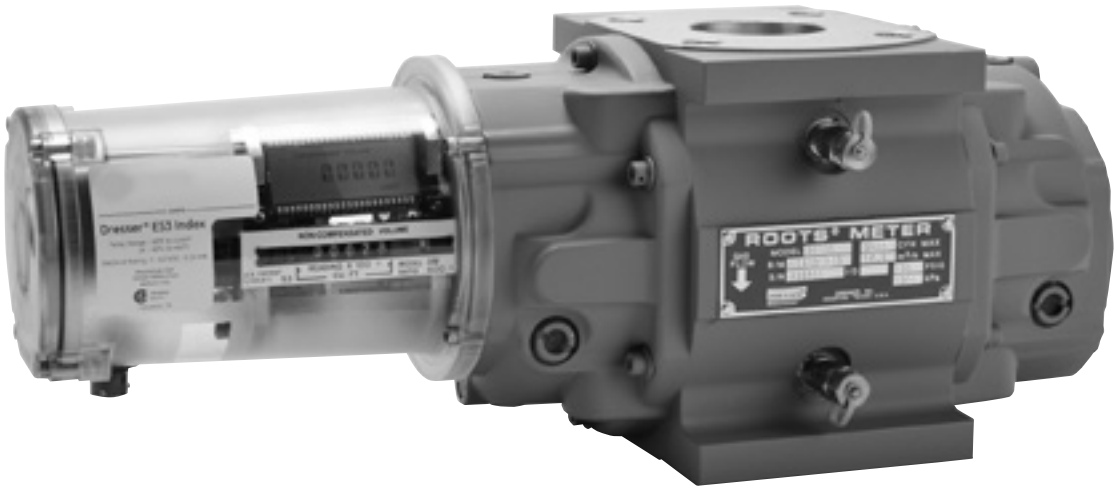
DRESSER
UTILITY SOLUTIONS

Dresser Measurement

Dresser ES3 Electronic TC

Installation, Operation and Maintenance Manual



Contents

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 B 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.

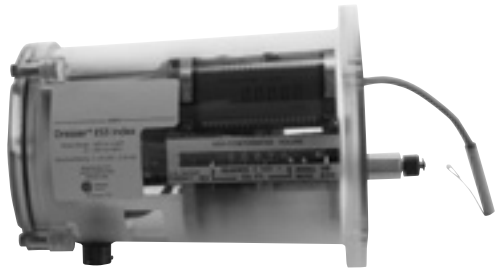
The electronic display of the ES3 is clearly visible throughout the stated temperature operating range of -40°F to 140°F (-40°C to 60°C) and provides accurate temperature measurement and compensation across the range as well. Temperature measurement accuracy is assured by the capability of the PT 1000 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 visible non-compensated odometer reading in the standard configuration. However, the mechanical index odometer can be masked in a variety of translucent and 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 protective circuitry, thus allowing for safely changing batteries in the field.

Accuracy testing with the Dresser Model 5 Transfer Prover is simplified via the ES3 infrared proving interface. The one-cable design provides a convenient method of establishing the connection between the ES3 index and the Model 5 Prover. Also, 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.

* Refer to section 13.1 for more information on battery life.

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.

Important Note

Do not attempt repairs or adjustments, as doing so may be a basis for voiding all claims for warranty.

Storage/Initial Testing

If the product is not tested or installed soon after receipt, store in a dry location in the original shipping container for protection.

If any serious problems are encountered during installation or initial operation of the meter, notify your Dresser Meter supplier immediately.

WARNING

This equipment is designed to operate at temperatures between -40° F to 140° F. Prior to going on-site for installation or maintenance, make sure proper safety equipment is worn before handling the equipment and that you are properly dressed for the work site environment temperatures.

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 8C 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.

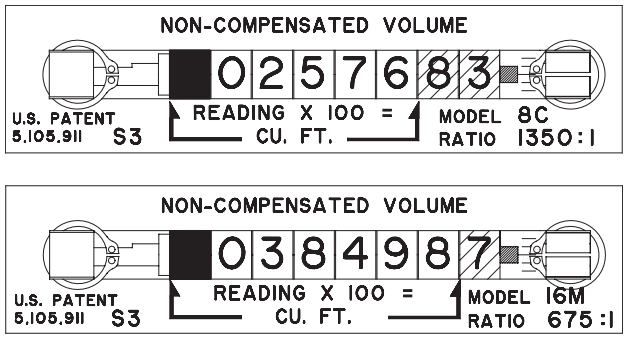


Figure 3.1a and 3.1b - Non-compensated Series 3 Imperial unit odometer for 8C (3.1a Top) and 16M (3.1b Bottom)

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 8C 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 prover testing with an optical photo-sensor (scanner).

6. Meter Start-Up

WARNING

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

WARNING

For installations in confined spaces, allow adequate room to safely handle product and equipment without causing bodily strain. Also verify proper ventilation is in place to maintain a breathable atmosphere.

For more detailed information on the operation of the actual meter bodies, refer to the following guides:

- Dresser Rotary Meter Series B3 Installation, Operation and Maintenance Manual (IOM:B3)

Important: The maximum working pressure of any rotary meter is limited by casing design. Meters shall not be installed where line pressure can exceed the Maximum Allowable Operating Pressure (MAOP). Refer to the basic meter body nameplate for the MAOP.

Slowly pressurize the meter in accordance with the following recommendations:

Important: Do not exceed 5 psig/second (35 kPa/second) maximum when pressurizing. Rapid pressurization can cause an over-speed condition which may damage the meter. Resulting damage is not covered by warranty.

1. Open the bypass and outlet (downstream of meter) gas valves.
2. Partially open the meter inlet gas valve until the meter starts operating at low speed.
3. It may be necessary to throttle the bypass valve to initiate gas flow through the meter:
   a. Verify gas is flowing through the meter by watching for movement of the black-and white RPM wheel on the Accessory Unit. The wheel shown in Figure 5.1 is visible on the left side of the mechanical counter.
   b. If movement is present, go to Step 4.
   c. If the RPM dial is not turning, verify gas is being delivered to the meter.
   d. If gas is flowing to the meter inlet and the RPM wheel is not moving, go to Step 5.

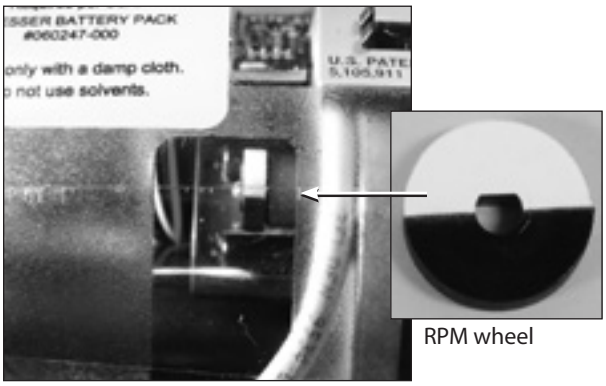


Figure 5.1 - Movement of the RPM wheel indicates impeller rotation

4. Let the meter operate at low speed for several minutes.
   a. Listen closely for unusual scraping or knocking sounds.
   b. If operation is satisfactory, go directly to Step 6.
5. If unusual sounds are present, or the accessory unit's RPM wheel is not turning:
   a. Place the meter in bypass
   b. Slowly depressurize and vent all pressure from the meter set before checking for piping misalignment, piping strain, torsion, or other related problems. (Release pressure at a rate less than 5 psig/second.)
   c. Once the problem is resolved, repeat the start-up procedure beginning with Step 1.

Danger: Slowly depressurize and vent all pressure from the meter set before working on the meter.

6. Gradually open the inlet valve until a full flow is passing through the meter and the inlet valve is fully open.
7. Slowly close the bypass valve.
8. Perform a leak test around the meter connections and the pressurized portion of the meter body housing.

WARNING

Follow your company's authorized procedures or common industry practices to leak test the meter and all pipe connections. Soapy water, Snoop® or gas analyzers are commonly used for this procedure.

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 two 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.

Caution: The Meter End Cover is Pressurized. Bleed off the line pressure before removing the oil fill or drain plugs from the meter.

Do NOT add oil to the ES3 Index

7.2 Meter Level

Since the meter is supported entirely by the gas pipe line, movement of the piping 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 operation 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.

Figure 9.1 - Label on ES3 Electronic TC

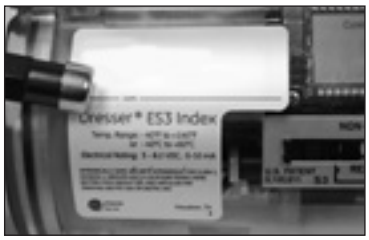


Figure 9.2 - Swipe magnet across the "swipe line" to change the screen displays

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 always will 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.

