

## Digital Energy Monitor — Electrical, Series 1000/2000

### Product Description

The Digital Energy Monitor (DEM) is a three-phase power transducer that monitors energy information in all areas of a commercial or industrial facility. Its applications include tenant submetering, aggregate billing, energy management, performance contracting, chiller optimization, demand limiting, and power diagnostics.

The DEM combines a microprocessor-based wattmeter and high accuracy split-core instrument-grade current transformers (CTs) in one unit. The DEM connects to field panels through the floor level network (FLN).

### Product Numbers



Housing	Max. Amps	Series 1000 Part Number	Series 2000 Part Number
Small	100	538-985	538-993
	300	538-984	538-992
Medium	400	538-983	538-991
	800	538-982	538-990
Large	800	538-981	538-989
	1600	538-980	538-988
	2400	538-979	538-987

The DEM Series 1000 provides information on electrical consumption and demand. In addition to power consumption and demand, the DEM Series 2000 provides power diagnostic information.

### Components

Figure 1 describes DEM components.

### Installation Conventions

<b>WARNING</b>		Personal injury/loss of life may occur if you do not perform a procedure as specified.
<b>CAUTION</b>		Equipment damage, or loss of data may occur if you do not perform a procedure as specified.

### Prerequisites

- Review all instructions before beginning installation.
- Verify that appropriate FLN field wiring corresponds to the maximum wiring length for the individual field panel.
- Completed DEM Equipment Schedule with FLN addresses listed.



#### **WARNING:**

This product is *not* intended for smoke control applications.

This product must not be interconnected to any APOGEE® panels that are performing any smoke control functions.

### Expected Installation Time

1.5 hours

### Required Tools

- Medium flat-blade screwdriver
- Multimeter
- Electrical tape or shrink wrap
- Trim screwdriver
- Wire cutter
- Amp clamp
- Tie wraps

