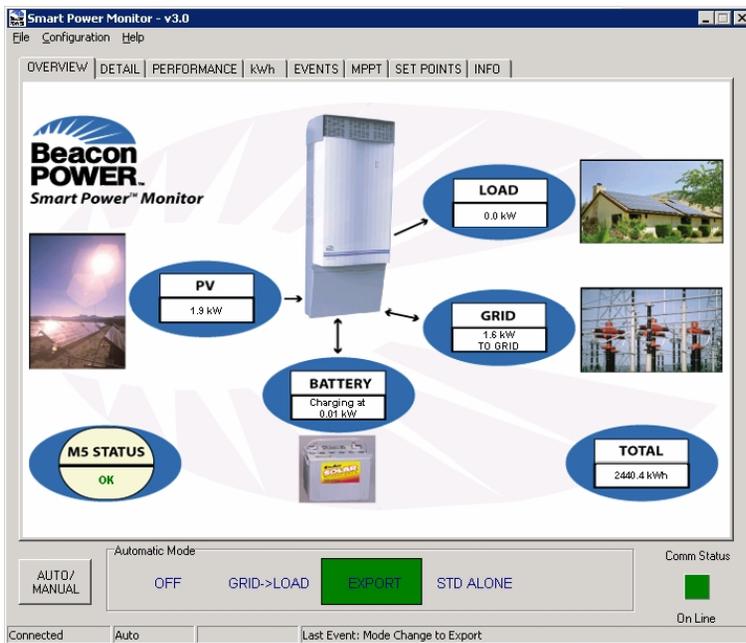




Smart Power™ Monitor Plus

User Manual



P/N PSD-0004

Revision -, December 15, 2006

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Table of Contents

Table of Contents	3
Introduction.....	4
Contents of the SP Monitor kit	5
Software Installation	6
Initial M4/M5-Plus Setup	7
Step 1: Establish Communication	7
Step 2: Set Date and Time	8
Step 3: Set Battery Parameters (optional)	8
Getting Around in SP Monitor	9
Tabbed Application Window.....	9
Overview.....	9
Detail	10
Performance.....	12
kWh – Energy Production.....	14
Events.....	16
Setpoints.....	18
Info.....	21
Pull-down Menus.....	22
File Menu.....	22
Configuration Menu	22
Help Menu	30
M4/M5-Plus Control and Status Buttons	30
Database	32
SP Monitor Communication.....	33
Packets.....	33
Time Out.....	33
Communications Protocol	33
Appendix 1	35
USB to RS232 Serial Port Adapter	35
Appendix 2	36
Setpoint Definitions	36

Introduction

Thank you for choosing a Smart Power™ M4/M5-Plus solar electric power conversion system (PCS). This Smart Power™ (SP) Monitor software will complement your M4/M5-Plus and allow you to explore your solar electric system in full detail. The Smart Power Monitor's features include detailed performance monitoring, data and event logging, installer setpoint access, and daily energy production information. After reviewing this manual you will have all the necessary information to enable you to take full advantage of the benefits of this software and your solar electric power system.

The Smart Power™ M4/M5-Plus PCS is ready to operate in the utility-connected mode “out of the box” – as soon as it is installed. However, as the M4/M5-Plus includes a built in clock as well as internal energy production logging, it is advantageous to use this software to set these parameters on initial installation. In addition, specific battery parameters can be programmed for battery-specific charging characteristics, as well as more accurate State of Charge (SOC) meter readings.

For improved versions of this document or the Smart Power™ Monitor, please check for updates on the Beacon Power website: www.beaconpower.com.

Contents of the SP Monitor kit

- This Manual
- CD-ROM containing the Microsoft® Windows® version of the SP Monitor software
- RS-232 (serial PC Com port) to RS-485 (M4/M5-Plus) adapter
- Communication Cable (standard four wire phone cable terminated RJ-11 with “twist”)

The RS-232 to RS-485 adapter enables your personal computer operating with Microsoft Windows and SP Monitor software installed to communicate with the Beacon Power M4/M5-Plus.

Note that the communication cable is not simply ordinary telephone cable. If both ends of the cable are held together side-by-side (with the RJ-11 clip tabs both facing down), a “twisted” cable will have the individual wire strands ordered opposite one another. For example, if the strand order is black, red, green, yellow (when read from the left to the right side) for one end of the cable, the other end of the cable should be ordered yellow, green, red, black (when read from the left to the right side). If the colored wires are in the same order, then the cable is a “straight” cable. A straight cable will **not** allow the SP Monitor software to communicate with the M4/M5-Plus.

Software Installation

SP Monitor is installed like most modern Windows applications. Many computers will auto-install the application as soon as the CD is placed into the drive and closed. If your computer does not auto-install click Start → Run then browse to your CD-Drive and select *SPM3.0setup.exe*, press Open then OK. If you are not installing from a CD, use Windows Explorer to view the contents of the folder where the installation file is located, and double click the file called *SPM3.0setup.exe*. Follow the instructions provided by the installation wizard.

The program files are created in the Program Files directory under:

/Program Files/Beacon/SmartPowerMonitor

The data files that will contain the kWh production data, event logs and detailed data logs will be located in the following directory:

/Program File/Beacon/SmartPowerMonitor/Data

To **uninstall** SP Monitor, remove the program from the Control Panel → Add or Remove Program option, or run the following file:

/Program File/Beacon/SmartPowerMonitor/UNWISE.EXE

Initial M4/M5-Plus Setup

The M4/M5-Plus is designed to operate in the utility-connected mode “out of the box” – as soon as it is installed. However, as the M4/M5-Plus includes a built in clock and the capability to charge batteries according to their make and model, it is advantageous to use this software to set these parameters on initial installation. This section will guide you through this initial setup in three easy steps.

Step 1: Establish Communication

Install the software on the designated desktop or notebook computer. Make sure that the computer has an available serial port, male DB9 connector (Figure 1). If no serial port is available, it will be necessary to obtain a USB to serial adapter (See Appendix 1 for more information).

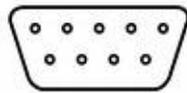


Figure 1: DB9 Connector

Connect the provided adapter to the DB9 serial port on the computer, and plug one end of the communication cable into the M4/M5-Plus and the other end into the adapter.

Start the SP Monitor Software. You should now see a green square *Comm Status* indicator in the bottom right of the software window. If this square is red see the *Select Com Port* section below, to change the Communications Port.

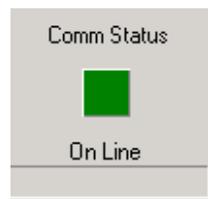


Figure 2: Comm Status

Step 2: Set Date and Time

If the clock onboard the M4/M5-Plus controller has not been set or is incorrect, an automatic *Date and Time* pop-up screen may appear when Smart Power Monitor is first opened. If the pop-up screen does not appear the clock can be checked or set manually by going to the *Configuration* Pull-down Menu and choosing *Date and Time*. Make sure the computer that is being used has the correct date and time setting. If the Date and Time in the menu box are correct press *Send* to update the internal clock. Should you get an error while this occurs simply close and re-open the *Date and Time* menu once more and repeat.

