



MICRO CELLTRON OPERATING MANUAL

For Micro Celltron Test Kits CTM-100 and CTM-300

This is a basic user's guide to the operation and features of the Micro Celltron by Midtronics, Inc. This guide is intended to help you configure the test equipment and provide a reference for battery testing. Always follow the applicable safety regulations governing your work operation.

Table of Contents:

Section	Page
1. Basic Safety	3
2. General Description	3
3. Battery Testing and Diagnosis	4
4. Utility Menu/Tester Set-Up	11
5. Data Interpretation	13
6. Battery Testing Conditions/Recommendations	14
7. Establishing Reference Numbers	16
8. Menu Screen Flow Chart.....	18
9. Troubleshooting	19
10. Sample Battery Data Sheets	20
11. Patents/Warranty/Service	21

Section 1: BASIC SAFETY

WORKING ON BATTERIES CAN BE DANGEROUS

Follow all safety practices as required by your employer, which may include but are not limited to the following:

- Safety glasses and/or a full face shield at all times
- Protective rubber gloves where required
- Protective apron or shop coat if required
- Only perform service work for which you have been properly trained
- Do not disconnect battery cables from power systems without proper authorization for the length of time needed to complete battery service
- Always avoid placing yourself into a circuit. Avoid contact with frame racks and adjacent hardware that may be grounded while in contact with the battery

TESTING DO'S & DONT'S FOR BEST RESULTS:

- DO follow ALL company safety rules that apply for battery service/maintenance activity
- DO place Midtronics' test probes or clamps firmly on the lead battery post for consistent results
- DO record all test results and store on site for future reference
- DO compare previous test results and look for changes or trends in battery performance
- DON'T take chances – if you are not sure about a battery condition you encounter, ask for help before testing
- DON'T test on Stainless Steel hardware when possible – you can get inconsistent test results (usually lower)
- DO look for physical clues related to battery problems, including corrosion, bulging cells, leaking electrolyte, radical voltage deviations or discoloration in hardware

Section 2: GENERAL DESCRIPTION

The **MICRO CELLTRON** is a microprocessor based test instrument that measures the *conductance* (Ohmic) value of lead-acid batteries and reports the results in Siemens (G). The Micro Celltron will measure the conductance of single cell (2 Volt) through six cell (12 Volt) batteries, either on-line or off-line. Test results are displayed as a direct reading in Mhos (Siemens) and as a percent (%) of a reference conductance value. The Micro Celltron provides quick, accurate, safe, repeatable and easy to understand test results. As many as 252 consecutive test results can be stored internally. The results can be printed via an Infrared Printer (Part #A050) for hard copy documentation, or transferred to a PC with our Battery Management Software and Infrared Receiver module (#C060) for database storage and analysis. The Micro Celltron is fully Y2K compliant.

Every Midtronics Conductance meter uses the same general electrical test described as an Ohmic or conductance test. This test technique can be used to identify the general condition of any battery within a group of batteries, or to compare a group of batteries to a known conductance reference value. Conductance testing is intended to provide a simple, quick, safe and accurate way to help identify which batteries are serviceable, which ones may be

failing, or to find any battery that may have reached the end of its useful life. For a given battery type, high conductance indicates more reserve capacity or a higher state of relative health. Midtronics' conductance testers use a value called Mhos or Siemens to describe the Ohmic Signature we observe in stationary or standby batteries.

What is a Mho? What is a Siemen? What is a "G"?

The term Mho(s), Siemen(s) and G are interchangeable. Mhos are more common in the U.S. while the rest of the world generally uses the term Siemens. "G" is the abbreviation for Siemens. These are both electrical terms used to describe an ohmic measurement, which is inversely proportionate to electrical resistance. Mho is Ohm spelled backward, and conductance testing is also sometimes referred to as admittance testing.

What is a Jar?

In the Micro Celltron, a jar defines the physical element that contains one or more individual cell elements. A jar can contain between 1 and 6 cells. The Micro Celltron can be configured to test 2, 4, 6, 8, 10 or 12 volt "jars".

What Will Ruin Test Results?

Always try to test in the same location or in a consistent position on every battery. Conductance testing is a sensitive procedure and changing the location of the test point may make a significant difference on the test results. For consistent test results, do not place test clamps or probes on stainless steel bolts or hardware. Many new battery designs may make this difficult, but irregular measurements can result when clamps or probes are placed on stainless steel surfaces. If you have no other options, make a note that testing was done on stainless steel for future reference and testing consistency.

Battery Test Range

The Micro Celltron has an effective operating range from 100 to 10000 Siemens which includes batteries in a range from approximately 5 Ah to 2000 Ah of reserve capacity, depending on the cell design. For larger batteries, contact Midtronics customer service at (800) 776-1995 for assistance.

Section 3: BATTERY TESTING AND DIAGNOSIS

The Micro Celltron makes a test measurement and reports the result as a value in Siemens. It measures jar/cell voltage for state-of-charge verification. It will also display a percent of a relative health if a reference value is entered. By comparing test results for batteries similar in age, model number and service history from any manufacturer, you should see similar conductance test results. For a given battery type, low conductance equates to low performance.

Battery maintenance and replacement decisions must conform to established company and battery manufacturer guidelines. When establishing a battery maintenance program you should also refer to the appropriate IEEE documents including IEEE Standard 1188-1996. This document covers the Recommended Practice for Maintenance, Testing and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Application. You may also reference IEEE standard 450 covering maintenance and testing of vented (flooded) batteries. To order documents or other materials, contact the IEEE directly at (800) 678-IEEE (4333) in the US and Canada, (908) 981-1393 outside the US and Canada. Additional information is available on the IEEE Web Site at www.stdsbbs.ieee.org/.

Prior to Testing:

Install the clamps or probes and attach securely to the tester. NOTE: Many stationary battery installations may have NO-OX grease applied to the battery terminals and connections for corrosion prevention. Cleaning away grease is not necessary prior to testing. The Micro Celltron requires a Kelvin connection for testing, which means both sides of each clamp or probe must make good contact for testing. If a "Check Connection" message appears, "rock" the clamps back and forth or push probes at a slight angle to break surface oxidation. Use care when cleaning the tips of the probe set.

Operating Instructions - Testing and Datalogging:**Step 1:**

Identify the battery manufacturer, the model number, number of cells per jar being tested, dates of manufacture and installation, battery temperature at the time of test and any physical evidence that may give an indication of the battery condition. Use the infrared Temperature Sensor (C058) included in CTM-300 kits for accurate temperature recording.

