FLUKE ®

754
HART Mode

Users Guide

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Introduction

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, read the Safety Information in the *753/754 Users Manual* before you use the 754 Documenting Process Calibrator.

Adjustment is necessary for analog transmitters during calibration. With HART® (Highway-Addressable Remote Transducer) transmitters, adjustments are by remote command. For these adjustments, use of a communication tool and a Calibrator is necessary. The 754 (Product or Calibrator) gives communication and calibration functions in one tool.

This guide tells you how to use the HART communication mode. HART mode is a procedure for the Product to communicate over its serial HART interface to a HART transmitter. See the *753/754 Users Manual* for safety information, analog mode use instructions, specifications, and more general data. All of the Product functions shown in the *753/754 Users Manual* are available and can be used with supported HART transmitters. The only transmitters addressed in this manual are HART transmitters.

Note

Some specific HART transmitter commands are only available with supported devices.

How to Contact Fluke

To contact Fluke, call one of the following telephone numbers:

- Technical Support USA: 1-800-44-FLUKE (1-800-443-5853)

- Calibration/Repair USA: 1-888-99-FLUKE (1-888-993-5853)

- Canada: 1-800-36-FLUKE (1-800-363-5853)

- Europe: +31 402-675-200

- Japan: +81-3-6714-3114

- Singapore: +65-6799-5566

- Anywhere in the world: +1-425-446-5500

Or, visit Fluke's website at www.fluke.com.
To register your product, visit http://register.fluke.com.
To view, print, or download the latest manual supplement, visit http://us.fluke.com/usen/support/manuals.

HART Channel Selection

For HART communication, use the HART connector on the side of the Product or the mA jack on the front of the Product. The procedure you use depends on the application and preference.

Use Setup mode to choose the correct HART channel:

1. Push **SETUP**. The first setup screen shows. See Figure 1.

2. Push ⏶ or ⏷ to select **HART Channel**.

3. Push **ENTER**.

4. Push ⏶ or ⏷ to select **HART Port** or **mA Jack**.

5. Push **ENTER**.

The selection is kept in Product memory. The Product uses this selection until it is changed in setup mode. Depending on the selection, **HART Port** or **mA Jack** shows at the top of the display when you push **HART**.

> *Note*
>
> *The figures in this guide show the mA Jack in use for HART communication.*

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Figure 1. HART Channel Selection

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Connect to a HART Transmitter

To connect and start communication with a HART transmitter:

Note

If only a communication connection to a transmitter that is powered in a loop is necessary, attach the HART alligator clips to the loop power terminals on the transmitter and push HART.

1. Connect the Product mA jacks to the loop power terminals of the transmitter. See Figure 3.

2. Connect the HART interface cable into the HART jack, and then connect the alligator clips to the terminals in step 1. There is no incorrect polarity. If the HART signal is directed through the mA jack in setup mode, this connection is not required.

3. Push HART.

4. If the transmitter is not powered by a loop power supply, push the **Loop Power** softkey to start loop power.

Notes

- *The Product supplies loop power through an internal series resistance of 250 Ω.*

- *If the Product shows a measurement of 0 mA, make sure you have not reversed the current leads.*

- *If an external loop power supply is used, a resistance of between 230 Ω and 270 Ω connected in series with the external loop supply and the transmitter is necessary.*

5. The Product tries to connect to Poll Address 0 (single transmitter per loop). If no connection is made, push the **Poll** softkey to examine Poll Addresses 1 through 15 (multidrop).

6. When the Product establishes communication with the transmitter, the Active Device screen shows. See Figure 2. In a multidrop configuration, you must choose a transmitter from a list, and push ENTER.

