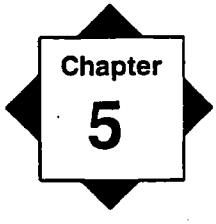


Interpreting Test Results

This chapter discusses various factors to consider when interpreting results of tests performed with the EBITE.

This chapter also explains that AVO International maintains a database of cell impedance values for many battery types and makes at various temperatures, applications, and cell age. This information is available from AVO International upon request.

Overview

EBITE measurements should be made a part of a battery maintenance program with readings taken and recorded semiannually (that is, approximately every six months).

While cell impedance can be an indication of an unhealthy cell, there are other factors that must be considered when interpreting the results of tests performed with the EBITE. For example, a change in cell impedance is not necessarily due to degradation of the cell. Impedance shifts can be caused by:

- Temperature
- State of charge
- Load conditions
- A combination of all three factors

These conditions should be monitored and recorded before making measurements. A large difference in the impedance of an individual or group of cells indicates a potential problem and warrants additional investigation.

Short-Term Interpretation

Impedance readings for individual cells can be used in the short term to compare with the average impedance reading for the entire battery. Individual cell values that vary by more than ±20 percent of the battery average typically indicate a problem with that cell. Additional investigation of that cell is recommended, including a verification of intercell connections and a load cycle test.

Long-Term Interpretation

Impedance readings for the entire battery can be used in the long term to determine the need for replacement. Battery cell impedance values should be recorded and compared to previous readings to determine the position of the cell on the curve of impedance versus cell life.

A sample curve for a generic lead-acid cell is shown in Figure 12. Curves may differ for other manufacturers and battery chemistries, such as nickel-cadmium. AVO International maintains a database of cell impedance values for many battery manufacturers at various temperatures, applications, and cell age.

✓ ***NOTE: This information is available from AVO International upon request. Call (215) 646-9200.***

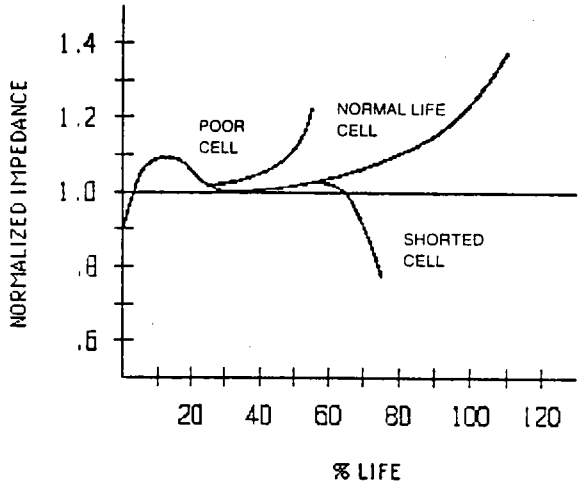


Figure 12: Generic Curve of Impedance Cell Life

Temperature Corrections

The internal impedance of a cell is inversely influenced by temperature. In addition, the degree of influence depends on battery type and length of exposure to the present ambient (or room) temperature.

Flooded battery types have a significant thermal mass and are slow to react to changing ambient temperatures. The actual internal cell temperature can be measured by inserting a thermometer into the cell via a fill tube or vent cap to determine the temperature present during impedance testing.

A suggested correction factor for impedance values of flooded lead acid cells is shown below:

$$Z_b \text{ @ } 77\,^\circ\text{F} = \frac{0.008\,(Z_m)}{(T + 30)^{-0.520}}$$

where:

Z_b = corrected battery impedance to 77 ° F

Z_m = measured impedance value

T = measured temperature value in °F

Valve-regulated or sealed cell technology is relatively new and temperature response may differ among battery vendors and electrolyte types. Gel style cells have a different temperature response curve than the starved-electrolyte or absorbed electrolyte types. If temperature correction is required, contact the battery manufacturer for this data, or contact AVO International for assistance.

Setting Options

This chapter explains how to set options that control the operation of the EBITE transmitter and receiver.

Overview

When you first receive the EBITE, default options are already set that control the operation of the transmitter and the receiver. These default options can be changed as needed.

Setting Options in the Transmitter

Transmitter options that you can set include:

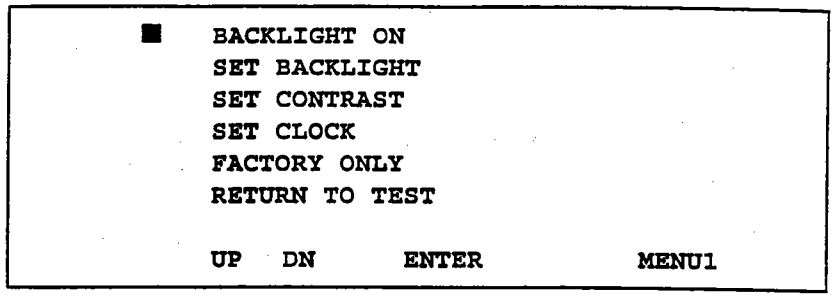
- Turning the backlight on and off so that the transmitter screen does or does not light up when the instrument is powered on
- Adjusting the brightness of the backlight
- Adjusting the screen contrast
- Setting the clock

Turning the Transmitter Backlight On and Off

To turn the transmitter backlight on or off so that the transmitter screen does or does not light when the instrument is powered on:

✓ *NOTE: If the transmitter has just been powered on and the display shows "DATA IS PRESENT", refer to Chapter 3, "Step 5: Connecting the EBITE to the Battery" for the procedures you need to access the Transmitter Menu 1.*

1. **Press the F key to access the transmitter Menu 2.**



2. **Press the UP ARROW or DOWN ARROW key to select Backlight On. Then press the ENTER key.**

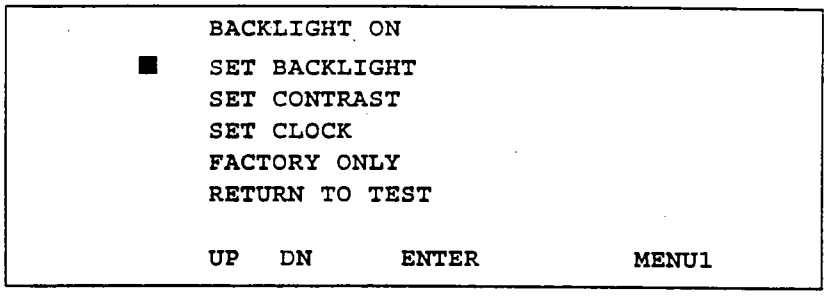
   The backlight toggles on and off.

Adjusting the Transmitter Backlight

If the transmitter backlight is turned on, you can adjust the brightness.

✓ ***NOTE: If the transmitter has just been powered on and the display shows "DATA IS PRESENT", refer to Chapter 3, "Step 5: Connecting the EBITE to the Battery" for the procedures you need to access the Transmitter Menu 1.***

1. **Press the F key to access the transmitter Menu 2.**



2. **Press the UP ARROW or DOWN ARROW key to select Set Backlight. Then press the ENTER key.**

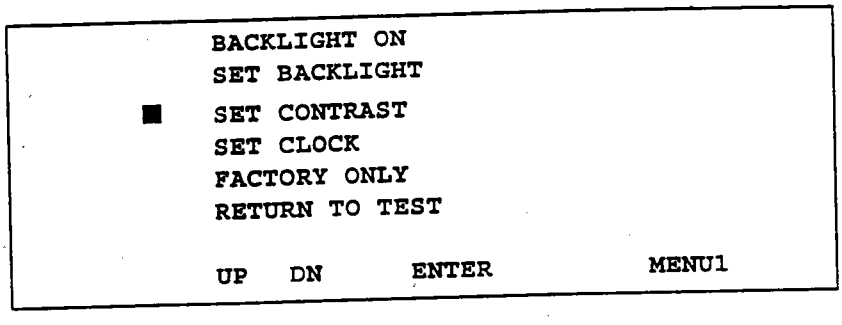
3. **Press the UP ARROW or DOWN ARROW key to adjust the brightness. Then press the ENTER key.**

   The backlight is adjusted.

