



User's Guide

XR5-SE Data Logger™ and LogXR Software™

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Software / Firmware Versions

LogXR Software works with all XR5 Data Loggers and is a [free download](#) from the Pace website. This manual is updated to LogXR Software Version 1.01.80

XR5 Firmware is periodically updated and is a [free download](#) from the Pace website. This manual is updated to XR5 Firmware version 1.01.04. Update instructions are on page 62.

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Introducing the XR5-SE Data Logger

The Pace XR5-SE is a small but powerful stand-alone data logger with 8 multi-range analog inputs and 3 pulse / frequency inputs.

Wide range of input signals supported

Mix and match sensors, contact closures, resistances, 0-2.5v and 0-5v signals and many 3rd party sensors. An internal amplifier option (page 93) adds two millivolt range selections to each analog input. Accessory scaling cables provide additional dc input voltage ranges, including 0-20vdc and 4-20ma (page 84).

Large Sensor Selection

Stocked direct-connect sensors include Temperature, Relative Humidity, Pressure, AC Current, AC Voltage, DC Current, Light, Solar Radiation, Wind Speed, Rainfall and others. All sensors require no external power. Built-in excitation terminals supply power for other 3rd party sensors.

Free Software

Pace provides LogXR Software™ for Windows, Mac OS X and Linux based computers. Set up an XR5 for a logging session, or transfer logged data to your computer for graphing and analysis. A real-time “strip-chart” display is included. Download the software at www.pace-sci.com/data-loggers-xr5.htm.

Long Battery Life

Battery life exceeds two years for typical logging applications. The estimated battery life is displayed in LogXR Software based on your selected setup.

High Accuracy

Using Pace’s precision PT9 series thermistor probes, temperature data is accurate to +/-0.15°C from 10 to 40°C (50 to 104°F) with no calibration. Voltage input accuracy is +/-0.25% of full scale.

Large Memory

The XR5-SE's non-volatile memory can store up to 260,250 readings (-M models).

Free Lifetime Updates

Since 1992, Pace has provided free lifetime software updates. We periodically enhance our software to support new technologies and sensors. New versions of LogXR software along with XR5 firmware updates are periodically posted on the Pace website for free download.

Versatile Logging Rates

Log at any interval between 1 second and 12 hours, or fast log from 2 Hz to 1000 Hz. Pulse/frequency inputs function with logging intervals of 1 second or slower. Logging rates above 100Hz limits channel count. Details on page 34.

Powerful Recording Modes

Logging may be triggered, stopped and re-triggered on a sensor level or using a dedicated trigger input. The Stop trigger includes an adjustable Stop delay. Sampling modes include Standard, Average and Peak. Logging may run until memory is full, or continuously in wrap-around mode. Channel pairs may be logged as differential readings (Channel A – Channel B).

Cycle Logging

Custom logging “cycles” may be selected. For example: Log for 10 seconds at 100 Hz, then pause for 59 minutes and 50 seconds, and then repeat. Another example: Log every minute from 8AM until 5PM, pause 16 hours, and then repeat.

Automated data collection

LogXR includes a built-in Scheduler. The Scheduler allows one or many XR5 Data Loggers to have their data automatically collected at preset time intervals. Collection intervals include hourly, daily, weekly, monthly and more.

Ethernet and Modem Connectivity

LogXR supports communications with one or more XR5s connected to an Ethernet LAN or phone line modems. Ethernet connectivity requires a Pace DS100 Ethernet module (see page 59). Required hardware for modem communications is discussed on page 101.

Excel Compatible Data

Transferred data is formatted as a readable, Excel compatible text file. Once opened in Excel, data may be saved as an Excel workbook. Using LogXR Software, data may be viewed in graphic form, with zooming and channel selection features.

Secure Data

The XR5’s rugged EEPROM memory retains data for over 100 years with no power. Data is securely transferred via the Xmodem-CRC protocol. Users can confirm data files have not been tampered or manually altered. A two-level password system may be utilized to prevent unauthorized access.

Individual Alarms

All analog inputs have individual high and low alarm limits. Alarm activity can trigger a variety of responses, including logging data, setting an external alarm output, and blinking the XR5’s Alarm LED. A relay module is available to switch external loads.

Real Time Graph Display

When an XR5 Data Logger is connected to a computer running LogXR Software, a real time “strip chart” display is available. When selected, sensor/signal readings are updated every 2 seconds. The Real Time Display can function while logging data in any logging mode except the “Fast Logging” modes.

Switch Closures

Up to eight unpowered switch closures or relay contacts can be logged by the XR5. If desired, a contact can be logged as the percentage of time the switch or contact is open with a one second resolution. See page 83 for details.

Pulse Logging

Each of 3 pulse inputs on the XR5 can log pulse counts or frequency over the selected log interval. Pulse counts can have slope/offset scaling. Channels set to “Totalize” will accumulate pulse counts over the entire logging session. For Wind Speed logging, both peak and average pulse rates may be logged.

Sensor "Front End"

The XR5 Data Logger can output a readable string containing the readings of all connected sensors in response to receiving a simple "read command"; LogXR software is not required. See the [XR5-SE Text Interface User’s Guide](#) for details.

LogXR Software™

Windows Installation

LogXR Software for Windows is distributed as a single executable file.

Install LogXR from the included CD-ROM:

Locate the CD labeled "Pace Scientific LogXR". Load this CD into your computer's CD-Rom drive, and using Windows Explorer (hold down the "Windows" key and press E), navigate to the installation file on the CD drive and double click it. The install file name begins with "LogXR-Install" and includes the current version number.

Install LogXR from the Pace website:

The current version of LogXR Software is posted on the LogXR Software web page at www.pace-sci.com/LogXR.htm. Follow the instructions to download the file, and then navigate to the installation file and double click it.

Installation

The installer displays a "default" directory for the LogXR installation near the beginning of the install process. You may enter a different directory name at this point. If the directory name you enter does not exist, the installer will create the directory and install LogXR into it.

LogXR can be installed to a new directory or "over" an existing LogXR directory. If an existing LogXR directory is used for a new installation, the older version of LogXR that was previously installed into this directory will be lost, but all previous data and setup files will be retained.

All existing setup, data, and configuration files are retained whenever a new version of LogXR is installed. File "pointers" used by LogXR to open the directories last used for your setup and data files are also retained.

To launch LogXR

Click Start | All Programs | LogXR Software

LogXR Software™

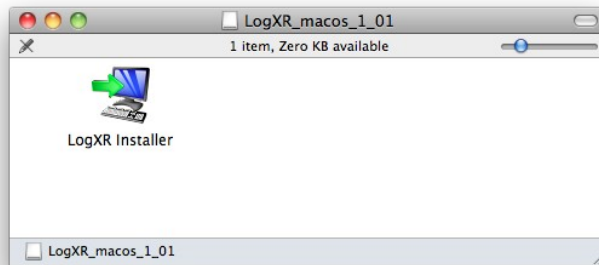
Mac OS X Installation

LogXR Software for Mac OS X is distributed in a dmg file.

LogXR Software for the Mac is posted at www.pace-sci.com/mac-data-logger-software.htm and runs on OSX 10.5 (Leopard) and higher.

From the LogXR Mac page (link above), press the Option key (Safari or Chrome browser) and click the linked LogXR-Mac-[x].dmg file ([x] is the current version number).

Once the file is downloaded to your computer, double click the dmg file and the LogXR Installer icon appears. Double click the LogXR Installer icon (below) to launch the Setup Wizard.



The Setup Wizard appears as shown below:

Click Next

Click Next to accept the /Applications folder as the destination directory.

Click Finish to complete the installation.

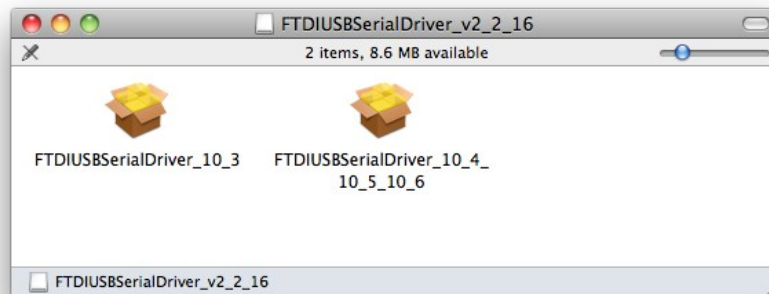


Mac OS X Installation (cont.)

Pace USB-A Driver Installation for Mac OS X

The Mac driver for the USB-A is posted at www.pace-sci.com/mac-data-logger-software.htm.

1. With the USB-A serial adapter disconnected from your Mac, download the driver to your computer and double click the driver file. The following window appears:

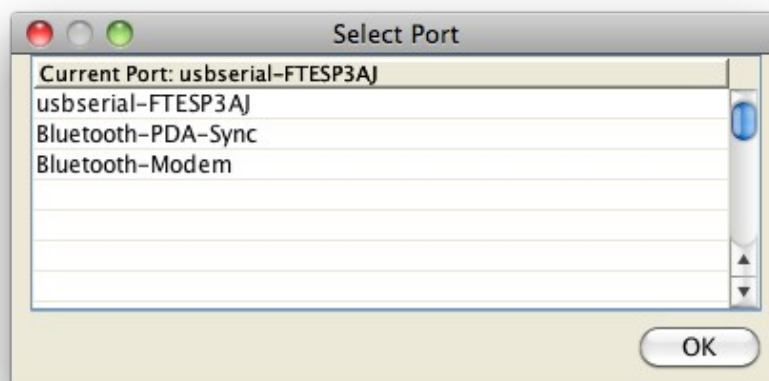


2. Double click the icon ending “10_5_10_6”.

3. After the Installer window appears, click “Continue” twice and then “Install”.

4. Plug the USB-A into a USB port.

5. Launch LogXR (double click the LogXR icon in your Applications folder), and click Port | Select. The Select Port window lists the USB-A adapter as “usbserial-” plus a serial number. Make sure “usbserial-” is selected as the Current Port (if it is not, click to select it) and click OK.



6. If a “usbserial” selection does not appear in Select Port: a) Make sure the USB-A Adapter is inserted into a USB Port *before* launching LogXR. b) If an older version of the Driver was previously installed, a Restart of your computer may be required.

LogXR Software™

Linux Installation

LogXR Software for Linux is posted at www.pace-sci.com/linux-data-logger-software.htm. Two formats are available: a GUI installer (.sh) file, and an RPM file.

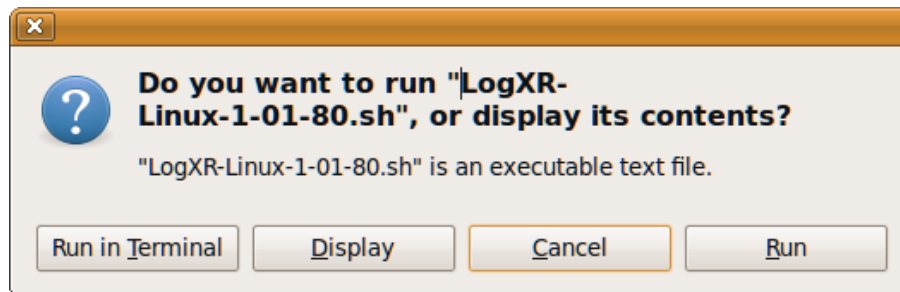
GUI installer (.sh) file for Ubuntu and other Linux distributions

Download the LogXR ".sh" file from the above link. Once the file is downloaded to your computer, double click the file and click Run (screenshot below) to install LogXR.

Note: If the window below does not appear:

If double clicking the ".sh" file does not display the window below, but attempts to open the file in an editor (like gedit), click Cancel on the displayed message.

Right click the ".sh" file, select Properties, then Permissions, and check "Allow executing file as a program". Then close the Properties window, double click the ".sh" file and click the Run button.



The installer displays a "default" directory for the LogXR installation near the beginning of the install process. You may enter a different directory name at this point. If the directory name you enter does not exist, the installer will create the directory and install LogXR into it.

LogXR can be installed to a new directory or "over" an existing LogXR directory. If an existing LogXR directory is used for a new installation, the older version of LogXR that was previously installed into this directory will be lost, but previous data and setup files will remain.

Existing setup, data, and configuration files are retained whenever a new version of LogXR is installed. File "pointers" used by LogXR to open the directories last used for your setup and data files are also retained.

Launch LogXR Software by clicking Applications | Other | LogXR

Serial Ports

LogXR is initially set to use serial port `/dev/ttyS0`. In order to choose a different serial port, you must first edit the text file "cplist.xsf" located in the Home/

[user]/Pace/System folder. Add a new line (for example: **/dev/ttyS1**) to "cplist.xsf" for each serial port that exists on your computer.

Pace USB-A USB Serial Adapter

The Pace USB-A Serial Adapter is typically recognized as ttyUSB0, so the text file "cplist.xsf" would be edited to include the line: **/dev/ttyUSB0**

Notes:

The USB-A should be recognized by all recent Linux distributions; a driver installation is not required.

The serial port assigned to the USB-A can be determined as follows:
With the USB-A connected to your computer, launch a Terminal window and enter **dmesg|grep tty**. All attached USB-A devices will be listed.
For example: "FTDI USB Serial Device converter now attached to ttyUSB1" Then edit cplist.xsf, entering the line: **/dev/ttyUSB1**

Alternately, serial port assignments can be viewed by selecting (in Ubuntu): System | Administration | Log File Viewer | syslog.

Linux RPM file

A zipped RPM file suitable for RedHat and other Linux distributions may be downloaded at www.pace-sci.com/linux-data-logger-software.htm.

To install:

1. Log in as user (not root).
2. Download the above file into your user home directory.
3. Unzip the file.
4. Double-click the LogXR rpm file to launch the RPM Installer.

After the installation is complete:

5. Log in as root.
6. Change permissions associated with **/dev/ttyS0** and any other serial port that LogXR will use to allow LogXR, running under any user, to execute the file.

When launching LogXR, you must be logged in as user (not root).

Serial Ports

Please see the section "Serial Ports" on the previous page for instructions to configure LogXR to recognize the serial port(s) on your computer.

XR5 Hardware Setup

A computer running LogXR Software is used to set up the XR5 Data Logger. Once set up, the XR5 can log data without being connected to a computer. While the XR5 is connected to a computer, you may send a setup, transfer logged data, view current status conditions, display readings in real time, and perform other functions.

Required Hardware

Pace XR5 Data Logger (any model)
 IC209 Interface Cable
 Windows 7, XP, Vista, Linux or Mac OS X (10.5 or higher) computer running LogXR Software

Minimum PC Hardware specs:

500MHz processor, 256Mb RAM, 1024 x 768 monitor resolution (lower monitor resolutions OK except when displaying LogXR Graphs with high channel counts)

IC209 Interface Cable

Connect the 9 pin end to an unused Com Port on your computer (ie: Com1; Com2). Plug the other end of the interface cable into the XR5.

USB Serial Adapter

Computers not equipped with a serial (com) port require a USB to Serial Adapter.

For Windows, Mac and Linux computers, Pace stocks a USB/Serial Adapter: Pace part # USB-A.

Installing the USB-A Serial Adapter

Mac OS X users see page 11.

Linux users see page 13.

Windows users see below and the following page.

Other USB to Serial Adapters may work with the XR5, but Pace only provides support for the USB-A and the discontinued USB-01 Serial Adapters. Some USB to Serial Adapters fail to work with any device that has a 3-wire communications interface (like the XR5 and some GPS devices).

Notes on IC209 Cable

It is OK to maintain a permanent connection from an XR5 to a powered or unpowered computer, if desired. Maintaining a permanent connection has no effect on the XR5's battery life.

The IC209 Cable's internal wiring is listed (for reference) on page 108.

USB-A Serial Adapter Installation on Windows XP

1. Disconnect (physically remove) the USB-A Adapter from your computer.
2. Using the supplied Pace Scientific CD-ROM*, click on the USB-A folder, and then double click the file "USB-A-Driver-Installer.exe" to install the USB-A Driver.
3. Insert the USB-A Adapter into a USB port on your computer (**after installing the driver**).
4. Launch LogXR and click Port | Select. A new serial port will be listed. Click on the port to select it.

USB-A Serial Adapter Installation on Windows Vista and Windows 7

1. Make sure your computer is connected to the Internet.
2. Insert the USB-A into a USB port on your computer. Driver installation will proceed automatically.
3. Launch LogXR and click Port | Select. A new serial port will be listed. Click on the port to select it.

Note:

LogXR identifies serial ports when it is first launched. If LogXR was running when you installed the driver, terminate LogXR (File | Exit) and restart it to have the new port listed in Port | Select.

* Driver may also be downloaded at www.pace-sci.com/USB-A-Driver-Installer.exe

Discontinued Pace USB-01 Serial Adapter

Please go to www.pace-sci.com/usb-01-xr5.htm for instructions to install the discontinued USB-01 Serial Adapter (the USB-01 is blue, the USB-A is white).

USB Wireless Link

The Pace WTP-100 consists of two miniature wireless modules. One module inserts into a computer's USB port and requires no external power. A second module plugs into the Pace IC209 Cable which connects to the XR5. The module on the XR5 side is powered from a battery cable or AC power adapter (both included); the module requires 4 to 12vdc. The WTP-100 has a range of up to 300 ft (100 meters) outdoors, and up to 100 ft (30 meters) indoors. Operating frequency is 2.4 GHz for world-wide compatibility. No software installation required. No setup required.

Part # WTP-100

Includes Battery cable and AC power adapter for XR5 side.

Overseas customers use part # WTP-100-exp

Includes Battery cable and AC power adapter with plugs for UK, EU and Australia.

Dimensions:

Computer side: 2.2" x 1.0" x 0.3" (56 x 24 x 8 millimeters).

XR5 side: 2.9" x 1.2" x 0.7" (72 x 31 x 16 millimeters)

*No software installation required. No setup required. Just plug and go.
See [website](#) for more details.*

Battery Options

The battery cable included with the WTP-100 connects to a 9V battery or battery pack with a 9v snap type connector and voltage between 4 and 12 volts. Pace offers weatherproof enclosures pre-configured for an XR5, WTP-100 and battery pack.

Sensor and Signal Connections

The XR5 has a removable screw-type terminal block for connecting sensors and signals. Wiring connections and software setup for all Pace sensors are listed in the Appendix of this User's Guide.

Terminal:	Function
1,2,3,4,5,6,7,8	Input terminals for analog channels 1-8.
C	Common (shared ground for all signals). Five "C" terminals are available.
D	Precision 2.5v sensor excitation, 40 ma maximum recommended current *
E	Precision 5.0v sensor excitation, 30 ma maximum current *
X	External Trigger input or Pulse / Frequency input
Y	Pulse / Frequency input
Z	Pulse / Frequency input or alarm output (voltage signal).
Q	External dc power input

* XR5-SE model series only. Total current from D and E terminals should not exceed 40ma. See page 109 for maximum excitation currents for previous generation XR5-8 models.

Multiple leads may be connected to a single terminal, in which case stranded type wires should be used. Multiple solid core wires, especially of different gage sizes, may result in a faulty connection. Maximum recommended wire size is 16 gage (AWG) stranded or solid.

Strain relief

If leads at the terminal block are flexed repeatedly, lead breakage is possible. If repeated lead flexure is possible, we suggest bundling all screw terminal leads with a plastic cable tie about 1" to 2" from the terminal block (25 - 50 mm) to provide some strain relief. Or mount the XR5 in an enclosure equipped with strain relief fittings, such as the [Pace EC45](#) or [Pace EC55](#) Weatherproof Enclosure.

Extension Cable

To reduce signal noise, shielded cable is recommended for cable lengths longer than twenty feet (6 meters). We recommend using 20-24 AWG shielded copper cable with stranded conductors. 24 AWG cable is acceptable for runs of up to 100 feet (30 meters). Sensor leads can be spliced to extension cable using wire nuts, crimp connectors or solder.

Outdoor Use

The XR5 Data Logger is not waterproof. Use outdoors requires a weatherproof housing such as the [Pace EC45](#) or [Pace EC55](#) Weatherproof Enclosure.

Grounding

If the XR5's sensor cables are longer than thirty feet (9 meters), we recommend grounding the XR5 for maximum noise immunity. Connect a short stranded copper wire from a "C" screw terminal to a good earth ground. Please see page 111 for additional suggestions if high levels of electrical noise may be present.

Overview: Using the XR5 Data Logger

(First time or typical user)

1. Launch LogXR Software (click Start | Programs | LogXR).
2. Connect the XR5 Data Logger to a com port on your computer using the IC209 Interface Cable.

From the main menu:

3. Click **Port | Select** and select the com port that is connected to the IC209 Cable.
4. Click **Setup | Extract** and then edit the Setup for your logging session.
5. Send the Setup to the XR5 (Click **Send | Send Setup** from the Setup menu).
6. Click **Status | Extract** to confirm that the XR5 is operating as intended.

While the XR5 Data Logger is connected to a computer running LogXR Software, you can initiate the following actions from the main menu:

Setup Extract	Create or Modify a Setup for a new logging session.
Real Time Text	Display sensor readings updated every two seconds.
Real Time Text and write to file	Similar to Real Time Text , but also writes sensor readings to a text file every two seconds. This is done while simultaneously logging data to the XR5's internal memory if logging is active.
Status Extract	The XR5's time clock, setup and current conditions are displayed.
Transfer Data	All logged data is saved to a text file.

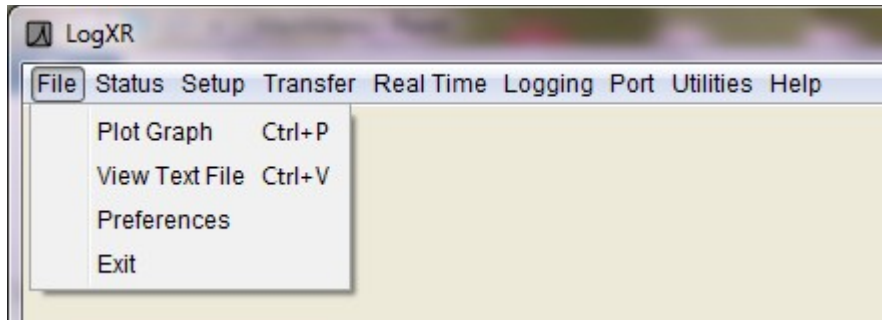
XR5 data files (created from **Transfer | Data**) may be plotted as a Graph (select **File | Plot Graph**) or viewed as tabular data (select **File | View Text File**). XR5 data files may also be opened with an external text editor (like Windows Notepad) or spreadsheet program (like Excel).

The next section explains the Main Menu selections available in LogXR.

LogXR Menu Selections

The following pages describe the Main Menu selections (from left to right). Some menu choices have keyboard accelerators (shown beside the menu selection). For example, the menu choice **File | Plot Graph** displays a keyboard accelerator of "Ctrl+P", which means that Plot Graph can also be invoked by holding down the Ctrl key (located at the bottom left on the keyboard) and pressing P.

File menu



Plot Graph

Graph an existing XR5 data file.

Zoom function

When a graph is displayed, you can use the zoom function to expand any portion of the graph. To zoom, place the mouse cursor on one corner of the area you wish to zoom, click the left mouse button, drag the mouse to the opposite corner of the area you wish to zoom, and release the mouse button. This operation can be repeated any number of times until you reach "Maximum zoom" (less than 4 points per channel). The "Back" button allows you to re-display your previous zoom operations. Please see page 98 for additional information on graphing.

View Text File

View an existing XR5 data file (or any readable text file). XR5 data files are readable text files.

Notes

You may also view XR5 data files by opening them in an external program such as Windows Notepad or Excel.

To open an XR5 data file with a ".txt" extension in Excel:

In Excel, select File | Open, change Files of Type: to "Text Files" and then navigate (using "Look in:") to your XR5 Data File. Select the desired XR5 file and click Open. In the Text Import Wizard check "Delimited" (step 1) and then check "comma" (step 2).

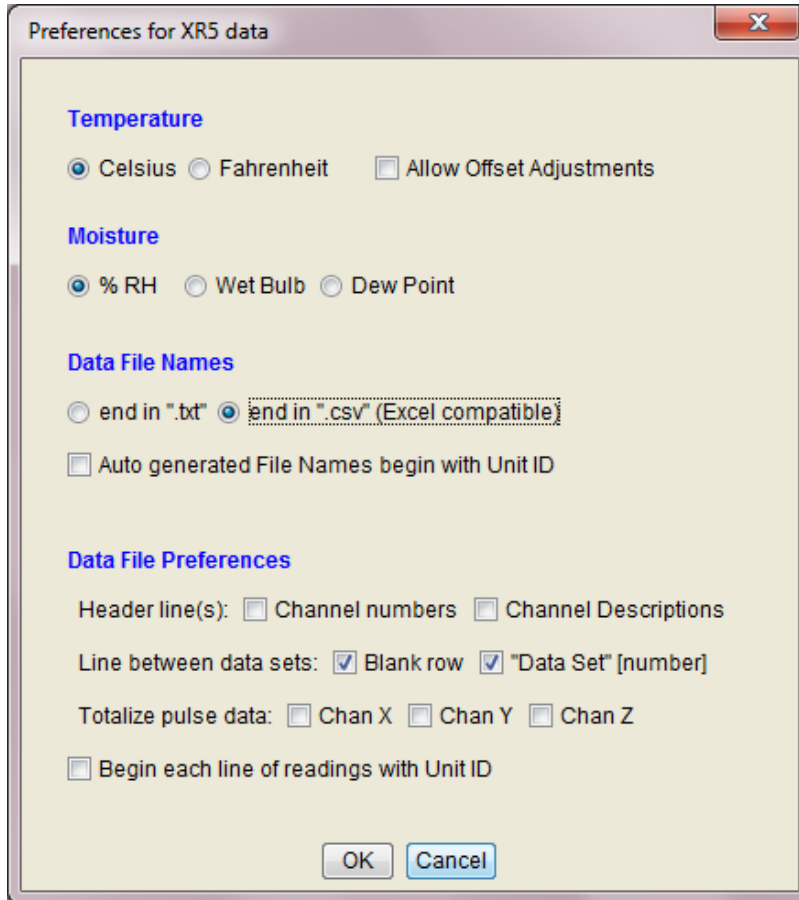
Data files with a ".csv" file extension open directly in Excel; Excel's Text Import Wizard is not used.

Excel limitation:

Excel 2003 and earlier versions can display a maximum of 65,530 lines of data. Data beyond the first 65,530 lines will not be displayed.

Preferences

Note: on the Mac version, Preferences are selected by choosing LogXR | Preferences.



Preferences affect all data files created via **Transfer | Data**, or **Transfer | Data / Auto Name**. They also apply to XR5 ".binary" files converted to readable files using **Utilities | Convert Binary File**.

Temperature

The temperature scale (**Celsius / Fahrenheit**) for all temperature data.

Allow Offset Adjustments - check to manually adjust the offset term of temperature sensors and probes. Please note: the unchecked setting is recommended for most users.

Moisture

The moisture scale (**%RH / Wet Bulb / Dew Point**) for readings from any Pace TRH-100 or TRH-160 Temperature/RH Probe.

Notes:

Changing "Temperature Scale" or "Moisture Scale" has no effect on existing XR5 data files. It only pertains to new files created using **Transfer | Data**, **Transfer | Data / Auto Name** or **Utilities | Convert Binary File**.

To change the Temperature or Moisture Scale of an existing data file, select **Utilities | Convert Binary File** and select the ".binary" version of the file. Then click Convert. The new data file will conform to the current Moisture and Temperature selections.

Dew Point and Wet Bulb calculations are valid for temperatures from 0 to 85°C (32 to 185°F). Wet Bulb temperatures are approximate.

When using a Real Time display mode (Text or Graph), Humidity Probe readings display %RH regardless of the Moisture Scale selection.

Data File Names

end in ".txt"

Appends a ".txt" extension to the data file's name.

end in ".csv" (Excel compatible)

Appends a ".csv" extension to the data file's name. Opens in Excel and other programs that recognize the ".csv" file format (comma separated values).

Note: The contents of the data file is identical with either setting.

Auto generated File Names begin with Unit ID

If checked, the XR5's Unit ID is added to the beginning of all auto-generated file names.

Data File Preferences

Header line(s):

Channel numbers

If checked, a header row of channel numbers is inserted immediately above the first row of readings (labels each column of data with its associated channel number).

Channel Descriptions

If checked, a header row of channel descriptions is inserted immediately above the first row of readings (labels each column of data with the setup's Channel Descriptions).

Channel Number and Channel "Description" headers can both be checked (both headers are inserted in the data file).

Line between data sets:

Blank row

If checked, a blank row is inserted between multiple data sets in the same data file. Visually separates multiple data sets within a single Data File.