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```
                    HART mA      LOOP (IIII) ☼
HART               Measure        3.954 mA
                   Source         0.00 psi

                   3051 C  PT-306-1

              PV      0.000 psi
              PVAO    4.0000 mA
              PV LRV  0.000 psi
              PV URV  14.200 psi
Select operation for this device

┌──────────┬──────────┬──────────┬──────────┐
│  Abort   │ Service  │  Setup   │ Process  │
└──────────┴──────────┴──────────┴──────────┘
```

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Figure 2. Active Device Screen

The Active Device screen supplies this data for all transmitters:

- Poll address (if not 0)
- Model number and Tag ID
- PV (Primary Variable)
- PVAO (digital representation of the Analog Output)
- PV LRV (PV Lower Range Value)
- PV URV (PV Upper Range Value)
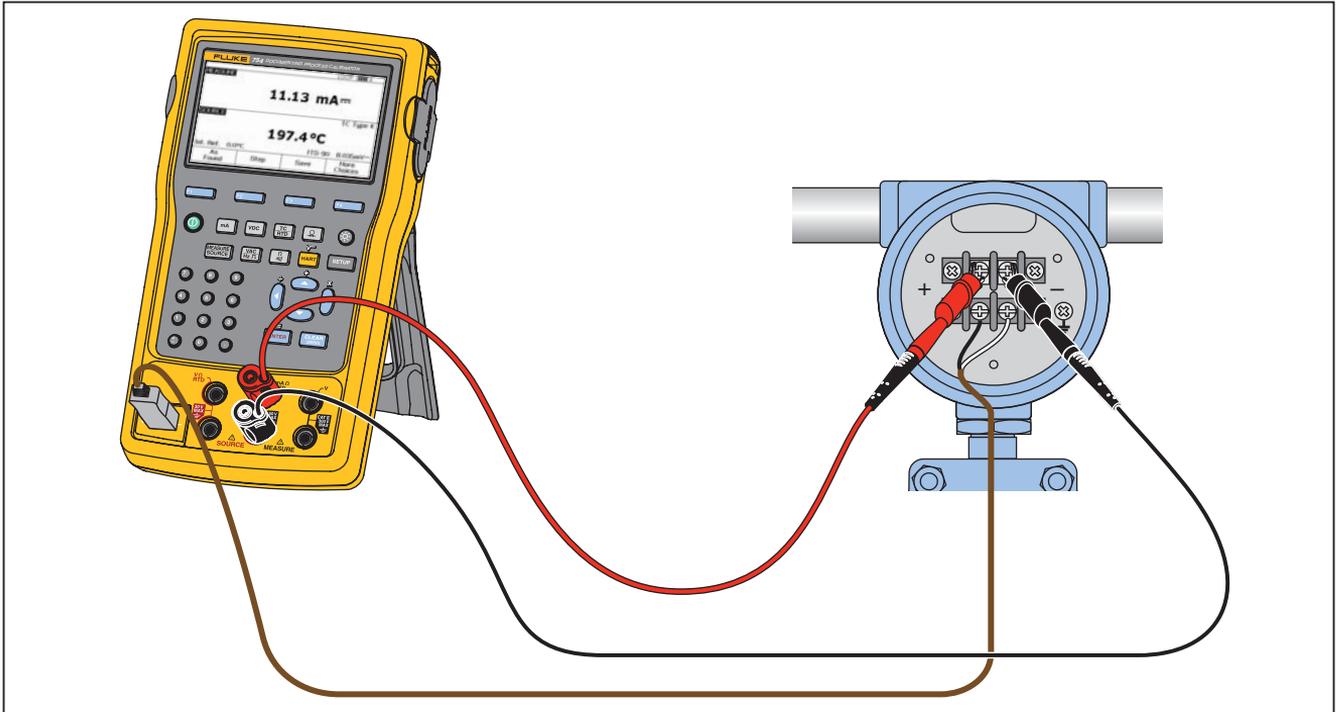- Softkeys for accessing HART operation menus

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Figure 3. HART Transmitter Connection

Supported vs. Generic Transmitters

The Product communicates with most HART transmitters. "Supported Transmitters" are transmitters in which the Product is programmed to use their device-dependent commands and software version. "Generic transmitters" are transmitters that are not programmed in the Product. Table 1 shows the operations that are available for supported vs. generic transmitters in single-point and multidrop configurations.
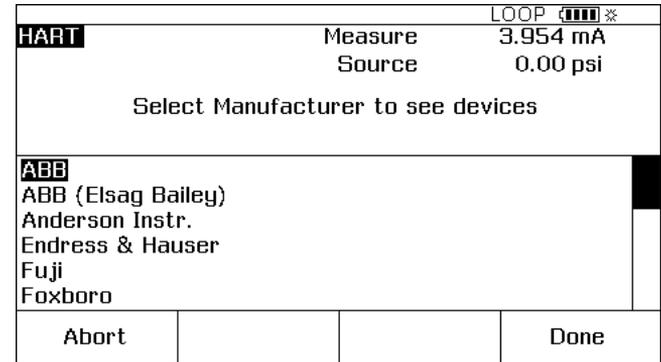
Table 1. Supported vs. Generic Transmitters (Devices)

Menu	Operation	Supported Transmitter		Generic Transmitter	
		Single Point	Multidrop	Single Point	Multidrop
Top Level	Active Device screen	●	●	●	●
Setup	Basic (read/write, cloning capability)	●	●	●	●
	Sensor	●	●	Read only	Read only
	(Temperature) Sensor (read/write)	●	●		
	Device Identification (read/write)	●	●	●	●
	HART Output (read/write)	●	●	●	●
	HART Information (read only)	●	●	●	●
Service	Loop Test	●	Not Available	●	Not Available
	Pressure Zero Trim	●	●	●	●
	Output Trim	●	Not Available	●	Not Available
	Sensor Trim	●	●	Not Available	Not Available
Process	Detailed process information	●	●	●	●

Note

Sensor trim is supplied for supported transmitters, with some exceptions, as identified in the list of supported transmitters that you can see on the display.

