

SMA Sunny Tripower 12-24000TL-US Inverter SolarVu® Installation Guide

Site Preparation

SolarVu® is an energy portal that provides remote monitoring of solar PV renewable energy generation sites over the web. It requires the installation of an M504 gateway (datalogger) which continuously transfers data from the inverter(s) to the SolarVu servers. This guide explains how to connect the M504 gateway to the SMA Sunny Tripower 12-24000TL-US family of 12-24kW inverters using ethernet Speedwire communications which is a standard feature of this inverter. The M504 gateway connects to one or more inverters using cat5e ethernet cable, daisy chained for multiple inverters. A persistent internet connection is required either by connection to an RJ45 ethernet jack connected to the building LAN or by installing the optional 3G cellular modem in the SolarVu enclosure. A source of 120VAC must be available to power the SolarVu equipment. The LAN must have high speed internet service to an ISP to provide a connection to the internet as shown in figure 1.

SolarVu Enclosure Installation

Before starting, review the drawings and instructions in the document pouch on the SolarVu enclosure door. The multiport M504-485 comms board should be connected correctly according to the SLD (single line drawing) provided. Use the SLD for the specific terminal connections that apply for the project with this guide for general instructions. Mount the SolarVu enclosure with conduit for the inverter ethernet cat5e cable, ethernet cat5e cable to the building LAN (unless 3G cellular is installed) and 120VAC control power as shown in fig 2 and 3. Normally the SolarVu enclosure will be mounted in the same electrical room as the inverter. However the ethernet connection to the first inverter can be up to 300' away.

Power Supply: Wire 120VAC control power from a suitable 15A circuit to the circuit breaker, N and G terminals.

Inverter Ethernet: Each SMA 12-24000TL inverter has 2 RJ45 jacks for ethernet in and out connection as a 2 port switch. Connect one end of a standard ethernet patch cable of the appropriate length to the SolarVu enclosure RJ45 jack marked Inverter #1 Speedwire module as shown in fig 2. Remove the lower inverter cover and insert the ethernet cable through a conduit opening. Flip up the black communications module as shown in fig 3 and plug the cable into either of the RJ45 jacks. Plug in a second ethernet patch cable into the second RJ45 jack that is long enough to reach the next inverter. Repeat this daisy chain connection for all inverters.

Building Ethernet: Plug an ethernet patch cable from the SolarVu enclosure to the building LAN jack for internet connection.

Fig 1 Internet Connection

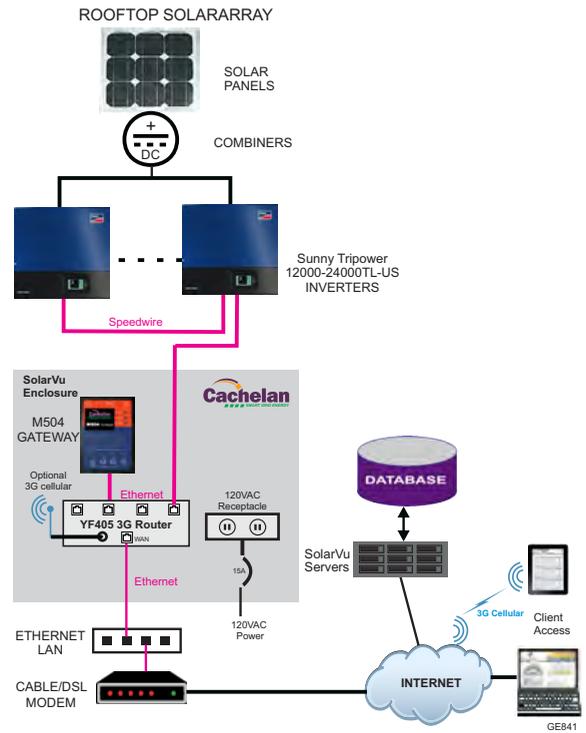
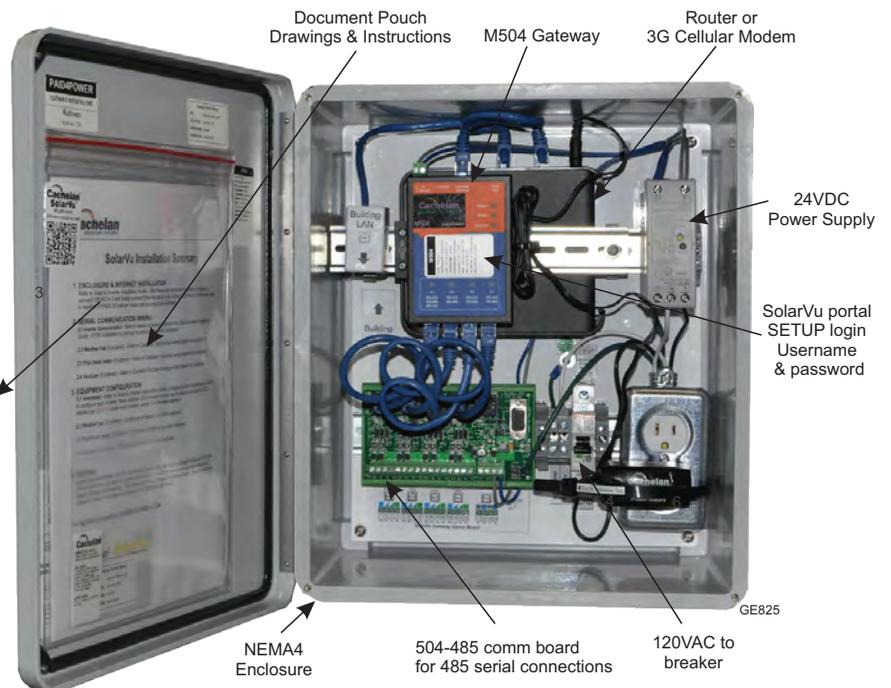
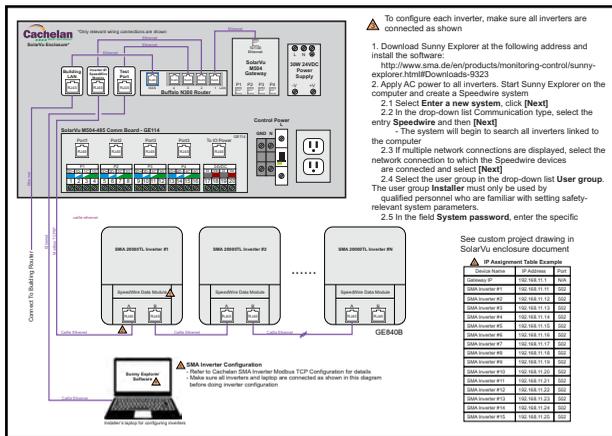


