

3095MV Calibration Procedure Using Meriam Process Technologies' MFT 4010 Multifunction Calibrator / HART Communicator



All 3095MV devices should initially be configured using the AMS MV Engineering Assistant Software from Emerson Rosemount. Engineering Assistant provides full configuration of the device for flow algorithms and media properties required by the 3095MV for flow calculation. These functions are beyond the scope of any handheld HART communicator.

The following procedures assume the user has knowledge of the Rosemount 3095MV and Instruction Manual as well as the Meriam MFT 4010 and Instruction Manual. The procedures also assume that the user has prepared the subject 3095MV for calibration activities including, but not limited to, initial configuration using Engineering Assistant, isolating the device from the process, opening vent valves, installing pressure connection fitting(s) and removing transmitter cover for access to the device terminals for loop current and HART connections.

The definition of “calibration” as used in this procedure is the process of ascertaining the error of a device by comparing the device output reading against an appropriate reference standard and correcting that error using the trim functions available in the device. Typically this calibration will consist of documenting the “as-found” condition, then using the necessary “trim” functions to return an out of tolerance device to in tolerance condition and finally documenting the “as-left” condition of the device.

The Rosemount 3095MV measures differential pressure, static pressure (gauge or absolute per factory configuration) and temperature (Pt 100 only with $\alpha = 0.00385$) in order to calculate flow rate and total flow from a head type flow meter (orifice plate, venturi, averaging pitot tube, etc.). The 3095MV has a digital “sensor” side and an analog “output” side, both of which have trim commands that are initiated by a HART[®] communicator. This makes the calibration of a multivariable transmitter more complicated than that of single variable transmitters. Not only are three calibrations

required, but also each measured parameter must alternately be assigned as the Primary Variable (PV) before calibration of the individual parameter can begin.

The Meriam Process Technologies model MFT 4010 is uniquely qualified to calibrate multivariable transmitters. First, it is a 3-bay modular calibrator capable of measuring DP, P (absolute or gauge with appropriate modules), T and voltage or current using its own NIST traceable sensor modules. These sensors provide the comparison values needed to determine the error of the subject transmitter measurements and whether they originate in the sensor side or in the analog side of the 3095MV. Secondly, the MFT 4010 is also a HART® communicator with full device specific command support for the Rosemount 3095MV. All HART functions can be initiated from the MFT. Consult the attached “Menu Tree for MFT 4010 Communicator / Rosemount 3095MV HART Transmitter” for helpful menu map information. Finally, because the MFT 4010 combines the features of both calibrator and communicator, unique interfaces allow the user to (1) view the HART reported PV and AO, (2) measure the actual values of these parameters using the MFT’s sensors, and (3) directly access the HART trim commands needed to correct the 3095MV. The “One Tool” approach of the MFT 4010 means that field users can carry just one instrument to calibrate the 3095MV instead of five separate devices (HART® communicator, DP standard, P standard, T standard and V / mA meter).

MFT / 3095MV preparations

1. Determine the appropriate sensor modules for the calibration task and install them in the MFT. Connect an RTD probe to the RTD1000 measurement module if used.
2. Turn the MFT On; display cycles to Measure Mode.
3. Zero the sensor modules using the left hand soft key before making any pressure or electrical connections. Temperature measurements on the display will not be zeroed out.
4. Isolate the subject 3095MV from the process
5. Vent and drain (if necessary) the subject 3095MV using the drain ports
6. Using appropriate tubing, connectors and tee fitting(s), connect the MFTs sensor, the pressure source and 3095MV's pressure or vent port(s) as needed for the procedure of interest.
 - a. See the attachment or the MFT Instruction Manual for sample diagrams
 - b. Consult the 3095MV Manual for special instructions that may be required
 - i. Example 1: DP calibration tubing connects only to the High side of subject 3095MV; Low side is vented to atmosphere
 - ii. Example 2: SP (AP or GP) calibration tubing connects to BOTH the High side and the Low side of the subject 3095MV
 - c. Make sure there are no leaks in the test system tubing or fittings
7. Remove the 3095MV's terminal side threaded cap
8. Use a standard test lead set to connect the MFT's mA jacks (as required) in series with the 3095MV's 2-wire loop
9. Verify the MFT is reading loop current – if not, trouble shoot electrical connections

10. At this point, the MFT display should look similar to the following

Measure		▣▣▣▣
S1:	0.00	inW60F
S2:	14.69	PSIA
S3:	24.31	C
IV:	4.037	mA
Zero Mn/Mx Damp More		

Typical Measure Mode Display
Consult MFT Instructions for details

11. Connect MFT HART jacks to 3095MV device
 - a. See the attachment or the MFT Instruction for sample diagrams
 - b. See 3095MV Manual for connection recommendations
 - c. Use the 250 ohm load resistor adapter on low load loops

**Assigning Variables as PV –
Using “HART” key or “Calibrate” key on MFT**

Field calibration of a multi-variable transmitter requires that each variable (DP, SP and PT [either AP or GP depending on model configuration]) be assigned as PV for calibration of that particular measurement aspect of the multi-variable transmitter. The MFT 4010 allows this to be accomplished in either of two ways. The following steps provide the needed menu detail.