Step 3: Set Battery Parameters (optional)

The make and model battery that will be used with the M4/M5-Plus may vary from installation to installation. The system parameters inside the unit are set to charging values that are compatible with all recommended Valve Regulated Lead Acid (VRLA) batteries, whether they are the Absorbed Glass Mat (AGM) or Gel type.

If preferred, the battery parameters can be changed by adjusting the setpoints inside the M4/M5-Plus. To do this you will need to change the Access Level to Tech by opening the *Configuration* Pull-down Menu and selecting *Access Level*. Call Beacon Power Service (800) 938-9112 to obtain the appropriate access code.

For best performance, a battery manufacturer may have recommended charging parameters that are unique. To set the battery specific values, you may manually change the charging setpoints (see the *Setpoints* section below), or simply use the Battery Wizard. This tool has preset values that were obtained directly from the battery manufacturer, and can be set up with the following information:

- Battery Make
- Battery Model / Group
- Total Amp-hour (Ah) rating of the battery system

To start this wizard go to the *Configuration* Pull-down Menu and chose *Battery Wizard*. A warning window will appear stating that you are about to change the operating parameters of the unit. Press Yes to continue, and follow the instructions on the screen.

Getting Around in SP Monitor

SP Monitor information and controls are found in three general locations:

- Tabbed windows (Overview, Detail, Performance, kWh, Events, MPPT, Set Points, and Info),
- Three pull-down menus (*File, Configuration, and Help*) at the top left corner of the screen,
- M4/M5-Plus control and status buttons below the tabbed window.

Each of these will be described in the subsequent sections of this manual.

The software includes three access levels (*User, Tech, and Factory*). By default the program will start in User mode. To change the access level, please see the *Access Level* description under the *Configuration Pull Down Menu* section.

Tabbed Application Window

Each of the SP Monitor tabbed windows enables the user to easily evaluate data from the M4/M5-Plus or to control specific M4/M5-Plus functions via a user-friendly graphical interface. All the data from the M4/M5-Plus displayed in these screens is stored in a database format. It is possible to export this data to a Microsoft Excel and Access or compatible file format for further analysis. For more detailed information about manipulating or managing the database for special applications refer to the *Database* section below.

Overview

When you start SP Monitor, your computer will open with the *Overview* panel active as shown in Figure 3. The values displayed on your computer may differ from those shown below. Also note that these values are typically only accurate to approximately +/- 50 Watts. Depending on the access level you may only see a select number of tabbed choices.

This window provides a concise summary of the performance of the various components of the energy conversion system. It displays the amount of power available at the following points in

the system: the PV panels, utility grid, batteries, and load. The bottom left indicates the M4/M5-Plus status, and may read OK, or FAULT. The bottom right indicates the Total AC energy in kilowatt-hours (kWh) produced by the system since the unit was first turned on. This is also called lifetime kWh. The readouts are grayed if a communications timeout has occurred.

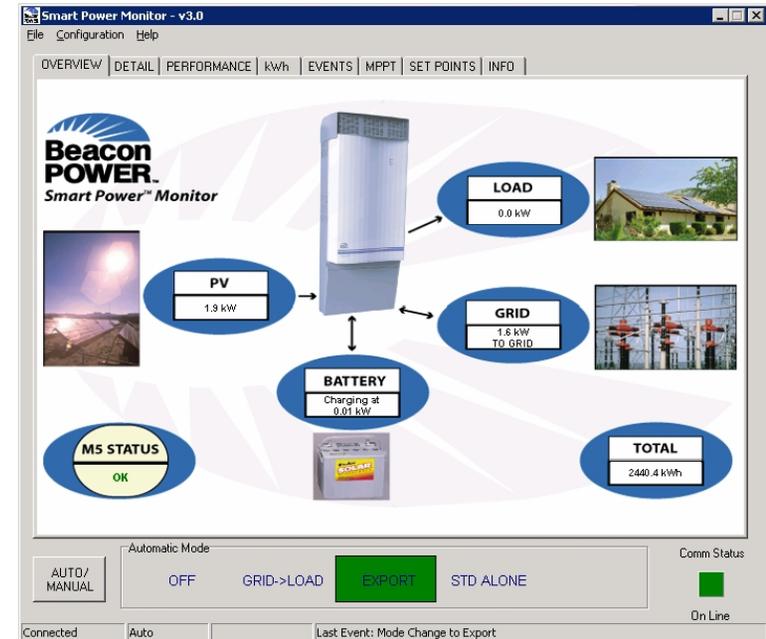


Figure 3: Overview Screen

Detail

The *Detail* window expands upon the information provided in the *Overview* screen, displaying the voltages, currents, frequency, and power levels between each of the nodes of your system, as shown in Figure 4. The term "node" is being used loosely in this context to refer to the point of entry or exit from any of the six main blocks in the diagram on this screen, viz., *PV, DC-DC CONV, BATTERY, INVERTER, Grid, and Load*. Other information is also given such as the battery temperature, fan level and mode status. To the right of the *INVERTER* block and between the *Grid* and *Load* blocks, the *Exported Today* field shows the AC energy production since sunrise. This value will reset at midnight each day. The green line indicates where power is flowing between the

components. As can be seen in Figure 4, the unit is in Export mode, so the PV is charging the battery as well as supplying power to the grid.

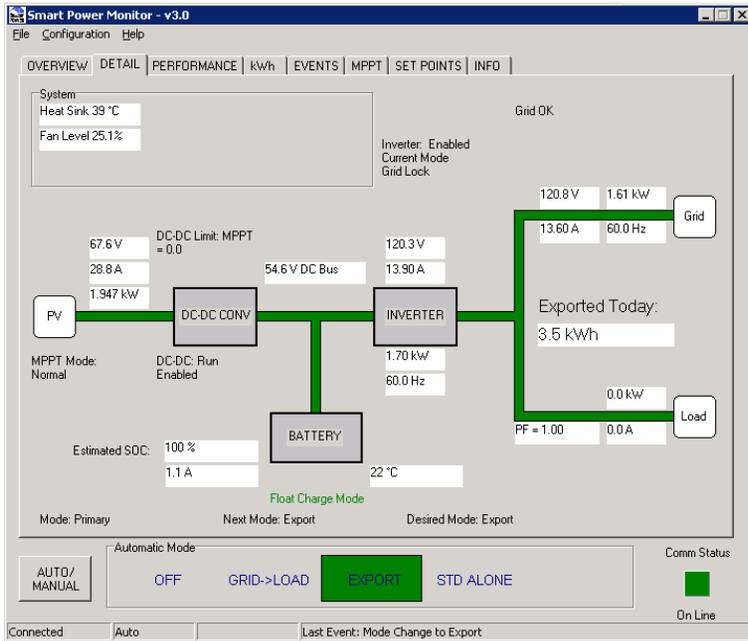


Figure 4: Detail Screen

The sign convention used in the boxes on this screen is as follows: a value is negative if it indicates electrical flow in a direction opposite to the preferred direction. For example, we would prefer not to consume power from the grid to run our loads. We would instead, prefer to be constantly selling power back to the utility (where connected in the preferred grid-tied net metering configuration). Hence, when current is flowing to the grid, the current readout next to the *Grid* box is positive and when power is being drawn from the grid, the sign is negative. Similarly, batteries are designed for storing DC power; therefore, when the batteries are charging, the current is positive. When they are exporting power, the battery current indicator is negative.

