class I, Div I, Groups A, B, C & D							0	0							
<b>Carrying Case and Strap Options</b> Rear Hand Strap with protective boot (Standard on all units) Rear Hand Strap with protective boot and Fitted Use in Place Soft Carrying Case Rear Hand Strap with protective boot and MFT Hanging/Shoulder Strap								0	1	2					
<b>User's Manual Language</b> English											0	1			
<b>Reserved</b> Always one														1	
<b>Firmware Language</b> English															0 1

Note: Selection of the DHH810-MFT12 model is required for configuration of HART devices and calibration of HART and conventional 4-20mA devices while selection of the DHH810-MFT22 model provides support only for calibration of HART and conventional 4-20 mA devices. The upgrade from DHH810-MFT22 to DHH810-MFT12 does not require the return of the hand-held and can be done via keypad entry after purchase of the upgrade with part number 3KXD311810L0300.

## 27.1 Accessories

<b>ABB Part Number, Sensor Modules</b>	<b>Description</b>
<b>3KXD311810L0260</b>	Open Bay Protection Module: Dummy module protects unused (open) sensor module bays in MFT Note 1)
<b>3KXD311810L0001</b>	Sensor Modules: 1...10 in. H2O dp (2.5...25 mbar), ± 0.1% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.009 H2O dp (± 0.022 mbar))
<b>3KXD311810L0002</b>	Sensor Modules: 0...20 in. H2O dp (0...50 mbar), ± 0.1% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.02 H2O dp (± 0.050 mbar))
<b>3KXD311810L0003</b>	Sensor Modules: 0...100 in. H2O dp (0...250 mbar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.025 H2O dp (± 0.062 mbar))
<b>3KXD311810L0004</b>	Sensor Modules: 0...200 in. H2O dp (0...500 mbar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.05 H2O dp (± 0.125 mbar))
<b>3KXD311810L0005</b>	Sensor Modules: 0...400 in. H2O dp (0...1 bar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.10 H2O dp (± 0.25 mbar))
<b>3KXD311810L0006</b>	Sensor Modules: 0...2000 in. H2O dp (0...5 bar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.50 H2O dp (± 1.25 mbar))
<b>3KXD311810L0020</b>	Sensor Modules: 0...20 PSIG (0...1.38 bar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.005 PSIG (± 0.35 mbar))
<b>3KXD311810L0021</b>	Sensor Modules: 0...200 PSIG (0...13.8 bar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.05 PSIG (± 3.5 mbar))
<b>3KXD311810L0022</b>	Sensor Modules: 0...500 PSIG (0...34.5 bar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.125 PSIG (± 8.6 mbar)) Note 1)
<b>3KXD311810L0023</b>	Sensor Modules: 0...1000 PSIG (0...69.0 bar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.25 PSIG (± 17.2 mbar))
<b>3KXD311810L0024</b>	Sensor Modules: 0...1500 PSIG (0...103.4 bar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.375 PSIG (± 25.9 mbar))
<b>3KXD311810L0025</b>	Sensor Modules: 0...2000 PSIG (0...137.9 bar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.500 PSIG (± 34.5 mbar))
<b>3KXD311810L0026</b>	Sensor Modules: 0...3000 PSIG (0...206.8 bar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 1.50 PSIG (± 103.4 mbar))
<b>3KXD311810L0040</b>	Sensor Modules: 0...900 mm Hg (0...1200 mbar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.225 mm Hg (± .30 mbar))
<b>3KXD311810L0041</b>	Sensor Modules: 0...2000 mm Hg (0...2500 mbar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 0.50 mm Hg Abs (± 0.67 mbar))
<b>3KXD311810L0042</b>	Sensor Modules: 0...5200 mm Hg (0...7000 mbar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 1.300 mm Hg Abs (± 1.75 mbar))
<b>3KXD311810L0043</b>	Sensor Modules: 0...52000 mm Hg (0...70000 mbar), ± 0.025% Full Scale from 23° F (-5 °C) to 122° F (50 °C) (± 13.00 mm Hg Abs (± 17.5 mbar))
<b>3KXD311810L0060</b>	Sensor Modules: T/C measure and simulate module supports types B,C,E,J,K,N,R,S,T,M,P. Recommend TIO Starter Kit (P/N 3KXD311810L0100)
<b>3KXD311810L0065</b>	Sensor Modules: RTD measure and simulate module supports 22 different RTDs. Requires Special Module Connectors from RIO Starter Kit (P/N 3KXD311810L0102)
<b>3KXD311810L0070</b>	Sensor Modules: V/I: meas ±55 Vdc, source 0-28Vdc; mA: meas ±100 mA dc, source 0-100 mA dc. Recommend VMA Starter Kit (P/N 3KXD311810L0101)
<b>3KXD311810L0100</b>	Module t/c meas. & sim - Universal includes: P/N 3KXD311810L0243, P/N 3KXD311810L0244, and P/N 3KXD311810L0245
<b>3KXD311810L0101</b>	VMA Starter Kit for P/N 3KXD311810L0070 module V/I meas. & sim. - Universal includes: P/N 3KXD311810L0203 VMA test lead kit, banana plugs on 9 in. breakouts both ends, assorted connectors
<b>3KXD311810L0102</b>	Module RTD meas. & sim. - Universal includes: P/N 3KXD311810L0242, P/N 3KXD311810L0241, and P/N 3KXD311810L0246