1. To show a list of supported transmitters and software versions:

   - If the Product is connected to a HART transmitter, push the **Abort** softkey, and then **More Choices**. Continue to Step 2.

   - If the Product is not connected to a HART transmitter, push ⌨HART and then **More Choices**. Continue to Step 2.

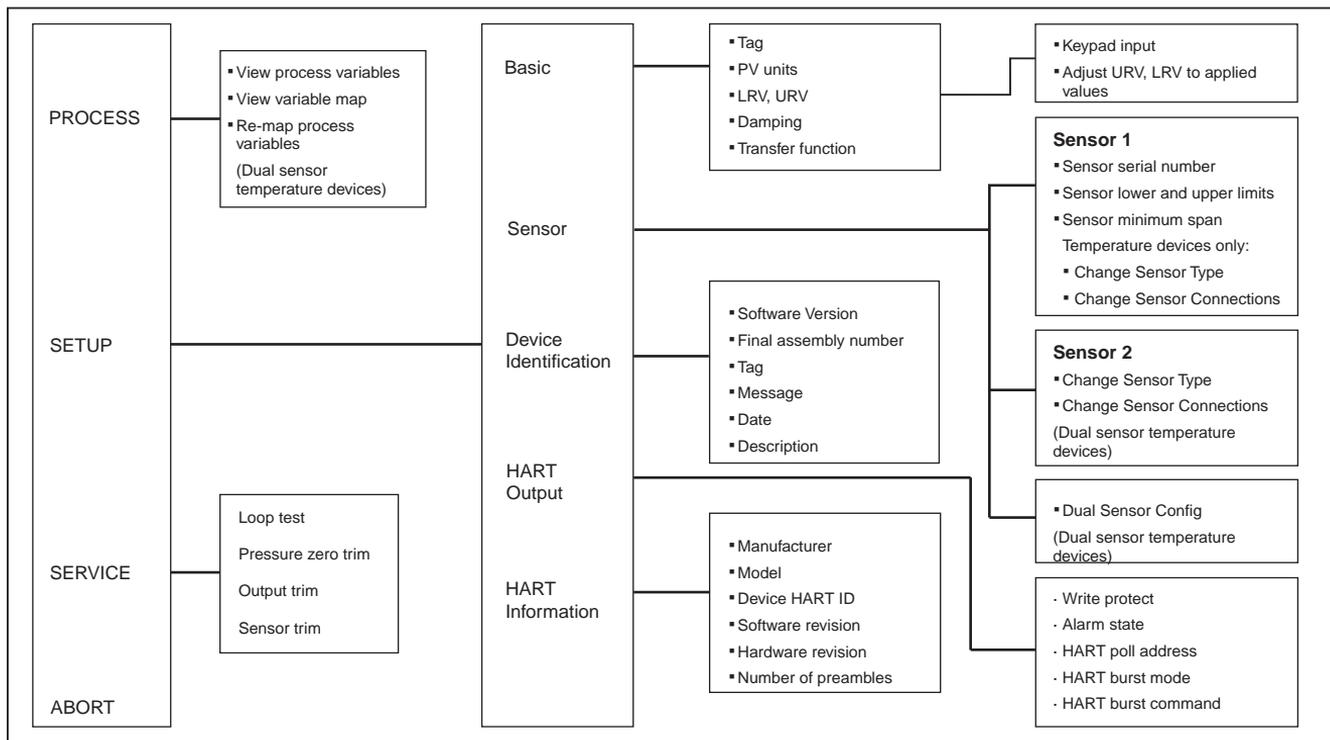2. Push the **Device Revs** softkey. The screen in Figure 4 is shown.

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Figure 4. Supported Device Screen

3. Push ⏶ or ⏷ to highlight the applicable manufacturer, and push ⌨ENTER. A list of model numbers is shown.

4. Push ⏶ or ⏷ to highlight the model number, and push ⌨ENTER. A list of software versions is shown.

Communication Operations

Figure 5 shows the HART Mode menu tree. Menu selections are determined by the type of transmitter that you use and the configuration connection type (current loop or multidrop).

Figure 5. 754 HART Mode Menu Tree

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See Process Variables

From the Active Device screen:

1. Push the **Process** softkey to see more device variables and their continuously updated values.

2. Select **View Process Variables**.

3. Push `ENTER`.

To see more data, push the **Next Page** softkey. See Figure 6.

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Figure 6. Device Variables Screen

Setup Operations

The **Setup** softkey gives access to these five setup functions:

- Basic
- Sensor
- Device Identification
- HART Output
- HART Information

Basic

Use the Basic setup screen to replicate a transmitter as described at the end of this manual.

From the Active Device screen, push the **Setup** and **Basic** softkeys. See Figure 7.

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Figure 7. Basic Setup Screen

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Sensor

This is where you can see data about the sensor in the transmitter, that includes serial number, limits, and span. The limits shown are the absolute limits for the sensor. (The Upper Range Value (URV) and Lower Range Value (LRV) are different, and are viewable and programmable through the Basic Setup screen.)

From the Active Device screen, push the **Setup** and **Sensor** softkeys to access the Sensor Setup screen. See Figure 8.