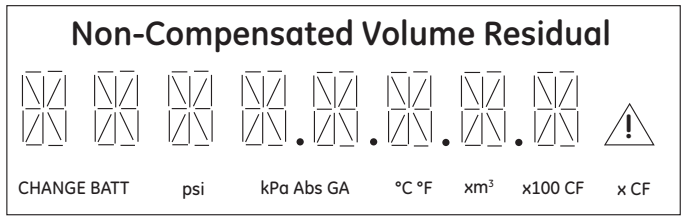


Figure 9.3 - Data Display Screen

Table 1 - Scrolling sequence for ES3 screen display

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

Table 2 - Icon descriptions

Icon	Description
CHANGE BATT	Change Battery
psi	Pounds per square inch
kPa	Kilopascal
Abs	Absolute
GA	Gauge
°C	Temperature in Celsius
°F	Temperature in Fahrenheit
xm3	Times meters cubed
x100 CF	Times 100 cubic feet
x CF	Times cubic feet
⚠	Alarm/Fault has occurred; consult software manual

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.

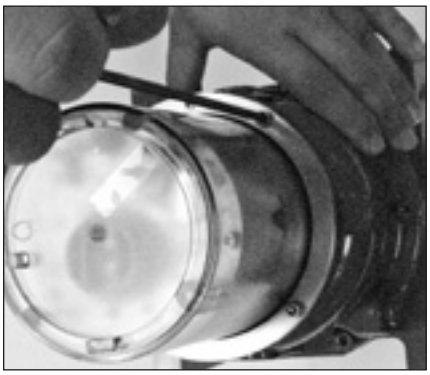


Figure 10.1 - Remove four hex screws

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.

Figure 10.2 - Remove slip flange

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.

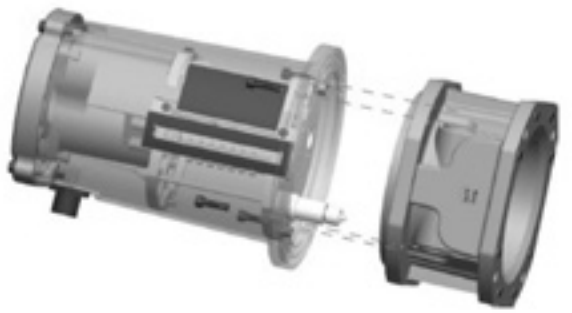


Figure 10.3 - ES3 with Circular Connector on a Series B Meter

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

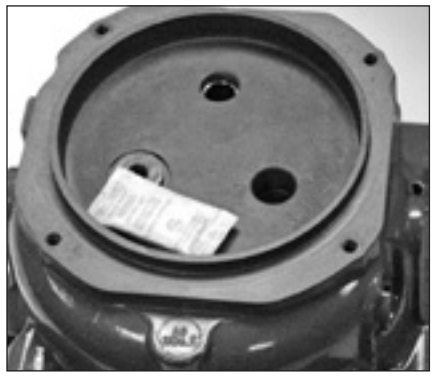


Figure 10.4 - New desiccant pack in place

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

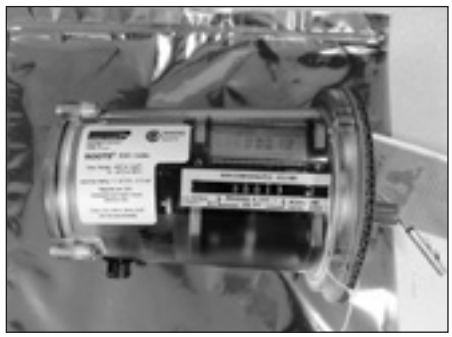


Figure 10.5 - ES3 removed from static bag

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.

Figure 10.7- Red protective cap

Figure 10.6 - Remove cardboard cover

Figure 10.8 demonstrates an exploded view of the ES3 Electronic TC unit as assembled on Series B meters.

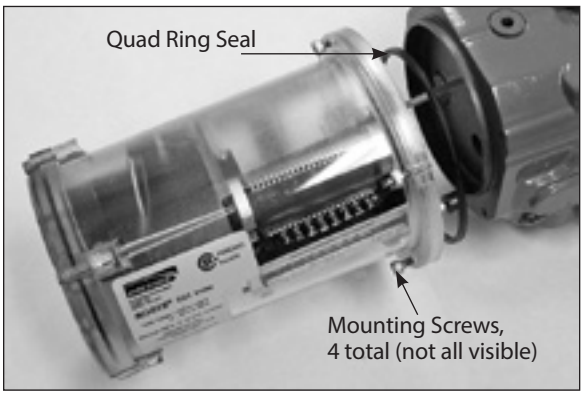


Figure 10.8 - Exploded view of assembling the ES3 on Series B meters

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

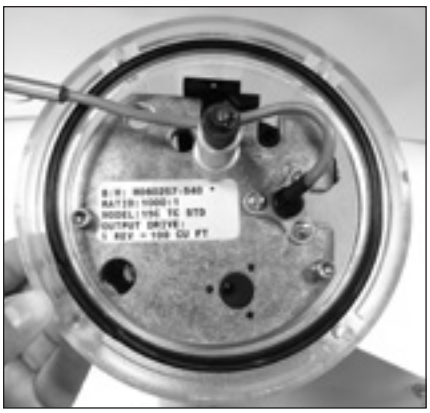


Figure 10.9 - Quad-Ring seal in circular groove

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.

Figure 10.10 - Insert Temperature probe

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.

Figure 10.11 - Seat magnet in magnet well

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.

Figure 10.12 - Torque mounting screws to a maximum of 12-14 inch-pounds

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.

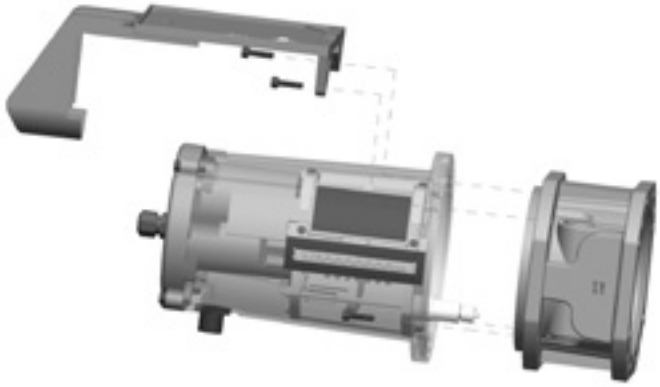


Figure 10.13 - ES3 with AMR mounting bracket on a Series B Meter

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

Figure 10.14 - New desiccant pack in place

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

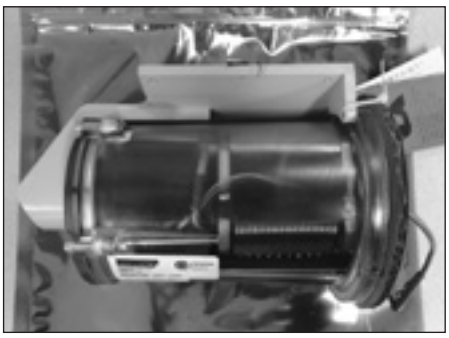


Figure 10.15 - ES3 removed from static bag

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.

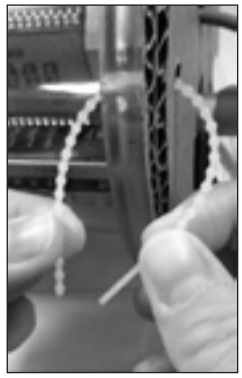


Figure 10.16 - Remove cardboard cover

Figure 10.17 - Red protective cap

Figure 10.18 demonstrates an exploded view of the ES3 Electronic TC unit as assembled on Series B meters.

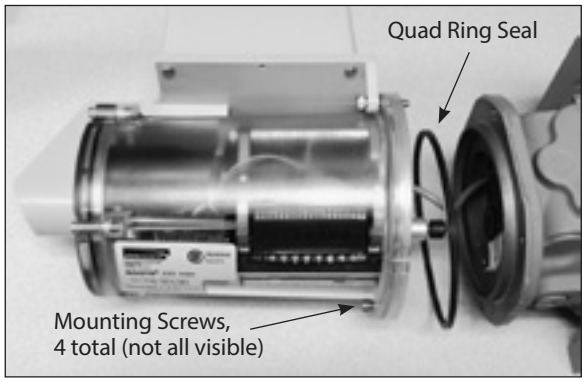


Figure 10.18 - Exploded view of assembling the ES3 on Series B meters

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

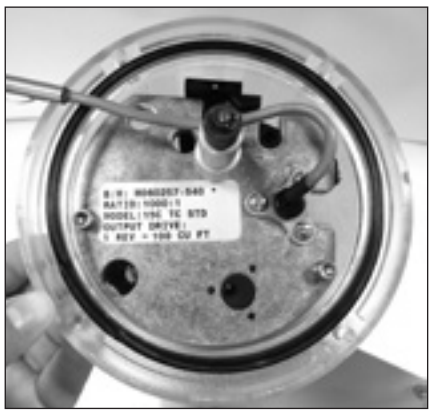


Figure 10.19 - Quad-Ring seal in circular groove

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.