Fig 2 SolarVu Enclosure components and connection

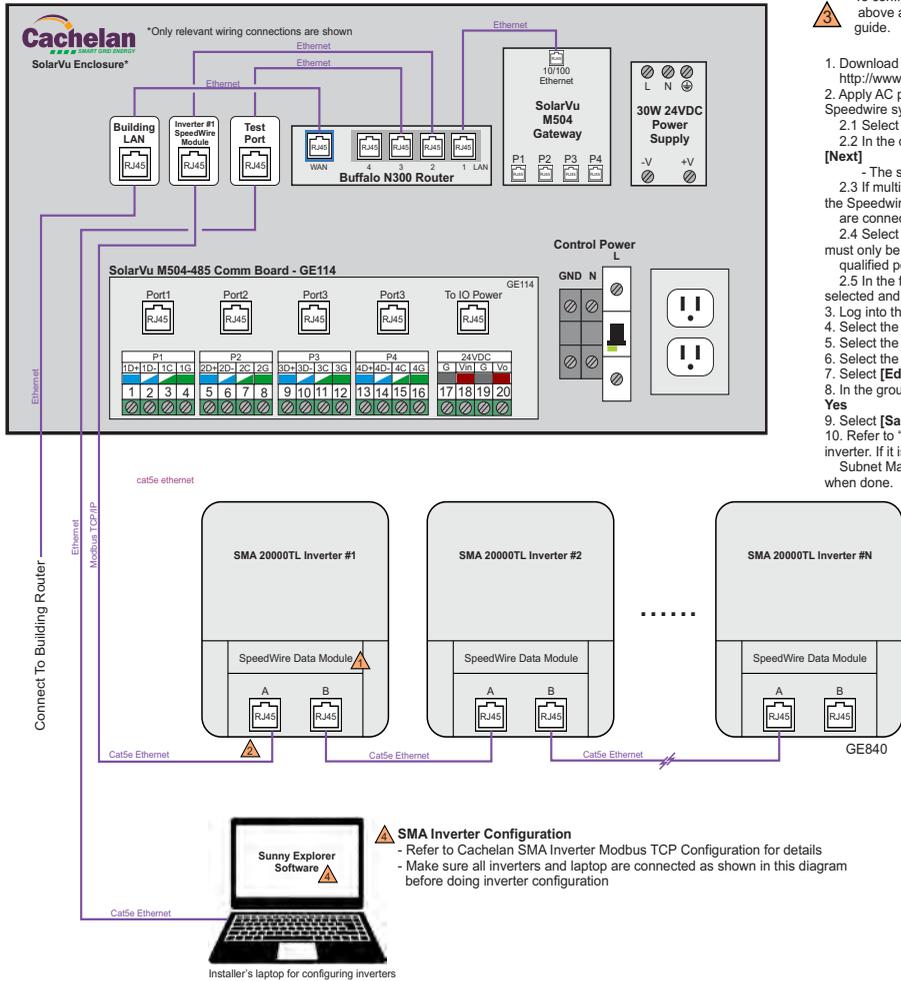
Use the project drawings in the document pouch for terminal connections and slave address assignment.



Communication Ethernet Wiring

Each SMA 12-24000TL inverter has 2 RJ45 jacks for ethernet in and out connection as a 2 port switch. Connect one end of a standard ethernet patch cable of the appropriate length to the SolarVu enclosure RJ45 jack marked Inverter #1 Speedwire Module as shown in fig 3. Remove the lower cover of the first inverter and insert the other end of the ethernet cable through the conduit opening in the bottom. Flip up the black communications module as shown in fig 3 and plug the cable into the left RJ45-A jack. Insert a second ethernet patch cable that is long enough to reach the next inverter through the conduit hole in the bottom of the inverter and plug it in to the right RJ45-B jack. Repeat this daisy chain connection for all inverters. Maximum distance of any single ethernet cable must be less than 300 feet. For convenience, use pre-made cat5 ethernet patch cables if possible. If RJ45 plugs are to be crimped on to cat5e cable in the field, be sure to use a cable tester to verify all 8 connections are made or the communications will not work.

