OPERATING GUIDE FOR
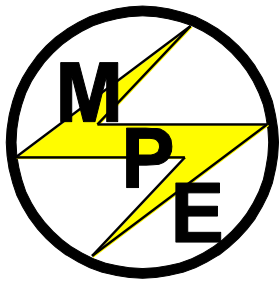
Photovoltaic Power

Profile Emulation Software

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1.0 GENERAL INFORMATION

1.1 Features

Magna-Power Electronics power supplies with D version front panel or any XR Series model offer an analog input to modulate the voltage or current setting using piecewise linear approximation. This feature enables the voltage or current setting to be adjusted by a sensor input, such as a thermistor, or by monitoring its own voltage or current. Modulation allows the output to be tailored for advanced process control applications, battery charging, and source emulation.

Photovoltaic Power Profile Emulator is a Microsoft Windows® based utility to enable Magna-Power Electronics' power supplies to emulate photovoltaic arrays. The software utilizes solar panel technology characteristics and creates a 50 point piecewise linear approximation table for use with the powerful modulation feature in the power supply. Implementation allows the user to program a soft knee as a function of both output voltage and current.

1.2 Requirements

This software is only available for use on Magna-Power Electronics DC power supplies that support modulation. This includes any power supply with the D version front panel option or any XR Series model. The D Panel power supply must have firmware revision 4.7 or higher. XR Series models require a firmware revision of 1.4 or higher for full functionality.

This software requires a computer running Windows XP or higher with a screen resolution of 1024x768 or higher. The Microsoft .NET Framework 2.0 or higher is also required. You will be prompted to install the .NET Framework if you do not already have it installed.

The computer must be able to establish communication with the power supply. You may use the power supply's RS-232 (Serial) port, optional LXI TCP/IP Ethernet, or option IEEE 488.2 GPIB.

2.0 QUICK START

The following instructions will help you get started using the software with a single profile immediately. See the related sections in the manual for additional information.

1. The software and hardware requirements for this Quick Start are:
   a. A Magna-Power Electronics DC power supply with modulation support (D version front panel or XR Series).
   b. A personal computer running Windows XP or higher.
   c. Communication established between the computer and power supply through either RS–232, GPIB, or TCP/IP.
   d. A PPPE software license for each power supply to be used.
2. Power supply setup:
   a. Jumper pins **5** and **25** on the connector **JS1** illustrated in Figure 1.1 of the power supply manual.
   b. Turn the power supply on but leave it in STANDBY mode.
   c. Connect the desired load to the power supply's output terminals.
3. Install and launch the software:
   a. Install the software using the provided CD or download. Follow the onscreen instructions. (Note: If downloading the software from the website, Microsoft Visual Studio .NET v3.5 or high is required).
   b. Launch the software from the Start Menu or the icon placed on the Desktop.
4. Establish communication
   a. Select **Setup Communication…** from the **Tools** menu.
   b. Enter the appropriate communication configuration information. If utilizing IEEE 448.2 GPIB or LXI TCP/IP Ethernet, use the **Find Devices** button to help locate the power supply automatically.
   c. Select **OK**.
   d. Verify that the power supply was identified and the model number was populated in the upper left portion of the software.
5. Select your desired solar panel technology and enter the remaining array specifications in the **Reference Parameters** box.
   The software will verify the parameters are within the connected power supply's capabilities and will display warning or error icons next to invalid or out of range parameters.
6. Select the **New** button under the **Profiles** grid to create a new profile based on the reference parameters
7. Modify the profile's name, temperature, and irradiance in the **Profile Parameters** box.
   Observe the automatically generated curve about these parameters.
8. Select the **Activate** to send the calculated points to the power supply.
9. Select the green **START** button to enable the power supply's output.

3.0 INSTALLATION

After inserting the Magna-Power Electronics' CD into the drive, a user is given a choice to install the RIS Panel or the Photovoltaic Power Profile Emulation software. Select the **Photovoltaic Power Profile Emulation Software** to view the Installation dialog box, Figure 3.1. Select **Next** to continue.
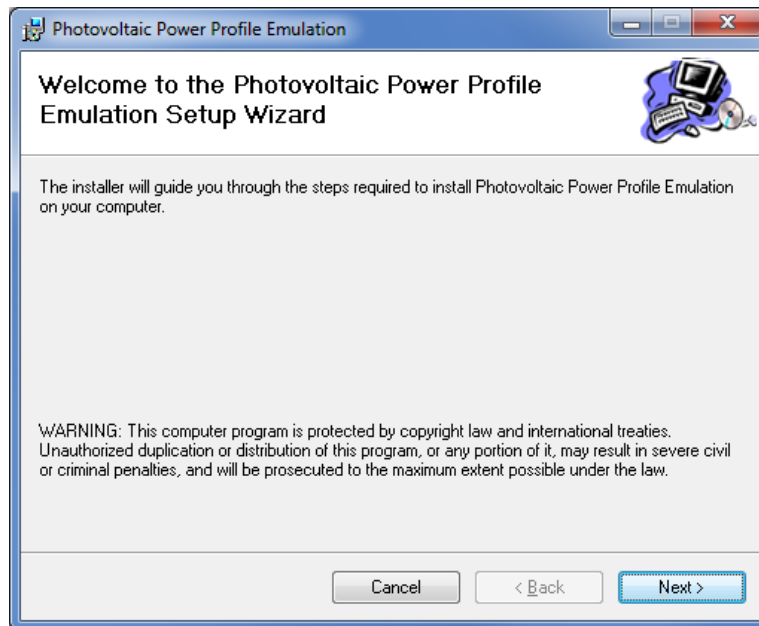
Figure 3.1 Initial installation dialog

The following dialog box, Figure 3.2, allows selection of the installation directory. Confirm the installation directory, Figure 3.3, and press **Next**. By default, the software will be installed in "**Program Files\Photovoltaic Power Profile Emulation**." To install the software to a different location, select **Browse** and then select your desired folder. When the install folder is correct, select **Next** to continue installation.

Figure 3.2 Installation path dialog

.
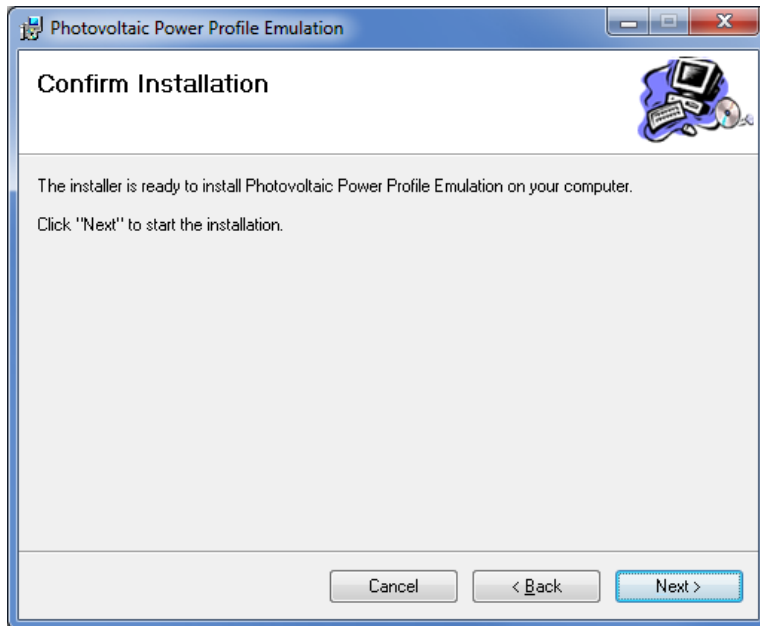
Figure 3.3 Installation confirmation dialog