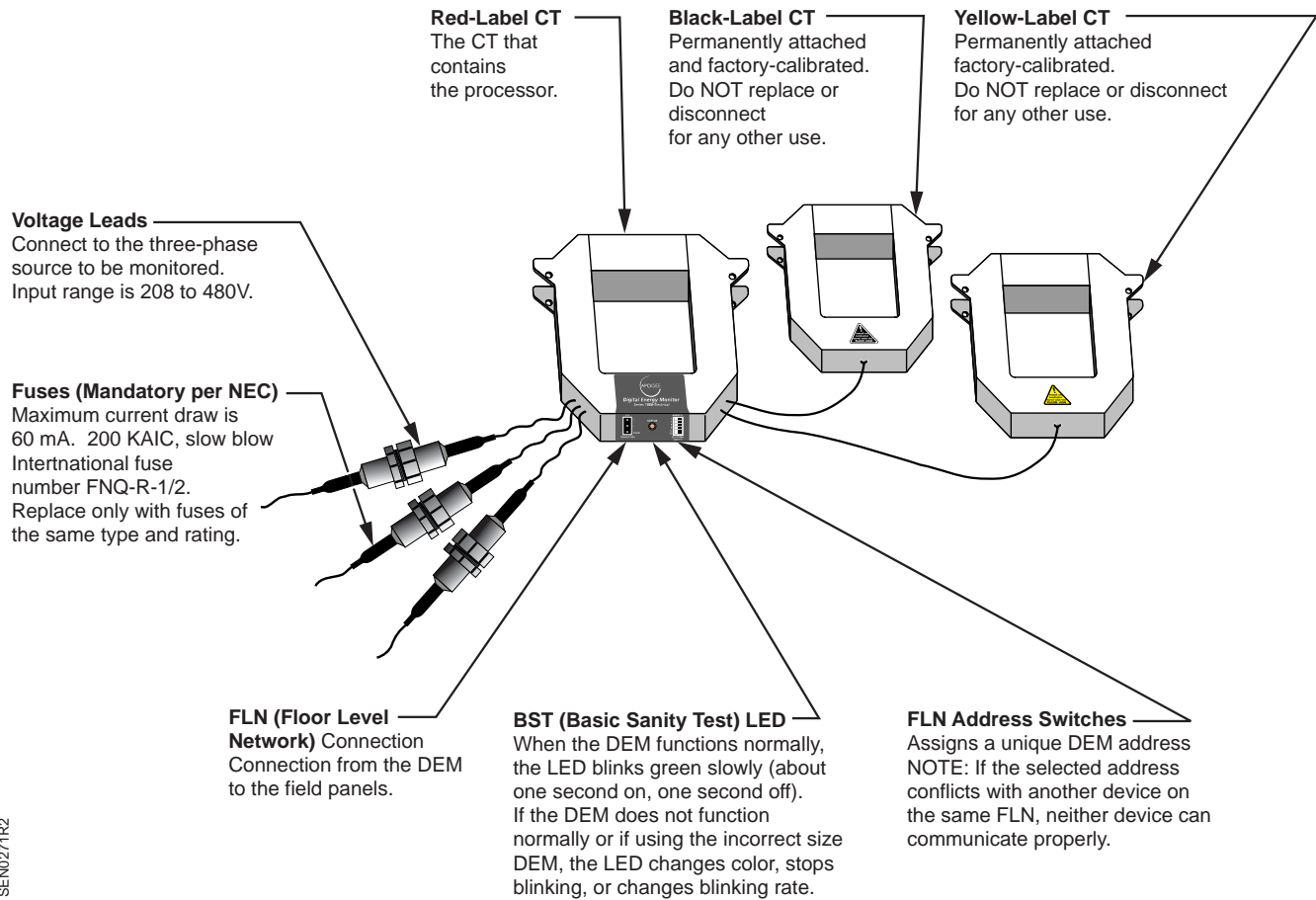


Figure 1. Digital Energy Monitor Components.

