

HART-enabled MFT B-Series

The Kurz Instruments MFT B-Series v2.x thermal mass flow transmitter (MFTB) can be ordered with a HART interface. The HART Field Communications Protocol is widely recognized as the industry standard for digitally enhanced 4-20 mA smart instrument communication. This feature allows the MFTB Flow Meter to communicate its device data over the same wiring used to transmit the 4-20mA signals without disturbing the 4-20 mA analog signal.

HART is a master/slave protocol which means that a field device (slave) speaks only when spoken to by a master. Two masters (primary and secondary) can communicate with slave devices in a HART network. Secondary masters, such as handheld communicators, can be connected almost anywhere on the HART network and communicate with field devices without disturbing communication with the primary master. A primary master is typically a DCS, PLC or computer based central control or monitoring system.

The MFTB complies with HART Protocol Revision 7.0.

Connecting with a HART Master

The HART Master can interface with the MFTB flow transmitter from the control room, at the flow transmitter, or any other wiring termination point in the 4-20mA loop, provided there is a minimum of 250 (ohm) between the connection and the power supply. Using the Device Descriptor (DD) files, the HART Master can fully configure the MFTB if it has the MFTB DD installed. If the HART Master does not have the DD for the MFTB, it will still communicate and configure the device using the HART Universal and Common Practice commands but cannot access the extra or device specific commands available in the MFTB (e.g. MFTB Flow Area Setup). Accessing device specific data and device specific commands requires the DD for the MFTB, as this provides the HART Master with the information needed to fully access all the MFTB capabilities.

Handheld communicator as HART Master

The HART handheld communicators will typically have clip on leads to connect to the field device. A commonly used HART handheld communicator is the Emerson 375 (the Emerson 275 will not work with the MFTB).

PC-based HART Master

A PC-based HART Master communicates with the MFTB through a HART modem. The HART modem typically uses the USB interface of the PC on one end of the modem and clips on the other end of the modem to connect to the MFTB flow transmitter. The ProComSol HM-USB is a recommended HART Foundation registered compliant HART Modem with a USB Interface.

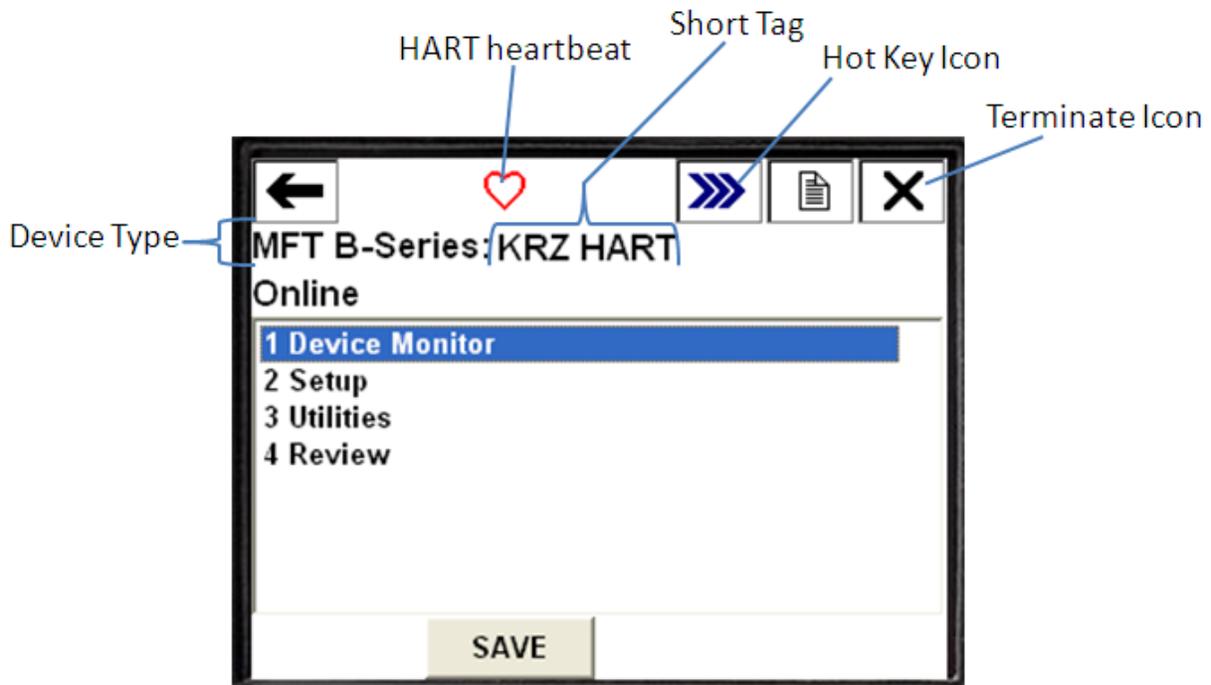


The MFTB HART DD for the Emerson Handheld Communicator can be obtained from Emerson. The HART Communication Foundation (HCF) also publishes a quarterly update of DDs for devices that have been certified by the HCF as HART compliant.

When the HART master is first turned on it will search for the flow transmitter on the 4-20mA loop to establish the connection and learn the device's identity. Once the HART master learns the identity of the MFTB, the HART master will locate the MFTB's DD (assuming it has been loaded in the memory module of the HART Master) and load it. If a DD for the MFTB is not present, the HART Master will generally load a generic DD.

The following sections provide the details unique to the MFT B-Series HART mass flow transmitter. The screen shots are the menus and displays using the Emerson 375 Handheld Communicator. It is assumed that the user is familiar with an Emerson 375/475 Field Communicator and how to connect to a HART loop or directly to a HART device.

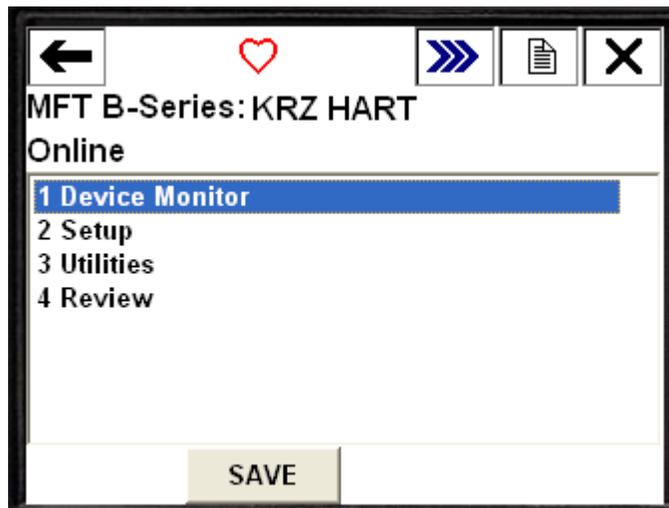
When the HART Communicator is powered on and connected to a current loop, it automatically searches for a live HART device on the loop. If the MFTB is connected to the HART Communicator, the "Online" menu will display, as shown below.



Field Communicator Screen Layout

Icon	Meaning
	The Field Communicator is communicating with a live, online HART device.
	The Field Communicator is communicating with a HART loop with a device in burst mode.
	The Field Communicator is running in shout/deaf mode, which helps communicate with a device when it is on a noisy loop.
	The Field Communicator is running in shout/deaf mode and communicating to a HART loop with a device in burst mode.
	Communication is not occurring. This is common when only non-dynamic parameters are listed.

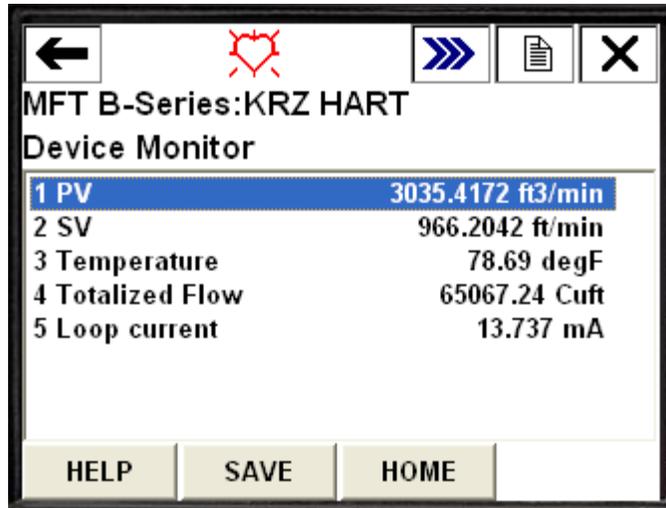
HART Heartbeat Icon meanings



The "Online" menu contains four submenus through which the user can (1) Monitor the MFTB dynamic variables – Device Monitor menu, (2) Modify MFTB configuration parameters – Setup menu, (3) Perform various calibration, maintenance/diagnostic, and utility functions on the MFTB – Utilities menu, and (4) Review the MFTB process and configuration data – Review menu.

DEVICE MONITOR Menu

When the Device Monitor menu is expanded, the MFTB Dynamic Variables and the Loop Current are displayed as shown.



A single dynamic variable can be displayed by selecting it. For example, selecting PV will show the following screen on the handheld communicator.



For the MFTB, the PV (Primary Variable) can be mapped to the MFTB measured flow rate or the MFTB measured velocity. This mapping is done by selecting the respective PV units as follows:

PV = Flow Rate	PV = Velocity
ft ³ /min	ft/min
ft ³ /h	m/s
L/min	
m ³ /h	
kg/min	
kg/h	
lb/min	
lb/h	

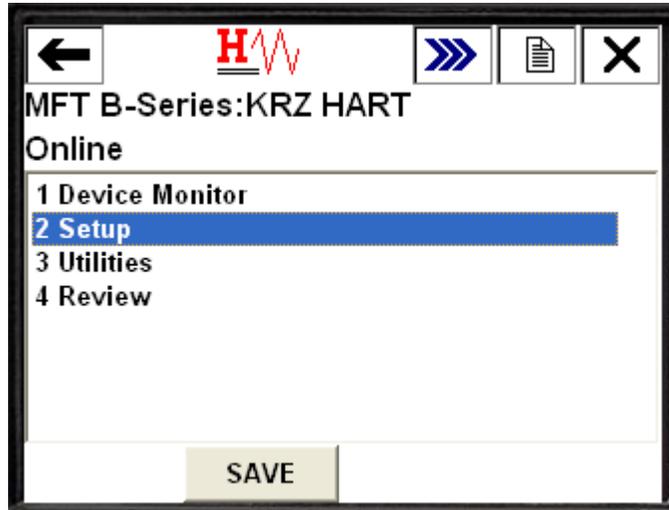
The flow meter actually measures and reports Standard Flow Rate and Standard Velocity referenced to the [Standard Temperature and Pressure programmed into the meter](#). For a detailed discussion on Standard Volumetric Flow and Standard Velocity please reference the section on [Thermal Anemometer Measurements](#).

When the PV units are changed and sent to the MFTB, the flow meter will make the associated changes to the analog output configuration to reflect the proper measured flow data being sent to the analog output channel. If Flow Rate is mapped to PV, then Velocity will be mapped to SV; and vice versa, if Velocity is mapped to PV, then Flow Rate is mapped to SV.

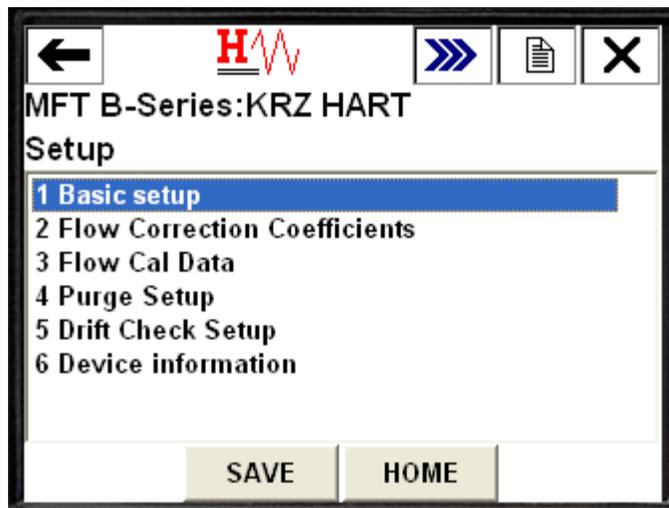
The MFTB TV (Tertiary Variable) and QV (Quaternary Variable) are mapped to temperature and totalized flow, respectively.

SETUP menu

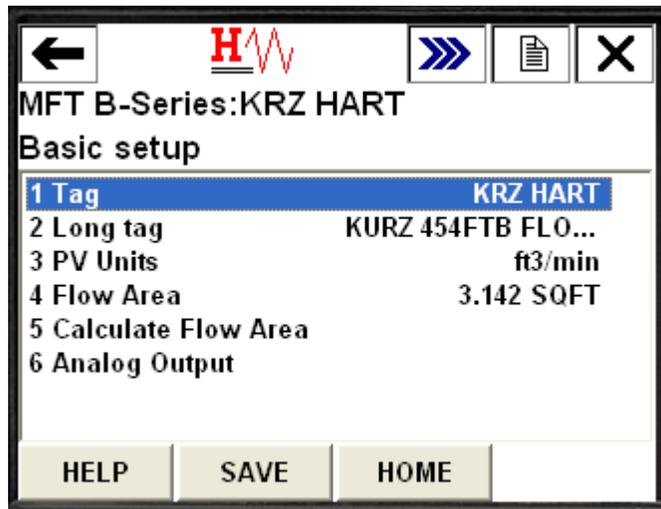
The Setup menu contains several sub-menus used to change the flow meter's basic and advanced configuration parameters.



