SymphoniePRO®

USER'S MANUAL

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SECTION 1 | INTRODUCTION

1.1 | About This Manual

This SymphoniePRO® User's Manual is organized to provide a system overview followed by more detailed configuration and installation instructions. Users already familiar with previous generations of Symphonie loggers and iPacks will notice similar menus and terminology in the SymphoniePRO system.

Throughout this manual, the term "iPack" refers to either iPackGPS or iPackACCESS. We recommend reading the entire manual to take advantage of all the features and get the most out of your SymphoniePRO system.

1.2 | Manual Style Guide

Typographic Conventions

This type style is used for the general body of this manual.

Links to other sections and relevant information are underlined. Links may also be **bolded** and/or *italicized* depending on the location of the link.

Instructions in **Bold Type** refer to software commands and require you to perform an operation on screen, such as select the **Sites** tab, or press the **Download** button.

Instructions in **[Brackets]** refer to the logger keypad functions.

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This style is used to show actual prompts and messages that appear on the
                    SymphoniePRO logger display.
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Symbols

	This symbol is used to represent tool tips in the SymphoniePRO Desktop App. Putting your cursor over the symbol will reveal additional information relevant to a term or feature.
	This symbol indicates information that is critical to understanding the operation of the equipment and/or actions that could damage the equipment without endangering the user.
	This symbol indicates when additional documentation is required or recommended for the user to find information pertaining to sensors, instruments, and/or equipment other than the SymphoniePRO logger.
	This symbol indicates a hazard to the user, the equipment, or both that could result in serious injury or damage.
	This symbol indicates an electrical hazard to the user.
	This symbol indicates a hot surface hazard to the user, the equipment, or both. It may also indicate that bacon is cooking nearby.
	This symbol indicates an ESD hazard to sensitive equipment.

1.3 | Quick Start

The basic steps necessary to start receiving data from your SymphoniePRO system are as follows:

1. **Confirm** that the SymphoniePRO logger & iPack have up-to-date firmware versions.
2. Establish wireless service for the iPack by contacting your preferred wireless service provider. (NRG Systems *is not* a wireless service provider.)
3. **Install** SymphoniePRO Desktop App software on PC.
4. **Configure network** firewall to allow for remote connections: Logger-to-PC, and PC-to-Logger.
5. **Configure logger and iPack** and set up site information and communication schedule using SymphoniePRO Desktop App software and USB cable; save a copy of the Instrument Configuration File (*.LGR).
6. **Get familiar with navigation** of logger and iPack using the logger's keypad and display.
7. **Perform communication tests** such as successfully transmitting a data file via email, making a direct connection, remotely changing the logger configuration, etc.
8. **Install the shelter box** and PV panel on the tower.
9. **Install hanging bracket** on the back of the iPack or logger & mount in the shelter box.
10. **Connect earth grounding** and mount the wiring panel in the shelter box.
11. **Connect sensors** to the wiring panel.
12. **Connect the wiring panel** to the logger.
13. Scroll through all channels on logger's display (or review using connected laptop running SymphoniePRO Desktop App) to verify correct sensor connection and configuration.
14. **Perform test call or connection** and confirm receipt of data file.
15. **Use SymphoniePRO Desktop App** to download and import a raw (*.RLD) file.
16. **Open some *.RLD files** and use QuickView to review data.

Look at this beautiful shelter box. It's open and inviting just like your favorite romantic novel as you sit down to read it.

1.4 | Getting Help

NRG Systems offers a variety of support options to help you get the most from your NRG product. If you have questions about your NRG product, first look in the product documentation or the Knowledge Base on the Technical Services section of the NRG Systems website: www.nrgsystems.com/technical-support

If you cannot find the answer, contact your salesperson or NRG Systems Technical Support for assistance using the information below. Customer support is available 8:30 AM to 5:00 PM ET, Monday through Friday.

Telephone: +1 802-482-2255 ext. 3
Fax: +1 802-482-2272
Email: support@nrgsystems.com

When you call or email, please have the appropriate product documentation at hand and be prepared to give the following information:

- Customer name
- Who purchased equipment
- Item number or description
- **Serial numbers of all involved sensors & equipment**
- When equipment was purchased
- Where equipment is installed - terrain conditions
- Description of the problem with some detail
- Once again, the serial numbers of all involved sensors & equipment
- What events took place leading up to the problem
- What you have tried while attempting to solve the problem
- And finally, the serial numbers of all involved sensors & equipment

SymphoniePRO and the SymphoniePRO Desktop App produce several types of diagnostic data related to the equipment operation and the software. You may be asked to provide data files or logs to help us investigate an issue. All information and data provided are kept strictly confidential.

 NRG Systems maintains an extensive website which includes an in-depth customer support area. If you need assistance at times other than our regular business hours, we suggest visiting our website, www.nrgsystems.com.

All instruments, sensors, software, and towers manufactured by NRG Systems are designed to be reliable and easy to use. We welcome your comments and appreciate your help in making our products the best available.

1.5 | Product Overview

The NRG SymphoniePRO Data Logger is an advanced, internet-ready, low-power, microprocessor-controlled data logging system specifically designed for conducting resource assessments for the renewable energy industry. Each of the 16 or 26 standard channels' averages, standard deviations, and other statistical values are calculated from continuous 1 second data samples.

The SymphoniePRO logger has selectable statistical averaging intervals (1, 2, 5, 10, 15, 30, 60 minutes). One second samples can be recorded by the logger allowing review of the sample-by-sample data for complex scientific studies. Data intervals are time-stamped with the beginning time of each interval and are written to the internal Flash memory. If an SD card is installed, the data will also be stored on the SD card.

Addition of an iPack allows flexible options for data transfer through remote MetLink connections or standard email services. MetLink is a proprietary protocol optimized for NRG loggers and transfers data over multiple types of communication interfaces. MetLink allows connections to be initiated from either direction (from the logger or from SymphoniePRO Desktop App), and the MetLink Monitor utility can be used to view the status of active connections.

Various communications options are available to fit your application and location anywhere in the world. Cellular iPackGPS units can be easily connected to the back of the SymphoniePRO logger to enable remote communications via a cellular network. iPackACCESS can be used in conjunction with a BGAN M2M Satellite module for satellite communications capability where cellular service is either unavailable or unreliable. iPackACCESS can also be used to connect the SymphoniePRO logger directly to a SCADA system or local area network (LAN), where real-time (i.e., 1 Hz) data can be polled via Modbus TCP.

The SymphoniePRO Desktop App is used to process raw data files as well as configure and communicate with the SymphoniePRO logger and iPack. On-site configuration requires a laptop and USB adapter cable, while remote communication requires internet service.

Sensor scale factors and offsets configured in the SymphoniePRO logger can be edited with the SymphoniePRO Desktop App after data has been collected. Raw data is stored in the Site database file and can be exported to a tab-delimited text file (ASCII). The potential to edit scale factors and offsets in the Timeline view at any time provides the opportunity to change how raw files will be processed before generating ASCII data files.

Features of the SymphoniePRO Data Logger System

The SymphoniePRO logger is a 26-channel or 16-channel data logger optimized for renewable energy resource assessment. SymphoniePRO and its accompanying iPack are designed to be easy to install and reliable in any climate.

Data

- Proprietary, encrypt-able data files
- Can be exported as tab-delimited text files (ASCII) compatible with leading industry software

Data Logger

- Complies with industry standards such as IEC61400-12-1
- Requires no complex programming for data collection
- Statistical data stored include Average, Standard Deviation, Maximum and Minimum values for each channel, Maximum 3-second Gust, and Direction of Maximum Gust
- 1 Hz sample data configurable
- 8 MB internal flash
- External write-only SD card slot
- High-resolution analog-to-digital conversion
- Firmware for the iPack (and SymphoniePRO logger) can be upgraded remotely or on site using the Desktop App.

Software

- Available free to download from NRG Systems' website
- Easily configures PRO data logger & iPack
- .LGR instrument configuration file can be created in the Desktop App, saved to a computer, and loaded onto the PRO logger at a later time
- Allows viewing of real-time 1-second data during a Metlink connection
- Convenient access to complete sensor history information in the Timeline screen
- Integrated satellite image map for viewing site locations
- POPAuto software utility to automate extraction of emailed data

Communications

- iPackGPS kits for cellular communications provide remote data collection via e-mail and/or MetLink (TCP/IP)
- iPackACCESS kits for Ethernet (Modbus-capable) and BGAN M2M satellite communications
- Remote changes to sensor configuration and communication parameters via MetLink
- Integrated Global Positioning System (GPS) in iPackGPS and iPackACCESS

Channels

Below is a summary of available measurement channels on LOGR Data Logger | PV:

Channel Type	Channel Count (Capacity)	Channel Number Range
Counter	12	1 to 12
Analog | 2.5 or 5 V Excitation	3	13-15
Analog | 5 or 12 V Excitation	4	16-19
Analog | P-SCM	7	20-26
Serial (RS-485)	24	27-50
Calculated	10	100-109

Power

- System power provided through rechargeable 2200 mAh batteries in the iPack
- 12V external power input terminals on iPack for connecting auxiliary power system

1.6 | Precautions

Failure to adequately ground the system puts the logger and sensors at risk for electrostatic damage (ESD). The included grounding cable should be affixed to Earth ground to provide a discharge path from the logger to earth.

Care should be taken to avoid ground loops in the system when planning out your installation.

Environmental Considerations

- Sensor cables become less flexible and are more easily damaged at very low temperatures. Make sure that all cables are securely fastened so they do not flap in the wind.

- If the equipment will be exposed to high salinity, use protective grease or other dielectric agent on terminals and ground connections.

SECTION 2 | SYSTEM OVERVIEW

This section of the manual is designed to provide you with the basic information needed to prepare and install your SymphoniePRO system successfully. Section 3 | Pre-Installation Preparation

This section provides an overview of the hardware and software you will use to prepare your SymphoniePRO system for installation in the field. Relevant operational details are provided to help you optimize the system and its communications for your site and project.

All SymphoniePRO logger settings are configured through the software via MetLink connection (USB or remote) rather than through the logger's keypad. Initial configuration of your logger should be completed via USB cable and not remotely.

Logger settings are configured in the **Logger** and **Channels** screens found in the Instruments section of the Site screen in SymphoniePRO Desktop App. To initially configure your logger, install the D-cell batteries or connect the iPack to power it up, connect the logger to your PC using the USB cable, and start SymphoniePRO Desktop App.

3.1 | Firmware Updates

It is critical that your SymphoniePRO logger and accompanying iPack are using the most recent versions of firmware. The most recent versions of firmware can be downloaded from the NRG Systems website or through the SymphoniePRO Desktop App.

Firmware files are loaded onto the PRO logger and iPack through the Desktop App while the logger and iPack are connected via USB cable, or remote Metlink connection. Automated actions can also be used to install the latest firmware.

Once connected with SymphoniePRO Desktop App, iPack firmware can be updated to the latest version compatible with the SymphoniePRO logger. SymphoniePRO iPack firmware will have a version number in the format NN.NN.NN.ifw.

Updating iPacks with SymphoniePLUS3 Firmware

Any iPack that you will be using with the SymphoniePRO logger must have SymphoniePRO iPack firmware installed on it.

For any **iPackGPS with SymphoniePLUS3 firmware version 60** or higher or any **iPackACCESS with SymphoniePLUS3 firmware version 06** or higher, the iPack can be updated using the Desktop App.

For any **iPackGPS with SymphoniePLUS3 firmware version 59** or lower or any **iPackACCESS with SymphoniePLUS3 firmware version 05** or lower, the iPack must be updated using Symphonie Data Retriever (SDR).

3.2 | Physical Equipment Preparation

Installing D-Cell Batteries

1. Remove the black ABS plastic cover by loosening the three captive thumbscrews.
2. Insert D-cell batteries in the orientation shown below.
3. Re-install the cover and tighten the captive thumbscrews or proceed to Installing P-SCMs.

D-Cell battery insertion is shown above. The fabulous nails are not included.

Installing P-SCMs

1. Remove the black ABS plastic cover by loosening the three captive thumbscrews.
2. Insert P-SCM card(s) into the proper channel(s) that correspond to the .LGR instrument configuration file. P-SCM slots are labeled with the channel number in the diagram below and on the logger PCB.
   P-SCM cards are keyed and can only be completely inserted in one orientation.

   Do not force P-SCM cards into slots. *Forcing a P-SCM card into a slot may bend or break the pins on the card.*

3. Re-install the cover and tighten the captive thumbscrews.

   P-SCM cards are inserted below the D-cell batteries. Again, with the nails: gorgeous but unfortunately not included.

Opening & Closing the iPack

The iPack enclosure consists of two halves secured together by four recessed screws, two from each side of the enclosure. A gasket in between the two halves and eight O-rings provide an environmental seal for the iPack, protecting the internal electronics from the elements.

Risk of ESD damage to internal components! Discharge static electricity by touching the metal shell of the DB25 connector on the iPack enclosure before proceeding.

Opening

To open the iPack, remove the four recessed screws from the relevant holes in the enclosure, as indicated below. There are two screws in each half-shell. The iPack enclosure will then split apart.

Closing

1. Verify that the gasket is seated properly, the eight O-rings are in place in the corners, and all cables are clear of the edges.
2. Place the empty enclosure half onto the half containing the PCB & battery.
3. Install the four screws into the appropriate holes and tighten- two screws per half-shell.
   To prevent cross-threading, gently turn the screw counterclockwise one turn before tightening— it will fall into the existing threads in the iPack enclosure.

Installing SIM Card

1. Open the iPack.

2. Locate the modem inside the enclosure. The modem is usually attached to the iPack PCB left of the battery. There may be some variation in appearance or location of the modem depending on the flavor of iPack, but you're a smart cookie so I'm sure you can find it.
3. If there is a SIM card already installed, remove it. Insert your SIM card gently into the SIM slot with the gold contacts facing downwards.
4. Close the iPack.

Installing or Replacing Internal Battery

1. <u>Open the iPack</u>.
2. Locate the battery. Given the size and prominent location of the battery within the iPack enclosure, this should not be difficult.
3. Disconnect the battery leads from the battery terminals.
4. Gently remove the battery from its location. The battery is held in place by battery supports underneath and bumpers on the ends.
5. Put the new battery into the same location and orientation as the old battery.
6. Reconnect the leads to the proper (+/-) terminals.
7. If the iPack has two batteries, repeat steps 2-6 with the second battery.
8. <u>Close the iPack</u>.

3.3 | SymphoniePRO Logger | Equipment Menu Guide

Once the SymphoniePRO logger and iPack are programmed, settings can be reviewed on the logger's display using the Measurements, Functions, and Configuration menus and their sub-menus as described below.

LCD Screen Symbols

Shown along the bottom of the logger's display are the date, time, 12 V analog sensor current, and icons. The table below shows what these icons mean when displayed on the logger screen.

iPack Status	iPack powered on & idle		iPack transmitting	iPack listening for a connection
Communication	Data transfer		Data uploading	Data downloading
Battery	Empty battery		Full battery	Battery charging
SD Card	SD Card empty	SD Card locked	SD Card full	SD Card error

Logger Keypad Button Color Code

Logger keypad diagrams are colored to show the order buttons are pressed. Refer to the key below.

1	2	3	4

Measurements Menu | [Home][1]

Once the logger is configured, sensor information can be reviewed on the display through the Measurements menu **[Home][1]** by scrolling through each channel using the **[Up]** and **[Down]** arrow keys on the logger's keypad or by entering the channel number on the keypad.

The screen will show the sensor description, real-time measurement, height, and boom orientation for each channel. Pressing the **[Right]** arrow key provides additional channel information such as sensor type, serial number, transfer function.

Functions Menu | [Home][2]

The Functions menu **[Home][2]** provides access to several logger and iPack functions through the logger's keypad.
The following menus are available within the Functions menu:

1. Logger Functions
2. iPack Functions
3. iPack Setup Mode
4. Recent Events

Logger Functions | [Home][2][1]

Logger Status | [Home][2][1][1]

Displays configured Site Number, number of saved files, firmware version, & SD Card capacity.

Diagnostics | [Home][2][1][2]

Displays voltage, current, & power supply information.

Utilities | [Home][2][1][3]

1. Format SD Card
   Functionally erases the SD card. Can be used to prevent the database from becoming cluttered with empty or test data files.
2. Set Contrast
   Temporarily changes the display contrast. Use the **[Up]** & **[Down]** arrow keys to change the contrast. This will reset to factory default the next time the display is powered on.
3. Display Off
   Turns the logger display off.
4. **Reset Logger**
   Reboots the logger. The LGR file & logger configurations will remain saved on the logger.

iPack Functions | [Home][2][2]

If no iPack is connected or if a connected iPack has a dead battery, no "i" icon will be displayed and "iPack unavailable" will be shown on the logger's screen. If an iPack is connected and powered up, the iPack activity icon will show on the logger's display to indicate the iPack is on.

If the iPack is idle or powered off, navigating to the iPack menu **[Home][2][2]** will initialize the iPack. It may take up to a minute for the iPack to initialize and warm up. The screen will display the iPack's current status throughout this process.

Connection Test | [Home][2][2][1]

For the actions listed below to be successful, the logger must first have a correctly configured .LGR file loaded onto it. See *5.11 | Data Transfer & Communications | Schedules* Tab for the relevant fields to complete.

1. Initiate Primary

   Tests Metlink Logger Initiated to the Primary Host
2. Initiate Backup

   Tests Metlink Logger Initiated to the Secondary Host
3. Metlink Listen

   Turns on Metlink Listening mode
4. Metlink Diagnosis

   Initiates a diagnostic check-in to NRG Tech Services' server
5. Email No File

   Forces an email to be sent without a data file attached
6. Email One File

   Forces an email to be sent with the most recent data file attached
7. Email All Files

   Forces all unsent files to be emailed to recipient(s)
8. SNTP Time Update

   Updates the logger time from the configured SNTP server

Connection Status | [Home][2][2][2]

The iPack Status screen appears first, and you can view the other screens by pressing **[Right]** arrow on the logger keypad.

− iPack Status
− Modem Status (iPackGPS)
− Ethernet Status (iPackACCESS)
− Network Status
− Metlink Status

Shutdown iPack | [Home][2][2][3]

Closes all open connections to the iPack, disconnects from the internet, & turns off the iPack.

Reset iPack | [Home][2][2][4]

Reboots the iPack. Saved settings are not affected.

Disconnect | [Home][2][2][5]

Ends any current connection – Metlink, email, Modbus.

GPS Status | [Home][2][2][6]

Displays the GPS signal status, latitude, longitude, altitude, & number of acquired satellites.

Modbus Status (iPackACCESS Only) **| [Home][2][2][7]**

Displays the Modbus server status & the number of clients connected.

iPack Setup Mode | [Home][2][3]

Enabling iPack Setup Mode forces constant 12V power from the iPack and disables any scheduled actions (MetLink, email) for 30 minutes or until disabled, whichever comes first. This feature is useful when configuring a BGAN satellite antenna with iPackACCESS.

Recent Events | [Home][2][4]

The Recent Events screen lists the 15 most recently recorded events for the SymphoniePRO logger and iPack including successful calls, remote firmware updates, or clock adjustments.

The **[Up]** and **[Down]** arrow keys can be pressed to scroll through numbered logger and iPack events. The most recent events are displayed first. The numeric keypad can be used to enter a number to jump to a particular event.

All events are recorded in the data file. A comprehensive list of SymphoniePRO logger events and iPack events and their definitions can be found in the **Troubleshooting Section** of this manual.

Configurations Menu | [Home][3]

The Configuration menu provides a way to view settings configured in the SymphoniePRO Desktop App using the logger's display and keypad. Reviewing the settings found in the software can be useful if a laptop running SymphoniePRO Desktop App is not available.

The Configuration menu is structured like the Instruments section of the Desktop App software and provides the same settings and information found on the Logger, Channels, Schedules, and iPack screens in the software.

Within the Configuration menu, selecting a number on the keypad and then using the arrow keys allows navigation through the corresponding screens and settings in SymphoniePRO Desktop App. Note that these settings are read-only in the logger interface and can only be changed by connecting the logger to a PC with SymphoniePRO Desktop App.

3.4 | Office Testing

Before heading out to the field, you should verify that all equipment is working as expected. Make sure all equipment has the latest firmware version and that you are using the latest version of SymphoniePRO Desktop App.

Updates can be found on the NRG Systems website in the Technical Services section under Software Downloads: https://www.nrgsystems.com/support/product-support/documents/software

Why It Is Important

To put this in simple terms, **testing your SymphoniePRO system prior to installation in the field will save you time and money.** Communication capabilities rely on perfect coordination between device programming and accounts in addition to ISP and network/firewall settings; if these are not set up correctly, the system will not communicate.

In the event you encounter a problem during office testing, SymphoniePRO Desktop App's test buttons, event logs, and communications logs can be helpful in troubleshooting connection issues.

What You Will Need

If you haven't done so already, read the rest of this manual, paying particular attention to the chapter covering Field Installation. If you are ready to begin testing your SymphoniePRO system, you should have already completed the pre-installation configuration tasks described previously in this section.

You'll also need a few test sensors with cables, the field wiring panel and related hardware, a USB cable, an SD card, the antenna(es) included with your iPack, any cables or connectors used with your iPack, an iPack universal wall charger, P2 (+) & 3mm slotted (-) screwdrivers, and a computer with the latest version of SymphoniePRO Desktop App installed.

Testing Setup

1. Attach the SymphoniePRO logger and iPack together.
2. Connect the iPack to the Universal iPack Charger at the PV terminals.
3. Connect the wiring panel to the plug on the side of the logger using the 62-pin cable connector. Use the thumbscrews to secure the connection at both ends.
4. Connect a few test sensors. Refer to the sensor wiring diagram in the Desktop App **Channels** tab if needed.

Testing Remote Connections

We recommend performing a communications test when using the iPack to ensure that your connections are working as expected before heading to the field. Be sure you are in a location with coverage and that the antenna is connected. Also make sure that the frequency for the connection mode you wish to use (MetLink or Email) is not set to **Disabled** on the Schedules screen.

Performing a "Connection Test" through the **Functions** menu (**[Home][2][2][1]**) allows you to test different aspects of the communications. After the test is completed, verify that the raw data file was received by the intended recipient(s).

A good first test is **MetLink Diagnosis [Home][2][2][1][4]**. This test verifies that the system can connect to a fixed IP address at NRG Systems. The logger's display will show a series of status messages followed by the transfer and receipt of bytes of information. The number of clients will go from 0 to 1. The system will then disconnect, and the number of clients will go back to 0.

If the system is configured to send data via email, use **Email No File [Home][2][2][1][5]** or **Email One File [Home][2][2][1][6]** to verify that the modem and email functions are working well. **Initiate Primary [Home][2][2][1][1]** verifies that the logger can connect to the assigned IP address behind your company's firewall and communicate with SymphoniePRO Desktop App. **MetLink Listen [Home][2][2][1][3]** puts the logger in listening mode so that a test connection can be attempted with the SymphoniePRO Desktop App. When a successful MetLink connection is made, you will see the client count increase.

SymphoniePRO Desktop App is designed with many features for testing the various types of connections SymphoniePRO can utilize. The **Listen Now**, **Email Now**, **Test Email Settings**, and **Test** buttons on the **Schedules** tab can be used to verify and troubleshoot any connection issues. The **Display iPack Status** button can be found on both the Schedules screen and the iPack screen, and a log of the current iPack's connection can be obtained by clicking **View log file** at the bottom of the iPack Status screen.

Reading Raw Data Files

Read the raw file sent during the test call to confirm that sensor configurations are correct. You can do this by choosing Import Raw Logger Data files (*.RLD) from the File menu and then use Data Export in the Site Utilities screen to export the data in *.txt format for viewing in Excel, Notepad, etc.

Data File Format

File name format is as follows: SSSSSS_YYYY-MM-DD_HH.MM_FFFFFF.rld

SSSSSS = 6-digit site number
YYYY-MM-DD = Year, Month, Day that the file was created by the logger.
HH.MM = Hour and minute (24-hour time) that the file was created.
FFFFFF = 6-digit file number

To look at sensor measurements, go to the folder where raw files (*.RLD) are stored, and double click to open up .RLD QuickView.

Data File Size

Unlike older Symphonie data loggers, the size of a SymphoniePRO data file varies depending on how much data is collected within the file.

The maximum file size is 128 kb. If the logger is collecting more than 128 kb of data per day, it will break the day's data into multiple files.
For example, if "Stats & Samples" is selected to collect one-second data on a particular channel, the amount of data being stored will increase greatly, pushing the data recorded over 200 kb. In the case where 200 kb of data were recorded in a day, two files would be sent: one 128 kb file and one 72 kb file.

3.5 | Power Budget

NRG Systems prides itself on our 30-year history of producing very low-power consumption data loggers that can be left to run autonomously for years with just a small PV attached to the iPack. Because the SymphoniePRO supports remote connections where a user can remotely monitor and update a logger, the logger system may spend more time with the modem on than previous Symphonie models (depending on the frequency of such activity). Communication settings and sensor load are the two main drivers of overall power consumption for the fielded system.

Underestimating power requirements can lead to data loss and/or damage to equipment!

It is up to the owner and/or installer of the SymphoniePRO logger to determine the estimated power budget for the site where the logger will be used. NRG Systems will assist where possible but claims no responsibility for problems with the logger, iPack, or other equipment due to excessive power consumption.

Sensor Power Consumption

To calculate an estimate of the total power consumption of the sensors connected to the logger, refer to the specifications for each individual sensor and add them together. Because of the vast number of compatible sensors that can be used with a SymphoniePRO logger, no sensor specs are published in this manual.

Section 4 | Field Installation provides detailed descriptions of each installation step and wiring instructions.

2.1 | Unpacking Your SymphoniePRO

Confirm that you have received all components by comparing your order to the packing list included with your shipment. Immediately contact NRG Systems if any of the components are missing.

Do not remove the SymphoniePRO logger's brown desiccant pack from the clear plastic package at this point. During the field installation procedure, you will remove the clear wrapper and place the desiccant pack inside the SymphoniePRO's logger enclosure to keep it dry.

2.2 | SymphoniePRO Components Map
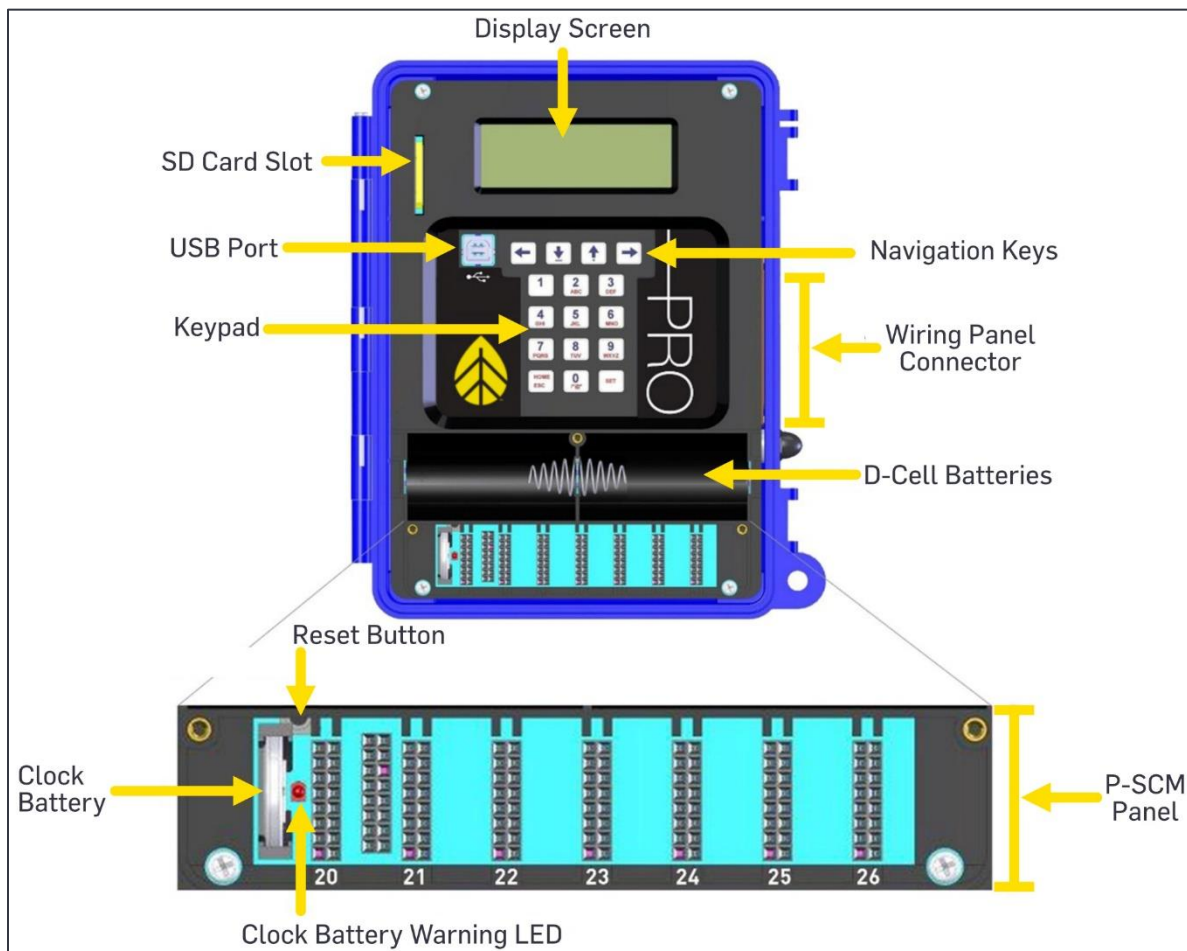
Keypad

The alphanumeric keys are used to enter the Logger Access PIN to gain access to the logger's display and to access logger menus. SymphoniePRO offers simplified programming through a USB connection to SymphoniePRO Desktop App software.

Navigation Keys

The navigation keys are used to move up and down lists, and to page forward and backward through items displayed on the logger's screen. Note that list items are also numbered and can also be selected by pressing the keypad number of the item.

Display

SymphoniePRO has a 20-character, 4-line display designed for reliable operation in extreme cold conditions. Display contrast can be adjusted for optimal viewing under different lighting conditions.

D-Cell Batteries

The logger's basic functions run on standard D-cell batteries which are protected by a battery cover. Batteries should be changed one at a time so that logging operations are not disrupted during the battery change. With an iPack installed, the D-cell batteries primarily function as backup batteries for all logging functions if the iPack is removed or loses power.

> *An iPack should be used even in the case where communications are not required. The "PV Only" iPack is recommended for this application.*
> *High-quality alkaline batteries (such as Energizer or Duracell) should be used in the logger, and they should be changed at least once per year to avoid leakage and equipment damage.*

Wiring Panel Connector

The 62-pin connector should be securely screwed down using the thumb screws. Protect the pins by aligning the connector well before inserting and avoid plugging in the connector at an angle.

USB Port

The USB port is the primary programming access port used for configuration of the logger and iPack settings.

USB Cable

The SymphoniePRO system uses a standard USB Type B to USB Type A connection (standard laptop USB connection). Cable sold separately.

Clock Battery

A lithium battery powers the logger clock even if D-cell batteries are not present. This allows the logger to retain date and time in the event of a reboot. Clock batteries will last 5+ years under normal use.

Clock Battery Warning LED

This LED illuminates if the clock battery has been installed backwards.

Reset Button

- A reset button is located between the clock battery and the first P-SCM slot on the main circuit board (partly hidden under the D-cell battery case).
- Should it become necessary to reset the SymphoniePRO logger, carefully place the NRG screwdriver (provided) or other long, thin tool in the upper corner just to the left of the "Channel 20" P-SCM slot and slide down to press the button. Hold until it beeps.
- When the reset button is pushed, the logger will beep and reset the logger's microprocessor, record a reset event, and resume sampling data for the current file.
- Resetting the logger may cause the data from the current statistical interval to be lost (depending on how long since data was last written to memory). The logger logs a reset event into the event log and continues adding data to the same file that was in progress before the reset.
- Collected data already written to memory and all logger configuration settings will be retained.

Note that a reset can also be initiated by the built-in watchdog in response to an ESD (electrostatic discharge) event. When an iPack is connected to a logger with no D-cells, this will also initiate a reset. The iPack provides auxiliary power to the logger and therefore powers it up in the absence of D-cells.

SD Card Slot

The SD card is inserted vertically in the SD card slot with the beveled front corner down. Care should be taken when inserting and removing the SD card – do not force the SD into the slot. Qualified, industrial-rated SD cards (512 MB or 2 GB) are available from NRG Systems.

Problems with SD cards not supplied by NRG Systems are not covered by warranty.

Hanging Bracket

The hanging bracket connects to the back of the iPack and allows the assembled logger and iPack to easily be installed in or removed from the shelter box using the keyed slots. The hanging bracket is included with the shelter box.

iPack Connector

On the back of the SymphoniePRO logger you'll find the 25-pin (male) connector for the iPack, which comes with a sticker over it to keep dust and moisture out until it's mated with the iPack. When ready to install the iPack to the logger, remove the protective water-resistant sticker from the back of the logger.

2.3 | Wiring Panel Options (16-Channel & 26-Channel)

SymphoniePRO supports two different wiring panels: A 16-channel version and a 26-channel version. The table below shows which logger channels are available for each wiring panel, and the SymphoniePRO software has a drop-down selector for choosing a wiring panel which makes configuration easy.

Logger Channel	Channel Type	26-Channel Wiring Panel	16-Channel Wiring Panel
1	Counter	✔	✔
2	Counter	✔	✔
3	Counter	✔	✔
4	Counter	✔	✔
5	Counter	✔	✔
6	Counter	✔	✔
7	Counter	✔	✔
8	Counter	✔	✔
9	Counter	✔	N/A
10	Counter	✔	N/A
11	Counter	✔	N/A
12	Counter	✔	N/A
13	Analog 2.5V or 5V EXC	✔	✔
14	Analog 2.5V or 5V EXC	✔	✔
15	Analog 2.5V or 5V EXC	✔	✔
16	Analog 5V or 12V EXC	✔	✔
17	Analog 5V or 12V EXC	✔	✔
18	Analog 5V or 12V EXC	✔	N/A
19	Analog 5V or 12V EXC	✔	N/A
20	Analog P-SCM	✔	✔
21	Analog P-SCM	✔	✔
22	Analog P-SCM	✔	✔
23	Analog P-SCM	✔	N/A
24	Analog P-SCM	✔	N/A
25	Analog P-SCM	✔	N/A
26	Analog P-SCM	✔	N/A
COM-A	RS-485	✔	N/A
COM-B	RS-485	✔	N/A

16-Channel Wiring Panel

The 16-Channel Wiring Panel (NRG Part #11178) connects directly to the right side of the logger in the same way previous versions of Symphonie loggers did.
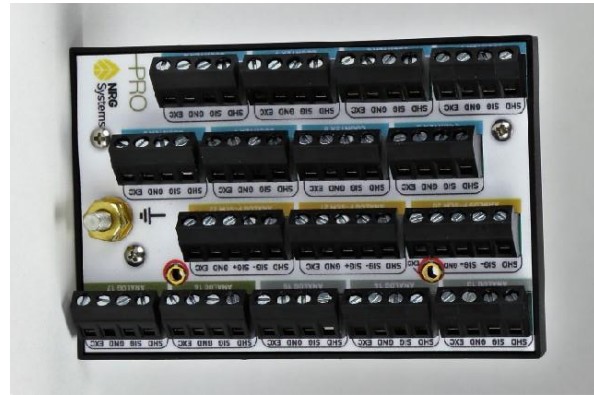
> **SymphoniePRO loggers produced prior to June of 2017, are not compatible with the 16-Channel Wiring Panel.** *Please check your logger serial number and manufacture date prior to ordering a 16-Channel Wiring Panel.*

> *Wiring Panels for Symphonie, SymphoniePLUS, and SymphoniePLUS3 loggers are NOT compatible with the SymphoniePRO logger.*
> **Do not connect these older generation wiring panels to a SymphoniePRO logger.**

26-Channel Wiring Panel

The 26-Channel Wiring Panel (item 8150) connects to the logger using an NRG cable assembly (NRG Part #8150). Installing the 26-Channel Wiring Panel in the shelter box prior to installing the SymphoniePRO logger and iPack may make it easier to wire the sensors.
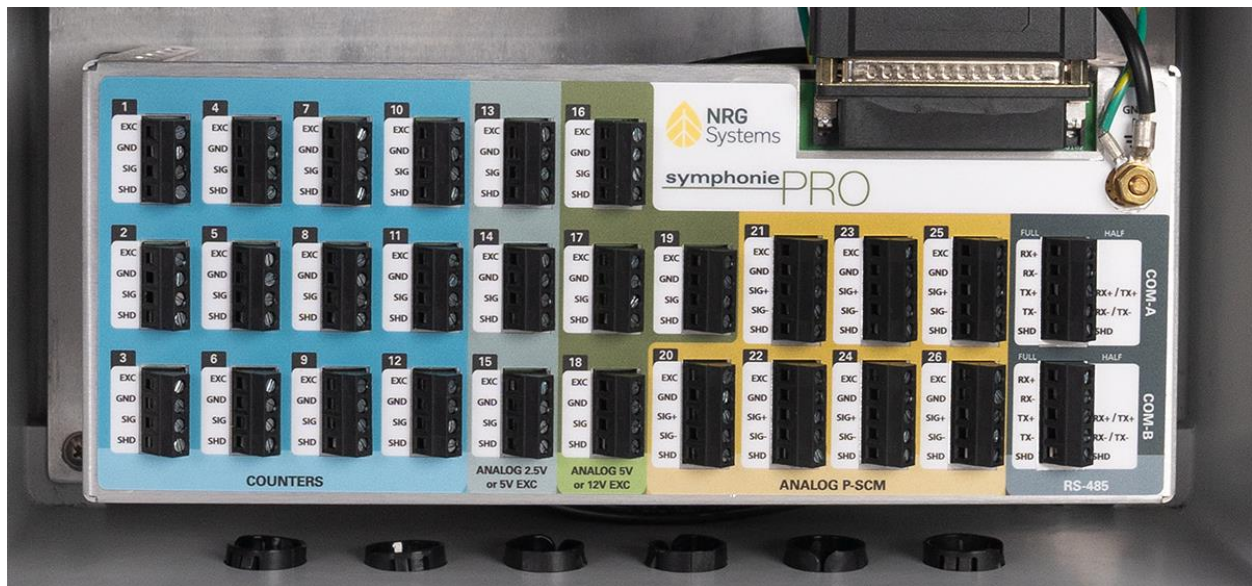
2.4 | Channels

Counter Channels 1 – 12

The counter channels are compatible with industry-standard anemometers and tipping rain buckets. A 12 V excitation is available for each channel. Signal type can be pulse or coil, and an internal pull-up resistor can be turned on for reed switch signals. Channels 8 and 9 can be configured to accept high frequency sine wave signals.

Analog 2.5 V or 5 V Excitation Channels 13 – 15

These analog voltage channels accept input signals from 0 to 5 V and are ideal for wind direction vanes and NRG temperature probes. A user-selectable excitation voltage of 2.5 V or 5 V is available for each channel.

Analog 5 V or 12 V Excitation Channels 16 – 19

These analog voltage channels accept input signals from 0 to 5 V and are intended for use with other met sensors, such as: NRG barometric pressure, relative humidity, and temperature sensors. Each channel has a user-selectable excitation voltage of 5 V or 12 V.

Analog P-SCM Channels 20 – 26

These analog channels accept a wider range of sensors when paired with a SymphoniePRO Signal Conditioning Module (P-SCM). Available inputs include analog voltage (up to 30 V), thermopile pyranometers, 0-20 mA current loops, and thermistors. Signal (+) and Signal (–) are available for differential inputs on each of the seven channels.

The best place to find the current list of available P-SCMs is in the **Channels** tab of the latest version of the SymphoniePRO Desktop App, which can be accessed when connected to a logger or creating an .LGR instrument configuration file. You can also contact your NRG Sales Representative or Technical Services.

Serial Channels 27-50

The serial channels are for RS485 digital "smart" sensors with Modbus RTU outputs. These sensors include advanced pyranometers, soiling measurement sensors, reference cells, ultrasonic sensors, and more. Depending on the specific sensor, multiple channels can be enabled for the same smart sensor for different measurands.

Calculated Channels 100-109

Calculated channels are available to produce statistical values using data from sensor channels. They can be used for irradiance comparisons and solar angles to verify and troubleshoot data.

2.5 | iPack

SymphoniePRO data loggers require an iPack to be attached to the back of the logger to allow it to operate autonomously in the field. The iPack provides 12 V DC excitation voltage to the logger and connected sensors. It is also a communications module used to establish remote MetLink connections and to email data files.

Battery & PV Panel

iPacks contain a 12 VDC rechargeable battery and integrated charge controller that allows the logger and iPack to run autonomously. A PV panel is wired into the iPack's "PV" terminal on the side of the iPack enclosure. This PV input can handle between 15 to 28 VDC, at up to 1 A.

The second input on the side of the iPack (labeled "12 V Ext. Bat") can be used to connect an external battery system to the iPack. **This terminal does not charge the internal iPack battery** and can only handle 14 V DC at 500 mA max. Applying higher voltage batteries or PV panels to this terminal may result in damage to the iPack. Use a voltage controller when connecting external batteries to the iPack.

GPS

All iPackGPS units (and the iPackACCESS) have an internal GPS module and an external terminal for a GPS antenna to be attached.

The GPS is enabled if it has been more than one day since it last successfully acquired lock with satellites. If the communication schedule is set to an interval of longer than one day, the GPS will be activated according to that schedule.

If the current location reported by the GPS is more than 200 meters from the last stored position, the logger updates the location information and creates an entry in the event log. The GPS is also used to sync the logger clock if it is selected as a Time Service in the logger configuration.

iPack Types

See _6.1 |_ Communication Options in Section 6.

2.6 | Additional Related Hardware

A USB Type-B to USB Type-A (standard laptop USB connection) cable is used to configure the logger and iPack with SymphoniePRO Desktop App software; router and other network infrastructure may be required to support some communication protocols.

2.7 | Software

SymphoniePRO Desktop Application

SymphoniePRO Desktop Application (or "Desktop App") is used to configure the SymphoniePRO logger & iPack, communicate remotely and upgrade instrument firmware in the field, view live data, process, & store incoming data, export data, and provide data summary reports.

Home Screen

The **Home Screen** provides a fleet view of existing sites listed in rows, sortable by column. Right-clicking on any Project site in the Fleet View list provides the option to edit remote connection settings, view site information, delete the site, refresh the site list, hide the map, or display times using the PC's local time zone (instead of the site's local time zone).

Selecting an existing site by double-clicking opens the **Site Utilities** screen. The **File**, **Site**, **Logger**, and **Help** menus appear in the upper right corner of the screen. More information about these is found in Section 5 of this manual.

Left Navigation Pane

The left pane is divided into three functional parts, **Fleet View**, **Site**, and **Instruments**.

Clicking on the **Fleet View** icon will return you to the home screen with all sites and connected loggers.

The **Site** section contains buttons to access the **Site Utilities**, **Automation**, **Timeline**, and **Reports** screens:

The **Site Utilities** screen handles database related functions such as editing site information, exporting data, and storing the data encryption password.

The **Automation** screen allows you to configure automated actions to be performed during the next MetLink connection such as upgrading firmware, retrieving files, and importing retrieved files into the database.

The **Timeline** screen is used for tracking and editing sensor histories, viewing logger events and communication logs.

The **Reports** screen allows generation of exportable and printable reports based on the site data.

The **Instruments** section contains buttons to access the **Logger**, **Channels**, **Schedules**, and **iPack** screens, and to **Connect** remotely to a logger in the field:

The **Logger** screen controls logger configuration and security settings.

The **Channels** screen allows individual channel configurations.

The **Schedules** screen is used to set the connection schedules for different types of remote connections.

The **iPack** screen provides connection status information and upgrades firmware for the iPack. Some advanced settings such as frequency band or mobile carrier selection are also available from the iPack screen.
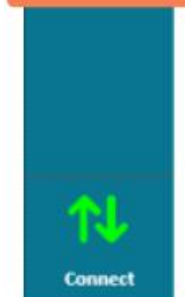
The **Connect** arrows indicate whether a logger is connected to the Desktop App (green) or not (gray).