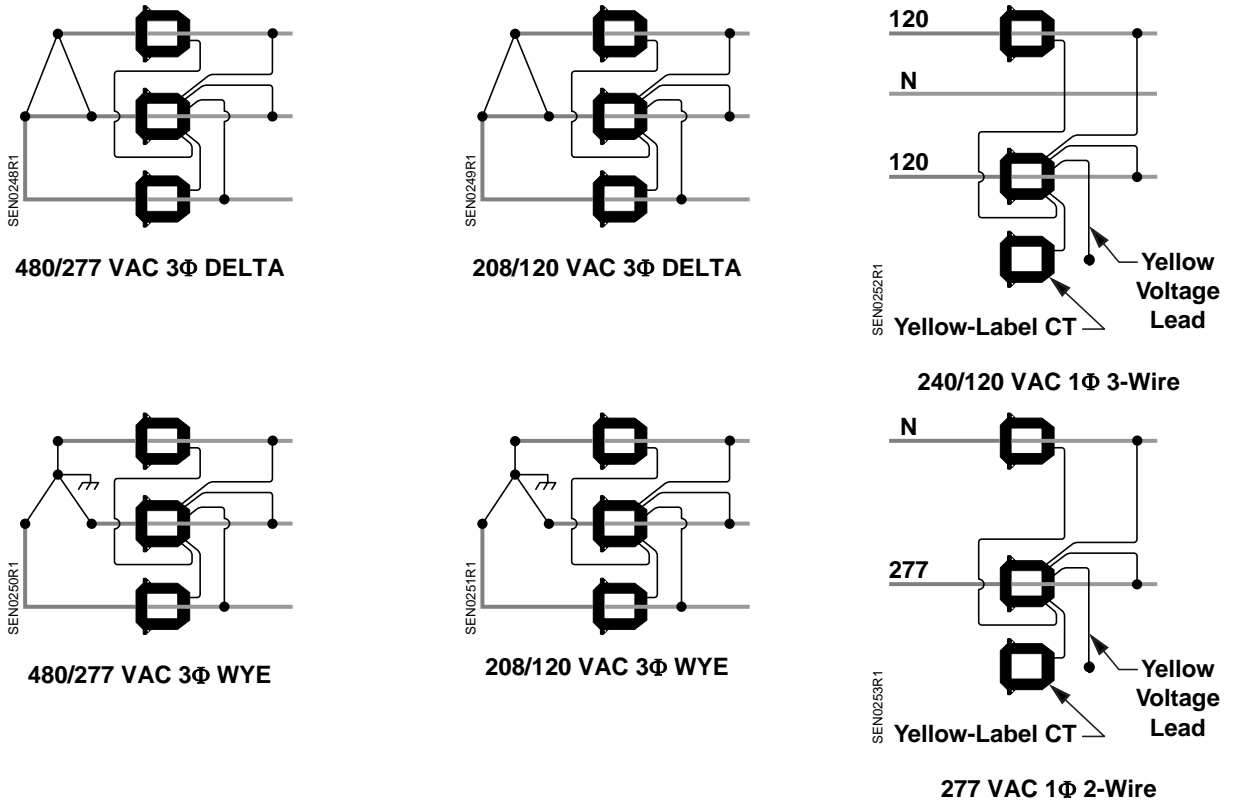


**WARNING:**

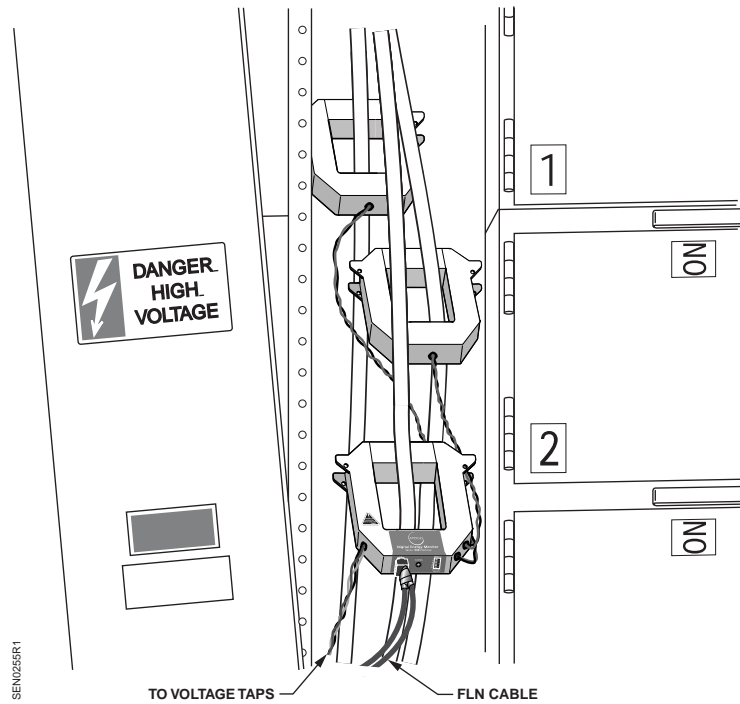
Potential electrocution hazard exists. Installing sensors in an energized motor control center or on any energized conductor can be hazardous.

Severe injury or death can result from electrical shock during contact with high voltage conductors or related equipment. During installation, disconnect and lock out all power sources.

Applications shown are suggested means of installing DEMs, but the installer must make sure the installation complies with all national and local codes. Do *not* attempt installation unless you are familiar with codes, standards, and proper safety procedures for high-voltage installations.



**Figure 2. Valid DEM Electric Power Applications.**



**Figure 3. Typical DEM Installation.**

## Instructions

- Before installing CTs, set FLN address switches per DEM Equipment Schedule as follows:



**WARNING:**

For safety reasons, set these switches *before* you install the CTs on the power conductors.

- Verify that each device has a unique address. If a DEM address conflicts with another FLN device address, neither device communicates properly.

