Calibrate Foxboro 870ITEC Conductivity Transmitter with 871FT Sensor

Tank Farm Maintenance Procedure

MAINTENANCE

USQ # Routine Maintenance

CHANGE HISTORY (≤ LAST 5 REV-MODS )

<table>
<thead>
<tr>
<th>Rev-Mod</th>
<th>Release Date</th>
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| C-2     | 08/23/2017   | Maintenance request | Reword Section 4.3 Step 4.3.1.1:  
   IF Calibrating RW-1:  
a. OPEN RC2-34.  
b. CLOSE RC2-28.  
c. CLOSE RC2-23.  
d. OPEN RC2-33.  
e. OPEN RC2-32.  
Reword Section 4.3 Step 4.3.1.2:  
IF Calibrating STM-1:  
a. OPEN RC1-34.  
b. CLOSE RC1-25.  
c. CLOSE RC1-22.  
d. OPEN RC1-20.  
e. OPEN RC1-33.  
Reword Section 5.3, Step 5.3.7.1:  
IF Calibrating RW-1:  
a. CLOSE RC2-2032.  
b. OPEN RC2-2523.  
c. OPEN RC2-2428.  
d. CLOSE RC2-34.  
e. OPEN RC2-2434.  
Add to Section 4.3:  Step 4.3.1.1  
IF restoring STM-1:  
a. CLOSE RC1-21.  
b. CLOSE RC1-27.  
c. OPEN RC1-26.  
d. OPEN RC1-31.  
Add to Section 5.3:  Step 5.3.7.1  
IF restoring RW-1:  
a. CLOSE RC2-32.  
b. OPEN RC2-25.  
c. OPEN RC2-31.  
Add 4th bullet under 2.2, Struck Step 3.1.2.  
Changed Note prior to 5.1.1 to Special Instructions above 5.1.  
Removed the word “Note” from Records Section 5.6.  
Page 10 – Step 5.2.22 Delete “Temperature and.”  
Page 11 – Step 5.2.28 Delete “Temperature and.”  
Step 5.2.29.1 Bullets 1 & 2 Delete “Temperature and.” |
| C-1     | 08/22/2017   | Maintenance request | Add to Section 4.3:  Step 4.3.1.1  
IF restoring STM-1:  
a. CLOSE RC1-21.  
b. CLOSE RC1-27.  
c. OPEN RC1-26.  
d. OPEN RC1-31.  
Add to Section 5.3:  Step 5.3.7.1  
IF restoring RW-1:  
a. CLOSE RC2-32.  
b. OPEN RC2-25.  
c. OPEN RC2-31.  
Add 4th bullet under 2.2, Struck Step 3.1.2.  
Changed Note prior to 5.1.1 to Special Instructions above 5.1.  
Removed the word “Note” from Records Section 5.6.  
Page 10 – Step 5.2.22 Delete “Temperature and.”  
Page 11 – Step 5.2.28 Delete “Temperature and.”  
Step 5.2.29.1 Bullets 1 & 2 Delete “Temperature and.” |
| C-0     | 03/09/2016   | Periodic Review | Add 4th bullet under 2.2, Struck Step 3.1.2.  
Changed Note prior to 5.1.1 to Special Instructions above 5.1.  
Removed the word “Note” from Records Section 5.6.  
Inconsequential Change to remove reference to Champs |
| B-3     | 07/16/2015   | Company Driven | Page 10 – Step 5.2.22 Delete “Temperature and.”  
Page 11 – Step 5.2.28 Delete “Temperature and.”  
Step 5.2.29.1 Bullets 1 & 2 Delete “Temperature and.” |
| B-2     | 10/02/2014   | Shift Operations Request | Page 10 – Step 5.2.22 Delete “Temperature and.”  
Page 11 – Step 5.2.28 Delete “Temperature and.”  
Step 5.2.29.1 Bullets 1 & 2 Delete “Temperature and.” |

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REFERENCE | 6-MISC-803 | C-2 | 08/23/2017 | 1
# Calibrate Foxboro 870ITEC Conductivity Transmitter with 871FT Sensor

## 3.2 Radiation and Contamination Control

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Figure 1 – Foxboro 870ITEC Conductivity Transmitter Display/Controls

Figure 2 – Test Connection Hook-Up with MCS Display

Figure 3 – Flow-Through Sensor with RTD and Wiring Layout

Figure 4 – Transmitter Calibration Menu Flowchart
1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for Calibrating Foxboro 870ITEC Conductivity Transmitter with 871FT Toroidal Flow-Through Conductivity Sensing Element.