Upon installation completion, the dialog box shown in Figure 3.4will appear.
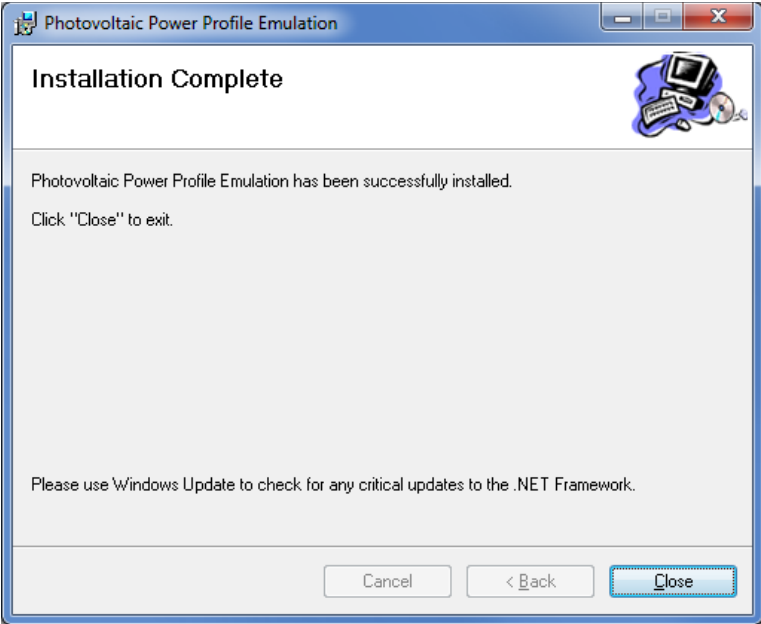
Figure 3.4 Installation complete dialog
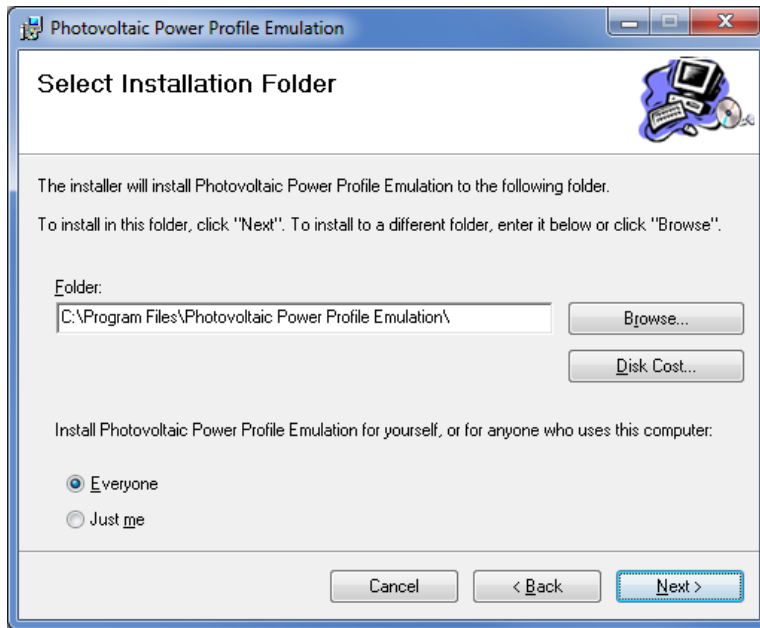
4.0 USING THE PHOTOVOLTAIC POWER PROFILE EMULATION

 Figure 4.1shows the main screen of Photovoltaic Power Profile Emulation Software. The software is divided into the following areas:

1. **Power supply status and control** (Section 4.1)
2. **Reference Parameters** (Section 4.2)
3. **Profiles** (Section 4.3)
4. **Profile Parameters** (Section 4.4)
5. **Power Profile Data Points** (Section 4.4.3)
6. **Power Profile Graph** (Section 4.6)
7. **Viewer Tab** (Section 4.8)
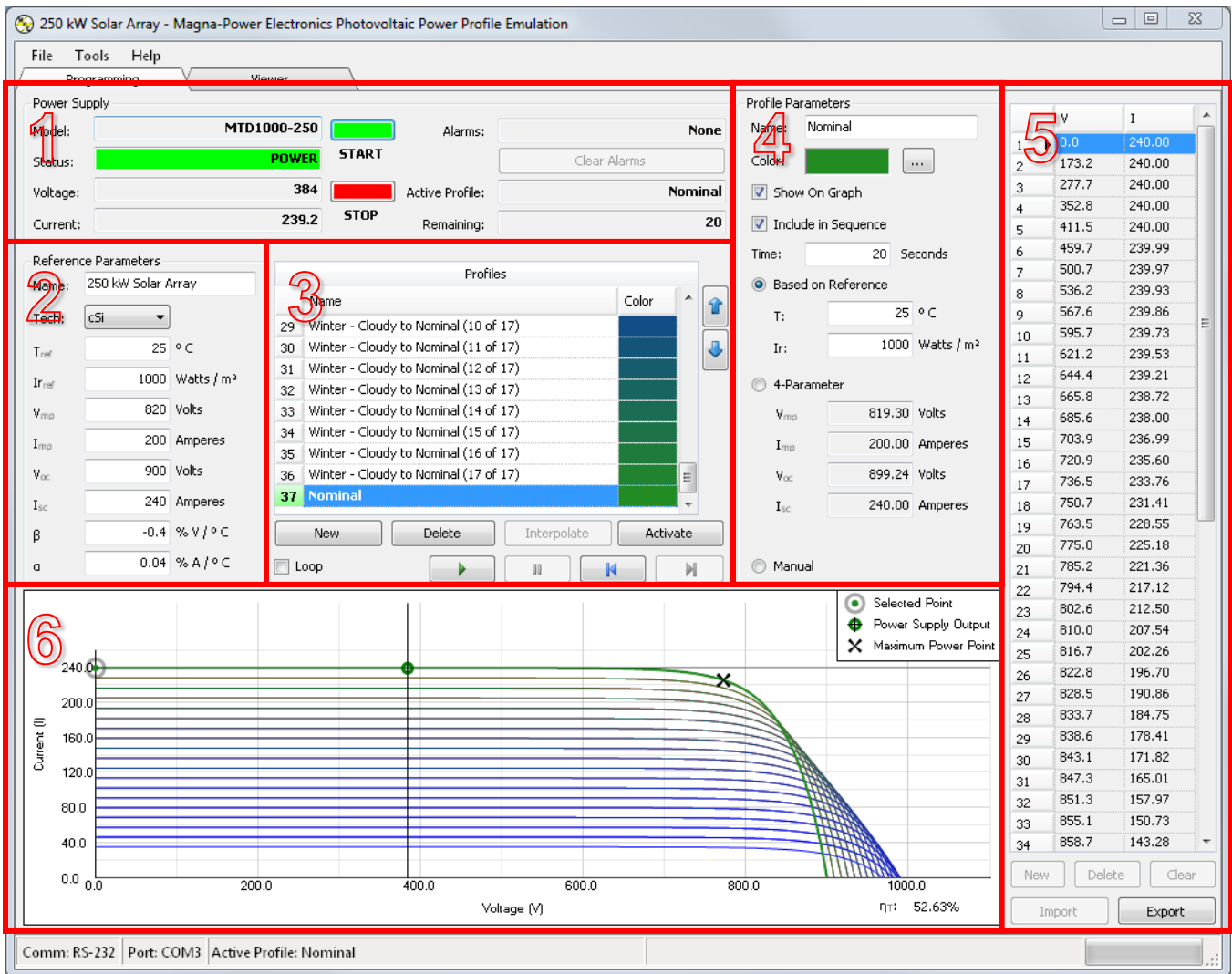
Figure 4.1 Screenshot of Photovoltaic Power Profile Emulation Software's Programming Tab
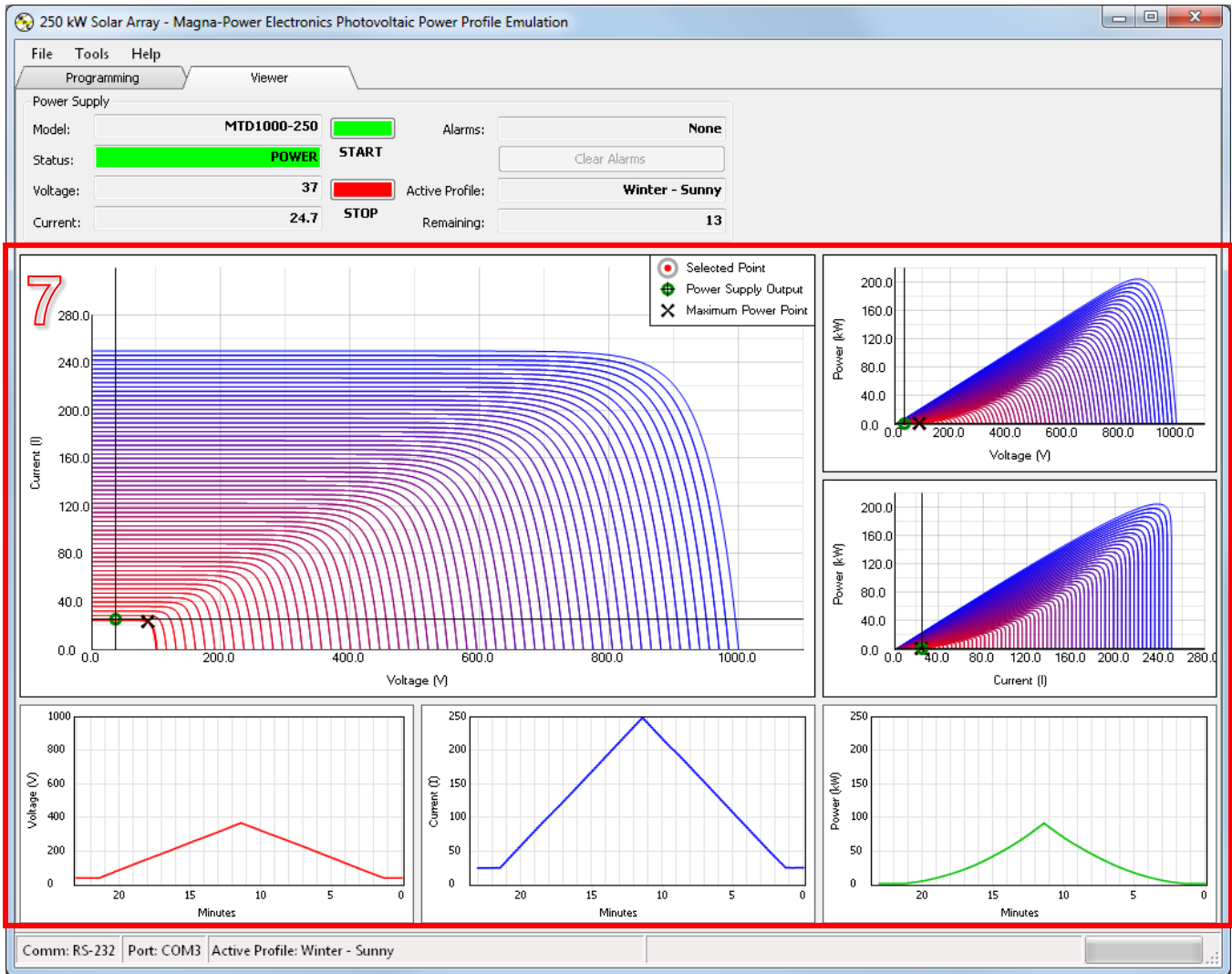
Figure 4.2 Screenshot of Photovoltaic Profile Emulation Software's Viewer Tab

