USQ # Routine Maintenance

<table>
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<tr>
<th>Rev-Mod</th>
<th>Release Date</th>
<th>Justification</th>
<th>Summary of Changes</th>
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<tr>
<td>D-2</td>
<td>08/11/2016</td>
<td>Maintenance Request</td>
<td>Added special instruction to 5.1 and changed 5.1.6, 5.1.7.3, 5.1.8.3, and 5.3.5</td>
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<tr>
<td>D-1</td>
<td>08/09/2016</td>
<td>Per maintenance management request placing the loop in manual control is conditional in certain cases.</td>
<td>Change step 5.1.2 to be conditional and added conditional step 5.3.7 to return to original configuration if the loop is switched to manual control.</td>
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<td>D-0</td>
<td>06/09/2016</td>
<td>Periodic Review</td>
<td>ADD-General Info Section 2.1, Steps 2.1.1, 2.1.2, 5.6.1, Reword-Steps 5.1.2, 5.1.7.1, 5.3.3, 5.3.4, 5.3.7, 5.3.8, Update Records Section 5.6, STRUCK-2nd &amp; 3rd Notes @5.1 and moved to General Info Section 2.1.</td>
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<tr>
<td>C-1</td>
<td>11/20/2014</td>
<td>CHAMPS Removal</td>
<td>Removed reference to CHAMPS, updated records statements and removed next periodic review date.</td>
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<tr>
<td>C-0</td>
<td>05/15/2013</td>
<td>Periodic Review</td>
<td>Removed 3.1.3 in personnel safety.</td>
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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for calibrating Foxboro Magnetic Flow Transmitters Model IMT25 I/A Series.

1.2 Scope

This procedure applies to Foxboro Magnetic Flow Transmitters Model IMT25 I/A Series.

2.0 INFORMATION

2.1 General Information

2.1.1 Model IMT25 I/A Series consists of a 32-alphanumeric character, 2-line back-lighted LCD display and 5-button keypad. The display can indicate positive total, negative total, net total, net inventory, and flow rate in conventional flow units. A (+) or (-) indicators show flow direction.

2.1.2 The clear plastic guard protects the display and keypad from the weather or during wash down operations preventing inadvertent activation of the buttons. However, the front panel is protected to NEMA 4X even without the guard.

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

3.1.1 If working around live circuits, extreme caution should be used. Failure to follow electrical safety practices as outlined in DOE–0359, Hanford Site Electrical Safety Program could result in serious injury or death.

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

3.2 Equipment Safety

CAUTION - Electrostatic discharge (ESD) can cause possible degradation of circuit calibration.

CAUTION - Radio frequency (RF) energy from intentional transmitters such as walkie-talkies within close proximity to an IMT25 with the cover removed, may affect accuracy.
3.1 Radiation and Contamination Control

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

4.0 PREREQUISITES

4.1 Special Tools, Equipment and Supplies

The following calibrated tools will be needed to perform this procedure:
- A calibrated Digital Multimeter (DMM) with range accuracy per data sheet, OR
  A calibrated Ammeter (AM) with range accuracy per data sheet
- I/A IMT25 Series Magnetic Flowtube Simulator (IMTSIM)
- 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:
- Vendor Information File: 50510.

4.3 Field Preparation

4.3.1 REQUEST operations to remove instrument from service to allow for this check and calibration.
5.0 PROCEDURE

NOTE - Local IMT25 calibration entries are made using the 5-button keypad (see Figure 1). Activating a feature is done by pressing the SHIFT key PLUS any other key. Entered data will appear on the first line of the 2-line x 16 character LCD display screen.

5.1 Transmitter As-Found Condition

Special Instructions

If any step is not required for procedure completion, record “N/A” in the applicable space(s) on the Data Sheet and document the justification in the Data Sheet’s Comments/Remarks section.

5.1.1 IF programmed ON, RECORD As-Found totalizer reading on data sheet IF required.

5.1.2 IF loop is required to be placed in manual control PLACE loop in manual control.

5.1.3 TURN OFF power to the transmitter.

CAUTION

Electrostatic discharge (ESD) can cause possible degradation of circuit calibration.

