

Cx Plus Monitor[™] User Manual

August 2021

Rx Monitoring Services, Inc.

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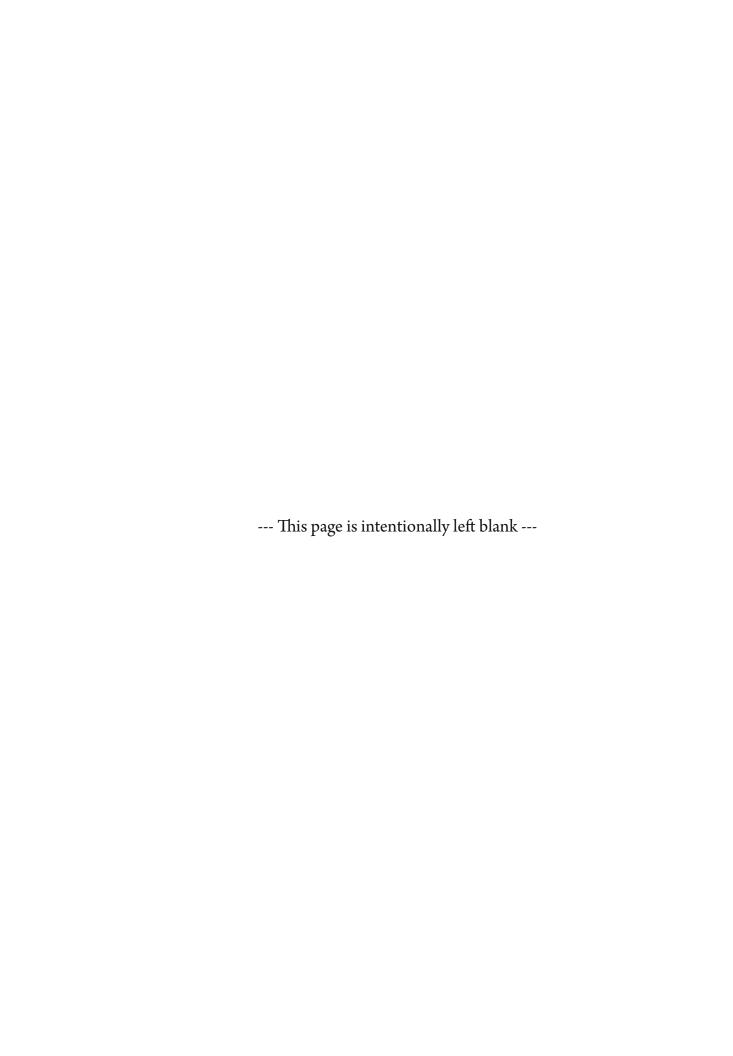


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Safety Information

Definitions

WARNING

This statement is to reinforce the practice of certain conditions may cause physical bodily harm or loss of life.

CAUTION

This statement is to reinforce the practice of certain conditions may cause physical damage to the Load Bank, Cx Plus Monitor, accessories, equipment or property.

NOTE

General information for simplifying the user experience.

Abbreviations

CT's: Current Transducers Wireless Probes: Wireless add-on's for power monitor
Rope Probes: Rogowski coil current transducers EWE: External Wireless Extensions
Cx: Power Monitor Site: Cx Plus Monitor data set.
Monitor: Power Monitor (Cx)

Symbols

The following are (IEC) symbols are used on this document or on the power monitor, and their definitions.



This symbol indicates AC or DC voltage or current



This symbol indicates that caution is necessary when operating the device or control close to where the symbol is placed, or to indicate that the current situation needs operator awareness or operator action in order to avoid undesirable consequences.



This symbol indicates DC only voltage or current



This symbol indicates high voltage. It calls your attention to items or operations that could be dangerous to you and other persons operation this equipment.

Read the message and follow the instructions carefully.



This symbol indicates AC only voltage or current



This symbol indicates safety ground conductor.



This symbol indicates earth ground conductor.



To avoid electric shock or fire:

Review the entire manual before using the Power Monitor and its accessories and observe all warnings and cautions.

- Before using the power monitor inspect wireless probes, voltage probes, current probes, leads and accessories for mechanical damage or broken plastic and call Rx Monitoring Services Inc. for replacements.
- Wear proper Personal Protective Equipment, including safety glasses and insulated gloves when making connections to power circuits.
- Use only current probes, test leads, and adapters supplied with equipment.
- Remove unnecessary voltage leads or accessories that are not in use.
- Make sure the power monitor is properly connected through the power cord to protective earth ground.
- Do not insert foreign objects into connectors, only use approved accessories.
- Never open the equipment, there are no customer replaceable parts.
- Never use equipment outside or when condensing water is present.
- Use proper lockout procedures on circuits under test.
- Hands, boots and the working area must be dry when making connections to power system.
- Do not operate the equipment or probes around volatile gas or vapor.

****** WARNING DO NOT EXCEED CAT RATINGS *******

Voltage Ratings:



Power Monitor: CAT III - 600VPollution Degree 2Rope CT's: CAT III - 1000VPollution Degree 2Clamp CT's: CAT III - 600VPollution Degree 2Wireless DC: CAT II - 600VPollution Degree 2Wireless DCx: CAT II - 150VPollution Degree 2

Statements, Notices and Liability Information

FCC Part 15 Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the affected equipment and the panel receiver to separate outlets, on different branch circuits.
- Consult the dealer or an experienced radio/TV technician for help.

STATEMENT OF FAULTLESSNESS:

The information in this manual has been reviewed for accuracy at the time of writing. No responsibility can be assumed by Rx Monitoring Services, Inc. for inaccuracy or changes that have taken place since production. The "Cx Plus Monitor User Manual" is for informational purposes only and is subject to change without notice.

LIABILITY:

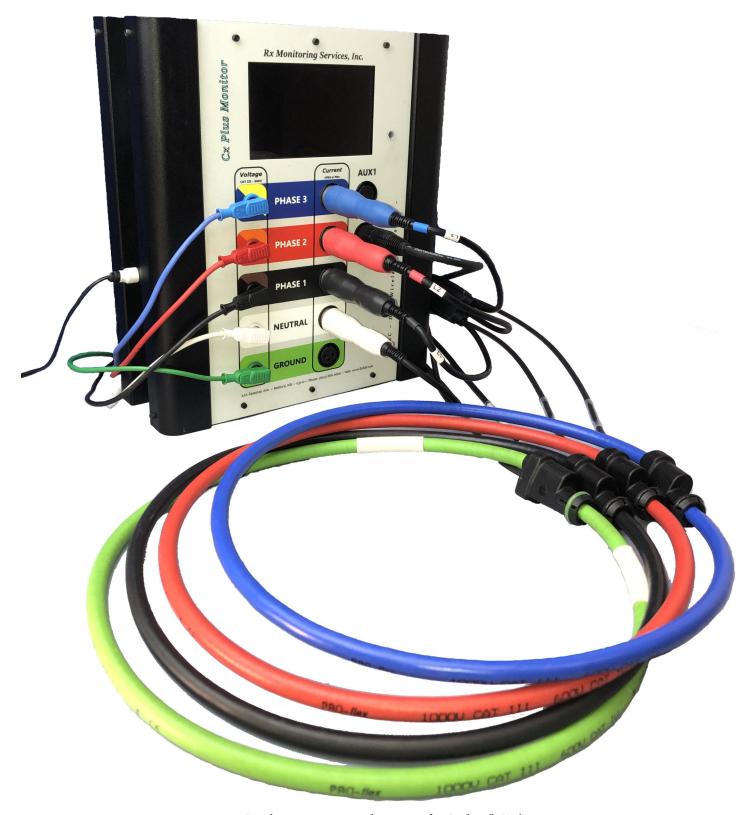
Rx MONITORING SERVICES, Inc. SHALL NOT BE LIABLE FOR ANY (A) SPECIAL, INDIRECT, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, INCLUDING LOSS OF PROFITS, ARISING FROM OR RELATED TO A BREACH OF THIS AGREEMENT OR ANY ORDER OR THE OPERATION OR USE OF THE MONITORING EQUIPMENT INCLUDING SUCH DAMAGES, WITHOUT LIMITATION, AS DAMAGES ARISING FROM LOSS OF DATA OR PROGRAMMING, LOSS OF REVENUE OR PROFITS, FAILURE TO REALIZE SAVINGS OR OTHER BENEFITS, DAMAGE TO EQUIPMENT, AND CLAIMS AGAINST CUSTOMER BY ANY THIRD PERSON, EVEN IF RXMS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES; (B) DAMAGES (REGARDLESS OF THEIR NATURE) FOR ANY DELAY OR FAILURE BY RXMS TO PERFORM ITS OBLIGATIONS UNDER THIS AGREEMENT DUE TO ANY CAUSE BEYOND RXMS' REASONABLE CONTROL; OR (C) CLAIMS MADE A SUBJECT OF A LEGAL PROCEEDING AGAINST RXMS MORE THAN TWO YEARS AFTER ANY SUCH CAUSE OF ACTION FIRST AROSE.

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Cx Plus Monitor™ with Rogowski Coil 24" CT's

Introduction

The Cx Plus Monitor™ Power Monitor was designed with one function in mind, bringing usability and simplicity to the power quality market.

Throughout this documentation the Cx Plus Monitor™ will be referred more simply as "Monitor".

Some of the key features:

• 15 Channels:

The fifteen channels consist of 10 Voltage channels (3 Ph-Ph, 3 Ph-G, 3 Ph-N, N-G) and 5 Current channels (L1, L2, L3, N, G). The voltage is sampled at two rates, 1,024 samples per cycle (15.36Khz @ 60 Hz) and a high speed module operating at 1.66Mhz / channel.

• Easy Setup:

No setup is needed, the power monitor self-identifies the incoming power and can configure and adjust to the conditions that it faces, making setup in the field obsolete.

Cross Triggering:

Voltage or current triggers on any single channel cause all 15 channels to capture data.

• Event, Time, and Manual Triggers:

Waveforms can be captured on a fixed time interval, on changes to incoming voltage and current readings and/or manually trigger using Live-View $^{\text{\tiny TM}}$.

• Minimum Maximum Average Logging:

Voltage readings are calculated at half cycle intervals (8ms @ 60hz) with current at full cycle. With a min/max/avg log files generated from 1 Second to 30 minutes.

• External Wireless Extensions (EWE) :

External wireless extension capabilities include the ability to capture 100 wireless probes consisting of Temperature & Humidity, 0-600V DC, DC Current, DC Watts, Voltage and Current Ripple %, High Temperature (up to 500 F) and a 10 channel battery monitor.

Communications:

Communication and download is simple using either, 10/100 Ethernet, USB stick download or WiFi.

• Internal Uninterruptible Power Supply:

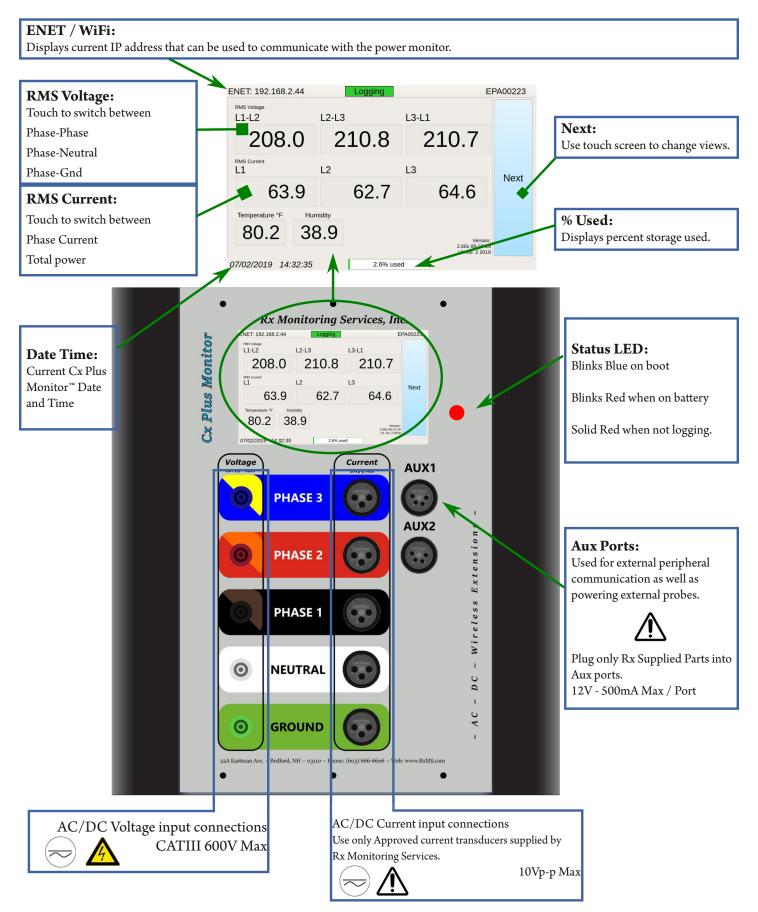
The (UPS) secures your data and makes sure that the power monitor always shuts down safely with adjustable time up to 20 minutes, protecting data regardless of incoming power conditions.

Software:

The packages used with the Cx Plus Monitor[™], Live-View[™], Multi-View, and U-View[™] are free for life. On a release cycle of 2 months, the software is all written and developed at RxMS, Inc. and are constantly being improved.

Minimum PC requirements:

Win 7/10 i3-8130 CPU 20Mbytes Hard Disk WiFi or Ethernet port Display: 1920x1080

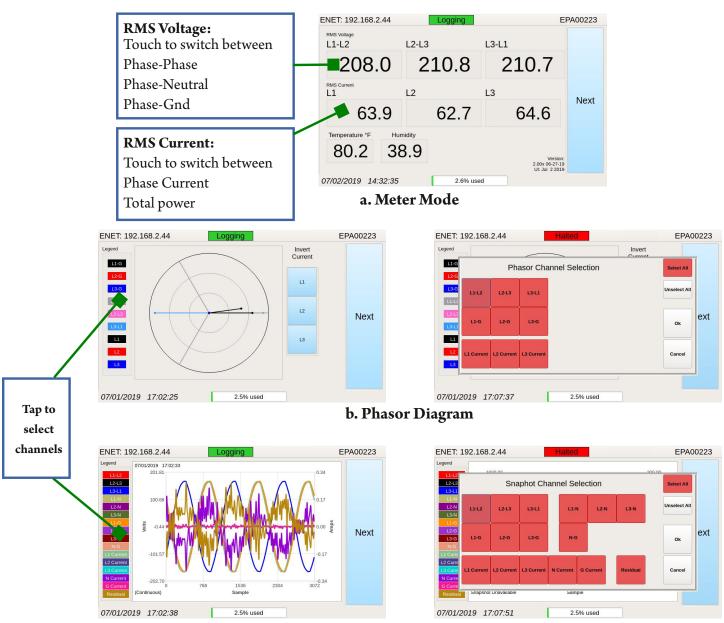


Front View

LCD Display

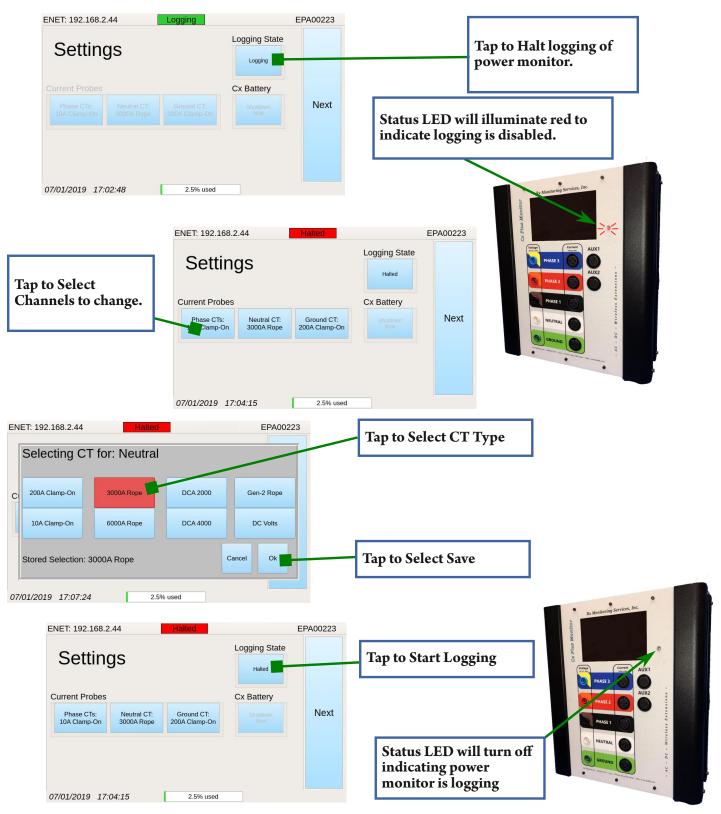
The LCD screen will illuminate when the Power Monitor is on. In about 30 seconds, the full color touch LCD screen will show real-time data, IP address, the date/time, and the percent of storage used.