Step 2:

Press the **MENU** key to turn the test set on. The display should read **CONFIGURE TESTER**. Press the **YES** key to continue.

Step 3:

DATALOGGING--ON will appear in screen, press the **YES** key to select datalogging. **RESET DATALOGGER** will appear, press the **YES** key to erase all stored data. The display now shows, **ALL DATA WILL BE LOST!!! - ARE YOU SURE???**. Press the **YES** key and all stored data will be erased. – OR –

Choose **CONTINUE TESTING** and press the **YES** key to begin testing at the next subsequent jar data point using the previously configured information.

Step 4:

Use the arrow keys and the **YES** key to answer the following series of tester configuration questions prior to starting to test:

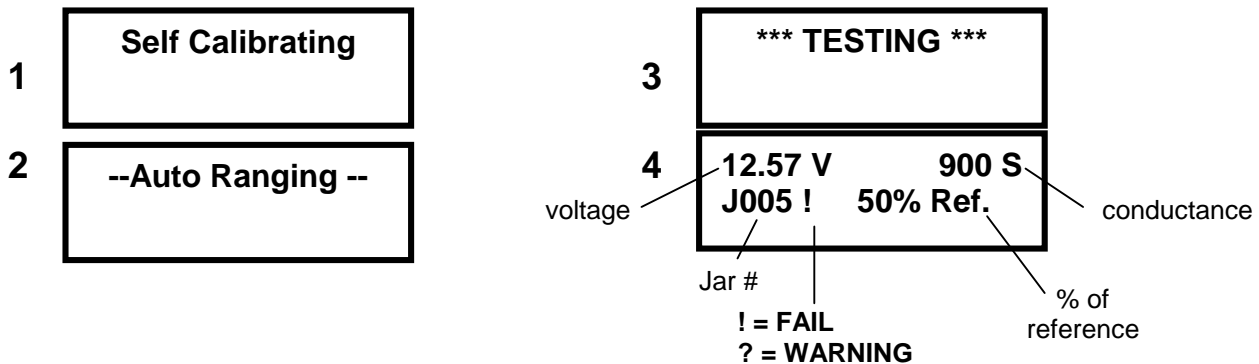
- Scroll to **TEST JARS ONLY** to test only the batteries/cells or to **JARS and STRAPS** to test cells and inter-cell connections of the string. Once your choice is displayed press the **YES** key to continue. Please refer to the diagram on page 7 for jar/strap testing detail.
- Scroll to the appropriate **VOLTS PER JAR** (2 - 12 volts) and press the **YES** key to continue.
- Scroll to **USE BATTERY TYPE** to test using a pre-programmed battery type entered by the operator or **SCROLL REFERENCE** to scroll to set the conductance reference value. Press the **YES** key to continue. *See the next section regarding Choosing Reference Setup.*
- In Scroll Reference, use the arrows to scroll to the battery's conductance reference value in Siemens. If you do not have a reference value, consult the testing tips in the next section. Press the **YES** key to continue.
- Input the battery/string temperature and press the **YES** key to continue. The message **** SAVING SETUP **** will be displayed and the display will go blank.

- ➔ Note that Temperature Compensation is built into the unit since conductance measurements will change with battery temperature change. The Micro Celltron always measures and displays an absolute conductance value. However, it uses the temperature entered to adjust the percent (%) of the reference value entered. The percent is compensated to equate to a measurement taken at a normalized temperature of 25°C/77°F. Compensation is adjusted at 0.7% per degree Celsius between 0°C and 35°C.
- Press the **MENU** key again and scroll down to **UTILITY MENU**. Press the **YES** key.
- **CONNECTION MODE** will appear in the screen, press the **YES** key to continue.
- Select **MANUAL PB START** if you want to press the **YES** key to begin each test. Select **AUTO PROBE START** to begin each test automatically once a connection is made. The connection mode stays the same unless changed by the user. Press the **YES** key with your choice showing in the display to continue. The message **** SAVING SETUP **** will be displayed and the display will go blank. The unit is now configured for the battery type selected and ready to test.
- ➔ The Automatic Probe Start feature can be used with any test connection option. This method is generally favored because it helps speed the test process and allows the operator to fully concentrate on connecting to the battery terminals.

Step 5:

Connect to the first battery/jar to begin testing. When battery contact is made, you will hear one audible “Beep” and the following series of screens will be displayed.

