MIDTRONICS

Battery Management Innovation

Celltron *Essential*™

Stationary Battery String Analyzer
CTE-1000 and CTE-1500 (Kit)

INSTRUCTION MANUAL

Table of Contents

Introduction

This manual provides descriptions and operating instructions for the Midtronics Celltron *Essential* CTE-1000 and CTE-1500 stationary battery string analyzers. It helps you understand the parts of the analyzer and how to use it to test batteries.

⚠ Safety instructions

Important

Read the instructions below before you operate the analyzer.

Guidelines

To avoid electric shock when testing batteries, follow your company safety practices and these guidelines:

- Wear safety glasses or a face shield.
- Wear protective rubber gloves.
- Wear a protective apron or shop coat.
- Perform service work only for which you have been trained.
- Do not disconnect battery cables from power systems without authorization for the length of time needed to complete testing.
- Avoid placing yourself into a circuit.
- Avoid contact with frame racks and adjacent hardware that may be grounded while in contact with the battery.

About the analyzer

Terminology

The analyzer and manual use the term “jar,” an international term for “battery.” A string is a series of jars connected together by straps to provide power as a whole.

Accessories

Table 1 lists the accessories that come with the CTE-1000.

Table 1. CTE-1000 accessories

Accessory	Part Number	Description
Softcase	C015	Soft vinyl case to hold the analyzer and cables.
DuraProbes	C087	Cables with 5-inch probes and 2-inch openings to attach to large battery terminals

Table 2 lists the accessories that come with the CTE-1500.

Table 2. CTE-1500 accessories

Accessory	Part Number	Description
Softcase	C015	Soft plastic case to hold the analyzer and the accessories in this table.
Midtronics Printer	A087	Handheld printer with an infrared light to accept test results for printing.
DuraProbes	C087	Cables with 5-inch probes and 2-inch openings to attach to large battery terminals
Replacement tips (DuraProbes)	C069	Four tips and two safety caps to replace the tips and caps on the DuraProbes.

Table 3 lists additional accessories for the analyzer.

Table 3. Additional accessories

Accessory	Part Number	Description
Amp test connector cable	C056	Cable with connector to an amp cable that connects to the battery terminals.
Mueller clamps	C052	Cables with 2-inch clamps and 1-inch openings to attach to small battery terminals.
MiniProbes	C046	Cables with 4-inch probes and ⅛-inch tips for instant contact with small battery terminals.
Replacement tips (MiniProbes)	C059	Eight tips and two safety caps to replace the tips and caps on the MiniProbes.
Extenders (DuraProbes)	C075	Thirty-six-inch plastic extenders.
Hardcase	C057	Hard plastic case to hold the analyzer and the accessories in this table.
Temperature sensor	C058	Sensor with infrared light to measure jar temperature.
DuraClamps	C088	Cables with 5-inch clamps and 2-inch openings to attach to large jar terminals.

For information about ordering these parts as replacements or additions to your analyzer, contact Midtronics Customer Service.

Chapter 1: Description

The Celltron *Essential* is a stationary jar string analyzer that measures the conductance and voltage of individual or strings of single-cell (2 V), three-cell (6 V), and six-cell (12 V) stationary, lead-acid jars to help identify those that

- Are good
- Are serviceable
- Need to be replaced

Specifications

Measurements

The analyzer measures the status of a jar in voltages and conductance values. It displays conductance values in siemens (S). Ampere hours (Ah) are a typical measurement of jar capacity; however, they are difficult to measure without knowing the load the jars supply power to.

Midtronics recommends that you use a reference value to compare the conductance value to the test results. A reference value is a typical conductance value for the type of jars you are testing. For more information about determining a reference value, refer to "Chapter 2: Pre-testing."

Test capability

The analyzer tests jars that are providing power to a load (in-service) or those that are not providing power (not in-service).

Test range

The analyzer has an operating range of 0 to 9999 S. This range includes jars that have about 5 to 2400 Ah of reserve capacity.

Data storage

The analyzer can store 480 test results for a string at one time. Tables 4 and 5 show the number of jars you can test depending on the number of jar posts and straps that you test.

Table 4. Test results when testing jars only

# of jar posts	# of jars you can test
2	480
4	240
6	160

Table 5. Test results when testing jars and straps

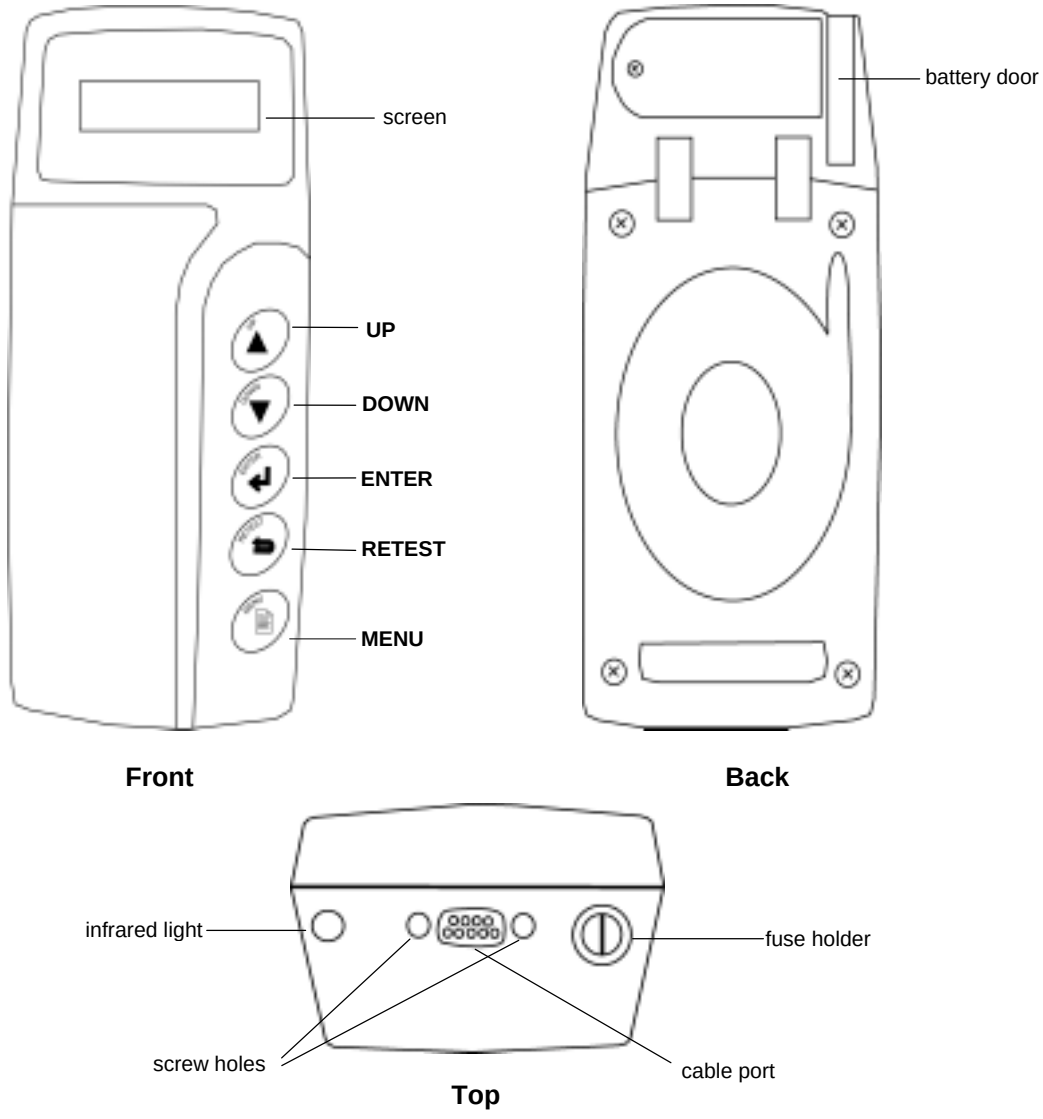
# of jar posts	# of straps	# of jars you can test
2	1	240
4	2	120
6	3	80

Parts of the analyzer

Panels

The panels allow you to use, care for, and hook up the analyzer. Figure 1 displays the front, back, and top panels of the analyzer and their parts.

