ZigBee™ Coldfire Ethernet Demo Kit
FSI Project #04034
User's Guide

Revision Draft 0.4

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1 Revision History

Date	Revision.	Section	Description	Author
11/5/04	Draft 0.0	All	Initial Draft	B. Fields
11/23/04	Draft 0.1	4, 7. 7.1, 7.2	Updated setup info and updated History file section added 7.1 and 7.2	B. Fields
11/29/04	Draft 0.2	All	Added comments from the group	B. Fields
12/2/04	Draft 0.3	4, 8	Added Win98 setup Added RDC node specs	B. Fields
12/6/04	Draft 0.4	All		B. Fields

NOTE: If this section grows to large please move it to the end of the document.

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Note:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

--Reorient or relocate the receiving antenna.
--Increase the separation between the equipment and receiver.
--Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
--Consult the dealer or an experienced radio/TV technician for help.

3 Introduction

3.1 Purpose

The purpose of this document is…

The intended audience for this document is…

3.2 Scope

This kit is designed to be a functional demonstration of how the Freescale ZigBee™ wireless system can provide an efficient and economical solution for your wireless needs. This kit provides an easy way to remotely monitor/control user devices. Included in the kit are 3 Remote Data Collectors (RDC) that will transmit data via the ZigBee™ wireless system to a Data Concentrator (DCON). The Data Concentrator receives this information and passes the information to a Personal Computer over a TCP/IP connection. Figure 1 illustrates the systems operation.

Custom ZigBee™ designs are also available upon request. Please consult our professional in-house sales staff for details.

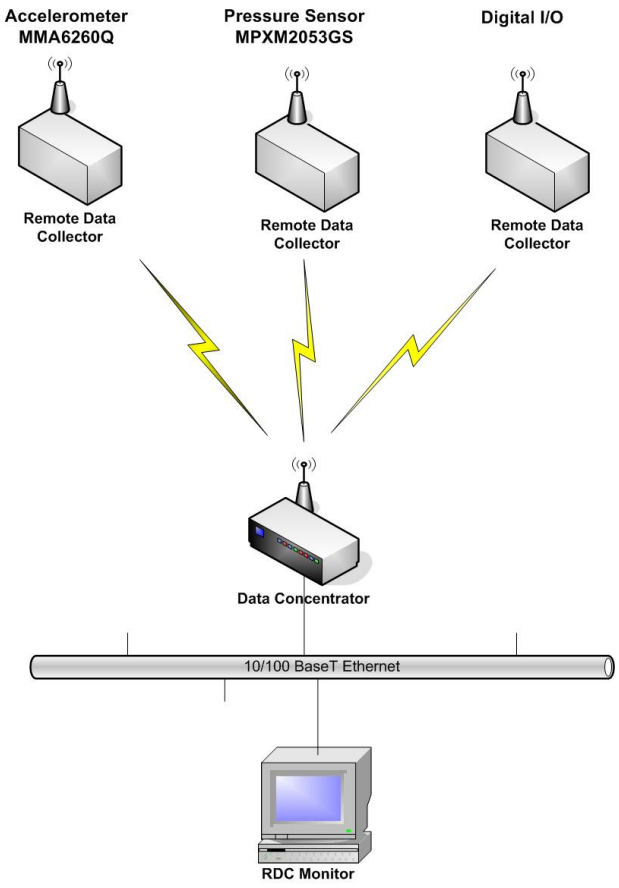


Figure 1

3.3 Definitions, acronyms, and abbreviations

Term	Definition
RDC	Remote Data Collector
DCON	Data Concentrator
RDCMonitor	PC application provided in ZigBee(TM) Coldfire Ethernet Demo Kit

3.4 Overview

The rest of this guide covers the installation and use of the ZigBee™ Coldfire Ethernet Demo kit.

Section 4 describes in detail how to setup and install the various components of the ZigBee™ Coldfire Ethernet Demo Kit.

Section 5 defines the kit's default settings and how to change them if necessary.

Section 6 provides instructions on how to operate the RDCMonitor application.

Section 7 describes the history files for data preservation.

Section 8 describes the use and functionality of the RDC nodes.

Section 9 provides FSI Systems contact information for problem reporting and resolution.

Section 10 is the Limited 30 Day Warranty.

4 Unpacking the Kit:

Verify with the packing checklist that all components have been received.

4.1 Module Setup

A) Remove the top cover from the Remote Data Collector (RDC) modules, and insert two AAA batteries per module. Observe the polarity markings on the battery holder as shown. In Figure 2.

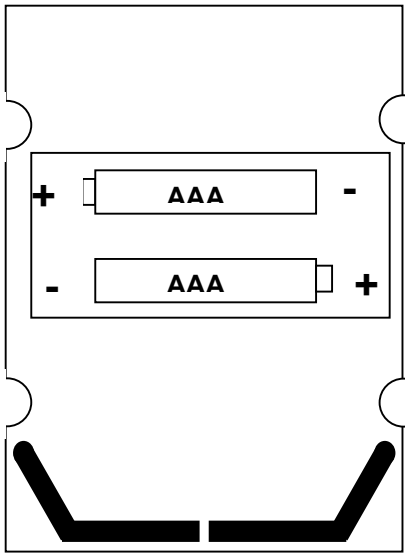
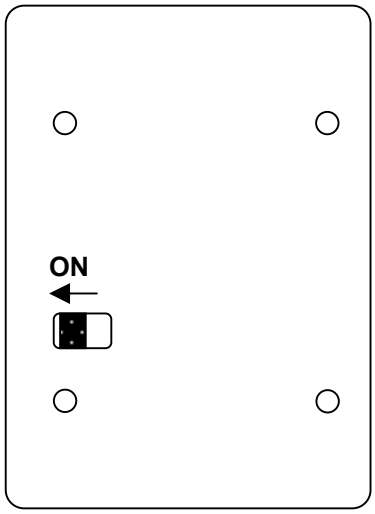


Figure 2

B) Replace covers.

C) Turn on power switch located on bottom side of RDC modules as shown below. Refer to Figure 3.



Bottom view of RDC

Figure 3

D) Plug either end of the crossover cable into the Data Concentrator (DCON) module as shown. Plug the opposite end into your PC's Ethernet connector. Refer to Figure 4.