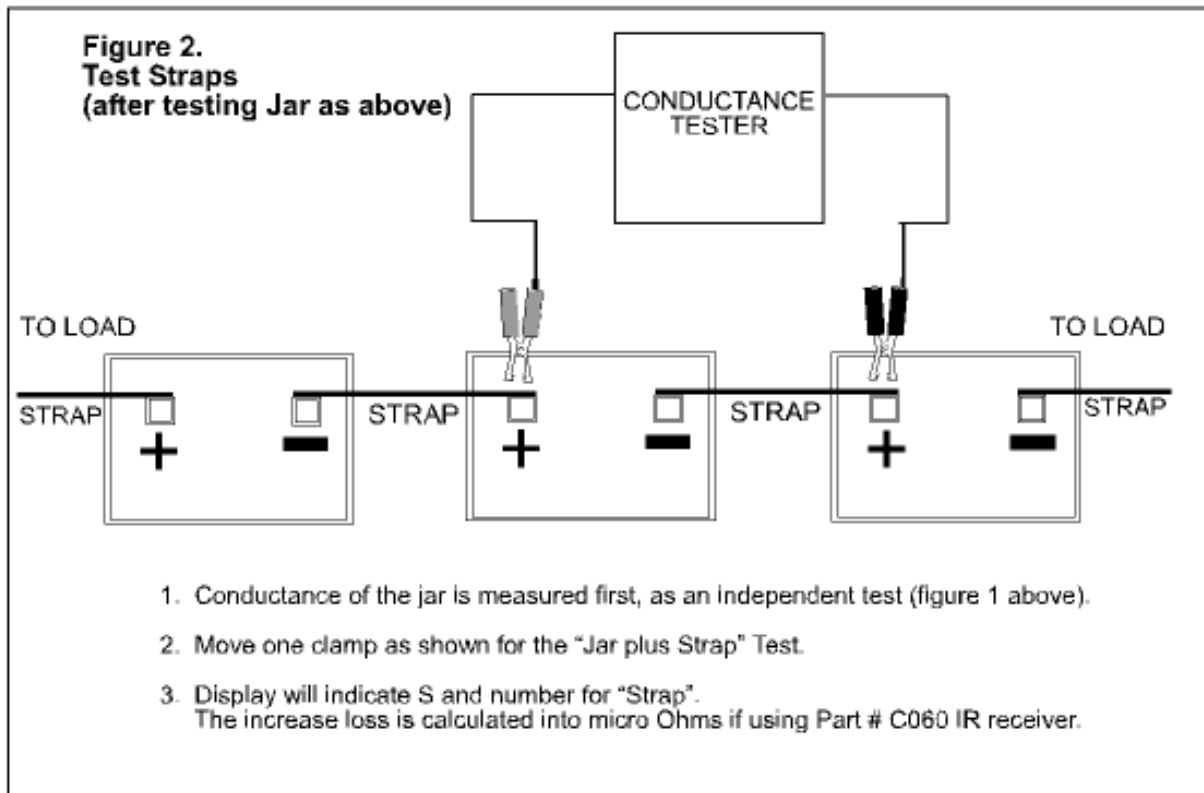
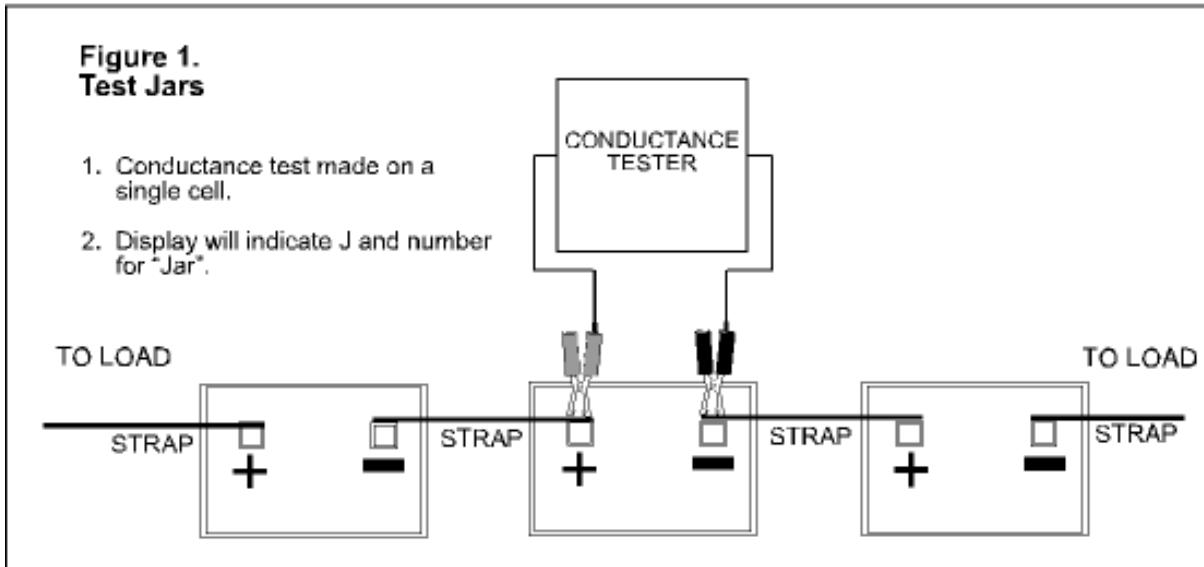
Testing In Auto Probe Start mode



The Micro Celltron gives an audible double BEEP each time a test is complete. If the test result is outside pre-programmed limits, there will be an additional extended warning BEEP at the end of the test for every nonconforming test result.

- ➔ If you have a questionable reading in **AUTO PROBE MODE**, you can retest the jar or strap by switching the Micro Celltron to **MANUAL PB MODE** and scrolling back through the stored results to test any jar or strap again. Once you have scrolled back to retest and overwrite, you must scroll forward to the end of the test data and turn datalogging back on to resume data collection of the string. See page 10 for more detail on manual testing.

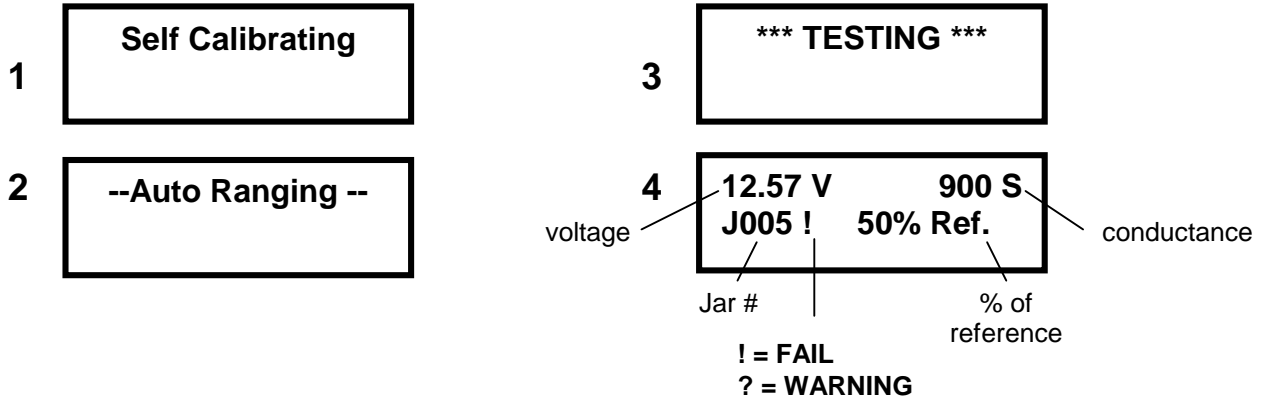
PROPER METHOD FOR CHECKING INTERCELL CONNECTION INTEGRITY USING CONDUCTANCE TEST EQUIPMENT



In Manual PB Start mode

**Ready to Test:
Jar Only # 5**

Press the **YES** key. The test will start and you will see the sequence as listed below. Note that the test starts from the last jar/strap tested unless you use the arrows to scroll back and retest a jar/strap.



The Micro Celltron gives an audible double BEEP each time a test is complete. If the test result is outside programmed limits, there will be an additional extended warning BEEP at the end of the test for each nonconforming result.

Step 6: DATA PRINTING OR REVIEW

To review or print any test data, DATALOGGING must be turned ON! A **REVIEW DATA SET DISABLED** message will appear if you try to review or print data with datalogging turned off, OR if there is no data currently stored. Datalogging is turned on/off from the Configure Tester menu.

Conductance Measurements

The Micro Celltron measures and displays conductance in a Siemens value. On the printout, this value is noted in the “JAR--G” column. For each cell test, the Micro Celltron also measures and displays VOLTAGE to verify state of charge. Finally, the percentage (%) of the measurement compared to the conductance reference value is shown, if a reference value was entered during setup.

