Dresser ES3 Electronic TC
Installation, Operation and Maintenance Manual
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1. Introduction

Dresser ES3 Electronic Temperature Compensator with Mechanical Counter

Accurate electronic compensation with the security of a proven mechanical index

Accuracy and reliability are key requirements when selecting a temperature compensating (TC) index. The Dresser ES3 Electronic TC provides the accuracy and reliability you have come to trust, plus the added security of the established Dresser Series 3 non-compensated mechanical index.

With an average 20-year battery life*, factory installation of the index, and the ability to request factory installation and configuration of the AMR endpoints, the ES3 provides the consistency and dependability required for custody transfer applications.

The ES3 family of products provides the accuracy of a fully electronic TC for the Series 8 meter bodies in combination with the proven reliability of the established Dresser Series 3 non-compensated mechanical index. Additionally, the 150 days of hourly data stored in the non-volatile memory of the electronic TC provides an accurate chronicle of historical gas consumption.

The electronic display of the ES3 is clearly visible throughout the stated temperature operating range of -40°F to 140°F (-40°C to 60°C) and provides accurate temperature measurement and compensation across the range as well. Temperature measurement accuracy is assured by the capability of the PT 100 temperature probe in combination with the conductive, wall-hugging design of the temperature probe housing, which provides continuous contact with the meter's temperature probe well.

The Series 3 mechanical index, which is incorporated into the ES3, provides an accurate and continuously non-compensated odrometer reading in the standard configuration. However, the mechanical index odrometer can be masked in a variety of translucent or opaque configurations, thus allowing for ease of viewing, obscured viewing through a transparent blue mask or completely covered using a black mask.

Two configurable Form A pulse outputs provide the volume output for Automated Meter Reading (AMR) endpoints. A convenient mounting platform is available for directly mounting AMR devices to the ES3. The low-profile AMR platform conceals the pulse output cabling to help prevent tampering. Factory mounting and programming of AMR devices are available upon request.

In conjunction with the expanded lifespan of today's AMR devices, the ES3 provides an average lifespan of 20 years. The ES3 uses a twin cell, CSA-certified lithium battery pack with the pulse output cabling to help prevent tampering. Factory mounting and programming of AMR devices are available upon request.

With the preconfigured test files provided with the ES3, testing is reduced to a fraction of the time normally associated with an ordinary mechanical TC index. Communication with the ES3 is quick and simple with the use of the Dresser MeterWare user interface software. This software is presented in a user-friendly format and is common to several other Dresser meter and instrument products.

2. Receiving, Handling and Storage

Do not accept any shipment that has evidence of mishandling in transit without making an immediate inspection of package for damage. If shipped as part of a meter assembly, the meter should be checked for free rotation soon after arrival as damage to internal working parts can exist without obvious external evidence.

At Time of Delivery

1. Check the packing list to account for all items received.
2. Inspect each item for damage.
3. Record any visible damage or shortages on the delivery record.

a. File a claim with the carrier if necessary.

b. Notify your Dresser Meter supplier immediately

Reporting a Problem

Our Product Services Department offers professional services for all Dresser Meters and Instruments products. Authorization for return is required for all products shipped to the Factory for repair, calibration, warranty, exchange or credit. To obtain authorization, a Return Materials Authorization (RMA) number for return of Dresser products must be issued. Please contact your Dresser meter supplier.

When reporting a suspected problem, please provide the following information:

1. Your purchase order number and/or Dresser's sales order number
2. The product model, serial number and bill of material number
3. A description of the problem
4. Application information, such as gas type, pressure, temperature and flow characteristics

All returns should be packaged in an original-type shipping container, if available, or shipping material that will protect the product. If the last two digits “83” to the right of the arrows were 3849870 cubic feet.

3. Mechanical Design Characteristics

The mechanical counter for the ES3 is based on the Series 3 Accessory Unit from the Series B3 Dresser Rotary Meter. For more detailed information on the meter operation and the accessory unit, refer to “Dresser Rotary Meter Series B3 Installation, Operation and Maintenance Manual (IOM:B3).”

The mechanical counter on the ES3 provides totalization of the non-compensated volume. A gear reduction unit is magnetically coupled to the meter impellers. Due to different gear ratios for different meter sizes, the mechanical counter of the ES3 is matched to a specific meter type and size. These units are permanently lubricated for long life and maintenance-free operation. They register displaced volume in actual cubic feet (ACF). The ES3 is isolated from the pressure vessel and is not pressurized.

The ES3 mechanical index registers volume in actual cubic feet (ACF) on an eight-digit odometer. The ES3 housing is molded from a clear polycarbonate material and uses quad ring seals on the lid and meter mounting flange to provide excellent protection from water intrusion. The cover's smooth cylindrical design easily sheds rain and resists accumulations of snow, ice and dirt.

4. Reading the Odometer

As an industry standard, the first digit on the left of the odometer is typically concealed with an opaque (black) mask. Translucent (see through) blue masks typically cover any digits to the right that represent less than 100 cubic feet.

When reading an I6C through 11M odometer (Figure 3.1a), the five exposed digits “02576” (between the arrows on the nameplate) are typically multiplied by 100, to read volume in hundreds of cubic feet or 257600 cubic feet.

Note: If the last two digits “83” to the right of the arrows were included in the reading, the odometer in Figure 3.1a would indicate a volume of 257683 cubic feet.

For the 16M meter size (Figure 3.1b), the six exposed digits “38498” (between the arrows on the nameplate) are typically multiplied by 100 to read the volume in hundreds of cubic feet or 3849800 cubic feet.

Note: If the last digit “7” to the right of the arrows were included in the reading, the odometer in Figure 3.1b would indicate a volume of 3849870 cubic feet.

5. Test Wheel

The index wheel numbers on the odometer have 10 marked divisions, ranging from 0 through 9, located on the right side of the odometer. The graduated increments on the test wheel represent 0.2 cubic feet for the I6C through 11M meters and 2 cubic feet for the 16M meters. This allows for accurately estimating readings of 0.1 cubic feet and 1 cubic foot, respectively.

The white reflective marks that are located to the left of the graduated increments are used for proving testing with an optical photo-sensor (scanner).

6. Meter Start-Up

WARNING

If equipment is installed/services/maintained at elevated heights, ensure proper safe site work practices are in place to prevent fall and drop hazards.
## 7. Meter Maintenance

### 7.1 Meter Lubrication

Use only Dresser Meter Oil or other instrument grade oils approved for service by the manufacturer.

Meters installed and maintained in accordance with Factory recommendations can be expected to operate dependably for many years. Proper oil level and cleanliness have the greatest effect on the meter's life expectancy. Visually inspect the oil reservoirs in the meter end covers for proper mid-gauge oil levels once a month until a practical interval is determined. Add oil as necessary.

Oil change frequency will depend upon the cleanliness of the gas being measured. Change oil when the color darkens or when the level changes. Under favorable conditions, these periods may be from three to five years, or longer.

#### 7.2 Meter Level

Since the meter is supported entirely by the gas pipe line, movement of the pipe due to accidents, settling of the ground or other causes may impede meter operation and accuracy.

Refer to "Installation" procedures in the appropriate meter installation and maintenance manual.

Make sure the meter remains level within 1/16" per foot (5 mm/m) in any direction, side-to-side and front-to-back.

