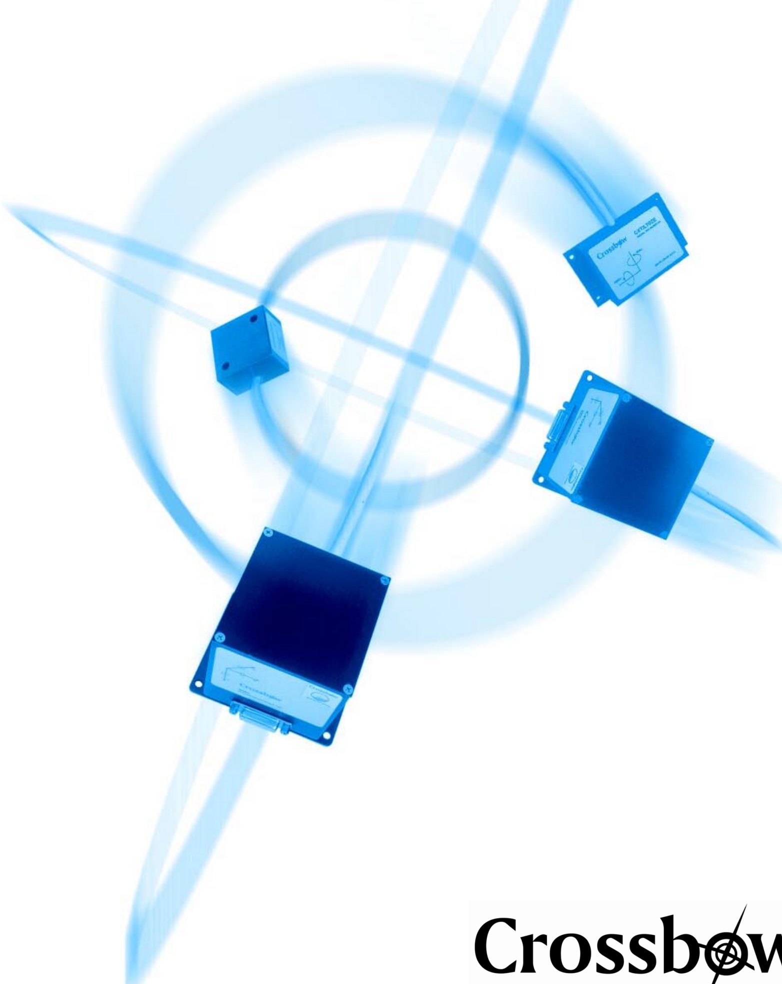
地址：深圳市福田区福华路福庆街鸿图大厦 1602 室
电话：0755-83607652 83376489 83376549 83370250 83370251 82500323
传真：0755-83376182 （0）13902971329 MSN: SUNS8888@hotmail.com
邮编：518033 E-mail:szss20@163.com QQ: 195847376
技术支持: 0755-83394033 13501568376

CrossNet™ Wireless
CN1100 Node Series
User’s Manual

Rev. A, July 23, 2001

Doc. P/N 6000-0015



Crossbow

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Caution: Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

Copyright Notice

Table of Contents

About this Manual

The following annotations are used to provide additional information.

NOTE

Note provides additional information about the topic.

☑ EXAMPLE

Examples may be given throughout the manual to help the reader understand the terminology.

IMPORTANT

This symbol defines items that have significant meaning to the user.

The following paragraph formatting is used in this manual:

Heading 1

Heading 2

Heading 3

Heading 4

Normal

User's Product Reference Page

Product Name(s)	
Model Number(s)	
Serial Number(s)	
Purchase Date	
Warranty	The CrossNet Node and any of the accessories come with a warranty for one year from date of shipment. See Appendix G for details.

Notes:

Introduction

Thank You for Purchasing CrossNet

Crossbow Technology values every customer. We appreciate your order and look forward to providing solution-oriented products to you in the future. User feedback and inquiries are welcome in order for us to continue to improve our products and meet customer requirements.

CrossNet Philosophy

CrossNet wireless communications products are based on open standards including IEEE-1451 to promote plug and play sensor connectivity and the Bluetooth radio specification for connection to a variety of computing platforms including laptop computers, handheld PDAs, and other Internet appliances. Further, CrossNet is designed to be compatible with a broad range of sensors for maximum flexibility. Software applications can easily be developed using popular data acquisition packages and programming languages.

How to Get CrossNet Support

- Go to the CrossNet website: www.crossnetwireless.com.
- See Appendix E, *Warranty and Support Information* for a complete listing of Crossbow contact and support information.

Related Documentation

IEEE-1451 family of standards

Specification of the Bluetooth System, Vols. 1 & 2, ver. 1.0B, Dec. 1, 1999

Websites

www.xbow.com

www.bluetooth.com, the official Bluetooth website

www.motion.aptd.nist.gov, NIST IEEE 1451 website

Getting Started

Unpacking Checklist

Single Node Package, CN1100LX

- AN100 Antenna
- CN1100LX Node
- CDROM containing SW100 PC ComWare Software and SmartCable, SIO Configuration Software

Kit Package, KT100

- AN100 Antenna
- CN1100LX Node
- MP100 Mounting Plate
- PS100 Battery Pack
- PS200 AC to DC Wall Plug-in Power Supply
- SC110 (qty 2) Smart I/O Cable
- CDROM containing SW100 PC ComWare Software and SmartCable, SIO Configuration Software

System Requirements

Bluetooth Communication

The CrossNet Node requires a host computer that is Bluetooth enabled; i.e., contains a RF transmitter/receiver/antenna that meets the Bluetooth communication requirements for passing Bluetooth–formatted data packets. One example would be a computer with a Bluetooth radio card installed in a PCI buss or PCMCIA (CrossNet LT110) connection. Another example would be a computer connected to an external Bluetooth radio module, such as a CrossNet BT110, via a RS-232 link. Crossbow offers the following PC Bluetooth options for communicating with the CrossNet Node:

- BT110 with serial port interface.
- LT110 with PCMCIA interface.

PC Requirements

The following are minimum capabilities that your computer should have to run PC ComWare successfully:

1. CPU: Pentium-class, 90 MHz or faster
2. RAM Memory: 32 MB minimum, 64 MB recommended

3. Hard Drive Free Memory: 15 MB
4. Operating System: Windows 95, 98, 2000, ME, NT4
5. Operating Screen Resolution: 1024 x 780
6. A free serial COMM port

Software Installation

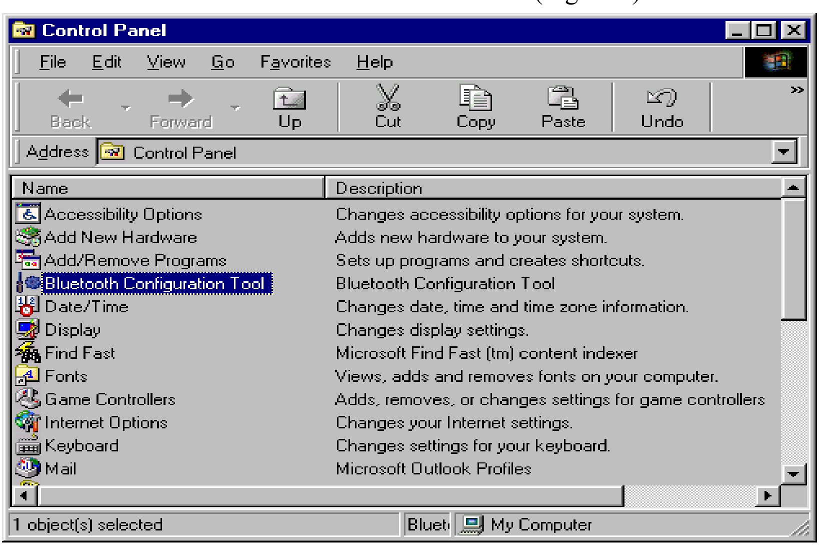
NOTE

If using the BT110 PC serial port radio proceed to the next section

LT110 Software Installation

When using LT110 (PCMCIA Bluetooth card):

1. Install the LT110 using the vendor supplied CD (ex:Toshiba).
2. Test that the LT110 card is operational using the vendor supplied software. If you do an Inquiry and the CrossNet node is powered , it should display the Node's Bluetooth address.
3. Configure a serial port. Access the Bluetooth Configuration icon in the Windows control panel (Figure 1A, top) . You'll see virtual serial ports assigned to the Toshiba card (Figure 1A,bottom). Add a virtual serial port (ex Com 3) and select 'Serial Port Profile' on the right side. Then close all windows and reboot. Use this Com Port number in the CrossNet installation (Figure 6).



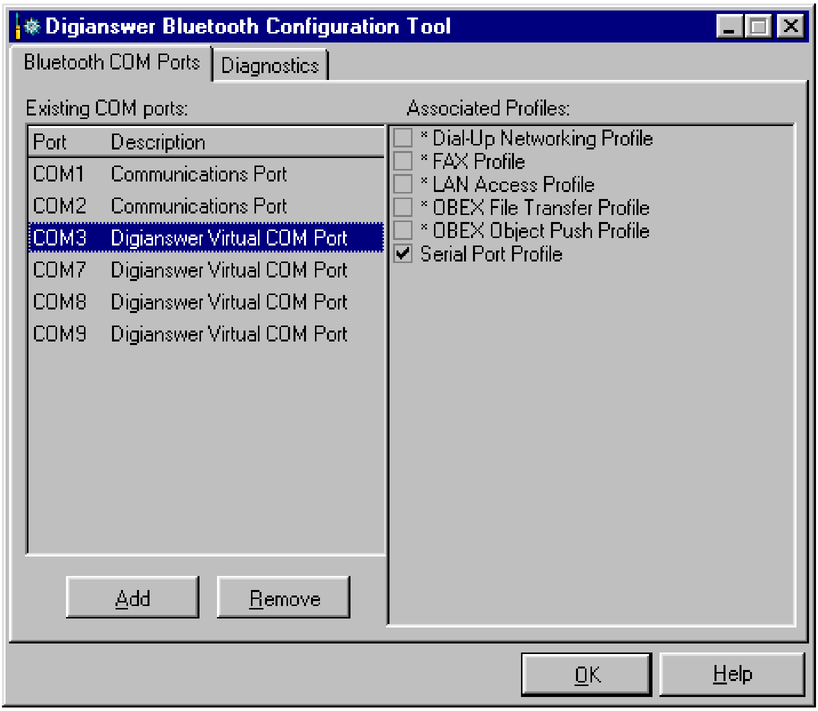


Figure 1A. LT110 (Toshiba) configuration

Complete the CrossNet installation (see following section) .

From the CrossNet installation CD in the /DigiAnswer Patches directory run: btsw108_patch.exe

This will install an updated software correction for the LT110 which is needed by CrossNet.

CrossNet Installation

1. Insert the Installation CDROM in the CD player in your PC.
2. The CrossNet InstallShield wizard, Figure 1, will appear.

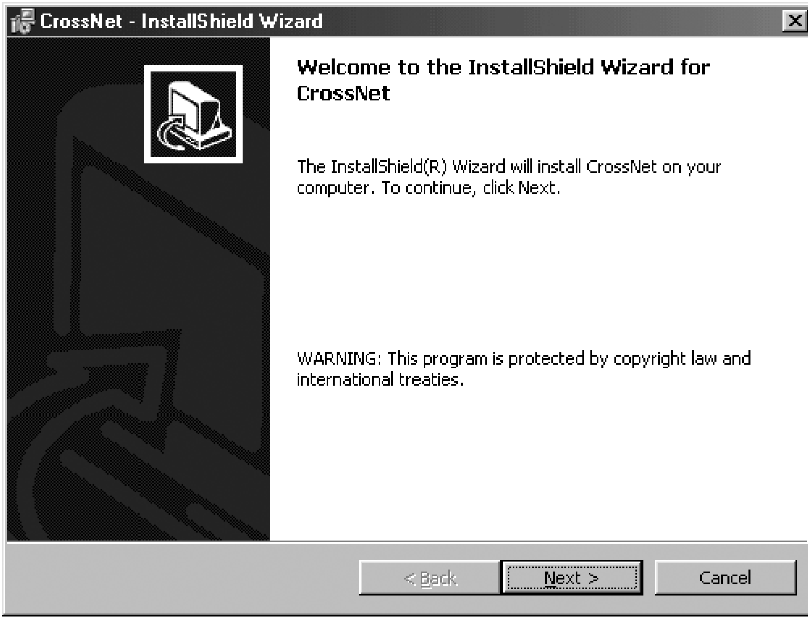


Figure 1. CrossNet Install Shield Wizard

3. If the installation screen does not automatically appear, access Windows Explorer to display the contents of the installation CDROM. Click on Setup.exe to bring up the installation screen.

4. Click "Next" to advance to the next screen.
5. The license agreement screen, Figure 2, will appear.

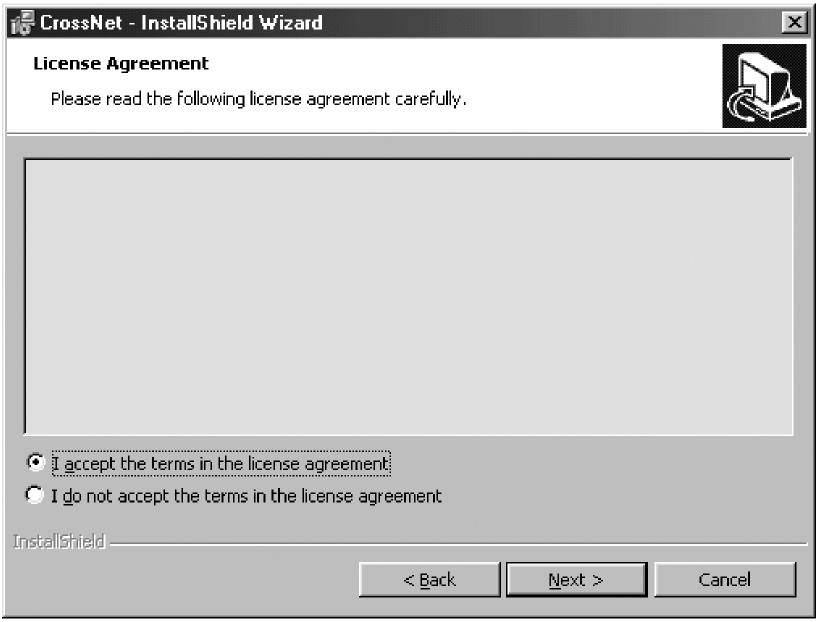


Figure 2. License Agreement Screen

6. Accept the terms of the license agreement and click "Next" to advance to the next screen.
7. The Customer Information screen, Figure 3, appears. Enter the appropriate information and click "Next" to advance to the next screen.

