RoHS 2 Compliant

ΩΞ OMEGA®

User's Guide

CHART

http://

Readings | **Chart** | Setup | Data

Gauge | Chart

Transmitter TXd259 ⌄ Group one ⌄

Temperature   **Pressure**   **Humidity**

25   31.3   504.2 630.3   18.8 25 31.3
378.2   12.5
756.3   6.0 **46.3 %**
08.2 hPa 882.4

Wi-Fi
Wireless Sensor System
802.11b/g Wireless Ethernet

wSERIES
Sensor System

ΩΕ OMEGA®

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LIST OF FIGURES:

NOTES, WARNINGS and CAUTIONS

Information that is especially important to note is identified by the following labels:

- **NOTE**
- **WARNING or CAUTION**
- **IMPORTANT**
- **TIP**

NOTE: Provide you with information that is important to successfully setup and use the wSeries Wireless System.

CAUTION or WARNING: Tell you about the risk of electrical shock.

CAUTION, WARNING or IMPORTANT: Tell you of circumstances or practices that can affect the instrument's functionality and must refer to accompanying documents.

TIP: Provide you helpful hints.

FEATURES

- ✔ **Web Server**
- ✔ **Virtual Coordinator**
  Data Logging Software
- ✔ **Alarms by Email or Text Message**
- ✔ **Temperature**
- ✔ **Humidity**
- ✔ **Barometric Pressure**
- ✔ **Dual Thermocouple Input**
- ✔ **NEMA4/IP65 Enclosure**
- ✔ **±100 mV, ±10 V Scalable Voltage Inputs**
- ✔ **±20 mA Scalable Current Input**

PART 1
INTRODUCTION
1.1 Safety and EMC Considerations

Refer to the Environment/Operating Conditions Section.

⚠️ **Warning:** the following parts of the unit are ESD sensitive:

- Plastic connector of the antenna
- LCD display
- Metal connectors for signal and power
- Metal body of the sensor probe

EMC Considerations

- Whenever EMC is an issue, always use shielded cables.
- Never run signal and power wires in the same conduit.
- Use twisted-pair wires for signal connections.
- Install Ferrite Bead(s) on signal wires close to the instrument if EMC problems persist.

Failure to follow all instructions and warnings may result in injury!

1.2 Before You Begin

Inspecting Your Shipment: Remove the packing slip and verify that you have received everything listed. Inspect the container and equipment for signs of damage as soon as you receive the shipment. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent. The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing the contents, save the packing material and carton in the event reshipment is necessary.

Customer Service: If you need assistance, please contact the Customer Service Department nearest you.

Manuals, Software: The latest Operation Manual as well as the latest software including the "Virtual Coordinator" are available at **the website listed on the cover page of this manual** or on the CD-ROM enclosed with your shipment.

1.3 Overview

wSeries wireless Transmitters take readings from the attached sensors, and transmit data on a wireless Ethernet 802.11b/g network commonly referred to as "Wi-Fi." These Transmitters are not "stand-alone" devices, they transmit data to the Virtual Coordinator.

The wSeries wireless sensor system provides Web-based monitoring of Analog Current and Voltage, Temperature, Humidity, and Barometric Pressure.

As with all Wi-Fi devices, the wSeries "Transmitters" are assigned unique IP addresses and connect to the LAN through a Wireless Access Point/Router.

To conserve battery power, the Transmitters wake up, take readings, transmit data and quickly go back to sleep. The user can select the frequency of transmissions. Less frequent transmissions result in longer battery life. In applications where battery life is not an issue, the wSeries device can transmit continuously, up to three sensor readings per second.

The wireless transmitter mount discretely on the wall in clean rooms, laboratories, museums, computer server rooms, warehouses, and any remote facility.

The Virtual Coordinator "VC" Web Server

The "Virtual Coordinator" is a data logging software application running on a Windows or Linux computer somewhere on the network. The "VC" logs/collects data from the wireless Transmitters.

The VC includes a Java-based Web server that can display readings, charts, and record data sent by the transmitters. The readings, data, and charts are viewed from a Web browser.

The browser accessing the VC Web server, can be the same computer on which the VC is installed-- or any other device with Web browsing capabilities on the local network or the Internet (a computer, tablet or smart phone).

For Windows PC's

The VC runs as a "Service" in the background, rather than a "Program". As long as the computer and its network connection is functioning correctly, the VC will collect data from the transmitters and serve it to Web browsing clients as requested. The VC can also provide data to popular Data Acquisition and Process Control programs running elsewhere on the network. Meanwhile, the computer running the VC server can be used for other tasks.