**MOBILITY DHH810-MFT CALBRATOR/CONFIGURATOR INSTRUCTION MANUAL**

<b>ABB Part Number, Carrying Accessories</b>	<b>Description</b>
3KXD311810L0140	Soft case with shoulder strap for carrying one MFT and installed modules, additional modules, test lead kit, hand pumps & fittings
3KXD311810L0141	ABS plastic carrying case with handle and foam insert for MFT base unit and installed modules, additional modules, test lead kit, hand pump, RTD temperature probe, fittings & tubing.
3KXD311810L0142	MFT Hanging/Shoulder Strap, includes factory mounted D-Rings to MFT case, adjustable strap, spring-loaded swivel snaps.
<b>ABB Part Number, Communication Accessories</b>	<b>Description</b>
3KXD311800L0011	HART Lead Kit (inc'd w/ MFC) - std banana plugs, mini-grabbers, 250 ohm resistor
3KXD311800L0012	Std size 250 ohm shunt resistor (inc'd w/ MFC) - req'd for HART low resistance loops
3KXD311800L0013	DB-9 cable, Male x Female, 6 ft length
3KXD311810L0201	Standard test lead kit with banana plugs and assorted connectors
3KXD311810L0101	VMA Test Lead Kit with banana plugs on 9" breakouts both ends, assorted connectors
3KXD311810L0204	Adapter, standard banana jack (F) to mini-banana jack (M)
3KXD311810L0225	24Vdc Power Supply, input: 120Vac 60 Hz, output: 24Vdc 350 mA
<b>ABB Part Number, Power Accessories</b>	<b>Description</b>
3KXD311801L0121	AA Alkaline Batteries, 6-pack (inc'd w/ handheld)
3KXD311810L0221	6-pack of AA 1.2V NIMH Batteries
3KXD311810L0222	Energy 8 NiMH battery Charger (100-240 AC/50 or 60 Hz), Univ. Plug Kit
3KXD311800L0036	Power adapter, 100 V AC to 240 V AC, 50 - 60 Hz and Universal Plug Adapters
3KXD311800L0034	Power Accessories: Power adapter, with pin connector 100 Vac to 240 Vac, 50-60 Hz
<b>ABB Part Number, DPC Manager Software Options</b>	<b>Description</b> <i>Each License covers unlimited DPC's for one Computer Install</i>
3KXD311820L0001	DPC Manager for Configuration Management
3KXD311820L0002	DPC Manager for Calibration Management
3KXD311820L0003	DPC Manager for Configuration and Calibration Management
3KXD311820L0004	Upgrade DPC Manager to Configuration and Calibration Management
<b>ABB Part Number, DLS - DOF Download Subscription</b>	<b>Description</b>
3KXD311800L0051	3 year download subscription per Mobility handheld for 1 handheld
3KXD311800L0052	3 year download subscription per Mobility handheld for 2 to 4 handhelds
3KXD311800L0053	3 year download subscription per Mobility handheld for 5 to 9 handhelds
3KXD311800L0054	3 year download subscription per Mobility handheld for 10 to 19 handhelds
3KXD311800L0055	3 year download subscription per Mobility handheld for 20 or more handhelds
<b>ABB Part Number, Media Accessories</b>	<b>Description</b>
3KXD311810R4301	Mobility MFT Operations Manual, printed hard copy-one copy supplied with order at no charge and pdf instructions included on CD
3KXD311800L0041	Media Accessories: Mobility Interface Software CD set, latest version
<b>ABB Part Number, License Upgrade</b>	<b>Description</b>
3KXD311810L0300	Upgrade from DHH810-MFT22 (Calibration only) to DHH810-MFT12 (Calibration + Configuration)