**NOTE:** The FLN device address is used to add the DEM to the field panel database.

- Figure 4 shows all possible FLN address switch block settings. On determining which FLN address to use for DEM, locate the switch block corresponding to that address number (0 to 31). Set the DEM address switch block according to the FLN address switch block in Figure 4.
- If the DEM Equipment Schedule does not specify any FLN addresses, record the selected DEM address settings on the schedule.

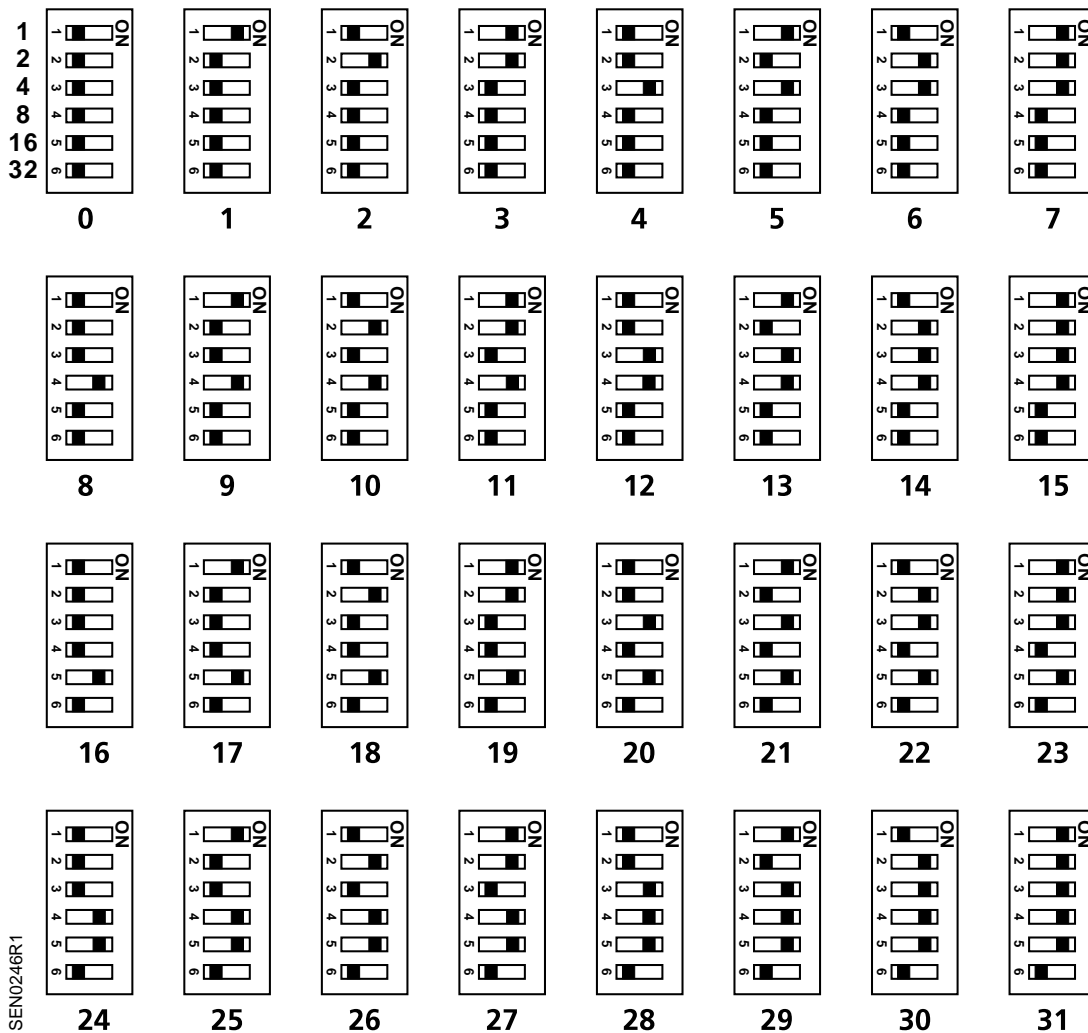


Figure 4. Setting the FLN Address Switch.