"Data Set" [number]

If checked, a row is inserted at the start of each data set labeled "Data Set" followed by the data set number (1, 2, 3, etc.). We recommend checking this selection (see next paragraph).

LogXR Graph Display

If multiple data sets occur in a data file and "Data Set..." is not checked, then the graph display will include continuation lines plotted from the last data value of each active channels data to the first data value of the next data set. If "Data Set..." is checked, visible "gaps" will appear in the graph, showing the time that logging was not active. For this reason, "**Data Set" [xx] between data sets** is the default setting.

Multiple data sets can occur using the following Logging modes: "Log on Ext. Trigger", "Cycle", "Log on Alarms" and, if logging is manually stopped and restarted, "Manual (Slow)".

Data File Preferences (continued)

Totalize pulse data:

Chan X Chan Y Chan Z

For each pulse channel checked, accumulated pulses of prior readings (for the logging session) are added to the current reading.

Begin each line of readings with Unit ID:

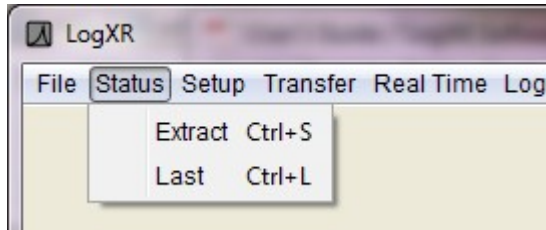
If checked, each line of readings data in the data file is prefaced with the XR5's unit ID.

Exit

Terminates LogXR Software.

(**LogXR** | **Quit LogXR** on Mac OS X).

Status menu



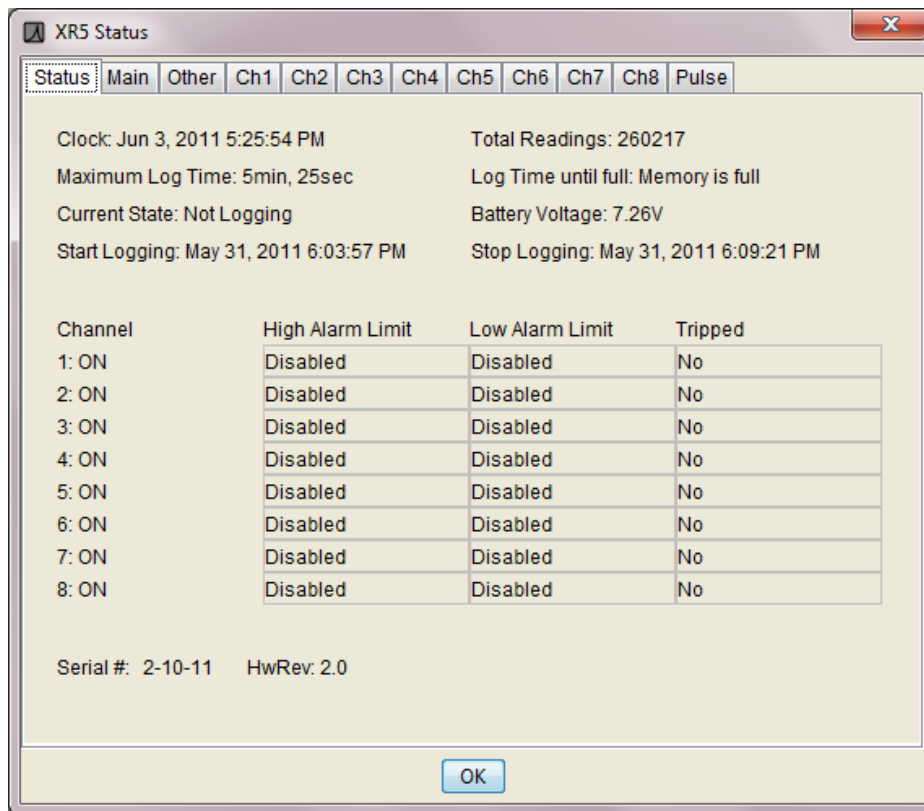
Extract

Extract and view current XR5 Status. The XR5 Data Logger must be connected to the selected port (click **Port | Select** to view the selected port).

Last

View the last extracted Status.

Status screen



The Status screen is a read-only screen that displays the conditions existing in the connected XR5 when **Status | Extract** was selected. It is similar to the Setup screen, but also has a Summary tab (details on next page). Please see the Setup section (starting at page 26) for information on the other Status tabs.

Status, “Sum” tab (Summary)

Clock: The XR5’s Time Clock (at the time **Status | Extract** was selected).

Total Readings: The total readings (from all active channels) currently logged in memory.

Maximum Log Time: The time span of the data when the memory is full.

“Maximum Log Time” Notes

If the Logging Mode is “Log on Ext. Trigger”, the Maximum Log Time is approximate: if many triggering cycles occur during the logging session, memory will be consumed logging additional timestamps, and the maximum log time will be less than the displayed value.

If the Logging Mode is “Log on Alarms”, the Maximum Log Time is approximate: if many alarm-driven data segments are logged during the logging session, memory will be consumed logging additional timestamps, and the maximum log time will be less than the displayed value.

If the Logging Mode is “Cycle Logging” the Maximum Log Time includes the pause time of each cycle, and therefore the Maximum Log Time represents the maximum duration of the logging session (from start, until the memory is full), as it does for the other logging modes except “Log on Ext. Trigger” and “Log on Alarms”.

Log Time until full: The logging time remaining until the memory is full (and logging stops).

Current State:

Not Logging: Logging is stopped indefinitely – user action is required to start logging.

Logging: Data is being logged at the selected Log Interval.

Waiting on Preset Time: Logging will start upon reaching the user selected Preset Time.

Waiting: Not logging; the condition which will cause logging to start depends on the current Log Mode:

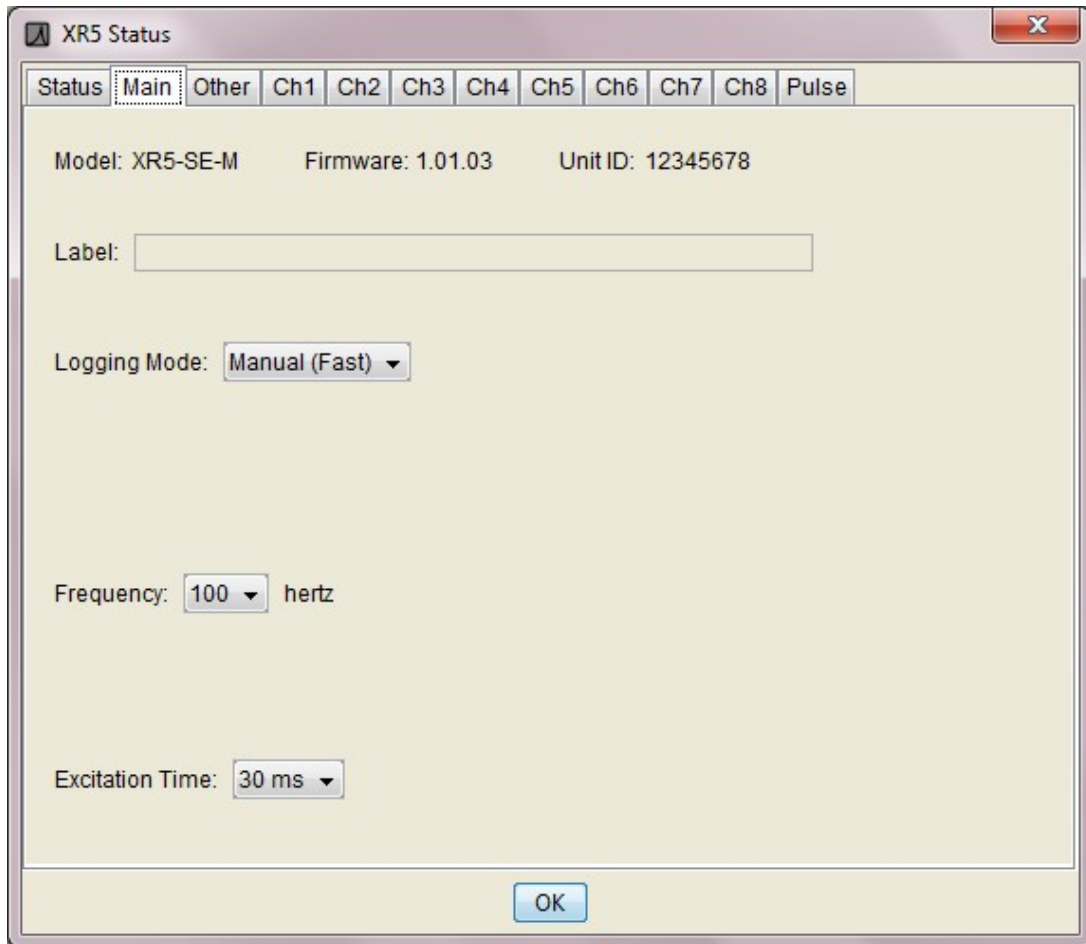
<u>Log Mode</u>	<u>Logging will become active when</u>
Cycle Logging:	the ‘Pause’ time has elapsed.
Log on Ext. Trigger:	a valid trigger exists.
Log on Alarms:	an alarm condition exists.

Note:

For the Logging Mode "Log on Ext. Trigger": If the Stop Delay is greater than 0 seconds, "Waiting" will be displayed if Trigger state is inactive, but Logging will continue until the Stop Delay has timed out.

Battery Voltage / Ext. Power:	The total voltage of the two internal batteries, or the external power voltage (Q terminal) if it is higher than the battery voltage. The reading is updated every time a setup is sent to the XR5, and at one hour intervals from the time that the setup is initially sent (it is not updated when Status Extract is selected). The batteries should be replaced when the Battery Voltage reads below 6.0 V. See page 69 for details. The Battery Voltage is also written to the header section of all XR5 data files.
Start Logging:	The time the first data value was logged (or will be logged, if the Log mode has a Preset Start Time which has not yet been reached). <u>Exception for Wrap modes:</u> For Manual/Wrap or Preset/Wrap logging modes, if the memory is full and the XR5 is currently logging, then although "Start Logging" indicates when logging began, the stored dataset begins at a later time, equal to the current time minus the Maximum Log Time (the earliest readings are overwritten in Wrap mode once the memory is full).
Stop Logging:	The calculated time that logging will end (when the memory becomes full). This time cannot be calculated if the Log Mode is 'Log on Ext. Trigger' or 'Log on Alarms'.
Alarm summary:	Displays user selected alarm limits. The 'Tripped' column displays 'Yes' if an alarm condition has occurred anytime since the start of the logging session.
Serial #:	Displays the unit's serial number. The serial number is factory set and cannot be changed. A label on the side of the battery holder inside the XR5 also displays the serial number.
HwRev:	Displays the hardware revision number (2.0 for all XR5-SE models).

Status, “Main” tab



Like all Status tabs, the Main tab is read-only and displays the current configuration of the connected XR5. It is similar to the Setup, Main tab, but also displays the XR5's Firmware Revision and Unit ID.

Firmware:

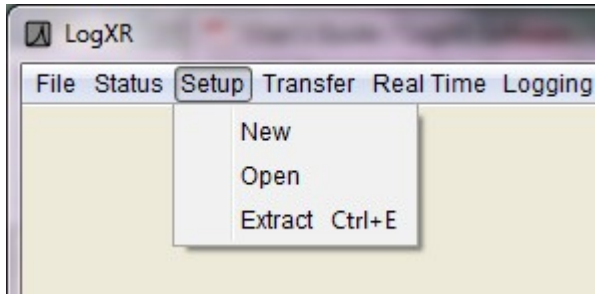
The XR5 Data Logger's current Firmware revision. XR5 Firmware is periodically updated and posted on the [Pace XR5 Firmware web page](#). The XR5's firmware may be updated by selecting **Utilities | Update Firmware**. See page 62 for details.

Unit ID:

The Unit ID is a semi-permanent identification number or label assigned by the user to a specific XR5. It may only be changed by selecting **Utilities | Change Unit ID**. See page 61 for details.

Please see the Setup section on the following pages for details on fields in the Status screen which have not been covered above.

Setup menu



New

Create a new Setup, starting with the “factory default” settings.

Open

Open a previously saved Setup file.

XR5 Setups are model specific. A setup for one XR5 model type cannot be sent to a different XR5 model type unless the difference is just the XR5 model's memory size. For example, a setup for the XR5-SE can also be sent to an XR5-SE-M.

To Open an existing setup file for a different XR5 model, click on the drop-down bar at the bottom of the file selection dialog and select the model. Previously saved setup files for the selected model will then be listed.

Extract

Extracts the Setup from the currently connected XR5. This is an easy way to modify the current setup in an XR5.

Setup, "Main" tab

XR5 Setup: C:\Users\Joe\Pace\Setup\information.8SE

File Send

Main Other Ch1 Ch2 Ch3 Ch4 Ch5 Ch6 Ch7 Ch8 Pulse

Model: XR5-SE-M

Label:

Logging Mode

Manual (Fast)

Logging Interval

0 hr 0 min 1 sec

Frequency: 100 hertz

Maximum Log Time: 5min, 25sec For model: XR5-SE-M

Sensor Excitation

30 ms Estimated milliamps: 0 Estimated battery life: 7385 sessions

The Setup screen consists of multiple pages. If a page Tab has focus (is clicked on), the arrow keys or Tab key may be used to select other pages. Click **Send | Send Setup** to send the Setup to the XR5. Click **File | Save As** to save a Setup for future use.

Model:

The XR5 model which is compatible with the current setup. Saved XR5 Setup files are model specific. If you attempt to send a setup file to a different model type, LogXR will display a warning screen and the operation will be halted.

Note:

Setups for the listed model can also be sent to the "-M" (extended memory) version of the same model. For example, a setup for the XR5-SE-20mv can also be sent to the XR5-SE-M-20mv.

Label:

You may enter an optional label describing the logging session. This label appears in the header portion of all transferred data files, as well as at the top of any displayed LogXR graphs.

Logging Mode

See page 31 for a detailed description of the logging modes available for the XR5.

Logging Interval

Channels set to ON will log data at the interval selected. Depending on the current Logging Mode selected, either the fast logging Frequency or Logging Interval will be grayed out. The fast logging Frequency is specified in Hertz, and defines the number of times *per second* that data is logged from each ON channel.

Maximum Log Time (read only)

The maximum log time, based on the number of channels set to ON and the selected Logging Interval.

If the Logging Mode is “Log on Ext. Trigger” or “Log on Alarms”, the Maximum Log Time is approximate: if many triggering cycles or alarm-driven data segments occur during the logging session, additional memory will be consumed due to the overhead of storing each data "segment", resulting in an maximum log time that is less than the displayed value.

If the Logging Mode is “Cycle Logging” the Maximum Log Time includes the pause time for each cycle, so that the Maximum Log Time represents the total time span of the logging session (from the Start Time until either: 1) the memory is full, or 2) the Stop Time has been reached).

For model:

Used to show the Maximum Log Time for the XR5's memory size (standard or -M). This selection has no effect on an XR5 data logger when the setup is sent; it is used only to display the Maximum Log Time for the two XR5 memory sizes. Millivolt model names are not listed here, but the "base" models (XR5-SE and XR5-SE-M) have the same Maximum Log Time as the millivolt models.

Sensor Excitation

The time period just prior to sampling its analog channels that power is pulsed to the XR5’s D and E excitation terminals. Pace Sensors that require excitation power connect to one of these excitation terminals.

Unless a longer excitation time is required, set Excitation Time to 30ms for best battery life.

The following Pace Sensors require an excitation time longer than the 30ms default setting:

<u>Pace Sensor</u>	<u>Excitation Time</u>
TRH-100 Temperature / Humidity Probe	150 ms
TRH-160 Temperature / Humidity Probe	150 ms
P1500 & P1510 Series Pressure Sensor	150 ms

If any of the above sensors are wired to the XR5, set the excitation time to 150ms.

All other Pace Sensors (including P1600 and P300 Pressure sensors) require only 30ms of excitation time.

Excitation Current Limits:

D terminal (2.50 volts): 40 ma recommended maximum; higher currents are possible but not recommended.
(2 ma max. for earlier generation [XR5-8 series](#))

E terminals (5.00 volts): 30 ma maximum, current limited.
(27 ma max for the XR5-8 series)

Sensor Excitation (cont.)

Excitation Time selections: 30 milliseconds, 150 milliseconds, 1 second, 5 seconds, and 10 seconds.

Notes:

Total excitation current draw from all connected sensors (D and E terminals) should be limited to a maximum of 40ma.

Sensor excitation time will be ON continuously (overriding the Excitation Time selected) if any of the following conditions are true:

1. The selected Excitation Time is greater than or equal to the selected Log Interval.
2. Fast Logging is active.
3. The Real Time Mode is active and the selected Excitation Time is equal to or greater than the Real Time Mode update interval (the Real Time Mode update interval is 2 seconds unless "When Logging" is selected).

If any of the 3 conditions listed above are true for an extended period of time, battery life will be significantly reduced, as seen in the "Estimated battery life" field (see next page).

Estimated milliamps

This field enables LogXR Software to more accurately calculate the Estimated battery life of the current Setup. You can specify the total Estimated milliamps drawn from the D and E terminals. "Estimated milliamps" defaults to 0. It can be increased or decreased by clicking on the up/down arrows.

If no sensors connect to the D or E terminals, leave Estimated milliamps at 0. See the next page for a list of all Pace sensors that connect to the D or E terminals.

Sensor Excitation (cont.)

The Pace sensors which connect to an excitation terminal (D or E) are listed below.

Sensor	Current draw (in milliamps) from E terminal unless specified
P300 Pressure (Baro and 0-1psi to 0-30psi models)	4
P300 Pressure (mBar and inch w.c. models)	6
P1600 Pressure (all models)	3.5
P1500 Pressure (all models)	3
P1510 and P1520 Pressure Sensors (all models)	4
P1000 Pressure (all models)	2
TRH-100 Temperature / RH Probe	0.4
TRH-160 Temperature / RH Probe	0.4
DC Current Sensor (all Pace models)	12
WSD-100 Wind Speed and Direction Sensor	0.2
SRS-100 Solar Radiation Sensor	1 (units shipped before 4/2008: 3 ma)
ES-1 External Switch	4
EC5 Soil Moisture Probe	10 ma if using D terminal (27 ma using E terminal)
EC10 and EC20 Soil Moisture Probe	2 ma if using D terminal (7 ma using E terminal)
<i>Resistive 2-wire sensors like the LS100 Light Sensor and all Pace Temperature Probes do not wire to the D or E terminals and use negligible power: about 0.06 ma or less per sensor.</i>	
<i>Total current draw from the E terminals must be 30 ma or less, and total combined current draw (D and E terminals) should be 40 ma or less. All Pace Sensors requiring excitation use the E terminal except the EC5 and EC20.</i>	

Add up the total milliamps for all connected sensors and set the "Estimated milliamps" field to this value. Any non-Pace sensor requiring XR5 excitation power should be included as well.

Note: Figuring estimated battery life is optional - it has no effect on the XR5 or LogXR Setups. Currently "Estimated milliamps" is not saved when the Setup is saved.

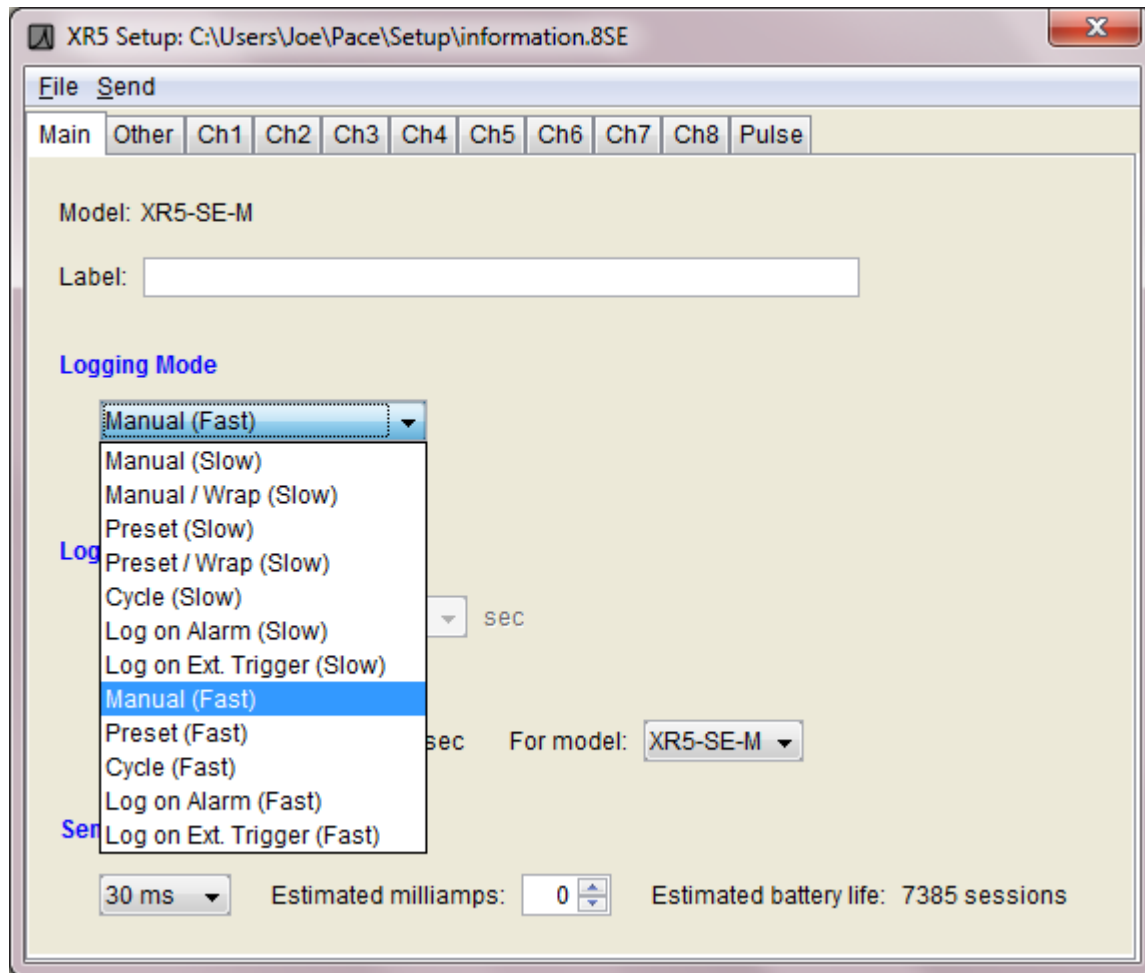
Estimated battery life

Provides a battery life estimate for the selected Setup *and assumes fresh batteries*. Also shows how changes to the Setup affect battery life.

Main factors which determine battery life:

Logging Interval, Excitation milliamps, Excitation time, Channel mode (Standard, Average, Peak), and number of ON channels. "Estimated battery life" does not account for XR5 communication time (Real Time display, Transfer Data, etc.). For typical applications, communication time will not appreciably affect battery life. Constant use (24/7) of the Real Time Graph will greatly reduce battery life. Please contact Pace for details.

Logging Mode



Logging modes are available for Slow Logging (1 sec – 12 hr) or Fast Logging (2Hz - 1000Hz).

While a Slow Logging mode is active, all communication functions are available. For example, while logging is active, you may Extract the XR5's Status, display Real Time data or transfer logged data without affecting the ongoing logging session.

For all Fast Logging modes, once logging has started, the XR5 will not respond to any communication requests except **Logging | Stop**.

'Log Ambient' check box

Visible only if the current setup is for an XR5-SE with a millivolt (-mv) option.

Automatically checked if a Thermocouple Type has been selected for one or more channels. Check 'Log Ambient' if you wish to log ambient temperature on a millivolt model's additional (ninth) analog channel (an on-board precision temperature sensor). Only available for XR5-SE models with a millivolt option.

Slow Logging Modes (1 sec – 12 hr logging interval)

Manual (Slow)

Logging will continue until the memory is full, or may be stopped using the **Logging | Stop** selection. Logging may be re-started (**Logging | Start**) and stopped (**Logging | Stop**) any number of times, until the memory is full. Multiple, non-contiguous data sets may be logged to memory using this mode.

Status LEDs

Green: Blinks continuously while logging.

Red: Blinks continuously once an alarm condition has occurred during the logging session.

Manual /Wrap (Slow)

Logging will continue indefinitely in a wrap-around mode. Once memory is full, oldest readings will be overwritten by new readings. Logging is stopped using the **Logging | Stop** selection.

Status LEDs

Green: Blinks continuously while logging.

Red: Blinks continuously once an alarm condition has occurred during the logging session.

Preset (Slow)

A future Start Time and optional Stop Time is entered. If the Stop Time is already past, it is ignored. Logging will continue until the memory is full or the Stop Time is reached. Logging may be manually stopped by selecting **Logging | Stop**.

Status LEDs

Green: Blinks continuously while logging.

Red: Blinks continuously once an alarm condition has occurred during the logging session.

Preset Start /Wrap (Slow)

Logging begins at a selected future Start time. If the Stop Time is already past, it is ignored. Logging will continue indefinitely in a wrap-around mode unless a future Stop Time was selected, in which case logging will stop with the Stop Time is reached. Once memory is full, oldest readings will be overwritten by new readings. Logging may also be stopped using the **Logging | Stop** selection.

Status LEDs

Green: Blinks continuously while logging.

Red: Blinks continuously once an alarm condition has occurred during the logging session.

Cycle (Slow)

Select a future “Start” time, “Active” logging time, “Pause” time and a “Stop” time. If the “Stop” time is past, Cycle logging continues until the memory is full. Cycle logging can be manually stopped by selecting **Logging | Stop**. The Active time and then the Pause time continuously repeat until the Stop time is reached or the memory becomes full.

Status LEDs

Green: Blinks during “Active” Logging interval, OFF during “Pause” interval.

Red: Blinks continuously once an alarm condition has occurred during the logging session.

Log On Alarm (Slow)

Data is logged (on all ON channels) only while one or more alarms are active. Alarm conditions are monitored at the selected Log Interval, so an alarm condition must be maintained for one Log Interval to insure that it will be logged. High and/or Low Alarm limits may be individually set on any number of analog channels. An alarm becomes active when a channel's sensor or signal value is above an enabled High Alarm level or below an enabled Low Alarm level. Logging stops when no alarm conditions exist or when the memory becomes full or by selecting **Logging | Stop**. Logging may be retriggered (any number of times) by one or more recurring alarm conditions until the memory becomes full.

Status LEDs

Green: Blinks continuously once setup is sent, even if alarm condition is not present.

Red: Blinks continuously once an alarm condition has occurred during the logging session.

Log on Ext. Trigger (Slow)

Data is logged only while the external trigger (screw terminal X) is in the selected state. The trigger state is selected using the "Type" selection for Channel X in the "Pulse" tab. When the trigger state is selected on Channel X, a Stop Delay may be selected, which causes logging to continue after the selected trigger condition is no longer present for the duration of the Stop Delay time.

The trigger input is polled every second, so data logging will begin within one second after the trigger becomes active. Controlled by the trigger input, any number of separate data sets may be logged in this mode until the memory is full. The logging session continues until the memory is full or **Logging | Stop** is selected.

Status LEDs

Green: Blinks continuously once setup is sent, even if the trigger condition is not present.

Red: Blinks continuously once an alarm condition has occurred during the logging session.

Stop Delay

A Stop Delay is available for **Log on Ext. Trigger (Slow)**. Immediately after a 'stop logging' trigger state occurs, logging will continue for the duration of the Stop Delay time. Click on the Stop Delay time field to set the Stop Delay. The Stop Delay can be set for any time between 1 second and 18 hours.

A 'start logging' trigger state which occurs and is maintained for at least one second while the Stop Delay is active will clear the Stop Delay timer and cause logging to resume.

A Stop Delay of all zeros disables the Stop Delay.

The Stop Delay is only available for **Log on Ext. Trigger (Slow)**.

Fast Logging Modes (2 Hz – 1000 Hz)

While Fast Logging is active, the Pulse inputs¹, Real Time Mode and Data Transfers are disabled. Alarm generation is disabled unless logging mode “Log on Alarm (Fast)” is selected. A Fast Logging session is terminated in one of three ways: the XR5’s memory becomes full, the Stop Time has been reached (Preset and Cycle logging modes), or by selecting **Logging | Stop**.

¹ A planned future firmware release will enable the pulse inputs to function during fast logging at some of the fast logging rates. Contact Pace for availability.

The four fastest logging rates only work with a limited number of ON channels:

Fast Logging Rate	Maximum ON Channels
1000 Hz	1
500 Hz	2
250 Hz	4
200 Hz	6
2 Hz - 100 Hz	8

Manual (Fast)

Logging stops when the memory becomes full or by selecting **Logging | Stop**.