Figure 1. Front, back, and top panels



Parts on the panels

Table 6 describes the parts of the panels.

Table 6. Parts of the panels

Part	Description
Screen	Displays menus, options, and test results.
UP	Enables you to scroll up in a menu or number selections.
DOWN	Enables you to scroll down in a menu or number selections.
ENTER	Moves to the option you select or enters number selections.
RETEST	Opens a menu with options to retest the jar or strap you just tested.
MENU	Turns the analyzer on and off.
Battery door	Covers the analyzer battery compartment.
Infrared light	Transfers data from the analyzer to the printer.
Screw holes	Enables screws to anchor the cable to the analyzer.
Cable port	Connects the probes or clamps to the analyzer.
Fuse holder	Houses the fuse for the analyzer.

Menu options

Menus

The analyzer displays menus on the screen that you can select options from before, during, and after testing. You can access options from the MAIN menu.

MAIN Menu

To access the main MENU, press and hold the **MENU** button. The MAIN menu displays these options:

1. SET PARAMETERS
2. TEST BATTERY
3. VIEW PARAMETERS
4. PRINT RESULTS
5. VIEW RESULTS
6. CHANGE REF.
7. UTILITIES

Notes: The MAIN MENU option is available on some menu screens to enable you to return to the MAIN menu.

If you turn off the analyzer while in the UTILITIES menu, it will be the first menu displayed when your turn on the analyzer. To return to the MAIN menu, scroll to I. MAIN MENU and press **ENTER**.

1. SET PARAMETERS menu

The SET PARAMETERS menu allows you to set values for a string so it is ready to test. The screen displays these options:

1. AUTO START
2. JARS ONLY
3. TEMP
4. REF
5. VOLTS/JAR
6. POSTS/JAR
7. EDIT STRING NAME
8. MAIN MENU

Table 7 describes these options.

Table 7. SET PARAMETERS menu options

Option	Description
AUTO START MANUAL START	• AUTO START begins a test automatically when you connect to the jar • MANUAL START prompts you to press ENTER to begin a test after you connect to the jar The default is AUTO START.
JARS ONLY JARS AND STRAPS	• Jars (JARS ONLY) • Cells and inter-cell connections of the string (JARS AND STRAPS) The default is JARS ONLY.
TEMP	Temperature of the string. The analyzer compensates for temperature since conductance measurements change with jar temperature. The analyzer measures an absolute conductance value. However, it uses the TEMP value to adjust the reference value you enter in REF. The percent is compensated to 25 °C (77 °F). Compensation is adjusted at 0.7% per degree Celsius between 0 °C and 35 °C. The default is 25 °C (77 °F).
REF	Reference value in siemens. The default is 2000 S. For more information about reference values, refer to "Determining a reference value."
VOLTS/JAR	Number of volts for a jar (2, 6, or 12 V). The default is 2 V.
POSTS/JAR	Number of posts for a jar (2, 4, or 6 posts). The default is 2 posts.
EDIT STRING NAME	Name of the string you can edit with numbers or characters.

You must set the values for these options for each string you test. If you do not set these options for a string, the analyzer tests the string against the last setting.

2. TEST BATTERY option

The TEST BATTERY option allows you to test a string after you connect the cables to the jar posts. If you do not have the cables connected to the jar posts before you select TEST BATTERY, the screen prompts you to connect to a jar.

3. VIEW PARAMETERS menu

The VIEW PARAMETERS menu displays the values you set up for a string under the SET PARAMETERS menu. This menu allows you to view the parameters only. For descriptions of these options, refer to "SET PARAMETERS menu."

4. PRINT RESULTS option

The PRINT RESULTS option allows you to print test results for a string you tested.

5. VIEW RESULTS menu

The VIEW RESULTS option allows you to view test results for a string you tested. When you select the string, the screen displays these options:

1. STRING SUMMARY
2. REVIEW DATA SET
3. MAIN MENU

Table 8 describes these options.

Table 8. VIEW RESULTS menu options

Option	Description
STRING SUMMARY	Lists these values as a summary of the string you tested: • AVG. % — Average percentage of the reference value. • AVG. SIEMENS: — Average conductance value. • TOTAL JARS: — Total number of jars you tested in the string. • LOW: — Jar number with the lowest percentage of the reference value. • HIGH: — Jar number with the highest percentage of the reference value. • STRING — Average percentage of the string as compared to the jar in the string with the highest conductance value.
REVIEW DATA SET	Lists these values for a jar or strap: • voltage • conductance value • number of the jar or strap • percent of the reference value

The analyzer keeps the test results for a string until you erase the data.

Helpful hint: The **RETEST** button provides a shortcut to the REVIEW DATA SET screen.

6. CHANGE REF. option

The CHANGE REF. option allows you to change the reference value for a string without changing other values in the SET PARAMETERS menu. For more information about reference values, refer to "Determining a reference value" in Chapter 2.

7. UTILITIES menu

The UTILITIES menu allows you to set up preferences in the analyzer. The screen displays these options:

A. PRINTER TYPE
B. LANGUAGE
C. DATE & TIME
D. SET DATE FORMAT
E. EDIT STRING NAME
F. SET WARN/FAIL %
G. LOW VOLTS
H. CONTRAST
I. MAIN MENU

Table 9 describes these options.

Table 9. UTILITIES menu options

Option	Description
PRINTER TYPE	Type of printer you are using to print test results to: • HP82240B • IRDA The default is the IRDA printer, which is included in the *Essential* CTE-1500 kit.
LANGUAGE	Language the screen displays text and results in: • ENGLISH (USA)
DATE & TIME	Current date and time set in the formats from the SET DATE FORMAT option.
SET DATE FORMAT	Formats for the date and time: • MM/DD/YY (month/day/year) and a 12-hour clock or DD/MM/YY (day/month/ year) with a 24-hour clock The default is the current date and time in Central Standard Time (CST). The default format is MM/DD/YY with a 12-hour clock.
EDIT STRING NAME	Name of the string you can edit with numbers or characters.
SET WARN/FAIL %	Percentages of the reference value for a jar and string that are thresholds to indicate test results that fall below them. A ? is displayed as a warning and a ! is displayed if the jar or string is failing. The defaults for a jar and string in-service: • JAR FAIL: <60% • JAR WARN: <70% • STRING FAIL: <60% • STRING WARN: <70%
LOW VOLTS	Threshold amount of low voltage for a string. The defaults are: • 2.1 V for a 2 V jar • 6.3 V for a 6 V jar • 12.6 V for a 12 V jar The analyzer will use a **!** to indicate a value below this threshold.
CONTRAST	Contrast between the screen and text.

Chapter 2: Pre-testing

Before you test a string with the analyzer, you need to:

- Determine a reference value
- Set options in the UTILITIES menu
- Set values in the SET PARAMETERS menu

Note: Make sure the jars you are testing are 2, 6, or 12 V jars.

Determining a reference value

Reference values

Reference values are average conductance values from a sample of strong jars similar in condition and age. You can compare reference values to test results from a string. The differences between test results and reference values help you determine the capacity of the string to see if it is providing enough conductance for the load. Differences can reflect how a string was treated, installed, or maintained.

Options

Midtronics recommends that you create your own reference values for a string to get values specific to the string you are testing. For this reason, the following options are listed in the order you should take to obtain a reference value.

To obtain a reference value for a string:

1. Consult your company documentation for previous reference values that were created for the string you are testing. If you do not have previous reference values for the string, do step 2.