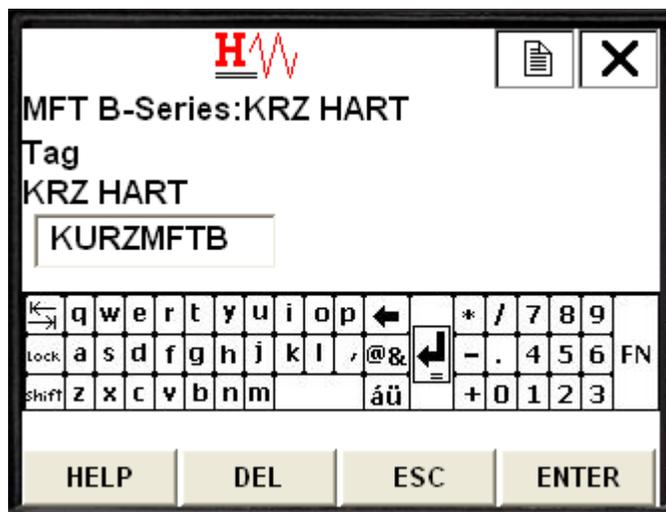
The following are the sub-menus available on the MFTB HART Setup Menu



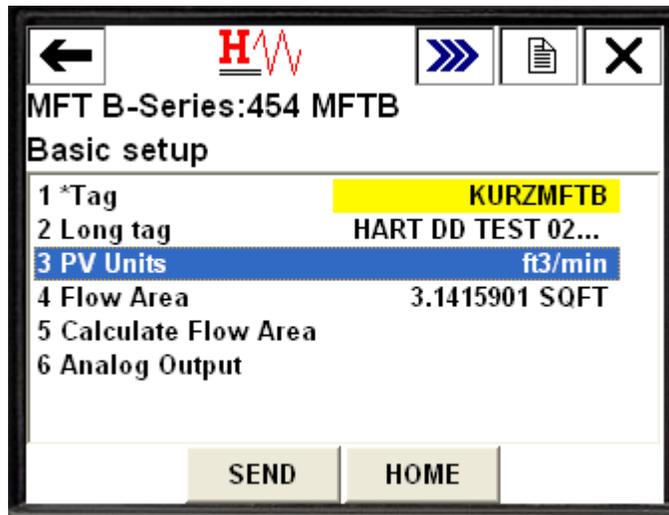
The Basic Setup sub-menu contains the parameters that setup the meter when it is first installed. The menu items are shown below.



When you tap on “1 Tag” the following screen is displayed on the 375 communicator where you can enter the HART Short TAG. The HART Short TAG is mapped to the MFTB Tag Name which is displayed on the the MFTB local LCD display.

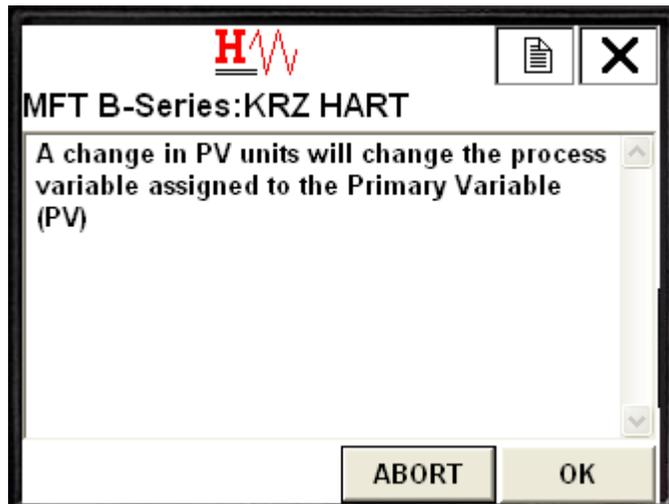


After entering the new HART Short Tag, tap “ENTER” to accept the entry. The change will be indicated with a **HIGHLIGHT** as shown below. The parameter name will also be marked with an asterisk. The highlight and asterisk indicate that the change has not been sent to the device. In order for the change to become permanent, you must tap on “SEND” to send the change(s) to the MFTB where the change(s) will be saved in the meter’s nonvolatile memory so that it will be persistent even after power cycling the meter.

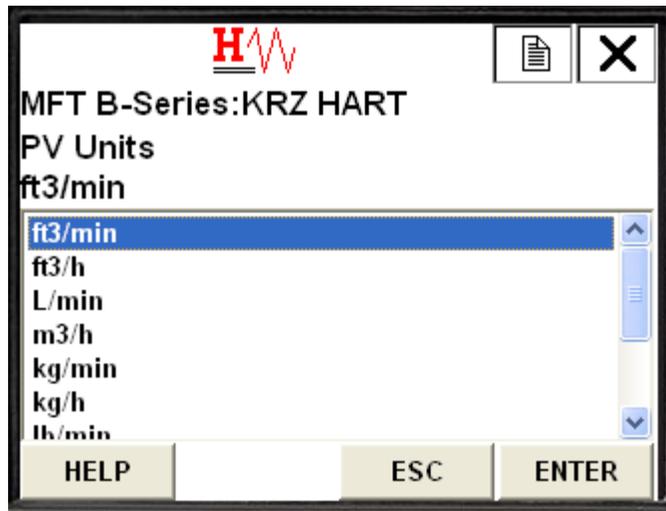


To change the PV Units, tap on “3 PV Units”.

An advisory message is displayed that will remind you that a change in PV units may change the process variable (flow rate or velocity) assigned to PV.



The PV Units is selected from a list of supported flow units.



The list of supported PV units is shown in the Table below:

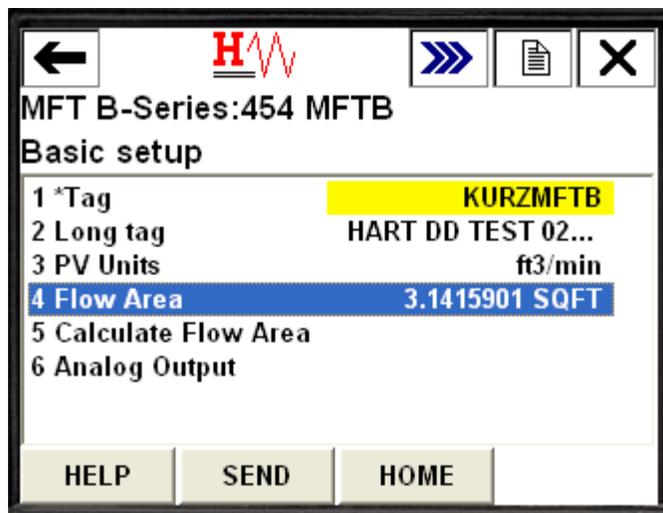
HART Menu List	Actual Meter Measurement
ft3/min	SCFM, Standard Cubic Feet per Minute
ft3/h	SCFH, Standard Cubic Feet per Hour
L/min	SLPM, Standard Liters per Minute
m3/h	SCMH, Standard Cubic Meter per Hour
kg/min	KGM, Kilograms per Minute
kg/h	KGH, Kilograms per Hour
lb/min	PPM, Pounds per Minute
lb/h	PPH, Pounds per Hour
ft/min	SFPM, Standard Feet per Minute
m/s	SMPS, Standard Meters per Second

The flow meter actually measures and reports Standard Flow Rate and Standard Velocity referenced to the [Standard Temperature and Pressure programmed into the meter](#). For a

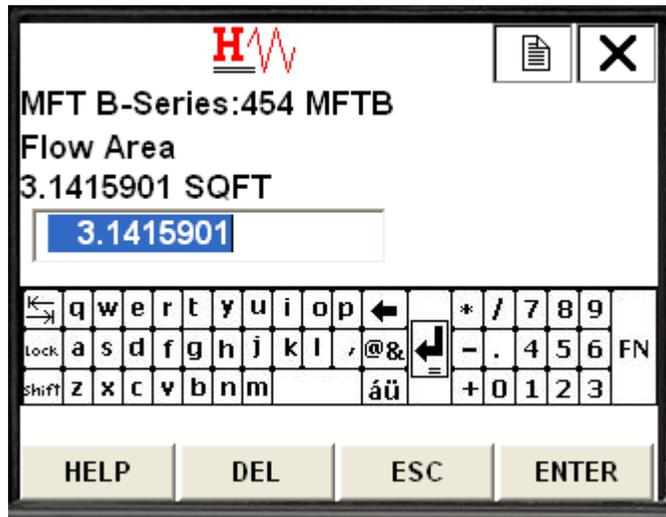
detailed discussion on Standard Volumetric Flow and Standard Velocity please reference the section on [Thermal Anemometer Measurements](#).

The Flow Area is another menu item that can be changed under the Basic Setup sub-menu. The value of the Flow Area can be entered directly by tapping on “4 Flow Area”. Alternatively, the method “Calculate Flow Area” can be used and guides you to enter the dimensions of your duct from which the Flow Area is automatically calculated. The Calculate Flow Area method is used, if you have a standard shaped duct or pipe that is either round or rectangular. For odd shaped ducts/pipe, you will need to calculate your flow area.

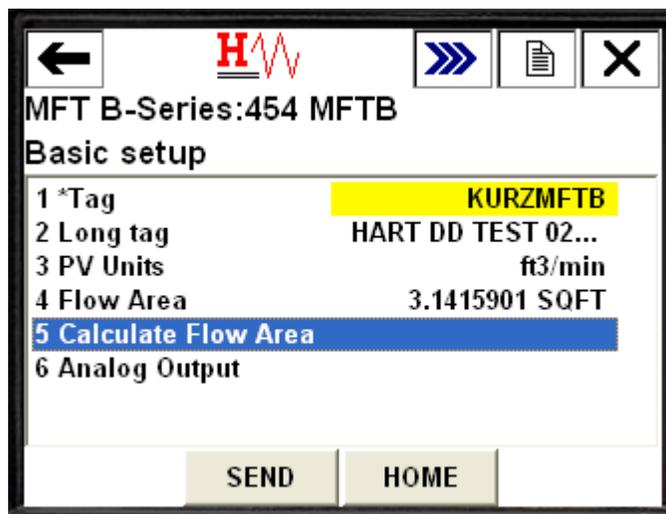
To enter your pre-calculated Flow Area, tap on “4 Flow Area”.



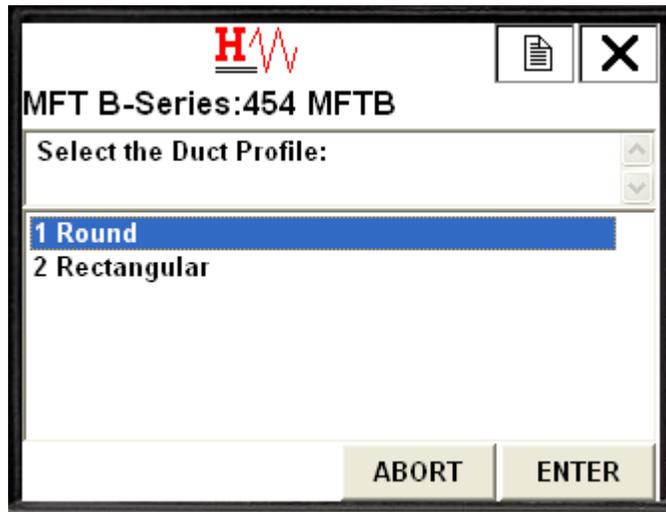
The following screen allows you to enter your flow area by using the keyboard on the display.



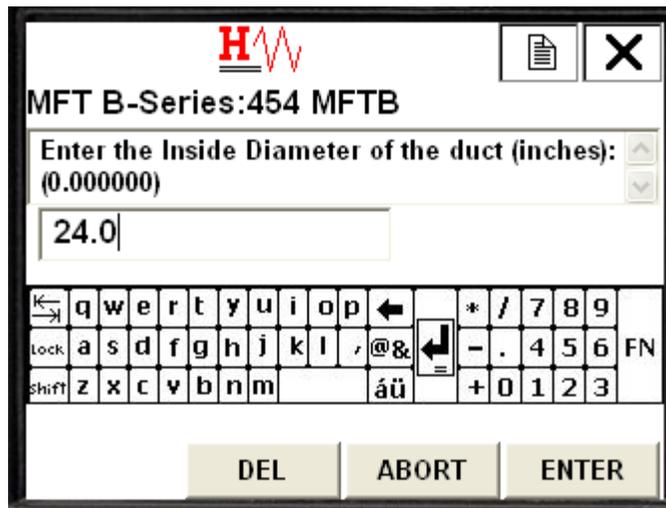
To use the Flow Area calculation method, tap on “5 Calculate Flow Area”.



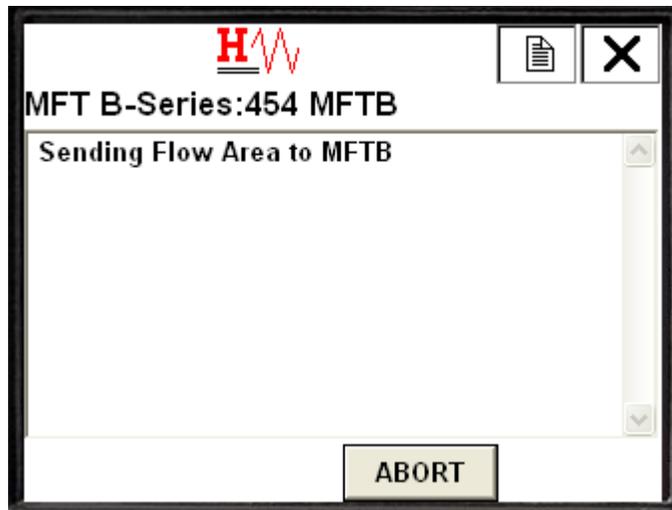
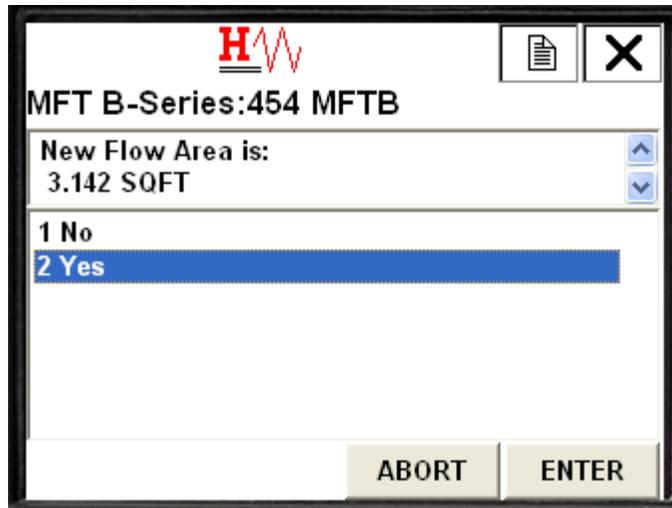
The method first prompts you to enter the profile of your duct or pipe.