Fig 3 Communcion wiring between SolarVu and the 12-24000TL inverters



To configure each inverter, make sure all inverters are connected as shown above and the computer has internet access. See SolarVu SMA Tripower installation guide.

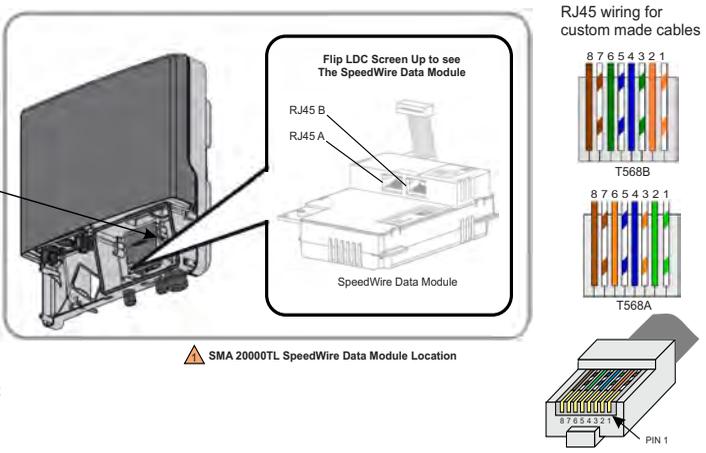
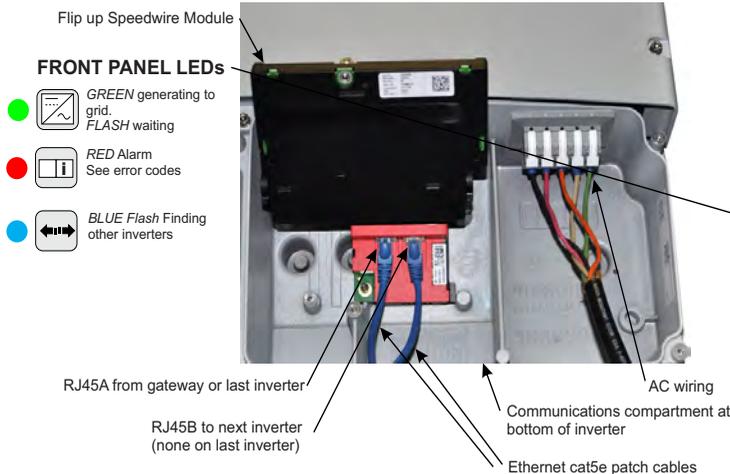
- Download Sunny Explorer at the following address and install the software: <http://www.sma.de/en/products/monitoring-control/sunny-explorer.html#Downloads-9323>
- Apply AC power to all inverters. Start Sunny Explorer on the computer and create a Speedwire system
 - Select **Enter a new system**, click **[Next]**
 - In the drop-down list Communication type, select the entry **Speedwire** and then **[Next]**
 - The system will begin to search all inverters linked to the computer
 - If multiple network connections are displayed, select the network connection to which the Speedwire devices are connected and select **[Next]**
 - Select the user group in the drop-down list **User group**. The user group **Installer** must only be used by qualified personnel who are familiar with setting safety-relevant system parameters.
 - In the field **System password**, enter the specific password for the user group selected and select **[Next]**
 - Log into the Speedwire system as **Installer**
 - Select the SMA inverter to be configured in the system tree
 - Select the tab **Settings**
 - Select the parameter group **External Communication**
 - Select **[Edit]**
 - In the group **Modbus > TCP server**, in the **Activated** drop-down list, select the entry **Yes**
 - Select **[Save]**
 - Refer to "Inverter IP Assignment" table and assign static IP address to each inverter. If it is required to assign Subnet Mask and Gateway, enter **255.255.255.0** and **192.168.11.1** respectively. Save it when done.

See custom project drawing in SolarVu enclosure document pouch for assigned IP addresses to be entered using the Sunny Explorer program

IP Assignment Table Example

Device Name	IP Address	Port
Gateway IP	192.168.11.1	N/A
SMA Inverter #1	192.168.11.11	502
SMA Inverter #2	192.168.11.12	502
SMA Inverter #3	192.168.11.13	502
SMA Inverter #4	192.168.11.14	502
SMA Inverter #5	192.168.11.15	502
SMA Inverter #6	192.168.11.16	502
SMA Inverter #7	192.168.11.17	502
SMA Inverter #8	192.168.11.18	502
SMA Inverter #9	192.168.11.19	502
SMA Inverter #10	192.168.11.20	502
SMA Inverter #11	192.168.11.21	502
SMA Inverter #12	192.168.11.22	502
SMA Inverter #13	192.168.11.23	502
SMA Inverter #14	192.168.11.24	502
SMA Inverter #15	192.168.11.25	502

SMA Inverter Configuration
 - Refer to Cachelan SMA Inverter Modbus TCP Configuration for details
 - Make sure all inverters and laptop are connected as shown in this diagram before doing inverter configuration