Edited fields are highlighted or un-highlighted when changes are saved or discarded. When navigating between the different tabs on left pane of the screen, unsaved changes are noted in the left navigation bar on the relevant screen icon as well as noted in the upper right corner of the page. A **Save All** button saves all changes made within the **Instruments** tabs. To discard changes made in the **Instruments** tabs, click the **Discard All** button.
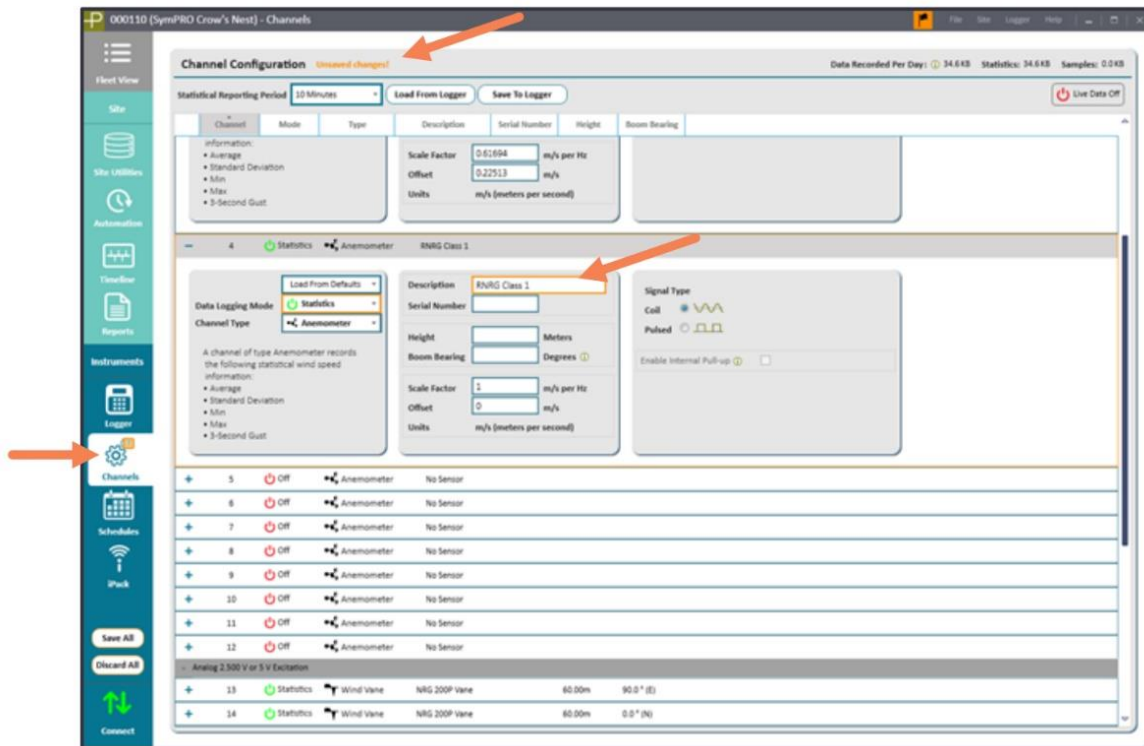
Network Considerations

You may need to consult with your organization's IT staff regarding network requirements and firewalls. The user must have administrative privileges to perform the software installation. However, the data folder can be written to without administrative privileges. For more information on firewall requirements, refer to **Section 6 | Communications & Data**.

SECTION 3 | PRE-INSTALLATION PREPARATION

This section provides an overview of the hardware and software you will use to prepare your SymphoniePRO system for installation in the field. Relevant operational details are provided to help you optimize the system and its communications for your site and project.

All SymphoniePRO logger settings are configured through the software via MetLink connection (USB or remote) rather than through the logger's keypad. Initial configuration of your logger should be completed via USB cable and not remotely.

Logger settings are configured in the **Logger** and **Channels** screens found in the Instruments section of the Site screen in SymphoniePRO Desktop App. To initially configure your logger, install the D-cell batteries or connect the iPack to power it up, connect the logger to your PC using the USB cable, and start SymphoniePRO Desktop App.

SymphoniePRO Initial Configuration via USB
User PC to SymphoniePRO
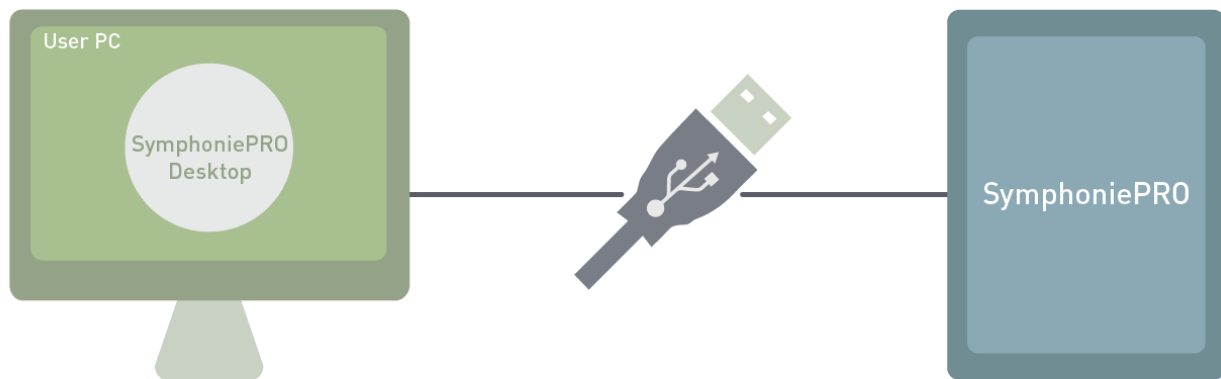
3.1 | Firmware Updates

It is critical that your SymphoniePRO logger and accompanying iPack are using the most recent versions of firmware. The most recent versions of firmware can be downloaded from the NRG Systems website or through the SymphoniePRO Desktop App.

Updating iPackGPS for SymphoniePRO use

Firmware files are loaded onto the PRO logger and iPack through the Desktop App while the logger and iPack are connected via USB cable, or remote Metlink connection. Automated actions can also be used to install the latest firmware.

Once connected with SymphoniePRO Desktop App, iPack firmware can be updated to the latest version compatible with the SymphoniePRO logger. SymphoniePRO iPack firmware will have a version number in the format NN.NN.NN.ifw.

Updating iPacks with SymphoniePLUS3 Firmware

Any iPack that you will be using with the SymphoniePRO logger must have SymphoniePRO iPack firmware installed on it.

For any **iPackGPS with SymphoniePLUS3 firmware version 60** or higher or any **iPackACCESS with SymphoniePLUS3 firmware version 06** or higher, the iPack can be updated using the Desktop App.

For any **iPackGPS with SymphoniePLUS3 firmware version 59** or lower or any **iPackACCESS with SymphoniePLUS3 firmware version 05** or lower, the iPack must be updated using Symphonie Data Retriever (SDR).

3.2 | Physical Equipment Preparation

Installing D-Cell Batteries

4. Remove the black ABS plastic cover by loosening the three captive thumbscrews.
5. Insert D-cell batteries in the orientation shown below.
6. Re-install the cover and tighten the captive thumbscrews or proceed to Installing P-SCMs.

D-Cell battery insertion is shown above. The fabulous nails are not included.

Installing P-SCMs

4. Remove the black ABS plastic cover by loosening the three captive thumbscrews.
5. Insert P-SCM card(s) into the proper channel(s) that correspond to the .LGR instrument configuration file. P-SCM slots are labeled with the channel number in the diagram below and on the logger PCB.
   P-SCM cards are keyed and can only be completely inserted in one orientation.

> **Do not force P-SCM cards into slots.** *Forcing a P-SCM card into a slot may bend or break the pins on the card.*

6. Re-install the cover and tighten the captive thumbscrews.

P-SCM cards are inserted below the D-cell batteries. Again, with the nails: gorgeous but unfortunately not included.

Opening & Closing the iPack

The iPack enclosure consists of two halves secured together by four recessed screws, two from each side of the enclosure. A gasket in between the two halves and eight O-rings provide an environmental seal for the iPack, protecting the internal electronics from the elements.

Risk of ESD damage to internal components! Discharge static electricity by touching the metal shell of the DB25 connector on the iPack enclosure before proceeding.

Opening

To open the iPack, remove the four recessed screws from the relevant holes in the enclosure, as indicated below. There are two screws in each half-shell. The iPack enclosure will then split apart.

Closing

4. Verify that the gasket is seated properly, the eight O-rings are in place in the corners, and all cables are clear of the edges.
5. Place the empty enclosure half onto the half containing the PCB & battery.
6. Install the four screws into the appropriate holes and tighten- two screws per half-shell.
   To prevent cross-threading, gently turn the screw counterclockwise one turn before tightening– it will fall into the existing threads in the iPack enclosure.

Installing SIM Card

5. <u>Open the iPack</u>.
6. Locate the modem inside the enclosure. The modem is usually attached to the iPack PCB left of the battery. There may be some variation in appearance or location of the modem depending on the flavor of iPack, but you're a smart cookie so I'm sure you can find it.
7. If there is a SIM card already installed, remove it. Insert your SIM card gently into the SIM slot with the gold contacts facing downwards.
8. <u>Close the iPack</u>.
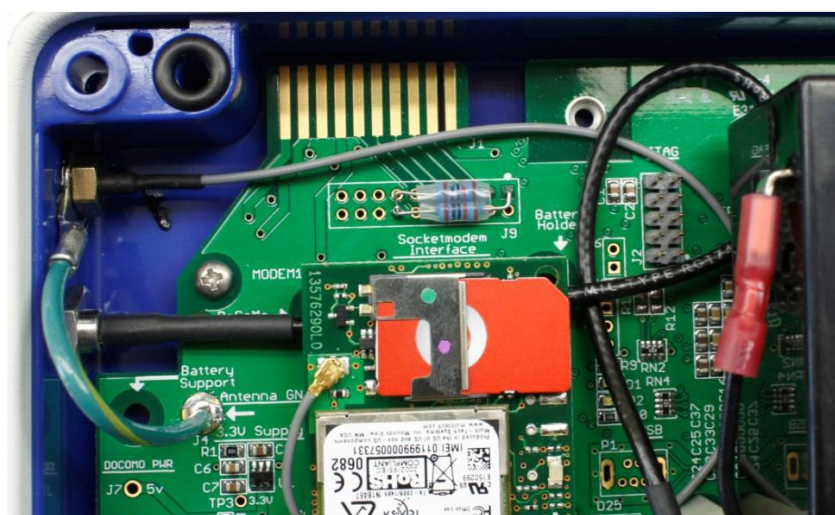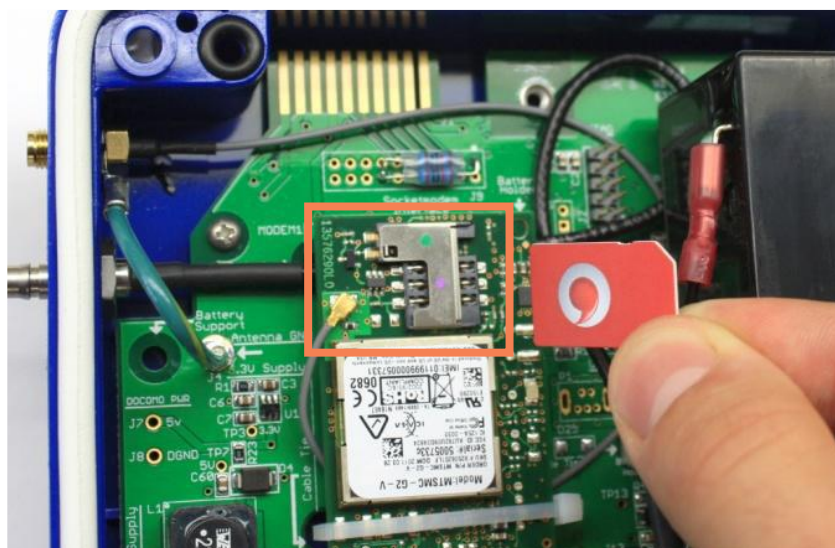
Installing or Replacing Internal Battery

9. Open the iPack.
10. Locate the battery. Given the size and prominent location of the battery within the iPack enclosure, this should not be difficult.
11. Disconnect the battery leads from the battery terminals.
12. Gently remove the battery from its location. The battery is held in place by battery supports underneath and bumpers on the ends.
13. Put the new battery into the same location and orientation as the old battery.
14. Reconnect the leads to the proper (+/-) terminals.
15. If the iPack has two batteries, repeat steps 2-6 with the second battery.
16. Close the iPack.

3.3 | SymphoniePRO Logger | Equipment Menu Guide

Once the SymphoniePRO logger and iPack are programmed, settings can be reviewed on the logger's display using the Measurements, Functions, and Configuration menus and their sub-menus as described below.

LCD Screen Symbols

Shown along the bottom of the logger's display are the date, time, 12 V analog sensor current, and icons. The table below shows what these icons mean when displayed on the logger screen.

iPack Status	iPack powered on & idle	iPack transmitting	iPack listening for a connection
Communication	Data transfer	Data uploading	Data downloading
Battery	Empty battery	Full battery	Battery charging
SD Card	SD Card empty / SD Card locked	SD Card full	SD Card error

Logger Keypad Button Color Code

Logger keypad diagrams are colored to show the order buttons are pressed. Refer to the key below.

1	2	3	4

Measurements Menu | [Home][1]

Once the logger is configured, sensor information can be reviewed on the display through the Measurements menu **[Home][1]** by scrolling through each channel using the **[Up]** and **[Down]** arrow keys on the logger's keypad or by entering the channel number on the keypad.

The screen will show the sensor description, real-time measurement, height, and boom orientation for each channel. Pressing the **[Right]** arrow key provides additional channel information such as sensor type, serial number, transfer function.

Functions Menu | [Home][2]

The Functions menu **[Home][2]** provides access to several logger and iPack functions through the logger's keypad.
The following menus are available within the Functions menu:

5. Logger Functions
6. iPack Functions
7. iPack Setup Mode
8. Recent Events

Logger Functions | [Home][2][1]
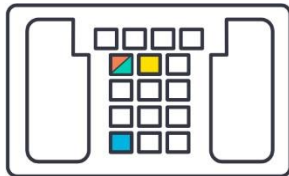
Logger Status | [Home][2][1][1]

Displays configured Site Number, number of saved files, firmware version, & SD Card capacity.
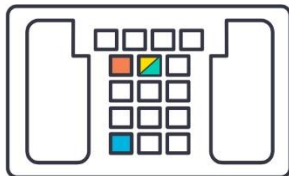
Diagnostics | [Home][2][1][2]

Displays voltage, current, & power supply information.

Utilities | [Home][2][1][3]
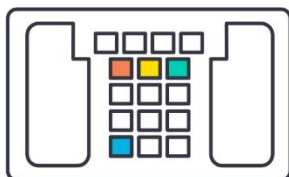
5. Format SD Card
   Functionally erases the SD card. Can be used to prevent the database from becoming cluttered with empty or test data files.
6. Set Contrast
   Temporarily changes the display contrast. Use the **[Up]** & **[Down]** arrow keys to change the contrast. This will reset to factory default the next time the display is powered on.
7. Display Off
   Turns the logger display off.
8. **Reset Logger**
   Reboots the logger. The LGR file & logger configurations will remain saved on the logger.

iPack Functions | [Home][2][2]

If no iPack is connected or if a connected iPack has a dead battery, no "i" icon will be displayed and "iPack unavailable" will be shown on the logger's screen. If an iPack is connected and powered up, the iPack activity icon will show on the logger's display to indicate the iPack is on.

If the iPack is idle or powered off, navigating to the iPack menu **[Home][2][2]** will initialize the iPack. It may take up to a minute for the iPack to initialize and warm up. The screen will display the iPack's current status throughout this process.

Connection Test | [Home][2][2][1]

For the actions listed below to be successful, the logger must first have a correctly configured .LGR file loaded onto it. See *5.11 | Data Transfer & Communications | Schedules* Tab for the relevant fields to complete.

9. Initiate Primary

    Tests Metlink Logger Initiated to the Primary Host

10. Initiate Backup

    Tests Metlink Logger Initiated to the Secondary Host

11. Metlink Listen

    Turns on Metlink Listening mode

12. Metlink Diagnosis

    Initiates a diagnostic check-in to NRG Tech Services' server

13. Email No File

    Forces an email to be sent without a data file attached

14. Email One File

    Forces an email to be sent with the most recent data file attached

15. Email All Files

    Forces all unsent files to be emailed to recipient(s)

16. SNTP Time Update

    Updates the logger time from the configured SNTP server

Connection Status | [Home][2][2][2]

The iPack Status screen appears first, and you can view the other screens by pressing **[Right]** arrow on the logger keypad.

- iPack Status
- Modem Status (iPackGPS)
- Ethernet Status (iPackACCESS)
- Network Status
- Metlink Status

Shutdown iPack | [Home][2][2][3]

Closes all open connections to the iPack, disconnects from the internet, & turns off the iPack.

Reset iPack | [Home][2][2][4]

Reboots the iPack. Saved settings are not affected.

Disconnect | [Home][2][2][5]

Ends any current connection – Metlink, email, Modbus.

GPS Status | [Home][2][2][6]

Displays the GPS signal status, latitude, longitude, altitude, & number of acquired satellites.

Modbus Status (iPackACCESS Only) **| [Home][2][2][7]**

Displays the Modbus server status & the number of clients connected.

iPack Setup Mode | [Home][2][3]

Enabling iPack Setup Mode forces constant 12V power from the iPack and disables any scheduled actions (MetLink, email) for 30 minutes or until disabled, whichever comes first. This feature is useful when configuring a BGAN satellite antenna with iPackACCESS.

Recent Events | [Home][2][4]

The Recent Events screen lists the 15 most recently recorded events for the SymphoniePRO logger and iPack including successful calls, remote firmware updates, or clock adjustments.

The **[Up]** and **[Down]** arrow keys can be pressed to scroll through numbered logger and iPack events. The most recent events are displayed first. The numeric keypad can be used to enter a number to jump to a particular event.

All events are recorded in the data file. A comprehensive list of SymphoniePRO logger events and iPack events and their definitions can be found in the **Troubleshooting Section** of this manual.

Configurations Menu | [Home][3]

The Configuration menu provides a way to view settings configured in the SymphoniePRO Desktop App using the logger's display and keypad. Reviewing the settings found in the software can be useful if a laptop running SymphoniePRO Desktop App is not available.

The Configuration menu is structured like the Instruments section of the Desktop App software and provides the same settings and information found on the Logger, Channels, Schedules, and iPack screens in the software.

Within the Configuration menu, selecting a number on the keypad and then using the arrow keys allows navigation through the corresponding screens and settings in SymphoniePRO Desktop App. Note that these settings are read-only in the logger interface and can only be changed by connecting the logger to a PC with SymphoniePRO Desktop App.

3.4 | Office Testing

Before heading out to the field, you should verify that all equipment is working as expected. Make sure all equipment has the latest firmware version and that you are using the latest version of SymphoniePRO Desktop App.

Updates can be found on the NRG Systems website in the Technical Services section under Software Downloads: https://www.nrgsystems.com/support/product-support/documents/software

Why It Is Important

To put this in simple terms, **testing your SymphoniePRO system prior to installation in the field will save you time and money.** Communication capabilities rely on perfect coordination between device programming and accounts in addition to ISP and network/firewall settings; if these are not set up correctly, the system will not communicate.

In the event you encounter a problem during office testing, SymphoniePRO Desktop App's test buttons, event logs, and communications logs can be helpful in troubleshooting connection issues.

What You Will Need

If you haven't done so already, read the rest of this manual, paying particular attention to the chapter covering Field Installation. If you are ready to begin testing your SymphoniePRO system, you should have already completed the pre-installation configuration tasks described previously in this section.

You'll also need a few test sensors with cables, the field wiring panel and related hardware, a USB cable, an SD card, the antenna(es) included with your iPack, any cables or connectors used with your iPack, an iPack universal wall charger, P2 (+) & 3mm slotted (-) screwdrivers, and a computer with the latest version of SymphoniePRO Desktop App installed.

Testing Setup

5. Attach the SymphoniePRO logger and iPack together.
6. Connect the iPack to the Universal iPack Charger at the PV terminals.
7. Connect the wiring panel to the plug on the side of the logger using the 62-pin cable connector. Use the thumbscrews to secure the connection at both ends.
8. Connect a few test sensors. Refer to the sensor wiring diagram in the Desktop App **Channels** tab if needed.

Testing Remote Connections

We recommend performing a communications test when using the iPack to ensure that your connections are working as expected before heading to the field. Be sure you are in a location with coverage and that the antenna is connected. Also make sure that the frequency for the connection mode you wish to use (MetLink or Email) is not set to **Disabled** on the Schedules screen.

Performing a "Connection Test" through the **Functions** menu (**[Home][2][2][1]**) allows you to test different aspects of the communications. After the test is completed, verify that the raw data file was received by the intended recipient(s).

A good first test is **MetLink Diagnosis [Home][2][2][1][4]**. This test verifies that the system can connect to a fixed IP address at NRG Systems. The logger's display will show a series of status messages followed by the transfer and receipt of bytes of information. The number of clients will go from 0 to 1. The system will then disconnect, and the number of clients will go back to 0.

If the system is configured to send data via email, use **Email No File [Home][2][2][1][5]** or **Email One File [Home][2][2][1][6]** to verify that the modem and email functions are working well. **Initiate Primary [Home][2][2][1][1]** verifies that the logger can connect to the assigned IP address behind your company's firewall and communicate with SymphoniePRO Desktop App. **MetLink Listen [Home][2][2][1][3]** puts the logger in listening mode so that a test connection can be attempted with the SymphoniePRO Desktop App. When a successful MetLink connection is made, you will see the client count increase.

SymphoniePRO Desktop App is designed with many features for testing the various types of connections SymphoniePRO can utilize. The **Listen Now**, **Email Now**, **Test Email Settings**, and **Test** buttons on the **Schedules** tab can be used to verify and troubleshoot any connection issues. The **Display iPack Status** button can be found on both the Schedules screen and the iPack screen, and a log of the current iPack's connection can be obtained by clicking **View log file** at the bottom of the iPack Status screen.

Reading Raw Data Files

Read the raw file sent during the test call to confirm that sensor configurations are correct. You can do this by choosing Import Raw Logger Data files (*.RLD) from the File menu and then use Data Export in the Site Utilities screen to export the data in *.txt format for viewing in Excel, Notepad, etc.

Data File Format

File name format is as follows: SSSSSS_YYYY-MM-DD_HH.MM_FFFFFF.rld

SSSSSS = 6-digit site number
YYYY-MM-DD = Year, Month, Day that the file was created by the logger.
HH.MM = Hour and minute (24-hour time) that the file was created.
FFFFFF = 6-digit file number

To look at sensor measurements, go to the folder where raw files (*.RLD) are stored, and double click to open up .RLD QuickView.

Data File Size

Unlike older Symphonie data loggers, the size of a SymphoniePRO data file varies depending on how much data is collected within the file.

The maximum file size is 128 kb. If the logger is collecting more than 128 kb of data per day, it will break the day's data into multiple files.
For example, if "Stats & Samples" is selected to collect one-second data on a particular channel, the amount of data being stored will increase greatly, pushing the data recorded over 200 kb. In the case where 200 kb of data were recorded in a day, two files would be sent: one 128 kb file and one 72 kb file.

3.5 | Power Budget

NRG Systems prides itself on our 30-year history of producing very low-power consumption data loggers that can be left to run autonomously for years with just a small PV attached to the iPack. Because the SymphoniePRO supports remote connections where a user can remotely monitor and update a logger, the logger system may spend more time with the modem on than previous Symphonie models (depending on the frequency of such activity). Communication settings and sensor load are the two main drivers of overall power consumption for the fielded system.

__Underestimating power requirements can lead to data loss and/or damage to equipment!__

It is up to the owner and/or installer of the SymphoniePRO logger to determine the estimated power budget for the site where the logger will be used. NRG Systems will assist where possible but claims no responsibility for problems with the logger, iPack, or other equipment due to excessive power consumption.

Sensor Power Consumption

To calculate an estimate of the total power consumption of the sensors connected to the logger, refer to the specifications for each individual sensor and add them together. Because of the vast number of compatible sensors that can be used with a SymphoniePRO logger, no sensor specs are published in this manual.

SECTION 4 | FIELD INSTALLATION

This section contains information & procedures for the installation of a SymphoniePRO logger & accompanying iPack at a typical site. Note that individual sites may vary and provide their own unique challenges outside the purview of this section or even this manual. Where necessary, consult other documents from NRG Systems or other appropriate sources.

4.1 | Grounding & Lightning Protection

As you can tell by the placement of this information at the forefront of this section, grounding your system is extremely important for maintaining long-term operation and data collection at your site.

Meteorological sensors, loggers, and towers accumulate static electrical charge unless they are properly grounded. High winds, low humidity, and the height of the tower above ground increase the rate of charge accumulation. Charge continues to accumulate until the developed voltage difference, sometimes thousands of volts relative to ground, causes dielectric breakdown and an electrostatic discharge (ESD). ESD will damage any scientific instrument or sensor, including NRG loggers, anemometers, wind vanes, and other met sensors.

The SymphoniePRO logger and connected sensors are grounded through the wiring panel ground stud. For adequate protection, the system must be connected to a properly grounded met tower or directly to a grounding rod through this ground stud and included ground wire.

*Properly grounding your system helps protect your sensors, your wind measurement instruments, and your wind data! It is your responsibility to provide proper earth grounding for the tower, logger, and sensors. **All warranties on NRG instruments and sensors are voided if your system is not properly grounded.***

Guidance on grounding an NRG TallTower, including procedures & average soil resistivity values for common types of soil, can be found in the product manual for the tower.

4.2 | Tools Required

The following list includes the tools necessary for installing the SymphoniePRO logger and associated components only. Additional tools may be necessary for installing specific sensors, booms, and other accessories at your site.
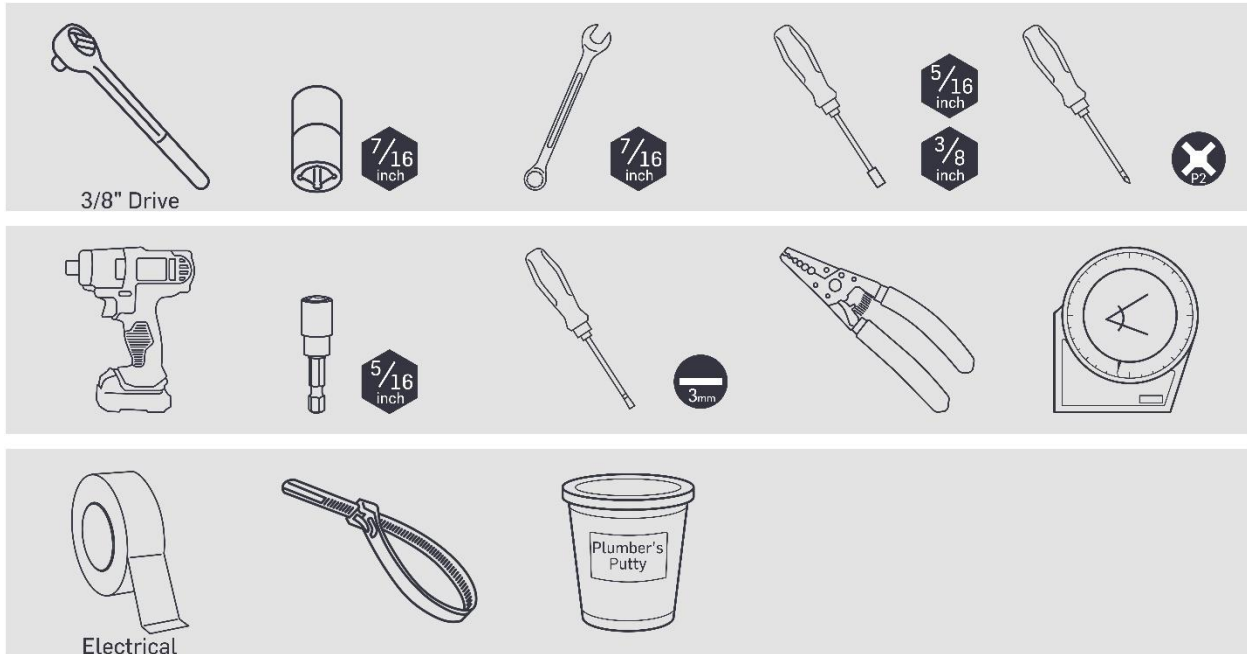
4.3 | Shelter Box

Logger & Wiring Panel Mounting Screws

The shelter box includes (8) #10-32x0.5" stainless screws. Loosely install these screws into the threaded holes in the back plate highlighted below.
Leave a 0.25" gap between the screw head and the back plate.

⭕ (blue)   26-Channel Wiring Panel

⭕ (yellow)   Logger/iPack/hanging bracket assembly
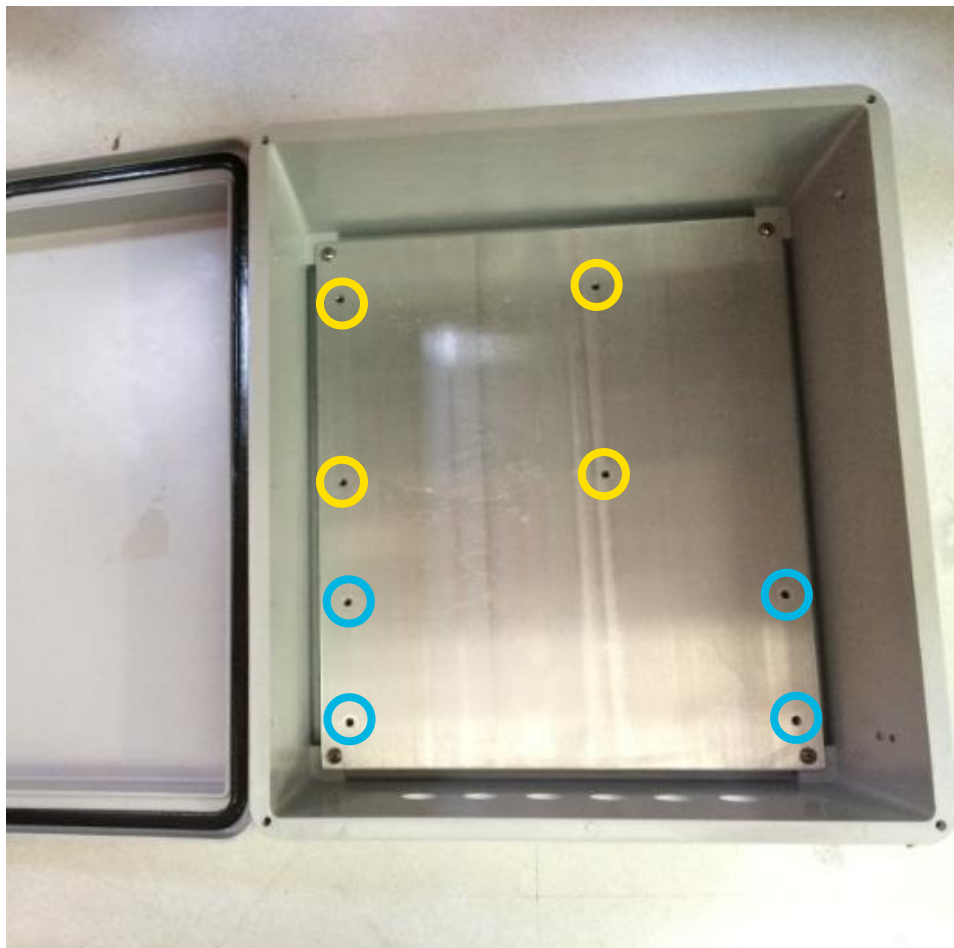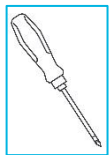
Mounting to the Tower

Tubular Tower

Feed the stainless band clamps (NRG Part #2703 | Size #164 | 2.0"-10.75") through the slots in the mounting brackets attached to the back of the shelter box, around the tower, and back through itself.
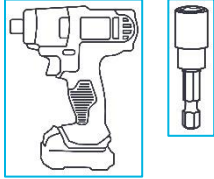
Lattice Tower

Mounting schemes for lattice towers vary based on the design & dimensions of your specific lattice tower. Refer to separate instructions for mounting the shelter box to your lattice tower.

Installing Logger & iPack

Logger/iPack/Hanging Bracket Assembly

Use the (4) 10-32 hex head screws that come with the iPack to attach the logger, iPack, and hanging bracket together. The screws feed through the hanging bracket and iPack enclosure holes before threading into the back of the logger enclosure.

- – #10-32x2.5" (NRG part #3566) screws are included with iPacks that have one battery.
- – #10-32x4" (NRG part #3574) screws are included with iPacks that have two batteries.
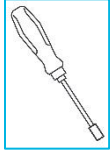
Mounting in the Shelter Box

1. Line the hanging bracket assembly up with the screws that were loosely threaded into the back plate previously.
2. Feed the screw heads through the respective mounting holes and lower the bracket into place. The keyhole shape allows the allows the screw head to fit through while it is installed in the back plate.
3. Tighten the (4) screws to secure the hanging bracket assembly to the shelter box back plate.
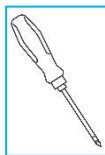
4.4 | Wiring Panels

The SymphoniePRO logger has two compatible wiring panels: 26-Channel & 16-Channel. Specific considerations for sensor wiring & installation for each wiring panel are explained below.

26-Channel Wiring Panel | #8150

Install the 26-Channel wiring panel by completing the steps in the following order:

1 | Mounting in the Shelter Box

1. Line the wiring panel mounting holes up with the screws that were loosely <u>threaded into the back plate previously</u>.
2. Place the wiring panel mounting feet against the back plate to the right of the screws.
3. Slide the wiring panel to the left so that the screws are captured within the slots on each side of the wiring panel mounting feet.
4. Tighten the (4) screws to secure the hanging bracket assembly to the shelter box back plate.
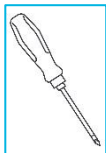
2 | Grounding the Wiring Panel

> ***Ground the wiring panel prior to connecting any sensor wires!***
> *Connecting sensor wires to the wiring panel prior to grounding the wiring panel may cause ESD damage to the sensors or the wiring panel.*

The wiring panel has a black 10 AWG ground wire pre-installed onto the ground stud.

Take the free end and feed it through one of the holes in the bottom of the shelter box and connect it to the copper-clad ground rod (or other appropriate grounding mechanism installed at the site).

3 | Connecting Sensor Wires

Connect the sensor wires to the wiring panel at the appropriate channels & terminals that match the SymphoniePRO logger's configuration. See **Sensor Wiring Procedure** for more information.
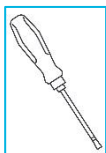
> *Because the list of compatible sensors and individual wire colors is subject to near-constant changes, a sensor wiring map has not been included in this manual.*
>
> *Refer to the **Sensor Wiring Map** in the SymphoniePRO Desktop App or to the sensor manufacturer's instructions for connection diagrams.*

16-Channel Wiring Panel | #11178

The 16-Channel wiring panel is a smaller option for users who do not need the additional channels and capabilities of the 26-Channel wiring panel.

Wiring panels from legacy Symphonie loggers (Classic, PLUS, & PLUS3) are not compatible with SymphoniePRO loggers. Do not attempt to re-use these older wiring panels with your SymphoniePRO logger.

Install the 16-Channel wiring panel by completing the steps in the following order:

1 | Grounding the Wiring Panel

Ground the wiring panel prior to connecting any sensor wires!
Connecting sensor wires to the wiring panel prior to grounding the wiring panel may cause ESD damage to the sensors or the wiring panel.

The wiring panel has a black 10 AWG ground wire pre-installed onto the ground stud.

Take the free end and feed it through one of the holes in the bottom of the shelter box and connect it to the copper-clad ground rod (or other appropriate grounding mechanism installed at the site).

2 | Connecting Sensor Wires
Because the 16-Channel wiring panel attaches to the side of the SymphoniePRO logger, it is easiest to connect sensor wires while the wiring panel is not inside the shelter box.

Connect the sensor wires to the wiring panel at the appropriate channels & terminals that match the SymphoniePRO logger's configuration. See **Sensor Wiring Procedure** for more information.
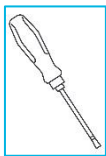
Because the list of compatible sensors and individual wire colors is subject to near-constant changes, a sensor wiring map has not been included in this manual.

*Refer to the **Sensor Wiring Map** in the SymphoniePRO Desktop App or to the sensor manufacturer's instructions for connection diagrams.*

iPack Grounding

Failure to connect the iPack ground wire may cause ESD damage to the logger and iPack.

iPacks have a green/yellow striped wire pre-installed in the appropriate terminal on the side of the iPack enclosure for grounding.

1. Unthread the outer nut from the wiring panel ground stud.
2. Locate the ring terminal crimped to the free end of the yellow/green striped iPack grounding wire. Put the ring terminal onto the wiring panel ground stud.
3. Thread the nut back onto the wiring panel ground stud to secure.
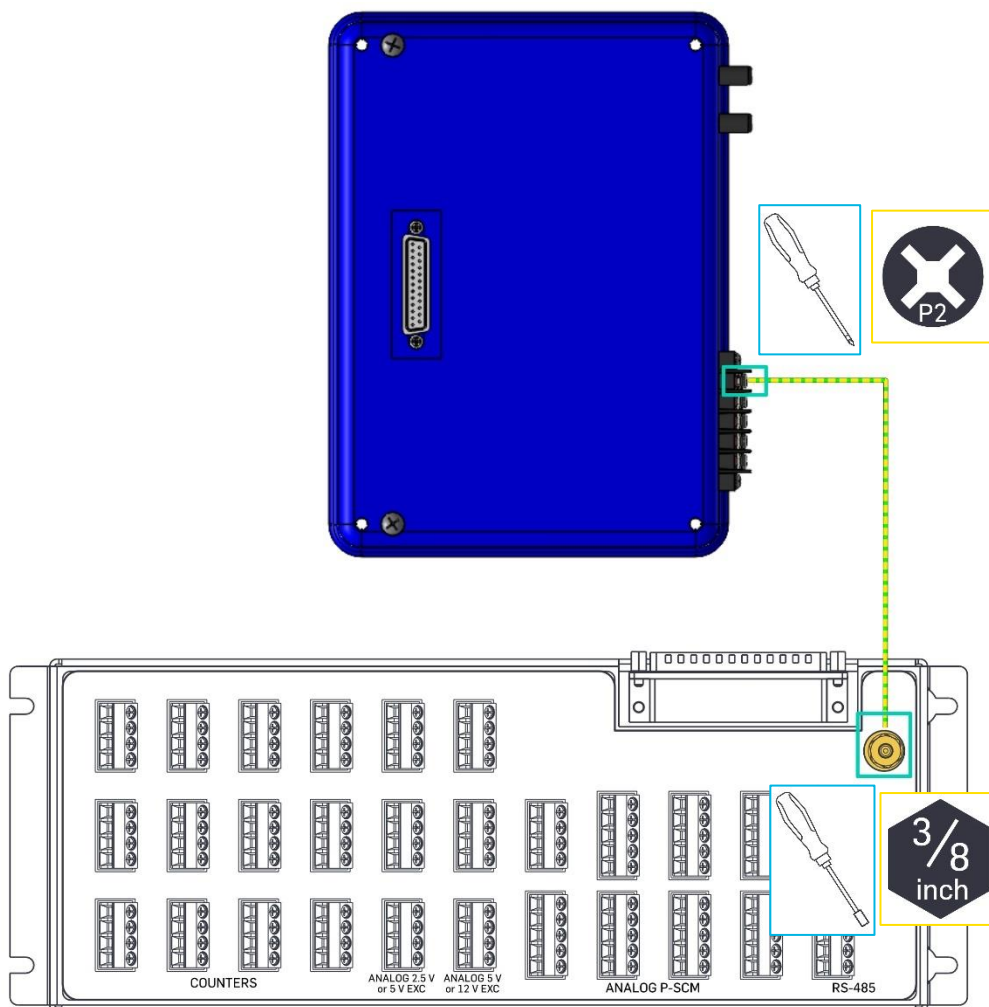
Sensor Wiring Procedure

Best Practices for Wiring

- Secure all sensor wires to the tower below the shelter box and then feed them inside to the wiring panel. This forms a drip loop in each wire and helps prevent water intrusion.
- Pass sensor wires through the black plastic grommets included with the shelter box. If more weather protection is desired, cord grips can be used in the holes provided that they are sized properly for the number of cables that pass through the shelter box holes.
- Tag & label the ends of each sensor cable or wires with appropriate identifying information.
- Strip individual sensor wire jackets to expose only 1/4" (5 mm) of bare wire.

Analog Sensor Procedure

1   Check that each individual wire (excluding the bare shield wire if present) has no more than 5mm (1/4") of bare wire exposed. Excessive stripping can lead to bare wires contacting each other and cause a short circuit.
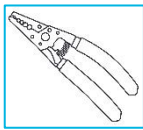
Note: For additional protection against shorts and for a more secure connection inside terminal wire cages, ferrules can be crimped onto sensor wires. Before installing on all wires, check that the ferrules are sized appropriately for the wiring panel terminals.
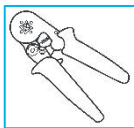
2   Touch the bare shield wire (if present) to the wiring panel ground stud, then connect to the SHD terminal for the appropriate channel.
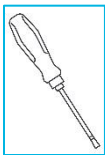
3 Connect the remaining wires to the terminals for the appropriate channel in the following order:
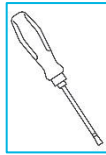
1	Ground	GND
2*	Signal (+/-)	SIG (+/-)
3	Excitation	EXC

*The (+/-) refers to sensors with differential signal outputs. Refer to individual sensor instructions from the manufacturer for clarity on which wire should be connected first.

Wiring instructions from the sensor manufacturer supersede the order outlined above. Whenever differences are encountered, follow the manufacturer's instructions.

4 Repeat until all analog sensors have been connected to the channels that correspond to the SymphoniePRO logger configuration.

Serial Sensors

Refer to the manufacturer's instructions for how to properly connect each sensor to the 26-Channel wiring panel. Serial sensors cannot be connected to the 16-Channel wiring panel.

Solar Maintenance Button

The NRG Solar Maintenance Button is an optional accessory which pairs with and is mounted near a Soiling Station. Pushing this button after cleaning the "Clean" Soiling Station PV panel, or after other maintenance will create a data timestamp to note the event.

Multiple Maintenance Buttons can be installed on a SymphoniePRO loggers (one button per counter channel.

Tools Needed

- 5/16" hex driver, socket, or slotted screwdriver
- 26 or 16 channel wiring panel
- USB Type B to Type A cable
- Small Flathead Screwdriver
- Computer with USB port and SymphoniePRO Desktop Application loaded

Mounting the Button

The Solar Maintenance Button is designed with a simple mounting bracket which utilizes a hose clamp for installation onto a tower, boom, or torque tube. The kit is sold with either a 3m (kit 18904) or 20m cable length (kit 18905).

Simply feed the hose clamp through the bracket mounted to the back of the button housing. Locate the button at an easily accessible height within cable distance to the logger and tighten the hose clamp using a 5/16" hex driver, socket, or slotted screwdriver.

Connecting the Button to the Wiring Panel

The button can be connected to any Counter Channels on the 16 or 26 channel panels. It can be wired with or without the Internal Pull-up enabled, however wiring will differ; see below.

SymPRO Connections – Solar Maintenance Button		
Color	**Reference**	**Termination**
Standard wiring		
Black	Clean Button Excitation	EXC
White	Clean Button Signal	SIG
Internal Pull-up Enabled		
White	Clean Button Signal	SIG
Black	Clean Button Ground	GND

Configuring the Counter Channel with SymphoniePRO Desktop Application

The Solar Maintenance button outputs a totalizer signal, and the logger will read the count as mm.