4.1 Power Supply Status and Control

The software's Power Supply area, shown in Figure 4.3, identifies the power supply's model, status, measured voltage and measured current, and any alarms. This area also shows the active profile and the remaining number of seconds before the next profile is activated.

Figure 4.3 Power supply status and control

The START and STOP buttons turns the power supply's output on and off, respectively. These are equivalent to pushing the physical START and STOP buttons on the power supply. The Clear Alarms button clears power supply alarms, such as Over Voltage Trip (OVT) or Over Current Trip (OCT). Alarms must be cleared before the power supply's output can be reenergized.

The Power Supply area is not active unless the software has established communication with a power supply. A valid license is required for each power supply serial number as described in Section 5.0. Figure 4.4 shows the status bar at the bottom of the main screen. It provides the current communication protocol and setup, such as COM port or IP address.

| Comm: RS-232 | Port: COM1 | Active Profile: Nominal |
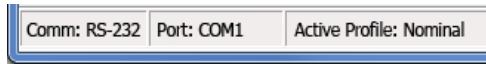
Figure 4.4 Communication protocol status bar

4.2   Reference Parameters

The software's Reference Parameters area, Figure 4.5, allows the user to enter the solar panel's reference parameters. Nominal parameters are typically supplied by the manufacturer of a photovoltaic array, namely:

V_{oc} photovoltaic array's open circuit voltage [V]

I_{sc} photovoltaic array's short circuit current [A]

V_{mp} photovoltaic array's voltage at maximum power point [V]

I_{mp} photovoltaic array's current at maximum power point [A]

T photovoltaic array temperature [°C]

T_{ref} nominal photovoltaic array temperature [°C]

Ir photovoltaic array irradiance PV generator temperature [W/m^2]

Ir_{ref} nominal photovoltaic array irradiance PV generator temperature [W/m^2]

α   temperature coefficient for current

β   temperature coefficient for voltage

Figure 4.5 Photovoltaic array reference parameters

Reference parameters may be changed at any time. Automatically calculated profiles will display new parameters, a new power profile on the grid, and will update the graph immediately, but they will not be sent to the power supply until the next time the profile is activated.

If the software detects any invalid parameters, as illustrated in Figure 4.6, it will display an icon next to the corresponding parameter label. The specification error can be displayed by holding the mouse cursor over the icon to display the error.

Figure 4.6 Reference parameters with invalid values

The EN50530 standard provides technology-dependent constants for the leading solar panel technologies: cSi and thin film (Table 4.1). Selecting one of these technologies from the Reference Parameter's Tech dropdown menu auto-fills these constants, as shown in Figure 4.7. (Note: At nominal values there is a slight offset from the reference parameters. This offset can be attributed to an offset from the EN50530 model and is considered very marginal).
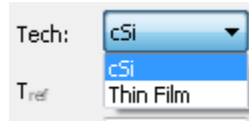

Figure 4.7 Reference parameters dropdown menu for technology dependent constants

Table 4.1 Technology dependent constants from EN50530 standard

	cSi technology	Thin film technology
FF_V [ ]	0.8	0.72
FF_I [ ]	0.9	0.8
C_G [W/m^2]	2.514E-03	1.252E-03
C_V [ ]	8.593E-02	8.419E-02
C_R [m^2/W]	1.088E-04	1.476E-04
V_{L2H} [ ]	0.95	0.98
α [%/C]	0.04	0.02
β [%/C]	-0.4	-0.2

4.3   Profiles

A profile is a current versus voltage curve that the power supply's output should emulate. There are two options for generating profiles with the Photovoltaic Power Profile Emulation software; they are:

1. **Automatic, based on solar array reference parameters:** Reference Parameters are defined in accordance with desired array. For each new profile, only temperature and irradiance values need to be defined. As further described in Section 4.4.1, remaining parameters are calculated automatically: maximum power point (V_{mp}, I_{mp}), open circuit voltage (V_{oc}), and short circuit current (I_{sc}) in accordance with the EN50530 model. This procedure is described in Section 4.4.1.
2. **Automatic, based on 4-parameters:** The user defines the maximum power point (V_{mp}, I_{mp}), open-circuit voltage (V_{oc}), and short-circuit current (I_{SC}). The profile is then generated based on these parameters. The procedure is described in Section 4.4.2.
3. **Manual:** The profile is defined with 50 current and voltage points using picewise linear approximation. The procedure is described in Section 4.4.3.

To create a new profile, select the **New** button. By default, a new profile is created based on the nominal reference parameters. To change the default profile generation, refer to Section 4.4**.**

The selected profile is displayed in the Profile Parameters area, the data table, and the power profile graph. The selected profile is highlighted in a power profile graph with its data points as dots.

To delete a profile, select the profile you wish to delete from the Profile dialog box, Figure 4.8, and then select the **Delete** button. A confirmation dialog box, shown in Figure 4.9, will appear. To hide a profile from the graph below, uncheck the Show On Graph checkbox from the profile you wish to hide. The selected profile is always shown on the graph.
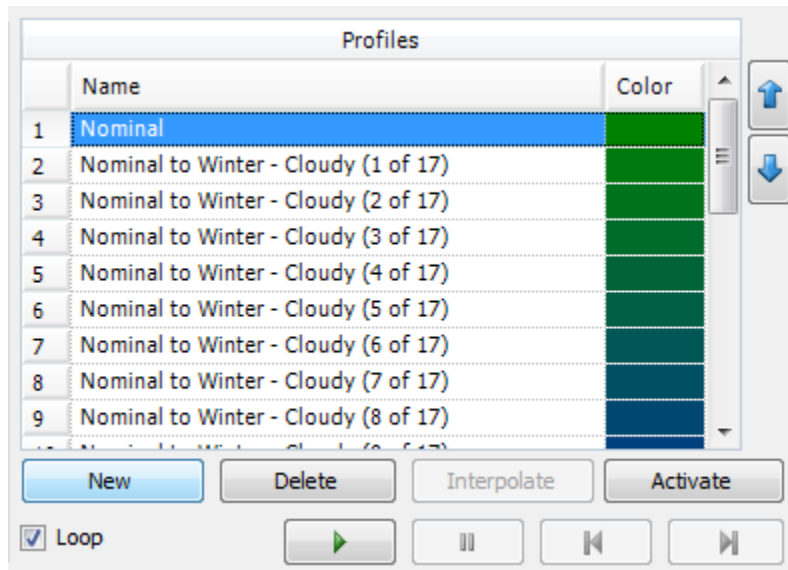
Figure 4.8 Photovoltaic profiles

