## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>3</td>
</tr>
<tr>
<td>1.1</td>
<td>3</td>
</tr>
<tr>
<td>1.2</td>
<td>3</td>
</tr>
<tr>
<td>2.0</td>
<td>3</td>
</tr>
<tr>
<td>2.1</td>
<td>3</td>
</tr>
<tr>
<td>3.0</td>
<td>4</td>
</tr>
<tr>
<td>3.1</td>
<td>4</td>
</tr>
<tr>
<td>3.2</td>
<td>4</td>
</tr>
<tr>
<td>4.0</td>
<td>6</td>
</tr>
<tr>
<td>4.1</td>
<td>6</td>
</tr>
<tr>
<td>4.2</td>
<td>6</td>
</tr>
<tr>
<td>5.0</td>
<td>7</td>
</tr>
<tr>
<td>5.1</td>
<td>7</td>
</tr>
<tr>
<td>5.2</td>
<td>9</td>
</tr>
<tr>
<td>5.3</td>
<td>13</td>
</tr>
<tr>
<td>5.4</td>
<td>13</td>
</tr>
<tr>
<td>5.5</td>
<td>13</td>
</tr>
<tr>
<td>5.6</td>
<td>13</td>
</tr>
<tr>
<td>Attachment 1 Water Trap/Pressure M&amp;TE</td>
<td>14</td>
</tr>
</tbody>
</table>

This is a new revision. The **First Time Use process** as defined in TFC-OPS-OPER-C-13 can be used during the initial performance of this revision.
Calibrate Rosemount 3051S Pressure Transmitters in TFSPS

1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for Calibrating Rosemount Model 3051S Series Pressure Transmitter as configured in Tank Farms Safety Programmable System.

1.2 Scope

This procedure involves Rosemount Model 3051S Series Pressure Transmitter using a HART communication device, a calibrated pressure source and a milliamp process calibrator.

2.0 INFORMATION

2.1 Terms and Definitions

- URV - Upper Range Value
- LRV - Lower Range Value
- AO - Analog Output
- PV - Process Variable
- HART - Highway Addressable Remote Transducer
- TFSPS - Tank Farm Safety Programmable System
- HMI Human Machine Interface
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

3.1.1 Access to DST Low Ventilation transmitters may require entry into a confined space and compliance with DOE-0360, Hanford Site Confined Space Procedure (HSCSP) is required for entry (107AN and All of AP Farm).

3.1.2 If a lock and tag is required during the performance of this procedure, perform Lockout/Tagout in accordance with DOE-0336, Hanford Site Lockout/Tagout Procedure.

3.1.3 Job specific protective equipment requirements should be addressed during the pre-job brief and be in accordance with TFC-ESHQ-S_IS-C-02. Failure to use protective equipment when working on or near energized systems could result in serious injury.

3.1.4 Comply with DOE–0359, Hanford Site Electrical Safety Program. An Energized Electrical Work Permit is not required when working energized parts that operate at less than 50 volts potential.

The maximum voltage encountered when connecting and disconnecting from terminal strips is less than 24 Vdc.

3.2 Radiation and Contamination Control

3.2.1 Work in radiological areas will be performed using a Radiological Work Permit following review by Radiological Control per the ALARA Work Planning procedure TFC-ESHQ-RP_RWP-C-03.

3.2.2 The opening of any system or component within a Radiological Area requires presence of a Health Physics Technician to verify contamination control.

3.2.3 When disconnecting, breaching, or opening systems or system components that are currently or previously connected to waste tanks or waste transfer systems:

[1] Follow the RWP for radiological control requirements
[2] Pre-job and post-job surveys are required
3.3 Industrial Hygiene

Industrial hygiene (IH) sampling and/or monitoring requirements for tank farm entry will be specified in the Risk Classification 1 (RC-1) Industrial Hygiene Sampling Plan identified in each farm specific Tank Vapor Information Sheet (TVIS). Contact Industrial Hygiene for Sample Plan. Sampling and/or monitoring requirements when breaching systems will be specified in the Risk Classification 2 (RC-2) Industrial Hygiene Sampling Plan identified in each farm specific Tank Vapor Information Sheet (TVIS).