Adjusting the Transmitter Screen Contrast

To adjust the contrast of the transmitter screen:

1. **Press the F key to access the transmitter Menu 2.**



2. **Press the UP ARROW or DOWN ARROW key to select Set Contrast. Then press the ENTER key.**

3. **Press the UP ARROW or DOWN ARROW key to adjust the contrast. Then press the ENTER key.**

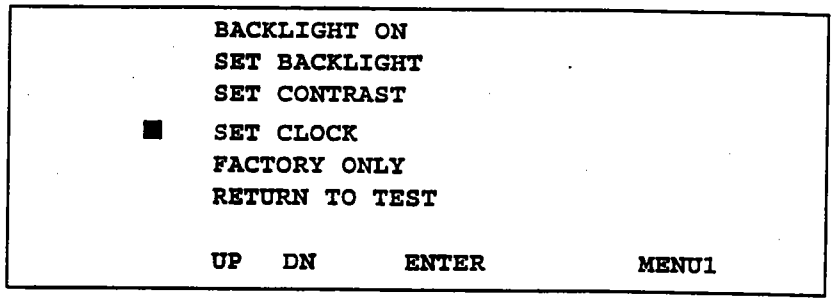
   The contrast is adjusted.

Setting the Transmitter Clock

To set the time and date in the transmitter:

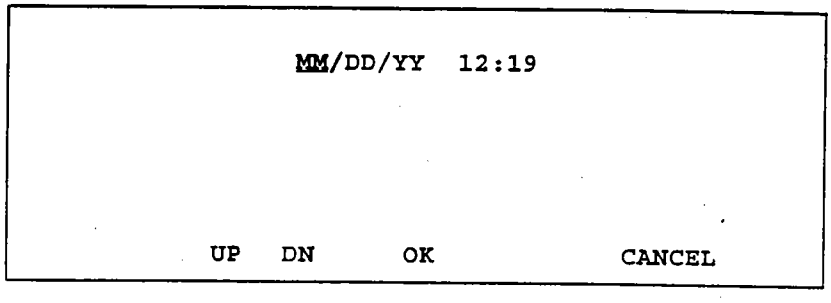
✓ *NOTE: If the transmitter has just been powered on and the display shows "DATA IS PRESENT", refer to Chapter 3, "Step 5: Connecting the EBITE to the Battery" for the procedures you need to access the Transmitter Menu.*

1. **Press the F key to access the transmitter Menu 2.**



2. **Press the UP ARROW or DOWN ARROW key to select Set Clock. Then press the ENTER key.**

   The time and date as they are now set in the transmitter are displayed. The month is automatically selected.



3. **If you want to change the month, press the UP ARROW or DOWN ARROW key until the month is set correctly. Then press the ENTER key.**

   Pressing the ENTER key moves the cursor from the month field to the day, year, hour, and minutes fields.

4. **Set the day, year, hour, and minutes as needed.**

✓ *NOTE: The EBITE uses military time. That is, it uses a 24-hour clock. For example, 3:15 pm would be displayed as 15:15.*

5. **When you are finished setting the date and time, press the ENTER key as needed so that the minutes field is selected. Then press the ENTER key again.**

   The transmitter clock is set.

Setting Options in the Receiver

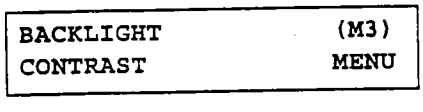
Receiver options that you can set include:

- Turning the backlight on and off so that the receiver screen does or does not light up when the instrument is powered on
- Adjusting the screen contrast
- Selecting the language in which the receiver displays information
- Setting the clock

Turning the Receiver Backlight On and Off

To turn the receiver backlight on and off so that the receiver screen does or does not light when the instrument is powered on:

1. **Press the ENTER key to access the receiver Menu 3.**



2. **Press the UP ARROW key to select Backlighting.**

   You are prompted to turn the backlight on or off.

```
ON   BACKLIGHT
OFF  ON/OFF?          MENU
```

3. **Press the UP ARROW key to turn the backlight on. Or press the DOWN ARROW to turn the backlight off.**

   The receiver backlight is set as you specified.

Adjusting the Receiver Screen Contrast

To adjust the contrast of the receiver screen:

1. **Press the ENTER key to access the receiver Menu 3.**

```
BACKLIGHT             (M3)
CONTRAST              MENU
```

2. **Press the DOWN ARROW key to select Contrast.**

   You are prompted to turn the contrast up or down.

```
UP   CONTRAST
DN                    DONE
```

3. **Press the UP ARROW key to turn the contrast up. Or press the DOWN ARROW to turn the contrast down. Select Done when the display is set as desired.**

Selecting the Receiver Language

The receiver is programmed to display information in a number of languages. English is the default; however, you can easily select another language.

1. **Press the ENTER key to access the receiver Menu 4.**

```
LANGUAGE                (M4)
SETTIME                 MENU
```

2. **Press the UP ARROW key to select Language.**

   The first two language choices are displayed.

```
ENGLISH
FRENCH                  NEXT
```

3. **Press the UP ARROW or DOWN ARROW key to select one of the languages displayed. Or press the ENTER key to view additional available languages.**

   Once you make a selection, the receiver displays screen information using the language you chose.

Setting the Receiver Clock

To set the time and date in the receiver clock:

1. **Press the ENTER key to access the receiver Menu 4.**

```
LANGUAGE                (M4)
SETTIME                 MENU
```

2. **Press the DOWN ARROW key to select Set Time.**

   The time and date as they are now set in the receiver are displayed. The month is automatically selected.

```
U    MM/DD/YY
D    15:30:00           SET
```

3. **If you want to change the month, press the UP ARROW or DOWN ARROW key until the month is set correctly. Then press the ENTER key.**

   Pressing the ENTER key moves the cursor from the month field to the day, year, hour, minutes, and seconds fields.

4. **Set the day, year, hour, minutes, and seconds as needed.**

✓ ***NOTE: The EBITE uses military time (that is, a 24-hour clock). For example, 3:15 pm would be displayed as 15:15:00.***

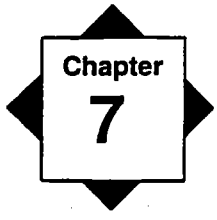
5. **When you are finished setting the clock, press the ENTER key as needed so that the minutes field is selected. Then press the ENTER key again.**

   The receiver prompts you to save the new time and date.

```
Y    SAVE NEW
N    TIME SETTING?
```

6. **Press the UP ARROW to enter Y (for yes).**

   The receiver clock is set.



Maintenance and Troubleshooting

This chapter explains:

- How to maintain the EBITE so that it remains in good operating condition
- How to interpret error messages
- What to do if repairs are needed

✓ ***NOTE: Before performing maintenance on the EBITE, read, understand, and observe all safety precautions as indicated in the "Safety Requirements" section, which starts on page x. Maintenance should be performed only by qualified personnel familiar with the hazards involved with line operated test equipment.***

WARNING:	The EBITE contains large high-voltage capacitors. During operation these capacitors could be charged up to 250 V. Normally these capacitors are automatically discharged when the instrument is switched off. However, under certain fault conditions, these capacitors may be left charged. Always use a voltmeter to check the state of the charge and wear rubber gloves as necessary when touching the capacitors and the circuits connected to them.

Cleaning and Inspecting the EBITE

WARNING: Always power off and disconnect the EBITE before cleaning it.

Since the EBITE is used in a corrosive environment, all components and test leads should be cleaned periodically (approximately every six months) with a mild detergent and a soft cloth.

CAUTION: Do not immerse the EBITE in water or allow moisture to enter the case.

Inspect measuring and source leads for corrosion and wear.