2. Disconnect power and lock out all power sources during installation.



**WARNING:**

To avoid personal injury, DO NOT connect voltage inputs live.

3. Mount CTs on conductors as follows:
  - a. Open the CTs.
  - b. Place CTs around power cables to be monitored.
  - c. Close CTs (Figure 5).



**CAUTION:**

DEMs are rated for use at 50 to 60 Hz. Exposure to extreme harmonics from Variable Frequency Drives or similar sources may permanently damage the product. Failure to follow these instructions can result in overheating and permanent equipment damage.

- d. Orient red-label CT so that LED can be seen to verify proper operation, and so that the FLN address switch box is accessible (Figure 5).

**NOTE:** DEM automatically detects phase reversal. It is not necessary to orient a particular side of each CT toward the load.

4. Connect red voltage lead to 3-phase conductor that is monitored by the red-label CT (Figure 5).

**NOTE:** Wire voltage leads so the device has continuous power. For example, if there is a disconnect in the circuit, such as a breaker, switch, or contact that periodically opens, connect the voltage leads upstream of these devices to avoid intermittent power loss to the DEM. If the monitored power feeds lose power, the DEM shuts off. This will cause a device failure alarm to appear at the Insight<sup>®</sup> workstation which indicates a loss of communication with the FLN device.

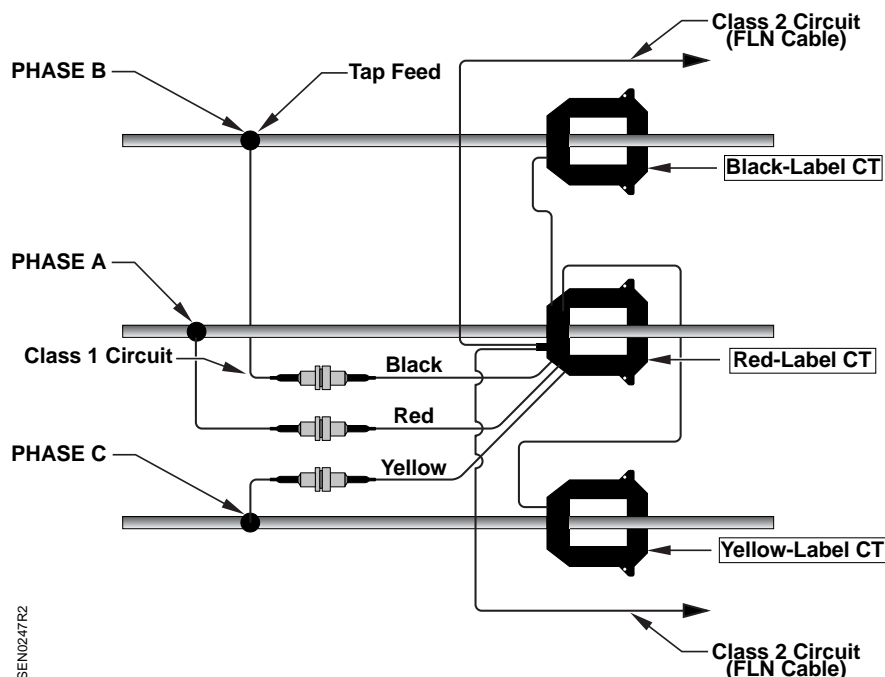


Figure 5. Wiring FLN Devices to the Electrical Utility Panel.

5. Connect remaining two voltage leads in any order, but make certain the color of each voltage lead matches the color on its corresponding CT label. Figure 6 shows several voltage tap suggestions.

To avoid confusion and possible incorrect wiring (especially when using multiple voltage taps), use a consistent color scheme for wiring. Table 1 shows industry standard color conventions for wiring the DEM to 208V and 480V conductors. If using another color convention where the meter is installed, use that convention for wiring consistency.