Performance

This screen displays the power and voltage from the PV array, power output from the inverter, power delivered to the load, and the power to the grid all in a graphical format. By selecting a different date in the pull-down box (located toward the bottom of this window), you can view the historical performance of your PV system. For example, if you wanted to see how much power your inverter exported to the grid a week ago, you would simply select the date in the pull-down menu, and the graph of that day's data would be plotted. In order to take advantage of this feature, your PV system must have been operational and your M4/M5-Plus must have been connected to the SP Monitor on the date in question.

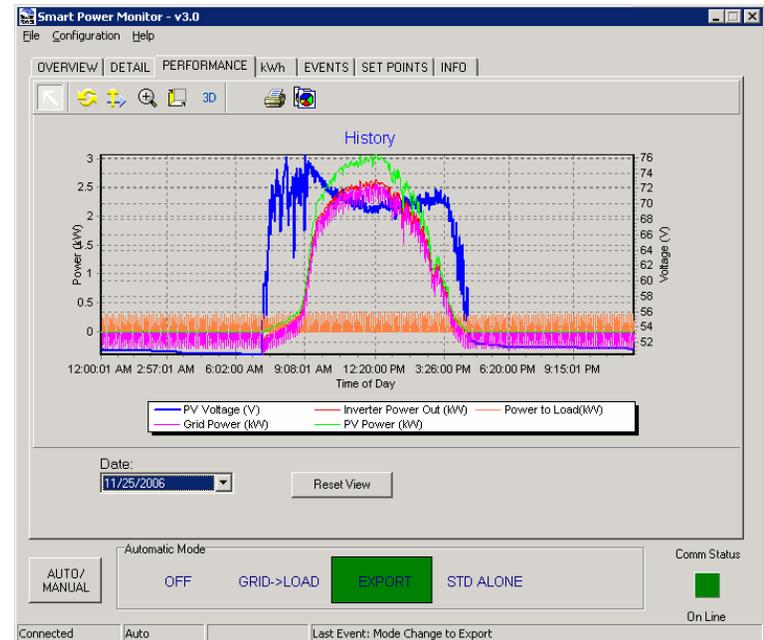


Figure 5: Performance Screen

New data points are added to the graph every 15 minutes. This default sampling rate can be changed by selecting the *Database* window from within the *Configuration* pull-down menu as described in the next section of this manual (refer to *Pull-down Menus* below). The graphical view may be changed by using the options at the top of the tab screen.

-  Normal: Drag Left button to Zoom, Right button to Scroll
-  Rotate: Drag Chart to Rotate
-  Move: Drag Chart to Move
-  Zoom: Drag Chart to Zoom
-  Depth: Drag Chart to resize 3D
-  Print: Brings up Print Options
-  Copy: Copies the current view to the clipboard

kWh – Energy Production

The kWh screen provides a graphical display of the daily energy produced by the M4/M5-Plus (Figure 6). The internal memory of each M4/M5-Plus will log a lifetime worth of energy that may be downloaded by the Smart Power Monitor at any time. This data will be stored inside the unit, even if all power has been removed.

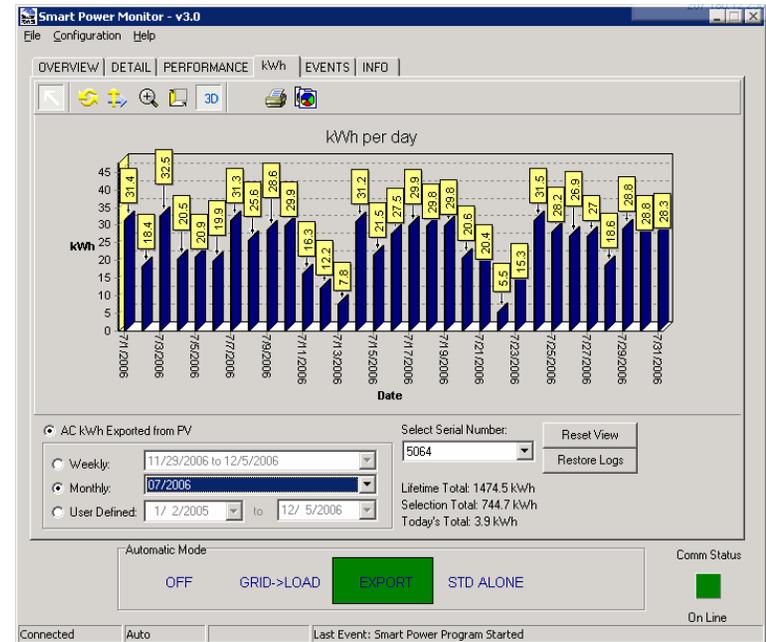


Figure 6: kWh Screen

When Smart Power Monitor is first connected to an M4/M5-Plus it will poll for the kWh data, and download all values that have not been previously downloaded by any other Smart Power Monitor. When this is completed, the range of data can be viewed:

- Weekly,
- Monthly, or
- Over a User-Defined period (this is helpful when comparing to specific utility invoice periods)

The energy produced over the selected range is summed in the field to the right labeled *Selection Total*. The *Lifetime Total* energy production of the unit since its first operating day, including *Today's Total* is also displayed. Note that *Today's Total* will be displayed until midnight, when it is cleared to zero and written to memory.

At any time to download all kWh data entries from the unit, even those that have previously been downloaded by another Smart Power Monitor session, click the *Restore Logs* button. It may take a few moments for the software to download the data, so please be patient. If the software has been used to monitor multiple units, you may choose which unit's data to look at, by selecting it from the *Select Serial Number* drop-down box.

Events

The event log displays information such as mode changes (e.g., from stand-alone to export), battery charging status, anti-islanding, and fault events (Figure 7). The M4/M5-Plus will store these events in the internal memory, which will not be erased if the unit is turned off (non-volatile). Each event receives a time-stamp from the internal M4/M5-Plus clock. Therefore, it is important to set the internal time using SP Monitor (see more on this under *Pull-down Menu* → *Date and Time*) during initial setup to allow accurate event log identification.

