

Operating Manual

CellMate EX Analyzer



Graphical 600-999 MHz Antenna Analyzer

AEA
AEA Technology, Inc.



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INTRODUCTION

WHAT IT DOES

The CellMate EX combines a microprocessor-controlled 600-999 MHz frequency sweep synthesizer with an accurate low-power directional coupler to present a graphical display of Return Loss and VSWR frequency values.

The CellMate EX is primarily used to graph and examine plots. These and other frequently used functions are assigned to dedicated keys that include all but the top row of the keypad. The Cellmate EX's more specialized functions are embedded in a system of menus that can be accessed using the top row of "softkeys" (F1-F5).

Once installed on your PC, the optional Analyst Director software can be used to interface with the CellMate EX. This software not only consolidates various CellMate EX function into single commands, but allows remote control of the unit as well.

NOTE: The CellMate EX can also be remotely controlled from an ASCII terminal; however, in this case, data flow is slightly delayed.

FEATURES

- . Return Loss and VSWR modes.
- . Auto-scaling.
- . Auditory cues.
- . Signal Generator Mode.
- . Relative field strength measurements.
- . Self-test and calibration functions.
- . Auto-Off and Auto-Hold.
- . Non-volatile memory.
- . Plot storage for up to 15 plots.
- . SuperTwist display for sharper images.
- . Display has EL Backlighting.
- . Compatible with optional Analyst Director software for plot transfer between PC and CellMate EX.
- . Compatible with NiCd and NiMH batteries.
- . Extensive onscreen Help function.

SPECIFICATIONS

Frequency Range:	600-999 MHz, 10 kHz steps
Frequency Resolution:	Increments of 10 kHz
Display Width:	0 to 200 MHz
Impedance:	50 Ohms
Antenna Connector:	Type N
Output Power:	+5 dBm minimum into 50 Ohms
Harmonic and Spurious:	>15 dB below fundamental
VSWR Plotting Range:	1:1 to 10:1
Return Loss Plotting Range:	-1.7 dB to -30 dB
Maximum Input:	+20 dBm
Measurement Speed:	Single frequency: Several readings/second Normal sweep: <1 second/sweep
Memory:	Non-volatile memory for 15 named plots and configuration data
Serial Interface:	9600 or 19200 baud, XON/XOFF-remote control, real time display, plot transfer
Power Requirements:	8 AA Alkaline, NiMH, or NiCd cells; 12-16 VDC @ <250 mA
Battery Saver:	Powers down or shuts OFF after 5 minute idle period
Battery Life:	6 hours typical on full charge, continuously plotting
Size:	4.3" W x 2.25" H x 8.5" L (including connector) (10.32 cm x 5.4 cm x 20 cm)
Weight:	1 lb. 10 oz. (including batteries)

QUICK START

To help you get started, we've included this brief introduction that outlines the general functions of the CellMate EX.

To begin, set your CellMate to its default settings. First, however, make sure the unit is OFF. Then, hold down the F1 and F5 function keys and press the ON button. Continue holding down the function keys until the unit beeps.

A simple plot will appear on the display. Notice that the center frequency is 900.00 MHz and the width is 0.00, indicating that you are in Single Frequency Mode. The plot has been given the default name "NEW". The RETL value (0.00) is highlighted, indicating that the unit is displaying Return Loss. The top of the vertical axis is labeled -1.70 dB, and the bottom of the axis is labeled -30.00 dB. Since there is no antenna connected to the CellMate, the plot is given an out-of-range value represented by a mostly straight line at the top of the screen.

To switch from RETL mode to VSWR mode, press F1. The DSPLY menu, which lists the display modes, will appear onscreen. Press F2 to select the VSWR display mode. Notice that the VSWR value (65.53) is now highlighted, and the vertical axis values have changed to 10:1 at the top and 1:1 at the bottom. Tick marks have also been added at intermediate integer values along the vertical axis.

Now, assume you want to measure VSWR over a 50 MHz range that is centered at 875 MHz. Press 8 7 5 0 0 ENTER to set the center frequency, and then press WIDTH▲ six times to increase the width to 5 MHz. Touch a small metal object (i.e. paper clip) to the center pin of the Antenna connector, and let your fingers touch the connector's shell. The plot line will immediately drop. You can move the plot up and down by changing your grip on the metal object. Once you have created an "interesting" plot, press the EXAM/PLOT key to freeze the display. A cursor will then appear at the center frequency. You can use the FREQ keys to move the cursor anywhere on the plot. Notice that by moving the cursor, you change the cursor frequency as well as the VSWR and Return Loss values.