2. Test a sample of jars. Refer to “Testing a sample of jars.” If you cannot test a sample of jars, do step 3.

3. Test the jars in the string that you need to test with the analyzer and use highest conductance value as a reference value. If you cannot test the jars for a reference value, do step 4.

4. Use the average from STRING SUMMARY after you test the string. Refer to “Using the average in STRING SUMMARY”).

5. Contact the jar manufacturer or Midtronics for a list of reference values for common jar types: www.midtronics.com

Note: The reference values from STRING SUMMARY and the website are guidelines only. Midtronics updates the website with new reference values when they are created. If you create a reference value for a jar model, e-mail the value and information to net@midtronics.com or fax it to 630.323.7752 (Attn: Reference value list).

Testing a sample of jars

To test a sample of jars for a reference value:

1. Choose at least 30 jars from one manufacturer with the same make, model, power rating, age (within 6 months), and service history.

2. Record this information about the jars:
   - Jar manufacturer
   - Model number
   - Date of manufacture
   - Date of installation
   - Condition the jar operates in, such as charge voltage (volts per cell), temperature, and DC current through the jar
   - Visible warnings, such as leaking acid, corrosion, or distorted jar cases

3. Test the jars. Refer to "Chapter 3: Testing."

4. Test one jar five times in a row on float charge. You should get the same conductance result.

   Note: If the test results do not conform to this pattern, an electrical signal might be present in the system.

5. Figure the average conductance of the jars.

   Note: Do not include jars that are higher or lower than 30% from the average because they might be outside an acceptable range.

Using the average in STRING SUMMARY

If you cannot obtain a reference value for a string, test the string and use the average conductance value (AVG. SIEMENS) in the STRING SUMMARY menu as your reference value. If jars in the string have been replaced recently, test the new jars, especially if they correlate to the HIGH jar value in STRING SUMMARY.

Setting options in the UTILITIES menu

Introduction

Before testing, you can set the options in the UTILITIES menu. If you do not set up values for the string in this menu, the analyzer uses the defaults when you test the string. For information about the defaults and descriptions of the values in the UTLITIES menu, refer to "Menu options" in Chapter 1.

Options

In the UTILITIES menu you can:

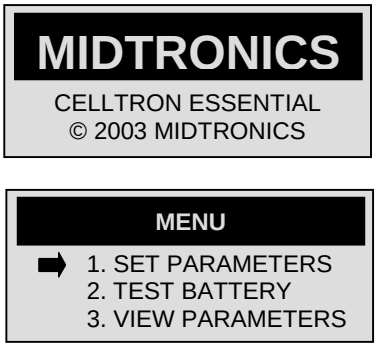
- Select a printer (A. PRINTER TYPE)
- Set the date and time (C. SET DATE & TIME)
- Set the date and time format (D. SET DATE FORMAT)
- Edit the string name (E. EDIT STRING NAME)
- Set percentages for warnings and failings (F. SET WARN/FAIL %)
- Set the low voltage value (G. LOW VOLTS)
- Adjust the screen contrast (H. CONTRAST)
- Return to (I. MAIN MENU)

Note: ENGLISH is the only language available for option B. LANGUAGE.

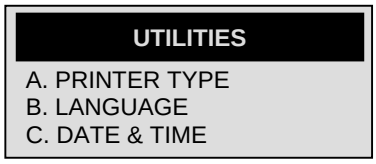
Accessing the UTILITIES menu

To access the UTILITIES menu:

1. Press and hold the **MENU** button until the analyzer powers on.



2. Press ▼or ▲ to scroll to 7. UTILITIES in the MAIN menu and press **ENTER**.

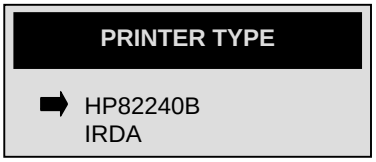


Note: If you select an option you do not want to change, press **ENTER** to return to the UTILITIES menu.

Setting the printer (A. PRINTER TYPE)

The default is IRDA. To set the printer:

1. Press ▼or ▲ to scroll to A. PRINTER TYPE in the UTILITIES menu and press **ENTER**.



2. Press ▼or ▲ to scroll to the printer you want to use to print test results and press **ENTER**.

Setting the date and time (C. DATE & TIME)

To set the date and time on the analyzer:

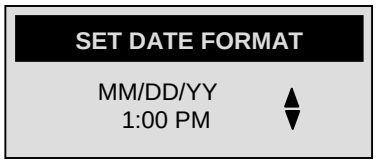
1. Press ▼or ▲ to scroll to C. DATE & TIME in the UTILITIES menu and press **ENTER**.

2. Press ▼or ▲ to select the number of the month, day, year, hour, minutes, and AM or PM and press **ENTER** after each selection.

Setting the date and time format (D. SET DATE FORMAT)

The default is the current date and time in Central Standard Time (CST). The default format is MM/DD/YY with a 12-hour clock. To set the date and time format in the analyzer:

1. Press ▼or ▲ to scroll to D. SET DATE FORMAT in the UTILITIES menu and press **ENTER**.

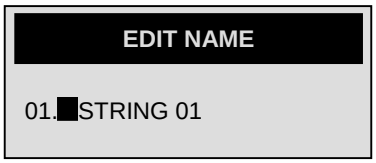


2. Press ▼or ▲ to select MM/DD/YY (month/day/year) and the 12-hour clock or DD/MM/YY (day/month/year) and the 24-hour clock. Press **ENTER** to return to the UTILITIES menu.

Editing the string name (E. EDIT STRING NAME) in the UTILITIES Menu

To edit the name of a string:

1. Press ▼or ▲ to scroll to E. EDIT STRING NAME in the UTILITIES menu, and press **ENTER**.



3. Press ▼or ▲ to scroll through the letters, numbers, and symbols for each character in the name. Press **ENTER** to select the character and move to the next character.

> **Notes:** The string name can be 12 characters long. When you are done entering characters, press **ENTER** to fill the rest of the name with spaces until the UTILITIES menu is displayed.

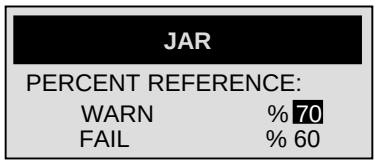
Helpful hint: You can also use the EDIT STRING NAME option in the SET PARAMETERS Menu.

Setting percentages for warnings and failings (F. SET WARN/FAIL %)

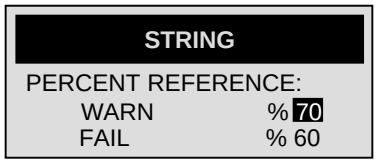
To set percentages for warnings and failings:

1. Press ▼or ▲ to scroll to F. WARN/FAIL % in the UTILITIES menu and press **ENTER**.

2. To set WARN and FAIL percentages for the jars in the string, press ▼or ▲ and press **ENTER** after each selection. Press **ENTER** move to the next parameter, the WARN and FAIL percentages for the string.



3. To select the WARN and FAIL percentages for the string, press ▼or ▲, and press **ENTER** after each selection. Press **ENTER** again to return to the UTILITIES menu.