- Sensor Type: Custom Totalizer
- Mode: Statistics
- Description: "Solar Maintenance Button" or similar
- Height: N/A
- Boom Bearing: N/A
- Scale Factor: 1
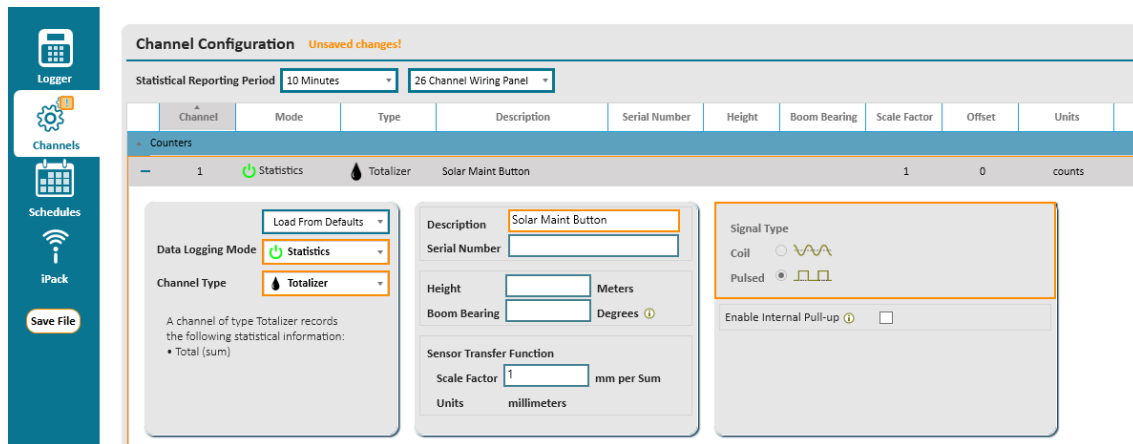
Note that the "*Enable Internal Pull-Up*" box can either be checked or unchecked, however if it is checked, the button cable wiring to the logger wiring panel will be different (see the above SymPRO Connections diagram).

Final Checks

Ensure the wired connections are properly seated and torqued. A pull test by hand is sufficient to check the wired connection from the Soiling Module. If any wires disconnect with this test, reseat and torque the terminals to hand-tight.

Verification

To view the maintenance timestamp created when the button is pushed, navigate to the *Logger* tab of the logger in SymphoniePRO Desktop Application. In the *Data Retrieval* section, input the date range desired, then click the "*Retrieve by Date Range*" button.
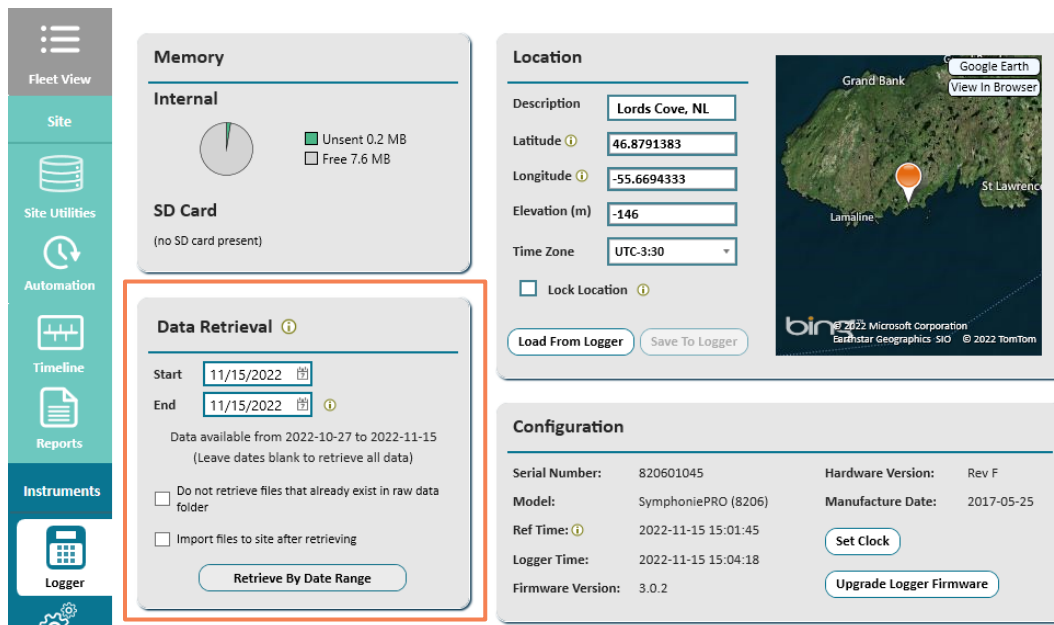
When data is viewed in Quickview, the Solar Maintenance Button channel will register data when the button is physically pushed.
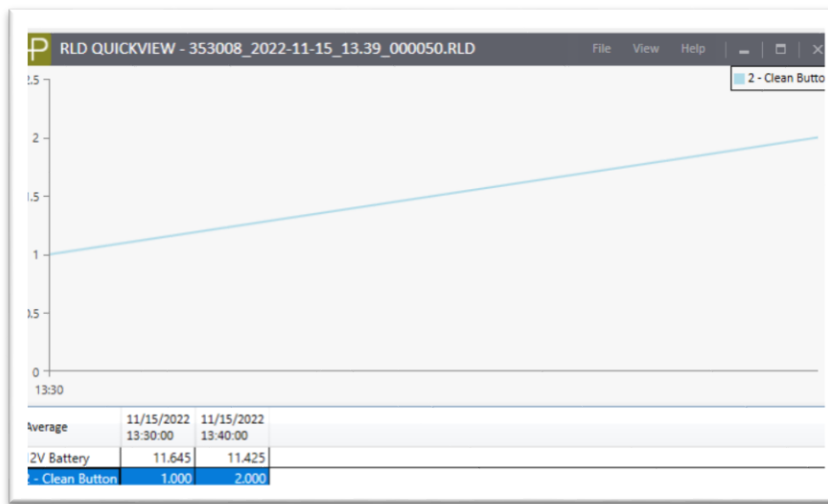
Connecting Logger & Wiring Panel

26-Channel Wiring Panel

Insert the ends of the black interconnect cable (NRG Part #8385) into the 62-pin plugs located on the top of the wiring panel and the side of the logger enclosure box.

> *To avoid bending pins when connecting to the DB62 plugs, line up the cable ends as straight as possible and gently plug them into the logger & wiring panel.*

16-Channel Wiring Panel

Mount the wiring panel onto the side of the logger by lining up the DB62 connectors on the logger and the back of the wiring panel.

4.5 | PV Panel

The SymphoniePRO logger & iPack are powered by the lead-acid iPack battery, which is recharged by a 15W PV panel attached to the tower. While there are other methods to power a site, particularly when using heated sensors and other higher-consumption equipment, they are not discussed in this section.

Assembly & Mounting

Kit #9108 (shown below) contains a 15W PV panel, mounting & angle brackets, and required hardware.
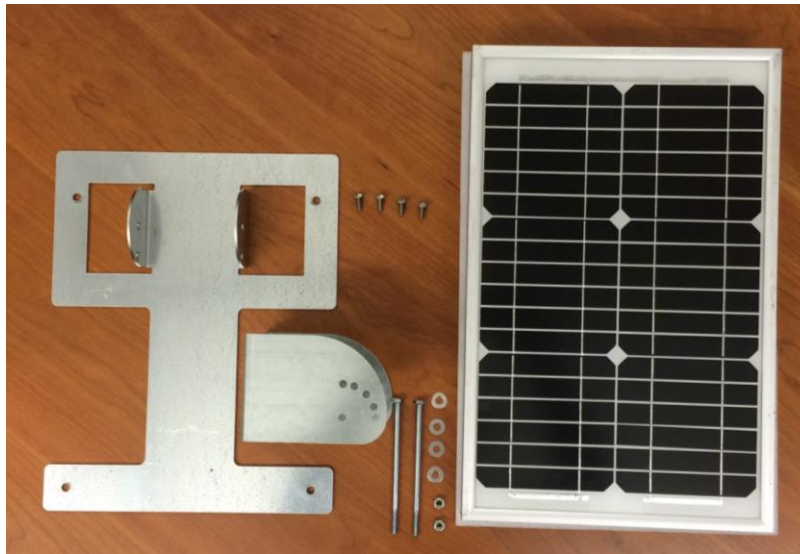
1　Attach the PV panel to the mounting bracket with the #10-32x0.5" screws. The PV panel has (4) #10-32-threaded clip nuts pre-installed into the frame to accept the screws.
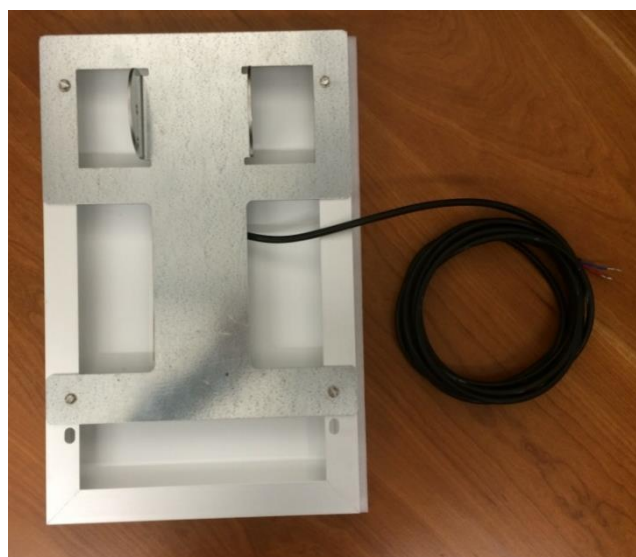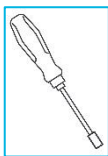
2 Attach the angle bracket to the tower using the (2) band clamps supplied with the kit (listed below by type). The longer side faces toward the top of the tower.

- Tubular tower kit #9112: Size #164 | 2.0"-10.75"
- Lattice tower kit #9111: Size #36 | 1.81"-2.75"

Use the outer slots for tubular tower and the inner slots for lattice.
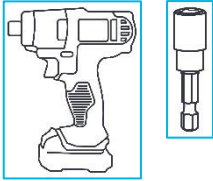
3 Attach the PV mounting bracket assembly to the angle bracket with the 1/4-20 hardware at the centered holes. Use a washer on each side between the bracket holes and bolt head or nut.

4   Adjust the PV mounting bracket angle according to latitude to optimize solar radiation and shedding of snow and ice. Line up the closest holes of the angle bracket & PV bracket assembly, then secure with the remaining 1/4-20 hardware.
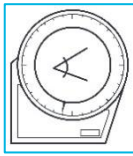
5   Tighten the 1/4-20 hardware to secure the PV panel in place.
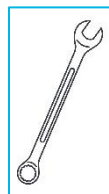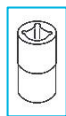
Wiring to iPack

Run the PV panel cable into the shelter box and to the terminals on the side of the iPack enclosure. **Attach the wires to the +/- PV terminals.**
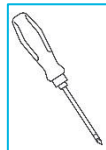
Note: The PV panel wires have tinned ends. If desired, spade terminals or ferrules (not included) can be crimped on in place of the tinned wire.

> ***Do not connect PV panel wires to the "12V Ext Bat" terminals. This will exceed the rated voltage for the circuit for these terminals and damage the iPack.***

4.6 | Testing Installed Equipment

If you haven't already done so, install the logger's D-cell batteries. Then verify the logger and iPack configurations and sensor settings as described below.

Checking SymphoniePRO Logger Status
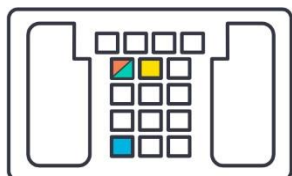
Use the **Logger Status** menu **[Home][2][1][1]** to check the following:

- – Number of saved files
- – Firmware version
- – SD card capacity & remaining free space
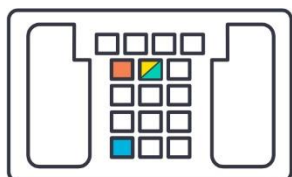
Use the **Diagnostics** menu **[Home][2][1][2]** to check the following:

- – D-cell voltage
- – Logger internal temperature
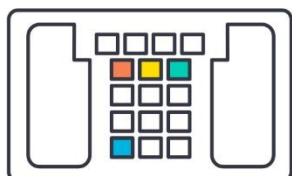
Use the **Utilities** menu **[Home][2][1][3]** to do the following:

- – Format SD card
- – Temporarily adjust display contrast
- – Reboot logger
- – Turn display off

Beep

The logger may beep if there are sudden changes in current. The 12 V sensor supply current can be seen in the status line of the logger's display. If a sensor was wired incorrectly or damaged and is causing a short-circuit, the logger will usually beep and register a high current event ("High_Curr_nV" where *n* is the voltage of the excitation circuit).

Checking iPack Status

Test calls and data connections should always be performed both before and after installing an iPack in the field. Verify that the iPack can communicate with the network and send data from the logger. For information about the different types of iPacks available and related communication options, see **Section 6 | Communications**.

When an iPack is connected and powered up, the iPack activity icon will show on the logger's display to indicate the iPack is on and an icon indicating iPack 12 V battery status will be shown in the lower right corner of the logger's display.

If no iPack is connected or if a connected iPack has a dead battery, no "i" icon will be displayed, and "iPack unavailable" will be shown on the logger's screen. Without an iPack connected, the battery icon represents the D-cell batteries.

> *If the iPack encounters problems communicating with the network (cellular, satellite, SCADA, or otherwise),* **contact the provider of the network for troubleshooting assistance before contacting NRG Systems!**
>
> *NRG Systems does not provide, service, or administer these networks and does not have the tools necessary to troubleshoot them.*

Cellular & Satellite Communication: Performing Connection Tests
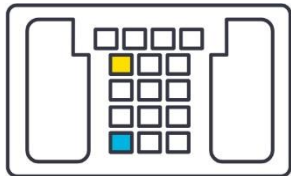
Use the **Connection Test** menu **[Home][2][2][1]** to test the following, when enabled & configured properly:

- Test Metlink Logger Initiate (Initiate Primary, Initiate Backup)
- Test Metlink connection from a computer (Metlink Listen)
- Test diagnostic check-in (Metlink Diagnosis)
- Test email capabilities (Email No File, Email One File)

Modbus & SCADA Communication
Successful integration into a SCADA system and Modbus communication using an iPackACCESS can depend on aspects of each individual network. See *6.8 | iPackACCESS With* Modbus Protocol in this manual and talk to the SCADA network expert within your organization.

Checking Sensor Measurements
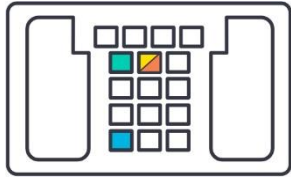
Use the **Measurements** menu **[Home][1]** to check that the sensors are working, and that the logger is configured correctly.

- Scroll through each channel using the **[Up]** & **[Down]** arrow keys. Disabled channels will be skipped.
- Press the **[Right]** arrow key to view additional channel information & 1-second samples.
- Channels can be viewed directly by pressing the corresponding numeric keys in quick succession.

4.7 | Completing the Installation

Weatherization

While the shelter box has both a gasket and a molded lip around the door as well as dual latches to secure it shut, the holes in the bottom for wires are still open to the outside and require further steps by the installer to protect the equipment inside from weather and wildlife.

Plumber's Putty

This is the most cheap, adaptable, and widely used method for plugging the area around wires in the bottom of a shelter box. It is easy to store in a tool kit, available from almost any hardware store, moldable around the wires in every hole, re-usable (when replacing or rerouting wires later), and does a decent job at keeping out unwanted residents.

Cord Grips

The best way to ensure the shelter box is weatherized is to install cord grips in each hole of the shelter box. This requires prior planning because cord grips are sold with many options for wire sizes & number of holes but offers superior protection to plumber's putty.

The wire holes in the bottom of the shelter box have a diameter of 0.875" (22 mm).

Shelter Box Security

A padlock can be installed on either latch of the shelter box to prevent unwanted opening of the door. Note that padlocks are not impossible to bypass, so use the logger keypad PIN and data encryption key features of the SymphoniePRO logger when additional security measures are needed.
The internal diameter of the padlock loop of each latch is approximately 0.36" (9mm).

The shelter box can also be installed high enough on a tower that a ladder is required to safely open it to access the instruments inside. This provides a deterrent for passersby who may "happen" upon your site and wish to investigate further.

Neatness

Keeping a site tidy will save time during future site visits and help reduce the risk of mistakes, miswiring, lost data, and other undesirable outcomes. Recommendations for how to keep a site neat are below.

- Coil & secure excess sensor wire below the shelter box
- Tag & label each sensor wire with sensor type, serial number, & wiring diagram
- Secure loose wire inside the shelter box
- Minimize crossing & tangling of sensor wires between wiring panel & shelter box thru-holes

4.8 | Site Installation Checklist

- ☐ Desiccant bag installed in logger enclosure
- ☐ iPack & logger battery levels full
- ☐ Sensors connected & measuring correctly
- ☐ SD card correctly formatted & empty
- ☐ Logger .LGR configuration file saved to laptop
- ☐ All sensors & equipment grounded
- ☐ Logger access PIN recorded
- ☐ Data encryption PIN recorded
- ☐ Shelter box padlock code recorded
- ☐ Shelter box weatherized
- ☐ Site tidied up

4.9 | Data Verification

SymphoniePRO can be configured to send both statistical data and raw sampled data. *.RLD files contain averages of the raw counts, voltages, and currents (at the specified averaging interval), channel configuration information, logger events, and logger and iPack diagnostic information.

After performing a test connection, download *.RLD files and browse to the folder where raw (*.RLD) files are stored, and double click to open a few of them using QuickView to make sure data stored on each channel looks normal.

If the logger is configured to collect raw sampled data, 1 second sampled channel measurement data will also be included in the *.RLD file. However, 1 second sampled data must be processed separately using Process Raw Sample Data in the Site menu (see **Process Raw Sample Data**).

4.10 | Maintenance Site Visits

Recommended Tools & Materials

See **4.2 |** Tools Required at the beginning of this section.

Site Visit Checklist

A routine site visit should include the following activities:

- ☐ Check sensor readings to assess sensor condition.
  Readings that vary widely with expected norms may indicate a sensor malfunction. Press **[Home][1]**, then **[Up]** or **[Down]** to scroll through the sensors.
- ☐ Check the logger's time & date displayed at the bottom of the home screen.
  Loggers connected to an iPack that is configured for Time Service will be automatically updated via SNTP or GPS; there should be no need to adjust the clock manually.
- ☐ Check battery voltages.
  Press **[Home][2][1][2]** to view internal and iPack battery voltages. Press the **[Right]** arrow key to view the D-cell battery voltage and additional internal diagnostic voltage readings.
- ☐ If the iPack battery voltage is low and the battery is more than 2 years old, it may need to be replaced. Contact NRG Systems to purchase a replacement.
- ☐ Replace D-Cell batteries.
  Use only alkaline D-cells, IEC type LR20. D-cell batteries are cheap and easy to find in many different stores, so replacing at regular intervals them is a good idea regardless of their age.
- ☐ Retrieve all data files from the SD card.
  The SD card should not be pulled while the logger is writing to it.
- ☐ Insert and format a new SD card **[Home][2][1][3][1]**.
- ☐ Check SD card status **[Home][2][1][1]**.
- ☐ Replace the desiccant pack inside the logger enclosure, especially if any condensation is noticed inside when opened. Write the date on the new desiccant bag.

Cleaning

If it should become necessary to clean the SymphoniePRO data logger, use a cloth slightly dampened with water and wipe clean. **Do not use solvents**. **Never submerge the unit**.

SECTION 5 | SYMPHONIEPRO DESKTOP APPLICATION

The SymphoniePRO Desktop Application (or "Desktop App") is an integral piece of the SymphoniePRO logger system. The Desktop App is used to process raw data files as well as configure and communicate with the SymphoniePRO logger and iPack. SymphoniePRO Desktop App keeps track of site data and produces versatile tab-delimited text files (ASCII) compatible with industry-leading software. Additionally, the software allows the user to view "live" data, apply firmware updates to SymphoniePRO loggers & iPacks, and preview data files in time-series format.

5.1 | Software & Firmware Updates

Keeping your software and equipment up to date is extremely important. An orange box with a flag will appear to the left of the **File** menu in the upper right corner of the Desktop App window to notify users when new versions of the following are available to download.

- Software
- Logger firmware
- iPack firmware
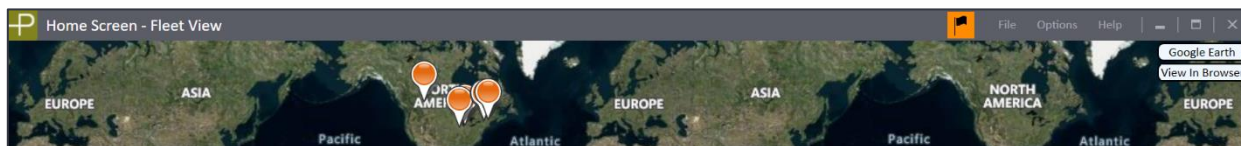
Clicking on the flag opens the SymphoniePRO Application Updates window, which can also be accessed at any time by clicking **Help>Application Updates**. This window displays the iPack and logger firmware versions and software updates available to download.
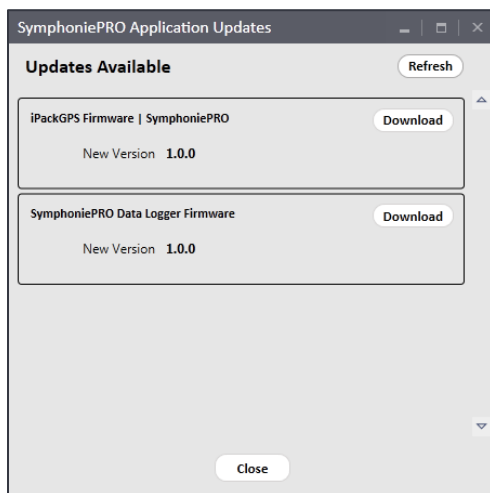
Press the download button next to any of the firmware options, and it will download to the **Firmware** path on your PC. A link to the firmware folder will appear after the download is complete. It is important to keep firmware up to date on all loggers and iPacks for the best functionality.

5.2 | Software Installation Requirements

SymphoniePRO Desktop App is a 32-bit application that runs on Windows 7, Windows 8, or Windows 10 operating systems. The installer typically installs all files needed to run the software. In some Windows 8 and Windows 10 installations, the target machine may need a Windows Update, so be sure that your network policies allow for some external components to be installed by the desktop installer. Other operating systems are not supported. The minimum computer hardware requirements are:

- − 1.6 GHz or faster 32-bit (x86) or 64-bit (x64) processor
- − 2 GB RAM minimum required
- − 4 GB RAM recommended

The latest version of SymphoniePRO Desktop App can be downloaded for free from our website: http://www.nrgsystems.com/technical-support/software

Software installation must be performed by an administrative user. It also requires Microsoft .NET Framework, which is distributed by Microsoft through updates (your Windows PC may already have it). If the installer software detects that Microsoft .NET Framework is not installed, you will be prompted during the installation process. To communicate with the logger, a remote MetLink connection or a MetLink USB port/USB cable connection is required.

The software installs to the Program Files ("Program Files (x86)" for 64-bit computers) folder within the NRG Systems folder. Site files are stored in the default folder C:\Users\...\Documents\Renewable NRG Systems. This folder location can be changed after installation under **File>Settings**. The locations of exported files and log files are also assigned in the Settings screen.

5.3 | Home Screen | Fleet View

Map Pane

The map pane shows all the sites with valid latitude and longitude information as pins on a map (satellite view).

Navigate the map by using the mouse to pan (click and drag) and zoom (scroll). The map view resets whenever the **Home Screen** is closed.

The map pane may be adjusted in height by dragging the intersection of the bottom of the map and the top of the site list. This setting resets when the app is closed.

The pane may be hidden entirely by right-clicking anywhere on **Home Screen** and choosing **Hide Map**. Hide Map can also be selected from the **Options** menu. The hide map setting is saved and does not reset across sessions.

Double-clicking a site pin will bring the user to the site screen for that site. Single-clicking on the site causes the corresponding site row to become highlighted, allowing the user to locate a site in the list using the map. Hovering over the pinpoint shows the same information for the site (Site, Location, Last Connection, etc.) as shown below in the site list.

Site List

The site list shows the valid site database files found by the software. When a connection is detected, the logger **Connection Status** icon for the site corresponding to the equipment turns green.

The upper right corner of the logger connection icon may show a small lock to identify the logger as locked or a clock symbol to indicate that automated actions are enabled. If there is no existing site or multiple sites corresponding to the connected equipment, then a new site row is created as a "new instrument row" for accessing the connected equipment.

Additional Site Row Information

Each site row contains multiple columns of information relevant to the high-level management of the site or equipment. The rows may be sorted by the user by any of the columns, and the order of the columns can be changed by dragging the column header. Hovering the mouse over each row reveals a box that contains the full path and file name for the associated site file (if applicable) as well as the connected logger serial number (if applicable). This always allows the user to uniquely identify any row in the list.

Site List Options

Right-clicking on any Project site in the Fleet View list provides the option to edit the site's remote connection settings, view site or logger information, delete the site, refresh the site list, export the site list, hide the map, or display the connection times using the PC's local time (instead of the site's local time).

Project

This column contains the project name for the site. This is listed as the first column as it is intended to be used in sorting to group related sites together.

Location

This column contains the site number, site name, and site location.

Instrumentation

The Instrumentation column contains the serial numbers and firmware versions of the site's logger and iPack.

Data

This column contains the start date and end date for the data in the database. The start date represents the earliest timestamp (and the end date represents the most recent timestamp) of any data point for that site.

Last Connection

The Last Connection column indicates the last date and time that a connection was made. The iPack battery voltage at the time of the connection is also displayed. By default, the connection time is shown in the logger's local time.

Next Connection

The Next Connection column indicates when the next remote connection opportunity or attempt is expected, along with the connection type and duration (e.g. Connected: USB, Listens Continuously, Listens for [<60] min, Listens for [$\leqslant$ 12] hours, MetLink Logger Initiated.) By default, the connection time is shown in the logger's local time. The next connection time and type is based on the communication schedule settings, which are stored in both the site file and logger.

Connection Status

The logger connection icons above are shown in the Connection Status column and indicate the status of connections for sites already established in SymphoniePRO Desktop App. Active connections are displayed in green. Clicking on an inactive connection icon will attempt to establish a connection. Putting the cursor over the green icon will display the connection type and clicking the icon during an active connection brings up more detail on the connection status and provides a disconnect button to terminate the connection. If automated data file downloads or firmware upgrades are enabled, the icon will show a small clock symbol in the upper right corner. A small padlock symbol will be shown in the lower left corner if the logger is locked.

Double-clicking a site from the site list opens the Site Utilities screen for that site if the logger is not currently connected. If the logger is connected, the Logger screen will open.

Metlink Monitor

The MetLink Monitor is a small app that runs in the background and can be viewed from the Windows system tray (notification area at lower right of your computer screen).
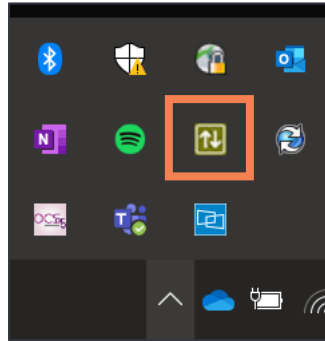
The monitor starts when SymphoniePRO Desktop App is launched and closes when the main application closes. The MetLink Monitor acts as an interface which manages connections between the main application and connected loggers. The MetLink Monitor icon looks like two arrows which symbolize two-way communications.

The MetLink monitor can be used to view the status of active logger connections. The monitor contains information like what can be found in the **Fleet View (**Site Number, 12 V battery voltage) and **Logger** tab (Site Description, Logger Serial Number), and **iPack** tab (iPack Serial Number and Firmware Version) in SymphoniePRO Desktop App.

Site Number	Site Description	SymPRO SN	SymPRO FW	iPack SN	iPack FW	Connection	Battery
000525	NRG Systems	820600980	3.4.1	939000127	2.4.0	USB820600980	13.6 V

Refresh

MetLink interface version: 2.1.0

5.4 | Header Bar Menus

File Menu

The File menu is in the upper right corner of every Desktop App screen. **Create Instrument Configuration File** (*.LGR) and **Edit Instrument Configuration File** (*.LGR) options are only accessible from the **Fleet View** screen.

Import Raw Logger Data Files (*.RLD)
Opens a File Explorer window and allows selection of one or multiple *.RLD raw data files for import into the database.

If files from a site have not been previously imported, a message will appear asking if you want to create a site file.

A progress bar is displayed showing the files as they are imported:
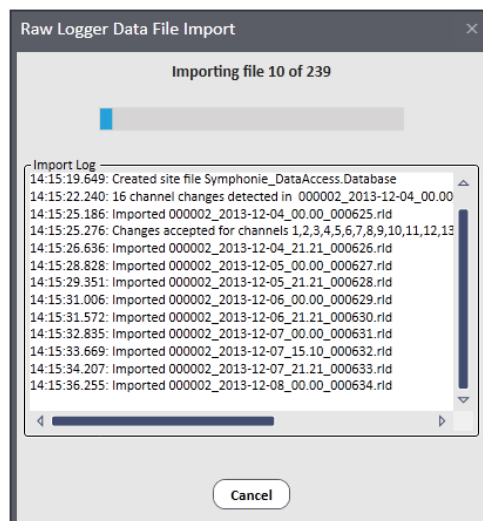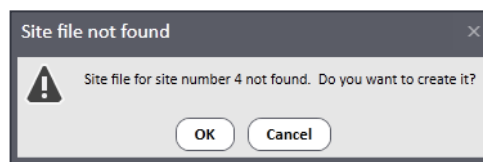
During the import process, other messages may be received such as requests to enter an encryption key or create a new sensor history entry when a change from a prior configuration is detected. When the import is completed, the software will display this screen:
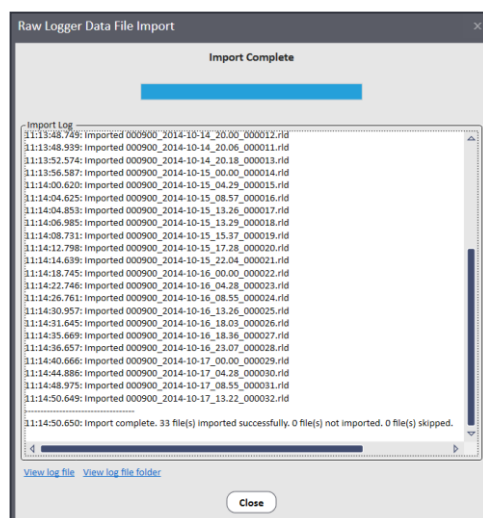
Settings

Brings up a window to configure the working directories for Site Files, Exports, Logs, Raw Logger Data Files, Reports, and Firmware Files. These paths are the locations on your computer that the software will point to when saving or opening these different types of files.
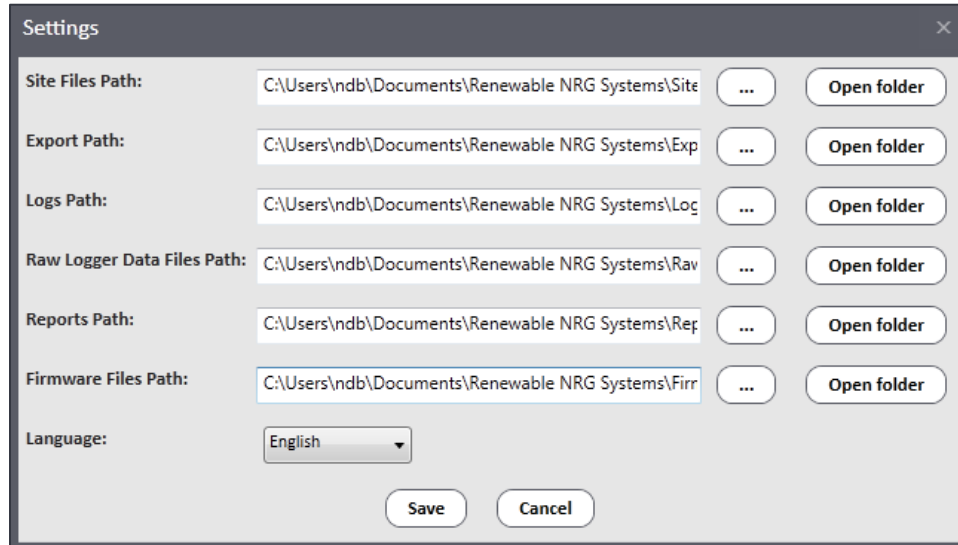
The **…** button next to each field allows the user to change the directory location.

The **Open Folder** button next to each field allows the user to open the current directory location.

At the bottom of the window, there is an option to change the language displayed in the software. The default language is English. Other available languages are Chinese, Spanish, and Portuguese. To change the language, select it from the drop-down list.

View Application Log

Opens a text log file which tracks the user's interactions with SymphoniePRO Desktop App. The **View Application Log** is a diagnostic tool that can be helpful in troubleshooting software error messages. The log opens in your designated text editor (e.g. Notepad or WordPad) and can be saved as a text file and emailed to NRG Systems Technical Support.

Create Instrument Configuration File (*.LGR)

Opens the **Instrument Configuration File Editor**. This feature allows Logger, Channels, Schedules, and iPack settings to be preconfigured and saved into a file without being connected to a logger. Creating configuration files in this way can be useful when sharing similar settings across multiple SymphoniePRO logger systems.
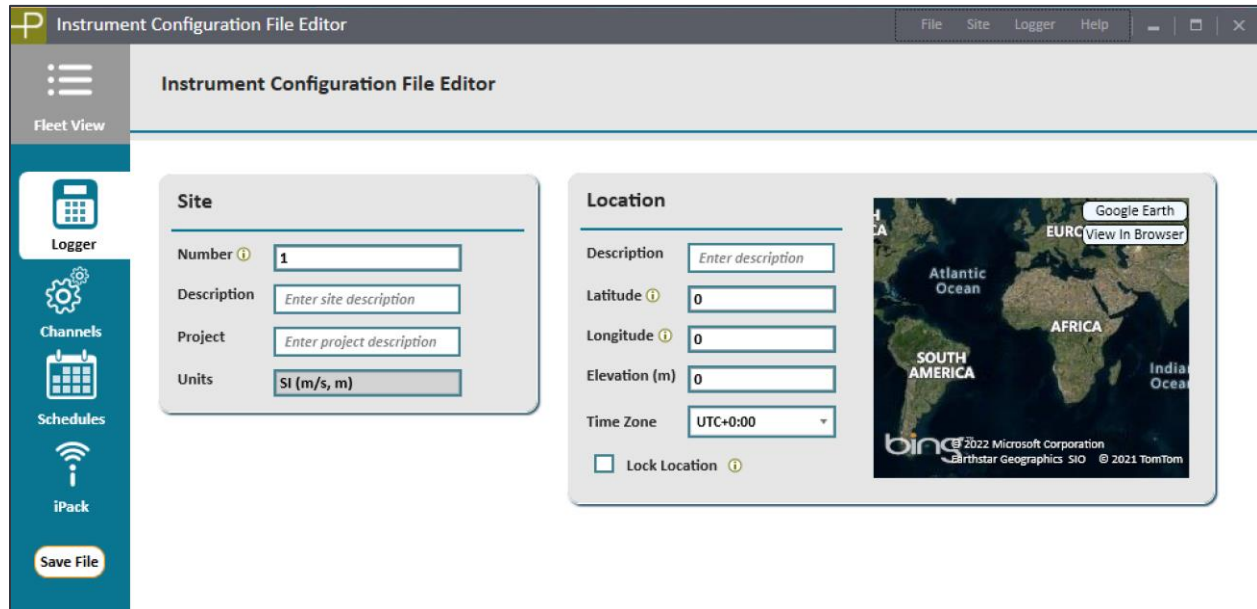
Press **Save File** to save the configuration as an *.LGR file that can be loaded onto a logger later.

A pop-up window will prompt which settings will be saved in the *.LGR configuration file. Press **Next** to continue after checking/unchecking the appropriate boxes.
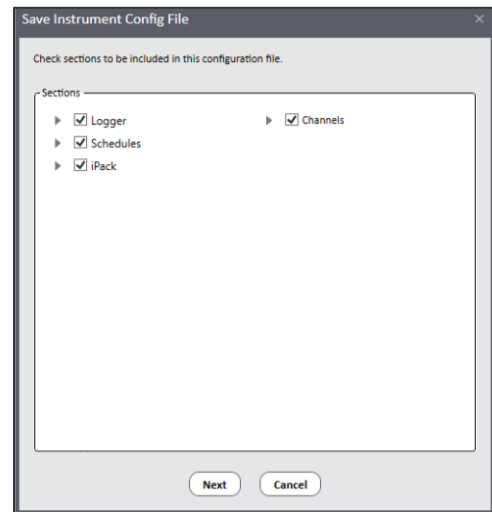
A File Explorer window will then allow for a user to select the desired location on their computer to save the file.

Edit Instrument Configuration File (*.LGR)

Allows editing of an existing *.LGR configuration file in the **Instrument Configuration File Editor** without being connected to the logger. The *.LGR configuration file must be loaded into the Editor from the File Explorer pop-up window.

Options Menu

The **Options** menu is in the upper right corner of Desktop App's home screen. These options may also be accessed by right-clicking anywhere on the **Fleet View** screen.

Metlink Initiate

Allows the user to enter the IP address of a SymphoniePRO logger & iPack to establish a Metlink connection. This connection type requires the iPack have a SIM card with a public static IP address and for the logger to be scheduled for MetLink Logger Listening at the time the connection is initiated.

Enter the IP address into the pop-up window shown here:
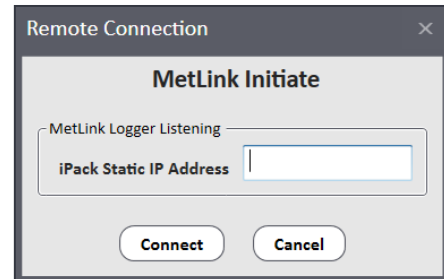
Refresh Site List

Reloads all information from site files and detects any changes to a site or the addition of a new site.

Hide Map/Show Map

Hides and shows the map pane on the **Fleet View** screen. This setting will persist across Desktop App sessions.

Help Menu

The **Help** menu is in the upper right corner of every Desktop App screen.

About

Displays information about the Desktop App, including **Software Version**, **Comm Version,** and links to the **End User License Agreement** & this **SymphoniePRO User Manual**. The Comm Version refers to the piece of the software that controls communications operations.

NRG Systems Technical Support may request this information for troubleshooting purposes. Links are available to copy the **About** window to an image or text, which can be sent to NRG Systems Technical Support if you need any help with the software.

Save Communication Log

Opens a standard File Explorer window to choose a file name and location for saving a communication log.

The communication log is a diagnostic tool that can be helpful in troubleshooting communications problems between the software and the connected equipment. The communication log is saved as an encrypted text file and can be emailed to NRG Systems Technical Support for troubleshooting purposes.

Application Updates

Opens the **SymphoniePRO Application Updates** window, which displays available software upgrades to download and install. This is the same window opened by the Error! Reference source not found. d iscussed at the beginning of Section 5.

Site

The **Site** menu is in the upper right corner of the Site Utilities, Timeline, Logger, Channels, Schedules, and iPack screens.

Process Raw Sample Data

Converts 1 second raw sample data within the *.RLD files to text files. Raw sample data are scaled according to scale factors and offsets in the site database.

After file conversion is complete, the name of the text file appears at the bottom of the window, and clicking it opens it in your default text editor.

Clicking **Open folder** shows where the *.txt file is stored.
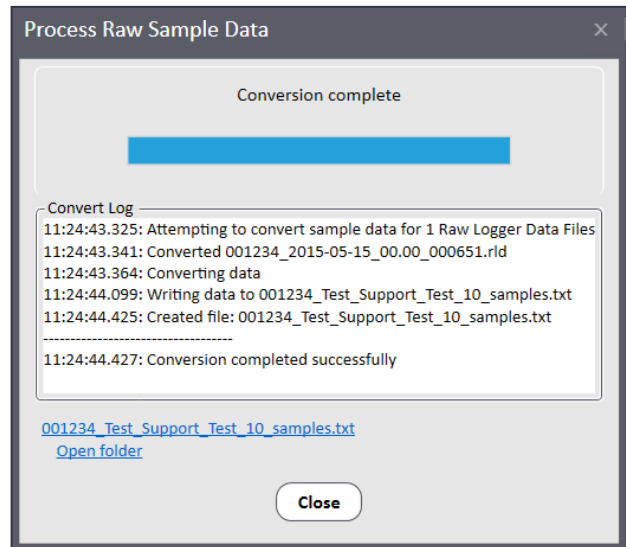
If the selected files or site contains no raw sample data, the conversion will fail, and an error message is displayed.
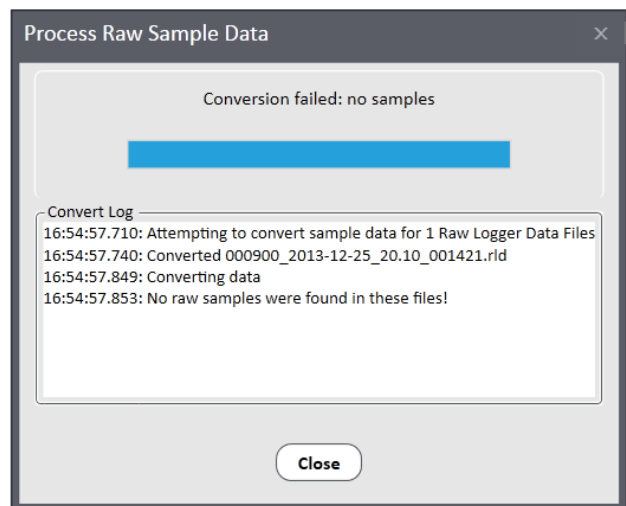
If the files you are attempting to convert are from a site that does not match the site you are currently working in, this message will be displayed:
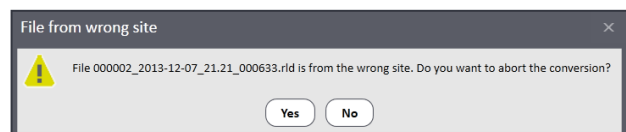
Logger

The **Logger** menu is in the upper right corner of the Site Utilities, Automation, Timeline, Logger, Channels, Schedules, and iPack screens. A logger must be connected to the PC, either by USB or through a remote connection, to access the Logger menu.

Load Instrument Configuration File

Allows the user to browse to and load into SymphoniePRO Desktop App an existing *.LGR instrument configuration file that includes logger settings such as site number, location, time zone, reporting period, plus the configuration of each channel.

Save Instrument Configuration File (*.LGR)

Allows the user to save a configuration file to their desired location within a standard File Explorer window. The configuration file includes logger settings such as site number, location, time zone, reporting period, plus the configuration of each channel.

If changes have been made to the configuration, SymphoniePRO Desktop App will display that there are unsaved changes to the logger and highlight the unsaved fields. These fields **must** be saved before selecting **Site>Save Instrument Configuration File (*.LGR)** if the user wants the changes to be captured within the *.LGR file that is being saved.

View Recent Events

View recent events on the logger while connected to it via USB or MetLink. Events are timestamped and include both an event type and some descriptive text. These events can be helpful in troubleshooting problems with the logger, iPack, sensors or communications.

Date	Class	Event	Event Name	Error	Description
2017-09-29 13:50:35	Fault	553	FID_SVCOM_OPEN_BACKUP_FAULT		Secondary Host unavailable or not responding
2017-09-29 13:50:18	Fault	552	FID_SVCOM_OPEN_MAIN_FAULT		Primary Host unavailable or not responding
2017-09-29 13:40:34	Fault	553	FID_SVCOM_OPEN_BACKUP_FAULT		Secondary Host unavailable or not responding
2017-09-29 13:40:17	Fault	552	FID_SVCOM_OPEN_MAIN_FAULT		Primary Host unavailable or not responding
2017-09-29 13:30:35	Fault	553	FID_SVCOM_OPEN_BACKUP_FAULT		Secondary Host unavailable or not responding
2017-09-29 13:30:18	Fault	552	FID_SVCOM_OPEN_MAIN_FAULT		Primary Host unavailable or not responding
2017-09-29 13:20:34	Fault	553	FID_SVCOM_OPEN_BACKUP_FAULT		Secondary Host unavailable or not responding
2017-09-29 13:20:18	Fault	552	FID_SVCOM_OPEN_MAIN_FAULT		Primary Host unavailable or not responding
2017-09-29 13:10:35	Fault	553	FID_SVCOM_OPEN_BACKUP_FAULT		Secondary Host unavailable or not responding
2017-09-29 13:10:19	Fault	552	FID_SVCOM_OPEN_MAIN_FAULT		Primary Host unavailable or not responding
2017-09-29 13:00:35	Fault	553	FID_SVCOM_OPEN_BACKUP_FAULT		Secondary Host unavailable or not responding
2017-09-29 13:00:18	Fault	552	FID_SVCOM_OPEN_MAIN_FAULT		Primary Host unavailable or not responding
2017-09-29 12:10:20	Info	299	IID_SVCOM_SMTP_FILE_SENT		
2017-09-29 07:50:36	Fault	553	FID_SVCOM_OPEN_BACKUP_FAULT		Secondary Host unavailable or not responding
2017-09-29 07:50:19	Fault	552	FID_SVCOM_OPEN_MAIN_FAULT		Primary Host unavailable or not responding

Mark Files as "Sent"

Prevents raw data files from being retrieved from the logger's internal memory and written to the SD card or sent via iPack. This is useful in several common ways:

- To send data files only after a particular commissioning start time & date, particularly once all sensors have been connected.
- To send data files after a site number change, particularly in the case of replacing a damaged or old logger with a spare previously installed somewhere else.
- After installing or configuring an iPack with a logger that has been operating without regular sending of data files to prevent the sending of all previously recorded files from the logger's internal memory.

