XR5 User's Guide

Models   XR5-8A-SE

XR5-8B-SE

XR5-8X-SE

March, 2005

Pace Scientific
Data Loggers and Sensors

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This manual is updated to the following versions:

LogXR Software 1.01.00
For customers with older software, please download and install the latest version; instructions on page 7. (click Help | About to view current LogXR version).

XR5 Firmware 1.00.86
For customers with older firmware, please update your XR5's firmware (instructions on page 34).

Contents

Introduction

XR5 Data Logger

Pace XR5 Data Loggers have 8 analog inputs with 12 bit resolution. Compatible direct-connect sensors include Temperature, Pressure, Relative Humidity, AC Current, and AC Voltage, *with no external power required.* Directly log contact closures, resistance, 4-20ma, 0-2.5v and 0-5v signals. Three 24 bit pulse / frequency inputs are available for logging parameters such as wind speed, KWH, rainfall, water flow and gas consumption. Battery life exceeds 2 years for typical applications.

Free Software

Pace LogXR Software is a free download from Pace Scientific's website www.pace-sci.com/data-loggers-xr5.htm. LogXR is currently available for Windows 98/ME/NT/2000/XP and Linux based computers.

Palm / Pocket PC Software

XR5 Data Loggers can also display text-based menu screens for setup and data transfer. Any computer or PDA equipped with a serial port and "off-the-shelf" communication software can be used with the XR5. See the XR5 Terminal Mode User's Guide for details.

High Accuracy / Large Memory

Using Pace's precision PT900 series thermistor probes, temperature data is accurate to +/-0.15°C at 25°C with no calibration. Voltage inputs are accurate to +/-0.25% of full scale. The XR5's non-volatile memory can store up to 63,642 time-stamped twelve bit readings (standard models) or up to 260,250 readings for models with extended memory.

Free Lifetime Firmware and Software Updates

Pace is committed to free lifetime firmware and software updates for the XR5. The latest versions will always be a free download from the Pace website. Pace customers who bought our first data logger, the XR220 Pocket Logger®, in 1992 can still get the latest Pocket Logger Software (greatly enhanced since the original release) as a free download from our website.

Fast or Slow Logging

Any log interval between 1 second and 12 hours may be selected, or fast log rates from 2Hz to 1000Hz.

Individual Alarms

All analog inputs have individual high and low alarm limits. Alarm activity can trigger a variety of responses, including logging data, sending a detailed SMS message to a cell phone (GSM modem required), setting an external alarm output, blinking the XR5's Alarm LED, and/or dialing out to a computer (modem required).

Powerful Recording Modes

Logging may be triggered (and stopped and re-triggered) by alarm conditions, an external trigger, or by the Logging | Start and Logging | Stop menu selections. Readings are stored at the selected log interval. Using the Average or Peak mode, readings are sampled every second and the Average or Peak value stored at the selected log interval. Channel pairs may be logged as differential readings (Channel A – Channel B) and differential readings may be used to generate alarms. Logging can stop when the memory is full, or continue in a wrap-around mode (overwriting oldest readings). In all but the "Fast Logging" modes, data may be transferred while logging is active, or real time readings may be simultaneously displayed.

Cycle Logging

Custom logging "cycles" may be selected. For example: Log for 10 seconds at 100Hz, 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 (until a pre-set time is reached or the memory is full).

Excel Compatible

Transferred data is formatted as a readable, Excel compatible text file. Data is securely transferred via the Xmodem CRC protocol. Data transferred from an XR5 conforms to US FDA 21 CFR Part 11; users can confirm that the original data has not been tampered or altered in any way.

Secure Data

The XR5 Data Logger's rugged EEprom memory retains data for over 100 years in the unlikely event of complete battery discharge. Data may be transferred securely using the industry-standard Xmodem communication protocol. A two-level password system may be utilized to prevent unauthorized data transfers or setup modifications.

Remote Communication Features

An XR5 Data Logger may connect to an optional land-line or cellular modem, allowing the user to collect data from remote sites. Using a land-line modem, the XR5 Data Logger can non-intrusively share an existing phone line, and periodically transfer data to a central computer.

Alarm messages on your cell phone

With an optional GSM modem and a GSM cell phone, the XR5's SMS text message capability may be utilized. The phone number of a GSM cell phone and an alarm text message are entered into the XR5 (see SMS Setup on page 25 for details). Then, when an alarm condition occurs, an SMS message consisting of the alarm message, the current reading and a time stamp, is sent to your GSM cell phone.

Real Time Display

When an XR5 Data Logger is connected to a computer or PDA, a Real Time Display is available. When selected, current XR5 readings are updated every 2 seconds. The Real Time Display can function while simultaneously logging data in all logging modes except the "Fast Logging" modes.

Long battery life

XR5 Data Loggers are powered by a pair of user-replaceable lithium batteries. Battery life is greater than 2 years under typical usage. The battery voltage is displayed on the XR5's Status Screen. An external power input is provided. If external power is used, the batteries will power the unit during power outages (battery shelf life is over 10 years).

Switch Closures

The states of up to 8 unpowered switches or contact closures can be directly logged by an XR5 Data Logger. If desired, the switches can be logged as % ON Time. For example, if Channel 1 is set to Type: Switch and Mode: Average, then Channel 1 data will display the % ON Time of the switch. If the Log Interval is set to 100 seconds, and during the first 100 second period the switch was closed for only 1 second, the Channel 1 data for this period will be 1.00 (1% ON time). If the switch is closed during the entire next 100 second period, the Channel 1 data for this next period will be 100.00 (100% ON Time).

Direct-Connect Sensors

PACE offers over 30 precision sensors optimized for XR5 Data Loggers, including Temperature, Humidity, Pressure, Light, AC Current and AC Voltage. All PACE sensors require no external power, simplifying field installations. Sensors from other manufacturers are compatible with XR5 Data Loggers; see page 51 for requirements.

LogXR Software

Installation

WINDOWS VERSION

LogXR for Windows is distributed as a single executable file; two versions are available:

LogXR-Install.exe   Installs LogXR application files and the Java Runtime
Environment.

LogXR-Install-without-JRE.exe   Installs LogXR application files only (a much smaller file).
Use only if you have JRE 1.4.2 or higher installed on your
computer (available from the Sun website).

To install:
Once the LogXR exe file is saved to your computer, double click the file to install it.
Then launch LogXR by clicking Start | Programs | LogXR

LINUX VERSION

LogXR for Linux is distributed as a single RPM file; two versions are available:

LogXR-Linux.rpm   Installs LogXR application files and the Java Runtime
Environment.

LogXR-Linux-no-JRE.rpm   Installs LogXR application files only (a much smaller file).
Use only if you have JRE 1.4.2 or higher installed on your
computer (available from the Sun website).

To install:
1. Log in as user (not root).
2. Download the above file into your user home directory.
3. Double-click the LogXR rpm file to launch the RPM Installer.
After the installation is complete:
4. Log in as root.
5. Change permissions associated with /dev/ttyS0 and any other serial port to "execute".

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

Serial Ports:
After installation, LogXR is initially set to use serial port /dev/ttyS0. In order to choose a
different serial port, you must first modify the text file "cplist.xsf" located in the
Pace/Systems folder. Add a new line to "cplist.xsf" for each serial port that exists on
your computer. Then launch LogXR. Any serial port can now be selected by clicking
Port | Select.

Note: A Macintosh version of LogXR is in development, please contact Pace for details.

XR5 Hardware Setup

A computer running LogXR Software is used to set up the XR5. 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
Win98/ME/2000/XP or Linux computer running LogXR Software

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 Port
Some newer computers do not have a serial (com) port. In this case a USB/Serial Port Adapter is required. USB/Serial Port Adapters are available at computer and office supply stores for under $40. We recommend the following USB/Serial Adapters:

For Windows computers
- IOGear USB Serial Adapter #GUC232A
- Belkin USB PDA Adapter #F5U109
- KeySpan USB Serial Adapter #USA-19HS
  http://www.keyspan.com/products/usb/usa19hs/.

For Linux computers
- KeySpan USB Serial Adapter #USA-19HS
  http://www.keyspan.com/products/usb/usa19hs/

Other USB/Serial Port Adapters that have a 9 pin male connector (to accept the IC209 Cable) and are compatible with your computer's operating system should also work fine.

NOTE:
If desired, it is OK to maintain a permanent connection (via the IC209 Interface Cable) to a powered or unpowered computer. Doing this does not reduce the XR5's battery life.

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	XR5 Common (shared ground for all signals and sensors)
D	Precision 2.5v sensor excitation, 5ma maximum current.
E	Precision 5.0v sensor excitation, 29ma 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

If necessary, multiple leads may be connected to each terminal. We recommend using stranded type wires if multiple wires must be connected to a single screw terminal. 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" from the terminal block to provide some strain relief. Or mount the XR5 in an enclosure equipped with strain relief fittings for all cables, such as the Pace EC45 Compact 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 is not waterproof. Use outdoors requires housing the XR5 in a suitable weatherproof enclosure such as the Pace EC45 Compact 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 the "C" screw terminal to a good earth ground.

Overview: Using the XR5 Data Logger

First time or typical user

1. Launch LogXR Software (click Start | Programs | LogXR).

2. Connect the XR5 to a com port on your computer using the IC209 Interface Cable.

From the Main Menu:

3. Click on 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 on Status | Receive to confirm that the XR5 is operating as intended.

While the XR5 is connected to a computer running LogXR Software, you can initiate the following actions from the Main Menu:

Setup	Extract	Create a new Setup for a new logging session.
Real Time	Standard	Display sensor readings and alarm conditions every two seconds.
Real Time	Stream to File	Similar to Real Time	Standard, but also writes real time readings to a text file every two seconds.
Status	Receive	The XR5's time clock, setup and current conditions are displayed.
Transfer	All Data	All logged data is transferred to a text file.

Your XR5 data files (from Transfer | All Data) are always available for viewing in the LogXR Viewer (select File | View) and may be opened in a text editor (like Notepad) or spreadsheet program (like Excel).

_____

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

LogXR Menu Selections

The following topics describe the Main Menu selections (from left to right).

File menu
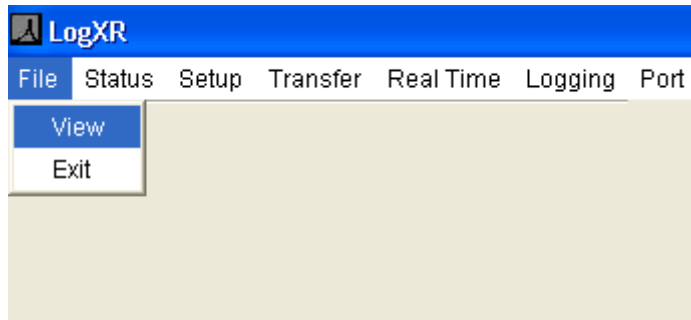
View
View an existing XR5 data file. XR5 data is in a readable, tabular format.

> <u>Notes</u>
> Very large data files (from XR5 –M models) may be too large to load into the LogXR Viewer. The LogXR Viewer's maximum file size is a function of available RAM in your computer and the memory allocated to Java programs.
>
> You may also view XR5 data files by opening them in a program such as Notepad or Excel.
>
> To open XR5 data files 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).

Exit
Terminates LogXR.

Status menu
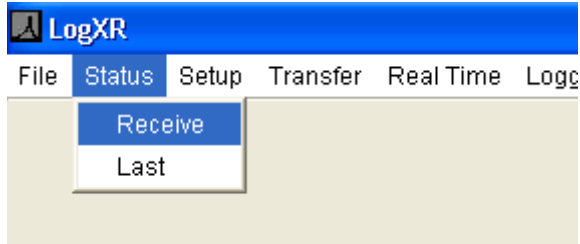
Receive
Receive and view current XR5 Status. The XR5 must be connected to the selected port (click
Port | Select to view the selected port).

Last
View the last received Status.