Status LEDs

Green: Blinks continuously once Logging is manually started. Off when Logging is manually stopped or memory becomes full.

Red: Off (alarm generation is disabled).

Preset (Fast)

Logging begins at a future selected Start Time. If the selected Stop Time is already past, it is ignored. Logging stops when the memory becomes full, or the selected Stop Time is reached, or by selecting **Logging | Stop**.

Status LEDs

Green: Blinks continuously once Preset time is reached. Off when Logging is manually stopped or the memory becomes full, or the Stop Time is reached.

Red: Off (alarm generation is disabled).

Cycle (Fast)

Enter a future “Start” time, “Active” logging time duration, “Pause” time duration and “Stop” time. If the “Stop” time is already past, it is ignored. Cycle logging continues until the memory is full, or the Stop Time is reached, or by selecting **Logging | Stop**. Note: When a setup is send with this logging mode, communication is available (**Status | Extract, Real Time | Text**, etc.), until the Preset Time is reached. Once the preset time is reached, Fast Logging becomes active. The only communication command that the XR5 will respond to while Fast Logging is active is **Logging | Stop**.

Status LEDs

Green: Blinks continuously once Preset time is reached. Continues to blink during Pause time. Off when Logging is manually stopped, memory becomes full, or Stop Time is reached.

Red: Off (alarm generation is disabled).

Log on Alarm (Fast)

Fast Log (on all ON channels) only while one or more alarms are active. Alarm conditions are monitored at the selected logging rate (2Hz – 1000Hz). High and/or Low Alarm limits may be individually set on any number of analog channels. An alarm becomes active when a channel's sensor or signal value is above an enabled High Alarm level or below an enabled Low Alarm level. Logging stops when the memory becomes full or by selecting **Logging | Stop**. Logging may be re-triggered (any number of times) by one or more recurring alarm conditions until the memory becomes full.

Status LEDs

Green: Blinks continuously once setup is sent, even if alarm condition is not present.

Red: Off (not used).

Notes:

When a Log on Alarm (Fast) setup is sent, fast sampling commences immediately, and the XR5 will not respond to any communications except **Logging | Stop**. Communications remain disabled until logging stops because the memory has become full, or the user clicks **Logging | Stop**.

Logging occurs when one or more alarms become active and stops when there are no alarms.

The Alarm output (Z terminal) is high when logging is active, and low when logging is not active.

Battery Life

Like all Fast Logging modes, power consumption is 10 to 30 times higher compared to the Slow Logging modes. However, Log an Alarms (Fast) and Log on Ext. Trigger (Fast) have a special possibility: The XR5 could remain in the "waiting" state indefinitely if no Alarm conditions occur. In this case, the XR5's batteries could discharge in as little as 1 month while continuously waiting for an Alarm condition at logging rates of 100Hz or higher.

Log on Ext. Trigger (Fast)

Data is logged only while the external trigger (Screw terminal X) is in the selected active state. The trigger active state is selected using the "Type" selection for Channel X in the "Pulse Channels" tab. The trigger input is polled at the selected logging rate (2Hz – 1000Hz), and data logging begins within one logging interval after the trigger becomes active. For example, if 100Hz is the selected Hz interval, logging will begin within 10 milliseconds after the trigger becomes active. Controlled by the trigger input, any number of separate data sets may be logged in this mode until the memory is full. The logging session continues until the memory is full or **Logging | Stop** from the main menu is selected.

Status LEDs

Green: Blinks continuously once setup is sent, even if valid trigger condition is not present.

Red: Off (alarm generation is disabled).

Notes:

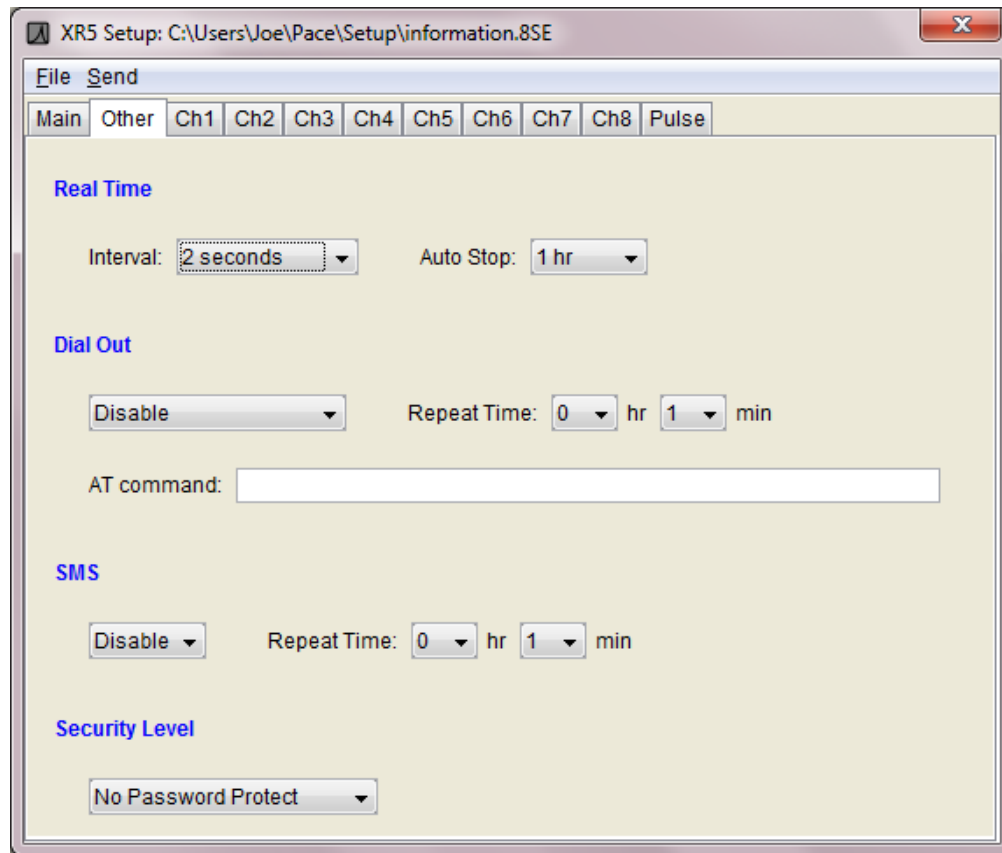
A Stop Delay is available for "Log on Ext. Trigger (Slow)" but is not available for "Log on Ext. Trigger (Fast)".

As with all Fast Logging modes, communications is disabled for the duration of the logging session, with the exception that the XR5 will respond to the menu selection **Logging | Stop**. Until **Logging | Stop** is selected (or the memory becomes full), the XR5 will be unable to respond to any other menu command.

Battery Life

Like all Fast Logging modes, power consumption is 10 to 30 times higher compared to the Slow Logging modes. However, Log an Alarms (Fast) and Log on Ext. Trigger (Fast) have a special issue: The XR5 could remain in the "waiting" state indefinitely if no trigger condition occurs. In this case, the XR5's batteries could discharge in as little as 2 months while continuously waiting for a trigger at logging rates of 100Hz or higher.

Setup, Other tab



Real Time Settings

Update mode

2 seconds Real Time display (Text or Graph) updates every 2 seconds
(recommended setting).

When Logging Real Time display updates whenever readings are logged to XR5's memory
 (controlled by the Logging Interval selected in the Main tab of the Setup).

Log Stream Special mode, currently undocumented, for future use.

Auto Stop

The Real Time mode (if active) automatically terminates after Auto Stop hours has elapsed.
 Select Disable for no Auto Stop.

Purpose of Auto Stop

Auto Stop prevents unintended power consumption when using the Real Time mode. For example, after using the Real Time mode at a logging site, the IC209 Cable is mistakenly detached before exiting out of LogXR's Real Time screen. As a result, Real Time data transmissions will continue until communication is re-established with the XR5, or the Auto Stop time has elapsed. Average power consumption is about 20 times higher when the Real Time mode is active.

Dial Out

Note: A data collection system utilizing this feature is not currently implemented in LogXR Software.

When the selected dial-out condition is met, the XR5 signals the connected modem to dial-out and connect to a modem-equipped central computer.

Dial Out Condition

- Disable** Disables all dial out functions.
- Upon Alarm** Enables Alarm dial out.
- Upon Time*** Enables Timed dial out and specifies a Timed dial out Interval.
- Upon Time and Alarm*** Enables both Timed dial out and Alarm dial out.
- Upon Memory 75% Full** Dial out occurs when XR5's memory is 75% full.

***Dial Out Time**

- Interval** Specify the time and the number of days between dial outs
- Daily** Specify the daily dial out time.
- Monthly** Specify the day of the month and the time of the dial out.

Repeat Time

Specifies the retry time delay if a Timed dial out is unsuccessful.

AT Command

Enter the AT command string to dial the phone number of the central "Host" computer. This string begins with "ATDT" and is followed by the phone number of the central computer's modem. For example, if the remote site needs to dial 111-222-3333 to reach the central computer, the AT command string would be "ATDT-111-222-3333" (Dash characters are ignored).

SMS

Disable /Enable

Enable: Turns on SMS alarm message generation. See page 43 for details.

Repeat Time

Specifies how often an SMS is sent if the alarm condition remains active.

Password Settings

Security Level

No Password Protect	Password not required.
Password Protect Setup	Password is required to send an XR5 Setup.
Password Protect System	Password is required for all XR5 communication.

The XR5's password is set from the main menu by clicking **Utilities | Change XR5 Password**. In order to change the XR5's password, you must know its current password. The XR5 ships from the factory with a password of "password".

If a Setup with the Security Level set for **Password Protect System** is sent to an XR5, then the XR5's password will have to be entered for any additional communications.

If a Setup with the Security Level set for **Password Protect Setup** is sent to an XR5, then the XR5's password will have to be entered in order to send a Setup.

Setup, Ch1-Ch8 Tabs

Channel ON/OFF button

Click to set channel ON or OFF. ON channels will log readings to memory when logging is active. OFF channels will not log readings to memory.

Description

Channel description (up to 24 characters).

Type

The following channel Type selections are available for each analog channel (1-8).

Temperature (A.rvt)	YSI 10k Thermistor (H mix)
Temperature (B.rvt)	YSI 10k Thermistor (B mix)
Temperature PT9xx (C.rvt)	Pace PT9xx Series Temperature Probe.
Temperature PT510 (P.rvt)	Pace PT510 or PT520 Platinum 10k RTD
Light Sensor LS100 (L.rvt)	Pace LS100 Light Sensor
Switch or Contact Closure	Unpowered Switch Closure
Resistance	Two-wire resistance (range midpoint is 30k ohm)
0- 2.5V	0-2.5v input (impedance >10M ohm)
0- 5V	0-5v input (impedance >10M ohm)

The following selections are available on even numbered channels only :

- TRH-100 Humidity Probe** Pace TRH-100 Temperature / Humidity Probe
see page 71 for details.
- TRH-160 Humidity Probe** Pace TRH-160 Temperature / Humidity Probe
see page 72 for details.

For models with a millivolt option, additional channel Type selections are available for each analog channel (1-8):

- Millivolt** Millivolt input; Millivolt range is determined by the XR5's millivolt option and the Full Range / Half Range selection (see table below).
- B Type** B Type Thermocouple
- C Type** C Type Thermocouple
- E Type** E Type Thermocouple
- J Type** J Type Thermocouple
- K Type** K Type Thermocouple
- N Type** N Type Thermocouple
- R Type** R Type Thermocouple
- S Type** S Type Thermocouple
- T Type** T Type Thermocouple
- E Type Cold** E Type Thermocouple, cold temperature range
- J Type Cold** J Type Thermocouple, cold temperature range
- K Type Cold** K Type Thermocouple, cold temperature range
- N Type Cold** N Type Thermocouple, cold temperature range
- T Type Cold** T Type Thermocouple, cold temperature range

A thermocouple's temperature range is set by the channel Type selection (above) and the millivolt input range (see tables starting on page 94). The XR5 model and Full Range / Half Range selection determines the millivolt input range.

Full Range / Half Range millivolt range selection

Full Range / Half Range selection is visible only if the XR5-SE has a millivolt option. The selection is enabled if the channel Type is set to 'millivolt' or if a thermocouple is selected. The Full Range / Half Range selection sets the millivolt range for the selected channel. Select 'Half Range' if the resulting range is within the span of the signal to be measured (see table below). Half Range provides 2X higher measurement resolution compared to Full Range.

Model number	'Full Range' selected		'Half Range' selected	
	range	resolution	range	resolution
XR5-SE-20mv	0-20 mv	4.8 µV	0-10 mv	2.4 µV
XR5-SE-50mv	0-50 mv	12 µV	0-25 mv	6 µV
XR5-SE-100mv	0-100 mv	24 µV	0-50 mv	12 µV
XR5-SE-250mv	0-250 mv	61 µV	0-125 mv	30 µV
XR5-SE-500mv	0-500 mv	122 µV	0-250 mv	61 µV
XR5-SE-1000mv	0-1000 mv	244 µV	0-500 mv	122 µV

For Thermocouples, select 'Full Range' or 'Half Range' using the Thermocouple tables beginning on page 94. Use 'Half Range' if your Thermocouple's temperature range will be within the smaller millivolt range listed in the Thermocouple table for your XR5 model.

Mode

The following Channel Mode selections are available for the analog channels (1-8).

Standard

Store reading at selected Logging Interval.

Average*

Accumulate readings every second, store Average value at selected Logging Interval.

Peak*

Acquire readings every second, store Peak reading at selected Logging Interval.

Differential

Subtract reading of immediately lower channel number from reading of selected channel, and store this differential value at the selected Logging Interval.

The Differential selection is available on even numbered channels

<u>Channel</u>	<u>Log value of</u>
2	Channel 1 - Channel 2
4	Channel 3 - Channel 4
6	Channel 5 - Channel 6
8	Channel 7 - Channel 8

** Average and Peak channel modes only function in the following Slow Logging modes: Manual, Manual/Wrap, Preset, Preset/Wrap and Cycle.*

Slope / Offset

Editable only if channel Type is 0-2.5v, 0-5v or optional 'Millivolt' range.

Slope and Offset values for all PACE Sensors are listed in the Appendix. For 4-20ma applications, see pages 71 and 72.

To scale data in actual volts for 0-2.5v or 0-5v ranges, or in millivolts for optional millivolt ranges, use Slope = 1, Offset = 0

For "raw" unscaled 12 bit data (displayed as values from 0 to 4095) enter the following:

<u>Range</u>	<u>Slope</u>	<u>Offset</u>
0-2.5v	1638	0
0-5v	819	0

Slope / Offset values for External Scaling Cables (for direct voltage readings) are listed on page 84.

For channels 1 through 8, slope and offset values can range from 16383 to -16383 if whole numbers are entered. Decimal values can range from 163.83 to -163.83 (a maximum of 2 digits after the decimal point; additional digits are ignored).

Pulse channels X, Y, and Z accept a wider range of slope and offset values.

Non-Pace Transducers

For scaling non-Pace, voltage output transducers, see page 87.

For 4-20ma signals, click "Current Loop" and see pages 88 and 89 for additional details.

Alarm High / Alarm Low

High and Low alarms may be enabled for each channel. If an Alarm for a channel is Enabled, and an alarm condition occurs after a Logging session has begun, the Red LED will blink every 5 seconds (slow logging modes only). The Red LED will continue to blink until a new logging session is started (a new Setup is sent to the XR5).

Notes:

1. A Channel Alarm may be enabled even if the channel itself is set to OFF. In this case, an Alarm will be generated if the channel input exceeds its Alarm limits even though no data is being logged for the OFF channel.
2. Channels are checked for alarms only at the selected Log Interval. If a channel exceeds its alarm limit between log intervals, and at log time the channel no longer exceeds its alarm limit, then no alarm will be generated.
3. Alarm conditions can only be generated if Logging is active. Once Logging has stopped (by selecting **Logging | Stop**, or because a stop condition determined by the logging mode has occurred (for example: memory is full, or the Preset Stop time was reached)), then Alarm conditions can no longer be generated.

Alarm Limitations:

1. Differential Temperature Alarm: Only Pace PT9xx series precision 30K thermistor probes (or equivalent) may be used to generate XR5 differential temperature alarms. Type: "Temperature PT9xx (C.rvt)" must be selected for both differential channels. This function can work with other type temperature sensors, contact Pace for details.
2. Channel alarms are disabled for all Fast Logging modes except "Log on Alarms".
3. Thermocouple temperature data is calculated in LogXR Software using the logged XR5 ambient temperature values for thermocouple cold-junction compensation. XR5 thermocouple alarm limits are not temperature-compensated but use a fixed cold-junction temperature of 25°C. Therefore thermocouple alarm limits must be considered as approximate values. Ambient temperature variation of the XR5 from 25°C will alter any thermocouple alarm limit by the same amount.

Alarm Limits

Enter High and/or Low alarm limits for the selected channel. The Allowable Range is based on the selected channel Type and current Slope and Offset values. The "Actual value" is calculated from your entered value based on the 12 bit resolution of the XR5.

For Temperatures, the Allowable range is based on the selected temperature scale (selected in the Setup screen's "Other" tab).

Thermocouple alarms (millivolt models): Thermocouple alarm limits are approximate values (see next paragraph).

Thermocouple Alarm limitation

Thermocouple Alarm processing in the XR5 presently uses a fixed cold junction temperature of 25°C (77°F). The XR5's ambient temperature difference from 25°C (77°F) shifts all Thermocouple Alarm Limits by the same amount.

For example, if a Thermocouple Alarm Limit is set to 400 deg. C, and the XR5 ambient temperature is 15°C, then the actual Alarm Limit will be 390°C. If the XR5's ambient temperature then rises to 35°C, the actual Alarm Limit becomes 410°C.

The above limitation only affects Thermocouple alarm limits.

Thermocouple temperature readings are accurate over the full ambient temperature range of the XR5.

SMS Alarm

This function is available when the XR5 is connected to a Pace approved GSM data modem operating on circuit switched data service (see page 101 for details).

Note to USA customers:

Before purchasing cellular modem hardware (see page 101) to implement SMS Alarming, first contact Pace at 704-799-0688 for cellular service details, in order to verify that the necessary service is available in your area.

Phone #

Enter a cell phone number that will receive the channel alarm in the form of an SMS text message when an alarm condition on the current channel is active.

Message:

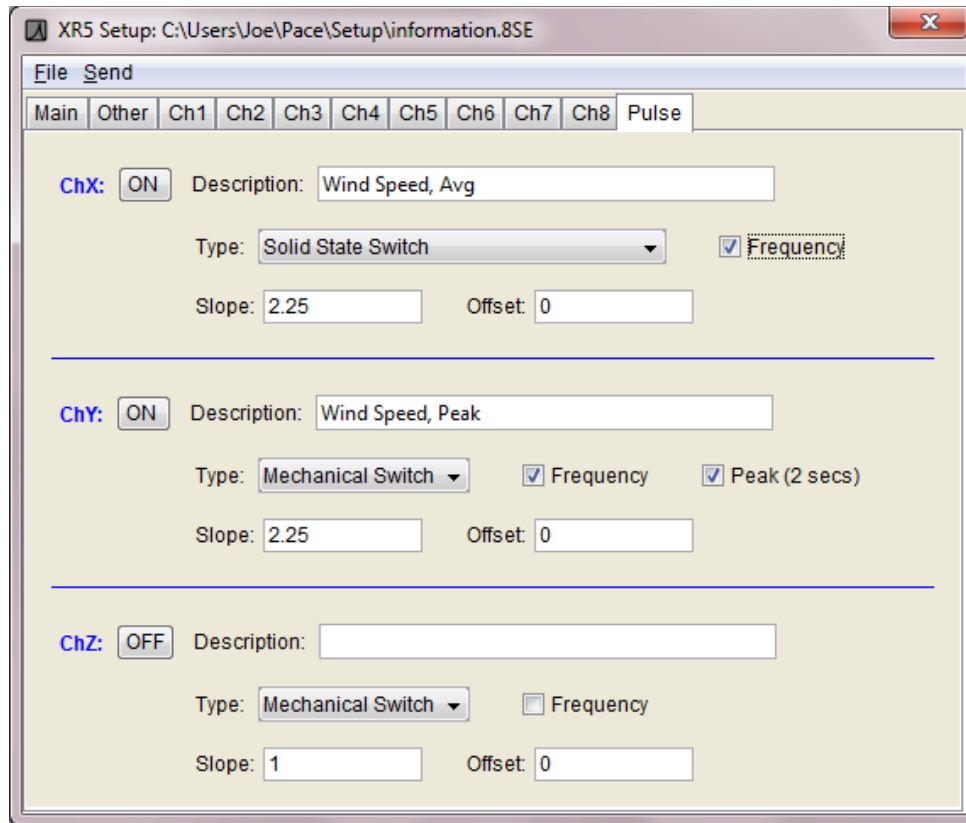
Enter a descriptive text message that will make up a portion of the alarm message that will be sent when an alarm condition on the current channel is active. The alarm message will also include the channel number that is causing the alarm, and the current, scaled reading of the channel.

For SMS Alarms to function, SMS must be set to "Enable" in the **Setup | Other** tab, and a High and/or Low Alarm Limit must be checked and the Alarm value entered. SMS Alarms will only function when a GSM modem, set up for "circuit switched" data/fax service by your local GSM cellular carrier, is connected to the XR5 using the Pace ICW-15 Cable. Please see page 101 for additional details.

Sensor limitation for SMS Alarm readings:

The XR5 can output scaled SMS alarm readings for any sensor or signal with slope/offset scaling, or any PT9xx series Temperature Probe. All other sensors or signals not using slope/offset scaling will output a voltage value and not scaled readings. The XR5 can be user-configured to output scaled SMS Alarm readings for other resistive sensors (like the PT510 Temperature Sensor or LS100 Light Sensor). Please contact Pace for details.

Setup, Pulse Channels tab



Ch ON/OFF

Sets the individual Pulse channel [X,Y or Z] to ON (enabled) or OFF (disabled).

Description

Enter a channel description of up to 16 characters.

Type

Select a Pulse type:

Mechanical Switch

Solid State Switch

Count pulses and store the pulse count at the selected Logging Interval. Reset the pulse count to 0 at start of each log interval. All pulse counting channels are disabled if Fast Logging is active. Select **Mechanical Switch** for pulse signals from 0 to 15 Hz. Select **Solid State Switch** for pulse signals having a maximum rate of 900 Hz.

Note: The above two selections set the XR5's switch debounce timer. The debounce time for **Mechanical Switch** is 30 ms; the debounce time for **Solid State Switch** is 0.5 ms.

Trigger: Log if ChX High (Switch Open)

Trigger: Log if ChX Low (Switch Closed)

Available on ChX only. Use with Log mode **Log on Ext. Trigger** (Slow or Fast). Specifies the active trigger state:

Log if ChX High (Switch Open): Voltage (2.1v to 12v) or unpowered switch.

Log if ChX Low (Switch Closed): Voltage (0v to 0.5v) or unpowered switch.

Stop Delay

A Stop Delay is available if **Log on Ext. Trigger (Slow)** has been selected in the Main Setup tab and a Trigger mode is selected for ChX. If the Stop Delay is enabled, then after a "stop logging" trigger state occurs, logging will continue for the duration of the Stop Delay time. The Stop Delay can be set for any time between 1 second and 18 hours. See page 33 for more details.

Alarm Output

Available on Channel Z only; Output must be externally buffered. A driver module for a solid state relay (AC or DC) is available, contact Pace for details.

If a 100k resistor is connected from Z to ground, the Z terminal will read approx. 0.25 volts if no alarm, and about 1.7v if one or more alarms are active.

Frequency check box

Checking "Frequency" converts the accumulated pulse count to average frequency in Hertz (average frequency of each log interval) in any transferred data files. The XR5's upper frequency limit is about 900Hz. If Frequency is checked, the Slope and Offset values are applied to the calculated Frequency before being written to the data file.

Peak check box

Available for channel Y only; If checked, the highest pulse count over a 2 second interval is stored for the selected log interval. Originally intended for logging Peak Wind Speed using the Pace WSD-100 Wind Speed and Direction sensor.

Slope and Offset

Slope and Offset edit boxes allow the pulse channel's count to be scaled to display the desired unit of measure. The raw pulse count is multiplied by the current slope and then the offset value is added to the result. The slope can be used either as a multiplier or a divider. For example, if the slope is set to 0.001, the raw pulse count will be divided by 1000. Setting the Slope to 1 and the Offset to 0 results in the actual "raw" pulse count with no scaling applied. Slope and Offset values can range from 21474.8 to -21474.8. Up to 6 digits may be entered plus an optional minus sign and a decimal point. The smallest fractional slope or offset value is +/-0.00001.

Pulse inputs and the Real Time display

With XR5 Firmware version 1.01.04, Real Time readings are scaled using the corresponding Slope and Offset values. If Frequency is checked (in the Setup), the Pulse Frequency is calculated (averaged over the 2 second update interval) and then Slope and Offset scaling applied.

Prior to firmware 1.01.04, Slope, Offset, and Frequency settings for the pulse channels were applied only to the XR5 data files (**Transfer | All Data**).

Notes

1. Selecting a trigger mode on ChX automatically disables Channel X for pulse counting.
2. Selecting Alarm Output on ChZ automatically disables Channel Z for pulse counting.
3. The Alarm Output follows the current alarm conditions while logging is active. If an alarm condition goes away, the Alarm Output will go low, if an alarm condition once again becomes active, the Alarm Output will go high. When logging stops the Alarm Output will go low, even if the alarm condition remains.
4. The Alarm Output has no drive capability. A relay module is available; contact Pace for details.
5. The Alarm Output functions with all slow logging modes, and with Log on Alarms (Fast).

6. The Peak function requires firmware 1.01.00 or higher.

Sending a Setup to the XR5

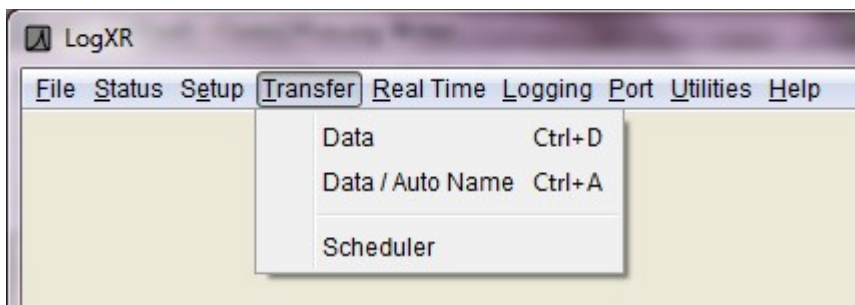
Once you have configured a Setup for your intended logging session, the Setup must be sent to the XR5 to take effect. From the Setup menu, select **Send | Send Setup**. If your setup has invalid selections a warning screen will appear. Unless your selected logging mode is "Log on Ext. Trigger" or has a Preset Start Time, you will be asked if you want to start logging immediately. You can choose to start logging immediately, or you can start logging at a later time (by selecting **Logging | Start** from the Main Menu).

Saving a Setup for future use

You may save any Setup as a named file by selecting **File | Save As...** from the Setup menu. All Setup files are saved with the indicated file extension for the currently selected model.

Loading a saved Setup file

From the Main Menu, select **Setup | Open**. In the Open Setup File dialog, click on the 'Files of Type' drop down box and select your XR5 model. All previously saved files for your model will be listed. Selecting a Setup file loads the file's parameters into the Setup screen. The Setup can then be Sent to the XR5 by selecting **Send | Send Setup** from the Setup menu.



Transfer | Data

Enter a file name for the transferred data. Data is transferred as a binary file. After the transfer is complete, LogXR creates a readable text file from the binary file. The text file consists of a “header” portion (information pertaining to the XR5’s setup during the logging session) followed by all of the logged data. The file has a “.txt” or “.csv” file name extension (determined by a **File | Preferences** selection, see pages 19-20). After the transfer is complete, data can be viewed graphically, or as text file. The file may also be opened in another program such as Notepad or Excel. Please see page 98 for details on using LogXR Graph.

Data Integrity

To verify that a LogXR Data File has not been modified or manually altered, select **Utilities | Verify Data**. After selecting the data file you wish to check, LogXR will display the status of the file. Manually adding (or editing) text at the very end of a LogXR data file (after the data portion) does not alter the file’s data integrity. Manually altering any other part of the file (data or header) will cause **Utilities | Verify Data** to display a “Modified” status.

Transfer | Data / Auto-Name

A faster way to transfer data from an XR5. Same as **Transfer | Data** except the transferred data file is automatically named by LogXR Software. The file name is constructed as follows:

The first part of the file name consist of the XR5’s factory embedded serial number (8 digits) followed by a "-" character *. The final 5 characters of the filename consist of a LogXR generated 5 digit auto-incrementing number starting with 00000. Each time another data file is transferred using **Transfer | Data / Auto-Name** this number is incremented by one. The filename ends with the standard LogXR Data File extensions: ".binary" for the binary file and ".txt" or ".csv" for the text file (see next page).