Marking files as sent will not delete them. However, once the logger's internal memory is full, it will overwrite the oldest internally stored data first (circular buffer), regardless of whether they have been marked as "sent".

5.5 | Site Utilities Tab

The **Site Utilities** tab allows the user to view and edit basic site database properties, save the data encryption password for the site to the site database, and perform standard data export functions. It can be viewed regardless of if the logger for the corresponding site is connected to the PV via USB or remote Metlink.
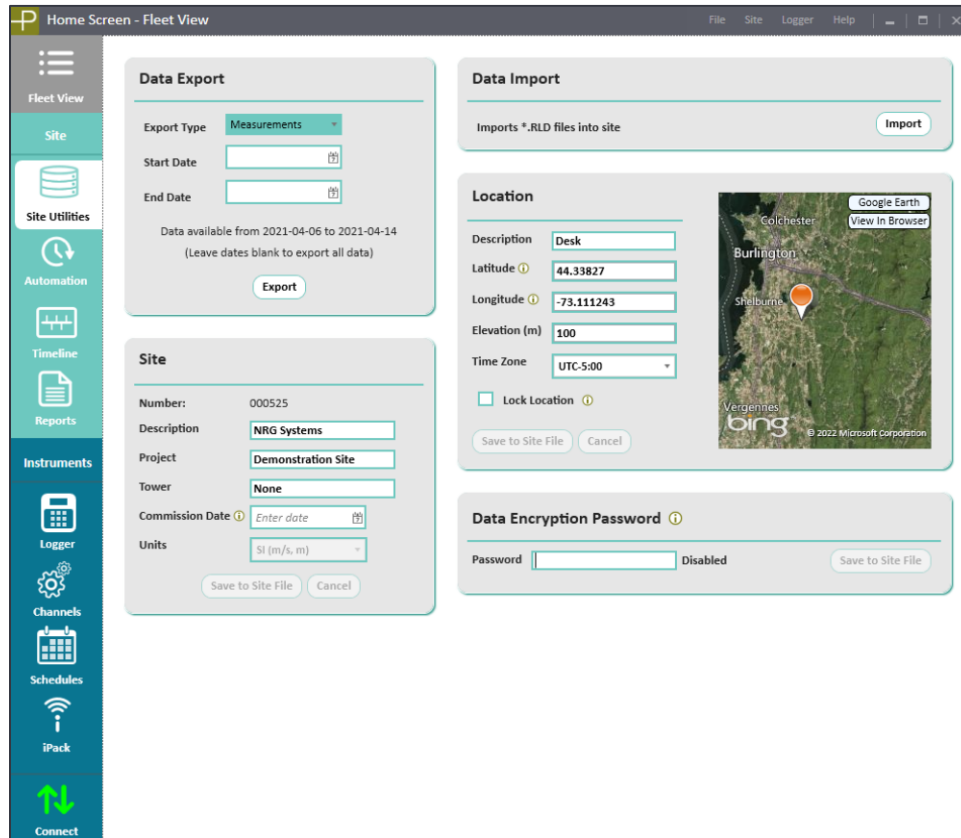
Data Export

Data Export controls exporting of data files from the site file into a common text file format that can be easily processed by third-party data analysis tools or viewed in a text editor. The Export Type defines what type of data (**Measurements**, **Diagnostic**, **Communication**, **Events**) are exported when the **Export** button is clicked.

The start and end dates define the data to be exported by a time range. By default, these are blank, which provides an easy way to export all data. The start and end dates of exports have a 1-day resolution (rather than hours, minutes, or seconds).

Details about data exports can be found in **5.14 | SymphoniePRO Text** File Formats.

Data Import

The **Import** button allows you to select and import raw data files into the site database.

Site

Site contains details about the site.
Description holds up to 20 text characters. Used to describe a site characteristic more specifically when a project has multiple sites that need differentiation.
Project holds up to 20 text characters. Used for a brief description of the project (for example, "Windy Wind Farm").
Tower describes the type of monitoring tower on which the instrumentation and sensors are mounted ("NRG 60 m XHD Tubular", for example). The Tower field appears only in the SymphoniePRO Desktop App and does not exist in the logger or in the data set generated by the logger.
Commission Date is the date the site began collecting data. Data imported before this date will be filtered out.

Units are fixes as SI (metric) units only. The Units setting defines how wind speed data are scaled upon export or in charts and reports.

Location

Location contains specific information about the site's location.
Description holds up to 20 text characters. Used for the town, address, or other related information.
Latitude and **Longitude** are entered in decimal degrees with precision to 7 decimal places.
Elevation of the site is entered in meters.
The latitude, longitude, and elevation will update automatically based on the GPS coordinates saved in the site's *.RLD files.
By checking the **Lock Location** checkbox, coordinates in the *.RLD files will be ignored and only values entered by the user will be used.

Time Zone is entered relative to UTC with up to 1/4-time zone resolution (for locations where the adjacent time zones are 1/2- and 1/4-hour difference rather than 1 hour).

Data Encryption Password

This is the storage location for the site's *.RLD data file encryption password.
The password is entered as a text string of up to 20 characters, displayed as "*" when entered.
The password stored in the SymphoniePRO Desktop App must match the password stored in the site's logger to decrypt data.

5.6 | Automation Tab

The **Automation** Tab is for selecting actions to be automatically performed during the next remote MetLink connection.

- File Download: Retrieve all unsent .RLD raw data files.
- Logger: Update logger firmware.
- iPack: Update iPack firmware
- Connection: End Metlink session when all actions are complete.

Automation functions will not be initiated with a USB MetLink connection, nor will automation functions be initiated if they are already in process as the result of an existing MetLink connection by another user. Logger or iPack firmware upgrades can also be automated from this screen rather than performed manually from the Logger or iPack screens.
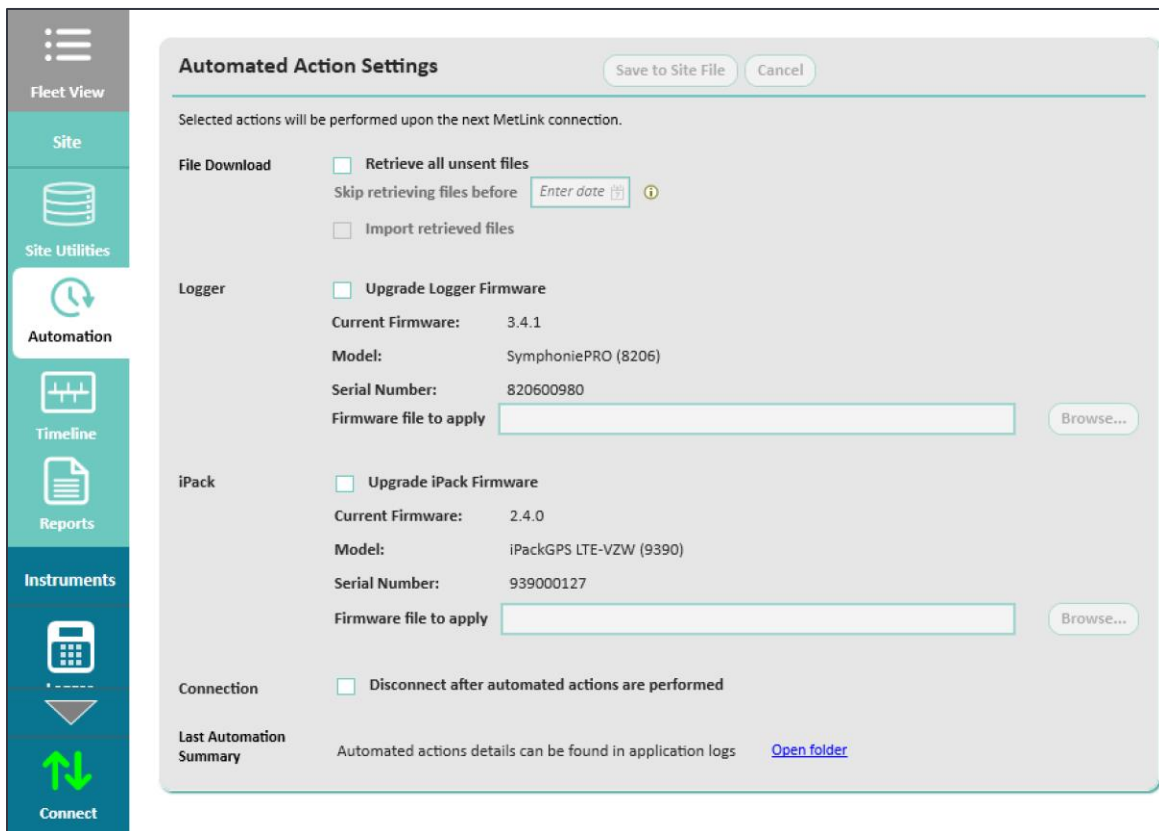
When connecting to the site, the Connection Status will indicate progress of automated actions.

Once automated actions have been completed, putting the cursor over the Connection Status "Completed Automation Actions" will display a summary of the automation actions.

5.7 | Timeline Tab
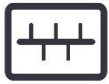
The **Timeline** Tab is used for viewing and editing all time-based site metadata. Many different data sources are shown chronologically alongside each other in this view to provide a comprehensive picture of what has happened to the site over the course of its
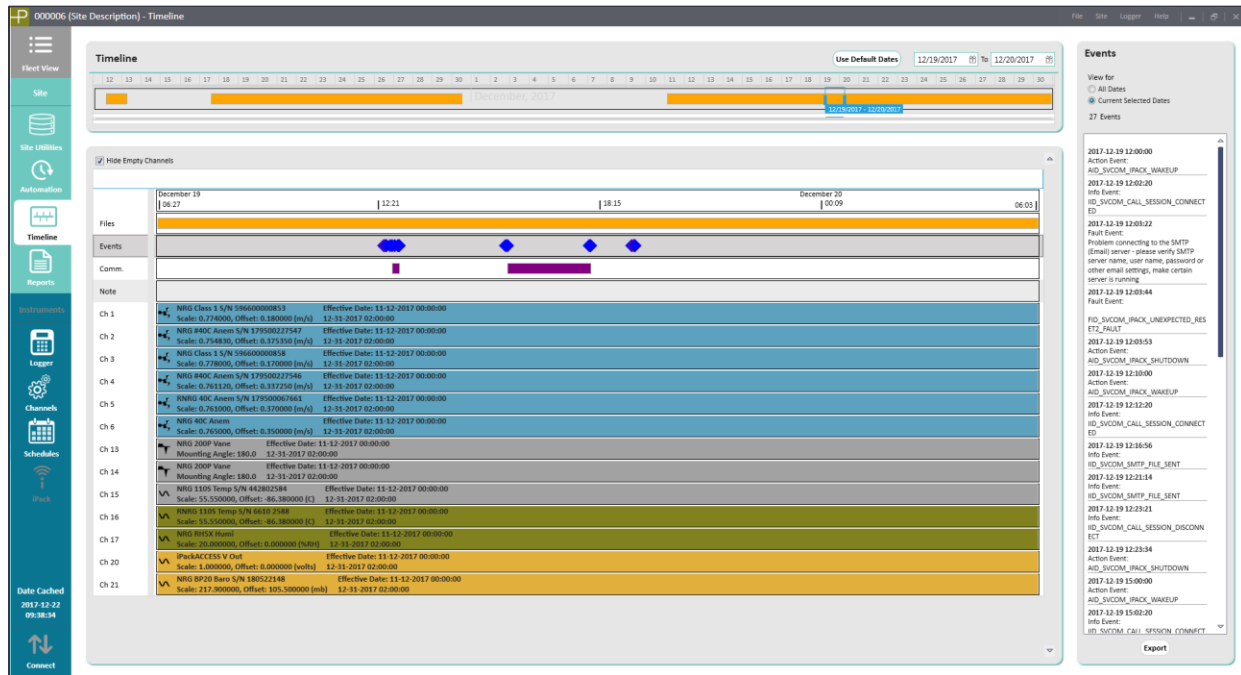
service life.

The top pane of the timeline screen provides a simple visual summary of available data and acts as the zoom and pan controls for the displayed date range. A solid bar indicates no gaps in data. Dates for which no data files have been imported are represented by blank spaces.

The user can define a specific date range to view by dragging the blue date selection handles or by zooming in or out by scrolling.

Large amounts of information can easily be viewed to find problem areas, quickly make adjustments to fix data export issues, or diagnose strange sensor behavior.

Unused channels can be hidden using the **Hide Empty Channels** checkbox.

Files

When the **Files** row is selected, file information is displayed in the pane on the right side of the screen. Details can be viewed for "All Dates" or for "Current Selected Dates."

The file name, size of the data file, start and end dates, and number of associated data points, events, and communication logs are displayed.

Double-clicking an *.rld file box will open the file in a QuickView window. The *.rld file must be stored in the Raw Logger Data Files Path defined in Settings to be viewed this way.

Events

SymphoniePRO logs all types of events and records them in the data stream. A history of fault events and user actions is recorded for each site. When the **Events** row is selected, the full details for that item are listed in the pane on the right side of the screen.

SymphoniePRO events are classified as faults, actions, or information. Further details like error codes provide supplemental information that can be helpful in troubleshooting. See the **Troubleshooting Guide** or more details about events.

Comm.

When the **Comm.** row is selected, communication information is displayed in the pane on the right side of the screen. Details can be viewed for "All Dates" or for "Current Selected Dates." The operator (carrier), signal strength, connection duration, bytes of information transmitted/received, and the timestamp of the communication are shown and can be exported with the **Export** button at the bottom of the window.

Note

The **Note** row allows comments to be entered by the user related to a particular date. For example, if a sensor is swapped out, or the SD card is pulled, a note can be entered for the date the action occurred.

Channels

When a sensor channel is selected, sensor history information is displayed on the right side of the screen. Details can be viewed for "All Dates" or for "Current Selected Dates."

Right-clicking on a sensor channel row will present the option to Edit, (through the Edit Sensor History screen), Delete, or Create New Sensor History (through the Add Sensor History screen). Double clicking a sensor channel row will open the Edit Sensor History screen.

Edit Sensor History allows the values to be modified and saved back to the site file. The effective date and time of the change can be entered, and the **Accept** button saves the changes into the site history. This is used when the logger was configured with or the site file was saved with incorrect sensor details.

Add Sensor History is used when a sensor on a particular channel is replaced or when its orientation on the tower has been changed. For example, if a sensor is changed and the new scale factor and offset are not entered in the logger, the correct scale factor and offset can be entered in the timeline with the date and time of the change so that the correct scaling is applied from that time forward.

Note - The raw data does not need to be re-imported for any changes in the sensor history to be applied.

5.8 | Reports Tab

The **Reports** Tab contains options for creating data reports.

To generate a **Summary Report**, select the desired date range for reporting in the **Start Date** and **End Date** fields in the top left corner of the screen. The dates are defaulted to the first and last day of the most recent complete month. Press the **Load Report** button to generate a report. The report will appear on screen.

After one report is generated, it can be changed by entering new start and end dates and pressing the **Refresh** button.

The report viewing window has vertical and horizontal scroll bars, as well as a zoom bar and zoom drop-down menu on the bottom right. If the report has multiple pages, use the arrows or the page number box at the top left to navigate through the report.

For each channel, the **Summary Report** contains the following information, based on how the channels were programmed and the data collected over the selected time range: sensor height, units of collected

data, average value, minimum and maximum 10-minute average values and their times of occurrence, average 10-minute standard deviation values, maximum 1-second sample value and its time of occurrence. In addition, the report contains the average turbulence intensity (TI) for each wind speed channel, the prevailing (most frequent) wind direction sector for each wind direction channel, and total for any totalizer channel. Note that no maximum or minimum values are listed for wind directions, because these statistics are not meaningful in the context of direction.

If a channel configuration was changed during the reporting period and the units remained the same, then the summary statistics are derived from a dataset that includes data from before and after the change. The channel number will have an asterisk next to it to indicate that a configuration change occurred. If a channel configuration was changed during the reporting period and the units changed, then the report will contain separate rows for the channel before and after the unit change.

Reports can be exported to PDF or TIFF files by pressing **Export Current**, which opens the Export Report window.

Select **Monthly** to export a single or multiple reports using data from complete months. If you select a range of months, a separate report will be generated for each month.

To specify a different date range, select **Date Range** and enter the desired dates in the **Start Date** and **End Date** fields. By default, these dates will be the same as the start and end dates for the currently displayed report. Use the **File Type** drop-down to select either PDF or TIFF.

After pressing **Save**, the report(s) will be saved in the Reports Path specified in File->Settings. Links to the report file (for a single report) and the Reports folder will appear under the **Export Current** button.

5.9 | System Configuration | *Logger* Tab

Memory

The Logger screen's **Memory** section allows monitoring and management of memory usage.

The SymphoniePRO logger can record data to an SD card in addition to recording data to its internal memory. If no SD card is present, the Memory section of the Logger screen will indicate "Internal" instead of "SD Card".
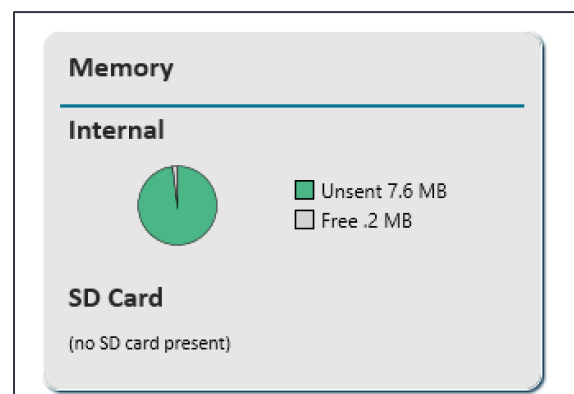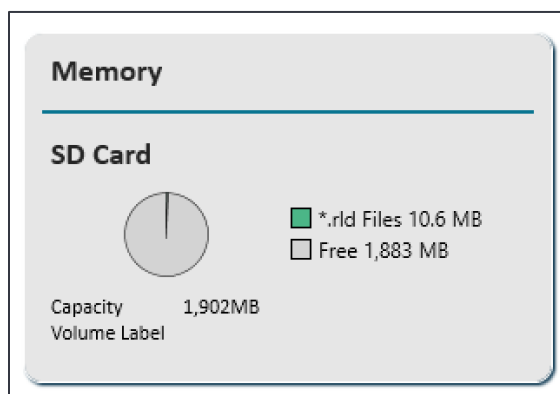
Internal Memory Storage

The logger will record data to its internal memory (7.8 MB capacity) until it is full; then it will overwrite the oldest internally stored data first (circular buffer). The time it takes to fill the internal memory varies depending on the number of installed sensors, the selected averaging interval, and whether raw data files are being recorded.

An SD card should be installed in the SymphoniePRO logger to provide redundant data backup. Industrial-rated 512 MB and 2GB SD cards are sold separately.

The SD card reader in the logger is write-only. When data files are transmitted by email or through a MetLink connection, they are sent from the logger's internal memory, not from the SD card.

SD Card Storage

The logger writes data to the SD card from the internal memory whenever a file closes; *.RLD files close every day at midnight. A file will also close whenever a configuration change is made to the logger (changing a sensor type or an averaging interval, for example). When an SD card is inserted, any files saved to the internal memory that had previously not copied to the SD card will be copied.

The amount of time to fill the SD card will vary according to sensor configuration and logger settings. A factory-formatted 512 MB card can hold over 10 years of data files for a typical wind resource assessment (WRA) installation collecting 10-minute statistical data.

For example, a meteorological tower outfitted with 7 anemometers, 3 wind vanes, 2 temperature sensors, 1 barometric pressure sensor and 1 relative humidity sensor, set to collect 10-minute statistics and connect once per day using a remote connection to the user's PC will transfer around 45 KB per day.

Because a MetLink connection uses very little bandwidth overhead, the transmitted byte usage will closely follow the data file size.

Enabling 1 Hz sample data drastically increases the size of .RLD data files- approximately 250 KB per enabled channel per day. If all channels are enabled and 1 Hz sample data are collected for all channels, the internal memory will be filled in about 18 hours so a 2 GB SD card will be filled after approximately 220 days.

For example, if 1 Hz sample data were collected for two of the anemometers and one of the vanes, the sample data size for the same one-day period would be 750 KB. Under this scenario, the daily file size would be 795 KB (45 KB + 750 KB), and a 2 GB SD card can hold over 6 years of data.

> *Because of the increased .RLD file size when recording 1-Hz sample data, 2 GB SD card is strongly recommended.* **The logger's internal memory should NOT be relied upon for long-term storage of raw data files.**

Data Retrieval

The **Retrieve By Date Range** button in the Data Retrieval section retrieves files via remote or direct (USB) MetLink connection from the internal memory and saves them to the Raw file folder on your PC. Double-clicking on files in the Raw file folder will open a QuickView window that shows a snapshot of recorded statistical data for each logger channel. The date range of available data is shown; leave dates blank to retrieve all available data files.

Site

Number

The Site Number field defaults to the last 5 digits of the logger's serial number but can be reset to any six-digit number. In the event the logger is replaced, the new logger should be programmed with the same site number to provide data continuity for that location.

> **Don't use duplicate site numbers.** *The site number is used throughout the system as the main identity of the site and the "home" for that logger and all its data and therefore must be unique across the fleet.*

Description

A site description of up to 20 characters can be entered. This is used to provide a brief description of the site, such as "Mtn Ridge-West Tower" and may include the site number. The description is typically a location within a project.

Project

A project description of up to 20 characters can be entered. Project is usually a broader term that describes multiple sites. This is used to provide a brief description of the overall project, such as "Windy Solar Farms".

Units

SI (metric) units of measure can be selected for displaying measurements on the logger's screen.

Location

Description

A site location description of up to 20 characters can be entered. This is used to provide a brief description of the site location, such as "Springfield, VT, USA".

Latitude

Enter latitude in decimal degrees (rather than degrees, minutes, seconds). Format will look like: 44.3286110. Use positive numbers for northern latitudes; use negative (-) numbers for southern latitudes. If an iPackGPS with adequate GPS signal is connected to the logger, this setting will be updated automatically at the end of a successful call.

Longitude

Enter longitude in decimal degrees (rather than degrees, minutes, seconds). Format will look like: -73.1100000. Use positive numbers for eastern longitudes; use negative (-) numbers for western longitudes. If an iPackGPS with adequate GPS signal is connected to the logger, this setting will be updated automatically at the end of a successful call.

Elevation (m)

Elevations are always provided in meters regardless of the logger's "Units" setting. If an iPackGPS with adequate GPS signal is connected to the logger, this setting will be updated automatically at the end of a successful call.

Time Zone

Select the logger's local time zone from the drop-down list. The SymphoniePRO logger defaults to time zone UTC+0:00.

> *Remember to use logger local standard time (not daylight savings time). The logger clock will not adjust for daylight saving time.*

Configuration

Logger **Configuration** details are automatically detected by SymphoniePRO Desktop App.

Serial Number
The unique 9-digit serial number that is embedded in the connected logger's microprocessor.

Model
The model number of the SymphoniePRO logger is 8206.

Ref Time
The PC clock's current time, displayed in the logger's local time zone (selected in the Location box). Pressing the **Set Clock** button will update the logger's clock to the reference time.

Logger Time
The logger clock's current time. Verify that this is the current time in the local time zone in standard time (not "daylight savings" time).

Firmware Version
The version of firmware the logger's operating system.

Pressing the **Upgrade Logger Firmware button** will open the Upgrade Logger Firmware window and allow a firmware version to be selected and the upgrade initiated with the Start Upgrade button.

When new firmware is available, an orange flag will appear on the on the menu bar of SymphoniePRO Desktop App. Current versions of firmware are always available for download from the NRG Systems website.

Hardware Version
The version of the assembled circuit board and its electronic components.

Manufacture Date
The date when the logger was manufactured is displayed.

Security

Data Encryption Password

As a security measure, SymphoniePRO can encrypt data as it's written to the file. A Data Encryption Password of 1-20 alphanumeric characters be enabled by setting a Data Encryption Password in the Desktop App's **Logger** screen.
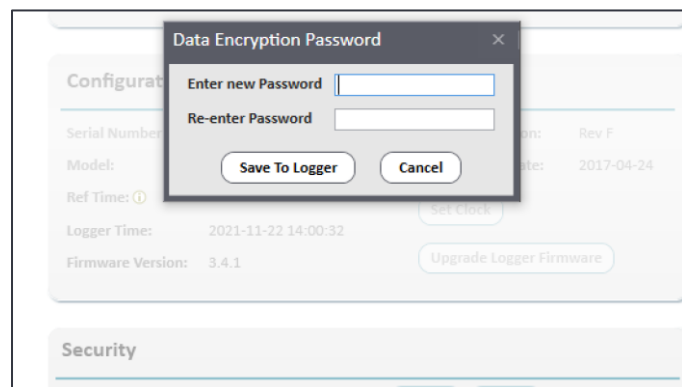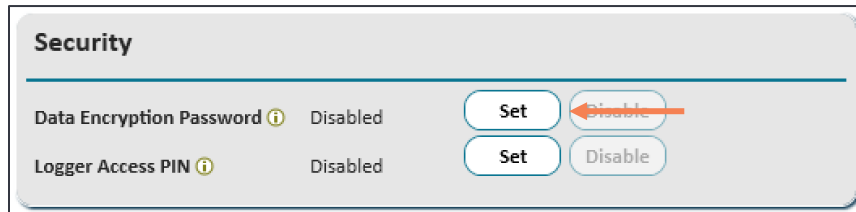
To decrypt imported data, the same Data Encryption Password must be saved in the corresponding site file (from the Site Utilities screen). It must also be entered to view the data in QuickView.
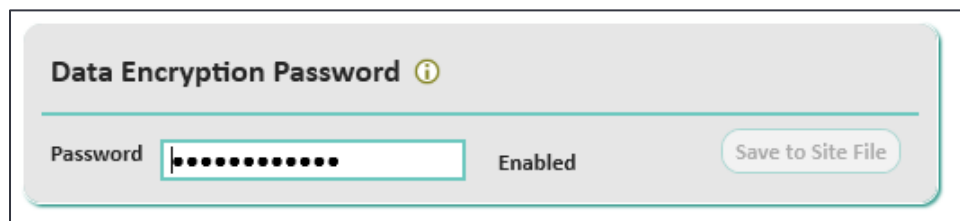
This is an optional feature intended only for those for whom data theft is a risk. If the data files are stored in an encrypted format on the SD card, the encryption password will also be needed for the software to decrypt the data. Encryption password status is indicated by the Desktop App. Loggers are shipped from NRG Systems with data encryption disabled.

> **Do not lose the Data Encryption password!** *Keep it in a safe place. NRG Systems does not save or store Data Encryption Passwords and cannot recover them if lost.*

Logger Access PIN

As a security measure, a numeric access/system lockout code of up to 6 digits can be set using SymphoniePRO Desktop App and USB connection. This is an optional feature intended only for use by those for whom logger theft is a serious risk. **Loggers are shipped from NRG Systems with the Logger Access PIN disabled.**

To change the Logger Access PIN, the current PIN, SymphoniePRO Desktop App, and a USB connection to the logger from a computer are required.

With a logger access PIN set, when a logger key is pressed, the first screen displayed will be:

```
                Enter PIN:
      Attempts Left:    8
           Site:000000
           SN: 000000000
```

Failure to enter the correct logger access PIN followed by the **[SET]** button will result in a message:

```
                Enter PIN:
      Attempts Left:    7
           Site:000000
           SN: 000000000
```

If the correct PIN isn't entered during one of the remaining attempts, access (via the keypad or communication interfaces) to the logger will be disabled for approximately 2 days. Logger access PIN status is indicated by SymphoniePRO Desktop App.
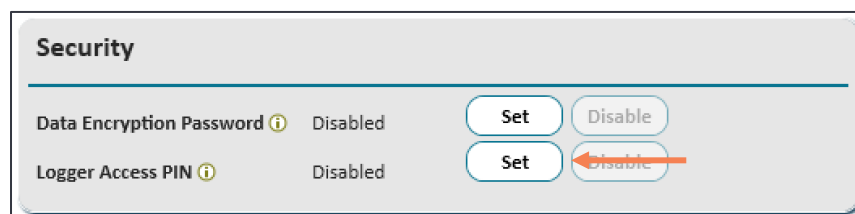
If the Logger Access PIN enabled and a matching PIN does not already exist in the site file, the user will be prompted to enter the Logger Access PIN into the following screen when MetLink communication with the logger is attempted:

Failure to enter the correct Logger Access PIN within 8 attempts will lock access to the logger for approximately 2 days. There is no way to defeat this lockout.

MetLink Authentication
In addition to the user-selected security features described above, each MetLink connection utilizes authentication to verify both the logger and Desktop App.

5.10 | Channel Configuration | *Channels* Tab

Logger configuration can be completed before connecting the sensors to the logger.

Connect your computer running SymphoniePRO Desktop App to the logger using the USB cable or remote connection, and double click the site on the Home screen. Under the Instruments section in the left navigation pane, click on the **Channels** icon. The Channel Configuration screen shows the current settings saved in the logger.

Header Bar Functions

Above the rows for individual sensor channels there is a header with several options that apply to the logger and/or all channels.
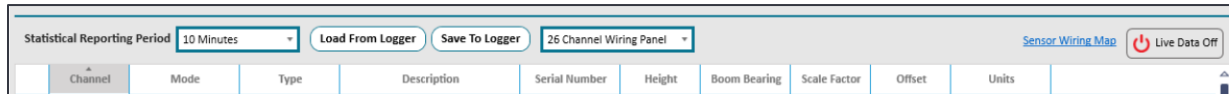
Statistical Reporting Period

The SymphoniePRO logger has a selectable **Statistical Reporting Period** of 1, 2, 5, 10, 15, 30, or 60 minutes.
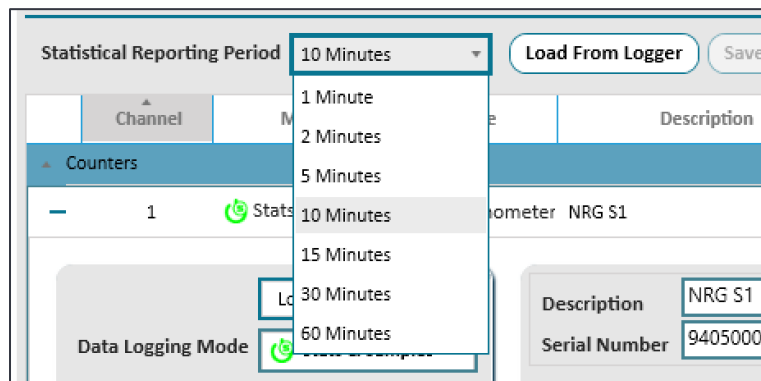
Load From Logger/Save To Logger

Changes in configuration can be saved to the logger's memory using the **Save to Logger** button, while the **Load from Logger** button will revert to the settings saved in the logger. Changes to individual sensor channels and logger settings can also be saved using the **Save All** button or discarded using the **Discard All** button located in the bottom left corner of the App window (shown only when changes are detected). Clicking the **Load from Logger** button restores the original settings without saving any changes.

Wiring Panel

There is a drop-down menu for choosing a 16-channel or 26-channel wiring panel. Choosing the 16-Channel Wiring Panel will hide the 10 unused channels and only display the 16 channels.
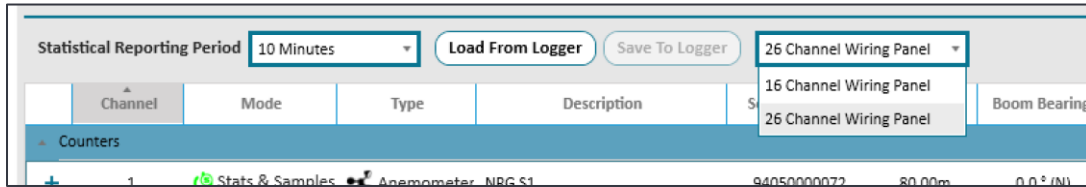
The 16-Channel wiring panel maintains the same logger channel numbers as the 26-Channel wiring panel, meaning that the channels are not all numbered consecutively.

Sensor Wiring Map

Clicking on the **Sensor Wiring Map** link to the right in the Header Bar will open a .PDF that contains wiring information for many sensors commonly used with the SymphoniePRO logger. The sensors shown in the Sensor Wiring Map do not constitute an exhaustive list of compatible sensors.
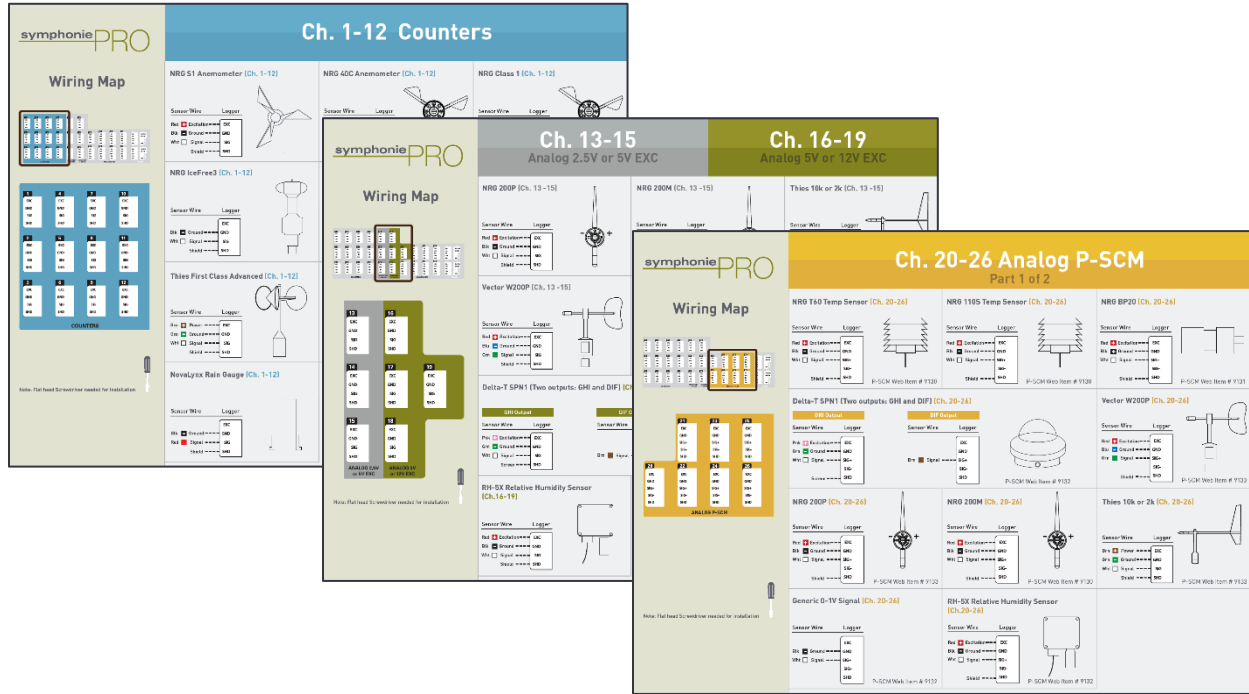
Viewing Live Data

The final function located in the Header Bar is viewing **Live Data**. This function displays 1-second sample data being recorded by the logger for all enabled channels. Live data can be used to verify sensor scale factors or to check sensor condition during or after a severe weather event.

Viewing live data from the logger requires that the channels are first configured, sensors are connected, and a connection (remote MetLink or USB MetLink) is established.

All sensor channel fields must be completed before live data will be transmitted for that respective channel.

The Live Data function consumes additional battery power and network airtime. Live data will automatically turn off after 5 minutes or if you navigate away from the Channel Configuration screen.

Enabling Channels

Logger channels are grouped by sensor signal type:

- – Counters
- – Analog 2.500 V or 5 V Excitation
- – Analog 5 V or 12 V Excitation
- – Analog (P-SCM)
- – Serial
- – Calculated

Clicking on the **[+]** symbol to the left of the channel number expands the window to show sensor details and clicking the **[–]** symbol hides them.

To configure each channel, select a sensor from the **Load From Defaults** drop-down list of commonly used sensors or simply turn on the channel in the **Data Logging Mode** drop-down list. The **Load From Defaults** list is there for easily configuring channels but selecting a sensor from that list is not required for enabling the channel.

Data Logging Mode offers the options of turning the channel off, recording statistical data only (averages, standard deviations, etc., over the statistical interval selected in **Statistical Reporting Period** above), or recording both statistical data and sample data (1 Hz).

Power consumption & transmission times will be significantly increased if 1 Hz raw sample data is recorded.
When a user selects "Stats & Samples" for any channel, the Desktop App will warn them about this and recommend the use of a 2GB SD card for data file storage.

Entering Sensor Configuration Information

All sensor configuration fields are outlined below. Note that some fields are only visible with certain channel types or sensor types.

Description
Used to describe the sensor in up to 20 alphanumeric characters.

Serial Number
A serial number of up to 20 characters can be entered in this field.
When a serial number is entered for an NRG #40C or NRG Class 1 anemometer and the PC you are using is connected to the Internet, the calibration report for the sensor will automatically be downloaded into the **Calibration Reports** folder. After the calibration report is downloaded, a link to it will appear below the **Serial Number** field.

Height
The height of the sensor in meters above ground level.

Boom Bearing
Indicates the sensor boom orientation in positive degrees relative to north. Record this value relative to true north (requires adding the magnetic declination; http://www.ngdc.noaa.gov/geomag-web/).

Vane Mounting Angle (Wind Vane Channels)
For wind vane channels, Vane Mounting Angle defines the angle of the "North Mark" on the vane relative to the boom. Zero degrees indicates the mark is facing away from the boom and tower; 180 degrees indicates that the mark is directly facing the boom and the tower.
In the rare case of using a vane mounting angle other than 0 or 180, the angle is measured clockwise starting from the 0-degree alignment example.

An explanation of the Boom Bearing and Vane Mounting Angle is available by hovering over the Vane Mounting Angle tooltip in SymphoniePRO Desktop App.
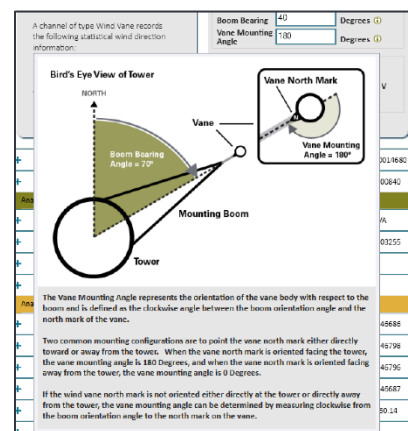
Scale Factor & **Offset**

Sensor signal scaling values.

Units

The units recorded by the sensor that should be displayed for the respective channel.

This field is view-only in instances where sensors (anemometers & vanes, for example) have units that cannot be changed by the user.

Signal Type (Counter Channels)

Selects whether the frequency signal from the sensor is coil (sine wave) or pulsed (square wave).

When **Pulsed** is selected, the user can additionally choose to enable a 12K ohm internal pull-up resistor to generate a 3.3 V pulse from the sensor output signal. The pull-up resistor is typically utilized for sensors that use switch closures to create the signal.
An explanation of this function is available next to the checkbox in the SymphoniePRO Desktop App.

Excitation (Analog Channels)

The **Mode** and **Voltage** options for the respective channel.

Dead Band Compensation (Wind Vane Channels)

For wind vanes with dead bands, the number of degrees of dead band on each side of the north mark.

SymphoniePRO Signal Conditioning Module (Analog P-SCM Channels)

Select the correct P-SCM that corresponds to the physical P-SCM inserted into the corresponding slot in the logger. When enabling a P-SCM channel, an option must be selected.

Using Serial Channels

A total of 24 serial sensor channels are provided for recording measurands from RS485 digital "smart" sensors with Modbus RTU output. These sensors include advanced pyranometers, soiling measurement sensors, reference cells, ultrasonic sensors, and more.

- **COM A** or **B** is chosen based on the terminal set that the sensor is connected to on the wiring panel. The selected COM port *must* match the terminal set used.
- **Slave Address** (Device ID) is entered to identify a specific sensor on a COM port because multiple sensors' wires can share the same terminal set on the wiring panel.
- The desired **Measurand** is selected from the available dropdown options. Depending on the specific model of serial sensor, multiple channels can be enabled for the same smart sensor with differing measurands.

Serial sensors also require configuration when using them with any type of data logger. Refer to the manufacturer's instructions for setup procedures.

Using Calculated Channels

Calculated channels are available to produce statistical values to verify and troubleshoot data. There are a total of 10 calculated channels available to use.

− **Direct Normal Irradiance** (DNI) represents the amount of light arriving perpendicular, in a straight line, towards a surface such as the ground or a sensor. This value is derived based on time of day, latitude, longitude, global horizontal irradiance (GHI), and diffuse horizontal irradiance (DHI). This calculated channel requires a channel input source of **GHI**, and a channel input source of **DIF** (diffuse irradiance).

− **Solar Zenith Angle** (SZA) is the angle between the zenith (an imaginary point directly above a location), and the center of the sun. This value is commonly used for solar data quality control and as input to additional calculations like DNI. The SZA is derived based on the time of day, time zone, latitude, and longitude. No sensor inputs are required for SAA; the **logger clock**, **time zone**, **latitude**, and **longitude** settings are used.

− **Solar Azimuth Angle** (SAA) is the horizontal angle of the sun along the local horizon, measured clockwise from true north. For example, due east has an SAA value of 90 degrees, and due west has a value of 270 degrees. This value is commonly used for solar data quality control such as to troubleshoot unexpected shading or reflection issues. The SAA is derived based on the time of day, time zone, latitude, and longitude. No sensor inputs are required for SAA; the **logger clock**, **time zone**, **latitude**, and **longitude** settings are used.

− **Albedo** is the ratio between reflected horizontal irradiance (RHI) and global horizontal irradiance (GHI). This ratio value is a measure of the reflectivity of a surface due to incoming solar radiation. To accurately calculate this value, two channels of the same type (i.e., analog or RS485) must be selected as the **RHI** (downward facing pyranometer) and the **GHI** (upward facing pyranometer) inputs. This ratio can be calculated for a tower albedometer or array albedometer. A high value (maximum of one, or 100%) indicates greater reflection by a surface back to the source. Complete absorption carries a value of zero.

− A **Ratio** calculated channel can be enabled to derive a ratio between any two channels of the same type (i.e., analog or RS485). One channel is used for the numerator and one for the denominator. The description of this channel can be edited to reflect the relevant ratio title.

5.11 | Data Transfer & Communications | *Schedules* Tab

Communication schedules are configured on the **Schedules Tab** in the Desktop App. SymphoniePRO offers several options for remote MetLink connections.

Refer to **Section 6 | Communications** to review the different connection types and choose what's appropriate for your situation.