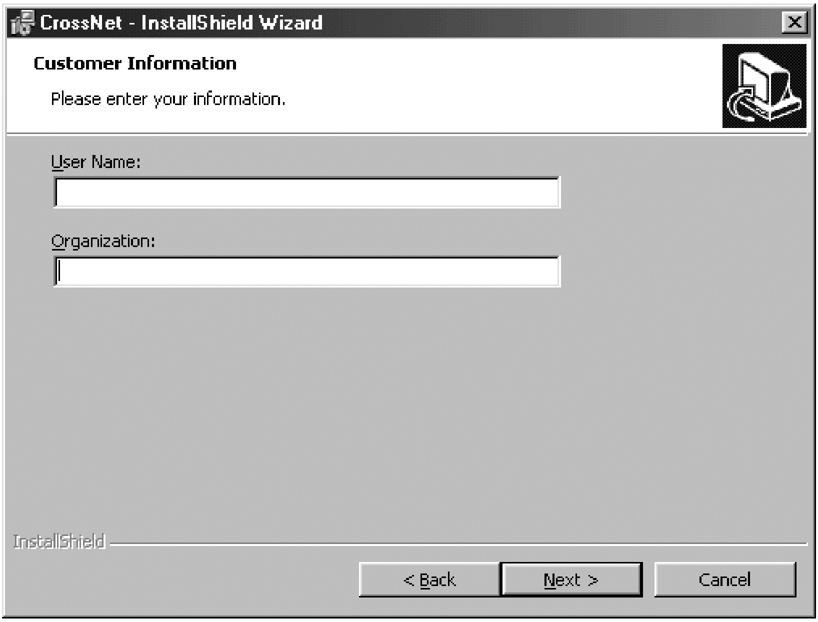


Figure 3. Customer Information Screen

8. Figure 4, the Setup Type screen appears. Make an appropriate selection and click "Next" to advance to the next screen.

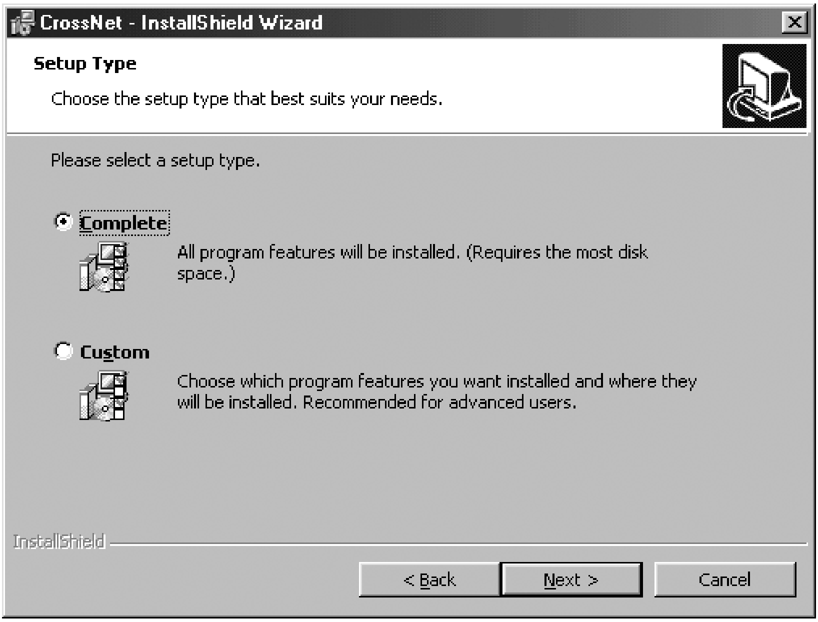


Figure 4. Setup Type Screen

9. Figure 5, the Installation Destination Folder screen, appears.

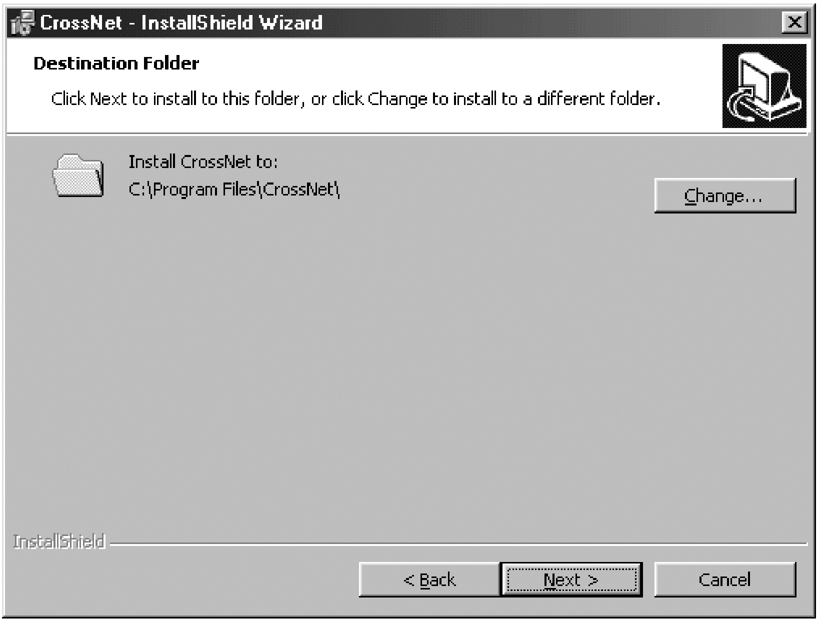


Figure 5. Installation Destination Folder Screen

10. Click "Next" to accept the default destination folder, "C:\Program Files\CrossNet," or click "Change" to assign an alternative. Clicking "Next" to enters the selection and brings up the next screen, Figure 6.

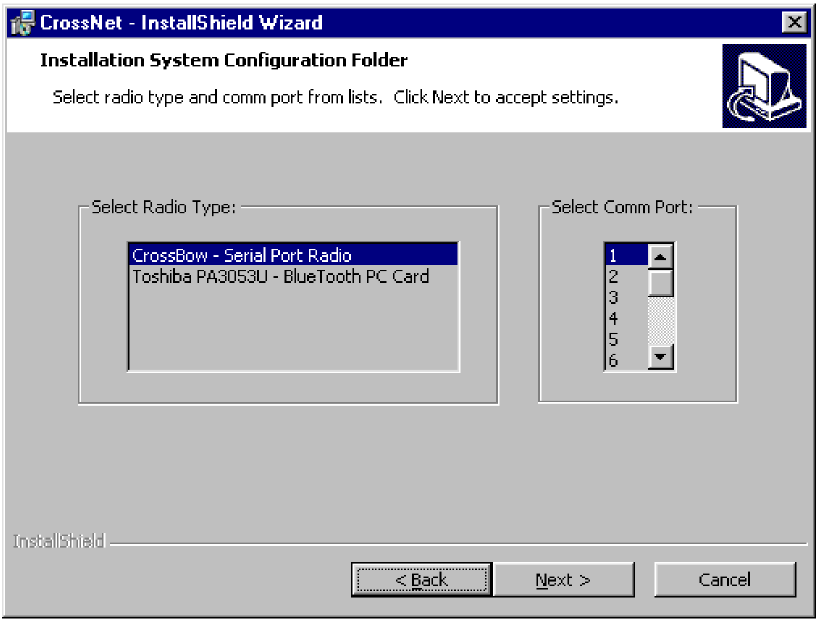


Figure 6. Radio Type and COMM Port Selection Screen

11. Select the Radio Type and appropriate COMM Port. Then click "Next" to advance to the next screen, Figure 7.

IMPORTANT

The Serial Port Radio (BT110) is typically connected to the PCs native port (1 or 2) or an add-on serial port adapter card port. The Comm Port for the Toshiba card (LT110) is determined during the Toshiba installation. The user should verify that any COMM port selection made in this step does not conflict with any assignments already in effect by Windows™. Check "My Computer/Control Panel/System/Ports" for conflicts.

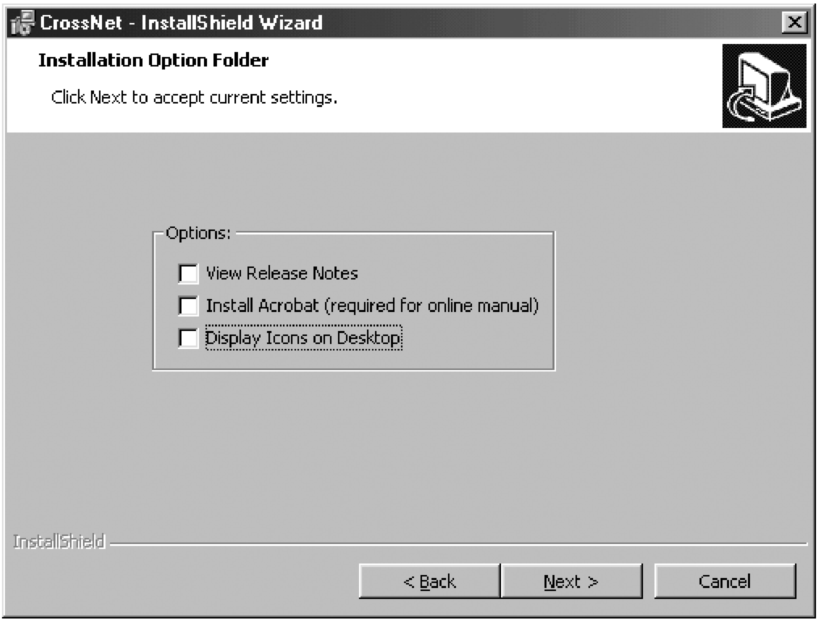


Figure 7. Installation Option Folder Screen

12. Select any appropriate options and click "Next" to advance to the next screen, Figure 8.

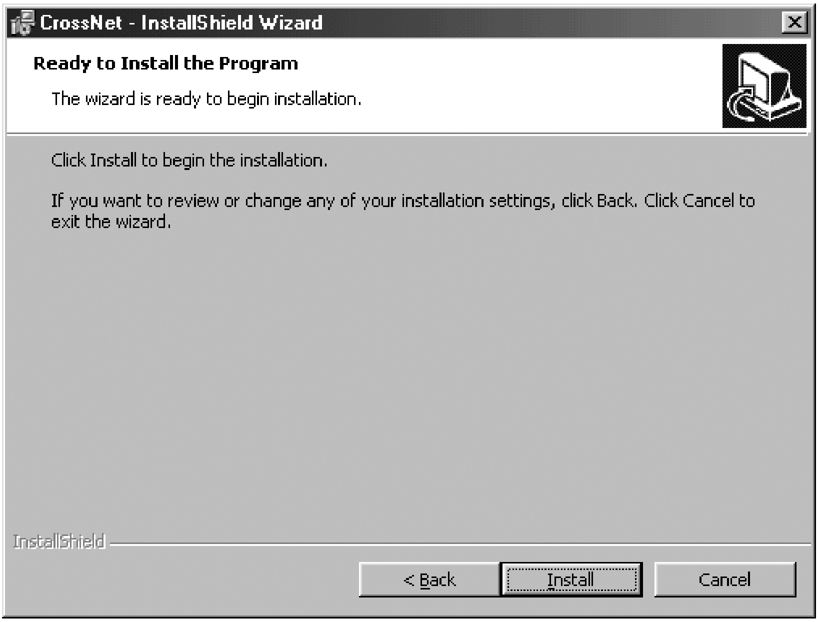


Figure 8. "Ready to Install" Screen

13. Click on "Install" to start the installation process.
14. Following a successful installation, Figure 9, appears.

Figure 9. Successful Installation Screen

15. Click "Finish" to exit the installation wizard.

IMPORTANT

The Digianswer patch v1.08 needs to be installed before attempting to run CrossNet using LT110.

Quick Start

1. Install PC ComWare software.
2. Insert the LT110 into the PC. For the BT110 (if not already installed) use the serial cable and power source.
3. Connect sensor(s), SIO(s), and power source to Node(s). Refer to Appendix B, *SIO Configuration*, and Appendix E, *Power Connection*.
4. Open PC ComWare. The main screen is displayed. Wait for "Inquiry" to discover and list the active Node(s) in the Nodes list box as shown in Figure 10.

IMPORTANT

For the LT110, the LED on the PCMCIA card will be active during the Inquiry command. If not then check for correct COM port assignment. If this does not fix the problem try the manufacturer's supplied software (typically Bluetooth Neighborhood) .

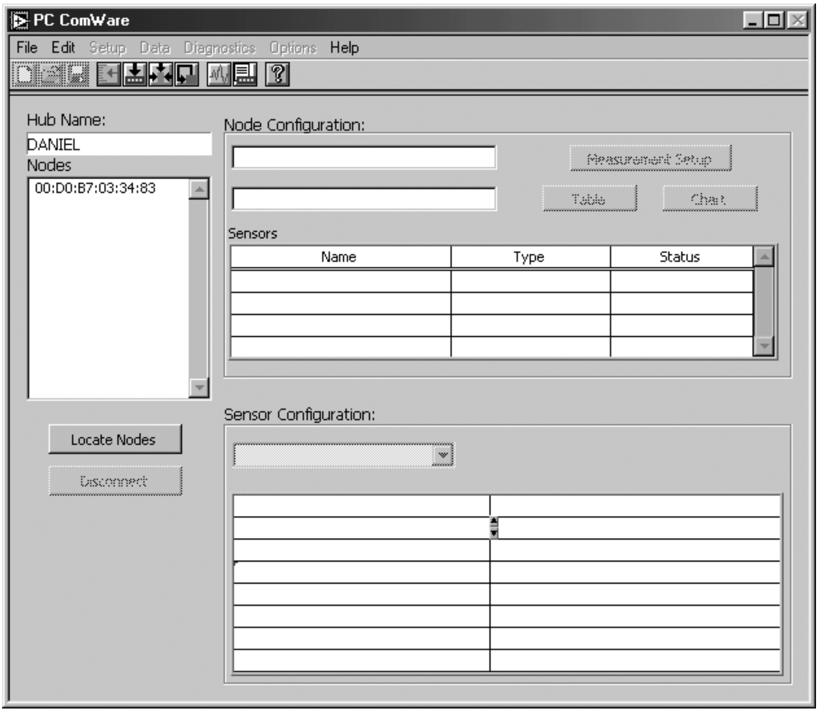


Figure 10. PC ComWare Main Screen

5. Select the desired Node in the Nodes list box by clicking on it. The grayed-out buttons in Figure 10 will become active as shown in Figure 11.