#### 7.3 Cleaning and Flushing

**Note:** Before removing the meter from the pipeline or performing this procedure, drain all oil from the meter end covers. Add oil after the meter has been replaced in the meter set. After removing the meter from the line, if there is any evidence of dirt or dust in the meter, a suggested method for cleaning is to windmill the impellers (at a speed less than maximum capacity) by injecting low pressure, dry compressed air from a nozzle into the meter inlet. Flush approximately 5 ounces (150 ml) of an approved non-toxic, non-flammable solvent through the meter. Drain any residual cleaning fluid from the meter body and end covers. Use compressed air to completely dry the meter.

### 7.4 Differential Pressure Testing

Rotary meters are tested for accuracy by several industry accepted methods. These test methods include, but are not limited to transfer, bell, piston, sonic nozzle and critical flow proving.

The Differential Test is unique to rotary meters and is a convenient method of comparing a meter's performance to previous or original performance records. Differential testing is accepted by many state Utility Commissions as a means of periodically verifying that the original accuracy of a meter has remained unchanged.

The flow rate indication on the ES3 is useful when performing a Differential Test. Refer to section 9 for activating and viewing the meter flow rate.

For more information on Differential Pressure Testing, please refer to Dresser Rotary Meter Series B3 Installation, Operation and Maintenance Manual (IOM:B3).

### 8. Recommended Installation/Maintenance Tools for ES3 Index

#### Suggested tools

- Adjustable torque wrench/driver
- 5/32" hex wrench/driver
- 9/64" hex wrench/driver
- Phillips-head screw driver
- Needle nose pliers
- Ball ended 5/32 Allen wrench

#### Items Provided with Repair Assembly #400

- Four short (3/4") screws for mounting without an AMR bracket or
- Two short (3/4"") and two long (1") screws for mounting with an AMR bracket
- Desiccant packet

#### Infrared (IR) Communications Kit

(Purchased separately)

- IR Sensor (USB connection)
- Holder – IR Assembly
- USB cable
- Magnet

**Note:** Dresser MeterWare software CD is not included in the communications kit and must be purchased separately.

#### Dresser Model 5 Prover Interface

(Purchased separately)

- IR Prover cable
- Holder – IR Prover cable
9. LCD Display

Scrolling through the screen displays and connecting to the ES3 Electronic TC requires use of the magnet. The magnet can be purchased as part of the Communications Kit, P/N 060542-000 or as an individual item, P/N 060541-000. Consult factory for pricing. The Dresser MeterWare software is also available as a separate item.

Swipe the magnet across the ‘swipe line’ as shown in Figures 9.1 – 9.2.

**Note:** The magnet will not change screen displays if swiped on another area of the label.

9.1 LCD Screen Displays

1. The default screen is either Compensated Volume or Non-Compensated Volume, depending on customer configuration. 
   a. This parameter is the home/default screen.
   b. After a time out of approximately 30 seconds, the home screen will always appear.

2. Repeat the swiping motion of the magnet across the ‘swipe line’, and the screens will appear in the following sequential order as shown in Table 1.

   **Note:** Using the Dresser MeterWare Software, the screens are configured by checking and un-checking the parameter to be displayed. Depending on the ES3 configuration, some screens may not appear.

3. Three to five seconds after the name of the value or the parameter appears, the screen will switch to show you the value of the selected parameter.

9.2 Data Display Screen and Icons

A. Data will be displayed in digital format as shown in Figure 9.3.

B. Individual icons will display depending on the function or parameter, and how you have configured the ES3 using the Dresser MeterWare software. Refer to Section 12 for more information. Refer to Table 2 for Icon descriptions.

### Table 1 - Scrolling sequence for ES3 screen display

<table>
<thead>
<tr>
<th>Displayed on Screen</th>
<th>Represents</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPENSATED VOLUME</td>
<td>Compensated Volume</td>
<td>Displays non-compensated volume which has been corrected to standard conditions</td>
</tr>
<tr>
<td>NON-COMPENSATED VOLUME</td>
<td>Non-compensated Volume</td>
<td>Displays actual non-compensated volume</td>
</tr>
<tr>
<td>LINETEMP</td>
<td>Line Temperature</td>
<td>Displays live line temperature</td>
</tr>
<tr>
<td>FIXED P</td>
<td>Fixed Line Temperature</td>
<td>Displays the line pressure as entered by the user</td>
</tr>
<tr>
<td>FLOWRATE</td>
<td>Flow Rate</td>
<td>Displays uncorrected flow rate (average of latest 30 seconds of captured data)</td>
</tr>
<tr>
<td>MTR INFO</td>
<td>Meter Info</td>
<td>Meter size and type</td>
</tr>
<tr>
<td>PROVE CV</td>
<td>Compensated Prove Mode</td>
<td>Allows for compensated volume accuracy testing</td>
</tr>
<tr>
<td>PROVE UV</td>
<td>Non-compensated Prove Mode</td>
<td>Allows for non-compensated volume accuracy testing</td>
</tr>
<tr>
<td>BATT VOLT</td>
<td>Battery Voltage</td>
<td>Displays battery voltage</td>
</tr>
<tr>
<td>REM LIFE</td>
<td>Remaning Life</td>
<td>Calculated remaining battery life - shown in months</td>
</tr>
<tr>
<td>FIRM REV</td>
<td>Firmware Revisions</td>
<td>Displays the firmware revision that is in the ES3 at the present time</td>
</tr>
<tr>
<td>LCD TEST</td>
<td>LCD Test</td>
<td>Tests all display segments</td>
</tr>
<tr>
<td>BATT CHNG</td>
<td>Change Battery</td>
<td>Saves data to memory and resets clock</td>
</tr>
<tr>
<td>COMP FACTR</td>
<td>Compensation Factor</td>
<td>Displays the factor applied to non-compensated volume in order to arrive at compensated volume</td>
</tr>
<tr>
<td>COMP RSV</td>
<td>Compensated Residual</td>
<td>Shows extended compensated volume data beyond the value shown in the compensated volume screen</td>
</tr>
<tr>
<td>NON-COMP RSV</td>
<td>Non-compensated Residual</td>
<td>Shows extended non-compensated volume data beyond the value shown in the non-compensated volume screen</td>
</tr>
<tr>
<td>BASE T</td>
<td>Base Temperature</td>
<td>Displays base temperature as entered by the user</td>
</tr>
<tr>
<td>BASE P</td>
<td>Base Pressure</td>
<td>Displays base pressure as entered by the user</td>
</tr>
<tr>
<td>ATMOS</td>
<td>Atmospheric</td>
<td>Displays average atmospheric pressure as entered by the user</td>
</tr>
<tr>
<td>NC VOL FLT</td>
<td>Non-compensated volume under fault</td>
<td>Displays non-compensated volume that has accumulated since a fault occurred</td>
</tr>
</tbody>
</table>

### Table 2 - Icon descriptions

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHANGE BATT</td>
<td>Change Battery</td>
</tr>
<tr>
<td>psi</td>
<td>Pounds per square inch</td>
</tr>
<tr>
<td>kPa</td>
<td>Kilopascal</td>
</tr>
<tr>
<td>Abs</td>
<td>Absolute</td>
</tr>
<tr>
<td>GA</td>
<td>Gauge</td>
</tr>
<tr>
<td>°C</td>
<td>Temperature in Celsius</td>
</tr>
<tr>
<td>°F</td>
<td>Temperature in Fahrenheit</td>
</tr>
<tr>
<td>x m3</td>
<td>Times meters cubed</td>
</tr>
<tr>
<td>x 100 CF</td>
<td>Times 100 cubic feet</td>
</tr>
<tr>
<td>x CF</td>
<td>Times cubic feet</td>
</tr>
<tr>
<td>!</td>
<td>Alarm/Fault has occurred; consult software manual</td>
</tr>
</tbody>
</table>
10. ES3 Electronic TC Mounting Instructions

10.1 Remove Existing Unit

10.1.1 Remove Existing Unit on Series B Meters

In order to install the ES3 Electronic TC, you must remove the existing accessory unit. Refer to Figure 10.1.