Header Bar Functions & iPack Status

The **Load from Logger** button retrieves and displays current settings in the iPack. The **Save to Logger** button saves all settings on the Schedules screen to the iPack.
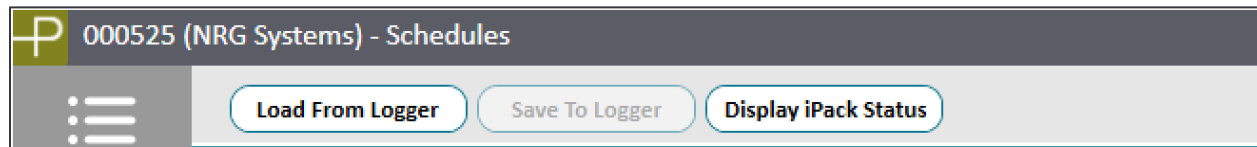
The **Display iPack Status** button shows the iPack's current status.
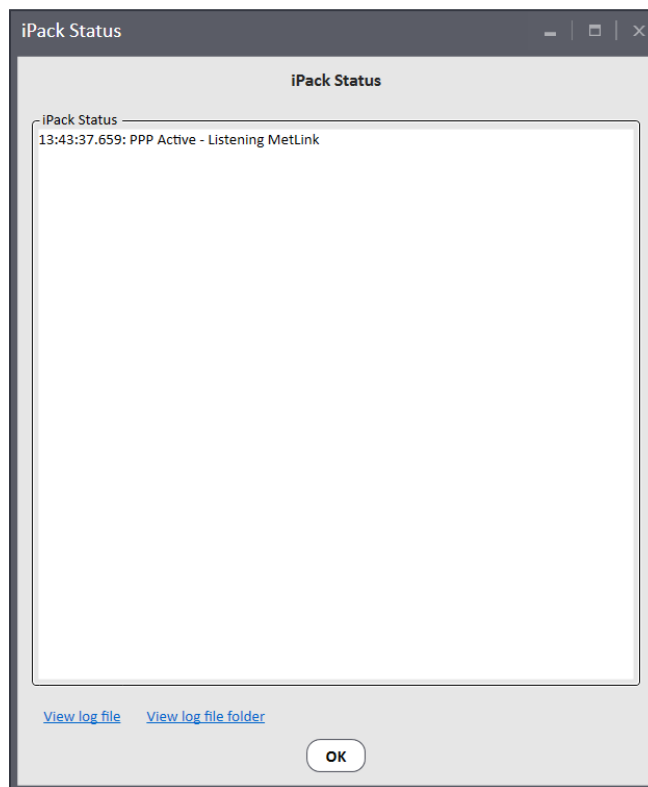
At the bottom of the **iPack Status** window are links to view the iPack log file and browse to the log file folder. Log files provide a record of connections and other iPack events and are described in further detail in the **Troubleshooting Guide**.

```
File  Edit  Format  View  Help
Renewable NRG Systems SymphoniePRO Desktop Application
Software version:       1.0.0.345 (build 21060 2014-10-15)
Log version:     1
Generated (local):      2014-10-15 15.01.04
Generated (UTC):        2014-10-15 19.01.04

User:   jma
Machine:        NRGCS004-7
Windows:        Microsoft Windows NT 6.1.7601 Service Pack 1
.Net Version:   4.0.30319.18063
System Culture: English (United States)
Decimal Separator:      "."

Timestamp       Site_Number     Mode    Type    Message
2014-10-15 15:01:04.397 global  Internal        Action: Application starting...
2014-10-15 15:03:50.373 global  User    Action: Device Connected. GSM cellular over Outbound to Logger
2014-10-15 15:30:09.575 global  User    Action: Device Disconnected.
2014-10-15 15:31:04.236 global  User    ERROR:  0: SymCom error during nrgcom_Open (UTTCP_DEV_NOT_FOUND_ERR)
SymphonieCommunication.SymComException: 0: SymCom error during nrgcom_Open (UTTCP_DEV_NOT_FOUND_ERR)
   at System.Runtime.CompilerServices.AsyncServices.<ThrowAsync>b__0(Object state)
   at System.Windows.Threading.ExceptionWrapper.InternalRealCall(Delegate callback, Object args, Int32 numArgs)
   at MS.Internal.Threading.ExceptionFilterHelper.TryCatchWhen(Object source, Delegate method, Object args, Int32 numArgs, Delegate
```

Metlink Logger Initiated Schedule

The MetLink Logger Initiated Schedule section controls how the logger initiates a connection and identifies the computer to which connection will be made. The information below explains how each field in the .LGR file pertains to the Metlink Logger Initiated connection.

For an explanation of remote Metlink connections and information about how the Host network should be configured, see **Metlink Connections** in Section 6.

Frequency
Connection frequency can be set to **10 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 12 hours, daily, 2 days, 3 days, 4 days, 5 days, 6 days, or weekly**.
Setting the connection frequency to **Disabled** will prevent the logger from attempting a MetLink Logger Initiated connection and attempts to initiate a connection from the logger's keypad will be ignored.

Time (Logger Local)
The Time field allows the user to select the time of day at which the connection will occur. The time chosen does not need to be at the top of the hour.
If unable to connect successfully on the first attempt, the connection will automatically be attempted again every 10 minutes up to 5 times.

Duration
Duration is the length of time the logger remains powered up and connected to the PC specified by the Primary Host or Secondary Host. This field is connected to the **Duration** field in the *Metlink Logger Listening Schedule* section, so changing the value of one also changes the value of the other.

> *The logger & iPack must be connected to grid power to use a continuous Duration. Failure to connect to grid power prior to enabling continuous logger-initiated connection to the Host network will result in battery failure and loss of data.*

The user can manually end the session sooner or program the logger to disconnect as soon as automated actions are completed. Closing SymphoniePRO Desktop App closes all MetLink connections.

Next
The Next field shows the next date and time at which the logger will attempt a connection based on the current schedule. This field is updated any time the Frequency or Time fields are changed, but the updated settings will only take effect after they have been saved to the logger.

Primary Host Name
The address that the logger first attempts to connect to. The primary host name will typically be in a format like myhost.mycompany.com or written as an IP address.

Port
The port configured for the Primary Host address. The port can be configured to any port number between 0 to 65535. The default port is 587. Consult your network administrator to choose a port not already in use.

Test
Clicking the Test button tests the connection between SymphoniePRO Desktop App and the Primary Host on the designated port number.

Secondary Host Name
The address that the logger attempts to connect to if the Primary Host connection fails. The Secondary Host name is optional. If left blank, the logger will only attempt connection to the Primary Host.

Port
The port configured for the Secondary Host address.

Test
Clicking the Test button tests the connection between SymphoniePRO Desktop App and the Secondary Host on the designated port number.

Enable Diagnostic Check-In
If the Enable Diagnostic Check-In box is checked, basic logger status information is automatically sent to NRG Systems Technical Support. This information can be useful in diagnosing communication problems. **No data files from the logger will be sent to NRG Systems if this box is checked.**

Test
Clicking the Test button tests the connection between the logger and NRG Systems servers. Contact NRG Technical Services (support@nrgsystems.com) to confirm successful receipt of diagnostic information.

MetLink Logger Listening Schedule

The MetLink Logger Listening Schedule section controls when the logger is made available for incoming connections from a user through the Desktop App. The information below explains how each field in the .LGR file pertains to the Metlink Logger Listening configuration.

For an explanation of remote Metlink connections and information about how the Host network should be configured, see **Metlink Connections** in Section 6.

Frequency
Connection frequency can be set to **10 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 12 hours, daily, 2 days, 3 days, 4 days, 5 days, 6 days, or weekly**.
Setting the connection frequency to **Disabled** will prevent the logger from attempting a MetLink Logger Initiated connection and attempts to initiate a connection from the logger's keypad will be ignored.

Time (Logger Local)
The Time field allows the user to select the time of day at which the logger will begin listening for incoming MetLink connections. The time chosen does not need to be at the top of the hour.

Duration

Duration is the length of time the logger remains powered up and listening for a connection. The duration can be set to **1 minute, 10 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 12 hours, or Continuous**. This field is connected to the **Duration** field in the *Metlink Logger Initiated Schedule* section, so changing the value of one also changes the value of the other.

> *Longer listening modes consume additional battery power, so the duration should be set as short as possible but long enough to establish a successful connection.*

> *The logger & iPack must be connected to grid power to use a continuous listening Duration. Failure to connect to grid power prior to enabling continuous listening will result in battery failure and loss of data.*

MetLink connections will remain active for up to 1 hour or up to 20 minutes beyond the programmed MetLink Logger Listening duration, whichever is greater.
For example, if the Duration is set for 10 minutes, the iPack will automatically disconnect after 60 minutes. If the Duration is set for 3 hours, the iPack will disconnect after 3 hours and 20 minutes.

MetLink Logger Listening connections can be initiated any time within the scheduled Listening period, and the connection will continue until manually disconnected or after the duration described above. Closing SymphoniePRO Desktop App closes all MetLink connections.
For example, if you connect 1 minute before the listening period ends, the connection will be maintained until you disconnect, or the session times out as described above.

The user can manually end the session sooner or program the logger to disconnect as soon as automated actions are completed. Closing SymphoniePRO Desktop App closes all MetLink connections.

Next

The Next field shows the next date and time at which the logger will attempt a connection based on the current schedule. This field is updated any time the Frequency or Time fields are changed, but the updated settings will only take effect after they have been saved to the logger.

End Time

The End Time defines the specific time at which the MetLink Logger Listening period will end.

Listen Now

The Listen Now button initiates a logger listening session separate from the regularly scheduled connection and allows SymphoniePRO Desktop App's connection to the logger to be tested.

Time Service

The logger's internal clock is synchronized to UTC time through the internet using an SNTP server or through the iPack's GPS. Both time synchronization methods are run independently during iPack communication operations with the SNTP server providing backup if no GPS signal is available.

If both boxes are checked, a GPS time sync will be attempted first, and SNTP will be used if the GPS time sync fails.
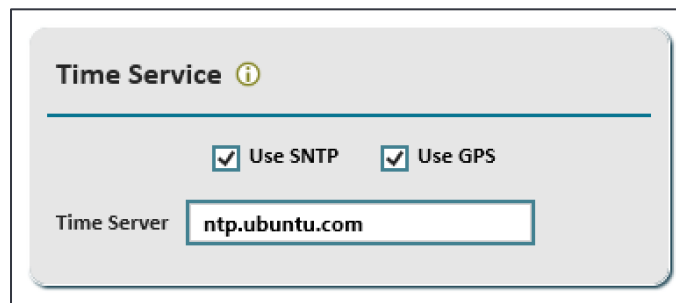
Use SNTP

When selected, the logger will attempt to connect to the SNTP server found in the **Time Server** field. If SNTP-based time synchronization has been selected, the logger will attempt to connect to the configured SNTP server if it has been more than one day since it last successfully communicated with an SNTP server.

Use GPS

When selected, the logger's internal clock is updated with UTC time provided by the GPS. If the time adjustment is larger than 60 seconds, an entry is made in the event log.

SymphoniePRO Data Logger

Email Schedule

The Email Schedule section controls when and where the logger will send .RLD data files.

Frequency

Email frequency can be set to **10 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 12 hours, daily, 2 days, 3 days, 4 days, 5 days, 6 days, or weekly**.

Setting the email frequency to **Disabled** will prevent the logger from attempting to email data files and attempts to initiate an email from the logger's keypad will be ignored.

Time

This field allows the user to select the time of day at which emails will be sent. The time chosen does not need to be at the top of the hour.

If unable to connect successfully on the first attempt, the connection will automatically be attempted again every 10 minutes up to 5 times.

SMTP Server

The server used by the logger to send data files via email.

> The SMTP server cannot use SSL or TLS encryption.

Packet-mail users will enter an SMTP server name of smtp.packet-mail.net.

SMTP Port

The port used by the logger to access the SMTP server. The SMTP Port is typically 587 or 25.

Consult your email service provider to confirm the correct port to use.

User Name

The login username provided for the email account used by the logger, typically something like "Person" or "person@companyABC.com."

Password

The password associated with the email account used by the logger.

Sender's Email

The full email address assigned to the logger for sending .RLD data files. Data files will be emailed from this address by the logger. **A valid email address must be entered if email is enabled.** This email address will appear in the "From" field of emails from the logger.

Sender's Name

Typically a descriptive name assigned to the logger. It may contain a site number and/or geographic location. It will also appear in the "From" field of emails from the logger.

Recipient's Email

The email address to which the logger will send data files.

Recipient's Name

The name of the person to whom the logger will email data files.

CC Email

Another email address to which the logger will send data files. This field can be left blank.

CC Email 2

Another email address to which the logger will send data files. This field can be left blank.

Subject Line

The subject line of emails from the logger that contain .RLD data files. It may contain letters, numbers, and other symbols. It should be descriptive of the email contents, such as "Windy Hills Site 12345 SymphoniePRO Data".

Email Now

The Email Now button initiates a connection to the internet (if not already connected) and prompts the logger to email any unsent data files. This button is disabled if an iPack isn't connected.

If there are many unsent data files, it will consume battery power to send them all.

Test Email Settings

This button attempts a connection to the designated SMTP server, using the settings entered, to confirm that a connection can be made, but it does not send a data file.

5.12 | iPack Configuration | *iPack* Tab

The iPack configuration information is entered and/or displayed in the **iPack Tab**. The fields displayed may change depending on the iPack connected to your logger.

To configure an iPackGPS or iPackACCESS, the iPack must be attached to a SymphoniePRO that is connected to a PC running SymphoniePRO Desktop App.

Header Bar Functions & iPack Status

The header bar contains the same options as the **Schedules Tab**, but they apply to the **iPack Tab** instead. The **Load from Logger** button retrieves and displays current settings in the iPack. The **Save to Logger** button saves all settings on the iPack screen to the iPack.

iPack Tab Screens

The image below shows the iPack screen when the SymphoniePRO is connected to a cellular iPackGPS.

The image below shows the iPack screen when the SymphoniePRO is connected to an iPackACCESS.

Modem Status (iPackGPS units only)

State
Indicates the current state of the modem.

Signal Strength
Indicates the signal strength of the modem from 0% to 100%.

Registration
Shows the network registration status of the modem.
Possible values are: **None**, **Home**, **Registered**, **Searching**, **Denied**, **Roaming**, **Direct**, and **Unknown**.

Cellular Band
Identifies the frequency band currently in use or assigned as the only band permitted to be used by the modem. This field is hidden for types of iPacks for which the frequency band can't be set by the user.

- **Set**
  Pressing the Set button brings up a list of frequency bands permitted to be used by the modem, including the value "Automatic", which causes the modem to pick the best band available in the region. This function is only available through a direct (USB) connection between the logger and SymphoniePRO Desktop App software.

Carrier

Identifies the wireless carrier currently in use or assigned as the only carrier permitted to be used by the modem. This field is hidden for types of iPacks for which the carrier can't be set to alternative carriers.

- **Set**
  Pressing the Set button brings up a list of available wireless carriers in the area permitted to be used by the modem, including the value "Automatic", which causes the modem to automatically pick a carrier available in the region. After pressing the button, it may take around 30 seconds for the modem to finish searching for available carriers.
  This function is only available through a direct (USB) connection between the logger and the Desktop App.

> *The iPack State must be "Disconnect" to make changes to the* Cellular Band *or* Carrier*.*

Network Status (iPackACCESS units only)

State

Indicates the current state of the network connection.

MAC Address

The Media Access Control (MAC) address of the Ethernet modem.

Network Speed

Displays the modem speed of the Ethernet modem in milibytes per second.

Duplex Mode

Displays the Duplex Mode of the Ethernet modem. The possible values are Half-Duplex or Full-Duplex.

Crossover

Displays if the Ethernet modem is connected via a crossover Ethernet cable or not.

The possible values are **Yes** or **No**.

Network (iPackGPS)

The following fields appear in the **Network** section when the logger is connected to an iPackGPS unit.

> *The values for these fields may vary depending on the type of iPack, SIM card, or location of the site.* **NRG Systems is not a cellular service provider.** *Contact your local service provider (or the provider of the SIM card) to verify the correct information to use.*

ISP Username

This field is for the username **assigned by your wireless carrier** for the iPack's data account. It may be a 10-digit account number or phone number, or it may be left blank.

WindLinx Username: web

ISP Password

This field is for the password **assigned by your wireless carrier** for the iPack's data account.

WindLinx ISP Password: web

APN

The Access Point Name (APN) is required by GSM iPacks.

Windlinx APN: nrg.windlinx.com

SIM PIN

Security PINs are sometimes required by service providers. This option is only available for GSM iPacks.

Dial String

The Dial String field is automatically populated based on the type of iPack being used. **Do not change these values.**

- LTE iPacksGPS dial string: *99#
- GSM iPackGPS dial string: *99***1#

Network (iPackACCESS)

The following fields appear in the **Network** section when the logger is connected to an iPackACCESS unit. See **iPackACCESS With Modbus Protocol** for information about Modbus communication & network settings.

BGAN M2M Satellite Module Connected
Check this box when using the iPackACCESS with a BGAN M2M Satellite module. This enables the smart switching of 12 V output power from iPackACCESS to the BGAN M2M modem for reliable remote operation and adjusts the iPack's activity timing to work well with the BGAN M2M device.

See **6.7 | iPackACCESS &** BGAN M2M in Section 6 for complete setup instructions.

> **(!)** *Be sure the Modbus Server checkbox is disabled when using iPackACCESS with a BGAN M2M Satellite module. Enabling Modbus over a satellite connection can result in stratospheric communications costs!*

Enable DHCP (iPackACCESS only)
This box is checked by default. Leave it checked to use DHCP to automatically assign an IP address to the iPackACCESS.

When this box is not checked, the fields for **iPack Static IP Address**, **Subnet Mask**, and **Gateway** must be filled in.

> **(!)** *If DHCP is enabled then the IP address assigned to the iPackACCESS may change, which could prevent the ability establish a MetLink Listening or Modbus connection. If using DHCP, the best practice is to create a rule for the router to apply a consistent IP address to the iPackACCESS.*

Primary DNS Server
By default, the Primary DNS Server is left open. Do not change this field unless your ISP requires a specific DNS server.

Secondary DNS Server
By default, the Secondary DNS Server is left open. Do not change this field unless your ISP requires a specific DNS server.

Configuration

Serial Number
The serial number of the iPack unit connected to the logger.

Model
The model of iPack (with item #) connected to the logger.

Firmware Version
The version of firmware loaded onto the iPack.

Upgrade iPack Firmware
Opens the Upgrade iPack Firmware window and allows a firmware file (*.ifw) that has been saved on the PC to be selected and the upgrade initiated with the Start Upgrade button.

Hardware Version
Describes the version of the iPack's assembled main circuit board with electronic components.

Manufacture Date
Date of manufacture of the iPack.

Modem ID (iPackGPS only)
The Modem ID is the unique identifying number for the modem. This number is what is recognized by a wireless carrier's network and is sometimes referred to as an ESN or IMEI number.

GPS

Status
Indicates status of GPS signal.

Latitude
Latitude is shown in decimal degrees (rather than degrees, minutes, seconds). Example: 44.3286110. Positive numbers are used for northern latitudes; negative (-) numbers are used for southern latitudes.

Longitude
Longitude is shown in decimal degrees (rather than degrees, minutes, seconds). Example: -73.1100000. Positive numbers are used for eastern longitudes; negative (-) numbers are used for western longitudes.

Elevation
Elevation of the site above sea level in meters.

Satellites
This field displays the number of acquired satellites.

Start
The Start button enables the GPS to acquire satellites and then update the latitude, longitude, and elevation.

Modbus Server (iPackACCESS only)

Enable Modbus Server

Check this box to enable Modbus functionality on the iPackACCESS.

Note that when Modbus is enabled, the iPack will remain active continuously and should be connected to a continuously available power source.

State

Shows the current status of the Modbus server when it is enabled.

Clients

Shows the number of Modbus clients currently connected.

Port

The port for the Modbus server to use. By default, the port is 502.

Use Secure IP Addresses

Check this box to limit Modbus connections to a list of up to 10 allowed IP addresses. When this box is checked, a Modbus Security section will appear where you may enter permitted IP addresses.

5.13 | RLD Quickview

The **RLD Quickview** function is an easy way to look at .RLD files without first importing them into a site within the Desktop App. Double-clicking a .RLD raw data file in the Raw file folder (or any File Explorer folder) will open the QuickView window and display the data contained within in both graphical and tabular form.
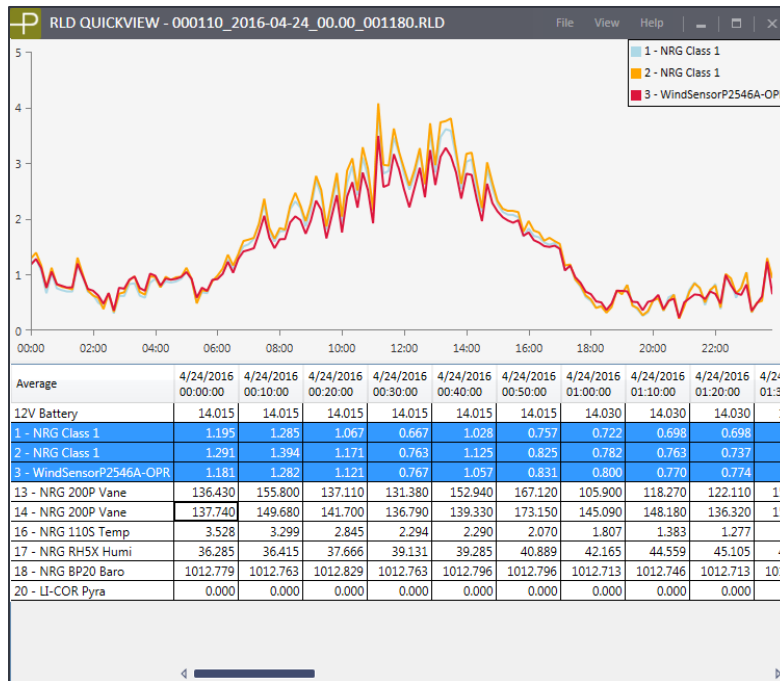
The table in the QuickView window has a row for each enabled channel's data and for the iPack battery voltage. Use the mouse or cursors to select a row of data to be displayed as a time series graph in the top half of the window. To select multiple rows of data to view at once, hold the left button of the mouse down while dragging over a series of rows, or use the Shift or Ctrl keys.

File Menu

The **File** menu of the QuickView window contains options to open a different *.RLD file, import the current file into the site database, and exit QuickView.

Open
Browse to the location of a different *.RLD file to view in QuickView.

Import File
Import the currently open *.RLD file into the corresponding site file. If no site file exists yet for this site, you will be asked if you want to create one.

Exit
Exit the QuickView window. If you have another SymphoniePRO Desktop App window or QuickView window open, it will remain open if you exit the current QuickView window.

View Menu

Show Unused Channels

View all SymphoniePRO logger channels, both enabled and disabled. This includes analog channels 1-26, serial channels 27-50, and calculated channels 100-109.

Show Additional Channel Details

Display Serial Number, Height, Boom Bearing, Scale, & Offset values in additional columns to the right of the channel descriptions in the data table. This information is pulled from the information entered in the **Channels Tab** during .LGR file configuration.

Precision

Select how many digits after the decimal are shown in the data table, 1-4 or All. The default is three decimal places.

File Header

Display the header information saved in the *.RLD file, including the time the file was created, time zone offset, site location name, geographical coordinates, site number, logger serial number and firmware version, and the iPack type, serial number, and firmware version.

File Header Information	
TimeStamp:	2016-04-22 18:00:00
Timezone Offset:	-5
Site Location:	RNRG Test Site
Longitude:	-73.1116583
Latitude:	44.3386916
Site Number:	000110
Logger Serial Number:	820600044
Logger Firmware:	1.1.0
iPack Type:	iPackGPS GSM 3G
iPack Serial Number:	798400005
iPack Firmware:	1.1.0
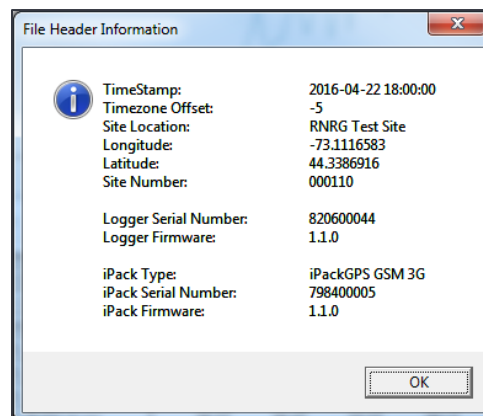
Events

View a table of any events recorded by the logger during the interval of time captured by the open *.RLD file.

Average, Standard Deviation, Maximum, Minimum, Turbulence Intensity

Display other statistic types. By default, QuickView shows the time interval averages for each channel. The data table will only display channels relevant to the selected statistic. For example, only wind speed channels are displayed when **Turbulence Intensity** is selected.

Help Menu

About

View information about the SymphoniePRO Desktop App version and find links to the End User License Agreement and the User's Manual.

5.14 | SymphoniePRO Text File Formats

Text File Export Types

This section describes the format of the text file exports. There are four types of export available:

- Measurements
- Diagnostic
- Events
- Communication

Export Text Conventions

This section describes the conventions used in this document to describe the export format.

Words enclosed in {curly braces} indicate fields that are always included.

Words enclosed in [square brackets] indicate optional content, which is driven by the configuration of the site or channel.

Words enclosed in (parentheses) indicate non-printing characters. In cases where the line is too long to fit on the page, the line is wrapped and a two-character indent is used.

All dates are specified in YYYY-MM-DD [HH:MM:SS] format, in local time.

Field Descriptions

The following table describes the fields used in the exports.

Field Name	Description	Example
Export Generation Timestamp	The date and time the export was generated.	2012-12-04 13:43:29
Software Version	The version of the utility running when the export was generated.	1.0.0.197 (build 17354, 2013-12-04)
Site Number	The number of the site.	000023
Site Description	The description of the site.	Windy Knoll
Project	The project description of the site.	New Development 23
Location Description	The location description of the site.	Mt. Mansfield, north ridge
Tower	The tower description of the site	NRG 60m XHD
Site Units	The units setting of the site	Imperial
Data Type	The type of data contained in the export: Measurements, Measurements (Turkish), Diagnostic, Events, and Communication.	Measurements
Start Date	The start timestamp specified in the query. If time is omitted, 00:00:00 is assumed. If no date is specified when creating the export (full range), then this will be blank.	2012-12-01
End Date	The end timestamp specified in the query. If time is omitted, 00:00:00 is assumed. If no date is specified when creating the export (full range), then this will be blank.	2012-12-04
Export Mode	The mode used for the export: Scaled, Sensor, P-SCM, Unscaled, Normal, Include Parameters. This field is hidden unless the mode does not match the default for the given export type.	Scaled
Coordinate System	The coordinate system used by NRG equipment	Always WGS84
Site Latitude	Latitude of site in signed degrees format.	34.2036866
Site Longitude	Longitude of site in signed degrees format.	-96.387250
Site Elevation	Elevation of site in meters or feet.	1102
Time Zone	Site time zone. All data is stored in UTC time but displayed in plots and exported in local time as indicated by the selected time zone.	UTC-4:00
Logger Start Date	The timestamp that the logger with this serial number was detected in the datastream	2014-01-01 12:34:56
Logger Model	The textual model of the logger	SymphoniePRO
Logger S/N	The logger's serial number	820600001
iPack Start Date	The timestamp that the iPack with this serial number was detected in the datastream	2014-01-01 12:34:56
iPack Model	The textual model of the iPack	iPackGPS GSM
iPack S/N	The iPack's serial number	462200001
Channel Number	The logger channel number.	1
Channel Type	The type of data recorded by a channel. Possible types include Anemometer, Vane, Totalizer, Analog, Analog Simple, Diagnostic, and Input.	Anemometer
Effective Date	The effective start date for a sensor history item.	2014-01-31 23:23:21
Height	Height above ground level of the sensor in meters or feet.	1.00
Bearing	Direction or bearing of the boom or device in degrees relative to true north.	225.11
Bearing Name	Direction or bearing of the boom or device in abbreviated cardinal directions.	NE
Scale Factor	Scale factor applied to the sensor data	0.638
Offset	Offset applied to the sensor data	0.35
Units	Units describing the sensor data	m/s

P-SCM Type	Type of P-SCM card configured for the channel. This is only applicable to analog P-SCM channels.	P-SCM #9130, (0 to 5) V, SE Input, Pulsed 5V EXC
VaneMountingAngle	Vane mounting angle	180.00
Serial Number	The serial number sensor for a given channel	3000010
Channel Description	The description of the sensor.	NRG 40C
Column N Name	The name of the nth column, which is built automatically from the configuration data for the channel.	Ch49_Anem_39.6m_E_Avg_m/s
Column N Data	The value of the nth column of data. If no data is available for a column at a particular timestamp, the value is left blank.	8.662
Timestamp	The date and time of the row of data.	2012-12-01 14:20:00
Diagnostic Type	The type of the diagnostic data shown in a column: LoggerBatt, iPackBatt, BoardTemp, 12VExcCurr, 5VExcCurr	LoggerBatt
Class	The class of event: Fault, Action, or Info	Info
Event Code	Numeric code of event.	201
Event	Shorthand text description of event	IID_SVCOM_CONNECT_START
Error	Short description of error if the event is a Fault	DNS server not responding.
Description	Detailed description of the event	This means that the main outbound logger connection cannot be completed due to a socket error.
Comm Duration	The length of time for the communication session in HH:MM:SS format.	00:00:21
Comm Reason MetLink Listen	Set if communication included a MetLink Listen schedule	True
Comm Reason MetLink Connect	Set if communication included a MetLink Connect schedule	False
Comm Reason SMTP	Set if communication included a SMTP schedule	True
Comm Reason FTP	Set if communication included a FTP schedule	False
Comm Reason Diagnostic	Set if communication included a MetLink Diagnostic check in	True
Comm Reason User Initiated	Set if communication was initiated by a user at the logger	False
Comm Reason Retry	Set if communication was initiated for a retry operation	False
Comm Reason Scheduled	Set if communication was initiated for a scheduled operation	True
Bytes Tx	Number of bytes transmitted by the logger during the session.	21696
Bytes Rx	Number of bytes received by the logger during the session.	23445
Signal	The strength of the cellular signal when the session was ended.	64
Result	The final result of the session. This is either Success or an error code.	Success
Comm Message	Message identifying connection to desktop application	NRGsystems\rhm

Column Types

The following table describes all the column types that appear in the measured data exports.

Column Type	Description
Avg	Arithmetic mean of all samples in the reporting period.
SD	Sample Standard Deviation. A measure of how much variation or dispersion exists from the average (arithmetic mean). A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data points are spread out over a large range of values.
Min	The lowest recorded sample in the period.
Max	The highest recorded sample in the period.
Gust	The mean value of the highest consecutive three samples of data in the reporting period.
GustDir	The direction of the maximum gust.
Total	The total value accumulated over the reporting period.
Sample	The measurement sample (not statistical) for the given time.

Column Modes

The following table describes all the column modes that appear in the measured data exports.

Column Mode	Description
Anem	The channel is reporting anemometer speed information
Vane	The channel is reporting wind direction information
Analog	The channel is reporting generic or simple analog information
Sum	The channel is reporting totalizer information

Column Names

Column names are described without spaces to improve readability in a basic text editor to avoid confusion with the tab column separators. The following describes how a column name is generated in an export:

Measurements Export:
Ch{Channel Number}_{Channel Mode}_{Height}_{Bearing Name}_{Column Type}_{Units}

Diagnostic Export:
{Diagnostic Type}_{Column Type}_{Units}

Export Rules

The exports must be able to present data from multiple datapoint types for a given channel, as that channel may change in its configuration over time or be independently disabled/enabled.

The following rules govern how the exports handle these cases:

— The columns generated for a channel represent the superset of all column types reported by that channel over the history covered by the given export.
For example, if digital channel 3 changed from anemometer to totalizer, then channel 3 would have the following columns: Avg, Min, Max, SD, Gust, & Total. The data for the first five columns would be mutually exclusive in the export, as the channel may not report both types at the same time.

— Columns that do not have any data in them are not exported. If channels 7-12 are disabled, then the export does not have any columns representing those channels (there are no blank "(tab)(tab)" columns).

— Rows that do not have any data in them are not exported. If there is no data for a time that would otherwise typically have data (10-minute boundary, for example), there is no row generated for that time.

These rules allow the export file to work in a manner that is similar to how the underlying datastream is structured. This is desirable because it allows future datapoints to be created without the repercussions of fitting the fields into a more rigidly structured export format and it reduces the overall file size.

Export Header Format

The beginning of the header information is identical across all export types. This is referenced in the proceeding export formats as `{Export Header}` and is defined as follows:

```
NRG Systems SymphoniePRO Desktop Application
Software Version:(tab){Software Version}
Export version:(tab)1
Generated:(tab){Export Generation Timestamp}

User:(

Export Parameters
Site Number:(tab){Site Number}
Data Type:(tab){Data Type}
Start Date:(tab){Start Date}
End Date:(tab){End Date}
Filters Applied:(tab){True | False}
[Mode:(tab){Export Mode}]

Site Properties
Site Description:(tab){Site Description}
Project:(tab){Project}
Tower:(tab){Tower}
Location:(tab){Location Description}

Coordinate System:(tab)WGS84
Latitude:(tab){Site Latitude}
Longitude:(tab){Site Longitude}
Elevation:(tab){Site Elevation}
Time Zone:(tab){Time Zone}
Site Units:(tab){Site Units}

Logger History
Date:(tab){Logger Start Date}
Model:(tab){Logger Model}
Serial Number:(tab){Logger S/N}

[Date: ...]

iPack History
Date:(tab){iPack Start Date}
Model:(tab){iPack Model}
Serial Number:(tab){iPack S/N}

[Date: ...]
```

Measurement Data Export Format

The measurements export format is generally the same across all modes, but the column units may change.

{Export Header}

Sensor History
Channel:(tab){Channel Number}
Effective Date:(tab){Effective Date}
Type:(tab){Channel Type}
Description:(tab){Channel Description}
Serial Number:(tab){Serial Number}
Height:(tab){Height}
Bearing:(tab){Bearing}
[Scale Factor:(tab){Scale Factor}]
[Offset:(tab){Offset}]
[Vane Mounting Angle:(tab){Vane Mounting Angle}]
Units:(tab){Units}
[P-SCM Type:(tab){P-SCM Type}]

[Channel: …]

Data
Timestamp(tab){Column 1 Name}(tab){Column 2 Name}…
{Timestamp}(tab){Column 1 Data}(tab){Column 2 Data}…
…

Diagnostic Data Export Format

The format for the diagnostic data export is the same as for the measurement data export in this version, except that the sensor history information is omitted.

Event Data Export Format (Normal)

The event export in normal mode includes the basic user-friendly information.

{Export Header}

Data
Timestamp(tab)Event_Description(tab)Class(tab)Code(tab)Error_Code
{Timestamp}(tab){Event Description}(tab){Event Class}(tab){Event Code}(tab)[{Error Code}]
…

Communication Data Export Format (Normal)

The normal mode of the communication data export includes the basic communication information that typically changes on each communication attempt and is of interest to the user.

{Export Header}

Data Timestamp(tab)Duration(tab)Comm_Reason_MetLink_Listen(tab)Comm_Reason_MetLink_Connect(tab)Comm_Reason_SMTP (tab)Comm_Reason_FTP(tab)Comm_Reason_MetLink_Diagnostic(tab)Comm_Reason_User_Initiated(tab)Comm_Reason_Retry(tab)Comm_Reason_Scheduled(tab)Bytes_Tx(tab)Bytes_Rx(tab)Operator(tab)Band(tab)Signal(tab)Result(tab)Comm_Message

{Timestamp}(tab){Comm Duration}(tab){Comm Reason MetLink Listen}(tab){Comm Reason MetLink Connect}(tab){Comm Reason SMTP}(tab){Comm Reason FTP}(tab){Comm Reason MetLink Diagnostic}(tab){Comm Reason User Initiated}(tab){Comm Reason Retry}(tab){Comm Reason Scheduled}(tab){Bytes Tx}(tab){Bytes Rx}(tab){Operator}(tab){Band}(tab){Signal}(tab){Result}(tab){Comm Message}

…

5.15 | NRG Export Configuration (NEC)

NRG Export Configuration (NEC) adds flexibility to the data export format from SymphoniePRO Desktop and is based on template files built using xml (with a *.nec extension). This feature will be further developed as needed. Please contact NRG with any questions regarding custom export formats as we can work with you to create the necessary functionality and NEC file.
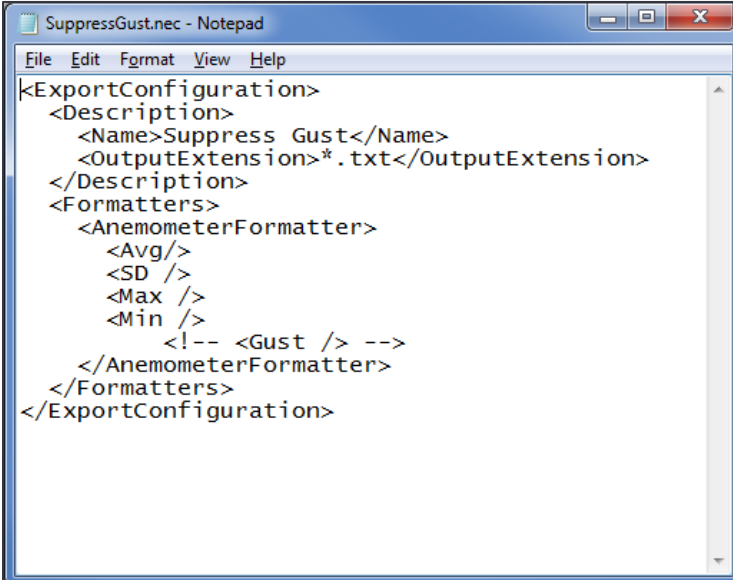
- Custom export format options include the following:
- Header options: standard, column headers only, or no header
- Channel order: re-order or omit certain channels from the header
- Timetsamp time zone: UTC or logger local time
- Channel statistics: re-order or omit certain statistic types, depending on the channel type

To use a custom export format, create an NEC file and save it in the NEC directory (C:\Users\~\Documents\Renewable NRG Systems\NEC). The NEC directory contains a file called ExampleExportConfiguration.nec. Modify this template file to create your own custom template.

Example: Suppress wind speed gust and re-arrange the wind speed columns as AVG, SD, Max, Min
The NEC file "SuppressGust.nec" can be used to make the SymphoniePRO wind speed export more like the SymphoniePLUS3 export. In this case, the NEC will remove the 3-second gust from the export and re-arrange the Avg, SD, Max and Min by placing them in order.

The contents of the SuppressGust.nec file are as follows:

```
SuppressGust.nec - Notepad
File  Edit  Format  View  Help
<ExportConfiguration>
   <Description>
      <Name>Suppress Gust</Name>
      <OutputExtension>*.txt</OutputExtension>
   </Description>
   <Formatters>
      <AnemometerFormatter>
         <Avg/>
         <SD />
         <Max />
         <Min />
            <!-- <Gust /> -->
      </AnemometerFormatter>
   </Formatters>
</ExportConfiguration>
```

This file is saved to the NEC directory.
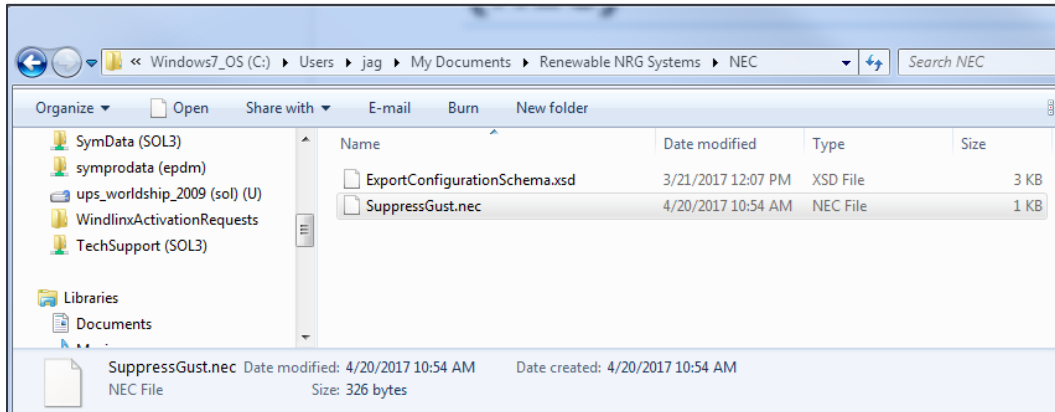
When *.nec files are saved in the NEC directory, they become a "save as" drop-down option in the measurements export.
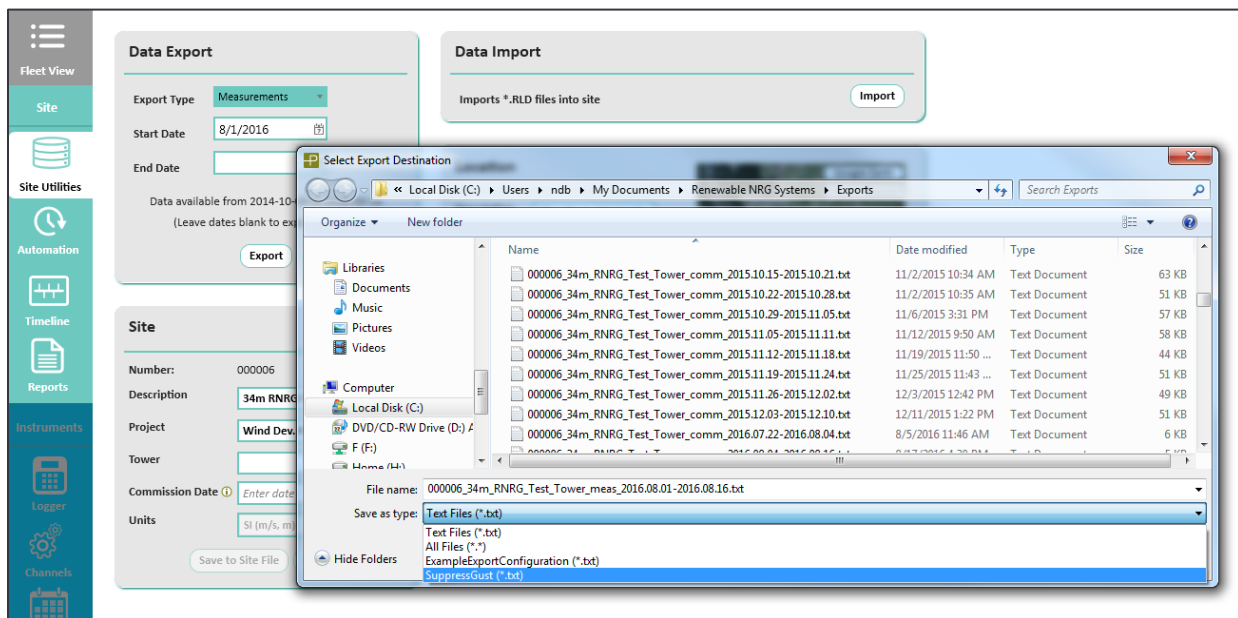
5.16 | SymphoniePRO Desktop Scripting & Automation

Running SymphoniePRO Desktop from the Command Line

To facilitate the automation of data processing, SymphoniePRO Desktop application has command line functions to convert and import data. The command line functions are typically evoked using scripts.

Scripts

A script is a file that contains a series of commands. Running the file runs all the commands it contains. A common script type found on all Windows machines is a .BAT (batch) file. Other script types include Perl or Python scripts, but these require additional software to run. The SymphoniePRO Desktop App can be executed from within a script to perform data convert and import operations.

Command Line Switches

Command line switches tell SymphoniePRO Desktop App which functions to perform. There are several command line switches that are useful in creating scripts for automation of data processing: `help`, `defaultfolder`, `import`, and `convert`.