Date Logged	Event#	Time	Value	Code	Description
12/13/2006 3:53:04 PM	2	195	0	16641	Mode Change to Grid->Load
12/13/2006 3:53:04 PM	1	195	0	16644	Mode Change to Droop-Export
12/13/2006 3:53:03 PM	1	157	0	18689	Mode-Select->Primary
12/13/2006 3:49:43 PM	1	191	2	8322	Bulk
12/13/2006 3:46:42 PM	6	59	0	16643	Mode Change to Stand-Alone
12/13/2006 3:46:42 PM	5	59	5997	13665	Grid Freq Synch Fail - Loss of Synch
12/13/2006 3:46:42 PM	4	58	0	18690	Mode-Select->Secondary
12/13/2006 3:46:42 PM	3	58	0	16640	Mode Change to Off
12/13/2006 3:46:42 PM	2	58	1172	20736	Grid mode exited due to bad VGRID
12/13/2006 3:46:42 PM	1	58	0	17184	UPS Mode Grid Fail
12/13/2006 3:00:53 PM	1	255	0	4864	DC Relay Open
12/13/2006 2:18:20 PM	1	178	0	16641	Mode Change to Grid->Load
12/13/2006 2:17:22 PM	1	62	0	4864	DC Relay Open
12/13/2006 8:25:23 AM	1	124	0	16642	Mode Change to Export
12/12/2006 4:15:12 PM	1	57	0	4864	DC Relay Open

Figure 7: Events Screen

The event table contains six columns with the following information:

Date Logged: The date and time stamp when the event occurred. This value may be blank if the internal M4/M5-Plus clock was not set properly. It is recommended to set the clock (see *Date and Time* below), so that the date and time of events can be identified, should a fault occur.

- Event #:** The order of events within a given time stamp.
- Time:** Logic cycle time (debugging use only).
- Value:** Information pertaining to a specific type of event. This may be a status code, voltage, frequency or any other specific variable depending on what the event code refers to.
- Code:** The code number that identifies the specific event that occurred.
- Description:** The definition of the event code that occurred (See Smart Power M4/M5-Plus user manual for full list of definitions).

Events Navigation and Restore



To navigate the table use the keyboard's cursor keys or these buttons. The minus button allows deletion of a single event. When an event is deleted it is removed from the event.db file and will not show up in the Events table. It does remain in the event log inside the M4/M5-Plus and may be downloaded/restored again at a later time.



To restore the entire contents of the internal M4/M5-Plus event log to the SP Monitor Events table, press this button. The software will poll the internal memory for ALL recorded events, which may take some time, depending on volume.



While restoring Events using the button explained above, you may press the *Catch Up* button to speed up the collection of logs. During the catch up process, other SP monitor operations, such as data logging, will be temporarily suspended.

Setpoints

(only available in Tech or Factory Access Levels) Generally, there is no need to adjust the setpoints since the M4/M5-Plus is configured to work “out of the box”. It is possible, however, to change specific operating parameters of the unit, such as battery charge settings, maximum power point window, or audible alert ON/OFF.

To change setpoints, you will need Tech or Factory access (see the *Access Level* section below). Load the provided default setpoint file for the specific unit and software revision by clicking on the *Change* button and locating the setpoint file (e.g. 'M5 Plus Setpoint File M5P1135.csv'). The original default files are located in the Setpoints directory of the CD-ROM. Should you have trouble locating the file or need a new file, contact Beacon Power Service (service@beaconpower.com, (800) 938-9112). Please provide the model and serial numbers of the unit, so the correct setpoint file may be identified.

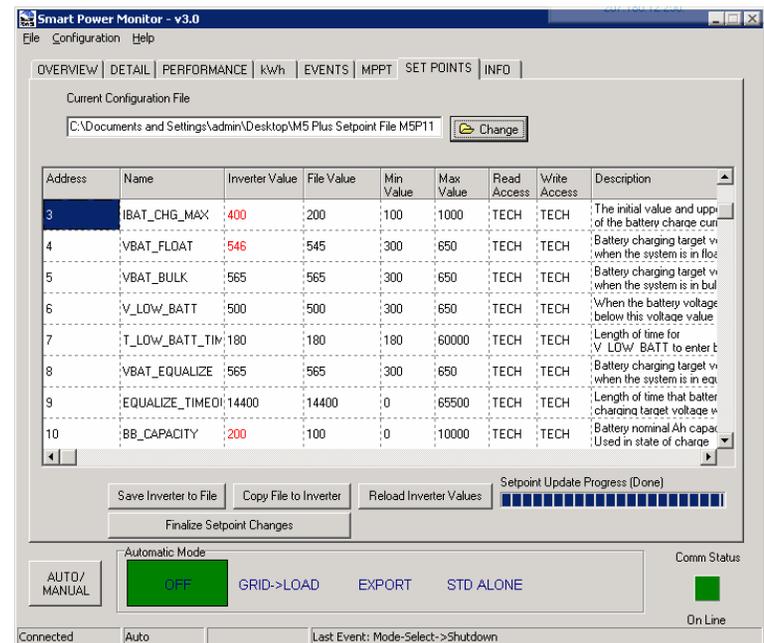


Figure 8: Setpoints Screen

Once the file has loaded, the table will be populated with the data from the file as well as from the M4/M5-Plus as shown in Figure 8. For reference, the default information is also included in Appendix 1. The values currently stored in the internal M4/M5-Plus memory are shown in the *Inverter Value* column. When these values differ from those values listed in the *File Value* column, they appear in red.

To view the full description of a setpoint, double-click on the description field.

Changing Setpoints

To change a setpoint, double-click on the value in the *Inverter Value* column. Delete the existing value and enter the new value. The new value must fall within the indicated Minimum and Maximum Values. Press Enter and a confirmation dialog box will appear (Figure 9).

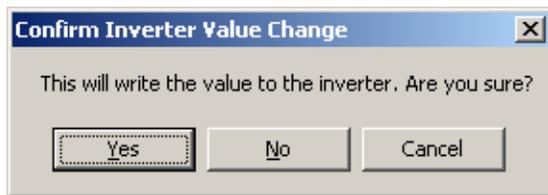


Figure 9: Setpoint Change Confirmation

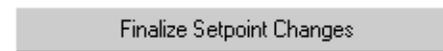
Click Yes to change the setpoint to the new value. Notice the Write Verification in the bottom right corner (Figure 10).



Figure 10: Setpoint Write Verification

Once you have changed all the desired setpoints, click the *Reload Inverter Values* button and verify that all values are entered correctly.

IMPORTANT: Even though the values are displayed, they have not been finalized to the memory. It is necessary to press the *Finalize Setpoint Changes* button:



You will be prompted to verify the finalization and informed whether the operation was successful. If it was unsuccessful, repeat or check the communication status.