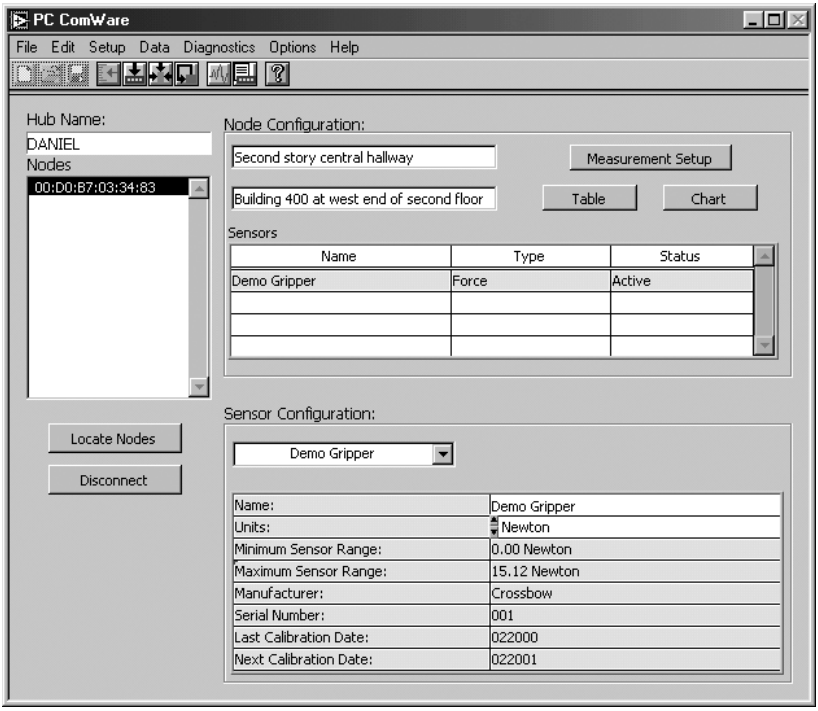


Figure 11. Node Selected

NOTE

In Figure 11 the first two lines in the Node Configuration area are editable. Click the "Update Node Config" button to save any changes in the Node memory.

6. Click on the Chart button to view the Sensors Display screen, Figure 12. This screen shows amplitude-versus-time output displays for all active sensor positions of the selected Node.

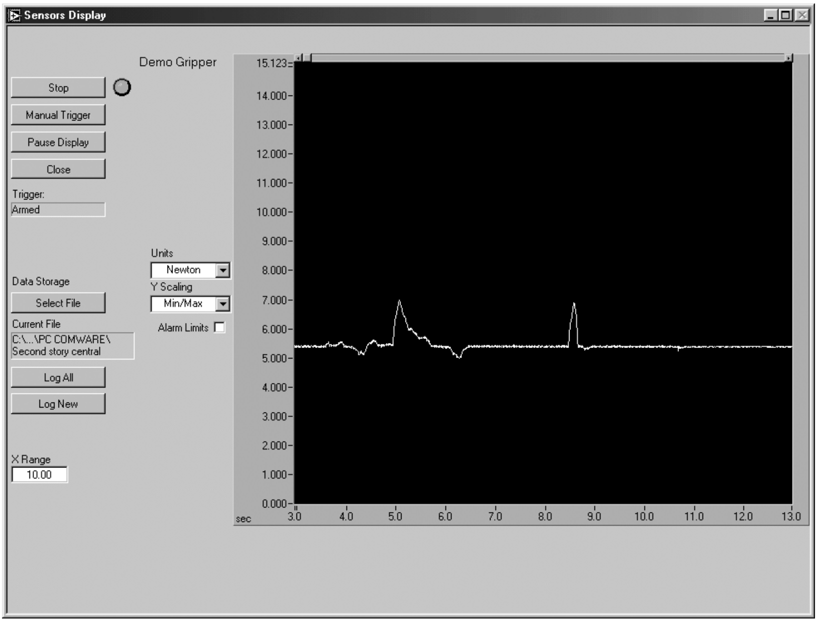


Figure 12. PC ComWare Sensors Display Screen

7. Figure 13 shows the "Measurement Setup Screen" as it appears at initial start up. Use the Measurement Setup screen to configure the measurement parameters.

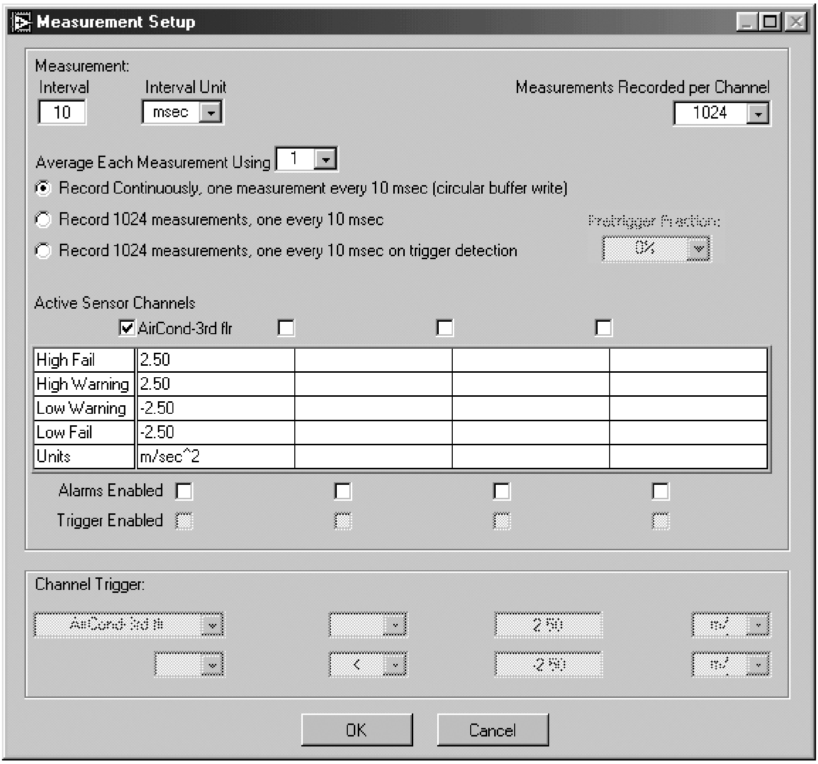


Figure 13. PC ComWare Measurement Setup Screen

Refer to the *Software Overview* section for details about measurement configuration.

Operational Overview

CrossNet System

Figure 14 is a top-level illustration of the CrossNet system.

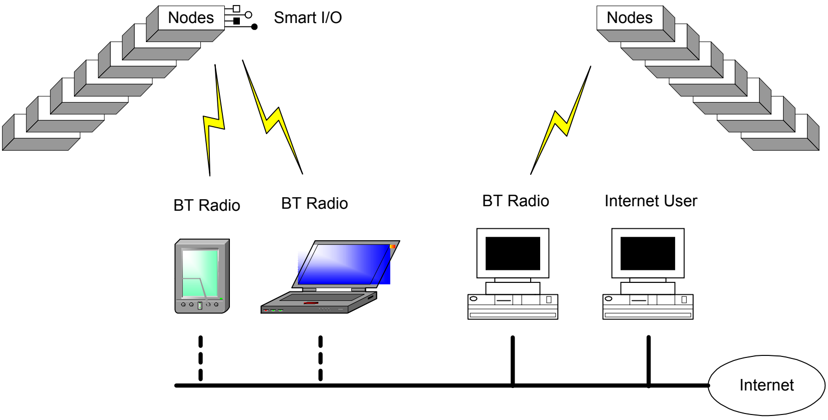


Figure 14. CrossNet System

The CrossNet system is composed of the following:

- A PC or other Hub with a Bluetooth Radio
- Nodes
- SIO Cables
- Sensors

Hubs control single or multiple Nodes. Using Bluetooth's Piconet capability, multiple Nodes (up to seven) can be accessed simultaneously. This allows up to 28 channels of data to be streamed to the hub at the highest data rate. Hubs can support more than seven Nodes through point-to-point connections.

Softsens® software runs in all hubs and controls, manages, and collects all data from the nodes. For PCs, Softsens is an ActiveX component that can be used in multiple development environments.

Nodes are the central part of the CrossNet system. Conditioned analog signals from the SIOs are converted to digital data in the chosen engineering units (e.g., psi). Onboard Node memory is used to buffer the data. This data can be continually streamed across the Bluetooth radio to the hub or stored in the Node for later readout. Data measurements can be taken at user-defined intervals.

After sensors are attached to a SIO and the SIO is configured, users can move the combination sensor/SIO to any Node without any recalibration or reconfiguration. The SIO enables a plug and play system. All sensor specific information (calibration, engineering units, etc.) is contained in the SIO. Also, the Node retains all of its configuration information (sampling rate, triggers, etc.) in its flash memory. Any hub (PC, PDA, etc.) can access the Node and retrieve all configuration information. Users do not have to create databases with configuration information.

Nodes

In a typical CrossNet application, the user mounts sensors on a machine or in a facility at any number of points to be monitored. The individual sensors are then connected to CrossNet Nodes through SIO cables. Each Node controls up to four sensors and incorporates a Bluetooth radio for wireless communication with a computer or handheld device, which serves as a hub. Figure 15 shows the CrossNet CN1100 Node.

Figure 15. CrossNet CN1100 Node

Because the Nodes are compact, lightweight, rugged units, they can be mounted close to the sensors they monitor. Any number of Nodes can be mounted in a building or on a machine. Refer to Appendix F, *Node Mounting*.

The CrossNet Node collects data from multiple sensors and transmits the data via Bluetooth wireless communications to a network hub or other Internet appliance such as a computer (desktop, laptop, or hand-held). The CrossNet Node can supply excitation to each sensor, or external sensor power can be supplied (see Figure 16). Up to four channels are available on each Node. Each channel is ready to receive fully conditioned analog sensor signals as well as the digitized IEEE 1451 TEDS (Transducer Electronic Data Sheet) information from the CrossNet Smart I/O (SIO). (See the next section, *Smart SIO*.) The sensor signal is digitized (16-bit A/D resolution) for transmission along with the TEDS for each sensor. This allows each channel to identify itself to the host system. The Node can operate from either an external power supply or an attached battery pack.

The CrossNet Node can initiate operation in a number of ways.

- Data can be acquired and returned upon request from the host device.
- An event trigger can be established to start acquiring data based on one of the sensor channels (enter or exit an alarm region or alarm threshold).
- An external TTL signal can be activated to initiate data sampling (future option).

The data can be a single measurement from each channel, an average of a number of measurements, or data that has been logged over a user determined amount of time at a user-defined sampling rate. In the data logging mode, a time stamp is included with the data.

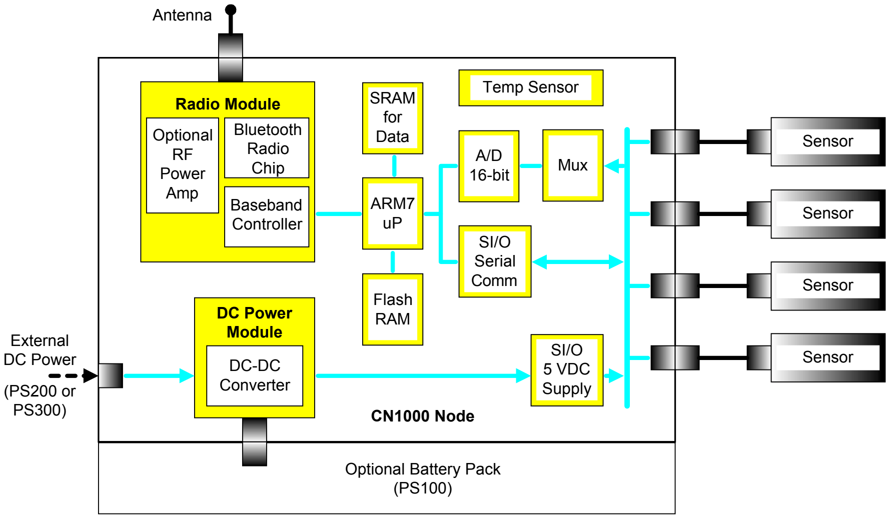


Figure 16. CrossNet Node Internal Architecture

Smart I/O (SIO)

The CrossNet architecture is specifically designed to support a broad range of sensor types. The sensor is connected to the SIO, which contains the sensing element, signal-conditioning circuitry including calibration and temperature compensation, and the IEEE 1451.2 TEDS (Transducer Electronic Data Sheet. These features can either be built directly into the sensor or included in a CrossNet Smart I/O (SIO) sensor-interface cable that contains the required circuitry (microcontroller for Node communications plus memory for TEDS configuration information). CrossNet cables are available for sensors with voltage, current, RTD, thermocouples, or resistive bridge outputs. Specialized CrossNet cables can easily be developed for specific sensor configurations. Also, user-defined "Sensor Types" may be added using the procedure in Appendix B.

SIO Architecture

SIOs consist of the following:

1. An internal µP that serially communicates with the CrossNet Node. The memory of the µP contains the following:
    - Transducer Electronic Data Sheet (TEDS). This contains all information to identify the sensor. It includes calibration coefficients, calibration dates, and engineering units. It also contains manufacturer and serial number identifications.

- Signal conditioning calibrations. There are several types of SIOs depending on the required sensor signal conditioning (e.g., voltage, current). The calibration values for these signal conditioning circuits are stored in the µP memory.

2. Signal conditioning electronics for the sensor. There are various types of SIO depending on the required signal conditioning. For example, RTDs require both an RTD excitation current and signal amplification. All SIOs output a high level 0 to +5V signal to the node (the actual levels are actually about 0.125 to 4.9V). This improves the signal-to-noise performance of the system. It also allows SIOs to be used with cables longer than the standard 3 foot length that comes with the unit; maximum range, however, will depend upon operating environment.
3. Terminal block for connection to an external sensor. A four-terminal block is supplied. Terminal block connections are described in the next section, *Connecting Sensors to SIOs.*
4. Standard, shielded, CAT5 cable with identical RJ45 connectors on each end is used for connecting Nodes and SIOs.

Connecting Sensors to SIOs

Table 2 shows the CrossNet SIOs.