Command	Parameters	Description
help		Opens a window containing a list of the supported commands and a brief description of each, software version information, and a hyperlink to the SymphoniePRO user's manual on the NRG website.
defaultfolder	/site /export /log /raw /firmware	Prints the path of the folder specified. If no parameter is specified, the default is /raw.
import	/file <filename> Specify the file to be imported	Imports a Raw Logger Data file into the site file. This requires the corresponding site file to exist and contain a decryption key if needed.
convert	/file <filename> Specify the file to be imported /mode <export mode> Specifies the export mode (scaled, sensor, p-scm, unscaled, normal or full). Leave blank for default mode (Scaled). /type <export type> Type of export (meas, diag, comm, events, sample). Default to meas if unspecified. /pass <encryptionpassword> Decrypt the file using the specified password /key <encryptionkey> Decrypt the file using the specified hex key /skipheader <mode> mode (skipcolumnnames) Default will skip file description header if [skipcolumnnames] is used then in addition to file description header column names will also be skipped /outputdir <dir> Directory to save result file /outputsubdir <subdirname> Save to result file to a sub folder of the input file [subdirname] or if left blank 'done' /site <sitefilename> Use scaling information from site file.	Converts the RLD directly to a text file, scaling using the settings in the file header. Does NOT require a site file. Allows serial processing of individual logger data files. Each command line execution when the file name is valid will produce a file with the extension of .txt (converted data) OR .log (containing the error(s) found when trying to convert the file). If the file name is not found, the result will be echoed to the screen. If no [sitefilename] passed in, use site number from RLD file to find a site file in default directory.
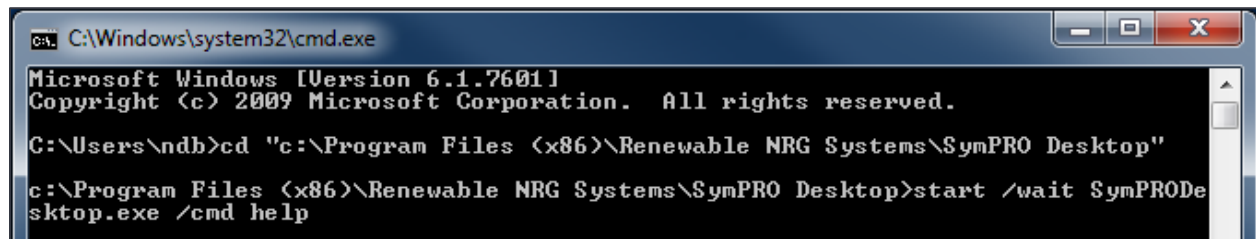
Command Line Examples

Commands should be run from within the directory which contains SymPRODesktop.exe (e.g. C:\Program Files (x86)\Renewable NRG Systems\SymPRO Desktop), and it is good practice to use the Windows `start` and `wait` command. These commands will help prevent errors under heavy processing load:

- `start` will start the process in a new command prompt window
- `wait` will execute the command and wait for it to end

The `help` switch opens a window that displays information about the version of SymphoniePRO desktop and the available commands and can be run using:

> start /wait SymPRODesktop.exe /cmd help

Running the help command will return:
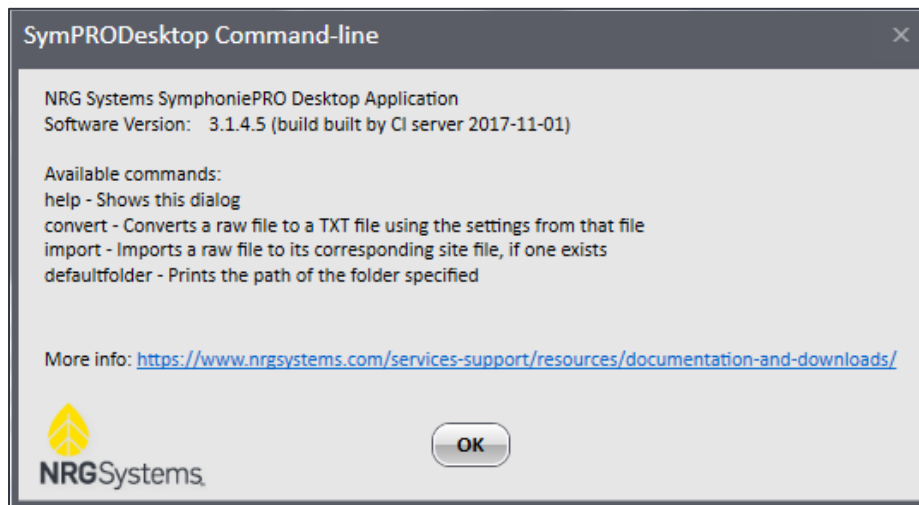
The **defaultfolder** switch prints the path of the folder specified in the parameter, as defined in the **Settings** of SymphoniePRO Desktop.

> start /wait SymPRODesktop.exe /cmd defaultfolder /site

```
c:\Program Files (x86)\Renewable NRG Systems\SymPRO Desktop>start /wait SymPRODe
sktop.exe /cmd defaultfolder /site
C:\Users\ndb\Documents\Renewable NRG Systems\Sites
```

The **import** switch imports an .RLD file into an existing SymphoniePRO Desktop site file.

> start /wait SymPRODesktop.exe /cmd import /file "c:\Users\user\Documents\Renewable NRG Systems\Raw\000110_2015-04-05_00.00_000727.rld"

```
c:\Program Files (x86)\Renewable NRG Systems\SymPRO Desktop>start /wait SymPRODe
sktop.exe /cmd import /file "c:\Users\ndb\Documents\Renewable NRG Systems\Raw\00
0002_2015-09-07_00.00_000482.rld"
Re-imported 000002_2015-09-07_00.00_000482.rld
Success
```

If no site file exists for the file that is being imported, then the file cannot be imported.

```
c:\Program Files (x86)\Renewable NRG Systems\SymPRO Desktop>start /wait SymPRODe
sktop.exe /cmd import /file "c:\Users\ndb\Documents\Renewable NRG Systems\Raw\00
0004_2014-05-04_00.00_001803.rld"
------------------------------------
Import cancelled
No site file - skipping import of file 000004_2014-05-04_00.00_001803.rld.
Skipped
```

The **convert** switch converts the binary .RLD file to a tab delimited text file (*.txt) and prints the name and path of the output file.

> start /wait SymPRODesktop.exe /cmd convert /file "c:\Users\user\Documents\Renewable NRG Systems\Raw\000110_2015-04-05_00.00_000727.rld"

```
c:\Program Files (x86)\Renewable NRG Systems\SymPRO Desktop>start /wait SymPRODe
sktop.exe /cmd convert /file "c:\Users\ndb\Documents\Renewable NRG Systems\Raw\0
00004_2014-05-04_00.00_001803.rld"
Convert output: C:\Users\ndb\Documents\Renewable NRG Systems\Exports\000004_2014
-05-04_00.00_001803_meas.txt
```

By default, the converted file is written to the **Exports** path defined in the **Settings** of SymphoniePRO Desktop and the exported file contains measured data that is scaled using the channel configuration information programmed into the logger (rather than a site file).

Various other exporting options are available by passing parameters along with the `convert` command.

For example, the following command line could be entered to convert a file with an encryption password of "windy", without the description header, using scaling information from the site file, and to be saved in a specified location.

> start /wait SymPRODesktop.exe /cmd convert /file "c:\Users\user\Documents\Renewable NRG Systems\Raw\000110_2015-04-05_00.00_000727.rld" /pass windy /skipheader /site /outputdir "c:\Users\user\Documents\000110_Measured"

The following command line could be entered to convert a file and export the event log into a subdirectory of the default raw data folder called \event_logs.

> start /wait SymPRODesktop.exe /cmd convert /file "c:\Users\user\Documents\Renewable NRG Systems\Raw\000110_2015-04-05_00.00_000727.rld" /type events /outputsubdir event_logs

5.17 | SymphoniePRO Desktop Utilities

To facilitate data processing and logger configuration, the SymphoniePRO Desktop App installation package includes a few utility applications, which by default are installed in the user directory:

`C:\Users\~user\Documents\Renewable NRG Systems\Utilities`

PopAuto

The POPAuto utility can be used to extract NRG logger data file attachments (RWD and RLD) from emails contained on a POP3 mail server. The utility will find "data emails" and download them. Once downloaded, data files are extracted and stored on a user accessible drive (the files can be sorted by site). Further, there are options to convert the files to .TXT using either the settings contained inside site database file or the RLD file. Additionally, downloaded files can be imported into the site database for the Desktop App.

The application can be run either manually or from within a script via command line. The screenshots below show manual setup.
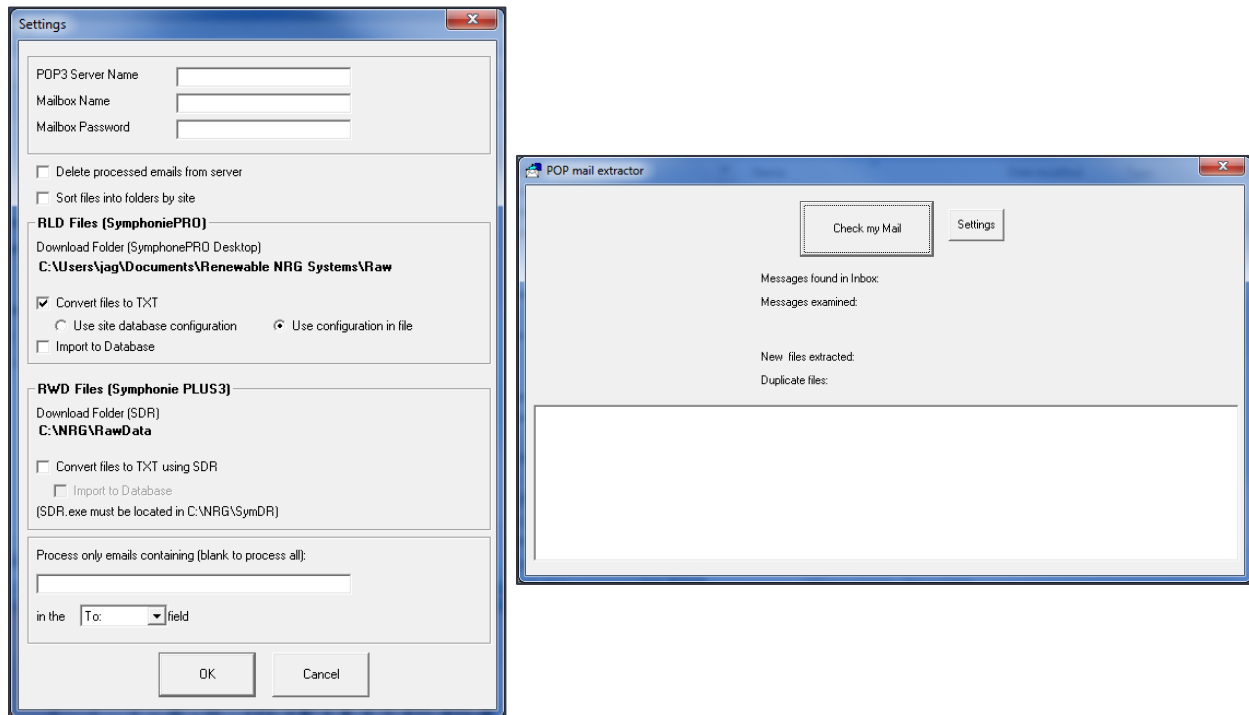
PopAuto Command Line

POPAuto can be run from the command line, making it possible to integrate the utility into your automated data flow process.

To see a list of commands:

- POPAuto.exe /?

To run POPAuto using the settings configured in the POPAuto GUI, use:

- POPAuto.exe /silent

Additional commands can be used as an "overlay" to the GUI commands. Note that all command modes must start with /silent.

- /server "{fserver}"
- /mailbox_name "{name}"
- /mailbox_password "{password}"
- /delete
- /sort

Command Line | Example 1

The command line POPAuto.exe /silent /delete /sort will run the POPAuto application using the settings found in the GUI panel. In this example, if the GUI panel does not have the delete and sort boxes checked, the command line will execute those functions as if they were checked.
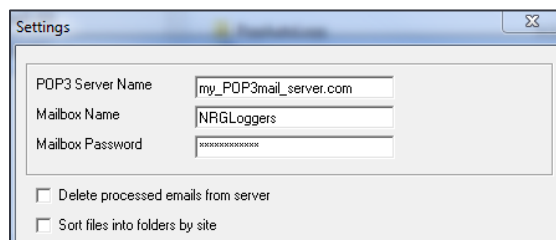
Command Line | Example 2

The command line POPAuto.exe /silent will run the POPAuto application using the settings found in the GUI panel. In this example, the GUI panel has the delete and sort boxes checked, so the command line will execute those functions as found in the settings.

OutAuto

The OutAuto 2.0 utility can extract RLD files contained as email attachments found in a Microsoft Outlook folder. There are three main selections the user needs to make:

- Choose the Outlook Folder to Extract From
- Extract RWD files
    - o Follow default folder settings or specify a path
- Extract RLD files
    - o Follow default folder settings or specify a path

For SymphoniePRO, the user can enable the "Extract RLD files" setting, and by default OutAuto will follow the folder settings that are configured in SymphoniePRO Desktop App for storing the extracted RLD files.

Alternatively, the user can specify individual folders to store extracted RWD and RLD files. Please be sure that the path is valid and that the directory is write enabled.

To run OutAuto, simply double-click on the "Extract files" button.
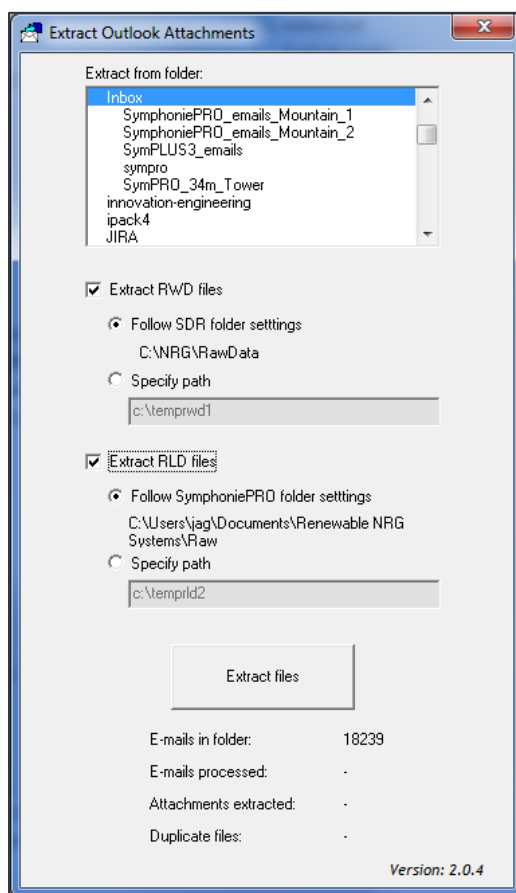
OutAuto Command Line

OutAuto can be run from the command line, making it possible to integrate the utility into your automated data flow process.

OutAuto.exe /?	This will return a list of available commands.
OutAuto.exe /silent	This will act the same as starting the app and clicking 'Extract Files' . The extract folder is sticky so it will process using the outlook folder that was selected the last time ran.
OutAuto.exe /folder "my emails"	Process the specified email folder. *The selected folder in the GUI is not affected. It's sticky but command line will not overwrite it.
/rwd_mode "follow"|"path"	Sets which destination path is used for rwd files extracted
/rwd_path {"path"}	Used in conjunction with rwd_mode when 'path' is selected to specify custom path to use
/rld_extract	Like checking the checkbox for extracting rld files.

/rld_mode "follow"|"path"
   • /rld_path {"path"}
	Just like when running the app which button is clicked.*
	   • Used in conjunction with rld_mode this one specifies the path if "path" is specified otherwise it will be ignored.*
	
	Will be ignored if rld_extract is not included

Modbus Demo Client

See ***NRG Modbus Demo Client*** in Section 6.

SECTION 6 | COMMUNICATIONS & DATA

The SymphoniePRO Data Logger, iPack and SymphoniePRO Desktop App act as a system which can transmit and receive information in a variety of ways. At its core, a Symphonie iPack contains a modem, antenna, GPS, 12 VDC battery, and a charging circuit.

iPacks are available with a variety of different modems, Ethernet (supports either Modbus or Inmarsat BGAN M2M Satellite), or even a "Power Only" version which does not contain a modem and functions as just a power supply. The modularity of the iPacks has proven to be very convenient and straightforward for installation, site maintenance and troubleshooting. SymphoniePRO Desktop App becomes a communication hub for the loggers and iPacks and will be explained in this section.

6.1 | Communication Options

The following iPack models are compatible with the SymphoniePRO data logger. NRG Systems maintains the largest number of iPack types possible at any given time, but some may be discontinued or unavailable without prior notice due to uncontrollable factors.

NRG Systems cannot guarantee the length of time that an iPack will be compatible with communication networks because it does not own or operate cellular antenna arrays, satellites, or any other equipment needed to create national or global communications networks.

iPackGPS With Cellular Modem

iPackGPS LTE-G | #9434

This iPackGPS model supports global cellular connectivity and allows the sending of data files and MetLink connections through 2G, 3G, and/or 4G LTE service (see product specifications on website for complete list of supported frequency bands). This iPackGPS is available with AT&T (**#16674**), Verizon (**#16675**), or global GSM WindLinx (**#16676**) SIM cards.

iPackGPS LTE | #9388, #9389, #9390

These iPackGPS models support global cellular connectivity and enable the sending of data files and MetLink connections through 4G LTE service (see product specifications on website for complete list of supported frequency bands). The three iPackGPS LTE versions available contain different modems for the following networks: AT&T (**#9389**), Verizon (**#9390**), or TDD (**#9388**).

iPackGPS DoCoMo 4G | #9419

This iPackGPS unit enables the sending of data files and MetLink connections through the DoCoMo cellular network found in Japan.

iPackGPS 3G | #7984

This iPackGPS unit enables the sending of data files and MetLink connections through HSPA+ and 2G/GPRS service. The modem inside the iPack operates on HSPA+ 850/900/1700/1900/2100 MHz and 2G/GPRS 850/900/1800/1900 MHz bands.

iPackGPS GSM/GPRS | #4622

This iPackGPS unit enables the sending of data files and MetLink connections through 2G/GPRS service. The modem inside the iPack operates on the 850/900/1800/1900 MHz GSM bands.

iPackGPS CDMA | #4621

This iPackGPS unit enables the sending of data files and MetLink connections through Verizon's CDMA network within the United States.
This iPack was discontinued as of May 2019.

iPackGPS DoCoMo | #4623

This iPackGPS unit enables the sending of data files and MetLink connections through the older DoCoMo cellular network found in Japan.
This iPack was discontinued and replaced with #9419 due to the inability to source the DoCoMo modems contained inside #4623.

iPackACCESS (Ethernet Communication Only)

iPackACCESS | #7169

This iPackGPS unit enables the SymphoniePRO data logger to be connected to a SCADA network and make real time data available via Modbus TCP. It does not have an internal modem but has an Ethernet port for a LAN connection. The Modbus registers are pre-defined allowing the device to be easily configured. See *6.8 | iPackACCESS With* Modbus Protocol for information about Modbus capabilities & configuration.

iPackACCESS + BGAN M2M Satellite

Connecting a BGAN M2M Satellite modem to an iPackACCESS enables the SytmphoniePRO data logger to send data from anywhere in the world using the Inmarsat Seattleite Network. *See 6.7 | iPackACCESS &* BGAN M2M for details on configuring the iPackACCESS and BGAN M2M modem.

iPackACCESS With Internal Cellular Modem

iPackACCESS LTE-G | #9429

This iPack enables the SymphoniePRO data logger to connect to a SCADA network and make real time data available via an internal 2G, 3G, or 4G LTE-G Cellular Network modem (see product specifications on website for complete list of supported frequency bands), or Modbus TCP. The Modbus registers are pre-defined allowing the device to be easily configured. The internal modem is available with AT&T (**#16691**), Verizon (**#16692**), or global GSM WindLinx (**#16693**) SIM cards. See *6.8 | iPackACCESS With* Modbus Protocol for information about Modbus capabilities & configuration.

iPackACCESS LTE-TDD | #9406

This iPack enables the SymphoniePRO data logger to connect to a SCADA network and make real time data available via global cellular connection through an internal 4G LTE-TDD Modem (see product specifications on website for complete list of supported frequency bands), or Modbus TCP protocol. The Modbus registers are pre-defined allowing the device to be easily configured. See *6.8 | iPackACCESS With* Modbus Protocol for information about Modbus capabilities & configuration.

Additional iPack Models

iPack Power Only | #9386

This iPack provides a "standalone" power solution to SymphoniePRO data loggers that don't need any communications. It contains the same 12 V rechargeable gel cell battery pack and a PV charging circuit as the other iPacks but does not include a modem or any communication ports.

6.2 | iPack Components Maps
iPackGPS

SymphoniePRO
Logger

Modem Antenna

GPS Antenna

$\div$ Ground
$-$ External Battery Circuit
$+$
$-$ PV In
$+$
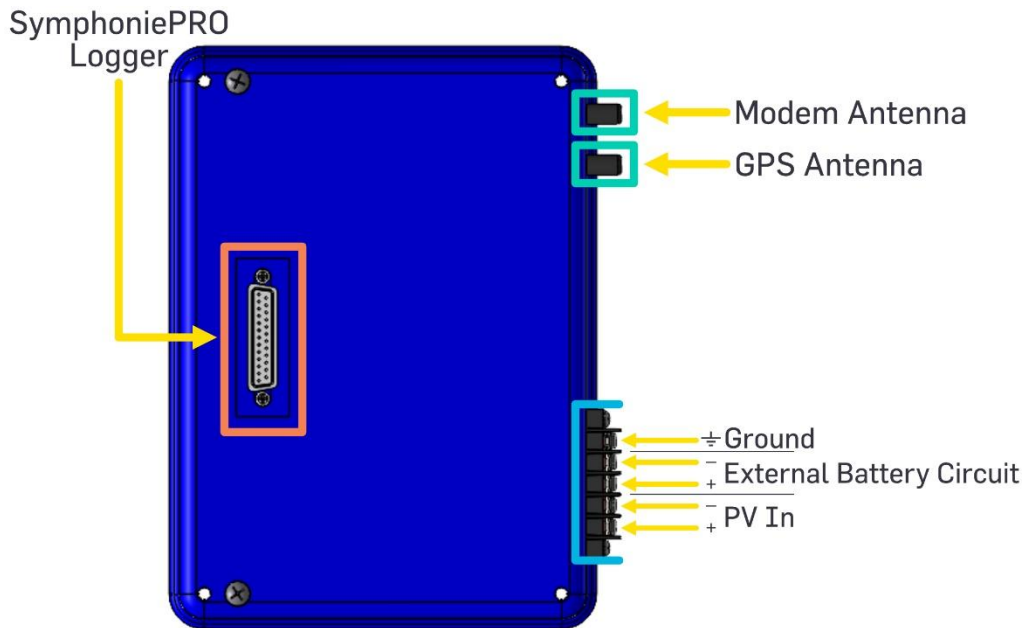
iPackACCESS

SymphoniePRO
Logger

GPS Antenna

$\div$ Ground
$-$ External Battery Circuit
$+$
$-$ PV In
$+$

Ethernet Port

$-$ BGAN Modem Power (12 VDC)
$+$
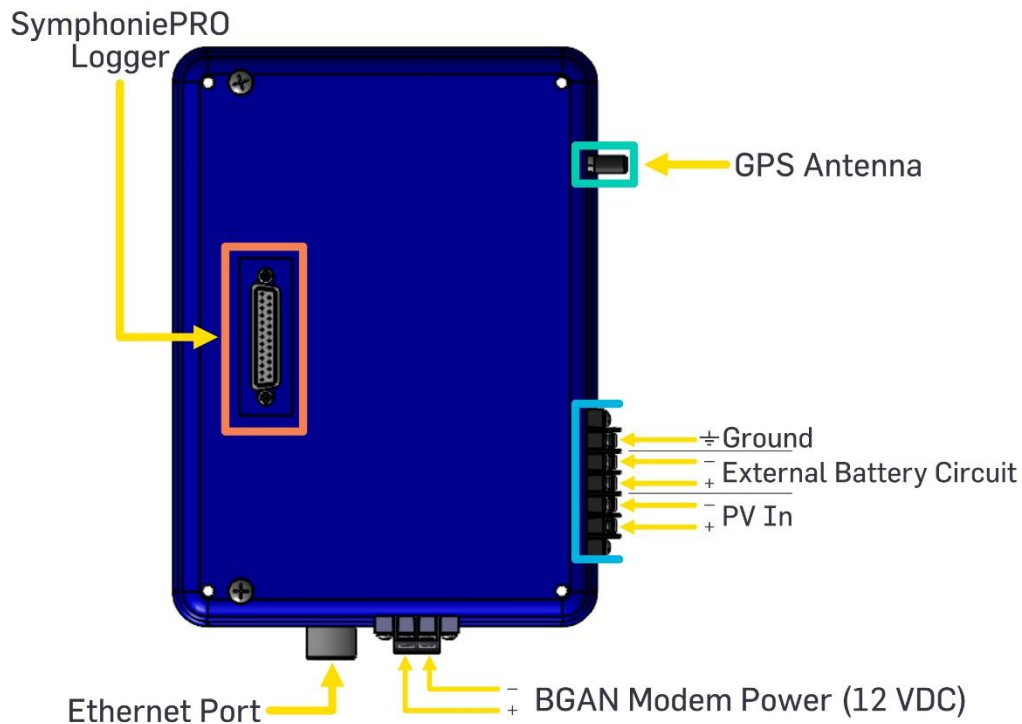
6.3 | Connecting the SymphoniePRO Logger & iPack

The SymphoniePRO logger connects to an iPack through the DB25 connector located on the backside of the logger enclosure and the frontside of the iPack enclosure.

New SymphoniePRO loggers have a sticker over the DB25 connector to protect it during shipping and pre-installation storage. *This sticker must be removed prior to attaching the logger and iPack together.*

The two instruments are secured together with #10-32 stainless screws (length varies depending on the iPack model), which feed from the back of the iPack enclosure through to threaded pems in the backside of the logger enclosure. Securing the instruments together is required to create a weather-resistant seal around DB25 connector.

See *Installing Logger & iPack* for more information.

6.4 | Metlink Connections

MetLink allows a SymphoniePRO logger to communicate with a PC remotely or over USB and change settings, apply firmware updates, or download meteorological and diagnostic data.

It is important that users familiarize themselves with MetLink and choose a communication scheme that best works with their business requirements. Although the options are presented as discrete scenarios, any combination of the communication options can be used concurrently.
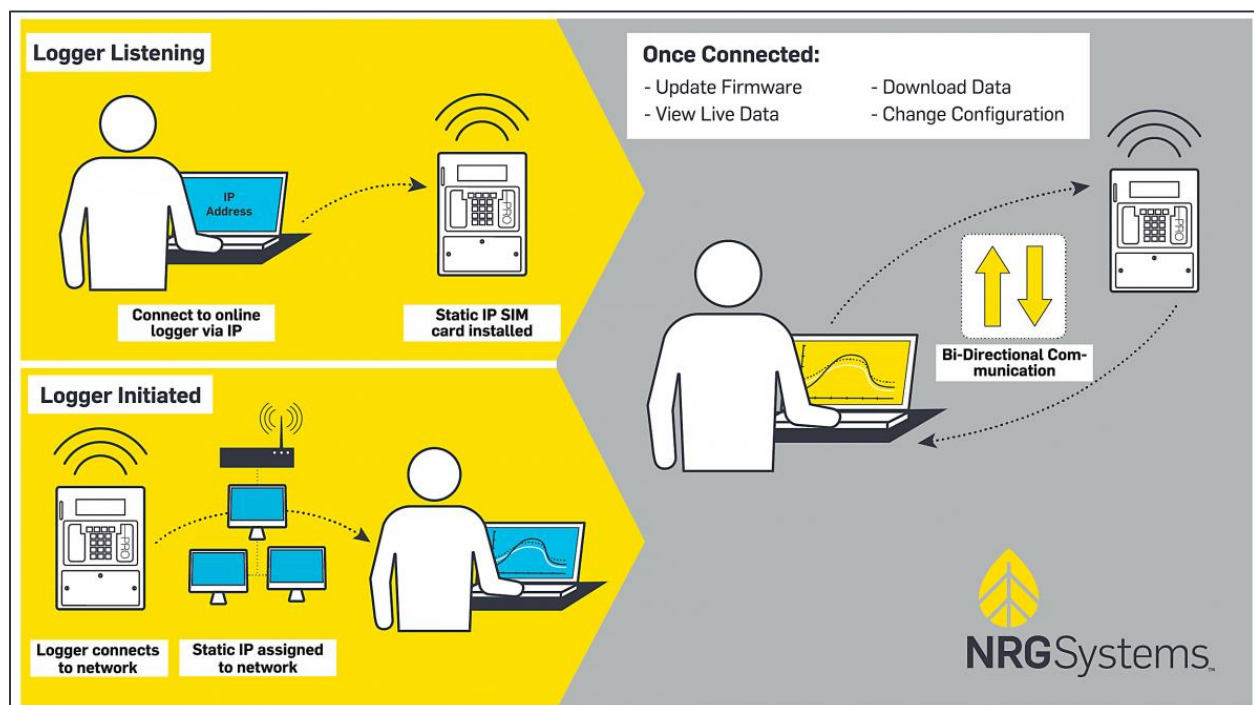
Metlink Logger Initiated

A MetLink Logger Initiated connection originates at the logger and terminates at an office PC running SymphoniePRO Desktop App. In this scenario, the iPack "wakes up" on a user-defined schedule and establishes a direct communication link with a static IP at an organization, which routes the connection to a PC within the organization running the Desktop App. The direct link can be established across a cellular or Ethernet connection, and the office PC must be powered on with the Desktop App running to receive logger-initiated connections. The best practice is to configure one PC in your organization to handle all the incoming traffic.

Logger-initiated connections have the advantage of optimizing power consumption by the logger, as the logger will spend most of its time with the modem turned off (the communications electronics are only powered on at the scheduled time). Once connected with the office PC, a user can retrieve data, apply firmware updates to the logger and iPack, change channel or communication settings, change site information settings, run automation actions, view live data and more.

SymphoniePRO Logger Configuration
The logger in configured within the Desktop App, generally at the time of initial configuration. The relevant information is entered into the Schedules Tab and saved to the .LGR instrument configuration file. See *Metlink Logger Initiated Schedule* in Section 5 for details.

User Network Configuration
The user's network must be configured to receive the inbound connections from SymphoniePRO loggers. This configuration may involve multiple firewalls and/or routers.

When the connection comes into [host.mycompany.com] on port 30406, the connection needs to be forwarded to a specific PC running the SymphoniePRO Desktop App.

Because even the most basic configuration involves a router, it is important to understand how **port-forwarding** works. The SymphoniePRO Desktop App running on the user's PC always expects connections to appear on port 30406. So when a connection to [host.mycompany] on port 30406 occurs, the router will "port forward" the connection to [User PC1] on port 30406.

Note that any free outward-facing port can be used so long as incoming connections on the desired port are then routed to [User PC1] on port 30406.

> *It is important to engage your IT professionals early on so that the appropriate rules can be created for your network infrastructure and policies. **NRG Systems does not know specific network details nor the policies of any other organizations, and therefore cannot provide any assistance with this.***

Windows Firewall Configuration

In addition to any corporate firewalls and firewalls associated with anti-virus software, a Windows PC has its own firewall. Therefore, a rule needs to be added so inbound connections can make it to the SymphoniePRO Desktop App.

The rule will allow the PC to accept TCP connections on port 30406, and the SymphoniePRO Desktop App will create the rule during the installation process if the user checks the box to add firewall rules during the software installation process. Another rule is created to allow connections out through port 30407.

Microsoft has extensive information on Windows Firewall, so use their documentation for guidance or discuss configuration details with an IT & network expert.

SymphoniePRO Desktop Application is the Master

Once a logger is connected to the SymphoniePRO Desktop App through MetLink, the logger acts as a server and waits for commands from the client software (Desktop App). Common MetLink actions (commands) include downloading of data and administering configuration changes on the logger (such as adjusting scale factors or applying new firmware to the logger or iPack). One important concept to recognize is that software function is independent of the connection transport, and a user who is remotely connected can perform most of the same actions a user can perform when connected locally through USB.

Metlink Logger Listening

A MetLink Logger Listening connection can be thought of as originating at the office PC and terminating at the logger. In this scenario, the iPack "wakes up" the modem on a user-defined schedule and waits to be contacted. The direct link can be established across cellular or Ethernet connection, and the office PC must be ready to initiate a connection within the scheduled time window that the iPack is "awake" (the Logger Listening schedule).

For the PC to remotely connect to a SymphoniePRO logger, the logger needs a public static IP address or local private IP address provided through a VPN service. *For cellular iPacks, you must request a static (fixed) IP SIM from your wireless service provider.*

MetLink Logger Listening connections are more easily established through typical corporate firewalls but are not as power-efficient for the logger & iPack because they typically result in the modem spending a considerable amount of time powered and idle.

The largest benefit of this connection method is that the user can connect to the logger "at will" if the time is within the logger listening schedule window. Configuring a longer or more frequent listening window does result in powering the logger & iPack communications electronics for more time, which

can quickly add complexity and cost if the power consumption exceeds the standard 15W PV & 12 VDC iPack battery setup. For 24/7 communication availability, additional power is required at the site to keep the modem powered continuously (a remote power system or connection to grid power, for example).

Configuration of SymphoniePRO Logger Provisioned with Public Static IP Address

The SymphoniePRO logger will need to be configured with a communication schedule, and the SIM should be provisioned with a public static IP address as described above. This configuration is initially performed using the SymphoniePRO Desktop App and a USB cable and can be updated remotely as needed.

The user does not actually enter the public static IP address into the logger. The public static IP of the logger must be entered into the SymphoniePRO Desktop App and may be stored in the site file. To verify the correct IP address has been assigned by the ISP, navigate to the **Network Status** display on the logger screen by pressing **[Home][2][2][2][Right]**.
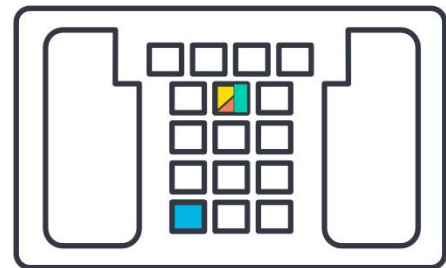
The logger in configured within the Desktop App, generally at the time of initial configuration. The relevant information is entered into the Schedules Tab and saved to the .LGR instrument configuration file. See *MetLink Logger Listening Schedule* in Section 5 for details.

Private Static IP Addresses

Some users can obtain private static IP addresses through a wireless service provider. In this case, a provider can subnet all the user's devices with IP addresses assigned and controlled by the provider. For this scenario, the user needs to connect their PC running the SymphoniePRO Desktop software via a software VPN to the provider's router. Once connected to the provider's network, the private addresses act the same as public addresses. There is also possibility for more advanced configurations with multiple computer users tied together on a hardware VPN; be sure to discuss with your provider.

Configuration of User Network

The SymphoniePRO logger listens on port 30407 and therefore the user's computer network firewall needs to allow connections out port 30407. In many cases, this is a default state for such networks, and no additional configuration is required. However, it is strongly recommended that you work closely with your IT professionals when first setting up the system to make certain your company firewall is properly configured.

6.5 | Sending Data

Data logger sends a data file to your email
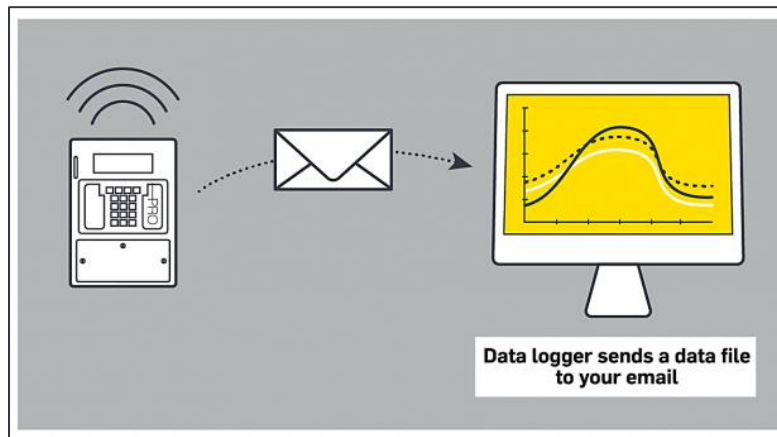
Configuration of SymphoniePRO Logger

SymphoniePRO can be configured to send data via email on a user-defined schedule. The relevant information is entered into the Schedules Tab and saved to the .LGR instrument configuration file. See *Email Schedule* in Section 5 for details.

The example here shows a logger which will attempt to email data each day at 9 AM by connecting to the SMTP server "mail.mysmtp.com" on port 587. The SMTP server requires a username and password and will relay the email from the logger to the recipient SymPROdata@mydomain.com.

The best practice is to name the **Sender's information** and **Subject Line** fields in a way that makes sorting of incoming emails easier.

Configuration of User Email Server

An SMTP server is required to relay emails from the logger to the end user. Additionally, the user needs access to incoming emails so that the *.RLD data files can be extracted from the email attachments and placed into a folder on the user network. Once the *.RLD files are on the user network, they can be imported into the SymphoniePRO Desktop App and processed further.

6.6 | Logger & Data Services

In 2019, NRG Systems began formally offering services that compliment the SymphoniePRO product line and help to provide users with a more seamless experience with their equipment. Brief descriptions of the services offered are below; contact NRG Systems or visit https://www.nrgsystems.com/services/ for more information about each.
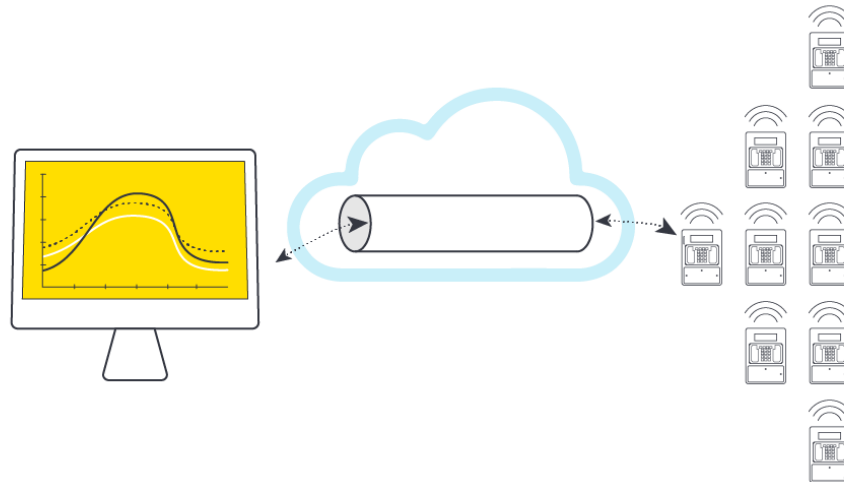
NRG Cloud

NRG Cloud is a web interface that lets you retrieve, store, and share your SymphoniePRO data from anywhere.
https://cloud.nrgsystems.com/

NRGDataMail Service

NRGDatamail is an email service from NRG Systems that is designed to provide sender's email functionality to Symphonie data loggers.

NRG Tunnel Service

Create a remote connection interface between your fielded SymphoniePRO Data Loggers and SymphoniePRO Desktop Application when static IPs are impractical.

NRGPy

NRGPY is the Python package for processing NRG data files
https://github.com/nrgpy/nrgpy

6.7 | iPackACCESS & BGAN M2M

In locations where cellular service is inconsistent, inadequate, or nonexistent, the SymphoniePRO logger can use satellite communications to send data files and establish remote connections. This section describes the steps required to use the Hughes 9502 BGAN M2M satellite terminal with a SymphoniePRO logger and iPackACCESS. The iPackACCESS with BGAN M2M terminal can be run from the standard NRG 15 W PV panel for typical resource assessment applications.

iPackACCESS Compatibility

iPackACCESS serial number 716900300 or higher is required for use with the BGAN Terminal. Compatible iPackACCESS units have smart-switched 12 V power out terminals for the BGAN M2M module, as well as double the battery capacity. Older iPackACCESS units cannot be retrofitted or be made compatible with BGAN Terminals.

Account Setup & Confirmation

The BGAN M2M satellite terminal includes an M2M SIM card and activation form for Ground Control Windlinx service. Upon receipt of your BGAN system, use the details found on the included activation sheet to activate BGAN M2M service through the web portal at www.windlinx.net. If you are new to WindLinx, please visit and review the information at www.windlinx.com.

> ⊘ *It is strongly advised to activate the account several days before your field installation.*

Once you have activated your account, Ground Control will send you an "infopack" that contains the settings required for using the Packet-Mail SMTP server. Additionally, a public static IP address will be sent to you via confirmation email. You will need this information to set up your BGAN M2M terminal and enable met tower communications.

Pre-Installation Considerations

Inmarsat's satellite constellation consists of geostationary satellites, which require the BGAN antenna to be installed (i.e., pointed) toward the appropriate satellite. It is advantageous to obtain the coordinates of the site ahead of the installation date, so that a Satellite Pointing Application or the Location Spreadsheet on the Hughes BGAN support page can be referenced to determine the approximate azimuth (compass heading) and elevation (vertical angle) for pointing the BGAN Antenna.

In complex terrain or in installations near structures, a clean line of sight must be established between the antenna and satellite. Determining the optimal antenna mounting location prior to installation will save time for the field crew when on site to point the antenna.

Required Tools & Materials

- Laptop with SymphoniePRO Desktop App installed
- SymphoniePRO Product Manual
- Hughes 9502 User Guide
- Windlinx Infopack & confirmation email (with static IP details)
- Windlinx SIM card
- USB-A to USB-B cable
- Ethernet cable
- Headphones or speaker with 1/8" jack
- Universal iPack charger (NRG #3614) or suitable 12 VDC power supply
- BGAN Pointer App for iPhone
- (2) 7/16" Wrenches
- Cordless impact driver
- 5/16" Nut driver bit (1/4" hex)
- 3mm Flat blade screwdriver
- P2 stubby screwdriver

Procedure

Follow these steps to complete the BGAN system setup. Refer to each sub-section below for details.

1. **Configure iPackACCESS settings** in the .LGR instrument configuration file.
2. **Install SIM card** in the BGAN Terminal.
3. Complete the installation of the **SymphoniePRO logger, iPackACCESS**, & **BGAN Terminal** into the shelter box, as well as the necessary wiring & cable connections.
4. Connect the antenna cable to the BGAN terminal and the antenna; leave the antenna on the ground or somewhere nearby in a horizontal orientation.
5. Complete **BGAN Web Interface settings configuration**.
6. Check for and obtain GPS fix.
7. **Mount the antenna & bracket** to the tower.
8. **Point the antenna**. Use the BGAN Web Interface to confirm that the signal strength is above 60.
9. Exit the BGAN Web Interface. Move the Ethernet cable from the PC to the iPackACCESS.
10. Confirm successful setup by **initiating a test call** from the SymphoniePRO logger.

BGAN Terminal SIM Card Installation

The provided Windlinx SIM card must be inserted in the BGAN M2M terminal to be able to establish satellite communications. Open the SIM Door on the terminal to insert the SIM card. The SIM card should be installed prior to the field installation.

iPackACCESS Configuration

The iPackACCESS needs to be configured for use with the BGAN M2M system using the Desktop App. The best practice is to configure iPack settings in the .LGR file prior to field installation.

iPackACCESS configuration details are below. For complete .LGR file configuration information & details, refer to **Section 5**.

iPack Tab – Network Section

- – "BGAN M2M Satellite Module Connected" box must be **checked**.
- – "Enable DHCP" box should **NOT** be checked.

iPack Static IP Address	192.168.128.200
Subnet Mask	255.255.255.0
Gateway	192.168.128.100
Primary DNS Server	8.8.8.8
Secondary DNS Server	8.8.4.4
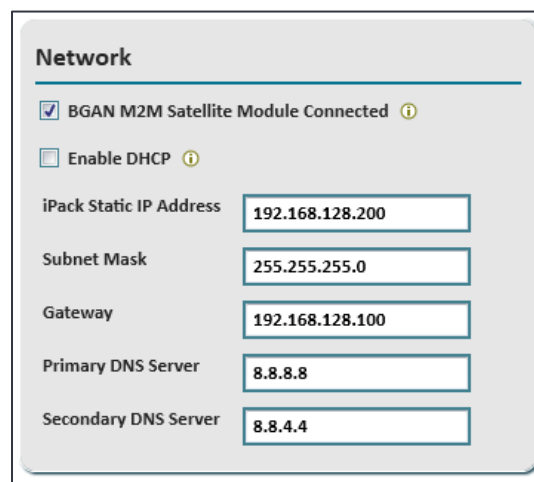
Schedules Tab – Email Schedule Section

Configure the email settings using the details provided in the Packet-Mail Infopack.

The remaining sections of the Schedules Tab can be completed with the same considerations as a cellular iPack in mind.

BGAN Terminal Configuration

The BGAN M2M terminal must be configured through the Hughes BGAN web user interface (WebUI). To access the configuration details, the terminal must be powered by a suitable 12 VDC power supply and connected to a PC with a web browser via an Ethernet cable.

When using the iPackACCESS to provide 12 VDC modem power: Press **[Home][2][3]** on the SymphoniePRO keypad to put the iPackACCESS in iPack Setup Mode. This mode continuously powers the 12 VDC modem power terminals next to the Ethernet port and blocks any scheduled actions (MetLink, email) for 30 minutes or until disabled, whichever is shorter.