* Early XR5-8 models did not have a factory embedded serial number; for these models, the filename begins with "d-" (two characters).

Transfer | Scheduler

Displays the LogXR Scheduler*. The Scheduler facilitates automatic data collection from any number of XR5 Data Loggers which are connected to a computer via Com port(s) or a Local Area Network**.

* LogXR includes a separate Dial-up Scheduler to automatically collect data from remote XR5 units over the phone lines. See page 101 for details.

** A Pace DS100 Ethernet Module is required to connect an XR5 to a LAN (details on page 59).

The Scheduler is arranged in a series of "rows". Each row defines a Project Folder name for storing the collected data, a "Location" which also defines the physical connection (Ethernet LAN, Com Port or USB Adapter), and the desired collection time. The left side of the Scheduler is divided into two panes (upper and lower). The upper pane lists the collected data files for the currently selected row. The bottom pane displays the Setup file (if present) for the currently selected row (details on the next page).

You create a schedule by clicking on the first available row under "Project Folder" and enter a folder name, then select the Location (Port) and finally the Collection time. These selections are explained below.

Project Folder

Choose a folder name that will become the "parent" folder for the collected data. Each row can have a different Project Folder name, or a combination of the same or different folder names may be used. If multiple remote sites belong to the same group or logging project, we suggest you use the same folder name for each logger in a given group, to help organize your collected data. Alternately, all data files can be transferred to the same folder selected in Transfer | Data from the main menu (see Options selection, below).

Location (Port)

Choose a Port from the list. Any Ethernet port you intend to use must have been previously created using a Pace DS100 module and main menu **Port | Network | New Network Port** selection (see page 59).

Collection Time

Choose a collection interval of Hourly, Daily, Weekly, or Monthly.

Hourly:

Select the minute after the hour. Data will be collected every hour at the specified minute.

Note: If you wish to collect data multiple times each hour, create multiple rows for the same XR5 and select a different minute value for each row.

Daily:

Select the time each day that the collection will occur. The hour selection is in 24 hour time format (for example, 10 AM = 10, 2 PM = 14, 5 PM = 17, etc).

Note: If you wish to collect data twice daily, create two rows for the same XR5 and set the Daily collection times 12 hours apart.

Weekly:

Select the day of the week and the time that the collection will occur.

Monthly:

Select the day of the month and the time that the collection will occur.

(Optional) Sending a Setup to reset the XR5

Immediately after successfully collecting data from an XR5, the Scheduler can send a Setup to clear the XR5's memory, resynchronize its time clock, and re-start logging. Each completed row in the Scheduler has a corresponding Setup folder. When a row is selected (clicked) the Setup pane (lower left pane) lists the Setup file, if it is present, for the selected row.

The presence of a Setup file in the Setup pane determines if a Setup will be sent after collecting data. If no Setup file is present (the default state), a setup is not sent after data has been collected. The directory path to locate the Setup folder for the selected row is listed directly above the Setup pane.

To copy an XR5 Setup file into this folder, use a file navigation program (on Windows systems, hold down the Window button (beside the Alt Key) and press E to launch Windows Explorer). Then navigate to and select a previously saved Setup file, select Copy, then navigate to the selected row's Setup folder (directory path listed above the Setup pane) and select Paste.

Setup file requirements

1. A Setup file used with the Scheduler must not have preset time fields (for example, a setup with logging mode "Preset / (Slow)"). Preset time fields will be invalid after their preset time has been reached.
2. The Setup file must be a setup that was created for your particular XR5 model, otherwise it will not be sent. For example, use **Setup | Extract** to create the setup file.

Existing Setup files can be modified by double clicking the Setup File in the Setup pane. Once you have modified the Setup file, click File | Exit in the Setup window. If you have made changes to the Setup file, the prompt "Do you wish to save changes?" appears. click Yes, and then click Save. Your modified Setup file is now available to be used by the Scheduler.

Starting the Scheduler

Once one or more rows have been filled, the Scheduler is activated by the menu selection **Contact | Activate List**. See Scheduler menu selections below for details.

Scheduler menu selections:

File Options	Display the Options window (see next page)
File Exit	Exit the Scheduler
Edit Modify	Modify the currently selected position on a row (Project Folder, Port, or Collection Time).
Edit Delete	Deletes the currently selected row.

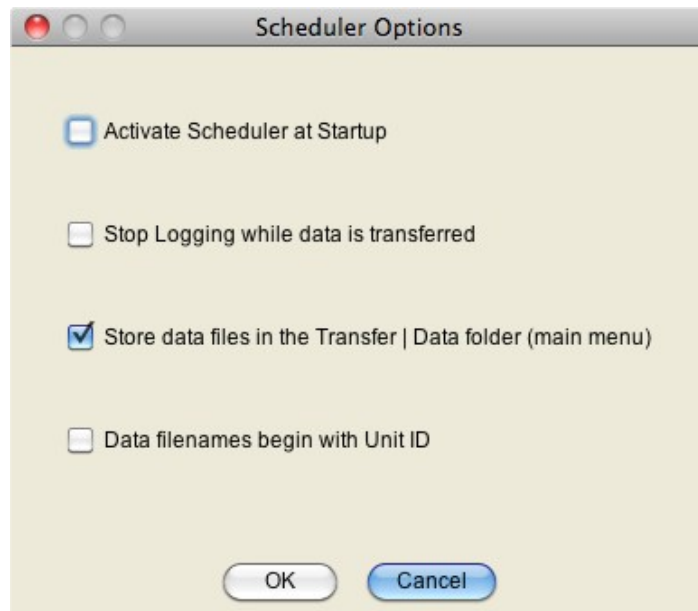
Contact | Contact Selected Unit Now

Brings up a new screen similar to LogXR's Main Menu that allows you to manually communicate with the selected XR5.

Contact | Activate List

Activates the Scheduler. Displays a dialog box to specify a name for the Scheduler's log file. All Scheduler activity will be logged to this file. The same log will be displayed in the Scheduler Activity box that appears when you click the Create button. Clicking "Create" activates the Scheduler. Once the Scheduler is activated, LogXR can not be used for other functions. Clicking Stop on the Scheduler Activity box terminates the Scheduler.

Scheduler Options (File | Options)



Scheduler Options (image from Mac OS X version of LogXR)

Activate Scheduler at Startup

When LogXR is launched, the Scheduler is automatically invoked and activated.

Stop Logging while data is transferred

Allows transfers to occur while Fast Logging is active. Logging restarts after transfer is complete.

Store data files in the Transfer | Data folder (main menu)

All transferred data files (from all projects and ports) are stored in a single common folder (the same folder that data files are stored in when selecting **Transfer | Data** from the main menu). This folder can be changed from **Transfer | Data** by navigating to a new folder before clicking "Begin Transfer".

Data filenames begin with Unit ID

Unit ID is appended to the beginning of all collected data files.

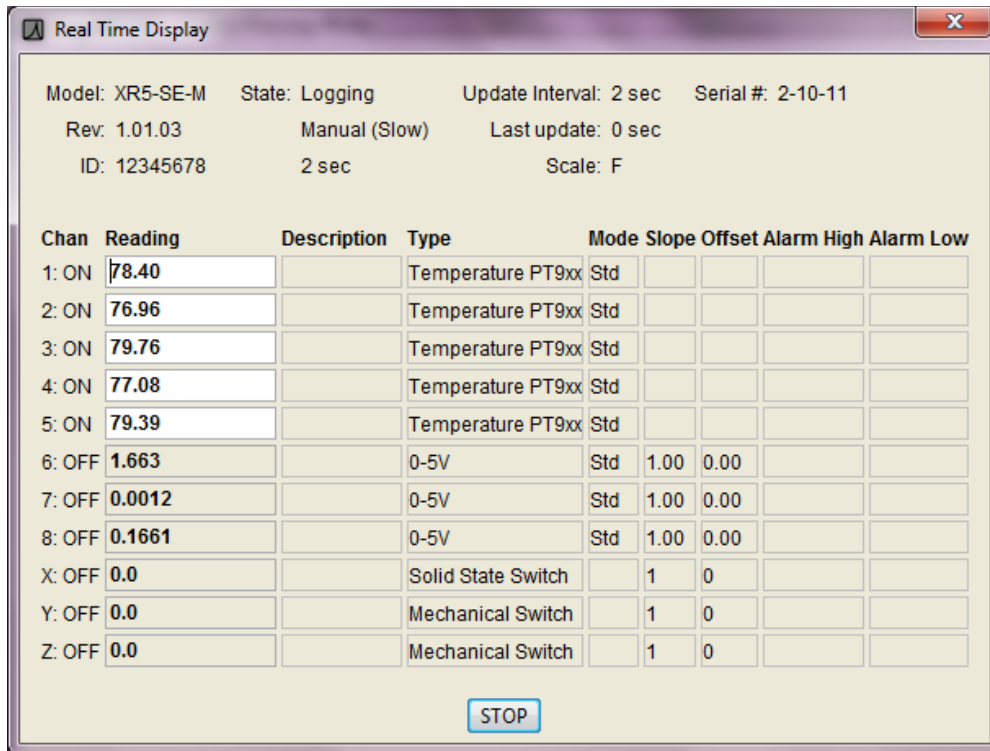
Scheduler limitations:

1. Each Row must list a unique Collection Time. If two rows list the same Collection Time, the second row with the same Collection Time will be ignored by the Scheduler.
2. If data collection is active and "overlaps" a Collection Time listed for another row, that row will be ignored by the Scheduler. Therefore, space each row's Collection Time so that there is sufficient time to transfer data before any other listed Collection Time occurs.

Scheduler notes and tips:

1. The vertical bar that separates the Scheduler rows from the Setup and Data file panes can be dragged with the mouse to provide more viewing area for the Setup and Data panes.
2. The number of USB ports on a computer can be expanded using a "USB Hub" available at computer or office supply outlets. Using the Pace IC209 Cable and USB-A Adapter connected to a USB Hub, any number of XR5 Data Loggers can be "hard wired" to a computer and used with the Scheduler.
3. The number of ports accessible to the Scheduler can also be expanded using Pace DS100 Modules connected to a LAN – see page 59 and following for details.
4. Data files are named as follows: Each data file name begins with the XR5's eight digit Serial Number, followed by a dash "-" character and an auto-incrementing 5 digit number, and a file extension of .txt or .csv based on the main menu's **File | Preferences** selection. If "Data filenames begin with Unit ID" is checked in the Scheduler's File | Options window, the XR5's Unit ID is added to the beginning of the filename.

Real Time | Text



Displays real time readings for all channels. The update rate (selected in the Setup / Other tab), is either every 2 seconds, or when the XR5 logs data (see page 36 for details).

The upper section displays a subset of the logger's Status information, including Model name and firmware Revision, unit ID, logging State, mode, and interval.

'State:' is the logging state active when the Real Time mode is *first* selected. If a change occurs to the logging state while the Real Time display is active, it will not be updated. For example, if the Log Mode is "Log on Ext. Trigger", and the trigger state changes while the Real Time display is active, so that logging stops, this new State is not displayed. The XR5's real time "data packet" only includes analog and pulse channel data.

Also displayed in the upper section is the Update Interval ("2 sec" or "When Logging"), elapsed time since the Last real time update, temperature Scale, and the logger's Serial number. Models with a Millivolt option also display the current ambient temperature below the Serial number.

Real time data displays in RED if its value exceeds the displayed Alarm limit and has a gray background if its channel is set to OFF.

Only Alarm limits that have been enabled (via the Setup | Channel tab) display in the Alarm High / Alarm Low columns.

"/ Half Range" displays in the Type column for a Millivolt or Thermocouple Type if "Half Range" was selected in Setup.

The Real Time Display is not available when Fast Logging (2Hz – 1000Hz) is active.

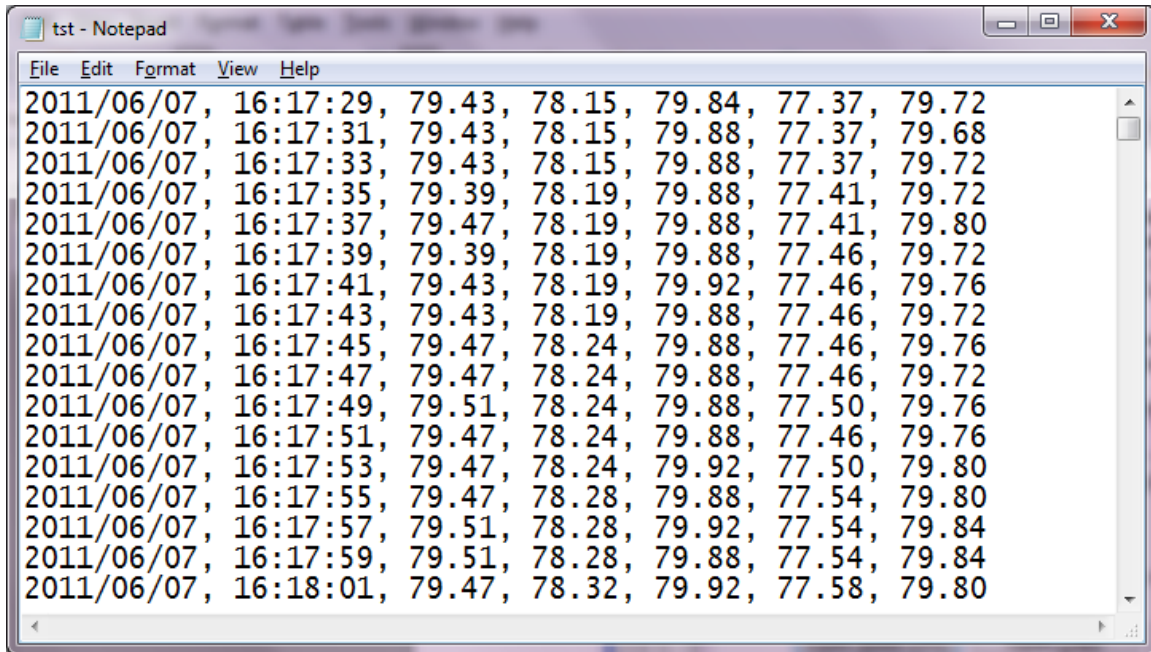
Real Time | Text and write to file

Same display screen as **Real Time | Text**, but real time data is simultaneously written to a text file. You are prompted to enter a file name for the file. A new line of data will be written to the text file whenever the Real Time Display is updated. The file can be opened in a Text Editor like Notepad (see below).

Please Note:

Data files created using **Real Time | Text and write to file** do not contain header information and are therefore currently unviewable in LogXR Graph. They may be graphed using a program such as Excel. If data logging is active while the Real Time Display is active, logged data may be transferred and graphed using LogXR after exiting the Real Time Display.

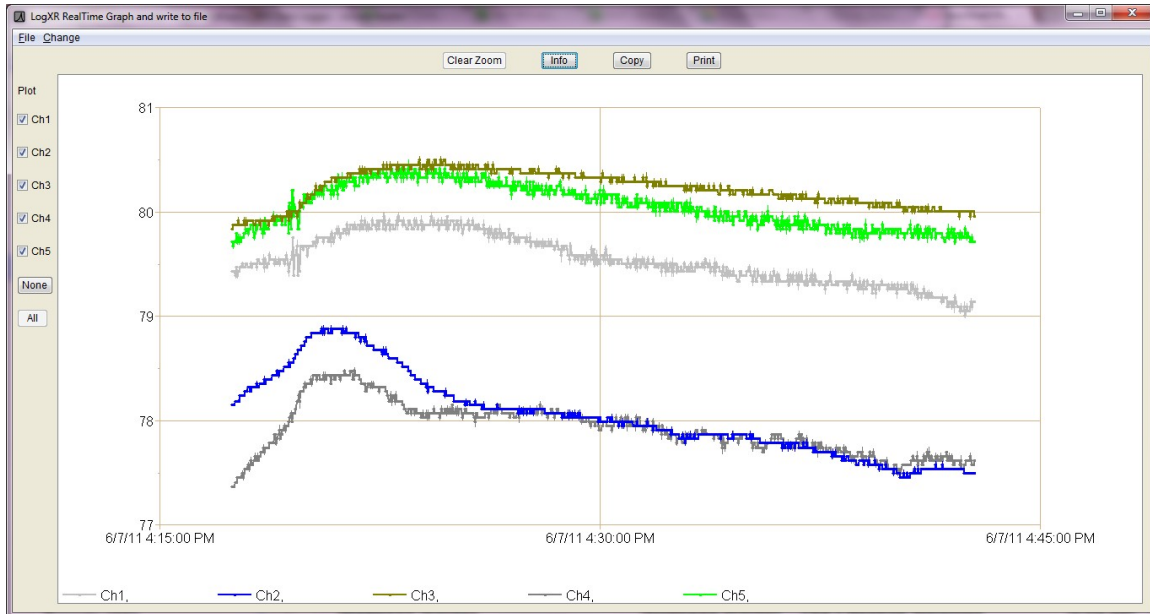
Real Time data is not available when Fast Logging (2Hz – 1000Hz) is active.



View of text file created using Real Time | Text and write to file (from Windows Notepad). Note that only the readings of the channels set to ON are written to the file.

Real Time | Graph

Displays real time data graphically for all sensors/channels previously set to ON in LogXR's Setup. The update rate (selected in the Setup / Other tab), is either every 2 seconds (recommended setting), or when the XR5 logs data (see page 36 for details). With the standard update rate (2 seconds), once 45 minutes of readings appear on the screen, oldest readings will scroll off as fresh readings are added. Thereafter, the Real Time Graph will continue to dynamically display all readings acquired over the past 45 minutes.



Currently all channels plot on a single "viewport" (and share a single vertical scale). Use the Zoom function (see table below) to expand one or more plots vertically (amplitude) and/or horizontally (time scale). When an area of the Real Time Graph is zoomed that includes the right hand edge of the graph, the zoomed portion will continue to update with fresh readings. When an area of the Real Time Graph is zoomed that does not include the right hand edge, the zoomed portion is static and does not change. Click "Clear Zoom" to display all data points read within the last 45 minutes*.

"Invisible" channels

When a data set has multiple channels with large and small values (for example, a 0-10,000 psi Pressure Sensor and a 0-1 volt signal), the plots of the small values appear missing or barely visible. Use the mouse to create a zoom rectangle along the bottom horizontal border of the graph. The small values can then expand to fill the screen. You can zoom additional times to "fine tune" the bounds of a particular plot or group of plots.

* Time Span of Real Time Graph

Using the recommended Real Time Interval of "2 seconds" selected in the Setup | Other tab, the Real Time Graph will display up to 45 minutes of past readings. If "When Logging" is selected, the maximum time span equals the selected Logging Interval times 1350 (Logging Interval * 1350). For example, if "When Logging" and a Logging Interval of 10 seconds are selected, the Real Time Graph will display a maximum of 3.75 hours (13500 seconds) of past readings.

The following controls are available for the Real Time Graph.

Graph control	Description
Plot channel #'s (check box)	Uncheck to “hide” individual channel plots.
None (button)	Hides all channel plots
All (button)	Displays all channels (the default setting)
Zoom (mouse function)	To Zoom, press and hold the left mouse button and drag the mouse across the graph to create a “Zoom rectangle”. When the mouse button is released, the data within the zoom rectangle will fill the entire graph. The Zoom operation may be repeated any number of times.
Clear Zoom (button)	Resets the graph to display up to the last 45 minutes of readings (or all readings if the Real Time Graph display has been active for less than 45 minutes).
Info (button)	Displays the model, serial #, Log Interval and Logging Mode of the XR5 Data Logger currently displaying real time data.
Copy (button)	Copies the current graph to the system clipboard. The graph can then be pasted into a word processing or graphics program, typically by clicking Edit Paste within the other program.
Print (button)	Prints the current graph to the computer's default printer.

Changing colors and plot widths

Select **Change | Settings** on the real time graph menu to change plot colors, plot widths and other parameters. Please see page 100 for details.

Using the Real Time Graph for an extended duration

Constant use (24/7) of the Real Time Graph is possible, but XR5 battery drain is substantially higher. If the Real Time Graph will be in constant use for extended periods of time (a week or more), and connected sensors are wired to the E or D terminals (drawing power), an external power supply is recommended: Pace PS-9V or equivalent, see page 69 for details.

Real Time | Graph and write to file

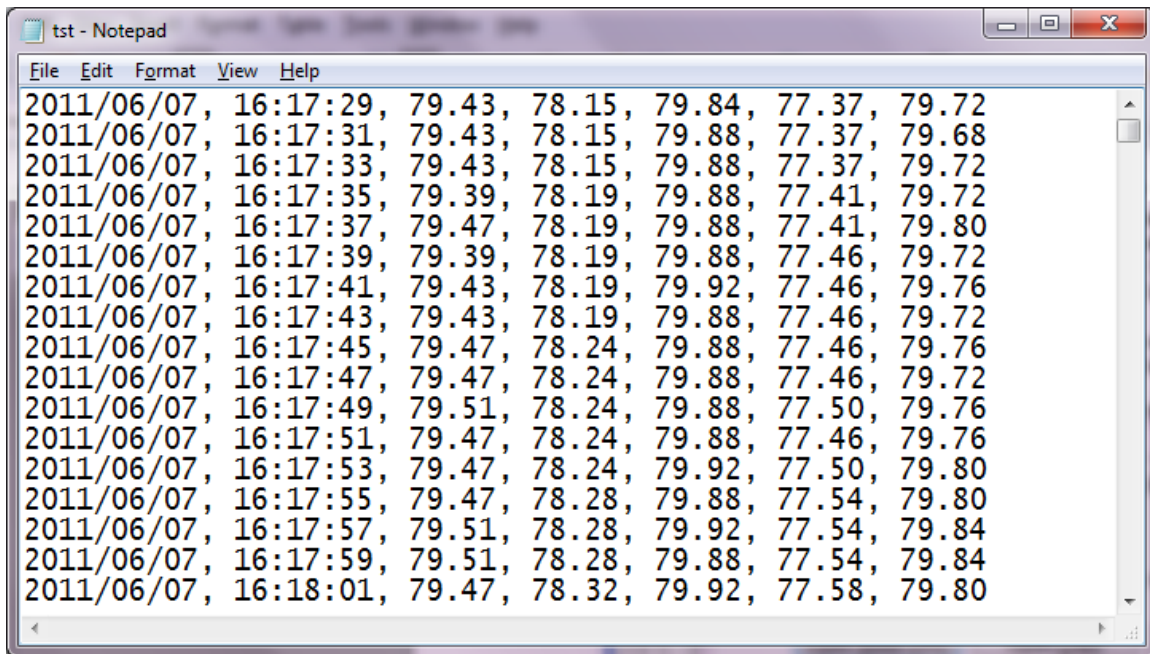
Same as **Real Time | Graph**, but real time display data is simultaneously written to a text file (".txt" or ".csv" file extension, based on the **File | Preferences** selection). You are prompted to enter a file name for the file. A new line of data is written to the text file whenever the Real Time Graph is updated with fresh readings. The file can be opened in a Text Editor like Notepad or a spreadsheet program like Excel.

Please Note:

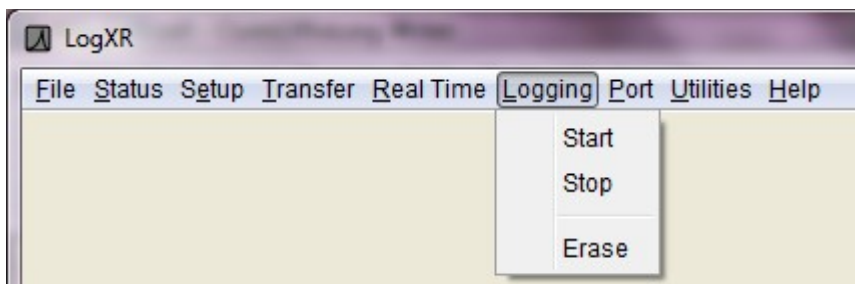
Data files created using **Real Time | Graph and write to file** do not contain header information and are currently unviewable by LogXR Graph (**File | Plot Graph**). They may be graphed using a program such as Excel. If data logging is active while the Real Time Graph is active, logged data may be transferred and graphed by LogXR after exiting Real Time Graph.

The date and time format of the data file uses the following fixed (non-regional) format:
Year / Month / Day Hour : Minute : Second. (Hour field is 24 hour format [0..23]).

Real Time data is not available when Fast Logging (2Hz – 1000Hz) is active.



Typical text file created using Real Time | Graph and write to file



Logging | Start

Commands the XR5 to start logging. This selection has no effect if the XR5 is set to a Preset or Cycle Logging mode, or if the XR5 is currently logging. Logging can also start immediately after a setup is sent (a prompt appears) in some Logging modes. If you elect (at the prompt) to not start logging when a setup is sent, use this selection to start logging at a later time.

Note:

Unlike all other logging modes, **Logging | Start** does not erase previously logged data when Manual (Slow) is the logging mode.

Logging | Stop

Commands the XR5 to stop logging. This is the only menu selection that the XR5 responds when Fast Logging (2Hz – 1000Hz) is active. In all logging modes except Manual (Slow), this selection ends the logging session. In Manual (Slow), the logging session may be started and stopped any number of times as desired (subject to available memory), in which case the XR5 will store multiple data sets.

Logging | Erase

Commands the XR5 to erase all logged readings. Useful only in special cases. For example: at the completion of a logging session in Manual (Slow) mode, after transferring data (**Transfer | Data**), you can use **Logging | Erase** to permanently delete all existing readings and then re-start logging by selecting **Logging | Start**.

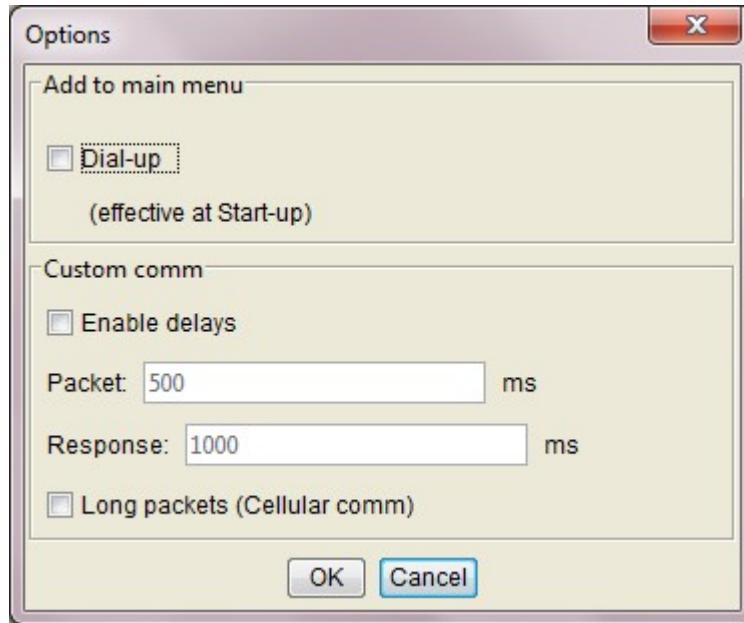
Note:

Sending a Setup to the XR5 is another way to erase all logged readings.

Port | Select

Displays the currently selected Port and a list of available ports. The port list includes all existing com ports, and all Ethernet ports that were previously set up using **Port | Network | New Network Port** (see next page). Select a port for XR5 communication. Click on a port name to select the port.

Port | Options



Add to Main Menu

Enables the inclusion of the Dial-up menu selection in the main LogXR menu. After the checkbox is changed, the main menu will not reflect the change until LogXR is terminated and then re-started.

Dial-up

Documentation for the Dial-up Menu is in the Appendix, beginning on page 101.

Custom comm

Enable Delays (for GSM cellular communication).

Allows the user to specify a custom Packet Delay and Response Timeout. Check only if communicating using a GSM cellular modem.

Packet

We suggest using 2000 ms for cellular communications. If you experience communication failures, increase this value to 3000 or higher (1000ms = 1 second).

Response

We suggest using 2000 ms for cellular communications. If you experience communication failures, increase this value to 3000 or higher (1000ms = 1 second).

Long packets

Checking "Long packets" will result in somewhat faster data transfers if you are using a wireless GSM modem. With very old firmware (1.00.75 or older) communications will fail if "Long Packets" is checked.

Port | Network

Configures XR5 Ethernet communications.

New Network Port

Create an Ethernet port to enable XR5 communications over an Ethernet LAN (Local Area Network).