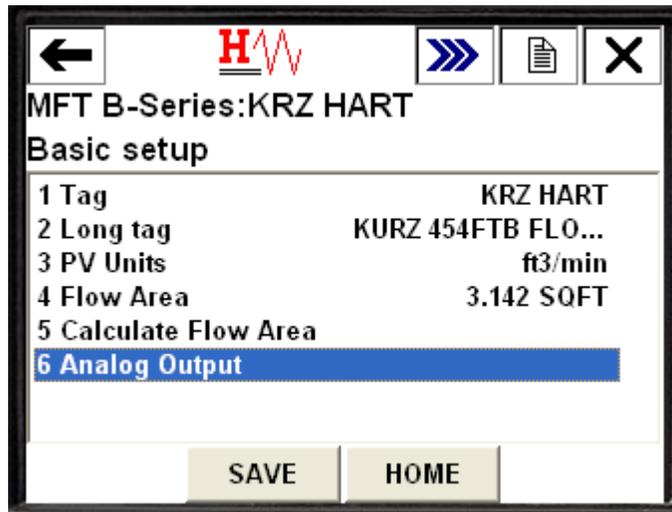
For round profiles, you will enter the inside diameter of the pipe/duct. For rectangular profiles, you will enter the inside height and width of the pipe/duct.



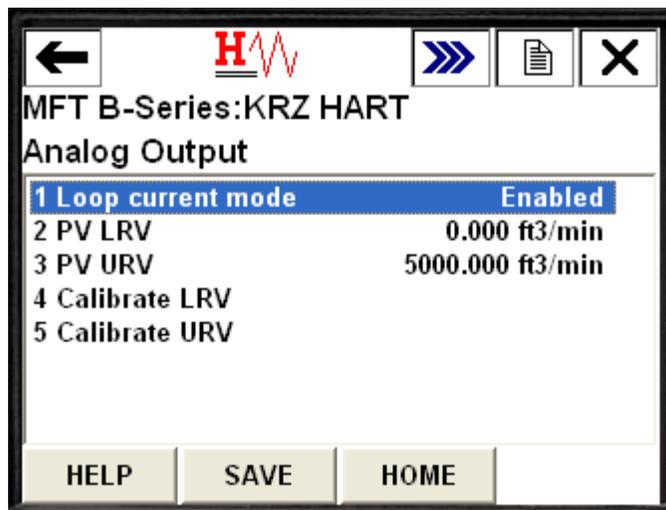
The method calculates the Flow Area from your input(s) and displays the value. You can choose to accept the calculated value by selecting “YES” and the new flow area will be sent to the MFTB.



The Analog Output sub-menu is where you set the analog output range of the 4-20 mA output.



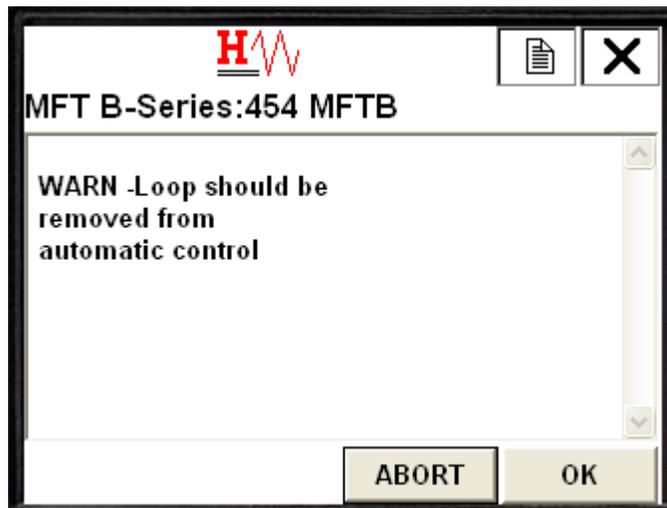
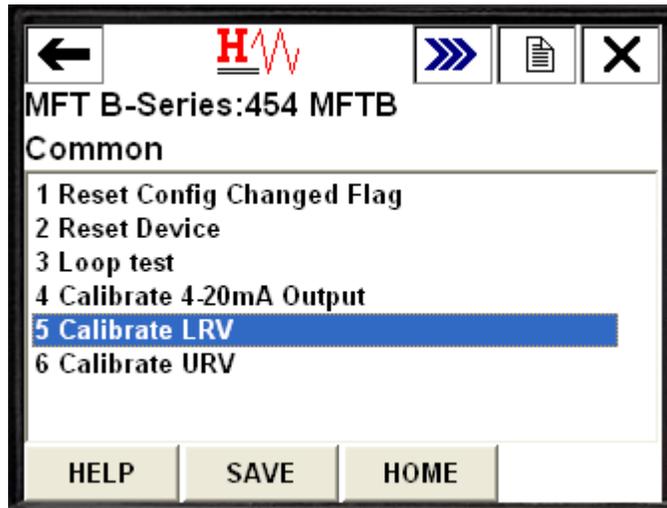
The following items are available in the Analog Output sub-menu.

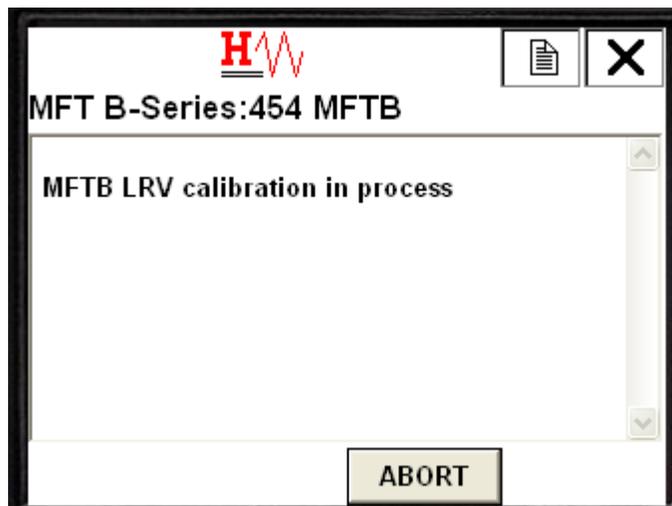
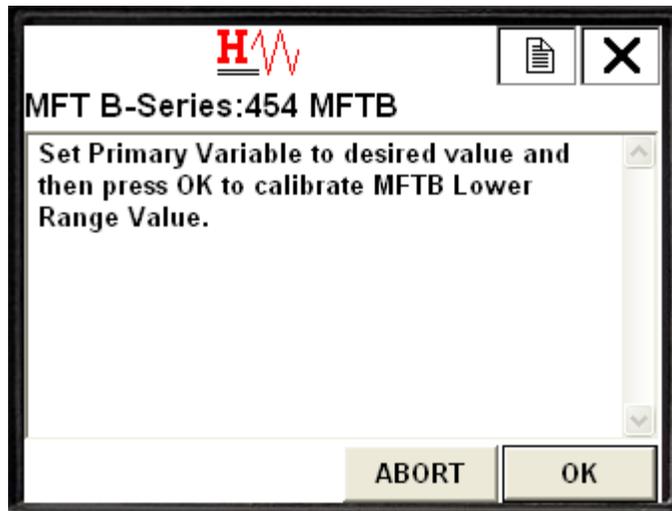


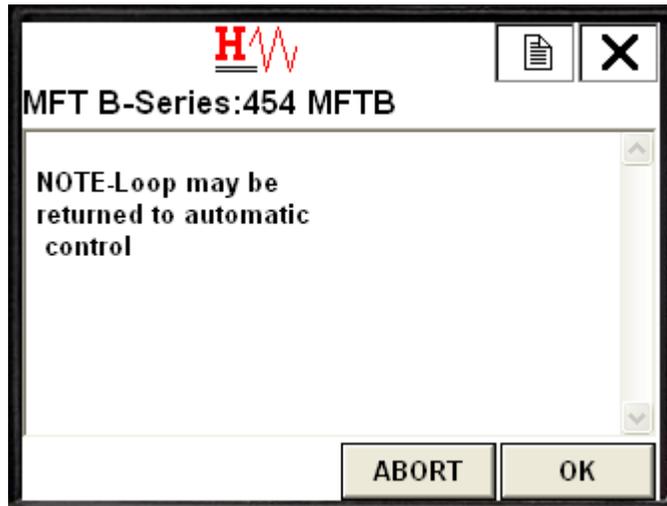
The Analog Output (or PV) upper and lower range values can be entered directly or you can use the “Calibrate LRV” and “Calibrate URV” methods to re-range the flow meter. Note, these two methods are also available under the Common Utilities menu.

The following screens will guide you through the re-range procedure if the “Calibrate LRV” and “Calibrate URV” methods are used.

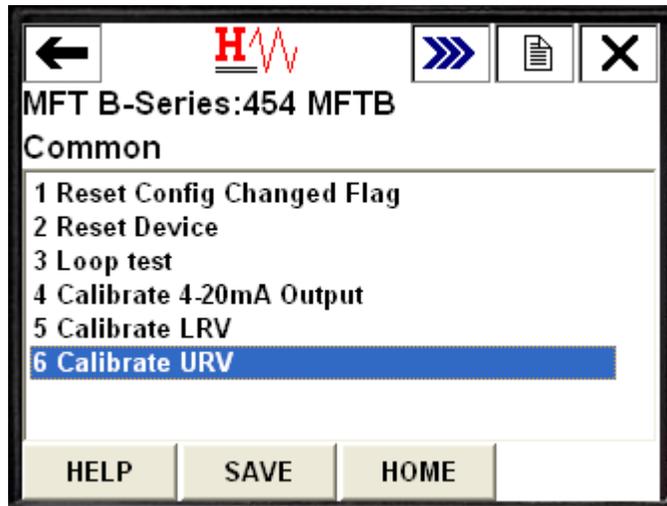
Calibrate LRV

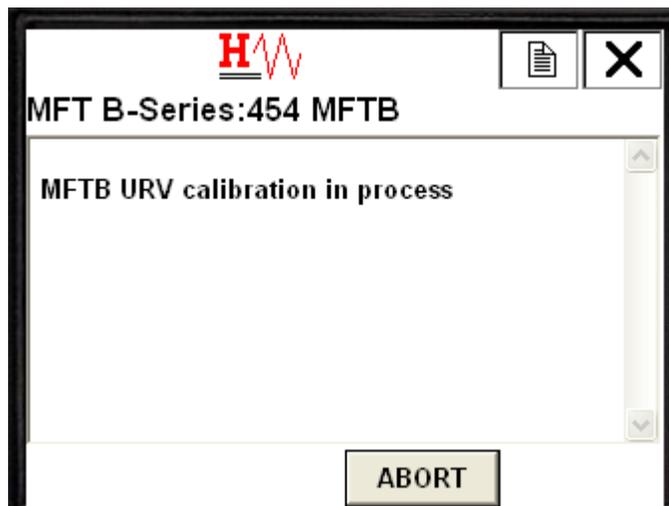
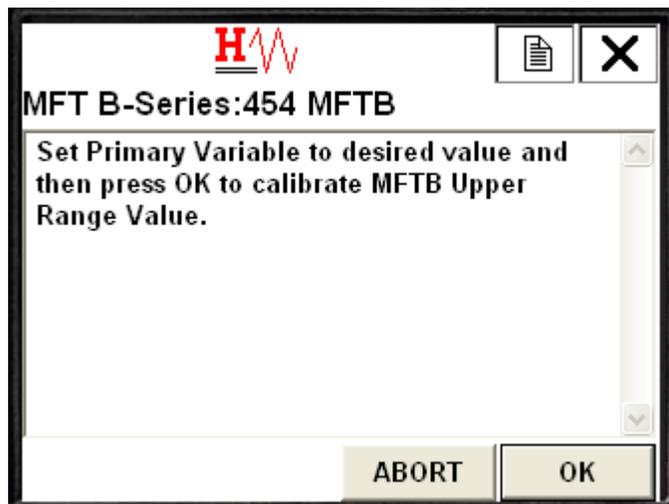
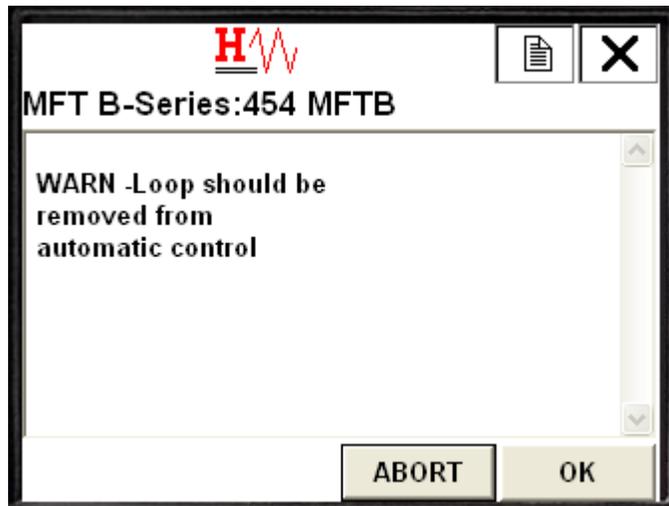