Figure 10.20 - Insert Temperature probe

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.

Figure 10.21 - Seat magnet in magnet well

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.

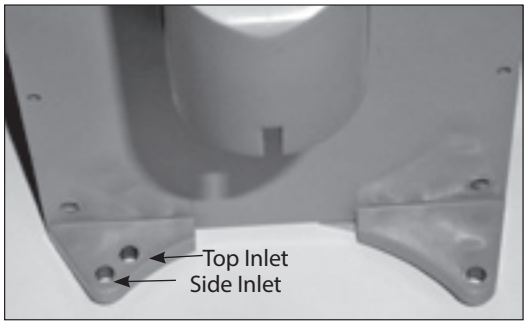


Figure 10.22 - Location of the screw holes

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.

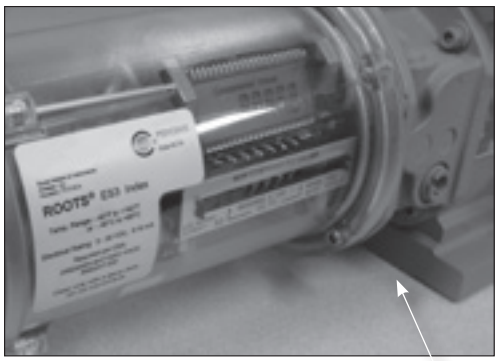


Figure 10.23 - Insert the 3/4 inch (short) screw

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.

Figure 10.24 - Place cable gland connector into recess

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.

Figure 10.25 - Insert the 7/8-inch (long) screws

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.

Figure 10.26 - Insert remaining 3/4 inch (short) screws

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.

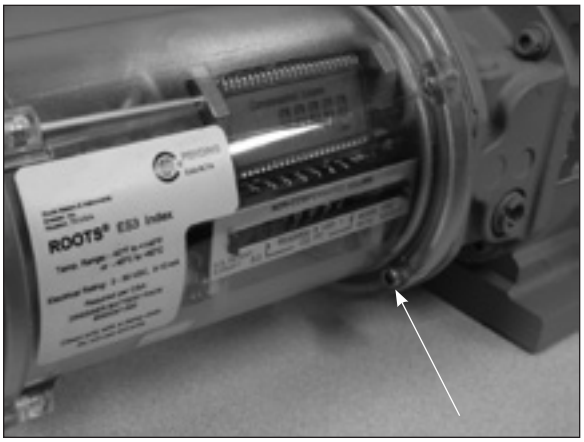


Figure 10.27 - Insert the 3/4-inch (short) screw

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.

Figure 10.28 - Place cable gland connector into recess

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.

Figure 10.29 - Insert the 7/8-inch (long) screws

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.

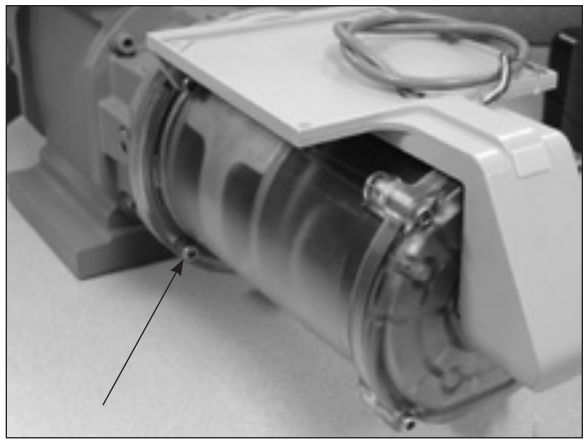


Figure 10.30 - Insert the 3/4 inch (short) screw

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.

Figure 10.31 -Top inlet orientation of AMR bracket

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.

Figure 10.32 -Remove screws attached to AMR bracket

Figure 10.33 - Remove screws attached to AMR bracket

Figure 10.34 - Leave screw under odometer in place

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.

Figure 10.35- Place cable gland connector into recess

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. The other 7/8-inch screw will be mounted through the bracket opposite the screw shown in Figure 10.36.

   Note: Do not tighten at this point.

Figure 10.36 - Insert the 7/8-inch (long) screws

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.

Figure 10.37- Insert the 3/4-inch (short) screw

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.

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.

Figure 10.38 - Place cable gland connector into recess

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. The other 7/8-inch screw will be mounted opposite the screw shown in Figure 10.39.

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

Figure 10.39 - Insert the 7/8-inch (long) screws

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.

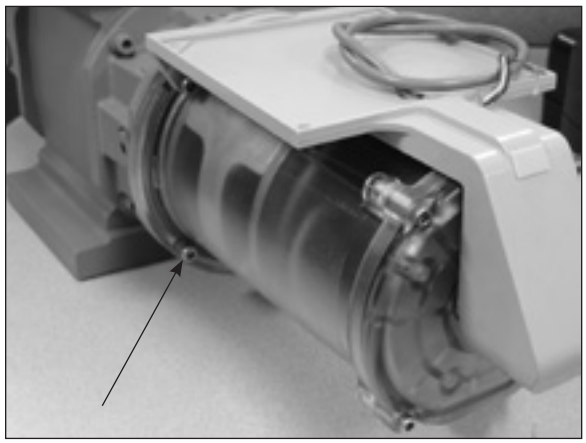


Figure 10.40 - Insert the 3/4 inch (short) screw

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

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

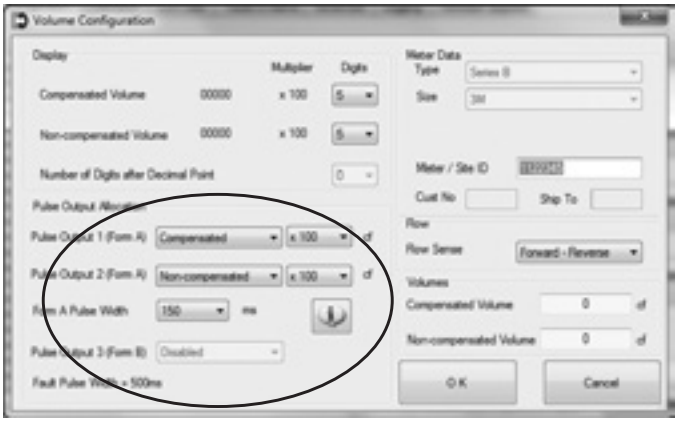


Figure 11.1 - Volume Configuration screen in Dresser MeterWare Software

To ensure that your pulse outputs are properly wired, the MeterWare software has a test function available on the **Advanced** screen, as shown in Figure 11.2.

Figure 11.2 - Advanced screen in Dresser MeterWare Software

Once you click the **Test Pulse Outputs** button, a screen will appear as shown in Figure 11.3. Click Yes to proceed with the pulse output test. For further information, refer to the MeterWare Manual.

Figure 11.3 - Send Test Pulses screen Dresser Meterware Software

Note: For more information on configuring and testing pulse outputs, consult the Dresser MeterWare manual.

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. Vi=8.2V b. Ii=10ma

2. The OUTPUT and power handling capability of a barrier should not exceed:

   a. Vout=30V b. Iout=50ma

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.

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.

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

Output	Name	Connector Pin	Pulse Type
Pulse Output 1 (+)	PO1 (+)	A	Form A
Pulse Output 1 (-)	PO1 (-)	B	
Drain	(Drain)	C	—
Pulse Output 2 (+)	PO2 (+)	D	Form A
Pulse Output 2 (-)	PO2 (-)	E	