For XR5 Ethernet communications to function, 1) your computer must be connected to an Ethernet LAN (wired or wireless connection), and 2) a Pace DS100 Ethernet Module is connected to the same LAN (a DS100 connection to a Wireless Access Point is also supported).

The **New Network Port** selection sets up an Ethernet port (socket) on your computer for communicating with a specific DS100 Ethernet Module. At the same time, LogXR Software will configure the DS100 Ethernet Module while it is temporarily connected to a serial port on your computer. Once the DS100 Module has been configured, it is then disconnected from your computer's serial port and connected to the LAN. An XR5 is connected to the DS100 Module using the Pace IC209 Interface Cable, thereby connecting the XR5 to the LAN.

Other computers on the same LAN may also communicate with a previously set up XR5 / DS100 Module. In this case, each user launches LogXR Software and selects **Port | Network | New Network Port** to create an Ethernet port that can access the same XR5 / DS100 Module. In this case, after completing steps 1-4 (below), click OK and then click NO when asked if you want to set up a DS100 Module. Steps 5-10 (below) are omitted, since the DS100 Module connected to the XR5 has already been configured.

The following steps enable an XR5 to communicate over an Ethernet LAN:

1. From LogXR Software, select **Port | Network | New Network Port**.
2. Enter a Port Name. The Port Name identifies the location where you intend to connect the DS100 Module to your LAN. The Port Name will be included in the list of ports displayed when **Port | Select** is chosen from the main menu.
3. Enter a compatible IP Address that does not conflict with any other IP Addresses on your LAN (request an IP Address from the System Administrator at your facility).

If you do not have a system administrator, and have a small LAN of Windows XP computers, an IP Address can be obtained as follows: click Start | Control Panel | Network Connections. Then double click your network connection icon, click the Support tab and write down the IP Address shown (this is the IP address for your computer's network connection). Repeat this for all the computers on your network, and then, looking at all the IP address numbers you have written down, you should find that the first 3 numbers of all the IP Addresses are the same, and the last number is different for each computer. Select an IP address for the DS100 that uses these same first three numbers, and select a different 4th number that is not used by any other computer or device on the LAN.

Later, if additional XR5 / DS100 Modules are added to the LAN, select **Port | Network | New Network Port**, and use these same initial 3 numbers for the first 3 numbers of the IP Address, and select a 4th number that is different from all the other IP Addresses on the LAN.

4. Use the default port number of 2048, or any higher number. We strongly suggest you settle on one port number and use this same number consistently when configuring any additional DS100 Modules.
5. Connect the power adapter to the DS100 Module to power it up.
6. Connect a null modem cable (Pace # IC-ES), from the DS100 Module to your currently selected com port (click **Port | Select** from the main menu to see the currently selected com port).
7. Place the DS100 Module into program mode by gently pushing the end of a paper clip into the small hole on the underside of DS100 (two leds on top of DS100 will blink alternately). Then click OK and then click YES. The DS100 Module is programmed with the selected IP Address and Port Number, and then the DS100 will stop blinking.
8. Detach the IC-ES Cable (this cable is only used to configure a DS100).
9. Connect the DS100 to your LAN using a Cat5 patch cable. This cable is not stocked at Pace, but is widely available in assorted lengths at retail computer supply outlets.
10. Connect an XR5 to the DS100 Module using the Pace IC209 Interface Cable.
11. From LogXR's main menu, click **Port | Select**, and then click the new Ethernet port name and click OK.

Now, all LogXR communications (for example: **Status | Extract**, **Setup | Extract**, **Transfer | Data**, **Real Time | Text**, etc) will be directed to the XR5 / DS100 Module that is selected in **Port | Select**.

Modify Network Port

Modify an exiting Ethernet port created by LogXR. In order to propagate the changes to the associated DS100 Module, the module must be connected to a serial port on your computer using the Pace IC-ES cable, and the same serial port must be selected using **Port | Select** just prior to selecting **Port | Network | Modify Network Port**. For instructions, please refer to **New Network Port** (above), as the procedure to modify an existing Ethernet port is the same as creating a new Ethernet port.

Delete Network Port

Delete an Ethernet port previously configured using LogXR. Select the port you wish to delete.

XR5 Ethernet Communications

Communicating with one or more XR5's over an Ethernet LAN functions the same as communicating over a serial port. The Ethernet port is first selected using **Port | Select**.* All menu commands involving communications operate just as if you were connected to a serial com port.

* Listed Ethernet ports are first created using the **Port | Network | New Network Port** menu selection, detailed on the previous page.

Multiple users, all using LogXR Software, can communicate with multiple (different) XR5's on the same LAN simultaneously. However, an XR5 can only communicate with one user at a time. If two users attempt to communicate with the same XR5, only the first user will be successful. The second user will receive a message that the command was not successful. Once the first user has finished communicating with the XR5, the second user will be able to communicate successfully.

Automated data collection is available using LogXR's Scheduler, see page 48 for details.

Utilities | Verify Data

Use this selection to determine if a readable XR5 data file (".txt" or ".csv" file extension) has been altered or modified from its original state. User comments added to the very end of an XR5 data file (manually edited using a text editor) do not affect the file's data integrity status.

Utilities | Change Unit ID

The Unit ID is a user editable field of up to 8 alphanumeric characters. It can be changed as desired using this menu selection. The Unit ID is intended to function as a unique, user-specified serial number or identifier for each XR5 Data Logger. Each XR5 also receives a unique, unalterable serial number at the factory that is displayed using **Status | Extract** and is also written on the first line of all readable XR5 data files.

Utilities | Change XR5 Password

Use to change the XR5's Password. A two-level Password system is available to prevent unauthorized users from accessing the XR5.

<u>Password Level</u>	<u>Effect</u>
None	No password protection
Setup	Altering the XR5's Setup requires a password. No password is required to transfer data, status, or use the Real Time Display.
System	A password is required in order to access the XR5 in any way.

The password protection level is selected in the Setup, Other tab. The XR5 factory default password (required to change to a new password) is "password". An XR5 password must be 8 characters.

Utilities | Convert Binary File

Converts an XR5 binary file into a readable XR5 data file. Every readable XR5 data file has a corresponding ".binary" file. LogXR automatically creates a readable text file from the binary file when a file transfer is completed. The readable text file has a ".csv" or ".txt" file extension, depending on the **File | Preferences** selection. This text file can be graphed in LogXR (**File | Plot Graph**), or opened in Excel or a text editor (for example: Window's Notepad, or LogXR's **File | View Text File**).

If a text file is ever lost, modified, or corrupted, it can be restored by selecting its associated binary file using **Utilities | Convert Binary File**.

Utilities | Update Firmware

Please see the next page.

Appendix

Updating your XR5's Firmware

Updated XR5 firmware is periodically posted on the Pace website. Firmware updates may include enhancements, bug fixes, or entirely new features. *Updating firmware erases any logged data stored in the XR5, so be sure to transfer existing data to your computer before updating firmware.* Follow these steps to update an XR5's firmware:

Note: If the XR5 was setup to require a password, you will have to disable password protection in order to update the XR5's firmware: select **Setup | Extract**, click the **Other** tab, change **Security Level** to "No Password Protect" and in the setup window click **Send | Send Setup**.

1. Click **Help | About** to view your current LogXR version and then see if a higher version is posted at <http://www.pace-sci.com/data-loggers-xr5.htm>. LogXR Software downloads for Windows, Mac OS X and Linux platforms are linked from this page.
If a higher version of LogXR is posted, we recommend that you first download and install the new version before proceeding.
2. The latest XR5 firmware is posted at <http://www.pace-sci.com/XR5-firmware.htm>. Download the firmware file to your computer.
3. Connect your XR5 to your computer using the IC209 Cable.
4. Select **Utilities | Update Firmware**.
5. Navigate to the XR5 firmware file (.zip) that you downloaded and select it.
6. The firmware update process takes about 2 minutes.

After updating the firmware, you will be prompted to send a new Setup to initialize the XR5, which will synchronize its time clock to your computer's current time. You can select **Setup | Extract** and then (from the Setup screen) **Setup | Send Setup** which will retain the logger's previous setup. Or select **Setup | New** if you do not need the previous setup.

XR5 Data Logger

Screw Terminal Assignments

Q	Regulated 9vdc or 12vdc Power Input (not required). Powers the XR5 if present, otherwise power is supplied from internal batteries. <i>Warning: Voltage levels higher than 14v on terminal Q can damage the XR5. Do not use an unregulated 9vdc or 12vdc Power Supply. Use PACE part # PS-9V (international versions available) to externally power the XR5.</i>
C	Ground
X	Channel X Pulse / Frequency input or External Trigger input (user selectable).
Y	Channel Y Pulse / Frequency input
Z	Channel Z Pulse / Frequency input or External Alarm output (user selectable).
D	2.5 vdc precision excitation
E	5.0 vdc precision excitation
E	5.0 vdc precision excitation (two terminals are provided for 5v excitation).
1	Channel 1 input
C	Ground
2	Channel 2 input
3	Channel 3 input
C	Ground
4	Channel 4 input
5	Channel 5 input
C	Ground
6	Channel 6 input
7	Channel 7 input
C	Ground
8	Channel 8 input

Screw Terminal use

Before inserting a wire into a terminal, use a screwdriver to rotate the terminal screw counter-clockwise until the terminal's clamp cage is fully open.

Use stranded wires if more than one wire must be terminated in a screw terminal. Mixing solid and stranded wires, or using multiple solid wires in a single terminal can result in faulty connections.

LED Functions

GREEN (Logging is Active).	If Slow Logging is active, blinks every 5 seconds. If Fast Logging is active, blinks every second or multiple times per second, depending on the fast logging rate selected. Cycle Logging Slow: Blinks when logging, OFF during Pause time.
RED (Alarm).	If Slow Logging is active, blinks every 5 seconds if an alarm becomes active. Continues blinking until a new Logging session is started (irrespective of alarm status). Disabled (always off) if Fast Logging is active. <i>If external power is connected to the XR5's Q terminal, the Red LED will display steady ON if an alarm is active.</i>

Available models

The XR5-SE Data Logger is available in two basic models:

- XR5-SE Up to 63,642 twelve bit readings.
- XR5-SE-M Up to 260,250 twelve bit readings.

Both models have eight multi-range analog inputs and three pulse inputs. Each analog input (channels 1-8) is user selectable for any of the following:

- Temperature (A.rvt): YSI 10k Thermistor ‘H mix’ or equivalent.
- Temperature (B.rvt): YSI 10k Thermistor ‘B mix’ or equivalent.
- Temperature PT9xx: Pace PT9xx series Temperature Probe.
- Temperature PT510: Pace PT510 or PT520 Platinum RTD (10k ohm element)
- Light Sensor LS100: Pace LS100 Light Sensor
- Switch or Contact: Non-powered contact closure or dc voltage (5v max).
- Resistance: 2-wire resistance (midpoint = 30k ohms, best resolution is from 1k to 300k ohms).

0-2.5v: 0 to 2.5v input, >10Mohm input impedance.

0-5v: 0 to 5v input, >10Mohm input impedance.
 Use for the following Pace sensors:
 All Pressure Sensors
 All AC Current Sensors
 All AC Voltage Sensors
 All DC Current Sensors

TRH-160 Probe: TRH-160 Temperature/Humidity Probe
 TRH-100 Probe: TRH-100 Temperature/Humidity Probe

4-20ma signals: Use the 0-2.5v input selection with a shunt resistor (part# INP-124ohm). When monitoring multiple 4-20ma signals, all shunt resistors connect to a shared common and all 4-20ma transducers should be powered by a single power supply (typically 24vdc).

Additionally, the XR5-SE may be factory equipped with two additional millivolt ranges allowing the direct connection of ground-referenced millivolt signals and thermocouples. See page 93 for details.

Millivolt model numbers (delete -M for standard memory size)	Millivolt Range A		Millivolt Range B	
	range	resolution	range	resolution
XR5-SE-M-20mv*	0-20mv	4.8µV	0-10mv	2.4 µV
XR5-SE-M-50mv*	0-50mv	12µV	0-25mv	6µV
XR5-SE-M-100mv	0-100mv	24µV	0-50mv	12µV
XR5-SE-M-250mv	0-250mv	61µV	0-125mv	30µV
XR5-SE-M-500mv	0-500mv	122µV	0-250mv	61µV
XR5-SE-M-1000mv	0-1000mv	244µV	0-500mv	122µV

* Best models for thermocouples. Please see page 93 for more details.

Specifications

ANALOG INPUTS

Resolution: 12 bits (1 part in 4095, 0.024% F.S.)

Temperature Accuracy:¹ +/- 0.15°C from 10 to 40°C
 +/- 0.3°C from -25 to 85°C

Temperature Resolution:¹ 0.02°C at 25°C (12 bits)
 0.06°C or better from -25 to 75°C

Temperature Range:¹ -40 to 150°C

¹ Temperature accuracy is valid over the full operating temperature range of the XR5 Data Logger (-40 to 60°C) and assumes use of Pace PT9xx series Temperature Probes.

0-5v and 0-2.5v ranges

Accuracy (0-2.5v range): +/- 0.15% F.S. (10-40°C)
 +/- 0.20% F.S. (0-60°C)

Accuracy (0-5v range): +/- 0.35% F.S. (10-40°C)
 +/- 0.40% F.S. (0-60°C)

Repeatability: +/- 0.05% F.S. for <10°C ambient temperature change.

Input impedance: >10Mohm (for all logging modes and when inactive or not logging).

Resistance range

(2 wire resistance)

Resolution at 30k ohms: Better than 0.1% of reading.

Accuracy at 30k ohms: ±0.15% of reading.

Approx. useable range: 100 ohms to 1.5 Mohms.
 (measurements near 30k midpoint have highest resolution)

Optional Millivolt ranges

Accuracy (low range): +/- 0.45% F.S. (10-40°C)
 +/- 0.50% F.S. (0-60°C)

Accuracy (high range): +/- 0.65% F.S. (10-40°C)
 +/- 0.70% F.S. (0-60°C)

Input impedance: >10Mohm (for all logging modes and when inactive or not logging).

Input offset: 5uV max. at 25°C, 10uV max. from -40 to 60°C.

Offset voltage drift: 0.02uV/°C max.

Millivolt resolution: Listed by millivolt range on page 93.

Thermocouple accuracy: See tables starting on page 94.

Switch closure:

Unpowered contact: Open = 100, Closed = 0
 Voltage signal: 2v to 5v = 100, 0v to 1v = 0

PULSE INPUTS

Three Pulse inputs (X, Y and Z) accept voltage pulses or unpowered contact closures. Alternate functions: Ch X: External Trigger, Ch Y: Peak Count (2 second window), Ch Z: Alarm Output. *Pulse Inputs are disabled during Fast Logging (see page 34 for details).*

Pulse Type (selected in setup)	Maximum Rate	Minimum Hold Time	Debounce Time
Mechanical Switch	15 Hz	30ms	30ms
Solid State Switch	900 Hz	0.5ms	0.5ms

Maximum count per Log Interval: 16,777,215

Active edge: Falling edge

Input Type: Schmitt Trigger

Dry contact: Bias voltage (from XR5): 3.3 v
 Current when contact is closed: 3.3 microamps

Number of channels:	11 or 12:	8 analog input channels, 3 pulse input channels; (Millivolt option adds ambient temperature channel)
Logging modes:		Manual, Pre-set, Log on Alarm, Cycle Logging (start time, active period, pause period, stop time), Log on Ext. Trigger, Manual/Wrap, Preset/Wrap. <i>Manual (slow), Log on Alarm, Log on External Trigger and Cycle Logging may have any number of individual data segments, limited only by available memory.</i> <i>Log on Ext. Trigger (Slow) includes a selectable Stop Delay time that causes logging to continue after a Stop trigger occurs, for the duration of the selected Stop Delay time.</i>
Sampling modes:		Standard, Average (1 second internal sampling), Peak (1 second internal sampling), Differential (Ch1-Ch2, Ch3-Ch4, Ch5-Ch6, Ch7-Ch8). <i>Peak and Average sampling are only available when using the following Slow Logging modes: Manual, Preset, Manual/Wrap Preset/Wrap and Cycle.</i>
Memory capacity:	XR5-SE: XR5-SE-M:	up to 63,642 analog readings up to 260,200 analog readings One pulse reading equals two analog readings in memory capacity. <i>LogXR displays the Total Log Time on the Main tab of the Setup screen based on the current Setup.</i>
Data retention:		Logged data and Setup data: Over 100 years with no power.
Logging interval:		Any time interval from 1 second to 24 hours, plus 2 Hz to 1000 Hz for Fast Logging modes. During Fast Logging, Real Time display, and data transfers are not available and pulse count inputs are disabled. <i>Fast Logging above 100 Hz results in reduced channel count (see page 34 for details).</i>
Alarming capabilities:		All eight analog channels have individually adjustable high and low alarm limits. Configurable alarm responses for all slow logging modes include activate Alarm output, dial out to a host computer (modem required), send a descriptive SMS alarm message to a cell phone (GSM modem required). <i>Alarms are disabled for all fast logging modes except 'Log on Alarm'.</i>
Real Time display:		Displays current readings and alarm conditions of all active channels. Updated every 2 seconds or when readings are logged to XR5 memory (selectable). Can be active while any slow logging mode is active with no effect on the logging session.
Real Time write to file:		Logs real time data to a text file every 2 seconds or when readings are logged to XR5 memory (selectable). When active, Real Time display is also active. Can be active while any slow logging mode is active with no effect on the logging session.

- Data transfer: Binary Xmodem transfer, converted to readable text file. Data may be transferred while any Slow Logging mode is active with no effect on the logging session. All data is transferred at 9600 bps.
- Clock accuracy: +/- 1 minute per month at 25°C.
+/- 2.5 minutes per month from -10 to 60°C.
Clock accuracy is also Time Stamp accuracy for all logging modes and logging intervals.
- Battery life: Battery life is mainly dependent on logging rate, channel Type (standard, Average, or Peak), Real Time Mode use, external sensors powered by the D and E terminals and selected excitation time.

LogXR Software displays the "Estimated battery life" on the Main tab based on the current setup and the Estimated Sensor milliamps (if any). See pages 28 and 29 for details.
- Battery type: Lithium, AA size, 3.6 volt; 2 required (Tadiran TL-5903/S or equiv.)
- External power input: Voltage range: 8.0 – 14.0 vdc (9vdc or 12vdc Linear Regulated Supply)
Warning! A voltage higher than 14vdc on the External Power Input may damage the unit.
- Current requirements: Average current for slow logging intervals is approximately 30 microamps (0.030 milliamps) plus periodic excitation current (if any) from the D and E terminals.
- Excitation terminals: E: 5vdc; maximum current: 30 ma. (current limited).

D: 2.5vdc; recommended maximum current: 40 ma.

Power from the excitation terminals is pulsed for the duration of the selected Excitation Time, just prior to logging readings or reading Real Time data. If Fast Logging (2 Hz – 1000 Hz), excitation terminals are continuously powered ON for the duration of the Logging Session.
- Sensor Excitation Time: User selectable for any of the following times:
30ms, 150ms, 1 second, 5 seconds, 10 seconds.

Specifications subject to change without notice.

Battery Replacement

The XR5 uses two AA size, 3.6v lithium batteries. When the XR5’s battery voltage reads below 6.2v, the batteries should be replaced. The battery voltage displays on the Status screen’s Summary tab [**Status | Receive**].

Battery replacement clears the XR5’s time clock. All other configuration settings and logged data are retained after battery replacement. The XR5’s time clock is set to your computer’s time whenever a Setup is sent to the XR5 from LogXR.

1. Remove the 4 screws from the underside of the XR5.
2. Place the unit “right side up” on a flat surface.
3. Starting at the end opposite the round communication jack, carefully lift off the top of the enclosure.
4. Remove the two batteries by pulling each one straight up using thumb and forefinger.
5. Install 2 new batteries (follow the polarity markings on the battery holder).
6. Align one end of the cover on the communication jack, and then bring the opposite end down so that it gently “snaps” over the end of the 20 position terminal block.
7. Re-install the 4 screws – **do not to over-tighten**.
8. **After replacing the batteries, the XR5’s Time Clock must be set by sending a Setup.**

External Power Supply

Pace Scientific offers a regulated 9vdc power supply for the XR5 Data Logger, part # PS-9V.

Wiring:

Color	Function	XR5 Terminal
Black	Ground	‘C’ terminal
White/Black	+9 volts	‘Q’ terminal

The external power voltage displays in the Status Screen’s Summary tab if it is higher than the XR5’s internal battery voltage (see note below). Although not recommended, the XR5 will run on external power if the internal batteries are discharged or not present. When external power is present, the internal batteries are not used. The internal batteries power the XR5 upon loss of external power.

WARNING!

Voltages above 14v on the Q terminal could damage the XR5.

Using an unregulated 9 vdc or 12 vdc power supply may expose the Q terminal to voltages above 14vdc and damage the XR5.

If the XR5 Data Logger is externally powered at all times, its batteries will remain in good condition for 10+ years.

Status screen’s Battery/External Power reading

The XR5’s battery and external power voltage is read hourly and stored in XR5 memory. The Status screen Summary tab displays the higher of these recorded values. From the time external power is initially connected to the XR5, it will be up to 1 hour before this new voltage level is displayed in the Status screen / Summary tab. One exception: The battery and external power voltage is also read and stored in the XR5 whenever a new Setup is sent. Selecting **Status | Extract** immediately after a Setup is sent will display the current Battery or External Power voltage (whichever is higher will be displayed).

Temperature Probes

All [Pace Temperature Probes](#) may be directly connected to the XR5-SE. Using Pace PT9xx Series Temperature Probes, system accuracy is +/-0.15°C and resolution is 0.02°C at 25°C. Additional accuracy and resolution specs are on page 65. See www.pace-sci.com/temperature-xr5.htm for available models.

Thermistor probes which conform to the Pace PT9xx Series resistance vs temperature table may also be used – contact Pace for details. The XR5-SE also accepts Pace PT510 and PT520 Platinum RTD Sensor and industry standard 10k Thermistor Probes (YSI mix H or mix B).

Compatibility

<u>Model</u>	<u>Maximum # of Pace (or compatible) Temperature Probes</u>
XR5-SE	8

Thermocouples

Only XR5-SE models with a Millivolt option support thermocouples. See page 94 for model-specific thermocouple temperature ranges. Thermocouple Types J, K, E, T, R, S, N, B, and C are supported. Functionality is limited to monitoring temperatures either above or below the XR5's ambient temperature.

LogXR Setup

The 'Type' selection in the channel tab must specify the Temperature Probe which will be (or is) connected to the selected channel. See page 39: Setup, "Channel" tab for details.

Thermocouples

For thermocouples, if you wish to monitor thermocouple temperatures below the ambient temperature of the XR5, select a thermocouple type which includes the word "Cold". For reading thermocouple temperatures above the ambient temperature of the XR5, select the thermocouple Type that does not include the word "Cold".

Wiring

All Pace PT9xx and PT5xx series

Connect one lead of the temperature probe to the Channel #. Connect the other lead to a 'C' terminal. Leads are not polarity sensitive.

Thermocouples

Thermocouples are polarity sensitive; if the reading is incorrect, reverse the thermocouple lead connections. Thermocouples can monitor temperatures either above or below the XR5's ambient temperature. See the Thermocouple tables starting on page 94 for thermocouple wiring connections by lead wire color.

Temperature probe recommendations

For monitoring temperatures from -40 to 105°C (-40 to 221°F) Pace [PT9xx series Temperature Probes](#) are recommended for best accuracy. The Pace PT916 Temperature Probe is rated for continuous duty to 120°C (248°F) and intermittent duty to 150°C (302°F).

For higher temperature applications, Pace stocks special RTD sensors:

Pace PT510 sensor: -40 to 200°C (392°F) temperature range.

Pace PT520 sensor: -40 to 260°C (500°F) temperature range.

See www.pace-sci.com/rtd-xr5.htm for details.

For very cold or very hot temperatures, thermocouples are a good choice, but require an XR5-SE Millivolt option (see page 93).

TRH-100 Temperature / RH Probe

The [TRH-100 Temperature / Humidity Probe](#) connects directly to the XR5-SE. Up to four TRH-100 Probes may be connected to the XR5-SE. Accuracy is +/-3% RH and +/-0.15°C at 25°C.

[Identifying a Pace Humidity Probe](#) (see next page).

LogXR Setup

Select Type: 'Temperature PT9xx' on an odd numbered channel (1,3,5,7).

Select Type: 'TRH-100 Humidity Probe' on the channel one higher than the selected temperature channel.

Note: The temperature channel for the RH probe must be odd numbered, and the humidity channel must be exactly one higher.

Examples: Channel 1: Temperature PT9xx, Channel 2: TRH-100 Humidity Probe;
Channel 5: Temperature PT9xx, Channel 6: TRH-100 Humidity Probe;

Wiring (XR5-SE)

Lead	XR5 Terminal	Function
Red	1, 3, 5, or 7	Temperature
Black	C	Ground
Green	See note below	Relative Humidity
White	E	5v Excitation for RH Sensor.

IMPORTANT!

The Red lead (temperature) must be wired to an odd numbered channel, and the Green lead (humidity) must be wired to the channel one higher than the temperature channel.

For example, if the red lead (temperature) is connected to channel 3, the green lead (humidity) must be connected to channel 4.

Scaling Values

In the Channel tab representing the channel you have selected for Humidity, enter the Slope and Offset values listed on the TRH-100 Probe.

Excitation Time

The TRH-100 requires 150ms Excitation time (the Excitation Time is selected in the Setup, Main tab).

Temperature Compensation

LogXR automatically temperature compensates the TRH-100's humidity readings to achieve +/-3% accuracy over the probe's full operating temperature range of -40 to 85 deg. C (-40 to 185 deg. F).

Installation Orientation

In moist environments, the TRH-100 Probe should be mounted with the stainless steel filter pointing down. This will allow any water condensate to drain out of the sensor.

Like most humidity sensors, if condensate forms on the sensor it will output an erroneous reading (typically above 100% RH).

TRH-160 Temperature / RH Probe

Follow the instructions on the previous page to connect a TRH-160 to an XR5-SE Data Logger, except select Type: "TRH-160 Humidity Probe".

Please Note

The TRH-160 Probe is compatible with all XR5 models.

The TRH-160 Probe is not compatible with the Pace XR440 series.

The TRH-100 Probe is compatible with all XR5-SE series and XR440 series models.

Make sure the [Excitation Time](#) is set to 150ms (see page 28)

Identifying older, non-serialized Pace Humidity Probes

The label on the probe's cable displays the probe model number and serial number.

Note:

Older non-serialized probes can be identified by their scaling values. The label on the probe's cable contains two scaling values, a positive value and a negative value. If the positive value is above 100, the probe is a TRH-100. If the positive value is below 100, the probe is a TRH-160.

Pressure Sensors

PACE offers direct-connect Pressure Sensors for XR5 Data Loggers. All require no external power. *Pace Pressure Sensors can read in any pressure scale (psi, bar, kPa, Mpa, etc.).*



P1600 Pressure Sensors

Connect directly to an XR5-SE analog input channel; no external power required. Stainless steel pressure port. Applications include high and low side air conditioning systems, chilled water, hot water, air, gas, oil and steam pressure. Pressure ranges from 0-30 psig to 0-20,000 psig and compound ranges of Vacuum-150 and Vacuum-300 psig. See next page for listing of stocked models.

Maximum number of Pressure Sensors for one XR5-SE:	P1600, P1500, P1000:	8
<i>(due to XR5-SE's maximum</i>	P1520:	7
<i>excitation current of 30 ma at 5v)</i>	P1510:	6

Wiring

P1600, P1510 and some P1500* models

Wire Color	XR5 Terminal	Function
Black	C	Ground
Red	E	Excitation
White	1 – 8*	Pressure Signal (connect to any analog channel 1 - 8)

Wiring for discontinued Pace Pressure Sensors:

P1520

Wire Color	XR5 Terminal	Function
Black	C	Ground
Red	E	Excitation
Green	1 – 8	Pressure Signal

** For P1500 and P1000 models, lead colors determine wiring connections.*

Models with Black, White and Green wires:

Wire Color	XR5 Terminal	Function
Black	C	Ground
White	E	Excitation
Green	1 – 8	Pressure Signal

Models with White, Red, and Yellow wires:

Wire Color	XR5 Terminal	Function
White	C	Ground
Red	E	Excitation
Yellow	1 – 8	Pressure Signal

LogXR Software Setup

Excitation Time*: P1600, P1520, P1000: 30ms
 P1500, P1510: 150ms

* Select in Main tab of Setup screen; see page 28 for details.

Channel Type selection: 0-5v In Setup Screen, click the Channel tab of corresponding channel and select Type: 0-5v.

Scaling Values

Enter the Slope and Offset scaling values from the list below to read pressure in psi (pounds per square inch).