A. Use a 5/32-inch hex wrench to remove the four hex screws attaching the existing accessory unit to the meter.

Note: while there is no required order for removing the screws, if the unit is side mounted, it is helpful to leave a screw at the top until last.

B. Lift and remove slip flange ring as shown in Figure 10.2.

Note: The slip flange is not required for installation of the ES3.

C. Carefully pull the unit straight out from the meter body.

D. Remove the existing desiccant pack, and clean the end cover if needed.

10.2 Install New ES3 Electronic TC Unit

10.2.1 Installing ES3 on Series B Meters

I. Installing the ES3 Circular Connector version on Series B Meters

The following steps instruct how to mount the ES3 with Circular Connector on a Series B Meter, as shown in Figure 10.3.

A. Apply the new desiccant by peeling the sticker backing and applying to the unit, as indicated in Figure 10.4

B. Remove the ES3 Electronic TC from the static bag, as shown in Figure 10.5.

C. Unhook and remove the bead tie wraps as shown in Figure 10.6 below, and remove the protective cardboard cover. Dispose of the cardboard cover and tie wrap properly.

D. Remove the RED protective cap from the magnet. See Figure 10.7.

E. Ensure the Quad-Ring seal is seated into the circular groove in the index cover as shown in Figure 10.9.

F. Holding the ES3 Electronic TC in front of the meter body, align the temperature probe with the probe well, and guide the probe into the well as shown in Figure 10.10.

G. While guiding the temperature probe into the temperature probe well, make sure the magnet comes into alignment with the magnet well, as shown in Figure 10.11.

H. Seat the magnet in the magnet well.

Note: The temperature probe and the magnet can only be inserted one way; you will not be able to align the unit with the body if they are not correctly oriented. Refer to Figure 10.11.

I. Using the four 5/32-inch screws provided:

1. Insert the screws in the top mounting holes
2. Insert the screws in the lower mounting holes
3. Using the 5/32-inch hex wrench, tighten the four screws just enough to hold the unit temporarily
4. Working in a cross pattern, tighten all screws to 12-14 inch pounds using a torque wrench as shown in Figure 10.12.

Important: Do not exceed this torque as damage may occur to the housing cover at higher torque values.

J. Using the four 5/32-inch screws provided:

1. Insert the screws in the top mounting holes
2. Insert the screws in the lower mounting holes
3. Using the 5/32-inch hex wrench, tighten the four screws just enough to hold the unit temporarily
4. Working in a cross pattern, tighten all screws to 12-14 inch pounds using a torque wrench as shown in Figure 10.12.

Important: Do not exceed this torque as damage may occur to the housing cover at higher torque values.
II. Installing the ES3 AMR version on Series B Meters

The following steps instruct how to mount the ES3 with AMR mounting bracket on a Series B Meter as shown in Figure 10.13.

A. Apply the new desiccant by peeling the sticker backing and applying to the unit, as indicated in Figure 10.14.

B. Remove the ES3 Electronic TC from the static bag, as shown in Figure 10.15.

C. The AMR bracket is temporarily held to the ES3 by tie wraps. Unhook and remove the bead tie wraps to remove the cardboard covering and to release the AMR bracket as shown in Figure 10.16. Dispose of the cardboard cover and tie wrap properly.

D. Remove the RED protective cap from the magnet. Refer to Figure 10.17.

E. Ensure the Quad-Ring seal is seated into the circular groove in the index cover as shown in Figure 10.19.

F. Holding the ES3 Electronic TC in front of the meter body, align the temperature probe with the probe well, and guide the probe into the well as shown in Figure 10.20.

G. While guiding the temperature probe into the temperature probe well, make sure the magnet comes into alignment with the magnet well, as shown in Figure 10.21.

H. Seat the magnet in the magnet well. Note: The temperature probe and the magnet can only be inserted one way; you will not be able to align the unit with the body if they are not correctly oriented. Refer to Figure 10.21.

I. Gently adjust the ES3 until it is seated on the meter body. Refer to Section 10.2.3 for AMR bracket installation.
10.2.3 Proper AMR Bracket Installation

There are two ways the AMR bracket can be installed: top or side inlet.

- For top inlet, the AMR bracket is directly opposite the odometer.
- For side inlet, the AMR bracket is on top (or 90°) from the odometer.

Note the location of the screw holes for top vs. side installation as shown in Figure 10.22.

Figure 10.22 - Location of the screw holes

Top Inlet Orientation:
A. Insert one 3/4-inch (short) screw on the unit below the odometer, and tighten with the 5/32-inch hex wrench just enough to hold the unit temporarily as shown in Figure 10.23. Do not fully tighten at this point.

B. Align the AMR bracket; placing the cable gland connector into the recess on the end of the accessory unit, as shown in Figure 10.24.

C. Insert the two 7/8-inch (long) screws through the AMR bracket, and tighten with the 5/32-inch hex wrench until the bracket is in contact with the ES3 housing. Do not fully tighten at this point. Refer to Figure 10.25. The other 7/8-inch screw will be mounted through the bracket opposite the screw as shown in Figure 10.25.

D. Insert the remaining 3/4-inch (short) screw into the open hole near the LCD display screen as shown in Figure 10.26. Note: If a security wire is required, the wire can be connected through this drilled head screw near the LCD display screen.

E. Working in a cross pattern, tighten all screws to 12-14 inch-pounds using a torque wrench.

Important: Do not exceed this torque as damage may occur to the accessory unit cover at higher torque values.

Side Inlet Orientation:
A. Insert one 3/4-inch (short) screw on the unit below the odometer, and tighten with the 5/32-inch hex wrench just enough to hold the unit temporarily as shown in Figure 10.27. Do not fully tighten at this point.

B. Align the AMR bracket; placing the cable gland connector into the recess on the end of the accessory unit, as shown in Figure 10.28.

C. Insert the two 7/8-inch (long) screws through the AMR bracket, and tighten with the 5/32-inch hex wrench until the bracket is in contact with the ES3 housing. Refer to Figure 10.29. Do not fully tighten at this point.

Note: If a security wire is required, the wire can be connected through this drilled head screw near the LCD display screen.

D. Insert the remaining 3/4-inch (short) screw into the open hole on the back side of the unit as shown in Figure 10.30.

E. Working in a cross pattern, tighten all screws to 12-14 inch-pounds using a torque wrench.

Important: Do not exceed this torque as damage may occur to the accessory unit cover at higher torque values.
Changing AMR Bracket Inlet Orientation if installed on a Series B Meter

If the ES3 Electronic TC was purchased already installed as a complete meter, the ES3 will arrive from the factory with the AMR bracket set for top inlet orientation, as shown in Figure 10.31, unless previously specified to the Factory.