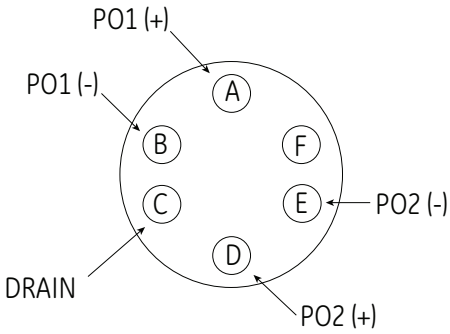


Fig 11.4 - Circular Connector

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

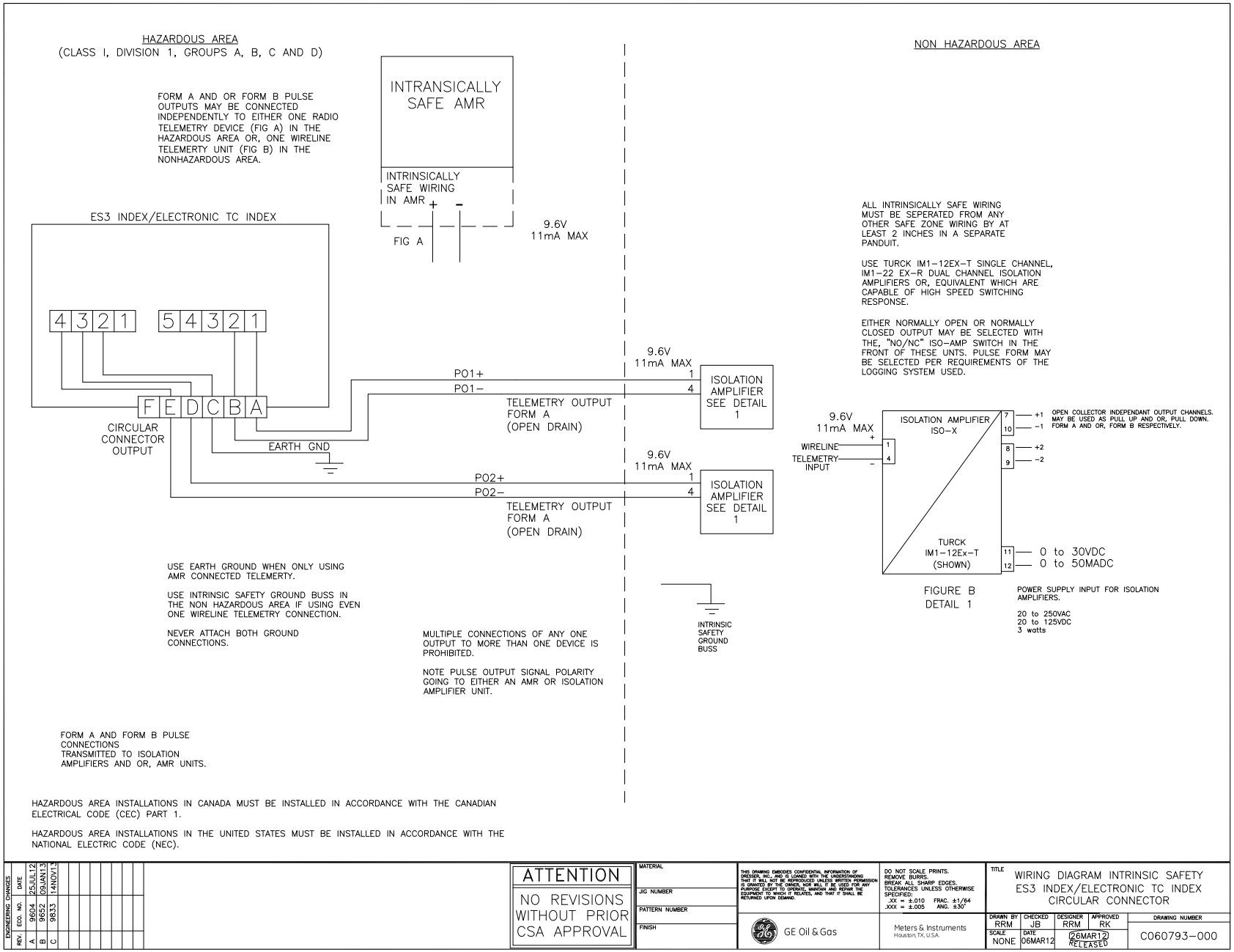


Figure 11.5 - Wiring diagram for hazardous locations (Circular Connector version - 060793-000).

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.

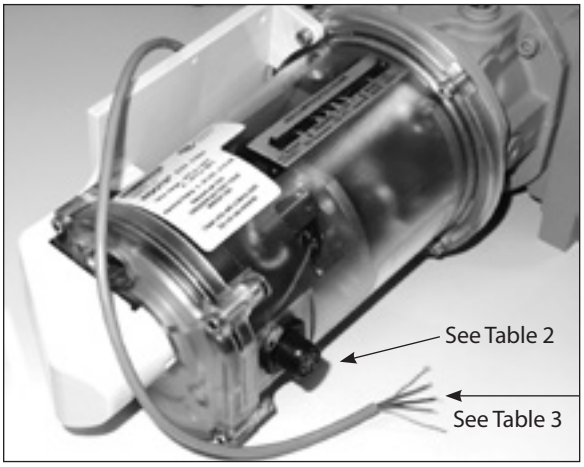


Figure 11.6 - ES3 with AMR Cable

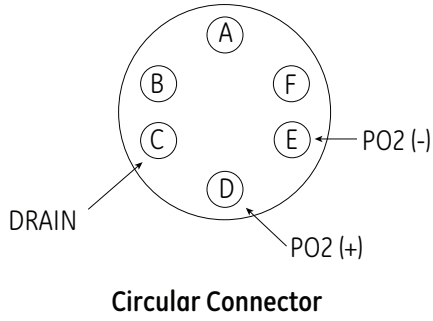


Figure 11.7 - Circular connector

Table 2 - Circular Connector

Output	Name	Connector Pin	Pulse Type
Drain	(Drain)	C	—
Pulse Output 2 (+)	PO2 (+)	D	Form A
Pulse Output 2 (-)	PO2 (-)	E	

Table 3 - AMR Cable

Output	Name	Wire Color	Pulse Type
Pulse Output 1 (+)	PO1 (+)	White	Form A
Pulse Output 1 (-)	PO1 (-)	Black	
Drain	(Drain)	Bare Wire	—
Pulse Output 3 (+)	PO3 (+)	Red	Form B
Pulse Output 3 (-)	PO3 (-)	Green	

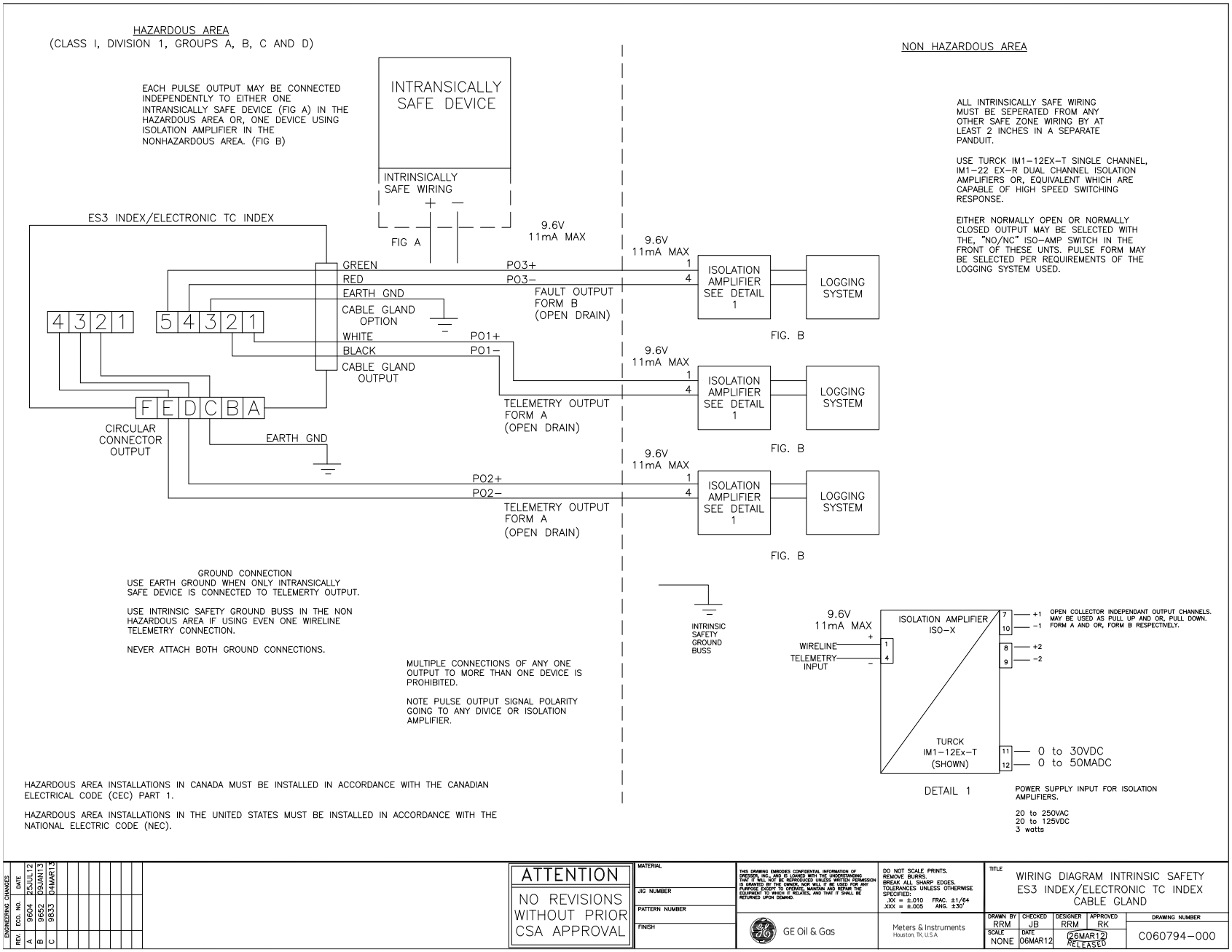


Figure 11.8 - Wiring diagram for hazardous locations (AMR version - 060794-000).

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.