Status screen
The Status screen is a read-only screen that displays current operating conditions of the connected XR5. It
is similar to the Setup screen, but also has a Summary tab (details on next page). Please see the Setup
section (page 15) for descriptions of the other Status tabs.
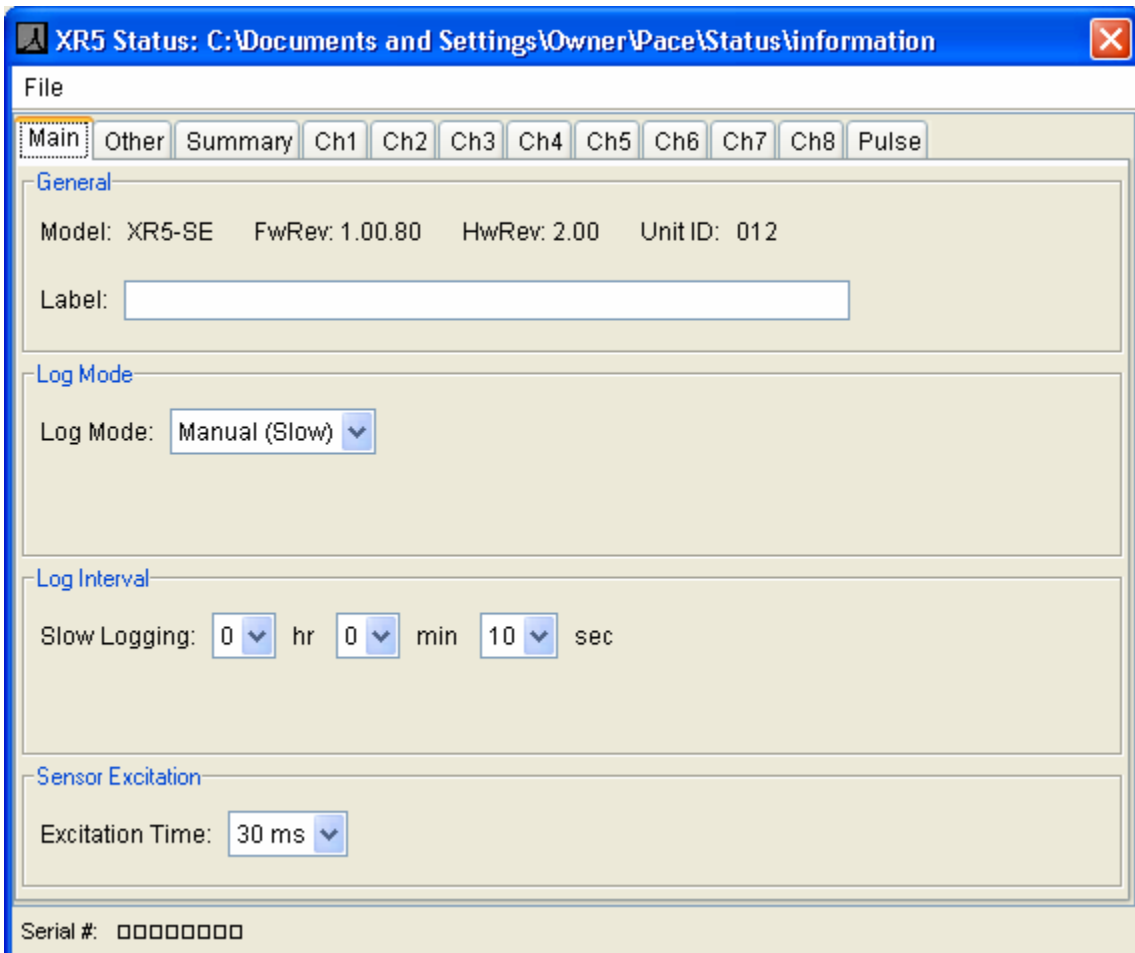
Status, "Summary" tab
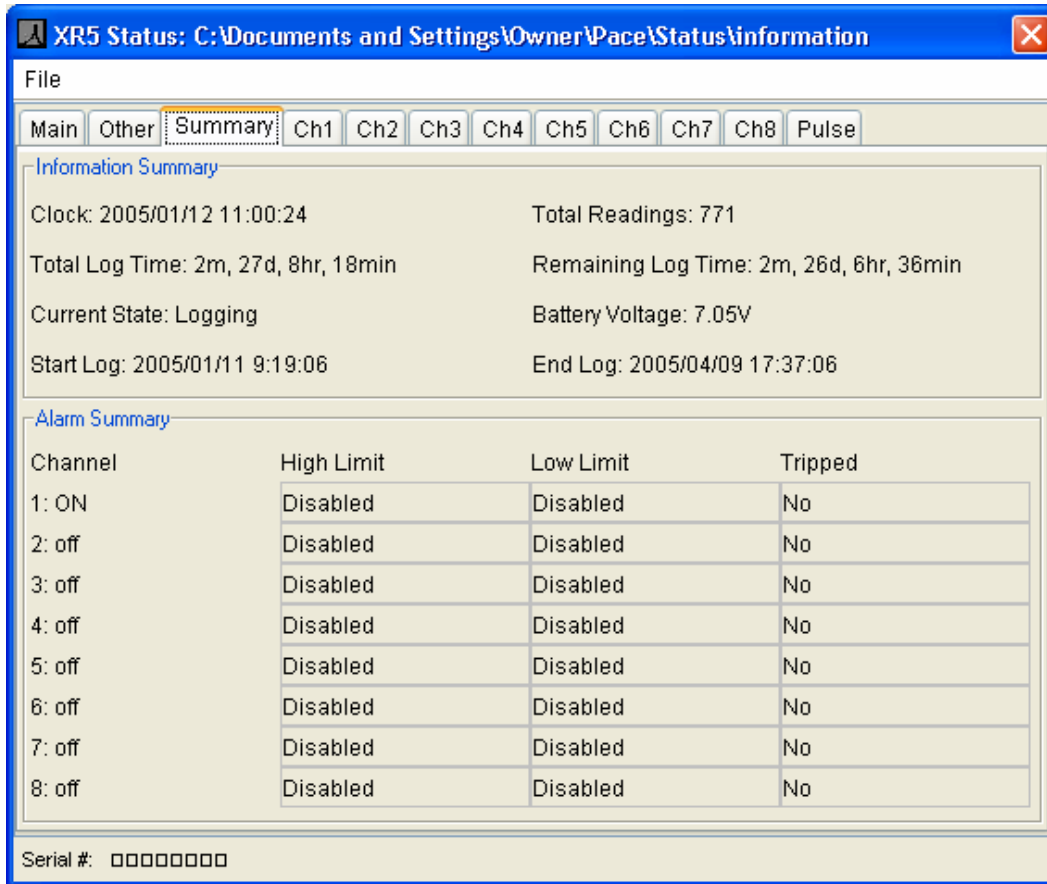
Clock:	The XR5's Time Clock (at the time Receive | Status was selected).
Total samples:	The total readings (from all active channels) currently logged in memory.
Total Log Time:	The maximum time span of the logged data (when the memory is full).
Remaining Log Time:	The logging time remaining until the 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.
Logging if Trigger active:	Data is being logged only if a valid trigger condition is present.
Logging if Alarm active:	Data is being logged only if one or more alarms are active.

Battery Voltage: The total voltage of the two internal batteries. The batteries should be replaced when the Battery Voltage reads below 5.8v. See page 41 for details. The battery voltage is also written to the header section of all XR5 data files.

Start Log: 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).

End Log: The calculated time that logging will end (when the memory becomes full). End Log time cannot be calculated if Log Mode is 'Log on Ext. Trigger' or 'Log on Alarms'.

Alarm Summary: Displays user selected alarm limits. The 'Enabled' column displays 'Yes' if alarm monitoring for the channel has been enabled in the Setup. 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. Older XR5 units do not have their serial number embedded in the XR5's firmware, in which case the serial number field is blank (the serial number is also written on a label applied to the side of the battery holder inside the XR5).

Setup menu
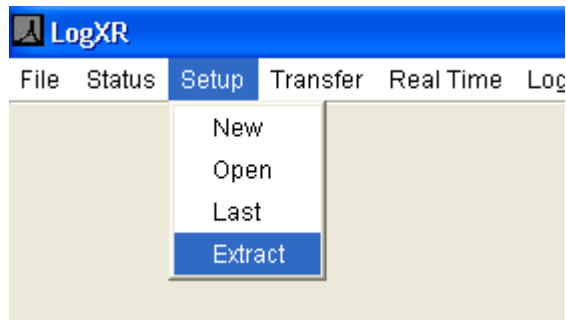
New
Create a new Setup (starting with the "factory default" settings).

Open
Open a previously saved Setup file.

Last
Open the last Setup used.

Extract
Extract Setup from the currently connected XR5. This is typically the most used Setup menu selection. It is an easy way to modify the existing setup in an XR5.

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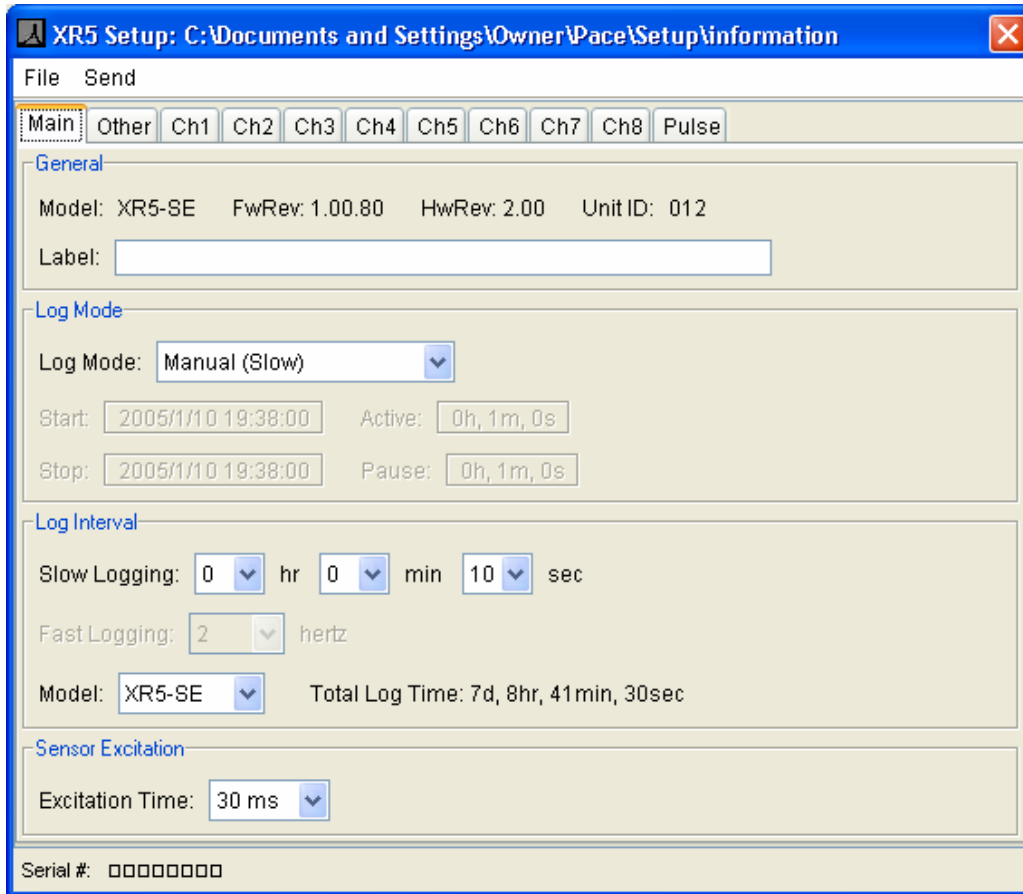
The Setup screen consists of multiple pages. If a page tab has focus (is clicked on), the arrow keys or Tab key may be used to select other pages. Click **Send | Send Setup** to send the Setup file to the XR5. Click **File | Save As** to save a Setup file for future use.

Model (read only)
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.

If **Setup | Extract** (or **Receive | Status**) is selected, the XR5's current Firmware Revision, Hardware Revision and Unit ID are displayed.

> **FwRev** (read only)
> The XR5's current Firmware Revision. XR5 Firmware is periodically updated and posted on Pace Scientific's web site. The XR5's firmware may be updated using the **Utilities | Firmware** selection. See page 34 for details.