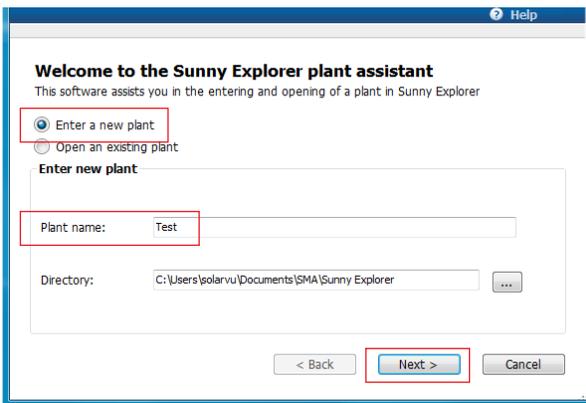
Inverter Configuration

Once the inverters are connected to the SolarVu enclosure as shown in fig 3 it is necessary to configure them using a PC with a free software program from SMA called Sunny Explorer. When prompted in the program, enter the IP address assignments for the inverters which are found in the project drawings located in the SolarVu enclosure door document pouch. Communications will not work until the inverters have been programmed with the IP settings that match how the SolarVu gateway has been configured.

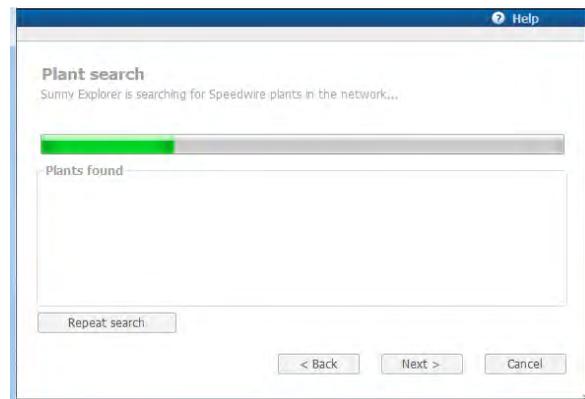
Fig 4 Follow inverter configuration steps 1-14 using the Sunny Explorer program

1. Download **Sunny Explorer** software from the following address:
<http://www.sma.de/en/products/monitoring-control/sunny-explorer.html#Downloads-9323>
When the download is complete, install Sunny Explorer software on a PC that can be taken to site.
2. For each inverter, write down the inverter serial number found on the side label and the corresponding inverter number 1-N assigned and labelled on the inverter. This information will be used in step 11 to ensure that the SolarVu displayed inverter number matches the physical equipment to aid O&M staff in troubleshooting.
3. Refer to the project drawings found in the document pouch. Using an ethernet patch cable, plug the PC into the SolarVu enclosure network jack usually marked Test Port. An ethernet patch cable must also be connected from the jack marked building LAN to an active LAN jack on the building network. Power on the SolarVu enclosure. Apply AC and DC power to all inverters.

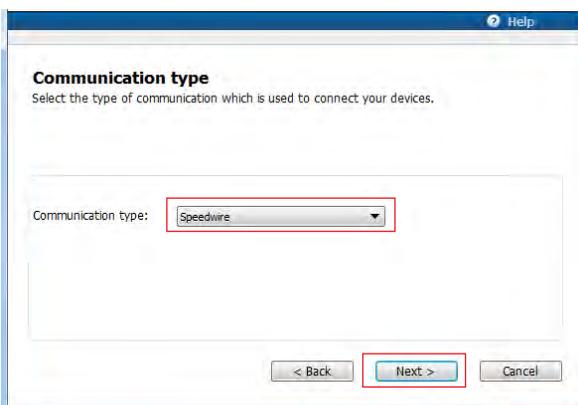
4. Open Sunny Explorer, select *Enter a new plant*, Enter the project name in the *Plant name* box Click *Next*



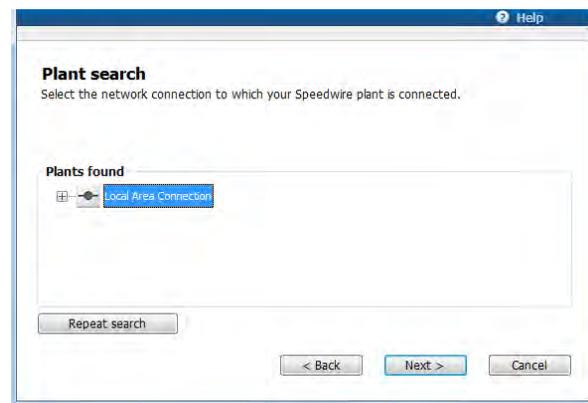
6. Then the program will automatically search for all inverters within the same network



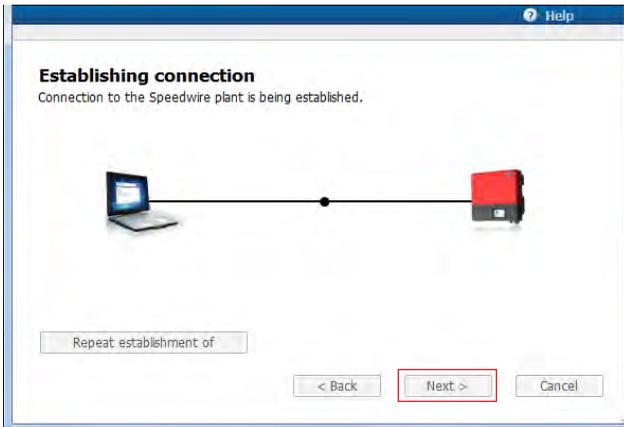
5. At Communication type, select *Speedwire* and click *Next*