These same measurements are displayed in the printout from your HP infrared printer. The printout also displays the reference value entered by the operator, the temperature entered, and the volts per jar selected and important string summary measurements as follows.

Important Battery String Statistics

1. Press **MENU** to turn on tester
2. Scroll to **--STRING SUMMARY--** and press YES
3. The display shows **STRING % OF REFERENCE**, which is the average conductance measurement for the entire string, or average for the total number of jars tested**
4. Press arrow or menu to display **Low Jar** in the string
5. Press arrow or menu to display **High Jar** in the string
6. Press arrow or menu to display the **String Average** as a percent of the highest jar

7. Press arrow or menu again to exit **STRING SUMMARY** menus. Press **NO** or **MENU** key anytime to exit the **STRING SUMMARY** displays.

➔ *This is one of the most powerful features in the Micro Celltron. This feature allows you to judge the overall string health, while still being able to quantify individual cell/jar measurements!*

These values give you the ability to immediately establish a mean, a range (high & low) and a sample size for statistical quality and process control, and the power to conduct thorough analysis by string, battery type or installation site.

Review Data Set:

Press the **MENU** key and scroll to **REVIEW DATA SET** and press **YES** to review the test results. Scroll and review results using the **ARROW** keys to each reading. Once finished, press the **NO** or **MENU** key to exit the data review.

Print Data Set:

The Micro Celltron print speed must be set correctly to Printer or Computer in the **UTILITY MENU!**

Press the **MENU** key and scroll to **PRINT DATA SET** to print the stored test information. Make sure the infrared output of the Micro Celltron is in line with the infrared input of the HP printer and the printer is on (or with the Midtronics IR Receiver for transfer to PC). Press the **YES** key and the display will show ****NOW PRINTING**** while the information is transferring. The printer should now be printing out the results. Once the printing is completed, you will be returned to the **SELECT ACTION** screen. To power off the tester, scroll to **-Exit This Menu-** and press the **YES** key. The message **** Saving SETUP **** will be displayed and the display will go blank.

To cancel printing: Wait for the **Press NO to Exit** display to appear. Press and hold the **NO** key until printing has stopped.

HINT: *The tester will continue to send data once the **YES** button is pressed. If the tester output and the printer input are not aligned, all the data may not print. If data has not printed, press and hold the **NO** key. Restart the print data sequence.*

If you suspect the printer is inoperative, perform the printer self-test. Press and hold the PAPER FEED key while turning the printer ON, then release the paper feed key. The self-test will print the complete list of font characters and the printer battery condition from 0 to 5. Refer to the enclosed printer manual for more detailed information.

Data Transfer/Download to PC:

Please refer to the Midtronics Infrared Receiver instruction manual.

Operating Instructions - Choosing Reference Value Setup:

The Micro Celltron allows the operator three reference modes to test and measure condition of a battery. From the **Configuration Menu** the choices are:

1. **Scroll Reference** – scroll to the appropriate Siemens value for the battery you are testing and press **YES**. This information should be obtained from historical measurement benchmarks or battery manufacturer information. See Section 6 for more on obtaining reference values.

2. **Use Battery Type** – Select a specific battery type and its corresponding rating and press **YES**. To utilize this option, the operator must have previously entered battery information in one of the 30+ memory locations. See Section 4: **UTILITY MENU** for information.
3. **String % of HI Jar** – This is a data collection only mode, located as the default setting of **Memory Location 32** of the **Use Battery Type** menu (Step 2 above). Scroll to Location #32 and press **YES**. No reference values are displayed for jars/straps! The tester records the average string reference based on the number of jars tested, and the highest jar tested in the string. See Section 4: **UTILITY MENU** for information.

Operating Instructions - No Datalogging, Testing in Manual mode

For testing varying cells/jars without recording state of health or charge data.

Step 1:

Identify the battery manufacturer, the model number, number of cells per jar, date of manufacture and installation, battery temperature at the time of test and any physical evidence that may give an indication of the battery condition.

Step 2:

Press the **MENU** key to turn the test set on. Scroll to **CONFIGURE TESTER** and press the **YES** key to continue. Scroll to **DATALOGGING- -OFF** and press the **YES** key. The message **** Saving SETUP **** will be displayed and the display will go blank.

Step 3:

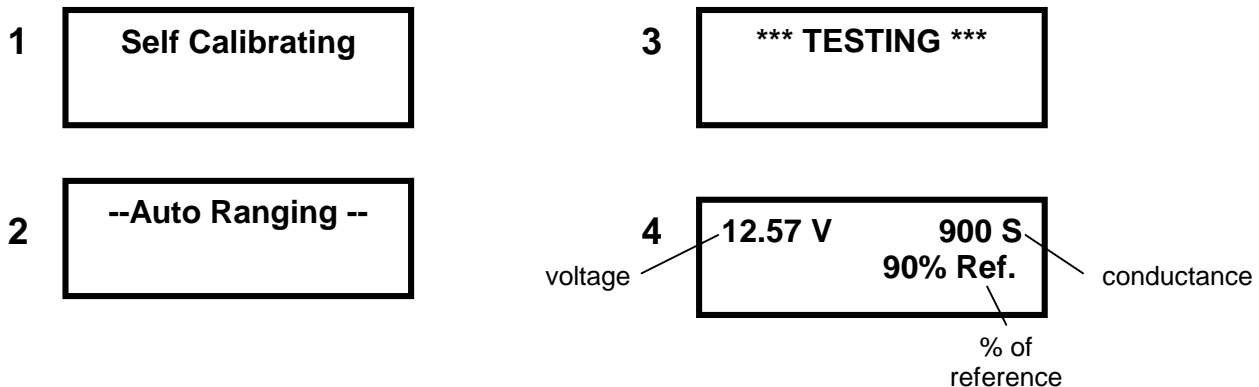
Press the **MENU** key to turn the test set on. Scroll to **UTILITY MENU** and press the **YES** key. Select **CONNECTION MODE**, press **YES**, and then select **MANUAL PB START**. The message **** Saving SETUP **** will be displayed and the display will go blank.

Step 4: TESTING

Connect to the first battery/cell to begin testing. You will be prompted to input information prior to each test:

- Scroll to **Volts per Jar** (2 – 12 volts) and press the **YES** key.
- Scroll to the **G Reference** and press the **YES** key.
- Scroll to the **Temperature in degrees Celsius** and press the **YES** key

The test starts and the following sequence will be displayed:



Section 4: UTILITY MENU

When first initiating the test set, there are several options you will need to select or setup prior to testing. To make any changes in the way the Micro Celltron memory functions are arranged, follow these steps:

1. Press the **MENU** key until the display powers on.
2. Scroll to **UTILITY MENU** and press the **YES** key.
3. Scroll to the desired function and press the **YES** key, (functions are shown below).
4. Scroll **↓↑** to edit the current selection and press the **YES** key to accept.