You can also program the Sensor Type and Sensor Connection registers in a supported temperature transmitter using this screen. Screen examples do not show Temperature device menu items.

gnx10s.bmp

Figure 8. Sensor Setup Screen

Device Identification

You can program the Tag, Message, Date, and Descriptor registers in the transmitter when you use this screen.

From the Active Device screen, push the **Setup** and **Device Identification** softkeys to see data about the transmitter. See Figure 9.

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Figure 9. Device Identification Screen

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HART Output

From the HART Output screen you can change the Poll Address (0 = single transmitter, any other address = multidrop), and control burst mode.

From the Active Device screen, push the **Setup** and **HART Output** softkeys to access the read/write HART Output screen. See Figure 10.

		HART mA	LOOP ▥ ※
HART	**SETUP**	Measure	3.954 mA

Press ENTER to change item

Write Protect	No
Alarm State	Hi
HART Poll Address	**0**
HART Burst Mode	Off
HART Burst Command	- - - -

			Done

gnx12s.bmp

Figure 10. HART Output Screen

HART Information

This screen shows more complete data about the transmitter model, hardware and software revision numbers, and how many preambles it sends.

From the Active Device screen push the **Setup** and **HART Information** softkeys to access the read-only HART Information screen. See Figure 11.

		HART mA	LOOP ▥ ※
HART	**SETUP**	Measure	3.955 mA
		Source	0.01 psi

Manufacturer	Rosemount
Device	3051C
Device ID	2690449
S/W Revision	5.3.178
H/W Revision	1
Preambles	5

			Done

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Figure 11. HART Information Screen

Service Operations

The **Service** softkey gives you access to Loop Test, Pressure Zero Trim (where applicable), Output Trim, and Sensor Trim operations. For generic transmitters, only Loop Test, Output Trim, and Pressure Zero Trim are available (see Table 1.) The trim (adjustment) operations are later in this manual.

Note

Loop Test and Output Trim are not available if the transmitter is in multidrop mode.

Abort Softkey