E) Plug in the supplied power adapter to a 120VAC 60Hz outlet. In non-North American installations the use of a plug adapter (not supplied) is required. The supplied power adapter is capable of operation from 85-250 VAC, 40-60 cycle AC. Refer to Figure 4.

F) Plug the coaxial fitting power plug on the power adapter into the DCON's power jack to apply power to unit as shown. The green power indicator LED will illuminate to indicate power. Refer to Figure 4.

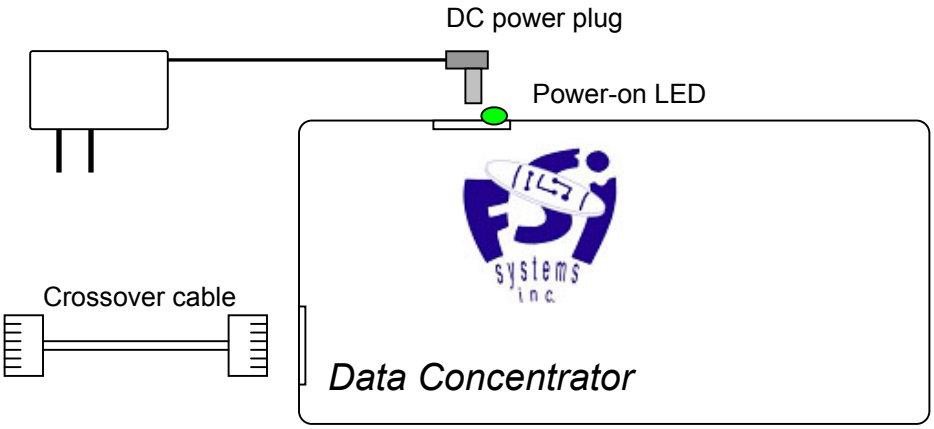


Figure 4

4.2 PC Network Setup

4.2.1 Installing RDCMonitor software

a) Insert the supplied CD into your PC's CD-ROM drive.
b) Follow prompts to install the ***RDCMonitor application.*** If the auto-run fails, select the CD_ROM drive (typically D:) and Double-Click on the Setup.exe file.

4.2.2 WinXP and Win2K:

Perform the following to connect the DCON directly to the PC's TCP/IP connection. If connecting to a network with a DHCP server, then skip this section and go to ***4.2.5 Setting up the DCON for DHCP:***

a) Right-Click on "My Network Places" icon, select "Properties".
b) In the Network and Dial-up Connections window Right-Click on "Local Area Connections", Select "Properties".
c) In the Network and Dial-up Connections window Right-Click on "Local Area Connections", Select "Properties".
d) Highlight the "Internet Protocol(TCP/IP)" selection and click on Properties.
e) Edit the TCP/IP properties page as shown below. Refer to Figure 5.
f) Reboot the PC.

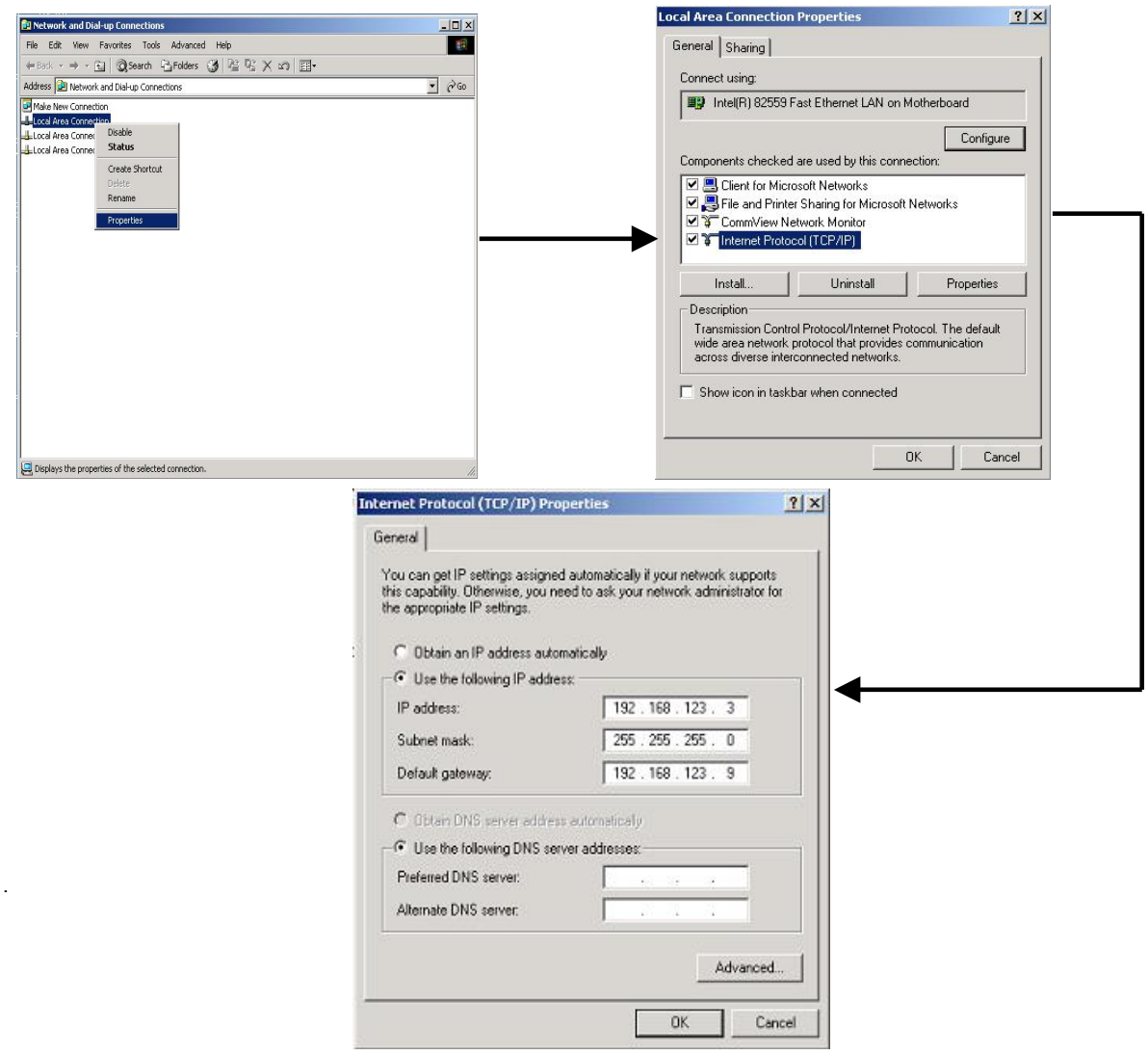


Figure 5

4.2.3 Windows 98 Setup

Perform the following to connect the DCON directly to the PC's TCP/IP connection. If connecting to network with a DHCP server, then skip this section and go to section ***4.2.5 Setting up the DCON for DHCP:***