CONNECTION MODE

Describes how the test set begins each test.

- Select **Manual PB Start** to have the tester prompt you to press the **YES** key for each desired battery test.
- Select **Auto Probe Start** and the tester will automatically start to test as soon as a good connection is made with a battery.

***HINT:** using the test probes in the **Manual PB Start** position will require three hands to operate the test. The **Manual PB Start** mode is designed to give you the opportunity to retest previously recorded data.*

SET IR SPEED

Allows you to change the output rate of the infrared output port for downloading stored test results to Midtronics HP printer (accessory #A050) or a PC using the optional IR receiver with Battery Management Software (#C060). Scroll to select an option and press the **YES** key to accept.

***HINT:** If the incorrect print speed option is chosen, the test data will not print/transfer correctly. Always confirm the correct **IR SPEED** if you are experiencing printing problems.*

BATTERY EDITOR

The Micro Celltron has 32 memory positions where names and reference values can be entered for frequently tested battery types and sites. Thirty-one of the memory locations are EMPTY and require the operator to input the battery's reference conductance and name/description. This option should decrease required setup time when repeatedly testing a variety of batteries.

As an added feature, **Memory Location #32** is named **STRING % OF HI JAR**. This location is already programmed to be used as reference-less testing. The string average as well as the highest and lowest measured jars are measured and stored. These values can be used to establish a meaningful reference value for the entire string. To set the Micro Celltron to test in this mode, select **USE BATTERY TYPE** from the **CONFIGURATION MENU**. Select **String % of HI Jar** (or #32) from the Battery Type selection and press **YES**.

The **Scroll Reference** for location #32 is also the lowest reference setting available, (scroll down **↓** below 110 Siemens). It is displayed as "#---" on the **SCROLL REFERENCE**.

The other memory positions are available starting from **MEMORY #01** up to **MEMORY #31** and can be edited by the operator for both:

- Battery name (Up to 16 characters)
- G (Conductance) reference value from 110 to 9990 Siemens

To program a new battery type/reference:

1. Turn Micro Celltron on, scroll to the **UTILITY MENU** and press the **YES** key.
2. Scroll to **BATTERY EDITOR** and press the **YES** key.
3. Scroll to the desired memory location and press the **YES** key.
4. Scroll to the battery's correct conductance reference and press the **YES** key.
5. To enter the battery name, use the **ARROW** keys to scroll to the desired letter/number/character. Once the desired letter is displayed, press the **YES** key to move to the next character position. Up to 16 characters can be used, including spaces, periods, etc.
6. Once the name is entered as desired, press the **YES** key to move the cursor past the end of the line until the tester shows **Editing Complete**, or press the **NO** key and the display will show **Edit Cancelled** followed by **Editing Complete**. All changes made prior to pressing the **NO** key will be saved.

Next, the tester will prompt you **Print Batteries?**

- Press the **YES** key to print the list of programmed batteries. You will be prompted to **LINE UP INFRARED** and **Press YES to GO!** With the printer turned on and the infrared lenses lined up, press the **YES** key to print a list of the programmed batteries.
- Press the **NO** key if you do not want to print a list of the battery names and reference numbers programmed in memory.

ADJUST CLOCK

Controls the time set of the internal clock of the tester. Adjustments available are Day, Date and Time. This clock and application is fully Y2K (Year 2000) compliant.

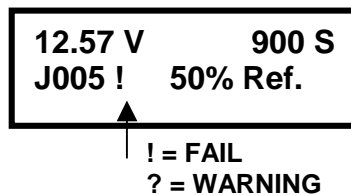
SET DATE FORMAT

Gives you the option of recording the date for the United States, which is MM/DD/YY or for the most common international format of DD/MM/YY.

EDIT PERCENT LIMITS

The indications for an out of limits test result are the ? for **WARNING** or the ! for a battery **FAIL**. This visual indication of an out of limit test result appears on the test set screen and also on the printed copy with the test results when using the datalogging feature. These values can be set anywhere from 10% to 99% in any of these categories.

For example:



The factory programmed settings are:

<u>On-Line</u>	<u>Off-Line</u>
JAR WARN: <70%	JAR WARN: <60%
JAR FAIL: <60%	JAR FAIL: <50%
STRING WARN: <70%	STRING WARN: <60%
STRING FAIL: <60%	STRING FAIL: <50%

Adjust each WARN/FAIL percent by using the tester's up/down arrows. Confirm each percent by pressing the **YES** key.

CHOOSE LIMIT SET

Allows the operator to utilize different WARN/FAIL alarm thresholds for battery testing either **ON-LINE** or **OFF-LINE**. Simply select on-line or off-line with the arrows and press **YES**. This is necessary to accommodate testing new batteries, batteries in storage or any time before installation. Once the battery is installed in a system you may select a modified (higher) alarm point for in-service (on-line) batteries. Consult your company Power Systems Manager or Director for specific requirements.

EDIT LOW VOLTAGE

Provides the option to give an extended audible warning **BEEP** at the end of the test when a voltage is recorded lower than expected during any test sequence. This may be adjusted for specific battery types (Flooded, AGM or GEL) having a unique value or when an indication of low cell voltage is desirable. Voltage range is from 1.5V to 2.5V; factory default is set at 2.1V. This may be a useful function for qualifying batteries prior to installation. Note that the tester automatically sounds an audible warning for voltage that is HIGHER than expected.

EXIT THIS MENU

Will shut the tester off and save any information as currently programmed. The software revision of the firmware and personality files and the serial number of the test set are displayed when exiting from the Utility Menu.

Section 5: DATA INTERPRETATION

The Micro Celltron is designed to give you a simple, safe, fast and accurate test process to allow you to perform routine maintenance on your standby batteries. Refer to the information below and your company's procedures to complete your battery maintenance visit.

Using measured conductance values:

The measured conductance value (Siemens) is important for a continuous preventative maintenance program. Simply print the site results after testing and leave the information at the site for comparison following the next scheduled test or keep the print-out in a site log for long term trending and reference. The measured values will provide an important site history to help with maintenance/replacement priority and warranty data needed for your supplier.

When comparing current test data to historical test data, look for cells/batteries that have changed significantly to determine what activity may need to take place. Refer to the section below for clarification of percentage difference from an expected or reference value. For the latest up to date reference information, consult your company's procedures and documentation or consult the Midtronics web site at www.midtronics.com or call customer service at (800) 776-1995 or (630) 323-2800.