At any time, should a setpoint NOT be properly written to the M4/M5-Plus, a dialog will appear (Figure 11). It is best at this point to hit the *Reload Inverter Values* button to refresh the setpoints shown on the screen and to retry writing the value in the inverter column.



Figure 11: Setpoint Write Failure

Loading and Saving Setpoint files



To load a setpoint file press the 'Change' button, and browse to the directory that contains the .CSV setpoint file (e.g. 'M5 Plus Setpoint File M5P1135.csv').



If you would like to save all setpoint values from the M4/M5-Plus to a file, simply press the 'Save Inverter to File' button.

Copy File to Inverter

To send all setpoint values contained in a loaded file (*File Value* column) to the M4/M5-Plus click the 'Copy File to Inverter' button.

Reload Inverter Values

At any point to refresh the *Inverter Value* column values, press the 'Reload Inverter Values' button, which reloads the internal EEPROM values from the M4/M5-Plus.

NOTE: If at any point you are unsure about what changes you have made prior to *Finalizing Setpoint Changes*, you may reset the inverter by turning off all power to the unit including the PV and battery source.

Info

The *Info* screen is rarely, if ever, used in normal operation. It reports such things as the model, serial number, and software revision level for your M4/M5-Plus. It is often useful to have this data if it should ever be necessary to contact Beacon Power Service (service@beaconpower.com, (800) 938-9112) for help with any questions or concerns with your M4/M5-Plus's performance.

Pull-down Menus

File Menu

EXPORT: Enables the user to export data from the performance window (discussed below) to a comma separated values (.CSV) file. This format can be read by spreadsheet and database software such as Microsoft Excel and Access. The export feature is beneficial to users who may wish to perform further analysis of their data. For example, by exporting to Excel, it is easy to graph the PV output of your power conversion system over the course of a week, month, or even an entire year.

QUIT: Closes the Smart Power™ Monitor screen and ends communication between the M4/M5-Plus and the PC. The PC will stop logging any data.

Configuration Menu

COMMUNICATIONS: (only available in Tech or Factory Access Levels)

Opens a window that gives the status of the information exchange between the M4/M5-Plus and the SP Monitor. Communications may be manually disabled by deselecting the *On Line* box. Deselecting the *Poll Every* check box will cause the software to stop writing the data to the database, but continue to poll the M4/M5-Plus for data. The rate at which the SP Monitor polls the M4/M5-Plus for new data may be adjusted from 200 milliseconds (ms) to 5000 ms by clicking the scroll arrows next to the *Poll Every* box. The default rate is 400 ms (=0.4 seconds). The higher the number the longer the time between the software polls to the M4/M5-Plus.



DATABASE: Allows changing the 15-minute default value in the *Database* window. The user can specify how often the software averages the M4/M5-Plus data and writes these values to the database. Clicking the *Manual Write DB averages* button forces a one time immediate averaging and writing of the M4/M5-Plus data to the database.

ACCESS LEVEL: Initiates the window that enables the user to view and change his/her access level. Higher access is required for certain M4/M5-Plus maintenance operations and to modify setpoints. To reach higher access levels you must call Beacon Power customer service at (978) 694.9121 or Toll-Free: (888) 938.9112 and provide the ten-digit number that automatically appears upon choosing one of the higher access level radio buttons. For example, if you were attempting to get technician level access, SP Monitor would generate a screen similar to the one depicted in Figure 12. You would then call Beacon Power and provide them with the number 65460-65412 (this number is randomly generated each time you try to change access level). Beacon Power would then give you a key (another number) that you would type into the response box. After clicking on the *Change Access Level* button, temporary access to technician level is granted.

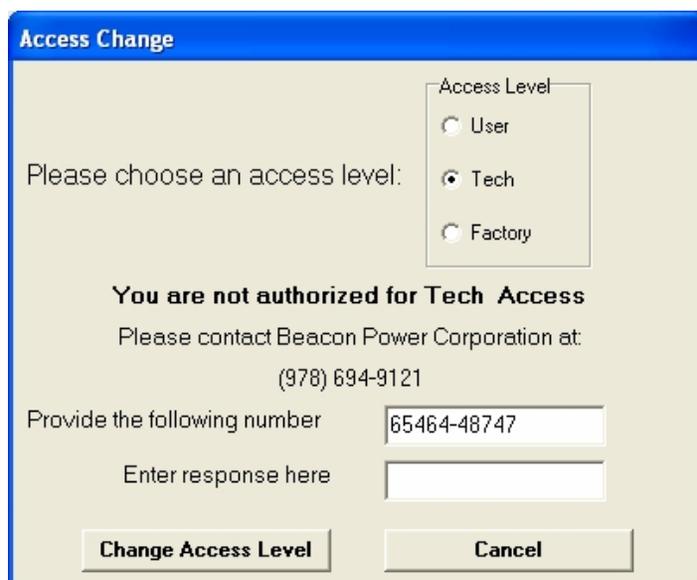


Figure 12: Changing to Technician Access Level

SELECT COM PORT: Reconfigures the communications port that SP Monitor uses to interface with the M4/M5-Plus. Click on the *Select Com Port* window to change to the correct Com port from the pull down list.

KIOSK: Automatically displays some or all of the tabbed panels in sequence. Choosing *Kiosk* in the *Configuration* menu will bring up a window in which you may specify how long each panel should be displayed (*Dwell Time* in seconds). You may also choose not to display particular panels by deselecting the check box next to it. After entering this information, click on *Cycle Tabs Start*. SP Monitor will continuously tab through the selected panels using the selected dwell times. This function is particularly useful in schools or other applications where it is desirable for an audience to be able to see much of the information provided by the SP Monitor without any direct physical contact with the computer. To stop the cycling, click the *Cycle Tabs Stop* button.

EMAIL SETTINGS: (*only available in Tech or Factory Access Levels*) Opens a window to establish automatic emailing of the data and event logs via either a Network or dial-up modem connection as shown in Figure 13.

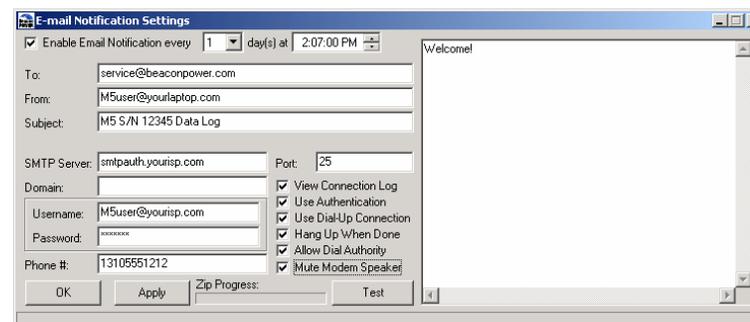


Figure 13: E-mail Notification Settings Window

To arrange to have emails automatically sent on a regular basis, click the *Enable Email Notification* check box, choose how often the emails should be sent from the drop down list of days and select the time of day the emails should be sent using the scroll buttons. Enter the recipient's email address, the sender's email address and a descriptive Subject. Enter the rest of the information as required for your connection. When complete, click the *Apply* button. To confirm that the settings are correct, click the *Test* button and verify that the recipient did receive the email as specified. When satisfied, click *OK*. Emails will automatically be

sent according to the parameters established, as long as the Smart Power™ Monitor is running and the connection is available.