The diagram below shows the setup for configuring the BGAN modem. Note that the components are not shown to scale, the SymphoniePRO logger is detached from the iPack to show the cable & wire connections, and that the PV panel wiring & GPS antenna cable have been omitted.

Required screwdriver sizes are color-coded to the terminal outlines in the diagram.
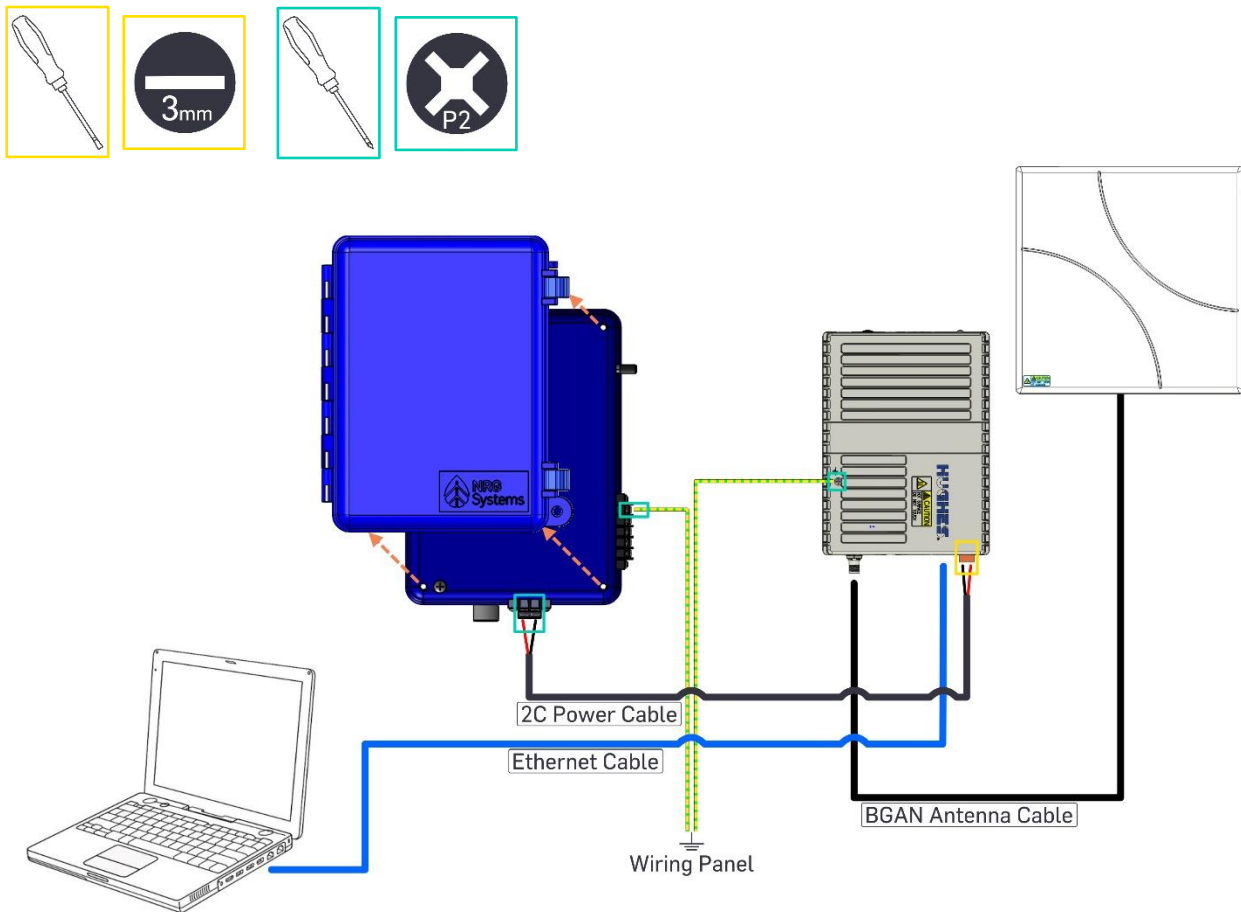
PC Network Adapter Settings

To successfully connect to the BGAN modem, the IP address and subnet assigned to the PC need to be changed.

To change your computer IP address, enter the "Network and Sharing" control panel, select change adapter settings, right-click on the Local Area Network connection, and select Properties. In the Local Area Network Properties window, select **Internet Protocol Version 4**, and click **Properties**.
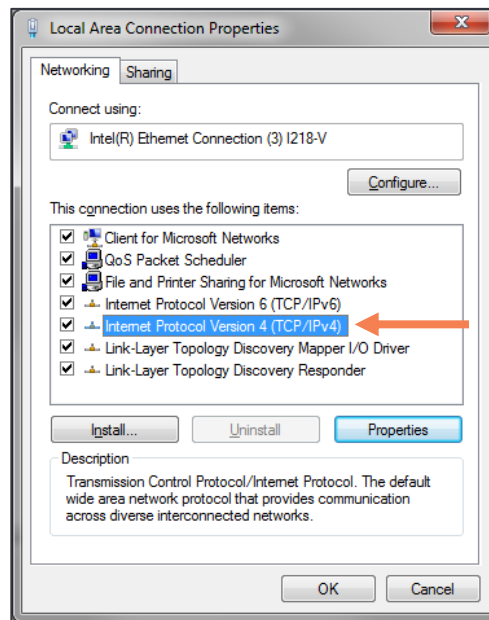
Select the radio button for "Use the following IP address:". Complete the fields below as follows:

IP Address	192.168.128.199
Subnet Mask	255.255.255.0
Default Gateway	192.168.128.100
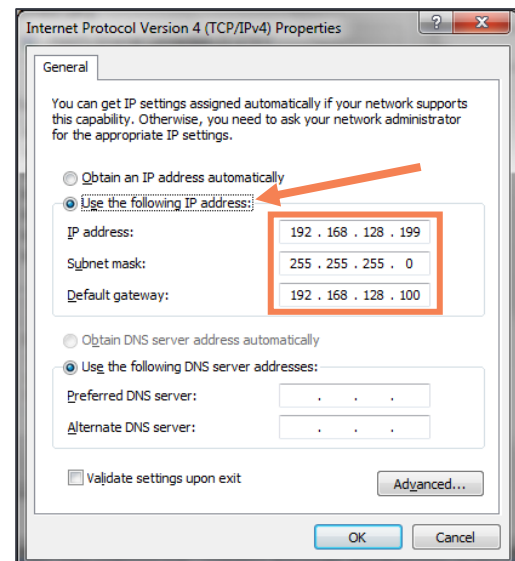
Connecting to BGAN M2M Terminal Web Interface

With the PC settings configured, the modem home page can be accessed using a web browser.

Navigate to the BGAN Home Page by entering the IP address **192.168.128.100** into the address bar of the web browser.

BGAN Web Interface | Home Page

The home page contains ID information for the BGAN including the IMEM, IMSI and APN. The APN "WILTD.BGAN.INMARSAT.COM" will only appear if the SIM card has been inserted.

BGAN Web Interface | Settings Page

Configure the Ethernet Settings as follows:

Wake On LAN	On
Triggered after Idle Timeout of	1 Minute
Triggered at Time of Day (UTC)	0000

BGAN Web Interface | M2M Page

Configure the M2M Setup as follows:

Ping Configuration	
Context Watchdog	Off
Primary Ping IP Address	8.8.8.8
Secondary Ping IP Address	8.8.4.4
Tertiary Ping IP Address	0.0.0.0
Ping Required	No

Always ON Context	
Always On Context	On
Static ACA IP Address	192.168.128.100
QoS	Standard
APN Config	WILTD.BGAN.INMARSAT.COM

BGAN Web Interface | Enabling Remote SMS

The BGAN M2M terminal can configured to allow remote management via SMS for remote support and diagnostics purposes. Once enabled, this functionality allows both the network provider and the client to remotely query key M2M terminal operating parameters or reset the terminal via password-protected AT commands delivered via SMS.

To enable this functionality, the first stage is to verify that the 'Remote Support' feature is enabled on the **Feature Management** page.
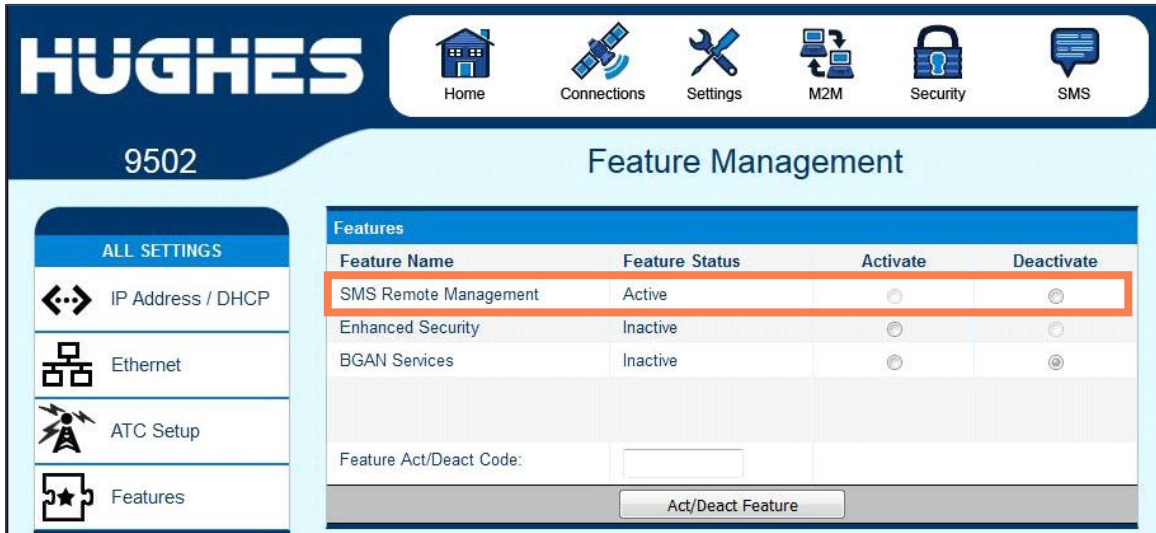
Enable Remote SMS Control from the **Security Passwords** page. Choose your Remote SMS Password and save it to your records for future use.

Installing BGAN Terminal In Shelter Box

Mounting BGAN Terminal

The BGAN Terminal is secured to the back plate of the logger shelter box with mounting bracket #10467 and (2) #10-32x0.5" stainless screws. Shelter box back plates designed for use with the BGAN terminal have threaded holes in the correct locations for the mounting bracket.
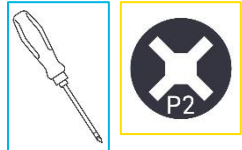
Power & Antenna Connections

Final cable connections for a BGAN installation are shown in the diagram below. Note that the components are not shown to scale, the SymphoniePRO logger is detached from the iPack to show the cable & wire connections, and that the PV panel wiring & GPS antenna cable have been omitted.
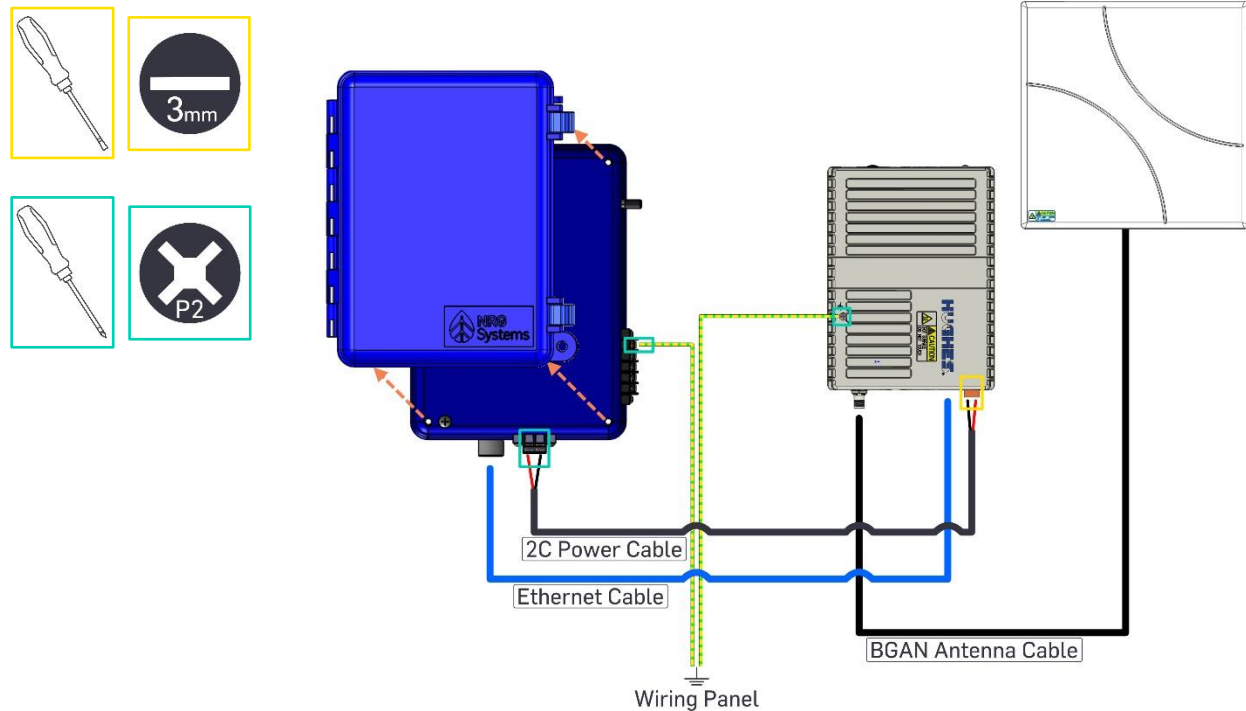
Mounting & Pointing BGAN Antenna

The BGAN uses a directional plate antenna, which requires accurate pointing toward a BGAN Satellite.

The correct azimuth (heading) and elevation (vertical angle) of the BGAN antenna depend on location and can be looked up using the BGAN Pointer iPhone application or the Hughes BGAN support webpage.
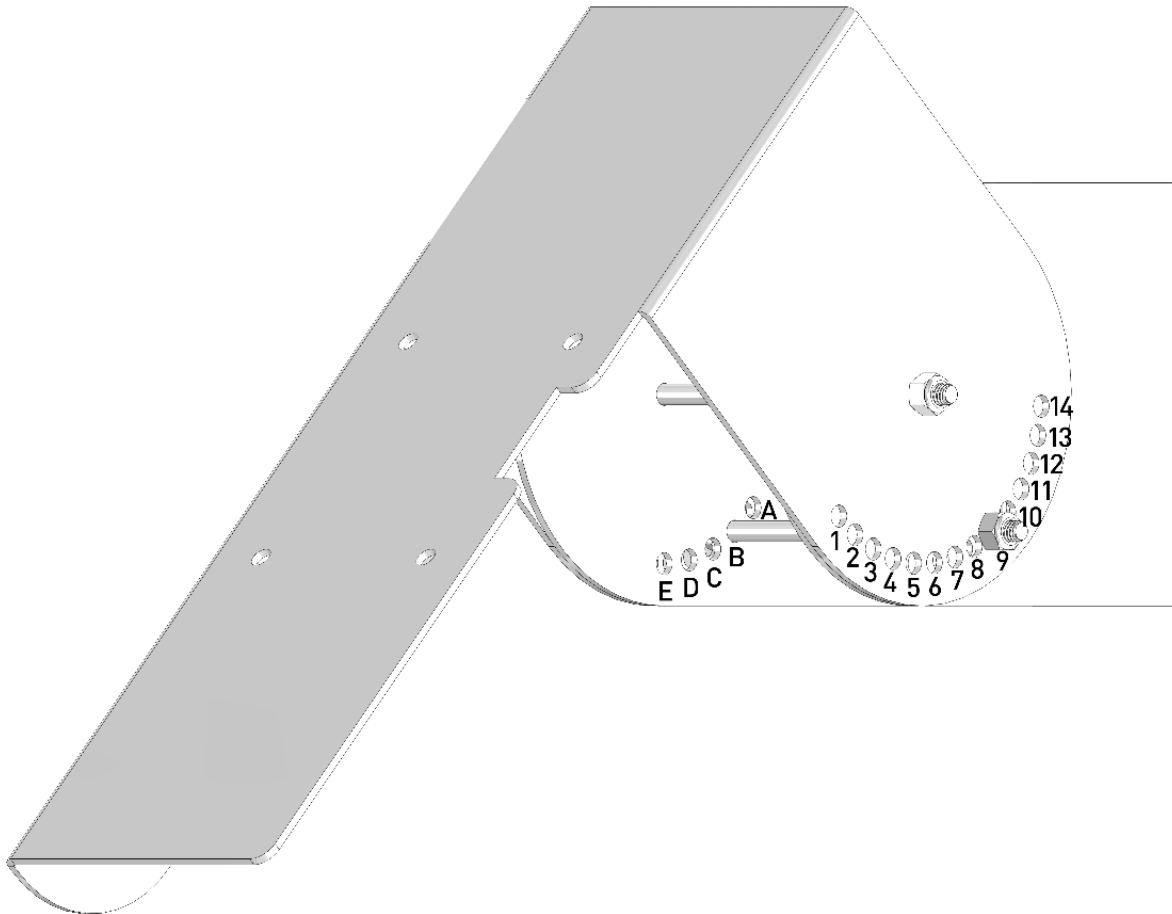
The hole-and-bolt arrangement designed into the bracket system allows the elevation to be adjusted in 2-degree increments, while the azimuth is continuously variable by moving the antenna bracket around the tower using the band clamps.

The inner portion of the bracket, which affixes to the tower, includes 5 holes A-E, with hole A closest to the tower. The outer bracket, which pivots about the center, contains 14 holes 1-14, with hole 1 located closest to the antenna plate.

Hole Alignment Reference Table

Tower / Antenna	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	-	-	-	-	-	2	12	22	32	42	52	62	72	82
B	-	-	-	-	4	14	24	34	44	54	64	74	84	-
C	-	-	-	6	16	26	36	46	56	66	76	86	-	-
D	-	-	8	18	28	38	48	58	68	78	88	-	-	-
E	0	10	20	30	40	50	60	70	80	90	-	-	-	-

Using the table above: The elevation is 0 degrees in position E1, 46 degrees in C8, or 90 degrees in E10.

Mounting

The antenna mounting bracket is attached to the tower using size #164 stainless band clamps for a tubular tower or size #36 stainless band clamps for a lattice tower.
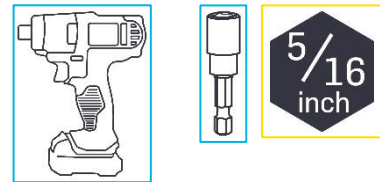
The inner & outer pieces of the bracket are connected together with (2) 1/4-20x5" bolts & nuts.
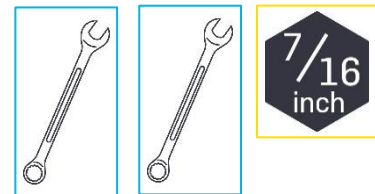
GPS Fix Confirmation

GPS lock can be done prior to setting final elevation. GPS acquisition is best done with the antenna mounted flat- either with bracket adjustment or by placing the antenna on the ground.

Verify GPS fix on the **Home Page** of the BGAN Web interface, underneath the "GPS" header on the left side of the screen. Note that the **Location** coordinates may not immediately be populated even after a GPS fix has been established.
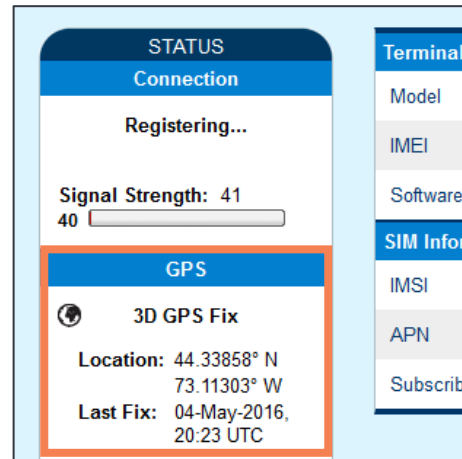
Pointing BGAN Antenna

After mounting the antenna & bracket to the tower it must be properly oriented to acquire sufficient signal strength to send data from the logger.

*The signal strength **must** be over 60% to send data files and establish MetLink connections.*

Use the information on the BGAN Web Interface **Home Page** as a guide for pointing the antenna. Begin with the azimuth & elevation values provided in the **Pointing Info** box and put the BGAN Terminal into "Pointing Mode" for an audible guide.

To enter pointing mode, remove power from the BGAN, wait a few moments and then apply power. The BGAN enters a self-test for about 15 seconds and then the LED will start flashing for another 15 seconds. Within 15 seconds when the LED is blinking, press the function button on the BGAN M2M twice (short presses). When the BGAN terminal first enters pointing mode, all three LEDs will flash. The LEDs will be solid after establishing a GPS fix.
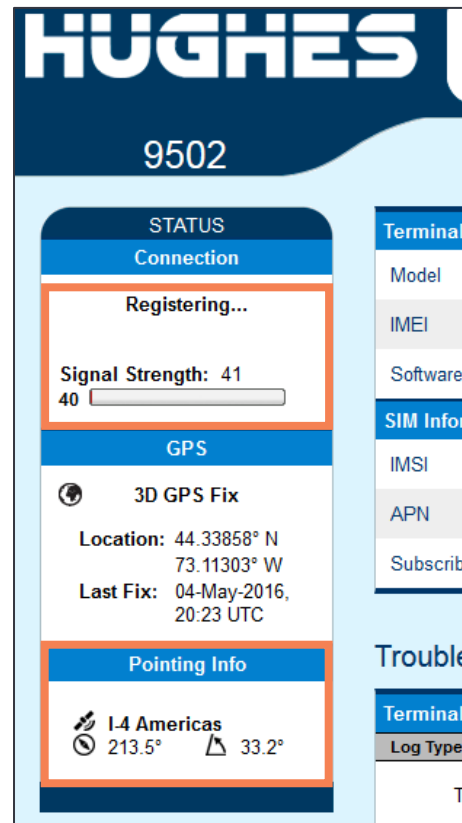
The beeps emitted during pointing mode can be very loud. Do not place the headphones directly onto ears when fine-tuning the antenna adjustments.

6.8 | iPackACCESS With Modbus Protocol

SCADA connectivity and data transmission through the Modbus TCP protocol is achieved using an iPackACCESS paired with a SymphoniePRO Logger. The (1-second) real-time and statistical (of a user-defined interval) data collected and computed by the SymphoniePRO are made available through the Modbus TCP protocol. When linked to a SCADA system, this setup to help project stakeholders analyze the performance of assets within a renewable energy project relative to the available resource. Stored statistical data are still available for wind or solar resource assessment (WRA or SRA) via email and/or MetLink over the network's internet connection, or by manually pulling the SD card from the logger.

iPackACCESS was developed to provide the following data stream options from the SymphoniePRO Data Logger:

- Real-time data provides one-second samples that are available to the SCADA system through the Modbus TCP protocol. These scaled data are pulled from the iPackACCESS to help project operators analyze the performance of assets within a project.

- Statistical data provide average, standard deviation, minimum, and maximum values at a user-specified interval (1, 2, 5, 10, 15, 30, or 60 minutes) through the Modbus TCP protocol. These data may be pulled from the iPackACCESS for analysis by project operators and forecasting service providers to predict the future energy production of an energy facility using a meteorological forecast model.

- Wind or solar resource assessment data are statistical data collected during a measurement campaign prior to the development of the project. These data are available via email delivery and/or MetLink (remote connection to the SymphoniePRO) over the SCADA network's internet connection or by manually pulling the SD card from the data logger to validate the wind resource after a wind farm becomes operational.

Modbus Data Flow Diagram

1. Sensor signals are received by the logger through its wiring panel.

2. The raw sample (1 second) data are scaled using the conversion factors in the logger. The scaled real-time data are passed to the iPackACCESS and formatted into Modbus registers (detailed in the Modbus Protocol section).

3. At the end of each statistical interval, statistical values are computed from the sample data in the logger, and the statistical data are passed to the iPackACCESS and formatted into Modbus registers.

4. When the Modbus server is enabled, the iPackACCESS makes the scaled statistical and real time data available on their designated registers.

5. The scaled real-time and statistical data can be polled through an Ethernet network by a Modbus client.

6. A Modbus client can poll the iPackACCESS registers for data once a second. The statistical data registers are updated at the end of each statistical interval.
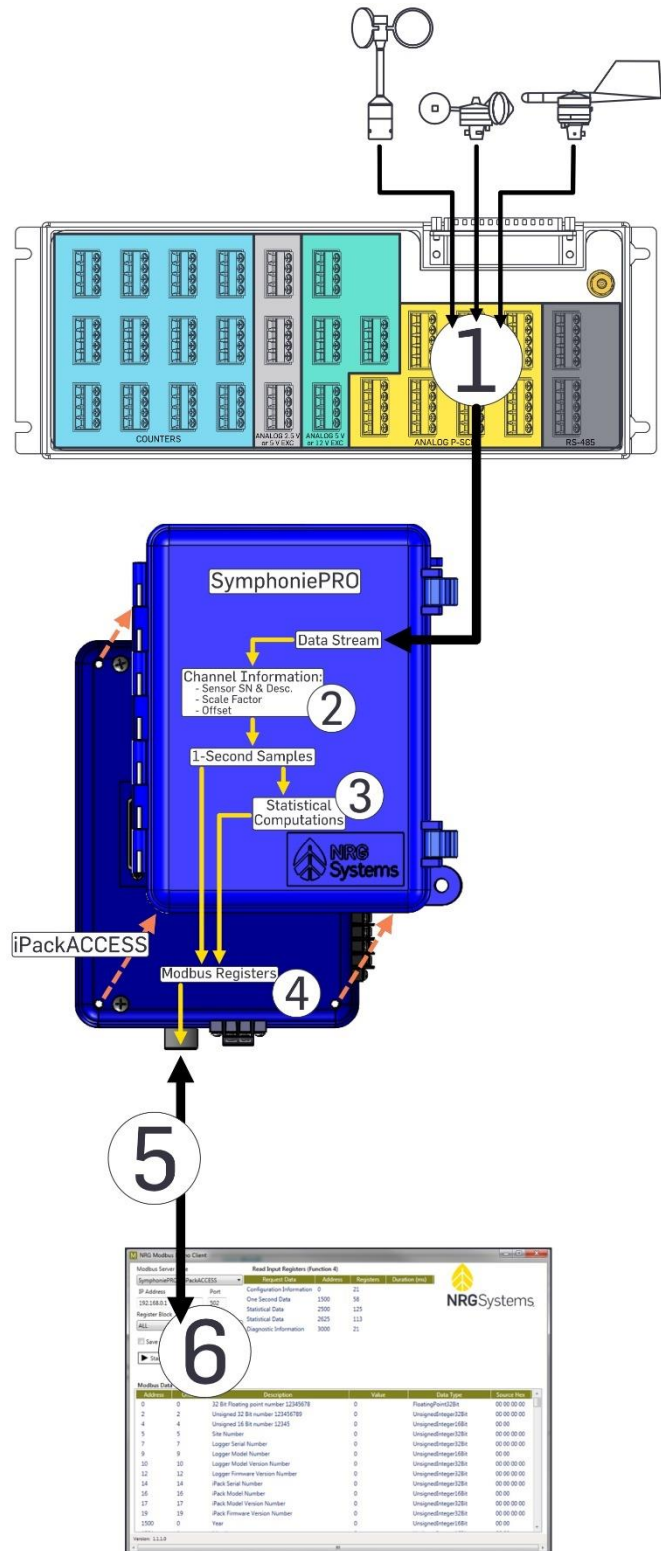
Network Configuration Examples

All examples in this section contain sample information (such as IP addresses) generated for demonstration purposes only. Consult your IT professionals for guidance on how to set up your network.

Direct Connection With Static IP Address
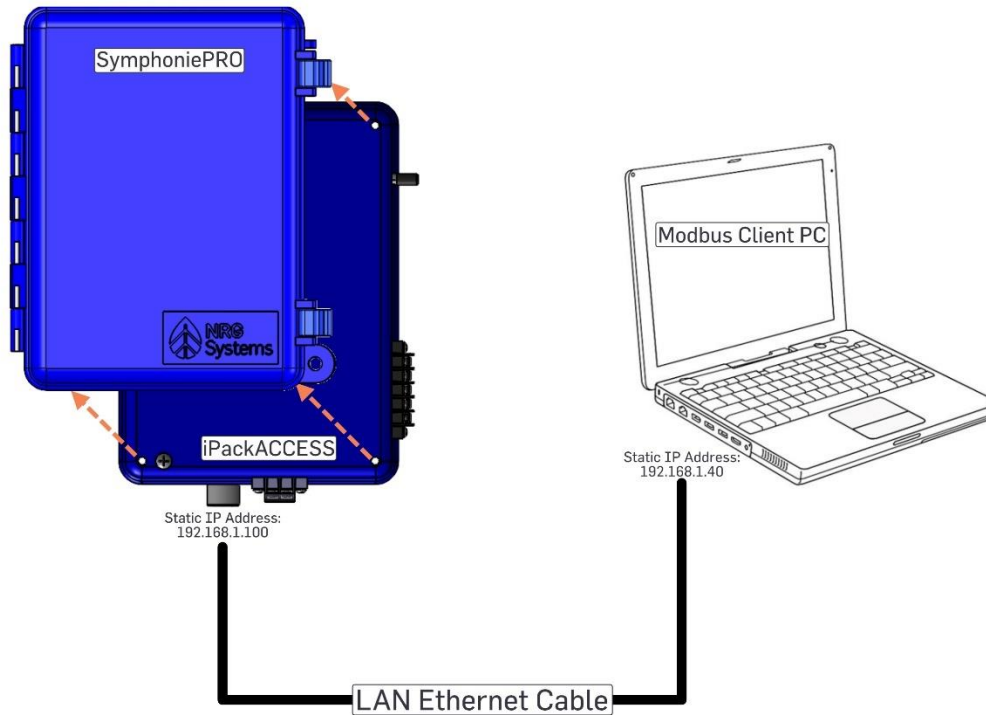
This is the most basic network setup: An iPack directly connected to a computer running a Modbus client. DHCP is disabled, and a fixed IP address (programmed in the iPackACCESS) is used to connect to the Modbus client. No email is enabled, and the DNS servers are left open.

Parameter	iPackACCESS	PC
Enable DHCP	No	No
Static IP Address	192.168.1.100	192.168.1.40
Subnet Mask	255.255.255.0	255.255.255.0
Gateway	0.0.0.0	Not used
Primary DNS Server	0.0.0.0	Not used
Secondary DNS Server	0.0.0.0	Not used

Router With DHCP
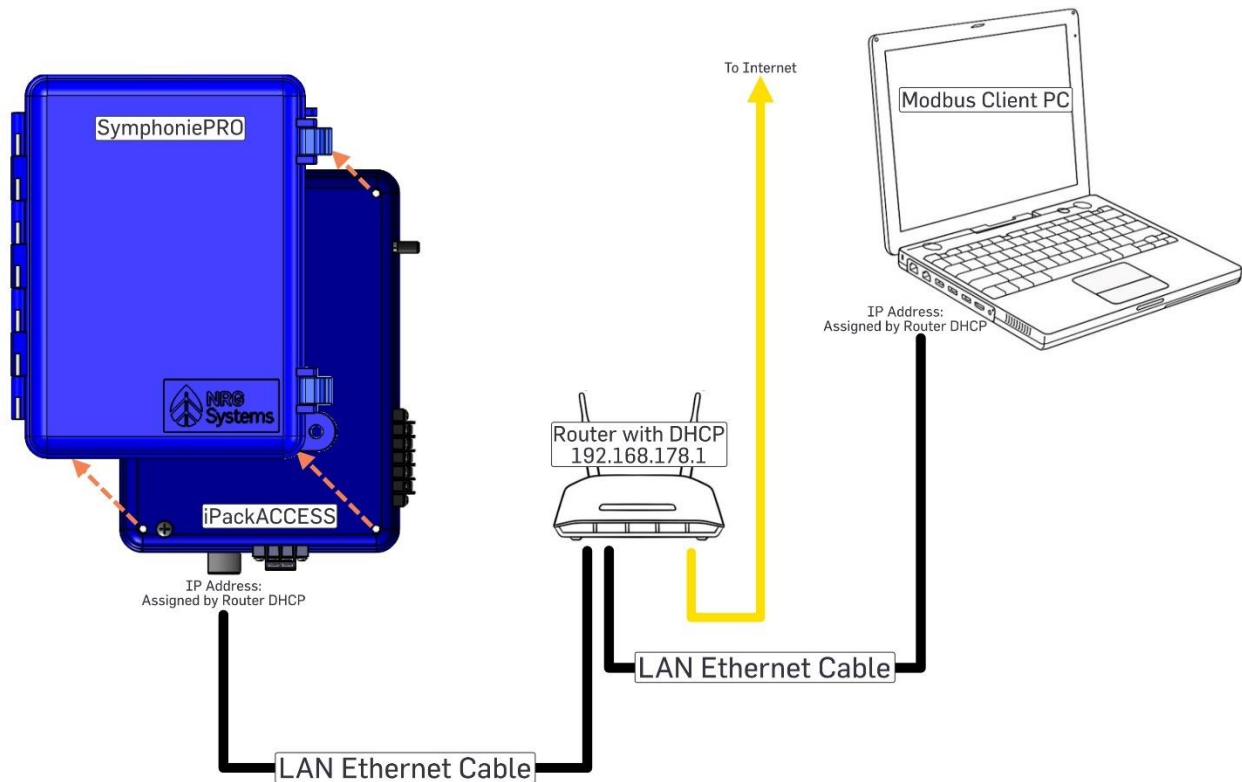
This is a common network setup where a DHCP server assigning IP addresses to all devices. DHCP is enabled and responsible for giving the iPackACCESS and computer their IP addresses. In the iPackACCESS settings, DHCP is turned "ON", and Static IP address is not used. No email is enabled, and no DNS servers are specified; data are available over the local network.

Parameter	iPackACCESS	PC
Enable DHCP	Yes	Yes
Static IP Address	[Assigned by DHCP]	[Assigned by DHCP]
Subnet Mask	[Assigned by DHCP]	[Assigned by DHCP]
Gateway	N/A	Not used
Primary DNS Server	0.0.0.0	Not used
Secondary DNS Server	0.0.0.0	Not used

Router With DHCP & Internet Email
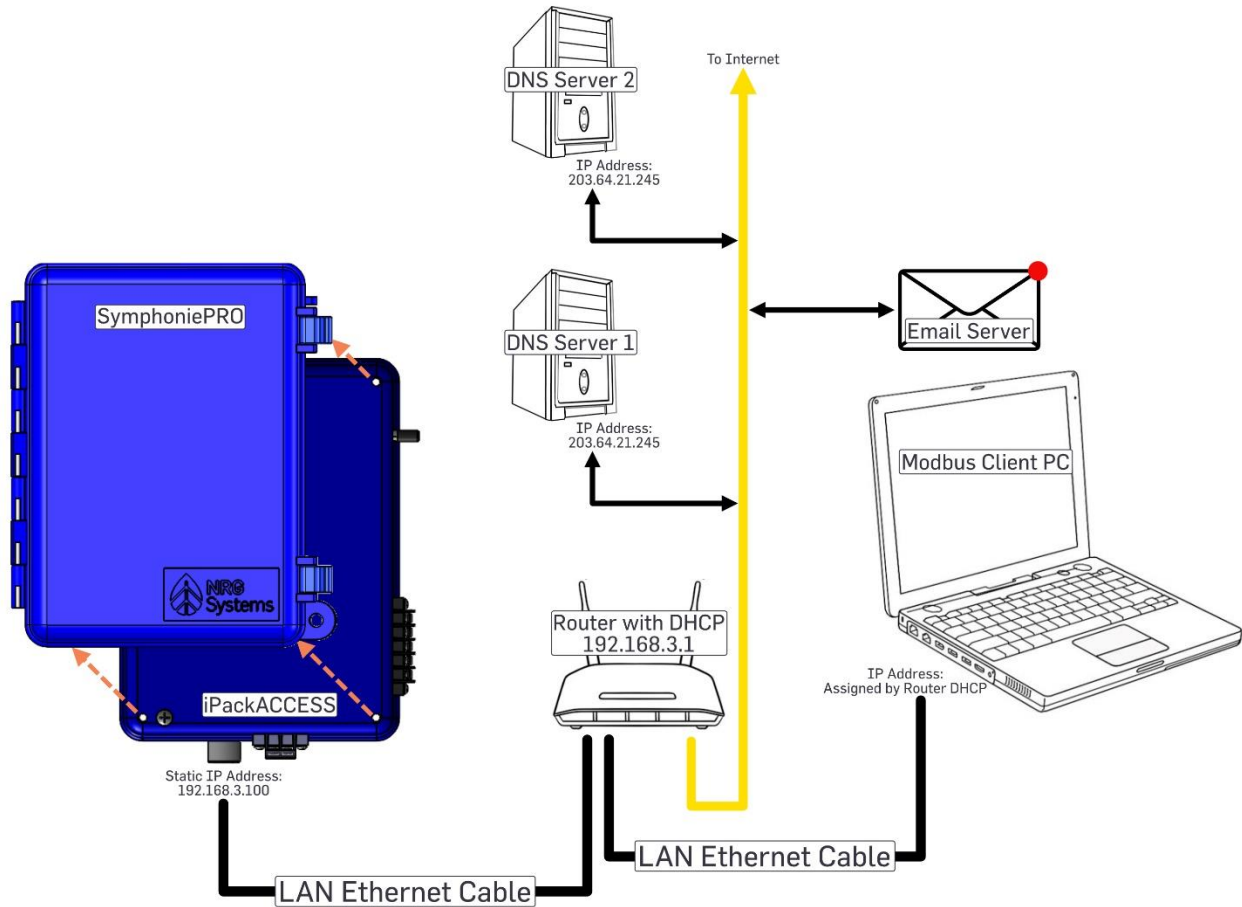
This is a network with email enabled and the DHCP server assigning an IP address only to the computer, but not the iPackACCESS. The iPackACCESS has DHCP off, which means it has a fixed IP address. The iPackACCESS must have the same Subnet as the computer and router. The computer has DHCP enabled, so the router provides the computer with an IP address. The iPackACCESS has both the DNS servers enabled and the SMTP server information populated (**Schedules Tab**; just like a cellular iPack sending data files via email).

Parameter	iPackACCESS	PC
Enable DHCP	No	Yes
Static IP Address	192.168.3.100	[Assigned by DHCP]
Subnet Mask	255.255.255.0	[Assigned by DHCP]
Gateway	192.168.3.1	Not used
Primary DNS Server	203.64.21.245	Not used
Secondary DNS Server	203.64.22.123	Not used

Network Considerations

- Modbus default port is 502 but iPackACCESS can be configured to use any port number.
- iPackACCESS supports DHCP for automatic configuration of network address.
- If DHCP is disabled on either the iPackACCESS or the PC, you will need to manually edit the Static IP Address, Subnet Mask, and Gateway IP Address on that device. Your IT administrator may be able to assist you with assigning the appropriate addresses.
- As a security feature, the iPackACCESS can be configured to limit the allowed connections.
- iPackACCESS implements a standard 10baseT Ethernet interface that can auto-negotiate full or half duplex and adjust for crossover.
- iPackACCESS allows up to 4 simultaneous client connections.
- iPackACCESS allows configuration of SMTP port to accommodate different firewall settings.

Verifying Network Connection

SymphoniePRO's Connection Status screen **[Home][2][2][2]** provides Ethernet status, Network status, email status, and MetLink status. Use the right arrow to toggle between the different status screens.

The Ethernet status screen will tell you if the iPack is connected via Ethernet, as well as the type of connection (Half Duplex or Full Duplex). If no network connection is detected, the screen will display "No Link Detected".

The Network status screen shows the IP address assigned to the iPackACCESS (either through direct assignment or DHCP) and the DNS server being used.

The Modbus status screen **[Home][2][2][7]** shows the Modbus server state and the number of clients connected.

To verify network communication, open a Command Prompt window on a computer connected to the same network as the iPackACCESS. At the command prompt, type "ping" followed by the IP address of the iPackACCESS and hit **Enter**. The display should show successful communication with no packet loss.

Once successful connection and communication have been verified, start your Modbus client and make sure that it communicates successfully.

NRG Modbus Demo Client

The NRG Modbus Demo Client communicates with the iPackACCESS via Modbus and can be used to poll the Modbus registers of the iPackACCESS. The purpose of this demo application is to provide a simple way to verify network connectivity and test data streams from each attached sensor.

The NRG Modbus Demo Client is included in the installation of SymphoniePRO Desktop App and can be found in Document\Renewable NRG Systems\Utilities after the first time SymphoniePRO Desktop App is run.

The Modbus Demo Client can also be downloaded from the NRG website: https://www.nrgsystems.com/support/product-support/documents/software

Using the Modbus Demo Client

Start the application by double-clicking the NRGModbusDemoClient.exe file. Make sure SymphoniePRO + iPackACCESS is selected from the Modbus Server Type dropdown.

Enter the active IP Address of the iPackACCESS (the IP address of the iPackACCESS can be found by pressing **[Home][2][2][2]** on the logger's keypad and pressing the right arrow to get to the Network status screen). If you are using a port other than 502 then change the **Port** number.

By default, the Modbus Demo Client will display all Modbus registers. You can choose to only look at a certain set of registers by selecting a different **Register Block** from the dropdown.

Press the **Start Modbus Client** to begin polling the iPackACCESS registers.

Since the iPackACCESS can support multiple Modbus clients, this application can be used simultaneously with other Modbus clients, which may be helpful in debugging the setup of Modbus tag information in the end user application.

Modbus Protocol

The iPackACCESS follows Modbus Application Protocol Specification V1.1b. The standard exception codes in the table below are supported.

Modbus Exception Codes		
Code	**Name**	**Meaning**
01	ILLEGAL FUNCTION	The function code is not supported by the iPackACCESS or is not in the correct state to be able to perform the function.
02	ILLEGAL DATA ADDRESS	An address in the requested data range is not an allowable address.
03	ILLEGAL DATA VALUE	The value in the data field is not allowable by the iPackACCESS.
04	SLAVE DEVICE FAILURE	An unrecoverable error occurred when the iPackACCESS was performing the request.

Input Register Data and Addressing

The iPackACCESS only supports the "Input Register" and "Holding Register" primary tables. Therefore, only Modbus function 3 and 4 will be supported. These functions are read-only. The client will request that the input register or holding register table be read by sending function 3 or 4, the start address, and the number of registers that it would like to read.

The Modbus registers are organized into contiguous address blocks, so that the client can easily query an entire block of one particular type of data. The blocks and their starting addresses are listed below, and a more complete list of registers is provided in the tables in the following section.

Configuration Information: Address 0

Real-time (1-second) scaled data from physical (counter, analog, and serial) channels: Address 1500

Statistical scaled data from physical (counter, analog, and serial) channels: Address 2500

Diagnostic data: Address 3000

Real-time (1-second) data from calculated channels: Address 3500

Statstical data from calculated channels: Address 4000

Each Modbus register holds 16 bits of data. For data that is larger than 16 bits, it will be split among multiple registers in big endian format. For example, all sensor data are represented in 32-bit floating point format. Each of these values is contained in two Modbus registers, where the first register contains the most significant half of the word, and the second register contains the least significant half. A list of register addresses is provided below.

A timestamp is provided for each block of data. The real-time data timestamp is the latest timestamp sent from the logger. The statistical data timestamp is the time at the beginning of the last calculated interval. Each timestamp has the year, month, day, hour, minute, and seconds stored in a different register in this sequence.

In the statistical data block, each channel contains a pair of registers for each type of statistic: average or total, standard deviation, maximum, minimum, and maximum gust (anemometer channels only), in that order. Channel 1's first register starts after the last timestamp register.