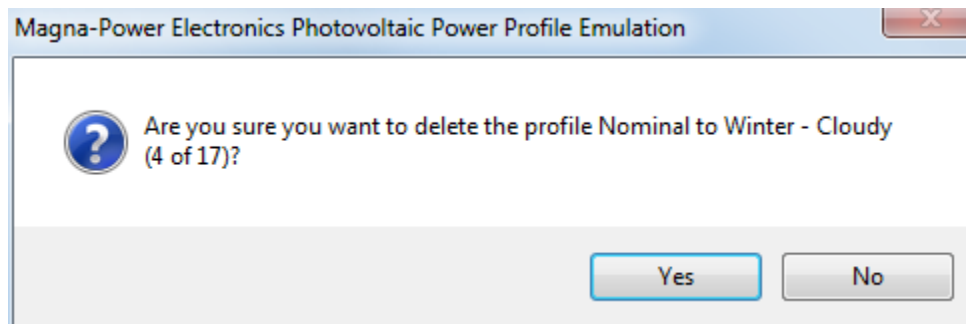Figure 4.9 Delete profile dialog

4.3.1   Manual Activation

To activate the selected profile, select the **Activate** button. The selected profile is sent to the power supply. During activation, a progress bar is displayed in the lower right corner of the status bar. Once activated, the profile is highlighted with green and is displayed in the Power Supply box above and the status bar at the bottom.

4.3.2 Sequential Activation

Profiles can be activated in sequence, one after another, automatically by the software. The order of activation is determined by the order the profiles listed in the Profiles grid. To rearrange the profiles up or down in sequence, select a profile and select on the up or down arrows next to the grid.

To loop the sequence, check the **Loop** checkbox. If this box is checked, the sequence will return back to the top of the profiles after the end of the sequence. If this box is not checked, the automatic sequence ends with the last profile.

To start sequential activation, select the green **Play** button. The sequence starts with the current active profile. If no profile is active, the first profile in the list is activated.

To pause, select the **Pause** button. The time remaining is stopped. Select the **Play** button to resume the sequence.

Select the >| button to skip to the next profile. Select the |< button to skip to the previous profile.

A different profile can be skipped at any time by selecting that profile and clicking the Activate button. After activation, the automatic sequence will continue from the newly activated profile.

4.3.3 Profile Interpolation

Profile interpolation allows automatic generation of intermediary profiles between two defined curves over a defined time period. To use this function, define two curves, the starting curve and the finishing curve, and place the curves in sequential order in the profile listing. Define the time period for the transition in the starting curve, then select the **Interpolate** button. The dialog will pop up, as shown in Figure 4.10, allowing the number of intermediary profiles to be selected. The number of seconds per profile will be evenly distributed for all the interpolated profiles, increasing or decreasing depending on the number of profiles to be generated.
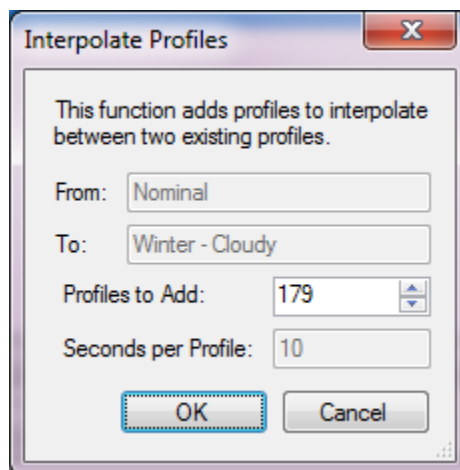

Figure 4.10 Interpolate profiles dialog

4.4   Profile Parameters and Generation

As shown if Figure 4.11, the selected profile's parameters can be adjusted in the Profile Parameters area. The parameters in this section are as follows:

Name: The profile's name, to distinguish a specific voltage-current curve from other profiles

Color: The color of the profile in the graph.

Show on Graph: To hide a profile from the graph below, uncheck the Show On Graph checkbox from the profile you wish to hide. The selected profile will always be shown on the graph.

Include in Sequence: If checked, the selected profile will be included in sequence of profiles. The next profile will be automatically loaded when the selected profile's time expires. If clear, the selected profile will be skipped during sequential operation.

Time: Duration the selected profile is active during sequential operation.

Based on Reference: Profile generation using the solar array reference parameters and the EN50530 model. (See Section 4.4.1)

> **T**: Photovoltaic array temperature [°C]; used only the Based of Reference profile generation method.
>
> **Ir**: Photovoltaic array irradiance PV generator temperature [W/m^2]; used only the Based of Reference profile generation method.

4-Parameter: Profile generation through definition of maximum power point, open-circuit voltage and short-circuit current. (See Section 4.4.2)

> **V_{mp}:** Voltage at the maximum power point [V]; used only the 4-Parameter profile generation method.
>
> I_{mp}: Current at the maximum power point [I]; used only the 4-Parameter profile generation method.
>
> V_{oc}: Voltage at open-circuit [V]; used only the 4-Parameter profile generation method.
>
> I_{sc}: Current at short-circuit [I]; used only the 4-Parameter profile generation method.

Manual: Profile generation through definition of 50 operating or data import. (See Section 4.4.3)

Figure 4.11 Profile parameters

4.4.1 Profile Generation Using Based on Reference Method

When the **Based on Reference** radial button is selected, the profile will be automatically calculated from the reference parameters, temperature, and irradiance values in accordance with the EN50530 model. Changes to the profile's temperature, irradiance will modify the selected curve. Changes to any of the reference parameters will automatically recalculate all 50 points in the curve.

To create a new profile, select the **New** button. By default, a new profile is created based on the nominal reference parameters. To change the default profile generation, refer to Section 4.4**.** The profile will vary from nominal values by altering the temperature (**T**) or irradiance (**Ir**) value for that profile.

Profile generation using the **Based on Reference** method will cause new data points in the table and on the graph to appear immediately, but they will not be sent to the power supply until the next time the profile is activated. Press the **Activate** button to have the newly calculated profile sent to the power supply. If the power supply output is energized when the new profile is activated, the power supply will update its output immediately.

4.4.2 Profile Generation Using 4-Parameter Method

When the **4-Parameter** radial button is selected, profiles will be automatically calculated based on V_{oc}, I_{sc}, V_{mp}, and I_{mp}. This method of profile generation assumes nominal values for temperature and

irradiance to generate profiles in accordance with EN50530. Changes to any of the 4-Parameter values will modify the selected curve.

To create a new profile, select the **New** button, then choose the **4-Parameter** radial button. The values prepopulated in the parameter fields are retained from the **Based on Reference** profile generation method.

When generating curves using the 4-Parameter method, V_{mp} and I_{mp} should always be less than V_{oc} and I_{sc}, respectively. Depending on the technology and furthermore, the fill factor, the ratio of $V_{mp}{:}V_{oc}$ (FF_V) and $I_{mp}{:}I_{sc}$ (FF_I) will vary. Reference Table 4.1 for fill factor values for various solar panel technologies.

Profile generation using the **4-Parameter** method will cause new data points in the table and on the graph to appear immediately, but they will not be sent to the power supply until the next time the profile is activated. Press the **Activate** button to have the newly calculated profile sent to the power supply. If the power supply output is energized when the new profile is activated, the power supply will update its output immediately.

4.4.3   Profile Generation Using Manual Method

When Automatic V/I checkbox is cleared, the software will be in a manual profile generation mode. Reference parameters are not required for this method of profile generation.

In manual profile generation, the data table becomes active, allowing all the values to be modified. Up to 50 voltage and current values may be entered. The **New**, **Delete,** and **Clear** buttons below the table allow manual control over the points. To edit a point for voltage or current, select in the appropriate cell and make the revision. The point being edited is highlighted with a light gray circle on the graph.

Requirements for the manual voltage/current data table entry are:

1. The first row must have a voltage value of 0 Vdc.
2. The last row must have a current value of 0 Adc.
3. The normalized slope $(\Delta I/\Delta V) \times (I_{max}/V_{max})$ cannot be greater than -0.05.