- a. Meter Mode shows current and temperature / humidity readings as well as the Date/Time the monitor is set to and the percent of storage used.
- b. Waveform Snapshot features voltage and current waveforms in a one-shot or continuous display. Go from one-shot to continuous by tapping the screen. Hit the Legend on the left side of the screen to select which channels are shown.
- c. Phasor Diagram presents the channel's phase angle. This screen also allows a user to invert the channels if the display shows an incorrect phase. Hit the Legend on the left side of the screen to select which channels are shown.
- d. Setting Gives ability to halt monitor, change current probe settings and shutdown immediately. (on next page)



d. Settings

- 1. Press the Logging State button to stop the Power Monitor and enable the Current Probe selection switches
- 2. Press the type of CT to change Phase CTs (L1, L2, L3), Neutral CT, or Ground CT
- 3. Select which AC or DC CT type to switch the meter and press Ok

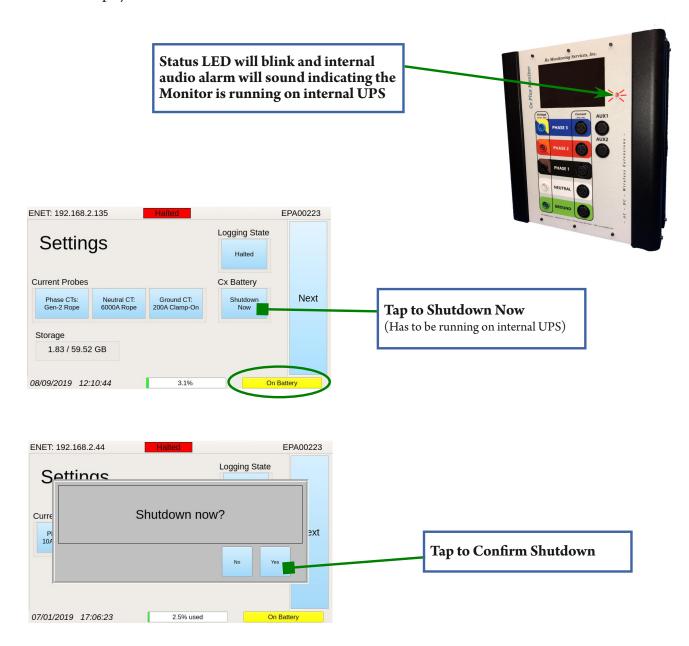


Shutdown

When the Cx Plus is disconnected from 120V power the monitor will have three indications that it is running on the internal UPS.

- 1. The LED will begin blinking red.
- 2. The Display will have a bar on the lower right indicating it's on battery.
- 3. The internal audio alarm will begin to beep.

This will continue till the shutdown timer is expired (5 seconds by default) the battery is depleted or the Shutdown Now is used on the display





Side View

Powering / Grounding Unit

Powering Unit



Caution - Always use a grounded receptacle

- 1. Plug power cord into grounded receptacle
- 2. Plug the supplied IEC cord into the external DC power supply.
- 3. Plug the male external DC power supply plug into the Power Monitor.
- 4. System powers up in 15 seconds.





DC Power Supply

Connect IEC

Plug In Barrel

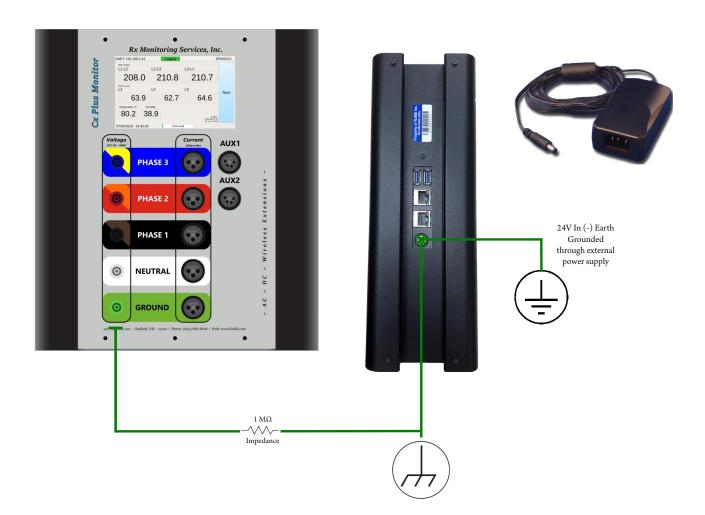


Grounding Unit

Safety earth ground is supplied by the external power supply's IEC320 connector.



The unit must be powered from a grounded receptacle. Failing to do so could cause voltages on the metal components.



Power Monitor Software

Live-View™

Description:

Live-View[™] software is used to actively communicate with the monitor and see real time data. Some of the abilities include capturing and displaying of waveforms, as well as phasor diagrams to ensure that the power monitor is connected properly. Setup is also included in this package giving the ability to configure log rate and waveform capture parameters. Site management gives the ability to add and delete sites when there are multiple data sets with this software. Downloading data sets from the power monitor is also done with the Live-View[™] program.

Download Software:

Live-View[™] is always available on our website at,

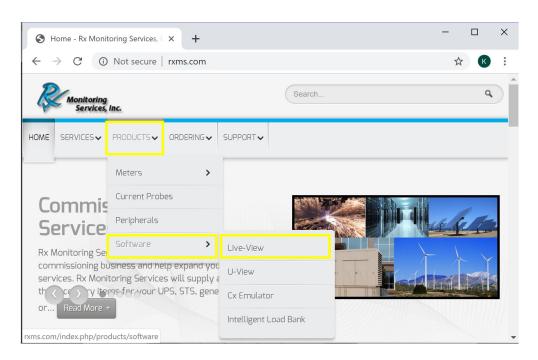
http://RxMS.com/index.php/products/software/Live-View

Click the Live-View download button under Links on the right side of the screen

After downloading the file "LiveView-Setup.exe", run the program to start the installation.

Download Instructions:

Instructions for usage of the Live-View[™] software package are maintained in a separate document. This document link can be found on the http://RxMS.com/index.php/products/software/Live-View website under the download link. Click on the Live-View.pdf.



To Start Live-View™:

Default installation is placed at,

Start Menu » All Programs » Rx Monitoring Service » Live-View » Launch Live-View

Updates:

Updates are common place and should be expected.

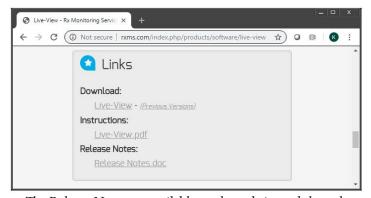
Updates are always free and can be found in the same location as above.

Download and run "LiveView-Setup.exe" to install the newest release.

Upon starting Live-View[™] if an internet connection is present Live-View[™] will confirm the installed version is up -to-date. If the installed version is not current, a window will appear with directions on how to obtain the newest release.



Pop-up shown when Live-View is opened and an update is available



The Release Notes are available on the website and show the history of Live-View updates. They can be found in the same section as the download link for the update.



The website will always show the latest versions of software released in the RxMS News section

Multi-View™

Description:

Multi-View $^{\text{\tiny TM}}$ software is used to actively communicate with multiple Cx Plus Monitors $^{\text{\tiny TM}}$ and see real time data. Some of the abilities include single click group collection of snapshots and waveform captures. It also gives the ability to group power monitors to sum their output data.

Single click to Live-View[™] makes setup of multiple monitors simpler in a larger installation.

Download Software:

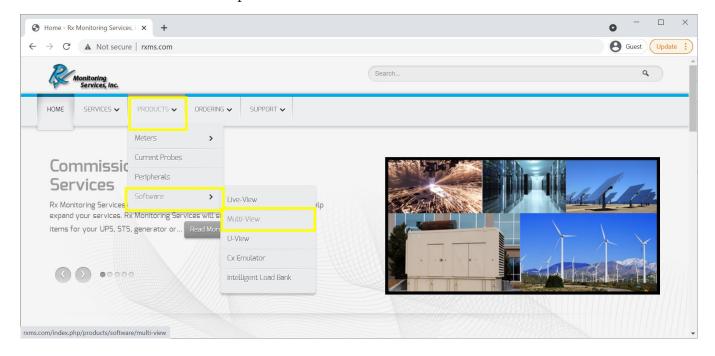
Multi-View[™] is always available on our website at,

http://RxMS.com/index.php/products/software/Multi-View

Click the Mult-View download button under Links on the right side of the screen After downloading the file "Multi-View-Setup.exe", run the program to start the installation.

Download Instructions:

Instructions for usage of the Multi-View[™] software package are maintained in a separate document. This document link can be found on the http://RxMS.com/index.php/products/software/Multi-View website under the download link. Click on the Multi-View.pdf.



To Start Multi-View™:

Default installation is placed at,

Start Menu » All Programs » Rx Monitoring Service » Multi-View » Launch Multi-View

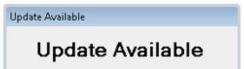
Updates:

Updates are common place and should be expected.

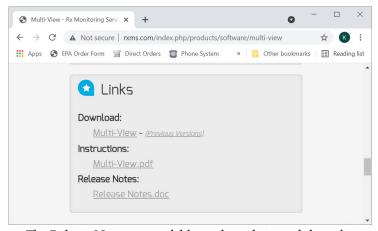
Updates are always free and can be found in the same location as above.

Download and run "Multi-View-Setup.exe" to install the newest release.

Upon starting Multi-View[™], if an internet connection is present Multi-View[™] will confirm the installed version is up-to-date. If the installed version is not current, a window will appear with directions on how to obtain the newest release.



Pop-up shown when Multi-View is opened and an update is available



The Release Notes are available on the website and show the history of Multi-View updates. They can be found in the same section as the download link for the update.



The website will always show the latest versions of software released in the RxMS News section

PC Connection Methods

To use the Live-View[™] program, an Ethernet or Wi-Fi connection must be established to the device.

There are 3 different connection types

- 1. Ethernet through DHCP network
- 2. Direct Ethernet connection with Cross-Over Cable
- 3. Wi-Fi Ad-hoc (Windows XP & 7 only)

Ethernet through DHCP network



- 1. Unplug Cx Plus Monitor™ wait for shutdown.
- 2. Plug Ethernet cord into side panel.
- 3. Plug DC power supply connector in to Cx Plus Monitor™.
- 4. System will get IP address from DHCP server upon startup (10-15 seconds).
- 5. Monitor will display valid IP address on the first line of screen display.
- 6. Computer should now be able to talk using IP address on the display of the Cx Plus Monitor™. Connect using this IP address in Live-View™.

IP Address of Cx Plus Monitor™ used to connect with Live-View™.



Ethernet Connection with Cross-Over Cable & Automatic Private IP





- 1. Unplug Cx Plus Monitor[™] wait for shutdown.
- 2. Plug Crossover Ethernet (Generally red) cord into side panel.
- 3. Plug opposite end of crossover cable into computer running Live-View™.
- 4. Plug power DC power supply in to Cx Plus Monitor™.
- 5. System will power up within 10-15 seconds.
- 6. System will wait 30 seconds before setting automatic IP address. Ex: 169.254.157.253
- 7. Computer running Live-View[™] will need to time-out of its old network (If configured for DHCP) which can take up to 2 minutes.
- 8. Computer should obtain an IP Address in the range 169.254.xxx.xxx (Automatic IP Range if set to DHCP).
- 9. Static IP's can also be set on the Live-View™ Computer in the range (as long as it's not the same IP as the Cx Plus Monitor™).

IP: 169.254.0.2 - 169.254.255.250

Subnet: 255.255.0.0

- 10. Computer should now be able to talk using IP address on the display of the Cx Plus Monitor™.
- 11. Connect using this IP address in Live-View™.

Wireless with Access Point and WiFi

Rx Monitoring Services, Inc. supplies all Access Points and WiFi adapters described in this section.

There are three different types of WiFi adapters:







The Access Point & Wi-Fi adapter (Red) gives the user a way to attach to the wireless network using a computer equipped with IEEE 802.11N connectivity. This unit will also provide an Ethernet to Wi-Fi connection for the Power Monitor, that is connected to it.

The second type is a Ethernet to Wi-Fi adapter (Blue) adapter that converts the wired 10/100 Ethernet to a 802.11N network for the Power Monitor. Please note that the Blue Wi-Fi adapter does <u>not</u> create a hot spot, it must be within range of a Red Wi-Fi adapter.

The Mesh adapter (Green) is a Access point with a mesh backend that can link multiple Green Mesh adapters together. They provide ethernet ports and a wireless AP to all reachable Green Mesh adapters. (Not compatable with Red/Blue)

Rx Monitoring Services, Inc. supplies all Access Points and WiFi adapters described in this section.

1. Plug the Ethernet and USB into the AP & WiFi adapter. (RED)



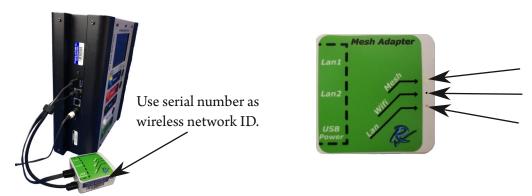
4. Cx Plus Monitor will power up, wait 30-40 seconds for configuration of the Access point, when the adapter attaches the display will show ENET: 172.16.xx.xxx.

WiFi only adapters (BLUE): Repeat for each additional Cx Plus Monitor™

- 5. Plug the Ethernet and USB into the WiFi only adapter. (BLUE)
- 6. Plug Ethernet and USB into Cx Plus Monitor.
- 7. Plug Power supply into Cx Plus Monitor



Mesh adapters (Green): Repeat for each Power Monitor (not compatable with Red or Blue)



- 8. Plug the Ethernet and USB into the Mesh adapter. (GREEN)
- 9. Plug Ethernet and USB into the Power Monitor.
- 10. Power up the Power Monitor.
- 11. Once the Cx Plus Monitor™ is powered up, wait 30-40 seconds for WiFi to attach to the Access point, when the adapter attaches the display will show ENET: 172.16.xx.xxx.
- 12. Using a Computer or device with 802.11N connectivity attach to the Wireless Network "RxClientWireless"

For Red Boxes =" RxClientWireless"
For Green Boxes ="WiFi00xxx" (Serial number on bar code)

This is a unsecured wireless connection, use at your own risk.



13. Computer should now be able to talk using IP address on the display of the Cx Plus Monitor™. Connect using this IP address in Live-View™.



Notes:

The WiFi only adapters will blink the "WiFi Activity" LED when they are connected to the wireless access point. If this LED is not blinking check to see if the access point is powered up.

The "Ethernet Activity" will also blink, if not blinking ensure connection to USB and Ethernet at both ends.

Two AP & WiFi boxes (Red) will not work in the same space.

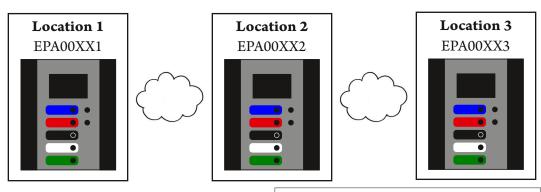
Remote Access

Remote Access was created to download data from Cx Plus Monitors[™] at sites that are not easily accessible or to access multiple units across different sites.

Every Cx Plus Monitor™ will be shipped with the Remote Access feature <u>disabled</u>.

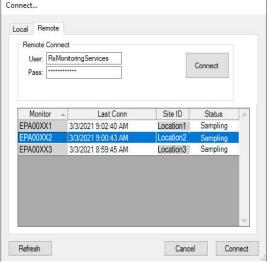
This feature has two modes:

- Remote Assistance: (No User entered) Once enabled, only RxMS can access the Cx Plus Monitor™
 remotely. Most helpful to use for RxMS written report completion or troubleshooting.
- **Remote Access**: Customer and RxMS can access remotely in this mode with a User Name and Password. The password provided is a secure password that will be reset following the completion of that site. Most helpful to use when managing an inaccessible site or when managing multiple sites at the same time.



Remote Assistance

RxMS has access to all enabled Cx Plus Monitors, regardless of site.



Remote Access

Customers are given a secure password and can only access the monitors on their network.

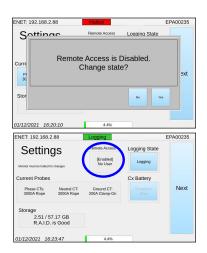




Enable Remote Assistance (RxMS can Access Remotely):

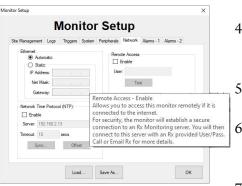
- 1. On the Cx Plus Monitor[™] touch-screen, go to the Settings display.
- 2. Click Logging to stop Logging State.
- 3. Press the Remote Access button, which will show the prompt to change the Remote Access state.
- 4. Touch Yes.
- 5. Settings will show "[Enabled] No User"
- 6. Now that Cx Plus Monitor can be accessed by RxMS. Call RxMS to enable that Cx Plus Monitor™ as part of your user name or for troubleshooting.

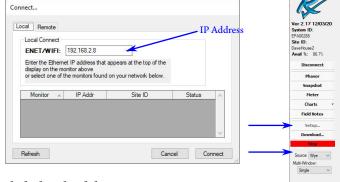




Enable Remote Access with Live-View™ (User can Access Remotely):

- 1. Contact RxMS for Remote Access User and Password.
- 2. Open Live-View[™] and connect to Cx Plus Monitor[™] by using the Local tab and inputting the IP Address from the screen then press Connect.
- 3. Click the Stop then Setup.



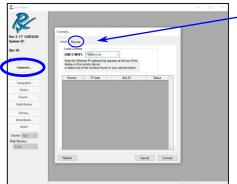


4. On the Network tab, click the check box Enable under the Remote Access section and input the provided User Name.

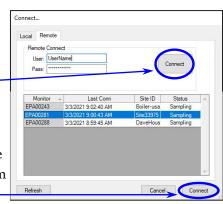
- 5. Click Test 2-3 times until it says Connected.
- The Cx Plus Monitor[™] touch-screen should should show "[Enabled] Connected".
- 7. Repeat these steps until all Cx Plus Monitors™ are connected.



To Access Remotely:



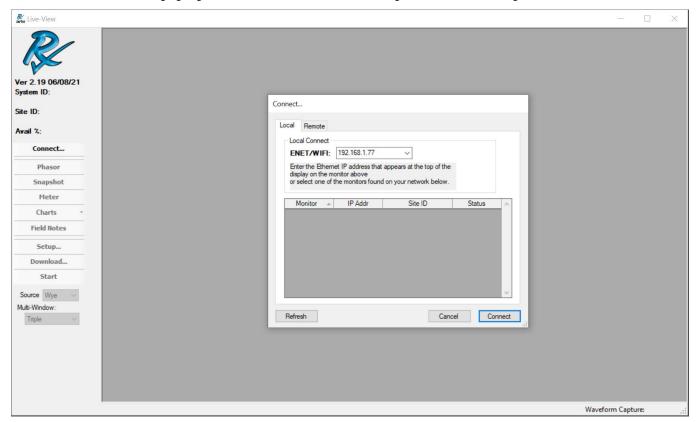
- Open Live-View and click Connect.
- Click on the Remote tab.
- Type in the User and Password supplied by RxMS and click to Connect to the right.
- All enabled monitors will show up in the list with the Site ID and Status.
- Each Cx Plus Monitor™ will be accessible by highlighting it and pressing the bottom right Connect.