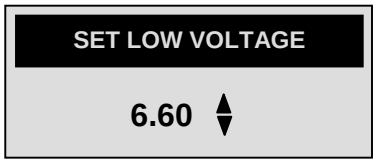
Setting the low voltage value (G. LOW VOLTS)

The low voltage value depends on the number of cells a jar:

Jar Voltage	Number of cells	Min. Range	Max. Range
2 V	1	1 V	2.5 V
6 V	3	3 V	7.5 V
12 V	6	6 V	15 V

To set the low voltage value for the jars in a string:

1. Press ▼or ▲ to scroll to G. LOW VOLTS in the UTILITIES menu and press **ENTER**.

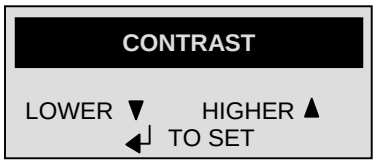


2. Press ▼or ▲ to select a low voltage value (in 10 mV) for the jars in the string and press **ENTER**.

Adjusting the screen contrast (H. CONTRAST)

To change the screen contrast:

1. Press ▼or ▲ to scroll to H. CONTRAST in the UTILITIES menu and press **ENTER**.



2. Do one of the following:
   - Press ▼to increase the screen shade.
   - Press ▲to decrease the screen shade.

Setting values in the SET PARAMETERS menu

Introduction

Before testing a string, you need to enter its test parameter values. If you do not set values for the string in this menu, the analyzer uses the defaults when you test the string. For information about the defaults and descriptions of the parameter values in the SET PARAMETERS menu, refer to "Menu options" in Chapter 1.

Note: When you set the values in this menu for a string and then test batteries, you cannot change settings. To change the values, you must delete the test results for the string.

If you have set parameters for a string and are ready to test it, refer to "Chapter 3: Testing."

Options

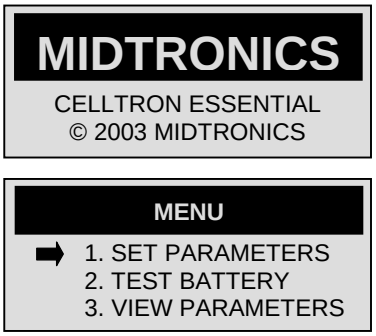
After you access the SET PARAMETERS menu, you can:

- Select a test start mode (1. AUTO START or MANUAL START)
- Select the test points (2. JARS ONLY or JARS AND STRAPS)
- Set the string temperature (3. TEMP:)
- Set the reference value (3. REF:)
- Set the number of volts per jar (5. VOLTS/JAR:)
- Set the number of posts per jar (6. POSTS/JAR:)
- Edit the string name (7. EDIT STRING NAME)
- Return to (8. MAIN MENU)

Accessing the SET PARAMETERS menu

To access the SET PARAMETERS menu:

1. Press and hold the **MENU** button.



> **Note:** If menus other than the MAIN menu is displayed, press ▼or ▲ to scroll to the MAIN MENU option and press **ENTER**.

2. Press **ENTER** to select 1. SET PARAMETERS.

Selecting 1. AUTO START or MANUAL START

In AUTO START mode the test will start automatically when you connect to the jar. In MANUAL START mode the analyzer will prompt you to press **ENTER** to start a test after you connect to the jar.

To change the test start mode:

1. Press ▼or ▲ to scroll to selection 1 in the SET PARAMETERS and press **ENTER**. (AUTO START is the factory default.)

2. Press ▼or ▲ to scroll to MANUAL START or AUTO START and press **ENTER** to select.

Selecting 2. JARS ONLY or JARS AND STRAPS as a test point

You can configure the Celltron *Essential* to test jars or individual cells and inter-cell connections of the string.

To change the test point mode:

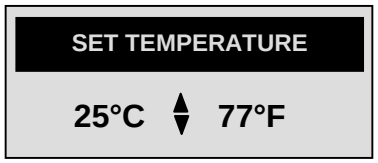
1. Press ▼or ▲ to scroll to selection 2 in the SET PARAMETERS and press **ENTER**. (JARS ONLY is the factory default.)

2. Press ▼or ▲ to scroll to JARS ONLY or JARS AND STRAPS, and press **ENTER** to select.

Setting the string temperature (3. TEMP:)

To set the temperature of the string:

1. Use the temperature sensor to measure the temperature of one of the jars in the string.
2. Press ▼or ▲ to scroll to selection 3. TEMP: in the SET PARAMETERS and press **ENTER**.



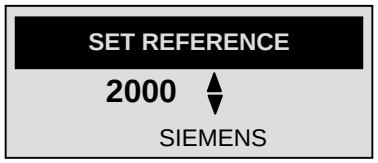
3. Press ▼or ▲ to select the temperature in either Celsius or Fahrenheit and press **ENTER**.

Note: The temperature converts automatically to Celsius or Fahrenheit.

Setting the reference value (4. REF:)

To set a reference value:

1. Press ▼or ▲ to scroll to 4. REF: in the SET PARAMETERS and press **ENTER**.



2. Press ▼or ▲ to select the reference value for the string you are testing and press **ENTER**.

Note: You can also set a reference value in the 6. CHANGE REF option in the MAIN menu.

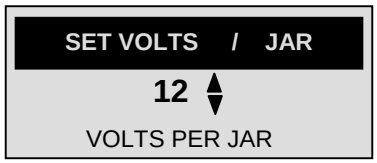
For information about determining a reference value, refer to "Determining a reference value."

Setting the number of volts per jar (5. VOLTS/JAR)

To set the number of volts per jar:

1. Press ▼or ▲ to scroll to 5. VOLTS/JAR in the SET PARAMETERS menu and press **ENTER**.

2. Press ▼or ▲ to scroll to 2, 6, or 12 VOLTS PER JAR and press **ENTER** to select.

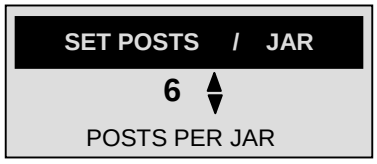


Setting the number of posts per jar (6. POSTS/JAR)

To set the number of posts per jar:

1. Press ▼or ▲ to scroll to 6. POSTS/JAR in the SET PARAMETERS menu and press **ENTER**.

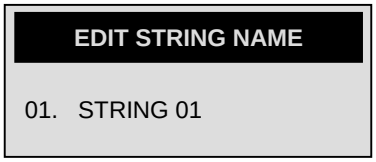
2. Press ▼or ▲ to scroll to 2, 4, or 6 POST PER JAR and press **ENTER** to select.



Editing the string name (7. EDIT STRING NAME) in the PARAMETERS Menu

To edit the name of a string:

1. Press ▼or ▲ to scroll to 7. EDIT STRING NAME and press **ENTER**.



2. Press ▼or ▲ to scroll through the letters, numbers, and symbols for each character in the name. Press **ENTER** to select the character and move to the next character.

Notes: The string name can be 12 characters long. When you are done entering characters, press **ENTER** to fill the rest of the name with spaces until the SET PARAMETERS menu is displayed.

Helpful hint: You can also use the EDIT STRING NAME option in the UTILITIES menu.

Chapter 3: Testing

Testing a string requires consistent practices in the procedures in this section and keeping records of the test results. Midtronics recommends that you establish a testing routine to monitor conductance loss and prevent failures.

Note: Power outages can affect test results. Do not test the string if a power outage occurred recently and the string is boost-charged.

Labeling jars and straps

Introduction

The analyzer assigns labels to jars and straps based on the values you enter in the SET PARAMETERS menu. It displays these labels in the test results to help you keep track of the jar posts and straps you have tested and lets you know the jar posts and straps you still need to test.

Labels

The labels consist of numbers and letters that correspond to the

- Locations and connections of the jar posts and straps
- Order in which you test the jars

The label identifies

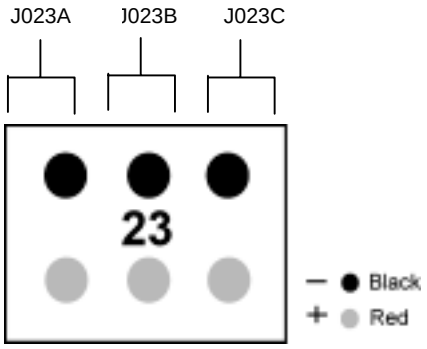
- Jar or strap
- Number of the jar
- Position of the posts

Jars

The analyzer uses “J” for jar. It assigns a number to the number of the jar you tested in sequence. It assigns a letter to the set of positive and negative posts you tested on a jar.