Before you can save this plot, you'll need to give it a recognizable name. In this case, use "BOGUS" as the plot name. Press F1 (MENU), F2 (NAME), F1 (ABCDE), F2 (B), F3 (KLMNO), F5 (O), F2 (FGHIJ), F2 (G), F5 (UVWX), F1 (U), F4 (PQRST), F4 (S), ENTER. Now save the BOGUS plot by pressing F1 (MENU), F3 (MEM), F2 (STORE), F1 (#1).

For more detailed information on each of these functions, please refer to later sections in the manual.

OPERATION

DISPLAY

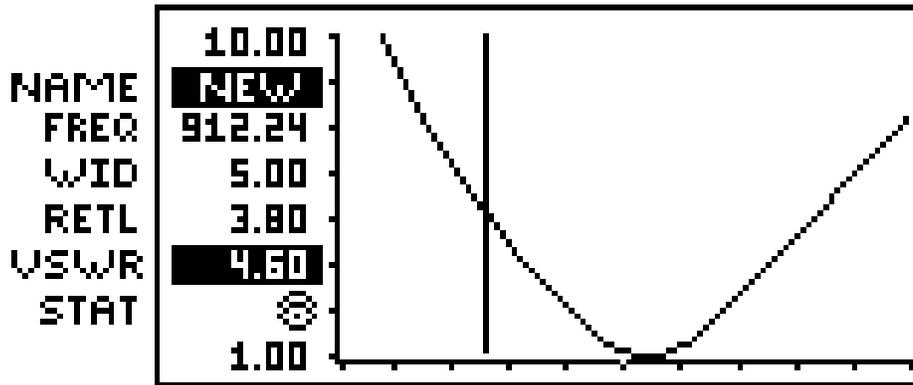


Fig. 1

The display's plotting area is 100 pixels wide. It is bordered on the left by a vertical axis representing Return Loss or VSWR values, and on the bottom by a horizontal frequency axis containing tick marks every 10 pixels. The center frequency is identified by a missing pixel above the center tick mark. During the plotting process, tick marks are added to the vertical axis at integer values of VSWR or 5 dB intervals of Return Loss, depending on the display mode selected (refer to DISPLAY MENU section).

For optimal resolution, activate the SCALE function (refer to SETUP MENU section). Depending on the mode selected, the CellMate EX will scan the current frequency range for the highest VSWR value greater than 2:1 and less than 10:1 (maximum scale value), or the highest Return Loss value greater than -9.5 dB and less than -1.7 dB (maximum scale value). It then sets the vertical scale's maximum (topmost) value to this number. A straight line at the top of the display represents values that exceed the scale's maximum value.

To the left of the vertical axis are eight lines of information. The top line indicates the plot's maximum VSWR/Return Loss value and the bottom line indicates minimum VSWR/Return Loss value. The six intermediate lines are identified by the following captions:

- NAME** Name of the current plot. If the plot has not yet been assigned a name, the word "NEW" will be displayed on this line.
- FREQ** Cursor frequency in MHz.
During plotting, the cursor invisibly relocates to the center frequency.
During Exam/Plot, the cursor is visible and moveable using the FREQ▲ and ▼ keys.
- WID** Width of the plot in MHz.
- RETL** Return Loss, measured in decibels, at the cursor frequency.
- VSWR** Voltage Standing Wave Ratio at the cursor frequency.
- STAT** Displays up to three icons indicating the current operational status of the instrument (refer to Icon key below). Any numbers entered on the keypad are also displayed here.

*Larger Return Loss values appear lower in the plot because the CellMate considers a Return Loss of -25 dB to be lower than a Return Loss of -20 dB.

ICONS

The following keys lists the eight icons that may appear on the STAT line at various times of operation.



Indicates that external RF energy may be sufficiently high to cause inaccurate readings.



Indicates that the batteries are getting low and should be replaced (or recharged) soon. *NOTE: You can get a more accurate battery reading by pressing F1 (MENU), F5 (MISC), F2 (CHECK).*



Indicates that the limit alarm setting has been exceeded somewhere in the current plot. *NOTE: If the ALARM function is enabled, a low-pitched beep will also sound at the completion of each plot in which the alarm limit was exceeded.*



Appears while the unit is scanning the frequency range.
NOTE: Refer to PLOT SCALING section for more information.



Indicates that a plot memory download from a PC is in progress. Downloads take only a few seconds to complete.



Indicates that either a plot memory upload or a display dump is in progress.



Indicates that the instrument is holding the plot for examination.



Indicates that the synthesizer has lost phase-lock.
NOTE: This icon may flash very briefly from time to time, but if it stays on longer, service may be required.