The “Allow Dial Authority” checkbox allows certain modem models to dial out and not be interrupted by the logging process. To determine if your modem requires dial authority, first, attempt to dial out with this check box unchecked. If the modem is not able to dial out, your modem requires preference over the logging function. Check the “Allow Dial Authority” check box, press “Apply” and try again.

UPGRADE CENTER: (only available in Tech or Factory Access Levels) Provides access to the M4/M5-Plus firmware upgrade center. As the microcontroller on the control board of the M4/M5-Plus contains an upgradeable firmware chip, this easy-to-use tool (Figure 14) performs the upload without replacing the sensitive computer chip.

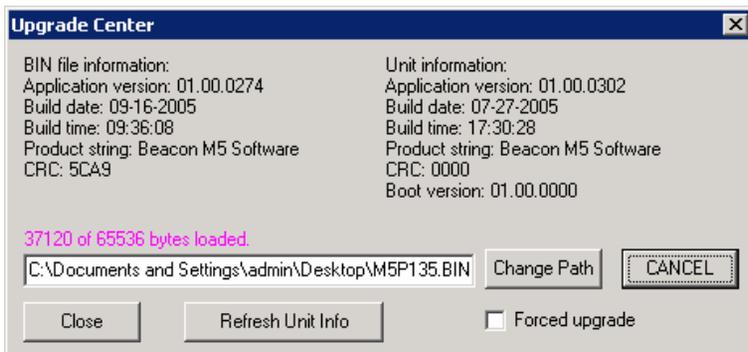


Figure 14: Upgrade Center Window

IMPORTANT: It is extremely important to command the unit to be OFF during the upgrade. To turn the system OFF exit the Upgrade Center Screen and press the AUTO/MANUAL button followed by the OFF button in the bottom left corner of the main screen (Figure 15).

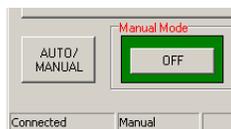


Figure 15: Mode Command buttons

Clicking the *Refresh Unit Info* button updates detailed M4/M5-Plus firmware data that will be displayed in the top right corner of this window.

By clicking the *Change Path* button you can browse to the directory that contains the new (.BIN) firmware file. The .BIN file will be provided to you should an upgrade become available. After the file has been loaded and the inverter set to OFF, press the *Upgrade!* button. You will now see a numerical counter in place of the word Filename.

This counter shows the amount of bytes that have been uploaded to the microcontroller. The maximum number of bytes that can be uploaded is 65536. When the whole file has been uploaded, a confirmation window will appear stating that the upload has been successfully performed (Figure 16).



Figure 16: Upgrade Successful Screen

Press OK, close the Upgrade Center, and Quit the Smart Power Monitor software. Finally, re-open the Smart Power Monitor, and make sure that you are now again communicating with the M4/M5-Plus. You may check the Info Tab in the software revision field for the latest revision.

The *Forced upgrade* option is available if the above procedure was used and problems occurred. Please contact Beacon Power Service (service@beaconpower.com, (800) 938-9112) before using this option.

After a firmware upgrade was made, it is advised to fully reset the M4/M5-Plus by cycling the power.

DATE AND TIME: Sets the unit's Date and Time. When first opening this screen (Figure 17) the fields will show the computer's date and time, so make sure that these are set correctly.



Figure 17: Date and Time Window

To check what date and time is set inside the M4/M5-Plus microcontroller press the *Get* button. To change back to the computer time, either adjust it manually or *Close* and re-open the *Date and Time* window. When the proper date and time are shown in the fields, press the *Send* button. If the update failed, a warning will appear. You can always double-check whether the internal time and date were set correctly by pressing the *Get* button.

This option may appear automatically if the Smart Power Monitor software detects an erroneous date and time in the M4/M5-Plus.

BATTERY WIZARD: Sets the battery charging parameters provided by the Smart Power software automatically.

The Battery Wizard welcome screen points out the information that is needed to complete the battery setup:

- Battery Make
- Battery Model / Group
- Total Amp-hour (Ah) rating of the battery system

To calculate the total Ah rating of the battery system, take the C/20 rate of a single battery (regardless of voltage) and multiply it by the number of battery strings. A battery string is made up of multiple battery packages in series that have been assembled to achieve the required nominal 48 Volts.

Manufacturer	Model / Series
MK Battery (Deka)	8A
	8G
	8L
C&D Powercom	VR Solar
	Liberty
	Orion
GNB	CPV
	Absolyte
	Sunlyte
Rolls	500 Series
	400 Series
Surrette	500 Series
	400 Series
Energys Powersafe	OpzV
	XP
	VE
	TS
	OpzS
	GLS
Trojan	30XHS
	SG90
	L-16
Generic	T-105
	Gel < 200 Ah
	Gel >200 Ah
	AGM < 200 Ah
	AGM > 200 Ah
	Flooded < 200 Ah
Flooded > 200 Ah	

Table 1: Battery Wizard default list Make and Model

By default the batteries that you will be able to choose from are listed in Table 1. Should the battery that you have used in the installation, not be listed here, please contact Beacon Power Service (service@beaconpower.com, (800) 938-9112) to have the battery parameters added.

Once you have entered the data and clicked the *Write Values* button, a screen with all the battery setpoints will appear (Figure 18). It is recommended to make a copy of this window, by

pressing Alt + Print_Scr, which places an image copy into the clipboard that may then be copied into Paint or Word and saved. Review the values and write them to the unit by clicking OK. When prompted, confirm your entries by clicking Yes.

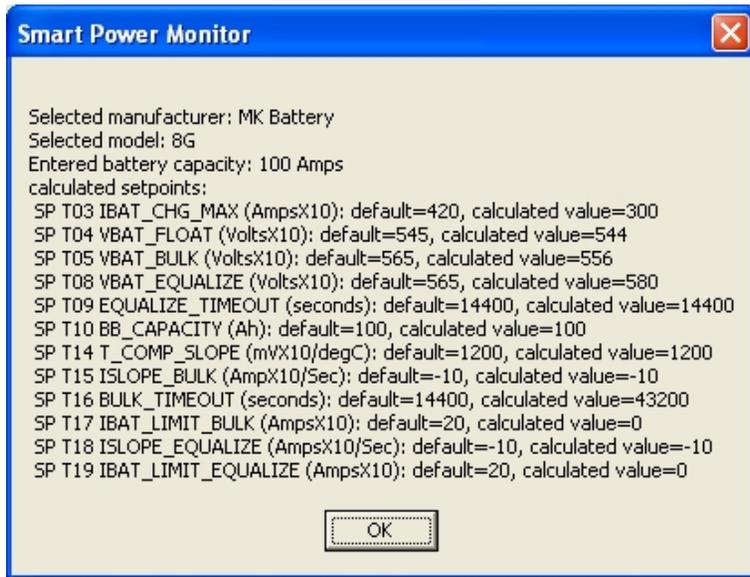


Figure 18: Capacity Screen in the Battery Wizard

The final screen of the Battery Wizard will confirm that the setpoints were written successfully. If a Setpoint Write Error prompt appears, try rewriting the parameters or check the communication status.