To use different pressure measurement units

Simply convert the slope and offset to the desired measurement units (bar, kPa, etc). Use a web page [calculator](#) or convert the values manually (see page 92 for an example).

Range	Slope	Offset
0 – 5 psig *	1.25	-0.62
0 – 25 psig *	6.25	-3.12
0 – 30 psig	7.5	-3.75
0 – 50 psig	12.5	-6.25
0 – 100 psig	25.0	-12.5
0 – 200 psig	50.0	-25.0
0 – 250 psig	62.5	-31.5
0 – 500 psig	125	-62.5
0 – 1000 psig	250	-125
0 – 1500 psig	375	-187.5
0 – 2000 psig	500	-250
0 – 2500 psig *	625	-312
0 – 3000 psig	750	-375
0 – 5000 psig	1250	-625
0 – 7500 psig	1875	-937.5
0 – 10,000 psig	2500	-1250
0 – 14,500 psig	3626	-1813
0 – 20,000 psig	5000	-2500
Vacuum - 30 psig	11.18	-20.29
Vacuum - 120 psig *	33.75	-31.87
Vacuum - 150 psig	41.18	-35.29
Vacuum - 300 psig	78.68	-54.04
Vacuum - 600 psig *	153.75	-91.87

* Range no longer in production.

Stocked ranges

Model	Range (psig)	Model	Range (psig)
P1600-30	0 - 30	P1600-3000	0 - 3000
P1600-50	0 - 50	P1600-5000	0 - 5000
P1600-100	0 - 100	P1600-7500	0 - 7500
P1600-200	0 - 200	P1600-10000	0 - 10,000
P1600-500	0 - 500	P1600-14500	0 - 14,504
P1600-1000	0 - 1000	P1600-Vac-30	Vacuum - 30
P1600-1500	0 - 1500	P1600-Vac-150	Vacuum - 150
P1600-3000	0 - 2000	P1600-Vac-300	Vacuum - 300

P300 Pressure Sensors

For indoor air applications including Lab/Clean Room Pressurization, Filter Differential Pressure, Fan Static Pressure, Absolute Pressure and Barometric Pressure.



Pressure media: dry air and inert gases.

See www.pace-sci.com/low-pressure-xr5.htm for complete specifications. See page 115 for listing of available models.

Compatibility

Model	Maximum # of Pace P300 Sensors, when powered by an XR5-SE
XR5-SE	7: Psi and Barometric models 5: Inch H2O models:

Wiring

Lead Color	XR5 Terminal	Function
Black	C	Ground
White	E	Excitation
Green	1 – 8	Pressure Signal (connect to any analog channel 1 - 8)

LogXR Software Setup

Excitation Time: 30ms Select from Main tab of Setup screen; see page 28 for details.

Channel Type selection: 0-5v In the Setup screen, click the Channel tab of the corresponding channel and select Type: 0-5v.

Scaling Values

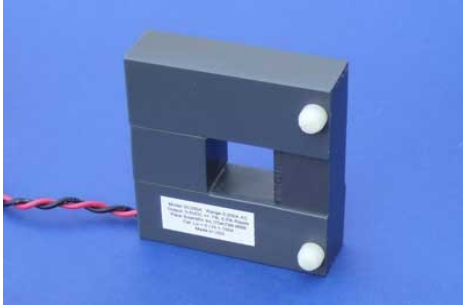
Enter the Slope and Offset scaling values from the list below.

To use different pressure measurement units

Simply convert the slope and offset to the desired measurement units (bar, kPa, etc). Use a web page [calculator](#), or convert the values manually (see page 92 for an example).

Model	Pressure Range	Slope	Offset
P300	±0.4 inch H2O diff. (±1mbar)		
	To read in inch H2O	0.2	-0.45
	To read in millibar	0.5	-1.12
	0 - 1 inch H2O gage	0.25	-0.16
	0 - 5 inch H2O gage	1.25	-0.31
	0 - 10 inch H2O gage	2.5	-0.62
	0 - 30 inch H2O gage	7.5	-1.87
	± 1 inch H2O differential	0.5	-1.12
	± 5 inch H2O differential	2.5	-5.62
	± 10 inch H2O differential	5.0	-11.25
	± 30 inch H2O differential	15.0	-33.75
	0 - 1 psig	0.22	-0.06
	0 - 5 psig	1.11	-0.28
	0 - 15 psig or psia	3.33	-0.83
	0 - 30 psig or psia	6.67	-1.67
	Barometric (600 - 1100 millibar)		
	To read in millibar:	125	569 (range: 600 – 1100 millibar)
	To read in inHg:	3.36	16.8 (range: 17.72 - 32.48 inHg)

AC Current Sensors



Connect directly to an XR5 input channel; no external power required. Self powered, split core design in a rugged plastic housing.

See www.pace-sci.com/ac-current-xr5.htm for complete specifications.

Maximum # Pace AC Current Sensors (XR5-SE): 8

Wiring

Lead Color	XR5 Terminal	Function
Black	C	Ground
Red	1 – 8	Signal (connect to any analog channel 1 - 8)

LogXR Software Setup

Pace Current Sensors may be connected to either 0-5v input or a 0-2.5v input. Using a 0-2.5v input causes the AC amps full-scale range to be reduced by 1/2.

Enter the Slope and Offset scaling values listed below.

Using a 0-2.5v input:*

Model	Range (ac amps)	Slope	Offset	Resolution
SC100A	0-50	20	0	0.01 amps
SC200A	0-100	40	0	0.02 amps
SC500A	0-250	100	0	0.06 amps
SC1500A	0-750	300	0	0.18 amps

Using a 0-5v input:*

Model	Range (ac amps)	Slope	Offset	Resolution
SC100A	0-100	20	0	0.02 amps
SC200A	0-200	40	0	0.05 amps
SC500A	0-500	100	0	0.12 amps
SC1500A	0-1500	300	0	0.36 amps

*Channel input range is selected via the Type selection on the individual Channel tab of the Setup screen.

DC Current Sensors



Connect directly to an XR5 input channel; no external power required.
Rugged, epoxy potted sensor.

See www.pace-sci.com/dc-current-xr5.htm for complete specifications.

Compatibility

The XR5-SE can power up to two Pace DC Current Sensors (30ma of 5v power is available from the XR5-SE's E terminal; Pace DC Current Sensors consume up to 13ma)

Wiring

Lead Color	XR5 Terminal	Function
Black	C	Ground
White	E	5v power
Green	1 – 8	Signal (connect to any analog channel 1 - 8)

LogXR Software Setup

Pace DC Current Sensor connects to a Type: 0-5v input.

Enter the Slope and Offset scaling values listed below.

Model	Range (dc amps)	Slope	Offset	Resolution
DC05A	±5	5.41	-13.51	0.007 amps
DC20A	±20	10	-25	0.01 amps
DC50A	±50	25	-62.5	0.03 amps
DC100A	±100	50	-125	0.06 amps
DC150A	±150	75	-187	0.09 amps

Excitation Time: 30 ms (see page 28 for details)

AC Voltage Sensors

Connects directly to an XR5 input channel; no external power required. Self powered design in a rugged plastic housing.

See www.pace-sci.com/ac-voltage-XR5.htm for complete specifications.

WARNING - SHOCK HAZARD!! - Disconnect AC Power BEFORE connecting sensor to AC Voltage Source.

IMPORTANT! AC Voltage Sensor(s) must be mounted in a box, panel or suitable enclosure.



Compatibility

Model	Maximum # of AC Voltage Sensors
XR5-SE	8

Wiring

Connect the AC Voltage Sensor to any analog input channel (1 – 8). Follow the wiring instructions printed on sensor.

Special notes for SV600 AC Voltage Sensor:

The SV600 AC Voltage Sensor must be wired to the included potential transformer. Follow the wiring diagram on the sensor. Sensor and transformer must be mounted in a box or suitable enclosure.

IMPORTANT!

The potential transformer's serial number must match the serial number on the AC Voltage Sensor. The transformer and sensor are calibrated as a pair.

Once wired, the potential transformer's input leads can be connected to AC voltages within the range of 0 to 600vac.

LogXR Software Setup

In the LogXR Setup screen, select the channel the sensor is connected to, and select the 0-5V range (Type selection).

Enter the Slope and Offset scaling values listed below.

Model	Range (ac volts)	Slope	Offset	Resolution	XR5 input
SV300	0-300	60	0	0.07 volt	0-5v
SV600	0-600	120	0	0.15 volt	0-5v

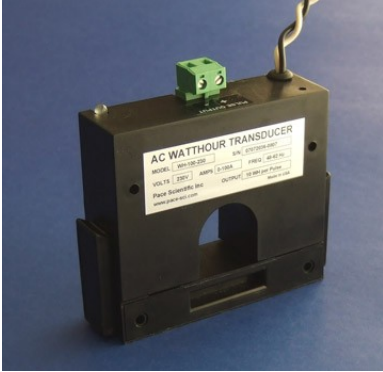
Pace AC Voltage Sensors may alternately be connected to an XR5 0-2.5v input.

Model	Range (ac volts)	Slope	Offset	Resolution	XR5 input
SV300	0-150	60	0	0.04 volt	0-2.5v
SV600	0-300	120	0	0.08 volt	0-2.5v

WH Series Watt Hour Sensors

Note: The WH series has been discontinued. See Pace WNB series WattHour Sensors at www.pace-sci.com/watthour-xr5.htm

Setup instructions for the WH Series WattHour Sensors follow below.



WH series WattHour Sensor

The WH series Watt Hour Sensors are single phase, bidirectional transducers with a pulse output.

Compatibility

Up to 3 WH series WattHour Sensors can connect to any model XR5 Data Logger.

Wiring

- AC Voltage: Connect the White and Black wires to the AC voltage: Black to Line, White to Neutral (or Line, if AC voltage is Line to Line).
- AC Current: Route a single AC current conductor through the Watt Hour Sensor: Temporarily remove one side of the Watt Hour Sensor (via the side latches) in order to route the ac current conductor through the Watt Hour Sensor without disconnecting the ac conductor. The Red polarity dot beside the conductor hole should ideally face the incoming line (away from the load). This will cause the LED to be shine Green when the transducer is operating. However, operating the the reverse direction (LED = Red) will cause no loss of accuracy, but will cause the XR5 to consume slightly more power.
- Output signal: Connect the Pulse Output terminal block* as follows:
 "+" terminal to XR5 pulse input (terminal X, Y or Z).
 "-" terminal to XR5 "C" terminal.
 *For units that have a red/black twisted pair instead of a terminal block:
 Connect the red lead to XR5 pulse input (terminal X, Y or Z).
 Connect the black lead to XR5 "C" terminal.

LogXR Software Setup

Display the LogXR Setup Screen (see page 26 for details)

Click the Pulse tab, then click the channel wired to the WH sensor to ON.
 Set the following:

Type: 'Mechanical Switch'
 Frequency: Not checked

Slope:	For data in Watt Hours:	10
	For data in kWh:	0.1
Offset:		0

Operating / Troubleshooting Details

WH series Watt Hour Sensors output 1 pulse per 10 Watt Hours. When the LED blinks OFF, the Watt Hour Sensor is outputting one 200 ms pulse (representing 10 Watt Hours).

Real Time mode (LogXR Software) displays pulse inputs as the "raw" accumulated pulse count which resets to 0 at the beginning of each log interval.

If connected correctly for operation in the forward power direction, the WH Sensor's LED will shine Green when power is ON.

If the LED is Red, and the application is not bi-directional (see below), either reverse the AC voltage connections (Black and White wires), or reverse the direction of the conductor through the Watt Hour Sensor. Although no loss of accuracy occurs in the reverse direction (Red LED), the XR5 consumes more battery power (about 15% more) when the sensor is operating in the Reverse direction.

Exception:

If the WH Sensor is being used in a Bi-direction application, the LED should be RED whenever current is flowing in the reverse power direction (see below).

Bi-Directional Power Logging

Note:

Pace Scientific's new Multi-phase WattHour Sensors support bi-directional power logging for net metering applications. Please contact Pace for details.

Method for logging bi-directional power with WH Series WattHour Sensors

Using WH series Sensors, logging the direction of power flow is possible by utilizing an analog input. Connect a "jumper wire" from the WH sensor's pulse output connection (Channel X, Y or Z) to an XR5-SE analog channel (1 - 8).

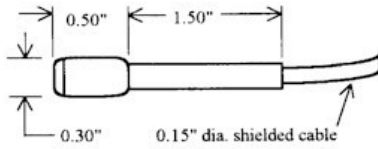
Set the analog channel as follows:

Type:	0-5v
Mode:	Average
Slope:	1
Offset:	0

When power is flowing in the forward direction (LED = Green), the analog input (averaged) will typically be above 2v. When power is flowing in the reverse direction (LED = Red), the analog input (averaged) will typically be under 1v. This is because in the forward power direction, the WH sensor's pulse output is normally high (about 3v), and in the reverse power direction, the WH sensor's pulse output is normally low (about 0v).

At the WH Sensor's highest pulse rate, the analog values logged for forward and reverse power will be closer to each other, but the analog value for forward power will always be higher than the value for reverse power.

LS-100 Light Sensor



The [LS-100 Light Sensor](#) connects directly to any XR5 Data Logger input channel. No external power is required. The sensor features a wide dynamic range and low cost. It is not designed for applications that require precise light readings. A typical application would be logging when room lighting is turned ON and OFF. For logging solar irradiance, we recommend the Pace [SRS-100 Solar Radiation Sensor](#).

See www.pace-sci.com/light-xr5.htm for complete specifications.

Compatibility

Model	Maximum # of Pace LS-100 Light Sensors
XR5-SE	8

LogXR Setup

Select "Light Sensor LS-100" for the 'Type' selection of the particular channel that will be connected to the Light Sensor. See page 39: Setup, "Channel" tab for details. Real time and logged readings are in units of footcandles.

Wiring

Connect one lead of the Light Sensor to the Channel #. Connect the other lead to a 'C' terminal.

Pace Sensors with separate Manuals:

- EC Series Soil Moisture Sensors
- RS-100 Rainfall Sensor
- SRS-100 Solar Radiation Sensor
- WSD-100 Wind Speed and Direction Sensor

Manuals for these sensors may be downloaded from the Internet (links below).

Pace Sensors for the XR5-SE not included in this manual	
Sensor Manual (pdf file)	Web page
EC5 / EC10 / EC20 Soil Moisture Sensors	www.pace-sci.com/soil-moisture-xr5.htm
RS-100 Rainfall Sensor	www.pace-sci.com/rainfall.htm
SRS-100 Solar Radiation Sensor	www.pace-sci.com/solar-radiation-xr5.htm
WSD-100 Wind Speed and Direction Sensor	www.pace-sci.com/wind-speed.htm

A web page listing all Pace XR5 Sensors: www.pace-sci.com/sensors-xr5.htm

Contact Closures

Any XR5 analog input can be used to log the state of a relay, switch, or contact closure. The contact must be unpowered, and not wired to anything else. An unused, isolated contact in a multi-pole switch or relay can be used.

Compatibility

<u>Model</u>	<u>Max # of contact closures</u>
XR5 (any model)	8

Wiring

Connect two wires to log a contact closure:

1. Connect one wire from one side of the contact closure to an XR5 "C" terminal.
2. Connect one wire from the other side of the contact closure to an unused analog terminal (any terminal number 1 - 8).

LogXR Software Setup

Display the LogXR Setup Screen (see page 26 for details)

Click the Channel tab number the contact closure is wired to.
Click the Channel button to ON.

Set the following:

Type: 'Switch or Contact Closure'
Mode: (see below)

Mode selection:

Standard: Contact state is sampled and stored at the selected Log Interval.
Logged Data will display as 0.0 if the contact is closed.
Logged Data will display as 100.0 if the contact is open.

Average: Contact state is sampled and added to an accumulator every one second. Data is stored at the selected Log Interval as the percentage of time that the contact was open, with 1 second resolution.

For example, if the selected Log Interval is 1 hour, and the contact was open for a total of 15 minutes during the last hour, the data for that hour will be stored as 25.0 (25.0%)

Using contact Note:

Up to 3 contact closures can be connected to the XR5's pulse inputs. This would log the "pulse count", the number of times during each log interval that the contact opened and closed (the pulse count is incremented when the contact closes). Do not wire a contact closure to a pulse input if you desire to know the time the contact changes state. To log when a contact changes state, it must be wired to an XR5 analog input and the Type set to "Switch or Contact Closure" as explained from the beginning of this page.

Additional Voltage Ranges

External Scaling Cables (below) are available to implement additional ranges. Optional millivolt ranges are also available, see page 93 for details.

External Scaling Cables

Pace offers external 'INP Cables' which provide alternate input ranges for the XR5-SE. Each INP Cable (except the 4-20ma cable) has an input impedance of approximately 100k ohms and each can implement multiple additional voltage ranges as detailed in the following table:

Part #	For input range of	Select channel Type	Connect black wire to XR5 Terminal #	Enter scaling values:	
				Slope	Offset
INP/2	+/-2.5vdc	0-2.5v	D	2	-2.5
	+/-5vdc	0-5v	E	2	-5.0
	0-10vdc	0-5v	C	2	0
	-2.5 to 7.5vdc	0-5v	D	2	-2.5
INP/4	0-10vdc	0-2.5v	C	4	0
	0-20vdc	0-5v	C	4	0
	-7.5 to 12.5vdc	0-5v	D	4	-7.5
INP/6	0-15vdc	0-2.5v	C	6	0
	0-30vdc	0-5v	C	6	0
	-12.5 to 17.5vdc	0-5v	D	6	-12.5
INP/12	0-30vdc	0-2.5v	C	12	0
	0-60vdc	0-5v	C	12	0
	-27.5 to 32.5vdc	0-5v	D	12	-27.5
INP/24	0-60vdc	0-2.5v	C	24.05	0
	-57.6 to 62.6vdc	0-5v	D	24.05	-57.62
INP-124	4-20ma	0-2.5v	See pages 87 and 88 for current loop wiring and Slope / Offset values.		

Wiring

Wire color

Yellow	Connect to voltage to be logged
Green	Connect to an XR5 input channel (1,2,3,4,5,6,7 or 8)
Black	see fourth column above

Additional wire for all Scaling Cables

Connect a wire from the monitored signal's common (or signal return) to an XR5 'C' terminal.

For 4-20ma current loops

Please see page 89 for wiring the INP-124 (for 4-20ma current loop applications).

LogXR Software Setup

Select the Channel tab the scaling cable's green wire is connected to. Select the voltage range Type from the third column of the above table, and enter the Slope and Offset scaling values listed. For 4-20ma current loops, please see pages 87 and 88.

Potentiometer Applications

The XR5 Data Logger can log analog readings from potentiometric devices. Potentiometric devices include wind direction vanes, inclinometers and linear displacement sensors.

Potentiometers less than 1k ohms may be used but are not recommended. The D Terminal can supply a maximum of 50ma. A 1k ohm potentiometer will draw 2.5ma from the D Terminal. Higher resistance potentiometers (10k - 100k) will draw much less power and extend the XR5's battery life.

Important: Wires should be kept as short as possible. The D terminal is the internal 2.5v reference for the XR5's A/D converter. Noise conducted on wires connected to the D terminal could result in reading instability and measurement errors.

Compatibility

Model	Maximum # of Potentiometric Sensors (1k or higher resistance)
XR5-SE	8

LogXR Software Setup

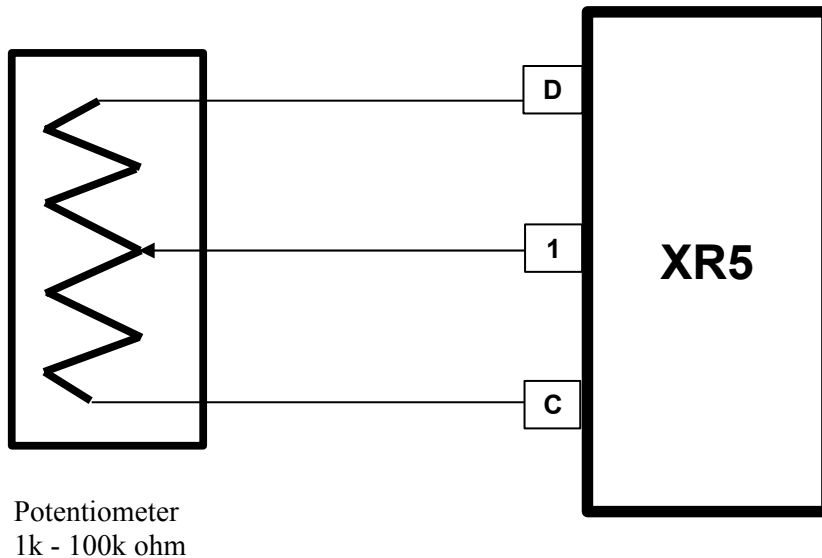
Use a 0-2.5v input range for the channel that will log the potentiometer.

Scaling

Depends on the application. To log potentiometer readings as % of full scale [0 to 100] use a Slope of 40 and an Offset of 0.

Wiring

Drawing shows potentiometer connected to channel 1, but any channel can be used.



Pulse Output Sensors

All XR5 SE Data Loggers have 3 pulse inputs. Select Mechanical Switch or Solid State Switch depending on the characteristics of the pulse.

Mechanical Switch:	Maximum Rate	15 Hz
	Debounce & Min. Hold Time	30 ms
Solid State Switch:	Maximum Rate	900 Hz
	Debounce & Min. Hold Time	0.5 ms

Pulses can originate from a “dry” unpowered contact closure, or an active voltage signal.

Active Voltage Signal:	Positive amplitude range:	2.3 to 18 v
	Positive-going input threshold:	2.3 v
	Negative-going input threshold	-18 to 0.8 v
Unpowered Contact:	Bias (pull-up) voltage	3.3 v
	Bias resistance	1 Mohm

Pulse data can be presented as total accumulated pulses per log interval or as average Frequency over the log interval (check the Frequency box in the Setup screens Pulse tab).

Pulse data can be scaled to read in any unit of measure by editing the Slope and Offset scaling fields. The actual pulse count is scaled as follows:

$$\text{Pulse channel reading} = (\text{pulse count} * \text{Slope}) + \text{Offset}.$$

If Slope = 1 and Offset = 0, then the Pulse channel reading will be the "raw" pulse count.

Guidelines for compatible devices:

For remote installations, a device which employs an unpowered magnetic reed switch to generate pulses is preferred because no power is required. A magnetic reed switch is used in tipping bucket rain gages and many gas and water meters. A device which outputs an electrical pulse is compatible if the pulse signal (with respect to ground) is between +/-18 volts.

Non-PACE Sensor Requirements

The XR5 Data Logger will accept a variety of sensors from other manufacturers. Sensors must meet the following requirements:

Sensors powered by XR5's internal batteries

Sensors powered with 5v

XR5 Excitation terminal	E
Maximum current draw	30 ma (total draw for all sensors powered from the E terminals)
Maximum warm-up time	10 seconds
Signal Output	A voltage within the range of 0-5vdc. Examples: 0-1v, 0.5-4.5v, 0-5v.
Output Signal Load	10M for XR5 0-5v input range. 10M for XR5 0-2.5v input range.

Sensors powered with 2.5v

XR5 Excitation terminal	D
Maximum current draw	40 ma (total draw for all sensors powered from the D and E terminals)
Maximum warm-up time	10 seconds
Signal Output	A voltage within the range of 0-2.5vdc. Examples: 0-1v, 1-2v, 0-2.5v
Output Signal Loading	10M for XR5 0-5v input range. 10M for XR5 0-2.5v input range.

See the next page for more details and scaling instructions for voltage output sensors.

Voltage output sensors, externally powered

Excitation voltage	Any, user provides necessary power supply.
Maximum current draw	Any, user provides necessary power supply.
Warm-up time	Any, if power is applied to sensor for duration of logging session.
Signal Output	A voltage output within the selected input range. Examples for 0-5v input: 1 to 3v; 0.5 to 4.5v, 0.25 to 4.75v. Examples for 0-2.5v input: 0-1v, 0-2.5v.
Output Signal Loading	10M ohm for 0-5v or 0-2.5v input range.

See the next page for more details and scaling instructions for voltage output sensors.

4-20ma sensors, externally powered

Excitation voltage	User provides current loop power supply (typically 24vdc).
Warm-up time	Any, if power is applied to sensor for duration of logging session.
Signal Output	4-20ma
Output Signal Load	124 ohms (XR5 0-2.5v input range using PACE # INP-124 resistor).

See pages 87-88 for more details and scaling instructions for 4-20ma sensors.

IMPORTANT:

XR5 inputs are not isolated; multiple 4-20ma signals share a common ground. In some cases, 4-20ma isolators may be required.

Non-Pace sensors, continued

Sensors with a voltage output

The XR5 is compatible with many non-Pace voltage-output sensors. However, in most cases, the user will have to provide an external power source to power the sensor. To determine if your non-Pace sensor can be powered by the XR5, see "Sensors powered by XR5's internal batteries" on the previous page.

Compatible sensors

Sensors with an output voltage that ranges from within 0-1Vdc to 0-5Vdc are a good fit for the XR5-SE and can be directly connected to any analog channel.

Sensors that output a ground referenced millivolt signal are compatible with an XR5-SE equipped with a matching millivolt range (millivolt option). For example: Thermocouples used in an application where one lead of each thermocouple is connected to a shared ground.

Incompatible Sensors

Most sensors with a differential millivolt signal (such as a strain gage or a millivolt output pressure sensor) are not compatible with the XR5, even if it is equipped with a millivolt option. This is because the XR5's inputs are all single ended; each signal's return must be connected to the XR5's shared common ground. Sensors that output a differential millivolt signal and require external power (like a strain gage or millivolt output pressure sensor) have two output leads, and each has a voltage potential of approximately 1/2 of the supply voltage. Connecting one of these output leads to ground will short out the signal.

Scaling the Sensor

In the XR5's Setup screen, click on the Channel tab that the sensor is connected to. If the sensor's maximum output voltage is 2.5v or less, select "0-2.5v" for the Type. Otherwise, if the sensor's maximum output voltage is 5v or less, select "0-5v" for the Type. If the output voltage can go above 5v (for example, 0-10v), a Pace Scaling Cable is required, see page 84 for details.

Click "Calculate Slope/Offset" and then click "Linear Transducer".

Enter the Minimum DC Voltage and Maximum DC Voltage of the sensor's output signal. For example, if the sensor has an output signal of 0.5v to 4.5v, enter 0.5 for the Minimum DC Voltage, and enter 4.5 for the Maximum DC Voltage.

Enter the Minimum and Maximum Reading of the sensor. For example, if the sensor is a pressure transducer that reads from 0-300 psi, enter 0 for the Minimum Reading and 300 for the Maximum Reading.

Click "Calculate" and the Slope and Offset values will appear that correspond to the entered values. Then click "OK".

Current Loop Applications

The XR5 Data Logger's 0-2.5v input can be configured to directly monitor a current loop if a Pace INP-124 resistor is wired to the XR5's terminal block.

PACE offers a precision, low temperature coefficient, 124 ohm resistor for current loop applications; part number INP-124.

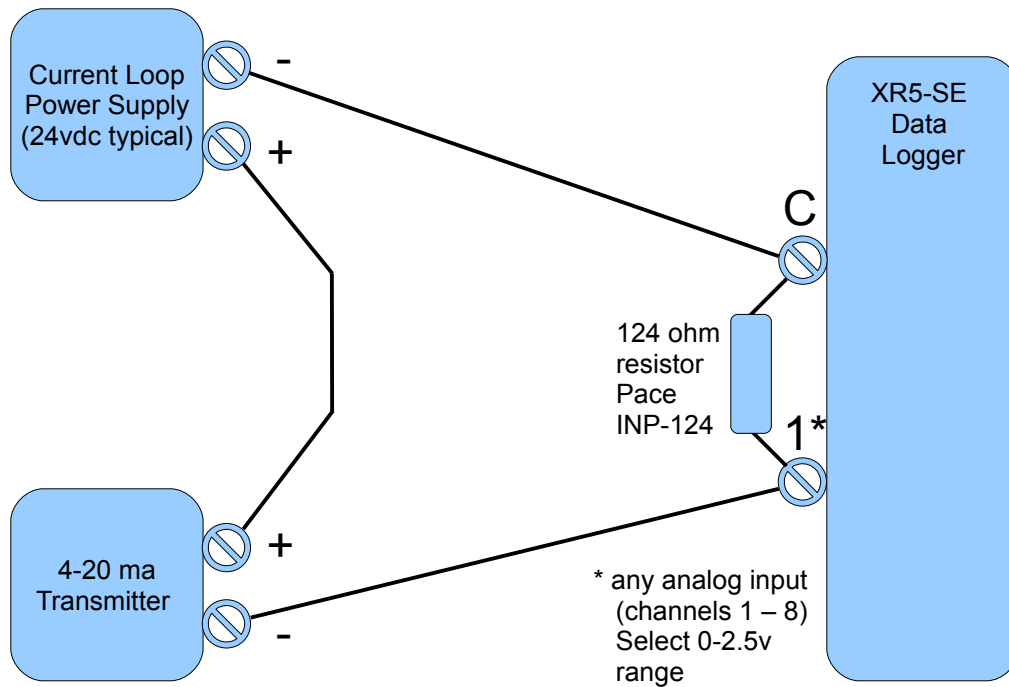
CAUTION

XR5 inputs are not isolated; all inputs share a common ground, which is also the XR5's RS232 ground. The Data Logger's 'C' terminal should be wired to the negative terminal of the Current Loop power supply. If this cannot be done, do not communicate with the XR5 using a grounded PC. If you must communicate to the XR5 using a grounded PC and the negative terminal of the current loop power supply is not at earth ground, use an RS232 isolator between your grounded PC and the XR5. Call Pace technical support for a recommended model.