**MOBILITY DHH810-MFT CALIBRATOR/CONFIGURATOR INSTRUCTION MANUAL**

<b>ABB Part Number, Fittings, Kits &amp; Accessories</b>	<b>Description</b>
<b>3KXD311810L0181</b>	1/8 in. (0.3175 cm) O.D. tubing to 1/8 in. (0.3175 cm) Male NPT connector (not for use above 250 PSIG (17.3 bar))
<b>3KXD311810L0182</b>	1/8 in. (0.3175 cm) O.D. tubing union tee (not for use above 250 PSIG (17.3 bar))
<b>3KXD311810L0183</b>	1/4 in. (0.625) Male NPT X 1/8 in. (0.3175) Female NPT reducer bushing, brass
<b>3KXD311810L0184</b>	10 ft (3.05 m) of 1/8 in. (0.3175 cm) O.D. nylon tubing (not for use above 250 PSIG (17.3 bar))
<b>3KXD311810L0185</b>	Push to read equalizing manifold for DP modules, brass, 1/8 in. (0.3175 cm) Female NPT connections
<b>3KXD311810L0186</b>	High Pressure Connection Kit (not for use above 9,000 PSIG (620.5 bar)) includes: 3 ft. (0.91 m) HP Hose with 1 pc 1/8 in. (0.3175 cm) Male NPT & 1 pc 1/4 in. (0.635 cm) Male (0.30 m) HP Hose with 1 pc 1/8 in. (0.3175 cm) Male NPT and 1 pc 1/4 in. (0.635 cm) Male NPT x HP Quick Connect fitting
<b>3KXD311810L0187</b>	
<b>3KXD311810L0188</b>	5 pcs 1/4 in. (0.635) MNPT x HP Quick Connect Fitting (not for use above 9,000 PSIG
<b>3KXD311810L0189</b>	1 pcs 1/8 in. (0.3175 cm) Male NPT HP Quick Connect fitting (not for use above 9,000
<b>ABB Part Number, Temperature Accessories</b>	<b>Description</b>
<b>3KXD311810L0241</b>	Temperature Accessories:Mating connector for RTD temperature modules facilitates use of customer's RTD
<b>3KXD311810L0242</b>	Temperature Accessories:User cable for RTD temp module, 5 ft (1.52 m) cable, 4 lead wires, alligator clip terminations (A900028-90500)
<b>3KXD311810L0243</b>	Temperature Accessories:T/C wire Kit 1 for types E, J, K, N, T; mini t/c connector, 1 m cable
<b>3KXD311810L0244</b>	Temperature Accessories:T/C wire Kit 2 for types B, K, R/S; mini t/c connector, 1 m cable
<b>3KXD311810L0245</b>	Temperature Accessories:mV measure/simulate cable assembly; mini t/c connector, 3.5 ft. (1.07 m) copper cable, alligator clips
<b>3KXD311810L0246</b>	Temperature Accessories:Simulate cable for RTD temp module, 5 ft (1.52 m) cable, 2
<b>3KXD311810L0240</b>	Pt 100 RTD, DIN Class "A", 0.00385 alpha, 4 lead, 1/4 in. (0.635 cm) O.D. 300 Series SS