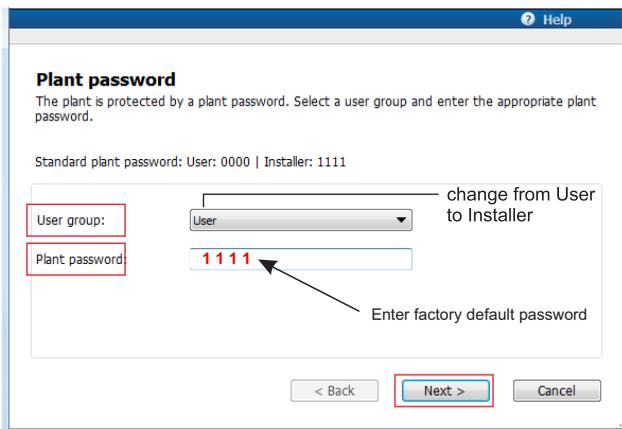
7. Select the found network and click Next. If no network is found, double check the Ethernet wiring between each inverter and SolarVu enclosure and click Repeat Search



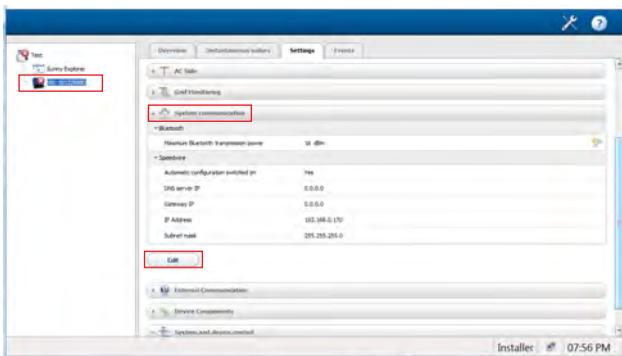
- SpeedWire will automatically establish connection, click *Next* when done.



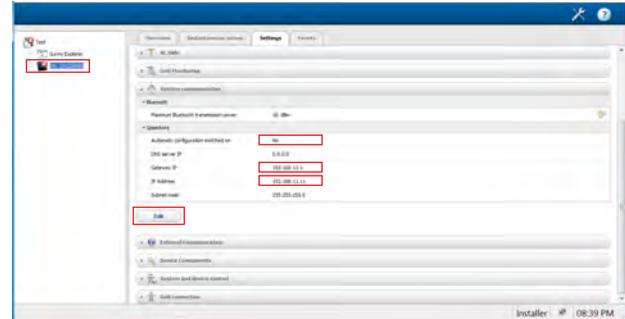
- In User group, select *Installer*, In Plant password, enter *1111*, click *Next*



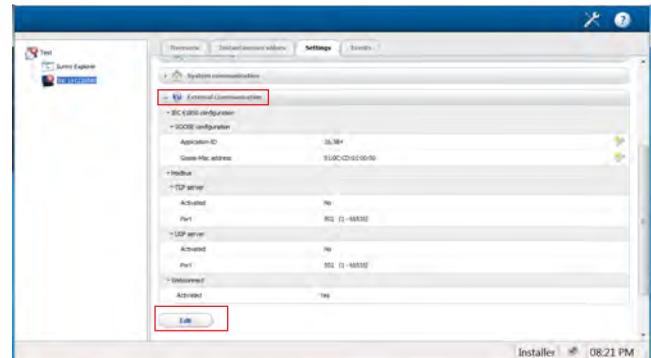
- Once logged in, in the left panel, select the inverter that needs to be programmed with its IP settings. Go to *Settings* tab, click *System communication*, click *Edit*.



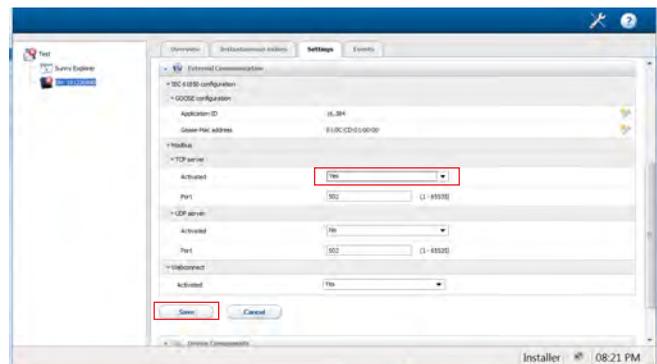
- 1) Change *Automatic configuration switched on* to No
- 2) Use the inverter number and matching serial number from step 2. Consult the project drawing in the document pouch for the required IP addresses for each inverter from the inverter IP Assignment table. Enter the IP address for this inverter in the Speedwire IP Address field.
- 3) The *Gateway IP* will be same as the *IP address* field with only the last number to be 1. For example, if the inverter IP Address is **192.168.11.12**, then the Gateway IP is **192.168.11.1** Normally the subnet mask is set to 255.255.255.0 and the DNS can be left at its default of 0.0.0.0



- In the Settings tab, go to External Communications, click Edit



- 1) Under *Modbus->TCP server*, change *Activated* to Yes
- 2) Under *Modbus->TCP server*, Make sure Port is 502
- 3) Click *Save*



- Repeat steps 10 to 13 for all inverters.