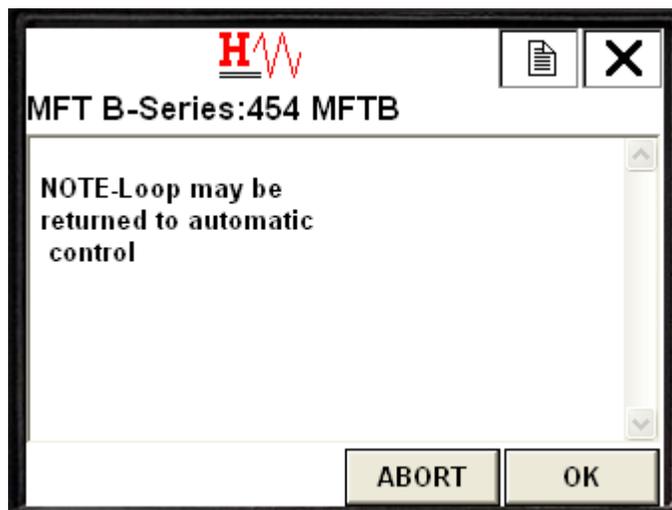




Calibrate URV







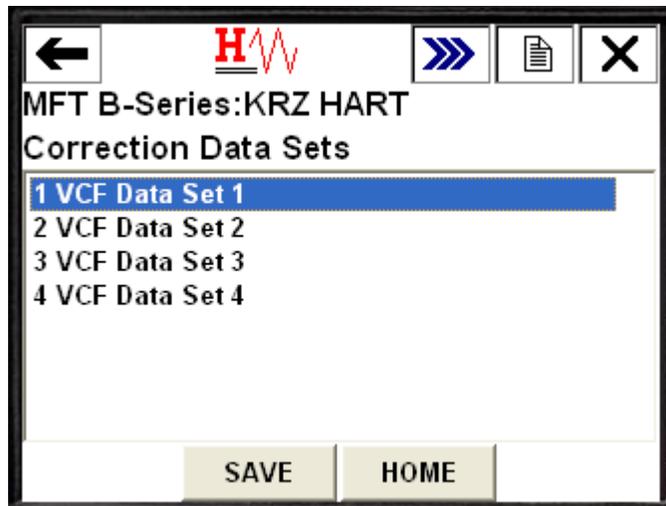
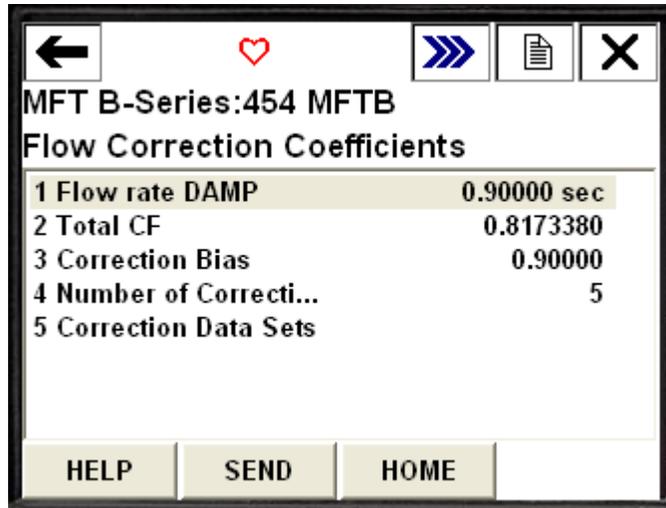
The remaining items in the Setup menu allow you to setup advanced features of the MFTB flow meter such as the Flow Correction Coefficients, Sensor Gas Purge Cleaning, and Drift Check.

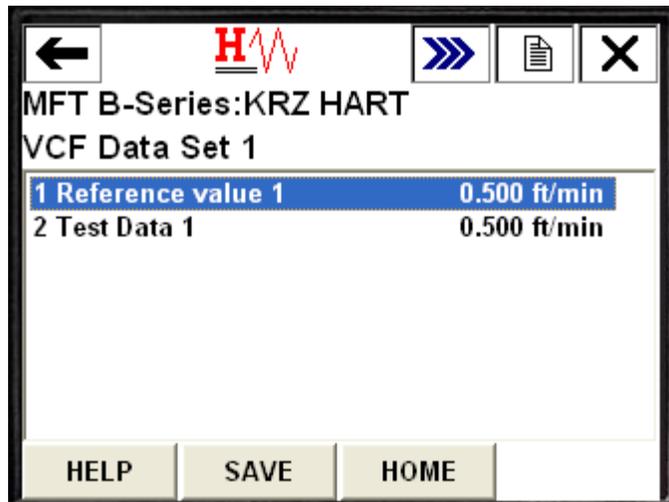
The following sections discuss those advanced setup menus.

Flow Correction Coefficients

The MFTB has various correction factors that are used to correct for velocity profile issues due to non-ideal installation effects on the measured flow. A sub-menu in the Setup menu contains all of the flow correction factors available for modification. The flow correction factors are obtained from the field calibration procedure ([CAL-16](#)) and may be entered into the flow meter using the Flow Correction Coefficients menu. Also available for display in the Flow Correction Coefficients menu is the Total CF (Total Correction Factor) which is the multiplicative

combination of all the flow correction factors. For a detailed explanation of the MFTB correction factors, see section [AK – Variable CF Setup and Operation](#).



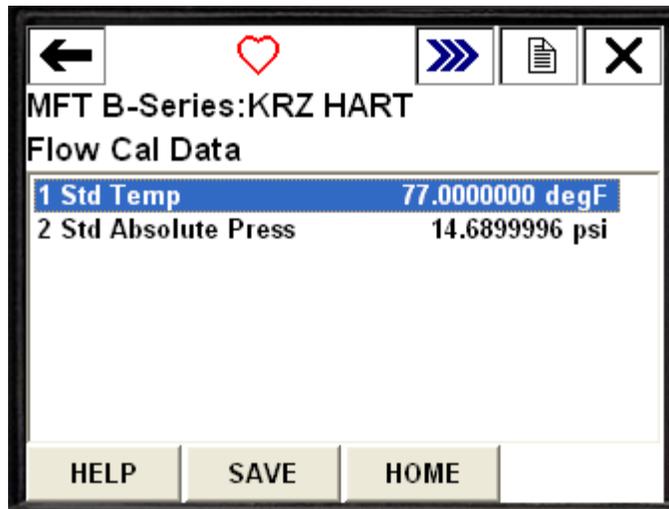


The "Reference value" is the actual/true velocity or flow rate. The "Test Data" is the indicated velocity or flow rate as measured by the Kurz meter.

Flow Cal Data

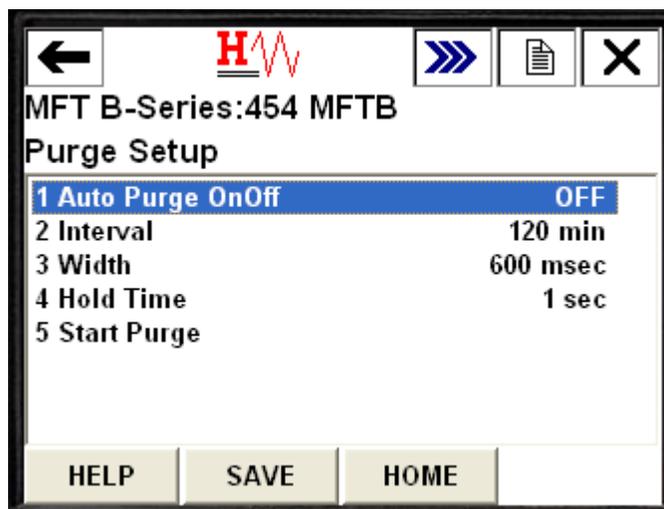
The Flow Cal Data menu contains the Standard Reference Temperature and Pressure conditions of the process gas. If your temperature and pressure is different than the STP used for factory calibration of the meter, then the actual values should be entered in this menu.





Purge Setup

The purge feature of the MFTB provides a method to clean the sensor with high velocity gas that blows off any build up of dirt on the sensor sting. The cleaning sequence can be initiated from the HART handheld communicator or it can be setup to be automatically triggered on a timer internal to the flow meter. The Purge setup menu is shown below.

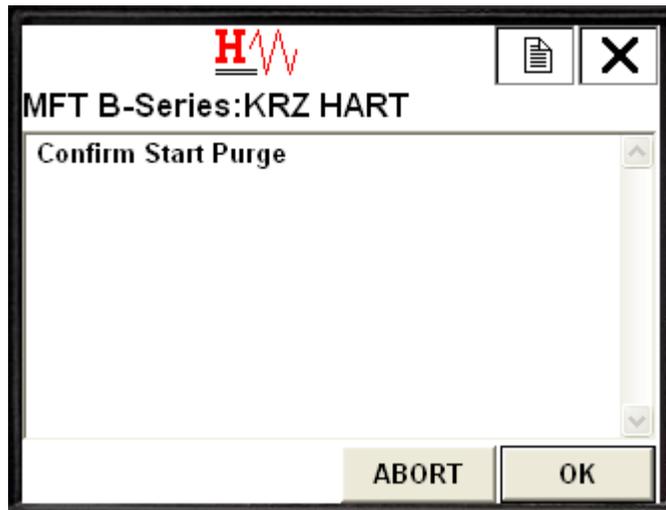
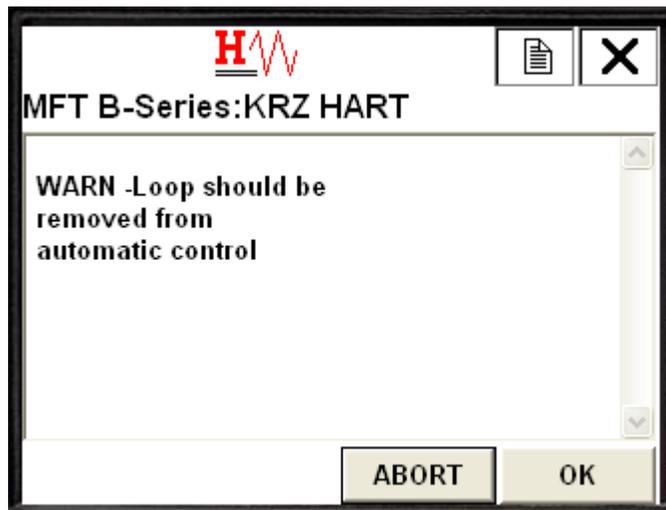


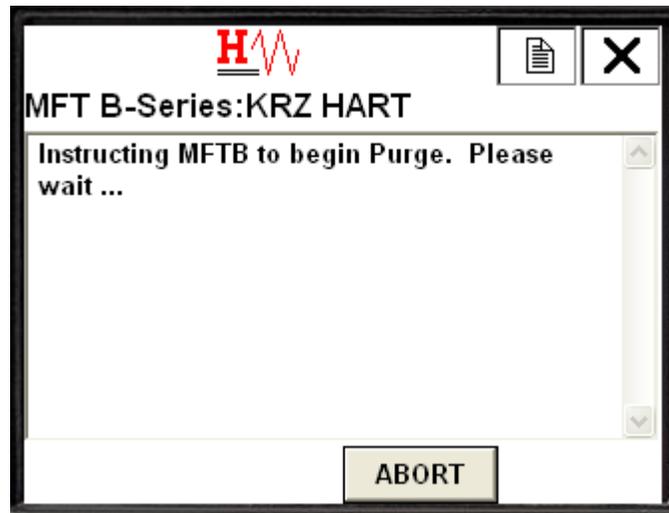
In order to have the cleaning sequence automatically triggered, Auto Purge needs to be set to ON and (Purge) Interval needs to be defined. The “Width” and “Hold Time” define parameters of the actual cleaning cycle. The Purge Width is the length of time the purge solenoid is held open. The Hold Time allows the sensor to recover from the purge cleaning to minimize the large flow spike following the purge. The Hold Time is the total time for the entire purge cycle (e.g. a Hold Time of 1 second (1000 milliseconds) with a Purge Width of 600 milliseconds means that the purge relay will be pulsed for 600 milliseconds, followed by an additional 400

milliseconds of idle time to allow for sensor recovery). During the Hold Time, the AO value is frozen at the pre-purge value to minimize disruption of a control loop during the purge cleaning cycle.

Start Purge method

To initiate a purge cleaning, tap on “5 Start Purge” (this method is also available on the Device Specific Utilities Menu). The following warning message will be displayed followed by a confirmation message before a command is sent to the flow meter to start a purge cleaning cycle.





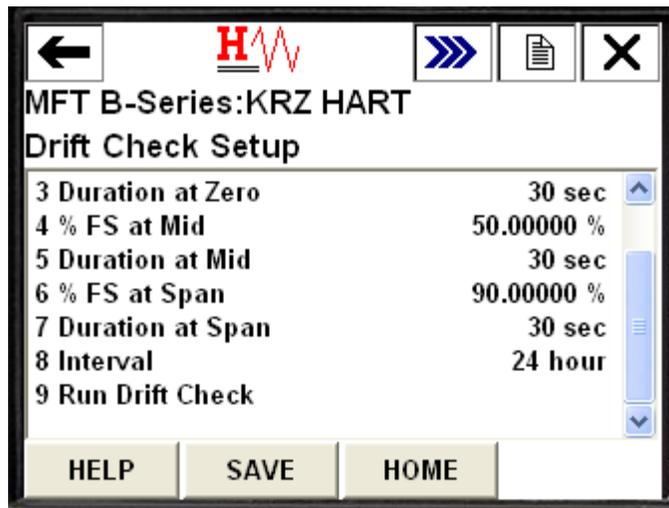
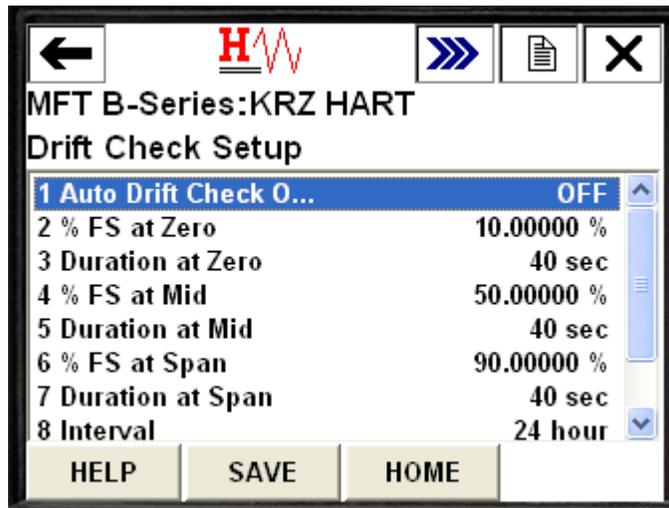
Drift Check Setup

The Drift Check feature in the MFTB is a diagnostic test wherein an independent voltage source within the MFTB electronics is used to drive the 4-20 mA output so that the expected output can be compared against the actual loop current signal to verify proper calibration of the 4-20 mA output of the flow meter. This is also known as the EPA zero-span drift check and is used for emission monitoring system daily compliance with the EPA. The independent voltage source has a range of 0 to 3.3 Volts.