RESETTING THE INSTRUMENT

The CellMate retains each stored plot's setting (i.e. mode, center frequency, display width, frequency step size, and limit alarm value) when it is turned OFF*. If you need to reset the CellMate to its default settings, first make sure the instrument is OFF. Next, hold down the F1 and F5 keys and press the ON button. Continue holding down the function keys until the unit beeps.

NOTE: Resetting the CellMate to its defaults clears all 15 plot memories!

DEDICATED KEYPAD

The ON key activates the CellMate while the OFF key deactivates the CellMate.

The number keypad is used to enter center frequencies, display widths, frequency step sizes, and plot names. Each number you enter will appear on the STAT line, which can accommodate up to 5 numbers. If you enter a wrong number, simply continue entering digits. The earlier digits will shift left to make room for new digits.

There are two ways to enter new center frequencies. You can enter a new value numerically on the keypad and press ENTER, or you can use the FREQ keys to increase or decrease the center frequency by a given step size. The step size default value is 10 kHz, but you can change it to any value between 0 and 150 MHz. Simply enter the desired value numerically on the keypad and press either FREQ key. For example, entering 123 FREQ▲ causes the center frequency to step up by 1.23 MHz.

NOTE: The step size is saved when the instrument is turned OFF.

The WIDTH keys are used to adjust the display width value between 0 and 200 MHz. The WIDTH keys step through these values in a 1-2-5 sequence unless they are preceded with a specific value. In other words, to select a specific display width, enter a value numerically on the keypad and press either WIDTH key.

Keep in mind that width settings must be given integer values (i.e. 123.00). Notice that the integer “123.00” is followed by two zeros. This is due to the fact that the two zeros were manually entered. The same value can be entered without the zeros (“123”), but will appear on the STAT line as “1.23” because the decimal point is in a fixed position. However, the CellMate will recognize the number as an integer because the two least-significant digits are not zeros.

NOTE: A width of 0 means that the entire width of the display represents a single frequency.

The EXAM/PLOT key freezes the current plot to enable further examination. Once this key is pressed, a cursor will appear on the plot. Use the cursor to maneuver around the plot and take measurements (Refer to EXAMINING A PLOT section). Also notice that the eye icon has appeared on the STAT line to indicate the activation of this mode. Press the EXAM/PLOT key again to resume plotting.

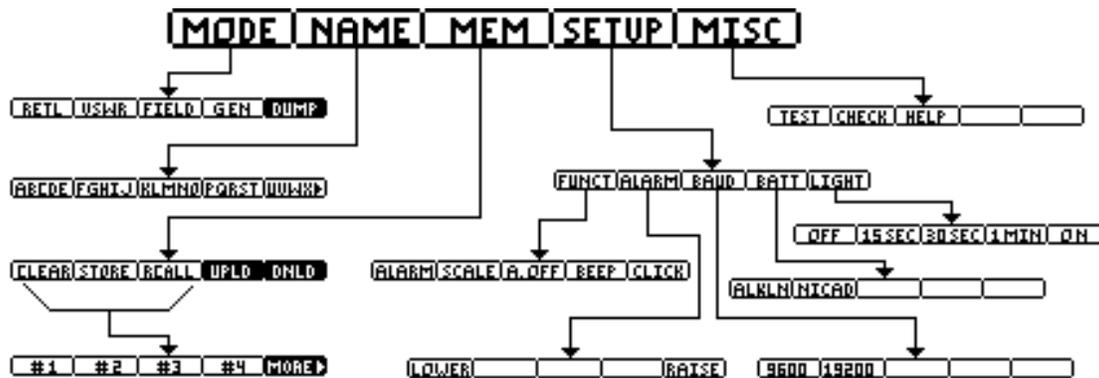
To clear a plot before it has been completed, simply press the ENTER key. If the SCALE function is activated, the plot will also be rescaled at this time.

*If the automatic shut-off function (described below) is enabled, the instrument will turn itself off after a five-minute idle period. If the automatic shut-off function is disabled, the instrument will conserve batteries by automatically powering down the synthesizer and entering the EXAM mode after a five-minute idle period.

MENUS

As mentioned in the introduction, the CellMate’s keypad contains two types of function keys. The dedicated keys, which include all but the top row of the keypad, control the most frequently used functions (i.e. ON/OFF, ENTER, FREQ, etc.). Unlike the dedicated keys, the F1-F5 softkeys don’t perform just one function, but allow you to access many features through the use of menus. These menus appear at the bottom of the CellMate’s display whenever you press one of the softkeys. Each menu contains five subdivisions that correspond to the five softkeys. Simply press the softkey located directly below the subdivision to select that function. In most cases, after you’ve made you final selection the menu will disappear. However, in a few cases, you must press ENTER to leave the menu.