Charging the Receiver

The EBITE receiver is powered by a 4.8 V rechargeable Ni-Cd battery pack. The Ni-Cd battery charger, provided with the EBITE, is designed to recharge the battery pack in approximately one hour.

CAUTION: The Ni-Cd battery charger is recommended for Indoor Use Only.

To recharge the receiver battery pack:

1. **Turn off the receiver.**

   Refer to Chapter3, "Powering Down and Disconnecting the EBITE."

   The receiver powers down.

2. **Connect the charger 3-PIN output connector to the receiver 3-PIN mating connector.**

Refer to Chapter 2, "Receiver Controls, Connectors, and Indicators," for the location of the 3-PIN connector.

3. **Verify that the charger ac line voltage selector is set for the correct ac line voltage (115 V or 230 V 50/60 Hz).**

   The voltage selector switch is located below the ac receptacle on the charger side panel.

4. **Insert the ac power cord into the charger ac receptacle. Plug the male end of the power cord into a 115 V (230 V) 50/60 Hz outlet.**

   The yellow light on the charger turns on to indicate that charging is underway. The yellow light flashes when charging is complete.

✓ ***NOTE: If the yellow light does not turn on after approximately 10 seconds, refer to the subsection, "Replacing Fuses in the Battery Charger," contained later in this chapter.***

5. **Unplug the ac power cord from the 115 V (230 V) outlet and disconnect the charger from the receiver.**

✓ *NOTE: The receiver cannot be operated while it is being charged.*

Replacing Batteries in the Receiver

The EBITE receiver is powered by four 1.2 V AA Ni-Cd batteries. AVO International recommends that you use the exact type of batteries for replacement since they match the corresponding charger characteristics.

To replace the receiver batteries:

1. **Turn off the receiver.**

Refer to Chapter3, "Powering Down and Disconnecting the EBITE."

The receiver powers down.

2. **Disconnect all cables from the receiver.**

WARNING:	Be sure to power down the receiver and disconnect all cables before disassembling the receiver to replace the battery pack. Do not connect the charger to the receiver while replacing batteries.

3. **Lay the receiver on a flat surface with the display screen face down. Using a Phillips head screwdriver, remove the eight screws fastening the back cover and probe housing.**

4. **Carefully remove the probe housing. Remove the back cover.**

CAUTION:	Do not disturb the wrist strap, TRIGGER assembly, or wiring harness.

5. **Locate the battery pack at the base of the receiver. Unplug the battery pack from the 5-PIN connector of the receiver printed circuit board. (See Figure 13.)**

6. **Install the replacement battery pack (part number 30654).**

Be sure to align the replacement battery pack connector with the keyed mating connector on the printed circuit board.

✓ ***NOTE: Dispose of the Ni-Cd battery pack in an environmentally safe way.***

7. **Reassemble the receiver by placing the back cover over the printed circuit board.**

Ensure that the two connector mounting plates are aligned with the channels inside the back cover.

8. **Snap the back cover into place, and then fasten it using the six Phillips head screws.**

9. **Snap the probe housing into place, and then fasten it using the two Phillips head screws.**

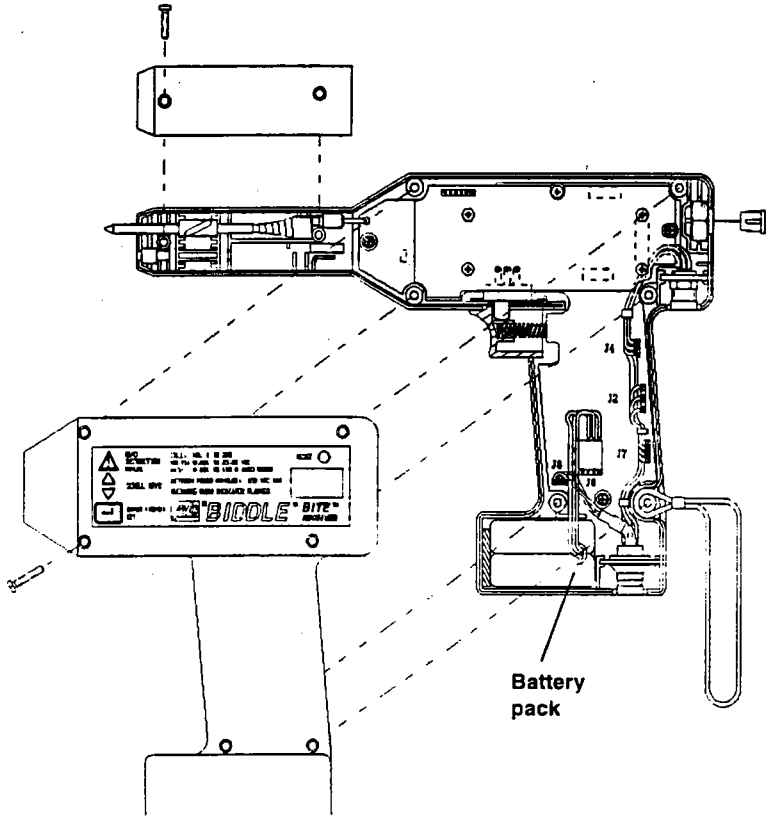


Figure 13: Replacing batteries in the receiver.

Maintaining the Charger

The receiver battery charger requires minimal maintenance; however, observe the following precautions:

- Do not immerse the charger in water or allow moisture to enter the case.
- Never operate the charger from a voltage source other than that set at the input voltage selector (115 V or 230 V 50/60 Hz) and the nameplate rating.
- Fuses should be replaced only by qualified personnel. (See the following subsections for fuse replacement procedures.)

Replacing Fuses in the Charger

The ac receptacle on the charger contains one 5mm x 20mm primary fuse and one spare. The fuse rating is 0.100 AT, 250 V.

To replace the charger fuse:

1. **Remove the ac power cord from the charger ac receptacle. If needed, disconnect the charger from the receiver.**
2. **Using a small blade screwdriver, open the fuse carrier drawer. Remove the suspect bad fuse and replace it with the exact replacement fuse as specified in *Appendix B: Replaceable Parts List.***
3. **Close the fuse carrier drawer.**

Maintaining Fuses in the Transmitter

The transmitter contains a primary fuse and two secondary fuses.

The J1 ac receptacle on the transmitter contains the following primary fuse configuration:

Catalog 246003	Single Pole 2 AT, 250 V, 1.25 in x 0.25 in
Catalog 246003-47	Double Pole 1 AT, 250 V, 5 mm x 20 mm

✓ *Refer to Chapter 2, "Receiver Controls, Connectors, and Indicators," for the location of the transmitter primary fuse.*

The output of the transmitter is double pole fused with two 15 ATM, 600 V type fuses.These secondary fuses are installed to protect the operator from possible shock and to protect the EBITE circuitry in the event of catastrophic component failure. The secondary fuses are mounted on the bottom base panel internal to the EBITE transmitter. (See Figure 14). The fuses are coordinated for fast response to a dc inrush from the battery under test.