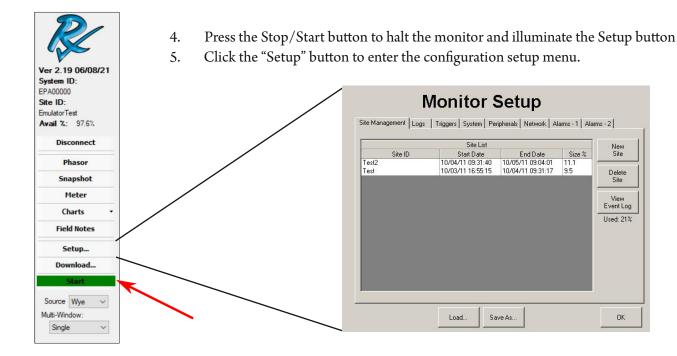


Monitor Configuration

All power monitor configuration is done within the Live-View[™] software.

- 1. Start the Live-View[™] program
- 2. Press the Connect button
- 3. In the "Connect..." pop-up box, enter the IP address of the power monitor and press Connect.

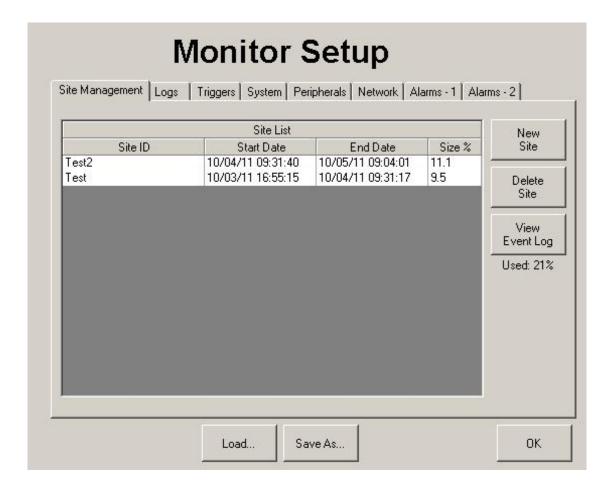




Site Management (Data Sets)

Site Management is the first tab in the "Setup" section of Live-View[™]. Site Management is the screen in Live-View[™] that provides all of the information on the data sets that are currently stored on the Cx Plus Monitor[™]. It gives an interface to create new data sets as well as deleting old ones.

This is the only way that data can be removed from the power monitor.



Site Management lists the sites on the monitor, the Start and End dates, as well as the percentage of total storage used. The total storage used is displayed below the View Event Log button.

The New Site button creates a new site folder and configures the monitor to store all logs to this folder. Site names are limited to 20 characters in length.

The Delete Site button deletes the selected site folder.

Please refer to the Live-View™ documentation to go through "Monitor Setup"

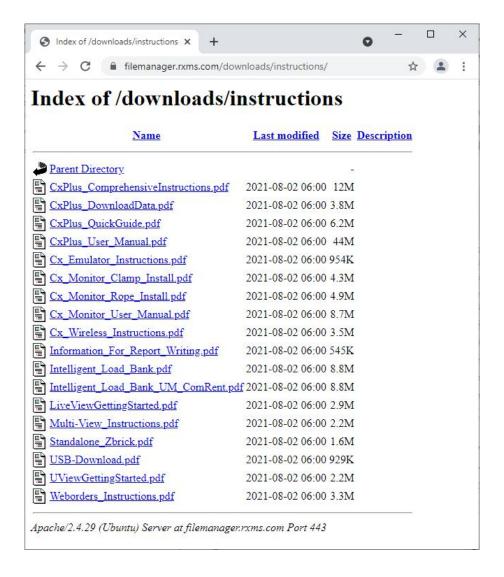
Installing Monitor

Installation Instructions:

Detailed step by step instructions are available in the Comprehensive Instructions and there is a quick install guide for basic power quality jobs. The comprehensive install with the wireless instructions can be found in the Appendix.

https://filemanager.rxms.com/downloads/instructions/CxPlus_QuickGuide.pdf

 $https://file manager.rxms.com/downloads/instructions/CxPlus_Comprehensive Instructions.pdf$



Voltage Lead and Current Probe Installation Points

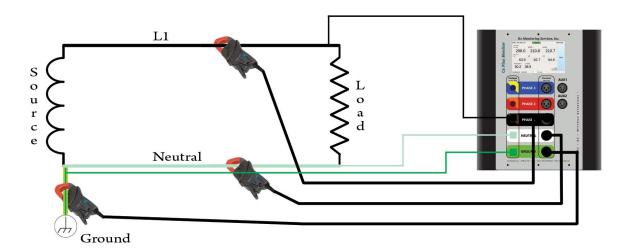
This section of the manual will show the basic guidelines on where to connect the voltage leads and current probes based on different power sources.

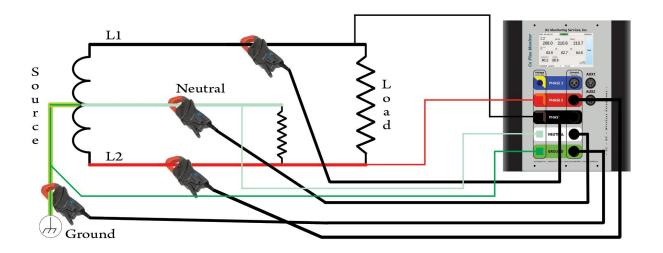
Because of the power monitor's ability to calculate and log power for delta, wye and single phase at the same time. There is no setup needed in Live-View™ to specify the type of source coming into the power monitor.

Note:

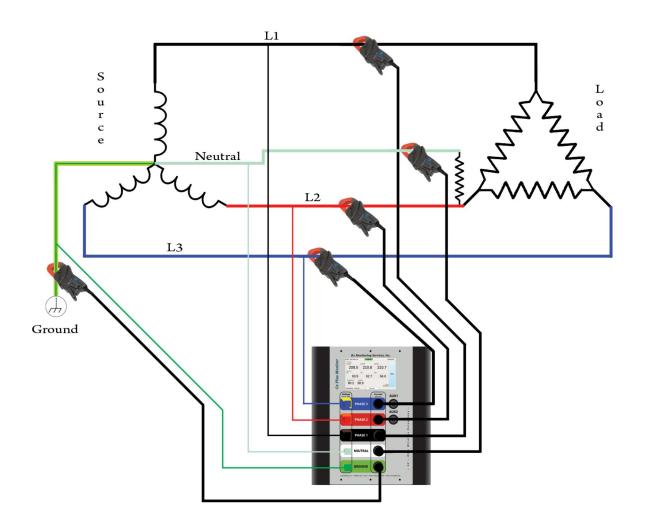
To ensure that the voltage and current transducers were installed and reading properly it is recommended to use the "Phasor" diagram in the Live-View™ software. See Appendix E for an overview of the phasor system.

Single Phase Connection (L1 - N - G)





3 Phase WYE / Delta Connection (L1 - L2 - L3 - N - G)

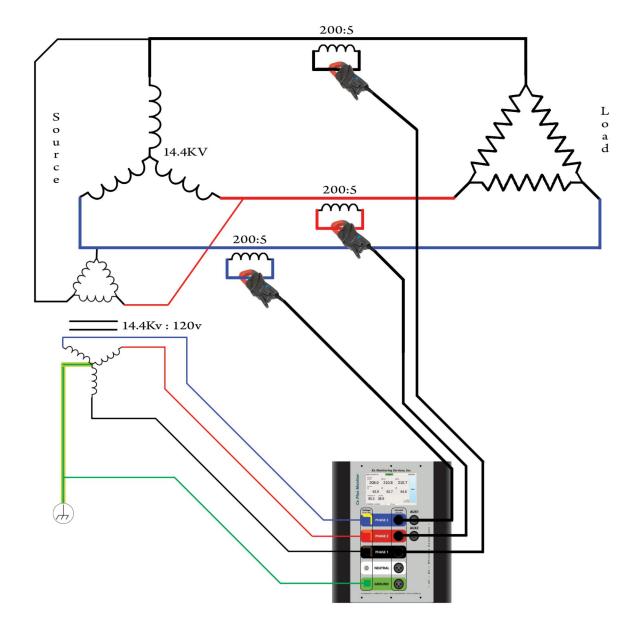




WARNING



WARNING: Connecting to PT's and CT's can contain hazardous voltages and can exceed the CAT rating on the monitor and probes. Be knowledgeable about the location of the power monitor before energizing any circuits.



Note: Medium voltage multipliers are set in "Live-View" -> Setup -> System -> Medium Voltage" .

The Voltage multiplier for the above example would be 14400/120 = 120.

The Current multiplier would be 200/5 = 40.

Downloading Data

Note:

It is not a requirement to halt the system from sampling to retrieve your data through the Live-View™ Method. The USB download will stop logging while it completes the download.

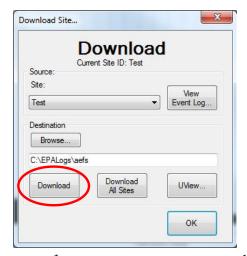
Live-View™ Download

Downloading data through direct Ethernet or a network is the fastest way to retrieve data from the monitor.



To download through Live-View:

- 1. Start the Live-View[™] program
- 2. Press the Connect button
- 3. In the "Connect..." pop-up box, enter the IP address of the power monitor and press connect.
- 4. Click the "Download..." button to enter the download menu.
- S. Select a site from the Site combo-box
- Specify a destination folder on the PC, either by typing the path, or using the Browse... button
 and selecting the destination (many files are created, so recommended to create a new file
 folder)
- 7. Click the Download button to download the data.



Note: If data files are already in the directory, it will prompt if you want to overwrite or cancel the download. If the folder does not exist, it will prompt to create the folder.

Note: Download All Sites button allows you to download all of the site data on the monitor. A folder with the site name will be created in the destination folder for each site downloaded.

Once the download is complete, use the U-View[™] button to launch U-View[™].

USB Download

The power monitor has the ability to download to a USB storage device through the mass storage class driver. Only certain USB sticks properly identify themselves and only USB sticks provided from Rx Monitoring Services, Inc. are guaranteed to work.

Note: SanDisk USB devices have the most reliable track record and are recommended.

There are multiple modes that the monitor can be operating in for USB downloads.

- If the monitor is running in "Normal" mode, nothing is changed upon USB download.
- If the monitor is running in "Reset on USB" mode, when the USB stick is inserted and data downloaded, the old "Site" is renamed with the date appended and a new data set is started.

Regardless of setup, data is never deleted when downloading using USB method. All data is stored on the power monitor.

Steps to perform USB download:

- 1. Power up monitor
- 2. Insert USB stick, wait 15 seconds for enumeration.
- 3. Monitor will automatically begin downloading data. Display will show: "Downloading..."

DO NOT REMOVE USB STICK

- 4. When USB download is done, this amount of time is dependant on the data download size. The display will show "--- Complete---".
- 5. It's now safe to Remove USB Stick from Monitor.

After Download:

Insert the USB stick into your computer and explore to the contents of USB stick.

In root directory of stick will be the power monitors serial number in format EPA*****

Depending on the configuration of the power monitor the data will either be a single zip file or a duplicate copy of data inside that directory.

Data Analyzation Software

U-View™

Description:

U-View[™] software is used to interpret the output files from the power monitor after downloading. Some of the abilities include graphical representations and exporting of log files. The package includes waveform analysis tools for power, RMS, frequency, (%) deviation and harmonics. There are multiple solutions to make the data more manageable including global zoom capabilities, on-graph annotations, and color-coded regions. The output of U-View[™] is in picture form directly from what is on the PC screen, so it is easy to understand what the output will contain. In addition to the picture output, the data can be easily exported to Excel.

Download Software:

U-View[™] is always available on our website at,

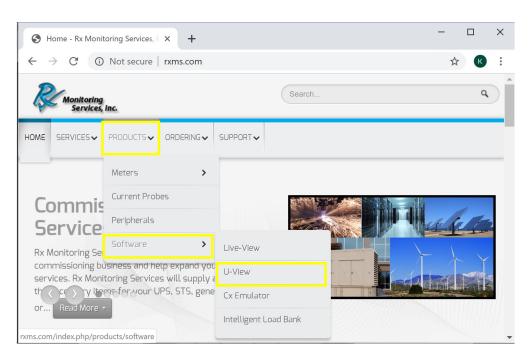
http://RxMS.com/index.php/products/software/U-View

Click the U-View download button under Links on the right side of the screen

After downloading the file "UView-Setup.exe", run the program to start the installation.

Download Instructions:

Instructions for usage of the U-View $^{\text{\tiny TM}}$ software package are maintained in a separate document. This document link can be found on the http://RxMS.com/index.php/products/software/U-View website under the download link. Click on the Live-View.pdf.



To Start U-View™:

Default installation is placed at,

Start Menu » All Programs » Rx Monitoring Service » U-View » Launch U-View

Updates:

Updates are common place and should be expected.

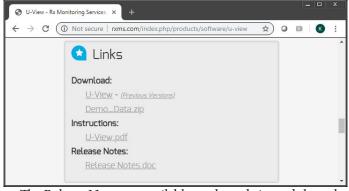
Updates are always free and can be found in the same location as above.

Download and run "UView-Setup.exe" to install the newest release.

Upon Starting U-View™ if a internet connection is present U-View™ will confirm the installed version is up to date. If the installed version is not current, a window will appear with directions on how to obtain the newest release.



Pop-up shown when U-View is opened and an update is available



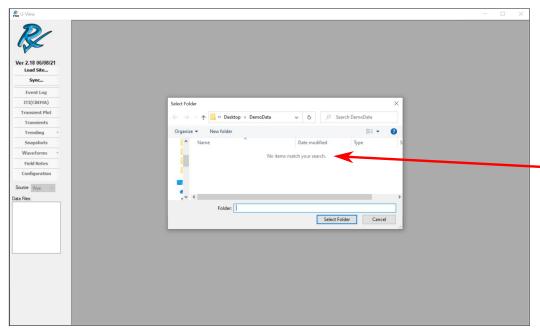
The Release Notes are available on the website and show the history of U-View updates. They can be found in the same section as the download link for the update.



The website will always show the latest versions of software released in the RxMS News section

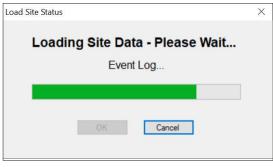
To Analyze downloaded data:

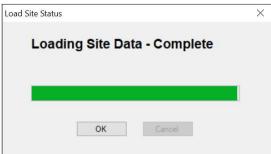
- 1. Start the U-View[™] program
- 2. Press the "Load Site..." button
- 3. In the "Select Folder" dialog select the desired data sets folder



Note: The display will not show the files in the folder, it is to select the folder that contains all of the files.

- 4. Click the "OK" to begin the loading process
- 5. U-View™ will begin loading the status bar will begin moving
- 6. "Complete" will appear in the "Load Site Status" box when complete.
- 7. Click "OK" to start analyzing data.





Appendix A - Theory Of Operation

Calculation types

This section will show the formulas for how the power monitor calculates the different logged values.

Min = Lowest calculated value over log period.

Max = Highest calculated value over log period

Average = Sum of all values divided by count of values.

RMS Voltage (Ph-Ph, Ph-G, Ph-N, N-G)

$$Vrms(Half\ Cycle) = \sqrt{\frac{1}{128}(x_1^2 + x_2^2 \dots x_{128}^2)}$$

RMS Current (L1, L2, L3, N, G)

Irms (Full Cycle) =
$$\sqrt{\frac{1}{128}(x_1^2 + x_2^2 \dots x_{128}^2)}$$

Harmonics (Ph-Ph, Ph-G, Current L1, L2, L3)

Harmonics are measured on a cycle by cycle basis. Every 1,024 samples a FFT (Fast Fourier transform) is performed. The harmonics are the calculated values from that transform. Logs contain: DC, fundamental and harmonics up to 31st.

RMS Current - Residual (L1+L2+L3 - N)

Residual Irms (Full Cycle) $= \sqrt{\frac{1}{128} \left(\left(L1_1 + L2_1 + L3_1 - N_1 \right)^2 + \dots \left(L1_{128} + L2_{128} + L3_{128} - N_{128} \right)^2 \right)}$

Frequency (L1-G, L2-G, L3-G)

Frequency is measured on a 20 cycle window. Every 5120 voltage samples a 20 cycle (5120 sample) a zero cross count is preformed.

The frequency is the calculated time from that zero count algorithm.