Chart scales are fully adjustable on the fly. For example, the chart can display one minute, one hour, one day, one week, one month or one year. Temperature and humidity can be charted across the full span (-40 to 125°C, and 0 to 100% RH) or within any narrow range such as (20 to 30°C).

The OPC Server software makes it easy to integrate the wSeries wireless sensor system with many popular Data Acquisition and Automation programs offered by Omega, Wonderware, iConics, Intellution, Rockwell Automation, and National Instruments, among others.

1.3 Overview (Continued)

The following example illustrates how you can hookup wSeries wireless system Software/Server to your network:

The wSeries wireless system consists of a single **Virtual Coordinator** and one or more **Transmitters**. Transmitters will send data periodically to the VC software where it serves as a gateway between the users and the Transmitters. The users can access the data through the VC's web server and data acquisition software.

A standard web browser can be used to monitor and chart analog current and voltage, temperature, humidity, and barometric pressure. The browser can also be used to configure the Transmitter's IP address, passwords for access and overall configuration parameters.
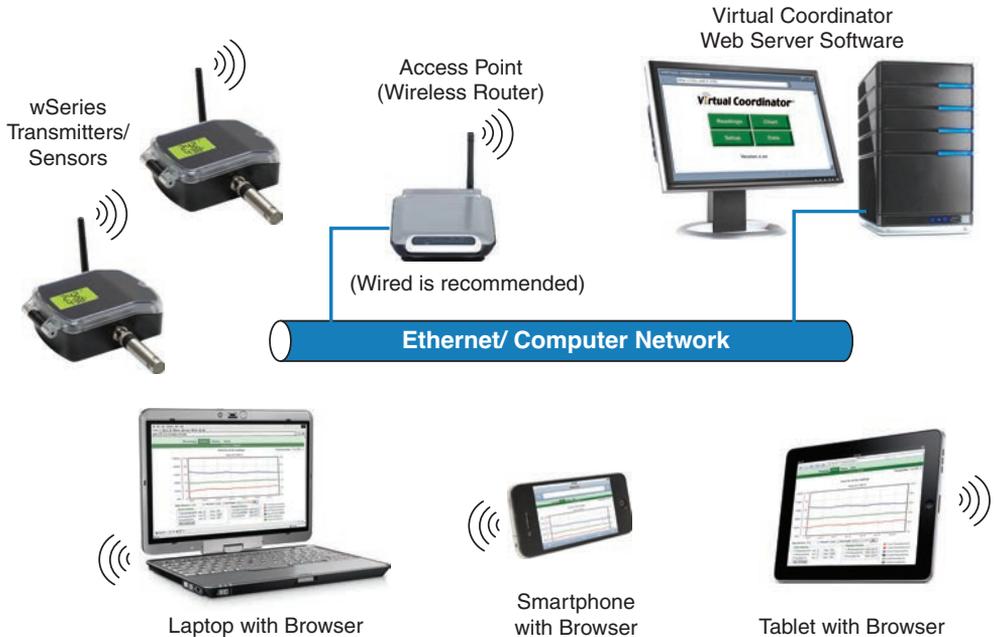
Figure 1.1 wSeries Wireless System on the Ethernet Network

PART 2 HARDWARE

2.1a Parts of the Transmitter (AC Powered)
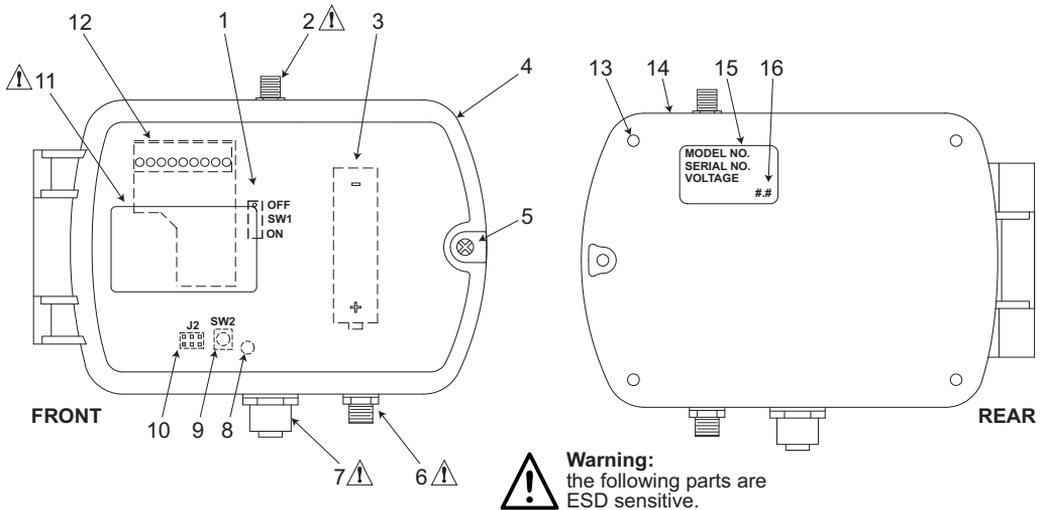
1	Red Power Slide Switch (under Cover)
2	Antenna Mount ⚠
3	One AA alkaline back-up battery
4	Case's cover
5	One Screw attaching Cover
6	Power Input, through quick disconnect M8 connector ⚠
7	External probe/sensor, through cable gland (for wTC, wVI) or quick disconnect M12 connector ⚠. Refer to **Figure 2.2a** for connector configurations.
8	Transmit LED (blue) Note: If you have an LCD option, the Blue LED will be on the LCD board.
9	White Default Push Button Switch (under Cover)
10	LCD Connection (if ordered as - LCD)
11	LCD Display (if ordered as - LCD) ⚠
12	Removable Terminal Block Connector (for wTC or wVI)
13	Four Wall mounting holes
14	Case's tray, where the PCB, and batteries are mounted
15	Label with model and serial numbers
16	Wi-Fi module firmware revision location on model label