Figure 11.9 - Cut the AMR cable

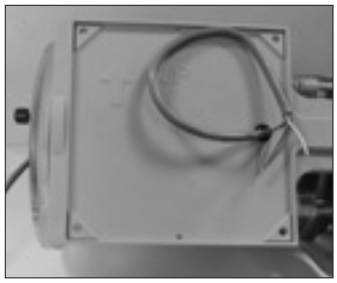


Figure 11.10 - Remove vinyl

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

ES3 External Cable Wire	AMR Device Wire
Black	Red
Green	Blue
White & Red	White

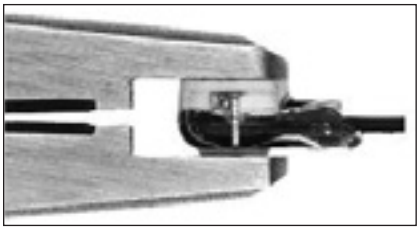


Figure 11.11 - Seal wire

Figure 11.12 - Splice wire

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.

Figure 11.13 - Clip unused wires

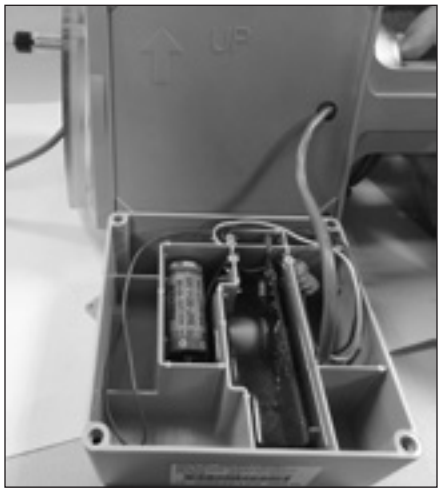


Figure 11.14 - Tuck extra cable into a pocket

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

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

Figure 11.17 - Top inlet: notice the space between the ES3 label and the bracket

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

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 1 - Volume Accumulation Methods

Volume Accumulation	Measured Flow Source		
	Forward	Reverse	Calculated Flow
Forward minus (-) Reverse	✓	✓	Volume in Reverse flow is subtracted from the volume calculated in Forward flow.
Reverse minus (-) Forward	✓	✓	Volume in Forward flow is subtracted from the volume calculated in Reverse flow.
Reverse	x	✓	Volume in Reverse flow only is calculated. All flow in the Forward direction is ignored.
Forward	✓	x	Volume in Forward flow only is calculated. All flow in Reverse direction is ignored
Forward plus (+) Reverse	✓	✓	Volume in Reverse and Forward flow are calculated. Calculated volume is the total of all flow in both directions.

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 - Location of meter size and gear ratio

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 Corrected Volume total is updated every 30 seconds and is displayed in standard cubic feet (SCF) or normal cubic meters (nm^3) over the temperature measurement range of -40°F to + 140°F (-40°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 2 - Temperature measurement accuracy over the temperature measurement range

Temperature Reading Accuracy
-40°F to 140°F: +/- 0.9°F (-40°C to 60°C: +/- 0.5°C)

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.

Figure 12.2 - Fault/Alarm symbol as displayed on LCD Screen

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.

Table 3 - Fault and Alarm types

	Screen Display	Represents
Faults	T FLT	Temperature Fault
	VOL FLT	Volume Fault
	INT FLT	Internal Operations Fault
	CHANGE BATT	Low Battery Fault
Alarms	HIGHT. AL.	High temperature alarm
	LOWT. AL.	Low temperature alarm
	HFLOW AL.	High flow rate alarm
	VL IN. AL.	Volume Input alarm
	LBATT AL.	Low battery alarm

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.

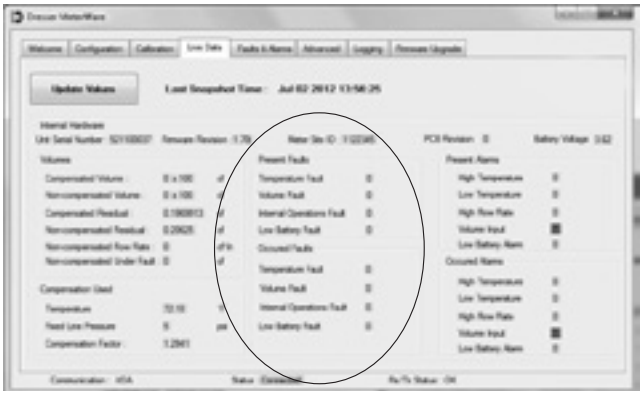


Figure 12.3 - Live Data Screen showing Faults in Dresser MeterWare Software

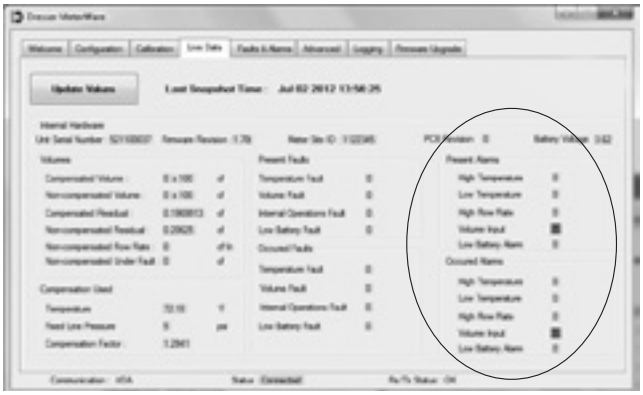


Figure 12.4 - Live Data Screen showing Alarms in Dresser MeterWare Software

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 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.

Figure 12.5 - Faults and Alarms Screen as displayed 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 **occured alarms**[1].

[1] 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.

5. Fault and Alarm Pulse Outputs

The ES3 is capable of providing a pulse output when a Fault or Alarm is present. This feature is configurable in the Volume Configuration screen of Dresser MeterWare. (The Volume Configuration screen is reached by selecting the "Configuration" tab in MeterWare and then selecting the "Volume" box.)

Pulse Output 1 and Pulse Output 2 provide a Form A (Normally Open) pulse when "Fault" is selected for the output. A pulse output is provided every 30 seconds when a Fault or Alarm is present. The pulse width is selectable as 50, 150, or 250 ms.

The AMR Version of the ES3 also provides the capability for a third pulse output (Pulse Output 3). There are only two settings for the pulse output; either "Disabled" or "Fault". No pulses are provided when disabled, but when the "Fault" feature is selected a pulse is provided once every 30 seconds whenever a Fault or Alarm is present. Unlike the other two pulse outputs, Pulse Output 3 is a dedicated Form B (Normally Closed) switch and is configured for a 500 ms pulse.

When a fault of any kind is present in the ES3:

- The pulse outputs for Compensated and/or Non-Compensated volume will not pulse out.
- Any pulse output configured to be a Fault pulse will function as an alarm/fault pulse output.
- All pulse outputs will continue to perform as configured, if an alarm is present.

If the ES3 is configured to utilize the "Fixed Temperature Under Fault" function to correct when the unit has a Temperature Fault, then the Compensated and Non-Compensated Volumes:

- Continue to increment and be displayed on the LCD
- Are logged in the Logged Data Reports

If the ES3 is not configured to utilize the "Fixed Temperature Under Fault" function and a Temperature Fault occurs, then the Non-Compensated volume only continues to be logged in the "Non-Compensated Volume Under Fault" register, and will be displayed as the same on the LCD, if that parameter is enabled at time of unit configuration.

12.5 Logging

12.5.1. Data Log

Data logs are recorded hourly. The ES3 maintains a 150 days of hourly logs on a first in first out (FIFO) basis. The Data Logging feature is not configurable.

The user can decide how many days of hourly logs to download using the Dresser MeterWare software.

12.5.2. Logged Parameters

The ES3 has non-volatile memory. If the unit experiences battery failure, all logs obtained within the last hour of operation are retained and are available and ready for use as soon as power is restored. In addition, the configuration is stored in non-volatile memory and is not lost in the event of main battery failure.

Data logs (order dependent) are continually stored in the memory on an hourly basis consisting of these 24 parameters:

- Log Number
- Log Date & Time
- Compensated volume
- Non-compensated volume
- Compensation factor
- Non-compensated volume under fault
- End temperature
- Battery voltage
- Present fault – temperature
- Present fault – volume
- Present fault – internal operation
- Present fault – low battery
- Occurred fault – temperature
- Occurred fault – volume
- Occurred fault – internal operation
- Occurred fault – low battery
- Present alarm – high temperature
- Present alarm – low temperature
- Present alarm – high flow
- Present alarm – low battery
- Occurred alarm – high temperature
- Occurred alarm – low temperature
- Occurred alarm – high flow
- Occurred alarm – low battery
- Occurred alarm – volume input

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:

- Meter type
- Pulse output 1
- Meter size
- Pulse output 2
- Revolution/Unit volume
- Pulse output 3
- Flow sense
- Pulse output 1 selected
- Temperature units
- Pulse output 2 selected
- Base temperature
- Pulse output 3 selected
- Temperature model
- Telemetry form A pulse width
- Fixed temperature
- Compensated volume
- Pressure units
- Non-compensated volume
- Base pressure
- Non-compensated volume under fault
- Atmospheric pressur
- Pressure calculation type
- Pressure factor
- User temperature calibration offset
- Fixed pressur
- High temperature alarm limit
- Pressure mode
- Low temperature alarm limit
- Compensated multiplier
- 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. Maintenance

13.1 Battery Replacement

The electronics are powered by a battery pack consisting of two Lithium Thionyl Chloride batteries having an average normal life of 20-years. The actual length of the battery life will depend upon the conditions of use. Battery life is calculated assuming continuous flow at 50% of the meter's maximum capacity. Temperature affects battery life. As an example, battery life expectancy for cooler climates such as Minneapolis, MN, are calculated at 20+ years, while warmer climates such as Las Vegas, NV, have a calculated battery life of 15+ years.