Using the “HART” key

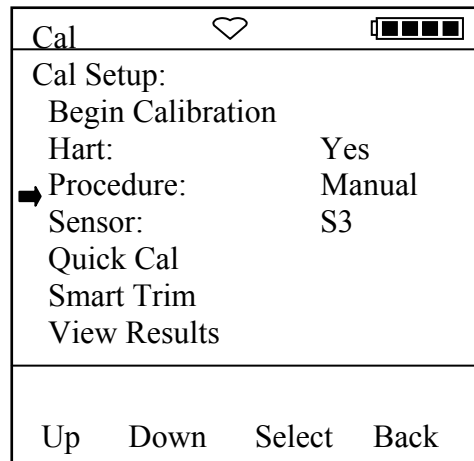
12. Press the HART key on MFT to establish communication with the subject 3095MV. An initial screen will appear showing the initial menu choice and Primary Variable (PV) information

Typical initial HART Communication Mode Display – The Variable featured here is the assigned Primary Variable

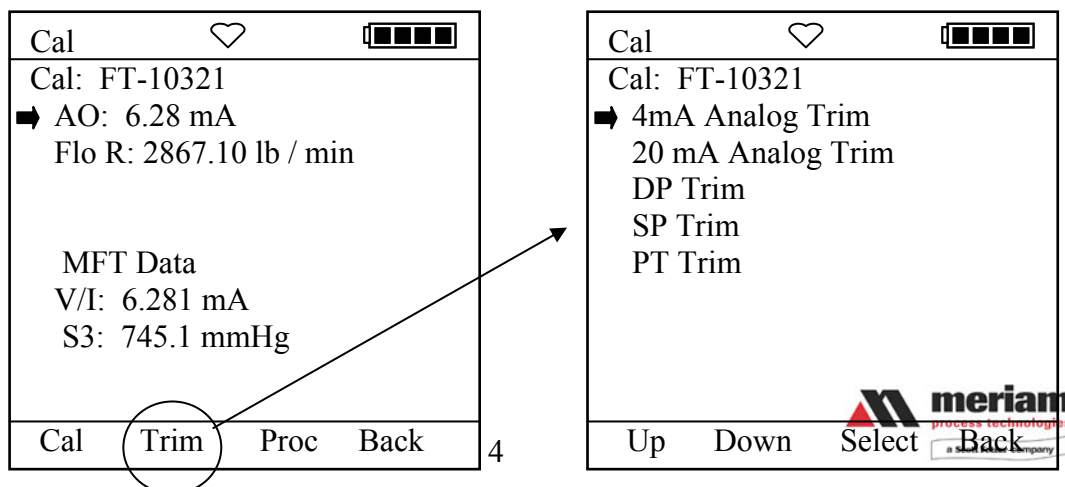
13. Manually assign a Variable (DP, SP, PT or Flo) to be the Primary Variable (PV).
The PV is that variable assigned to be the Analog Output (AO) from the 3095MV.
14. Review screen from #12 above. The Variable featured on the initial display after pressing the “HART” key is the current PV.
15. If the desired variable is not shown, make the following menu selections to assign the desired Variable as PV.
 - a. Device setup / Process variables / View output vars / View PV – Analog 1 / PV is: xx /
 - b. Edit the “PV is: xx” screen to assign the desired Variable as PV. Push the Edit key and then Inc or Dec key(s) to display available Variables. Press the Done key to assign the displayed Variable as PV (and AO).

Using the “Calibrate” key and “Quick Cal” option to eliminate manual assignment of variables as PV.

16. Press the “Calibrate” key to display the following screen. This can be done directly from the Measure Mode of MFT.



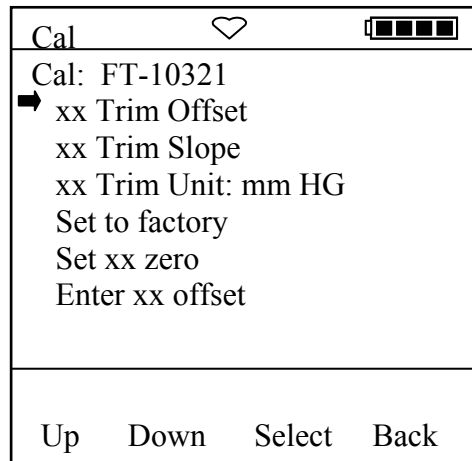
17. Move the cursor arrow Down to “Sensor” option, press the Select soft key. Then select the MFT sensor module that will be used for the first calibration. Press the Back key to return to the Cal Setup display. Use appropriate Pressure module ranges and types (DP, GP or AP) for the calibration at hand.
18. Select the Quick Cal option. The display shown below left will appear. Then press the Trim soft key and the display shown below right will appear.