Profile generation using the **Manual** method will cause new data points in the table and on the graph to appear immediately, but they will not be sent to the power supply until the next time the profile is activated. Press the **Activate** button to have the new profile sent to the power supply. If the power supply output is energized when the new profile is activated, the power supply will update its output immediately.

4.5   Profile Import and Export

4.5.1   Profile Import

When the **Manual** profile generation method selected, profiles can be imported from a comma-separated value (.csv) file. With the **Manual** radial button selected, select **Import** under the 50-point table. Then,

---

from the drop-down menu in the import window, select Comma separated value (.csv). Guidelines for the .csv file to be imported are as follows:

- The first column must be voltage and the second column must be current.
- Any columns beyond the first two columns are ignored.
- The .csv file may have text headers on the first row. The software will parse the first row and if text, will begin the import on the second row, and if numeric, will begin the import on the first row.
- Single and double quoted values are supported, for example: "40.000" and '60.000'
- The values are trimmed of whitespace and quotes before being parsed.

The import will handle values where a comma is used as a decimal point as reflected by the regional settings, for example: "40,000" and '60,000'. Otherwise a comma is treated as a thousand separator.

4.5.2   Profile Export
Profiles may be exported regardless of the profile generation method. Export requires an active connection to a licensed Magna-Power Electronics power supply. There are three export formats, selectable from the drop-down export window. The export formats are as follows:

- **Photovoltaic Power Profile Emulation Export (.pppeExport):** A proprietary photovoltaic power profile format that can only be read by Magna-Power Electronics Photovoltaic Power Profile Emulation software, compatible with legacy version of the software.
- **SCPI Commands (.txt):** The SCPI commands issued by the PPPE software to the power supply to define the profile for emulation. Each SCPI Command export is approximately 55 commands. The PPPE software can be used to generate complex photovoltaic profiles, while SCPI command export enables these complex profiles to be transferred to other software environments, such as LabVIEW or Visual Studio. Commands will vary whether **Voltage Control** or **Current Control** is selected in the **Options** menu; make sure to note the proper jumper setting from this control configuration.
- **Comma-delimited (.csv):** Data export of the generated 50-point curve in a widely accessible format.

4.6   Power Profile Graph

The graph displays calculated power profiles, maximum power point, power supply output, and information about a selected data point. The selected profile is displayed with its data points as dots. Hovering over one of these dots highlights the corresponding point on the V/I table. The scale of the graph is automatically calculated based on what is being displayed.

Additionally, the power supply's measured output is displayed as a green circle. The measured power supply output is updated continuously on the graph while communicating with the power supply. The power supply output is not displayed if communication is not established or it is disrupted.

The selected profile's maximum power point is displayed at the X on the curve. The maximum power point is not displayed for manually entered power profiles.

The bottom right corner of the graph displays the tracking efficiency, η_T. This percentage is calculated as follows:

$$\eta_T = \frac{Power\ supply\ ouput\ power}{Power\ at\ maimum\ power\ point} \times 100\%$$

The power profile graph can be displayed as either current versus voltage or as a power versus voltage curve as illustrated in Figure 4.12 and Figure 4.13, respectively. The procedure for selection of graphical representation is described in Section 4.8.
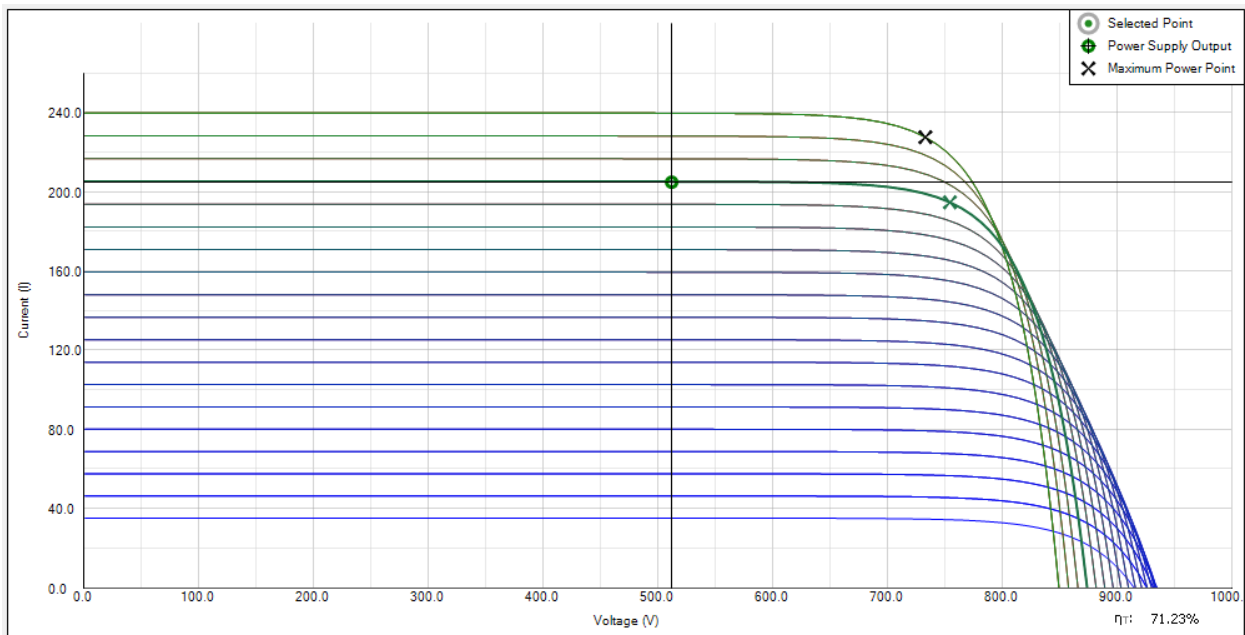

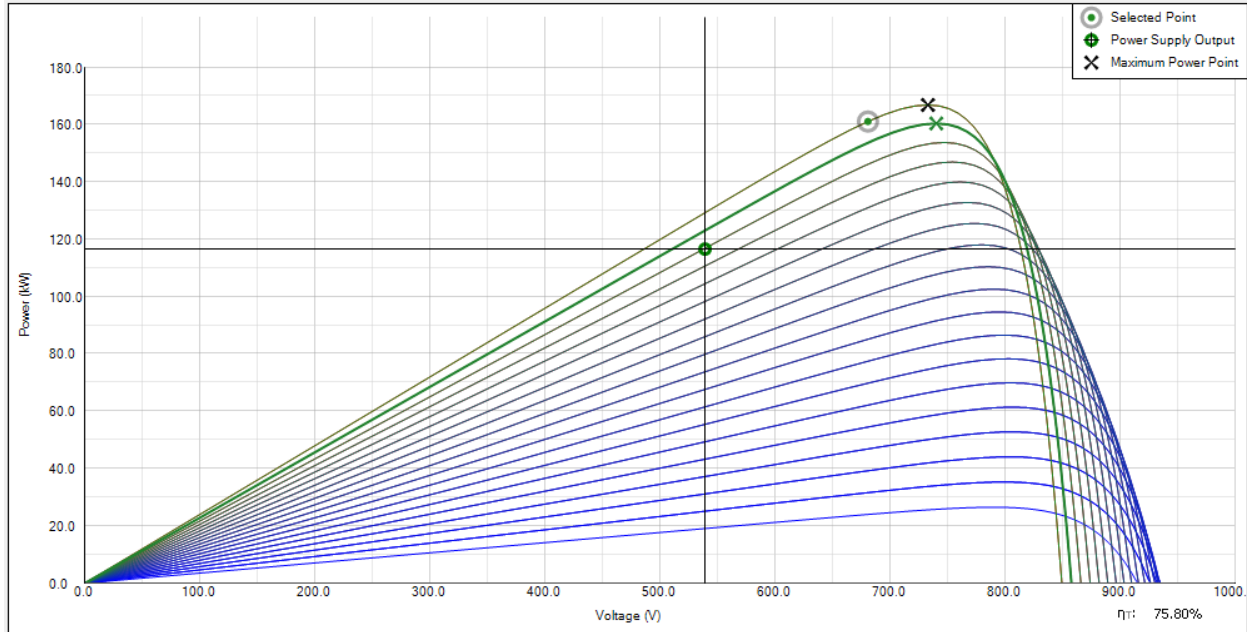Figure 4.12 Current vs. voltage graphical display

Figure 4.13 Power vs. voltage graphical display

4.7   Sessions

A session is a set of reference parameters of one or more profiles based off those parameters. Sessions can be saved and loaded as .pppe files. When the software is first launched, a blank session is created.