1.2 Scope

This procedure pertains to Foxboro 870ITEC Conductivity Transmitter with 871FT sensing element using the EP485A Calibration Plug.

2.0 INFORMATION

2.1 General Information

2.1.1 This equipment has been “Configured” by the manufacture for the requested parameters and should not have need of additional configuration. If configuration is necessary refer to vendor manual MI 611-212, Structure Diagram 2 “CONFIGURATION”.

2.1.2 Calibration Plug EP485A is used to set the Upper Range Value (URV) and eliminates the need for a calibration solution.

2.1.3 After the Sensor has been installed in the line, preparation for calibration is performed by one of the following methods:

- Removing Sensor from process line and cleaning and drying it
- Leaving it in the “empty” line for testing.

2.1.4 A Bench Calibration (using a Foxboro calibration plug or a decade resistance box) typically provides a more reliable, more consistent, and far easier calibration than a Solution Calibration.

2.2 Terms and Definitions

- LRV - Lower Range Value
- URV - Upper Range Value
- MCS - Monitor and Control System
- $\mu$S/cm Microsiemens per Centimeter (measure of conductivity).
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.

The loop voltage of 24 VDC is the highest voltage encountered when calibrating this instrument.

3.2 Radiation and Contamination Control

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.
4.0 PREREQUISITES

4.1 Special Tools, Equipment and Supplies

The following supplies may be needed to perform this procedure:

NOTE - Measuring and Test Equipment (M&TE) used to collect acceptance criteria data during performance of this procedure shall meet the following requirements:

- Be within its current calibration cycle as evidenced by an affixed calibration label
- Be capable of desired range
- Have an accuracy consistent with state-of-the-art limitations
- Accuracy is equal to or greater than M&TE tolerance specified on PMID/Data Sheet or is at least 4 times greater than specified device tolerance.

- Digital Multimeter (DMM)
- Foxboro EP485A Calibration Plug
- RTD patch cord (Aux. Spec. BS809UN)
- Power supply capable of outputting 24 VDC
- Digital Temperature indicator
- Contact Digital Thermometer or equivalent
- 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:

- Foxboro 870ITEC Transmitter Instruction Manual # MI 611-212
- Foxboro 870ITEC Transmitter Instruction Manual # MI-611-220
4.3 Field Preparation

4.3.1 IF performing a calibration with the Sensor installed in the process line, REQUEST operations to configure system as follows:

4.3.1.1 IF Calibrating RW-1:

a. OPEN RC2-34.

b. CLOSE RC2-28.

c. CLOSE RC2-23

d. OPEN RC2-33.

e. OPEN RC2-32

4.3.1.2 IF Calibrating STM-1:

a. OPEN RC1-34

b. CLOSE RC1-25.

c. CLOSE RC1-22

d. OPEN RC1-20.

e. OPEN RC1-33.
5.0 PROCEDURE

Special Instructions

If performance of any steps in this procedure is not required for procedure completion, steps not performed are to be marked, "N/A" in appropriate Data Sheet signoff space, and explained in comments/remarks section of Data Sheet.

5.1 Obtain As-Found Values with Sensor Installed in Process Line

5.1.1 CONFIRM system process line is drained for the Conductivity Sensor.

5.1.2 CONNECT the DMM in series with the 4 - 20 mA output (ref. Figure 2).

5.1.3 ALLOW the equipment under test to warm for approximately 2 minutes to achieve stability.

5.1.4 REFER to Figure 1 for Display and key usage information.

NOTE The first line on the transmitter display is the process value and the second line is the temperature reading.

5.1.5 PRESS the “MEASURE” key AND

RECORD the following As-Found information on Data Sheet:
• displayed process LRV (Lower Range Value)
• LRV mA reading from the DMM.

5.1.6 USE contact digital thermometer AND

MEASURE the temperature at the RTD probe port or on the pipe at the probe location.