5.1.4 DISCHARGE your body by touching a transmitter cover mounting screw before connecting the IMTSIM (Simulator).

5.1.5 REMOVE main enclosure cover.

5.1.6 REMOVE spare plug cover IF equipped.

5.1.7 CONNECT DMM to output as follows:

5.1.7.1 CHECK output leads are labeled to assist re-connection.

5.1.7.2 DISCONNECT one output lead from transmitter.

5.1.7.3 PASS DMM lead(s) through the spare plug opening IF equipped AND CONNECT DMM in series with output observing polarity.
5.1 Transmitter As-Found Condition (Cont.)

NOTE - The simulator leads are larger than the process leads. To assist inserting the simulator leads, it is helpful to back the capture screws to their full open position.

5.1.8 CONNECT IMTSIM (simulator) to the IMT25 transmitter as follows (see Figure 2 and Figure 3):

5.1.8.1 LOCATE terminal block labeled “coil”.

**Red and Green Wires**

5.1.8.2 IF flowtube wires are connected to “coil1” and/or “coil 2” terminals, ENSURE they are labeled to assist re-connection AND REMOVE them.

5.1.8.3 PASS Simulator lead(s) through the spare plug opening IF equipped AND CONNECT the red IMTSIM wire to “coil 1” terminal and the green IMTSIM wire to “coil 2” terminal.

<table>
<thead>
<tr>
<th>IMTSIM WIRE</th>
<th>TO</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Coil 1 Terminal</td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>Coil 2 Terminal</td>
<td></td>
</tr>
</tbody>
</table>

**Black and White Wires:**

5.1.8.4 LOCATE terminal block labeled “signal”.

5.1.8.5 IF flowtube wires are connected, REMOVE all wires connected to “signal terminal”.

5.1.8.6 CONNECT black IMTSIM wire to “signal B” terminal and white IMTSIM wire to “signal W” terminal.

<table>
<thead>
<tr>
<th>IMTSIM WIRE</th>
<th>TO</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Signal B</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>Signal W</td>
<td></td>
</tr>
</tbody>
</table>

5.1.9 RE-INSTALL main enclosure cover so the arrow keys can be accessed.
5.1 Transmitter As-Found Condition (Cont.)

CAUTION

Radio frequency (RF) energy from intentional transmitters such as walkie-talkies within close proximity to an IMT25 with the cover removed, may affect accuracy.

5.1.10 RECONNECT power to the transmitter.

5.1.11 CONFIRM IMT25 Transmitter is in Measurement Mode (default upon power-up).

5.1.11.1 IF IMT25 Transmitter is not in Measurement Mode, CONSIDER trouble shooting per work package.

5.1.12 ENTER Test Mode B (see Appendix 1).

NOTE - Present Simulator does not have a selection for 75%, so cannot simulate a standardized 16 mA output.

5.1.13 SIMULATE input values per Data Sheet.

NOTE - When in Test Measurement mode, the local display can usually be toggled using the up or down keys to show readings like SIM(ulator setting), GPM, % (of range), and MA (output).

5.1.14 READ DMM AND

RECORD values in As-Found section of data sheet.
5.1 Transmitter As-Found Condition (Cont.)

5.1.15 IF As-Found values are not within specified tolerance per Data Sheet, GO TO section 5.2 Calibration,

OR

IF As-Found values are within specified tolerance, but deemed marginal, and optimization is desired, GO TO section 5.2 Calibration,

OR

IF readings are within tolerance per data sheet RECORD readings in As-Left section of data sheet AND

GO TO Section 5.3 Restoration.
5.2 Calibration

5.2.1 EXIT Test Mode (see Appendix 2).

5.2.2 FROM RATE screen, PRESS left arrow key to go to 1 TOP LEVEL, Measurements.

5.2.3 PRESS down arrow key to Setup.

5.2.4 PRESS right arrow key SETUP, System.

5.2.5 PRESS down arrow key to SETUP, Calibration.

5.2.6 PRESS right arrow key CALIBRATION Meter Factor.

5.2.7 PRESS down arrow key CALIBRATION Analog Out Cal.

5.2.8 PRESS right arrow key to "GO Off-Line?"

5.2.9 PRESS right arrow key say yes to GO Off-Line (Yes).

5.2.10 PRESS right arrow key to go to 4 ANALOG OUT CAL, 4 mA ADJUST.

5.2.11 PRESS right arrow key to go to 4 mA ADJUST Done.

5.2.12 IF a large change is needed, PRESS up or down arrow key to go to 4 mA Adjust < -{0.05 mA} + > or 4 mA Adjust < -{0.5 mA} + >. **AND**

AS required, PRESS left or right arrow key(s)s to change output up or down on DMM.