Below is a diagram of the CellMate’s menu levels:



MAIN MENU



The **F1** softkey is labeled *Menu* to remind you that pressing it, or any softkey, will display the Main menu.

MODE MENU



Select the MODE menu (**F1**) from the Main menu to switch back and forth between Return Loss (RETL) mode and VSWR mode. Although both the VSWR and Return Loss values are displayed during plotting, the scale itself represents one mode at a time. Notice that only the selected mode’s corresponding value is highlighted.

Default Mode: Return Loss

F3 in the MODE menu contains the FIELD function, which allows you to activate the relative field strength mode. This function allows you to check a cell phone for output. It must be emphasized that excessive RF at the Antenna connector will damage the CellMate. Do not connect any transmitting equipment directly to the Antenna connector. Use only enough coupling to obtain a reading. As a reminder, the word “CAUTION!” will flash on the display while you are in this mode. To exit the field strength mode, press ENTER.

F4 in the MODE menu pulls up a single frequency SIGNAL GENERATOR. In this mode the RF is constant and at +5 to +7 dBm output power. The frequency is selected as normal and can be changed without leaving the generator mode.

The MODE menu also contains a DUMP function that transfers the current plot (through the serial port) to your PC. (The optional Analyst Director Software accesses this function automatically).

NAME MENU

ABCDE FGHIJ KLMNO PQRS TUVWXY

Before you can save a plot, you will need to assign it a recognizable name. To do this, select the NAME menu (F2) from the Main menu. Five new menus containing groups of letters and punctuation marks will immediately appear on the display. To access one of the groups, simply press its corresponding softkey. Each letter or character will then appear individually as its own menu.

For example, assuming you have already pressed F1 to access the first group of letters, press F1 again to display the following menus:

A B C D E

To access the last few letters of the alphabet not visible in any of the groups, press the F5 Softkey (UVWX>).

U V W X MORE>

Press the F5 softkey (MORE>) a second time to display the letters Y and Z, a hyphen, a period, and <DEL.

Y Z - . <DEL

Use <DEL to delete the last character entered.

Any letters and/or characters that are selected will appear on the NAME line. Plot names can contain up to five characters. After each selection is made, the groups of letters will reappear and the process begins again. Once you've finished entering a name, press ENTER.

*NOTE: Names may contain numbers as well as letters. To enter a number, simply press the desired number key when the **groups** of letters are displayed.*

NOTE: Using more than one of the wider letters (G, M, N, Q, W) may cause the name to be truncated to fit on the NAME line.

MEMORY MENU

CLEAR STORE RCALL UPLO DNLO

Choose the MEM menu (F3) from the Main menu to access any of the 15 plots stored in the CellMate's memory. You can save new plots, recall old plots, or clear any of the 15 plots. Initially, the plots are given numerical default names (“#1”-“#15”). When you save a plot to one of these memories, the name you have previously given it will replace the default name. As soon as you clear a plot memory, it can be reassigned to another plot you wish to save.

When you select CLEAR, STORE, or RCALL from the MEM menu, the name of the operation will appear on the STAT line and the first four plot selections will appear on the display:

#1 #2 #3 #4 MORE>

Each time the MORE> softkey is pressed; the next four plot selections appear on the display. Simply press the corresponding softkey to select a desired plot. If you decide you don't want to perform the selected operation, press ENTER to leave the menu.

After selecting the CLEAR function, press the softkey that corresponds to the plot you wish to clear. Two built-in safety features prevent accidental plot clearing or overwriting. The first safety feature is a prompt box that appears after you have designated the plot you wish to clear. This box displays the name of the selected plot and prompts you to press the F5 softkey if you are certain you want to clear the plot from memory. The second safety feature makes it impossible to save a new plot in an occupied plot memory without clearing it first.

Before you can save a plot using the STORE function, you must give it a recognizable name (refer to NAME MENU section). After doing so, return to this menu and select an available plot memory in which to store the plot.

NOTE: If you wish to rename a saved plot, recall it to the display, clear the location you recalled it from, enter a new name, and re-save it.

After you have selected the plot you wish to RCALL (recall), the CellMate will automatically activate the EXAM mode. This freezes the CellMate's display. The plot, its name, display mode, center frequency, display width, and scale factor (vertical axis values) are then recalled to the display. In effect, plot memories double as "settings" memories. After recalling the plot, simply press EXAM/PLOT to resume plotting. If you attempt to recall an empty plot by mistake, the CellMate will sound an error beep and wait for you to make a new selection.