Table 2. CrossNet Sensors

SIO Model	***Description***
Voltage Sensor	**Sensor Output Voltage**
SC110	0 to +5 volts
SC111	0 to +10 volts
SC112	-5 volts to +5 volts
SC113	-10 volts to +10 volts
Current Sensor	**Sensor Output Current**
SC210	4 to ± 20 mA output current
RTD Sensor	**RTD Type**
SC510	100 Ohm, temperature range - TBD
SC511	1000 Ohm, temperature range - TBD
Bridge Sensor	**Sensor Output**
SC410	0 to +5 volts

Voltage Sensors (SIO models SC110 – SC113)

These SIO units interface to sensors with high-level voltage outputs and accept either single or differential inputs. The SIOs supply a limited +5 volts to power sensors. Select the SIO unit based on the output voltage levels of the sensor. The SIO inputs/outputs on the terminal block are shown in Table 3.

Table 3. Voltage Sensor Pinout

Pin	Signal
1	Ground (Node ground)
2	Differential positive (or single ended) voltage input
3	Differential negative voltage input
4	+5 VDC out

The SIO can supply power (+5 VDC) to the sensor, if the sensor power requirements are within the SIO current supply range (see Node specifications, Appendix A). This is the preferred method of connection. Internally powered (node powered) sensor connections, illustrated in Figure 17, are:

a. Sensor ground (Ground) to pin 1.

b. Sensor power (Vcc) to pin 4.

c. Sensor ground (Ground) to pin 3 (negative differential input).

d. Sensor output (Out) voltage to pin 2 (positive differential input).

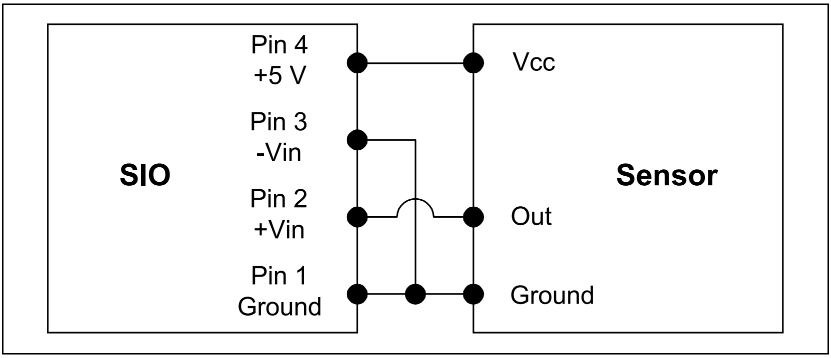


Figure 17. Internally Powered Sensor Connections

Externally powered (Node powered) sensor connections, illustrated in Figure 18, are:

a. Sensor ground (Ground) to the external power supply ground.

b. Sensor power (Vcc) to the external power supply output.

c. Sensor output (Out) to SIO pin 2.

d. External power supply ground to SIO pin 3.

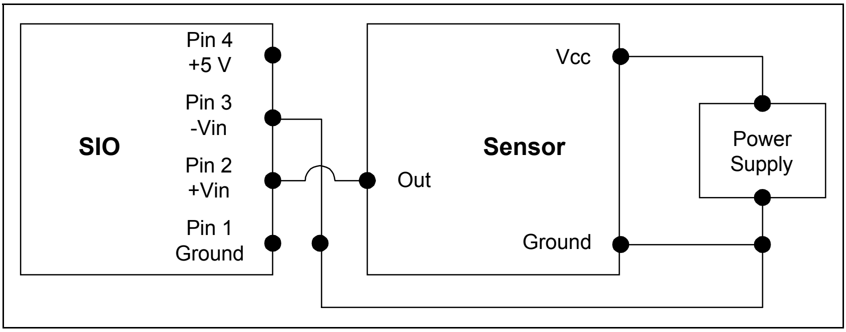


Figure 18. Externally Powered Sensor Connections

Current Sensor (SIO model SC210)

This SIO interfaces to sensors with current outputs in the range of ± 20 mA maximum. The SIO inputs/outputs on the terminal block are shown in Table 4.

Table 4. Current Sensor Pinout

Pin	Signal
1	Ground (Node ground)
2	Current input
3	Not used
4	+5 VDC out

Current sensor connections, illustrated in Figure 19, are:

a. Refer to the previous section on Voltage Sensor for internally or externally powered sensors for the power connections.

b. Connect the sensor output current to pin 2.

c. Connect pin 3 to a local ground.

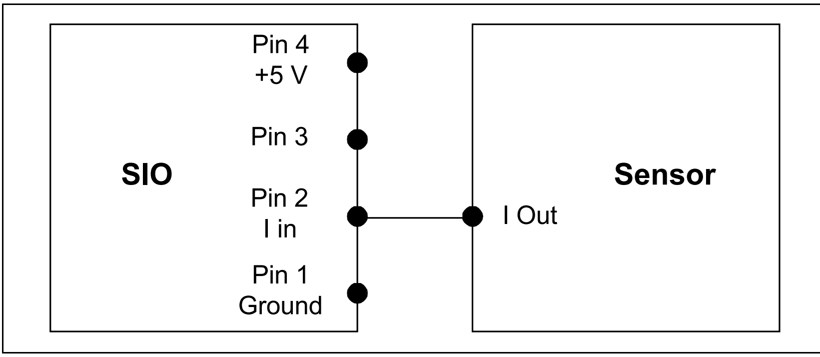


Figure 19. Current Sensor Connections

RTD (SIO models SC510 – SC511)

These SIO units interface to either 100 Ohm or 1000 Ohm RTD sensors. Two-, three-, or four-wire configurations are accommodated. The SIOs supply both excitation and amplification for the RTDs. The SIO inputs/outputs on the terminal block are shown in Table 5.

Table 5. RTD Sensor Pinout

Pin	Signal
1	Ground (Node ground)
2	+ Sense
3	- Sense
4	Excitation

4-Wire RTD configuration:

4-Wire RTD sensor connections, illustrated in Figure 20, are:

a. Pin 1 (Ground) to the RTD.

b. Pin 2 (+ Sense) to the RTD.

c. Pin 3 (- Sense) to the RTD and SIO pin 1 at the RTD.

d. Pin 4 (Excitation) to the RTD and SIO pin 2 at the RTD.

IMPORTANT

The RTD must not be connected to any local ground.

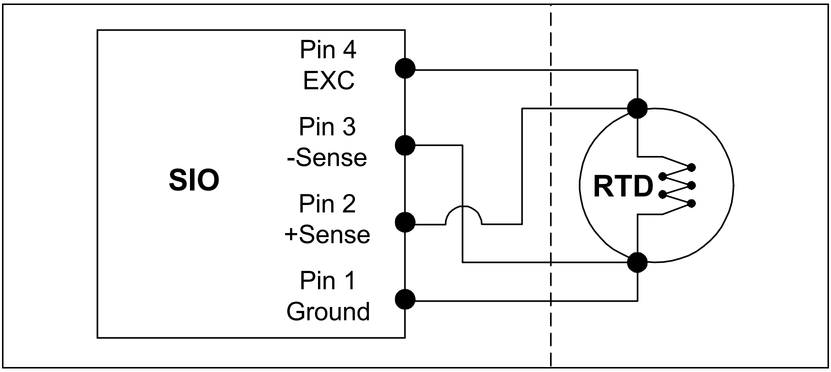


Figure 20. 4-wire RTD Sensor Connections

3-Wire RTD configuration:

3-Wire RTD sensor connections, illustrated in Figure 21, are:

a. Pin 1 (Ground) to the RTD.

b. Pin 2 (+ Sense) to the RTD.

c. Pin 3 (- Sense) to the RTD and SIO pin 1 at the RTD.

d. Pin 4 (Excitation) to the RTD and SIO pin 2 at the RTD.

IMPORTANT

The RTD must not be connected to any local ground.

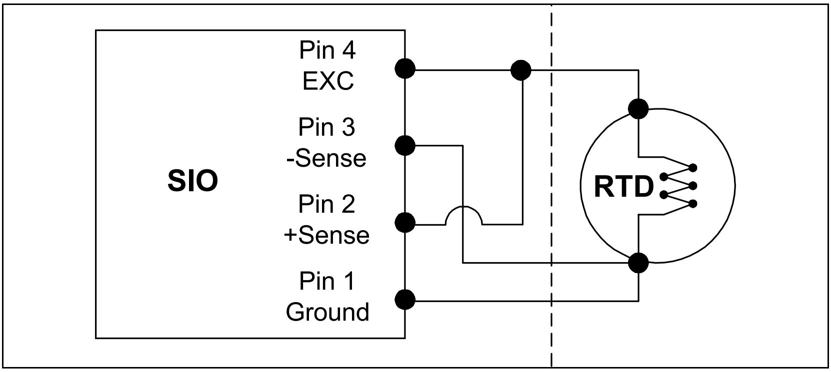


Figure 21. 3-wire RTD Sensor Connections

2-Wire RTD configuration:

2-Wire RTD sensor connections, illustrated in Figure 22, are:

a. Pin 1 to pin 3 on the SIO (at the SIO).

b. Pin 4 to pin 2 on the SIO (at the SIO).

c. Pin 3 (-Sense) to the RTD.

d. Pin 4 (Excitation) to the RTD.

IMPORTANT

The RTD must not be connected to any local ground.

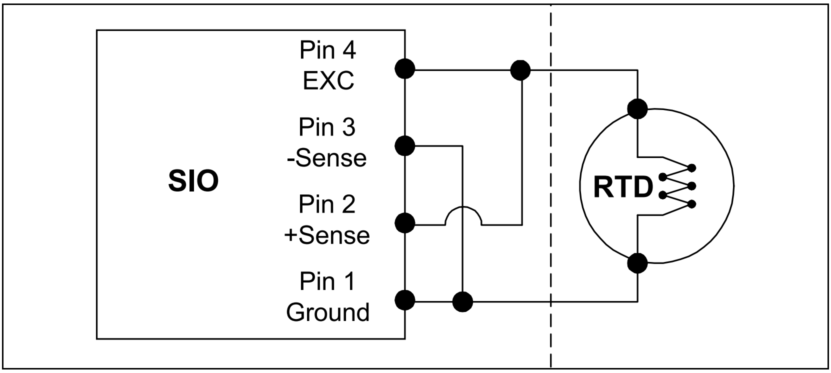


Figure 22. 2-wire RTD Sensor Connections

Bridge (SIO model SC410):

Model SC410 supplies a regulated +5 VDC bridge excitation signal. The bridge current requirements should not exceed that maximum current rating of the SIO. However, since the Node uses a common regulator to supply all four SIOs, some bridges could exceed that maximum rating as long as the total current consumption (of all four attached SIOs) does not exceed the aggregate maximum. The SIO inputs/outputs on the terminal block are shown in Table 6.

Table 6. Bridge Sensor Pinout

Pin	Signal
1	Ground (Node ground)
2	Positive bridge input
3	Negative reference
4	Excitation

Bridge sensor connections, illustrated in Figure 23, are:

a. Pin 1 (Ground) to the bridge's Exc –.
b. Pin 2 (Signal +) to one output side of the bridge.
c. Pin 3 (Signal -) to the other output side of the bridge.
d. Pin 4 (+5 V) to the bridge's Exc +.

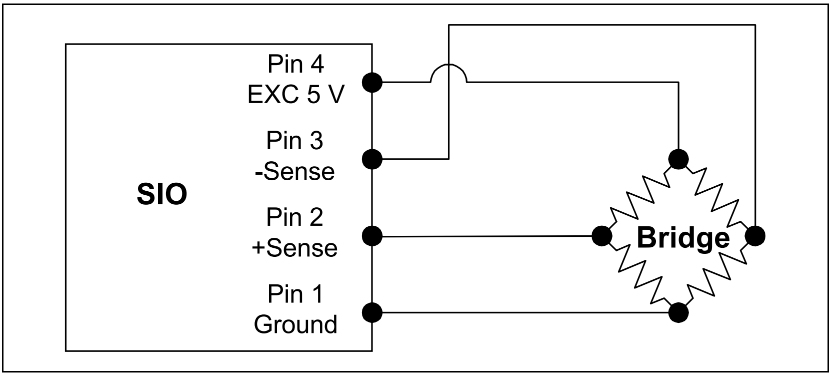


Figure 23. Bridge Sensor Connections

SIO/Node Communication

When the SIO is plugged into the CrossNet Node, an interrupt signal is generated to the Node. This causes the Node to interrogate the µP in the SIO and request the TEDS to be uploaded. The Node extracts the calibration information for the sensor so that all Node measurements can be converted to engineering units. The Node also transmits the TEDS to the hub to make all sensor information available to the user.

Configuring the SIO

SIOs have been designed so that users can program the TEDS in the field. This is done using a PC utility program, CrossNet SIO Configurator. See Appendix B for SIO configuration and programming details.

Hubs

A CrossNet hub can be any Bluetooth-enabled device for data acquisition and/or analysis that is running Softsense software. The hub downloads data, including the TEDS information for sensor self-identification, from multiple nodes. Application software running on the host system then displays the data in a user-defined format or links the data to a number of popular Windows™ based data acquisition and control software packages such as LabVIEW™ or Excel™.

Hubs can range in complexity from single computers or handheld devices logging and/or displaying the data to web servers communicating using TCP/IP Internet communications protocol for wide area networking. Hubs can also connect using the TCP/IP protocol to other wired or wireless network architectures including Ethernet, LonWorks, and other protocols. Crossbow is developing a family of network hubs or gateways that allow multiple CrossNet Nodes to be connected to the Internet or other network architecture.

Stand Alone PC

Any PC with a Bluetooth radio can be a hub. Crossbow supplies a LabVIEW application, PC ComWare, for users to use to interface to CrossNet Nodes.

Contact Crossbow regarding any PC ComWare support issues.

Software Overview

Software is available for the PC to provide Bluetooth wireless connectivity to the CrossNet Node. PC ComWare is available free of charge for the PC or laptop. PC ComWare allows the user to configure a CrossNet Node and analyze the resulting data on their Windows™ based PC.

PC ComWare

PC ComWare allows the user to configure the Node to take data as single measurements from each channel or as an average of a number of measurements. User-definable trigger levels and variable sampling rates allow data to be acquired in a flexible manner to maximize sensor effectiveness. The data is displayed in real time and can be stored by the host computer as a time-stamped ASCII file that is easily exported into a spreadsheet or other data analysis program.

Menus and Toolbar

Figure 24 shows the PC ComWare Menus and Toolbar.