THD Even % (Ph-Ph, Ph-G, Current: L1,L2,L3)

THD Even %(Cycle) =
$$\sqrt{\left(\frac{h_2^2 + h_4^2 + \cdots h_{30}^2}{h_1^2}\right)}$$

THD Odd % (Ph-Ph, Ph-G, Current: L1,L2,L3)

THD Odd %(Cycle) =
$$\sqrt{\left(\frac{h_3^2 + h_5^2 + \cdots h_{31}^2}{h_1^2}\right)}$$

THD Total % (Ph-Ph, Ph-G, Current: L1,L2,L3)

THD %(Cycle) =
$$\sqrt{\frac{h_2^2 + \cdots h_{31}^2}{h_1^2}}$$

THD Max % (Ph-Ph, Ph-G, Current: L1,L2,L3)

 $THD \% (Cycle)_{max} = Max THD\% calculated$ $over \log interval$

Phase Angle: (Ph-Ph, Ph-G)

Calculated when V1 > 50Vrms & I1 > 2Arms Phase Angle \emptyset (Cycle) = $(V_1 \angle \emptyset) - (I_1 \angle \emptyset)$

Phase Angle
$$\emptyset$$
 (Avg) = $\sum (V_1 \angle \emptyset) - \sum (I_1 \angle \emptyset)$

$$V = L1-G, L2-G, L3-G$$
 $I = L1, L2, L3$

Power: KVA - Three Phase (Min, Max, Avg)

 $KVA(Cycle)_{1,2,3} = Vrms * Irms$

Power: KW - Three Phase (Min, Max, Avg)

 $KW(Cycle)_{1,2,3} = \frac{1}{64} \sum_{n=1}^{64} ((V_1 * I_1) + \cdots (V_{64} * I_{64}))$

V = L1-G, L2-G, L3-G I = L1, L2, L3

V= L1-G, L2-G, L3-G

I=L1, L2, L3

Power: PF - Three Phase (Min, Max, Avg)

$$PF(Cycle)_{1,2,3} = \frac{KW(Cycle)}{KVA(Cycle)}$$

$$KW = 1, 2, 3$$

$$VA = 1, 2, 3$$

Power: KVAR - Three Phase (Min, Max, Avg)

$$KVAR(Cycle)_{1,2,3} = \sqrt{(KVA^2 - KW^2)}$$

$$I = L1, L2, L3$$

Power: Total (KW, KVA, KVAR, PF)

Based on the Average values.

$$KVA(Cycle)_{total} = KVA_1 + KVA_2 + KVA_3$$

$$KW(Cycle)_{total} = KW_1 + KW_2 + KW_3$$

$$KVAR(Cycle)_{total} = KVAR_1 + KVAR_2 + KVAR_3$$

$$PF(Cycle)_{total} = PF_1 + PF_2 + PF_3$$

Power: Energy KVAh, KWh, KVARh

Based on the Average values.

$$x = \frac{3600}{Log \ Rate}_{seconds}$$

$$KWh = \frac{1}{(x)} \sum_{n=1}^{(x)} (KW(Total)_1 + \cdots KW(Total)_{(x)})$$

$$KVARh = \frac{1}{(x)} \sum_{n=1}^{(x)} (KVAR(Total)_1 + \cdots KVAR(Total)_{(x)})$$

$$KVAh = \frac{1}{(x)} \sum_{n=1}^{(x)} (KVA(Total)_1 + \cdots KVA(Total)_{(x)})$$

Power: Demand KVA, KW, KVAR

Based on the Average values.

$$x = \frac{3600}{Log \ Rate}_{seconds}$$

$$y = \frac{x}{Demand\ Interval_{seconds}}$$

$$Demand_{KWh} = \frac{1}{(y)} \sum_{n=1}^{(y)} (KW(Total)_1 + \cdots KW(Total)_{(y)})$$

$$Demand_{KVARh} = \frac{1}{(y)} \sum_{n=1}^{(y)} (KVAR(Total)_1 + \cdots KVAR(Total)_{(y)})$$

$$Demand_{KVAh} = \frac{1}{(y)} \sum_{n=1}^{(y)} (KVA(Total)_1 + \cdots KVA(Total)_{(y)})$$

Power: KW - Single Phase (Min, Max, Avg)

$$KW(Cycle)_1 = \frac{1}{64} \sum_{n=1}^{64} ((V_1 * I_1) + \dots (V_{64} * I_{64}))$$

$$V=L1-L2$$
 $I=L1$

Power: KVA - Single Phase (Min, Max, Avg)

$$KVA(Cycle)_1 = Vrms * Irms$$

$$V=L1-L2$$
 $I=L1$

Power: PF - Single Phase (Min, Max, Avg)

$$PF(Cycle)_1 = \frac{KW(Cycle)}{KVA(Cycle)}$$

$$V=L1-L2$$
 $I=L1$

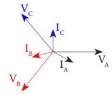
Power: KVAR - Single Phase (Min, Max, Avg)

$$KVAR(Cycle)_1 = \sqrt{(KVA^2 - KW^2)}$$

$$V=L1-L2$$
 $I=L1$

Symmetrical Components

Given: Fundamental Voltage Vectors $V_{A'}V_{B'}V_{C'}$ either Phase-Ground or Phase-Phase and Current Vectors $I_{A'}I_{B'}I_{C}$.

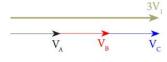


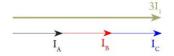
Zero Sequence: $V_0 = 1/3(V_A + V_B + V_c)$ $I_0 = 1/3(I_A + I_B + I_c)$





Positive Sequence: $V_1 = 1/3(V_A + V_B(+120^\circ) + V_c(+240^\circ))$ $I_1 = 1/3(I_A + I_B(+120^\circ) + I_c(+240^\circ))$





Negative Sequence: $V_2 = 1/3(V_A + V_B(+240^\circ) + V_c(+120^\circ))$ $I_2 = 1/3(I_A + I_B(+240^\circ) + I_c(+120^\circ))$





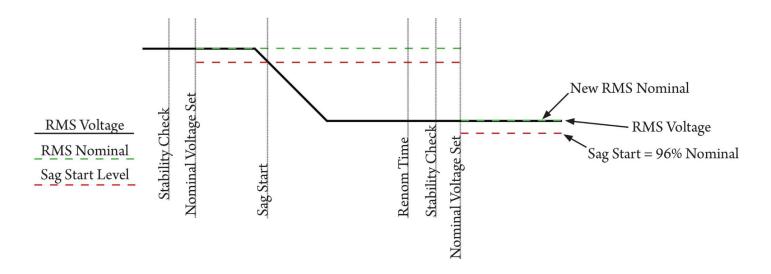
Symmetrical Components: Imbalance

Voltage Imbalance % = V_1 / V_2 Current Imbalance % = I_1 / I_2

RMS Nominal

The RMS nominal is the voltage level that the power monitor "normalizes" to either on sampling start (first 5 seconds) or after renominaling based on the parameter set in the "Live-View™ -> Setup -> Triggers -> Volts -> (Renom)" time. The system will re-nominalize the RMS voltage if there is a voltage sag or surge that is outside the set "Live-View™ -> Setup -> Triggers -> Volts -> (Surge Start)" and lasts longer than the Renom time.

Stability Check = Power monitor confirms less than 20% deviation in RMS voltage for 5 Seconds after sampling start. Nominal Voltage Set = Power monitor Sets nominal voltages and the Sag/Surge Thresholds.



Input Frequency PLL

The AC Frequency setup in "Live-View" -> Setup -> System -> AC Frequency "configures the power monitor on how to detect input frequency, there are three options.

Fixed Mode

The monitor uses only the configured AC Frequency either 50.0 or 60.0 Hz.

Auto 50/60 Mode

The monitor selects either 50.0 or 60.0 Hz if the input frequency on channel L1-L2 is within the configured Band setting. (Ex. If Band = 2Hz, if signal is 58Hz-62Hz Monitor sets to 60Hz) The Time setting is used as a hysteresis band, it waits that amount of time after AC frequency is in the Band range before setting the master sample frequency.

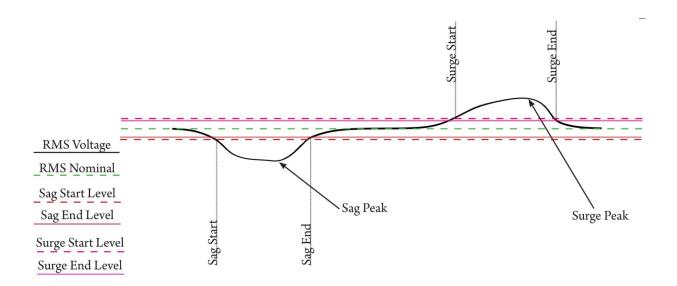
Auto Mode

The monitor "Syncs" to the incoming frequency on channel L1-L2, Time is used as the amount of time the signal must be stable and out of band before setting a nominal frequency. Band is used as the amount of frequency deviation from the nominal sample frequency before a new nominal frequency is calculated. Time can be set from 10 seconds to 30 minutes. Auto Mode should only be used if frequency is known to change, such as a transfer to generator set. Sites with large THD or wave shape faults can be unstable and cause problems in this mode.

Sag / Surge Voltage Triggers

The Sag or Surge events occur when the RMS Voltage falls outside the set "Live-View" -> Setup -> Triggers -> Volts -> (Sag Start)" or "Live-View" -> Setup -> Triggers -> Volts -> (Surge Start)" and lasts until the RMS returns to "Live-View" -> Setup -> Triggers -> Volts -> (Surge End)" or "Live-View" -> Setup -> Triggers -> Volts -> (Surge End)" value.

Duration = The total time that the RMS voltage was outside of the set parameters. **Peak** = The highest (surge) or lowest (sag) RMS voltage that was calculated during the event.



Current Trigger

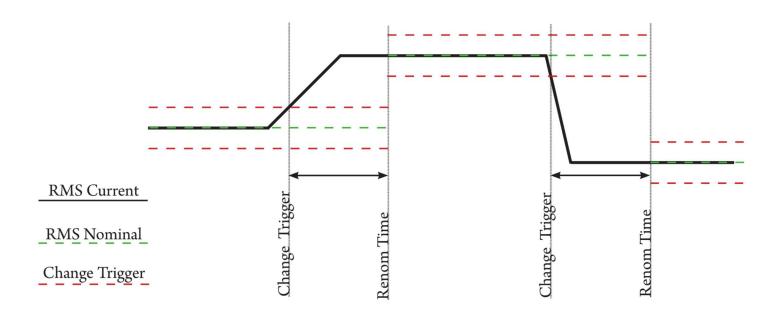
The Current Trigger starts when power monitor calculates a deviation from the nominal RMS Current falling outside the set "Live-View" -> Setup -> Triggers -> Phase Current -> (Change)", "Live-View" -> Setup -> Triggers -> Neu Current -> (Change)" or "Live-View" -> Setup -> Triggers -> Gnd Current -> (Change)".

The Current Trigger ends when the RMS Current stabilizes for "Live-View™ -> Setup -> Triggers -> Current Triggers -> (Settle)" cycles, or the "Live-View™ -> Setup -> Triggers -> Phase Current -> (Renom)" value is reached.

Change = Change from RMS nominal that causes a Current Trigger Event. Phase, Neutral and Ground current triggers are configured in Live-View independently.

Settle = Time in cycles the RMS current must stabilize before ending the Current Trigger event.

Renom = Maximum time in seconds the monitor will wait for the RMS Current to stabilize before ending the Current Trigger and forcing a Renominal. The power monitor will then take a 4 cycle average and use that as its new RMS nominal.



Waveform Capture

Waveform capture can be started from either the Sag/Surge Voltage Triggers or the Current Triggers. Upon start, they record 10 voltage and 5 current channels at 64 samples/cycle.

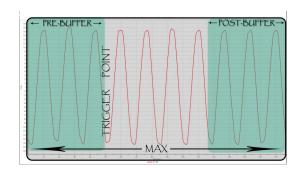
There are 4 parameters that can be set for the Waveform captures.

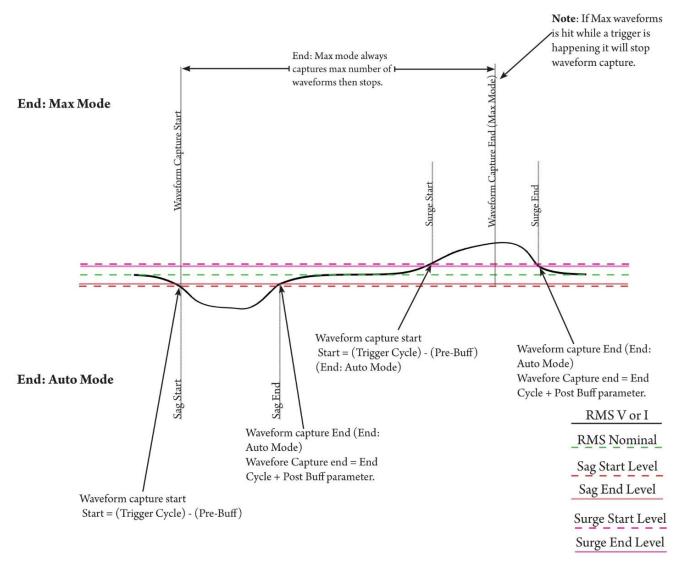
Pre-Buff = Amount of cycles captured before the triggering event occurred.

Post-Buff = For Auto End, number of cycles captured after all triggering events have cleared. Any triggers occurring during this time will reset the Post-Buff time and cause the waveform capture to continue recording.

Max = Total amount of cycles that will be captured during a event.

End = How the waveform capture ends, this can be set to Max (The capture ends when the Max parameter cycle count is reached) or Auto (When the triggering event ends)





Appendix B - Monitor Specifications

General Specifications:

- Clock: Leap Year, 24-Hour, with time zone info
- Real-time Clock Accuracy: +/- 1 sec / day max.
- Synchronize time between Cx Plus Monitors to +/- 10 mSec / day.
- Internal Memory: Minimum 64Gbytes high speed NAND Flash
- Wireless 802.11g Integration (Ad-hoc mode)
- Two 10/100/1000Mbit Ethernet; SFTP, SMTP, HTTP, HTTPS, SSL, SSH, NTP.
- Two USB Mass storage class support
- Max number of events: Only limited by internal memory
- Power Requirements: 100V-240V ACrms +/-10% 47-63 Hz 10Watts 24Vdc 0.5Arms Center positive barrel
- UPS standby time: Programmable Max time 20 Minutes
- Dimensions: 11.5 x 10.25 x 4 Inches.
 (Height x Width x Depth)
- Weight: 5.55lb

Environmental & Safety:

- Operating environment: Indoors (Pollution degree 2)
- Storage Temperature: -20°C to 50°C (-4F-122F)
- Operating Temperature: 0°C to 40°C (32F-104F)
- Max Changes per hour temp: 30°C
- Operating Humidity: 80% Max Non-Condensing
- Conforms to IEC61010 CAT III 600V

Synchronization & Sampling:

Low Frequency:

- Sampling Frequency: 1,024 samples/cycle
- A/D Resolution: 18 bit oversampled voltage 2X; current 4X
- Auto 50/60 Hz; or locked to input
- Voltage & Current RMS triggers; Cross triggering
- Adaptable trigger thresholds

High Frequency:

- 1.666Msample/sec per channel.
- A/D Resolution: 14 bit

Voltage and Current Measurement:

Low Frequency

- Voltage Measurement Range: 0-600Vrms
- Voltage input impedance: 1Mohm

High Frequency

- Voltage Measurement Range: 0-2,500V
- Measurement type: AC coupled digital threshold trigger 500 sample buffer per channel
- Voltage input impedance: 1Mohm

Current Measurement Range (Probe dependant)

• Current input type: AC/DC +/- 6Vdc Input impedance 120K, 1M to gnd.

Voltage Current & Time Accuracy:

V/I Calibrated at 72° f. TC = 0.003%/°F

+/-((% of reading) + (% of range))

Low Frequency

- A/D Measurement type: True RMS calculated every half cycle
- A/D Measurement Uncertainty: AC +/-0.1% reading +/-0.1% full scale above 50Vrms DC +/-0.1% reading +/-0.1% full scale above 50V dc Offset Error: AC/DC: 0.05Vrms

High Frequency

- A/D Measurement type: Sampled Threshold cross 500 sample buffer per channel
- A/D Measurement Uncertainty: AC +/- 5% reading Offset Error: AC: 5V

Current:

- A/D Measurement type: True RMS calculated every cycle
- A/D Measurement Uncertainty System:
- AC +/-0.1% reading +/-0.1% full scale above 50Arms
- DC +/- 0.1% reading +/- 0.1% full scale above 50Adc Offset Error: AC/DC: 1Arms

Time:

• 10mSec/day calibrated at 72° f. TC = 100ppb/°F

Log Rates and Types

RMS Voltage / Current:

1 Second to 30 Minutes

10 Voltage Channels Ph-Ph, Ph-G, Ph-N & N-G

5 Current Channels { L1, L2, L3, N & G}

1 Residual Current {L1+L2+L3+N}

RMS Voltage Imbalance

Frequency:

10 Seconds to 30 Minutes

3 Voltage {L1-G, L2-G, L3-G}

Peripherals:

4 Seconds to 30 Minutes

Up to 100 Probes

Wireless DC Voltage +/- 0-600V Auto Ranging

Wireless DCx Voltage {10Ch - 60dc}

Wireless DC Current {2,000A, 4,000A}

Wireless Temperature / Humidity

Wired Temperature / Humidity

Power:

10 Seconds to 30 Minutes

3 Phase Delta

{Min/Max/Average} Apparent Power(KVA), Real power(KW), Reactive (KVAR) Power Factor (PF). Total KVA, Total KVAR, Total KVAR, Total KVAH, Total KWH, Total KVARH, Total Demand(KVA) and Total Demand(KW)

3 Phase Wye - Split Phase - Single Pole Single Phase

{Min/Max/Average} Apparent Power(KVA), Real power(KW), Reactive (KVAR) Power Factor (PF). Total KVA, Total KVAR, Total KVAR, Total KVAH, Total KWH, Total KVARH, Total Demand(KVA) and Total Demand(KW)

2 Pole Single Phase

{Min/Max/Average} Apparent Power(KVA), Real power(KW), Reactive (KVAR) Power Factor (PF). Total KVA, Total KVAR, Total KVAR, Total KVAH, Total KWH, Total KVARH, Total Demand(KVA) and Total Demand(KW)

Harmonics:

10 Seconds to 30 Minutes

3 Ph-Ph, 3 Ph-G & 3 Current channels to the 31st.

THD:

10 Seconds to 30 Minutes

3 Ph-Ph, 3 Ph-G & 3 Current{Odd, Even, Total & Max}

Phase Angle:

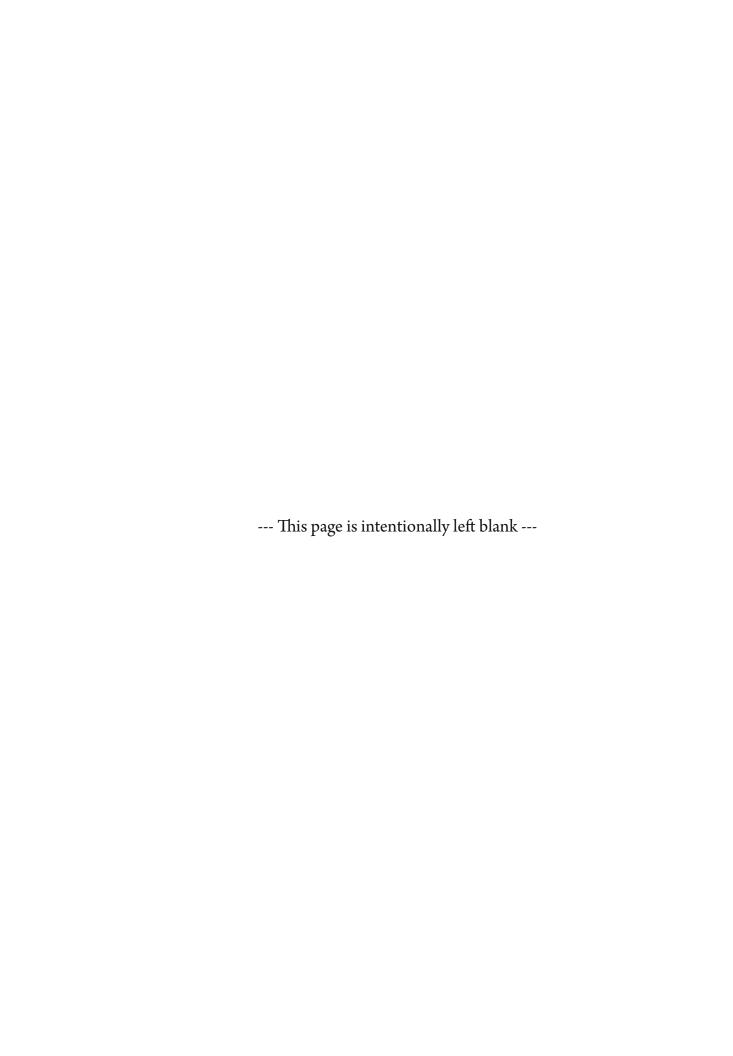
10 Seconds to 30 Minutes

3 Ph-Ph, 3 Ph-G

Symmetrical Components:

10 Seconds to 30 Minutes

Voltage & Current : Magnitude, Angle & Imbalance



Appendix C - Current Probe Specifications

Split Core (Clamp) Current Probes

 $Full\ Spec.\ Sheet:\ https://filemanager.rxms.com/downloads/spec_sheet/Spec_AC_Current.pdf$

10A Clamp-On 0.75" Diameter



Wire Length 12ft

• Measuring range: 0.01A- 12Arms AC

• Max Working Voltage: 600Vrms

• Basic probe accuracy: Of reading

0.1A-0.5A: 2.5% 0.5A-1A: 2.5%

1A-12A: 1.0%

12A-24A: 4.0%

• Linearity: 0.1% + accuracy

• Conductor sensitivity: none

• Frequency Response 40Hz – 10 kHz

• Phase Shift:

0.1A-0.5A: < 5.0 degrees 0.5A-1A: < 3.0 degrees

1A-12A: < 2.5 degrees

12A-24A: < 5.0 degrees

• Total System Accuracy: +/- 2.6% rms with offset errors of +/- 0.05Apk

• System Gain: 0.002A/Count (16bit a2d)

• Output voltage: 100mV/Amp

• Total Range: +/- 30Apk

200A Clamp-On 0.75" Diameter



Wire Length 12ft

• Measuring range: 0.5A- 240Arms AC

Max Working Voltage: 600Vrms

• Basic probe accuracy: Of reading

 0.5A-10A:
 3.0%

 10A-40A:
 2.5%

 40A-100A:
 2.0%

 100A-240A:
 1.0%

 240A-350A:
 8.0%

• Linearity: 1% + accuracy

• Conductor sensitivity: none

• Frequency Response 40Hz – 10 kHz

• Phase Shift:

0.5A-10A: Not Specified 10A-40A: <5.0 degrees 40A-100A: <3.0 degrees 100A-240A: <2.5 degrees 240A-350A: <5.0 degrees

• Total System Accuracy: +/- 4% rms with offset errors of +/- 0.5Apk

• System Gain: 0.02A/Count (16bit a2d)

Output voltage: 10mV/AmpTotal Range: +/- 600Apk

3,000A Rope 24" & 36" Lengths



Wire Length 8ft

- Measuring range: 5A- 3,200Arms AC
- Max Working Voltage: 600Vrms
- Basic probe accuracy: $\pm 1\%$ of reading $\pm 1A$
- Linearity: \pm 0.2% of reading
- Conductor position sensitivity: \pm 1% of reading
- Frequency Response: 10Hz to 10 kHz (-1dB)
- Phase Shift: < 1 degrees
- Total System Accuracy: +/- 2% RMS with offset errors of +/-2.5Apk
- System Gain: 0.2A/Count (16bit a2d)
- Output voltage: 1mV/Amp
- Total Range: +/- 6,000Apk probe limited to 4,500Apk
- DC offset on startup can be significant for approximately 10 sec.

Powered from power monitor or 2xAA

10,000A Gen2 Rope 36", 48" & 60" Lengths



Wire Length 12ft

- Measuring range: 20A- 10,000Arms AC
- Max Working Voltage: 600Vrms
- Basic probe accuracy: $\pm 1\%$ of reading ± 20 A
- Linearity: ± 0.2% of reading
- Conductor position sensitivity: ± 1% of reading
- Frequency Response: 40Hz to 7 kHz (-1dB)
- Phase Shift: < 1 degrees
- Total System Accuracy: +/-2% RMS with offset errors of +/-20Apk
- System Gain: Frequency dependant
- Output: 0.122mV/ARMS @ 60Hz
- Total Range: +/-50,000Apk at 60Hz to +/-60,000Apk at 50Hz
- DC offset on startup can be significant for approximately 2 sec.

Self-powered no external source needed

Appendix D - EWE (External Wireless Extensions)

The EWE (External Wireless Extensions) is a system that extends the capabilities of the Cx Plus Monitor[™]. It adds wireless communications to 100 external probes. Adding additional functionality including, DC Voltage (600V single), DC Current (2000A & 4000A), Temperature and Humidity and a battery voltage tester (10 Channel 60V).

This section will give specifications for those devices.

For use, see the "Installing Monitor" section of this manual for obtaining installation instructions for the wireless system.

Features:

- Individual log file created for each probe
- Programmable log rate of 4 seconds to 30 minutes
- Up to 100 probes per Cx Plus Monitor™, mix and match probe types
- Range: Indoor up to 100 ft
- Range: Line of sight up to 1 mile

https://filemanager.rxms.com/downloads/instructions/Cx Wireless Instructions.pdf

Battery Operated: 600V DC Single

Full Spec. Sheet: https://filemanager.rxms.com/downloads/spec_sheet/Wireless_battery_Specsheet.pdf



Auto Dual Range:

+/- 24Vdc

- Uncertainty: +/- 0.5% +/- .01% Full scale
- Resolution: 0.001 V

+/-600Vdc

- Uncertainty: +/- 0.5% +/- .01% Full scale
- Resolution: 0.005 V

DC Probe Specifications:

- 1 Sample per second minimum
- 4 Readings per log entry {Min, Max, Avg}
- Dimensions: $3" \times 4.5" \times 1.5" (L/H/W)$
- Battery life between 20wks 50wks dependant on log rate



Temperature Probe Specification:

Range: 0° - 122° Fahrenheit

Resolution: 0.02° Fahrenheit

• Accuracy: ±1.5° Fahrenheit

1 Reading per log entry

Humidity Probe Specifications:

Range: 0%-100% Relative Humidity Non-Condensing

• Resolution: 0.03% Relative Humidity

Accuracy: ±2% (10%-90%) Relative Humidity ±5% Full Range

• 1 Reading per log entry

Battery Operated: High Temperature

 $Full\ Spec.\ Sheet: https://filemanager.rxms.com/downloads/spec_sheet/Wireless_HT_Specsheet.pdf$



High Temperature Specification:

- 14 bit resolution 0.45°F resolution
- On Board LED to give connection status
- Cold Temperature compensated gain increases accuracy across large temperature variations
- Type K Thermocouple range (-20°F 500°F)
- 2 week battery life at 4 second log interval
- Power Requirements: 2 AA Batteries
- K Thermocouple types: Beaded, Bolt On, & Immersion

Readings:

Thermocouple (Typical):

- Accuracy: 4.0°F or 0.75%, whichever is greater
- Response time: 2.9 seconds, 63.2% of a 25-77°C step change per method ASTM E839

Device:

• Accuracy: +/- 3 °F

Resolution: 0.45°F



Dual Range

+/-2,000A

Resolution: 0.017 A

• Uncertainty: +/- 0.5% +/- .01% Full scale

+/-4.000A

Resolution: 0.035 A

• Uncertainty: +/- 0.5% +/- .01% Full scale

DC Current Probe Specifications:

- 12V DC powered
- Sample speed 1 second
- Min, Max, Avg logging
- Hall effect probe powered from system, no batteries required



4,000A 4.5"x2.5" ID Probe Specifications:

- Range: 40-4,000 ADC / 28 -2,800 AAC 0-5,000 Hz
- Operating Conditions: 14-122 ° F / Max 600V

Accuracy:

- Noise: +/- 2ADC
- 1.5% from 400-4,000ADC
- 2% from 40-400ADC
- 4% from 8-40ADC



2,000A 2" ID Probe Specifications:

- Range: 20-2,000 ADC / 14 -1,400 AAC 0-5,000 Hz
- Operating Conditions: 14-122 ° F / Max 600V

Accuracy:

- Noise: +/- 1 ADC
- 1.5% from 200-2,000ADC
- 2% from 20-200ADC
- 4% from 4-20ADC



General Specifications:

- True RMS sampling @ 4kHz input frequency
- On Board LED to give connection status
- Wired (Ethernet) or Wireless stream to Cx Monitor
- Temperature compensated gain increases accuracy across large temperature variations
- CAT III 600V
- Power Requirements: 24V DC 3W

Readings:

 DC Voltage 1-600Vdc:
 Accuracy: 0.01% (+/- 5mV)

 DC Current @ 2000A:
 Accuracy: 0.01% (+/- 100mA)

 DC Current @ 4000A:
 Accuracy: 0.01% (+/- 200mA)

AC Voltage 1-480Vrms @ 60hz: Accuracy: 0.1% (+/- 10mV)
AC Current 2000A @ 60hz: Accuracy: 0.1% (+/- 100mA)
AC Current 4000A @ 60hz: Accuracy: 0.1% (+/- 200mA)
Watt: Accuracy: 0.1% (+/- 1W)

Accuracy stated @ 72°F: Temp error compensated and not to exceed stated accuracy from 50°F - 120°F ambient

Dual Powered: DCx

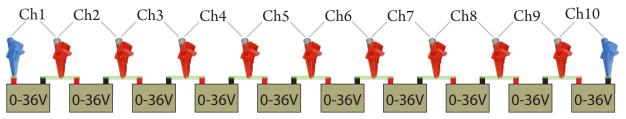
 $Full Spec. Sheet: \ https://filemanager.rxms.com/downloads/spec_sheet/Wireless_DCx_Specsheet.pdf$



DCx Voltage Probe Specification:

- 10 Channel
- +/- 60 Vdc
- Accuracy: ±0.1%
- Noise: +/-2mV
- $TC = 1.63 ppm/{}^{\circ}F$
- 1 Sample per second minimum
- 4 Readings per log entry {Min, Max, Avg}
- Operating Temperature: 0° C to 40° C(32F-104F)
- Operating Humidity: 80% Max Non-Condensing
- Conforms to CAT II 150V

Only 11 Connections for 10 Batteries



Appendix E - Advanced Network Configuration

Network options:

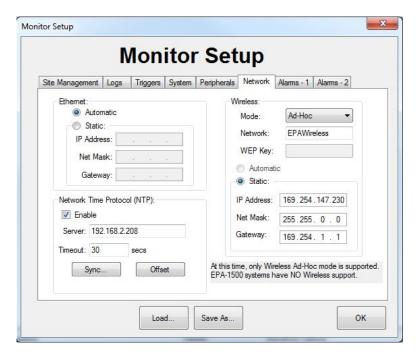
The network parameters are set up in

"Live-View™ -> Setup -> Network"

The Ethernet port can be configured either for Automatic, using Dynamic Host Configuration Protocol (DHCP), or as a static IP address.

To configure the monitor to use DHCP, just select Automatic.

To configure the monitor for a static IP address, select Static and fill in the IP Address, Net Mask, and Gateway from a network administrator.



Reset a mis-configured system's network settings:

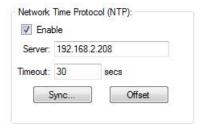
If a power monitor's settings had been configured in a unknown state, it is possible to reset using the USB stick interface.

- 1. On the base directory of a USB stick, place a file called "resetnetconfig" with no file extension.
- 2. Insert the USB stick into the power monitor
- 3. After the USB stick is recognized there will be a message on the power monitor saying "Network Reset Complete".
- 4. Remove the USB stick
- 5. Ethernet will now be in default settings
- 6. Reboot Cx Plus Monitor™ to save Ethernet settings

Time Sync: NTP Server / Client

NTP:

The NTP parameters are set up in "Live-View" → Setup → Network"



Use "Offset" to check if Cx Plus Monitor's time is in sync with server.

Theory of operation:

The Cx Plus Monitor $^{\text{\tiny TM}}$ can act as a client to an NTP server (either local or internet based) or as a server. This gives the ability for Cx Plus Monitor $^{\text{\tiny TM}}$ to sync to each other, or to a time server. When enabled the Cx Plus Monitor $^{\text{\tiny TM}}$ automatically synchronizes the time under three conditions, upon system boot up (if enabled), when "Start" is pressed in Live-View $^{\text{\tiny TM}}$ and using the "Sync..." button in the NTP section of network setup.

The NTP Server/Client can operate in any Ethernet configuration shown in the "PC Connection Methods" section of this manual.

- 1. Auto-IP Direct cross over Ethernet (Between two Cx Plus Monitors, Cx Plus Monitor™ as server)
- 2. Auto-IP with multiple Cx Plus Monitors on a network switch (One Cx Plus Monitor™ server multiple client Cx Plus Monitors)
- 3. AD-Hoc mode with USB stick (One Cx Plus Monitor™ server multiple client Cx Plus Monitors)
- 4. DHCP/WiFi AP with multiple Cx Plus Monitors on a network (One Cx Plus Monitor[™] server multiple client Cx Plus Monitors)
- 5. DHCP/WiFi AP with multiple Cx Plus Monitors on a network (External NTP Server)

Server Mode:

The Cx Plus Monitor™ upon boot up will get the time from the RTC time clock (This has a 1 second resolution) it will lock its NTP server to the RTC time at this point.

The Cx Plus Monitor™ will then use its internal clock with a 10mSec/day accuracy to synchronize its NTP server time.

If you check "Enable" in the NTP section of Live-View™ this mode starts.

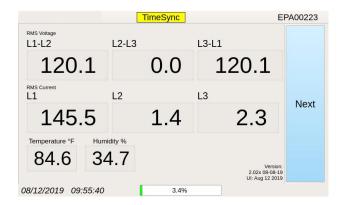
Client Mode:

The Cx Plus Monitor™ will synchronize its clock using the settings in the NTP section of Live-View™. NTP is automatically run on boot up when enabled, and when the "Start" button is pressed in Live-View.

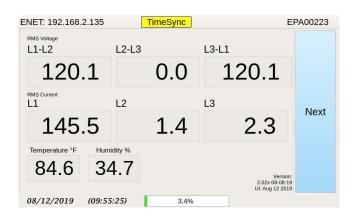
The "Server:" setting is the server that will be attemped to synchronize to using the NTP protocol. This time will be trusted so ensure it's a server that has a valid time.

The "Timeout:" setting in Live-View™ gives the amount of seconds to wait while requesting a time from the configured NTP server. If unable to connect to the server the monitor will begin sampling after this time-out. (un-synchronized)

Display when Cx Plus Monitor's time is synchronizing with time server.



2) Ethernet link connected and Cx Plus Monitor™ waiting for response from NTP server.



 Ethernet not established Cx Plus Monitor™ waiting for IP address.

Cx Plus Monitor™ waits 60 seconds in this mode before skipping NTP sync.



3) After successful sync parenthesis (xx:xx) appear around the time. This ensures the time is synchronized to the server's and time-out was not reached.

If this is not shown, check cabling and either reboot system or re-synchronize with Live-View[™].