During testing, if it is necessary to temporarily turn AFCI trip off, follow these steps in Sunny Explorer:

- Select the inverter (on the left hand side), go to Settings tab, under Device, click on Edit
- Under Device->Inverter->AFCI switched on, click the dropdown list and select No to disable AFCI. To manually reset an inverter with arc fault trip set AFCI to no then yes.
- Click Save button

Network Setup

Ensure the SolarVu enclosure is connected to the building LAN as shown in fig 3 (unless 3G cellular was ordered). On power up, the M504 gateway looks for a DHCP server to provide it a dynamic IP address. If a PC connected to the network can automatically connect to the internet through a browser then the network is already configured to accept the M504. If a dedicated IP address was programmed instead, subnet mask and DNS server address are required. This needs to be entered into the M504 before shipment. Network configuration is shown on the M504 label and the Configuration Settings page in the doc pouch. Once the M504 receives its IP address it acts as a client. It will automatically try to connect to the SolarVu server and begin transferring data from the inverters and options to the server.

Fig 5A Serial connection to the M504-485 comm board with biasing and termination set on for port 1.

Blue data LED flashes when transmitting and receiving data from the inverter.

JUMPER SETTINGS
Terminator Resistor + Biasing

B+ Bias high = ON
B- Bias low = ON
T 120R termination = ON

B+	B-	T	Setting
ON	ON	ON	ON
OFF	OFF	OFF	OFF

Inverters are normally daisy chained to PORT1. See SLD drawing in doc pouch for details.

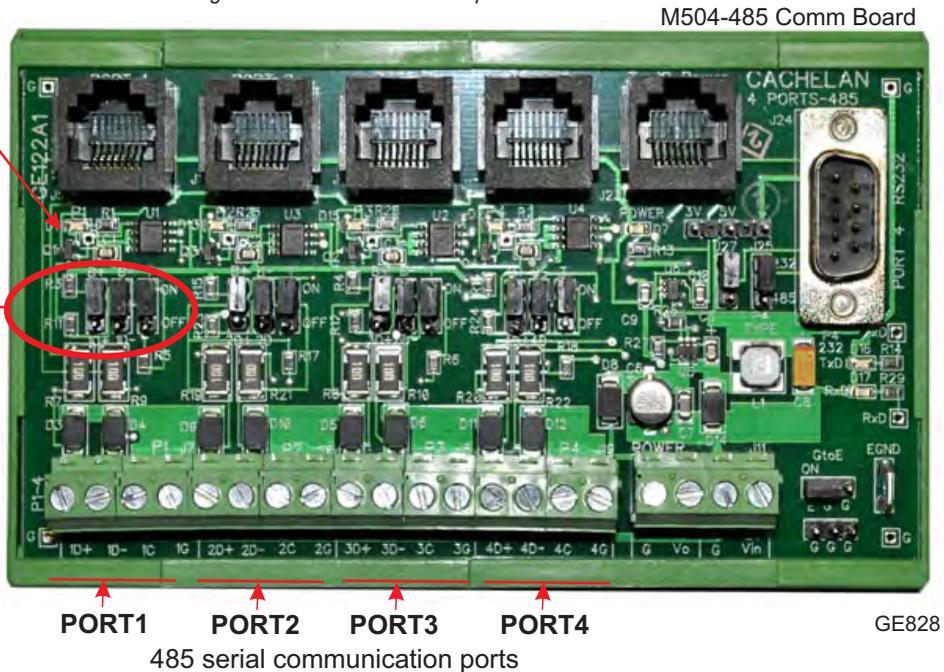


Fig 5B M504 indicators



INDICATOR STATUS		
LED	NORMAL	STATUS
Power	●	OFF-no power ON-power OK
Ready	●	ON M504 booted up and running
Link/Act	●	OFF-no ethernet connection FLASH- data traffic activity
P1	●	Serial Port 1 usually inverter Transmit=orange, Receive=green, flashing
P2	●	Serial Port 2 usually option Transmit=orange, Receive=green, flashing
P3	●	Serial Port 3 usually option Transmit=orange, Receive=green, flashing
P4	●	Serial Port 4 usually option Transmit=orange, Receive=green, flashing

TROUBLESHOOTING CHECKLIST	
IP Address	Obtain IP by DHCP or set static IP Network must be configured to same settings
Serial	Check inverter connected to correct port. Polarity of serial twisted pair wires. Serial ID entered correctly in each inverter
Inverter	Powered on. Serial ID has been set to match SLD drawing. Serial wiring correct.
Internet	Internet connection for ISP to LAN working
Support	For Cachelan technical support 905.470.8400 x224 contactus@cachelan.com

IP & login settings are on the M504 label



Testing

Ensure the inverter and SolarVu M504 gateway are powered on, the ethernet cable is plugged into a network jack and the ethernet cable is connected between SolarVu and the first inverter with the others daisy chained as shown in fig 3. The M504 Power and Ready lights should be on if the power supply is plugged in. The Link/Act LED will periodically flash showing network activity. Ports 1-4 are serial RS485 used for communicating with SolarVu accessories. The inverters communicate over ethernet and do not use ports 1-4.