**Table 1. Suggested Color-Coding Conventions.**

Phase	DEM	208 Volt Power	480 Volt Power
A	Red	Black	Brown
B	Black	Red	Orange
C	Yellow	Blue	Yellow

6. Record conventions (color-coding) for local wiring in Table 2.



**WARNING:**

To avoid confusion, potential injury, and an incorrect meter installation, use the local color convention consistently, especially where multiple meters share a voltage tap.

**Table 2. Local Wiring Color-Coding Conventions.**

Phase	DEM	208 Volt power	480 Volt power
A	Red		
B	Black		
C	Yellow		

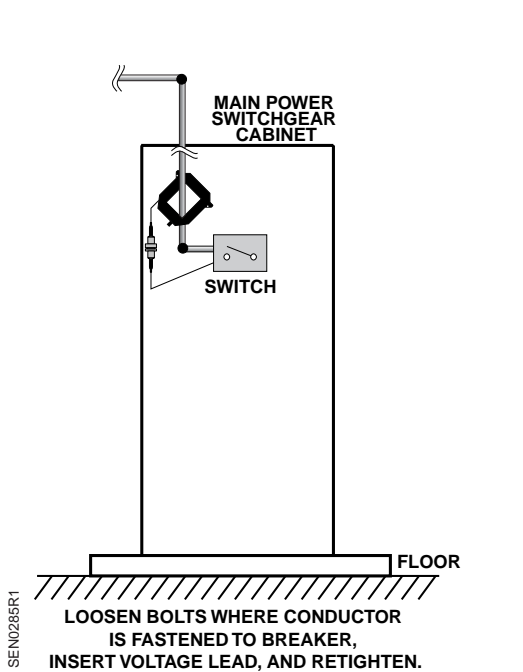
7. Mechanically secure FLN cable where it enters electrical utility panel.



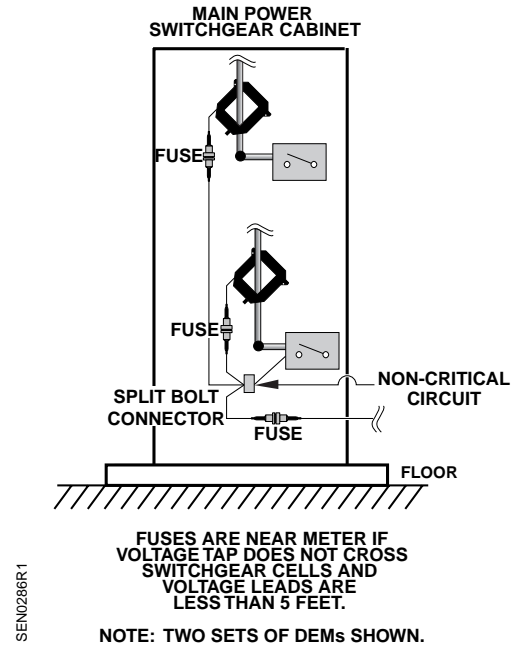
**WARNING:**

- The FLN cable within electric panels and switchgear should be jacketed, shielded, twisted pair wire BELDEN 1120A. The jacket insulation rating should be 600V.
- DO NOT connect FLN cable to field panel yet.

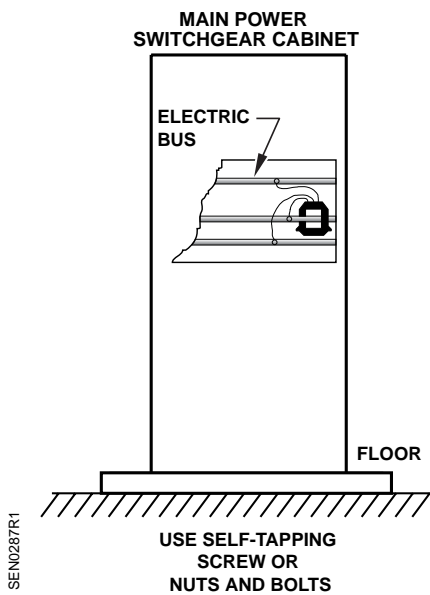
**NOTE:** Each CT shown in Figure 6 is the primary (red) CT of the DEM's three-CT set. Only one is shown for clarity.