For example, in the label “J023C,” “J” means you tested a jar, “023” is the 23rd jar you tested, and “C” is the third set of posts you tested on that jar. Figure 2 shows an example of the labels for a jar when testing the posts from left to right.

Figure 2. Labels for a jar



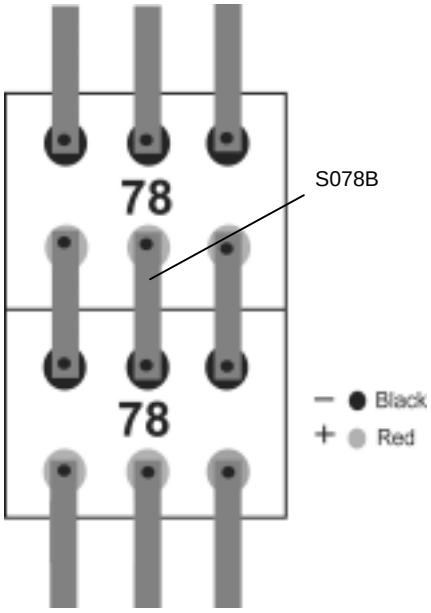
If the jars you are testing have one set of posts, the analyzer does not assign a letter. For example, “J023” means the jar has one set of posts.

Straps

The analyzer uses “S” for strap. It assigns a number to the jar that is connected to the strap. It assigns a letter that corresponds to the letter for the set of posts the strap is connecting.

For example, in the label “S078B,” “S” means you tested a strap, “078” is the number of the jar connected to the strap, and “B” is the second strap you tested for that jar. Figure 3 shows an example of this label.

Figure 3. Labels for a strap



Recommendations

Recording jar information

Because conductance values vary with such factors as age, temperature, and site conditions, record the following about the jars you are testing each time you test:

- Power load
- Physical condition of the jars
- Site condition
- Jar rating

For convenience, print the results for each test, make notes, and tape the printout to one of the jars.

Labels for jars and straps

To make sure the test results correlate to the same jar or strap each time you test, you should identify the jars and straps on the string with a label to make sure the labels the analyzer uses are the same. For information about how the analyzer labels jars and straps, refer to "Labeling jars and straps."

Preparing to test

Introduction

To prepare for testing, you need to

- Select a cable
- Attach the cable to the analyzer

Requirements

To do these procedures, you need

- Flat-tip screwdriver
- Clamp or probe cables

Selecting a cable

You can use the probe cables (or optional clamp cable) to test the string.

To choose a cable:

1. Determine the type of testing you are doing:
   - One or a few jars
   - Jars and straps in a string

2. From Table 10, select a cable type based on the type of testing you are doing.

Table 10. Advantages of cables

Probes	Clamps (optional)
Quick testing of jars and straps in a string	Retest without reconnecting
Make contact with small posts or straps	Attach to straps and post and free both hands to use the analyzer keypad

3. When using the probe cable, do one of the following:

    - Select AUTO START from the SET PARAMETERS menu to keep both hands free to hold the probes.

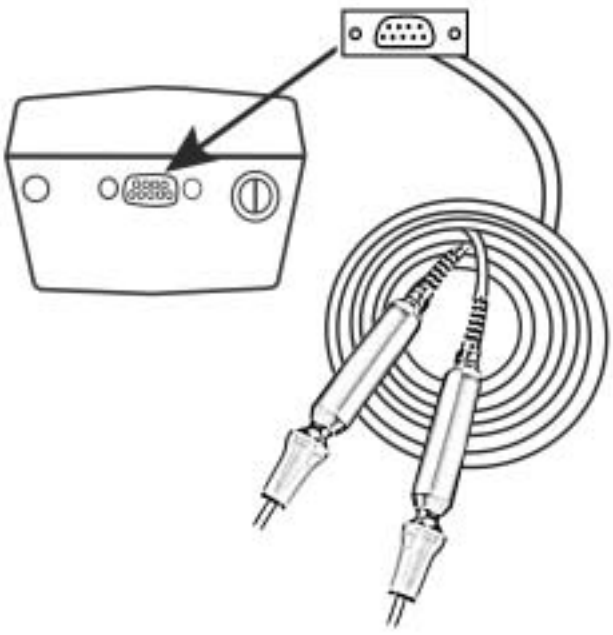
    - Have someone hold the analyzer while you connect the probes to the jars during testing.

Attaching the cable to the analyzer

To attach the cable to the analyzer:

1. Insert the DB-9 connector at the end of the cable into the cable port at the top of the analyzer. Refer to Figure 4.

Figure 4. Attaching the cable to the analyzer



2. Tighten the two screws on the sides of the DB-9 connector in the screw holes on the analyzer with a flat-tip screwdriver.

Determining a test pattern

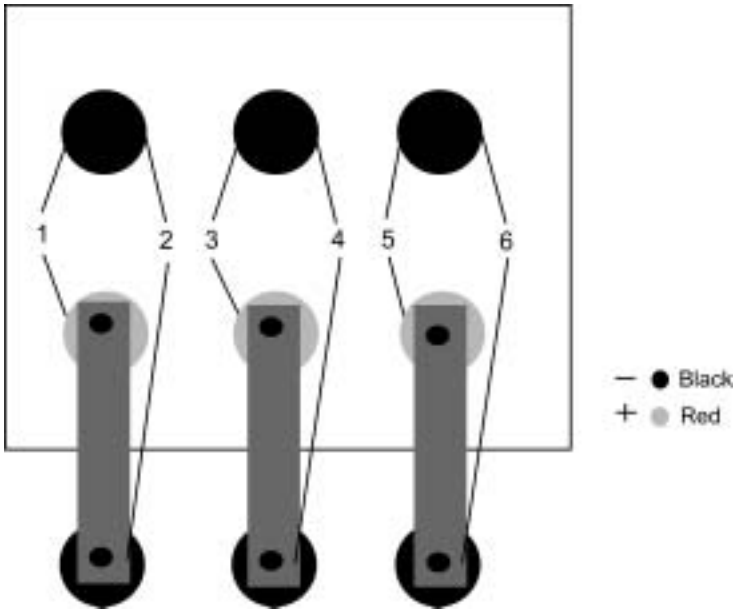
Introduction

Before you attach the cable to the jar, you should determine a pattern for testing to make testing a consistent and fluid process.

Posts and straps

You must test all posts and straps on a jar before testing the next jar in the string. You can test jar posts in any direction as long as you are consistent for each jar. However, you must test a jar post and then the strap that connects it before you test the next post on the jar. Figure 5 displays the pattern you should test posts and straps in.