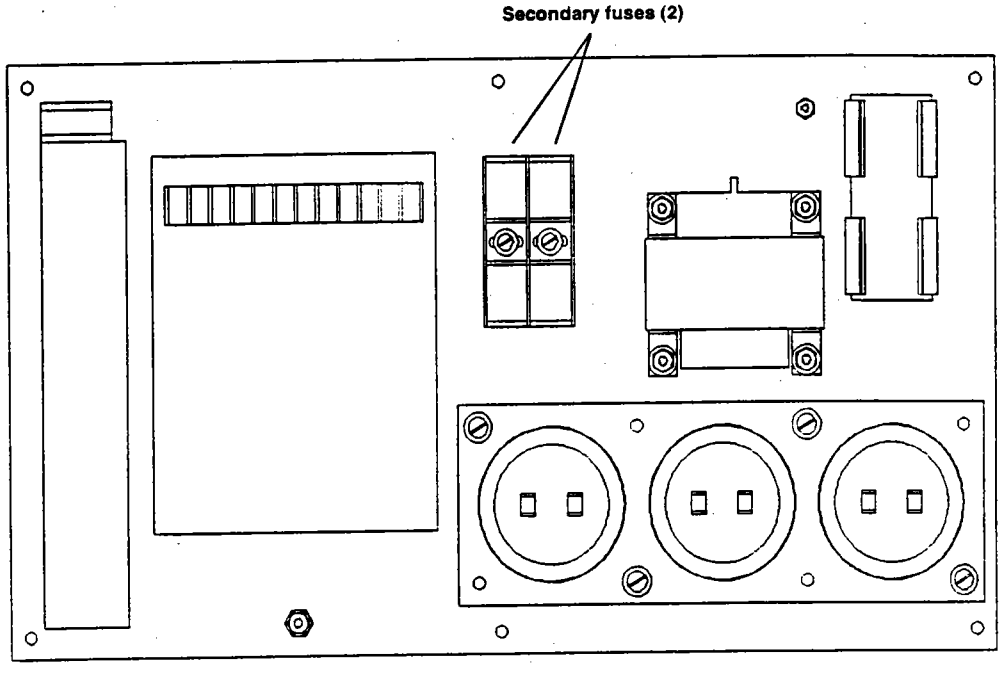


Figure 14: Transmitter secondary fuses (top view).

WARNING: Under no circumstances should any fuse be defeated or replaced with another type of fuse. Replace with the fuse types specified in *Appendix B: Replaceable Parts List.*

Verifying a Transmitter Fuse Problem

If you encounter a problem with the transmitter, check the primary and secondary fuses to see if the problem is fuse related.

Identifying a Primary Fuse Problem

To identify a primary fuse problem in the transmitter:

1. **Move the transmitter from the vicinity of the battery under test.**

2. **Verify that the transmitter ac line voltage selector is set for the correct ac line voltage (120 V or 240 V 50/60 Hz).**

   The arrow located on the connector panel directly to the left of the J1 receptacle should point to the arrow on the fuse carrier that corresponds to the proper voltage.

3. **Insert the ac power cord into the J1 ac receptacle. Then plug the male end of the power cord into the 120 V (240V) 50/60 Hz outlet.**

4. **Press the S1 power switch to the | (on) position to power on the transmitter.**

   The transmitter screen should illuminate and the buzzer should sound. If neither indication occurs, the primary fuse may be bad. Refer to the subsection, "Replacing Fuses in the Transmitter," contained later in this chapter.

Identifying a Secondary Fuse Problem

To identify a secondary fuse problem in the transmitter:

1. **Move the transmitter from the vicinity of the battery under test.**

2. **Verify that the transmitter ac line voltage selector is set for the correct ac line voltage (120 V or 240 V 50/60 Hz).**

   The arrow located on the connector panel directly to the left of the J1 receptacle should point to the arrow on the fuse carrier that corresponds to the proper voltage.

3. **Insert the ac power cord into the J1 ac receptacle. Then plug the male end of the power cord into the 120 V (240V) 50/60 Hz outlet.**

4. **Connect the current source leads to the J2 connector on the transmitter connector panel. Then short (or clamp) together the red and black clamps of the current source leads.**

5. **Press the S1 power switch to the | (on) position to power on the transmitter.**

   The transmitter screen should illuminate, the buzzer should sound, and initialization screens should be displayed.

6. **Enter the EBITE Test mode.**

   Refer to Chapter 3, "Step 5: Connecting the EBITE to the Battery" for the procedures you need to access the Transmitter Menu 1.

7. **Observe the output current reading on the transmitter screen.**

   If the displayed reading is 0.00 A and a low current message appears, the transmitter secondary fuses may be bad. See the following subsection, "Replacing Fuses in the Transmitter."

Replacing Fuses in the Transmitter

If you identify a fuse problem and suitably trained repair personnel are available to perform the operation, refer to the following subsections to replace primary and secondary fuses.

Replacing the Transmitter Primary Fuse

To replace the transmitter primary fuse:

1. **Press the transmitter S1 power switch to the O (off) position. Then disconnect the ac power cord from the 120/240 V ac outlet.**

2. **Remove the current source leads from the battery under test.**

> **WARNING:** Do not remove the EBITE transmitter current source leads from the battery until the EBITE transmitter is powered down or the current DISCON (disconnect) feature is applied. Always disconnect the current source leads from the battery before removing them from the J2 connector on the transmitter.

3. **Remove the current source leads from the J2 connector on the transmitter.**

4. **Remove the fuse carrier from the Power Module on the transmitter.**

5. **Remove the damaged fuse and replace with exact replacement spares (not provided) as specified in *Appendix B: Replaceable Parts List*. Verify with an ohmmeter that the removed fuse is indeed bad.**

   If the fuse is not bad, refer to the preceding subsection, "Identifying a Secondary Fuse Problem."

6. **Replace the fuse carrier in the Power Module on the transmitter.**

✓ ***NOTE: An arrow is located on the transmitter directly to the left of the J1 receptacle into which you insert the fuse carrier. Make sure that this arrow points to the arrow on the fuse carrier that corresponds to the voltage you want (120 V or 240 V).***

7. **Test the transmitter as described earlier in the subsection, "Verifying a Transmitter Fuse Problem."**

   If the instrument still does not respond correctly, return it to AVO International for service.

Replacing the Transmitter Secondary Fuses

To replace the transmitter secondary fuses:

1. **Move the transmitter from the vicinity of the battery under test.**

2. **Press the transmitter S1 power switch to the O (off) position to power down the transmitter. Then remove all cables from the J1, J2, and J3 connectors.**

> **WARNING:** Do not remove the EBITE transmitter current source leads from the battery until the EBITE transmitter is powered down or the current DISCON (disconnect) feature is applied. Always disconnect the current source leads from the battery before removing them from the J2 connector on the transmitter.

3. **Locate and remove three screws on the bottom of the transmitter case. Then locate and remove eight Phillips head screws on the top front panel.**

4. **Using the front panel handle and connector panel frame, carefully lift the transmitter chassis out of the case.**

5. **Locate the two pole fuse block on the base plate of the transmitter chassis (see Figure 14 shown ealier in this chapter). The fuses should be marked 15 ATM or 15 KLM.**

6. **Remove the fuses from the fuse block. Verify if one or both fuses are bad.**

7. **If needed, replace the bad fuse(s) with the exact replacement type as specified in *Appendix B: Replaceable Parts List.***

8. **Reassemble the transmitter. Then test the transmitter as described earlier in the subsection, "Verifying a Transmitter Fuse Problem."**

   If the instrument still does not respond correctly, return it to AVO International for service.

Replacing the Transmitter Clock Battery

The transmitter clock is powered by a 3.0 V lithium battery. The shelf life of the battery is one year. However, the clock battery should last several years under normal instrument operation.

If the time and date displayed on the transmitter are incorrect and cannot be reset using the Set Clock menu selection, then the lithium battery should be replaced.

✓ *NOTE: For procedures on changing the time and date, refer to Chapter 6, "Setting the Transmitter Clock."*

To replace the transmitter clock battery:

1. **Move the transmitter from the vicinity of the battery under test.**

2. **Press the S1 power switch to the O (off) position to power down the transmitter. Then remove all cables from the J1, J2, and J3 connectors.**

WARNING: Do not remove the EBITE transmitter current source leads from the battery until the EBITE transmitter is powered down or the current DISCON (disconnect) feature is applied. Always disconnect the current source leads from the battery before removing them from the J2 connector on the transmitter.

3. **Locate and remove three screws on the bottom of the transmitter case. Then locate and remove eight Phillips head screws on the top front panel.**

4. **Using the front panel handle and connector panel frame, carefully lift the transmitter chassis out of the case.**

5. **Locate the lithium battery on the main processor printed circuit board.**

   The battery is a 24.5mm disc mounted in a plastic holder. The main processor board is the larger printed circuit board mounted to the bottom of the front panel assembly. The battery holder is mounted on the back edge of this board and is accessible without further disassembly.