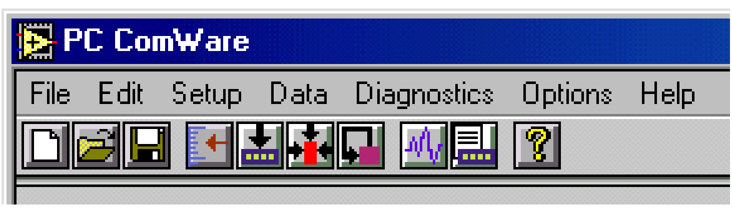


Figure 24. PC ComWare Menus and Toolbar

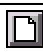
Table 7 lists the PC ComWare menus and line items.

Table 7. PC ComWare Menus

Menu	Command
File	New Open Save Save As Exit
Edit	Cut Copy Paste
Setup	Measurement Setup
Data	Sensor Display Nodes Summary
Diagnostics	Node Advanced Sensor Advanced Self Test
Options	
Help	About Show Help

Table 8 lists the PC ComWare Toolbar Buttons and Commands.

Table 8. PC ComWare Toolbar Buttons and Commands

Button	Command
	Open File
	Open Folder
	Save
	Measurement Setup Screen
	Node Configuration Screen
	Advanced Sensor Screen
	Self Test Screen
	Sensors Output Display
	Node Summary
	Help

Set Up

After PC ComWare is installed per the *Quick Start* section, the following user-definable parameters can be configured using the Measurement Setup screen, Figure 25:

- Sampling Rate – set the rate at which measurements are taken.
- Active Sensors – select the sensor channels to be displayed on the Sensor Display screen where they can be logged. See the *Displaying Data on the PC* section.
- Triggering – set the point at which data acquisition ceases and measurement data recorded in the Node SRAM is available for logging and external storage.

Sampling Rate

(Also refer to appendix A)

Use the Measurement section of the Measurement Setup screen, Figure 25, to set parameters:

- Measurement Interval – the whole integer time difference between the start of one measurement and the start of the next measurement. The Measurement Interval should be chosen between 2 msec and 1 hour; these are the minimum and maximum supported values.
- Measurement Interval Units – select from the dropdown list.
- Measurements Recorded per Channel – the number of measurements making up a record stored in the Node SRAM; select a number from the dropdown list.
- Measurement Averaging – the choices on the dropdown list are dictated by the Measurement Interval selection. Select a number from the list for the number of samples to be averaged to produce a single measurement in the specified Sample Interval. The Sample Interval box appears when a Measurement Interval greater than 1 is selected. The relationship between Samples and Measurements is illustrated in Figure 26.
- Recording Options – select 1 of 3 possible choices to store a measurement record in the Node SRAM.
    1. Record continuously, one Measurement every Measurement Interval. This is a continuous measurement/recording function, where new data overwrites previous data.

2. Discrete recording. Record the number of measurements shown in the Measurements Recorded per Channel box, then stop recording.
3. Record when triggered. This is the trigger detection option and requires setting Pretrigger Fraction and trigger levels; refer to the *Triggering* section.

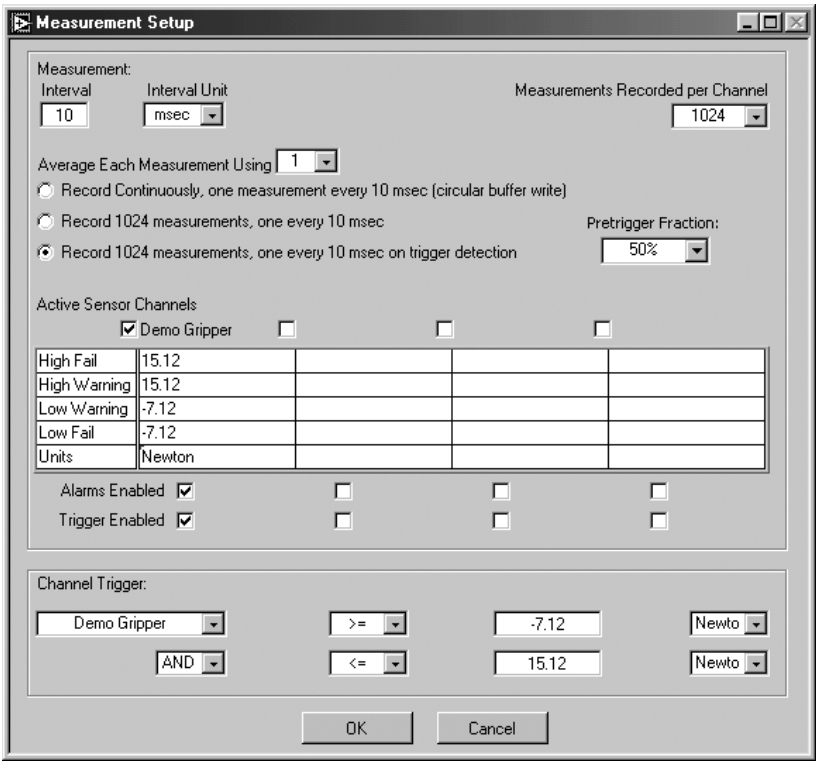


Figure 25. Measurement Setup Screen

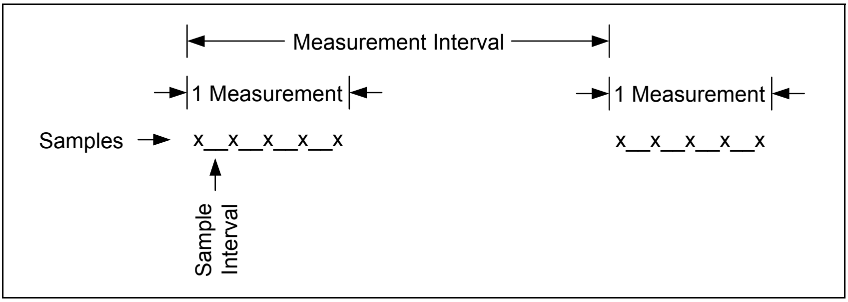


Figure 26. Samples and Measurements

Active Channels

Use the Measurement section of the Measurement Setup screen, Figure 25, to set sensor channel activity parameters. All of these settings are optional and do not affect data measurement and recording:

- Active Sensor Channels – 1 to 4 checkboxes to enable channel output display on the Sensor Display screen; channel output readings on the Node Summary screen are not affected; user's option.
- Enter Alarm Information – High/Low Fail/Warning and Units; user's option.
- Alarms Enabled - 1 to 4 checkboxes; user's option.

Triggering

Triggering is a user's option, selected in the recording options of the Measurement section of the Measurement Setup screen. If selected, an entry for Pretrigger Fraction must be selected from its dropdown list, 0%, 50%, or 100%. Pretrigger Fraction is the percentage of the measurements recorded just prior to the trigger event. Figure 27 illustrates the three choices for this parameter.

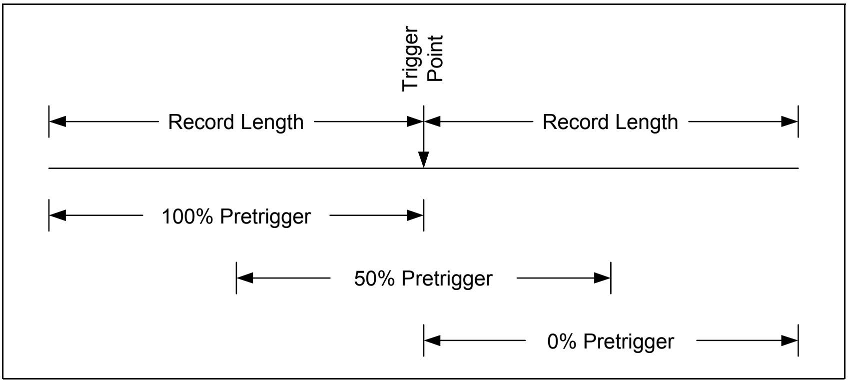


Figure 27. Pretrigger Fraction Options

After Pretrigger Fraction is set, then the Trigger Enabled checkboxes must be appropriately checked in the Active Sensor Channel section.

Use the Channel Trigger section of the Measurement Setup screen, Figure 25, to set triggering parameters for each sensor channel. A single value or two values can be set. The two-value setting can be either AND'ed or OR'ed in the small dropdown list box beneath the sensor selection box.

Displaying Data on the PC

There are two ways to display measurements:

1. Sensor output data is displayed as an amplitude-versus-time plot on the Sensors Display screen, Figure 28, for each sensor channel checked as active on the Measurement Setup screen (see *Active Channels*).
2. Figure 29 shows the Nodes Summary screen, where data is displayed in the Value column, one measurement at a time in real time by clicking on the Start/Stop button. The Nodes Summary screen is displayed by clicking on the button labeled Table on the Main screen or the Node Summary button on the toolbar.

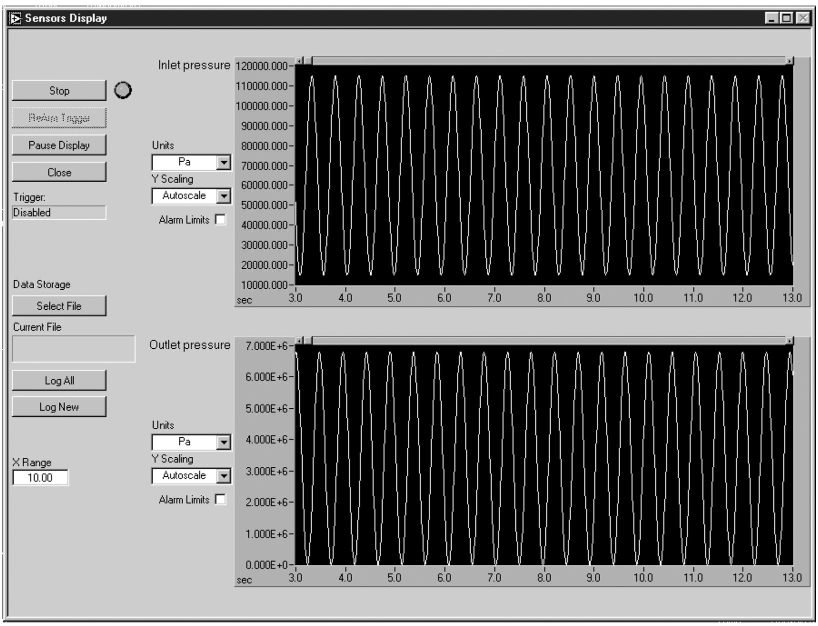


Figure 28. Sensors Display Screen with Two Active Sensors

The control buttons and boxes on the Sensors Display Screen are summarized in Table 9.

Table 9. Sensors Display Control Buttons and Boxes

Label	Function
Control Buttons	
Stop	Stop data recording from the node to PC ComWare.
Manual Trigger/ ReArm Trigger	If in Trigger mode, capture currently displayed data.
Pause Display/ Resume Display	Stop displaying newly recorded data. Measurements continue to be made and displayed discretely on the Node Summary screen. While paused, the user can use the scroll bar at the top of each output display to manually go back in time to view data. Unpausing a paused display restarts the Sensors Display in real time, not at the point where it was paused.
Close	Close Sensors Display screen.
Select File	Select and open a new or existing file in the PC ComWare host PC to use to store sensor data.
Log All/ End Logging	Store (in PC file) all new Node data from this point on plus all data already in the node plus all data in PC ComWare buffers. See *Logging Data* section.
Log New/ End Logging	Store (in PC file) all new Node data from this point on. See *Logging Data* section.
Control Boxes	
Units	Dropdown list box to select the appropriate physical units for scaling the associated plot. See *Display Scaling*.
Y Scaling	Dropdown list box to select the appropriate amplitude scaling for the associated plot.
Alarm Limits	Checkbox to display red Alarm line(s) and yellow Warning line(s) on the associated plot.

Display Scaling

The Y Scaling dropdown list box provides the user with 3 choices:

1. Min/Max – the range over which data is valid, the sensor's inherent limits taken from the TEDS and the manufacturer's configuration settings. No user input or control.
2. Manual – user settable using the editable limit boxes on the vertical scale of each display. Click on any of the vertical scale numbers to highlight it, enter a new number, press Enter on the PC keyboard, and the vertical scaling will adjust itself.
3. Autoscale – amplitude scaling automatically done by PC ComWare at each screen update. No user input or control.

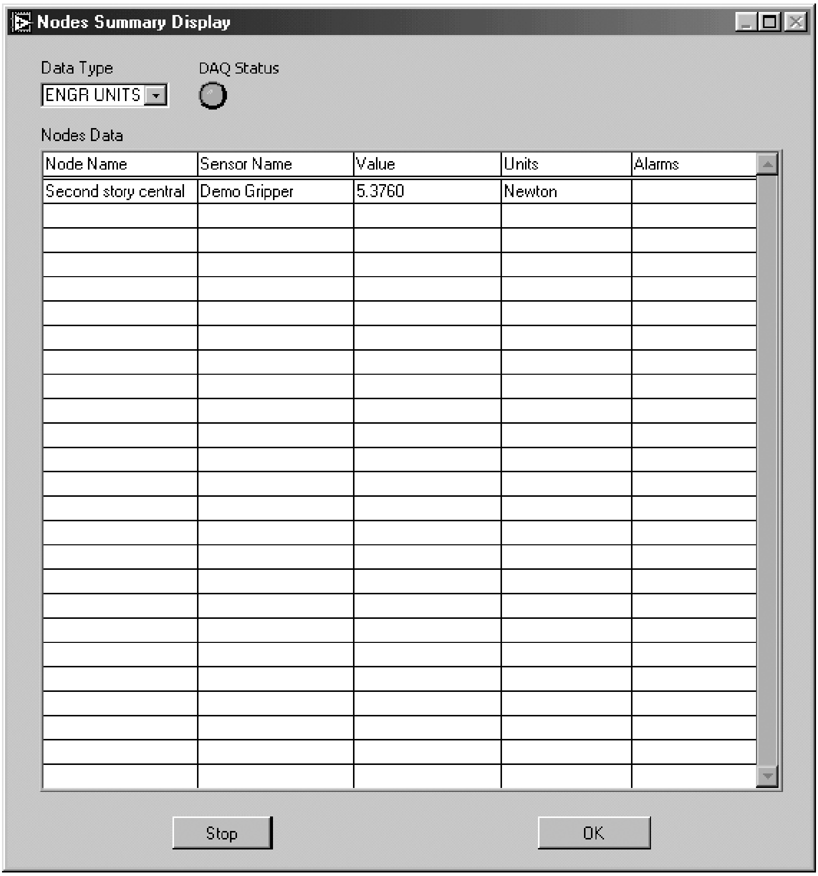


Figure 29. Nodes Summary Screen

Logging Data

Data is logged to (stored in) a file on the host PC when the user clicks on either the Log All or Log New button in the Sensors Display screen, Figure 28, to start logging. Once clicked, the label on either button changes to End Logging. Click on End Logging to stop logging. If in Trigger mode, logging is stopped by the triggering settings.