5.2.13 IF a small change is needed, PRESS up or down arrow key to go to 4 mA Adjust < -{0.005 mA} + >.

AS required, PRESS left or right arrow key(s)s to change output up or down on DMM.

5.2.14 PRESS up or down arrow key to go to DONE.

5.2.15 PRESS up or down arrow key to accept DONE.
5.2 Calibration (Cont.)

5.2.16 PRESS down arrow key to go to 20 ANALOG OUT CAL, 20 mA ADJUST.

5.2.17 PRESS right arrow key to go to 20 mA ADJUST, Done.

5.2.18 IF a large change is needed, PRESS up or down arrow key to go to 20 mA Adjust < -{0.05 mA} + > or 20 mA Adjust < -{0.5 mA} + >. **AND**

AS required, PRESS left or right arrow key(s) to change output up or down on DMM.

5.2.19 IF a small change is needed, PRESS up or down arrow key to go to 20 mA Adjust < -{0.005 mA} + >.

AS required, PRESS left or right arrow key(s) to change output up or down on DMM.

5.2.20 PRESS up or down arrow key to go to DONE.

5.2.21 PRESS up or down arrow key to accept DONE.

5.2.22 PRESS left arrow key repeatedly to "GO On-Line?".

5.2.23 PRESS right arrow key say yes to GO On-Line (Yes).

5.2.24 PRESS right arrow key to go to 1 TOP LEVEL, Measurements.

5.2.25 PRESS right arrow key to go to RATE screen.

5.2.26 ENTER Test Mode B (see Appendix 1).

**NOTE** - Present Simulator does not have a selection for 75%, so cannot simulate a standardized 16 mA output.

5.2.27 SIMULATE input values per Data Sheet.

**NOTE** - When in Test Measurement mode, the local display can usually be toggled using the up or down keys to show readings like SIM(ulator setting), GPM, % (of range), and MA (output).

5.2.28 READ DMM AND

**RECORD** values in As-Found section of data sheet.
5.2 Calibration (Cont.)

5.2.29 IF values are within tolerance per Data Sheet, RECORD As-Left values on Data Sheet AND

GO TO Section 5.3 Restoration.

5.2.30 IF values are not within tolerance per Data Sheet, REPEAT Steps 5.2.1 through 5.2.29 until values are within tolerance, OR

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

STOP WORK until further directed.
5.3 Restoration

5.3.1 EXIT Test Mode (see Appendix 2).

5.3.2 DISCONNECT power from the transmitter.

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

5.3.4 IF not already connected, RE-CONNECT process leads.

5.3.5 REINSTALL spare plug cover IF equipped.

5.3.6 RE-CONNECT power to the transmitter.

5.3.7 IF loop was placed in manual control RETURN to original configuration.

5.3.8 RECORD Test Equipment information and calibration status on Data Sheet.

5.3.9 CHECK equipment system restoration by observing indications are consistent with expected conditions.

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

5.3.11 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, as applicable.
5.6 Records

The following records are generated during the performance of this procedure and are maintained in the work package as record material.

5.6.1 **SUBMIT** the completed records/work package to the supervisor for record retention.
- Step 5.1.8.3 and 5.1.8.6

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.
Appendix 1 - Transmitter Enter Test Mode B Menu Navigation Example

NOTE - This example assumes starting from "Measurement" mode after connecting the simulator and powering the transmitter up. If you start from a different place in the transmitter menu or repeat steps, prompts to go "on/off line" will appear in different places.

a. PRESS left arrow key one or more times to move to 1 TOP LEVEL, Measurements.

b. PRESS up or down arrow key to move to 1 TOP LEVEL, Test Mode.

c. PRESS right arrow key to move into Test Mode menu.

d. When asked "Go Off-Line?", PRESS right arrow key to accept.

e. Simultaneously PRESS "shift" and "right arrow key" to change Test Mode.

f. PRESS up or down arrow key to Select Test Mode B.

g. PRESS right arrow key to confirm selection of Test Mode B.

h. PRESS right arrow key to view SIMULATOR COEFF?.