Help Menu

If you have any questions, please contact Beacon Power Service (service@beaconpower.com, (800) 938-9112) or check our website for more information www.beaconpower.com. We welcome the opportunity to offer our customers the personal attention they deserve.

M4/M5-Plus Control and Status Buttons

The status buttons and the auto/manual toggle button are located just below the tabbed window. A close-up of these controls is shown below in Figure 19. In this figure, the M4/M5-Plus is in automatic mode, which means that the M4/M5-Plus decides the most efficient way of operating. For example, if your system is generating excess power, it will automatically export power to the grid (as indicated in Figure 19 by the green box around *Export* mode) while keeping your batteries at their optimal operating voltage. If your loads require you to draw power from the grid, the display would switch to the *Grid→Load* mode. If utility power were interrupted for some reason, the green box would illuminate *Stand Alone* mode. On the right hand side of the screen, the green *Comm Status* light and the words "On Line" indicate that SP Monitor is communicating with the M4/M5-Plus. If the communications cable between the computer and the M4/M5-Plus were defective or absent or if you manually disable communications with the M4/M5-Plus (see *Configuration Menu* above), the *Comm Status* light would be red and display "On Line Timeout".



Figure 19: The M4/M5-Plus Control and Status Bar

To toggle between automatic and manual operation click on the *auto/manual* button. In general, Beacon Power does not recommend changing your M4/M5-Plus to manual operation. If you click on the *auto/manual* button, the warning shown in Figure 20 will appear, asking you to reconsider. The *Auto/Manual* button will blink red to remind you to return the M4/M5-Plus to automatic

mode as soon as you have completed your manual adjustments to the M4/M5-Plus.

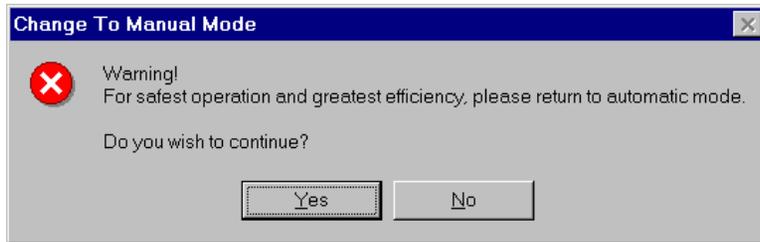


Figure 20: Warning displayed when attempting to switch to manual control of the M4/M5-Plus

Database

When the Smart Power Monitor software is connected to an M4/M5-Plus, it will continuously poll for display data, as well as log data in three different locations: data, events, and energy production in kWh. All of these are located in the following folder:

/Program File/Beacon/SmartPowerMonitor/Data

The filenames are, Data.DB, Events.DB, and #####.sum where ##### will be the respective serial number of the unit that is being monitored. The data.db file will have log entries with the interval set in the *Configuration* → *Database* window. This file contains a vast amount of operating parameters offering greatest insight into the operation of the power conversion system. The events.db file contains information such as mode changes (e.g., from stand alone to export), battery charging status, anti-islanding, and fault events. Both of these files may be opened directly in Excel 2003 or later, or imported into Microsoft Access, and then exported into Excel versions prior to Excel 2003. Should you need to convert the .db file through Access, it will be necessary to have the Smart Power Monitor software installed on the computer that will be running Access for the proper database engine files to be installed.

The #####.sum file that contains each day's energy production value can be imported into Excel and designating comma delimitation.

Should the program be run for a long period of time, logging a lot of data from an M4/M5-Plus system, the software may slow down significantly due to the size of these database files. In particular the data.db file tends to grow to a multi MB size and slow things down. When this occurs, it is recommended to copy the data.db, event.db and #####.sum files to a new folder to backup the data, and reinstall the Smart Power Monitor software. During installation you may be asked to backup the data, which is also recommended.

SP Monitor Communication

Packets

The Smart Power Monitor software communicates with the M4/M5-Plus by exchanging data packets. The language (i.e., the format of the packets) used to do this is called a protocol. In a typical exchange the software sends a request in packet form to the M4/M5-Plus for information about the M4/M5-Plus operating points and status. This process is referred to as *polling*. The M4/M5-Plus then responds by sending a packet with the requested data; upon receipt of this information, the monitoring software stores the data and uses it as necessary.

Time Out

If SP Monitor does not receive packets from the M4/M5-Plus after a significant period of time (after three consecutive polling cycles, to be more exact), the software will go into “time out” mode. This will happen if, for example, the communication line is damaged, disconnected, or a “straight” cable is used instead of a twisted cable. Time out mode will also occur if the user disables polling on the SP Monitor (see discussion of the *Configuration Menu* below).

Communications Protocol

The communication protocol between the SP Monitor and the M4/M5-Plus is referred to as half duplex, indicating that *either* the M4/M5-Plus *or* the software can transmit packets on the communication line at any given moment. It is not possible for both to transmit information simultaneously. If both devices attempt to transmit at the same time, the packets will collide and data may be truncated, damaging the packet. The communications protocol will recognize damaged packets, but it cannot make sense of them and they will be discarded. Damaged packets are inevitable (if rare) with software running on the Microsoft Windows operating system (OS), for it is not a true “real-time” OS. After receiving a truncated packet, SP Monitor will retry up to 11 times to send or receive a good packet from the M4/M5-Plus for critical commands (like mode changes).

The net effect of these communication concerns is that SP Monitor may occasionally perform sluggishly. In such instances it may be necessary to perform the operation more than once before the command will be successfully communicated to the M4/M5-Plus. The M4/M5-Plus should confirm mode changes within 4 seconds.

If not, retry the command. If communication errors are frequent, try changing the polling rate (found in *Configuration Menu* → *Communications*), to a higher number (e.g. 800ms).

Appendix 1

USB to RS232 Serial Port Adapter

Should the computer that you are using to run Smart Power Monitor not contain a DB9 serial port, it will be necessary to obtain a USB to RS232 Serial Port Adapter. This adapter is generally a cable with a USB male type A connector on one end and a DB9 male connector on the other end. The following products are two suggested options:

1. Vendor: RadioShack® (www.radioshack.com)
 Catalog #: 26-183
 Description: 6 Ft. (1.8m) USB-to-Serial Port Cable

2. Vendor: CompUSA® (www.compusa.com)
 SKU: 309975
 Description: Keyspan High Speed USB Serial Adapter, Black\Clear, USB Type A Male to DB9 pin RS-232 Male

As we have no control regarding the accuracy of the suggested parts, please check with the respective vendor for availability.