6. **Remove the battery from the holder. Observing correct battery polarity, replace the battery with the exact replacement type as specified in *Appendix B: Replaceable Parts List.***

7. **Reassemble and then power on the transmitter. Reset the time and date.**

   Refer to Chapter 6. "Setting the Transmitter Clock."

Loading Paper in the Built-In Printer

To load paper in the transmitter's built-in printer:

1. **Press the S1 power switch to the O (off) position to power down the transmitter.**

WARNING:	Do not remove the EBITE transmitter current source leads from the battery until the EBITE transmitter is powered down or the current DISCON (disconnect) feature is applied. Always disconnect the current source leads from the battery before removing them from the J2 connector on the transmitter.

2. **Using a screwdriver or coin, turn the locking mechanism located in the slot immediately to the right of the triangle symbol on the front panel of the transmitter. Turn one-quarter turn in either direction.**

3. **Lift off the printer paper cover.**

4. **Move the head-up lever toward the front of the transmitter to lift the roller and release the tension on the paper. Then manually roll the remaining paper out of the printer.**

5. **Remove the empty roll of paper by pulling the paper roll support spindles away from the roll.**

   The roll is released and you can discard it.

6. **Check the replacement roll of paper to see if it has a straight edge. Cut or tear approximately half an inch from each corner of the edge.**

   This makes it easier to feed the paper into the printer.

7. **Rest the replacement roll in the lid of the transmitter, feed the paper through the back entrance of the printer, between the platen and the head, until paper goes around and appears at the front of the platen.**

8. **Carefully pull out approximately six inches of paper, centering the paper in the printer.**

9. **Return the head-up lever to its original position. Replace the printer paper cover, while feeding paper through the cover opening.**

10. **Install the replacement roll in the paper roll support spindles.**

11. **Power on the transmitter.**

    The transmitter screen should illuminate, the buzzer should sound, and initialization screens should be displayed.

12. **Enter the EBITE Test mode.**

    Refer to Chapter 3, "Step 5: Connecting the EBITE to the Battery" for the procedures you need to access the Transmitter Menu 1.

13. **Press the UP ARROW or DOWN ARROW key on the transmitter to select View/Print Menu. Then press the ENTER key.**

    The View/Print Menu is displayed.

14. **Press the F key to advance the paper (form feed).**

15. **Tear off any excess paper.**

    The printer is now ready to use.

Interpreting Error Messages

Condition	Display	Explanation
Low Current	Lo_A	Receiver screen display for transmitter current measurement (I < 3.0 A)
High Current	Hi_A	Receiver screen display for ripple and transmitter current measurement (I > 15.0 A)
Overrange	OVER	Receiver screen display for dc terminal voltage, impedance, and strap resistance
Low Battery	LOW BATTERY	Receiver screen display indicating low battery pack capacity
Low Current	LOW CURRENT	Transmitter screen display for low current condition

If the EBITE Needs Repairs

AVO International offers complete repair service and recommends that its customers take advantage of this service in the event of equipment malfunction.

Ship to:

AVO International
ATTN: Repair Department
510 Township Line Road
Blue Bell. PA 19422 U.S.A.

Please indicate all pertinent information, including problem symptoms and attempted repairs. Equipment returned for repair must be shipped prepaid and insured and marked for the attention of the Repair Department.

Optional Equipment and Test Procedures

This chapter describes optional equipment that you can use with the EBITE.

This chapter also explains how to perform optional test procedures, including reversing the current source leads and sectioning battery systems to correct high or low current situations.

Optional Equipment

To accommodate testing requirements of various battery installation configurations, AVO International offers the following optional equipment.

- **Current sensor**: clamp-on CT with 0.5-in. (12.7-mm) opening for use in small cabinets. This current sensor has shrouded banana-jack connections and includes a 2.5 ft (0.76 m) lead.
- **Bar code wand**: for use with the receiver's 7-PIN connection as a means of electronically scanning cell, location, and operator identification. This option includes a wand and prompt sheets with alphanumeric characters for scanning. DOS and Windows based software for producing bar code labels using a personal computer and printer is also available as another option.
- **Extended source leads**: 30 and 40 ft (9 and 12 m).
- **Extension cable**: 20 ft (6 m) for clamp-on current sensor (CT).
- **Canvas carrying case**: for transmitter.

Custom designs also may be possible if kept within strict safety guidelines and within the operating specifications of the instrument.

WARNING:	Contact AVO International for assistance before attempting to use the EBITE in a customized design.

Optional Test Procedures

If the transmitter displays a high current or low current message, you need to modify the test procedure. See the following subsections for optional EBITE procedures.

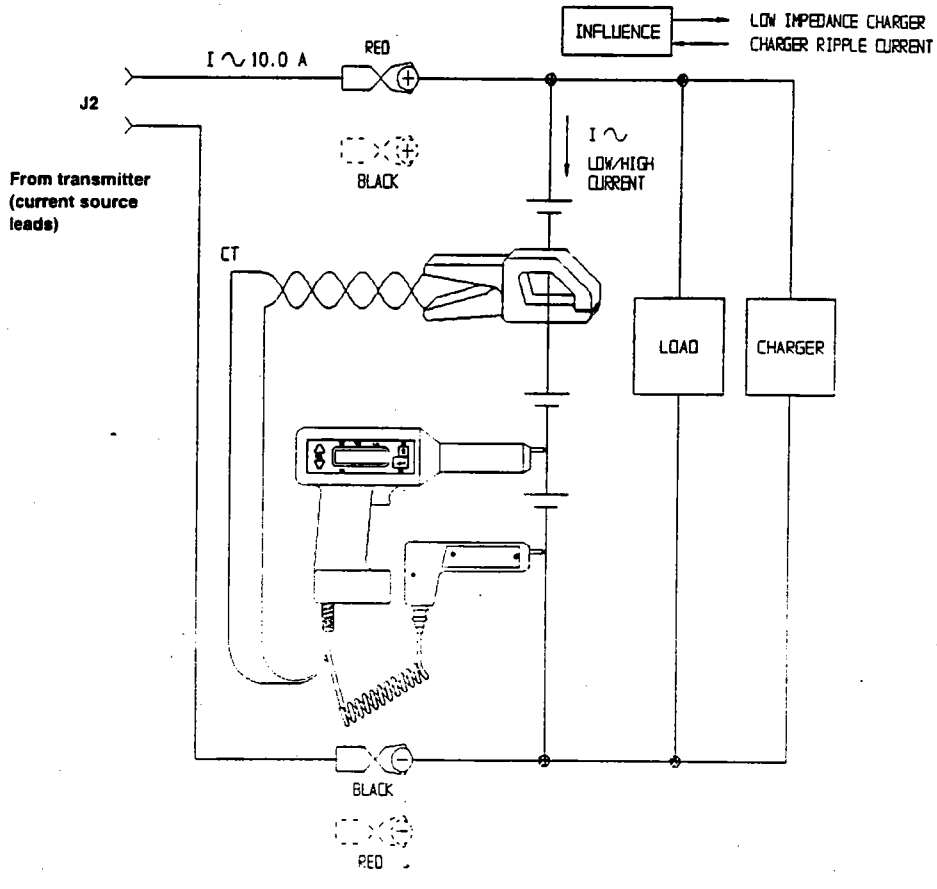


Figure 15: Reversing the current source leads on a single string of cells when a high current or low current message is displayed.

Reversing the Current Source Leads If a High Current or Low Current Message Is Displayed on the Transmitter

Figure 15 shows a battery system with a single string of cells. If a high current or low current message is displayed on the transmitter after you connect the current source leads to a similar battery configuration, try reversing the positions of the current source lead clips. Doing so shifts the test current by 180 degrees and offsets the effect of the system ripple current in the receiver. This helps ensure sufficient test current in the section of the battery string to enable computation of cell impedance or strap resistance.