3.4 Environmental

If any hazardous waste is generated during performance of this procedure, consult with Facility/Plant/Area Hazardous Waste Coordinator for Specific instructions to ensure compliance with all environmental standards for disposal.
4.0 PREREQUISITES

4.1 Special Tools, Equipment and Supplies

The following supplies may be needed to perform this procedure:

- HART Communicator
- 250 Ohm precision resistor @ 1%, ½ watt
- Digital Multimeter (DMM), 3.5 digit, 0.125% accuracy
- Power Supply, 10.5 to 42.4 Vdc (e.g., Transmation)
- Druck Pressure Calibrator, or equivalent
- Water trap device (Figure 1)
- Other tools, equipment and supplies as identified by Shift Manager/OE/FWS/User.

4.2 Performance Documents

The following documents may be needed to perform this procedure:

- Rosemount Reference Manual, 00809-0100-4801, Rev CA
- Waste planning checklist
- Pressure M&TE vendor manual.

4.3 Field Preparation

4.3.1 NOTIFY Shift Office that testing will cause alarms in Central Control Room and that alarms should be acknowledged or reset.
5.0 PROCEDURE

5.1 Obtain As-Found Data

5.1.1 IF performing this procedure on a system that has the potential for free liquids or moisture to enter the Pressure M&TE, USE a water trap device.

5.1.1.1 ENSURE the Water Trap is installed in a vertical position to operate correctly. (Figure 1)

5.1.1.2 IF liquids or moisture gets into the Water Trap or Pressure M&TE REFER to Attachment 1.

5.1.2 IF performance of this procedure is on a potentially contaminated system, FOLLOW Calibration Instructions (Attachment 2)

5.1.3 IF any step is not required for procedure completion, RECORD”N/A” in the applicable space(s) on the Data Sheet AND DOCUMENT explanation in the Data Sheet’s Comments/Remarks section.

5.1.4 CONNECT HART Communicator in parallel on current loop for input pressure reference as applicable.

5.1.5 USING HART Communicator, READ device alerts AND RECORD device alerts on Data Sheet.

5.1.6 REMOVE pressure transmitter from service.

5.1.7 CONNECT AND INITIALIZE Test Equipment as follows:

5.1.7.1 IF power source is needed, CONNECT power supply and 250Ω load resistor.

5.1.7.2 CONNECT pressure source to transmitter Hi pressure side AND VENT Low pressure side to atmosphere.

5.1.8 USING HART communicator, ENSURE transmitter terminal (body) temperature is in degrees Fahrenheit AND RECORD transmitter terminal (body) temperature on Data Sheet.
5.1 **Obtain As-Found Data (Cont.)**

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.9</td>
<td>APPLY a negative pressure until transmitter saturation is below 4ma.</td>
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<tr>
<td>5.1.10</td>
<td>VERIFY primary variable out of limits and Analog output saturated with HART communicator <strong>AND</strong> RECORD on Data Sheet.</td>
</tr>
<tr>
<td>5.1.11</td>
<td>APPLY inputs using the values given on the Data Sheet.</td>
</tr>
<tr>
<td>5.1.12</td>
<td>RECORD observed output values in &quot;As-Found&quot; column of Data Sheet.</td>
</tr>
</tbody>
</table>
| 5.1.13 | IF As-Found values are not within specified tolerance per Data Sheet, **OR**
| 5.1.14 | IF As-Found values are within specified tolerance, RECORD As-Found values in As-Left column of Data Sheet. |
| 5.1.15 | IF Independent Verifier (Second Technician) is required by Data Sheet, VERIFY on the Data Sheet the output values recorded are within tolerance. |
| 5.1.16 | FWS VERIFY on Data Sheet completion of Steps 5.1.9 and 5.1.15 |
| 5.1.17 | GO TO Restoration, Section 5.3. |
5.2 Calibration

Choosing a Trim Procedure

NOTE - To decide which trim procedure to use, you must first determine whether the “analog-to-digital section” OR, the “digital-to-analog section” of the transmitter electronics need calibration.

5.2.1 CONNECT test equipment as given in Step 5.1.6, AND

ESTABLISH communication between the transmitter and the HART communicator.

5.2.2 APPLY Maximum input value per Data Sheet AND

COMPARE Applied Pressure to the Process Variable (PV) line at HART Communicator On-Line Menu.