This section explains changing bracket inlet orientation if required.

**10.2.4. Remove AMR Bracket**

**Note:** AMR bracket is shown in Figure 10.31 as top inlet position, however these instructions apply to either top or side inlet orientations.

A. Using a 5/32-inch hex wrench, remove the two screws that hold the AMR bracket to the ES3 unit, as shown in Figures 10.32 and 10.33.

B. Do not remove the screw that is under the odometer (see Figure 10.34), as it holds the ES3 unit to the meter while you remove the other short screw.

C. Retain the three screws for re-attaching the AMR bracket.

**10.2.5. Re-attach AMR Bracket**

**Top Inlet Orientation:**

A. Align the AMR bracket; placing the cable gland connector into the recess on the end of the accessory unit, as shown in Figure 10.35.

B. Insert the two 7/8-inch (long) screws through the AMR bracket, and tighten with the 5/32-inch hex wrench until the bracket is in contact with the ES3 housing. Refer to Figure 10.36. Do not tighten at this point.

**Note:** Do not exceed this torque as damage may occur to the accessory unit cover at higher torque values.

C. Insert the remaining 3/4-inch (short) screw into the open hole near the LCD display screen as shown in Figure 10.37. Do not tighten.

**Side Inlet Orientation:**

A. Align the AMR bracket, place the cable gland connector into the recess on the end of the accessory unit, as shown in Figure 10.38.

B. Insert the two 7/8-inch (long) screws through the AMR bracket, and tighten with the 5/32-inch hex wrench until the bracket is in contact with the ES3 housing. Refer to Figure 10.39. Do not tighten at this point.

**Note:** If a security wire is required, the wire can be connected through this drilled head screw near the LCD display screen.

C. Insert the remaining 3/4-inch (short) screw into the open hole near the LCD display screen as shown in Figure 10.37. Do not tighten.

**Note:** If a security wire is required, the wire can be connected through this drilled head screw near the LCD display screen.

D. Working in a cross pattern, tighten all screws to 12 - 14 inch-pounds using a torque wrench.

**Important:** Do not exceed this torque as damage may occur to the accessory unit cover at higher torque values.

C. Insert the remaining 3/4-inch (short) screw into the open hole on the back side of the unit as shown in Figure 10.40. Do not tighten.
11. Pulse Output Connections

The ES3 Electronic TC provides pulse outputs for both a circular pulse output connector and an AMR cable output. Using the Dresser MeterWare software, the Corrector pulse output allocation is configured in the Volume configuration screen, as shown in Figure 11.1. Refer to this screen to verify proper configuration. Refer to the MeterWare Manual for complete operating instructions.

Note: Some customers will have their ES3 Electronic TC configured by the factory. Verify your company policy prior to making any configuration changes.

11.1 Pulse Output Wiring Instructions for Hazardous Locations

To maintain compliance with CSA requirements, use a suitable Intrinsic Safety barrier for a Class 1, Division 1 hazardous area for groups A, B, C and D:

1. Do not exceed the following input values for the barrier device:
   a. \( V_i = 8.2 \text{V} \)
   b. \( I_i = 10 \text{ma} \)

2. The OUTPUT and power handling capability of a barrier should not exceed:
   a. \( V_{out} = 30 \text{V} \)
   b. \( I_{out} = 50 \text{ma} \)

For hazardous areas, use a recommended barrier such as Turck Brand IM1-12EX-T Single Channel or IM1-22 EX-R Dual Channel Barrier or an equivalent.

Wiring diagrams are provided for the Circular Connector Version ES3 and AMR Version ES3 in Sections 11.2 and 11.3 respectively.

11.2 Circular Connector Version Pulse Output Wiring

See Table 1 and Figure 11.4 for output pulse wiring for Circular Connector.

### Table 1: Circular Connector Pulse Wiring

<table>
<thead>
<tr>
<th>Output</th>
<th>Name</th>
<th>Connector Pin</th>
<th>Pulse Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse Output 1 (+)</td>
<td>PO1 (+)</td>
<td>A</td>
<td>Form A</td>
</tr>
<tr>
<td>Pulse Output 1 (-)</td>
<td>PO1 (-)</td>
<td>B</td>
<td>_</td>
</tr>
<tr>
<td>Drain</td>
<td>Drain</td>
<td>C</td>
<td>_</td>
</tr>
<tr>
<td>Pulse Output 2 (+)</td>
<td>PO2 (+)</td>
<td>D</td>
<td>Form A</td>
</tr>
<tr>
<td>Pulse Output 2 (-)</td>
<td>PO2 (-)</td>
<td>E</td>
<td>_</td>
</tr>
</tbody>
</table>

**WARNING**

Ensure properly licensed/trained professionals are used to install equipment if installed in hazardous locations containing explosive atmospheres. All local codes and standards shall be maintained during installation.

**WARNING**

Products certified as intrinsically safe installations shall be:

- Installed, put into service, used and maintained in compliance with national and local regulations and in accordance with the recommendations contained in the relevant standards concerning potentially explosive atmospheres.
- Used only in situations complying with the certification conditions shown in this document and after verification of their compatibility with the zone of intended use and the permitted maximum ambient temperature.
- Installed, put into service and maintained by qualified and competent professionals who have undergone suitable training for instrumentation used in areas with potentially explosive atmospheres.

**Fig 11.4 - Circular Connector**

Note: The Circular mating connector is available with 5, 10 or 20 feet of cable. Contact Factory for price, part number and availability.
11.3 AMR Version Pulse Output Wiring

The ES3 Electronic TC provides pulse outputs from both an AMR cable output and a circular pulse output connector as shown in Figures 11.6 and 11.7. Reference Tables 2 and 3 for the appropriate wiring configuration outputs.

The pulse outputs are configurable utilizing the Dresser MeterWare software. For more information, consult the Dresser MeterWare manual.

**Note:** The Circular mating connector is available with 5, 10 or 20 feet of cable. Contact Factory for price, part number and availability.

---

**Table 2 - Circular Connector**

<table>
<thead>
<tr>
<th>Output</th>
<th>Name</th>
<th>Connector Pin</th>
<th>Pulse Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain</td>
<td>(Drain)</td>
<td>C</td>
<td>—</td>
</tr>
<tr>
<td>Pulse Output 1 (+)</td>
<td>PO1 (+)</td>
<td>White</td>
<td>Form A</td>
</tr>
<tr>
<td></td>
<td>PO1 (-)</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Pulse Output 3 (+)</td>
<td>PO3 (+)</td>
<td>Red</td>
<td>Form B</td>
</tr>
<tr>
<td></td>
<td>PO3 (-)</td>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

**Table 3 - AMR Cable**

<table>
<thead>
<tr>
<th>Output</th>
<th>Name</th>
<th>Wire Color</th>
<th>Pulse Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain</td>
<td>(Drain)</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Pulse Output 2 (+)</td>
<td>PO2 (+)</td>
<td>White</td>
<td>Form A</td>
</tr>
<tr>
<td></td>
<td>PO2 (-)</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Pulse Output 3 (+)</td>
<td>PO3 (+)</td>
<td>Red</td>
<td>Form B</td>
</tr>
<tr>
<td></td>
<td>PO3 (-)</td>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

---

See Table 2

See Table 3
### 11.4 Wiring the Itron Remote Gas Endpoint Device to the ES3 Electronic TC

#### A. Cut the cable and remove the vinyl, which will make for a cleaner and easier installation. Be sure not to damage the wires when removing vinyl cover. See Figures 11.9 and 11.10. Leave some cable available for any future changes to the AMR device.