Verifying the Source Current If a Low Current Message Is Displayed on the Transmitter

A low current message can be caused by high resistance in the cell string. To verify whether the magnitude of the source current is within the required limits (10 A):

1. **Press the DISCON (disconnect) switch on the transmitter.**

   This temporarily "disconnects" the transmitter and blocks the current from going to the battery.

2. **Disconnect the current source leads from the battery.**

WARNING: Do not remove the current source leads from the battery until the current disconnect (DISCON) feature is applied.

3. **Connect the current source lead clips together and continue current flow.**

   If the low current message disappears, the instrument test current is sufficient.

You can then section the battery system by connecting the current source leads across individual sections of the cell string to isolate high resistance or open cells and straps. (See "Sectioning a Battery System" for the procedures you need.)

Sectioning a Battery System

To test certain battery systems with the EBITE, you must measure individual sections, one at a time. Examples are included in the following subsections.

Sectioning a Battery System with Parallel Strings

Figure 16 shows how to start sectioning a battery system with parallel strings of cells. To test this string, you must section the system to supply the proper level of test current needed to stimulate the cell impedance or strap resistance measurements.

You may see other ripple current influences as noted in the single string of cells (see Figure 15) and you may have to interchange the position of the source current clips (that is, reverse the polarity).

WARNING:	Do not remove the current source leads from the battery until the transmitter is turned off or the current disconnect (DISCON) feature is applied. Always remove the leads at the battery connection before removing them from the J2 connection on the transmitter.

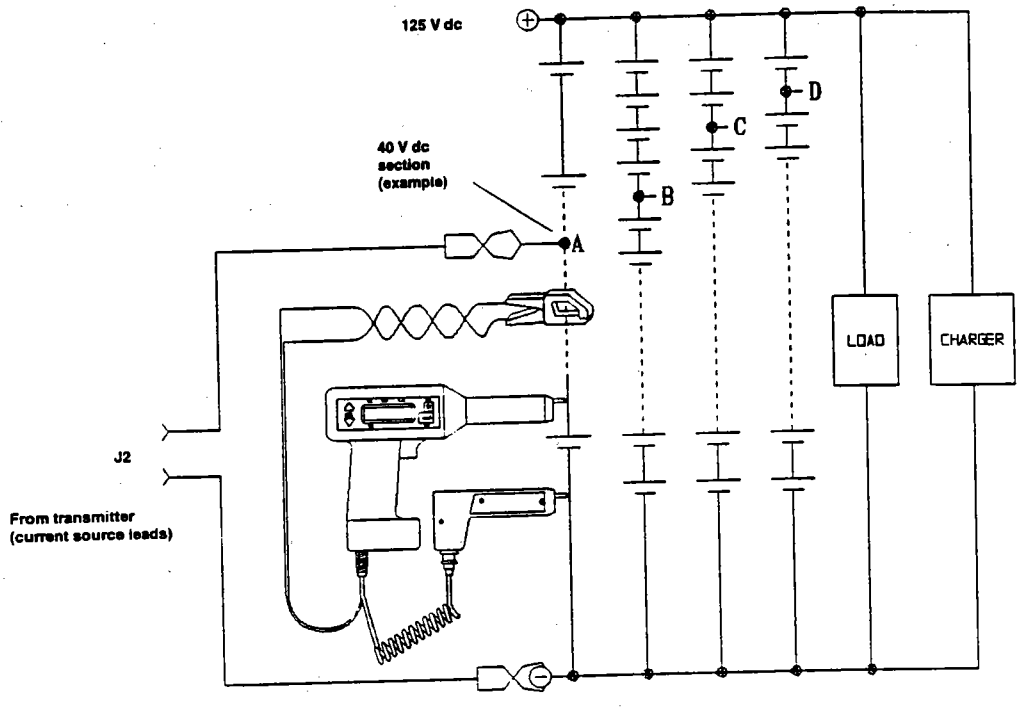


Figure 16: Sectioning a parallel string of cells.

Sectioning a Battery System with More than 250 Volts

The nonpolarized coupling capacitor in the EBITE's current source is limited to 250 V. This restricts the injection of the source current across battery systems of 250 V dc and higher.

If the battery system to be tested is more than 250 V, you must test the system in sections that are 250 V or less. It is recommended that you structure the test procedure so that the same number of sections (group of cells less than 250 V) are stimulated as the test proceeds.

Figure 17 shows a 600 V dc UPS system in which the source current leads are connected across a 200 V section of the battery string.

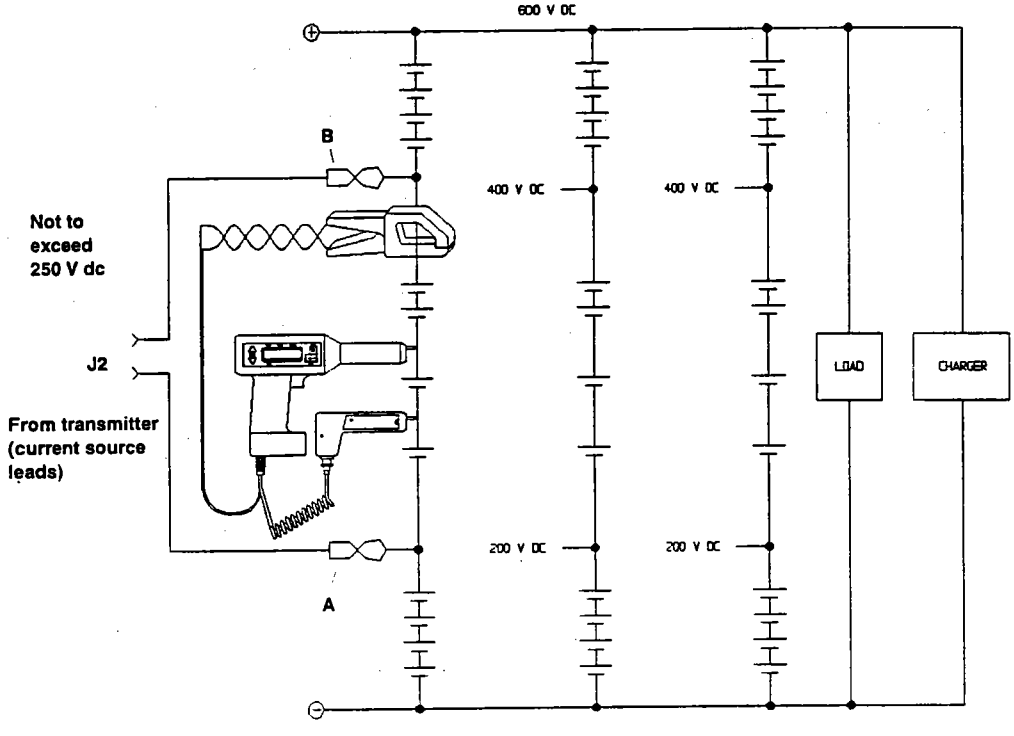


Figure 17: Sectioning a battery system with more than 250 V.

The potential between the current source leads (A and B) in Figure 17 cannot exceed 250 V. To section the string:

1. **Place the current source leads (A and B) in the string so that the potential does not exceed 250 V.**

2. **Test the cells located between connections A and B.**

3. **When you are finished testing the cells, press the DISCON (disconnect) switch on the transmitter.**

✓ ***NOTE: If you have to move the transmitter to test the next section, you may need to power down and disconnect the transmitter rather than using the DISCON function. (See "Powering Down and Disconnecting the EBITE.")***

4. **Remove the current source leads from the battery. Then move them to the next section to be tested (not to exceed 250 V).**

WARNING:	Do not remove the EBITE transmitter current source leads from the battery until the EBITE transmitter is powered off or the current DISCON (disconnect) feature is applied. Always disconnect the current source leads from the battery before removing them from the J2 connector on the transmitter. Do not leave the EBITE connected to the battery when not in use.