The state of the battery pack is monitored and the ES3 unit generates either a low battery alarm or fault before the batteries are discharged. A low battery **alarm** is generated when the battery pack voltage drops below 3 volts and an alarm icon in the form of a triangle is generated on the LCD of the unit. A low battery **fault** is generated when the battery pack voltage drops below 2.7 Volts and a "CHANGE BATT" message appears on the LCD of the unit. The period of time between the Low Battery Alarm and the Low Battery Fault is approximately 90 days.

13.1.1 Changing the battery on Series B Meters – Circular Pulse Output Connector Version:

A. **Important:** Using the battery change function (BATT. CHNG) will create a data log, which will ensure that you do not lose any data during the battery change. **This will also reset the battery life clock.**

1. 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.
2. When the screen automatically returns to the default screen (either **Compensated Volume** or **Non-Compensated Volume**, 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.

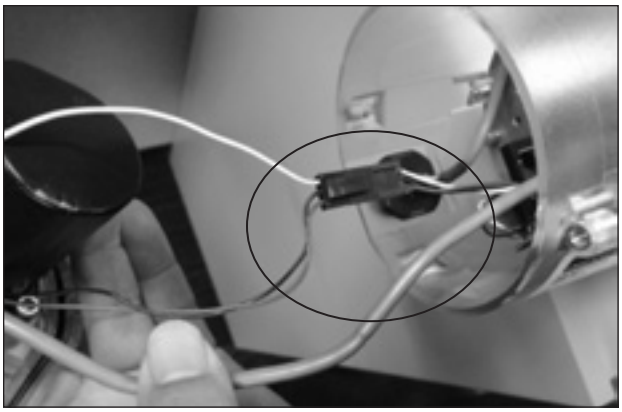


Figure 13.1 -Squeeze to release cord

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.

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.

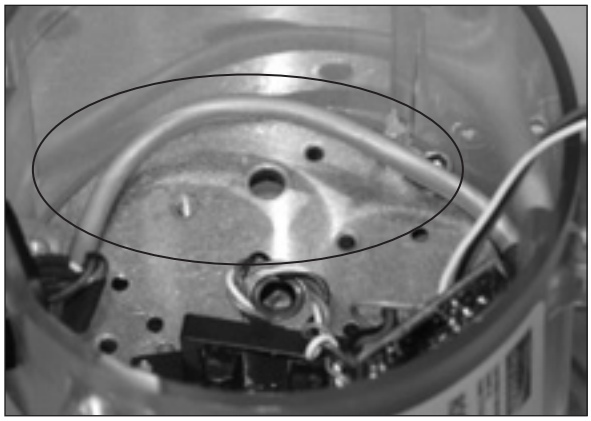


Figure 13.2 -Gray wire against wall of the cover

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.

Figure 13.3 -Remove excess slack: circular version

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.

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

13.1.2 Changing the Battery on Series B Meters - AMR Version

A. **Important:** Using the battery change function (BATT. CHNG) will create a data log, which will ensure that you do not lose any data during the battery change. **This will also reset the battery life clock.**

1. 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.

2. When the screen automatically returns to the default screen (either **Compensated Volume** or **Non-Compensated Volume**, depending on customer configuration), the log has been created, and you can proceed with the battery change.

B. To remove the existing battery in AMR version:

1. Using a 5/32 allen wrench, remove the (2) 5/32 screws that attach the AMR bracket to the ES3 as shown in Figure 13.4.

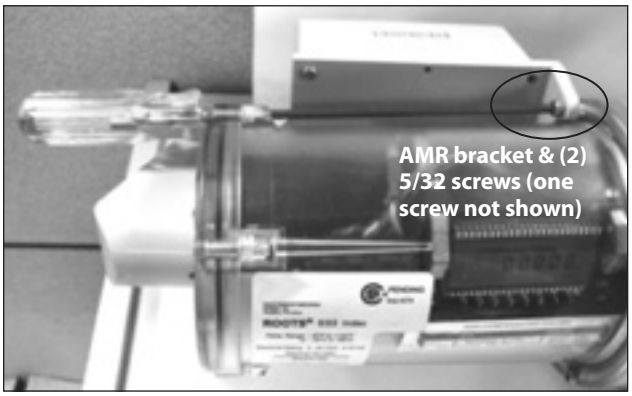


Figure 13.4 -Remove 2 screws attaching AMR bracket to ES3

2. Carefully remove the AMR bracket from the ES3.

   Note: Do not open AMR or cut the cable that is wired from the ES3 to the AMR. Refer to Figure 13.5 below.

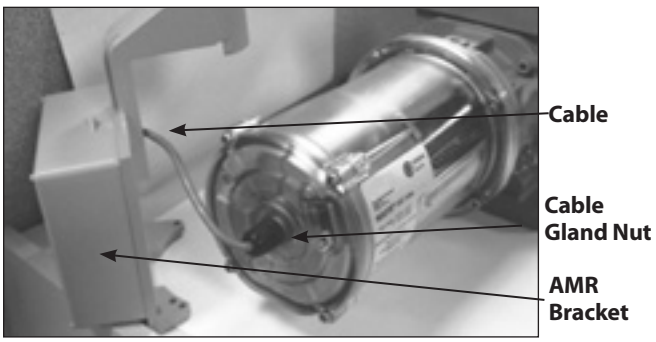


Figure 13.5 -Remove AMR bracket from ES3

3. Loosen the nut on the Cable Gland shown in Figure 13.5.

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

4. 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 re-installation of the end cap.

5. Pull the end cap straight out, away from the unit, extending only far enough to access the connected wires.

6. Squeeze to release the black connector (circled in Figure 13.6), from the mating connector.

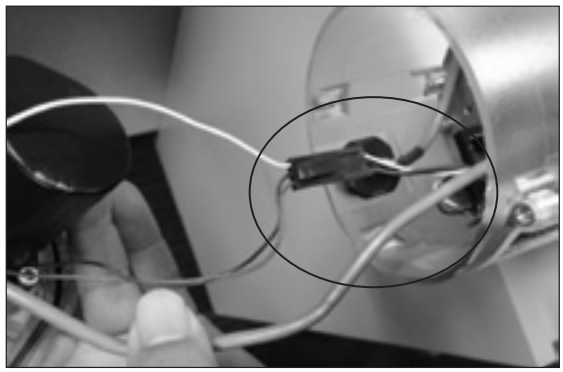


Figure 13.6 -Squeeze to release cord

7. 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.

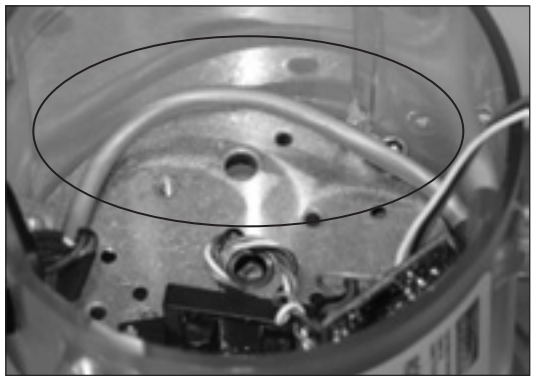


Figure 13.7 -Gray wire against wall of the cover

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.

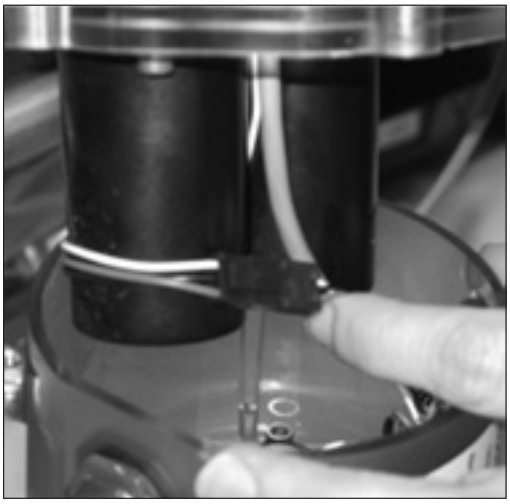


Figure 13.8 - Remove excess slack: AMR version

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.