> **HwRev** (read only)
> The XR5's Hardware Revision (factory build revision number).

> **Unit ID** (read only)
> The Unit ID is a unique, user assigned serial number or label. It may be changed using **Utilities | Change Unit ID**. See page 33 for details.

Label
You may enter an optional label describing the logging session.

Log Interval
Channels set to ON will log data at the interval selected. Depending on the current Log Mode selected, either the Fast Log Interval or Slow Log Interval will be grayed out. The Fast Log Interval is specified in Hertz, and selects the number of times *per second* that data is logged for each ON channel.

Total Log Time (read only)
The total log time, based on the number of channels set to ON and the selected Log Interval.

Sensor Excitation
Time period just prior to logging data that power is pulsed to the XR5's excitation terminals.

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

Pace Sensors (listed according to excitation time required):

Sensor	Excitation Time
All Temperature Sensors	none required
All AC Current Sensors	none required
All AC Voltage Sensors	none required
LS100 Light Sensor	none required
P300 Series Pressure Sensors	30ms
P1000 Series Pressure Sensors	30ms
TRH-160 Temperature / Humdity Probe	150ms
P1500 Series Pressure Sensors	150ms

Select the longest excitation time required among all the sensors connected to the XR5. For example, if a TRH-160 Probe and a P300 Sensor are connected to an XR5, the excitation should be set to 150ms.

Excitation Current Limits:

D terminal (2.50 volts):   5ma maximum, current limited.

E terminals (5.00 volts):   29ma combined maximum (D and E terminals), current limited.

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

NOTES:

1. If the selected Excitation Time is greater than or equal to the selected Log Interval, Sensor Excitation will be ON continuously, which will reduce battery life.

2. If a Fast Logging mode is active, Sensor Excitation will be ON continuously (while logging is active) and the selected Excitation Time is ignored.

Serial #:
Displays if **Setup | Extract** was selected. The serial number is factory set and cannot be changed. Older units do not have a firmware embedded serial number, in which case the serial # field is blank. The serial number is also written on a label inside the XR5.

Log Mode
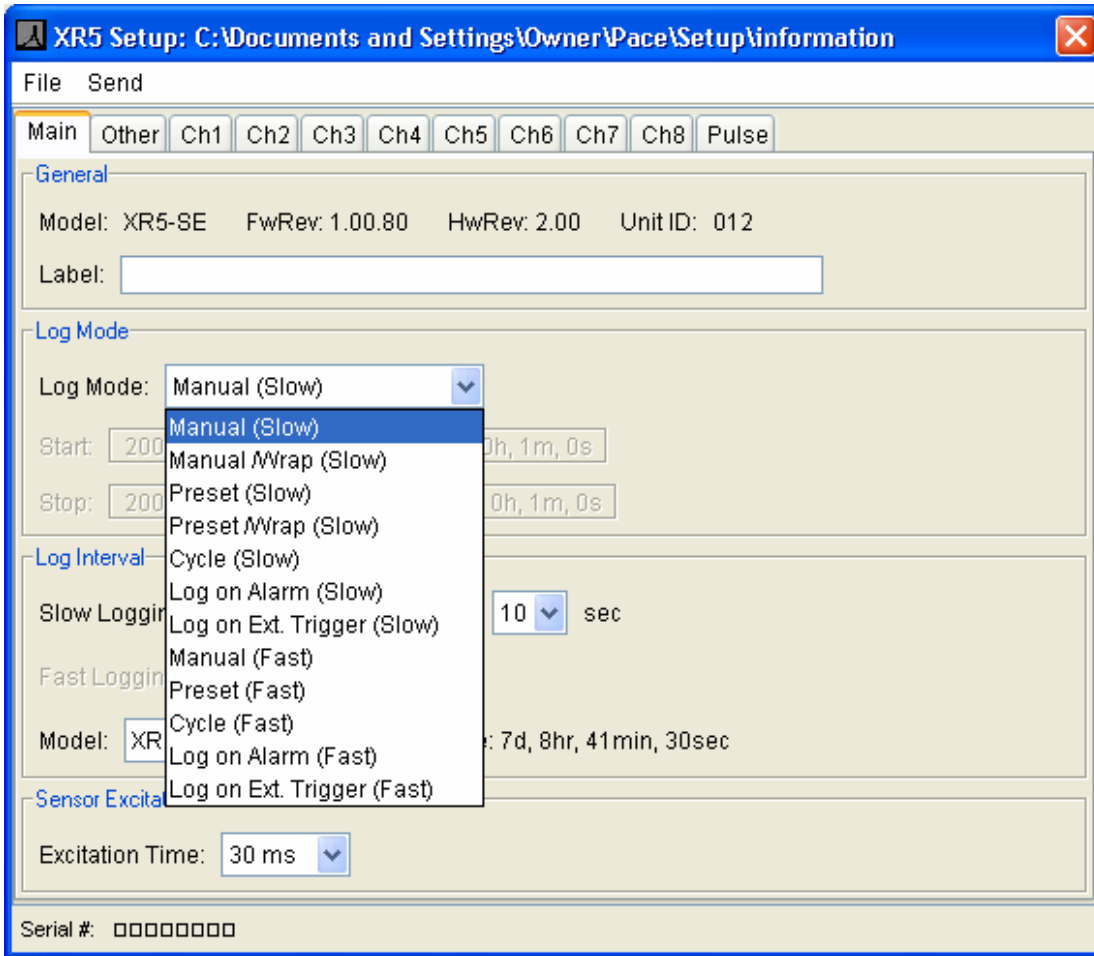
Logging modes are available for Slow (1 sec – 12 hr) or Fast (2Hz - 1000Hz) Logging. While a Slow Log mode is active, all communication functions are available. You can display Status or Real Time data or transfer logged data anytime without affecting the logging session. With Fast Log modes, once logging has started, most communication selections (**Status | Receive**, **Setup | Extract**, **Real Time**, **Transfer**) are disabled. **Logging | Stop** does function while Fast Logging is active.

To start a logging session, a Setup must first be sent to the XR5 by clicking **Send | Send Setup** from the Setup window.

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 this 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 when 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 "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 active channels) only while one or more alarms are active. Alarm limits are checked at the selected Log Interval, so an alarm level must be maintained for one Log Interval to insure that it will be logged. Any number of independent "data sets" may be logged until the memory is full (logging only while alarm conditions exist). The logging session continues until the memory is full or logging is stopped by selecting **Logging | Stop**.

> 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 at the selected Log Interval, so data logging will begin within one Log Interval after the trigger becomes active. Controlled by the trigger input, any number of independent "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.

FAST LOGGING MODES (2 HERTZ – 1000 HERTZ)

While Fast Logging is active, the Pulse inputs[1], Real Time Mode and Data Transfers are disabled. Alarm generation is disabled unless the "Log on Alarm (Fast)" mode 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] In the future, pulse inputs may function when logging at some fast logging rates. Contact Pace for details.

The 3 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
2 Hz - 200 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**.

> 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 active channels) only while one or more alarms are active. Alarm conditions are checked at the selected fast log interval (2Hz – 1000Hz). Logging stops when the memory becomes full or by selecting **Logging | Stop**.

> Status LEDs
> Green: Blinks continuously once setup is sent, even if alarm condition is not present.
> Red: Off (not used).

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 Log Interval, so data logging will begin within one Log 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 independent "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 valid trigger condition is not present.
> Red: Off (alarm generation is disabled).

> Note:
> The Stop Delay available in Log on Ext. Trigger (Slow) is not available for Log on Ext. Trigger (Fast).

Setup, "Other" tab

Real Time Settings

Update mode

2 seconds	Real Time Mode update interval is 2 seconds.
When Logging	Real Time display updates whenever readings are logged to XR5's memory. For example, if the XR5 is set to Log on Alarms, the Real Time Display updates only when Alarms are active, and the update rate is the selected Slow Logging Interval.
Log Stream	Special Real Time Mode for use only with **Networking	Single Host - Ethernet**. See <u>XR5 Networking User's Guide</u> for details.

Auto Stop
Prevents battery loss due to XR5 being left inadvertently in Real Time Mode. Real Time mode automatically terminates after Auto Stop hours has elapsed. Select Disable for no Auto Stop.

Dial Out Settings

Enables an XR5 connected to a modem to dial out to a central "host" computer running LogXR Software (**Networking | Single Host – Modem**). The Dial-Out Condition may be either a pre-selected time and interval (daily, weekly, monthly, or every x number of days), or when an alarm condition occurs, or both. Another selection: "Upon Memory 75% Full" causes the XR5 to dial out to the host computer if its memory is 75% full. If LogXR is running Single Host – Modem mode, whenever an XR5 calls in, its data will be automatically transferred to the host and (optionally) a new setup sent, clearing the XR5's memory.

AT Command

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

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 Rate

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

SMS Settings

SMS Control

Enable	Allow SMS Alarm generation as defined in the individual Channel tabs.
Disable	Disable all SMS Alarm generation.

Repeat Rate

Specifies the SMS message repeat interval if an alarm condition is maintained.

Password Settings

Security Level

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

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 new Setup.

Setup, Ch1-Ch8 Tabs
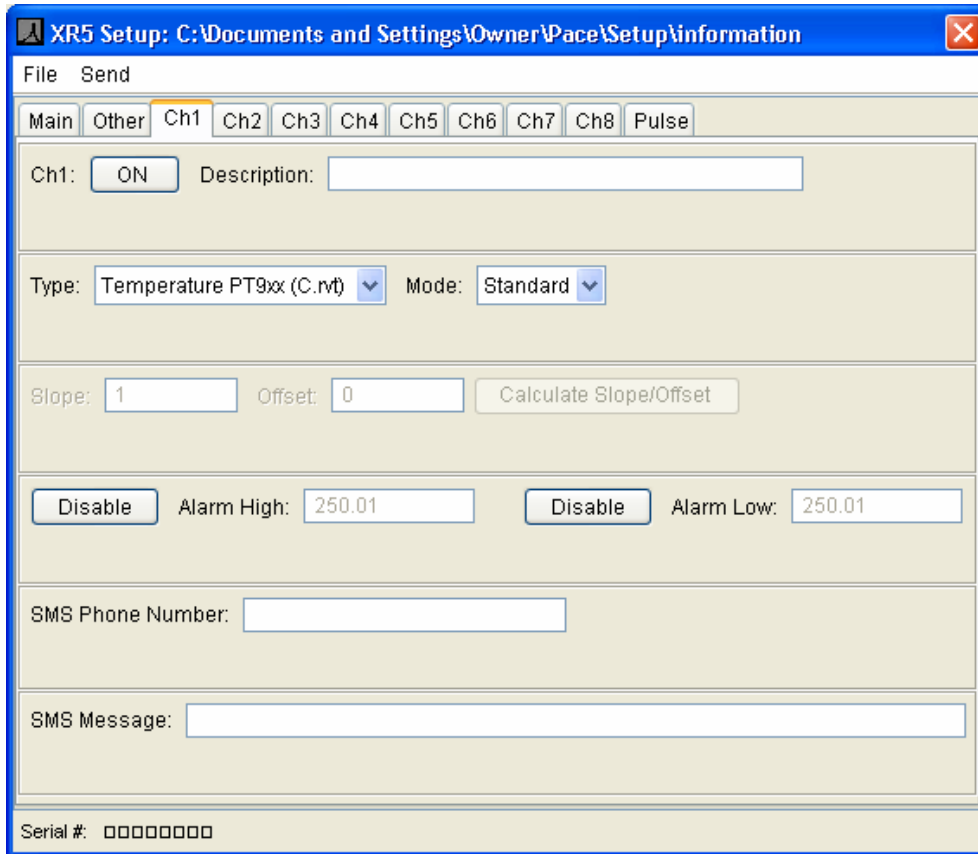
Channel ON/OFF button
Click to set channel ON or OFF. ON channels will log readings to memory when logging is active. OFF channels will not log readings to memory.

Description
Channel description (up to 24 characters).

Type
Channel Type selections vary based on the channel number and XR5 model number.