5. **Select Return to Test. Then press the ENTER key.**

   The current is sent to the battery and you can continuing testing.

6. **Test the section.**

   Repeat the procedure, as needed, depending on the number of sections in the battery string.

Sectioning High-Voltage UPS Batteries

Some UPS systems with voltages up to 600 V dc are designed with parallel strings of cells. To test one of these systems, position the current source leads accordingly to satisfy both the test current and the voltage limit of the EBITE.

Refer to the procedure explained in the preceding subsection, "Sectioning a Battery System with More than 250 Volts." In addition, consider the string impedance with reference to the remaining parallel string influences. Ensure that the majority of the current flows through the cells under test and not through parallel influences. (See Figure 17.)

Sectioning Noisy UPS Systems

The EBITE source current may be affected by the noise generated by the switching power supply or the invertor. In this situation, test only a few cells at a time. See Figure 17 and refer to the procedure explained earlier in the subsection, "Sectioning a Battery System with More than 250 Volts."

Technical Specifications

APPLICATION

The EBITE can test lead-acid and nickel-cadmium cells of less than 2500 Ah capacity.

Tests on most battery systems require the standard clamp-on current sensor (CT) with a 2-inch opening.

Maximum total voltage at EBITE transmitter current source connections is 250 V dc (larger battery systems can be sectioned to accommodate this specification).

ELECTRICAL

Transmitter

Supply voltage:

100 – 130 V, 50/60 Hz, 200 VA max (Cat. No. 246003)
210 – 250 V, 50/60 Hz, 200 VA max (Cat. No. 246003-47)
IEC 1010-1 Class I, Installation category II.

Source Output Current:

10 A nominal, 50/60 Hz operation
IEC 1010-1 installation category I.

Accuracy:

dc voltage ± (3% of Rdg + 1 LSD)

Maximum battery test voltage:

250 V dc at transmitter source lead terminals

Receiver

IEC 1010-1 Class II, Installation category I

Accuracy:

dc voltage ± (1 % of Rdg + 1 LSD)

ac impedance ± (5 % of Rdg + 1 LSD)

Resolution:

dc voltage
(0 - 2.5 V) 1 mV
(2.5 - 25 V) 10 mV

ac impedance
(0 - 1.000 mΩ) 1 μΩ
(1 - 10.00 mΩ) 10 μΩ
(10 - 100.0 mΩ) 0.1 mΩ

Supply:

4.8 V dc, 800 mAh, quick charge nickel cadmium battery pack

Battery pack life, full charge:

5 hours continuous

Maximum Voltage between receiver potential probes:

25 V dc

Charger

IEC 1010-1 Class I, Installation category II

Supply Voltage:

100 – 130 V, 50/60 Hz, 14 VA
210 – 250 V, 50/60 Hz, 14 VA
IEC 1010-1 installation category II

Output:

6.50 V dc @ 1.10 A dc charging (max)
9.60 V dc open circuit

Fuses

Function	Location	Type
Primary (Cat. No. 246003) Single Pole	J1, Conn. Panel	T, 2 A, 250 V 1.25 in x 0.25 in
Primary (Cat. No. 246003-47) Double Pole	J1, Conn. Panel	T, 1 A, 250 V 5mm x 20mm
Secondary Double Pole	Internal XF1, XF2	ATM 15, 600 V 10.3mm x 38.1mm
Leads (Cat. No. 246003-47) Double Pole	Source Leads	ATM 15, 600 V 10.3mm x 38.1mm
Battery Charger Single Pole	Accessory	T, 100 mA, 250 V 5mm x 20 mm

MECHANICAL

Dimensions

Transmitter Enclosure: 12 x 19.6 x 11.1 in. (H x W x D)
(30.4 x 24.3 x 28.0 cm)

Receiver Enclosure: 7.25 x 11.25 x 2 in. (irregular shape)
(18.4 x 29.2 x 5.1 cm)

Receiver Charger Enclosure: 3 x 5.25 x 3.65 in. (H x W x D)
(7.7 x 13.4 x 9.3 cm)

Weight (Total)

Transmitter: 32.9 lb (14.9 kg)

Receiver: 1.6 lb (0.72 kg)

Receiver Charger: 1.9 lb (0.86 kg)

Transmitter Display

Digital LCD meter, 240 x 64 pixel with a viewing area of 5.2 x 1.5 in. (132 x 39 mm), displays measured parameters in dark numbers on an electroluminescent background. Commercial temperature and humidity ranges for the LCD will limit the useful measurement environment.

Receiver Display

Digital LCD meter, 5 x 7 dot matrix, 2-line x 16 character, electroluminescent backlighting, 2.19 in. (55.7 mm) x .43 in. (11 mm) viewing area, displays measured parameters in dark numbers on an electroluminescent background. Contrast adjustable from menu selection. Commercial temperature and humidity ranges for the LCD will limit the useful measurement environment.

Printer

The transmitter has a built-in printer with a 4.25 in. (110 mm) printing width. Thermal paper for the printer, as currently stocked by AVO International, is listed in the Replaceable Parts List, Appendix B.

ENVIRONMENTAL

Operating temperature range: 32 to 104°F (0 to 40°C)

Storage temperature range: -4 to 131°F (-20 to 55°C)

Humidity: 20 to 90% relative humidity, noncondensing.

ACCESSORIES

- **Current source leads (transmitter to battery)**: two 14 AWG stranded copper leads with acid resistant insulation.

Wire rating:	600 V dc
Length:	20 ft (3.0 m)
Termination (transmitter):	4-pin, shrouded
Termination (battery):	Bulldog-type Mueller clips
Fuse (Cat. No. 246003-47):	15 ATM, 600 V (each conductor)

- **Current sensor:** clamp-on CT with 2-in. (50.8 mm) opening.

Wire rating:	600 V dc
CT ratio:	1000:1, 4% accuracy
Length:	5 ft (1.5 m)
Termination(transmitter):	Nonmetallic push loc 7 pin
Termination (CT):	Direct connection

- **CT Extension cable:** for clamp-on current sensor (CT).

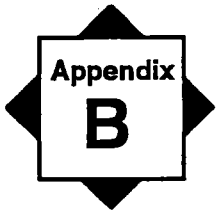
Wire rating:	300 V
Length:	6 ft (1.8 m)
Termination:	Nonmetallic push loc 7 pin, both ends

- **Accessory bag:** for receiver, charger and test leads.

- **Battery charger, Ni-Cd:** for receiver battery pack. (Refer to the technical specifications for the charger, included earlier in this appendix.)

- **Communication cable:** interconnects receiver to transmitter or personal computer serial port.

Wire rating:	300 V dc
Length:	6 ft (1.8 m)
Termination (receiver):	Nonmetallic push loc 7 pin
Termination (computer):	D-receptacle 25 pin



Replaceable Parts List

Catalog Number 246003 (60 Hz)

Replaceable Part	Part Number
ac line cord, 8 ft (2.4 m)	17032
EBITE receiver (60 Hz)	246301
EBITE transmitter	30630-1
Current source leads, 10 ft (3 m)	246310
Current source leads, 20 ft (6 m)	29386-1
Current source leads, 30 ft (9.1 m)	246330
Current source leads, 40 ft (12.2 m)	246340
Primary fuse, 2 AT, 250 V, 1.25 x 0.25 in	2567-27
Secondary fuses, 15 ATM, 600 V, 10.3 x 38.1 mm	29440-1

Catalog Number 246003-47 (50 Hz)

Replaceable Part	Part Number
ac line cord, 8 ft (2.4 m)	17032-3
EBITE receiver (50 Hz)	246301-47
EBITE transmitter	30630-2
Current source leads (fused), 10 ft (3 m)	246147
Current source leads (fused), 20 ft (6 m)	29386-2
Current source leads (fused), 30 ft (9.1 m)	246347
Current source leads (fused), 40 ft (12.2 m)	246447
Primary fuse, 1 AT, 250 V, 5 x 20 mm	2554-9
Fuse, source lead, 15 ATM, 600 V, 10.3 x 38.1 mm	29440-1
Secondary fuses, 15 ATM, 600 V, 10.3 x 38.1 mm	29440-1