a) Right Click on the "Network Neighborhood" icon on the Desktop, and select Properties.
b) Select the TCP/IP connection to be used, and Click on the Properties button.

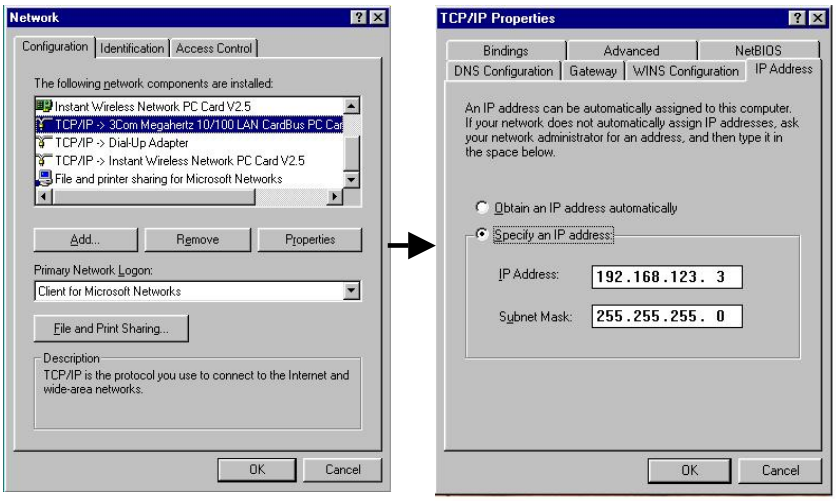


Figure 6

c) Select the IP Address tab in the TCP/IP Properties Window (See Figure 6).
d) Select the Specify an IP Address and fill in the IP Address and Subnet Mask Fields as shown in Figure 6. To use a DHCP connection, select Obtain IP Address automatically.
e) Click OK.
f) Reboot PC.

4.2.4 Setting up the PC and DCON for DHCP on WinXP and Win2K

Perform the following if the DCON is to be connected to a DHCP server instead of directly to the PC's TCP/IP connection:

Setting up the PC for DHCP:

a) Right-Click on "My Network Places" icon, select "Properties".
b) In the Network and Dial-up Connections window Right-Click on "Local Area Connections", Select "Properties".
c) In the Network and Dial-up Connections window Right-Click on "Local Area Connections", Select "Properties".
d) Select "Internet Protocol (TCP/IP)" and click on Properties (Figure 5).
e) Make sure "Obtain an IP address automatically" is selected (Figure 5).
f) Hit "OK" twice.

4.2.5 Setting up the DCON for DHCP:

a) Connect the DCON to a network with a DHCP server to automatically obtain an IP address. To use the default IP (192.168.123.2), simply reset the DCON when it is NOT connected to a DHCP server.

4.3 Running the RDCMonitor Application

A) Select “Start” -> “Programs” -> “FSI Systems” -> “RDCMonitor”

B) Answer ***Yes*** to prompts to use the system default settings and system default file. (The kit has been pre-configured to match these settings. Refer to section 6.2.2 to create RDC configuration files, for further details).

C) You are now monitoring the ZigBee™ ColdFire Ethernet system! Please refer to section 6 for a complete guide to operating this system.

5 Default Configuration Settings

The ZigBee™ Coldfire Ethernet Demo Kit is pre-configured to provide a quick and easy "out of the box" experience. The PC uses a default RDC configuration file (see section 4.2.2 for more information about the configuration files) that reflects the packed system. The application will use this file on startup. The system default settings are as follows:

A) DCON radio channel = 8. (This only needs to be changed if more than one DCON system is running)

B) All time data is in msec.

C) The Remote Data Collector default Addr/Ch jumper settings* are as follows:

I/O Mod default Addr/Ch (J2)

Label	Pin	J2		Pin
CH.3	1	Jumper	In	2
CH.2	3	Jumper	Out	4
CH.1	5	Jumper	Out	6
CH.0	7	Jumper	Out	8
A.3	9	Jumper	Out	10
A.2	11	Jumper	Out	12
A.1	13	Jumper	Out	14
A.0	15	Jumper	Out	16

Channel 08, Address 00

Pressure Mod default Addr/Ch (J2)

Label	Pin	J2		Pin
CH.3	1	Jumper	In	2
CH.2	3	Jumper	Out	4
CH.1	5	Jumper	Out	6
CH.0	7	Jumper	Out	8
A.3	9	Jumper	Out	10
A.2	11	Jumper	Out	12
A.1	13	Jumper	Out	14
A.0	15	Jumper	In	16

Channel 08, Address 01

Accelerometer Mod default Addr/Ch (J2)

Label	Pin	J2		Pin
CH.3	1	Jumper	In	2
CH.2	3	Jumper	Out	4
CH.1	5	Jumper	Out	6
CH.0	7	Jumper	Out	8
A.3	9	Jumper	Out	10
A.2	11	Jumper	Out	12
A.1	13	Jumper	In	14
A.0	15	Jumper	Out	16

Channel 08, Address 02

* For proper operation, the RDC node jumper settings and the RDC configuration file information must correspond to one another. See section 8 for RDC Node's electrical characteristics.

6 Operating the Kit

At this point your PC monitor should look similar to Figure 7 below. Each Window shown displays the activity that its corresponding RDC node is reporting via the ZigBee™ wireless system.