5.1.6.1 RECORD the (M&TE) thermometer temperature reading on Data Sheet.

5.1.7 RECORD the MCS Low Range Values for Used Raw Water per Data Sheet.

5.1.8 PRESS the “STATUS” key to enter Status Mode AND

USE the down arrow to cycle to the temperature (“TEMP”).
5.1 Obtain As-Found Values with Sensor Installed in Process Line (Cont.)

5.1.9 RECORD the As-Found Display temperature on the Data Sheet.

5.1.9.1 IF As-Found temperature is within tolerance with the temperature taken with the Digital Thermometer in Step 5.1.6, RECORD in As-Left Section of Data Sheet.

5.1.10 REMOVE the RTD connector plug from the Sensor port AND INSTALL Foxboro Calibration Plug EP485A into the RTD port connection.

5.1.11 ALLOW the instrument to stabilize.

5.1.12 PRESS the “MEASURE” key AND RECORD the following on the Data Sheet:

- Process URV (Upper Range Value) on the Data Sheet.
- URV mA reading from the DMM on the Data Sheet.
- MCS Upper Range Values per Data Sheet.

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

OR

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

OR

IF As-Found values are within specified tolerance, RECORD As-Found values in As-Left Section of Data Sheet AND GO TO Restoration, Section 5.3.
5.2 Calibration

NOTE - Output cannot be read on the transmitter display while calibrating instrument. To see the As-Left data, one should exit Calibration and go to “Measure”.

5.2.1 IF Foxboro Calibration Plug is installed, REMOVE the Foxboro Calibration Plug EP485A from the RTD port connection AND

RE-INSTALL the RTD connector plug to the RTD sensor port.

5.2.2 IF the As-Found temperature was found within tolerance per Data Sheet, GO TO Step 5.2.8.

5.2.3 IF performing calibration with Sensor “removed” from process line, PLACE the RTD probe against Sensor for comparable temperature reading.

5.2.3.1 PLACE the digital temperature indicating device (M&TE) alongside the RTD probe location for temperature conformation.

5.2.4 IF performing calibration with the Sensor “installed” in the process line; CONFIRM system process line is drained for the Conductivity Sensor.

5.2.4.1 USE contact digital thermometer AND

MEASURE the temperature at the RTD probe insertion port,

OR

MEASURE the temperature on the pipe at the probe location.

a. RECORD the digital (M&TE) thermometer temperature reading on the Data Sheet.

5.2.5 PRESS the “CAL” key on transmitter.

NOTE - The initial pass-code from the factory will be 0800 until changed.

5.2.6 AT the prompt, APPLY the pass-code (0800) AND

PRESS “ENTER”.
5.2 Calibration (Cont.)

5.2.7 PRESS the down arrow key to go to “CALxTemp” (ref. Figure 4).

5.2.7.1 PRESS the right arrow key to go to “TEMP”.

5.2.7.2 APPLY the correct temperature AND

PRESS “ENTER”.

5.2.7.3 GO TO Step 5.2.10

5.2.8 PRESS the “CAL” key on transmitter.

NOTE - The initial pass-code from the factory will be 0800 until changed.

5.2.9 AT the prompt, APPLY the pass-code (0800) AND

PRESS “ENTER”.

5.2.10 USE the Up/Down arrow keys AND

SELECT “BENCH”.

5.2.10.1 PRESS “ENTER”.

5.2.11 AT the prompt “SUSPEND IN AIR” (zero measurement), PRESS ‘ENTER’.

5.2.12 ADJUST ZERO (LRV) to “0000” AND

PRESS “ENTER.”

5.2.13 AT the prompt “Connect Loop Resistor,” DISCONNECT the RTD connector plug from the Sensor AND

CONNECT the Calibration Plug (EP485A) into the RTD port connection on the Sensor.

5.2.13.1 PRESS “ENTER.”

5.2.14 ALLOW the instrument to stabilize THEN

PRESS “ENTER.”
5.2 Calibration (Cont.)

NOTE - Although the instrument range is 0 to 200 µS/cm the actual URV from the Calibration Plug may differ slightly.

5.2.15 ENTER µS/cm (URV) value from information tag on the Calibration Plug (e.g. xxx resistance = 199.5 µS/cm) AND PRESS ENTER.