Temperature (A.rvt)	YSI 10k Thermistor (H mix)
Temperature (B.rvt)	YSI 10k Thermistor (B mix)
Temperature PT9xx (C.rvt)	Pace PT900 Series Temperature Probe.
Temperature PT510 (P.rvt)	Pace PT510 Platinum 10k RTD
Light Sensor LS100 (L.rvt)	Pace LS100 Light Sensor
Switch	Unpowered Switch Closure
Resistance	Two-wire resistance (range midpoint is 30k ohm)
0- 2.5V	0-2.5v input (impedance 10M ohm)

Above selections are available on: XR5-8A-SE, Channels 1- 8
XR5-8X-SE, Channels 1- 4

Pace Humidity Probe Available on certain channels, see page 43 for details.

0- 5V	0-5v input (impedance 100k ohm)

A fixed 0-5v input exists on: XR5-8X-SE, Channels 5- 8
XR5-8B-SE, Channels 1- 8

Mode
Channel mode selections are common to all models.

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

Channel	Reading is
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 or 0-5v.

Slope and Offset values for all PACE Sensors are listed in the Appendix.
For 4-20ma applications, see pages 53 and 54.

To scale data in actual volts (0-2.5v or 0-5v range), use
Slope = 1
Offset = 0

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

Range	Slope	Offset
0-2.5v	1638	0
0-5v	819	0

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. 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.

Alarm Limitations:
1. Differential Temperature Alarm: Only PACE PT900 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.
2. Channel alarms are disabled for all Fast Logging modes except "Log on Alarms".

Alarm Limits

Enter High and/or Low alarm limits for the selected channel. The Allowable Range is based on the selected channel Type or the 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).

> Please note:
> If you change the temperature scale (in the Setup screen's "Other" tab), any alarm limits previously entered will not automatically convert to the new scale. Instead, you have to manually enter new temperature limits based on the selected temperature scale.

SMS Alarm Messages

The following two fields configure an XR5 to send SMS messages to a GSM cell phone when an alarm condition occurs. A GSM modem must be connected to the XR5 in order to send SMS messages.

> **SMS Phone Number**
> Enter the cell phone number of the GSM cell phone. Enter the same number you would use to call the cell phone.

> **SMS Message**
> Enter a descriptive alarm message, including a site description, for the selected channel. Up to 59 characters may be entered. For example: "Temperature Alarm, ABC Cold Storage, 121 Central St, Unit 4". The channel's current reading and time stamp are appended to this message when it is sent to the cell phone.

> *To generate an SMS Alarm message, the channel's Alarm must be set to ON and the channel's desired High and Low alarm limits entered.*

> *Note: Please contact Pace Scientific for our recommended GSM cellular modem and modem setup instructions.*

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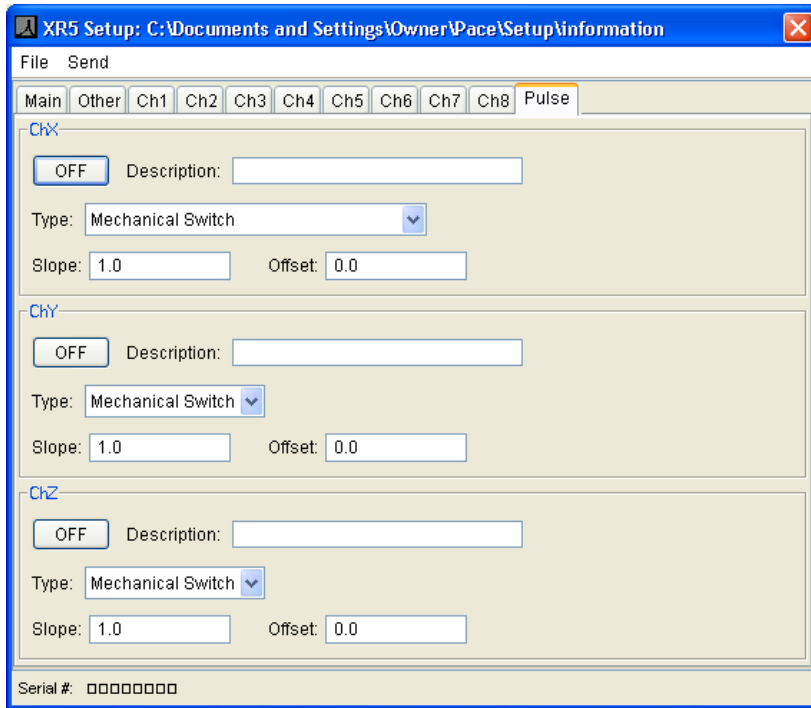
Ch ON/OFF
Sets the individual Pulse channel [X,Y or Z] to ON (enabled) or OFF (disabled).

Description
Enter a channel description of up to 24 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.

> **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 3.6v) or unpowered switch.
>> **Log if ChX Low (Switch Closed):** Voltage (0v to 0.5v) or unpowered switch.

>> **Stop Delay**
>> (Appears if **Log on Ext. Trigger (Slow)** has been selected in the Main Setup tab and a Trigger mode is selected for ChX). After a 'stop logging' trigger 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. A Stop Delay of all zeros disables the Stop Delay.

A 'start logging' trigger which occurs and is maintained for at least 1 log interval while the Stop Delay is active will clear the Stop Delay timer and cause logging to resume. The Stop Delay only applies to **Log on Ext. Trigger (Slow)**.

Alarm Output

Available on Channel Z only; Connect a 100k resistor from the Z terminal to ground (C terminal) when using the Alarm output function. With a 100k resistor connected from Z to ground, the Z terminal will read approx. 0.25 volts if no alarm, and about 1.8v if one or more alarms are active. An optional external alarm module (future product) will connect to the Z terminal and contain a high voltage relay.

NOTES:
1. Selecting a trigger mode on ChX automatically disables Channel X for pulse counting.
2. Selecting Alarm Output on Channel Z automatically disables Channel Z for pulse counting.

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 the result is added to the offset value. 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 would 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.

Frequency check box

Checking "Frequency" will cause the accumulated pulse count for each log interval to be converted to frequency readings in Hertz. The XR5's upper frequency limit is about 900Hz. Frequencies significantly above 900Hz will display incorrectly as a value closer to 900Hz.

NOTES:
1. Pulse channel Slope and Offset terms are applied to the all transferred XR5 data files (**Transfer | All Data**).

2. The Real Time main menu selections (**Real Time | Standard** and **Real Time | Stream to File**) display the "raw" pulse count accumulated from the beginning of the current log interval, regardless of the Slope and Offset scaling values and the state of the Frequency check box.

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 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 sometime later (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 a model specific file extension.

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 | All Data

Enter a data file name for the transferred data. Data is transferred in a binary format. After the transfer is complete, a readable text file of the binary data is created by LogXR, compatible with Excel and other programs. The created text file has a ".txt" file name extension. XR5 data can be viewed immediately after a data transfer or, at a later date by selecting **File | View** from the main menu. XR5 data may also be viewed by opening the data file in another program such as Notepad or Excel.

Progress Bar accuracy

For most logging modes, the Progress bar displays an accurate "transfer complete" percentage. If your log mode is Manual (Slow), Cycle, Log on Alarms, or Log on External Trigger, hundreds or thousands of separate data sets could exist in the logger's data, in which case the Progress Bar's % complete value can be inaccurate, and may display decreasing % complete values after reaching almost 100%.

Message: "File Too Large for Viewer"

Some very large data files (files from XR5 models with extended memory) are too large to be loaded into the current LogXR file viewer. The maximum file size for the Viewer is a function of the Java Runtime Environment memory allocation, which varies based on the available free memory in your computer. This limitation will be corrected in a future version of LogXR.

Files that are too large to be displayed in the LogXR File Viewer can be opened in a text editor like Notepad or in a spreadsheet program like Excel.

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 Options
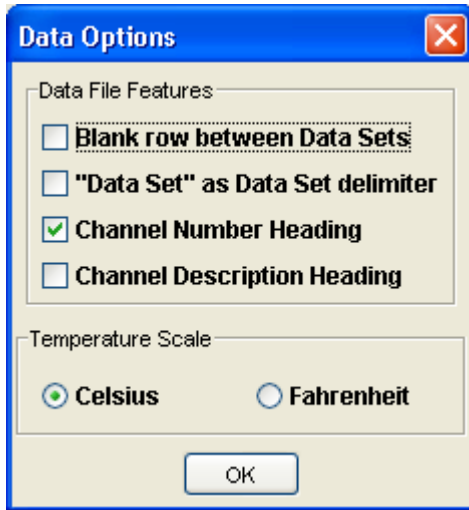
Data File Features

Four check boxes customize the format of XR5 Data Files. These selections apply to all XR5 data files created when **Transfer | All Data** is selected. Any combination can be checked.

> ### Blank row between Data Sets
> If checked, a blank row is inserted between multiple data sets in the same data file, to delimit the data sets.
>
> ### "Data Set" as Data Set delimiter
> 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.).
>
> > Note: The above two selections especially apply to data files that have multiple data sets. For example, Log on Ext. Trigger, Cycle Logging, and Alarm Logging are Logging modes which can have many data sets.
>
> ### Channel Number Heading
> If checked, a header row of channel numbers is inserted immediately above the first row of readings to label each column of data.
>
> ### Channel Description Heading
> If checked, a header row of channel descriptions is inserted immediately above the first row of readings to label each column of data.

Temperature Scale

Select the temperature scale (Celsius or Fahrenheit) for all temperature readings.

> Warning! If you have XR5 Setup files that include temperature alarm limits, the temperature limits will not be automatically converted to the new temperature scale if Temperature Scale is changed.

Real Time | Standard

Real time data is displayed in a readable format in the Real Time display. The Real Time update rate is selected in the Setup, Other tab, and is either every 2 seconds, or whenever the XR5 logs data [when logging].

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.

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

Real Time Display

General

Model: XR5-8A-SE   **FwRev:** 1.00.52   **Unit ID:** 001   **Log Mode:** Manual (Slow)

Real Time Interval: 0 hr, 0 min, 2 sec   **Log Interval:** 0 hr, 0 min, 10 sec   **Time since last update:** 0 sec

Values
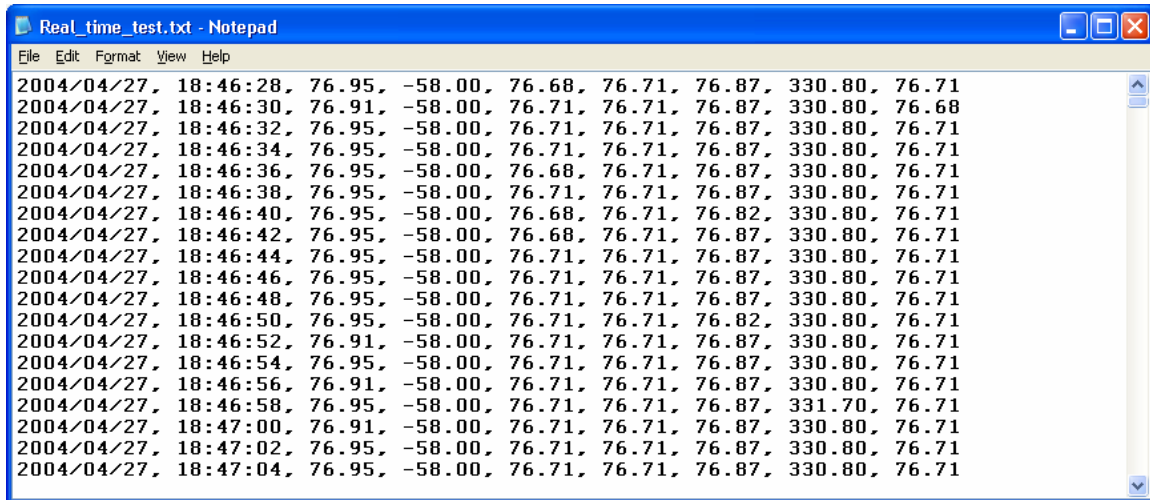
Channel		Description	Type / Mode	Slope / Offset	Alarm High / Low
1: ON	76.95	Channel 1	Temp "C" / Std	1.0, 0.0	89.98, 39.97
2: ON	-58.00	Channel 2	Temp "C" / Std	1.0, 0.0	89.98, 39.97
3: ON	75.24	Channel 3	Temp "C" / Std	1.0, 0.0	89.98, 39.97
4: ON	75.27	Channel 4	Temp "C" / Std	1.0, 0.0	89.98, 39.97
5: ON	76.87	Channel 5	Temp "C" / Std	1.0, 0.0	89.98, 39.97
6: ON	330.80	Channel 6	Temp "P" / Std	1.0, 0.0	500.00, 110.12
7: ON	75.24	Channel 7	Temp "C" / Std	1.0, 0.0	89.98, 39.97
8: OFF	75.24	Channel 8	Temp "C" / Std	1.0, 0.0	89.98, 39.97
X: OFF	0		Pulse		
Y: OFF	0		Pulse		
Z: OFF	0		Pulse		

STOP

Real Time | Stream to File

This selection generates the same display screen as Real Time | Standard, but real time data is simultaneously written to a text file. You are prompted to enter a file name for this data file. A new line of data will be written to the text file whenever the Real Time Display is updated.