If you attempt to create new session, open a different session, or exit the program and the current session has changed, the software will prompt you to save the current session first.

As illustrated in Figure 4.14, select **Yes** to save the current session, or select **No** to discard the changes to the current session. Select **Cancel** to return to the current session.
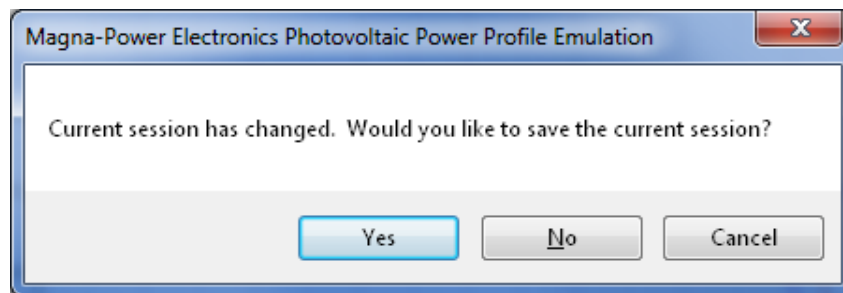

Figure 4.14 Save current session dialog

To save a session, select **Save Session** from the **File** menu or use the keyboard and type Ctrl+S. If the file has not been saved previously, the software will prompt for a filename. To save a session to a different file, select the **Save As** item from the **File** menu. Browse the folders on the computer where to save the session, type the file name, and then select the Save button.

To open a session, select the **Open Session** item from the **File** menu or use the keyboard and type Ctrl+O. Browse to the folder on the computer that contains the session (.pppe file) to be opened. Select the file and select the **Open** button.

To create a new session, select the **New Session** item from the **File** menu or use the keyboard and type Ctrl+N.

To exit the software, select the **Exit** item from the **File** menu or use the keyboard and type Alt-F4. Alternatively, select the X in the upper right corner of the application to exit the software.

4.8 Viewer

The **Viewer** tab (Figure 4.15) provides a graphical view of both the voltage/current profiles as well as key parameters as a function of time. In clockwise order, starting with the largest graph in the top left, the graphical outputs are:

- Current (Adc) versus voltage (Vdc) profile(s) programmed by the user for the power supply to emulate, identical to the graph on the **Programming** tab.
- Power (kW) versus voltage (Vdc) profile(s) programmed by the user for the power supply to emulate.
- Power (kW) versus current (Adc) profile(s) programmed by the user for the power supply to emulate.
- Power (kW) versus time (min) continually updated at the interval specified in the **Options** menu.
- Current (Adc) versus time (min) continually updated at the interval specified in the **Options** menu.
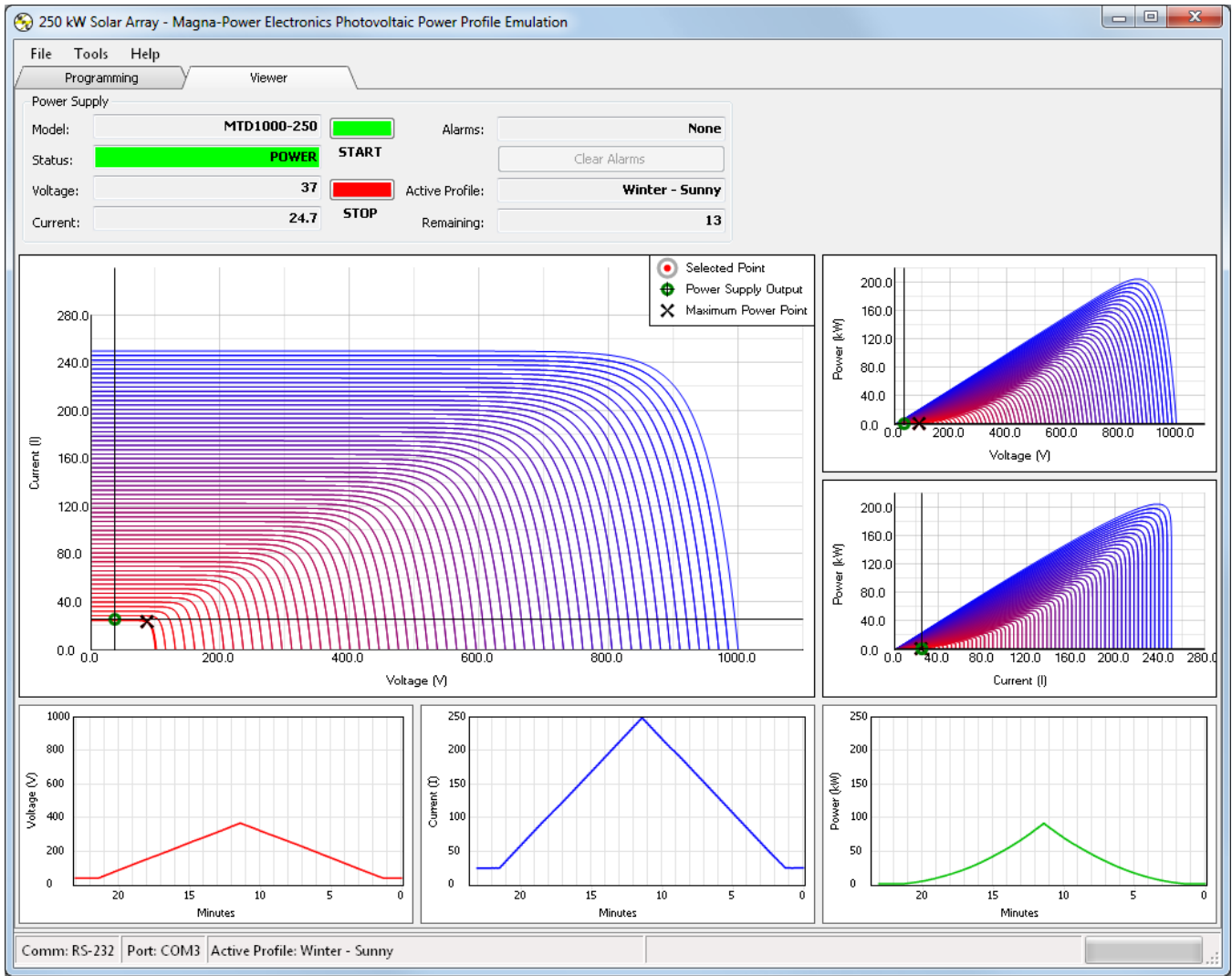- Voltage (Vdc) versus time (min) continually updated at the interval specified in the **Options** menu.

Figure 4.15 Viewer tab panel

4.9 Options Menu

To enter the options menu, select **Options** from the **Tools** menu. The options menu is illustrated in Figure 4.16.