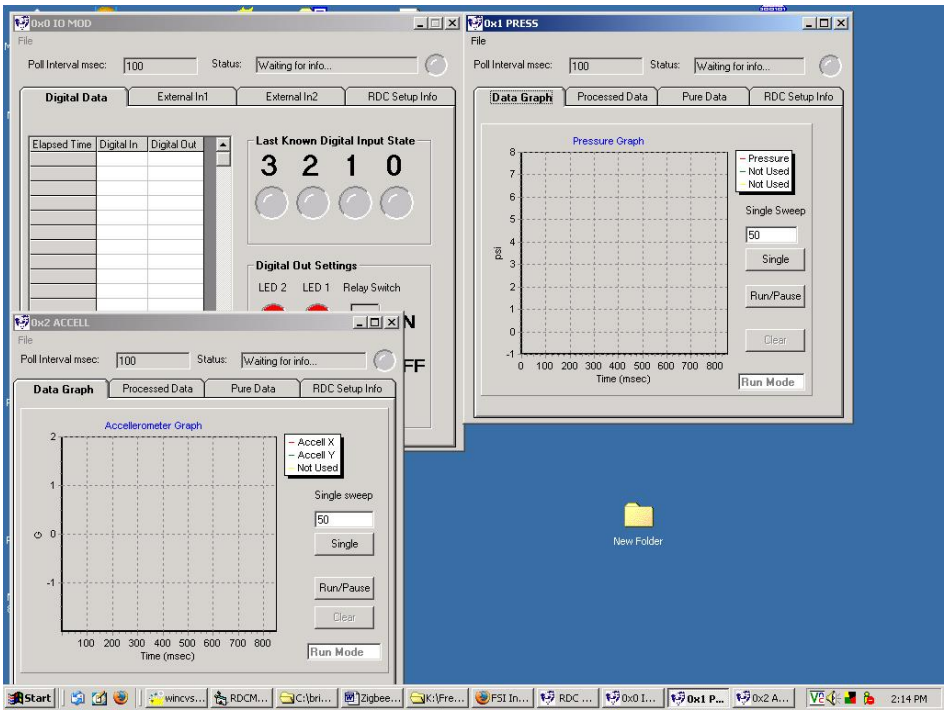


Figure 7

6.1 Using the RDC Node Window

The RDC Window displays the information that a particular RDC node is transmitting. The data in these Windows varies according to the module it represents. Included in this kit is an Accelerometer module, I/O module, and Pressure module. The following subsections describe these different types of RDC Windows.

6.1.1 Accelerometer/Pressure Windows

The Accelerometer and Pressure nodes operate in the same manner. The only difference is in the data itself. The Pressure node Window displays the data in pounds-per-square-inch (psi) units, and the Accelerometer data is displayed in gravities (G) units. Both nodes use milliseconds for the time base units. The main components of these Windows are (See Figure 8):

1) The Windows title corresponds to the nodes address and name as stated in the configuration file.

2) Poll Interval text box informing the user of the rate at which the DCON is polling the individual RDC nodes.

3) Status text box and LED to indicate the RDC node's current state.

4) A Data Graph tab, Processed Data tab, Pure Data tab, and RDC Setup Info tab.
    a) Graph tab displays the Processed data vs. Time (msec) in graphical Window.
    b) Processed Data tab displays the data, in tabular format, after the appropriate calculation has been performed on the incoming data.
    c) Pure Data tab displays the data, in tabular format, that was transmitted by the RDC node.
    d) RDC Setup Info tab displays the RDC node's configuration information, and has commands for changing a node's filter setup, and also to poll a node on demand.