The **Abort** softkey stops the communication operation in process, and gives control to the previous screen. From the Active Device screen, **Abort** calls up the browser, in which you can see the list of connected transmitters.

Analog Mode and HART Mode Interaction

Analog mode is usual Product operation, as given in the *753/754 Users Manual*. HART Communication mode starts when HART is pushed.

Push HART to change between HART and analog modes, or push MEASURE SOURCE to change to analog mode from HART mode. This lets the transmitter automatically set up analog mode for applicable measure and source functions, if necessary.

For supported transmitters, the change to analog mode goes to the MEASURE/SOURCE screen. This makes it easy to continue with an "as found" calibration.

For generic transmitters, the change to analog mode makes you choose the MEASURE or SOURCE screen, from which you select the applicable function.

For supported or generic transmitters, when you push HART to return to HART mode, the Active Device screen is shown. The HART serial communication connection stays active as you change between HART and analog modes.

HART Calibration

An analog transmitter has one step of electrical conversion from a measured physical parameter to a 4-20 mA current loop output. A HART transmitter has the three blocks. See Figure 12.

It can be necessary to examine and adjust the Input block, the Output block, or both. For example, if your application requires the Primary Variable (PV) to be correct when read by a host computer, you must calibrate the Input stage.
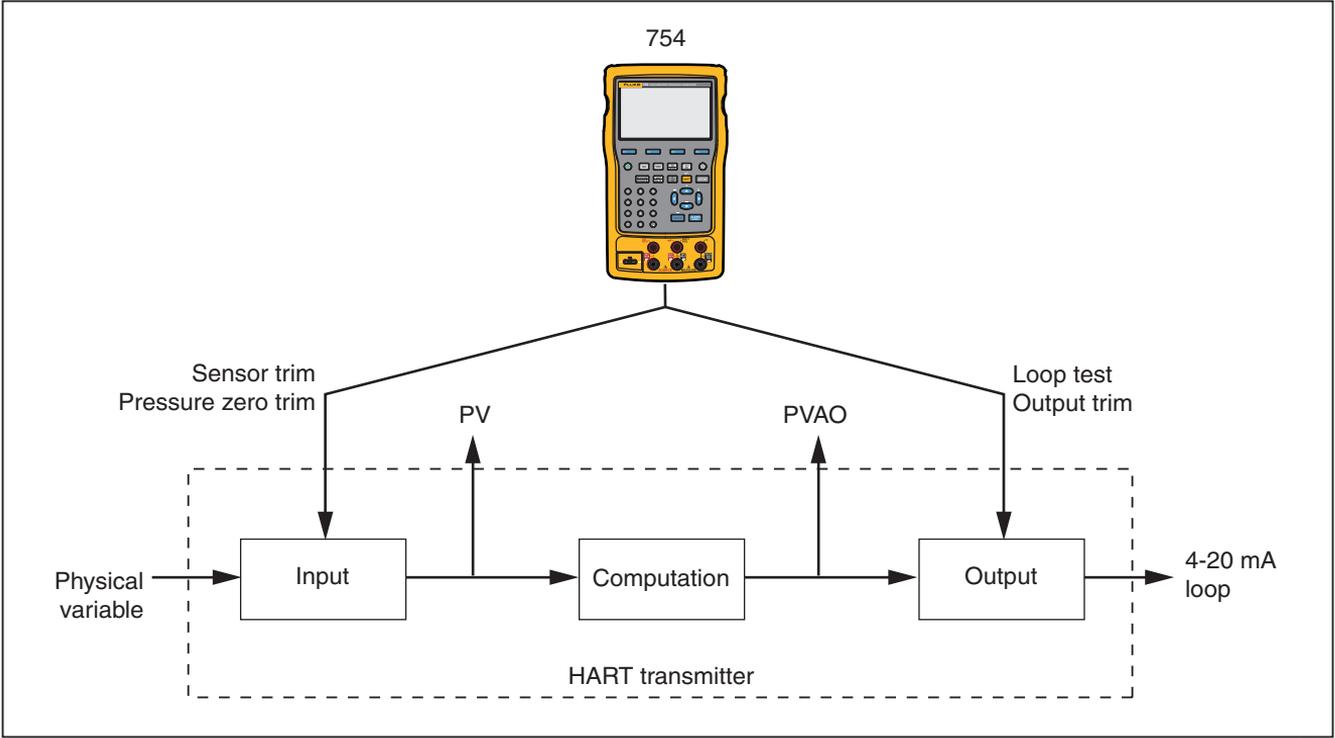
If your application requires that the 4-20 mA current output value accurately show what the Input block is measuring, you must calibrate the Input and Output block.

Transmitters in multidrop systems, in which more than one is wired in parallel, do not use their Output blocks. Their analog outputs are all held at an idling level of 4 mA no matter what the Input block measures.

HART Mode Menus for Adjustment

Sensor Trim in HART mode is when you adjust the Input block. **Output Trim** is when you adjust the Output block. These adjustments are made from the **Service** menu.

For pressure transmitters, **Pressure Zero Trim** is an additional adjustment. This adjustment is the same as when you set the lower sensor point at zero. All three operations are energized from the HART mode **Service** menu.