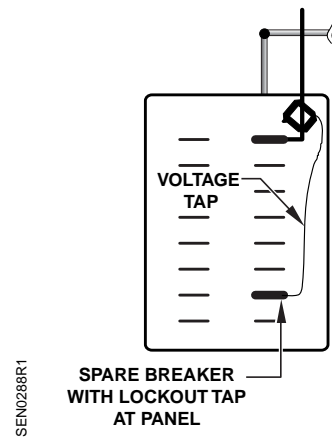
**Example 1 – Local Voltage Taps into the Monitored Circuit.**



**Example 2 – Shared Voltage Taps Combine Taps into a Single Spare Circuit.**



**Example 3 – Bus Tap.**



**Example 4 – Panel Location with Voltage Tap at Spare Breaker.**

**Figure 6. Examples of Voltage Taps.**

8. Wire FLN cable only to DEM (using daisy-chain method):



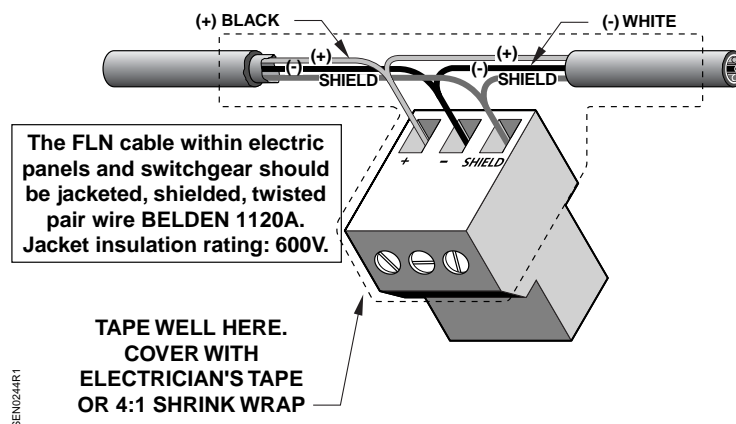
**WARNING:**

At this time, **DO NOT** connect FLN cable to FLN trunk. Doing so may damage FLN devices or cause personal injury.

- a. Remove FLN connector from red-label CT and wire FLN cable to FLN connector. Connect positive (+), negative (-) wires to FLN connector (Figure 7). Keep length of exposed wire to a minimum.
- b. For the DEM 1000, connect the SHIELD wire to the FLN connector (Figure 7).

For the DEM 2000, **DO NOT** connect the SHIELD wire to the FLN connector. Instead, ground the SHIELD wire to the electric utility panel near to where it enters the panel (Figure 8). To comply with FCC wiring guidelines for emission control and per standard wiring practices, tie back the shield of the incoming cable to avoid ground loops. Make certain the shield conductor is completely covered (Figure 8) to avoid inadvertent contact with high voltage.

- c. Tape or shrink wrap all FLN wire terminations and insulate any other exposed FLN wiring. Make certain insulation complies with local and national electrical codes.
- d. Plug terminal block back into red-label CT, and mechanically secure FLN wire terminations to DEM to prevent accidental removal.



**WARNING:**

- Carefully insulate all FLN lines, including shield, to prevent accidental contact to high voltage conductors.
- After wiring FLN cable, remove all scraps of wire or foil shield from electrical utility panel.

Figure 7. Connecting Positive and Negative Wires to FLN Connector and DEM 1000 (Shield) Wiring.