13.2 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:

   Note: These instructions apply for both Circular Connector and AMR Versions.

1. Once you have carefully pulled the ES3 Electronic TC from the meter body, remove the black grommet that secures the probe in its place (Figure 13.9).
2. Using a Phillips-head screwdriver, remove the three screws holding the plate around the temperature probe (Figure 13.9); save the screws and plate for replacement.

Figure 13.9 - Remove grommet securing previous probe; remove plate for probe

3. Using a 9/64-inch hex wrench, and inserting through the indicated hole (see Figure 13.10), remove the single screw that holds the counter to the unit; save the screw for replacement.
4. Gently remove the mechanical counter from the clear housing cover far enough that you can access the connection that holds the wire from the probe to the wire for the unit.

   Important: Slide the mechanical counter from the housing until you feel resistance. Do not pull beyond this point. Pulling to hard can damage the electronics.

Figure 13.10 - Remove single screw holding counter to unit

5. Squeeze the connecting end of the wires (as circled in Figure 13.11) to release the cord from the receiving end.

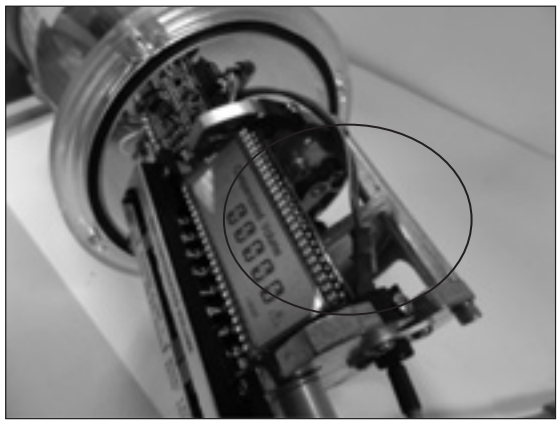


Figure 13.11 - Squeeze connector to release and make the wire connection.

C. Insert new temperature probe

1. Using the wire from the replacement temperature probe, squeeze the receiving end of the wire and slide the connecting end into place. (See 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

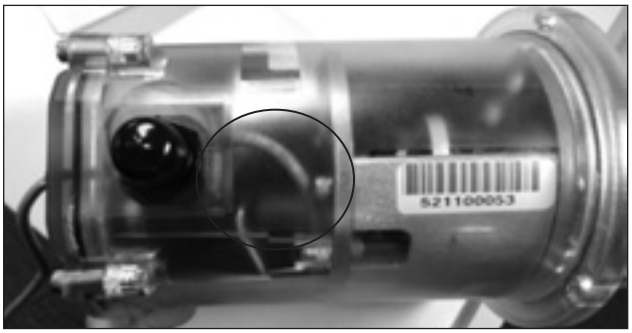


Figure 13.12 - Ensure the insulated gray wire is not pinched

3. Using a torque wrench with a 9/64-inch hex adapter, tighten the single screw that holds the counter to the unit to 6 – 7 inch pounds.
4. Replace the plate over the temperature probe.
5. Using a torque wrench with a Phillips-head screw adapter and working in a cross pattern, replace the three screws holding the plate around the temperature probe; tighten to 8-inch pounds.
6. Return the grommet to its place above the black part of the probe by encircling the cable; use needle-nose pliers to compress the grommet until it reseats in the hole.
7. Push gently with fingers, and the grommet will snap into place.

   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.

   This procedure requires a stable and accurate temperature reference device for comparison. Allow enough time for the temperature to stabilize between the new probe and the reference temperature device. For the best results, submerge the new temperature probe and the reference temperature probe in a temperature controlled liquid bath.

D. Re-attach accessory unit to the meter body

Refer to section 10.2.1 for assembling ES3 index to Series B meters.

13.3 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. Proving the ES3 Electronic TC with Dresser Model 5 Transfer Prover

14.1 Establish IrDA Cable Connection

A. Insert the IrDA adapter in the cover of the ES3, as shown in Figure 14.1.

B. Attach the cable connector of the IrDA to the ID Pulser connection port on the Prover field meter junction box, as shown in Figure 14.1.

C. Turn on the power switch of the Model 5 Prover, and wait for light on the IrDA to come on and start flashing.

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

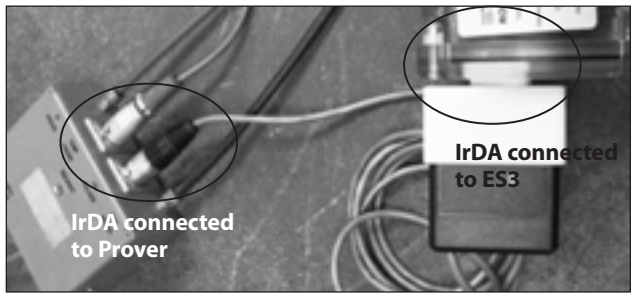


Figure 14.1 - Connect IrDA to ES3 and Model 5 Prover

Figure 14.2 - Light indicating connections is established

14.2Set Prove Mode on the ES3

This section details how to configure the ES3 to go into the prover test mode. If you are able to scroll to a screen stating "PROV C.V" (for compensated testing) or to "PROV NC.V" (for non-compensated testing) the ES3 is already configured for prover 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.

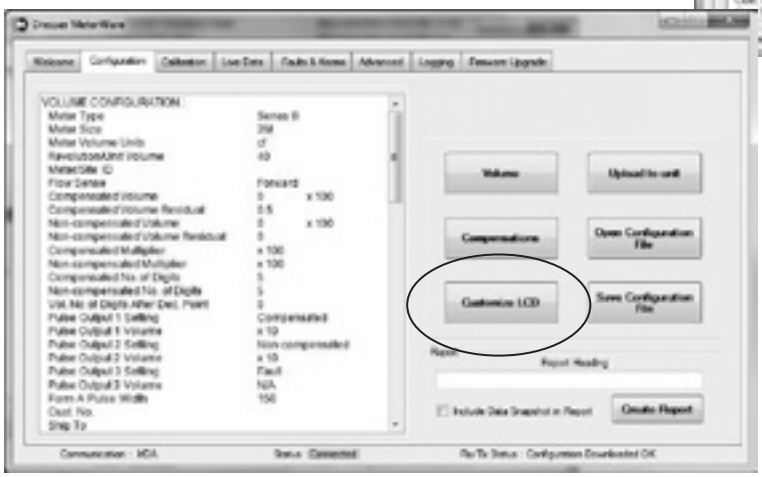


Figure 14.3 - Configuration screen in Dresser MeterWare

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**.

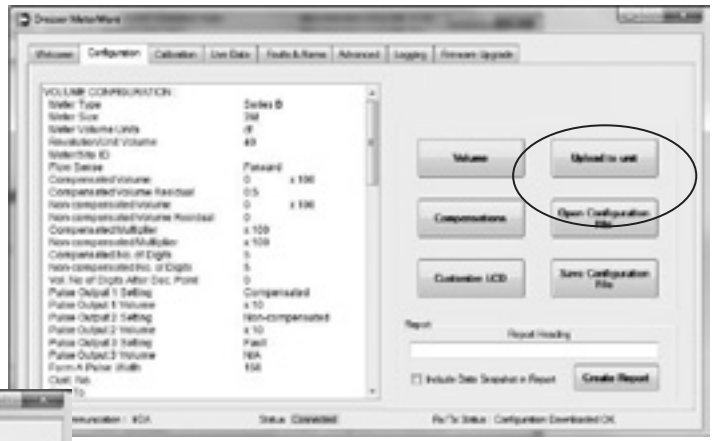


Figure 14.5 - Configuration screen in Dresser MeterWare

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).

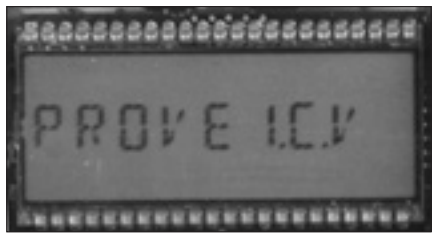


Figure 14.7 - LCD screen displays **PROVE I.C.V**

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.

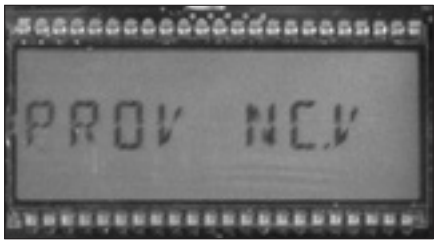


Figure 14.9 - LCD screen displays **PROV NC.V**

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

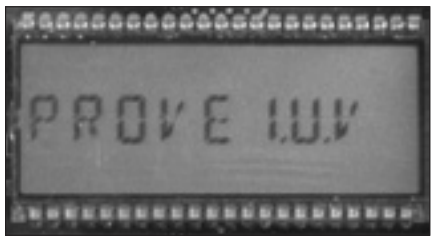


Figure 14.10 - LCD screen changes to **PROVE I.U.V**

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.