The Drift Check tests provide for three voltage test levels, a zero, middle and span check. For each Drift Check test level you must configure an amplitude of the output signal and a duration that the output signal is applied. The amplitude is given as a % of the full-scale of the independent voltage source (3.3V). For example, if you enter 10.0 for “% FS at Zero”, this

means that 0.33V (10% of 3.3V) will be applied to the 4-20mA output for the Drift Check at Zero. The duration is the time the 4-20mA output is forced at the % level specified for the test.

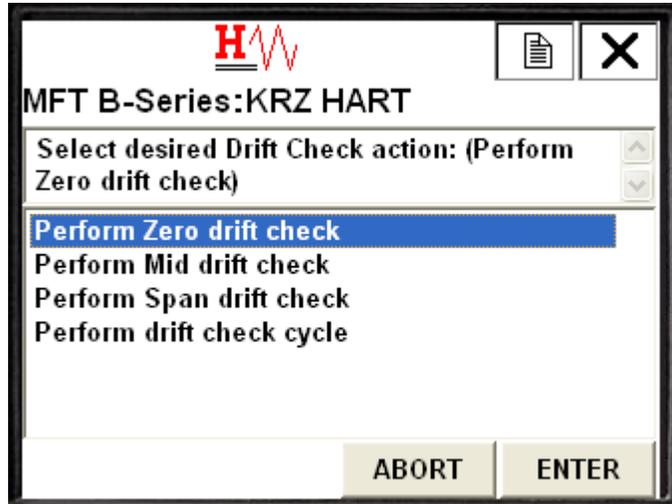
The Drift Check setup parameters are shown below.



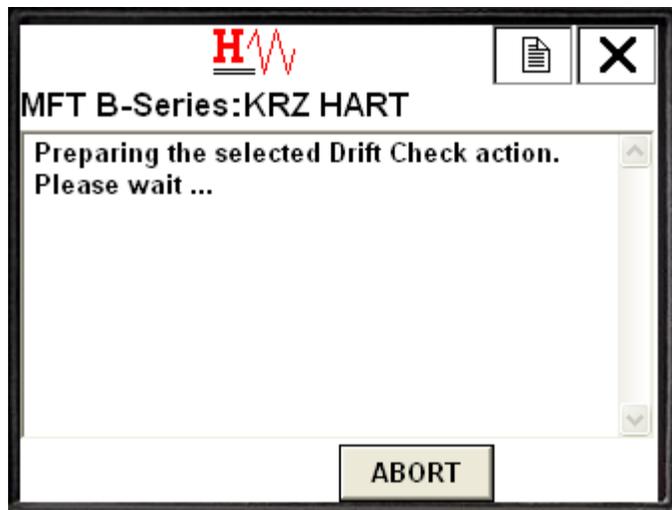
The Drift Check test can be configured to automatically initiate on a specified interval. This is done by setting the parameter “Auto Drift Check” to ON and specifying a drift test interval (“8 Interval”). Alternatively, you can initiate a Drift Check through the 375 communicator, by selecting “9 Run Drift Check”. The Run Drift Check method is also available under the Device Specific Utilities menu.

Run Drift Check

When you select Run Drift Check, the following screen provides the option to run any of the Drift Checks individually or perform the entire cycle of drift check tests.



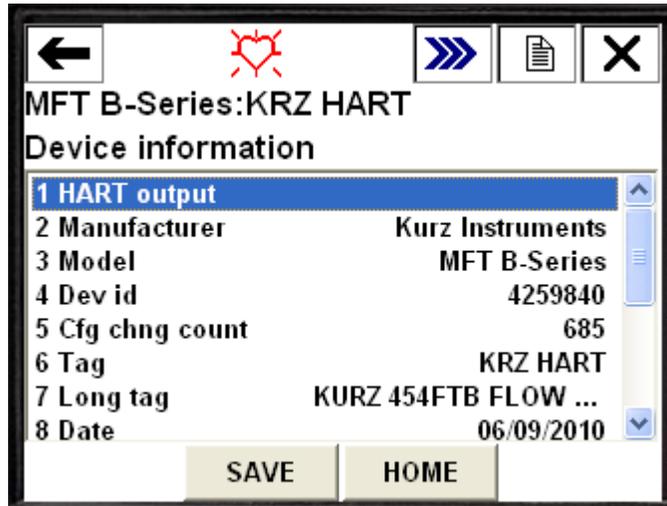
Once a Drift Check test is selected, the following informational screen will be displayed while the 375 sends the appropriate command to the MFTB to initiate the test.



Note, while a Drift Check is running, the 4-20mA output (loop current) will represent the percent of Full Scale (of 3.3V) that the Drift Check level was configured at, not the PV reading.

Device Information

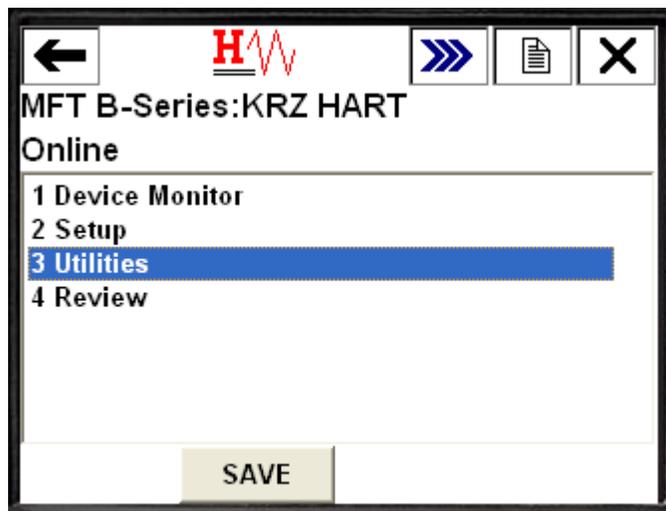
The Device Information Setup menu contains the HART universal and common variables, some of which can be modified in this Setup menu. The items included in this menu are shown below.



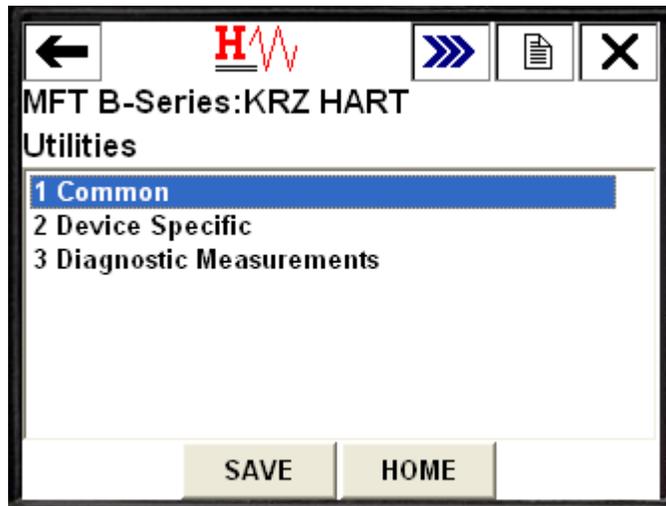


UTILITIES Menu

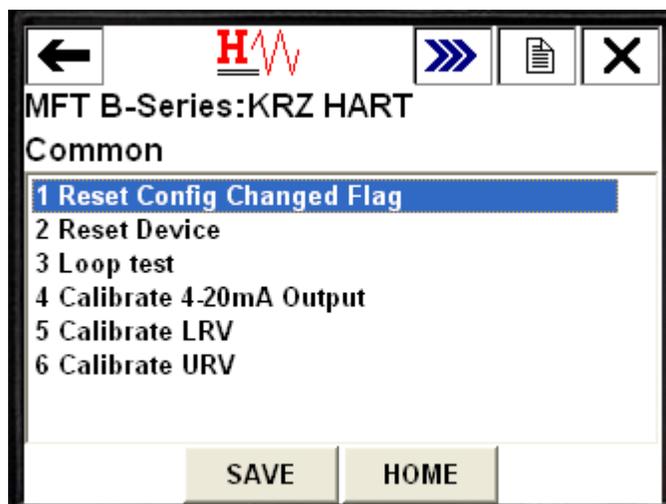
The Utilities menu contains various methods and MFTB diagnostic data used for maintenance and troubleshooting of the MFTB.



The menu is divided into three categories as shown below.

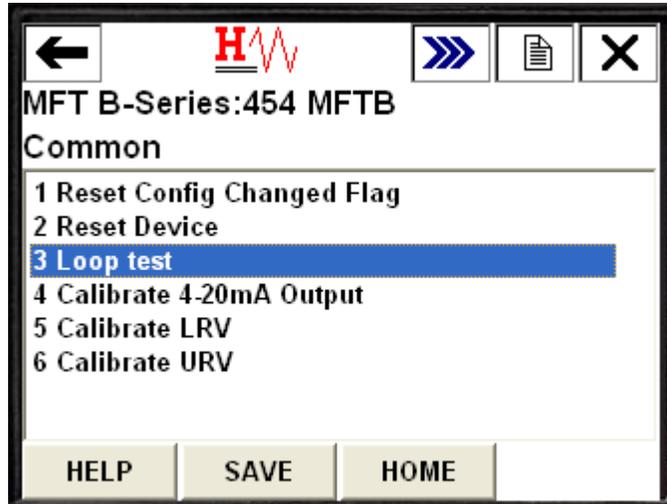


The Common sub-menu contains the common methods that all HART registered devices are required to support. Those common methods are shown below.

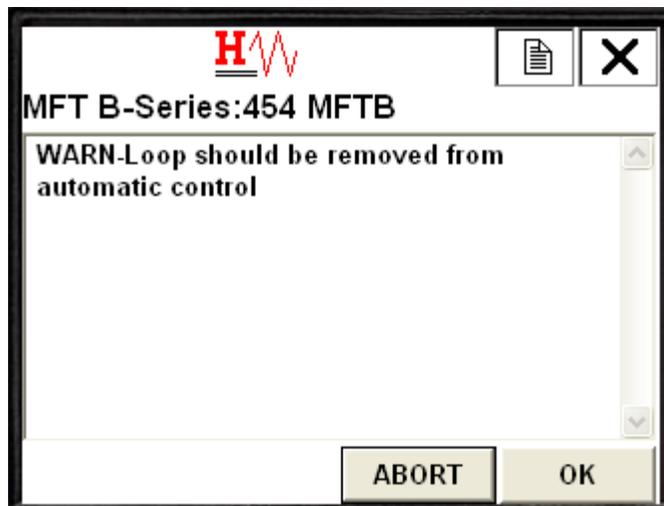


Loop Test

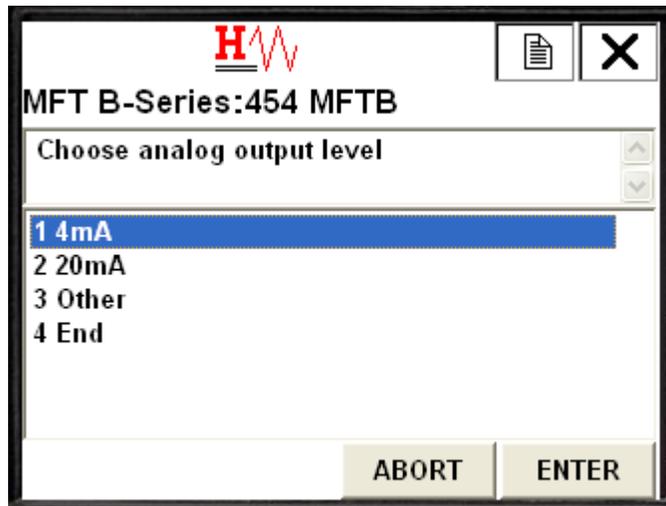
The loop test allows you to verify the 4-20mA output of the flow meter. You will need a precision ampere meter or current meter to verify the output during the test.



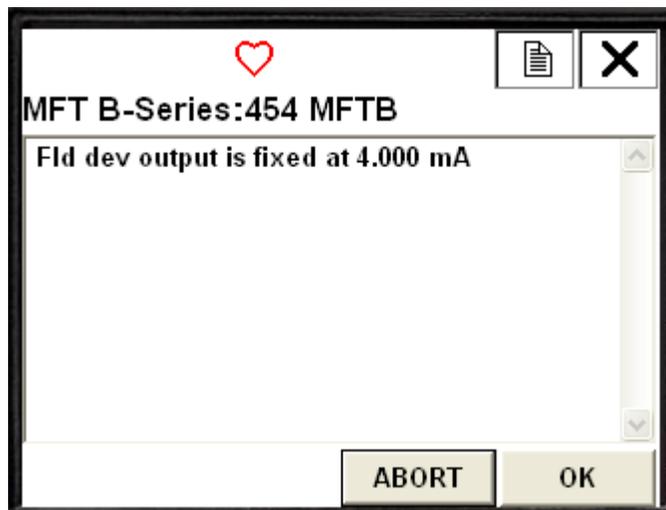
When the loop test is selected, the 375 will display the following informational screen.



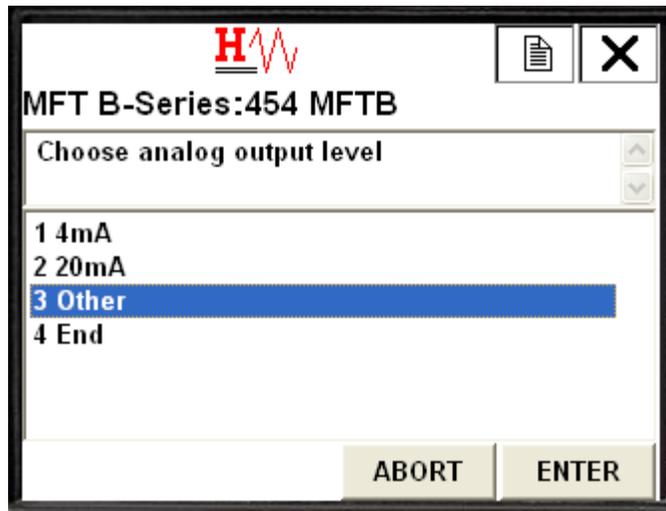
The next screen allows you to select an analog output level.