**MOBILITY DHH810-MFT CALIBRATOR/CONFIGURATOR INSTRUCTION MANUAL**

<b>ABB Part Number, Pressure Kits</b>	<b>Description</b>
<b>3KXD311810L0120</b>	Standard kit includes: hard carrying case (P/N 3KXD311810L0141), pressure (P/N 3KXD311810L0160) or vacuum (P/N 3KXD311810L0161) pump, low pressure connection kit (P/N 3KXD311810L0180). Standard kit with P/N 3KXD311810L0160 pressure pump
<b>3KXD311810L0121</b>	Standard kit with P/N 3KXD311810L0161 vacuum pump
<b>3KXD311810L0160</b>	Pressure Sources: 961P pressure pump with integral variator, bleed valve, 1/8 in. (0.3175 cm) Female NPT connection, 0...145 PSIG (0...10 bar)
<b>3KXD311810L0161</b>	Pressure Sources: 961V vacuum pump with integral variator, bleed valve, 1/8 in. (0.3175 cm) Female NPT connection, -650 mm Hg (-867 mbar)
<b>3KXD311810L0165</b>	Pressure Sources: Repair parts kit for pressure pump 3KXD311810L0160 (961P)
<b>3KXD311810L0166</b>	Pressure Sources: Repair parts kit for vacuum pump 3KXD311810L0161 (961V)
<b>3KXD311810L0167</b>	M600FT Combo Pneumatic Scissor Pump, 28" Hg vac to 600 PSIG, push button vac to pressure switch, 1 1/4" and 1/8" NPT connections, vernier for fine adjustments, vent valve, fittings, 2 ft hose, canvas carrying bag
<b>3KXD311810L0168</b>	MH10-KT Hydraulic Calibration Pump, 0 to 10,000 PSIG, compatible with most hydraulic fluids, oils and water, 1/4" NPT connections, vernier for fine adjustments, vent valve, fittings, 3 ft high pressure hose, 3 spare filters, canvas carrying bag
<b>3KXD311810L0180</b>	Low pressure kit - not for use above 250PSIG(17.3 bar)incl:5.5 m of 1/8 in.(0.32 cm)OD tubing,(2)"T" fittings 1/8 in.(0.32 cm)OD,(6)1/8 in.(0.32 cm)OD tube M NPT+(1)1/8in.(0.32 cm)F NPT to 3/16 in.(0.48 cm)barb,&(2)NPT reducers from 1/4in.(0.64 cm) M to 1/8 in.(0.32 cm)F