*Note:* You do not need to strip the wire as the Gel Cap splices supplied with the AMR are Insulation Displacing Connection (IDC) type connectors.

#### B. Use appropriate crimping pliers to seal and splice wires per the table.

<table>
<thead>
<tr>
<th>ES3 External Cable Wire</th>
<th>AMR Device Wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Red</td>
</tr>
<tr>
<td>Green</td>
<td>Blue</td>
</tr>
<tr>
<td>White &amp; Red</td>
<td>White</td>
</tr>
</tbody>
</table>

#### C. Clip off the unused green, red and shield wires from the ES3 cabling and tuck all of the wires into the appropriate pocket in the back of the AMR. See Figures 11.13 and 11.14.

*Note:* Ensure the cable fits into an open pocket inside the ERT. The individual wires do not need to remain in a pocket since the walls of the pockets are lower than the outside walls of the housing and the mounting bracket has raised mounting points in the corners to prevent pinching of the individual wires.
D. Use a T15 Torx screwdriver to attach the AMR to the ES3 AMR bracket. See Figure 11.15.

11.5. Confirm Itron Remote Gas Endpoint Device is Properly Mounted

**Important:** Regardless of AMR model or meter orientation (side or top inlet) the bar code on the side of the AMR device must always face up, as shown in Figure 11.15. This puts the tilt/tamper switch in the proper orientation in the AMR.

![Figure 11.15 - Bar code faces up](image)

A. For side inlet, the AMR bracket is on top (or 90°) from the odometer, as shown in Figure 11.16.

B. For top inlet, the AMR bracket is directly opposite the odometer, as shown in Figure 11.17.

![Figure 11.16 - Side inlet: notice the close positioning of the ES3 label to the bracket](image)

![Figure 11.17 - Top inlet: notice the space between the ES3 label and the bracket](image)

**Note:** When properly installed, whether the top or side inlet, the arrow on the AMR mounting bracket will point up, away from the ground, as shown in Figure 11.18.

![Figure 11.18 - Correct orientation of mounting](image)

12. Operation Mode

Dresser MeterWare is the software on your computer that connects your computer to ES3 index. The software provides the capability to configure the ES3, as well as download logged data and update the ES3 firmware. An infrared cable using the IrDA protocol connects the MeterWare to the ES3.

Once MeterWare is connected to the ES3, a Live Data screen displays current operating conditions. The Volume Configuration screen provides the ability to adjust volume information, such as odometer readings and pulse output configurations. Also, Faults and Alarms are configurable and the screens that are displayed on the ES3 Liquid Crystal Display (LCD) are selectable.

For detailed information on the installation and operation of the MeterWare user terminal interface, consult the MeterWare User Manual.

12.1 Volume Measurement

1. Imperial or metric measurement options

The uncorrected mechanical counter is manufactured to display either imperial or metric units, and is ordered as such from the factory. The measurement unit displayed through the LCD screen display is set through the Dresser MeterWare software.

Configurable items:
- Volumetric units
- Temperature (Fahrenheit or Celsius)
- Fixed Factor Pressure (PSI or kPa)

2. Volume detection

Volume from the meter to the ES3 accessory unit is detected via a volume input board. This volume input board utilizes the same Wiegand sensor technology used in the Dresser solid-state pulsers and the magnetic pickups used to detect volume on the Dresser Integral Micro Correctors, Model IMC/W2.

There are 5 volume accumulation methods based on the capability to read either the forward or reverse flow directions. The five volume accumulation methods are shown in Table 1 below.

<table>
<thead>
<tr>
<th>Volume Accumulation Method</th>
<th>Measured Flow Source</th>
<th>Calculated Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward minus Reverse</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Reverse minus Forward</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Reverse</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>Forward</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Forward plus Reverse</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Note:** The factory default method for volume accumulation is Forward minus Reverse in order to maintain the correlation between the non-compensated readings on both the mechanical and electronic counters. Refer to the MeterWare manual to change the accumulation method.

3. Volume Sample Frequency

Volume is sampled every 30 seconds.

4. Volume Update Frequency

All parameters on the LCD are updated every 30 seconds.

5. Pulse Outputs in real time

Volume pulses are provided in real time. The Form A outputs are configurable by:
- Volume per pulse
- Pulse width
- Imperial or metric

The Form B fault/alarm pulse output is not configurable and provides a 500 ms pulse every 30 seconds when a fault or alarm is present.

6. Uncorrected Mechanical Counter

The uncorrected mechanical counter is a backup to the uncorrected reading displayed on the LCD screen. Meter size and gear ratio are located on the uncorrected counter nameplate. Refer to Figure 12.1.

![Figure 12.1 - Volume Accumulation Methods](image)

Other parameters on the LCD are:
- Meter size = 16M
- Ratio = 675
12.2 Temperature Measurement

Temperature is measured using a Class A, PT1000 precision RTD and is sampled every 30 seconds. In normal operation, the accumulated temperature correction volume total is updated every 30 seconds and is displayed in standard cubic feet (SCF) or normal cubic meters (nm³) over the temperature measurement range of -40°F to +140°F (-60°C to +60°C).

The total ambient temperature effect is less than 0.1°F (0.05°C) over the entire temperature range. Additionally, temperature measurement accuracy is graduated over the measurement range as shown in Table 2.

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Measurement Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 to 32°F (-40 to 0°C)</td>
<td>+/- 0.4°F (+/- 0.2°C)</td>
</tr>
<tr>
<td>32 to 140°F (0 to 60°C)</td>
<td>+/- 0.5°F (+/- 0.3°C)</td>
</tr>
</tbody>
</table>

The units of measure (°F or °C) and the reference base temperature are configurable using the Dresser MeterWare software.

Note: The default base temperature is 60°F for imperial applications and 15°C for metric applications.

For ease of calibration, there is a provision in the Dresser MeterWare software to perform a single point temperature field calibration. Consult the MeterWare manual for details.

12.3 Flow Rate

Flow rate is accessed by scrolling to Flow Rate screen on the ES3 display screen as described in Section 9.

The flow rate for the ES3 is an average value based on the last 30 seconds of stored uncorrected volume data. Since the data collected by the ES3 is updated and stored every 30 seconds, there is always a slight delay in the timing of the displayed results ranging anywhere from 1 to 29 seconds until the results are updated again.

When the gas flow is fairly steady, the flow rate information is accurate. However, when the flow rate is shifting, there is a notable amount of error calculated by the ES3 depending directly on how rapidly and how much the gas flow is actually changing. As long as the flow through the meter set is fairly steady, the flow rate provided by the ES3 is valid for testing the differential pressure across the meter.

In summary, the flow rate indication is recent (but not instantaneous) and is based on the average flow rate of the last 30 seconds of saved information.

12.4 Faults and Alarms

1. Faults

A Fault is a problem with the ES3 accessory unit hardware or the firmware.

Fault types:

- Temperature: when the temperature probe is faulty or disconnected from the ES3 unit.
- Volume: when the volume input board has a problem such as a bad sensor.
- Internal Operations: when there is a software bug or failure within the microprocessor. This also may occur when memory access fails.
- Low Battery: when the battery voltage drops below 3.0 V.