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

Logging | Start

Commands the XR5 to start Logging. This menu selection is not valid (and is ignored) if the XR5 is set to a Preset or Cycle Logging mode. Alternately, you can start logging immediately upon sending a setup (a prompt appears). If you elect to not start logging when the setup is sent, use this selection to start logging at a later time.

Logging | Stop

Commands the XR5 to stop Logging. This is the only menu selection that the XR5 responds to if it is in a Fast Logging mode (2Hz – 1000Hz). 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 data file will contain multiple data sets.

Port | Select

Displays currently selected Port and a list of available ports. The port list includes any Ethernet ports that were previously set up using **Port | Ethernet | New Ethernet Port**. Select a port for XR5 communication. Click on a port name to select the port.

Port | Ethernet

Use to create, modify or delete a LogXR Ethernet port (see <u>XR5 Networking User's Guide</u> for details).

Port | Options

<u>Enable Port Delay</u> (For cellular communications).
If checked, enables a user specified Packet Delay and Response Timeout. Check only if communicating via cellular modems.

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

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

<u>Modem Connect Timeout</u>
The time from when a modem call is initiated until LogXR reports that it is unable to establish a connection with the remote modem. We suggest 1 minute for land-line modems and 2 minutes if using cellular modems.

<u>Encryption</u>
If 'Display Encryption Menu' is checked, 'Encryption' will appear in the main menu the next time LogXR is launched. Normally leave unchecked.

> CAUTION!
> Use Encryption only for special applications. Non-matching encryption keys can disable an XR5! The Encryption feature is discussed on page 56 in the Appendix.

<u>Xmodem Packet Size</u>
If your XR5 has firmware 1.00.76 or higher, checking "1024 bytes" for the Packet Size will result in faster communications.

> Please Note:
> If your XR5's Firmware rev. is lower than 1.00.76, communications will fail if "1024 bytes" is checked.

Networking

The Networking menu enables LogXR Software to communicate with XR5 Data Loggers over phone lines using land-line or cellular modems and over the Ethernet and Internet using Pace DS100 Ethernet Modules connected to a Wireless or Wired Ethernet LAN.

> Note: A separate <u>XR5 Networking User's Guide</u> is being prepared to document Ethernet and Modem connectivity using LogXR Software. Please contact Pace Scientific for availability.

Utilities | Verify Data

Use this selection to determine if an XR5 data file 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 from this menu selection, but it is designed to function as a unique, user-specified serial number or identifier for each XR5 Data Logger. If using a "Single Host" Networking mode (Ethernet or Modem communications), the Unit ID must be exactly 8 characters (letters and/or numbers) with no leading or trailing spaces.

Utilities | Change Password

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

Password Level	Effect
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. XR5 binary files are transferred using the XR5's Terminal Mode. In Terminal Mode, the XR5 can communicate with any computer (Win, Mac, Linux, etc) or PDA that is running a serial communications program. See the XR5 Terminal Mode User's Guide for details. The converted file is identical to a standard LogXR data file.

Appendix

Updating your XR5's Firmware

Updated XR5 firmware is periodically posted on the Pace website. Firmware updates may include enhancements or entirely new features. To update your XR5's firmware, please proceed as follows:

1. Make sure you are using the latest LogXR Software. Click Help | About to view your current version and then see if a higher version is posted at http://www.pace-sci.com/data-loggers-xr5.htm If a higher version is posted, download and install this 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 | Firmware | 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, LogXR automatically sends a "factory default" setup to initialize the XR5.

If updating from firmware version 1.00.49 or older
After updating from firmware 1.00.49 or older, LogXR does not automatically send a new setup to initialize the XR5. Therefore, please do the following to properly initialize the XR5:

1. Select **Setup | New**, select your model and click OK, then click **Send | Send Setup**.

2. If you are unable to send a setup then a hardware reset must be performed. To perform a hardware reset, remove the XR5's batteries (see page 41), wait a full minute and re-install the batteries. Then repeat step 1.

XR5 Data Loggers

Screw Terminal Assignments

Q   Regulated 9vdc Power Input. Not required. Provides power to the XR5 if present, otherwise power is supplied from internal batteries.
> *Warning: Voltage levels higher than 11v on terminal Q can damage the XR5.*
> *Do not use an unregulated 9vdc Power Supply.*
> *Use PACE part # PS-9V (120vac adapter) to externally power the XR5.*

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 (typically used to excite potentiometers).
E   5.0 vdc precision excitation (typically used to power pressure and humidity sensors and accelerometers).
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 <u>rotate the terminal screw counter-clockwise until the terminal's clamp cage is fully open</u>.

If more than one wire must be terminated in a screw terminal use stranded wires. Mixing solid and stranded wires, or using multiple solid wires of different diameters 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.

Available models

The XR5 Data Logger is available in three analog input configurations:

XR5-8A-SE   Channels 1-8 'Type A' inputs.

XR5-8B-SE   Channels 1-8 'Type B' inputs.

XR5-8X-SE   Channels 1-4: 'Type A' inputs; Channels 5-8: 'Type B' inputs.

Extended memory:
An extended memory version (260,250 readings) of each of the above models is also available.
Add a '–M' to the model number to specify the extended memory version.

INPUT TYPE: CHARACTERISTICS AND COMPATIBLE SENSORS

'TYPE A' INPUT
User selectable for the following:

Temperature (A.rvt):	YSI 10k Thermistor 'H mix'
Temperature (B.rvt):	YSI 10k Thermistor 'B mix'
Temperature PT9xx	Pace PT900 series Temperature Probe.
Temperature PT510	Pace PT510 10k ohm Platinum RTD
Light Sensor LS100	Pace LS100 Light Sensor
Switch:	Unpowered contact closure or dc voltage (3.6v max).
0-2.5v:	0 to 2.5 volt input, >10Mohm input impedance. Select for Pace TRH-160 Humidity Probe.
Resistance:	2-wire resistance (midpoint = 30k ohms, highest resolution is between 1k and 300k ohms).
4-20ma signals:	Use 0-2.5v input with a shunt resistor (part# INP-124ohm). When monitoring multiple 4-20ma signals, all shunt resistors connect to a shared common.

Alternate Input Ranges:
A 'Type A' input may be converted to a +/-2.5v, 0-5v, 0-10v, 0-15v, 0-30v, or 0-60v input using a Pace Scaling Cable. See page 48 for details.

'TYPE B' INPUT
Fixed 0-5v input with 100k input impedance.

Connect to any PACE Pressure Sensor.

Any or all 0-5v "Type B" inputs may be converted at the factory to fixed 0-10v, 0-15.3v, 0-30.6v, or 0-60v inputs. External Scaling Cables do not work with 'Type B' inputs. See page 49 for details.

Note: All XR5 SE models have three 24 bit pulse / frequency inputs and eight analog inputs.

Selection guide

XR5-8A-SE

If your primary need is for up to eight channels of temperature, contact closures, 0-2.5v or 4-20ma signals, or up to four TRH-160 Temperature/RH Probes, we would recommend the XR5-8A-SE. PACE Pressure Sensors do not directly connect to this model.

XR5-8B-SE

If you need to log up to eight 0-5v signals (which accept a 100k load), and/or PACE Pressure or AC Current Sensors, the '8B-SE' is the best choice. The '8B-SE' will not accept PACE Temperature Probes, PACE AC Voltage Sensors, Contact closures or the LS100 Light Sensor.

XR5-8X-SE

All PACE sensors and probes directly connect to the '8X-SE'. If you need to simultaneously log Pressure, Temperature, Relative Humidity, AC Current and AC Voltage, the '8X-SE' is a good choice.

ADDITIONAL COMMENTS

XR5-8A-SE
Direct connect to all PACE sensors and probes (up to 8 of any type, or any combination of up to 8) except PACE Pressure Sensors. Compatible sensors include all Pace Temperature Probes, 10k Thermistors, SVN Series AC Voltage Sensors, and LS100 Light Sensor. Pace AC Current Sensors are compatible but actual full scale range is ½ the listed full scale range (with no reduction in accuracy). Logs up to eight 0-2.5v or 4-20ma signals (each 4-20ma signal requires a PACE resistor #INP-124). Logs up to eight contact closures.

XR5-8B-SE
Eight fixed 0-5v inputs with 100k input impedance. PACE AC Current and PACE Pressure Sensors direct connect to the XR5-8B-SE. All other Pace sensors are not compatible with the 0-5v inputs of the XR5-8B-SE.

XR5-8X-SE
Direct connect to all PACE sensors and probes (up to 4 of any type, except a maximum of two TRH-160 Temperature Humidity Probes). Logs up to four 0-5v signals (which accept a 100k load), and up to four 0-2.5v signals or 4-20ma signals (each 4-20ma signal requires a PACE shunt resistor #INP-124). Directly logs up to four contact closures.

0-10v, 0-15 volt and 0-30 volt Inputs
Any 0-5v input may be converted at the factory to a fixed 0-10v, 0-15.3v or 0-30.6v input. Input impedance is reduced to about 60k ohm (100k ohm for 0-10v). Up to 4 inputs on the XR5-8X-SE and up to 8 inputs on the XR5-8B-SE may be factory converted. See page 49 for details.

Pulse Inputs
All XR5 SE models have three 24 bit pulse inputs, which may connect directly to pulse output Wind Speed or KWH Transducers, Rain Gages, Water Meters and Gas Meters. One pulse input may be used as an External trigger input (for the 'Log on Ext. Trigger' logging modes). One pulse input may be used as an Alarm Output.

Specifications

TYPE A INPUT[1]

Temperature Accuracy:[2]	+/- 0.15°C from 10 to 40°C
	+/- 0.3°C from -25 to 85°C
Temperature Resolution:	0.02°C at 25°C (12 bits)
	0.06°C or better from -25 to 75°C
Temperature Range:[2]	-40 to 150°C

0-2.5v range:	Accuracy:	+/- 0.25% F.S.
	Resolution:	1 part in 4095 (12 bits)
	Input impedance: >10Mohm (true for all logging modes and when inactive or not logging).	
Switch closure:	Unpowered contact: Open = 1, Closed = 0	
	Voltage signal: 2V to 12V = 1, 0V to 1V = 0.	

[1]*See page 36 for available analog input configurations.*
[2]*Assumes use of Pace PT900 series Temperature Probe or equal.*

TYPE B INPUT[3]

0-5v range	Accuracy:	+/- 0.25% F.S.
	Resolution:	1 part in 4095 (12 bits)
	Input impedance: 100k ohms	

[3] *See page 36 for available analog input configurations.*

PULSE INPUTS

Three pulse / frequency inputs (X,Y,Z) are provided. Pulse inputs accept voltage pulses or dry (unpowered) contact closures. Two pulse inputs (X and Z) may be configured for alternate functions: X as an external trigger input, and Z as an alarm output.