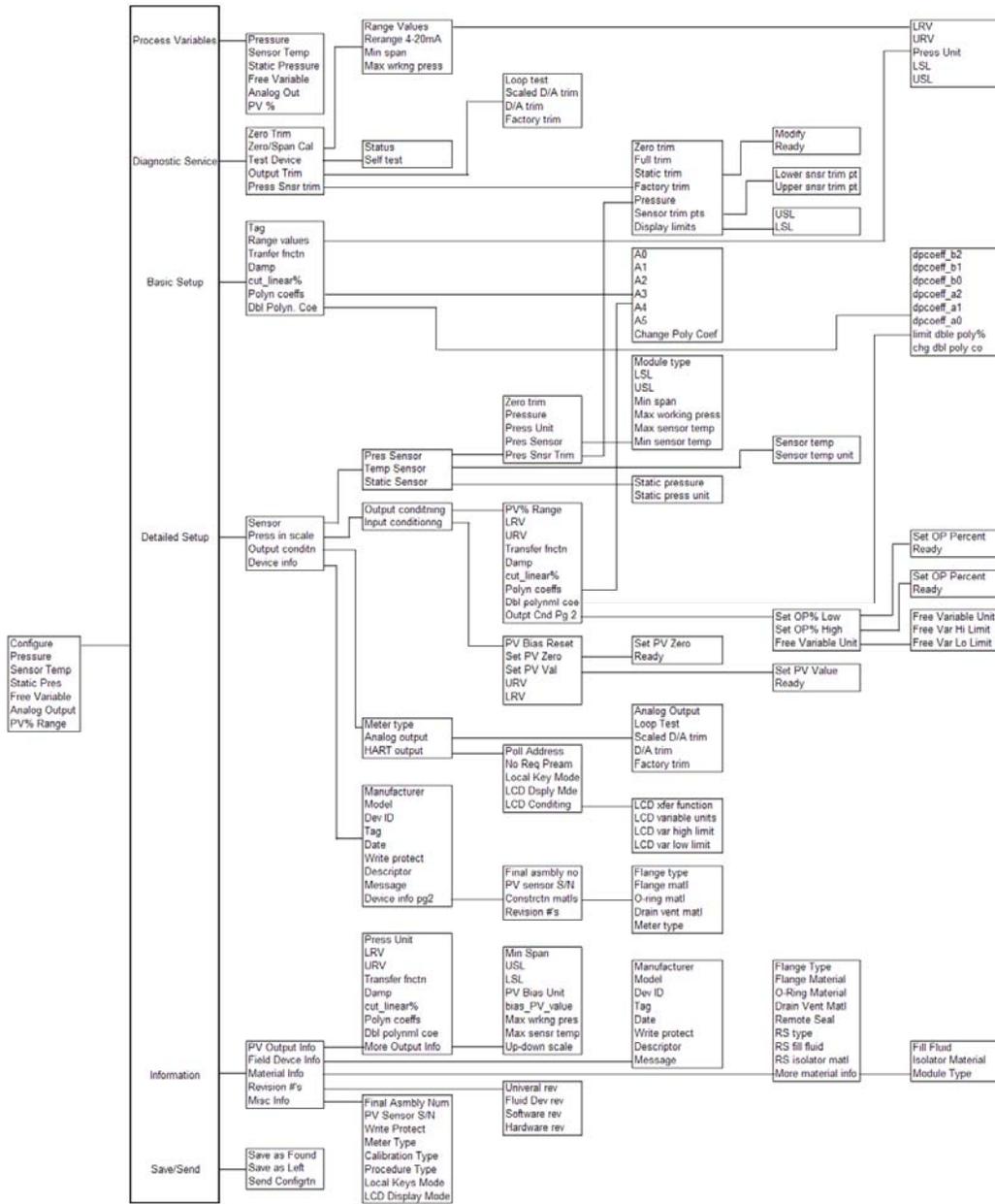




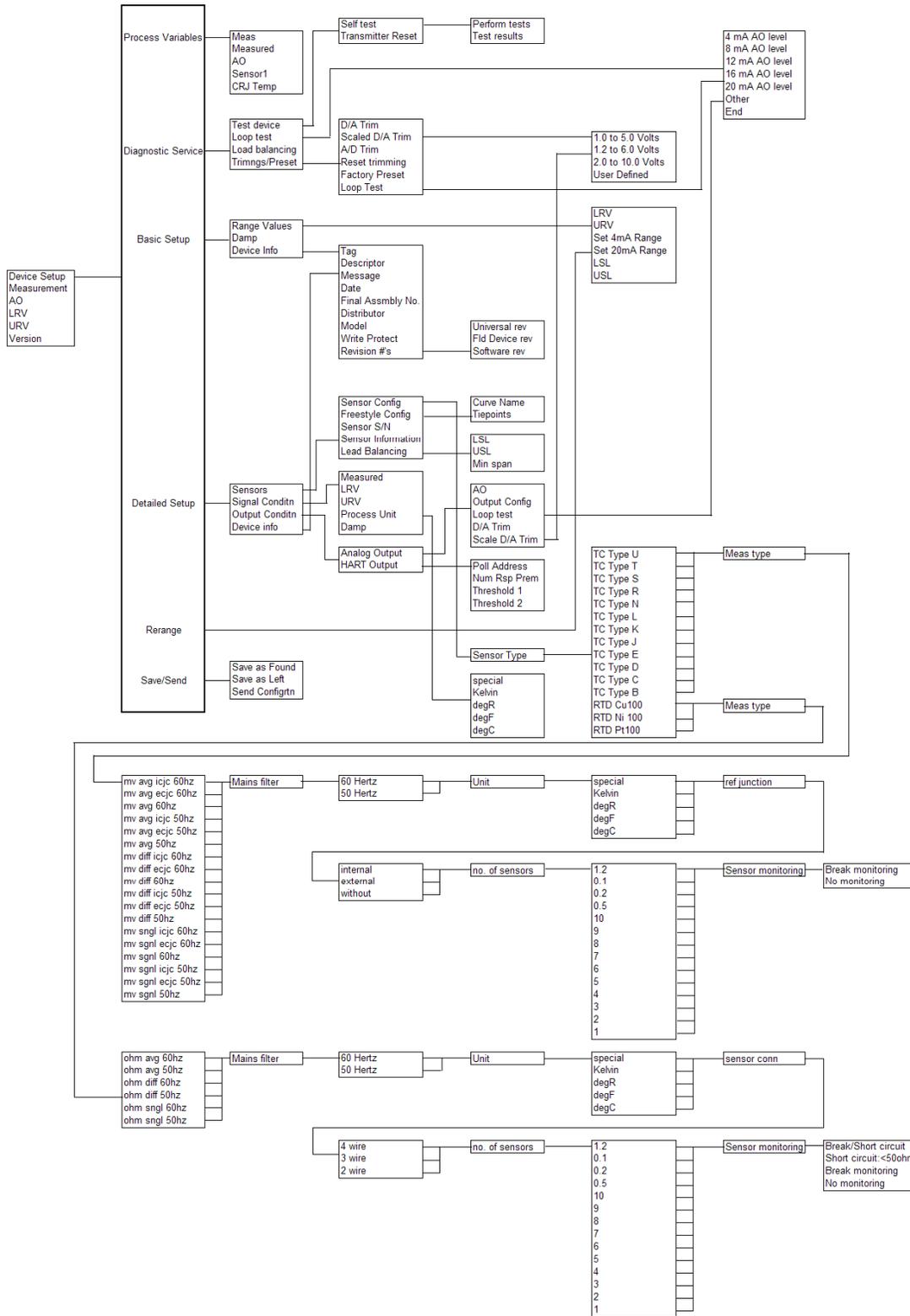


# 29.0 HART Command Structure Menu Tree

## 