Figure 5. Pattern for testing posts and straps

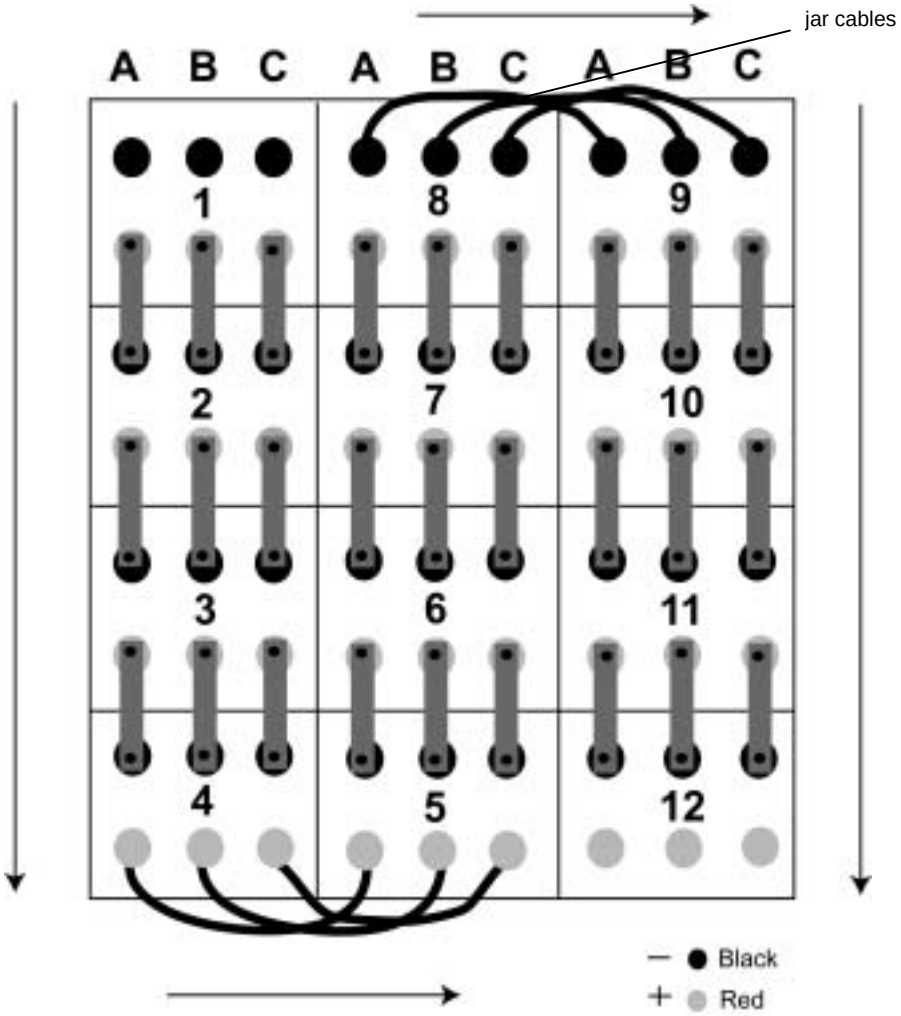


Step 1 shows a connection between the first set of positive and negative posts. Step 2 shows a connection between the negative post and the strap end attached to the next jar. This connection ensures that you test the entire strap and its connections. Steps 3 and 4 and steps 5 and 6 repeat steps 1 and 2.

String

After you test the posts and straps for a jar, you should test the next jar in the direction the straps and jar cables connect the jars in. Figure 6 shows an example of how to test jars in a string.

Figure 6. Pattern for testing jars in a string



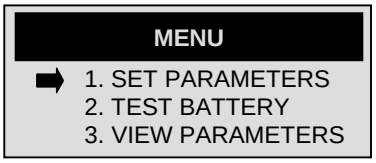
The numbers on the jars indicate the direction you should test based on the connections. The straps connect the jars from top to bottom and the cables connect the jars from side to side.

Setting the 2. TEST BATTERY option

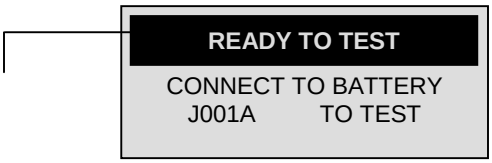
After you determine a test pattern, you need to set the analyzer to test the string.

To set the TEST BATTERY option:

1. If the analyzer has timed out, press the **MENU** button for the MAIN menu.



2. Press ▼or ▲ to scroll to 2. TEST BATTERY and press **ENTER**.



Note: You can also start a test by connecting to a jar when the analyzer is turned off.

Attaching the cables

Introduction

After you turn on the analyzer and set the TEST BATTERY option, you are ready to test. To test a string, you need to attach the clamp or probe cables to the first jar in the string.

Note: The figures in this section show probes connecting to the jar posts or straps. However, you can connect the clamps in the same positions.

General rules

You should follow these guidelines when testing a jar:

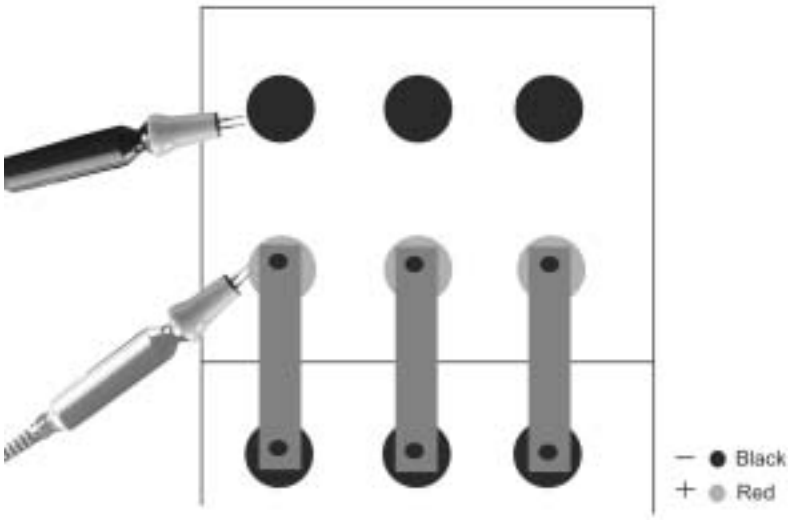
- Do not place probes or clamps on stainless steel hardware, such as bolt heads, washers, or threaded posts. Stainless steel hardware can yield low conductance values. If you have to test on stainless steel, record it in your testing records.
- The jars might have grease on the terminals and connections to prevent corrosion. You do not have to wipe off the grease before connecting the probes or attaching the clamps.
- Test each jar in the same location or position. Changing the location of the test point might vary test results.

Attaching the cable to jar posts

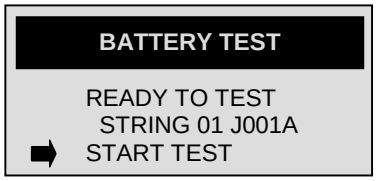
To attach the cable to the jar:

1. Press the black probe tip against the black (–) terminal. Refer to Figure 7.
2. Press the red probe tip against the red (+) terminal.

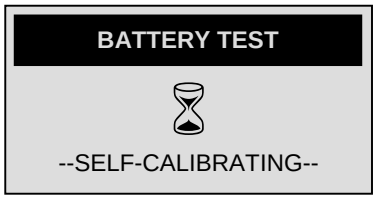
Figure 7. Attaching the cable to jar posts

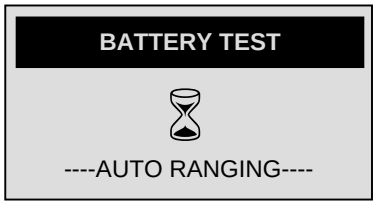


Screen if the analyzer is in MANUAL START:



3. If you selected MANUAL START when you set values in the SET PARAMETERS menu, press **ENTER** to start testing.





The analyzer beeps twice when the test is done. If test results are under the values you set in the SET PARAMETERS and UTILITIES menus, the analyzer also beeps longer for each of the following:

- Conductance value is below the reference value and the percentage of the reference is below the values for WARN or FAIL
- The voltage is below the LOW VOLTS value
- The voltage is above 2.5 volts per cell
- All 480 memory locations have been used