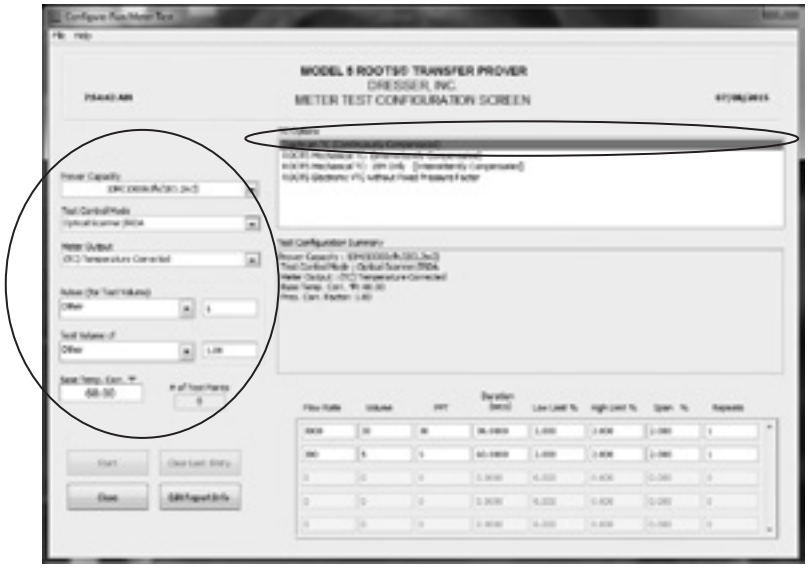


Figure 14.12 - Prover Configurations screen for Model 5 Prover software

Figure 14.13 - Recommended prover configuration settings based on meter size

Meter Size	Flow Rate (% of Maximum Flow Rate			
	100%		10%	
	Min. # of Pulses	Min Test Volume	Min. # of Pulses	Min. Test Volume
8C	8	8	4	4
11C	10	10	4	4
15C	15	15	5	5
2M	20	20	5	5
3M	30	30	5	5
5M	50	50	10	10
7M	70	70	15	15
11M	20	200	5	50
16M	20	200	5	50

14.6 Explanation of Prover Configuration Screen

14.6.1 Left Side of Prover Configuration Screen:

- Prover Capacity: Select "10M (10,000cfh/283.2 m^3)" 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 at a 100% flow rate.
- 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.
- Start this process again to continue adding additional test points. Always start with the highest flow rate and progress downward to the lowest flow rate.

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.

Figure 15.1 - Proper installation of IrDa cable in ES3 accessory unit

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.

Figure 15.2 - Firmware Upgrade Tab

B. From the next screen, click **Select File**. Refer to Figure 15.3.

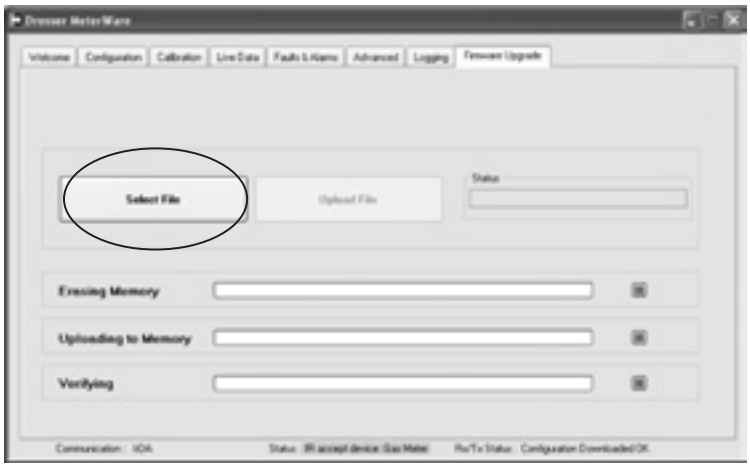


Figure 15.3 - Firmware Upgrade Screen

C. From the **Open** screen, select the appropriate firmware upgrade file ending in ".hex," which in this example is "SW-0294-U3-1.67a.hex. (Figure 15.4)

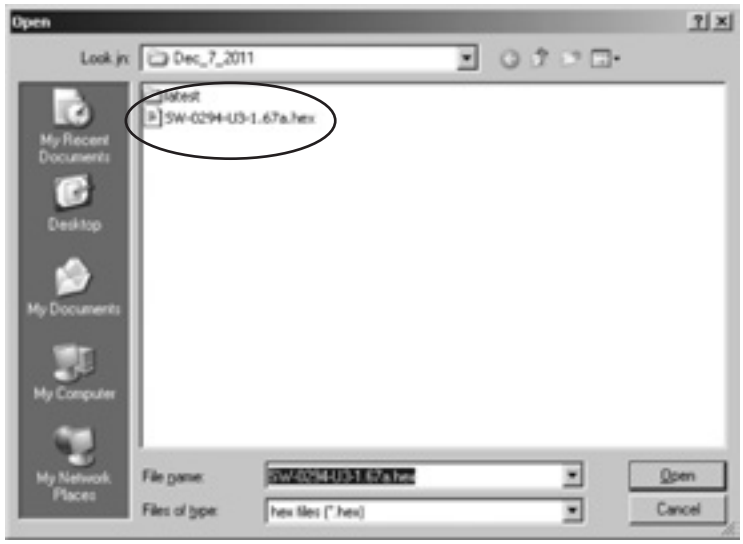


Figure 15.4 - Select the .hex file

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.

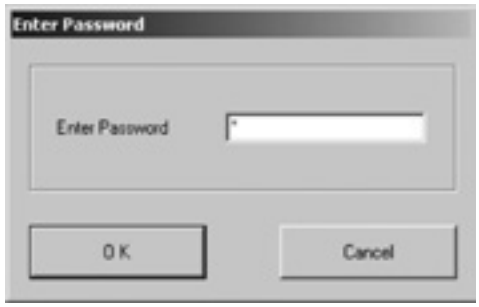


Figure 15.5 - Enter the Advanced Password

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)

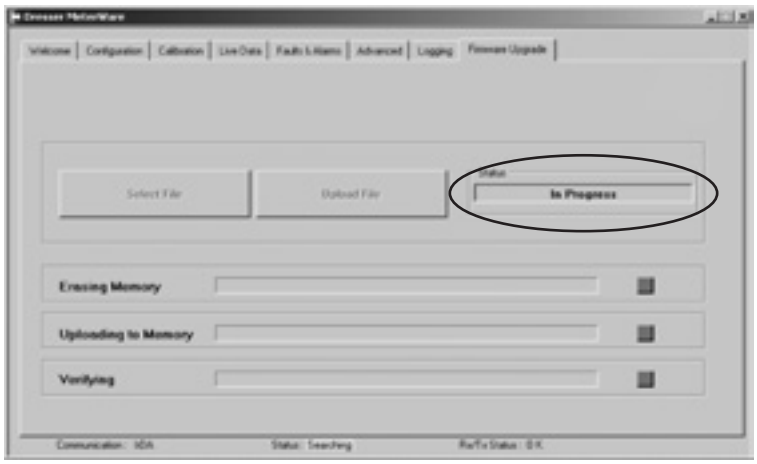


Figure 15.6 - MeterWare software showing In Progress status

G. The software also begins to search for the **BootLoader,** which is necessary to up grade 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 messaged when located.

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

Figure 15.7 - Device in Range: BootLoader

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.

Figure 15.8 - Progression of three steps for uploading the new f irmware to the unit

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

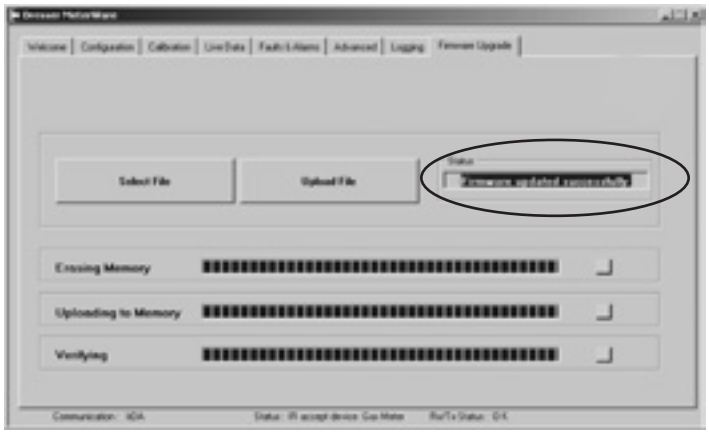


Figure 15.9 - Firmware upgrade is complete.

16. ES3 Specifications

Physical:

- Dimensions:

  Circular Version: 6-3/4 x 5-1/4 x 5-1/4

  AMR Version: 8-3/8 x 5-1/4x 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 Reading Accuracy:

Temperature Reading Accuracy
-40°F to 140°F: +/- 0.9°F (-40°C to 60°C: +/- 0.5°C)

- 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 Intrinsic Safety 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 – Parameter, 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.

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