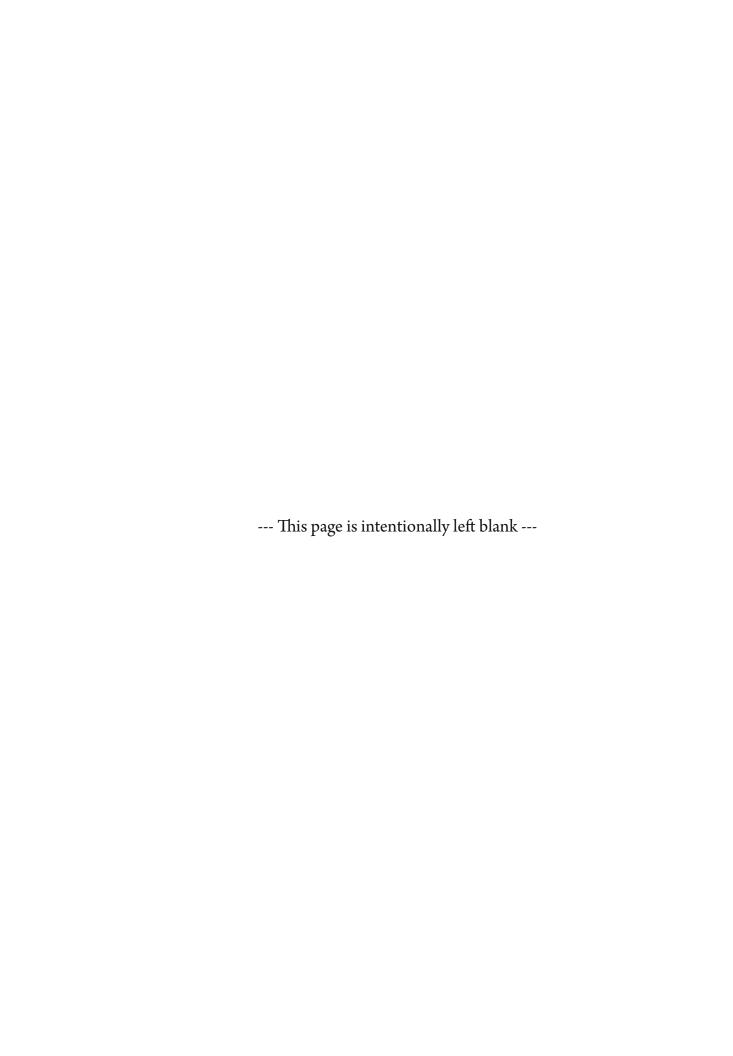
NTP NOTES:

The Cx Plus Monitor™ does not re-synchronize time after the initial start, if the server's time is changed, the clients will have to be rebooted or re synchronized using Live-View™.

The Cx Plus Monitor™ time will drift after the initial synchronization point, up to ten milliseconds per day.

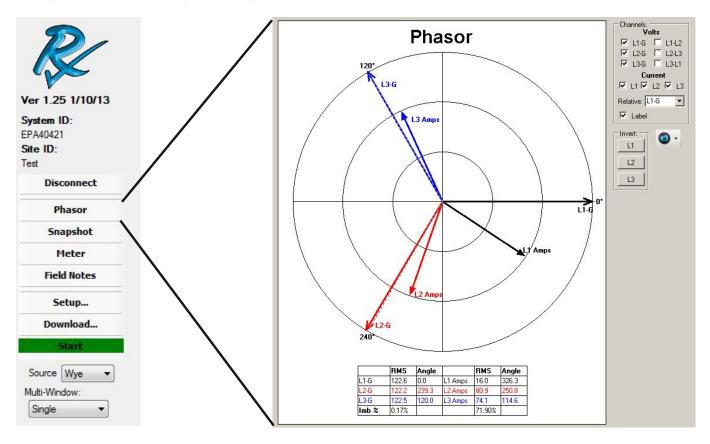
Temperature can affect the time keeping ability, see the Cx Plus specification sheet for drift rates under different temperature conditions.

When NTP is enabled, the "Set" time functionally of the Cx Plus Monitor™ to the computer running Live-View™ is disabled.



Appendix F - Phasor Diagram

The Phasor Diagram in Live-View[™] displays the phase angles and magnitudes of the incoming voltage (Ph-Ph and Ph-G) and current values (L1, L2, L3).



he phasor diagram in Live-View[™] is a powerful tool to be sure that the Voltage and Current signals coming into the power monitor are properly connected and configured.

The relative phase angle (0°) is changed by using the "Relative" drop down menu. It can be either L1-Ground or L1-L2.

The displayed voltage and current can be disabled / enabled by marking the corresponding check boxes. Suggested Settings:

```
Single Phase (L1- N - G): Relative: L1-G (Channels Enabled: L1-G, Current L1)

2 Pole Single (L1 - L2 - N - G): Relative: L1-L2 (Channels Enabled: L1-L2, Current L1, L2)

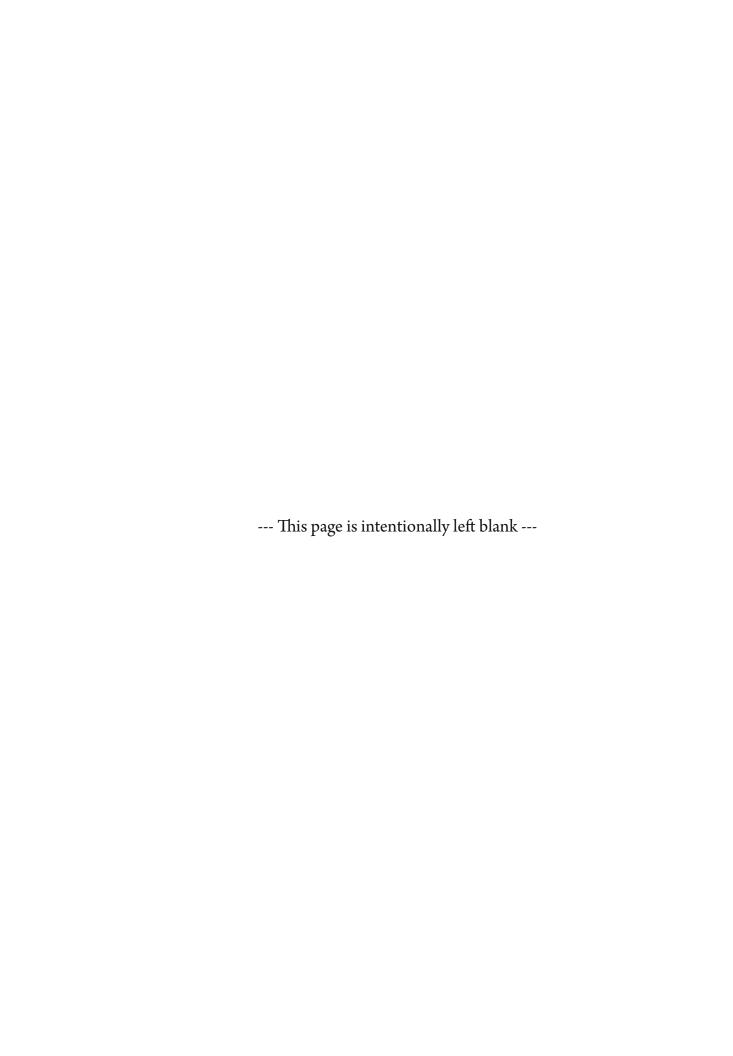
3 Phase (L1 - L2 - L3 - N - G): Relative: L1-G (Channels Enabled: L1-G, L2-G, L3-G)

Current L1, L2, L3)
```

Note: If a delta source is provided select "Delta" from the Source drop down box in the left Live-View™ panel.

The phase angle of each Voltage channel extends to the outer circle while the current channel is represented by a shorter line with a closed arrow head.

The Phasor Diagram gives the user the option to invert each of the phase current channels. If the current is hooked up backwards, it will display 180 degrees relative to its corresponding voltage. To correct for this, click the L1, L2, or L3 buttons to invert the current signal.



Appendix G - Cx Emulator

The Cx_Emulator is a program that is designed so you can simulate the usage of the Cx Plus Monitor™ and its software without having to have the hardware available.

Download Cx Emulator

Go to Website:

http://weborders.rxms.com/

Under Software -> Select Cx Emulator -> Add to Cart Go to Checkout

If you do not have an account you will have to set one up.

Finish the checkout

No Shipping Required - Free Pick today as delivery date

Free Checkout - Agree to terms and conditions.

Confirm order.

You can now go to the download section in your account and download the software.

Install Cx Emulator

Install "Cx Emulator" by running the installer package after download.

Follow the instructions through the installer process.

Windows® XP / Windows® 7, 8 Compatible

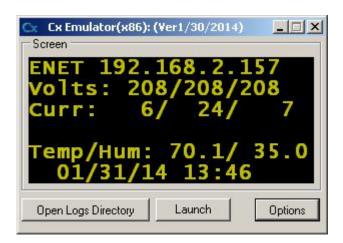
Run Cx Emulator

Go to Start Menu » All Programs » Rx Monitoring Service » Cx_Emulator » Launch Cx_Emulator Or other location if default was changed during installation.

NOTE:

Windows map pop-up a "Windows Security Alert." Press Unblock for the program to operate properly.

Get IP address to connect with Live-View[™] from Cx Emulator display



IP address of Cx_Emulator is displayed in the Cx_Emulator window

Appendix H - RxMS Tips

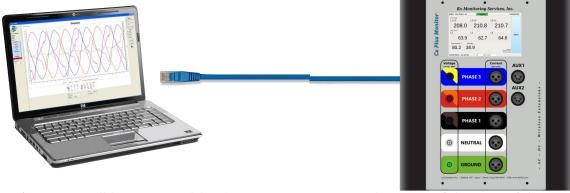
Tips include help with:

- Ethernet Cord Not Establishing Connection
- Current Transformers Not Reading Correctly
- DCw Not Appearing in Live-View

RxMS Tips: Monitor is not connecting with Direct Connect Ethernet Cable

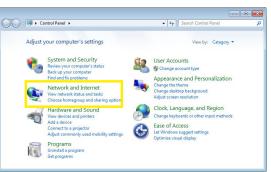
1) Windows auto configures an IP Address when no router is present. This auto IP is used so you do not have to set a static IP on your computer or laptop to connect to the Cx Monitor™. The drawback is that Windows needs to time out to set the address, which would start with 164.254.xx.xx.

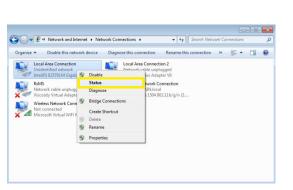
Please wait 4-6 minutes to give the software time to establish the IP Address before changing Ethernet cords.



2) If you are still having trouble, the power settings might turn off the port if the computer is powered from an external supply.

Please either plug in laptop or check power settings to ensure Ethernet port has power.

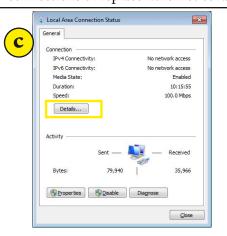


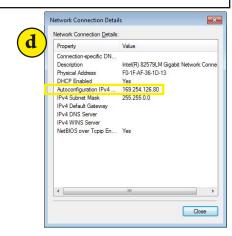


Connect Cx Monitor to Live-View

- a. Open Network and Internet in the Control Panel
- b. Right click on the Local Area Connection and open the Status window
- c. Click the Details button
- d. An Autoconfiguration IP Address should appear

If the Local Area Connection says "Network Cable Unplugged" check all connections or replace Ethernet cord.





For any other any other issues or questions about equipment or paper work contact support@rxms.com or call 603-666-6606. Thanks!

RxMS Tips: Current Transformers/Current Probes

RxMS equipment is tested before and after every shipment, but when sites have multiple sizes or different types of CTs, some confusion with the setup can occur.

If the CTs do not appear to be working correctly, below are items to check before returning:

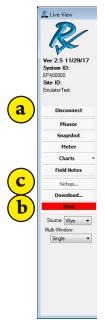
1) If the CT has a dial, make sure the dial is set to the correct setting - either 3,000A or 6,000A. These CTs also need to be powered either by battery or the power supply.

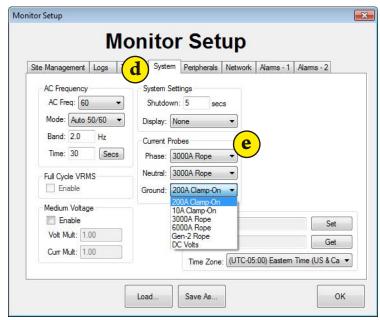
Please make sure the dial is the same as PQM setting and the CT



2) If the dial is set to 3,000A or 6,000A, but the CTs are not working correctly, connect to Live-View[™] and make sure the monitor is set for the value that is used.

Please make sure Live-View is set to the correct settings.





- a. Connect Cx Monitor to Live-View
- b. Stop the monitor by pressing the red Stop button and the Setup button will appear
- c. Press the Setup button
- d. On the Monitor Setup go to the System tab
- e. Check the Current Probe settings and adjust if necessary

For any other any other issues or questions about equipment or paper work contact support@rxms.com or call 603-666-6606. Thanks!

RxMS Tips: DCw

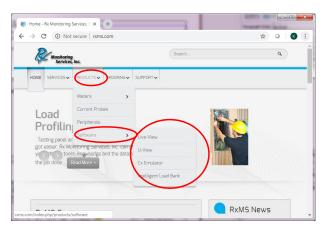
If the DCw peripherals are not appearing in Live-View before testing there are a few settings to check.

1) Make sure all software is updated.

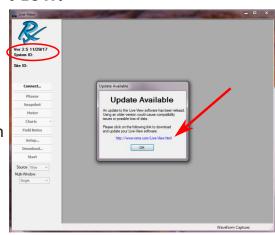
The minimum software versions to support the DCw are:

Cx Plus Monitor: 1.66 Live-View: 2.7 U-View: 2.9 The Cx Plus Monitor software can only be updated in our lab, if the monitor has been on site prior to <u>November 2018</u>, contact us to replace the monitor. The most recent versions of Live-View and U-View can be found on our website - www.rxms.com.

Please make sure to download the most up-to-date version of Live-View and U-View.

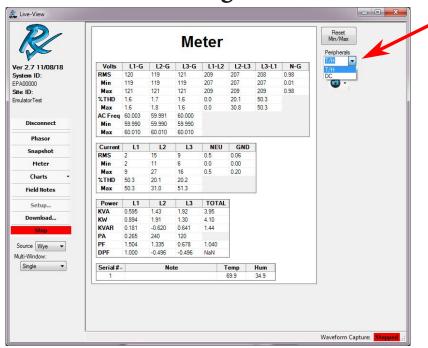


If Live-View and U-View are already downloaded, an update prompt will show up with a link to the website to download the latest version.



2) In Meter Mode, the DC equipment is on a different setting than the temp/humidity equipment. Change the setting to DC and the equipment should appear if connected to the monitor.

Please switch setting in Meter Mode.



For any other any other issues or questions about equipment or paper work contact support@rxms.com or call 603-666-6606. Thanks!

Appendix I - Comprehensive Instruction Manual

Cx Plus Monitor™ **Comprehensive Instructions**



INSTALLATION INSTRUCTIONS OF THE POWER ANALYZER



WARNING-WARNING

Read and understand this manual before connecting device.

Death, fire or serious injury can occur from using equipment outside of safety ratings or improper use.

Installation must be performed from qualified personnel only. Follow applicable safety work practices, including using the proper personal protective equipment during install.

ALWAYS POWER DOWN ALL ELECTRICAL CIRCUITS BEFORE INSTALLATION

System must be powered from grounded receptacle.
These steps require system-trained or local qualified personnel only!





Definitions

WARNING

This statement is to reinforce the practice of certain conditions may cause physical bodily harm or loss of life.

CAUTION

This statement is to reinforce the practice of certain conditions may cause physical damage to the Load Bank, Cx Plus Monitor, accessories, equipment or property.

Abbreviations

CT's: Current Transducers Wireless Probes: Wireless add-on's for power monitor

Rope Probes : Rogowski coil current transducers EWE: External Wireless Extensions
Cx : Power Monitor Site: Cx Plus Monitor data set.

Monitor: Power Monitor (Cx)

Symbols

The following are (IEC) symbols are used on this document or on the power monitor, and their definitions.



This symbol indicates AC or DC volrage or current



This symbol indicates safety ground conductor.



This symbol indicates high voltage. It calls your attention to items or operations that could be dangerous to you and other persons operation this equipment.

Read the message and follow the instructions carefully.



This symbol indicates that caution is necessary when operating the device or control close to where the symbol is placed, or to indicate that the current situation needs operator awareness or operator action in order to avoid undesirable consequences.



WARNING, to avoid electric shock or fire:



- Before using the power monitor inspect wireless probes, voltage probes, current probes, leads and accessories for mechanical damage or broken plastic and call Rx Monitoring Services Inc. for replacements.
- Wear proper Personal Protective Equipment, including safety glasses and insulated gloves when making connections to power circuits.
- Use only current probes, test leads, and adapters supplied with equipment.
- Remove unnecessary voltage leads or accessories that are not in use.
- Make sure the power monitor is properly connected through the power cord to protective earth ground.
- Do not insert foreign objects into connectors, only use approved accessories.
- Never open the equipment, there are no customer replaceable parts.
- Never use equipment outside or when condensing water is present.
- Use proper lockout procedures on circuits under test.
- Hands, boots and the working area must be dry when making connections to power system.
- Do not operate the equipment or probes around volatile gas or vapor.

****** WARNING DO NOT EXCEED CAT RATINGS *******

Voltage Ratings:



Power Monitor: CAT III - 600VPollution Degree 2Rope CT's: CAT III - 1000VPollution Degree 2Clamp CT's: CAT III - 600VPollution Degree 2Wireless DC: CAT II - 600VPollution Degree 2Wireless DCx: CAT II - 150VPollution Degree 2

Quick Reference Guide for the Power Monitor: Please refer to the Installation Instructions for full details on how to install the Power Monitor on the following pages and the user manual for more explanation.

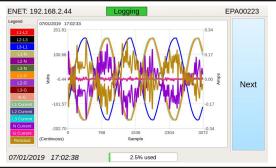












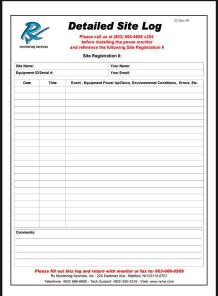
Follow these simple steps:

- 1. Unpack the Power Monitor
- 2. Power down the load and turn off the power at the main circuit breaker
- 3. Connect the Alligator or Strip Voltage Leads
- 4. Connect the Current Probes
- 5. Check Current Probe Settings, if dial present
- 6. Connect Current Probe Power Supply, if required
- 7. Connect the wired Temp/Hum Probe, if supplied
- 8. Power up the Power Monitor
- 9. Power up Load Circuit and System
- 10. Turn on Wireless Peripherals, if supplied
- 11. Connect to Live-View[™]
- 12. Download Data
- 13. Fill out Site Info and Detailed Site Log
- 14. For power quality testing, let the system run for approximately a week and then remove the Power Monitor.