2. Alarms

Alarms inform the user when line temperature or flow rate has moved above or below the desired limits; the limits are user configurable using the Dresser MeterWare software.

Alarm Types:

- High Temperature Alarm Limit: when temperature goes above the user defined limit.
- Low Temperature Alarm Limit: when temperature drops below the user defined limit.
- High Flow Rate Alarm Limit: when flow rate goes above the user defined limit. Default high flow alarm allows for a 20% overspeed.
- Low Battery Alarm: when battery voltage drops below 3.0 V. (not user configured).

3. LCD display notices:

When an Fault or Alarm is active, the LCD display will show a caution symbol as shown in Figure 12.2.

Scroll though the LCD displays, using the magnet provided in the Communication Kit, until the relevant Fault or Alarm is displayed. Faults and Alarms are displayed on the LCD screen as listed in Table 3.

In order to clear existing Alarms and Faults, connect the ES3 to the Dresser MeterWare software and clear the items in the “Faults and Alarm” tab as shown in Figure 12.5. For more information on these features, refer to the MeterWare Manual.

Note: If a battery fault is present, the battery must be disconnected and reconnected (or replaced) to eliminate the fault. If the battery is replaced be sure to reset the battery life clock. Refer to Section 13.1 for complete instructions on accessing and replacing the battery.

Table 3 - Fault and Alarm types

<table>
<thead>
<tr>
<th>Screen Display</th>
<th>Represents</th>
</tr>
</thead>
<tbody>
<tr>
<td>F T F U</td>
<td>Temperature Fault</td>
</tr>
<tr>
<td>VOL FLT</td>
<td>Volume Fault</td>
</tr>
<tr>
<td>INT FLT</td>
<td>Internal Operations Fault</td>
</tr>
<tr>
<td>CHANGE BATT</td>
<td>Low Battery Fault</td>
</tr>
<tr>
<td>HIGHT AL</td>
<td>High temperature alarm</td>
</tr>
<tr>
<td>LOWT AL</td>
<td>Low temperature alarm</td>
</tr>
<tr>
<td>HIFLOW AL</td>
<td>High flow rate alarm</td>
</tr>
<tr>
<td>VI IN AL</td>
<td>Volume input alarm</td>
</tr>
<tr>
<td>LBBATT AL</td>
<td>Low battery alarm</td>
</tr>
</tbody>
</table>

4. MeterWare Notices:

Faults and alarms are also listed on the Live Data screen in the Dresser MeterWare software as shown in Figure 12.3 and Figure 12.4. When a Fault or Alarm is present, the value is highlighted in red.

Figure 12.3 - Live Data Screen showing Faults in Dresser MeterWare Software

In order to clear existing Alarms and Faults, connect the ES3 to the Dresser MeterWare software and clear the items in the “Faults and Alarm” tab as shown in Figure 10.4. For more information on these features, refer to the MeterWare Manual.

In order to clear faults and alarms without using the MeterWare software, use the magnet to scroll to the LCD TEST value screen and after 20 seconds the FLT AL screen will appear. Hold the magnet on the word “Swipe” for at least 6-10 seconds and this will clear the occurred faults and occurred alarms.

Note: Please note this will not clear present faults or present alarms as these will remain active until the fault or alarm is resolved.

Note: If a battery fault is present, the battery must be disconnected and reconnected (or replaced) to eliminate the fault. If the battery is replaced be sure to reset the battery life clock. Refer to Section 13.1 for complete instructions on accessing and replacing the battery.
12.5.3. Audit Log

The audit log includes a tracking facility that details parameter changes that affect billing. This log maintains the most recent change and the original information. Historical changes beyond the most recent change are not retrievable. The audit log cannot be deleted. Changes are recorded in the audit log, which include:

- Parameter changed
- Date and time the change occurred
  - Old value
  - New value

Parameters captured in the audit log are:

- Compensated volume
- Non-compensated volume
- Base pressure
- Non-compensated volume under fault
- Atmospheric pressure
- Pressure calculation type
- Pressure factor
- User temperature calibration offset
- Fixed pressure
  - High temperature alarm limit
  - Low temperature alarm limit
  - Non-compensated multiplier

Both the data logs and the audit log are saved as a CSV (comma-delimited) file to expedite easy import into spreadsheets such as MS Excel®.
13.1.1 Changing the battery on Series B Meters – Circular Pulse Output Connector Version:

A. Use a magnet to scroll (refer to Section 2) through the LCD screens to the BATT.CHNG screen. Note: do not pass the BATT.CHNG screen, as the data will not save. If you do pass the screen, be sure to come back to this screen and leave it displayed. This action forces a data save and creates a log.

B. When the screen automatically returns to the default screen, depending on customer configuration), the log has been created, and you can proceed with the battery change.

Note: The same instructions in Section A (1-2) apply to changing the battery in the ES3 AMR version.

B. To remove the existing battery:

1. Using a 9/64-inch hex wrench, remove the four hex-head screws on the end cap of the ES3 Electronic TC unit cover; save screws for reinstallation of the end cap.
2. Pull the end cap straight out, away from the unit, extending only far enough to access the connected wires.
3. Squeeze to release the black connector (circled in Figure 13.1), from the mating connector.
4. Using a 9/64-inch hex wrench, remove the three screws holding the battery in place on the lid of the end cap; save these screws for later use.
5. Take excess slack out of the battery wires by threading through the center of the two battery stacks and gently wrapping the wires around the stacks as shown in Figure 13.3.
6. Squeeze the black connector while sliding it into the mating connector.

    Important: Dispose of the expired battery according to your company’s standards or to RoHS (Restriction of Hazardous Substances) compliance standards.

C. To install the new battery:

1. Insert three saved screws in battery bracket openings.
2. Align the battery with the screw holes on the end cap
   Note: there is only one way in which the battery can be installed.
3. Using a torque wrench with a 9/64-inch hex adapter, work in a cross pattern to tighten the three screws to 6 - 7 inch pounds.
4. Ensure the gray wire is against the wall of the cover as shown in Figure 13.2.
5. Loosen the nut on the Cable Gland shown in Figure 13.5.

    Note: The Cable Gland nut does not need to be removed.

6. Using a 9/64-inch hex wrench, remove the four hex-head screws on the end cap of the ES3 Electronic TC unit cover; save screws for reinstallation of the end cap.
7. Pull the end cap straight out, away from the unit, extending only far enough to access the connected wires.
8. Squeeze to release the black connector (circled in Figure 13.6), from the mating connector.
9. Using a 9/64-inch hex wrench, remove the three screws holding the battery in place on the lid of the end cap; save these screws for later use.

C. To install the new battery:

1. Insert three saved screws in battery bracket openings.
2. Align the battery with the screw holes on the end cap
   Note: there is only one way in which the battery can be installed.
3. Using a 9/64-inch hex wrench, work in a cross pattern to tighten the three screws to 6 - 7 inch pounds using a torque wrench.
4. Ensure the gray wire is against the wall of the cover as shown in Figure 13.7.
5. Take excess slack out of the battery wires by threading through the center of the two battery stacks and gently wrapping the wires around the stacks as shown in Figure 13.8.

6. Squeeze the black connector while sliding it into the mating connector. Note: The connectors are keyed and will only fit together in one orientation.