19. At this point, the user can select the Trim function desired. Selecting 4mA or 20 mA trim will allow trimming of the AO corresponding to the current PV assignment.

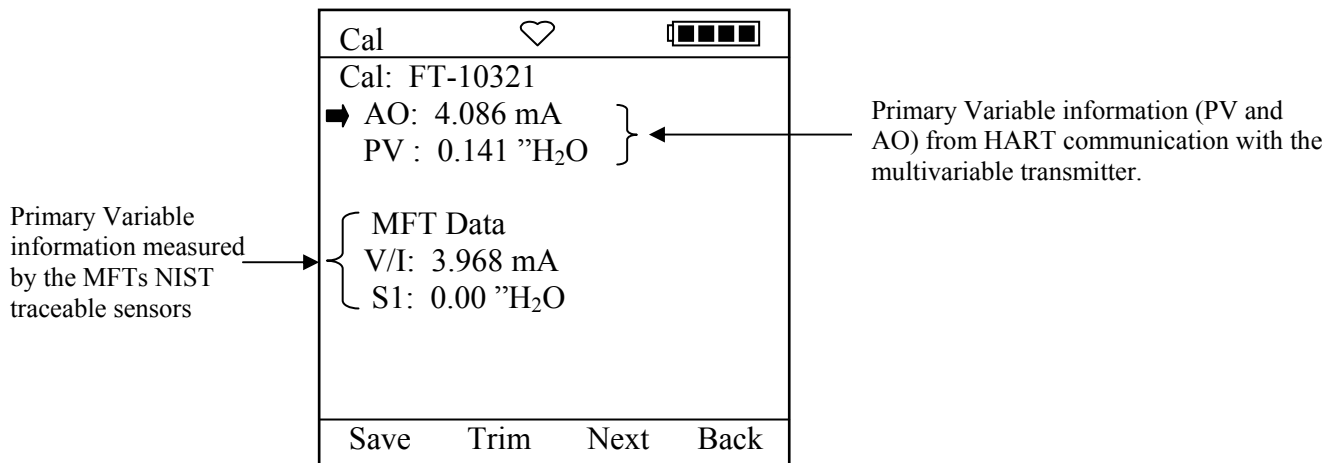
Selecting DP Trim, SP Trim or PT Trim will automatically change the PV assignment to the variable selected. For example, selecting SP Trim will assign SP (either Gauge Pressure or Absolute Pressure depending on the transmitter) as PV. **All HART commands necessary to complete this re-assignment are carried out invisible to the user.**

20. Once DP Trim, SP Trim or PT Trim is selected, a display similar to the following is shown. “xx” is replaced with DP, SP or PT in actual operation. See the procedures below for each trim option.



Use the MFT 4010s “Quick Cal” screen for evaluation of the HART PV and AO values and execution of Trim functions.

21. Press the MFTs “Calibrate” key, scroll down to the “Quick Cal” menu option and press the “Select” soft key to initiate the Quick Cal screen - example shown below



Sample Quick Cal Screen: PV = Differential Pressure
Pressure source is teed into UUT and MFT sensor and
the MFT mA meter is in series with transmitter loop

Calibrate Differential Pressure – using “Quick Cal” Mode

Be sure “Sensor” option under the “Calibrate” menu is set for the MFT sensor bay location (S1, S2, or S3) corresponding to the desired trim and measurement module (see 16 above). Enter “Quick Cal” option.

DP Sensor Trim Offset will normally be 0.00 but may be a non-zero value in some applications.