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Figure 12. Block Diagram of a HART Transmitter

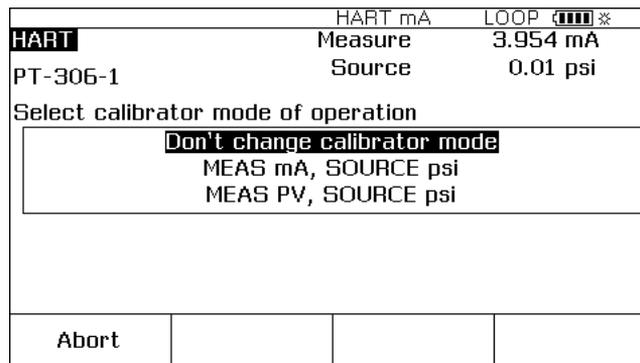## *Calibrate a Supported HART Transmitter*

An "as found" and "as left" transmitter calibration has an easier, more automated procedure for HART transmitters than for analog transmitters. The calibration procedure is the same as given in the *753/754 Users Manual*. How to set up the calibration template, and how you adjust the transmitter are different.

Note

If you start a calibration procedure from an installed task, do not push **Task** *until the Product is connected to the HART transmitter and communication in analog mode is established.*

The subsequent procedure assumes that you know how to use a 754 Series Documenting Process Calibrator to calibrate analog transmitters, and are not running an installed Task.

1. Make the applicable measure, source, and HART interface connections between the Product and the transmitter.

2. Push HART to establish communication.

3. Push HART to change to analog mode.

4. You are shown a set of selections for analog mode. Use ⏶ and ⏷ to select one of the measure/source choices. This is where you select measure mA (analog output), or measure PV, which does not involve the Output block of the transmitter. See Figure 13.

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Figure 13. Calibrator Mode Select Screen

5. Push ENTER.

6. Push the **As Found** softkey.

7. Push ⏶ or ⏷ followed by ENTER to select an instrument calibration procedure. You can see that the calibration template is installed with applicable data. You can make changes to items if necessary. The Error% value must be entered before you continue.

8. Continue with calibration as given in the *753/754 Users Manual*. When calibration is complete, do step 9.

9. Push the **Adjust** softkey to go back to HART mode and launch the Service menu for the transmitter.
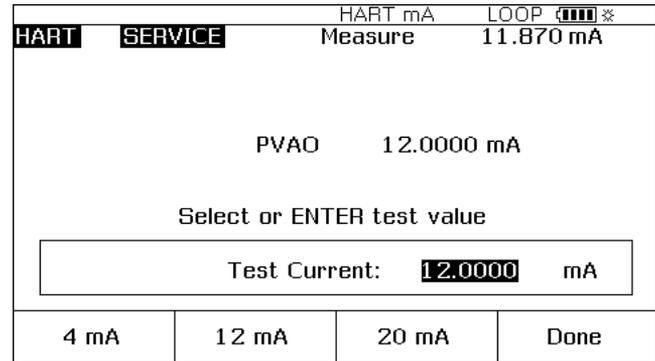
10. Do an Output Trim, and/or a Sensor Trim. These are Service operations. See "Output Trim" and "Service Trim". When you are done with the trim procedures, push the **Done** softkey.

11. Push the **As Left** softkey and do the calibration procedure again to make sure that the transmitter passes.