Compatibility

Model	Maximum # of Current Loops
XR5-SE	8

Wiring



Multiple Current Loops

Logging multiple current loops with an XR5 is possible, provided all 4-20ma transmitters share a common Loop power supply. The same cautions detailed in the paragraph above apply.

In applications with multiple Current Loop power supplies, or transmitters having "active" 4-20ma signals (no Loop Power supply is used), adding one or more loop isolators (not stocked at Pace) may be required. For more details and assistance, please contact Pace technical support.

LogXR Software Setup

In the Channel tab Select Type: 0-2.5v.

Scaling

Click 'Calculate Slope/Offset'. Then click 'Current Loop'. The following screen appears.

To scale the 4-20ma transducer to the desired engineering units, enter the transducer reading that represents a 4ma output in "Low Reading:", and enter the transducer reading that represents a 20ma output in "High Reading".

'Resistor Ohms' is set to 124 and assumes the use of a Pace precision resistor (# INP-124).

Using an alternate Resistor

If you are using a non-Pace resistor, enter the actual resistance in the Resistor Ohms box. For best resolution, we recommend using a resistor between 100 and 125 ohms.

WARNING

Using a resistor above 125 ohms with a 0-2.5v input range will result in the upper range of a 4-20ma transducer being clipped and logged as a lower value.

Click 'Calculate', and the Slope and Offset values are displayed. Then click 'OK'.

ES-1 External Switch

The ES-1 is a miniature isolated solid state switch designed to reduce the power requirement for a current loop powered by a battery. The ES-1 is wired in series with the current loop. Control wires from the ES-1 connect to the XR5's C and E terminals. In this way the external battery (the current loop power supply) is switched on only for the duration of the XR5's selected Excitation Time (powering the current loop and up to eight 4-20ma transducers). When the selected Excitation Time ends, the ES-1 switches off the current loop. With the ES-1, readings can be logged from 4-20 ma transmitters for extended periods of time using a relatively small external battery to power the loop.

The table below shows some examples of how the life of a battery powering a current loop can be extended using the ES-1.

Selected Log Interval	Selected Excitation Time	Loop Battery Life extended
5 seconds	5 seconds	None (always ON)
1 minute	5 seconds	12 times
5 minutes	5 seconds	60 times
15 minutes	5 seconds	900 times
1 hour	5 seconds	3,600 times

The above table does not account for inrush current that may occur each time the ES-1 switches loop power on. Inrush current will vary depending the 4-20 ma transducer's internal circuitry. Inrush current typically occurs in the first 5 to 20 milliseconds that power is applied to a transducer, and may be 4 to 10 times higher than its "normal" state. Inrush will be a more significant factor with shorter excitation times (30 ms or 150 ms), and should not significantly reduce the "Loop Battery Life" shown in the above table for excitation times of 5 seconds or longer.

Using LogXR Software, the Excitation Time selected should satisfy the 4-20ma transducer's "warm up time" specification. For example, if two transducers are to be powered by the loop, and one has a 1 sec warm-up specification and the other requires a 2 second warm up time, select an Excitation Time of 2 seconds.

Wiring

Yellow wires:

The two yellow wires connect "in series" at a place in the loop that is common to all transducers. For example, between the C terminal of the XR5 and the "-" terminal of the Loop Power Supply. In other words, remove the wire that goes from the "-" terminal of the Loop Power Supply to the "C" terminal of the XR5. Then connect one Yellow wire from the ES-1 to the "-" terminal of the Loop Power Supply, and connect the other Yellow wire to a "C" terminal of the XR5.

The two yellow wires are connected to each side of a bi-directional SPST switch inside the ES-1.

Black wire: Connect to an XR5 "C" terminal (ES-1 control return)

White wire: Connect to an XR5 "E" terminal (ES-1 control)

The ES-1 incorporates a Resettable "Fuse" that opens if the current through the switch exceeds about 500 ma. After the condition that caused the excessive current is removed, the fuse will automatically reset, allowing the ES-1 to function normally.

Using a different Pressure Scale

To convert a pressure sensor to read in a different pressure unit, simply convert the slope and offset values from the existing pressure scale to the new pressure scale.

Click [here](#)* for a pressure converter on the Pace website which will provide the slope and offset values for a different unit of pressure.

If an Internet connection is not available, and you have a pressure conversion table or reference, you can do the conversion manually. For example:

Convert a P1600-200 Pressure Sensor scaled for psi to read in kPa (kilopascal).

The scaling values listed in this manual for the P1600-200 for psi:

Slope = 50.0

Offset = -25.0

Convert these values from psi to kPa using a pressure converter* or a pressure conversion table:

50.0 psi = 344.74 kPa

-25.0 psi = -172.37 kPa

Use the following scaling to read the P1500-200 in kPa:

Slope = 344.74

Offset = -172.37

* A web-based pressure converter is available at www.pace-sci.com/pressure-converter.htm

Millivolt / Thermocouple Option

The XR5-SE may be factory-configured with one of six millivolt options. Each millivolt option adds two selectable millivolt ranges to each analog input, compatible with ground-referenced millivolt signals. All existing XR5-SE features are retained.

Model number (also applies to -M models)	Millivolt Range A		Millivolt Range B	
	range	resolution	range	resolution
XR5-SE-20mv	0-20mv	4.8 μ V	0-10mv	2.4 μ V
XR5-SE-50mv	0-50mv	12 μ V	0-25mv	6 μ V
XR5-SE-100mv	0-100mv	24 μ V	0-50mv	12 μ V
XR5-SE-250mv	0-250mv	61 μ V	0-125mv	30 μ V
XR5-SE-500mv	0-500mv	122 μ V	0-250mv	61 μ V
XR5-SE-1000mv	0-1000mv	244 μ V	0-500mv	122 μ V

For each analog channel, the millivolt ranges may be mixed and matched along with the XR5's existing range selections and input types. An on-board precision thermistor sensor provides cold junction compensation for thermocouples, and can also be used to log ambient temperature (as a 9th analog input). LogXR Software supports thermocouple Types J, K, N, E, T, S, R, B and C.

Compatible millivolt signals

The XR5-SE's millivolt ranges are suitable for ground referenced uni-polar millivolt signals, thermocouples, pyranometers, and other millivolt signals that can have a grounded return. Millivolt signals connected to the XR5 have one lead connected to XR5-SE common (ground).

Not suitable for Strain Gages

XR5-SE's millivolt ranges are not suitable for monitoring strain gages or other bridge type millivolt sensors. Bridge type sensors require a differential input.

Thermocouple temperature range limitation

Only thermocouple temperatures either above or below the XR5-SE's ambient temperature may be logged. In many cases this is not a significant limitation, because logging temperatures near ambient is better suited for thermistor-based temperature sensors like the Pace PT9xx series. For thermocouple applications that require monitoring temperatures above and below the ambient temperature of the XR5, two thermocouples could be utilized to monitor the same physical location: one thermocouple wired for high temperatures and one thermocouple wired for cold temperatures (using two XR5 channels).

Thermocouple temperature alarm limitation

Currently, user-entered thermocouple alarm limits must be treated as approximate values. Please see page 42 for details.

Thermocouple electrical limitation

The XR5-SE does not have isolated inputs; A thermocouple in contact with metal at a raised electrical potential must not be connected to the XR5-SE. When using thermocouples to log metal temperatures with the XR5-SE, the thermocouples must only be in contact with metal that is grounded or at 0V with respect to XR5 ground. **Metals at non-zero voltages are not suitable for thermocouple measurements with the XR5-SE.**

SHOCK HAZARD!

A thermocouple placed in contact with metal at an elevated voltage and connected to the XR5 creates a dangerous shock hazard. The XR5-SE is designed only for thermocouple applications where all thermocouples have one lead connected to XR5 ground.

NOTE: The above limitations pertain only to thermocouple probes. Pace PT9xx and PT5xx series temperature sensors and probes do not have the above limitations.

Minimizing thermocouple noise pickup

XR5-SE inputs have limited filtering. Always use thermocouples with relatively short lead length to minimize noise pickup. We suggest using thermocouples with leads of about 10 FT (3 meters) or less. Do not run thermocouple leads parallel to AC power wiring. If noise pickup is evident, it may be reduced by connecting a good earth ground to an XR5 C Terminal.

Selecting a millivolt option for thermocouple application

- 20mv option: Highest measurement accuracy and resolution for all thermocouples.
 Reduced temperature range for Type J, K, E, N and C thermocouples.
- 50mv option: Reads highest temperatures for J, K, N and C thermocouples.
 Reduced accuracy (compared to the 20mv option).

Thermocouple Accuracy specifications

A precision thermistor for cold junction compensation is located at the right end of the terminal block (beside screw terminal #8). The ‘Max Error’ specification assumes a stable temperature along the terminal block, free from sudden variations and gradients. One way to maintain uniform terminal block temperature is to house the XR5 in the Pace EC45 Enclosure. ‘Max Error’ includes cold junction compensation error, but not inherent thermocouple error *. ‘Max Error’ is worst case, over an ambient temperature range of 0 to 60°C (32 to 140°F); ‘Typical Error’ is significantly less.

* Thermocouple error is dependent on thermocouple wire purity and thermocouple temperature. ASTM standard wire error for the J Type thermocouple is ±2.2°C (4.0°F) from 0 to 277 °C (32 to 531°F) and increases linearly to ±5.7 °C (10.3°F) at 760°C (1400°F).

J Type Thermocouple				
<i>Temperatures Above XR5 ambient</i>				
Thermocouple Lead Connections: Red: C terminal; White: Channel #				
Model	Range	~ Max. Temp.	Max. Error	Approx. resolution
XR5-SE- 20mv	0-10mv	165°C (329°F)	1.1°C (2.0°F)	0.05°C (0.1°F)
	0-20mv	350°C (662°F)	2.7°C (4.9°F)	0.1°C (0.2°F)
XR5-SE- 50mv	0-25mv	435°C (815°F)	2.4°C (4.3°F)	0.1°C (0.2°F)
	0-50mv	760°C (1400°F)	6.6°C (12°F)	0.2°C (0.4°F)
<i>Temperatures Below XR5 ambient</i>				
Thermocouple Lead Connections: Red: Channel #; White: C terminal				
Model	Range	Minimum Temp.	Max. Error	Approx. resolution
XR5-SE- 20mv	0-10mv	-130°C (-202°F)	1.1°C (2.0°F)	0.05°C (0.1°F)
	0-20mv	-130°C (-202°F)	use 0-10mv range	
XR5-SE- 50mv	0-25mv	-130°C (-202°F)	2.4°C (4.3°F)	0.1°C (0.2°F)
	0-50mv	-130°C (-202°F)	use 0-25mv range	

K Type Thermocouple				
<i>Temperatures Above XR5 ambient</i>				
Thermocouple Lead Connections: Red: C terminal; Yellow: Channel #				
Model	Range	~ Max. Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	235°C (455°F)	1.4°C (2.6°F)	0.05°C (0.10°F)
	0-20mv	475°C (887°F)	3.6°C (6.4°F)	0.11°C (0.20°F)
XR5-SE-50mv	0-25mv	590°C (1094°F)	3.2°C (5.8°F)	0.14°C (0.25°F)
	0-50mv	1220°C (2228°F)	8.8°C (16°F)	0.30°C (0.50°F)
<i>Temperatures Below XR5 ambient</i>				
Thermocouple Lead Connections: Red: Channel #; Yellow: C terminal				
Model	Range	Minimum Temp.	Accuracy	Approx. resolution
XR5-SE-20mv	0-10mv	-50°C (-58°F)	1.4°C (2.6°F)	0.05°C (0.10°F)
	0-20mv	-50°C (-58°F)	use 0-10mv range	
XR5-SE-50mv	0-25mv	-50°C (-58°F)	3.2°C (5.8°F)	0.14°C (0.25°F)
	0-50mv	-50°C (-58°F)	use 0-25mv range	

T Type Thermocouple				
<i>Temperatures Above XR5 ambient</i>				
Thermocouple Lead Connections: Blue: C terminal; Red: Channel #				
Model	Range	~ Max. Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	200°C (392°F)	1.4°C (2.4°F)	0.05°C (0.1°F)
	0-20mv	400°C (752°F)	3.3°C (6.4°F)	0.10°C (0.2°F)
XR5-SE-50mv	0-25mv	400°C (752°F)	3.2°C (5.8°F)	0.10°C (0.2°F)
	0-50mv	400°C (752°F)	use 0-25mv range	
<i>Temperatures Below XR5 ambient</i>				
Thermocouple Lead Connections: Blue: Channel #; Red: C terminal				
Model	Range	Minimum Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	-190°C (-310°F)	1.4°C (2.4°F)	0.05°C (0.1°F)
	0-20mv	-190°C (-310°F)	use 0-10mv range	
XR5-SE-50mv	0-25mv	-190°C (-310°F)	3.2°C (5.8°F)	0.10°C (0.2°F)
	0-50mv	-190°C (-310°F)	use 0-25mv range	

E Type Thermocouple				
<i>Temperatures Above XR5 ambient</i>				
Thermocouple Lead Connections: Red: C terminal; Purple: Channel #				
Model	Range	~ Max. Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	155°C (311°F)	1.0°C (1.8°F)	0.04°C (0.07°F)
	0-20mv	285°C (545°F)	2.2°C (4.0°F)	0.07°C (0.12°F)
XR5-SE-50mv	0-25mv	350°C (662°F)	2.0°C (3.6°F)	0.09°C (0.15°F)
	0-50mv	660°C (1220°F)	4.9°C (8.8°F)	0.15°C (0.25°F)
<i>Temperatures Below XR5 ambient</i>				
Thermocouple Lead Connections: Red: Channel #; Purple: C terminal				
Model	Range	Minimum Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	-100°C (-148°F)	1.0°C (1.8°F)	0.04°C (0.07°F)
	0-20mv	-100°C (-148°F)	use 0-10mv range	
XR5-SE-50mv	0-25mv	-100°C (-148°F)	2.0°C (3.6°F)	0.09°C (0.15°F)
	0-50mv	-100°C (-148°F)	use 0-25mv range	

N Type Thermocouple				
<i>Temperatures Above XR5 ambient</i>				
Thermocouple Lead Connections: Red: C terminal; Orange: Channel #				
Model	Range	~ Max. Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	300°C (572°F)	1.8°C (3.2°F)	0.07°C (0.125°F)
	0-20mv	570°C (1058°F)	4.2°C (7.6°F)	0.14°C (0.25°F)
XR5-SE-50mv	0-25mv	700°C (1292°F)	3.8°C (6.8°F)	0.17°C (0.3°F)
	0-50mv	1300°C (2372°F)	9.4°C (17°F)	0.33°C (0.6°F)
<i>Temperatures Below XR5 ambient</i>				
Thermocouple Lead Connections: Red: Channel #; Orange: C terminal				
Model	Range	Minimum Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	-50°C (-58°F)	1.8°C (3.2°F)	0.07°C (0.125°F)
	0-20mv	-50°C (-58°F)	use 0-10mv range	
XR5-SE-50mv	0-25mv	-50°C (-58°F)	3.8°C (6.8°F)	0.17°C (0.3°F)
	0-50mv	-50°C (-58°F)	use 0-25mv range	

B Type Thermocouple				
<i>Temperatures Above XR5 ambient</i>				
Thermocouple Lead Connections: Red: C terminal; Gray: Channel #				
Model	Range	~ Max. Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	1500°C (2732°F)	8°C (14°F)	0.36°C (0.66°F)
	0-20mv	1700°C (3092°F)	21°C (38°F)	0.73°C (1.3°F)
XR5-SE-50mv	0-25mv	1700°C (3092°F)	19°C (34°F)	0.9°C (1.6°F)
	0-50mv	1700°C (3092°F)	use 0-25mv range	

C Type Thermocouple				
<i>Temperatures Above XR5 ambient</i>				
Thermocouple Lead Connections: Red: C terminal; White: Channel #				
Model	Range	~ Max. Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	550°C (1022°F)	3°C (5°F)	0.13°C (0.25°F)
	0-20mv	1070°C (1958°F)	8°C (14°F)	0.26°C (0.5°F)
XR5-SE-50mv	0-25mv	1370°C (2498°F)	7°C (13°F)	0.33°C (0.6°F)
	0-50mv	2320°C (4208°F)	20°C (35°F)	0.7°C (1.2°F)

R Type Thermocouple				
<i>Temperatures Above XR5 ambient</i>				
Thermocouple Lead Connections: Red: C terminal; Black: Channel #				
Model	Range	~ Max. Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	950°C (1742°F)	5°C (9°F)	0.25°C (0.45°F)
	0-20mv	1670°C (3038°F)	12°C (21°F)	0.5°C (0.9°F)
XR5-SE-50mv	0-25mv	1760°C (3200°F)	11°C (19°F)	0.7°C (1.2°F)
	0-50mv	1760°C (3200°F)	use 0-25mv range	

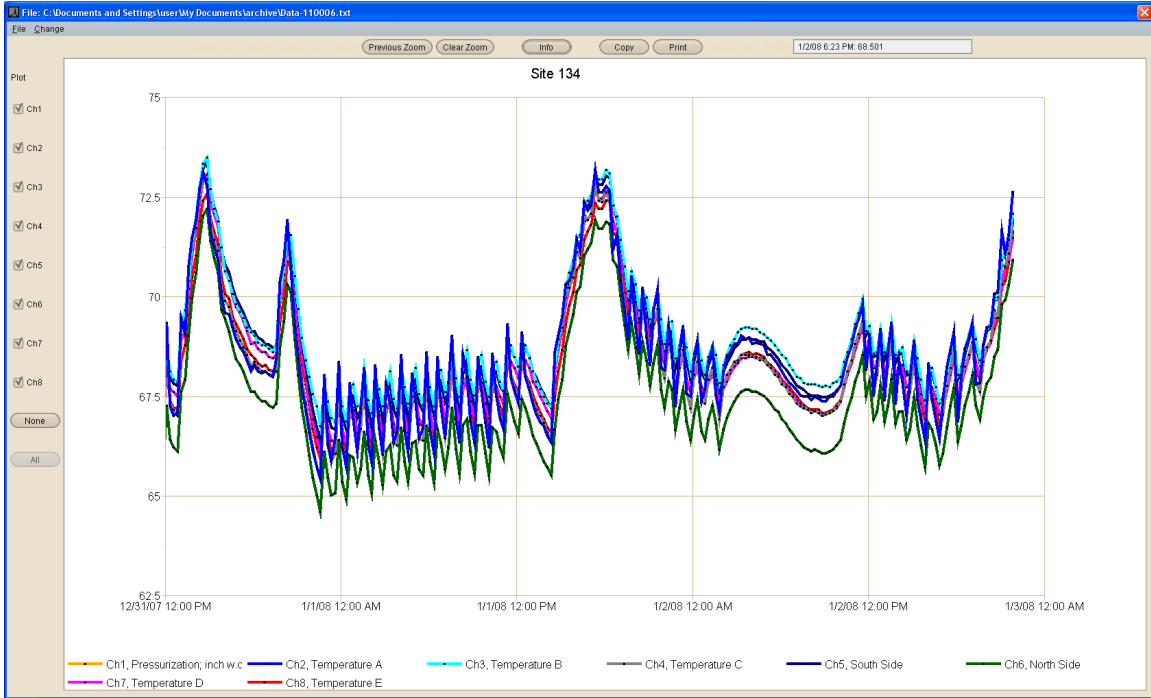
S Type Thermocouple				
<i>Temperatures Above XR5 ambient</i>				
Thermocouple Lead Connections: Red: C terminal; Black: Channel #				
Model	Range	~ Max. Temp.	Max. Error	Approx. resolution
XR5-SE-20mv	0-10mv	1030°C (1886°F)	5°C (10°F)	0.25°C (0.45°F)
	0-20mv	1450°C (2642°F)	13°C (24°F)	0.5°C (0.9°F)
XR5-SE-50mv	0-25mv	1450°C (2642°F)	12°C (22°F)	0.7°C (1.2°F)
	0-50mv	1450°C (2642°F)	use 0-25mv range	

LogXR Graph

This section applies to both LogXR Graphs and LogXR Real Time Graphs.

Graphs of XR5 data are viewed by clicking ‘Graph’ after a data file has been transferred (**Transfer | Data** or **Transfer | Data / Auto Name**), or an existing data file may be selected from the File menu (**File | Plot Graph**).

A Real Time Graph is viewed by selecting **Real Time | Graph** or **Real Time | Graph and write to file**.



Menu and control buttons are provided to display and manipulate the graph.

Menu selection	Description
File Plot Graph	Plot new graph of selected data file
File View Text File	View selected data file in its text format (default selection is the currently graphed file)
File Exit	Exit the graph display
Change Settings	Displays the "Graph Settings" window for changing graph colors and other parameters (see page 100).

The following graph controls are currently available (additional features are in development).

Graph control	Description
Plot channel #'s (check box)	Uncheck to “hide” individual channel plots.
None (button)	Hides all channel plots
All (button)	Plots all logged channels (the default setting)

Zoom (mouse function)	To Zoom, press and hold the left mouse button and drag the mouse across the graph to create a “Zoom rectangle”. When the mouse button is released, the data within the zoom rectangle will fill the entire graph. The Zoom operation may be repeated any number of times.
Previous Zoom (button)	Each click of the 'Previous Zoom' button displays the prior Zoom. (not present in the Real Time Graph display)
Clear Zoom (button)	"Unzooms" the graph to display the entire data set.
Info (button)	Displays information pertaining to the data file being graphed.
Copy (button)	Copies the current graph to the system clipboard. The graph can then be copied to a word processing or graphics program, typically by clicking Edit Paste within the other program.
Print (button)	Prints the current graph to the computer's default printer.
Date/Time & Value (text box)	Displays the time and value of the current mouse position on the graph.

"Hidden" channels

When a data set has multiple channels with large and small values (for example, a 0-10,000 psi Pressure Sensor and a 0-1 volt signal), the plots of the small values can appear to be missing. Use the mouse to create a zoom rectangle along the bottom horizontal border of the graph. The small values will now be visible.

Files with multiple data sets

In order to visibly display "time gaps" in data files with multiple data sets*, **“Data Set x” between data sets** must be checked in **File | Preferences**. Otherwise, channel plot lines will be continuous, and will not show an unplotted "time gap" from the end of one data set to the beginning of the next data set.

* Logging Modes that can generate multiple (non-contiguous) data sets:
Manual (Slow), 'Log on Ext. Trigger', 'Cycle Logging' and 'Log on Alarms'.

Date/Time Format

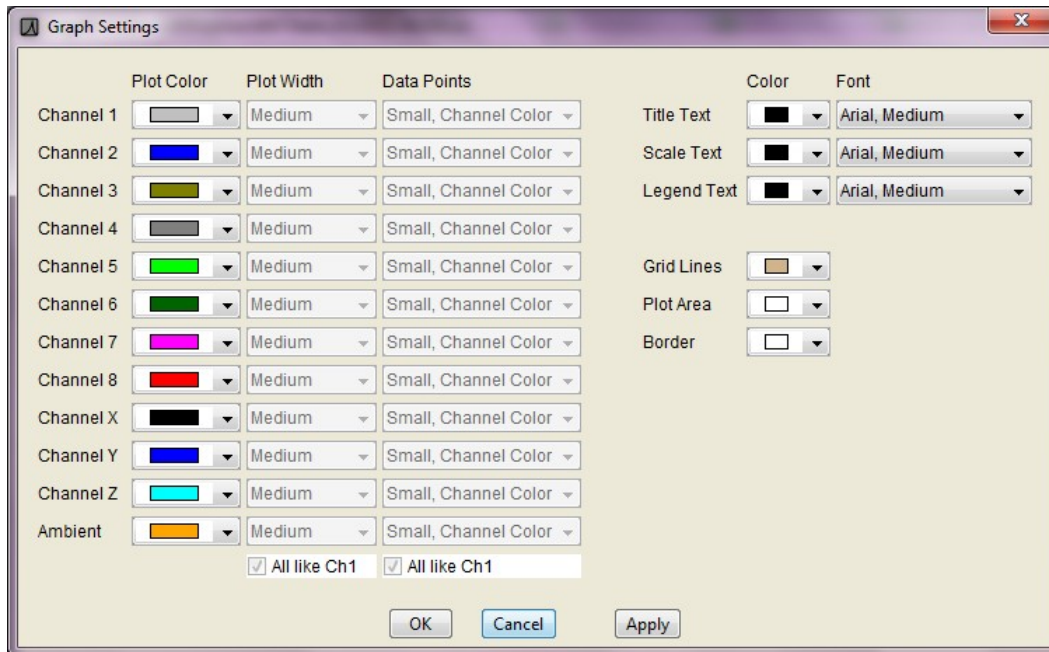
The date/time values at the bottom of the graph display (x-axis) conform to the regional date and time format of the user's computer (short format).

The date and time format in the data portion of an XR5 data file (.txt or .csv file) uses the following fixed (non-regional) format:

Year / Month / Day Hour : Minute : Second. (Hour field is 24 hour format [0..23]).

Graph Settings

Displayed by selecting **Change | Settings** on the graph menu.



The Graph Settings screen can be displayed both from the Graph and the Real Time Graph display.

Plot Color

Click on a color box to display the color pallet. Click on a color to select it.

Plot Width

Select Thin, Medium, or Thick for each individual channel. If "All like Ch1" is checked (at the bottom of the Plot Width column), all plot widths replicate the Channel 1 selection.

Note

If the current data file has over 100,000 readings, LogXR overrides the Plot Width selections and plots thin lines to insure acceptable plotting times. Files with less than 100,000 readings may also plot thin lines until only a portion of the file is displayed using the Zoom feature. The Real Time Graph always utilizes the current Plot Width selections.

Data Point Style

Select a data point style for each channel. If "All like Ch1" is checked (at the bottom of the Data Points column), data point style selections for all channels replicate the Channel 1 selection.

Note

If the current data file has over 100,000 readings, LogXR overrides the Data Point selections with "Don't Show" to insure acceptable plotting times. Files with less than 100,000 readings may not display the selected style until only a portion of the file is displayed using the Zoom feature. The Real Time Graph always utilizes the current Data Point selections.

Dial-up Scheduler & Modem setup

LogXR supports XR5 communications over telephone lines using additional modem hardware. Click the main menu selection **Dial-up*** to display the Dial-up Scheduler screen*

* The **Dial-up** menu selection does not appear by default in LogXR. First, select **Port | Options** and click the Dial-up checkbox. Then click OK and exit out of LogXR (**File | Exit**). Now, whenever LogXR is started, the **Dial-up** selection will appear in the Main menu.

Dial-Up Scheduler

The Scheduler enables automatic data collection from any number of modem-equipped XR5 Data Loggers. Individual modem-equipped XR5's may also be accessed manually using the Dial-up Scheduler.

Required hardware

Listed below is the hardware required for either a Land-line or Cellular based system. A Land-line system provides reliable performance. A cellular based system is affected by signal strength, antenna position, interference and other factors, so reliability is more installation dependent.

LAND LINE SYSTEM

Modem: Zoom 2949 External Fax Modem, Serial RS-232.

Available from various vendors such as www.buy.com and www.amazon.com.
 Required quantity: One at user's computer and one at each remote XR5.

Note: In many cases a PC's internal modem or other external data/fax modem can be used for the PC's modem. However, Pace can not provide troubleshooting support for a customer's system that uses a non-Zoom modem. Please see the next page for details.

Modem cables: Pace part # IC211 One required for each remote XR5.
 Modem Serial Cable One required. Connects "Local" Zoom modem to your computer. Available at retail computer outlets.
 Telephone line: One at user's computer, one at each remote site.

CELLULAR SYSTEM

GSM cellular modem: Multi-Tech model MTCBA-G-F4
 (for all countries with GSM/GPRS service)
 Available from www.buy.com and other vendors.