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	2.2 microamps
Voltage pulse		
	Positive range:	2.3 to 3.6 v
	Negative range	0 to 0.6 v

Alarm Output	(If selected on Terminal Z)	
	100k connected from Z to C	0.25V inactive, 1.8V active

INPUT PROTECTION
All analog and pulse inputs meet the following surge protection requirements:

IEC 61000-4-2 (ESD) 15kV (air) 8kV (contact)
IEC 61000-4-4 (EFT) 40Amps (5/50ns)
Maximum Continuous fault voltage:

Type A (0-2.5v) input:	+/-3.6v
Type B (0-5v) input:	+/-7.25v

GENERAL SPECIFICATIONS

Overall dimensions:	4.88" length, 2.21" width, 1.28" height. (124mm x 56.2mm x 32.5mm).

Length includes mounting ears, width includes detachable terminal block.

Weight (with batteries):	4.2 ounces; 120 grams
Mounting:	Two 0.187" dia. mounting holes on enclosure centerline, spaced 4.5" (114.3mm) apart.
Input termination:	Detachable 20 position screw terminal block.
Screw terminals (20):	Recommended wire size: 16 to 28 awg, solid or stranded.

Use stranded wire if multiple wires are terminated in a single terminal block.

Operating limits:	-40 to 70°C; -40 to 158°F
	5-90% R.H. non-condensing
Case material:	Tough, Flame Retardant ABS Plastic
	UL flammability rating 94V-O
IP Protection rating:	IP50
Memory capacity:	All standard models: 63,642 time stamped readings.
	All –M models: 260,250 time stamped readings.
Data retention:	Logged data and setup information: Over 100 years with no power.
Number of channels:	Eight analog input channels and three pulse input channels.
Communication interface:	Serial, 3 wire, EIA/TIA-562 signal levels (RS232 compatible), 9600 bps.
LED indicators (2)	Green: 5 second blinks: Slow logging is active.
	1 second (or faster) blinks: Fast Logging is active.
	Red: 5 second blinks: One or more active Alarms.

The Red LED does not function when Fast Logging.

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.

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.

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.

Sampling modes:	Standard, Average* (1 second internal sampling), Peak* (1 second internal sampling), Differential (Ch1-Ch2, Ch3-Ch4, Ch5-Ch6, Ch7-Ch8).

*Peak and Average sampling are only available when using the following Slow Logging modes: Manual, Preset, Manual/Wrap Preset/Wrap and Cycle.

Logging interval:	Any time interval from 1 second to 24 hours, plus 2Hz to 1000Hz for Fast Logging modes. During Fast Logging, the Real Time display and data transfers are not available, and pulse count inputs are disabled.

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).
	Alarms are disabled for all fast logging modes except 'Log on Alarm'.
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 Stream 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 9600bps.
Clock accuracy:	+/- 1 minute per month at 25°C.
	+/- 2.5 minutes per month from -10 to 60°C.
	Clock accuracy is also the time stamp accuracy for all logged data in all logging modes and logging intervals.
Battery life:	Battery life is dependent on logging rate and Real Time Mode use*

Logging Interval	Battery life
1 second	2 months
10 seconds	1 year
1 minute	5 years

*Displaying data constantly in Real Time reduces battery life. For example, if real time mode is constantly active (24/7) with a 2 second update interval, the batteries will discharge in about 3 months.

Battery type:	Lithium, ½ AA size, 3.6 volt (2 required).
External power input:	Voltage range: 8.0 – 10.0 vdc (9vdc nominal)
	Warning! A voltage higher than 11vdc on the External Power Input may damage the unit.
	Maximum current draw (sampling, writing to memory and communications all active) is approx 5ma (higher if external sensors are drawing power from the XR5's excitation terminals). Average power draw is approx 12 microamps (0.012 milliamps).
Excitation terminals:	E: 5vdc; maximum current draw, D + E terminals: 29 ma. (current limited).
	D: 2.5vdc, maximum current draw: 5 ma. (current limited).
	Note: 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. Revised March, 2005

Battery Replacement

The XR5 uses two ½ AA size, 3.6v lithium batteries. If the XR5's battery voltage reads below 5.8v, 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 your 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	+9volts	'Q' terminal

Although not recommended, the XR5 will run on external power if the internal batteries are discharged or not present. When external 9v power is present, the internal batteries are not used. The internal batteries power the XR5 upon loss of external power.

WARNING! Using an unregulated 9vdc power supply would expose the Q terminal to voltages above 11vdc and damage the XR5.

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

Temperature Probes

All Pace Temperature Probes may be directly connected to the XR5-8A-SE and XR5-8X-SE. Using PACE PT900 Series Temperature Probes, system accuracy is +/-0.15°C and resolution is 0.02°C at 25°C. Thermistor probes which conform to the PACE PT900 Series resistance vs temperature table may be used – contact PACE for details. The PACE PT510 Platinum RTD Sensor and industry standard 10k Thermistor Probes (YSI mix H or mix B) may also be connected to an XR5.

Compatibility

Model	Maximum # of Temperature Probes
XR5-8A-SE	8
XR5-8B-SE	0
XR5-8X-SE	4

LogXR Setup

The 'Type' selection in the channel tab must specify the Temperature Probe you wish to connect to the XR5. See Setup, "Channel" tab for details.

Wiring

Connect one lead of the Temperature Probe to the Channel #. Connect the other lead to 'C'.

Temperature / RH Probe

The PACE TRH-160 Temperature / Humidity Probe connects directly to the XR5-8A-SE. Up to 4 PACE
TRH-160 Probes may be connected to the XR5-8A-SE. Accuracy is +/-2%RH and +/-0.15°C at 25°C.

LogXR Setup
Select Type: 'Temperature PT9xx' for the channel that will log temperature.
IMPORTANT: The RH probe's temperature channel must be an odd numbered channel (1, 3, etc).

Select Type: 'Pace Humidity Probe' for the channel that will log relative humidity.
IMPORTANT: The humidity channel must be exactly one higher than the temperature channel.

Compatibility

Model	Maximum # of TRH-160 Probes
XR5-8A-SE	4
XR5-8B-SE	0
XR5-8X-SE	2

Wiring (XR5-8A-SE)

Lead	XR5 Terminal	Function
Red	1, 3, 5, or 7	Temperature
Black	C	Ground
Green	2, 4, 6, or 8	Relative Humidity
White	E	5v Excitation for RH Sensor.

The red temperature lead must be wired to an odd numbered channel, and the green humidity must be wired
to an even numbered channel, one higher than the temperature.
For the XR5-8X-SE, wire the red temperature lead to either channel 1 or 3.

Scaling Values
In the Channel tab representing the channel you have selected for Humidity, enter the Slope and Offset
values listed on the TRH-160 Probe.

Excitation Time
The TRH-160 requires 150ms Excitation time (the Excitation Time is selected in the Setup, Main tab).

Temperature Compensation
LogXR automatically temperature compensates the TRH-160's humidity readings to achieve +/-2%
accuracy over the probe's full operating temperature range of –40 to 85 deg. C (-40 to 185 deg. F).

> **Using the TRH-160 without a Pace Data Logger or without LogXR Software**
> For customers using the TRH-160 Probe with other (non-Pace) data acquisition systems, or
> acquiring humidity data via the XR5's text interface, a compensation formula should be applied to
> the humidity data for best accuracy. The formula is as follows:
>
> $$RHc = RH/(1.0546 - 0.00216 * T)$$
>
> Where: RH = %RH (not temperature compensated).
> T = Temperature of TRH-160's temperature sensor (in °C).
> RHc = %RH (compensated for TRH-160 Probe temperature).

Installation
In moist environments, the TRH-160 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).

Pressure Sensors

PACE offers direct-connect Pressure Sensors for XR5 Data Loggers. All require no external power.

P1000 or P1500 / P1510 Pressure Sensor

Connect directly to an XR5 Data Logger's 0-5v input channel; no external power required. Recommended for high and low side refrigeration and air conditioning systems, chilled water, hot water, air, gas, oil and steam pressure.

Compatibility

Model	Max # of P1000 Sensors	Max # of P1500 / P1510 Sensors
XR5-8A-SE	0*	0*
XR5-8B-SE	8	5 (due to higher power requirement of P1500/P1510)
XR5-8X-SE	4	4

*Up to eight P1000 Pressure Sensors or up to five P1500 / P1510 Pressure Sensors can connect to an XR5-8A-SE using INP-5V Scaling cables. See page 55 for details.

Wiring

P1500 or P1000 if leads are Green, Black and White

Lead Color	XR5 Terminal	Function
Black	C	Ground
White	E	Excitation
Green	Any 0-5v input	Pressure Signal

P1500 or P1510 if leads are Red, Black and White

Lead Color	XR5 Terminal	Function
Black	C	Ground
Red	E	Excitation
White	Any 0-5v input	Pressure Signal

P1000 if leads are Red, Yellow and White

Lead Color	XR5 Terminal	Function
White	C	Ground
Red	E	Excitation
Yellow	Any 0-5v input	Pressure Signal

LogXR Setup

Use a 0-5v input range for the pressure sensor's input channel.

Excitation Time

All PACE P1000 Pressure Sensors require 30ms of Excitation time. All PACE P1500 and P1510 Pressure Sensors require 150ms of Excitation time (see Setup, page 16 for details).

Scaling Values

The Slope and Offset scaling values for PACE Pressure Sensors are listed below. The values are listed for units of PSI. To read pressures in a different measurement unit, contact PACE Technical Support for the Slope and Offset values.

Model	Range	Slope	Offset
P1000	0 - 25 psig	6.25	-3.12
	Vac (-15) - 120 psig	33.75	-31.87
	Vac (-15) - 600 psig	153.75	-91.87

Models	Range	Slope	Offset
P1500 / P1510	0 – 25 psig	6.25	-3.12
	0 – 50 psig	12.5	-6.25
	0 – 100 psig	25.0	-12.5
	0 – 250 psig	62.5	-31.2
	0 – 500 psig	125	-62.5
	0 – 1000 psig	250	-125
	0 – 2500 psig	625	-312
	0 – 5,000 psig	1250	-625
	0 – 7,500 psig	1875	-937.5
	0 – 10,000 psig	2500	-1250

P300 Pressure Sensors

For indoor air applications including Lab/Clean Room Pressurization, Filter Differential Pressure, Fan Static Pressure, Absolute Pressure and Barometric Pressure. Compatible pressure media: dry air, nitrogen, oxygen, hydrogen, helium, neon, argon, krypton, xenon.

Compatibility

Model	Maximum # of P300 Sensors
XR5-8A-SE	0*
XR5-8B-SE	8
XR5-8X-SE	4

*Up to eight P300 Pressure Sensors can connect to an XR5-8A-SE using INP-5V Scaling cables. See page 55 for details.

Wiring

Lead Color	XR5 Terminal	Function
Black	C	Ground
White	E	Excitation
Green	Any 0-5v input	Pressure Signal

LogXR Setup

Use a 0-5v input range for the channel that will log the pressure sensor.

Excitation Time

All PACE P300 Pressure Sensors require 30ms of Excitation time (see Setup, page 16 for details).

Scaling Values

The Slope and Offset scaling values for PACE P300 Pressure Sensors are listed below. To read pressures in a different measurement unit, contact PACE Technical Support for the Slope and Offset values.

Model	Range	Slope	Offset
P300	0-1 inch H20 gauge	0.25	-0.16
	0-5 inch H20 gauge	1.25	-0.31
	0-10 inch H20 gauge	2.5	-0.62
	0-30 inch H20 gauge	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
	0-15 psig or psia	3.33	-0.83
	0-30 psig or psia	6.67	-1.67
	Barometric 600 - 1100 millibar	125	569
	17.72 - 32.48 inHg	3.36	16.8 (alternate inHg scaling)

AC Current Sensors

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

Compatibility

Model	Maximum # of PACE AC Current Sensors
XR5-8A-SE	8
XR5-8B-SE	8
XR5-8X-SE	8

Wiring

Lead Color	XR5 Terminal	Function
Black	C	Ground
Red	Any 0-2.5v or 0-5v input	Signal

LogXR Setup

Pace Current Sensors may be connected to either a 0-5v input or a 0-2.5v input. If using a 0-2.5v input, the sensor's maximum AC amps become ½ the full-scale range listed on the sensor. For example, a Pace SC200A has a 0 to 200 Amp range, but when connected to a 0-2.5v input, the usable range becomes 0 to 100 amps.