The MEM menu also contains functions that allow you to upload (UPLD) the entire plot memory, which includes all 15 plots and their parameters, to a PC file, or download (DNLD) the plot memory from a PC file to the CellMate. (The optional PlotCon software accesses these functions automatically.)

SETUP MENU

```
FUNCT ALARM BAUD BATT LIGHT
```

Choose the SETUP menu (F4) from the Main menu to apply universal functions to each plot. Changes made in this menu are saved when the instrument is turned OFF.

FUNCTION MENU

```
ALARM SCALE A.OFF BEEP CLICK
```

Select the FUNCT menu to activate or deactivate the following functions: ALARM, SCALE, A.OFF, BEEP, and CLICK. When you select one of these functions, its current state will appear in parentheses on the STAT line. To switch the function ON or OFF simply press the corresponding softkey, or exit this function by pressing ENTER. Either way, you will return to the FUNCT menu where you can make a new selection or exit the menu by pressing ENTER again.

When a VSWR or Return Loss value (depending on which mode is selected) exceeds the maximum scale value anywhere in an active plot, a bell icon will appear on the STAT line at the plot's completion. If the ALARM function is ON, a low-pitched beep will sound as well.

Default Mode: OFF

When the SCALE function is activated, the CellMate quickly sweeps the current frequency range before plotting any values. It sets the top of the vertical axis to the highest VSWR (to a maximum of 10:1) or Return Loss (to a maximum of -1.7 dB) value found (refer to PLOT SCALING section). This allows the CellMate to scale the plot for maximum resolution. While the CellMate is scanning the frequency range, an hourglass icon will appear on the STAT line, indicating that you should wait before making any further selections. When the SCALE function is OFF, the top of the vertical axis is fixed at -1.70 dB in Return Loss mode and 10:1 in VSWR mode.

Default Mode: ON

If the A.OFF (Automatic Off) function is activated, the CellMate will turn itself OFF after a five-minute idle period. If this function is OFF, the CellMate will enter the EXAM mode after a five-minute idle period. This mode reduces battery drain since it causes much of the circuitry to power down.

Default Mode: ON

NOTE: If you are using ANY software to control the CellMate, this function is temporarily disabled, despite previous activation. This is done to ensure that communication (data flow) between the PC and the CellMate is continuous.

If the BEEP function is activated, the CellMate will beep at a frequency that is proportional to that of the VSWR value when the Width is set to 0 and the Return Loss is lower than -1.7 dB (or the VSWR is lower than 10:1). This auditory cue allows you to make antenna adjustments without having to keep an eye on the display. This function also enables the beep in field strength mode.

Default Mode: ON

When the CLICK function is activated, an audible click is produced each time you press a key, move the cursor, or adjust the limit alarm.

Default Mode: ON

ALARM MENU



The ALARM menu allows you to adjust the limit alarm value, which determines the Return Loss or VSWR value at which the ALARM function will activate. When you select this function, the current limit alarm value, which varies depending on the mode selected, is displayed on the STAT line. To change the limit alarm value, use the LOWER and RAISE softkeys to step through the 128 values ranging between (approximately) -19.8 dB and -4.4 dB Return Loss (1.22:1 and 4:1 VSWR).

Default Limit Alarm value: -9.54 dB/2.0:1 VSWR

NOTE: If you change the display mode, the limit alarm value automatically converts to match the new mode.

BAUD RATE MENU



The BAUD menu allows you to select 9600 or 19200 as the baud rate for serial I/O.

Default Baud Rate: 19200 baud

NOTE: Make sure to configure the external Software to the same baud rate selected here.

BATTERY MENU



The BATT menu lets you specify the type of batteries – Alkaline or NiCd – powering the CellMate. If an incorrect selection is made, the CellMate will report battery status inaccurately.

Default: Alkaline

LIGHT MENU



The LIGHT menu allows you to select the amount of time the EL Backlight is activated each time you press a key. REMEMBER! The EL Backlight draws considerable current from the batteries. The longer the light is ON, the shorter the life of your batteries.

MISCELLANEOUS MENU

The MISC menu (f% of the Main menu) contains three functions: TEST, CHECK, and HELP. These functions ensure the CellMate is operating at an optimal level.

The TEST function causes the CellMate to run self-diagnostics on its display, program ROM, synthesizer, serial port, and non-volatile memory. The results of these self-diagnostics, as well as the firmware version number, will be displayed on the CellMate's LCD. After viewing the test results, press ENTER.