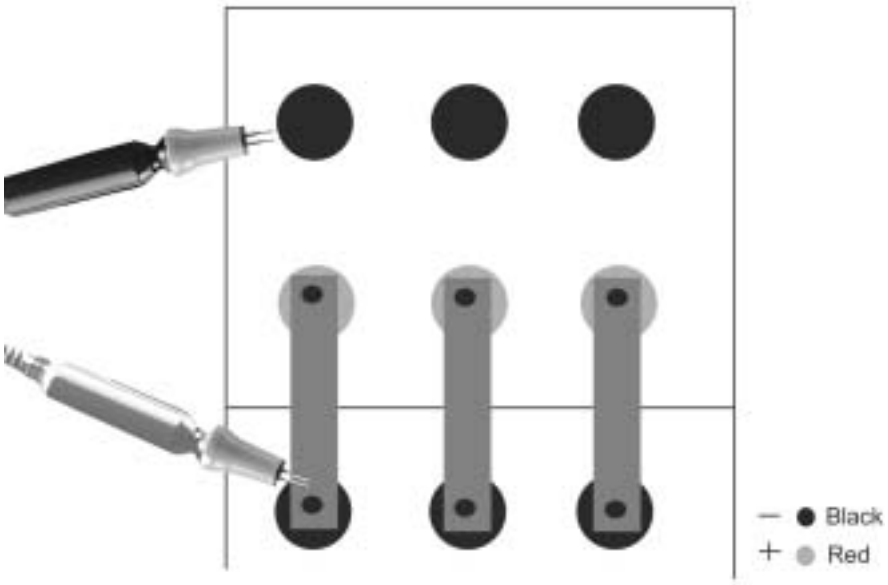
4. Choose one of the following based on the type of testing you are doing:
   - If you are testing jars only, test the next set of jar posts if you have more than one set of posts or test the next jar in the string. Refer to the test patterns in "Determining a test pattern."
   - If you are testing jars and straps, follow the steps in "Attaching the cable to a strap."

Attaching the cable to a strap

To attach the cable to a strap:

1. Remove the red probe or clamp from the red (+) terminal.
2. Attach the red probe or clamp at the end of the strap above the black (–) terminal on the next jar. Refer to Figure 8.

Figure 8. Attaching the cable to a strap



3. Choose one of the following based on the number of posts the jars have:

    - If the jar has more than one set of posts, attach the black and red clamps or probes to the next set of posts on the jar.

    - If the jar has one set of posts, test the jar connected to the jar you just tested. Follow the steps in "Attaching the cable to jar posts."

4. Repeat the steps in "Attaching the cable to jar posts" and "Attaching the cable to a strap" until you are finished testing the string.

5. Refer to "Chapter 4: Test Results" to view test results or "Retesting jar posts or straps" to retest the set of jar posts or straps.

Retesting jar posts or straps

Introduction

You can retest jar posts or straps if you get test results you think are not accurate. Factors such as operating conditions, site conditions, manufacturer changes, can vary test results. If you accept results under these conditions, your maintenance routine might not have an accurate history.

You can retest a set of jar posts or straps right after you test them or you can test the rest of the string before you retest certain jar posts or straps.

Retesting after testing the jar post or strap

To retest a set of jar posts or a strap just after you test it, press **RETEST**. The test results are displayed again for that jar post or strap.

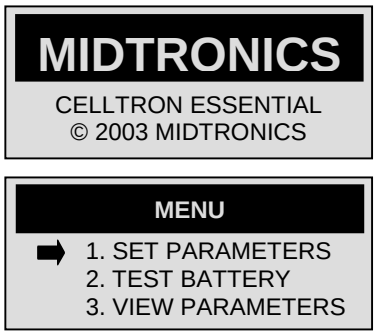
If you are still connected to the jar and in AUTO START, the retest will begin immediately.

Retesting after testing the string

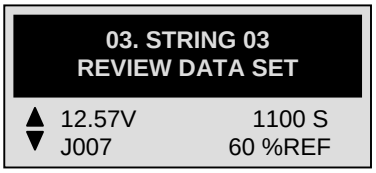
To retest a set of jar posts or a strap after you test the entire string:

1. Remove the probes or clamps from the set of jar posts or strap.

2. Press and hold the **MENU** button to turn on the analyzer.



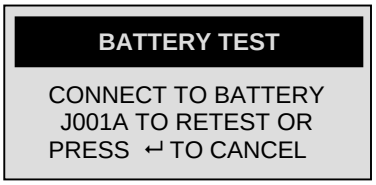
3. Press **RETEST**.



Note: For information about this screen, refer to "Interpreting test results" in Chapter 4.

4. Press ▼or ▲ to scroll through the test results to find the set of jar posts or strap you want to retest.

5. Press **RETEST**.



6. Follow the steps under "Attaching the cables" to retest the set of jar posts or strap.

Chapter 4: Test Results

After you test a string, you can:

- View test results
- Interpret test results
- Archive test results

Viewing test results

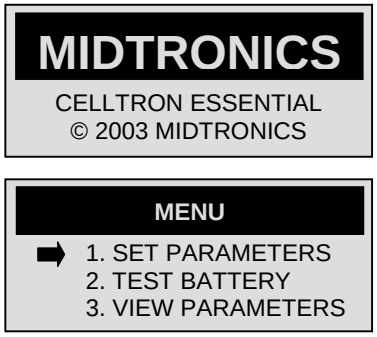
Introduction

After you test a string, the analyzer saves the test results that are displayed on the screen. You can view the test results for a string as many times as you want until you erase the values you set for the string by attempting to change the test setup.

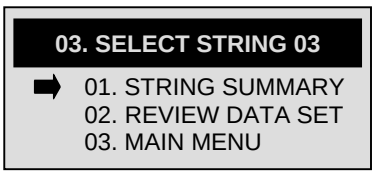
Viewing test results

To view test results:

1. Press and hold the **MENU** button to access the MAIN menu.

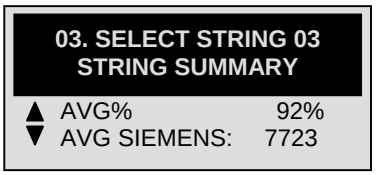


2. Press ▼or ▲ to scroll to VIEW RESULTS and press **ENTER**. The analyzer will display the number of STORED READINGS. Press **ENTER** for the viewing options.

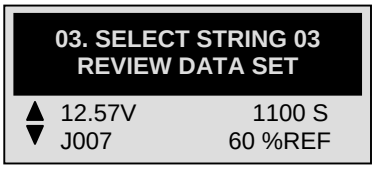


3. Choose one of the following options:

    - To view a summary of averages and high and low values, scroll to STRING SUMMARY and press **ENTER**.



    To view the test results as the analyzer displayed them when you tested the string, scroll to REVIEW DATA SET and press **ENTER.**



Interpreting test results

STRING SUMMARY

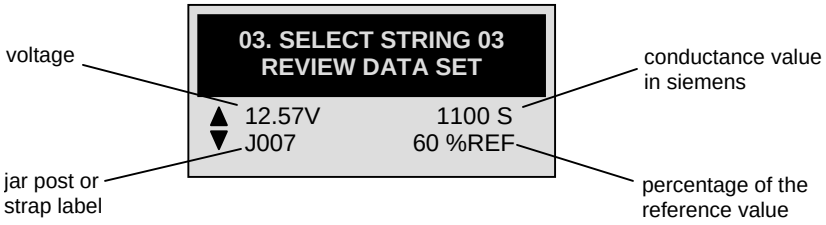
The values in the STRING SUMMARY option are a summary of values, such as averages, from all jar posts and straps you tested in the string.

For descriptions of these values, refer to "Menu options" in Chapter 1. To view all summary values in STRING SUMMARY, press ▼or ▲.

REVIEW DATA SET

The values in the REVIEW DATA SET option are the test results for all jar posts and straps you tested in the string. Figure 9 labels the values.

Figure 9. REVIEW DATA SET values



These values are displayed for each set of jar posts and straps in the order you tested them in the string. The conductance value is not displayed if you selected VOLTS ONLY from the SET PARAMETERS menu. If the voltage, conductance value, or percentage of the reference value is below the value you set in the UTILITIES MENU, a warning (?) or fail (!) symbol is displayed next to the value. To view the data for other sets of jar posts or straps, press ▼or ▲.

Using the percentages of the reference value

You can use the percentages of the reference value from STRING SUMMARY for all of the jar posts and straps to help you determine the strength of the string. Table 11 lists ranges of reference value percentages, the condition the string is in, and the action you should take.