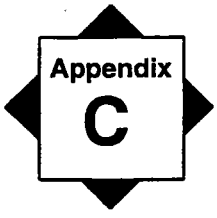
Catalog Numbers 246003 and 246003-47

Replaceable Part	Part Number
Clamp-on current sensor, CT with 0.5 in (12.7 mm) opening, 2.5 ft (0.76 m) lead	246034
Clamp-on current sensor, CT with 2.0 in (50.8 mm) opening	33863

Replaceable Part	Part Number
Extension cable for CT, 6 ft (1.8 m)	33864-1
Extension cable for CT, 20 ft (6 m)	246033
RS-232 communication cable, 6 ft (1.8 m)	30648
Data Extraction Tool For WINDOWS	33734
Single contact probe cable	29435-2
Optional Bar-Code Wand with preprinted code sheet	246201
Bar-code labeling software for WINDOWS	33506-2
Bar-code labeling software for DOS	33506-1
Battery charger (for Ni-Cd battery pack)	33497-1
Battery pack (receiver), Ni-Cd, 800 mAh	30654
Fuse (battery charger), 100 mAT, 250 V, 5 x 20 mm	2544-17
Battery (clock), Lithium disc, 200 mAh	28353
Thermal printer paper	26999
Instruction manual, EBITE	AVTM246003J
Canvas carrying case, instrument	246010
Canvas accessory bag	29996

How to Order Replaceable Parts for the EBITE

To order one or more replaceable parts for the EBITE, call (215) 646-9200. Ask for an Inside Sales Representative.



Export Data Format Specification

This specification describes the data format for the EBITE export function. This is the format a device connected to the serial port will see during the export to PC function.

HEADER INFORMATION

"Location_ID"crlf
"Ambient_Temperature"crlf
"Pilot_Temperature"crlf
"Ripple_Current"crlf
"Transmitter_Current"crlf
"Test_Start_Date_Time"crlf
"Multiplier"crlf

RECORD INFORMATION

"Cell_Id","MM/dd/yy hh:mm:ss","Cell_Imp","Strap_Imp.","Volts_DC","LOW"crlf

"Cell_Id","MM/dd/yy hh:mm:ss","Cell_Imp","Strap_Imp.","Volts_DC","LOW"crlf

.
.
.

"Cell_Id","Date_Time","Cell_Imp","Strap_Imp","Volts_DC","LOW"crlf

HEADER DEFINITIONS

"Location"	A wanded string usually indicating the location of the test site.
"Ambient_Temperature"	A wanded string usually indicating the room temperature.
"Pilot_Temperature"	A wanded string usually indicating the operating temperature of a sample cell.
"Ripple_Current"	A measured quantity indicating the measurable current before applying test current.
"Transmitter_Current"	A measured quantity indicating the combined ripple current and test current.
"Test_Start_Date_Time"	Date and Time stamp of when the test began.
"Multiplier"	A number from 1 to 9, indicating what the current was multiplied by.

RECORD INFORMATION

"Cell_Id"	will always be a null string: ""
"Date_Time"	date and time stamp of test for this cell "MM/dd/yy hh:mm:ss"
"Cell_Imp"	the cell impedance to 3 decimal places (ie. "23.012")

"Strap_Imp"	the strap impedance to 3 decimal places (ie. "00.234")
"Volts_DC"	the cell voltage to 3 decimal places (ie. "-12.654") may include minus sign if appropriate
"LOW"	indicates either low voltage or low current condition, always the null string: ""

crlf - means a carriage return and linefeed character pair are transmitted.

NOTES

In the 3 value positions (Cell Imp., Strap Imp., and Volts DC), the following special values have specific meanings as follows:

65532 (0xfffc) - This value means a low current condition occurred during the test.

65533 (0xfffd) - This value means a high current condition occurred during the test.

65534 (0xfffe) - This value means an over-range occurred for the reading.

65535 (0xffff) - This value means the test was not performed.

Since multiple tests can be stored in the instrument, multiple tests will be transmitted one after another with no pauses or break in the data flow. Each test will contain a header section where each header item is on a separate line and a record section which will have several data items per line separated by commas and

have several data items per line separated by commas and terminated in a carriage return, line feed pair. No extra spaces will be sent between tests and when all data is sent no extra characters will be provided to indicate end of transmission. End of transmission is indicated by an infinite pause.

SAMPLE

```
""
"75.0F"
"85.3F"
"2.5"
"10.8"
"11/1/94"
"Location"crlf
"Operator"crlf
"10.00"crlf
"001","11/01/94 12:00:00","23.012","00.123","-12.654","0"crlf
"002","11/01/94 12:00:00","23.012","00.123","-12.654","0"crlf
"003","11/01/94 12:00:00","23.012","00.123","-12.654","0"crlf
"004","11/01/94 12:00:00","23.012","00.123","-12.654","0"crlf
"005","11/01/94 12:00:00","23.012","00.123","-12.654","0"crlf
""
"75.0F"
"85.3F"
"2.5"
"10.8"
"11/1/94"
"001","11/02/94 12:00:00","23.012","00.123","-12.654","0"crlf
"002","11/02/94 12:00:00","23.012","00.123","-12.654","0"crlf
"003","11/02/94 12:00:00","23.012","00.123","-12.654","0"crlf
"004","11/02/94 12:00:00","23.012","00.123","-12.654","0"crlf
"005","11/02/94 12:00:00","23.012","00.123","-12.654","0"crlf
```

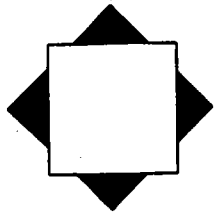
Appendix D

Glossary

	Use only in accordance with this Instruction Manual.
--.--	Transmitter screen display for over current condition.
cell	A receptacle containing electrodes and an electrolyte either generating electricity by chemical action or for use in electrolysis.
EBITE	Battery Impedance Test Equipment. Patent No. 4,697,134.
equivalent circuit	An arrangement of circuit elements that has characteristics, over a range of interest, electrically equivalent to those of a different circuit or device (used for convenience of analysis).

float	A method of operation for storage batteries in which a constant voltage is applied to the battery terminals sufficient to maintain an approximately constant stage of charge.
Hi_A	High current—receiver screen display for ripple and transmitter current measurement (I > 15.0 A).
LCD	Liquid crystal display.
Lo_A	Low current—receiver screen display for transmitter current measurement (I < 3.0 A).
LOW BATTERY	Receiver screen display indicating low battery pack capacity.
LOW CURRENT	Transmitter screen display for low current condition.
OVER	Overrange—receiver screen display for dc terminal voltage, impedance, and strap resistance.
ripple	The alternating component whose instantaneous current values are the difference between the average and instantaneous values of a pulsating unidirectional current.
rms	Root mean squared.
stationary battery	A storage battery designed for service in permanent battery location.

sulfating	Deposit formation of a white scale containing lead sulfate (on the plates of a storage battery).
UPS	Uninterrupted power supply.



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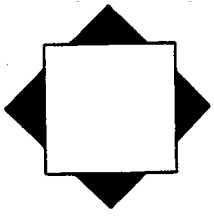

Warranty

Products supplied by AVO International are warranted against defects in material and workmanship for a period of one year following shipment. Our liability is specifically limited to replacing or repairing, at our option, defective equipment. Equipment returned to the factory for repair must be shipped prepaid and insured. This warranty does not include batteries, lamps or similar items, where the original manufacturer's warranty shall apply. We make no other warranty. The warranty is void in the event of abuse (failure to follow recommended operating procedures) or failure by the customer to perform specific maintenance as indicated in this guide.