Modbus Register Table

Modbus Register Address	Number of Registers	Description of Data	Data Type
System Configuration Data			
0	2	32-bit Floating-point representation of the number 12345678	32-bit Floating Point
2	2	Unsigned 32-bit representation of the number 123456789.	Unsigned 32-bit Integer
4	1	Unsigned 16-bit representation of the number 12345	Unsigned 16-bit Integer
5	2	Site Number	Unsigned 32-bit Integer
7	2	Logger Serial Number	Unsigned 32-bit Integer
9	1	Logger Model Number	Unsigned 16-bit Integer
10	2	Logger Model Version Number	Unsigned 32-bit Integer
12	2	Logger Firmware Version Number	Unsigned 32-bit Integer
14	2	iPack Serial Number	Unsigned 32-bit Integer
16	1	iPack Model Number	Unsigned 16-bit Integer
17	2	iPack Model Version Number	Unsigned 32-bit Integer
19	2	iPack Firmware Version Number	Unsigned 32-bit Integer
Scaled Real-Time (1 Second) Data for Physical (Counter, Analog, and Serial) Channels			
1500	1	Real Time Year	Unsigned 16-bit Integer
1501	1	Real Time Month	Unsigned 16-bit Integer
1502	1	Real Time Day	Unsigned 16-bit Integer
1503	1	Real Time Hour	Unsigned 16-bit Integer
1504	1	Real Time Minute	Unsigned 16-bit Integer
1505	1	Real Time Second	Unsigned 16-bit Integer
1506	2	Channel 1 Real-Time Data	32-bit Floating Point
1508	2	Channel 2 Real-Time Data	32-bit Floating Point
…			
1604	2	Channel 50 Real-Time Data	32-bit Floating Point
Scaled Statistical Data for Physical (Counter, Analog, and Serial) Channels			
2500	1	Statistical Interval Year	Unsigned 16-bit Integer
2501	1	Statistical Interval Month	Unsigned 16-bit Integer
2502	1	Statistical Interval Day	Unsigned 16-bit Integer
2503	1	Statistical Interval Hour	Unsigned 16-bit Integer
2504	1	Statistical Interval Minute	Unsigned 16-bit Integer
2505	1	Statistical Interval Second	Unsigned 16-bit Integer
Statistical Data for Counter Channels			
2506	2	Channel 1 Average or Total	32-bit Floating Point
2508	2	Channel 1 Standard Deviation	32-bit Floating Point
2510	2	Channel 1 Maximum	32-bit Floating Point
2512	2	Channel 1 Minimum	32-bit Floating Point
2514	2	Channel 1 Maximum Gust	32-bit Floating Point
Repeat for 11 more Counter Channels			
…			
Statistical Data for Analog Channels			
2626	2	Channel 13 Average	32-bit Floating Point
2628	2	Channel 13 Standard Deviation	32-bit Floating Point
2630	2	Channel 13 Maximum	32-bit Floating Point
2632	2	Channel 13 Minimum	32-bit Floating Point
Repeat for 13 more Analog Channels			
…			
Statistical Data for Serial Channels			
2738	2	Channel 27 Average	32-bit Floating Point
2740	2	Channel 27 Standard Deviation	32-bit Floating Point

2742	2	Channel 27 Maximum	32-bit Floating Point
2744	2	Channel 27 Minimum	32-bit Floating Point
Repeat for 23 more Serial Channels			
...			
Diagnostic Data			
3000	1	Real Time Year	Unsigned 16-bit Integer
3001	1	Real Time Month	Unsigned 16-bit Integer
3002	1	Real Time Day	Unsigned 16-bit Integer
3003	1	Real Time Hour	Unsigned 16-bit Integer
3004	1	Real Time Minute	Unsigned 16-bit Integer
3005	1	Real Time Second	Unsigned 16-bit Integer
3006	2	Temperature (Celcius)	32-bit Floating Point
3008	2	12V Nominal Battery Voltage (Volts)	32-bit Floating Point
3010	2	12V Nominal Battery Current to Sensors (mA)	32-bit Floating Point
3012	2	2V Nominal DCell or iPack Voltage (V)	32-bit Floating Point
3014	2	5V Current to Sensors (mA)	32-bit Floating Point
3016	1	Is an SD card loaded in the logger (1) True/(0)False	Unsigned 16-bit Integer
3017	2	Free Memory in the SD Card in KB	Unsigned 32-bit Integer
3019	2	Used Memory in the SD Card in KB	Unsigned 32-bit Integer
3021	2	Timezone Offset Hours	32-bit Floating Point
Real-time (1-second) Data for Calculated Channels			
3500	1	Real Time Year	Unsigned 16-bit Integer
3501	1	Real Time Month	Unsigned 16-bit Integer
3502	1	Real Time Day	Unsigned 16-bit Integer
3503	1	Real Time Hour	Unsigned 16-bit Integer
3504	1	Real Time Minute	Unsigned 16-bit Integer
3505	1	Real Time Second	Unsigned 16-bit Integer
3506	2	Channel 100 Real-Time Data	32-bit Floating Point
3508	2	Channel 101 Real-Time Data	32-bit Floating Point
...			
3524	2	Channel 109 Real-Time Data	32-bit Floating Point
Scaled Statistical Data for Calculated Channels			
4000	1	Statistical Interval Year	Unsigned 16-bit Integer
4001	1	Statistical Interval Month	Unsigned 16-bit Integer
4002	1	Statistical Interval Day	Unsigned 16-bit Integer
4003	1	Statistical Interval Hour	Unsigned 16-bit Integer
4004	1	Statistical Interval Minute	Unsigned 16-bit Integer
4005	1	Statistical Interval Second	Unsigned 16-bit Integer
4006	2	Channel 100 Average	32-bit Floating Point
4008	2	Channel 100 Standard Deviation	32-bit Floating Point
4010	2	Channel 100 Maximum	32-bit Floating Point
4012	2	Channel 100 Minimum	32-bit Floating Point
Repeat for 9 more Calculated Channels			
...			

SECTION 7 | TROUBLESHOOTING GUIDE

The SymphoniePRO logger and SymphoniePRO Desktop App provide numerous to assist in troubleshooting any issues with the logger, iPack, or any other part of the installation. These tools include Recent Events, Logs, and Exports.

Logs

Application Log

The Application Log provides a detailed history of activities performed using the SymphoniePRO Desktop Application. This includes actions such as downloading files, importing files, connections, and firmware updates. The Application Log can be viewed in Notepad by selecting **File**>**View Application Log** from the File menu or by clicking the **View Log File** link after actions such as downloading files or importing data. A new log is created each time you start the SymphoniePRO Desktop App. Logs are saved with the format SymPRO_Desktop_YYYY-MM-DD_HH.MM.log and are stored in the Logs Path location defined in **File**>**Settings**.

Communication Log

The Communication Log can be accessed by choosing **Help**>**Save Communication Log**. The Communication Log contains a detailed history of the SymphoniePRO Desktop App communications with loggers and iPacks. The file is in a compressed format that can be sent to NRG Systems for troubleshooting analysis. Logs are saved with the format SymPRO_Desktop_CommHist_YYYY-MM-DD_HH_MM_SS.log and are stored in the Logs Path location defined in **File**>**Settings**.

iPack Log

The iPack Log can be accessed by clicking the **Display iPack Status** button and then choosing **View Log File**. The **Test Email Settings** button and the MetLink **Test** buttons on the Schedules Tab also provide a **View Log File** link. The iPack Log contains a detailed history of the iPack's MetLink and/or SMTP communications. Logs are saved with the format SymPRO_Desktop_iPack_YYYY-MM-DD_HH.MM.SS.log and are stored in the Logs Path location defined in **File**>**Settings**.

Exports

In addition to storing measurements, the SymphoniePRO records important information about logger activities: Diagnostics, Events, and Communications. This information is stored in each RLD file and is imported into the site database along with the measurement data. Each category of information can be separately exported (in text format) from the Site Utilities Tab for a specific date range or for the entire measurement period. Exported files are saved in the Export Path location defined in **File**>**Settings** with a filename containing the site number and project name.

Measurements

The meteorological (sensor) data recorded by the logger. A careful review of the measurement data can often provide clues related to storm activity, icing conditions, or other events or trends that can be helpful in diagnosing a problem.

The top part of the text file contains header information like site location, logger and iPack serial numbers and firmware versions, and sensor configuration information. The remainder of the file is timestamped and sorted into columns.

Diagnostic

Includes the logger D-cell battery voltage (average, minimum, and maximum), iPack 12 V battery voltage (average, minimum, and maximum), internal circuit board temperature (average), 12 V excitation current (average, minimum, and maximum), and 5 V excitation current (average, minimum, and maximum).

Communications

The complete communication history for the site, including bytes sent & received, modem type, signal strength, connection time, cellular carrier, and connection mechanism used to send data.

Events

SymphoniePRO logs all types of events and records them in the data stream. A history of fault events and user actions is recorded for each site.

Common Error Codes

Below is a table of common error codes encountered in the event log of a SymphoniePRO logger when performing troubleshooting. The table does not include all possible errors and events, so contact support@nrgsystems.com with additional questions.

Fault	FaultCode	Error	Error (Hex)	ErrorCode	Description
64	FID_GSPARAM_VERSION_FAULT	20132	4EA4	GSPARAM_VERSION_ERR	Parameter version not correct, so reset nominal values
101	FID_GSGPS_INIT_FAULT	25004	61AC	IPCMDPR_INVALID_CMD_ERR	Problem communicating with the GPS - please contact rNRG systems
101	FID_GSGPS_INIT_FAULT	25163	624B	IPCMDPR_IN_PROGRESS_ERR	Problem communicating with the GPS - iPack is busy
101	FID_GSGPS_INIT_FAULT	20143	4EAF	GSGPS_STATE_ERR	Fault with GPS
101	FID_GSGPS_INIT_FAULT	1115	45B	HWSCI_TX_OVERRUN_ERR	Transmit overrun on serial bus
101	FID_GSGPS_INIT_FAULT	2104	838	SRVINET_SNTP_ERR	Failed connecting to time server
101	FID_GSGPS_INIT_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Problem communicating with the GPS
101	FID_GSGPS_INIT_FAULT	2512	9D0	SRVIPACK_NOT_ACTIVE_ERR	Problem initializing the GPS
101	FID_GSGPS_INIT_FAULT	2516	9D4	SRVIPACK_SEMA_TIMEOUT_ERR	Problem communicating with the GPS - iPack is busy
103	FID_GSGPS_GET_DATA_FAULT	2516	9D4	SRVIPACK_SEMA_TIMEOUT_ERR	Problem retrieving data from the GPS
103	FID_GSGPS_GET_DATA_FAULT	2512	9D0	SRVIPACK_NOT_ACTIVE_ERR	Problem retrieving data from the GPS - iPack powered down
103	FID_GSGPS_GET_DATA_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Problem retrieving data from the GPS
103	FID_GSGPS_GET_DATA_FAULT	2102	836	SRVINET_DNS_ERR	Cannot resolve DNS of time server
103	FID_GSGPS_GET_DATA_FAULT	20143	4EAF	GSGPS_STATE_ERR	Problem retrieving data from the GPS
103	FID_GSGPS_GET_DATA_FAULT	2520	9D8	SRVIPACK_INVALID_CMD_RESPONSE	Couldn't get GPS data due to Logger/iPack communication error
103	FID_GSGPS_GET_DATA_FAULT	25163	624B	IPCMDPR_IN_PROGRESS_ERR	Problem retrieving data from the GPS - iPack is busy
103	FID_GSGPS_GET_DATA_FAULT	10025	2729	UTGPS_STALE_DATA_ERR	Problem retrieving data from the GPS
106	FID_GSGPS_SET_TIME_FAULT	20291	4F43	GSTM_RTC_TIME_RANGE_ERR	Time outside of bounds
107	FID_GSGPS_SHUTDOWN_FAULT	25163	624B	IPCMDPR_IN_PROGRESS_ERR	Problem shutting down the GPS - iPack busy
107	FID_GSGPS_SHUTDOWN_FAULT	2520	9D8	SRVIPACK_INVALID_CMD_RESPONSE	Tried to shut down GPS and failed
107	FID_GSGPS_SHUTDOWN_FAULT	20143	4EAF	GSGPS_STATE_ERR	Problem shutting down the GPS
107	FID_GSGPS_SHUTDOWN_FAULT	2104	838	SRVINET_SNTP_ERR	Problem updating time - an internal fault was encountered
107	FID_GSGPS_SHUTDOWN_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Problem shutting down the GPS
107	FID_GSGPS_SHUTDOWN_FAULT	2512	9D0	SRVIPACK_NOT_ACTIVE_ERR	Problem shutting down the GPS
107	FID_GSGPS_SHUTDOWN_FAULT	2516	9D4	SRVIPACK_SEMA_TIMEOUT_ERR	Problem shutting down the GPS - iPack is busy
107	FID_GSGPS_SHUTDOWN_FAULT	10015	271F	UTGPS_NOT_VALID_ERR	Problem shutting down the GPS
107	FID_GSGPS_SHUTDOWN_FAULT	10018	2722	UTGPS_NO_DATA_ERR	GPS returned no data
186	FID_GSTM_RTC_FAULT	20291	4F43	GSTM_RTC_TIME_RANGE_ERR	Problem reading time from the logger clock
186	FID_GSTM_RTC_FAULT	3111	C27	DRVRTC_INVALID_TIME_ERR	Problem reading time from logger clock
252	FID_GSSA_TASK_STACK_OVERFLOW_FAULT				Task overflow
253	FID_GSSA_LOW_POWER_SAFETY_TIMEOUT_FAULT	20481	5001	GSSA_LOW_POWER_SAFETY_TIMEOUT_ERR	Logger was unable to enter low power state - after 23 hours a reset was performed (this can occur if you leave USB connected to logger)
254	FID_GSSA_QUEUE_NULL_FAULT	20483	5003	GSSA_QUEUE_RECEIVE_ERR	A recoverable fault event occurred

311	FID_GSFWU_VALIDATE_AND_CLOSE_FILE_FAULT	20197	4EE5	GSFWU_NO_OPEN_FILE_ERR	Validates the open firmware file failed: FAT table not valid
311	FID_GSFWU_VALIDATE_AND_CLOSE_FILE_FAULT	20199	4EE7	GSFWU_FILE_FW_IMAGE_INVALID_ERR	Invalid firmware file
382	FID_GSSD_WRITE_FILE_TO_CARD_FAULT	20162	4EC2	GSSD_CARD_WRITE_PROTECT_ERR	SD card write protection error - file write problem
382	FID_GSSD_WRITE_FILE_TO_CARD_FAULT	20168	4EC8	GSSD_MMC_CARD_NOT_SUPPORTED_ERR	SD Card not supported
382	FID_GSSD_WRITE_FILE_TO_CARD_FAULT	2233	8B9	SRVFS_FSCOMM_NO_DIR_ERR	Problem writing file to SD card - directory not found
382	FID_GSSD_WRITE_FILE_TO_CARD_FAULT	2228	8B4	SRVFS_FSCOMM_FS_ERR	File system error when writing to SD card
382	FID_GSSD_WRITE_FILE_TO_CARD_FAULT	3081	C09	DRVSDMMC_INIT_ERR	Issue writing to SD Card
383	FID_GSSD_SERVICE_TASK_FAULT	3081	C09	DRVSDMMC_INIT_ERR	Problem initializing the SD card
383	FID_GSSD_SERVICE_TASK_FAULT	2228	8B4	SRVFS_FSCOMM_FS_ERR	File system error
383	FID_GSSD_SERVICE_TASK_FAULT	2233	8B9	SRVFS_FSCOMM_NO_DIR_ERR	Problem finding directory on SD card
383	FID_GSSD_SERVICE_TASK_FAULT	2221	8AD	SRVFS_FSCOMM_HW_ERR	Hardware driver error
383	FID_GSSD_SERVICE_TASK_FAULT	2222	8AE	SRVFS_FSCOMM_NO_FORMAT_ERR	Invalid SD Card format
383	FID_GSSD_SERVICE_TASK_FAULT	20162	4EC2	GSSD_CARD_WRITE_PROTECT_ERR	Problem writing data to the SD card - SD card is write protected, please disable the write protection on the SD card
383	FID_GSSD_SERVICE_TASK_FAULT	20168	4EC8	GSSD_MMC_CARD_NOT_SUPPORTED_ERR	SD Card not supported
383	FID_GSSD_SERVICE_TASK_FAULT	20161	4EC1	GSSD_CARD_NOT_PRESENT_ERR	SD card is not detected
383	FID_GSSD_SERVICE_TASK_FAULT	20442	4FDA	GSSD_CARD_FULL_ERR	SD Card full
383	FID_GSSD_SERVICE_TASK_FAULT	20445	4FDD	GSSD_ACTION_QUEUE_OVERFLOW_ERR	Problem writing to the SD card - SD card may not be present, data still recorded in logger internal memory
481	FID_SVCMDPR_USB_FAULT	2303	8FF	SRVHID_IN_TIMEOUT_ERR	Problem with USB communication
531	FID_SVM_ANALOG_SAMPLE_FAULT	20541	503D	GSPWQ_BUFFER_FULL_ERR	The buffer does not have space to queue this element.
532	FID_SVM_DIGITAL_SAMPLE_FAULT	20541	503D	GSPWQ_BUFFER_FULL_ERR	The buffer does not have space to queue this sample.
533	FID_SVM_DIAGNOSTIC_SAMPLE_FAULT	20541	503D	GSPWQ_BUFFER_FULL_ERR	The buffer does not have space to queue this sample.
536	FID_SVM_GET_COUNTS_FAULT	3151	C4F	DRVSVC_INVALID_RSP_ERR	Digital counts error
539	FID_SVM_12V_BAT_PROTECT_FAULT	32065	7D41	SVM_12V_BAT_ERR	Low battery alert! Possible causes: Battery charging issue or excessive 12 V current draw (e.g., sensor wiring issue or sensor failure)
540	FID_SVID_BASE	32065	7D41	SVM_12V_BAT_ERR	Combination should never happen
541	FID_SVID_SUPPLY_FAULT	32042	7D2A	SVID_33V_RAIL_OUT_OF_RANGE_ERR	Problem with 3.3 V reference - possible low battery condition, if problem persists contact rNRG
541	FID_SVID_SUPPLY_FAULT	32043	7D2B	SVID_53V_RAIL_OUT_OF_RANGE_ERR	Problem with 5.3 V supply- possible low battery condition, if problem persists contact rNRG
541	FID_SVID_SUPPLY_FAULT	32044	7D2C	SVID_3V_REF_OUT_OF_RANGE_ERR	Problem with 3 V reference - possible low battery condition, if problem persists contact rNRG
541	FID_SVID_SUPPLY_FAULT	32045	7D2D	SVID_5V_REF_OUT_OF_RANGE_ERR	Problem with 5 V reference - possible low battery condition, if problem persists contact rNRG
541	FID_SVID_SUPPLY_FAULT	32046	7D2E	SVID_25V_REF_OUT_OF_RANGE_ERR	Problem with 2.5 V reference - possible low battery condition, if problem persists contact rNRG
551	FID_SVCOM_CONNECT_TCP_FAULT	25104	6210	IPMAIN_LOW_BAT_ERR	Problem connecting to the network - iPack battery is below 10.5 V, iPackGPS will not attempt call under this condition
551	FID_SVCOM_CONNECT_TCP_FAULT	25005	61AD	IPCMDPR_SOCKET_ERR	Problem connecting to the network - issue communicating with the network
551	FID_SVCOM_CONNECT_TCP_FAULT	25004	61AC	IPCMDPR_INVALID_CMD_ERR	Problem connecting to the network - internal error, please contact rNRG Systems

551	FID_SVCOM_CONNECT_TCP_FAULT	10112	2780	UTMDM_NO_CARRIER_ERR	Problem connecting to the network - network connection issue detected
551	FID_SVCOM_CONNECT_TCP_FAULT	32101	7D65	SVCOM_TIMEOUT_ERR	Problem connecting to the network
551	FID_SVCOM_CONNECT_TCP_FAULT	32107	7D6B	SVCOM_OLD_FW_ERR	Problem connecting to the network - old version of iPack detected
551	FID_SVCOM_CONNECT_TCP_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Problem connecting to the network
551	FID_SVCOM_CONNECT_TCP_FAULT	1118	45E	HWSCI_RX_FRAMING_ERR	Problem connecting to the network - communication error with iPack
551	FID_SVCOM_CONNECT_TCP_FAULT	2105	839	SRVINET_PPP_ERR	Problem connecting to the network - PPP connection could not be established
551	FID_SVCOM_CONNECT_TCP_FAULT	2102	836	SRVINET_DNS_ERR	Problem connecting to the network - DNS server not responding
551	FID_SVCOM_CONNECT_TCP_FAULT	2516	9D4	SRVIPACK_SEMA_TIMEOUT_ERR	Problem connecting to the network - iPack is busy
551	FID_SVCOM_CONNECT_TCP_FAULT	10042	273A	UTMDM_NOT_OK_ERR	Problem connecting to the network
551	FID_SVCOM_CONNECT_TCP_FAULT	10044	273C	UTMDM_ATCMD_ECHO_ERR	Problem connecting to the network - modem error detected
551	FID_SVCOM_CONNECT_TCP_FAULT	10046	273E	UTMDM_ATRSP_TIMEOUT_ERR	Problem connecting to the network - modem not responding
551	FID_SVCOM_CONNECT_TCP_FAULT	10048	2740	UTMDM_UNKNOWN_MODEM_ERR	Problem connecting to the network - modem identification error
551	FID_SVCOM_CONNECT_TCP_FAULT	10051	2743	UTMDM_NOT_DIRECT_ERR	Problem connecting to the network - issue communicating to the modem
551	FID_SVCOM_CONNECT_TCP_FAULT	10057	2749	UTMDM_NO_SIM_ERR	Problem connecting to the network - no SIM card installed, please make sure the SIM card is properly installed inside the iPack
551	FID_SVCOM_CONNECT_TCP_FAULT	10059	274B	UTMDM_NOT_REGISTERED_ERR	Problem connecting to the network - modem not registering with network; check with provider that account is active, for CDMA make certain iPack was provisioned in home area
551	FID_SVCOM_CONNECT_TCP_FAULT	2512	9D0	SRVIPACK_NOT_ACTIVE_ERR	Problem connecting to network - iPack not responding, there may be a low battery condition
551	FID_SVCOM_CONNECT_TCP_FAULT	2514	9D2	SRVIPACK_BAD_SYNC_ERR	Problem connecting to the network - communication error with iPack
551	FID_SVCOM_CONNECT_TCP_FAULT	2503	9C7	SRVIPACK_NOT_PRESENT_ERR	Problem connecting the network
551	FID_SVCOM_CONNECT_TCP_FAULT	2134	856	SRVMAIL_SMTP_TCPCONN_ERR	Problem connecting to the network - issue with connection to the SMTP (Email) server
552	FID_SVCOM_OPEN_MAIN_FAULT	2102	836	SRVINET_DNS_ERR	Problem connecting to Primary Host - DNS server not responding
552	FID_SVCOM_OPEN_MAIN_FAULT	32101	7D65	SVCOM_TIMEOUT_ERR	Problem connecting to the Primary Host - iPack not responding
552	FID_SVCOM_OPEN_MAIN_FAULT	10112	2780	UTMDM_NO_CARRIER_ERR	Problem connecting to the Primary Host - unable to connect to network
552	FID_SVCOM_OPEN_MAIN_FAULT	25005	61AD	IPCMDPR_SOCKET_ERR	Primary Host unavailable or not responding
553	FID_SVCOM_OPEN_BACKUP_FAULT	25005	61AD	IPCMDPR_SOCKET_ERR	Secondary Host unavailable or not responding
553	FID_SVCOM_OPEN_BACKUP_FAULT	2102	836	SRVINET_DNS_ERR	Problem connecting to the Secondary Host - DNS server not responding

553	FID_SVCOM_OPEN_BACKUP_FAULT	2512	9D0	SRVIPACK_NOT_ACTIVE_ERR	Problem connecting to the Secondary Host - iPack may be powered down
553	FID_SVCOM_OPEN_BACKUP_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Problem connecting to the Secondary Host - iPack not responding
554	FID_SVCOM_START_SMTP_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Problem communicating with the SMTP (Email) server
554	FID_SVCOM_START_SMTP_FAULT	2134	856	SRVMAIL_SMTP_TCPCONN_ERR	Problem connecting to the SMTP (Email) server - please verify SMTP server name, user name, password or other email settings, make certain server is running
554	FID_SVCOM_START_SMTP_FAULT	2132	854	SRVMAIL_SMTP_NONAME_ERR	Problem connecting to SMTP (Email) server. Check server name and compatibility (servers which use SSL encryption such as Gmail or Yahoo Mail are not compatible)
554	FID_SVCOM_START_SMTP_FAULT	32101	7D65	SVCOM_TIMEOUT_ERR	Problem connecting to the SMTP (Email) server
555	FID_SVCOM_END_SMTP_FAULT	10	A	CID_NOT_FOUND_ERROR_10	Problem sending Email
555	FID_SVCOM_END_SMTP_FAULT	2125	84D	SRVMAIL_SMTP_TIMEOUT_ERR	Problem sending Email - issue communicating with SMTP (Email) server
555	FID_SVCOM_END_SMTP_FAULT	0	0	NO_ERR	Issue emailing
555	FID_SVCOM_END_SMTP_FAULT	2124	84C	SRVMAIL_SMTP_SERVER_ERR	Problem sending Email - issue communicating with SMTP (Email) server
555	FID_SVCOM_END_SMTP_FAULT	10112	2780	UTMDM_NO_CARRIER_ERR	Problem sending Email - issue with network connection couldn't find carrier - check settings
555	FID_SVCOM_END_SMTP_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Problem sending Email - took too long
558	FID_SVCOM_REQUEST_DISCONNECT_TCP_FAULT	2516	9D4	SRVIPACK_SEMA_TIMEOUT_ERR	Problem disconnecting from the network - iPack is busy
558	FID_SVCOM_REQUEST_DISCONNECT_TCP_FAULT	10112	2780	UTMDM_NO_CARRIER_ERR	Problem disconnecting from the network
558	FID_SVCOM_REQUEST_DISCONNECT_TCP_FAULT	2124	84C	SRVMAIL_SMTP_SERVER_ERR	Problem with the network connection - issue communicating with SMTP (Email) server
558	FID_SVCOM_REQUEST_DISCONNECT_TCP_FAULT	2102	836	SRVINET_DNS_ERR	Problem disconnecting from the network - DNS server not responding
558	FID_SVCOM_REQUEST_DISCONNECT_TCP_FAULT	2132	854	SRVMAIL_SMTP_NONAME_ERR	Problem with network connection - SMTP (Email) server name or other settings may be incorrect
558	FID_SVCOM_REQUEST_DISCONNECT_TCP_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Problem disconnecting from the network
558	FID_SVCOM_REQUEST_DISCONNECT_TCP_FAULT	32101	7D65	SVCOM_TIMEOUT_ERR	Problem disconnecting from the network
558	FID_SVCOM_REQUEST_DISCONNECT_TCP_FAULT	25005	61AD	IPCMDPR_SOCKET_ERR	Network disconnected unexpectedly
580	FID_SVFWU_BASE	2519	9D7	SRVIPACK_ENABLE_CLEAR_5V_HOLD_ERR	iPack not present
581	FID_SVFWU_LOAD_IPACK_FAULT	32112	7D70	SVCOM_STARTUP_ERR	iPack firmware update failure
581	FID_SVFWU_LOAD_IPACK_FAULT	2518	9D6	SRVIPACK_DISABLE_ERR	Tried to shutdown/disable iPack and failed
581	FID_SVFWU_LOAD_IPACK_FAULT	32149	7D95	SVFWU_IPACK_VERIFY_FAILED_ERR	Verification of iPack firmware failed
581	FID_SVFWU_LOAD_IPACK_FAULT	32142	7D8E	SVFWU_INCORRECT_FW_IMAGE_ERR	Problem updating firmware in the iPack - corrupted or incorrect firmware detected
581	FID_SVFWU_LOAD_IPACK_FAULT	32107	7D6B	SVCOM_OLD_FW_ERR	Tried to load out of date firmware onto Logger
581	FID_SVFWU_LOAD_IPACK_FAULT	25163	624B	IPCMDPR_IN_PROGRESS_ERR	Problem updating the iPack firmware - iPack busy
581	FID_SVFWU_LOAD_IPACK_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Problem updating iPack firmware - please try again
581	FID_SVFWU_LOAD_IPACK_FAULT	2516	9D4	SRVIPACK_SEMA_TIMEOUT_ERR	Problem updating the iPack firmware - iPack busy
581	FID_SVFWU_LOAD_IPACK_FAULT	2507	9CB	SRVIPACK_FW_ERASE_TIMEOUT_ERR	Problem updating iPack firmware - please try again
583	FID_SVFWU_FAULT	20246	4F16	GSFWU_FILE_SEARCH_COMPLETE_ERR	Problem updating the Logger or iPack firmware - please try again

583	FID_SVFWU_FAULT	32142	7D8E	SVFWU_INCORRECT_FW_IMAGE_ERR	Problem updating firmware in SymphoniePRO Logger - corrupted or incorrect firmware detected
583	FID_SVFWU_FAULT	32143	7D8F	SVFWU_UNSUPPORTED_IPACK_ERR	Problem updating the iPack firmware - this version of iPack firmware is not supported
583	FID_SVFWU_FAULT	32145	7D91	SVFWU_HWTARGET_MISMATCH_ERR	Loading incorrect firmware
621	FID_SVM_DATA_WATCHDOG_TIMEOUT	32066	7D42	SVM_DATA_WATCHDOG_ERR	Data sampling task stopped
559	FID_SVCOM_SNTP_FAULT	25005	61AD	IPCMDPR_SOCKET_ERR	Problem connecting to SMTP (Email) server - encountered socket error
559	FID_SVCOM_SNTP_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Problem connecting to SNTP (Time) server
559	FID_SVCOM_SNTP_FAULT	2125	84D	SRVMAIL_SMTP_TIMEOUT_ERR	Problem sending mail (SMTP) and updating time (SNTP) - SNTP, SMTP server not responding
559	FID_SVCOM_SNTP_FAULT	2132	854	SRVMAIL_SMTP_NONAME_ERR	Problem sending Email and updating time (SNTP)
559	FID_SVCOM_SNTP_FAULT	2102	836	SRVINET_DNS_ERR	Problem connecting to SNTP (Time) server - DNS server not responding
559	FID_SVCOM_SNTP_FAULT	2104	838	SRVINET_SNTP_ERR	Problem retrieving time from SNTP (Time) server
561	FID_SVCOM_STARTUP_FAULT	2512	9D0	SRVIPACK_NOT_ACTIVE_ERR	iPack couldn't start up - serial link showing no iPack
563	FID_SVCOM_STARTUP_OLD_FW_FAULT	32107	7D6B	SVCOM_OLD_FW_ERR	iPack Old Firmware Fault
564	FID_SVCOM_LOW_BATT_FAULT				iPack battery too low
565	FID_SVCOM_STARTUP_LOW_BATT_FAULT	564	234	CID_NOT_FOUND_ERROR_564	Warning! Low battery voltage of %P1.fix3%.
565	FID_SVCOM_STARTUP_LOW_BATT_FAULT	32119	7D77	SVCOM_IPACK_LOW_BATT_ERR	Battery voltage too low, shutting down iPack to conserve power.
567	FID_SVCOM_DIAGNOSTIC_TIMEOUT_FAULT				Check-in with diagnostic server timed out
569	FID_SVCOM_IPACK_OFF_ENABLE_FAULT	2517	9D5	SRVIPACK_ENABLE_ERR	iPack not present or connection to iPack from Logger bad
572	FID_SVCOM_IPACK_INIT_TIMEOUT_FAULT	32114	7D72	SVCOM_INIT_TIMEOUT_ERR	iPack Initialization Fault
574	FID_SVCOM_CALL_NO_RESPONSE_FAULT	25163	624B	IPCMDPR_IN_PROGRESS_ERR	Too many comm errors between Logger and iPack
577	FID_SVCOM_IPACK_NO_RESPONSE_FAULT	32111	7D6F	SVCOM_IPACK_STATUS_UPDATE_ERR	Communication between Logger and iPack has errors
577	FID_SVCOM_IPACK_NO_RESPONSE_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	iPack timeout in response to Logger request
577	FID_SVCOM_IPACK_NO_RESPONSE_FAULT	2516	9D4	SRVIPACK_SEMA_TIMEOUT_ERR	Logger to iPack communication failure.
584	FID_SVFWU_MODE_TIMEOUT_FAULT	2501	9C5	SRVIPACK_RSP_TIMEOUT_ERR	Firmware timeout
584	FID_SVFWU_MODE_TIMEOUT_FAULT	32150	7D96	SVFWU_IPACK_INIT_WAIT_IDLE_TIMEOUT_ERR	iPack firmware update timed out
641	FID_SVCOM_IPACK_STARTUP_COMM_FAULT	2519	9D7	SRVIPACK_ENABLE_CLEAR_5V_HOLD_ERR	iPack not recognized
652	FID_SVCOM_UNEXPECTED_DISCONNECT_STATE2_FAULT	25005	61AD	IPCMDPR_SOCKET_ERR	Mismatch between Logger state and iPack state: TCP connection (socket) error
652	FID_SVCOM_UNEXPECTED_DISCONNECT_STATE2_FAULT	10112	2780	UTMDM_NO_CARRIER_ERR	Mismatch between Logger state and iPack state: no carrier detect
652	FID_SVCOM_UNEXPECTED_DISCONNECT_STATE2_FAULT				Mismatch between Logger state and iPack state
622	FID_SVM_12V_BAT_PROTECT_STARTUP_FAULT2	32065	7D41	SVM_12V_BAT_ERR	iPack Battery Voltage too low

APPENDIX A | TECHNICAL SPECIFICATIONS

Specifications subject to change without notice. See *nrgsystems.com* for up-to-date product specifications.

Description	
Instrument type	26 channel internet-enabled micropower data logger for the renewable energy industry
Applications	Wind and solar resource assessment, power performance monitoring, and forecasting
Instrument compatibility	Symphonie iPack Communication + Power Modules: iPackGPS | GSM/GPRS iPackGPS | 3G GSM iPackGPS | LTE iPackGPS | DoCoMo iPackACCESS | BGAN M2M Satellite iPackACCESS | Modbus TCP
Data Collection	
Sampling interval	1 Hz (IEC 61400-12-1 compliant)
Averaging interval	10-minute by default; user-selectable alternatives (1, 2, 5, 10, 15, 30, and 60 minutes)
Real time clock	Internal battery-backed with GPS or internet time synchronization (with iPack)
Storage medium	User-selectable storage of statistical data with optional storage of raw (1 Hz) sample data 8 MB internal flash memory Options for either 512 MB or 2 GB SD card
Channel Capacity	12 counter channels 14 analog channels: 7 built-in, 7 configurable with signal conditioning modules (P-SCMs) 2 RS-485 communication channels, each full or half duplex with support for up to 6 devices
Counter Channels Sensor Compatibility	Compatible with a wide array of industry-standard anemometers including: Sine wave anemometers Opto anemometers Reed switch anemometers Other frequency signals up to 2,500 Hz, 12 V excitation is provided by logger Includes totalizer mode for Tipping Bucket Rain Gauge and other accumulator sensors
Analog Channels Sensor Compatibility	Compatible with a wide array of sensors including: NRG standard analog sensors (200P Wind Direction Vane, 110S Temperature, BP20 Barometric Pressure, RH5X Relative Humidity, etc.) Industry-standard pyranometers (Li-Cor LI-200SZ, Hukseflux LP02, SR11, SR12, SR20, Kipp & Zonen CMP3, CMP11, CMP21) Wide range of other compatible sensors, individually verified upon request Built-in channels 13-15: 0 to 5 V Analog; 2.5 or 5 V excitation; no P-SCMs required Built-in channels 16-19: 0 to 5 V Analog; 5 or 12 V excitation; no P-SCMs required P-SCM Channels 20-26 (signal range dependent on individual P-SCM card)

Analog Measurement Accuracy	0.04% of full scale
RS-485 Channels Sensor Compatibility	Contact NRG to discuss support for specific model types
Parameters recorded for each channel	Average Standard Deviation Minimum / Maximum 1-sec sample Maximum 3-sec gust with direction Sum for totalizer inputs *Note - Statistics reported on each channel dependent on measurement type*
Data delivery	Automated delivery via iPack Direct live connection through iPack USB connection Read from SD card
Security	Logger access PIN with 2-day lockout after 8 failed attempts 128-bit data file encryption with user-specified password
Resolution	
Analog measurement resolution	16-bit A/D conversion (76 uV resolution across 5 V range)
Software	
Type	Windows (7or later) compatible application
Capabilities	Import data files Output tabular text files Configure SymphoniePRO data loggers and Symphonie iPacks Store configuration files for repeat programming View live data including diagnostics via remote connections Manage automated connections Administer firmware updates to SymphoniePRO data loggers and Symphonie iPacks Integrate with enterprise-level programs via command line mode Includes integrated map and exports KML files
Configuration	
User interface	SymphoniePRO Desktop Application LCD with 16 button keypad with audible feedback
Configurable parameters	All parameters configured with PC using SymphoniePRO Desktop Application through MetLink connection (USB or TCP/IP)
Connections	
Sensor wiring	Sensors connected to wiring panel Field wiring panel mounted in shelter box connected to logger via interconnect cable Ground stud connects to earth ground with included ground cable

APPENDIX B | DECLARATION OF CONFORMITY

NRG Systems Declaration of Conformity

SymphoniePRO Logger System

NRG Systems

Declaration of Conformity

(in accordance with ISO/IEC 17050-1:2004)

NRG Systems Document Number: 11606

Supplier: NRG Systems, Inc.

Supplier Address: 110 Riggs Road, Hinesburg, VT 05461, USA

Telephone: 802 482 2255, Fax: 802 482 2272

Email: sales@nrgsystems.com

Declares under its sole authority that the Products: SymphoniePRO Logger System, including:

Logger-SymphoniePRO, with accessories	**Item 8206**
P-SCM Cards	**Items 9128, 9129, 9130, 9131, 9132, 9133, 9134, 9135, 9136, 9137, 9138**
Symphonie iPacks	**Items 4620, 4621, 4622, 4623, 7169, 7984, 3146, 9386, 9388, 9389, 9390, 9391, 9406, 9419**
SymphoniePRO Wiring Panels	**Item 8150 (26 channel), 11178 (16 channel)**
SymphoniePRO Interconnect Cable	**Item 8385**
Symphonie iPack Charger	**Item 3614**
DB9 Cables	**Items 3333, 3178**
Antenna, Yagi	**Item 3124**

are in conformity with the requirements of the relevant Union harmonization legislation and technical specifications below:

EMC:

Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast)

EN 61326-1:2013 Electrical equipment for measurement, control, and laboratory Use - EMC requirements; Clause 7.2:

CISPR 11 Edition 5.0: 2009, A1:2010   Radiated Emissions, Group 1, Class A

EN 61326-1:2013; Table 1**:**

IEC 61000-4-2: 2008   Electrostatic Discharge
IEC 61000-4-3: 2006, A1: 2007, A2: 2010   Radiated Immunity
IEC 61000-4-4: 2004, A1: 2010   EFT/Burst, I/O Ports
IEC 61000-4-5: 2005   Surge Immunity, I/O Ports
IEC 61000-4-6: 2008   Conducted Immunity, I/O Ports

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NRG Systems Declaration of Conformity

SymphoniePRO Logger System

RoHS:

Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment

Safety:

Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety

IEC 61010-1:2010-06 Safety requirements for electrical equipment for measurement, control, and laboratory use

Additional Information:

1. This product complies with the requirements of the applicable directives **2014/30/EU, 2011/65/EU**, and standard **2001/95/EC** and therefore, the product is CE marked in accordance with **93/68/EEC**.
2. All circuits are extra low voltage (ELV), therefore **Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits,** known as the Low Voltage Directive (LVD), does not apply.
3. FCC compliance is demonstrated with compliant CISPR data.
4. The design documentation, test reports, and assessment laboratory accreditation are under document control in NRG Systems, Engineering Department.

Issued at Hinesburg, VT, USA
10 April 2020

Michael Purdue,   VP of Engineering

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APPENDIX C | WARRANTY

NRG Systems (NRG) warrants its products for a period of two years from date of original purchase solely for the benefit of the original consumer purchaser. If this product is determined to be defective in materials or workmanship, NRG will, at NRG's option, repair or replace this product without charge. This warranty does not cover damage due to improper installation or use, accident or misuse, damages due to any unauthorized service or lightning. This warranty also will not apply if any seal on any instrument or sensor is broken, if any internal components have been manipulated, if any cable has been severed, or the equipment was not adequately grounded.

To return a defective product, request an RMA (return merchandise authorization) number by calling us at the number below or by emailing support@nrgsystems.com, or by submitting a request through our website's Technical Services area.

Please provide the serial number of the item as well as date of purchase. No products will be accepted for warranty work without an RMA number. The product must be returned, postage prepaid, to NRG with a brief description of the problem, RMA number and a return address with phone number.

The foregoing limited warranty is given in lieu of all other warranties, express or implied. NRG specifically disclaims all implied warranties including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose.

The above limited warranty expressly excludes, and NRG shall not be liable for, any incidental or consequential damages caused by or related to the selection, use of, inability to use or malfunction of this product.

NRG will make a good faith effort to repair or replace promptly any product which proves to be defective within the warranty period. First, contact NRG or the representative from whom the product was purchased and ask for an RMA number. Inspect your shipments for damage to packages or missing packages immediately upon receipt. Record any such exceptions on the freight receipt of the delivery agent. If any contents are damaged or missing, report this in writing to the freight carrier and send NRG a copy of the damage report. If you insured the shipment yourself, report any damages to your insurance carrier.

Sending Items for Repair

International Customers

Contact NRG Systems by phone, email, or through our website to obtain an RMA number (Return Material Authorization). Write the RMA number clearly on all shipping cartons.

Tel: 802-482-2255 Fax: 802-482-2272

Email: *support@nrgsystems.com* Website: *https://www.nrgsystems.com/support/customer-support/*

Before sending the repair item to NRG Systems, check with your local customs authorities about provisions in your country for exporting and re-importing repair items. Some countries treat repair shipments like new shipments and charge import duties and taxes again upon re-importation. Other countries have specific steps to follow or specific forms to complete which help reduce the import duties upon re-import of the item.

Send your item to NRG Systems "Delivery Duty Paid" (see address below) using a door-to-door courier service such as UPS, FedEx, or DHL. If the repair is not urgent, please send your package by Airmail. (Courier services deliver the package directly to us, customs cleared.)

NRG Systems will not accept packages shipped Freight Collect or with Collect charges.

If NRG Systems refuses the shipment, the courier service will charge your account return freight charges.

DO NOT send return items by direct or consolidated air freight service with an airline.

The cost for air freight may seem lower than the courier service, but air freight costs do not include customs clearance, airport handling, break bulk fees, and inland delivery to NRG Systems.

Attach a Commercial Invoice to the carton. The Commercial Invoice should include the following information:

Name and address of the shipper.

NRG Systems' complete address and telephone number as the consignee.

Description of the items being returned.

Quantity of each item being returned.

Value for customs / insurance (purchase price or replacement cost).

Number of cartons with respective weights and dimensions.

Example of ship-to address:

> **NRG Systems**
> **Attn: RMA# _____**
> **110 Riggs Road**
> **Hinesburg, VT 05461 USA**
> **1-802-482-2255**

Please include the following statement to avoid paying US import duties:

"These items are being returned to their U.S. manufacturer. Country of manufacture and origin is USA, HTS CODE 9801.00.1012."

Pack your repair item in a sturdy packing carton. Tag each item with a brief description of the problem.

Insure your shipment against damage or loss in transit. Be sure to check the appropriate box and enter a "Value for Carriage" (insurance) on your air waybill. The value is the purchase price of the equipment or what it would cost to replace the equipment if the shipment were lost. Keep a record of the tracking number.

Once your item arrives, we will assess the item and notify you of the repair cost. Any repair charges and freight costs, if applicable, are payable before NRG Systems will return the repaired item to you via door-to-door courier service. NRG Systems will send you a shipment advisement when the repaired item is shipped.

US Customers

Please see items 1, 4, and 5 above. Send your item(s) to NRG Systems "Freight Prepaid and Insured." **Shipments sent freight collect will not be accepted by NRG Systems.**

REFERENCES

FreeRTOS

Some of our products incorporate software that is available in the open-source community, including www.freertos.org (version 6.00) and www.savannah.nongnu.org. The information that follows is provided to comply with the terms of use.

www.freertos.org

FreeRTOS is a real time operating system available in the open-source community and utilized in SymphoniePRO firmware. Source code is available from NRG upon request.

lwIP lightweight TCP/IP stack

https://savannah.nongnu.org/projects/lwip/

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Radio compliance

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 harmful 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: Re-orient or relocate the receiving antenna, increase the separation between the equipment and receiver, connect equipment and receiver to outlets on different circuits, or consult the dealer or an experienced radio/TV technician for help.

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