NOTE - SIMULATOR COEFF value requested in the following step can be found on the Simulator Name Plate (typical value of "1.000").

i. If needed, simultaneously PRESS "shift" and "right arrow key" to change SIMULATOR COEFF?.

j. PRESS right arrow to accept.

k. PRESS right arrow to accept VER SIM DATE?.

l. PRESS right arrow to accept VER SIM NAME?.

m. When asked "Go On-Line Test?, "PRESS right arrow key to accept.

n. Wait about one minute for Test Mode to be established.

o. If sent to this appendix from the Section 5.1, GO TO Step 5.1.13.

p. If sent to this appendix from the Section 5.2, GO TO Step 5.2.27.
Appendix 2 - Transmitter Exit Test Mode B Menu Navigation Example

NOTE - This example assumes starting from "Test Mode" after completing simulation and preparing to restore the transmitter. If you start from a different place in the transmitter menu or repeat steps, prompts to go "on/off line" will appear in different places.

a. PRESS left arrow key one or more times to move to 1 TEST LEVEL, Measurements.
b. PRESS down arrow key to move to 1 TEST LEVEL, Test Mode.
c. PRESS right arrow key to move into Test Mode Select menu.
d. When asked "Go Off-Line?", PRESS right arrow key to accept.
e. PRESS shift and right arrow key to change Test Mode.
f. PRESS up or down arrow key to Select Test Mode Off.
g. PRESS right arrow key to confirm selection of Test Mode Off.
h. If "Go On-Line?" does not display, PRESS right arrow key one more time.
i. When "Go On-Line?" is displayed, PRESS right arrow key to accept.
j. CONFIRM Normal Measurement Mode has been re-established.
Figure 1 – IMT25 Face Plate View

1 TOP LEVEL
Measurements

5-KEY KEYPAD
PRESSING SHIFT +
ANY KEY PERFORMS
THE FUNCTION
INDICATED ON THE
KEY. PRESSING THE
KEY WITHOUT
SHIFT PERFORMS
AN "ARROW"
FUNCTION, MOVING
THROUGH THE
MENU STRUCTURE
IN THE DIRECTION
INDICATED.
Figure 2 – Typical Simulator System Setup
Figure 3 – Typical Transmitter Terminals
Figure 4 – IMT25 Typical Level 1 Menu

- **1 TOP LEVEL MEASUREMENTS**: This is the normal operation mode. It displays flow rates and/or totals. It also indicates if alarm or diagnostic conditions exist. The selected default measurement (flow rate or totalizer value) will be displayed when the transmitter is turned on.

- **1 TOP LEVEL STATUS**: This mode provides details about all the transmitter output values, state of contact inputs and outputs, AZL state, alarm conditions, diagnosis errors, and more.

- **1 TOP LEVEL IDENTITY**: This mode is used to save and display reference information such as tag name and calibration dates. The transmitter software version number can also be found here.

- **1 TOP LEVEL QUICK START**: This mode can be used to quick start your transmitter if GPM flow units are used and only digital and 4-20 mA outputs are needed.

- **1 TOP LEVEL TEST MODE**: This mode can be used in conjunction with a Foxboro IMTSIM unit to verify the calibration of the transmitter.

- **1 TOP LEVEL SETUP**: This mode is used to customize (configure) the transmitter to your application. This includes defining flow rate ranges, output used, alarm conditions, and so forth.
Calibration of the Foxboro Model IMT25 I/A Series Magnetic Flow Transmitters

Figure 5 – IMT25 Typical Level 2 to Level 3 Menu

GOING FROM ON-LINE TO OFF-LINE MODE BECAUSE OF SETUP CHANGES ALWAYS DISPLAYS THE WARNING MESSAGE.

GO OFF-LINE?