5.2.2.1 IF PV reading does not match Applied Pressure, GO TO Full Sensor Trim, Step 5.2.4.

5.2.3 COMPARE Analog Output (AO) line, on HART communicator to the digital readout device. This can be located by selecting overview selection and primary purpose variable from the home main home screen.

5.2.3.1 IF AO reading does not match digital readout device, GO TO Analog, Step 5.2.10.

Full Sensor Trim

NOTE - Full trim is a two-point sensor calibration where two end-point pressures are applied, and all output is linearized between them. The low trim value should always be performed first to establish the correct offset.

5.2.4 CONNECT test equipment as given in Step 5.1.5, AND

ESTABLISH communication between transmitter and HART communicator.

5.2.5 CALIBRATE sensor with a HART Communicator using the full trim function as follows:

5.2.5.1 SELECT Lower sensor trim
5.2 Calibration (Cont.)

**Full Sensor Trim (Cont.)**

5.2.5.2 **ALLOW** the input pressure to stabilize for 10 seconds before entering any values.

5.2.5.3 **APPLY** Minimum input pressure value per Data Sheet **AND**

**FOLLOW** commands provided by HART Communicator to complete adjustment of the Lower Range Value (LRV).

5.2.5.4 **SELECT** Upper sensor trim.

5.2.5.5 **APPLY** Maximum input pressure value per Data Sheet **AND**

**FOLLOW** commands provided by HART Communicator to complete adjustment of the Upper Range Value (URV).

5.2.6 **AFTER** Full Sensor Trim has been completed, **APPLY** inputs values per Data Sheet **AND**

**CHECK** output values for tolerance.

5.2.7 **IF** values are not within tolerance per Data Sheet, **REPEAT** Steps 5.2.4 through 5.2.7 twice to obtain tolerance.

5.2.7.1 **IF** values cannot be brought into tolerance, **NOTIFY** FWS for resolution **AND**

**STOP WORK** until further directed.

5.2.8 **IF** Independent Verifier (Second Technician) is required by Data Sheet, **VERIFY** on the Data Sheet the output values recorded are within tolerance.

5.2.9 **IF** values are within tolerance per Data Sheet, **GO TO** Restoration, Section 5.3.
5.2 Calibration (Cont.)

Digital-to-Analog Trim

NOTE - The Analog Output Trim commands allow adjustment of the transmitter’s current output at the 4 and 20 mA points to match Data Sheet values. This command adjusts the digital to analog signal conversion.

5.2.10 IF values cannot be brought into tolerance after two attempts using the steps below, NOTIFY FWS for resolution.

5.2.11 PERFORM a digital-to-analog trim following HART Communicator prompt:

5.2.11.1 SELECT online

5.2.11.2 SELECT Service Tools

5.2.11.3 SELECT Maintenance

5.2.11.4 SELECT Calibration

5.2.11.5 SELECT Analog Output

5.2.11.6 SELECT Analog Calibration

NOTE - HART Communicator prompts you to verify whether or not the Low output value equals value on the DMM.

5.2.11.7 IF DMM value equals transmitter output value, SELECT (Yes)

GO TO Step 5.2.11.9

5.2.11.8 IF DMM value does not equal the transmitter output value, SELECT (No) AND

FOLLOW HART Prompts for a 2\textsuperscript{nd} attempt on lower output.
5.2 Calibration (Cont.)

**Digital-to-Analog Trim (Cont.)**

NOTE - HART Communicator prompts you to verify whether or not the High output value equals the value on DMM.

5.2.11.9 IF DMM value equals transmitter output value, SELECT (Yes) AND

GO TO Step 5.2.11.11.

5.2.11.10 IF DMM value does not equal transmitter output value, SELECT (No) AND

FOLLOW HART Prompts for a 2\textsuperscript{nd} attempt on high output.

5.2.11.11 RETURN control loop to automatic control AND

SELECT OK.

5.2.12 AFTER the Digital-to-Analog Trim has been completed, APPLY inputs values per Data Sheet AND

CHECK output values for tolerance.

5.2.13 IF Independent Verifier (Second Technician) is required by Data Sheet, VERIFY on the Data Sheet the output values recorded are within tolerance.