5.2.16 REMOVE the Foxboro Calibration Plug EP485A from the RTD port connection.

5.2.17 RECONNECT the RTD to its port connection on the sensor.

5.2.18 PRESS the “MEASURE” key.

5.2.19 CHECK the displayed temperature for tolerance per Data Sheet AND NOTE the displayed temperature reading.

Check Tolerance at Minimum Value (LRV) Reading

5.2.20 CHECK display µS/cm reading for LRV tolerance per Data Sheet AND NOTE the LRV µS/cm reading.

5.2.21 CHECK milliamp (mA) reading for LRV tolerance per Data Sheet AND NOTE the LRV milliamp (mA) reading.

5.2.22 CHECK the MCS Low Range Values for Used Raw Water per Data Sheet AND NOTE the µS/cm readings.

5.2.23 REMOVE the RTD connector from the Sensor port AND INSTALL the Foxboro Calibration Plug, EP485A into the RTD port connection.

5.2.24 ALLOW the instrument to stabilize.
5.2 Calibration (Cont.)

Check Tolerance at Maximum Value (URV) Reading

5.2.25 IF unit doesn’t update, PRESS the “MEASURE” key.

5.2.26 CHECK display µS/cm reading for URV tolerance per Data Sheet AND

NOTE the URV µS/cm reading.

5.2.27 CHECK the milliamp (mA) reading for URV tolerance per Data Sheet AND

NOTE the URV mA reading.

5.2.28 CHECK the MCS Upper Range Values for Used Raw Water per Data Sheet AND

NOTE the µS/cm readings.

5.2.29 IF all values are within tolerance per Data Sheet, RECORD the following in the As-Left section of the data sheet:

- Displayed temperature noted in Step 5.2.19
- Display LRV (µS/cm) noted in Step 5.2.20
- LRV mA reading from the DMM noted in Step 5.2.21
- Display URV (µS/cm) noted in Step 5.2.26
- URV mA reading from the DMM noted in Step 5.2.27.

5.2.29.1 IF calibrated in the field with Sensor in line, RECORD the following:

- LRV MCS µS/cm readings noted in Step 5.2.22.
- URV MCS µS/cm readings noted in Step 5.2.28

5.2.29.2 GO TO Restoration Section 5.3

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 unable to bring values into tolerance, NOTIFY FWS/OE for resolution.
5.3 Restoration

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

5.3.2 REMOVE Calibration Plug (EP485A) from the RTD port.

5.3.3 ATTACH the RTD connector to the sensor RTD port.

5.3.4 REMOVE the DMM and power supply from the transmitter output.

5.3.5 IF removed, RECONNECT field leads (observing polarity) to the Transmitter as applicable (see Figure 2).

5.3.6 RECORD the Test Equipment information and calibration status on Data Sheet as applicable.

5.3.7 NOTIFY Operations that testing is complete and system may be returned to desired configuration as follows:

5.3.7.1 IF Calibrating RW-1:
   a. CLOSE RC2-32.
   b. CLOSE RC2-33
   c. OPEN RC2-23.
   d. OPEN RC2-28.
   e. CLOSE RC2-34

5.3.7.2 IF Calibrating STM-1:
   a. CLOSE RC1-33.
   b. CLOSE RC1-20.
   c. OPEN RC1-22.
   d. OPEN RC1-25.
   e. CLOSE RC1-34.

5.3.8 CHECK equipment restoration by observing indications are consistent with expected conditions.
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 CORRECT the following as necessary:

- 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 performance of this procedure generates no records. However PMID’s associated with the procedure, identified for the activity, are record material and are maintained in the work package as record material.

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.
Calibrate Foxboro 870ITEC Conductivity Transmitter with 871FT Sensor

Figure 1 – Foxboro 870ITEC Conductivity Transmitter Display/Controls

![Display/Controls Diagram]

**FIGURE 1** - Human Interface, Display and Keypad
Calibrate Foxboro 870ITEC Conductivity Transmitter with 871FT Sensor

Figure 2 – Test Connection Hook-Up with MCS Display

Wiring from 871FT Flow-Through Sensor

Sensor Wiring to 870ITEC Analyzer
Figure 3 – Flow-Through Sensor with RTD and Wiring Layout

NOTE: "DRAIN" is also referred to as "CLEAR" on Transmitter drawing.

Flow-Through Sensor with Teflon-Jacketed 9-Conductor Cable
Figure 4 – Transmitter Calibration Menu Flowchart