> 80% of reference conductance

If all cells/batteries in the string are above 80% of a valid reference conductance the batteries are in good condition and no additional action is normally required. However, use common sense and make sure there are no physical signs of damage to any of the batteries. The Micro Celltron measures the internal condition of the battery, and may not detect recent physical damage or connection resistance problems if you only test the jar condition.

60%-80% of reference conductance

The cells/string is serviceable with additional maintenance suggested. Check for obvious problems and refer to any site history for an indication of what may be causing low readings. Refer to your company's maintenance procedures for cell/string maintenance for guidance or refer to IEEE standard 1188-1996: Recommended Practice for Maintenance, Testing and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Application.

< 60% of reference conductance

If any of the measured cells or the average reading of the string is near or below 60% of a valid reference conductance, the cell or string is generally considered unserviceable and requires immediate action. Refer again to your company's battery replacement procedures or IEEE standard 1188-1996 document for additional details.

Section 6: BATTERY TESTING RECOMMENDATIONS

Testing a New String for the First Time with No Reference Value

When testing a new battery string for the first time after installation, you must first establish a reference value for that battery type and configuration. **See Section 7 of this manual for guidelines for establishing reference numbers.**

Once established, this reference will be used to test as part of your regular maintenance routine. If the battery model is common, there may already be an established reference value. Midtronics keeps a quarterly updated list of battery reference values on its web site at www.midtronics.com or you can call (800) 776-1995 and obtain a list from customer service. As new reference values are established for battery models, Midtronics will continue to add new information to this list. If you establish your own reference value and would like to help other potential users, please email your information to net@midtronics.com or fax to us at (630) 323-7752 to ATTN: DAN - Reference Value List.

Once reference values are set, you can program the tester for your specific battery type or manually input the reference prior to testing. New batteries tend to measure within 10% ($\pm 5\%$) of each other, but can vary to up to 20%. **Batteries in a battery string will perform best when they are matched within roughly 20% of each other ($\pm 10\%$).** When checking incoming batteries, you can use this technique to find possible problem batteries prior to installation. There may have been physical damage that occurred in transportation, a long period without being charged (stand loss) or some other problem that should be identified prior to installation.

Testing an Existing String with Established Reference Values

If Micro Celltron conductance reference values have been established for the cells/string you are testing, test using the reference value or using a pre-programmed battery if you have set-up the battery type in memory.

Testing an Existing String with Reference Value from another Midtronics tester

If testing an existing string using references created for use with another Midtronics tester (**Celltron CCT 20, Celltron PLUS, Midtron Series**) you must convert the reference for use with the Micro Celltron. The Micro Celltron uses a new advanced conductance testing method with HNR technology, which means the Siemens value may be different from the previously established Mhos reference value depending on the specific battery type and construction being measured. To convert the reference value, follow the procedure below. Once converted, program your tester to that battery type for future testing. Note the new reference number using the Micro Celltron may be higher or lower, depending on the battery's construction.

Each conductance test set uses a circuit designed to do a specific test based on the specific application. The Midtron testers work on 6V and 12V Lead/Acid batteries in off-line applications only. Both the Celltron Plus and the Micro Celltron are designed to test single cell through 6 cell batteries either on-line or off-line and use a special circuit design to allow battery testing without having to remove the battery from service.

Converting Battery Reference Data

Data conversion is ONLY important if you already have taken measurements with a different Midtronics battery tester. For the most reliable data conversion, we strongly suggest testing the battery system in consecutive order with the two test sets you are comparing. If the old test set is not available for direct comparison and the battery test data is more than one year old, we urge you to be cautious in what you infer from these comparative test results. There may or may not have been significant change in one or more of the cells being tested and it can be difficult to spot the difference between a change in the battery and a change in the test result based on test hardware. This rule is also true for data comparison between a conductance test set and comparative test equipment available from other manufacturers.

- If you cannot do a direct test set comparison, simply treat the battery string as a new system and record all data using your Micro Celltron test set.
- If you do not have another tester, use the last recorded percent of conductance reading.
- If no previous measurement data is available, refer to Section 8.

Next, test the batteries using the Micro Celltron. Use the conversion information below to convert the readings.

Micro Celltron readings \div old % reference = new Micro Celltron Reference Value

Example:

1. Celltron PLUS measures the battery at 80% of reference using 1000 MHOS reference value.
2. Micro Celltron measures the battery at 700 Siemens.
3. New Micro Celltron Reference value = $700 \div 0.80 = 875$ Siemens.

Section 7: ESTABLISHING REFERENCE NUMBERS

Testing an Existing String with No Known Reference Values

If testing an existing battery or string with no known reference value, measure each cell or battery and print or download the results.

1. Test the whole string.
2. Use the String Average (displayed in **STRING SUMMARY** or printout) as your reference and make future analysis from it.
3. If some batteries in a string have been replaced recently, use the newer batteries as a benchmark, especially if they correlate to the Highest Jar measurement (displayed in **STRING SUMMARY** or printout).
4. The Highest Jar and String Average are a starting point for that particular battery in that particular string. Other battery strings measurements will vary with age, temperature and other site conditions.
5. Test the batteries every 3 months to monitor any loss in conductance and prevent further decline and failures.

HINT: *Testing inconsistently can critically affect conductance measurements.*

- Avoid testing on stainless steel of any kind. It will lower your conductance measurements.
- Avoid bolt heads, washers, threaded posts, or any hardware.
- GET ON THE LEAD POST ITSELF, or in the middle of the lead intercell connection strap.

If battery and cabinet construction makes testing at the post or lead strap impossible, **BE CONSISTENT** with every test. If you must test on the hardware, test in the same spot for every cell, every time. If you are inconsistent with your probe or clamp placement, your reading will be inconsistent as well.

Additional Notes to Establishing Meaningful Reference Numbers:

Many battery manufacturers now publish baseline or reference conductance values. Batteries of the same amp-hour size and construction (Flooded, AGM or GEL) from a single manufacturer tend to exhibit a similar conductance signature when tested at the same temperature in a fully charged state where all batteries are in good condition. To create a valid conductance reference number for any battery you simply need to follow the instructions below and document the following data.

Sample at least 30 batteries from one manufacturer with the same model number that are the same relative age and have the same service history. Take conductance measurements with the Micro Celltron for all these cells with datalogging turned on, and use the **STRING AVERAGE** as the average conductance.