As described in Section 4.6, there are two options to format the graph: Voltage versus Current or Voltage versus Power.
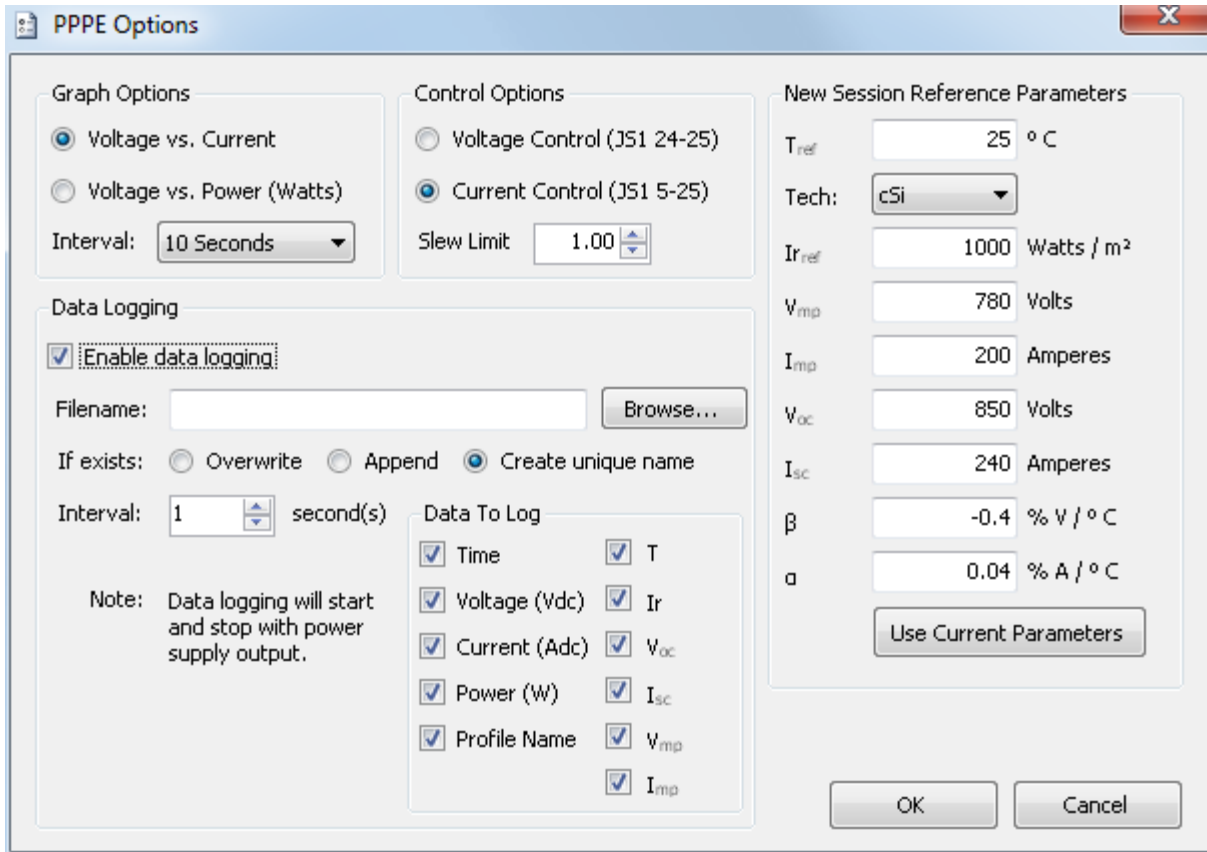
Figure 4.16 Options menu

4.9.1 Graph Options

The primary graph may be displayed as either current versus voltage (default, Figure 4.12) or power versus voltage (Figure 4.13). Select the radial button next to the desired graphical display and hit confirm the selection by pressing **OK** to update the display.

The **Interval** parameter is the graphical x-axis time parameter's display interval, used in the **Viewer** tab. This interval parameter is the time period in which each time-dependent graph in the **Viewer** tab is updated.

4.9.2 Control Options

The power supply is capable of either modulating voltage as a function of current (current control, default) or current as a function of voltage (voltage control). A jumper of the power supply's rear JS1 connector (Figure 4.17) provides the necessary analog feedback loop necessary for the high-speed computation. **Current Control** requires creating a jumper or short between pins 5 (VO2) and 25 (VMOD). **Voltage Control** requires creating a jumper or short between pins 24 (IO2) and 25 (VMOD) on the JS1 connector.

Both methods of control are available to accommodate various load control methodologies. For voltage-mode controlled loads, setting the power supply to Current Control (JS1 5-25) is recommended. For

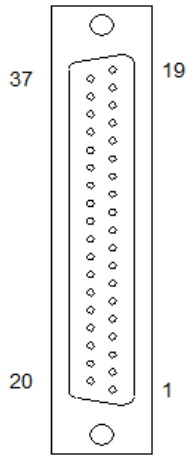current-mode controlled loads, setting the power supply to Voltage Control (JS1 24-25) is recommended.

Figure 4.17 JS1 37-Pin External Programming Connector

The **Slew Limit** factor allows the power supply's modulation performance to be adjusted to account for various load requirements. This command controls the allowable slew rate as a function voltage/current profile. The factor ranges between 0.0 and 1.0, where 0.0 has the highest stability/lowest slew rate and 1.0 has the lowest stability/highest slew rate. For loads demanding high bandwidth, the slew limit should be increased until an adequate performance level is reached.

4.9.3   New Session Reference Parameters

The New Session Reference Parameters section features parameters identical to the photovoltaic array reference parameters in the main software, previously illustrated in Figure 4.5. Configuring the New Session Reference Parameters in the options menu enables default photovoltaic array reference parameters to be specified. These parameters can be manually entered or they can be automatically entered using the **Use Current Parameters** button. Whenever a new session is created, the reference parameters will be automatically populated with the defined New Session Reference Parameters. If no parameters are specified, the default reference parameters will be blank.

4.9.4   Data Logging

Data logging is available to store both profile and measured data to a comma separated value (.csv) file as a function of time. This data can later be used for external report generation or analysis.

By default, data logging is disabled. To enable data logging, select the checkbox labeled **Enable data logging**. Unselect this checkbox to disable data logging. The following functions will be enabled when data logging is enabled.

The **Filename** field is the location on your computer or network where the data should be saved. Data will start logging and stop logging in accordance with the power supply's start and stop functionality.

The **If exists** radial button determines how data logging will resume if the file already exists. If **Overwrite** is selected and the target file already exists, all existing log data will be lost each time the power supply starts. If **Append** is selected and the target file already exists, all existing log data will be maintained and new data will be logged at the end of target file. If **Create unique name** is selected and the target file already exists, all existing log data will be maintained and a new file will be created with a unique "-#" suffix, iterating to another number each time the power supply output is enabled.

5.0 LICENSING

5.1 Overview

A license is required to connect to a power supply. One license is required for each power supply. A single PPPE installation can connect to several licensed power supplies. License files are provided on a CD when the power supply is shipped. The license automatically configures on installation. Section 5.2 describes the configuration for additional power supply licenses.

If you have misplaced your original CD, please contact Magna-Power Electronics at support@magna-power.com or call (908) 237-2200 to retrieve your license file.

5.2 License Manager

As shown in Figure 5.1, PPPE Software features a built-in license manager to manage licenses for several power supplies. The license manager is available by selecting **Help** from the main toolbar and then selecting **License Manager**.
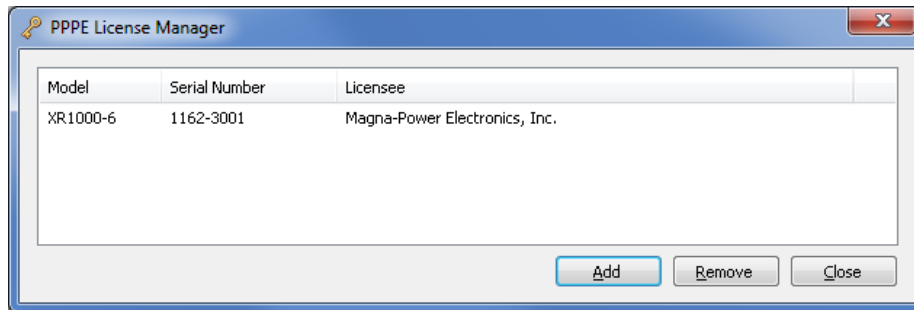
Figure 5.1 License Manager for PPPE

To add a license file, select **Add** and then browse for your .lic file that was provided by Magna-Power Electronics. To remove a license file, select a license from the license manager then select **Remove**.

6.0 COMMUNICATION

The software can communicate with a power supply via any of the following:

- RS-232 (Serial)
- LXI TCP/IP Ethernet
- IEEE 488.2 GPIB

Sessions and profiles can be setup without connecting to a power supply, but activating the profiles, power supply, status, and control are not possible unless communication is established.

The software will save the communication settings when exiting the program. The next time the software is launched, it will attempt to reestablish communication with the power supply using the previous settings.

To establish communication, select **Setup Communication** item from the **Tools** menu. When communication is established, the Power Supply dialog box in the upper left will display information about the power supply's current state. In addition, the status bar at the bottom will show the communication method and information.