The user may elect to click the Select File button to append the data to an existing file or default to a new file, which PC ComWare will automatically set up.

Clicking on Log New logs all new Node data starting from the time at the click. Clicking on Log All logs all new Node data from the time at the click plus all data already in the Node plus all data in the PC ComWare buffers in the PC. Figure 30 illustrates the functions of the logging buttons.

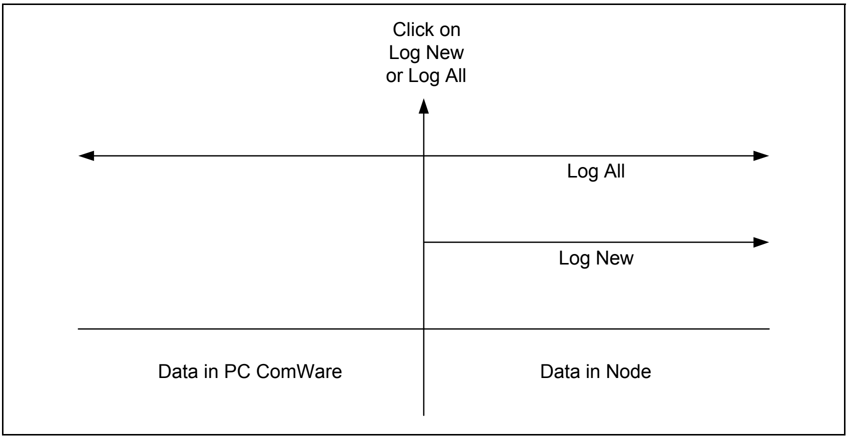


Figure 30. Log Button Functions

Appendix A. Model CN1100LX Specifications

System Specifications

Compatible Sensors

- 4 to ±20 mA
- RTD (100Ω, 1kΩ)
- Thermocouple (J, K, T)
- Bridge
- Analog (0-5V, 0-10V, ±5V, ±10V)

Electrical Specifications

General	
Number of SIO Channels	4
Sampling Frequency per Channel	500 Hz
Sampling Resolution	16-bit
Data Memory per Channel	8000 samples
Power Supply	
SIO Current Source Capability	25 mA
Current Consumption, Transmit[1]	150 mA (typical)
Current Consumption, Standby[1]	110 mA (typical)
Power Consumption[1]	550 mW (typical)
Battery Capacity (4 AA Alkaline)	3 A-hrs
External Power Supply	5 VDC
External Regulator Option	8 to 30 VDC
Wireless Transmission[2]	
Radio Frequency	2.4 GHz
Modulation	FHSS
Range[3]	100 meters
Output Power	20 dBm (100 mW)

Notes:

1. Node only. Does not include any power supplied to sensors.
2. Per Bluetooth Specification 1.0
3. Typical Range. Actual range depends on environment. Line-of-sight, typically > 100 meters. Indoor, office environment, typically 33 meters.

Sampling

Sampling Limits

- The CN1100 will sample, average and trigger detect at a maximum continuous rate of 100Hz.
- Between 100 Hz and 500Hz sampling rate, the CN1100 can only record and transmit data; averaging and trigger detection cannot be performed with four active SIOs.
- At 1Khz and four active SIOs the unit can only record data then transmit after completion of data acquistion. Also, averaging and trigger detection cannot be enabled. Users need to run in the following burst mode: (refer to Softsens manual)
    - Issue a "DAQ_OFF" command to stop data acquisition.
    - Set the sampling rate to 1Khz.
    - Issue a "DAQ_ON" command to start data acquisition.
    - To stop acquisition issue a “DAQ_OFF” command
    - Transfer the data.

Data Throughput

The following tables benchmark typical block data transfer times between the Crossnet node and a PC using a PCMCIA (Bluetooth radio card) or a serial port BT110. Data requests are made to the Node to transfer all new data acquired since the last data transfer request. Data is transferred in blocks; longer transfer times imply larger data block sizes and also greater latency.

The fastest transfer mode is the Raw mode; scaling to engineering units (EU) on the local PC. Requesting EU units from the Node requires floating point conversion and increases the latency; in some cases the system cannot maintain a continual flow of data.

Applications requiring low latency should use the Raw mode; applications that log data or don’t care about latency can use the EU modes. Either using fewer SIOs or decreasing the sampling rate can improve data transfer rates. For example, in the table below, changing the sampling rate from 500Hz (2 msec) to 333Hz (3 msec) changed the transfer time (EU mode) from 2.2 sec to 0.25 sec.

PC COMWARE

PC Radio	Sampling Rate	Data Xfr Mode [1]	Data Transfer and Graphics Update Time			
			1 SIO	2 SIOs	3 SIOs	4 SIOs
PCMCIA	500 Hz	Raw	0.5 sec	0.5 sec	1.2 sec	2.0 sec
BT110	500 Hz	Raw	0.5 sec	0.7 sec	2.0 sec	2.0 sec

NOTE: PCCOMWARE does all conversion to EU (floating point) locally on the PC

Visual Basic Test Program

PC Radio	Sampling Rate	Data Xfr Mode [1]	Data Transfer Time (no graphics)			
			1 SIO	2 SIO	3 SIO	4 SIOs
PCMCIA	500 Hz	Raw	0.1 sec	0.1 sec	0.2 sec	0.2 sec
	500 Hz	EU	0.1 sec	0.2 sec	0.6 sec	2.2 sec
	333 Hz	EU	0.1 sec	0.1 sec	0.2 sec	0.25 sec
BT110	500 Hz	Raw	0.1 sec	0.2 sec	0.4 sec	0.8 sec
	500 Hz	EU	0.2 sec	0.6 sec	NU[2]	NU [2]
	333 Hz	EU	0.1 sec	0.6 sec	0.7 sec	NU [2]
	250 Hz	EU	0.1 sec	0.2 sec	0.3 sec	0.7 sec

[1] Data Xfr Mode:

Raw : 2 byte integer transfer. Node does not do any . floating point operations.

EU: 4 byte floating point transfer. Node does scale and offset calculation before transferring data.

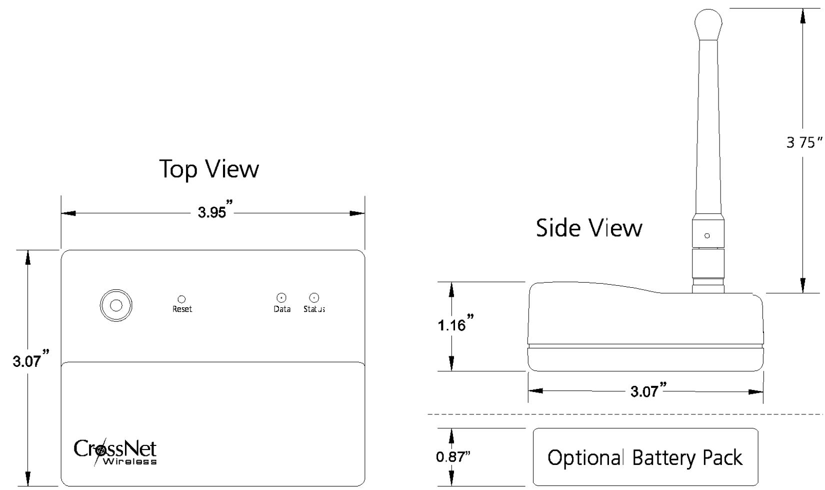
[2] NU : Not usable for real time data transfer, system will not maintain throughput

Mechanical Specifications

Environmental	
Operating Temperature	0 to 70ºC
Storage Temperature	-30 to 85ºC
Humidity, non-condensing	10 to 90% RH
Shock	3 foot drop
Vibration	10 g rms, 20 to 20000 Hz
Physical	

Connectors	RJ45
Weight (w/o battery pack)	140 grams (4.9 oz)
Weight (w/ battery pack and 4 AA)	340 grams (12.0 oz)
Mounting Methods	Desk Mount/ Wall Mount

Outline Drawing



Pin Designations

The SIO cable contains an 8-pin RJ45 connector. The CN1100LX Node has 4 SIO channels. The SIO transmits the high-level analog sensor data from the SIO signal conditioning circuitry along with the digital TEDS information. In addition, the SIO cable supplies 5 VDC excitation from the Node to the signal conditioning electronics in the SIO, which in turn can provide 5 VDC excitation to the sensor.

Pin	Mnemonic	I/O	Description
1	VGND	I	Analog signal ground
2	VSIG	I	Analog signal
3	SIO_VCC	P	5.0 VDC power supply, 25 mA maximum
4	SIO_GND	P	Power supply ground return
5	SIO_ACTV	I	Pulled up internally to 3.3 V. A low signal implies that an SIO is present on this port, allowing the node to detect a connection with the SIO.
6	SIO_TX	O	Serial output to SIO (3.3 V logic)
7	SIO_RX	I	Serial input from SIO (3.3 V logic)
8	-	-	Not used

Appendix B. SIO Configuration

SIO Configuration and Programming

This program, CrossNet SIO Configurator, allows users to program the SIO TEDS and signal conditioning. It features the following:

- User can read the TEDS contained in the SIO.
- User can modify the TEDS.
- User can read a TEDS from a PC file and load into TEDS.
- User can store a TEDS file on the PC.

To use the program:

IMPORTANT

Close PC ComWare when running CrossNet SIO Configurator.

1. Physically connect the SIO to be programmed to the Node.
2. Start the program. The main screen, Figure B1, appears.
3. In the Communications section of the screen, click on the Inquire button. Then select the Node that the SIO is attached to in the Address dropdown list box.
4. In the Communications section of the screen, click on the Connect button. Then select the Node Channel where the sensor is attached in the Channel dropdown list box.

IMPORTANT

The SIO must be read first before it can be programmed.

Refer to Figure B1. Beginning with the Transducer Identification section of the screen, enter the following:

1. Select the type of sensor in the Type(General) dropdown list box. Different types are supported, for example: Temperature, Humidity, and Acceleration.
2. Select the specific type of sensor in the sensor Type(Specific) dropdown list box. This has to do with the sensor element. For example, temperature sensors can have thermocouple or RTD elements. They could also be voltage or current types. This selection must agree with the type of signal conditioning on the SIO. If the user selects an incompatible type an error message will

be displayed when trying to write the TEDS to the SIO. For example, if the user selects a "General Voltage" type but the SIO is an RTD signal conditioner then an error message will appear. Users can determine which type of signal conditioning is present by:

   a. Reading the SIO – this will automatically update the "Type" (specific) selection box.
   b. Viewing the Signal Conditioning screen.

3. Select the "Preferred Units." This only affects display boxes in the program. This information is not downloaded to the SIO. SIOs and Nodes only work with SI units such as K (Kelvin). The text below this box displays the conversion formula from user-preferred units to the SI units.
4. Input the "Name" of the sensor. This is a user-defined name.
5. Input the sensor "Manufacturer."
6. Input the sensor "Model" number.
7. Input the sensor "Serial" number.
8. In the Transducer Range section of the screen, enter the maximum sensor range and minimum sensor range from the sensor data sheet.
9. In the Calibrated Transducer section of the screen, select whether or not the sensor can be calibrated. If it can be calibrated enter the last calibration date and next required calibration date.
10. In the Warm-up Time section of the screen, enter the sensor warm-up time from the sensor data sheet. This tells the Node how long it takes from applying power to the sensor before valid measurements can be taken. (This is presently not used by the system; it will be used later for low power applications where the Node turns off the sensor power.)
11. In the Calibration Coefficients section of the screen, C1(Gain) is the output of the sensor in volts/unit. For example, the screen shot shows that the temperature sensor has an output of 0.100 volts per degree C. Also enter the voltage offset of the sensor.
12. SIO Info: No user input. Shows revision levels of SIO.

Menu Selections:

- File:Exit - exit program
- File:Save TEDS File - allows user to store a TEDS file.
- File:Open TEDS File - allows user to select and read-in a TEDS file.

- SIO:Program SIO - programs a TEDS in an SIO connected to a Node.
- SIO:Read SIO - reads in the TEDS from an SIO attached to a Node.
- SIO:Signal Conditioning - allows user to view the SIO's signal conditioning calibration after the SIO has been read.
- SI Exp - No user input required. This shows the storage of the SI units in the TEDS as defined by the IEEE 1451.2 specification.

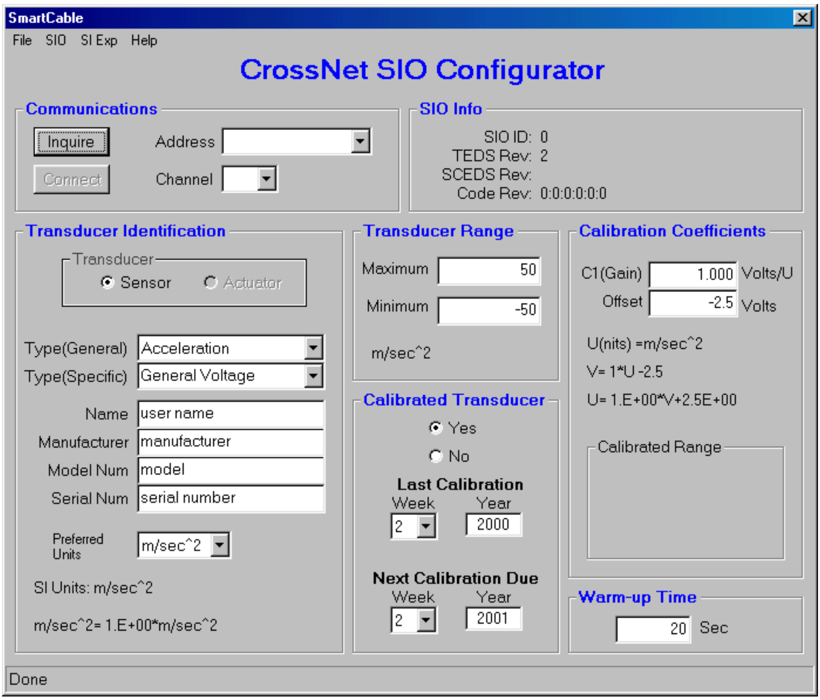


Figure B1. CrossNet SIO Configurator Main Window

SIO Signal Conditioning

The screen in Figure B2 shows the calibration constants for fixed voltage SIO model SC110. The gain and offset are factory calibrated and cannot be changed in the field. The Max and Min voltage into the SIO are displayed also.