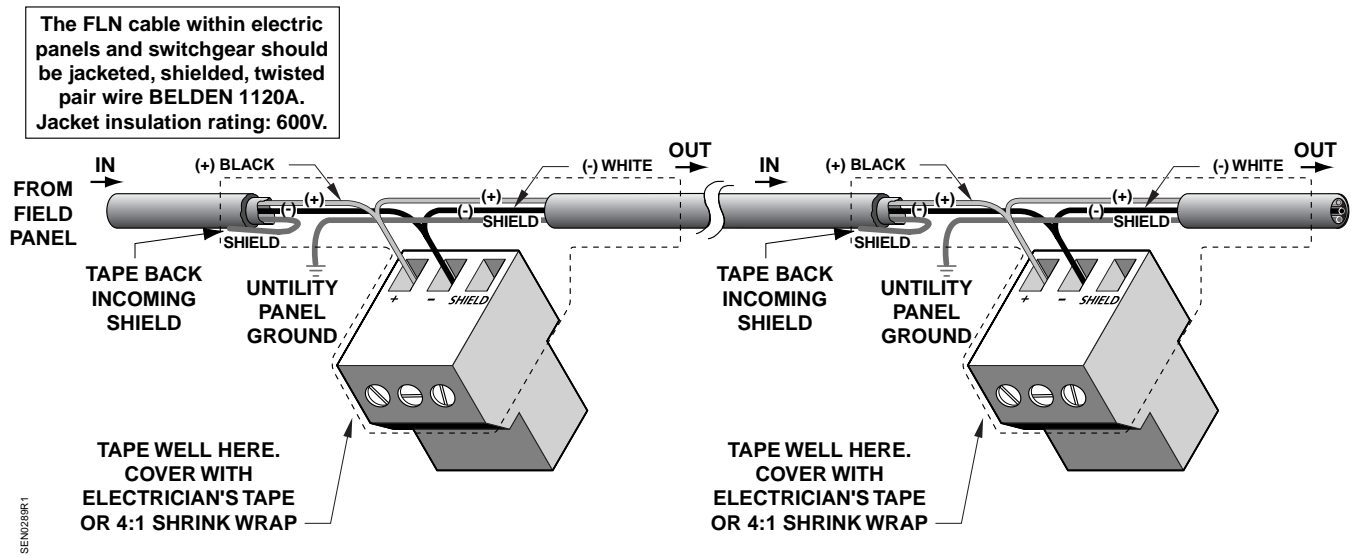


Figure 8. DEM 2000 (Shield) Wiring.

9. Energize the DEM. It is powered through the voltage taps.
10. Verify proper DEM operation. For normal operation, the BST LED blinks green slowly (about 1 second on and 1 second off). If DEM operation is not normal, see the *Possible Installation Problems* section in this document.
11. Close the electric equipment housing.
12. With a voltmeter, check for high voltage. There should be no significant voltage (no more than 5V AC or DC) from either FLN leg to ground. If voltage is higher than 5V, check for incorrect wiring.



**WARNING:**

To avoid personal injury or damage to FLN trunk devices, verify no significant voltage (no more than 5V) exists on the FLN. The DEM is designed to be located inside high voltage switchgear. It measures electrical use, and connects directly to the FLN.

13. If Step 12 passes successfully, *then* connect the DEM FLN cable to the field panel FLN trunk connection. The installation is complete.

## Possible Installation Problems

Table 3 lists problems that may occur during installation.

**Table 3. Possible Installation Problems.**

<b>BST LED Status</b>	<b>Solution</b>
LED off.	Check fuses and voltage connections. DEM is powered by the voltage connections. LED should blink regardless of CTs, FLN connections, and DIP switch setting.
LED on and <i>not</i> blinking.	Unit is defective. Replace it.
LED blinks red quickly.	If the LED blinks quickly (approximately 5 blinks in 2 seconds), the current rating for the DEM is too low. Use a DEM with a larger current rating.
LED blinks red slowly.	If the LED blinks slowly (approximately 1 blink in 2 seconds), either: <ul style="list-style-type: none"><li>• CTs are not installed on the correct conductors and must be correctly reinstalled.</li><li>• Load's Power Factor is less than 0.5. This is OK; take <i>no</i> action.</li></ul>

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