NO           YES <
Figure 6 - Typical Level 3 Transmitter Menu

- **3 TRANSMITTER XMTR MODE**: XMTR MODE?
  - On-Line
  - Off-Line

- **3 TRANSMITTER LINE FREQUENCY**: LINE FREQUENCY?
  - 60 Hz
  - 50 Hz

- **3 TRANSMITTER FLOW DIRECTION**: FLOW DIRECTION?
  - REVERSE
  - Positive
  - Reverse
  - BiDir Positive
  - BiDir Reverse

- **3 TRANSMITTER CONTACT IN 1**: C1 1 FUNCTION?
  - SIGNAL LOCK
  - Off
  - Ack Alarm
  - Reset Net Tot
  - Reset Gr Tot
  - Reset All Tot
  - Multi-Range
  - Signal Lock

- **3 TRANSMITTER CONTACT IN 2**: C1 2 FUNCTION?
  - SIGNAL LOCK
  - Off
  - Ack Alarm
  - Reset Net Tot
  - Reset Gr Tot
  - Reset All Tot
  - Multi-Range
  - Signal Lock

- **3 TRANSMITTER NOISE RED ON**: NOISE REDUCTION?
  - On
  - Off

- **3 TRANSMITTER EPD DETECT**: EPDr DETECT
  - CALCULATE SETPT
  - Press key if tube is filled
  - Please wait
  - Calculate setpt successful

- **EPDr SETUP**: OFF
  - No effect
  - Auto sig. lock

**Note**: The "EPD CALCULATE SET-POINT" routine must be used to complete activation of the empty pipe detection feature.
Figure 7 - Typical Level 3 Calibration Menu

- **3 CALIBRATION**
  - METER FACTOR
  - MFACTOR FORMAT
    - ###.####
  - METER FACTOR?
    - #######

- **3 CALIBRATION**
  - ANALOG OUT CAL
    - 4 MA ADJUST
      - Done
      - Cancel
      - 0.5 mA
      - 0.05 mA
      - 0.005 mA
    - 20 MA ADJUST
      - Done
      - Cancel
      - 0.5 mA
      - 0.05 mA
      - 0.005 mA

- **3 CALIBRATION**
  - PRESET OUTPUTS
    - 4 PRESET OUTPUTS
      - ANALOG PRESETS
        - ANALOG PRESETS?
          - ###.## MA
          - ANALOG PSET ON?
            - Off
            - On

**ENTERING A PRESET VALUE WHILE ON-LINE WARNS THE USER WITH A STANDARD MECHANISM FOR GOING OFF-LINE. WHILE OFF-LINE, SINCE MEASUREMENTS ARE NOT UPDATED, PRESET VALUES STICK UNTIL THE TRANSMITTER RETURNS TO ON-LINE.**

**LEFT AND RIGHT ARROW KEYS DECREMENT AND INCREMENT THE STEP PICKED WITH THE UP AND DOWN ARROWS KEYS. PICK DONE EXITS VIA LEFT OR RIGHT KEYS.**
Figure 8 - Typical Level 3 Test Mode Menu

- **GO OFF-LINE?**
  - NO
  - YES

- **SIMULATOR COEFF?**
  - 1.000

- **CONFIG ALARMS?**
  - INACTIVE

- **CONFIG TOTALS?**
  - ACTIVE

- **ENTER DATE?**
  - [##/##/##]

- **ENTER NAME?**
  - [DONE BY]

- **SELECT MODE**
  - TEST MODE A

- **Picklist:**
  - Test Mode Off
  - Test Mode A
  - Test Mode B

- **Nodes will appear only if Alarms On in normal mode is configured On.**

- **Go OnLine Test?**
  - No
  - Yes

- "NO" goes back to SELECT MODE?
- "YES" goes back to TOP LEVEL in Normal Mode.
Figure 9 - Simulator Face Plate View

8 POSITION ROTARY SELECTOR SWITCH

PUSHBUTTON POLARITY SWITCH

POTENTIOMETER FOR THE ADJUSTABLE RANGE

(RANGE: mV/A
RANGE ADJUST
POLARITY
INC
ADJ 0.0 0.25 0.5 1.0 2.0 4.0 8.0
OXBORO
POSITION ROTARY SELECTOR SWITCH

NOTE THAT THE ROTARY SWITCH MUST BE SET TO THE ADJ POSITION TO ACTIVATE)