WARNING! HIGH VOLTAGE!

The above steps require system-trained personnel or local qualified personnel only. (i.e. a local electrician)





1. Unpack the Power Monitor



Power Monitor

- a. Check the packing list to make sure all of the requested equipment was received.
- b. Position near the connection point to be testedbe sure the Power Monitor is positioned in an area where it will not be interfered with or dropped).
- c. Be sure a 120V-240V receptacle is available for powering the device.

2. Power down system and turn off the power at the main breaker



a. To ensure safe working conditions make sure to remove voltage from testing source. (Lockout if required)



3. Connect the Voltage Leads



Connect Voltage Leads



Connect Banana Leads

- Confirm that the system under test is powered down and that power at the main circuit breaker is off.
- b. Connect the L1, L2 and L3 voltage leads (alligator clip or strip) to the main circuit breaker. Connect the N lead to the Neutral bar (if present), and the G lead to the main chassis or the Ground bar.
- c. Connect the right-angle banana plug end of the voltage leads into their corresponding color-coded ports on the front panel of the Power Monitor.



<u>Caution</u>: If running Voltage leads out of the panel or system, wrap the "Safety Sleeves" provided in the safety kit around wires at pinch points.

4. Connect the Current Probes



For Phases (3 Wire ProSys 3,000 & 6,000)



For Neutral & or Ground (1 Wire ProSys)



For Phases, N & Ground (Singles, Gen2 10,000A)

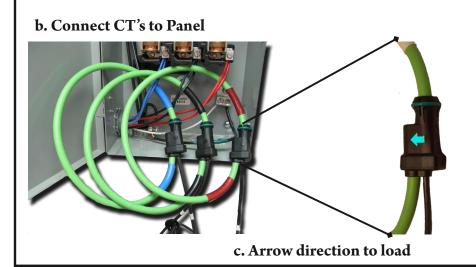
- a. Connecting the current probes is a crucial part of the data gathering process. Make sure you connect them to ensure that all supporting data is gathered.
- b. Connect the current probes around L1, L2, L3, N & G (or all applicable phases) and make sure that there is only one phase in each current probe.
- c. Make sure that each current probe is encompassing the correct phase and that the direction of the arrow on the probe is pointing toward the load.
- d. Plug the connector end of the current probes into their corresponding ports on the front of the Power Monitor (to the right of the color-coded voltage ports).
- e. Clamp and Gen2 rope CTs do not need to additional power, but the ProSys CTs have a dial that needs to be powered separately, see Steps 5 & 6.



<u>Caution</u>: If running CT wires out of the panel or system, wrap the "Safety Sleeves" provided in the safety kit around wires at pinch points.



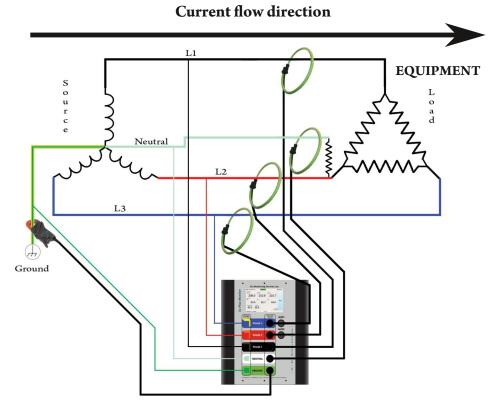
For Phases, N & Ground (Clamp 200A & 10A)



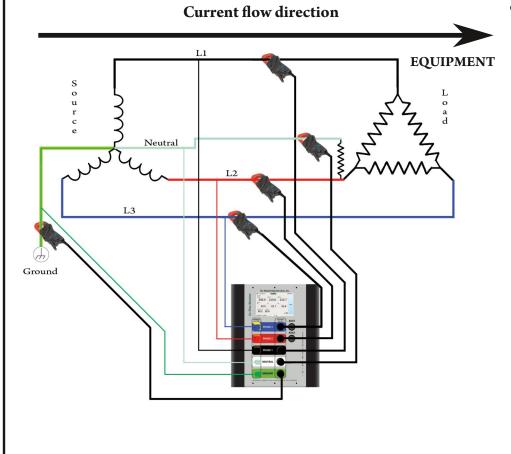




Connection Diagram for Standard Setups:



toward





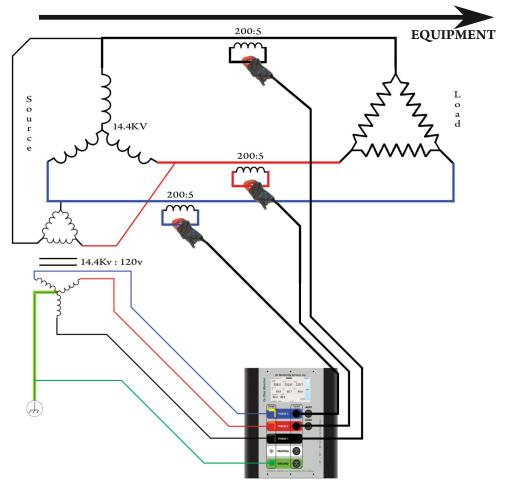
Important:

Arrow on CT's must point toward load being monitored, or the direction of current flow.



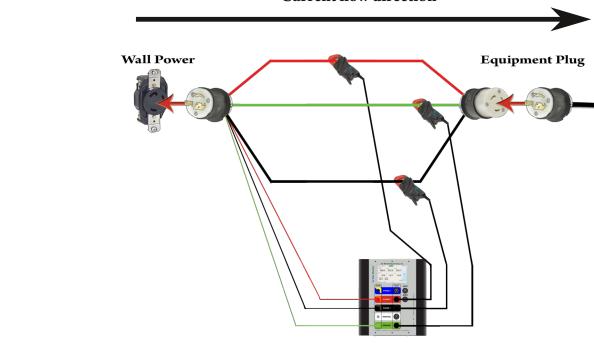
Connection Diagram for Medium Voltage:

Current flow direction



Connection Diagram for "Breakout" Cable Connection:

Current flow direction



Steps 5 & 6 are for the 3,000A and 6,000A ProSys probes only.

5. Check Current Probe Settings

Current Probes Settings: Phases and Neutral will have the same settings.

For Phases & Neutral Testing:

Make sure the rope probe dial is set to either 3,000A (1mV/A) or 6,000A (0.5mV/A).

For Ground Current Testing:

Use either the clamp-on current probe or use the Neutral single wire Rogowski probe and change the setting to 300A (10mV/A).



Clamp-On Current Probe



FOR MEASURING
GROUND
CURRENT
SET TO
300A(10mV/A)
ONLY

Single-Wired Rogowski Probe

6. Connect Current Probe Power Supply

a. Plug current probe power supply into Power Monitors Aux 2 Port.

OR

b. Plug barrel connector from current probe power supply into current probe DC input jack on left side. (LEDs should illuminate for a moment)







b.

a.

7. Connect the Wired Temperature & Humidity Probe

(If Supplied)



- a. Hang the Temp/Hum probe at a minimum height of 6 feet (if possible), and make sure it is not positioned near a door, window, or ventilation unit.
- b. Plug into the Port 1 under AUX on the front of the Power Monitor.

8. Power up the Power Monitor





Caution - Always use a grounded receptacle

- a. Plug power cord into grounded receptacle
- b. Plug the supplied IEC cord into the external DC power supply.
- c. Plug the male external DC power supply plug into the Power Monitor.



DC Power Supply



b. Connect IEC

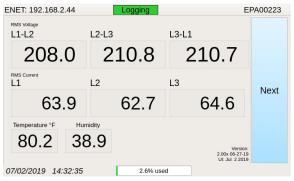


c. Plug In Barrel

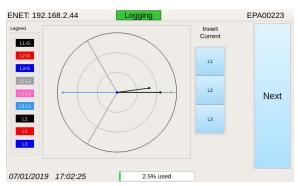
9. Power up load circuit and system

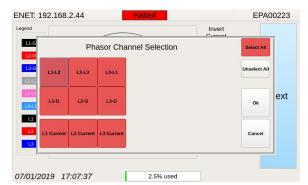
The LCD screen will illuminate when the Power Monitor is on. In about 30 seconds, the full color touch LCD screen will show real-time data, IP address, the date/time, and the percent of storage used.

Three different displays can be shown - Meter Mode, Phasor Diagram, and Waveform Snapshot. Hit "Next" to move from one screen to another.

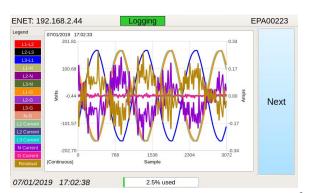


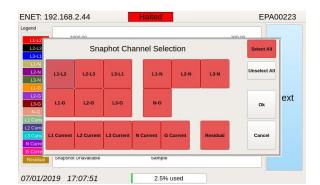
a. Meter Mode





b. Phasor Diagram

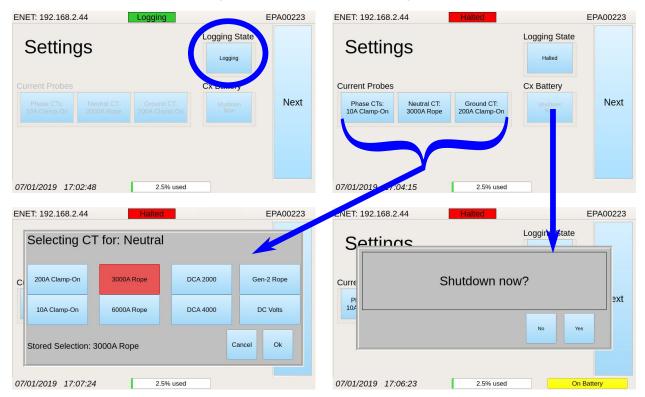




c. Waveform Snapshot

To change the Power Monitor settings with the display:

- a. Go to the Settings screen
- b. Press the Logging State button to stop the Power Monitor and enable the Current Probe selection switches
- c. Press the type of CT to change Phase CTs (L1, L2, L3), Neutral CT, or Ground CT
- d. Select which AC or DC CT type to switch the meter and press Ok



To Shutdown using the display:

- a. Unplug and Shutdown prompt will appear
- b. Hit Yes to shutdown now and No for the monitor to use battery

In addition to the LCD screen, on there is a light on the Power Monitor. The light will be blue upon start up and will blink red if the Power Monitor is on but not collecting data.





10. Connect to the Power Monitor with Live-View

To use the Live-View[™] program, an Ethernet or Wi-Fi connection must be established to the device.

There are 3 different connection types

- 1. Ethernet through DHCP network
- 2. Direct Ethernet connection with Cross-Over Cable
- 3. Wi-Fi Ad-hoc (Windows XP & 7 only)

Ethernet Connection with Cross-Over Cable & Automatic Private IP



- 1. Unplug the Power Monitor wait for shutdown.
- 2. Plug Crossover Ethernet (generally red) cord into side panel.
- 3. Plug opposite end of crossover cable into computer running Live-View™.
- 4. Plug power DC power supply in to the Power Monitor.
- 5. System will power up within 10-15 seconds.
- 6. System will wait 30 seconds before setting automatic IP address. Ex: 169.254.157.253
- 7. Computer running Live-View[™] will need to time-out of its old network (If configured for DHCP) which can take up to 2 minutes.
- 8. Computer should obtain an IP Address in the range 169.254.xxx.xxx (Automatic IP Range if set to DHCP).
- 9. Static IP's can also be set on the Live-View[™] Computer in the range (as long as it's not the same IP as the Power Monitor).

IP: 169.254.0.2 – 169.254.255.250

Subnet: 255.255.0.0

- 10. Computer should now be able to talk using IP address on the display of the Power Monitor.
- 11. Connect using this IP address in Live-View™.



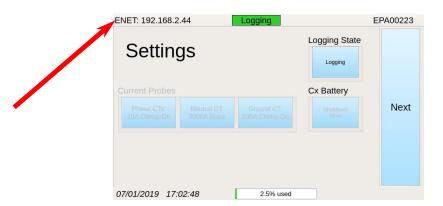
.

Ethernet through DHCP network



- 1. Unplug the Power Monitor wait for shutdown.
- 2. Plug Ethernet cord into side panel.
- 3. Plug DC power supply connector in to the Power Monitor.
- 4. System will get IP address from DHCP server upon startup (10-15 seconds).
- 5. Monitor will display valid IP address on the first line of screen display.
- 6. Computer should now be able to talk using IP address on the display of the Power Monitor. Connect using this IP address in Live-View[™].

IP Address of the Power Monitor used to connect with Live-View™.



Wireless with Access Point and Wi-Fi

Rx Monitoring Services, Inc. supplies all Access Points and Wi-Fi adapters described in this section.

There are two different types of Wi-Fi adapters:







The Access Point & Wi-Fi adapter (Red) gives the user a way to attach to the wireless network using a computer equipped with IEEE 802.11N connectivity. This unit will also provide an Ethernet to Wi-Fi connection for the Power Monitor, that is connected to it.

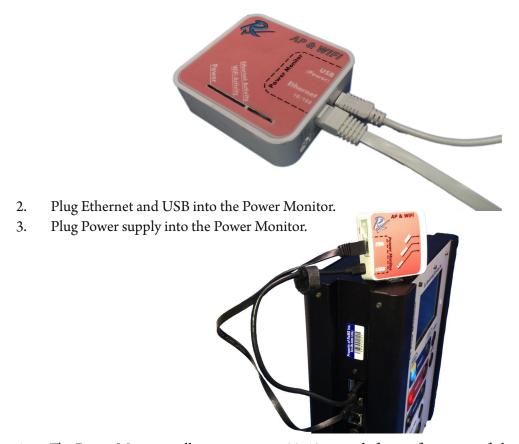
The second type is a Ethernet to Wi-Fi adapter (Blue) adapter that converts the wired 10/100 Ethernet to a 802.11N network for the Power Monitor. Please note that the Blue Wi-Fi adapter does <u>not</u> create a hot spot, it must be within range of a Red Wi-Fi adapter.

The Mesh adapter (Green) is a Access point with a mesh backend that can link multiple Green Mesh adapters together. They provide ethernet ports and a wireless AP to all reachable Green Mesh adapters. (Not compatable with Red/Blue)

Rx Monitoring Services, Inc. supplies all Access Points and Wi-Fi adapters described in this section.

Hotspot adapters (Red): Cannot use more than one in same space

1. Plug the Ethernet and USB into the AP & Wi-Fi adapter. (RED)



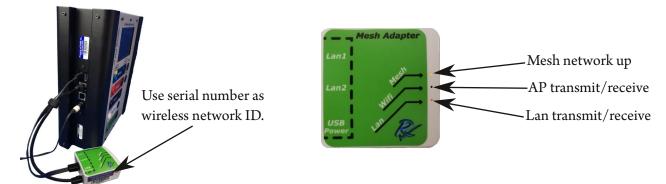
4. The Power Monitor will power up, wait 30-40 seconds for configuration of the Access point, when the adapter attaches the display will show ENET: 172.16.xx.xxx.

Wi-Fi only adapters (BLUE): Repeat for each additional the Power Monitor

- 5. Plug the Ethernet and USB into the Wi-Fi only adapter. (BLUE)
- 6. Plug Ethernet and USB into the Power Monitor.
- 7. Plug Power supply into the Power Monitor.



Mesh adapters (Green): Repeat for each Power Monitor (not compatable with Red or Blue)



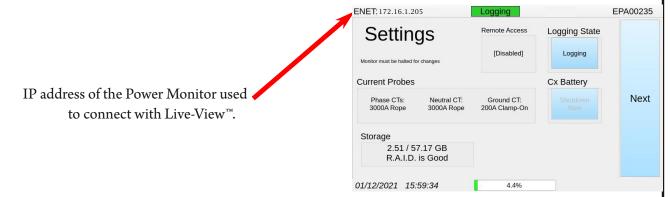
- 8. Plug the Ethernet and USB into the Mesh adapter. (GREEN)
- 9. Plug Ethernet and USB into the Power Monitor.
- 10. Power up the Power Monitor.
- 11. Once powered up, wait 30-40 seconds for Wi-Fi to attach to the Access point, when the adapter attaches the display will show ENET: 172.16.xx.xxx.
- 12. Using a computer or device with 802.11N connectivity attach to the Wireless Network

For Red Boxes =" RxClientWireless"

For Green Boxes = "WiFi00xxx" (Serial number on bar code)



13. Computer should now be able to talk using IP address on the display of the Power Monitor. Connect using this IP address in Live-View™.



Notes:

The Blue Wi-Fi only adapters will blink the "Wi-Fi Activity" LED when they are connected to the wireless access point. If this LED is not blinking check to see if the Red Access Aoint is on.

The "Ethernet Activity" will also blink, if not blinking ensure connection to USB and Ethernet at both ends.

Two AP & Wi-Fi boxes (Red) will not work in the same space.

Remote Access

Every Cx Plus Monitor™ will be shipped with the Remote Access feature <u>disabled</u>.

This feature has two modes:

- Remote Assistance: (No User entered) Once enabled, RxMS can access the Cx Plus Monitor™ remotely.
- Remote Access: Customer and RxMS can access remotely in this mode with a User Name and Password.

Enable Remote Assistance (RxMS can Access Remotely):

- 1. On the Cx Plus Monitor™ touch-screen, go to the Settings display.
- 2. Click Logging to stop Logging State.
- 3. Press the Remote Access button, which will show the prompt to change the Remote Access state.
- 4. Touch Yes.
- 5. Settings will show "[Enabled] No User"
- 6. Now that Cx Plus Monitor can be accessed by RxMS. Call RxMS to enable that Cx Plus Monitor™ as part of your user name or for troubleshooting.