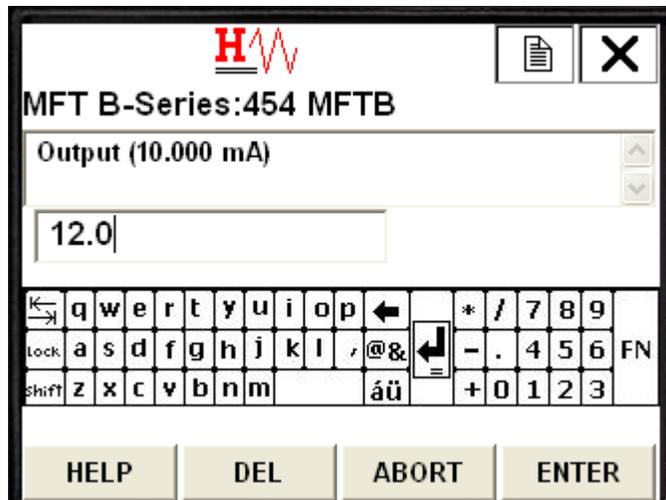
If 4mA is selected, the 375 will display the following.

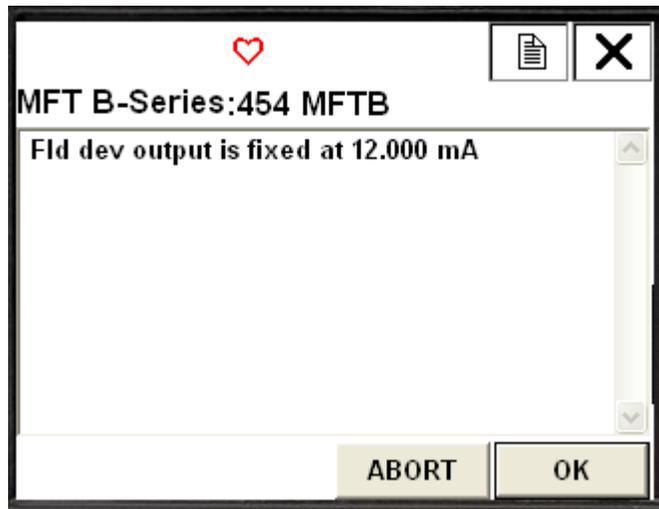


While this is being displayed you can verify the reading on your ampere meter or current meter that it is displaying 4.0 mA (if it is not, you may need to run the "Calibrate 4-20mA Output" method). You can select a mid-range output level by selecting "Other".

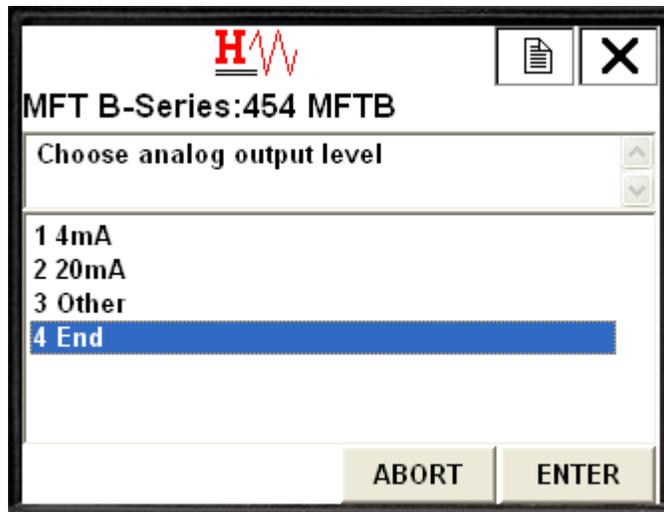


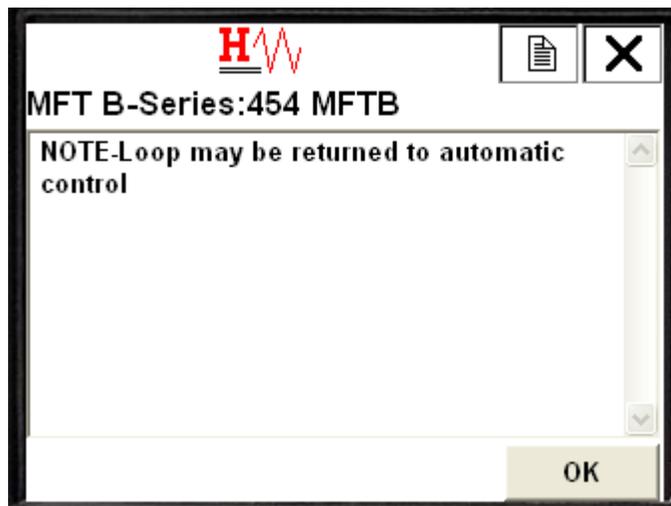
The following screen will be displayed for you to enter an output level.





To exit the loop test, select "End" and the 375 will command the MFTB to return to normal operating mode.



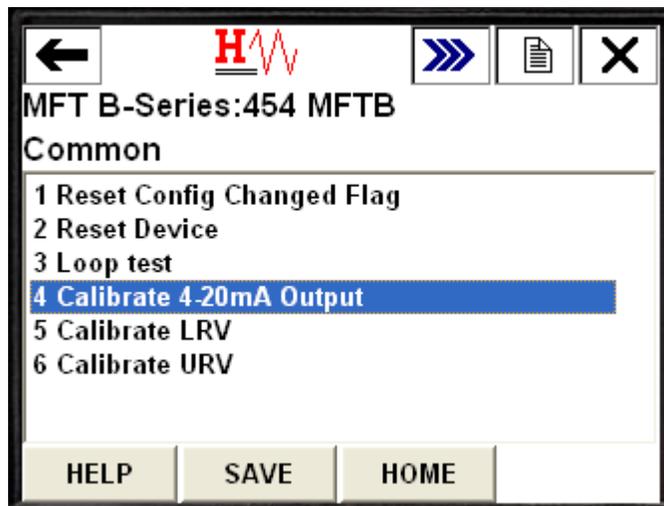


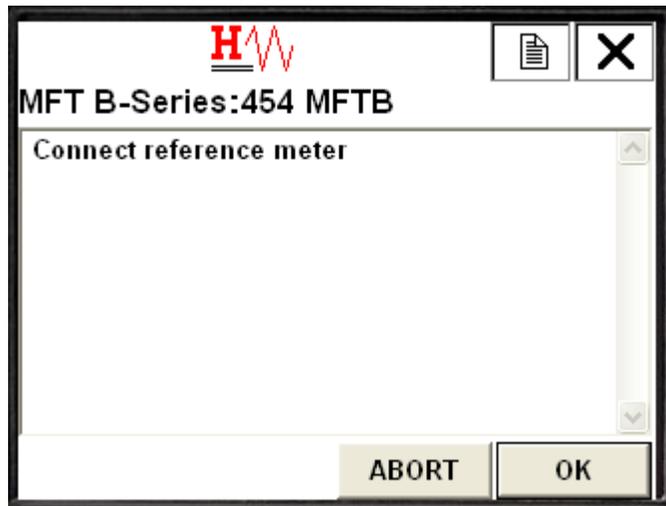
Calibrate 4-20mA Output

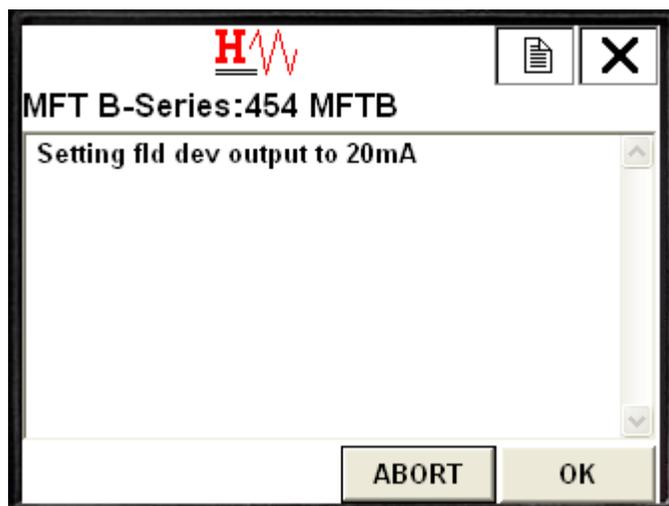
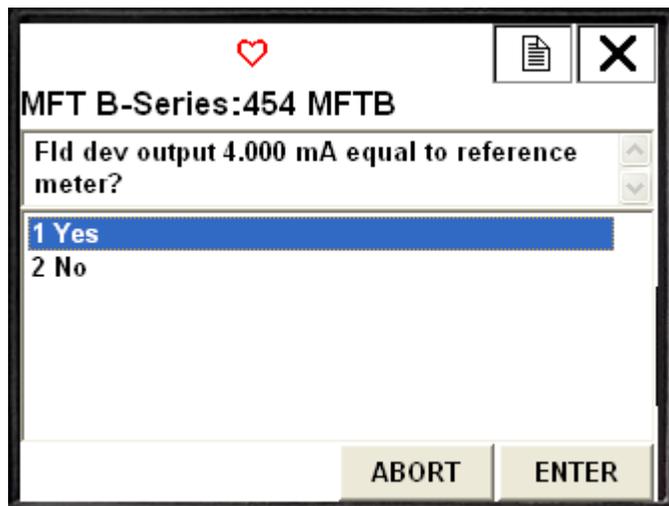
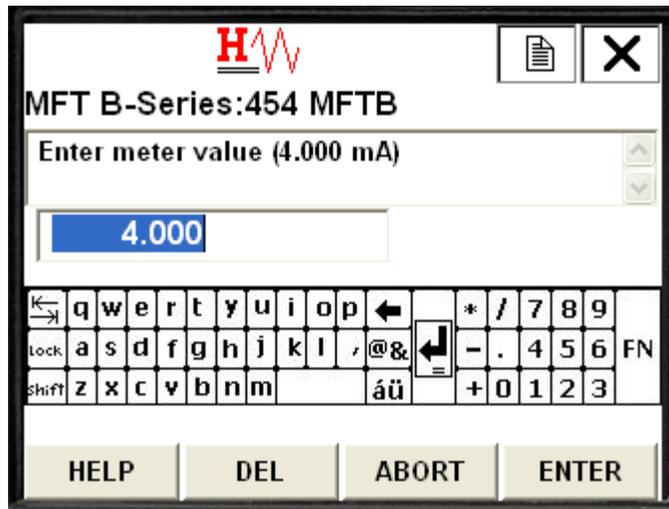
The 4-20 mA calibration refers to modifying the transmitter conversion of the digital signal to an analog signal through comparison and characterization of expected output values with values actually reported by a calibrated accurate output measurement device, in this case, an ampere meter or current meter. The calibration method in the MFTB DD guides the user through the steps to calibrate the 4-20 mA output channel. The calibration procedure is performed as follows:

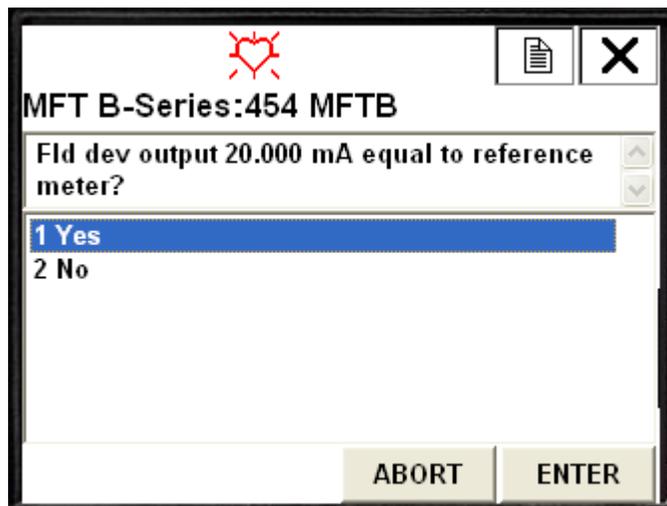
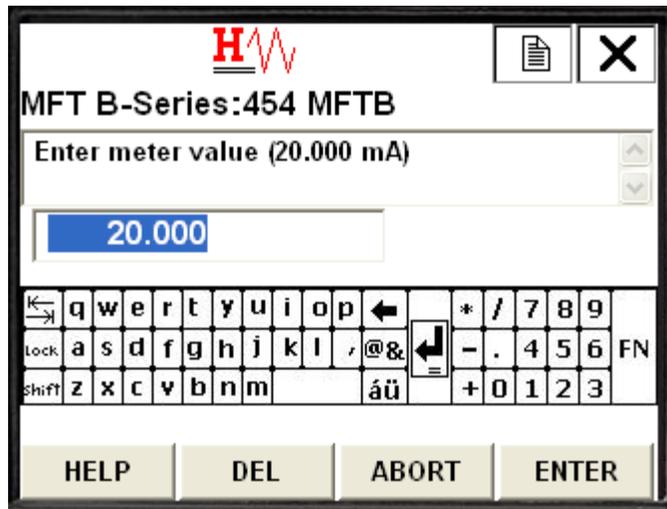
1. From the Online menu, select “3 Utilities”
2. From the Utilities menu, select “1 Common”
3. From the Common (Utilities) menu, select “4 Calibrate 4-20 mA Output”

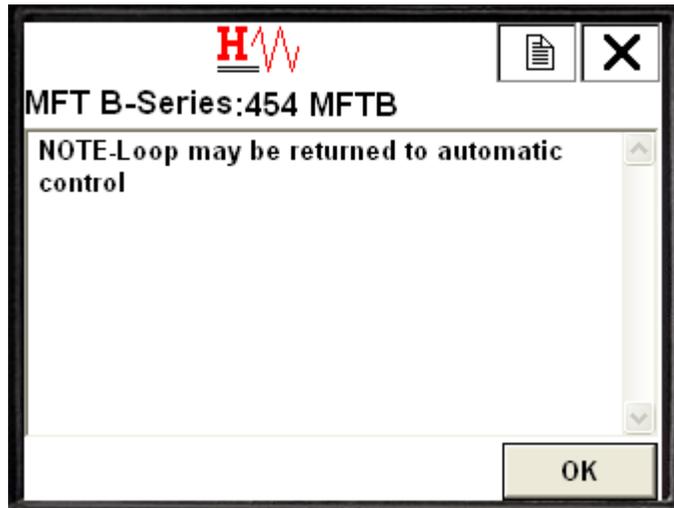
The following screen shots below show the step by step instructions using an Emerson handheld communicator to calibrate the 4-20mA output.