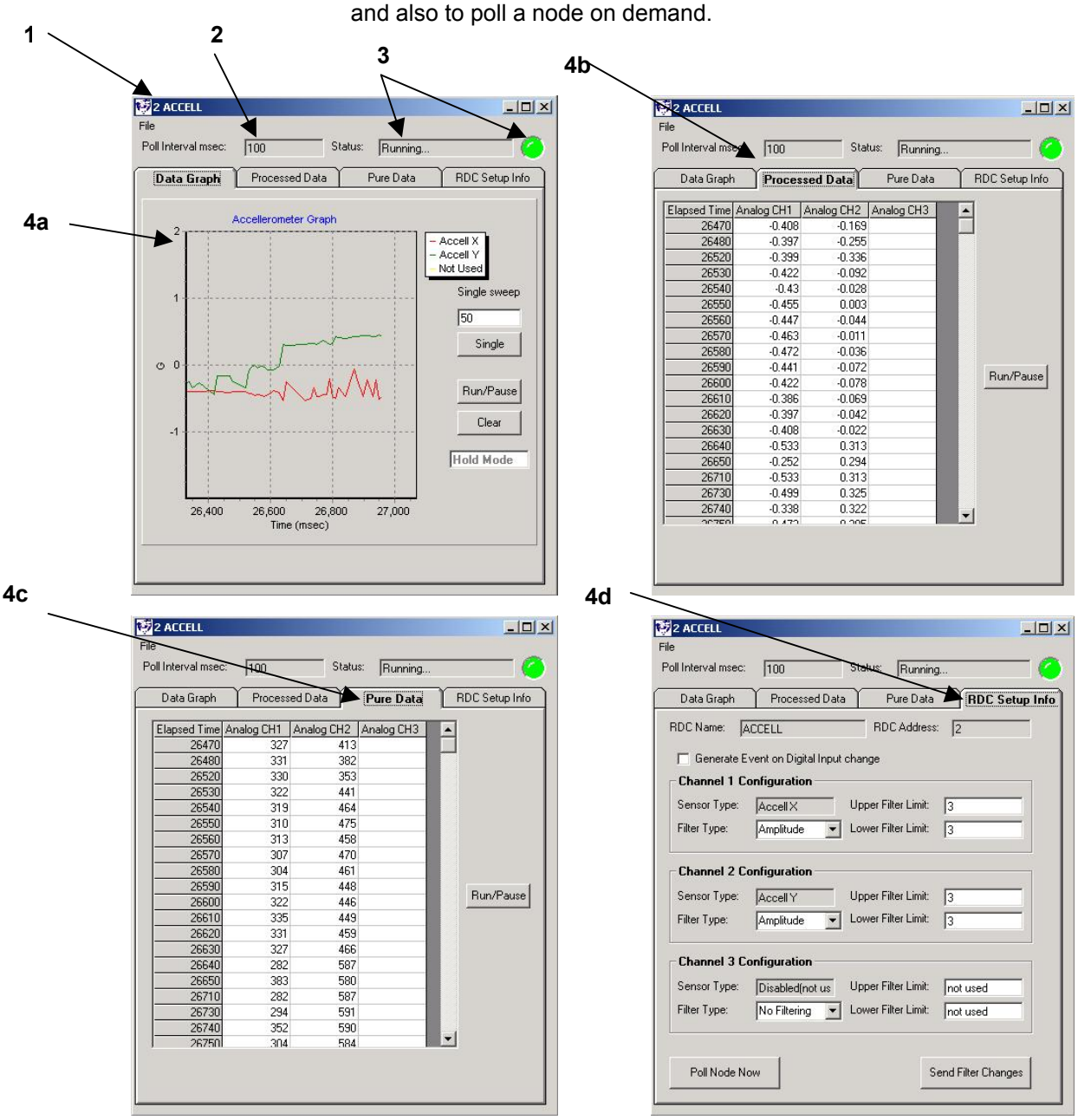


Figure 8

6.1.1.1 Using The Data Tabs

The Data Graph tab consists of a graph that represents the A/D data sent from an RDC node vs. Time. The data that the RDC node transmitted is shown in the Pure Data tab. This data is then run through a calculation based on the type of node being displayed and a plot of this calculated value is made on the graph. The calculated data is also shown in tabular format on the Processed Data tab.

To pause the data updates, select any of the Run/Pause buttons in the node's window. Any data received for this node will be stored in a history file (see section 7 for more info on this file), but will not be updated on the GUI.

To get a single sweep of data over a specified period of time enter the desired span of time to collect data before pausing. Then click on the Single command button. This will display the data from the last time plot to the (last time plot + specified period), and then hold. To continue normal data collection, select either the Clear or the Run/Pause button.

6.1.1.2 Using The RDC Setup Info Tab

The RDC Setup Info tab provides all of the configuration information about the node. This tab also provides the user with the ability to change the A/D upper and lower filter limits* for a desired channel, and to cause an event to occur based on a change in the digital input. To do this enter the new upper and lower filter limits for all channels (that are to change), check the *Generate event on Digital Input change* check box (if desired), and click on the Send Filter Changes button.

To force the DCON to poll a node for its data independent of the Polling rate click on the Poll Node Now button. This can be useful if a node is not responding or has reported and maintained an error condition.

**An analog channel's upper and lower filter limit determines its upper and lower sensitivity to detect changes with the sensor, and generate data to send to the DCON. The smaller the limit number the smaller the sensor change that is required to be for data to be transmitted to the DCON.*

6.2 RDCMonitor Main Window

The RDCMonitor Window (see Figures 9 and 10) is intended to provide the user with overall system information, and to provide some system wide functionality. This Window consists of two tabs: a Connect/Monitor tab and a Configuration tab.

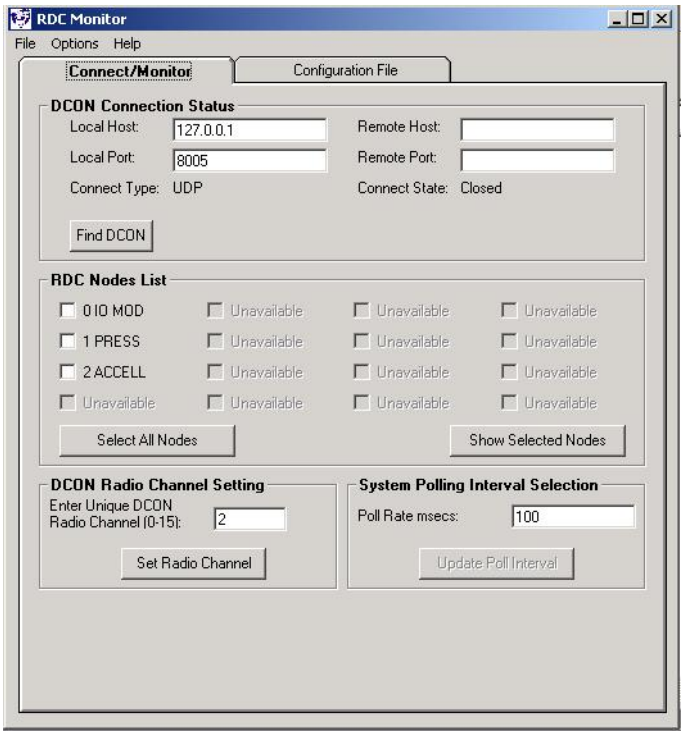


Figure 9

6.2.1 Connect/Monitor Tab

There are four sections to the Connect/Monitor tab (as shown in Figure 9) the DCON Connection Status, the RDC Nodes List, the DCON Radio Channel Settings, the System Polling Interval Selection.

6.2.1.1 DCON Connection Status

This section provides information about the connection between the PC and the DCON. The Find DCON button is used to connect to the DCON if the user does not want to connect using the auto-connect, or if the auto-connect failed.

6.2.1.2 RDC Nodes List

This section shows what nodes are connected to the system. All nodes that have a checkmark will be displayed when the Show Selected Nodes command has been clicked on. To select all nodes click on the Select All Nodes command.

6.2.1.3 DCON Radio Channel Settings

This section displays the current radio channel that the wireless system is operating on. This setting can only be changed prior to connecting to the DCON. The DCON needs this setting in order to communicate to the RDC nodes. This setting must be set to the same value as the RDC nodes' Channel Jumper settings. To change the DCON radio channel setting, enter the desired radio channel setting and click on the *Set Radio Channel* command button.

6.2.1.4 System Polling Interval Selection

This section displays the polling interval time, in milliseconds; the DCON uses to wait in between polling each node. This setting can be changed anytime while the system is running. To do this, change the number of milliseconds in the textbox and click on the Update Poll Interval command button.