7. Align the flat side of the end cap with the flat side of the ES3 Electronic TC cover.

8. Working in a cross pattern, tighten the four exterior screws to 6 – 7 inch pounds using a torque wrench.

9. Torque the cable gland nut to 15-inch pounds on the end cap before installing the AMR bracket to the ES3. Important: Dispose of the expired battery according to your company’s standards or to RoHS (Restriction of Hazardous Substances) compliance standards.

10. Return the grommet to its place above the black part of the ES3 Electronic TC. Ensure the insulated gray wire from the mechanical counter from the housing until you feel resistance. Do not pull beyond this point. Pulling to hard can damage the electronics.

11. Using the wire from the replacement temperature probe, insert it into the center of the two battery stacks and gently through the center of the two battery stacks and gently

12. Re-attach accessory unit to the meter body. Once you have carefully pulled the ES3 Electronic TC from the mechanical counter to the unit; save the screw for replacement.

13.4 Temperature Probe Replacement for Series B Meters

A. Remove the ES3 Electronic TC from the meter body. Refer to Section 10 for complete directions. B. Temperature probe removal: Important: Prior to returning the ES3 to service, the temperature probe requires calibration. Refer to the MeterWare manual for the procedure to perform a single point calibration of the temperature probe.

C. Insert new temperature probe

1. Using the wire from the replacement temperature probe, squeeze the receiving end of the wire and slide the connector into the receiving end of the wire as shown in Figure 13.11. 2. Replace the mechanical counter into the clear housing, making sure to align the screw hole and the screw within the mechanical counter.

Important: Ensure the insulated gray wire from the counter unit is not pinched between the counter and the housing unit. See Figure 13.12

D. Once the ES3 unit is put into “Prove Mode,” the flashing light changes to a solid light, as shown in Figure 14.2.

14.4 Cleaning, Chemicals List

Important: No oil is required for the ES3 accessory unit. To clean the clear housing cover, use hot water and soap, mineral spirits, isopropyl alcohol or cleaning products approved for use on the cover.

Important: Aromatics, Ketones and chlorinated hydrocarbons will damage the accessory unit cover. Do not use acetone, carbon tetrachloride, etc.
14.2 Set Prove Mode on the ES3
This section details how to configure the ES3 to go into the prove test mode. If you are able to scroll to a screen stating “PROV C.V” (for compensated testing) or “PROV NC.V” (for non-compensated testing) the ES3 is already configured for prove testing.

If the ES3 is already configured for testing, go to Section 14.3 for testing compensated volumes or to Section 14.4 for testing non-compensated volumes.

A. Using the Dresser MeterWare software (refer to Section 12), go to the Configuration screen (Figure 14.3), and click Customize LCD, which will open the LCD Settings screen.

Figure 14.3 - Configuration screen in Dresser MeterWare

B. From the LCD Settings screen (Figure 14.4), choose either Compensated Prove Mode or Non Compensated Prove Mode, or both, and then click OK to return to the Configuration screen.

Figure 14.4 - Settings screen in Dresser MeterWare

C. Once back on the Configuration screen (Figure 14.5), click Upload to unit.

Figure 14.5 - Configuration screen in Dresser MeterWare

D. The chosen prove mode can then be selected on the LCD screen display of the ES3.

14.3. Prove Compensated Volume
A. Swipe the magnet across the “swipe line” (next to the LCD screen display of the ES3) until the screen displays PROV C.V (Figure 14.6), and then stop swiping.

Figure 14.6 - LCD screen displays PROV C.V

B. After five seconds, the display will change to PROVE I.C.V (Figure 14.7).

Figure 14.7 - LCD screen displays PROVE I.C.V

C. Hold the magnet for about five seconds on the word “swipe” (next to the LCD screen display) until the display changes to PRVE_CO.R (Figure 14.8). The ES3 is now ready to be proved using the compensated volume output.

Figure 14.8 - LCD screen displays PRVE_CO.R

D. Exit Prove Mode by holding the magnet on the word “swipe” (next to the LCD screen display) for five seconds.

14.4 Prove Non-Compensated Volume
A. Swipe the magnet across the word “swipe” until the screen displays PROV NC.V (Figure 14.9), and then stop swiping.

Figure 14.9 - LCD screen displays PROV NC.V

B. After five seconds, the display will change to PROVE I.U.V (Figure 14.10).

Figure 14.10 - LCD screen changes to PROVE I.U.V

C. Hold the magnet for about five seconds on the word “swipe” next to the LCD screen display until the display changes to PRVE_NC.V (Figure 14.11). The ES3 is now ready to be proved using the non-compensated volume output.

Figure 14.11 - LCD screen changes to PRVE_NC.V

D. Exit Prove Mode by holding the magnet on the word “swipe” on the LCD screen display for five seconds.

14.5 Model 5 Prover Software Configuration
The Model 5 Prover software must be set up as circled on the left side of the screen shot as shown in Figure 14.12. The TC options box must also be set for Diaphragm TC for all meter sizes, as circled in Figure 14.12. For reference, the values for the prover configuration are explained in Section 14.6.

Note: The recommended pulses per test and test volume are shown in Table 14.13 according to meter size. Using the shown values will allow for a test lasting a minimum of the factory recommended 30 seconds.

Click Start and the prover test will begin to run.

Figure 14.12 - Prover Configurations screen for Model 5 Prover software
### 14.6 Explanation of Prover Configuration Screen

#### 14.6.1 Left Side of Prover Configuration Screen:
- **Prover Capacity**: Select “10M (10,000cfh/283.2 m³)” for flow rates above 100 cfh. For flow rates between under 35 cfh and 100 cfh, select the “2M (2,300cfh/65.1 m³)” master meter if the prover is equipped with this option. This will allow for testing an 8C meter at 10% capacity (80 CFH).
- **Test Control Mode**: Select “Optical Scanner”.
- **Meter Output**: Select “Temperature Correction”.
- **Pulses/Test (PPT)**: Select “Other”. Also select the pulses per test based on Table 14.13. This information is entered in the small box attached to the right of the “Pulses/Test” box. 
  
  **Note**: Figure 14.12 is showing “100” pulses based on the configuration for a 16M meter.
- **Test Volume cf**: Select “Other”. In the small box on the right, enter the same number as the value input in the “Pulses/Test (PPT)”. This is necessary since one pulse = 1 cf.

#### 14.6.2 Top Right Side of Prover Configuration Screen:
- **TC Options**: Select “Diaphragm TC (Continuously Compensated)”.

### 14.6.3 Bottom Portion of Prover Configuration Screen:
- **Flow Rate**: Enter the desired flow rate for the first test. Since the meter configuration shown in Figure 14.12 is for the 16M meter, the flow rate selected is 10,000 since this is the maximum capacity of the 10M master meter.
  
  **Note**: The “Volume” and “Drive Rate/PPT” and other boxes will automatically populate based on the information provided on the left side for the Prover Configuration Screen.

#### 14.6.4 Adding Additional Test Points:
- **Flow Rate**: To add additional test points, enter the desired flow rate in the next available box in the “Flow Rate” column. Figure 14.12 shows a value of “1600” representing 10% of flow for a 16M meter.
- **Volume**: Enter the desired test volume. Suggested values are provided in Table 14.13. A value of “20” is shown in Figure 14.12 representing the recommended test volume for testing a 16M meter at 10% of maximum flow rate.
- **Drive Rate/PPT**: As stated previously, the drive rate will always match the volume.
- **The remaining boxes in the row will auto populate based on the current prover default settings.**
  
  **Important**: When entering values, always move to the next box by either pressing “Enter” or using the cursor. Using “Tab” will cause errors in the test configuration.