Table 11. Strength of the string

% of the reference value	Jar strength	Action
> 80 %	Good condition	Check the jars to look for physical damage.
60–80%	Serviceable with maintenance	Check for problems and refer to • Test results or other information about the string to determine the cause of low readings • Your company maintenance procedures for jar maintenance • IEEE standard 1188-1996: Recommended Practice for Maintenance, Testing and Replacement of Valve-Regulated, Lead-Acid (VRLA) Jars for Stationary Application
< 60 %	Unserviceable	Replace the jars. Refer to your company jar replacement procedures or IEEE standard 1188-1996.

Archiving test results

Advantages of archiving

Archive test results and keeping them onsite will help you establish a routine maintenance program. Archiving can also help you:

- Compare results for changes or trends in string performance.
- Recognize when your string needs maintenance or repair.
- Provide warranty data for your supplier.

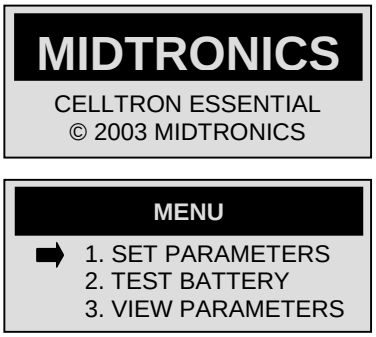
Printing test results

To print test results:

1. Turn on the printer.

2. Aim the infrared light on the top analyzer next to the cable port at the infrared light on the printer below the **MODE** button.

3. Press and hold the **MENU** button to access the MAIN menu.



4. Press ▼or ▲ to scroll to PRINT RESULTS and press **ENTER**.

The printout displays the following values for each jar post or strap:

- Voltage
- Percentage of the reference value
- Conductance value
- Temperature
- Volts per jar

For more information about the printer, refer to the printer *User Guide*.

Chapter 5: Troubleshooting

The sections below describe how to troubleshoot and maintain your Celltron *Essential*.

If you have problems with the printer or temperature sensor, refer to their manuals or call Midtronics Customer Service.

Screen does not light during testing

Possible causes

If the screen does not light when you test a jar, check the connection to the jar. If the connection is secure, the following conditions could prevent the analyzer from functioning:

- Jar voltage is too low (<1 V) to test.
- Analyzer battery needs replacement.
- Fuse needs replacement.

Replacing the analyzer battery

Replace the analyzer battery if the display does not light when you press and hold the **MENU** button.

To replace the battery:

1. Use a Phillips screwdriver to remove the screw in the door to the battery.compartment.

2. Insert a new 9-volt battery, aligning the battery terminals.

3. Insert and tighten the screw.

Replacing the fuse

To replace the fuse:

1. Unscrew the fuse holder on the top of the analyzer. Refer to Figure 1 in Chapter 1.

2. Remove the fuse.

3. Insert the spare fuse included with the analyzer or a 5 x 20 mm, 1.25 A fuse.

Probe tip is bent or stops retracting

Replacing a probe tip

To replace a probe tip:

1. Use pliers to grasp the probe tip at the top of the sleeve that encases it.

   Caution: Do not grasp the sleeve. You can damage the probe.

2. Pull the tip straight out.

3. Grasp the replacement tip with the pliers and insert it into the sleeve.

4. Push the probe tip into a soft surface, such as cardboard, until the tip reaches the bottom of the probe sleeve.

Note: To obtain replacement tips, contact Midtronics Customer Service and ask for the part number C069 for the DuraProbes or C059 for the MiniProbes.

Chapter 6: Specifications

<table>
<tr><td>Model Number:
CTE-1500 (Kit), CTE-1000 (analyzer only)</td><td>Power Requirements:
One 9-volt high capacity/heavy duty lithium battery or rechargeable battery pack accessory</td></tr>
<tr><td>Applications:
Tests individual lead acid cells or monoblocs (2, 6, 12 volts) in any common configuration</td><td>Environmental Operating Range:
0 to +40°C, 95% relative humidity, non-condensing</td></tr>
<tr><td>Voltage:
1.0–15.0 volts DC</td><td>Storage Temperature:
–20 to 82°C</td></tr>
<tr><td>Conductance:
100–9,999 siemens</td><td>Over Voltage Protection:
• Fused protection to 60 volts DC
• Reverse polarity protected</td></tr>
<tr><td>Test Data Storage:
Up to 480 consecutive test results</td><td>Housing Material:
Acid-resistant ABS plastic</td></tr>
<tr><td>Accuracy:
+ 2% across test range</td><td>Analyzer Dimensions:
9 in x 4 in x 2.5 in
230 mm x 102 mm x 65 mm</td></tr>
<tr><td>Voltmeter Resolution:
10 mV DC</td><td>Case Dimensions:
19 in x 15.5 in x 5 in
750 mm x 610 mm x 200 mm</td></tr>
<tr><td rowspan="2">User Programmable Functions:
• Low voltage alarm setting
• Low conductance warning
• Low conductance failure
• Day/date/time formats (USA/international)
• Test mode (push button/auto start)</td><td>Analyzer Weight:
1 lb / 500 gm</td></tr>
<tr><td>Shipping Weight: CTE-1500 Test Kit
9.5 lb / 4 kg</td></tr>
<tr><td>Calibration:
Auto-calibration prior to every test; no future calibration required</td><td rowspan="2">Special Features:
• Impact-resistance tested
• Connection interfaces tested for durability and endurance
• No-Ox grease petroleum product resistance</td></tr>
<tr><td>Test Cable Options:
• Dual contact clamps
• Dual contact probes
• Custom cables by quotation</td></tr>
</table>

Patents

Made in the U.S.A. by: Midtronics, Inc., protected by one or more of the following U.S. Patents: 6,456,045. 6,441,585. 6,392,414. 6,359,441. 6,323,650 B1. 6,316,914. 6,310,481. 6,304,087. 6,172,505 B1. 6,163,156. 6,091,245. 6,051,976. 5,914,605. 5,598,098. 5,592,093. 5,572,136. 5,343,380. 5,140,269. 4,881,038. 4,816,768. Canadian Patents: 2,091,262. 1,280,164. European Patent: 0,548,266. EP: C382.13-0026. WO: C382.13-0040. China Patent: C382.13-0027. Hong Kong Patent: C382.13-0038. Japan Patents: C382.13-0041. 30006800. Other U.S. and Foreign Patents issued and pending. This product may utilize technology exclusively licensed to Midtronics, Inc. by Johnson Controls, Inc. and Motorola, Inc.

Warranty

The analyzer is warranted to be free of defects in materials and workmanship for a period of one year from date of purchase. Midtronics will, at our option, repair the unit or replace the unit with a remanufactured analyzer. This limited warranty applies only to Midtronics battery analyzers and does not cover any other equipment, static damage, water damage, over-voltage, dropping the unit or damage resulting from extraneous causes including owner misuse. Midtronics is not liable for any incidental or consequential damages for breach of this warranty. The warranty is void if owner attempts to disassemble the unit, or to modify the cable assembly.

Service

To obtain service, purchaser should contact Midtronics for a Return Authorization number, and return the unit to Midtronics freight prepaid, Attention: RA# _____. Midtronics will service the analyzer and reship, the next scheduled business day following receipt, using the same type carrier and service as received. If Midtronics determines that the failure was caused by misuse, alteration, accident, or abnormal condition of operation or handling, purchaser will be billed for the repaired product and unit will be returned freight prepaid with freight charges added to the invoice. Battery analyzers beyond the warranty period are subject to the repair charges in effect at that time. Optional remanufacturing service is available to return the analyzer to like new condition. Out of warranty repairs will carry a 3-month warranty. Remanufactured units purchased will carry a 6-month warranty.

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