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

*Because of its higher output impedance, we recommend connecting the SC100A to a 0-2.5v input for best accuracy. For all other PACE AC Current Sensors, using either a 0-2.5v or 0-5v input will give excellent performance.

AC Voltage Sensors

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

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 SVN Series AC Voltage Sensors
XR5-8A-SE	8
XR5-8B-SE	0
XR5-8X-SE	4

Wiring

Follow wiring instructions printed on sensor.

Special notes for SVN600 AC Voltage Sensor:

> The SVN600 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 Setup

Connect the AC Voltage Sensor to a 0-2.5v analog input channel (Type A input). Follow the wiring instructions printed on sensor.

Enter the Slope and Offset scaling values listed below.

Model	Range (ac volts)	Slope	Offset	Resolution	XR5 input
SVN300	0-300	120	0	0.07 volt	0-2.5v
SVN600	0-600	240	0	0.15 volt	0-2.5v

PACE SV series Voltage Sensors (for the XR440 Pocket Logger) may be connected to an XR5 0-2.5v input. The AC Input Voltage Range of the SV300 and SV600 will be ½ the listed full-scale range if used with the XR5.

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

Both SV and SVN series AC Voltage Sensors are not recommended for use with an XR5 Type B input (0-5v input range). Doing so will result in a measurement error of about 4%.

Additional Voltage Ranges

External Scaling Cables

Pace offers external 'INP Cables' that provide alternate input ranges for any 0-2.5v 'Type A' analog input. See next page for additional fixed voltage ranges available for 'Type B' inputs.

Part #	Input Range	Input Impedance
INP/2	+/-2.5vdc	Approx. 100k
INP/2	0-5vdc	Approx. 100k
INP/4	0-10vdc	Approx. 100k
INP/6	0-15vdc	Approx. 100k
INP/12	0-30vdc	Approx. 100k
INP/24	0-60vdc	Approx. 100k
INP-124	4-20ma	124 ohm

Notes:
Pace INP Cables cannot be used with 0-5v 'Type B' inputs.
The INP/2 Cable can be wired to provide either a 0-5v input or a +/-2.5v input.

Wiring

For 4-20ma current loop applications, follow the wiring instructions on page 53.

INP Cable Lead color	XR5 Terminal	Function
Black*	C	Ground
Green	Channel #	Scaled signal to XR5
Yellow	none	Connect to Signal

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

*Special wiring for ±2.5v input
Connect the black wire of INP-5V to the XR5's D terminal.

LogXR Setup

Click the Channel tab the scaling cable is connected to, select Type: 0-2.5v, and enter the following scaling values to read the input signal as a voltage.

Part #	Input Range	Slope	Offset
INP/2	+/-2.5vdc	2	-2.5
INP/2	0-5vdc	2	0
INP/4	0-10vdc	4	0
INP/6	0-15vdc	6	0
INP/12	0-30vdc	12	0
INP/24	0-60vdc	24.05	0
INP-124	4-20ma	Please see pages 54 and 55.	

Fixed 0-10v, 0-15v and 0-30v Inputs

Any XR5 0-5v 'Type B' inputs may be converted at the factory to 0-10v, 0-15.3v, 0-30.6v, or 0-60v inputs. A "-10v, "-15v" or "-30v" added to the XR5 model number specifies each converted input. Up to four XR5-8X-SE inputs and up to eight XR5-8B-SE inputs may be converted. For example, model # XR5-8B-SE-15v-15v-30v-30v specifies 0-15v for channels 5 and 6 and 0-30v for channels 7 and 8. The input impedance of a converted channel is about 60k ohms (100k ohms for 0-10v).

LogXR Setup
Click the Channel tab of the converted channel, and enter the following scaling values to read the input signal as a voltage.

Input Range	Slope	Offset
0-10vdc	2	0
0-15.3vdc	3.06	0
0-30.6vdc	6.12	0

Potentiometer Applications

The XR5 Data Logger can log analog readings from potentiometric devices.   The potentiometer should be 10kohms or higher (see note below). Potentiometric devices include wind direction vanes, inclinometers and linear displacement sensors.

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 pickup on wires connected to the D terminal could result in measurement errors.

Compatibility

Model	Maximum # of Potentiometric Sensors
XR5-8A-SE	8
XR5-8B-SE	0
XR5-8X-SE	4

LogXR Setup
Use a 0-2.5v input range (Type A input) 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 with a 0-2.5v range can be used.

Potentiometer
10K – 100k
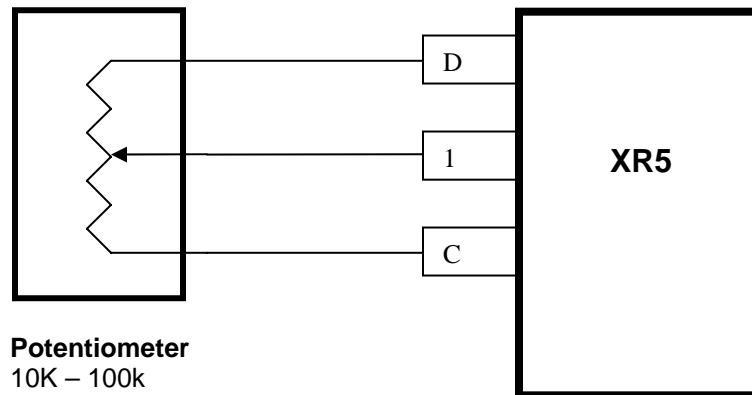
NOTE: Potentiometers less than 10k ohms may be used but are not recommended. The D Terminal can supply a maximum of 5ma. A 1k ohm potentiometer will draw 2.5ma from the D Terminal.

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	25ma (total draw for all sensors powered from the E terminals)
Maximum warm-up time	10 seconds
Signal Output	A voltage output within the range of 0-5vdc.
Output Signal Load	100k 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	5ma (total draw for all sensors powered from the D terminal)
Maximum warm-up time	10 seconds
Signal Output	A voltage output within the range of 0-5vdc.
Output Signal Load	100k for XR5 0-5v input range.
	10M for XR5 0-2.5v input range.

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 Load	100k for XR5 0-5v input range.
	10M for XR5 0-2.5v input range.

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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).

IMPORTANT:

XR5 inputs are not isolated; multiple 4-20ma signals share a common ground. In some cases, 4-20ma isolators may be required. See page 53 for more details.

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 3.6 v
	Positive-going input threshold:	2.3 v
	Negative-going input threshold	0.6 v
Unpowered Contact:	Bias (pull-up) voltage	3.3 v
	Bias resistance	1.5 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).

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 0 and 3.6 volts.

Current Loop Applications

An 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 terminal block.

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

> WARNING
> XR5's 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
XR5-8A-SE	8
XR5-8B-SE	0
XR5-8X-SE	4

Wiring
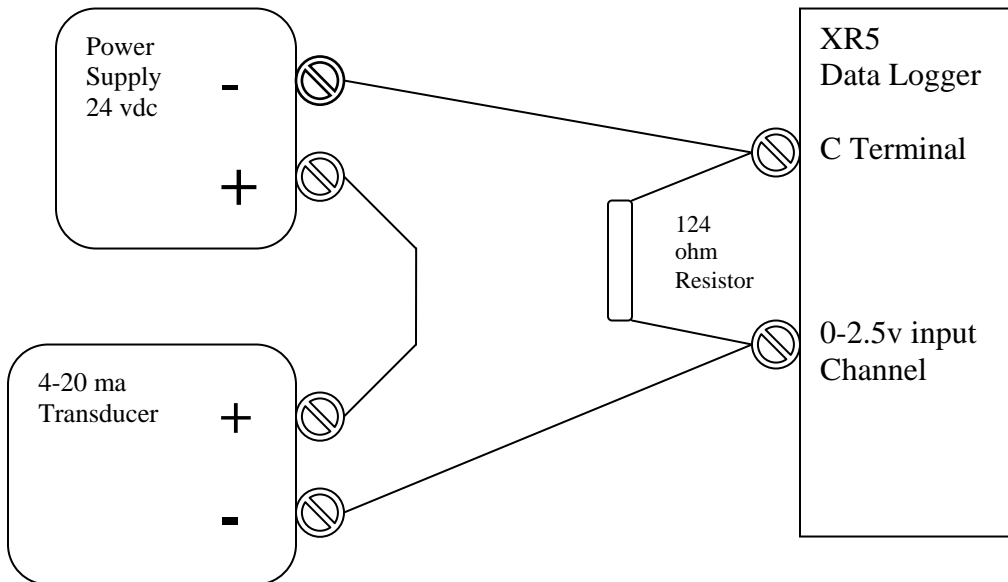
XR5 Setup
In the Channel tab Select Type: 0-2.5v.

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 will result in the upper range of the 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

PACE offers an external switch designed for battery powered 4-20ma current loop applications. The external switch is wired in series with the current loop. Sensing wires from the ES-1 are wired to the XR5's C and E terminals. In this way an external battery can be switched on, powering the current loop just prior to logging readings (for the duration of the XR5's selected Excitation Time), and then be switched off. With the ES-1, a remote site can log readings from 4-20ma transmitters for extended periods of time using a relatively small external battery to power the current loop.

Using Pressure Sensors with 0-2.5v inputs.

All Pace Pressure Sensors require a 0-5v input channel. The XR5-8A-SE Data Logger does not have 0-5v inputs, but you can use an INP-5V cable to convert a 0-2.5v input to a 0-5v input. Multiple INP-5V Cables can be used to convert multiple 0-2.5v inputs to 0-5v inputs.

Pace Pressure Sensors with Red, Black and White leads.

Connect the INP-5V's Black lead to an XR5 C terminal.
Connect the INP-5V's Green lead to an XR5 0-2.5v input.
Connect the INP-5V's Yellow lead to the Pressure Sensor's White lead (the pressure signal lead).

The connections of the two remaining wires from the Pressure Sensor do not change:
Connect the Pressure Sensor's Red lead to an XR5 E Terminal.
Connect the Pressure Sensor's Black lead to an XR5 C Terminal.

Pace Pressure Sensors with Green, Black and White leads.

Connect the INP-5V's Black lead to an XR5 C terminal.
Connect the INP-5V's Green lead to an XR5 0-2.5v input.
Connect the INP-5V's Yellow lead to the Pressure Sensor's Green lead (the pressure signal lead).

The connections of the two remaining wires from the Pressure Sensor do not change:
Connect the Pressure Sensor's White lead to an XR5 E Terminal.
Connect the Pressure Sensor's Black lead to an XR5 C Terminal.

Pace Pressure Sensors with Red, White and Yellow leads (older P1000 models).

Connect the INP-5V's Black lead to an XR5 C terminal.
Connect the INP-5V's Green lead to an XR5 0-2.5v input.
Connect the INP-5V's Yellow lead to the Pressure Sensor's Yellow lead (the pressure signal lead).

The connections of the two remaining wires from the Pressure Sensor do not change:
Connect the Pressure Sensor's Red lead to an XR5 E Terminal.
Connect the Pressure Sensor's White lead to an XR5 C Terminal.

Scaling

Offset: Use the Offset Value listed.
Slope: Use twice the value listed.*

*For example, if the listed Slope value is 62.5, use 125 for the slope (62.5 * 2).

Slope and Offset values for all Pace Pressure Sensors are listed on pages 44 and 45 or this manual.

Data Encryption

Data encryption allows a user to control the readability of XR5 data files. Encryption is enabled by sending an encryption key to the XR5. Once an XR5 has an encryption key, all XR5 data files (Transfer | All Data) are automatically encrypted. Data files transferred using the XR5's Terminal Mode are also encrypted. A matching key must exist in LogXR Software to decrypt an encrypted XR5 data file.

> WARNING!
> There is no way to extract the encryption key from an XR5. If the encryption key in LogXR Software is lost (LogXR Software is deleted, hard drive failure, etc), and the user does not have a backup record of the key, data transfers will yield no data. The only solution is to return the unit to Pace Scientific.
>
> NOTE:
> Setting up LogXR Software for data encryption will not affect non-encrypted XR5 Data Loggers.