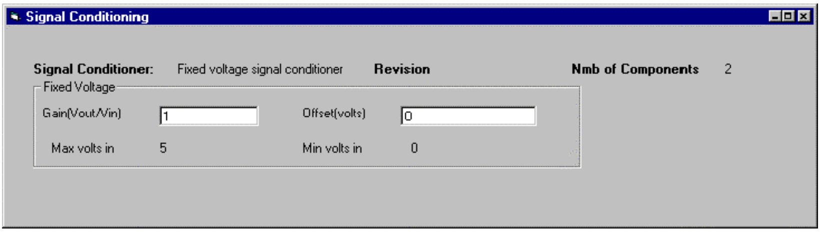


Figure B2. SIO Fixed Voltage Calibration Constants

The screen in Figure B3 shows the signal conditioning for a current input SIO model SC210. The signal conditioning circuit converts current to voltage and there are two calibration constants that are factory programmed. The Min and Max current input are also displayed.

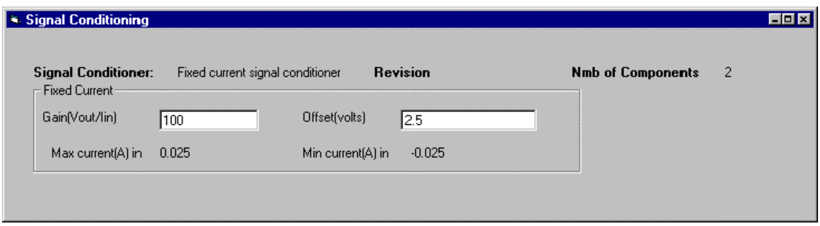


Figure B3. SIO Current Input Calibration Constants

The screen in Figure B4 shows an RTD signal conditioner model SC510. There are two parts to the signal conditioner:

1. Excitation current supplied to the RTD.
2. A programmable amplifier circuit

All parameters are factory calibrated.

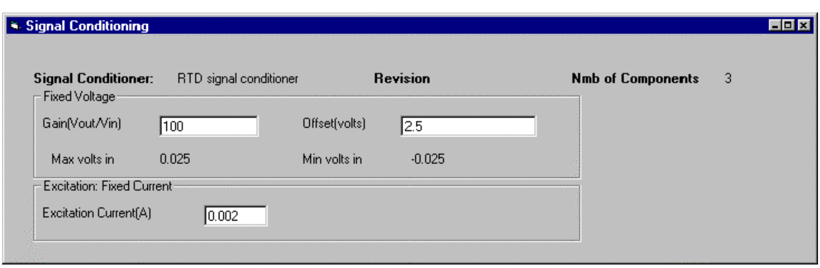


Figure B4. SIO RTD Signal Conditioning

The screen in Figure B5 is for bridge sensor signal conditioning. Note that it will add an ADC readout value. The bridge circuit has three programmable parameters:

- PreGain Null: This is used to zero the voltage differential from the bridge outputs into the SIO's amplifier circuit.
- Programmable Gain: Controls the gain of the SIO amplifier.
- PostGain Null: Sets the output level of the amplifier.

Three control buttons (plus EXIT) are available:

1. CONFIGURE: Loads the selected PreGain Null, Gain, and Post Gain Null into the SIO but doesn't store them into the SIO's flash memory.
2. PROGRAM: Stores the selected values into the SIO's flash memory.
3. RESTORE DEFAULT: Restores the old SIO values stored in flash memory.

The output from the bridge sensor must be balanced. Before proceeding, the sensor's sensitivity and the system's ideal gain need to be determined.

1. Determine the bridge sensor sensitivity in Volts/EU as follows:

   Sensitivity = Full Scale Voltage Output/Full Scale EU

   As an example, for a 300 lbs load sensor with a 3 mV output per volt excitation at full scale and a SIO providing 5 V excitation, the sensitivity would be:

   Full Scale Output = 3 mV * 5 V Excitation * 0.001 V/mV
   = 0.015 V

   Sensitivity = (0.015 V)/(300 lbs) = 5E-5 V/lbs

2. Determine the ideal gain for the SIO-sensor as follows:

   Ideal Gain = SIO Output Voltage Range/Sensor Full Scale Output

   Assume the example sensor is a compression cell with a small tension overshoot; then the desired Node voltage gain could be chosen as 4 V with 1 V being zero load. The ideal gain would be:

   Ideal Gain = 4 V SIO Volt Range/0.015 V Sensor FSO = 266

To balance the bridge:

1. Connect to the Node and SIO. Use the "SIO Configurator" main window, Figure B1, "Read SIO" command on the SIO dropdown menu to read in the SIO information.
2. Set the Calibration Gain for the sensor.

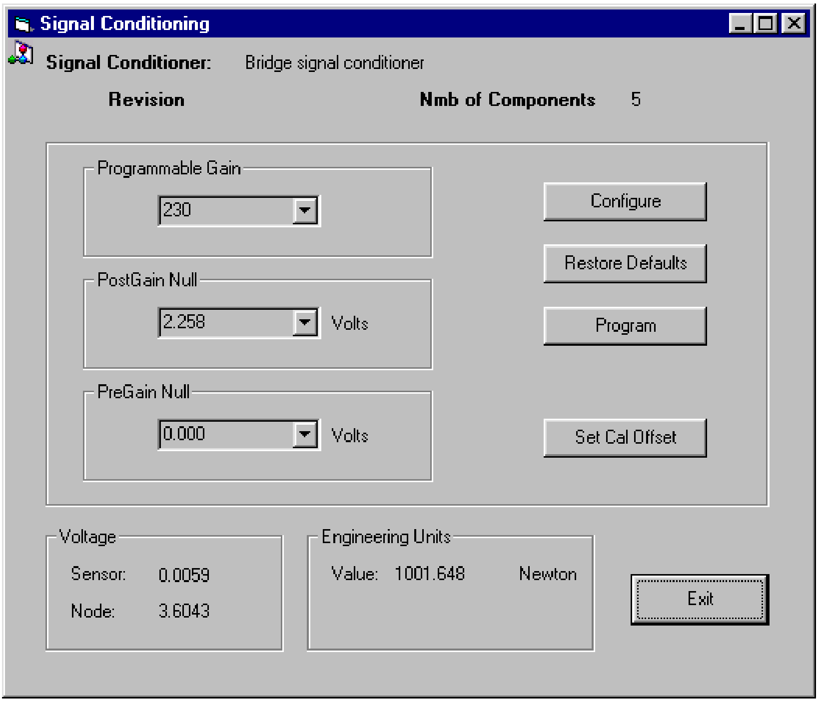


Figure B5. SIO Bridge Signal Conditioning

3. Set the Transducer Minimum and Maximum Range values.
4. Select "Program SIO" from the SIO dropdown menu.
5. Select "Signal Conditioning" from the dropdown menu.
6. On the Signal Conditioning screen, Figure B5, select the "Programmable Gain" value that is closest to the ideal gain without exceeding it. Then click the "Configure" button.

   The "Configure" button downloads the settings to the SIO without writing them into flash memory.
7. Short the SIO signal inputs. Set the "PreGain Null" voltage so the Node voltage, displayed at the bottom of the dialog, is as close to the offset voltage as possible. Then click the "Configure" button.

   Note that the PreGain Null settings are very coarse, so the resulting Node voltage may not be close to the desired setting.
8. Remove the short and attach the sensor to the SIO. Set the "PostGain Null" voltage so the Node voltage is as close to the offset voltage as possible, then click the "Configure" button.

9. If satisfied with the settings, click the "Program" button to write the settings into flash memory.
10. To zero the engineering units, click the "Set Cal Offset" button to set the Calibration Offset. To save this setting in memory, exit the Signal Conditioning window and select "Program SIO" from the SIO dropdown menu in the SIO Configurator main window.

Adding New Sensor Types

To add a new sensor type to CrossNet applications, update the SI.dat file to include information describing the sensor. First, the type is added to the sensor selection list in the file and then a new file section is added which contains sensor information.

To add the sensor type to the selection list, open SI.dat in a text editor and add a record to the [Sensors] section of the file using the format:

<index> = <type>

where the index is the next sequential item in the list and type is the type of sensor being added. The type will appear in the General Type list in the SIO Configurator application and the Type column of the Sensor table in PC ComWare.

The sensor section contains records defining the:

Sensor type section name
Si units
Conversion parameters

The sensor section name has the form:

[Sensor.<type>]

The sensor SI units record has the format:

SI = <Si Units>, <Enumeration>, 0, 0, <meter exponent>,
<Kg exponent>, <Sec exponent>, <Amp exponent>,
<Kelvin exponent>, <Mole exponent>, <Ca exponent>

Most sensors can be defined by the exponents of their SI units. These types include force, acceleration and temperature sensors. The units record for these sensor types would have an enumeration value of 0. As an example, force, defined as F=m*a, would be expressed as $Kg*M*Sec^{-2}$. The units line would then be:

SI = Newton, 0, 0, 0, 1, 1, -2, 0, 0, 0, 0

For sensors which can not be expressed in terms of SI units, such as those which give results as a percentage, the enumeration value would be greater than 3. As an example of a relative humidity sensor, the units line would be:

SI = RH%, 5, 0, 0, 0, 0, 0, 0, 0, 0, 0

Unit conversion records define the conversion from the desired units to the SI units. They have the form:

CVT<n> = <units>, multiplier, offset

The first conversion record, converts the SI unit into it and is defined as:

CVT1 = <SI units>, 1, 0

There can be up to 31 additional records defining unit conversions. An example to convert degrees Fahrenheit to degrees Kelvin is:

K = 9(F – 32)/5 + 273.15 = 5.56*F + 255.37

The resulting conversion record would be:

CVT<n> = F, 0.56, 255.37

Appendix C. Troubleshooting Guide

Troubleshooting Flow Diagram

If you have the following trouble	Check the following things	Notes
PC ComWare does not run.	Verify that system requirements are met. Verify proper installation of PC ComWare. Verify SIO Configurator is not running.	
PC ComWare application crashed.	Reset the PC Radio, reset the Node, and restart the application.	
Desired Bluetooth address not seen by PC ComWare.	Check Node power. Check PC radio function. Verify Node is within range of PC radio. Verify Node is not in use with another host. Repeat the Inquiry by clicking on Locate Nodes. Check if the Comm Port assignment is correct. Restart the Application, reset the PC Radio and reset the Node.	
LT110 does not locate and Nodes on Inquiry	Verify that the PCMCIA led flashes during the Inquiry command. Verify that the patch software has been installed. Verify that the correct Comm port has been selected.	
Node connection/power lost.	Reset the Node and re-establish the connection by clicking on Locate Nodes.	
No sensors show up in the sensor table in PC ComWare.	Verify that the SIO is connected to the node.	
Sensor TEDS data is not correct.	Verify that the TEDS in the SIO is programmed for the sensor connected to the SIO. Verify proper TEDS programming in SIO configuration program.	

Troubleshooting Flow Diagram (Continued)

If you have the following trouble	Check the following things	Notes
Data acquisition is not working correctly.	Verify that sensor channels are enabled for data logging. Verify proper excitation to sensor (and confirm that excitation matches assumptions in TEDS). Check sample rate. Check voltage output from node in display mode while supplying a known input voltage.	
Data storage to file does not work properly.	Verify that the system is set up properly for data storage. Confirm sufficient disk space.	
Troubleshooting using LED operation.	Refer to next section, *LED Operation*.	

LED Operation

The CN1100 Node has two LEDs, Status and Data, which can be used for troubleshooting. The four Status LED pulse sequences for normal operation are shown in Figure C1. The Status LED can be in any one of four modes where it is emitting one to four pulses, respectively.

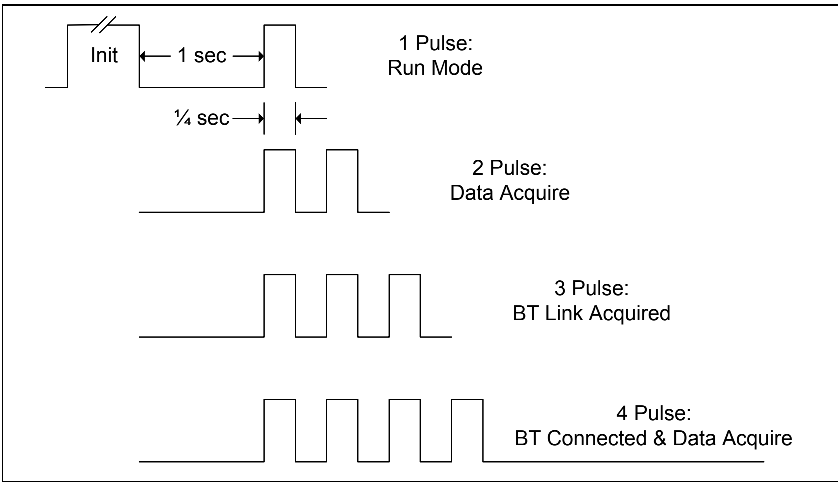


Figure C1. Status LED Pulse Sequences

The Data LED pulses whenever data is being transferred to or from the Node.

Low Battery Indication

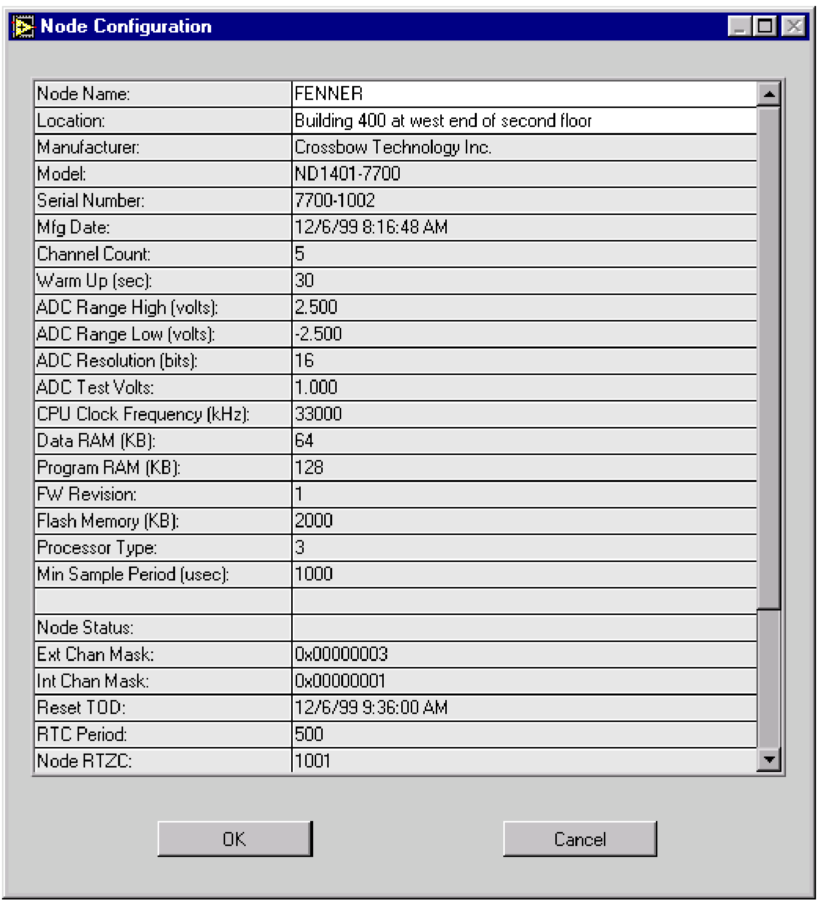
Both LEDs will pulse together once every five seconds (approximately) to indicate low DC input voltage to the Node.