NOTE: In order for the serial port to pass the self-diagnostic test, you must insert a mating connector into it with "tip" connected to "ring". If you do not insert the plug, you can ignore the "BAD" test result displayed on the LCD.

The CHECK function displays two bar graphs labeled POWER and COUPLER. The POWER bar graph indicates the battery's status. For the exact battery voltage, check the upper left corner of the LCD. The COUPLER bar graph represents the forward and reflected voltages produced by the directional coupler at the frequency last plotted. Keep in mind that the thicker sections of the bars represent normal operating areas. Press ENTER to leave this display.

NOTE: On the bar graphs, the letters F and R should be aligned within a pixel or two of each other if there is no load attached to the Antenna connector. If this is not the case, refer to the CALIBRATION section.

The HELP function accesses an index of onscreen help pages covering virtually every aspect of CellMate operation. The page that appears when you first press the HELP softkey explains how to use this function efficiently. To exit HELP, press ENTER one to three times depending on how far you advanced in the HELP system.

EXAMINING A PLOT

During active plotting, the frequency, return Loss, and VSWR values displayed on the left side of the LCD, correspond to the center frequency. (Remember that the center frequency is located just above the missing pixel in the horizontal axis.) To take measurements at other points on the plot, press EXAM/PLOT to freeze the display. A cursor, superimposed on the plot at center frequency, will appear. Use the FREQ keys to move the cursor left or right. Hold down either FREQ key to move the cursor in its current direction at an accelerating rate. The frequency, Return Loss, and VSWR values will update as the cursor is moved. When you have finished taking measurements, press ENTER to return the cursor to the center frequency. Press EXAM/PLOT to resume plotting. Keep in mind that the most current cursor frequency will be moved to the center of the display when EXAM/PLOT is pressed. If you do not want the center frequency to change, simply press ENTER to center the cursor before pressing EXAM/PLOT the second time. If the plot you are examining was somehow cut off before it was completed, the Return Loss and VSWR values will appear blank beyond the cut off point.

NOTE: Since much of the circuitry is powered down in the EXAM/PLOT mode, you may want to enter this mode whenever possible to extend battery life. Or, simply turn the CellMate OFF when you are not plotting.

NOTE: The EXAM mode is automatically activated when you recall a plot from memory.

Regarding Saved Plots:

If you attempt to examine any Return Loss or VSWR values that exceed the scale's range (indicated by a straight line positioned along the top of the graph), the CellMate will display the message "!OVER!". This is due to the fact that the CellMate does not save the actual values at each point, but rather the positions of each point on the display.

NOTE: It is usually best to save plots with the SCALE function activated, as this will result in more accurate readings of Return Loss and VSWR values when the plot is recalled for examination.

PLOT SCALING

For optimal resolution, activate the SCALE function (refer to SETUP MENU section). Depending on the mode selected, the CellMate will scan the current frequency range for the highest VSWR value greater than 2:1 and less than 10:1 (maximum scale value), or the highest Return Loss value greater than -9.5 dB and less than -1.7 dB (maximum scale value). It then sets the vertical scale's maximum (topmost) value to this number. A straight line at the top of the display represents values that exceed the scale's maximum value.

NOTE: The VSWR value of 10:1 and Return Loss value of -1.7 dB are the highest values that are plotted. Higher Return Loss and VSWR values are shown for the center frequency while the CellMate is graphing a plot.

In VSWR mode, the bottom of the vertical axis is always set to 1:1. In Return Loss mode, however, the bottom of the axis varies depending on whether or not the SCALE function is ON. This is necessary due to the logarithmic scale. A perfect match implies an infinite Return Loss. The lowest (most negative) Return Loss value the CellMate can display is -30 dB (1.065:1 VSWR).

If the bottom of the vertical axis is fixed at the -30 dB, the Return Loss plot of an antenna with even a small mismatch could be squeezed near the top of the display, thus resulting in very poor screen resolution. Therefore, before it begins to graph a plot, the CellMate scans the frequency range for the lowest return Loss and sets the bottom of the graph to the next lower 5 dB increment. For example, if the lowest Return Loss found is -4 dB, the bottom of the axis is labeled -5 dB. These values are updated whenever you change the center frequency or width, and when you press ENTER. For example, if you are optimizing an antenna in Return Loss mode, and the plot reaches the bottom of the display, you may need to press ENTER to allow the instrument to re-scale. The hourglass icon will appear on the STAT line during these updates.

NOTE: If you press ENTER while the hourglass icon is displayed, all scaling will be temporarily disabled. When this happens, the top and bottom values will return to their default settings [i.e. top: -1.7 dB Return Loss (10:1 VSWR) and bottom: -30 dB return Loss (1.065:1 VSWR)].