Microsoft® and Windows® are registered trademarks of Microsoft Corporation.
 RadioShack® is a registered trademark of RadioShack Corporation.
 CompUSA is a registered service mark of CompUSA Management Company.
 Beacon Power® is a registered trademark and Smart Power™ is a trademark of Beacon Power Corporation.

Appendix 2

Setpoint Definitions

Address	Value	Name	Min	Max	Description
0	-30086	CRC	0	65535	Cyclic Redundancy Check of the TECH setpoint group. This value is created automatically when setpoints are changed and cannot be manually changed.
1	2	MODCOUNT	0	65535	Modification Count of the TECH setpoint group. This value is created automatically when setpoints are changed and cannot be manually changed.
2	0	DUMMY2	0	65535	Dummy. Not Defined.
3	200	IBAT_CHG_MAX	100	1000	The initial value and upper limit of the battery charge current. Note that this is NOT the limit value for the DCDC converter – it controls the BATTERY maximum current. This value can be controlled dynamically via the ccSET_BATTERY_CURRENT_LIMIT command in the range 0 - IBAT_CHG_MAX. Setting the dynamic limit to zero is functionally equivalent to changing battery mode to zero-current mode. (Amps x10)

Appendix 2: Setpoint Definitions

Address	Value	Name	Min	Max	Description
4	545	VBAT_FLOAT	300	650	Battery charging target voltage when the system is in float charge mode. (Volts x10)
5	565	VBAT_BULK	300	650	Battery charging target voltage when the system is in bulk charge mode. (Volts x10)
6	500	V_LOW_BATT	300	650	When the battery voltage is below this voltage value for T_LOW_BATT_TIME (seconds) then the battery charger enters the bulk charge mode. (Volts x10)
7	180	T_LOW_BATT_TIME	180	60000	Length of time for V_LOW_BATT to enter bulk charge mode. (Seconds)
8	565	VBAT_EQUALIZE	300	650	Battery charging target voltage when the system is in equalize charge mode. This value will be set by the LCD Equalize Menu. (Volts x10)
9	14400	EQUALIZE_TIMEOUT	0	65500	Length of time that battery charging target voltage will be held for during equalize charge mode. This value will be set by the LCD Equalize Menu. (Seconds)
10	100	BB_CAPACITY	0	10000	Battery nominal Ah capacity. Used in state of charge calculations. Must be set at installation for SOC % to read accurately. (Amp hours)
11	420	AC_CHARGE_MAX	0	420	Maximum allowable AC charge current (Amps x10)

37

Appendix 2: Setpoint Definitions

Address	Value	Name	Min	Max	Description
12	0	T_COMP_TEMP_1	0	1000	Lower temperature limit of temperature compensation range. (Degrees Celsius)
13	40	T_COMP_TEMP_2	0	1000	Upper temperature limit of temperature compensation range. (Degrees Celsius)
14	1200	T_COMP_SLOPE	0	5000	Slope of Voltage Temperature Compensation. (mV/DegC x10)
15	-10	ISLOPE_BULK	-32768	32768	Three hours after the absolute value of the derivative of current with respect to time falls below this value, the battery charger enters the Float state. (Delta Amps/Hour)
16	14400	BULK_TIMEOUT	0	65500	Length of time for which the bulk voltage will be held. (Seconds)
17	40	IBAT_LIMIT_BULK	0	1000	Current threshold for exiting bulk charge mode. (Amps x10)
18	-10	ISLOPE_EQUALIZE	-32768	32768	Three hours after the absolute value of the derivative of current with respect to time falls below this value, the battery charger enters the Float state. (Delta Amps/Hour)
19	20	IBAT_LIMIT_EQUALIZE	0	2000	Current threshold for exiting equalize charge mode. (Amps x10)
20	240	BACKLIGHT_TIMER	0	3600	Length of time the backlight stays illuminated. (Seconds)

38

Appendix 2: Setpoint Definitions

Address	Value	Name	Min	Max	Description
21	180	TCURRENT_CUTOFF_TIME	0	1000	This is maximum amount of time the battery charger is permitted to stay in current limit. (Seconds)
22	440	VBAT_LOW	0	620	Low Battery Voltage Shutdown. If the battery voltage stays below this value for more than 60 seconds the system will shutdown. If the battery voltage returns to 1.0 Volt below VBAT_FLOAT the shutdown clears. (Volts x10)
23	500	VIN_MPPL	450	1100	When the MPPT search algorithm drops to this voltage value it reverses direction and starts searching up again. If the true MPP is below VIN_MPPL the input voltage will be held at VIN_MPPL. (Volts x10)
24	850	VIN_MPPH	450	1100	When the MPPT search algorithm exceeds this voltage value it reverses direction and starts searching downwards. If the true MPP is above VIN_MPPH the input voltage will be held at VIN_MPPH. (Volts x10)

Appendix 2: Setpoint Definitions

Address	Value	Name	Min	Max	Description
25	600	VIN_NOM	450	1100	Active Vin limit. This setpoint is the initial load value for the dynamic input voltage limit. If MPPT is ON it is the initial value for MPP tracking – at low input current (less than 0.3A) the PV array is controlled to operate at this voltage. If MPP tracking is off this value becomes the lower limit of DCDC operation. If the input voltage drops to VIN_NOM the DCDC converter will back off and maintain the input at VIN_NOM. In a similar manner to DCL control if MPPT is OFF the Vin limit can be changed dynamically using the ccSET_INPUT_VOLTAGE_LIMIT command. This command should be used rather than changing the setpoint when the unit is running as this setpoint is only loaded at startup. (Volts x10)
26	1	ALARM_ENABLE	0	1	1 = audible alarm ON 0 = audible alarm OFF

Appendix 2: Setpoint Definitions

Address	Value	Name	Min	Max	Description
27	-1	COMM_ADDRESS	0	65535	The Standard Inverter Protocol (SIP) address of the M4/M5-Plus. Set to 65535 (-1) at shipment. Any value will work for a single M4/M5-Plus system as monitoring products use address zero (broadcast) to poll a single M4/M5-Plus. Multiple M4/M5-Plus systems monitored with one software require that this setpoint be set to a unique value. (####)
28	1100	VIN_HIGH	500	1200	Maximum PV input voltage. If DCDC Vin exceeds this value the DCDC status bit CS_HIVIN is set; an event is logged; and the DCDC converter shuts down until the input voltage drops to VIN_HIGH – 0.4 Volts. The inverter stage can still operate. If the unit was in export it will go to export standby (grid-load) with the normal 4 minute delay on loss of PV power. (Volts x10)