29.1 2600T-262/264 Rev. 1 Menu Tree

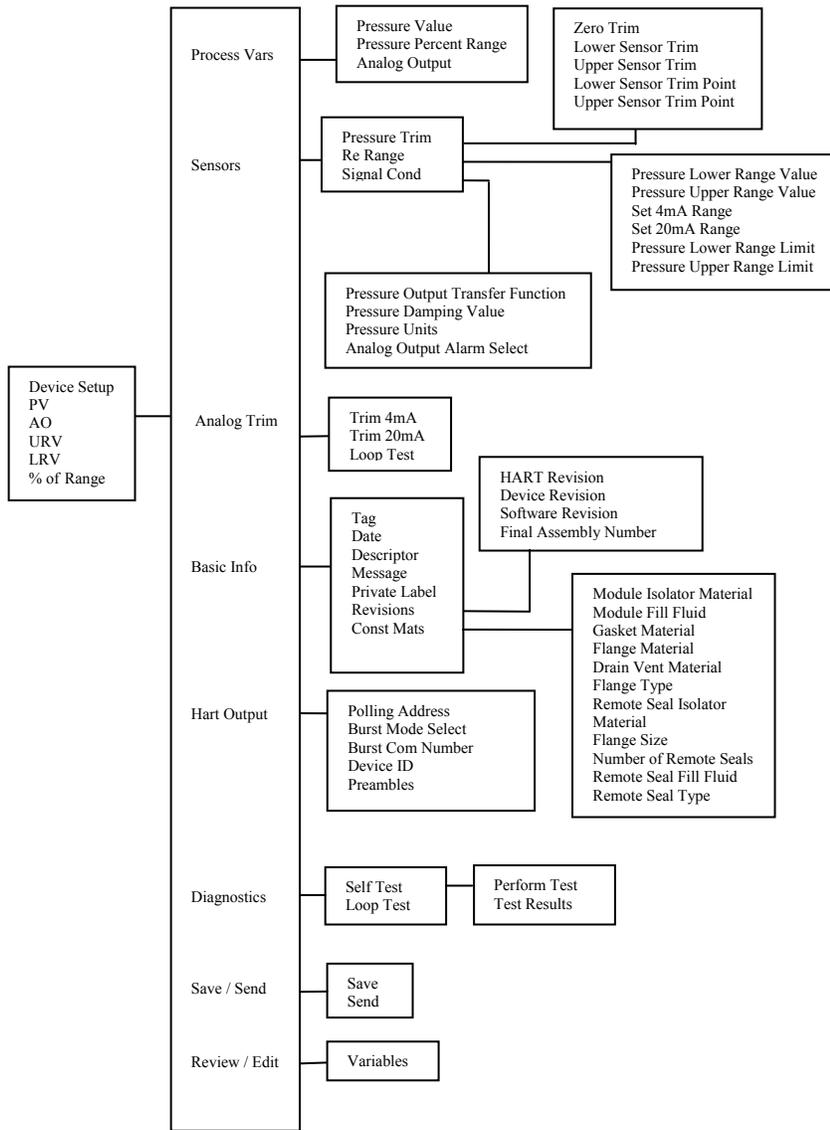


29.2 THx02 Rev. 1 Menu Tree

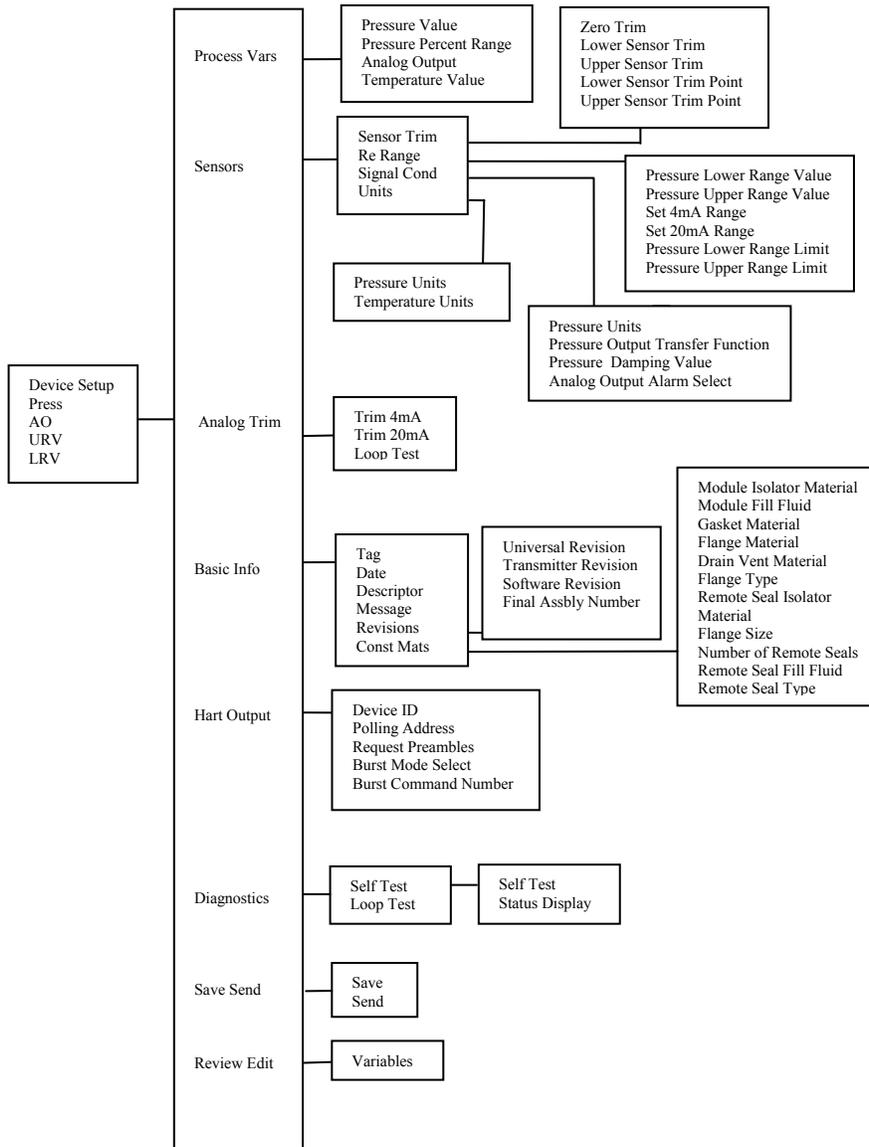




29.4 1151 Rev. 5 Menu Tree



29.5 3051C Rev. 2 Menu Tree



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