- a. DP Trim Offset will be 0.00 on applications where no pressure offset is present during normal operation.
 - b. DP Trim Offset will be a non-zero value when normal operation requires an offset (such as that caused by diaphragm seal legs of dissimilar length)
22. Press the Trim soft key (see 18 above)
 23. Select DP Trim option
 24. Select DP Trim Offset
 - a. Take loop off line (prompt by MFT)
 - b. Apply Offset value of 0.00 (or other if appropriate)
 - c. Press the Select soft key when stable
 - d. Trim successful notice
 - e. Put loop back on line (prompt by MFT)

25. **DP Sensor Trim Slope** is used to provide a sensor trim point at a high pressure value (high but below the URL set for DP of the 3095MV)

26. Select DP Trim Slope
 - a. Take loop off line (prompt by MFT)
 - b. Apply desired differential pressure thru a tee to the appropriate MFT sensor and the High-pressure side of the 3095MV. Vent the Low-pressure side of the 3095MV to atmosphere.
 - c. Press the Select soft key when desired high pressure is stable.
 - d. Trim successful notice
 - e. Put loop back on line (prompt by MFT)

Calibrate Static Pressure (Absolute or Gauge) – using Quick Cal Mode Be sure “Sensor” option under the “Calibrate” menu is set for the MFT sensor bay location (S1, S2, or S3) corresponding to the desired trim and measurement module (see 16 above). Enter “Quick Cal” option.

SP Sensor Trim Offset for ABSOLUTE Pressure 3095MV can be accomplished in either of two ways

- A. On the bench by pulling a complete vacuum on both the High and the Low pressure sides of the 3095MV, letting the pressure stabilize, and then selecting SP Trim Offset
 - B. In the field by referencing an absolute pressure module in the MFT for a precise barometer reading and selecting SP Trim Offset
27. Apply pressure (not required for B. above) and allow to stabilize
 28. Select SP Trim option
 29. Select SP Trim Offset

- a. Take loop off line (prompt by MFT)
- b. Apply offset value (full vacuum if following A. above or vent MFT's absolute sensor module and 3095MV's High and Low pressure ports to atmosphere if following B.
- c. Press the Select soft key when pressure is stable
- d. Trim successful notice
- e. Put loop back on line (prompt by MFT)

SP Sensor Trim Slope for ABSOLUTE Pressure 3095MV is used to provide a sensor trim point at a high-pressure value (high but below the URL set for AP)

30. Select SP Trim Slope

- a. Take loop off line (prompt by MFT)
- b. Apply desired pressure through tees to the appropriate MFT sensor and to BOTH the High and the Low-pressure sides of the 3095MV.
- c. Press the Select soft key when pressure is stable
- d. Trim successful notice
- e. Put loop back on line (prompt by MFT)

SP Sensor Trim Offset for GAUGE Pressure 3095MV is entered with the 3095MV's High and Low pressure ports vented to atmosphere for a 0.00 gauge pressure reference

31. Select SP Trim

32. Select SP Trim Offset

- a. Take loop off line (prompt by MFT)
- b. Apply Offset value of 0.00
- c. Press the Select soft key when pressure is stable
- d. Trim successful notice
- e. Put loop back on line (prompt by MFT)

SP Sensor Trim Slope for GAUGE Pressure 3095MV is used to provide a sensor trim point at a high-pressure value (high but below the URL set for GP)

33. Select SP Trim Slope

- a. Take loop off line (prompt by MFT)
- b. Apply desired high pressure through tees to the appropriate MFT sensor and to BOTH the High and the Low pressure sides of the 3095MV
- c. Press the Select soft key when pressure is stable
- d. Trim successful notice
- e. Put loop back on line (prompt by MFT)

Calibrate Process Temperature – using Quick Cal Mode

Be sure “Sensor” option under the “Calibrate” menu is set for the MFT sensor bay location (S1, S2, or S3) corresponding to the desired trim and measurement module (see 16 above). Enter “Quick Cal” option.

PT Trim Offset is always 32.00° F (0.00° C) and requires an ice bath. This is normally a bench calibration procedure, not a field procedure.

34. Prepare ice bath

- a. Insert the Multi-Variable's RTD into an ice bath
- b. Insert the MFT's reference RTD into the same ice bath

35. Select PT Trim

36. Select PT Trim Offset

- a. Take loop off line (prompt by MFT)
- b. Ice bath temperature of 32.00° F (0.00° C) should be displayed
- c. Press the Select soft key when temperature is stable
- d. Trim successful notice
- e. Put loop back on line (prompt by MFT)

PT Trim Slope is used to provide a sensor trim point at a high temperature value (high but below the URL set for PT). This can be done on the bench or in the field.

37. Select PT Trim Slope

- a. Take loop off line (prompt by MFT)
- b. Measure process temperature with MFT's reference RTD inserted into temperature well on bench or into process pipe thermal well in field. Multivariable's RTD should be inserted into same temperature source.
- c. Press the Select soft key when temperature is stable
- d. Trim successful notice
- e. Put loop back on line (prompt by MFT)

Completing calibration procedure

38. The MFT re-assigns the original variable as the Primary Variable (PV) of the 3095MV automatically after any "Quick Cal" Trim function. The user can verify this by pressing the "HART" key on the MFT and reviewing the PV information displayed.