6.1 RS-232 (Serial) Setup

To connect to the power supply with a serial (comm) port, select RS-232 from the **Type of Communications** dropdown as illustrated in Figure 6.1. The software populates the detected serial (comm) ports in the **Comm Ports** dropdown. Select the port used by the power supply to and then select the **OK** button.
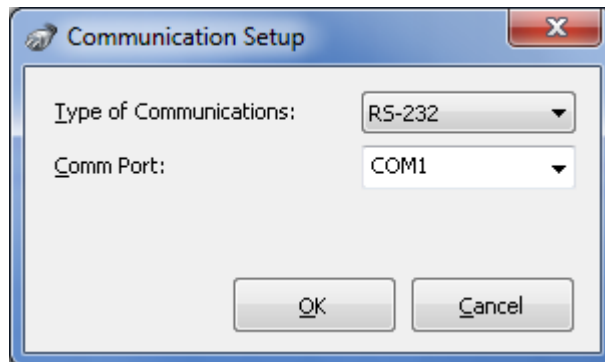

Figure 6.1 RS-232 communication setup

6.2 LXI TCP/IP Ethernet Setup

To connect to the power supply via TCP/IP (Ethernet), select TCP/IP from the **Type of Communications** dropdown as illustrated in Figure 6.2. Enter the power supply's hostname or IP

address in the **Address** textbox and enter the appropriate port (typically 50505) in the **Port** textbox. Then select **OK**.
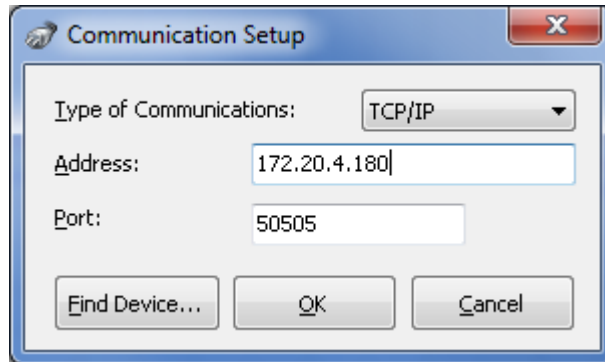

Figure 6.2 TCP/IP communication setup

Alternatively, devices can be located on the network automatically with the Find Device button. As shown in Figure 6.3, select the power supply from the list and then select **OK**. Select the **Refresh** button to rescan the network for power supplies or select **Cancel** to return to the previous screen without selecting a power supply.
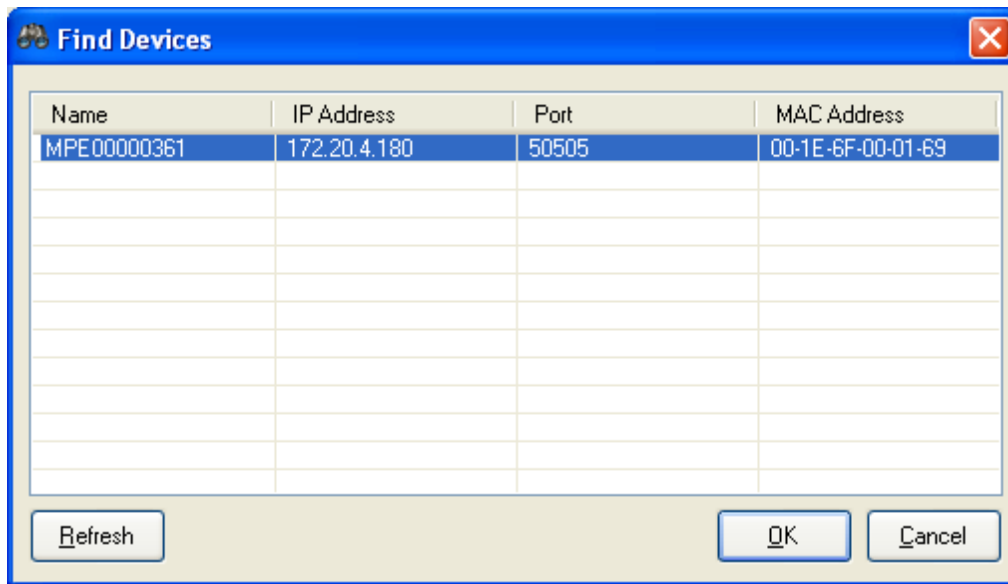

Figure 6.3 TCP/IP Find Devices dialog

6.3 IEEE 488.2 GPIB Setup

To connect to the power supply via GPIB (IEEE 488.2), select GPIB from the **Type of Communications** dropdown as illustrated in Figure 6.4. Select the power supply's **GPIB Address** from the dropdown and then select **OK**.

Figure 6.4 GPIB communication setup

Alternatively, the Find Device button can be used to try to locate the device on the GPIB bus automatically, as illustrated in Figure 6.5.
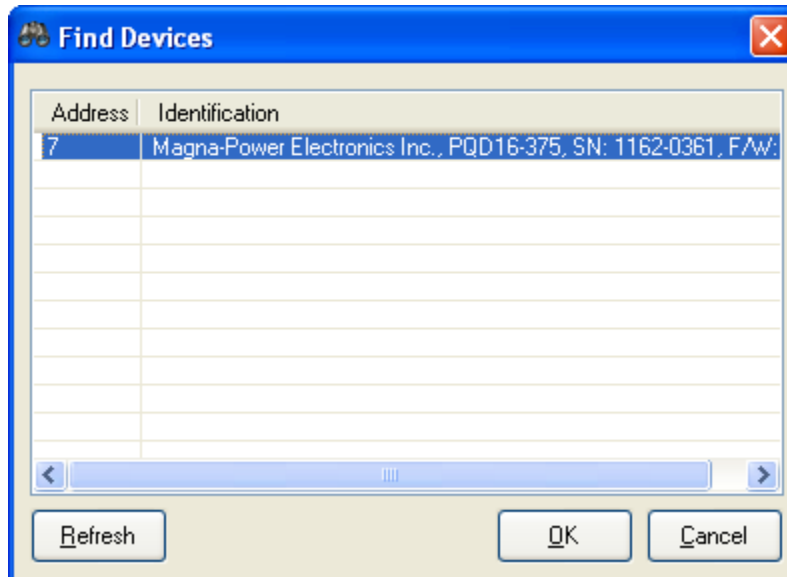

Figure 6.5 GPIB Find Devices dialog

The software will scan the GPIB bus and will display the devices found along with their responses to the *IDN? query. Select the power supply from the list and then select **OK**. Select the **Refresh** button to rescan the bus or **Cancel** to return to the previous screen without selecting a power supply.

6.4 Communication Problems

If communication cannot be established or there is a disruption in communication with the power supply, an error will be displayed as illustrated in Figure 6.6. Select the Show Details button to display internal information about the error. Use the Copy to Clipboard button to copy the detailed information to the clipboard. This information may be useful to troubleshoot the error.
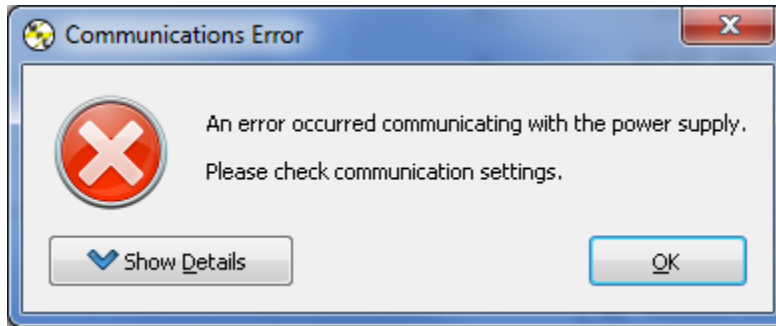
(a)
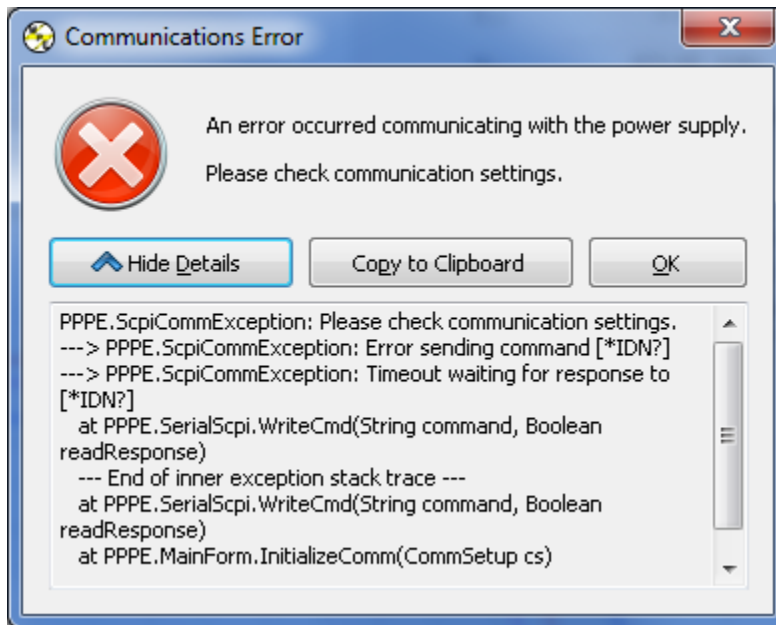
(b)

Figure 6.6 (a) Communication error dialog (b) Details of communication error