Loop Test

The Loop Test feature sends a command to the transmitter to set its output block to a specified value. Use this to examine the calibration of the output block, or to verify a correct indication on an external loop reading device.

To do a Loop Test:

1. From the Active Device screen, push the **Service** softkey, followed by **Loop Test**. See Figure 14.

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Figure 14. Loop Test Screen

2. Push a softkey to command the transmitter to set its analog output to the related value, or manually record a value with the numeric buttons.

The transmitter acknowledges the selected PVAO (digital representation of the Output stage) in the middle of the screen. The Product shows the measured value at the top of the screen so you can use Loop Test as a fast procedure to check the calibration of the transmitter's Output block.

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Output Trim

An Output Trim adjusts the transmitter's Output block. You can do an Output Trim on generic and supported transmitters.

To do an Output Trim:

1. From the Active Device screen, push the **Service** softkey and then **Output Trim**. See Figure 15.
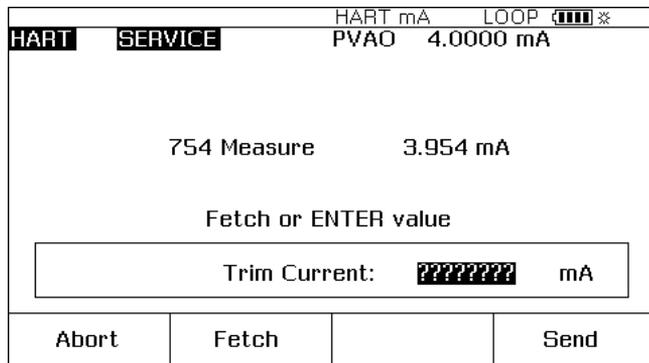

gnx16s.bmp

Figure 15. Output Trim Screen

2. Push **Fetch** to put the mA value you measure with the Product into the dialog box.

3. Push **Send** to trim the low analog output point.

4. To trim the high analog output point, do steps 2 and 3 again. Follow the prompts on the display.

Sensor Trim

You can only do a Sensor Trim on a supported transmitter. A Sensor Trim adjusts the Input block of a HART transmitter. If your application does not use the Output block of the transmitter, Sensor Trim is the only adjustment necessary.

A Sensor Trim can involve one or more trim points. This is controlled by the transmitter's software.

To do a Sensor Trim:

1. From the Active Device screen, push the **Service** softkey, and then **Sensor Trim**. See Figure 16.
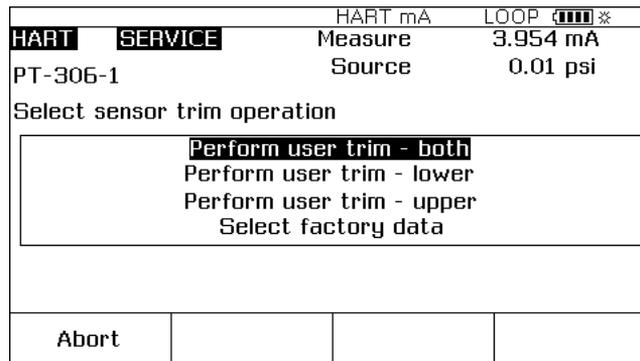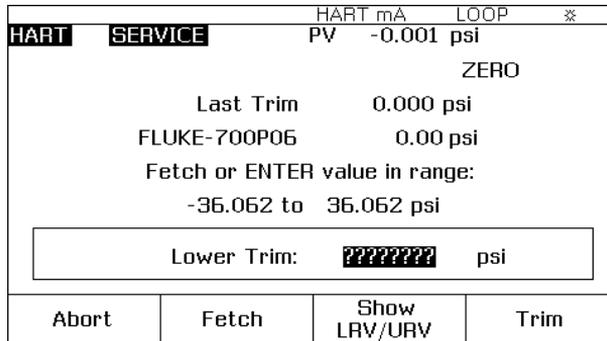

gnx17s.bmp

Figure 16. Sensor Trim Screen

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2. Push ⏶ or ⏷ to select the Sensor Trim operation, and push [ENTER].