6.2.2 Configuration File Tab

Configuration files are used to provide a way for the user to define the system based on their specific needs. These settings are sent to the DCON via the IP connection, and then the DCON relays this information to the proper RDC nodes via ZigBee™ wireless. Prior to connecting to the DCON this file is loaded into the application's memory. Upon connecting to the DCON this information is transmitted to the DCON, which in turn transmits the information to the RDC nodes. This information assigns available sensors to analog data channels. The Configuration File tab provides an interface for the user to define the system configuration based on their individual needs. There are six sections to the Configuration File tab (as shown in Figure 10) the Config File/Path Info, the RDC Identifier Info, 3 Analog Selector Channel sections (Channel 1-3), and the Commands section.

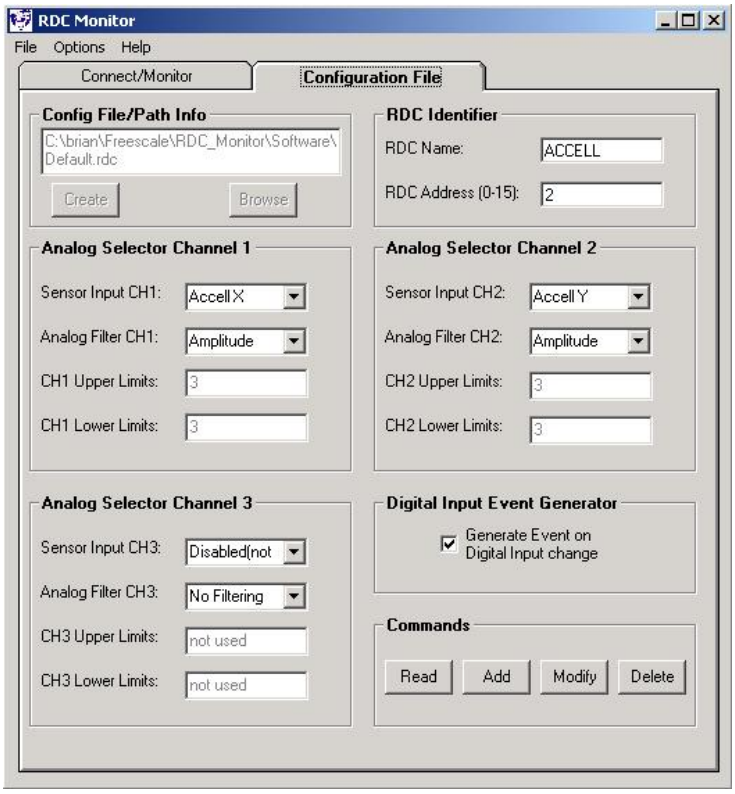


Figure 10

6.2.2.1 Config File/Path Info

The textbox in this section displays the RDC configuration file that is currently loaded into the application. If no file is selected then the user can use the Browse command to select an existing file or the Create command to make a new configuration file.

6.2.2.2 RDC Identifier

The user can enter either an RDC node name or an RDC node address to be used to perform the Read, Add, Modify, and Delete commands.

6.2.2.3 Analog Selector Channel

These three sections are used to define how each analog channel of the RDC node is to be configured. This includes selecting the type of sensor and the analog filter to be used. The upper and lower filter limits are also defined here.

6.2.2.4 Digital Input Event Generator

Each RDC node has a Generate Event on Digital Input Change check box associated to it. If this box is checked then any change in a digital input on the RDC node will cause an event to be recorded for that RDC node.

6.2.2.5 Commands

The Commands section provides a way to manipulate the RDC Configuration files. There are four basic operations Read, Add, Modify, and Delete.

6.2.2.5.1 Read

The Read command will fill in the various sections of the Configuration File tab according to what is stored in the file for a node specified by the RDC Name or RDC Address field of the RDC Identifier section.

6.2.2.5.2 Add

To add an RDC node to the configuration file, fill in all of the sections of this tab and select Add. This is also how the user can create new configuration files.

6.2.2.5.3 Modify

To modify an existing node's configuration settings perform the following:

1) Perform the Read command for the desired node.
2) Change the node's configuration information as desired.
3) Click on the Modify command.

6.2.2.5.4 Delete

To delete a node from the configuration file Perform the following:

1) Enter the Node's name or Address in the appropriate text box
2) Click on the Delete command button.

7 History Files

To preserve the data that has been collected by an RDC node, a log of data for a node is saved in a history file. Each node has a file associated with its individual data.

7.1 History File Path and Name Format

A “C:\RDC_Files” folder is created by the application. Sub-folders are created with the current days date, and history files created on that date are stored with a timestamp encoded in its file name. Figure 11 illustrate the history’s path and file name.