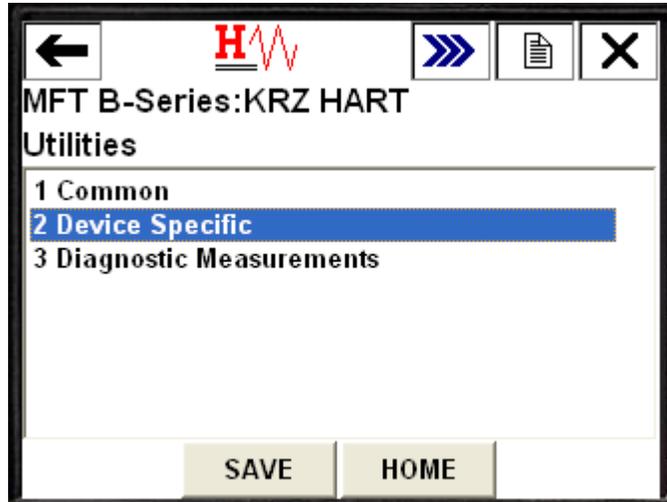






Device Specific menu

The Device Specific menu contains methods for features/functions that are unique to the MFTB.



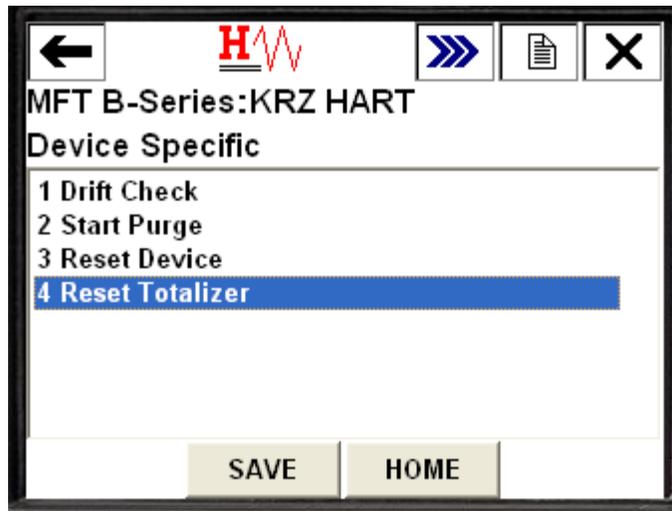
The following items are available in the Device Specific Utilities menu.



The Drift Check and Start Purge methods were discussed previously in the Setup Menu section since these methods are also available in sub-menus available under the Setup menu.

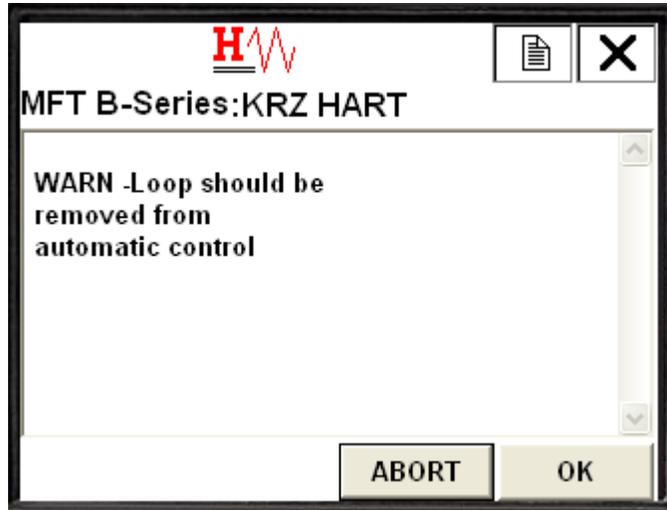
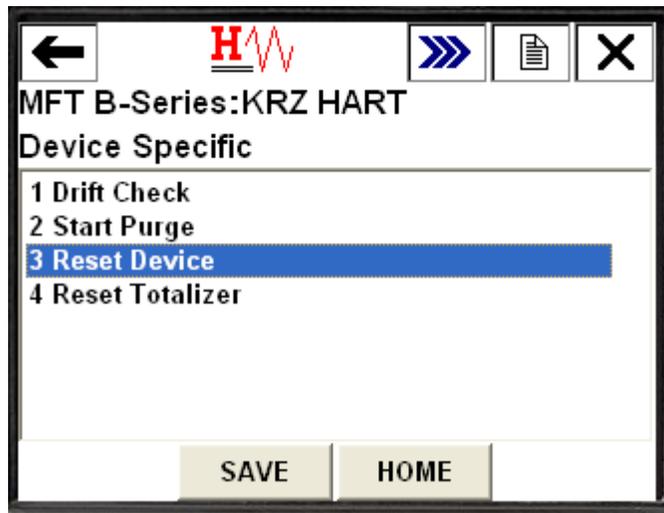
Reset Totalizer

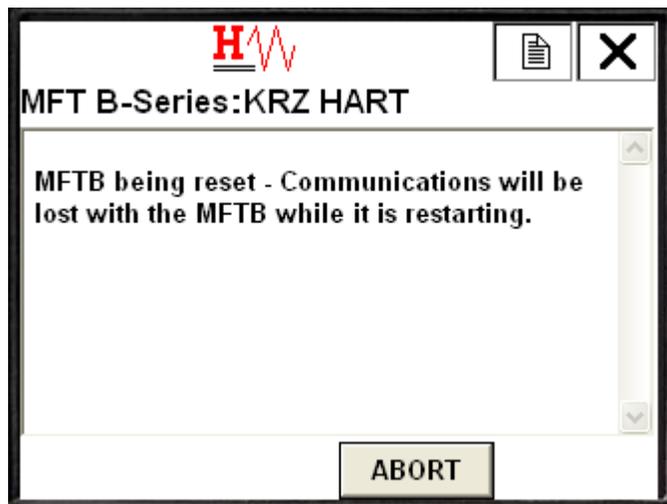
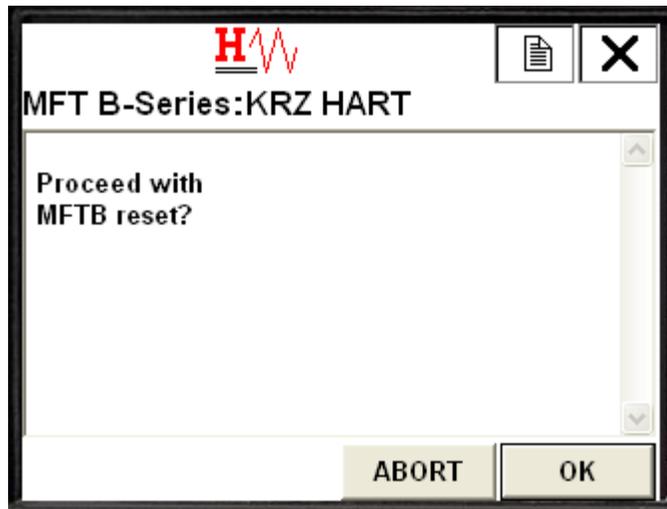
The Reset Totalizer method allows you to reset the Totalized Flow accumulator. The following screens show the steps involved to reset the totalizer.



Reset Device

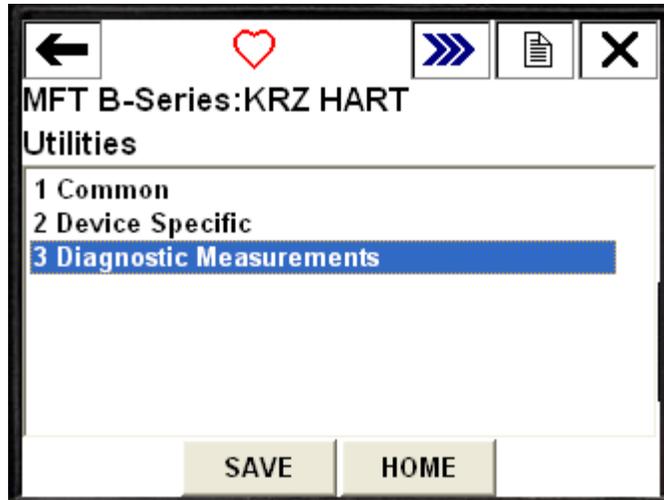
The Reset Device method allows you to power cycle the meter through the 375 communicator. The following screens show the steps to perform the flow meter reset.



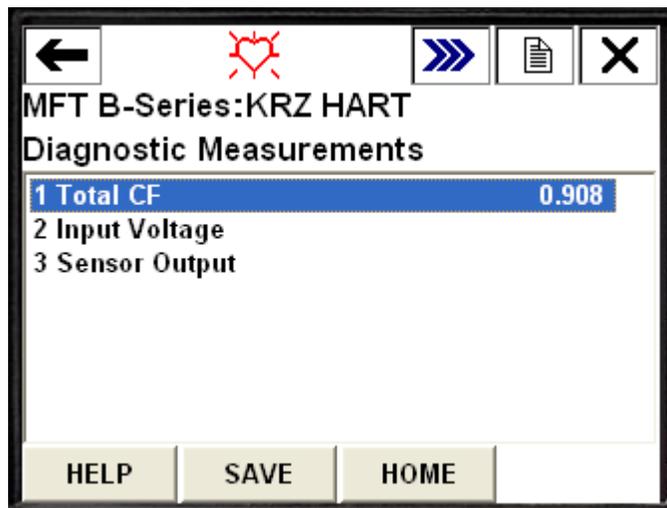


Diagnostic Measurements

The Diagnostics Measurements sub-menu provides diagnostic data specific to the MFTB that is useful for field support technicians to diagnose and troubleshoot a malfunctioning flow meter.

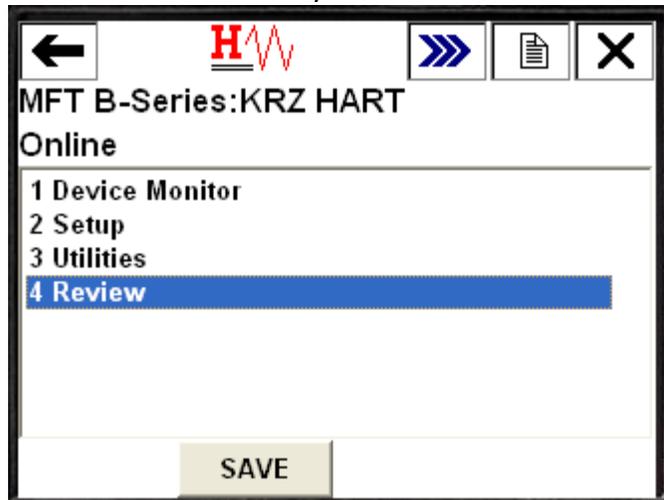


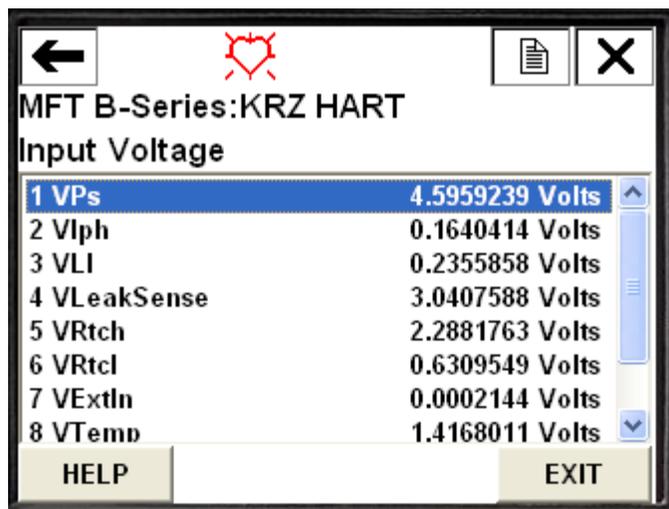
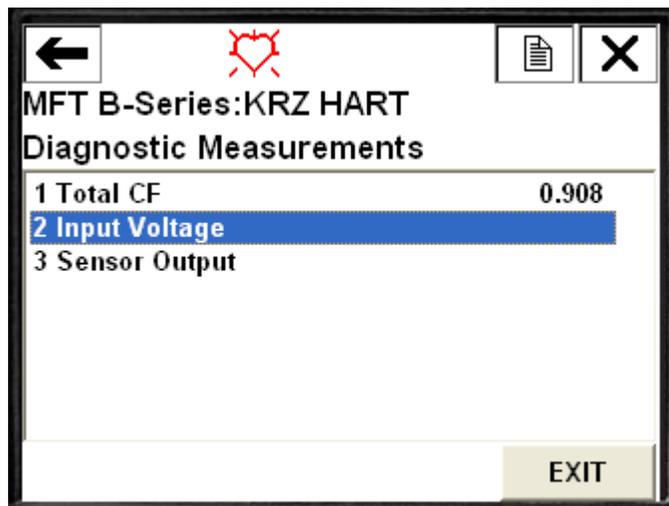
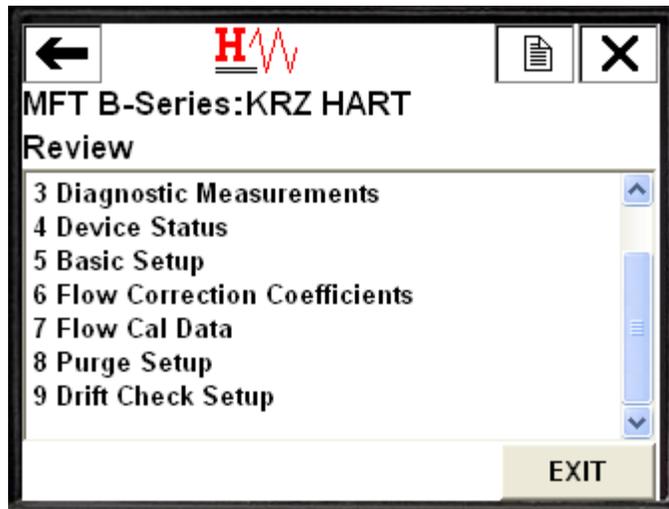
The following shows the MFTB data available in the Diagnostic Measurements menu.