**Note**: Contact factory to request pre-configured test files if preferred.

### 15. Upgrading the Firmware in the ES3

Using the Dresser MeterWare software and the IrDA cable assembly, you have the option to upgrade current firmware revision to newer revision levels. The installation of new firmware takes approximately two minutes.

**IMPORTANT**: The IrDA cable assembly must be held firmly in place when attempting to upgrade firmware revision levels. If the upgrade is interrupted while in process, the firmware in the unit will be corrupted, and the unit will need to be returned to the factory for reprogramming.

#### 15.1 Attach IrDA cable
Refer to Figure 15.1 for the proper attachment of the IrDA cable to the ES3 Electronic TC.

#### 15.2 Establish Communication for Firmware Upgrade
A. From the Welcome screen in the MeterWare software, select the **Firmware Upgrade** tab. Refer to Figure 15.2.

B. From the next screen, click **Select File**. Refer to Figure 15.3.
C. From the Open screen, select the appropriate firmware upgrade file ending in "hex" which in this example is "SW-0294-U1-1.67a.hex. (Figure 15.4)

D. The Enter Password screen will open, prompting for a password (Figure 15.5).
   1. The password is the Advanced password. The Advanced password is a numeric only password. The default advanced password is the number zero (0). If this password is changed by the user, the user should make note of the new password and keep this in a safe place.

E. Select OK and the firmware upgrade will begin.

F. In the Status box on the Firmware Upgrade screen, the message In Progress will appear (Figure 15.6).

G. The software also begins to search for the BootLoader, which is necessary to upgrade the firmware (Figure 15.7).
   1. The Status area at the bottom of the screen shows progress locating the BootLoader, moving from Searching to a yellow highlighted message when the device is in range and a green highlighted message when located.

H. Once communication is fully established, the firmware upgrade begins.

15.3. Firmware Upgrade Process

A. There are three status bars, which will move across the screen as each of the three steps is completed (Figure 15.8).
   1. Erasing Memory: the current firmware in the unit must be erased.
   2. Uploading to Memory: once the previous firmware is erased, the unit is ready to accept the new firmware and begins the process.
   3. Verifying: confirms that the new firmware has been uploaded properly.

B. The square to the right of a particular function will change from red to green, confirming that a particular step in the firmware upgrade process has been completed, and the function can move to the next step.

C. When the firmware upgrade is complete, the three squares are green and the screen displays the message Firmware updated successfully. (Figure 15.9)
16. ES3 Specifications

Physical:
• Dimensions:
  - Circular Version: 6-3/4 x 5-1/4 x 5-1/4
  - AMR Version: 8-3/8 x 5-1/4 x 5-1/4
• Weight:
  - Circular Version: 2.75 lbs
  - AMR Version: 3.20 lbs

Display:
• Capacity Registration – 5, 6, 7, or 8 digit
• Screens – 20 (user selectable)
• Screen scrolling – magnetic switch

Temperature Measurement System:
• Extremely stable Class A, PT1000 RTD
• Range: -40 to 140°F (-40 to 60°C)

Temperature Accuracy:
<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Measurement Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 to 32°F (-40 to 0°C)</td>
<td>+/- 0.4°F (+/- 0.2°C)</td>
</tr>
<tr>
<td>32 to 140°F (0 to 60°C)</td>
<td>+/- 0.5°F (+/- 0.3°C)</td>
</tr>
</tbody>
</table>

• Computational accuracy: +/- .25% of compensated volume reading
• Total Ambient temperature effect: Less than 0.1°F (0.05°C) over entire temperature range

Environmental Conditions:
• Ambient Temperature Range: -40 to 140°F (-40 to 60°C)
• Ambient Humidity Range: 0 to 100% non-condensing

Communication:
Optical reading port requires IrDA (Infrared) probe and Dresser MeterWare software for:
• Downloads
• Programming
• Firmware upgrades

Pulse Outputs:
• Form A (normally open outputs
  - Two user-selectable Form A Outputs
  - Output Representation: Compensated, Non-Compensated, Fault or Disabled
  - Pulse Rate: User Scalable (x 1, x 10, x 100 or x 1000 cu.ft.)
  - Pulse Duration: User Scalable (50, 150 or 250 ms)
• AMR Compatibility: Any Form A pulse collector such as Itron ERT
• Form B (normally closed output
  - Dedicated Form B fault/alarm output
  - Output Representation: Fault or Disabled
  - User selectable fault output type:
    - Continuous: One 500 ms pulse every 30 seconds while fault is present
    - Latched: Provides a single 500 ms pulse output per each fault and selected alarm
  - All pulse outputs are opto-isolated.
  - 8.2V is the maximum applied voltage the isolation amplifier presents to the opto-isolators.
  - To maintain compliance with CSA requirements, use a suitable Intrinsically Safe barrier for a Class 1, Division 1 hazardous area for groups A, B, C and D.
  - Do not exceed the following input values for the barrier device:
    - Vi=8.2V
    - Ii=10ma
  - The OUTPUT and power handling capability of a barrier should not exceed:
    - Vout=30V
    - Iout=50ma

Testing:
• 2 minute compensated and non-compensated proving with Dresser Model 5 Transfer Prover
• IrDA (Infrared) communications cable for compensated and non-compensated proving on Model 5 and sonic nozzle provers

Flow Selection:
• Forward
• Reverse
• Forward – Reverse
• Reverse – Forward
• Forward + Reverse

Alarms:
• High Temperature
• Low Temperature
• High Flow Rate
• Low Battery
• Volume Input

Faults:
• Temperature
• Volume
• Low Battery
• Internal Operation

Data Logging:
• Data Logging – 150 days of hourly logs
• Logged Data – Time, Stamp, Compensated Volume, Non Compensated Volume, Line Temperature, Battery voltage, Faults and Alarms
• Audit Trail – Parameters, Time Stamp, Old Value and New Value
• Data exportable to Microsoft® Excel®

Power:
• Sealed Battery Pack – Lithium Thionyl Chloride Pack with CSA certified protective circuitry
• Voltage Range: 3.0 - 3.7 V DC
• Average battery life of 20 years
• Battery Access: Field Replaceable
• Battery life remaining indicated in months
• Flash memory for permanent information retention without power

Warranty:
• Four year ES3 manufacturer's warranty
• Twelve year battery warranty

Certifications:
• CSA: Class 1, Div 1, Group A, B, C and D Certification, to C22.2 No. 213 (pending)
• Meets internationally recognized standards for moisture ingress protection (IP 65 and IP 67)
• Electromagnetic compliance per IEC standards
• Electrostatic discharge compliance per IEC standards

17. Warranty
The warranty for Dresser ES3 and Dresser ETC products shall expire four (4) years from delivery, except that software is warranted for ninety (90) days from delivery. Battery packs for the Dresser ES3 and Dresser ETC products have a separate warranty which expires twelve (12) years from delivery. All other terms of the Terms and Conditions for Sale of Products and Services Form ES 104 apply.

Contact factory for the latest revision of Terms and Conditions for Sale of Products and Services Form ES 104.