NOTE: It is normal for the plot to appear quite "noisy" in the vicinity of a good match, particularly in Return Loss mode, where rather large steps may be seen. These large steps occur because even a single count difference from the reflected channel's A/D converter, due to noise or uncertainty, will result in a calculated difference of several decibels of Return Loss.

USING NICD BATTERIES

If you choose to use NiCd batteries, use the BATT function from the SETUP menu to change the battery type to NICD. Current-limiting resistor R37 is then selected for C/10 charging of 700 mA-hour Nicds which provide approximately 4 hours of continuous plotting on a full charge. To charge the NiCds, plug the accessory AC-1 battery eliminator/charger into a wall socket, and its connector into the Analyst's power jack. The batteries will be fully charged in approximately 14 hours.

USING NiMH BATTERIES

Nickel Metal Hydride (NiMH) batteries provide the longest battery life of all choices as of this writing. The problem with NiMH batteries is the need for precise charge current monitoring. There are 2 things that must be followed if you decide to use these batteries:

CAUTION! *Never attempt to charge NiMH Batteries inside the Analyzer. ONLY use a charger as recommended by the battery manufacturer.*

CAUTION! Since the Analyzer supplies charging current to the batteries when an external power supply is connected, **IT IS NOT RECOMMENDED TO USE AN EXTERNAL POWER SUPPLY WHEN NiMH BATTERIES ARE INSTALLED IN THE UNIT.** Remove the batteries from the unit before connecting an external power supply.

INTERNAL ACCESS

Remove the CellMate's rear cover to reveal a number of trimmer resistors and capacitors. Since your CellMate was carefully aligned at the factory for optimal performance, we recommend that you make no adjustments other than to display contrast, and only then if you strictly adhere to the following directions.

There are six screws on the rear cover. The two screws behind the rubber foot, when removed, give access to the battery compartment. When replacing this cover, make sure the foot's pegs are seated in the slots in the top of the battery cover before reinstalling the screws.

The four screws in the corners of the rear cover, when removed, give access to the circuit board, where the controls referred to in the following paragraph are located.

NOTE: The battery cover screws do not need to be removed in order to remove the rear cover. After removing the rear cover screw, hold the front cover in your right hand and carefully flip the rear cover over to the left to avoid stressing the battery connection wires. As you remove the rear cover, make sure that the connector panel remains lodged in the front cover.

BATTERY REPLACEMENT

Turn the instrument OFF before replacing batteries. To avoid damage to the CellMate, be sure to insert the batteries according to the markings located on the inside of the case bottom. If Alkaline batteries are replaced with NiCd's, or vice versa, be sure to use MENU, SETUP, BATT to select the new battery type.

FUSE REPLACEMENT

To protect the CellMate from damage, the fuse will blow if an external power supply is accidentally connected with the wrong polarity. The fuse should only be replaced with a 315 mA, slow-blow type.

CALIBRATION

The following adjustments should not be made unless the proper test equipment is available, and the calibration has been determined to be out of specification.

DISPLAY CONTRAST

Adjust R1, near the bottom of the circuit board, for best display contrast.

FREQUENCY ADJUSTMENT

With an accurate frequency counter connected between ground and test point **TU3**, adjust trimmer capacitor C13 for a reading of 1.200000 MHz \pm 10 Hz.

DIRECTIONAL COUPLER GAIN

It is important that the inputs to the A/D converter from the directional coupler never exceed 5.0 Volts, or inaccurate readings will occur. RF output from the CellMate varies somewhat with frequency. For maximum accuracy, R27 and R54 should be adjusted so that inputs to the A/D converter are close to +5 Volts at the frequency where maximum output occurs.

It cannot be overstated that the following procedure merely performs a coarse calibration of the Analyst. Fine calibration must be performed using (at a minimum) a quality 50-ohm microwave test load with known VSWR points across the frequency band; a better alternative is to attach to a known-good antenna of known VSWR.

Prior to any attempt at calibration, rotate trim-pot R-103 (blue multi-turn) to its full CCW position.

A) If the Cellmate EX is to be used at a variety of Center Frequencies and Sweep Widths, Directional Coupler gain adjustments are best performed by using a Spectrum Analyzer to determine the point of maximum RF output, and then setting the Cellmate EX to that frequency with a Sweep Width of 0. After disconnecting the Spectrum Analyzer from the Cellmate, press F5, F5, and F2; this will summon the Bridge Check screen. Adjust R-27 and R54 to position the R and F icons approximately 5 pixels from the R/H side of the screen.