Again, if you are measuring an installed site for the first time, measure the entire string with the Micro Celltron and use the **STRING AVERAGE** and **HIGHEST JAR** measurement. Use this value as your reference number for that site and program the battery name and reference into one of the 32 available memory locations.

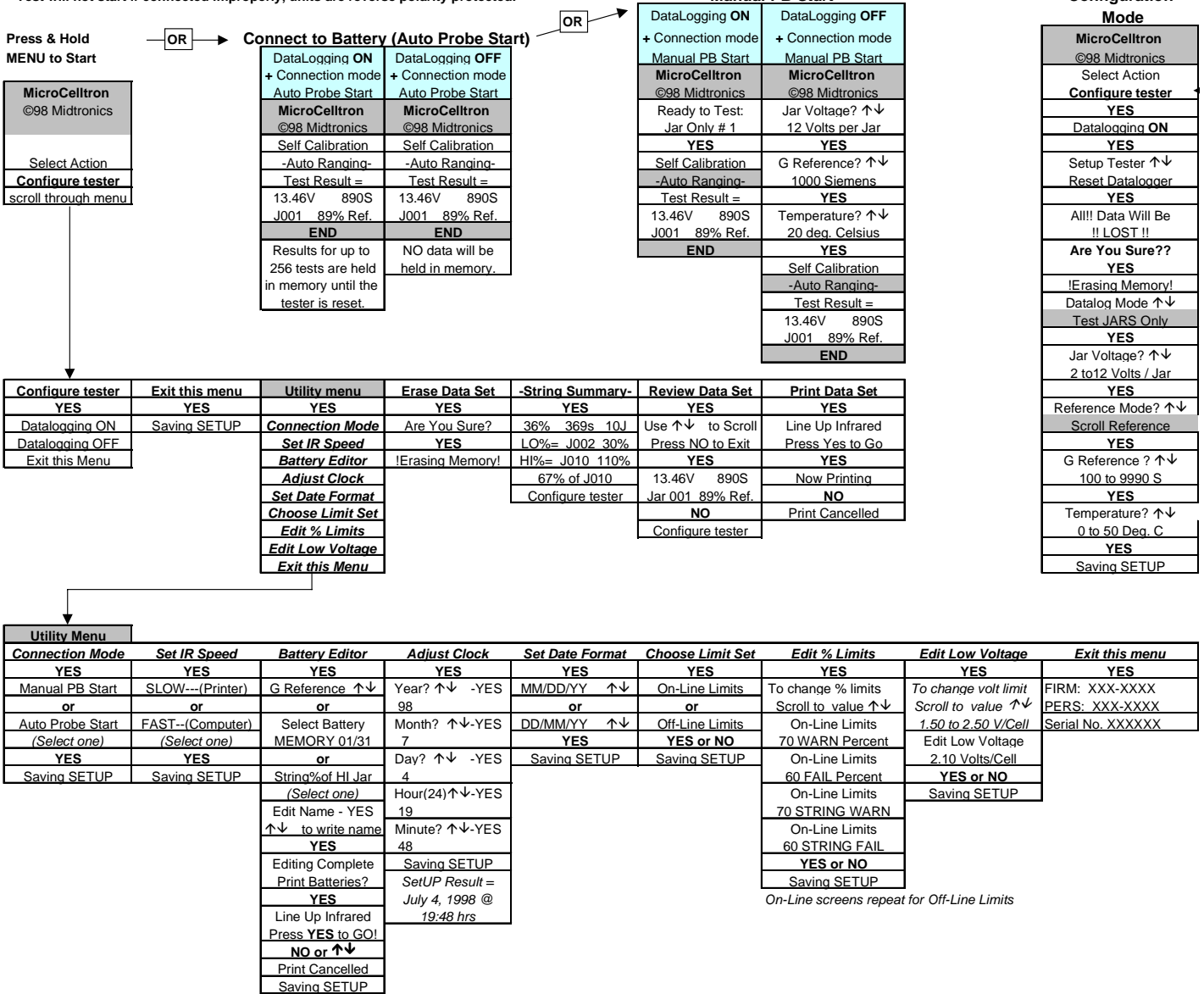
You should note and record the following information for a valid conductance reference number:

- Battery manufacturer and model number
- Date of manufacture and installation date if available
- Battery operating conditions including charge voltage (Volts Per Cell), battery operating temperature and DC current through the battery
- Any physical signs indicating trouble - - - leaking battery acid, visible corrosion, distorted battery cases can all signal serious problems
- For on-line testing, don't take readings if there has been a recent power outage and the system is being boost charged – you will get erratic results.
- With the batteries on float charge, test one battery 5 times consecutively – you should get virtually the same conductance result
- Now move one test set clamp or probe to a position which will include the battery and an intercell connector and take one more test – the reading should be slightly lower depending on the size and length of the strap.
- If the test results do not conform to this pattern, there is an electrical signal present in the system that may stop you from getting good test results. Use maintenance procedures for troubleshooting the source of the noise in the power system.
- If there are any batteries in your sample that read exceptionally high or low (>30% from the mean), do not include them in your averaging calculation because it is possible they may already be outside of an acceptable range.
- After installation, it is typical for the conductance to increase (along with capacity) in the first 3 months as the battery fully forms and the recombination process stabilizes.

Section 8: TESTER MENU SCREEN FLOW-CHART

MicroCelltron CTM-100 Flow Chart Rev. 4 Modified 12/17/98

**Test will not start if connected improperly, units are reverse polarity protected.



Section 9: TROUBLESHOOTING

Trouble with the tester:

If the display does not illuminate when testing:

- Check connection to the battery.
- Battery being tested may be too low (<1 volt) to perform test.
- Internal 9-volt battery may need to be replaced. Replace the 9-volt battery and retest.
- A fuse may be blown. The Micro Celltron has a replaceable fuse on the top of the tester near the cable connection. If the tester will not operate, replace the fuse using the spare fuses included with the tester or fuse type 5mm x 20mm 1.25 Amp, available anywhere fuses are sold.

If the display does not illuminate when pressing the menu key:

- Replace the internal 9-volt battery.

If the tester fails to advance to the next JAR count:

- Attempt to retest. If the problem persists, call Midtronics for assistance.