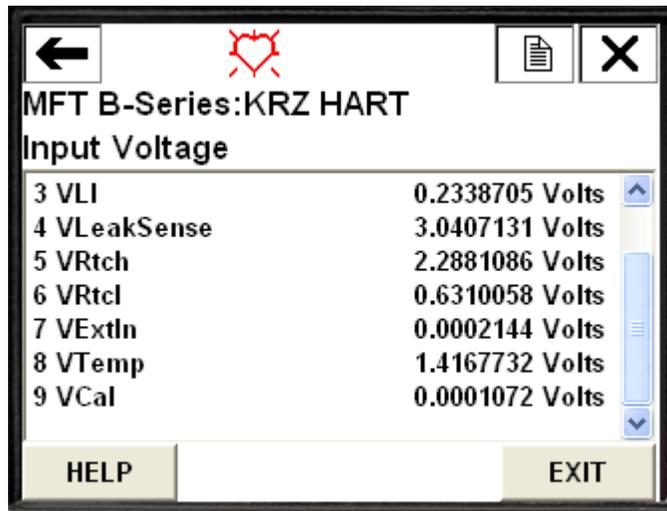


REVIEW Menu

The Review Menu provides a means to review the MFTB data without the risk of accidentally changing any value. This is a View-only menu.



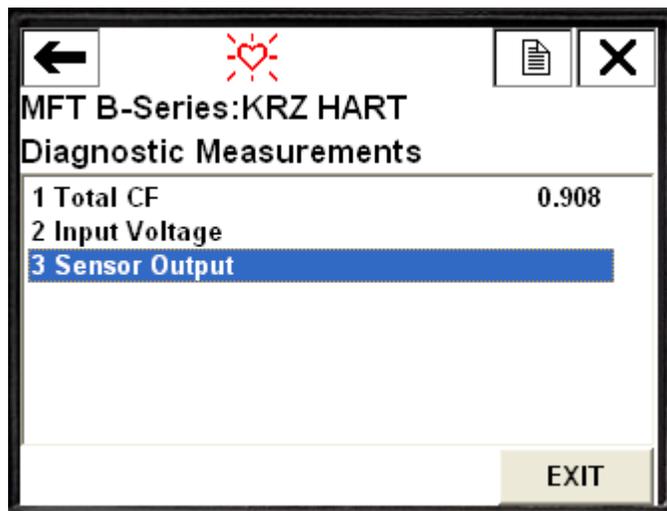




MFT B-Series:KRZ HART
Input Voltage

3 VLI	0.2338705 Volts
4 VLeakSense	3.0407131 Volts
5 VRtch	2.2881086 Volts
6 VRtcl	0.6310058 Volts
7 VExtIn	0.0002144 Volts
8 VTemp	1.4167732 Volts
9 VCal	0.0001072 Volts

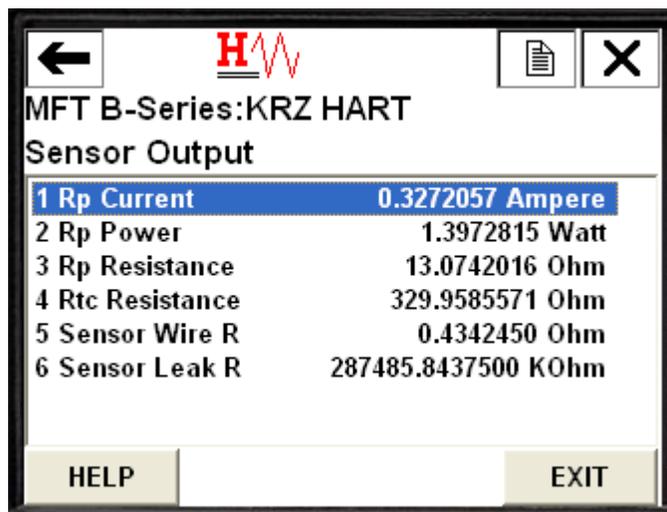
HELP EXIT



MFT B-Series:KRZ HART
Diagnostic Measurements

1 Total CF	0.908
2 Input Voltage	
3 Sensor Output	

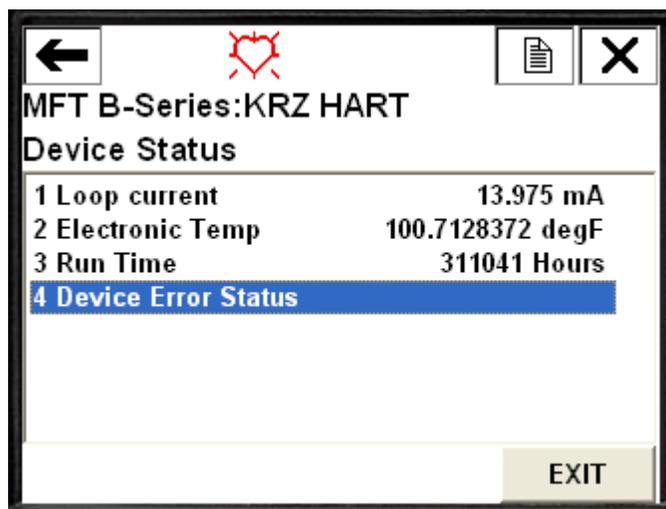
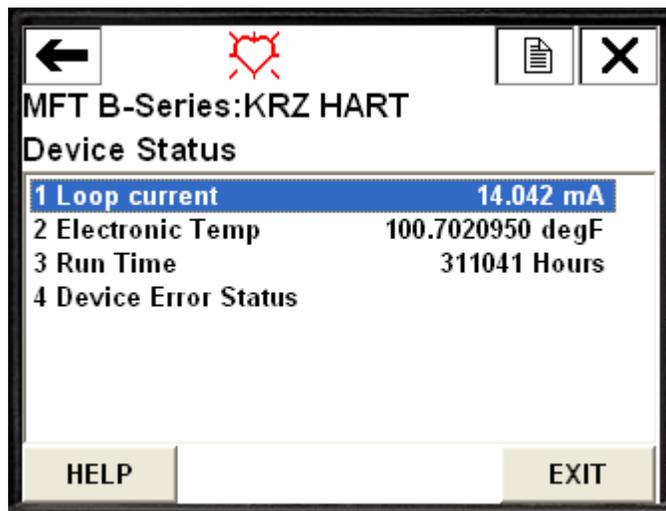
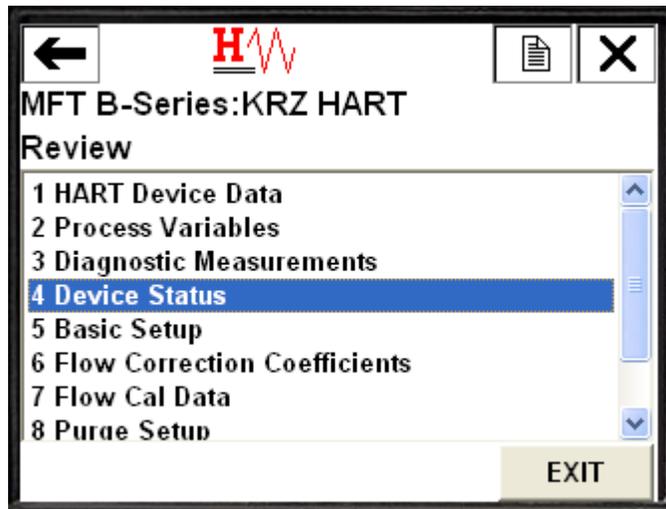
EXIT

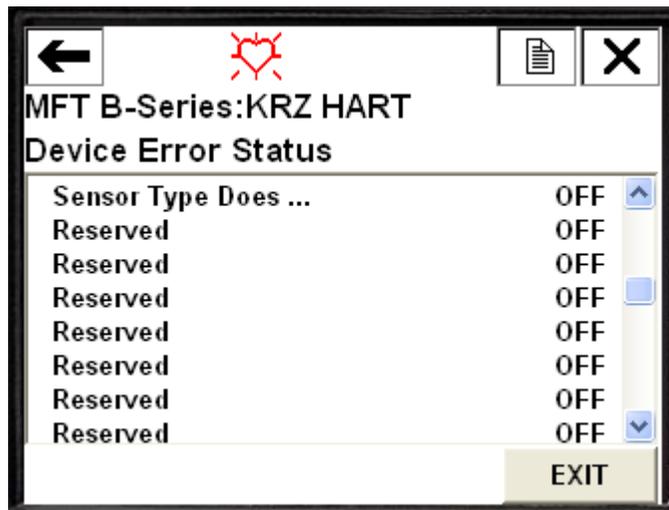
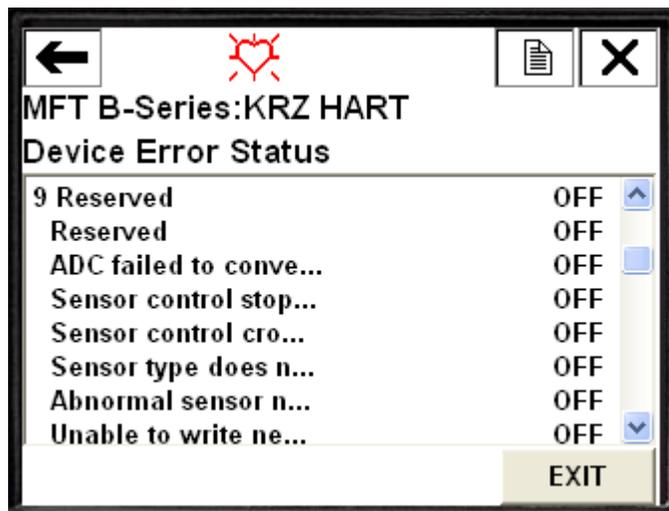
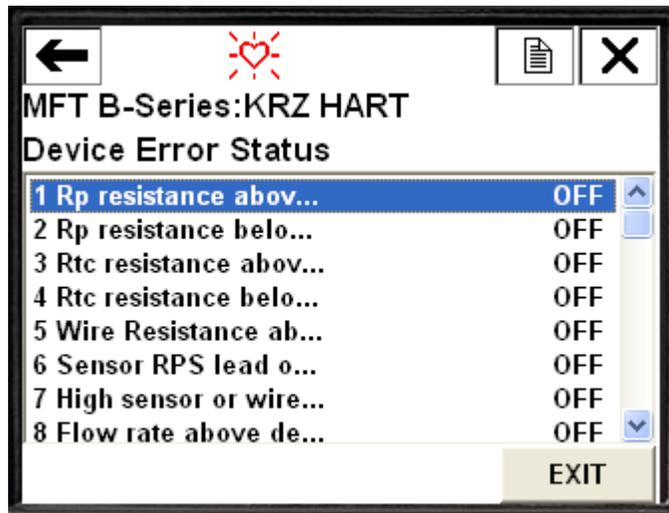


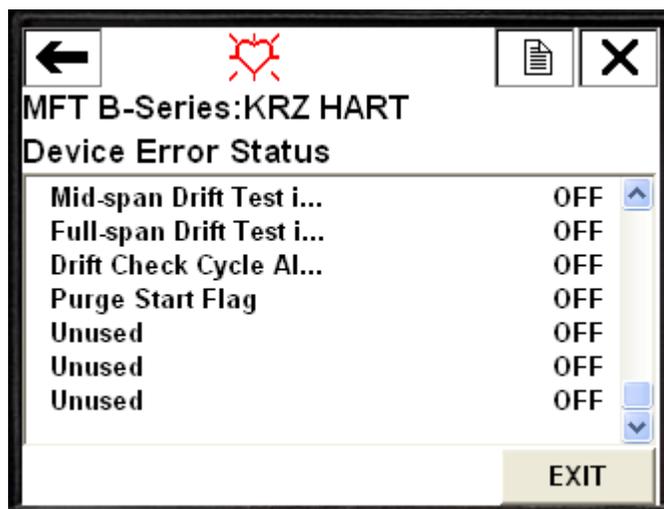
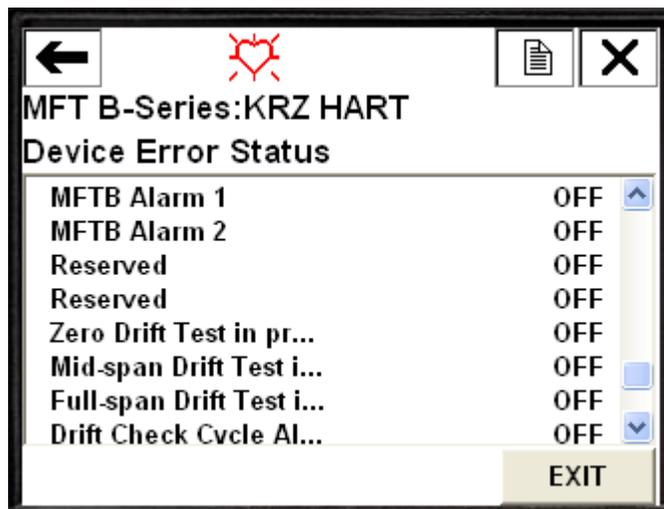
MFT B-Series:KRZ HART
Sensor Output

1 Rp Current	0.3272057 Ampere
2 Rp Power	1.3972815 Watt
3 Rp Resistance	13.0742016 Ohm
4 Rtc Resistance	329.9585571 Ohm
5 Sensor Wire R	0.4342450 Ohm
6 Sensor Leak R	287485.8437500 KOhm

HELP EXIT







HOT KEY Menu

The MFTB DD contains a preconfigured Hot Key menu that contains menus that are frequently used. The Hot Key menu is invoked by pressing the >>> (triple arrow symbol) at the top right hand corner of the screen.

The following screen shows the menus available on the Hot Key menu.