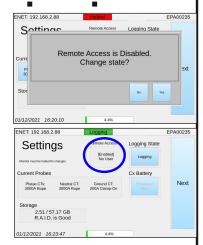
Local Remote

Refresh

Local Connect

ENET/WIFI: 192.168.2.8

Enter the Ethernet IP address that appears at the top of the display on the monitor above or select one of the monitors found on your network below



Enable Remote Access with Live-View™ (User can Access Remotely):

- 1. Contact RxMS for Remote Access User and Password.
- 2. Open Live-View[™] and connect to Cx Plus Monitor[™] by using the Local tab and inputting the IP Address from the screen then press Connect.
- 3. Click the Stop then Setup.



- 4. On the Network tab, click the check box Enable under the Remote Access section and input the provided User Name.
- 5. Click Test 2-3 times until it says Connected.
- 6. The Cx Plus Monitor™ touch-screen should show "[Enabled] Connected".
- Repeat these steps until all Cx Plus Monitors[™] are connected.



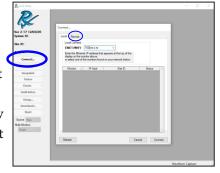
IP Address

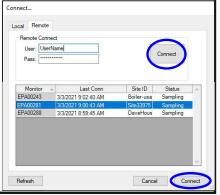
Cancel Connect

NET: 192.168.2.88

To Access Remotely:

- Open Live-View and click Connect.
- Click on the Remote tab.
- Type in the User and Password supplied by RxMS and click to Connect to the right.
- All enabled monitors will show up in the list with the Site ID and Status.
- Each Cx Plus Monitor[™] will be accessible by highlighting it and pressing the bottom right Connect.





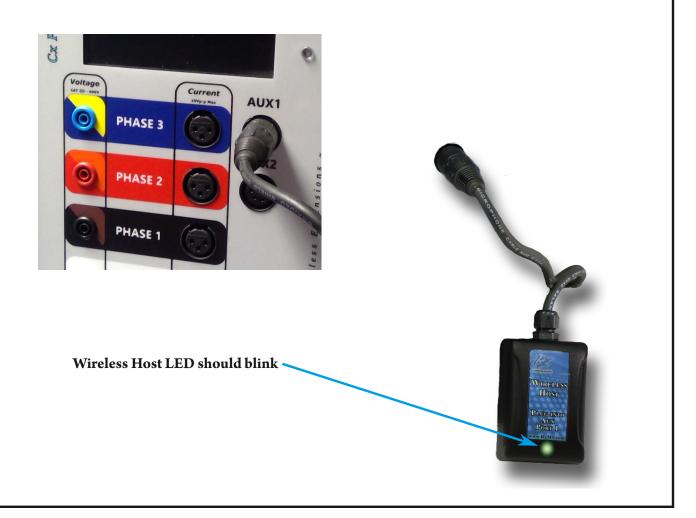
11. Power up and connect External Wireless Extensions

If your order does not include wireless extensions, please skip section and go to step #12.



THESE STEPS MUST BE FOLLOWED IN THE ORDER PRESENTED OR PROBLEMS WITH THE WIRELESS COMMUNICATION COULD OCCUR.

i. Plug wireless host into Aux port 1 of the Power Monitor

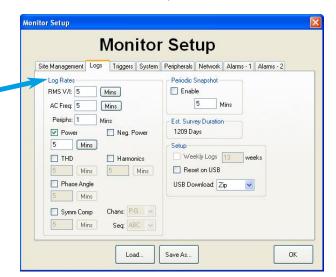


Equipment will come pre-programmed from Rx Monitoring Services, Inc. but for any changes in rate of data captured or if additional equipment is added, the instructions to setup peripherals are below, steps ii. and iii.

ii. Set Log Rate with Live-View[™] (See User Manual)

- a. Connect to the Power Monitor using Wi-Fi box or Ethernet crossover cable with Live-View™
- b. Go to Live-View[™] ==> Setup ==> Logs ==> Log Rates
- c. Set periphs log rate in Live-View[™], from 4 seconds to 30 minutes

If you change the log rate with peripherals already running, they will need to be reset to obtain new value.

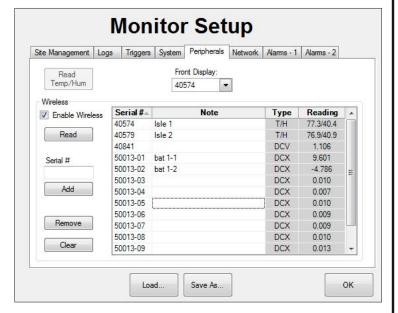


iii. Add peripherals serial numbers and notes

Use the Peripherals tab in Live-View[™] configure the monitors external peripherals

Click "Enable Wireless" to configure wireless mode.

- To add new peripherals, enter the serial number in the text box and click "Add".
- Remove peripherals by highlighting the serial number and clicking "Remove".
- User the "Clear" button to remove all of the currently entered serial numbers.
- "Front Display" selects which peripherals readings are to be displayed on the from panel of the monitor.





Peripheral Serial Number

iv. Power up units & confirm communication

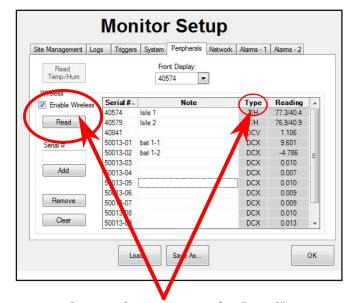
Switch & LED

- a. For the temperature & humidity and DC-1 probes, turn on by pressing the button at the top, for the DCx™ switch is on the front, and the DCw and DC Current probes are wall powered and have no on/off switch.
- An LED will blink red a number of times and then blink green when it has established communications with the Power Monitor.
- c. Click "Read" in Live-View™.



If it does not blink red or green or flickers red, check your batteries or outlet power. If it does not blink green, make sure you entered the serial number correctly and the wireless host is blinks.

- d. Current reading should appear as well as type for each of the peripherals. (This can take up to the log interval to appear.)
- e. Any peripherals that show a blank reading have not established or have lost communication with the monitor. Turn those peripherals off, wait 5 seconds, then turn on to have it reregister with the host



Readings and type appear after "Read" button is pressed.

The wireless peripherals will auto-shutoff if they are unable to communicate with the wireless host for more than ten minutes. Be careful not to power the system off while monitoring!

Battery life is directly linked to peripheral log rates, at the minimum log rate (4 seconds) the probes should last 8 weeks before batteries need to be changed. (DCx⁻⁻⁻ - 2 Weeks)

At max log rate (30 Minutes) batteries can last up to a year. (DCx⁻⁻⁻ - 3 Months)

v. Peripheral Specific Documentation

All wireless peripherals have a 100ft indoor range.



Temperature and Humidity Wireless Probe

Temperature and Humidity Wireless Usage

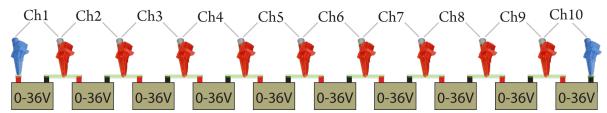
Use magnet on back of peripherals to place in desirable location for accurate readings.

DCx Wireless Usage

 Connect labeled wires from alligator clips to corresponding banana jacks on DCx™ probe. Note: Wireless DCx[™] probe is AC powered or battery powered. Each channel (10) can accept up to 60Vdc, for a total system voltage of 600V max.

If less the 11 connections are used, remaining channels will float to center point of connected voltage system.

Only 11 Connections for 10 Batteries



- b. Plug 12V adapter into 120Vac. (If used)
- c. Connect the 12V multi-plug adapter to DCx[™] or use 2x AA batteries.
- d. Turn power switch on. ("I" is on)
- c. Confirm LED operation. If it does not blink red or green or flickers red, check your batteries or outlet power.
- f. Use Live-View[™] (Meter Mode) to confirm battery state of charge (0-100%)
 This reads 100% if AC powered.



To connect more than one DCx[™] probe in series, connect Wire 11 of DCx[™] 1 (blue) to the same point as Wire 1 of DCx[™] 2 (Blue).

DCw Wireless Usage



This mode will use the wireless function of the DCw, attempting to communicate thought the wireless host on the Power Monitor.

Ensure the Power Monitor is powered on and the Wireless Host is plugged into port 1.

Attach 5 pin plug to DC current probe.



MAX 600V /



Attach the voltage leads.

The DCw inlcudes a DC Current probe that is calibrated to either 2000A or 4000A, they are NOT interchangeable.

The zeroing procedure for Hall effect current transducer:

- a. Leave the probe unconnected, but powered on.
- b. Turn the ZERO knob until the probe reads +/- Amp.
- c. Use Live-View[™] to see value or add DC current probe to Front Display.





Power up unit using the 24Vdc supply provided: At this point the DCw will attempt to communicate with the Power Monitor that was assigned to it.

The Host LED has two modes: Blinking = Searching for Host Solid = Host found and communicating. After DC probe is connected to the DCw, connect probe to point to be monitored.

Use the hanging kit to place in a convenient location.



Air Pressure Wireless Usage



This mode will use the wireless function of the Air Pressure probe. Attempting to communicate thought the wireless host on the Cx Monitor.

Ensure the Cx Monitor is powered on and the Wireless Host is plugged into port 1.

Attach the Air Pressure probe:

Use only the provided air pressure kit.



Power up unit using the 24Vdc supply provided:

At this point the Air pressure probe will attempt to communicate with the Cx Monitor that was assigned to it.



The Host LED has two modes:

Blinking = Searching for Host

Solid = Host found and communicating.

DCw/Air Pressure Wired Usage

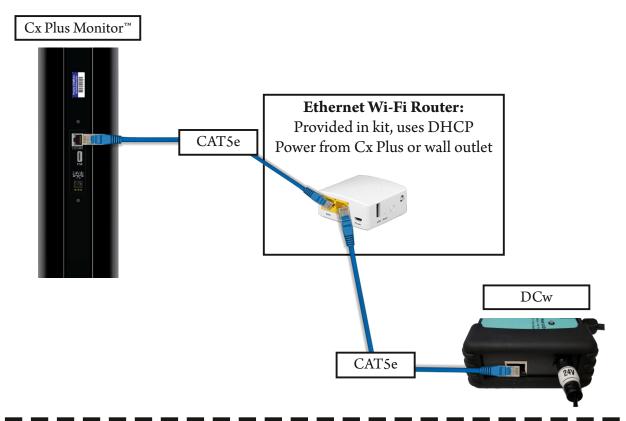
This mode will use the wired (Ethernet) function of the DCw, attempting to communicate though the Ethernet jack on the side of the DCw.

When DCw is attached to the Power Monitor through Ethernet it will not attempt wireless communication.

Equipment needed for this communication type:

- 1.) DCw
- 2.) Cx Plus Monitor[™]
- 3.) 2x Ethernet cords (CAT 5E or above)
- 4.) Ethernet router (DCw uses DHCP for IP address)

Basic layout





LED blinking when searching for Cx Plus Monitor™
Solid when Cx Plus found.

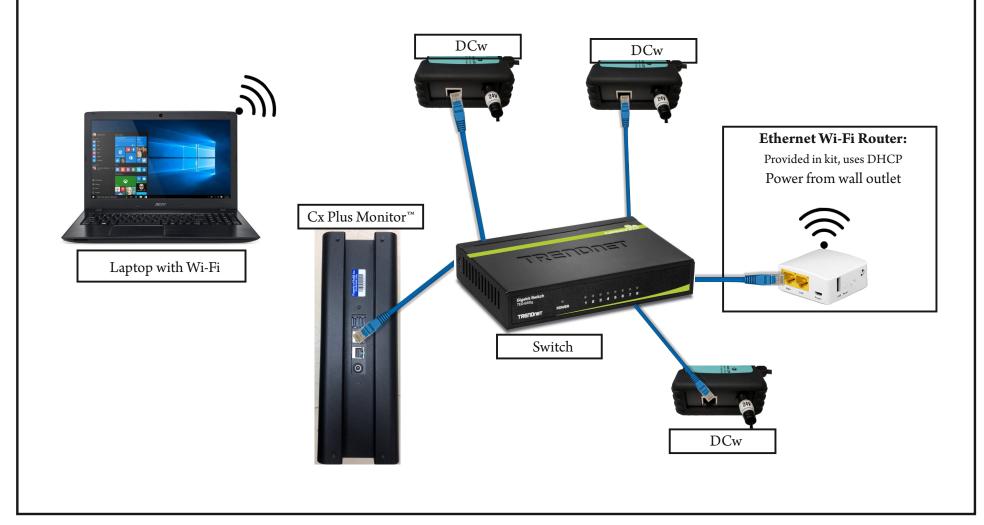
LED on if talking to the Power Monitor through Ethernet.

LED on and blinking if Ethernet cord and switch are working.

Advanced layout

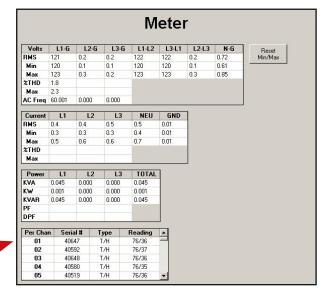
Equipment needed for this communication type:

- 1.) DCw, up to 6 with a 8 port switch
- 2.) Cx Plus Monitor™
- 3.) Ethernet cords (CAT 5E or above)
- 4.) Ethernet router (DCw uses DHCP for IP address)
- 5.) Ethernet switch (TRENDnet TEG-S80G) or similar



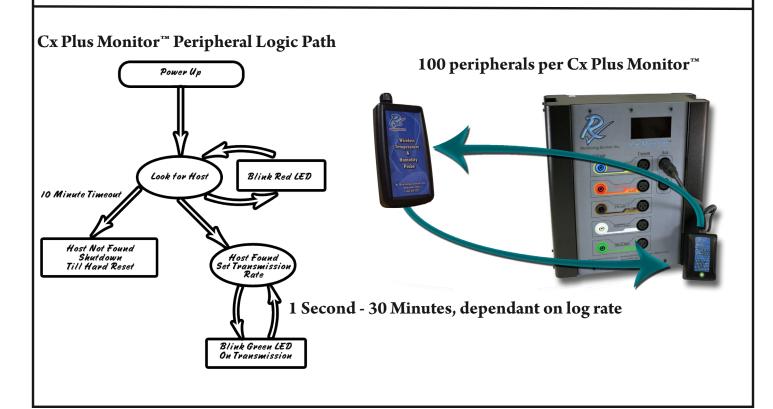
vi. Check complete setup in meter mode

The Meter Mode display shows measurement values in real time. The display is broken down into multiple sections; Volts, Current, Power, and if enabled, Wireless Peripherals.



The Wireless Peripherals section displays the current reading for each of the configured probes. If wireless peripherals are not enabled in Setup, the section is not displayed.

If a blank value is displayed for the reading, the monitor is unable to communicate with the peripheral. Check the peripheral to ensure that it is properly plugged in or that the batteries are still working.

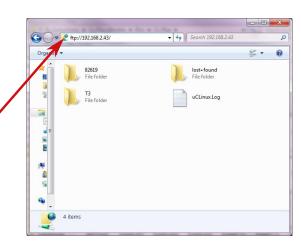


12. Download Data

- 1. Direct Download
- Establish an IP Address on the Power Monitor by using the Wi-Fi box or an Ethernet cord.
- Open Windows Explorer on your computer, then type in

ftp://IP Address shown on monitor/

• Copy or drag the files to a folder to save.





2. Using Wi-Fi

- Connect to the Power Monitor through an Ethernet cord or Wi-Fi box.
- Open Live-View[™] and connect to the monitor by using the IP Address displayed on the screen.
- Click Download from the left panel.
- Select and folder to download the data.



3. USB Download

- Power up monitor and insert USB memory stick.
- Monitor will automatically begin downloading data.

The screen will show a pop-up displaying what is downloading

 When USB download is done, time is dependant to the amount of data downloaded.

Display will show --- Complete--- Please remove USB device.



There are multiple modes that the Power Monitor can be operating in for file formats:

If the monitor is running in "Normal" mode, nothing is changed upon USB download.

If the monitor is running in "Weekly" mode, every Sunday at 12AM a new folder is created, the week number appended to the with original site code. These are in a FIFO format for a certain amount of weeks (Normally 26). If the monitor is running in "Reset on USB" mode, when the USB stick is inserted and data downloaded, a new folder is created with the date appended to the original site code.

Regardless of setup, data is never deleted when downloading using USB method.

All data is stored on the power monitor.

4. Send the monitor back to Rx Monitoring Services, Inc. download the data and can write the report.

13. Fill out Site Info and Detailed Site Log



Site Information Sheet



Detailed Site Log

- a. Please make sure you fully complete the RxMS Site Information sheet with the detailed information of the site and equipment being monitored.
- b. Make sure you leave the Detailed Site Log that was provided with the Power Monitor with your customer. Ask them to record any system events or errors that will help RxMS correlate gathered data to any issues you may be having with your system.
- c. Place the "Electrical Test In Progress" tag on the system under test (either on the main disconnect, panel or wires) so it is not disturbed during the monitoring period.
- d. Please contact RxMS at 1-888-329-2321 or email "support@rxms.com" once you have installed the Power Monitor.

14. Uninstall the Power Monitor and ship back to RxMS



Shipping Return Label

- a. Power down load and the main power.
- b. Unplug the power cord from the Power Monitor.
- c. Disconnect all probes from the Power Monitor.
- d. Pack all equipment in provided shipping case. Make sure the Cx Plus Monitor™ is FACE DOWN.
- e. Attach the enclosed return label and ship equipment back to RxMS.
- f. Please contact RxMS at 1-888-329-2321 or email "support@rxms.com" once you have dropped off or FedEx has picked up the Power Monitor.

Statements, Notices and Liability Information

FCC Part 15 Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the affected equipment and the panel receiver to separate outlets, on different branch circuits.
- Consult the dealer or an experienced radio/TV technician for help.

STATEMENT OF FAULTLESSNESS:

The information in this manual has been reviewed for accuracy at the time of writing. No responsibility can be assumed by Rx Monitoring Services Inc. for inaccuracy or changes that have taken place since production. The "Cx Plus Monitor User Manual" is for informational purposes only and is subject to change without notice.

LIABILITY:

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