Note: Additional hardware is required for operation in North America, contact Pace for details.

GSM cellular modem cable: Pace part # ICW-15
 (Connects Multi-Tech modem to XR5).

Setting up a Land line system

Configuring the Remote Modem

The remote modem connects to the XR5 at the remote site. The remote modem must be a Zoom model 2949. Other modems may work, but we will not be able provide support if you use a different modem and have problems. The Zoom 2949 includes lightning protection and some other features that make it especially suitable for use at unattended remote sites. The remote modem must first be configured (initialized) before it is deployed at the remote site. This can be done using LogXR Software by following the steps below:

1. Connect the Modem Serial Cable to the Zoom modem, and to your computer's 9 pin com port. The same com port must be selected in LogXR (**Port | Select**).
2. Make sure the modem is powered ON. The PWR and TR (Terminal Ready) lights should be illuminated.
3. Select the **Dial-up** main-menu selection, and then select **Edit | Initialize Remote Modem**
4. The Dialog box should show the following Setup String: AT&FE&D&KS0=1&W0
If it does not, change the contents to the above string.
5. Click the "Send to Modem" button. A message box should appear: "Modem response: OK". If you get a different message, try a second time, and make sure your modem is connected to the port listed in the **Port | Select** screen. The modem's AA light should now be illuminated. (AA means Auto-Answer). Click OK. A message box appears: "Modem successfully initialized." Click OK.
6. The modem can now be disconnected from your computer and connected to the XR5 using the Pace IC211 Cable.

NOTES:

We strongly recommend that you test the system using two phone lines locally (ideally in the same office or building) before installing the XR5 and modem at the remote site.

Each Zoom modem should be powered up AFTER its serial cable is properly connected.

Once the Zoom modem is connected to a com port and is powered up, a Windows operating system "Wizard" may appear to install the Zoom modem. Although it is OK to allow the Wizard to proceed, it is not necessary if the modem will only be used with LogXR. In that case, you can click Cancel to terminate the Wizard.

Installing the Local Modem

We recommend using the same Zoom 2949 modem at your computer. Other modems may work, but if you have problems, Pace can only provide limited support because of the subtle and not-so-subtle variations found in other modems, especially when used in the non-mainstream application of communicating with a remote device like the Pace XR5.

Connect the local modem to your computer using the same cable that was used to set up the "remote" modem. Make sure that the local modem is connected to the same com port selected in the **Port | Select** screen. Select **Edit | Local Modem Setup** to view or change the Local modem setup string. For the Zoom 2949 modem, the string should be as follows: AT&FE&D

The Setup String is automatically sent to the local modem whenever the Scheduler is activated or a remote site is manually contacted from the **Contact** menu selection. See page 105 for details.

Setting up a Cellular-based System

The supported cellular system uses a Zoom 2949 modem (or equivalent) at the "local" computer end, and a cellular modem at the XR5. Please contact Pace for setup instructions for the remote cellular modem. Use the instructions [Installing the Local Modem](#) in the paragraph above to install the local modem.

Customers in North America: Contact Pace for additional hardware requirements.

Setting up the Dial-up Scheduler

The Dial-up Scheduler supports XR5 Data Loggers connected to phone lines via a Zoom 2949 modem. The Scheduler is arranged in a series of "rows". Each row contains three cells which define a "Project Folder" name, a Location (and the phone number of the remote modem), and the desired collection time. The left side of the Scheduler is divided into two panes (upper and lower). The upper pane lists the collected data files for the currently selected row. The bottom pane displays the Setup file (if present) for the currently selected row (details on the next page).

You create a schedule by clicking on the first available row under "Project Folder" to name a Folder, then select the Location and finally the Collection time. You can also select the cell you wish to edit and click **Edit | Modify** from the Scheduler menu to edit a new cell or to make a change to an existing cell. The three "cells" in each row are explained below.

Project Folder

A master folder for the collected data. Each row can have a different Project Folder name, or if you have a group of remote loggers that are being used for a particular logging project, you could give each row the same Project Folder name. Then, data from all the remote sites in this group would be stored in the same "Data" subdirectory of your Project Folder.

Location (phone number)

Enter a descriptive location name for the remote site. Then enter the phone number of the telephone line at the remote site. Enter a number as you would dial it. You can add multiple "-" characters if desired to make the phone number more readable.

Collection Time

Choose a collection Interval of Hourly, Daily, Weekly, or Monthly.

Hourly:

Select the minute after the hour. Data will be collected every hour at the specified minute.

Daily:

Select the time each day that the collection will occur. The hour selection is in 24 hour time format (for example, 10 AM = 10, 2 PM = 14, 5 PM = 17, etc).

Note: If you wish to collect data twice daily, create two rows for the same remote site (same Project Folder and Location/phone number for each row) and set the Daily collection times 12 hours apart.

Weekly:

Select the day of the week and the time that the collection will occur.

Monthly:

Select the day of the month and the time that the collection will occur.

(Optional) Sending a Setup to reset the XR5

Immediately after collecting data from an XR5, the Scheduler can send a Setup to clear the XR5's memory, resynchronize its time clock, and re-start logging. Each completed row in the Scheduler has a corresponding Setup folder. When a row is selected (clicked) the Setup pane (lower left pane) lists the Setup file, if it is present, for the selected row.

The presence of a Setup file in the Setup pane determines if a Setup will be sent after collecting data. If no Setup file is present (the default state), a setup is not sent after data has been collected. The directory path to locate this Setup folder is listed directly above the Setup pane.

To copy an XR5 Setup file into this folder, use a file navigation program (on Windows systems, hold down the Window button (beside the Alt Key) and press E to launch Windows Explorer). Then navigate to and select a previously saved Setup file, select Copy, and then navigate to the selected row's Setup folder (the directory path is listed above the Setup pane) and select Paste.

Setup file requirements

A Setup file used with the Scheduler must not have preset time fields, because these fields will become invalid after their initial use. For example, a setup with logging mode "Preset / (Slow)" will have invalid time fields after its initial use.

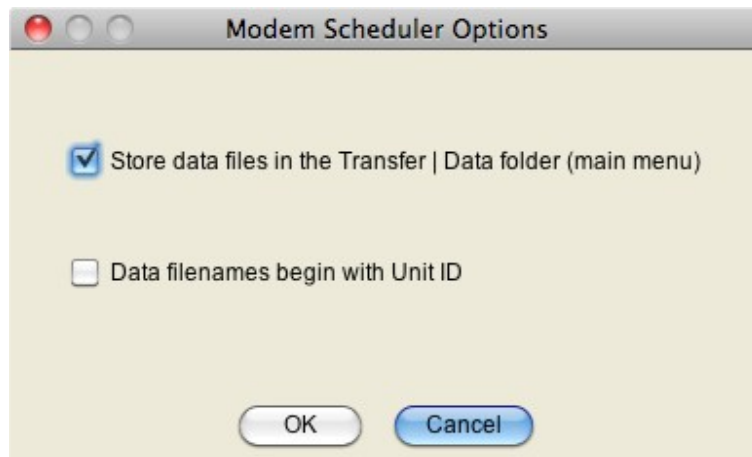
The Setup file must be a setup that was created for your particular XR5 model, otherwise it will not be sent.

Starting the Scheduler

Once one or more rows have been filled, the Scheduler is activated by the menu selection **Contact | Activate Dial-up Scheduler**. Alternately, if the scheduler is not active (running), you can communicate with individual remote sites manually by selecting **Contact | Contact Selected Unit Now**. See the Scheduler menu selections on the next page for more details.

Scheduler menu selections:

File | Options



Store data files in the Transfer | Data folder (main menu)

If checked, data files collected by the Scheduler are stored in the same folder used for Transfer | Data from the main menu. Enables all collected data files to be stored in a single common folder.

Data filenames begin with Unit ID

If checked, collected data files have a name that includes the XR5's Unit ID appended to the beginning of the filename.

File | View Phone Numbers

Display all current Locations and their associated Phone Numbers.

File | Exit

Exit the Scheduler.

Edit | Modify

Modify the selected cell (Project Folder, Location, or Collection Time).

Edit | Delete

Delete the selected row.

Edit | Initialize Remote Modem

Configures a modem for remote use. See [Configuring the Remote Modem](#) on page 102

Edit | Local Modem Setup

Edit the Local modem's initialization (setup) string. This string is sent to the local modem when the Scheduler is activated, or when a remote site is manually contacted. See page 102 for details.

Contact | Contact Selected Unit Now

After successfully connecting with the selected remote site, a screen appears similar to LogXR's Main Menu that allows you to manually communicate over phone lines with the selected XR5. The remote modem must have previously been configured (see page 102) and the local modem connected to the currently selected Com port (**Port | Select** from the main menu).

Contact | Activate Dial-up Scheduler

Activates the Scheduler. First brings up a dialog box that allows you to specify a name for the Scheduler's log file. All Scheduler activity will be logged to this file (the same activity log displays in the Scheduler Activity box that appears when the Scheduler is activated). Clicking "Create" activates the Scheduler. Once the Scheduler is activated, LogXR can not be used for other functions. Clicking "Stop" on the Scheduler Activity box terminates the Scheduler.

Scheduler Activity box

Provides a scrollable listing of all the Scheduler's actions. The Scheduler Activity box should initially contain 3 lines of information:

Line 1: Date and time the Scheduler was started.

Line 2: Name and location of the log file (a text file listing all of all the Scheduler's actions).

Line 3: Modem initialization status.

If the modem did not successfully initialize, it is likely that the modem is either not powered ON, is not correctly cabled to the computer, or the incorrect COM port has been selected (**Port | Select** from the main menu). In this case, click Stop on the Activity box to terminate the Scheduler. Once you have taken action to resolve the problem, activate the

Scheduler again by selecting **Contact | Activate Dial-up Scheduler** and make sure that the Activity box lists the modem as having been successfully initialized.

Scheduler Notes and Tips:

1. Each Row must list a unique Collection Time minutes. If two or more rows list the same Collection Time minutes, these additional rows will be ignored by the Scheduler.
2. If data collection is active and "overlaps" a Collection Time listed for another row, this other row will be ignored by the Scheduler. Therefore, space each row's Collection Time so that there is sufficient time to transfer data before any other listed collection time occurs.
3. The vertical bar that separates the Scheduler rows from the Setup and Data file panes can be dragged with the mouse to provide more viewing area for the Setup and Data panes.
4. To insure against the possibility that a modem dial-out is unsuccessful, we suggest setting the collection time interval to represent no more than ½ of the time it will take for the logger's memory to fill. Then, if a dial-out is unsuccessful, all data will be recovered the next time the Scheduler contacts the XR5.
5. Data files are named as follows: Each data file name begins with the XR5's eight digit User ID, followed by a dash "-" character and an auto-incrementing 5 digit number.

Scaling XR440 sensors

The XR5 uses Slope/Offset scaling for linear sensors. Linear sensors for the [Pace XR440 Data Logger](#) are compatible with the XR5 but require Slope/Offset scaling values.

Pace sensors for the XR440 are listed in this manual with Slope/Offset scaling values, except for the TRH-100 Temp/RH Probe. For the TRH-100, LogXR Software accepts the Low/High scaling printed on the TRH-100 Probe and converts these values to Slope and Offset values. See page 72 for details.

Using XR440 linear sensors with the XR5

Slope and Offset scaling values for most "XR440" Sensors are listed in this manual in the sensor section from pages 71-77.

High/Low scaling values can also be converted to Slope/Offset Scaling values as follows:

$$\text{Slope} = (|\text{Low scaling value}| + \text{High scaling value}) / 5$$

$$\text{Offset} = \text{Low value}$$

Note:

|Low scaling value| is the absolute value of the Low scaling value; if the value is negative, simply remove the negative sign, if the value is positive, use the number as it is. (If $x < 0$ then $x = x * -1$).

Example: A P1500-100 Sensor has scaling values of Low: -12.5, High: 112.5

$$\text{Slope} = (12.5 + 112.5) / 5 = 25$$

$$\text{Offset} = -12.5$$

Using XR5 linear sensors with the Pace XR440 Pocket Logger

If a customer has an XR5 sensor that he wishes to use with the XR440, he can obtain the Low/High scaling values required by the XR440 with Pocket Logger Software's* Help. For example: To find the Low/High scaling for a P1600 Pressure Sensor, in Pocket Logger Software click Help | Contents | Index, type P1600 and click on the topic "P1600 Pressure Sensor".

Or, convert the XR5's Slope/Offset scaling to the XR440's Low/High scaling as follows:

$$\text{Low Value} = \text{Offset}$$

$$\text{High Value} = (\text{Slope} * 5) + \text{Offset}$$

* [Pocket Logger Software](#) is free software for the XR440 available from the Pace website.

IC209 Interface Cable, Internal Wiring

<u>9 Pin Connector</u>	<u>3.5mm Stereo Plug</u>
Pin 2	Tip
Pin 3	Middle
Pin 5	Ground (opposite tip)

Pin 7
Pin 8

Add a jumper wire from pin 7 to pin 8 on the 9 pin connector

Pin numbers are legible on the 9 pin connector (a magnifying glass may be needed).

Data Flow:

Data is transmitted from XR5 to PC on Pin 2.

Data is transmitted from PC to XR5 on Pin 3

IC211 Modem Cable, Internal Wiring

<u>25 Pin Connector</u>	<u>3.5mm Stereo Plug</u>
Pin 2	Tip
Pin 3	Middle
Pin 7	Ground (opposite tip)

Pin 4
Pin 5

Add a jumper wire from pin 4 to pin 5 on the 25 pin connector.

Pin 6
Pin 20

Add a jumper wire from pin 6 to pin 20 on the 25 pin connector.

Pin numbers are legible on the 25 pin connector (a magnifying glass may be needed).

Data Flow:

Data is transmitted from XR5 to Modem on Pin 2.

Data is transmitted from Modem to XR5 on Pin 3

XR5-SE models compared to earlier generation XR5-8 models

The [XR5-8 series](#) consists of the following models:

XR5-8A-SE
 XR5-8B-SE
 XR5-8X-SE
 XR5-8A-SE-M
 XR5-8B-SE-M
 XR5-8X-SE-M

Differences between XR5-SE series and XR5-8 series are summarized below:

	XR5-8 series	XR5-SE series
D terminal excitation	5 ma max	40 ma max (D + E terminals)
E terminal excitation	25 ma (29 ma D + E terminals)	30 ma max
Batteries	Two ½ AA-size Lithium	Two AA size Lithium
Battery amp-hours	0.95 amps	2.4 amps
Internal circuit board(s)	Main and Daughter board	Single PCB
Optional millivolt input ranges	No	Yes
External Power Input	9 Vdc (10 Vdc max)	9 Vdc - 12 Vdc (14 Vdc Max)
Pulse input voltage range	0 - 3.6 Vdc	+/- 18 Vdc
Pace multi-range analog inputs*	No	Yes

*XR5-8 models have fixed combinations of 0-2.5v inputs (which also read 2-wire resistances) and/or 0-5v inputs. Please see the section “Model Selection Guide” in the [XR5-8 User's Guide](#) for details.

Pace Humidity Probe Differences

TRH-100

Nominal 1 to 4v output (optimized for the 0-5v input of the XR440)
Use with XR440 and the XR5-SE

TRH-160

Nominal 0.5 to 2v output (optimized for a 0-2.5v XR5 input)
Use with XR5-SE and earlier generation XR5-8 models.

Pace Humidity Probe without LogXR Software

For customers using the TRH-100 or TRH-160 Probe to acquire humidity data via the [XR5 Text Interface's](#) read command, or with other (non-Pace) data acquisition systems, the following compensation formula should be applied to the humidity data for best accuracy:

$$RH_c = RH / (1.0546 - 0.00216 * T)$$

Where: RH = %RH (not temperature compensated).

T = Temperature of TRH-160's temperature sensor (in °C).

RH_c = %RH (compensated for TRH-160 Probe temperature).

If the TRH-100 or TRH-160 Probe is used in a conditioned environment (indoor climate controlled space) temperature compensation will be less than 1% RH, and the above formula could be omitted. In outdoor environments, or in applications with large ambient temperature swings, the above formula should be used.

Electrically Noisy Environments

For optimum accuracy and performance, the following steps are recommended when using the XR5 in electrically noisy environments*.

*For example, mounting the XR5 in an electrical panel containing relay contactors.

1. Do not locate the XR5 in close proximity to relay contactors or similar inductive devices.
2. Ground the XR5. Connect a heavy wire from a C terminal to a good earth ground. Use as short a wire as is practical.
3. Use shielded cable for long signal leads (leads longer than 20 ft). Ground the shield at one end only.

Examples of problem installations and solutions:

A Pace Data Logger located outdoors logged temperatures using long sensor leads. Data corruption sometimes occurred during lightning storms. Driving a ground rod into the soil and connecting a short wire from the ground rod to the C terminal permanently solved the problem.

A Pace Data Logger, cellular transceiver, antenna and battery were housed in a compact plastic case. RF energy radiating from the antenna caused communication errors when transferring data. Enclosing the data logger within a small metal box (shielding it from the RF energy) eliminated the errors.

Alternate batteries for the XR5-SE

Any true cross to the Tadiran TL-5903 will work fine in the XR5-SE. Three compatible batteries are listed below.

GM Battery part # ER14505 <http://www.gmbattery.com/dl/cp1/eng/ER14505.pdf>

Saft part # LS14500C <http://www.saftbatteries.com>

Xeno part # XL-060F Xeno Energy <http://www.xenousa.com/products.htm>

Pertinent specifications:

AA size, approx 2.4 amp hour (less is OK, but battery life will be proportionally shorter)

3.6v (3.7 is OK)

Pulse current: 50ma or higher.

Limited Warranty

All XR5 Data Loggers are warranted against defects in materials and workmanship for three years from date of shipment. All other Pace Scientific products are warranted against defects in materials and workmanship for one year from date of shipment. During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you return the product, shipping prepaid, to Pace Scientific Inc.

This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

This warranty does not apply if the product has been damaged by accident or misuse or as the result of modifications or repair by anyone other than Pace Scientific Inc. No other express warranty is given. The repair or replacement of a product is your exclusive remedy. ANY OTHER IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS IS LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. IN NO EVENT SHALL PACE SCIENTIFIC INC. BE LIABLE TO YOU FOR ANY DAMAGES, INCLUDING LOST PROFITS, LOST SAVINGS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF OR INABILITY TO USE SUCH PRODUCT, EVEN IF PACE SCIENTIFIC OR AN APPROVED RESELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY OTHER PARTY.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Products are sold on the basis of specifications applicable at the time of manufacture. Pace Scientific Inc. shall have no obligation to modify or update products once sold.

Service

Technical Support

Call Pace Scientific at (704) 799-0688, Monday - Friday between 8AM and 5PM Eastern Standard Time.
Or email support@pace-sci.com

Repair

Contact technical support to confirm that the product is not functioning properly. If repair is needed, Technical Support will issue an RMA number and a shipping address.

Product List: XR5-SE and Accessories

XR5 Data Loggers	Description
XR5-SE	8 analog (multi-range) and 3 pulse inputs, up to 63,642 readings
XR5-SE-M	8 analog (multi-range) and 3 pulse inputs, up to 260,250 readings

Millivolt option: Adds two additional millivolt range selections and one internal precision temperature sensor (12th channel). **All existing input capabilities of the XR5 are retained.** See page 93-94 for details.

To specify:

<u>Add to model</u>	<u>Additional range selections for each analog input</u>
20mv	0-10mv and 0-20mv
50mv	0-25mv and 0-50mv
100mv	0-50mv and 0-100mv
250mv	0-125mv and 0-250mv
500mv	0-250mv and 0-500mv
1000mv	0-500mv and 0-1000mv

IC209	Interface Cable (required), 5 ft length
USB-A	USB Adapter (use with IC209 if your computer does not have a serial port)
ICE-12ft	Extension Cable, 12 ft (3.6 meters)

Wireless Link

WTP-100	Wireless Communications Link (range of up to 30 meters indoors, 100 meters outdoors) Includes Battery cable and AC power adapter for XR5 side; see page 15 for details. EC24 , EC45 and EC55 Enclosures are available configured to house an XR5 and a battery powered WTP-100 (enclosure includes internal battery holder and short version of IC209 Interface Cable).
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Probes / Sensors *All connect directly to any XR5 Data Logger and require no external power.*

Temperature Probes, 0.1°C interchangeability

PT907	Epoxy body	0.127" dia. x 0.37" length	4 ft cable
PT916-4	SS sheath	1/8" dia. x 4" length	3 ft Teflon leads
PT916-6	SS sheath	1/8" dia. x 6" length	3 ft Teflon leads
PT916-12	SS sheath	1/8" dia. x 12" length	3 ft Teflon leads
CF916-1/8	SS compression fitting	for any PT916 probe, 1/8 NPT male threads	
PT933	SS sheath	3/16" dia. x 1" length	20 ft cable
PT940	SS sheath	3/16" dia. x 1" length, water res.	20 ft cable
PT956	SS sheath	¼" dia. x 2" length, waterproof	20 ft heavy-duty cable

High temperature sensors, size: 0.2" x 0.6" x 0.08" for air or surface temperature applications

PT510	Max. Continuous Temperature: 200°C (392°F)	40" Teflon leads
PT520	Max. Continuous Temperature: 260°C (500°F)	40" Teflon leads

Thermocouple Probe (requires XR5-SE with -20mv, -50mv or -100mv millivolt option)

PT450	J type; Stainless Steel sheath 1/8" dia. by 6" length, with 10 ft Teflon Cable
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XR5-SE Accessories

Relative Humidity & Temperature Probes, 3% RH accuracy, 0.1°C interchangeability

TRH-160	1 ft leads
TRH-160-10FT	10 ft shielded cable
TRH-160-20FT	20 ft shielded cable
TRH-160-50FT	50 ft shielded cable

Pressure Sensors – P1600 Series (¼ NPT male, 10 ft cable)

P1600-vac-30	Range: Vac-30 psig
P1600-vac-150	Range: Vac-150 psig
P1600-vac-300	Range: Vac-300 psig
P1600-30	Range: 0-30 psig
P1600-50	Range: 0-50 psig
P1600-100	Range: 0-100 psig
P1600-200	Range: 0-200 psig
P1600-500	Range: 0-500 psig
P1600-1000	Range: 0-1000 psig
P1600-1500	Range: 0-1500 psig
P1600-2000	Range: 0-2000 psig
P1600-3000	Range: 0-3000 psig
P1600-5000	Range: 0-5000 psig
P1600-7500	Range: 0-7500 psig
P1600-10000	Range: 0-10,000 psig
P1600-20000	Range: 0-20,000 psig

Pressure Sensors – P300 Series (3/16" plastic hose fitting, 1 ft leads)

P300-0.4in-D	Range: ±0.4 in H2O (±1millibar)
P300-1in-D	Range: ±1in H2O
P300-5in-D	Range: ±5in H2O
P300-10in-D	Range: ±10in H2O
P300-30in-D	Range: ±30in H2O
P300-5-G	Range: 0-5 psig
P300-15-G	Range: 0-15 psig
P300-15-A	Range: 0-15 psia
P300-30-G	Range: 0-30 psig
P300-30-A	Range: 0-30 psia
P300-Baro	Barometric pressure: 600 – 1100 mbar (8.7 - 15.95 psia)

AC Current Sensors (split core, 0-5vdc output, 8 ft twisted leads)

SC100A	0-100 ac amps	Conductor clearance: 0.5" square (12.7mm)
SC200A	0-200 ac amps	Conductor clearance: 1.0" square (25.4mm)
SC500A	0-500 ac amps	Conductor clearance: 2.0" square (51mm)
SC1500A	0-1500 ac amps	Conductor clearance: 2.5" square (63mm)

DC Current Sensors (linear dc voltage output, accepts ring terminals for two ¼-20 studs, 10 ft signal cable)

DC05A	±5 dc amps
DC20A	±20 dc amps
DC50A	±50 dc amps
DC100A	±100 dc amps
DC150A	±150 dc amps

XR5-SE Accessories

AC Voltage Sensors

SV300	0-300 ac volts	One-piece din-rail type module
SV600	0-600 ac volts	Din-rail type module with external matching transformer

External Scaling Cables - see page 84

INP/2	Configurable Ranges: $\pm 2.5\text{vdc}$, $\pm 5\text{vdc}$, 0-10vdc, -2.5 to 7.5vdc	
INP/4	Configurable Ranges: 0-10vdc, 0-20vdc, -7.5 to 12.5vdc	
INP/6	Configurable Ranges: 0-15vdc, 0-30vdc, -12.5 to 17.5vdc	
INP/12	Configurable Ranges: 0-30vdc, 0-60vdc, -27.5 to 32.5vdc	
INP/24	Configurable Ranges: 0-60vdc, -57.6 to 62.6vdc	

Current Loop Accessories - see page 89

INP-124	Precision Series Resistor for 4-20ma current loop
ES-1	External Switch, 1500 Vac isolation, potted housing (see page 91)

Light Sensor – not recommended for high accuracy applications

LS100-4FT	4 ft cable
LS100-15FT	15 ft cable

Watt Hour Sensors – Single or 3 phase loads, pulse output

Contact Pace for WattHour sales literature and price list.

Compact Weatherproof Case with 9 weatherproof cable glands. Overall size: 6.5" x 5" x 3.3"

<u>EC45</u>	Color: Blue
EC45-IC	EC45 with built-in communications cable (8 cable glands available for sensors)
EC45-BP	EC45 with battery holder for C cells and short comm. cable for Wireless Link

Heavy Duty Weatherproof Case with 6 weatherproof cable glands. Overall size: 8.2" x 6.5" x 3.5"

<u>EC55</u>	Color: Blue
EC55-IC	EC55 with built-in communications cable (5 cable glands available for sensors)
EC55-BP	EC55 with battery holder for D cells and short comm. cable for Wireless Link

Low Profile Weatherproof Case with 2 weatherproof cable glands. Overall size: 8.1" x 3.9" x 2.5"

<u>EC24-YEL</u>	Color: Yellow
EC24-YEL-IC	EC24 with built-in communication cable (1 cable gland available for sensors)
EC24-YEL-BP	EC24 with battery holder for AA cells and short comm. cable for Wireless Link
EC24-BLK	Color: Black
EC24-BLK-IC	EC24 with built-in communication cable (1 cable gland available for sensors)
EC24-BLK-BP	EC24 with battery holder for AA cells and short comm. cable for Wireless Link

Modem cables - see page 101

IC211	Connects XR5 to Zoom 2949 Data/Fax modem
ICW-15	Connects XR5 to Multi-Tech cellular modem.

Note: The above modems are not stocked at Pace

XR5-SE Accessories

Ethernet connectivity - see pages 58-59

Each XR5 connected to an Ethernet LAN requires one DS100 and one IC209 Interface Cable

DS100 Ethernet Module, includes plug-in power supply adapter for 120vac (US plug)
Power supply adapters suitable for other countries are available, contact Pace for details

IC-ES Setup Cable (6 ft) for DS100 Ethernet Module (required for initial setup only)

IC209 Interface Cable, 5 ft length

*A Cat5 cable to connect DS100 to Ethernet LAN is not included with DS100;
 Cat5 cables are available in assorted lengths from retail computer suppliers.*

Rainfall Sensor

RS-100 Pulse output, 0.01" or 0.2mm rainfall per pulse, 40 ft (12 m) cable

Solar Radiation Sensor

SRS-100 Output: 0-2.5v (0-1500 Watts / Square Meter), 1.8 ft (55 cm) cable

WE-100 Weatherproof extension cable, 100 ft

Wind Speed and Direction Sensor

WSD-100 Wind speed: pulse output; wind direction: analog output; 40 ft (12 m) cable

Soil Moisture Sensors

EC5 5 cm active length 10 ma current draw 16 ft (5 m) cable

EC20 20 cm active length 2 ma current draw 16 ft (5 m) cable

External Power Supply (for all XR5 Data Loggers)

PS-9V 9 volt regulated power supply, 120vac input (US plug)

PS-9V-EU 9 volt regulated power supply, 90-260vac input, European plug

PS-9V-UK 9 volt regulated power supply, 90-260vac input, UK plug

PS-9V-AU 9 volt regulated power supply, 90-260vac input, Australian plug

Spare Parts

TB-20 XR5 Terminal Block, 20 position

Replacement Batteries for XR5-SE Data Loggers, two required

U3.6V-AA-E Battery, Lithium AA size, 3.6v

Replacement Batteries for earlier generation XR5-8 Data Loggers, two required

U3.6V-1/2AA-E Battery, Lithium 1/2AA size, 3.6v

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USA Price List: www.pace-sci.com/XR5-SE-Domestic.pdf

Export Price List: www.pace-sci.com/XR5-SE-Export.pdf