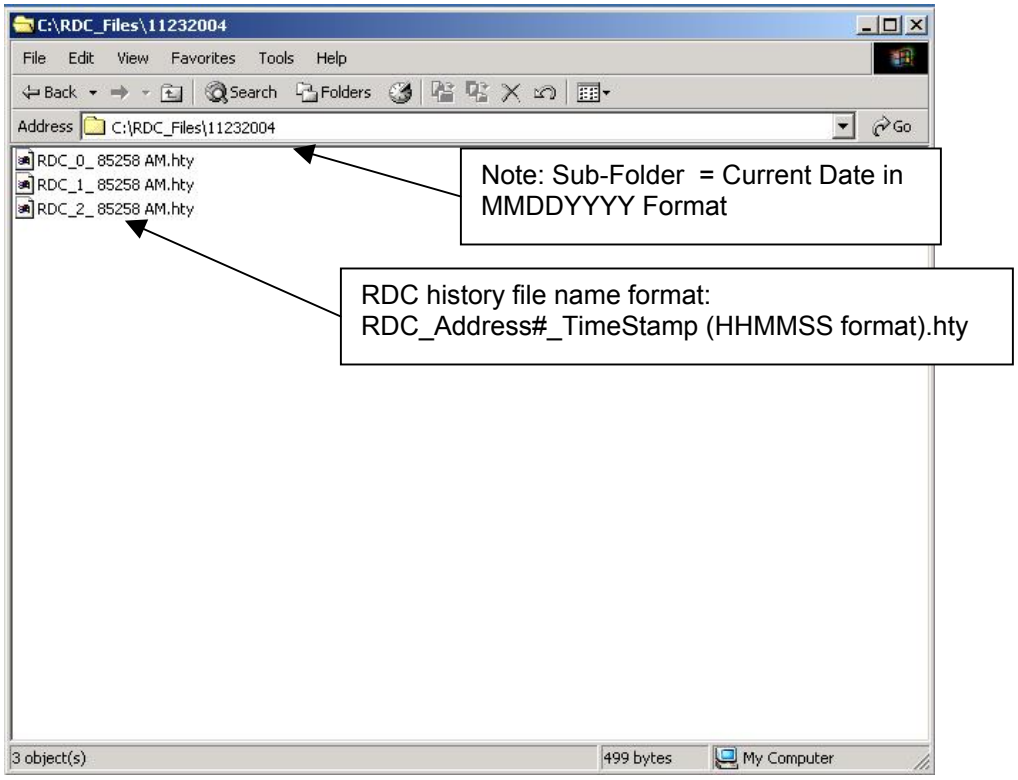


Figure 11

7.2 Viewing History Files

To view an RDC node's history file select ***File→ View RDC Node History*** from the main RDCMonitor Window's menu. A dialog box will appear prompting for a file to open. Upon selecting a History file (type .hty), the History viewer Window will appear. This Window is similar to the individual node Windows described in section 5. To start the viewer select the ***Start >>*** button. The data is then displayed in the same way as in an RDC Node Window. Select the ***More >>*** button to scroll through the entire file.

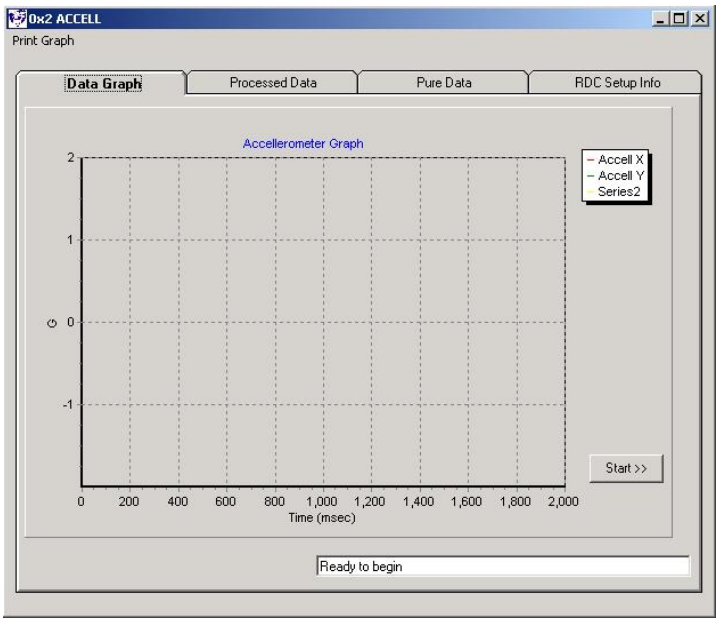


Figure 12

8 Use and Functionality of RDC Nodes

The kit contains three different types of RDC nodes; Pressure, 2-Axis Accelerometer, and Input/Output (I/O) Module. Section 8.1 provides common RDC node electrical characteristics. Section 8.2 provides electrical characteristics and a description of the Input/Output header for the I/O module. Section 8.3 provides electrical characteristics for the Pressure module. Section 8.4 provides electrical characteristics for the 2-Axis Accelerometer module. Refer to the Remote Data Collector Specification sheet for the complete specifications of these nodes.

8.1 Common RDC Node Electrical Characteristics

The following is true for all three types of RDC nodes:

Common Electrical Characteristics For All RDC Nodes

Symbol	Parameter	Comment	Min	Typ	Max	Units
Vin	Supply Voltage		1.6		3.6	VDC
Vsys	System Voltage	When Vin is met		3.3		VDC
Vio[1]	IO Voltages		-0.3		3.6	VDC
Van[1]	Analog Voltages		0.0		3.3	VDC
Vrelay[1]	Relay Voltage				30[2]	VDC
Isys	System Current	Current draw on the battery		90[3]		mA

Module Characteristics

Symbol	Parameter	Comment	Min	Typ	Max	Units
tL	Lifetime			540[4]		Min.

[1] IO Module only

[2] The relay is an Aromat TK1-3V and is capable of operating $120V_{RMS}$, however it is not advised to connect $120V_{RMS}$ to the RDC nor is the RDC designed to handle the TK1-3V maximum current load of 2A.

[3] The I/O Module has LEDs and a relay that draw about 8mA (each) and about 80mA respectively.

[4] Typical for Alkaline AAA batteries

8.2 I/O Module

The I/O module does not contain any internal sensors. Instead, it provides a 7x2 0.1" pin header with the following signals:

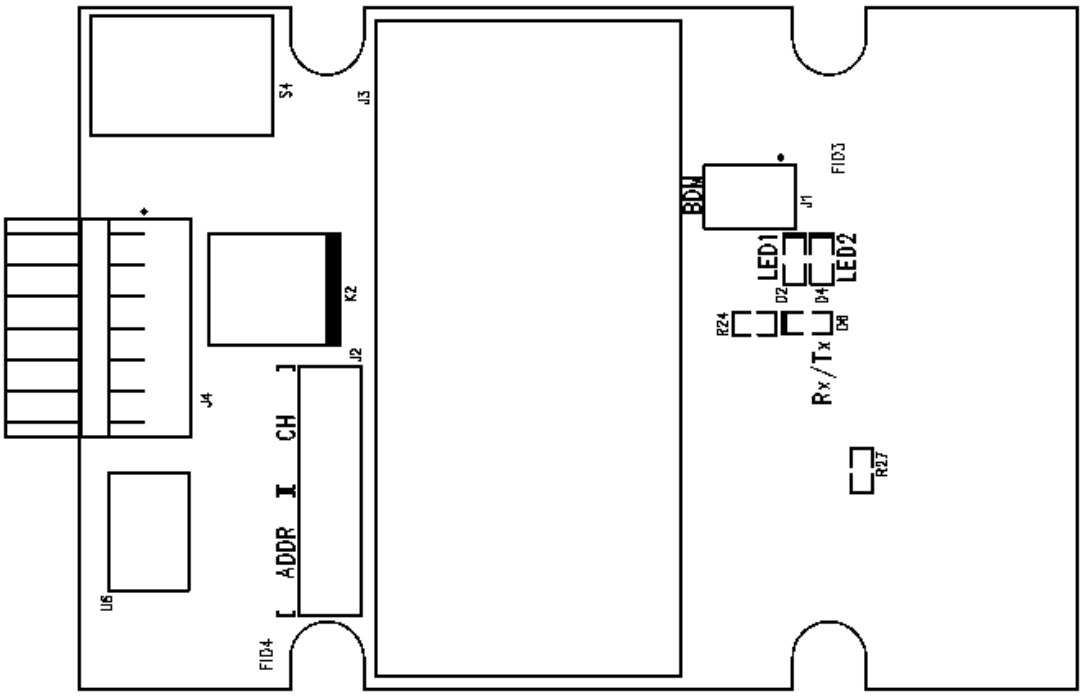


Figure 13

Note: Table is orientated with reference to figure 13.

I/O Mod Pin Header (J4)

Pin	Signal	Signal	Pin
1	3.3V (Power)	Analog 1 (ATD input)	2
3	K2.6 (Relay output normally open)	Analog 2 (ATD input)	4
5	K2.5 (Relay output common)	Switch 4 (Logic input)	6
7	K2.4 (Relay output normally closed)	Switch 3 (Logic input)	8
9	0V (Reference)	Switch 2 (Logic input)	10
11	0V (Reference)	Switch 1 (Logic input)	12
13	LED1 (Logic output)	LED2 (Logic output)	14

Note: J4 is a right angle header. Facing J4 (from the side), pin 1 is the lower leftmost pin.

With the module's rear cover off, S4 (DIP switches 1-4) and LED1 and LED2 are accessible. If the switches are left open, the corresponding pins on J4 can be used for external switches. The switch lines are pulled high. Assertion is active low.

LED1 and LED2 outputs can be used for other purposes so long as the port driving capacity of the HCS08 (as defined in the Freescale MCHCS08 data sheet) is not exceeded (including the LED current). The LEDs will still turn on and off with the output states.

The power draw on the module from any external circuitry must be below the regulator's maximum output current minus the system current. Anything above 50mA (especially with the relay engaged and low batteries) will be subject to intermittent brownout due to the charge pump regulator used.

Analog 1 and 2 inputs are tied directly to the HCS08 A/D peripheral and are protected by ESD diodes.

The relay (K2[4..6]) is an Aromat TK1-3V unit. Since the engaged current draw of the relay is on the level of the entire system current draw, it is advised that applications requiring more relay on time than off make use of the normally closed contact. When the batteries are near the end of their useful life, it is possible for the relay to oscillate between engaged and off. This is due to the relay holding current being marginally higher than the charge pump regulator output current at the low battery voltage. Since the HCS08 will operate at less than 3.3V, it will maintain assertion of the relay circuit even at a point where the relay holding current draw brings the regulator output voltage below the relay trigger voltage.

IO Module Characteristics

Symbol	Parameter	Comment	Min	Typ	Max	Units
Vio	IO Voltages		-0.3		3.6	VDC
Van	Analog Voltages		0.0		3.3	VDC
Vrelay	Relay Voltage				30	VDC
Isys	System Current	Current draw on the battery		90	185	mA

8.3 Pressure Module

The following describes the Pressure Module's electrical characteristics.

Pressure Module Characteristics

Symbol	Parameter	Comment	Min	Typ	Max	Units
Pkpa	Pressure in kPa	kilo Pascal	0		50	kPa
Ppsi	Pressure in psi	Pound-force per square inch	0		7.25	psi
Isys	System Current	Current draw on the battery		90		mA

8.4 2-Axis Accelerometer Module

The following describes the 2-Axis Accelerometer Module's electrical characteristics.

2-Axis Accelerometer Module Characteristics

Symbol	Parameter	Comment	Min	Typ	Max	Units
Agx	Accel in g, x dir		-1.5		1.5	g
Agy	Accel in g, y dir		-1.5		1.5	g
Isys	System Current	Current draw on the battery		90		mA

9 Problem Reporting/Resolution

Every effort has been made to provide a high quality product that is free of hardware and software defects. It is possible that other problems may be found in the field through use. FSI Systems will fix all critical problems found after product release as specified in the product warranty.

A critical problem is defined as any problem that renders the integrated product inoperative or severely degraded for any of the provided features or functions. To facilitate problem closure the user is requested to complete a problem description and submit by mail to:

FSI Systems Inc.
Attn: Customer Support
5847 County Road 41
Farmington, NY 14425
(585)-924-7510

Or via e-mail to:

support@fsisys.com

The problem description should include:

1) The software version level, obtained by selecting Help→About.

2) The nature of the problem (functional failure etc.)

3) The sequence of events leading to the problem (what actions were being Performed at the time)

4) The manifestation of the problem as well as other information supporting resolution such as repeatability, display indications etc.

Submission of the problem to FSI Systems will result in problem investigation, isolation and resolution. If the solution is a software fix FSI Systems will provide an appropriate electronic file that can be used to upgrade units.

10 Limited 30 Day Warranty

FSI Systems Inc. has made every effort to provide a high quality product that is free of hardware and software defects, and warrants to the original purchaser that this product is free from defects in materials and workmanship for the period of 30 days from the date of purchase. This warranty does not apply to damage due directly or indirectly to misuse, abuse, negligence, or accidentals; repairs or alterations outside our facilities; or to lack of maintenance. FSI Systems Inc. is not liable for death, injuries to persons or property, or for incidental, contingent, special or consequential damages arising from the use of our product. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation of exclusion may not apply to you.

To take advantage of this warranty, the product or part must be returned to us with transportation charges prepaid. Proof of purchase date and an explanation of the complaint must accompany the merchandise. If our inspection verifies the defect, we will either repair or replace the product at our election or we may elect to refund the purchase price if we cannot readily and quickly provide you with a replacement. We will return repaired products at our expense, but if we determine there is no defect, or that the defect resulted from causes not within the scope of our warranty, then you must bear the cost of returning the product.

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

**ZigBee™ is a trademark of the ZigBee group.*