Internet Connection

Power on the M504 and allow at least 2 minutes for communication to be established. From any internet connected computer, open the browser and type in the SolarVu site address found on the M504 label.

Once the SolarVu portal is accessed from a browser, the opening screen is the SITE view shown in fig 6. Click the ANALYZER tab then Inverter Status from the pull down box (fig 7). If there is a internet connection from the site, the Last Communication light will be green. The M504 gateway does not need to be connected to the inverter for this light to be green. If this indicator is red, it indicates no internet connection has been established. In this case, check internet connections at the site by trying to browse the internet at the site with a PC connected to the network.

If the M504 gateway is successfully collecting data from the inverter, the Last Data Updated indicator will be green and inverter data will appear in the Inverter Status screen. If this indicator is red but the Last Communication indicator is green, check the serial connection to the inverter and that the inverter is operating. When both lights are green the gages on the SITE and LIVE screens will display live data and

Video Tour

For an overview of available features, visit www.cachelan.com and play the What is SolarVu video. Each screen has a HELP button that explains how the features work for that screen. An online help guide is also available for printing under SETUP > Download > Documents > Printed Help shown in fig 9. Login with the username and password on the M504 label or from the configuration settings sheet to access SETUP screens.

Site Screen

For a summary of information about the site, click the SITE menu tab (fig 6). On the upper left, the current charging status of the solar panels, total power being generated now and in the last 30 days is displayed. Underneath, the carbon footprint of energy equivalents is displayed since startup. Links to other websites can be left as defaults or changed in SETUP to personal preferences. The local weather is preset. Email contactus@cachelan.com to have it changed. For viewing on a widescreen TV suitable for display in a public place, click the WIDE PAGE button (fig 10). On the right is a slide show for public viewing. Content can be personalized using uploaded graphics in SETUP.

Fig 6 Site screen shows site overview, photos, weather and user programmable links to other webpages



Fig 7 Check ANALYZER > Inverter Status to see data received from the inverter



Fig 8 Watch the SolarVu video for a tour of SolarVu screens and features.

www.cachelan.com/link-solarvutour

Other videos are available at cachelan.com



Fig 9 Use the HELP button on each screen for information about that screen or access a Help guide

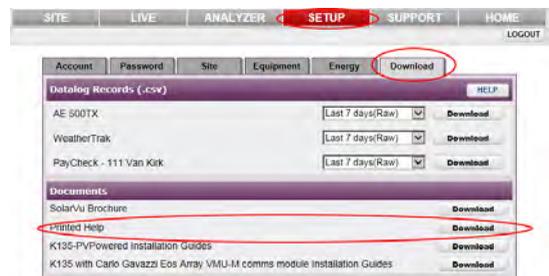


Fig 10 Click the Wide Page button to reformat the SITE screen for an HDTV lobby display



Live Data

Click the LIVE tab to display current power being generated for the whole site. Actual power and energy generated today are shown on the meter dial shown in fig 11. For a system operating normally, the status indicator should be green with the last update time less than 15 minutes ago. Lifetime energy and revenue are shown digitally. For correct revenue display, the sell price per kWh must be entered in SETUP. If connection to the site is lost, or if an alarm is detected, the status indicator will be red. Click the Listen button with sound on for more information.

Trends are shown for the lifetime of the system using the graphs on the right. Select either an Energy, Revenue or Savings using the button. Click the desired time period above the graph or select any interval with the Range button. Data is stored for the life of the system. Scroll over a bar or data point with your mouse for a popup box with more detailed information about that period. The CO₂ carbon footprint selection gives energy equivalents for the solar power generated over the selected time period.

Analyzer - Troubleshooting

When problems occur with the system or to check inverter operation, click the ANALYZER tab and select Inverter Status in the pull down box. Each inverter connected to the system with a M504 gateway will have its own display panel showing actual values sent. Remotely located technical personnel can assist in interpreting what the values are conveying. If no communication has been received from the device for more than 2 hours a No Data Available message will be shown with a red warning indicator.

For detailed analysis, select the ANALYZER > Equipment Log (fig 13) to see all inverter readings for the last 30 days. Watch the Equipment Log video by clicking the HELP-video icon for more details on how to use this powerful feature. For further analysis download all readings for the time period of interest into a spreadsheet using SETUP > Download.

A reliable internet connection is essential for SolarVu to collect and display data. If the internet is intermittent or not available, a communications warning alarm will be displayed. Use the ANALYZER - Communications screen to study the hourly connection status (fig 14). red squares indicate dropout which may be due to poor 3G cellular connection requiring antenna orientation or a bad land line connection. Contact your service provider for assistance if the condition persists.

Depending on which options are installed, additional tools may be accessible in the ANALYZER pull down box. These include SnoCam, WeatherTrak, PayCheck and SmartStrings. For each option, click the HELP button found on the option screen for more details. Option descriptions and additional instructional videos are available from the cachelan.com website. When returning to the ANALYZER, the screen displayed will be the last one selected on exit.

Analyzer - Performance

Click the ANALYZER tab and select a performance tool from the pull down box. Verify that the system reaches its designed output on sunny days in the Top 10 Days view. The carbon footprint will compute the energy equivalents to the solar energy generated over the selected time period. This helps visitors get a practical feel for the environmental impact. To find the carbon equivalent for an arbitrary energy value, override the actual solar amount by entering a kWh amount and selecting a category, then click the Calculator button. The Payback calculator is useful for determining return on investment.