Diagnostics

PC ComWare provides three diagnostic screens for system calibration and health checks:

- Node Configuration
- Advanced Sensor
- Node Self Test

Node Configuration Screen



Node Configuration

Node Name:	FENNER
Location:	Building 400 at west end of second floor
Manufacturer:	Crossbow Technology Inc.
Model:	ND1401-7700
Serial Number:	7700-1002
Mfg Date:	12/6/99 8:16:48 AM
Channel Count:	5
Warm Up (sec):	30
ADC Range High (volts):	2.500
ADC Range Low (volts):	-2.500
ADC Resolution (bits):	16
ADC Test Volts:	1.000
CPU Clock Frequency (kHz):	33000
Data RAM (KB):	64
Program RAM (KB):	128
FW Revision:	1
Flash Memory (KB):	2000
Processor Type:	3
Min Sample Period (usec):	1000
Node Status:	
Ext Chan Mask:	0x00000003
Int Chan Mask:	0x00000001
Reset TOD:	12/6/99 9:36:00 AM
RTC Period:	500
Node RTZC:	1001

OK   Cancel

Figure C2. Node Configuration Screen

NOTE

In Figure C2 the text in the first two lines (with the white backgrounds) is editable. Click on “OK” to save edits.

Advanced Sensor Screen

The Advanced Sensor screen, Figure C3, displays the sensor TEDS and Calibration data.

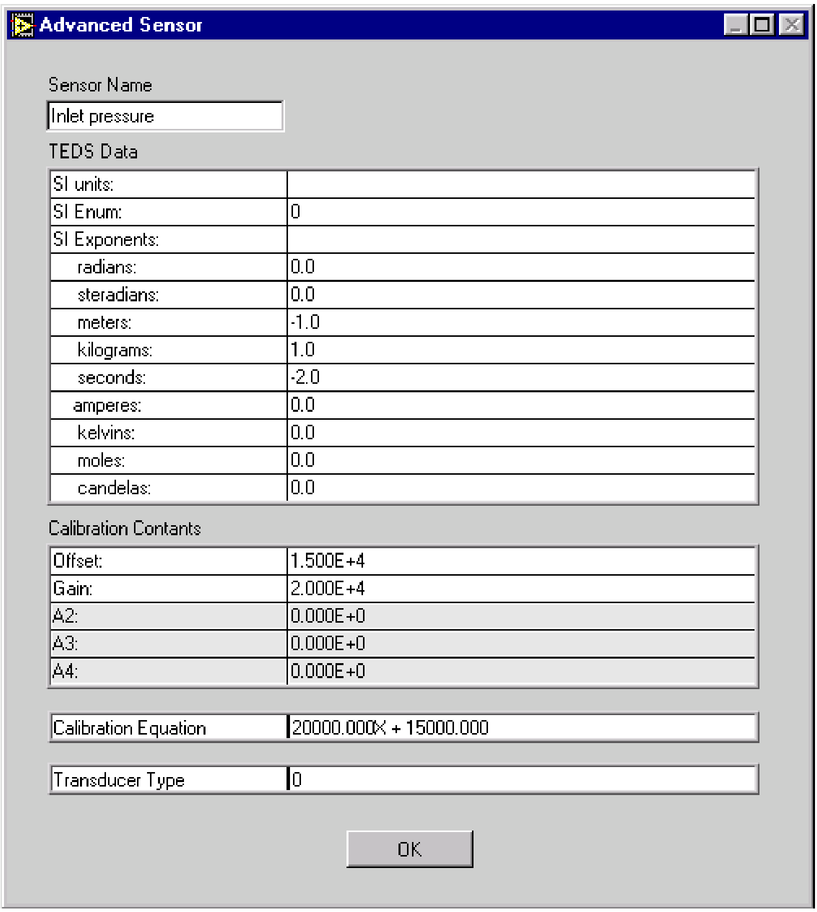


Figure C3. Advanced Sensor Screen

Node Self Test

A Self Test screen, Figure C4, is provided for diagnostic purposes.

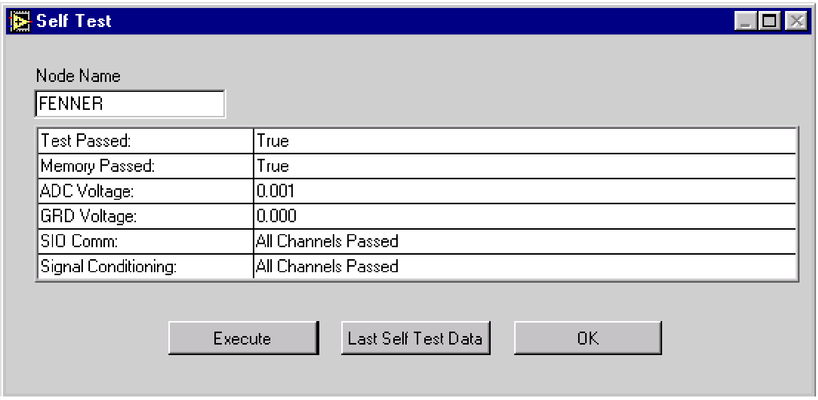


Figure C4. Node Self Test Screen

Appendix D. PC Radio

Crossbow PC Radio Package

- AN100 Antenna
- BT110 PC Radio
- PS200 AC to DC Wall Plug-in Power Supply
- RS-232 Cable and USB adapter

The BT110 PC Radio with the AN100 Antenna attached is shown in Figure D1.

Installation

When PC ComWare is installed in the host computer, it installs the driver, WinHub, for the BT110 PC Radio.

The BT110 PC Radio requires DC power from a DC source such as the PS200 AC to DC Wall Plug-in Power Supply, a nominal 5 VDC @ 350 mA.

By default, the BT110 PC Radio connects to a free RS-232 port on the host PC by means of a standard RS-232 cable with a 9-pin female connector on one end and a 9-pin male connector on the other end. Alternatively, a USB port may be used with the included USB adapter. For a laptop computer, a PCMCIA adapter must be used. Refer back to Table 1.

Figure D1. BT110 PC Radio

Appendix E. Power Connection

External Power

Both the PC Radio and the CN1100 Node may be powered by the PS200 external power supply, shown in Figure E1. One PS200 per device is required. The PS200 plugs into a standard 110 VAC wall socket and provides a nominal 5 VDC output @ 350 mA max.

Figure E1. PS200 External Power Supply

Node Battery Pack

The PS100 is a two-piece assembly, battery holder and cover, that holds four AA cells. The battery holder is designed to mount to the backside of the CN1100 Node with four screws, and the cover attaches to the battery holder with four captive screws. The PS100 has a protruding, built-in electrical connector that aligns and connects through an opening in the backside of the Node. One side of the PS100 assembly has an ON/OFF switch to control power to the Node.

Figure E2 shows the PS100 Battery Pack.

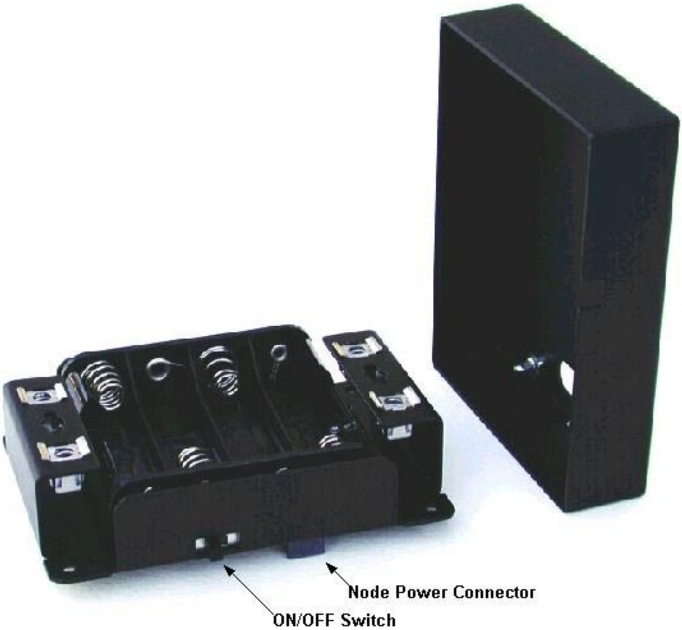


Figure E2. PS100 Battery Pack

PS300 Node DC-DC Pack

The PS300 is a DC-DC power converter assembly which mounts to the CN1100 and accepts external DC power .

Input voltage range :	9 - 30 VDC.
Input current range:	Approximately 75ma (CN1100LX) at 9 VDC
	Approximately 25 ma (CN1100LX) at 30 VDC
Protection:	Reverse voltage to –40 VDC
	Over-voltage protection to 35 VDC
	2.5A fuse

The PS300 (figure E3) is a two-piece assembly similar to the PS100 battery case. The converter is designed to mount to the backside of the CN1100 Node with four screws, and the cover attaches with four captive screws. The PS300 has a protruding, built-in electrical connector that aligns and connects through an opening in the backside of the Node. One side of the PS300 assembly has an ON/OFF switch to control power to the Node.

Figure E3. PS300 Node DC-DC Pack

Figure E4 shows the pin connection for the supplied female connector and the PS300.

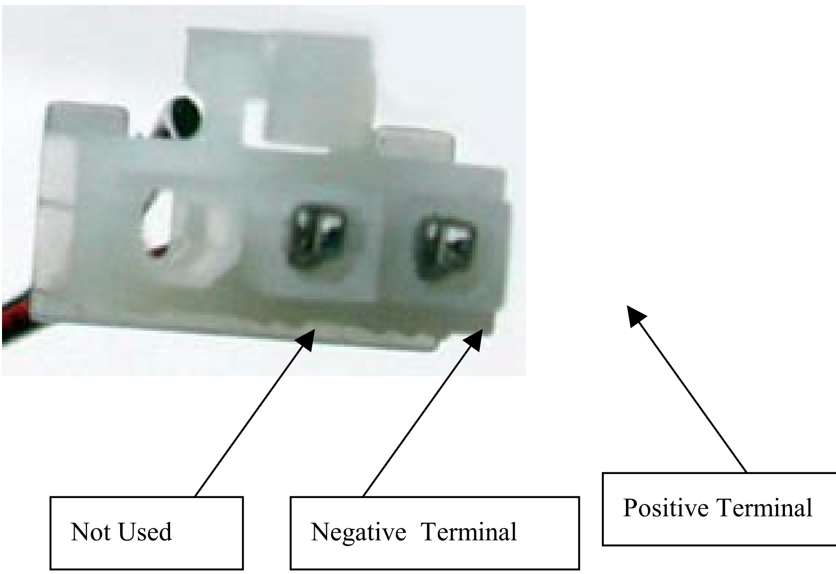


Figure E4. Pin Connection Diagram

Appendix F. Node Mounting

Mounting Plate

The MP100 Mounting Plate, shown in Figure F1, is designed for use with the CN1100 Node. The MP100 mounts to structure by means of screws in its four corners and has two protruding, grooved studs to hold the Node. The backside of the Node (and the backside of the battery pack, if used) has two slots with a central hole to fit over the studs. Once the studs are in the holes and the slots align with the groove depth, the Node is secured by sliding it away from the center hole.

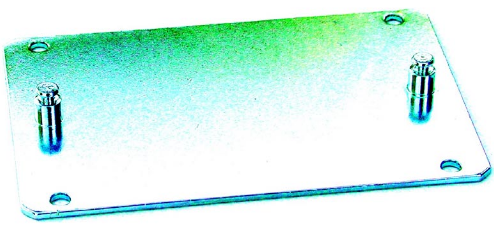


Figure F1. MP100 Mounting Plate

Appendix G. Warranty and Support Information

Customer Service

As a Crossbow Technology customer you have access to product support services, which include:

- Single-point return service
- Web-based support service
- Same day troubleshooting assistance
- Worldwide Crossbow representation
- Onsite and factory training available
- Preventative maintenance and repair programs
- Installation assistance available

Contact Directory

United States:	Phone:	1-408-965-3300 (7 AM to 7 PM PST)
	Fax:	1-408-324-4840 (24 hours)
	Email:	techsupport@xbow.com
Non-U.S.:	refer to website	www.crossnetwireless.com

Return Procedure

Authorization

Before returning any equipment, please contact Crossbow to obtain a Returned Material Authorization number (RMA).

Be ready to provide the following information when requesting a RMA:

- Name
- Address
- Telephone, Fax, Email
- Equipment Model Number
- Equipment Serial Number
- Installation Date
- Failure Date
- Fault Description

Identification and Protection

If the equipment is to be shipped to Crossbow for service or repair, please attach a tag TO THE EQUIPMENT, as well as the shipping container(s), identifying the owner. Also indicate the service or repair required, the problems encountered, and other information considered valuable to the service facility such as the list of information provided to request the RMA number.

Place the equipment in the original shipping container(s), making sure there is adequate packing around all sides of the equipment. If the original shipping containers were discarded, use heavy boxes with adequate padding and protection.

Sealing the Container

Seal the shipping container(s) with heavy tape or metal bands strong enough to handle the weight of the equipment and the container.

Marking

Please write the words, "***FRAGILE, DELICATE INSTRUMENT***" in several places on the outside of the shipping container(s). In all correspondence, please refer to the equipment by the model number, the serial number, and the RMA number.

Return Shipping Address

Use the following address for all returned products:

Crossbow Technology, Inc.
41 E. Daggett Drive
San Jose, CA 95134
Attn: RMA Number (XXXX)

Warranty

The CrossNet Node and any of the accessories come with a warranty for one year from the date of shipment.