3. Follow the instructions on the display. For pressure, there is a message to connect a pressure module to the Product, and a message to push [CLEAR (ZERO)] to zero the pressure module.

4. Push **Continue**. See Figure 17.

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Figure 17. Sensor Trim Zero Screen

5. Record the necessary trim value the Product must produce, and push [ENTER]. In the case of a pressure transmitter (as above), push **Fetch** to put the value that is measured by the Fluke pressure module into the dialog box.

6. Push **Trim**.

7. If asked, do steps 2 and 3 again to trim the remaining points. Follow the display prompts.

Note

Select trim points at the LRV or URV values. To review these values, push the **Show LRV/URV** *softkey.*

If you receive an error that shows excessive correction for the selected trim point, it is possible to repair the problem with a series of sensor trims. Start the sensor trims in small increments from the previous trim point to the necessary trim point.

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Duplicate a Transmitters Basic Information

The Product lets you duplicate the Basic Setup data from one transmitter to a different transmitter. You can copy generic and supported transmitters.

To use the Product to duplicate a transmitter:

1. Connect the Product to the transmitter you want to duplicate. Only a communication connection is necessary.

2. From the Active Device screen, push the **Setup** softkey.

3. Push ⌃ or ⌄ keys to select **Basic** from the list on the screen and push ⏎. See Figure 18.

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Figure 18. Basic Screen

4. Push the **Store Page** softkey to put the settings into Product memory (not the transmitter).

5. Disconnect the Product from the transmitter and connect it to the transmitter that you will configure.

6. Push the **Abort** softkey to start communication.

7. Push the **Setup** softkey, and then select **Basic** to go back to the Basic Setup screen.

8. Push the **Recall Page** softkey to refresh the Product display with the duplicated parameter settings. The settings are not transmitted to the transmitter at this time.

9. Push ⌃ or ⌄ and ⏎ to select parameters individually, change them, or leave them as duplicated, and push the **Send** softkey to transmit them to the transmitter.