Fig 15 Top 10 Days and Carbon Footprint ANALYZER performance screens



Fig 11 View power and energy now or output for any time period on the LIVE screen.

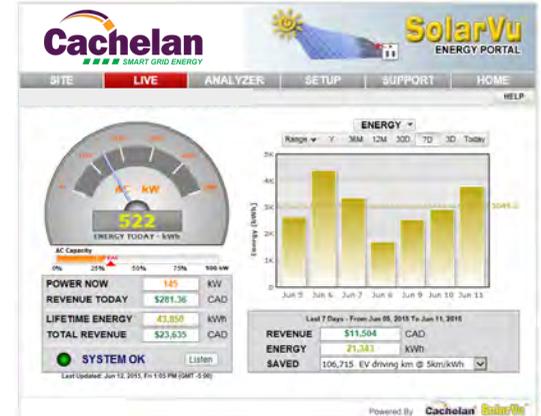


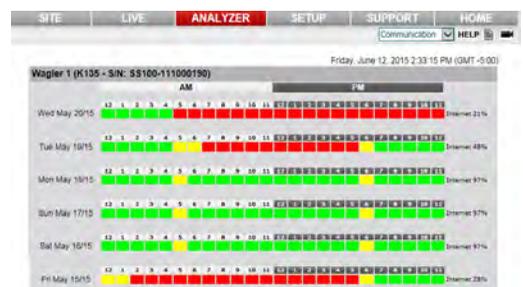
Fig 12 Watch the Equipment Log video from the Help video icon to see how to use this powerful troubleshooting tool. <http://www.cachelan.com/link-equipmentlog>



Fig 13 Log shows all inverter readings for last 30 days with record of fault messages for diagnosing problems



Fig 14 Detect intermittent internet connection from weak cellular or down land lines with the 30 day Communication log



Setup

Each SolarVu portal is pre-configured with factory settings based on information provided at the time of purchase. You can modify preferences, settings, add a slideshow, link to other websites, set email recipients for alarms and reports etc. To configure your site, click the SETUP tab. Enter your unique username and password from the account label found on the M504 gateway and the configuration settings sheet in the SolarVu enclosure doc pouch (fig 16).

For revenue and payback calculators to work properly, correct parameters for energy sell rate, capacity, average insolation etc should be entered. Enter the email address for each individual that wants to receive alarm notifications and a daily output report. This report will include energy and revenues for different time periods and indicate if there are any alarms.

In the Password tab, include an email address to receive the Setup login password from the Forgot your password? link if this is forgotten. The SETUP > Equipment tab is for factory use. For further analysis, individual energy readings for any time period can be downloaded into a spreadsheet from the DOWNLOAD section.

Click the Help button in each section for a description of the effect for each entry. All

Fig 16 Login to SETUP to change settings

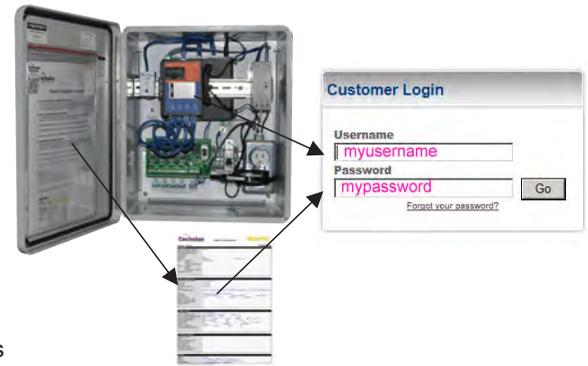


Fig 17 Change system configuration parameters and settings by logging in to SETUP

Account Password Site Equipment Energy Download

System Parameters **HELP**

Default Web Address:

Alias Web Address: solarvu.net **QR Code**

Site Name:

Location:

Description:

Installation Date: Mar 28th 2014 **Lifetime:** 25 Years

AC Output Capacity: 240 kW ac **Insolation:** 1097 kWh/kWp/Yr

DC Input Rating: 366 kW dc **Time Zone(GMT):** -5.0

Startup kWh Offset: 7573 kWh

Currency: Symbol \$ Units CAD

System Cost: CAD \$ 2,378,181 **Annual Cost:** CAD \$ 24994

Sell Rate: CAD \$ 0.713 /kWh Hide **Buy Rate:** CAD \$ 0.110 /kWh

Maintenance Notes:

Save

Email Setup **HELP**

Frequency	Email Address	Type	Active	Remove
Immediate		Alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Immediate		Alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Immediate		Alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Immediate		Alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Daily @ 11:00 PM		Status	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Immediate		Alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Every 1 Hrs		Status	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Add Email:

Frequency	Email Address	Type
Daily @ 11:00 PM	<input type="text"/>	Status

Add / Save

Support

See the What is SolarVu? video at www.cachelan.com for a feature overview. Each screen has a HELP button with details for the items on that view. A printable HELP guide can be downloaded in SETUP > Download.

Before leaving the site after commissioning, if assistance is needed, contact Cachelan technical support at 905.470.8400 x224 in Toronto. Send emails to contactus@cachelan.com.

Cachelan Technical Support
contactus@cachelan.com
905.470.8400 x224