5.2.14 IF values are within tolerance per Data Sheet, GO TO Restoration, Section 5.3.
5.3 Restoration

5.3.1 IF any problems were encountered with calibration, INFORM FWS.

5.3.2 ENSURE Test Equipment information and calibration status are recorded on Data Sheet.

5.3.3 IF not already removed; DISCONNECT AND REMOVE Test Equipment.

5.3.4 ENSURE pressure transmitter has been properly valved in and returned to service.

5.3.5 ENSURE equipment system restoration by observing indications are consistent with expected conditions.

5.3.6 NOTIFY Operations that testing is complete and system may be returned to desired configuration.

5.4 Acceptance Criteria

Acceptance Criteria has been met when Steps in this procedure have been satisfactorily performed and As-Left values meet the specifications and tolerance(s) per the Data Sheet.

5.5 Review

5.5.1 INFORM FWS test is complete.

5.5.2 FWS REVIEW AND ENSURE the following:
   - Completed Data Sheets meet the acceptance criteria.
   - Comments sections are filled out appropriately.
   - Work requests needed as a result of this procedure are identified and generated.
   - Work request number(s) of any work documents generated as a result of this procedure, are recorded in the Comments/Remarks section of the Data Sheet.

5.6 Records

This procedure is performed within a work package, as such, the procedure in its entirety will be maintained as a record per the Work Control process.

The record custodian identified in the Company-level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.
Attachment 1 Water Trap/Pressure M&TE

Water Trap with Potentially Contaminated Liquid

1. If potentially contaminated liquid gets into Water Trap, Suspend the work.
2. Notify the FWS.
3. When provided approval from the FWS proceed as follows.
4. Remove Pressure M&TE from field.
5. Return to a RMA.
6. Disassemble the Water Trap.
7. Allow trap to dry overnight.
8. Survey disassembled trap components in accordance with Radcon survey plan.
9. If the Water Trap can be released return it to tool crib.
10. If the Water Trap cannot be released, dispose of it per waste planning checklist.

Water Trap with Clean Liquid (NOT Contaminated)

1. If clean liquid gets into Water Trap, disassemble the Water Trap.
2. Allow Water Trap to dry overnight.
3. Re-assemble the Water Trap.
4. Return the Water Trap to the tool crib.
Attachment 1 – Water Trap/Pressure M&TE (Cont.)

M&TE with Potentially Contaminated Liquid

1. If potentially contaminated liquid gets past water trap and inside Pressure M&TE, Suspend the work.

2. Notify FWS.

3. Wait for further directions.

M&TE with Clean Liquid (NOT Contaminated)

1. If clean liquid gets past the water trap disassemble and dry out Pressure M&TE per manufactures direction.

2. Return the M&TE to the tool crib.

3. Request the M&TE to be returned to NIST calibration lab for recalibration.
Calibrate Rosemount 3051S Pressure Transmitters in TFSPS

Attachment 2 – Calibration Instructions

Positive pressure calibrations:

Note: Vent Valve assembly is required on all positive pressure calibrations to ensure M&TE is not contaminated by venting potential process air back through M&TE.
Install vent valve assembly Per Figure 3
Ensure IV is open and VV is closed
Proceed with calibration per work package
➢ Whenever venting is required during calibration steps, vent stored pressure as follows.
Ensure IV valve is closed
Ensure VV valve is opened
Repeat sequence as necessary to complete the calibration.
After all steps are completed for the calibration, perform RCT survey release plan.

Negative pressure calibrations:

Note: use of surrogate filter is required for negative pressure calibrations to ensure M&TE is not contaminated by pulling process air into M&TE while drawing Vacuum.
Negative calibrations should be performed as Follows.
Ensure surrogate filter holder has media installed.
Connect filter in-line per Figure 2
Ensure IV is Open
Pull a representative vacuum into MT&E through filter
Ensure IV is Closed
Vent through VV
RCT to perform survey of the media.
IF no contamination found remove surrogate filter holder/manifold and proceed with calibration.
Figure 1 – How the Trap Works

1. Gas/Air enters through the top slot which goes into the chamber.
2. Dirt and Moisture particles are collected in the chamber, which is visible through the clear transparent glass window.
3. Then Gas/Dry Air goes into the centre slot where it enters the instrument.
Figure 2 – Negative Pressure Connection
Figure 3 – Positive Pressure Connection