B) If the Cellmate EX will be used at a repetitive center frequency, simply set it to that frequency with a Sweep Width of 0 (and nothing attached to the ANTENNA connector). Press F5, F5, and F2 to summon the Bridge Check screen, and adjust R-27 and R-54 to position the R and F icons approximately 5 pixels from the R/H side of the screen.

After completing either of the above steps, perform the following:

A)(with a 50-ohm resistive load) Set the Cellmate Sweep Width to 200; attach the resistive load and observe that the displayed VSWR profile is flat across the frequency band, and that the VSWR Numeric Display at the L/H side of the screen reads 1.10 or lower. If the reading is higher than specified, adjust trim pot R-103 clockwise until the Numeric Display reads approximately 1.05.

NOTE-Although it is possible to adjust the VSWR reading down to 1.00 with a resistive load installed, doing so may result in the Cellmate displaying a 1:1 bandwidth when attached to a resonant load.

B)(with a Test Resonator or a known-good antenna) Set the Cellmate to the center frequency of the antenna or resonator (as applicable) with a Sweep Width of 50. Adjust trim pot R-103 clockwise until the VSWR Numeric Display at the L/H side of the screen corresponds to the known resonant frequency VSWR of the load. If the 2:1 points of the load are known, set the lower point as the center frequency of the Cellmate, and adjust R-54 until the Numeric display reads approximately 2.00. Then reset the center frequency to the upper 2:1 point and verify that the Numeric display reads 1.9-2.1.

OPERATION FROM A TERMINAL

You can control all of the CellMate's functions (except power ON) from a terminal, or a computer running a terminal emulator program. The terminal's baud rate must be set to the CellMate's baud rate (either 9600 or 19200), and it should also be set for no parity, 8 data bits, and 1 stop bit. The keyboard functions are listed below:

0-9	Function the same as the digit keys on the Analyst
A-E	Access softkeys F1 through F5
R	Raises the frequency (same as FREQ▲)
L	Lowers the frequency (same as FREQ▼)
W	Widens the plot (same as WIDTH▲)
N	Narrows the plot (same as WIDTH▼)
Enter	Functions the same as the ENTER on the keypad
Spacebar	Toggles EXAM/PLOT modes
!	Turns the instrument OFF

IN CASE OF TROUBLE

If your CellMate EX doesn't seem to be working properly, please try the following suggestions before sending the unit in for repair:

- When the Analyst is being used as a portable instrument, low batteries are the most likely cause of difficulty. See instructions on how to check batteries.
- If the Analyst is plugged in, is your power supply providing 12 to 16 volts DC under load? In other words, is your power supply capable of delivering at least 12 volts while the CellMate is ON? If you're not sure, try another 12 volt power supply. Also make sure the center pin of your power cable is positive. If it is not, then the CellMate's internal fuse is probably blown. Replace the fuse and rewire the power cable for center pin positive.
- Make sure all cables are securely connected. Check cable continuity with an ohmmeter.

If you can't seem to solve the problem yourself, our Technical Service staff may be reached at 800-258-7805 or +1-760-931-8979 7AM-4PM M-F Pacific Time, or by e-mail at techsupport@aeatechnology.com. Users are also encouraged to check the Application Notes and Software for updates using the "Literature and Software" button in the tool bar at www.aeatechnology.com.

please let us try to help you over the phone before sending the unit in. Many of the products we receive for service are in perfect working order when we receive them. Calling us for technical assistance can save you both time and money.

If you call for assistance, please have your CellMate's serial number available and have the CellMate and antenna connected and powered ON. The technician you speak with may ask you to perform certain functions to aid in diagnosis. If you have a voltmeter, you might have the CellMate open so you can report measurements to the technician.

If you contact us via e-mail, we ask that the Model and Serial numbers be included in the message, along with a brief description of the problem. You will normally receive a response within 24 hours (during the business week).

If the unit needs to be returned to the factory, the user is requested to call (760) 931-8979 for a Return Merchandise Authorization (RMA) number. The user is also requested to include a statement giving a complete description of the problem, including the conditions under which it occurred. Include return information (name, company, address, and daytime phone number) with each unit.

Units should be sent to:

AEA Technology, Inc.
5933 Sea Lion Place Suite 112
Carlsbad, CA 92010
Attn: RMA_____

LIMITED WARRANTY

AEA Technology, Inc., warrants to the original purchaser that the CellMate EX shall be free from defects in material or workmanship for a period of one year from the date of shipment. All units returned to the factory, delivery charges prepaid, and deemed defective under this warranty, will be replaced or repaired at this company's option. No other warranties are implied, nor will responsibility for operation of this instrument be assumed by AEA Technology, Inc.

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