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The Netherlands

11/99
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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 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 [r].

Note

The figures in this guide show the mA Jack in use for HART communication.
Connect to a HART Transmitter

To connect and start communication with a HART transmitter:

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 [enter].
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].
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
HART Mode

Connect to a HART Transmitter

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>
<thead>
<tr>
<th>Menu</th>
<th>Operation</th>
<th>Supported Transmitter</th>
<th>Generic Transmitter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Single Point</td>
<td>Multidrop</td>
</tr>
<tr>
<td>Top Level</td>
<td>Active Device screen</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Setup</td>
<td>Basic (read/write, cloning capability)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td>Sensor</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td>(Temperature) Sensor (read/write)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td>Device Identification (read/write)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td>HART Output (read/write)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td>HART Information (read only)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Service</td>
<td>Loop Test</td>
<td>•</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td>Pressure Zero Trim</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td>Output Trim</td>
<td>•</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td>Sensor Trim</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Process</td>
<td>Detailed process information</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>
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 [ ] and then More Choices. Continue to Step 2.

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

3. Push ⌈ or ⌺ to highlight the applicable manufacturer, and push [ ]. A list of model numbers is shown.

4. Push ⌈ or ⌺ to highlight the model number, and push [ ]. 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
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 [next].

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

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.
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.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HART</td>
<td>mA</td>
<td>LOOP</td>
</tr>
<tr>
<td>SET UP</td>
<td>Measure</td>
<td>3.954 mA</td>
</tr>
<tr>
<td></td>
<td>Source</td>
<td>0.01 psi</td>
</tr>
<tr>
<td></td>
<td>Sensor S/N</td>
<td>2690449</td>
</tr>
<tr>
<td></td>
<td>Sensor Lower Limit</td>
<td>-36.062 psi</td>
</tr>
<tr>
<td></td>
<td>Sensor Upper Limit</td>
<td>36.062 psi</td>
</tr>
<tr>
<td></td>
<td>Sensor Minimum Span</td>
<td>0.361 psi</td>
</tr>
</tbody>
</table>

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.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HART</td>
<td>SETUP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measure</td>
<td>3.955 mA</td>
</tr>
<tr>
<td></td>
<td>Source</td>
<td>0.01 psi</td>
</tr>
<tr>
<td></td>
<td>Sensor S/N</td>
<td>2690449</td>
</tr>
<tr>
<td></td>
<td>Sensor Lower Limit</td>
<td>-36.062 psi</td>
</tr>
<tr>
<td></td>
<td>Sensor Upper Limit</td>
<td>36.062 psi</td>
</tr>
<tr>
<td></td>
<td>Sensor Minimum Span</td>
<td>0.361 psi</td>
</tr>
</tbody>
</table>

Figure 9. Device Identification Screen
HART Mode
Communication Operations

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.

<table>
<thead>
<tr>
<th>HART</th>
<th>SETUP</th>
<th>Measure</th>
<th>3.954 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Press ENTER to change item

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

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.

<table>
<thead>
<tr>
<th>HART</th>
<th>SETUP</th>
<th>Measure</th>
<th>3.955 mA</th>
<th>Source</th>
<th>0.01 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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 \( \text{HART} \) is pushed.

Push \( \text{HART} \) to change between HART and analog modes, or push \( \text{Analog} \) 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 \( \text{HART} \) 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.
HART Mode
HART Mode Menus for Adjustment

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 to establish communication.
3. Push to change to analog mode.
4. You are shown a set of selections for analog mode. Use or 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.
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.
9. Push the Adjust softkey to go back to HART mode and launch the Service menu for the transmitter.

Figure 13. Calibrator Mode Select Screen

<table>
<thead>
<tr>
<th>HART MA</th>
<th>LOOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>3.954 mA</td>
</tr>
<tr>
<td>Source</td>
<td>0.01 psi</td>
</tr>
</tbody>
</table>

Select calibrator mode of operation
- MEAS mA, SOURCE psi
- MEAS PV, SOURCE psi
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.

```
<table>
<thead>
<tr>
<th>HART mA</th>
<th>LOOP mAh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>11.870 mA</td>
</tr>
</tbody>
</table>
```

PVAO 12.0000 mA

Select or ENTER test value

```
Test Current:  12.0000 mA
```

4 mA 12 mA 20 mA Done

**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.
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.

   | HART | mA | LOOP
   |------|----|------
   |      | 4.000 | mA |

   754 Measure 3.954 mA

   Fetch or ENTER value

   Trim Current: ??????? mA

   Abort    Fetch    Send

   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.

   | HART | mA | LOOP
   |------|----|------
   |      | 3.954 | mA |

   PT-305-1 Measure 3.954 mA

   Source 0.01 psi

   Select sensor trim operation

   Perform user trim - both
   Perform user trim - lower
   Perform user trim - upper
   Select factory data

   Abort

   Figure 16. Sensor Trim Screen
2. Push or to select the Sensor Trim operation, and push [Setup].

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 [Zero] to zero the pressure module.

4. Push Continue. See Figure 17.

<table>
<thead>
<tr>
<th>HART mA</th>
<th>Loop</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PV</td>
<td>-0.001 psi</td>
</tr>
</tbody>
</table>

5. Record the necessary trim value the Product must produce, and push [Setup]. 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.


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.

---

**Figure 17. Sensor Trim Zero Screen**
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 \( \uparrow \) or \( \downarrow \) keys to select Basic from the list on the screen and push \( \text{Done} \). See Figure 18.
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 \( \uparrow \) or \( \downarrow \) and \( \text{Done} \) to select parameters individually, change them, or leave them as duplicated, and push the Send softkey to transmit them to the transmitter.

<table>
<thead>
<tr>
<th>HART</th>
<th>PV Unit</th>
<th>Measure</th>
<th>Loop</th>
<th>Lower Range Value</th>
<th>Upper Range Value</th>
<th>Damping</th>
<th>Transfer Function</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>psi</td>
<td>3.054 mA</td>
<td></td>
<td>0.000 psi</td>
<td>14,200 psi</td>
<td>0.0000 s</td>
<td>Sq root</td>
<td></td>
</tr>
</tbody>
</table>

Figure 18. Basic Screen