Trouble with printing:

- Make sure the printer is on. A red dot is shown on the printer on switch when the printer is on.
- If the printer is on and won't print, check the display of the Micro Celltron. The tester display will show that printing is in progress while sending information.
- The Micro Celltron must have the **DATALOGGING** function turned **ON** to print.
- Make sure the printer is functional by performing the printer self-test. Hold the Paper Feed button down while turning on the printer, then release the paper feed button. The printer should print all of its characters and the printer battery condition as a test.
- If the tester is showing that it is sending data as described above, abort the print, turn off the printer and replace the batteries. The printer requires 4 AA batteries for operation.
- If the printed data is unclear, the IR speed may be set incorrectly. Refer to **Set IR Speed** in Section 4 of the manual. Always check the **IR Speed** selection if you are experiencing printing problems.
- If unable to print after ensuring the tester is functioning, the printer is on, the batteries are good, and the IR ports are aligned, check the printer manual for further instructions or call Midtronics at 1-800-776-1995 for additional assistance.

Battery Replacement:

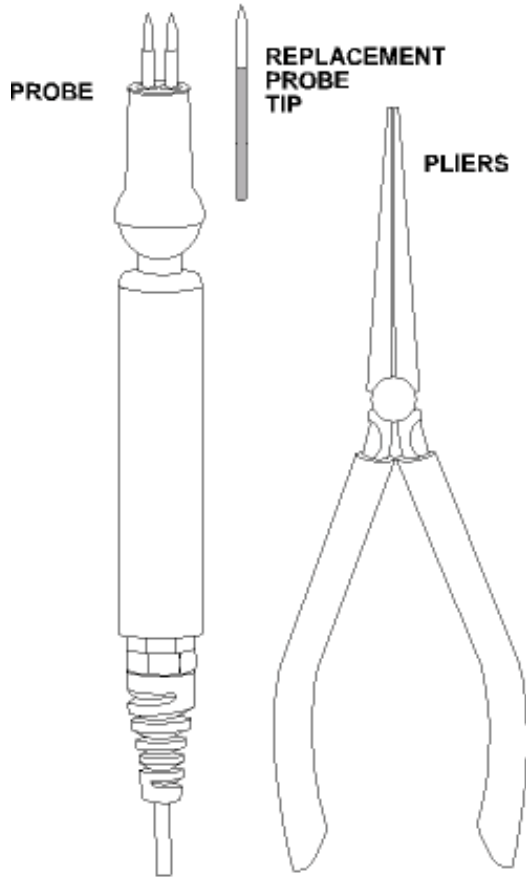
Step 1: Carefully remove the battery door on the back of the Micro Celltron using a small flat tip screwdriver.

Step 2: Insert a new 9-volt battery, making sure the battery terminals are properly aligned.

Step 3: Snap the back cover into place and you are ready to test again.

Probe Tip Replacement

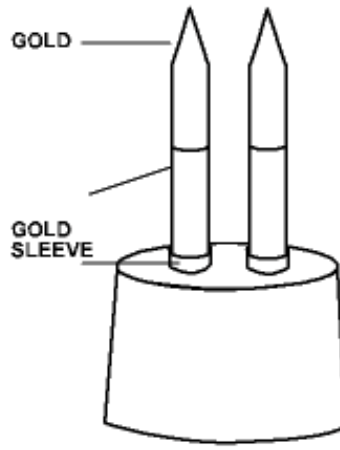
The Micro Celltron probes use replaceable tips. If the probe tips get bent or stop moving, simply remove the tips by pulling them straight out one by one and replace using the spare tips included with the test kit. Please refer to the following diagram for correct tip replacement. Replacement probe tips are sent with each complete CTM-300 Battery Testing Kit. If you need additional help, contact Midtronics Customer Service.



C 069 REPLACEMENT PROBE KIT

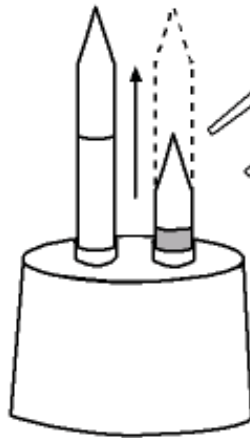
KIT CONTENTS:
4 SPARE PROBE CONTACTS
2 SPARE PROTECTIVE CAPS

PROBES AT NORMAL POSITION



168-610A Copyright 1998 Midtronics Inc.

**REPLACE PROBE
USE PLIERS.**



CAUTION:

DO NOT CRUSH GOLD SLEEVE THAT EXTENDS OUT OF PLASTIC PROBE BODY. THIS WILL PERMANENTLY DAMAGE THE PROBE.

- GRASP PROBE AS CLOSE TO TIP AS POSSIBLE.
- USING FIRM, STEADY PRESSURE, PULL THE PROBE TIP STRAIGHT OUT.
- CAREFULLY INSERT THE REPLACEMENT PROBE TIP INTO THE OPEN PROBE PORT.
- COMPLETE INSERTION BY PUSHING PROBE TIP AGAINST A RELATIVELY SOFT SURFACE, (MOUSE PAD, PIECE OF WOOD OR PHONE BOOK) UNTIL THE TIP "BOTTOMS" GENTLY IN THE PROBE SOCKET.

Section 10: Sample Battery Data Sheets

Battery data collection sheets are included in the last pages of this manual for your reference. Use this or a similar format.

Section 11: PATENTS/WARRANTY/SERVICES

PATENTS

Made in the USA by Midtronics, Inc. and is protected by one or more of the following U.S. Patents: 6,037,777, 6,002,238; 5,831,435; 5,821,756; 5,757,192; 5,598,098; 5,592,093; 5,585,728; 5,574,355; 5,572,136; 5,343,380; 5,140,269; 4,912,416; 4,881,038; 4,825,170; 4,816,768; 4,322,685; Canadian Patents: 1,280,164; 1,295,680; United Kingdom Patent: 0,417,173; German Patent: 689 23 281.0-08; European Patent 0,548,266; and other U.S. and Foreign patents issued and pending. This product may utilize technology exclusively licensed to Midtronics, Inc. by Johnson Controls, Inc. and /or Motorola, Inc.

Limited Warranty

This battery tester 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 tester. This limited warranty applies only to Midtronics battery tester and does not cover any other equipment, static damage, water damage, overvoltage, 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 tester 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 testers beyond the warranty period are subject to the repair charges in effect at that time. Optional remanufacturing service is available to return the tester to like new condition. Out of warranty repairs will carry a 3-month warranty. Remanufactured units purchased will carry a 6-month warranty.



Midtronics, Inc. Midtronics b.v.

7000 Monroe Street
Willowbrook, IL 60521
U.S.A.

Noord IJsseldijk 24
3402 PH IJsselstein
The Netherlands

Tel: (630) 323-2800
Fax: (630) 323-2844

Tel: +31 306 868 150
Fax: +31 306 889 015

ISO9001 Certified ISO9002 Certified

Toll Free in North America (800) 776-1995

Visit us on the www.midtronics.com