Data Encryption is set up as follows:

1. Enable the Encryption Menu
Data encryption is set up by first enabling the LogXR Encryption menu. To do this, click Port | Options and check 'Enable Encryption Menu'. Then terminate and re-start LogXR. The Encryption menu selection will now be visible.

2. Set the Encryption Password
The default encryption password is "password". We recommend you create your own password by clicking Encryption | Change Password. The Encryption Password is required to access the Encryption Key.

3. Set the Encryption Key
Click Encryption | Set Key. Enter your password. The Encryption Key appears. The Encryption Key consists of four numbers. Each number can be from 0 to 254. The default key is all zeroes. Enter a new key by clicking the Change button. Any key is valid as long as each number is from 0 to 254 and that all four numbers are not 0 (which disables encryption). When you have entered a new key, click OK and the new key is saved in an encrypted format on your hard disk.

4. Send the Encryption Key to the XR5.
Sending a valid Encryption Key to an XR5 enables data encryption.
Click the 'Send to XR5' button. A warning screen appears; click OK.
Enter the XR5's current Encryption Key and click OK. If encryption is not currently enabled in the XR5, then the current key is four zeroes (encryption disabled). An encryption key can not be sent to the XR5 unless the current key is known.

All data files transferred from the XR5 will now be unreadable unless the LogXR Software being used to transfer the data has a matching key. A data file transferred using LogXR that does not have a matching encryption key will be saved as a binary file with a '.binary' file extension. These files can be decrypted using a copy of LogXR Software which has a matching key by clicking Utilities | Convert Binary File.

Disabling Data Encryption
Any XR5 that is enabled for data encryption (has received a valid key) can have data encryption disabled by sending an encryption key of all zeroes to the XR5. In order to do this the existing XR5 key must be known. There is no way to extract the current encryption key from an XR5.

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.

Once an RMA number is issued, return item for repair to:

Pace Scientific Inc.
Attention: Service Dept. / RMA# <u>your RMA# here</u>
542 Williamson Rd Unit 6
Mooresville NC 28117
USA

XR5 Data Loggers and Accessories - Price List

XR5 Data Loggers	Description			Price
XR5-8A-SE	Eight 'Type A' inputs and 3 pulse inputs; up to 63,642 readings			$499.
XR5-8B-SE	Four 'A', four 'B' inputs and 3 pulse inputs; up to 63,642 readings			$499.
XR5-8X-SE	Eight 'Type B' inputs and 3 pulse inputs; up to 63,642 readings			$499.
XR5-8A-SE-M	XR5-8A-SE with extended memory for up to 260,250 readings			$599.
XR5-8B-SE-M	XR5-8B-SE with extended memory for up to 260,250 readings			$599.
XR5-8X-SE-M	XR5-8X-SE with extended memory for up to 260,250 readings			$599.
IC209	Interface Cable (REQUIRED)			$20.

Temperature Probes, 0.1°C interchangeability

PT907	Epoxy body	0.127" dia. x 0.37" length	4FT cable	$20.
PT916	SS sheath	1/8" dia. x 4" length	3FT Teflon leads	$44.
CF916-1/8	SS compression fitting for PT916 probe, 1/8 NPT male threads			$12.
PT933	SS sheath	3/16" dia. x 1" length	20FT cable	$40.
PT940	SS sheath	3/16" dia. x 1" length, water res.	20FT cable	$46.
PT956	SS sheath	¼" dia. x 2" length, waterproof	20FT heavy-duty cable	$52.

High temperature sensor, 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	$39.
PT520	Max. Continuous Temperature: 260°C (500°F)	40" Teflon leads	$58.

Relative Humidity & Temperature Probes, 2% RH accuracy, 0.1°C interchangeability

TRH-160	1FT leads	$205.
TRH-160-10FT	10FT shielded cable	$225.
TRH-160-20FT	20FT shielded cable	$233.
TRH-160-50FT	50FT shielded cable	$258.

Pressure Sensors – P1500 Series

P1500-100	Range: 0-100 psig	¼ NPT female	8FT cable	$275.
P1500-250	Range: 0-250 psig	¼ NPT female	8FT cable	$275.

Pressure Sensors – P1510 Series

P1510-25	Range: 0-20 psig	¼ NPT male	2FT cable	$260.
P1510-50	Range: 0-50 psig	¼ NPT male	2FT cable	$260.
P1510-500	Range: 0-500 psig	¼ NPT male	2FT cable	$260.
P1510-1000	Range: 0-1000 psig	¼ NPT male	2FT cable	$260.
P1510-2500	Range: 0-2500 psig	¼ NPT male	2FT cable	$260.
P1510-5000	Range: 0-5000 psig	¼ NPT male	2FT cable	$260.
P1510-7500	Range: 0-7500 psig	¼ NPT male	2FT cable	$260.
P1510-10,000	Range: 0-10,000 psig	¼ NPT male	2FT cable	$260.

Pressure Sensors – P1000 Series

P1500-120	Range: Vac-120 psig	¼ NPT female	8FT cable	$350.
P1500-600	Range: Vac-600 psig	¼ NPT female	8FT cable	$350.

XR5 Accessories - Price List

Pressure Sensors – P300 Series

P300-1in-D	Range: ±1in H2O	3/16" plastic	1FT leads	$210.
P300-5in-D	Range: ±5in H2O	3/16" plastic	1FT leads	$200.
P300-10in-D	Range: ±10in H2O	3/16" plastic	1FT leads	$200.
P300-30in-D	Range: ±30in H2O	3/16" plastic	1FT leads	$200.
P300-1-G	Range: 0-1 psig	3/16" plastic	1FT leads	$160.
P300-5-G	Range: 0-5 psig	3/16" plastic	1FT leads	$160.
P300-15-G	Range: 0-15 psig	3/16" plastic	1FT leads	$160.
P300-15-A	Range: 0-15 psia	3/16" plastic	1FT leads	$160.
P300-30-G	Range: 0-30 psig	3/16" plastic	1FT leads	$160.
P300-30-A	Range: 0-30 psia	3/16" plastic	1FT leads	$160.
P300-Baro	Range: 600-1100mbar	3/16" plastic	1FT leads	$200.

AC Current Sensors - split core, 0-5vdc output, 8FT twisted leads

SC100A	0-50 / 0-100 ac amps	Conductor clearance: 0.5" square (12.7mm)	$95.
SC200A	0-100 / 0-200 ac amps	Conductor clearance: 1.0" square (25.4mm)	$95.
SC500A	0-250 / 0-500 ac amps	Conductor clearance: 2.0" square (51mm)	$180.
SC1500A	0-750 / 0-1500 ac amps	Conductor clearance: 2.5" square (63mm)	$195.

AC Voltage Sensors

SVN300	Range: 0-300 ac volts	One-piece din-rail type module	$160.
SVN600	Range: 0-600 ac volts	Din-rail type module + ext. matching transformer	$205.

Light Sensor – not recommended for high accuracy applications

LS100-4FT	4FT cable	$25.
LS100-15FT	15FT cable	$33.

External Scaling Cables

INP/2	Ranges: ±2.5vdc or 0-5vdc	$20.
INP/4	Range: 0-10vdc	$20.
INP/6	Range: 0-15vdc	$20.
INP/12	Range: 0-30vdc	$20.
INP/24	Range: 0-60vdc	$20.
INP-124	Range: 4-20ma (or 0-20ma)	$15.

Weatherproof XR5 Cases – quick-release latches, six weatherproof cable glands

EC45	Overall size: 6.5" x 5" x 3.3"		$59.
EC45-IC	Overall size: 6.5" x 5" x 3.3"	EC45 with built-in com extension cable	$79.
EC55	Overall size: 8.2" x 6.5" x 3.5"	Includes carry handle, can be padlocked	$68.
EC55-IC	Overall size: 8.2" x 6.5" x 3.5"	EC55 with built-in com extension cable	$88.

PDA Connectivity

AN-9M	Adapter, mates PDA Serial Hot Sync Cable to IC209 Interface Cable	$10.

Spare Parts

U3.6V-1/2AA	Battery, Lithium 1/2AA size, 3.6v (two used in XR5 Data Logger)	$8.
TB-20	XR5 Terminal Block, 20 position	$15.

XR5 Accessories - Price List

NEW SENSORS AND ACCESSORIES – CONTACT PACE FOR MORE DETAILS.

Ethernet Connectivity - each XR5 connected to an Ethernet LAN requires one DS100.
DS100	Ethernet Module, includes 12vdc plug-in adapter for 120vac (US plug)	$150.
	Cat5 patch cable to connect DS100 to Ethernet LAN is not included with DS100	
IC-ES	Setup Cable for DS100 Ethernet Module (used for initial setup only)	$10.

Soil Moisture Probes
EC-10	Length 5", width 1.25", sensing area is 3.9" in length, 10FT cable	$150.
EC-20	Length 10", width 1.25", sensing area is 7.8" in length, 10FT cable	$150.

Rainfall Sensor – pulse output, adjustable for 0.01" or 0.2mm rainfall per pulse, heavy-duty shielded cable
RS100-10FT	10FT cable	$120.
RS100-20FT	20FT cable	$125.
RS100-50FT	50FT cable	$140.
RS100-100FT	100FT cable	$165.

Wind speed and direction sensor
WSD-100	Wind speed: pulse output; wind direction: analog output; 40FT cable	$140.

WattHour Sensors – Single CT models for single phase loads, pulse output
WH-100-115	Range: 0-100 ac amps, 115vac	Conductor clearance: 1.06" dia. (27mm)	$310.
WH-200-115	Range: 0-200 ac amps, 115vac	Conductor clearance: 1.06" dia. (27mm)	$310.
WH-400-115	Range: 0-400 ac amps, 115vac	Conductor clearance: 1.06" dia. (27mm)	$310.
WH-100-230	Range: 0-100 ac amps, 208/230vac	Conductor clearance: 1.06" dia. (27mm)	$310.
WH-200-230	Range: 0-200 ac amps, 208/230vac	Conductor clearance: 1.06" dia. (27mm)	$310.
WH-100-277	Range: 0-100 ac amps, 277vac	Conductor clearance: 1.06" dia. (27mm)	$310.
WH-200-277	Range: 0-200 ac amps, 277vac	Conductor clearance: 1.06" dia. (27mm)	$310.

WattHour Sensors – Single CT models for balanced three phase loads, pulse output
WH-1-0100-2	Range: 0-100 ac amps, 208-480vac, conductor clearance: 1.25" (32mm)	$632.
WH-1-0300-2	Range: 0-300 ac amps, 208-480vac, conductor clearance: 1.25" (32mm)	$650.
WH-1-0400-3	Range: 0-400 ac amps, 208-480vac, conductor clearance: 2.45" (62mm)	$668.
WH-1-0800-3	Range: 0-800 ac amps, 208-480vac, conductor clearance: 2.45" (62mm)	$688.
WH-1-0800-4	Range: 0-800 ac amps, 208-480vac, conductor clearance: 2.45" (62mm)	$706.
WH-1-1600-4	Range: 0-1600 ac amps, 208-480vac, conductor clearance: 2.45" (62mm)	$725.
WH-1-2400-4	Range: 0-2400 ac amps, 208-480vac, conductor clearance: 2.45" (62mm)	$743.

WattHour Sensors – Three CT models for three phase loads, pulse output
WH-3-0100-2	Range: 0-100 ac amps, 208-480vac, conductor clearance: 1.25" (32mm)	$785.
WH-3-0300-2	Range: 0-300 ac amps, 208-480vac, conductor clearance: 1.25" (32mm)	$808.
WH-3-0400-3	Range: 0-400 ac amps, 208-480vac, conductor clearance: 2.45" (62mm)	$832.
WH-3-0800-3	Range: 0-800 ac amps, 208-480vac, conductor clearance: 2.45" (62mm)	$857.
WH-3-0800-4	Range: 0-800 ac amps, 208-480vac, conductor clearance: 2.45" (62mm)	$882.
WH-3-1600-4	Range: 0-1600 ac amps, 208-480vac, conductor clearance: 2.45" (62mm)	$908.
WH-3-2400-4	Range: 0-2400 ac amps, 208-480vac, conductor clearance: 2.45" (62mm)	$935.

Prices are subject to change without notice. Revised March 28, 2005