Figure 2.1a Parts of the Transmitter (AC Powered)

2.1b Parts of the Transmitter (for C-CELL)

Warning: the following parts are ESD sensitive.

FRONT

REAR
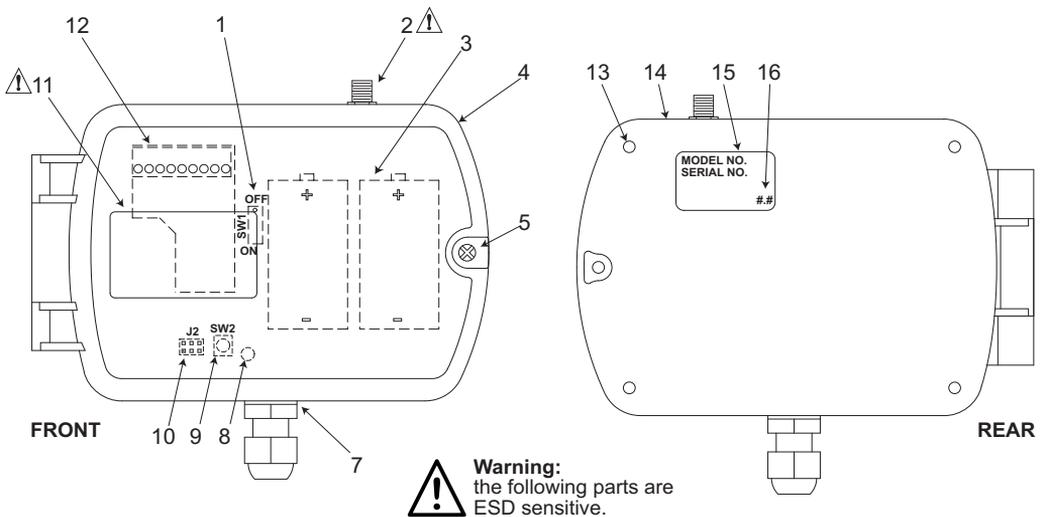
1	Red Power Slide Switch (under Cover)
2	Antenna Mount ⚠
3	Two C-Cell alkaline batteries
4	Case's cover
5	One Screw attaching Cover
7	External probe/sensor, through cable gland (for wTC, wVI) or quick disconnect M12 connector ⚠. Refer to **Figure 2.2a** for connector configurations.
8	Transmit LED (blue) Note: If you have an LCD option, the Blue LED will be on the LCD board.
9	White Default Push Button Switch (under Cover)
10	LCD Connection (if ordered as - LCD)
11	LCD Display (if ordered as - LCD) ⚠
12	Removable Terminal Block Connector (for wTC or wVI)
13	Four Wall mounting holes
14	Case's tray, where the PCB, and batteries are mounted
15	Label with model and serial numbers
16	Wi-Fi module firmware revision location on model label

Figure 2.1b Parts of the Transmitter (for C-CELL)

2.2 Dimensions and Mounting - Transmitter

Dimensions are in Inches with mm in [ ].
Material: Polycarbonate
Sabiclexan
Protection: NEMA4/IP65 rated housing

1) Position unit where required. Mark and drill holes as required, using a #6 screw.

2) Attach antenna (refer to **Section 5** for Environmental/Operating Conditions)

3) Attach sensor probes/signal wires (refer to **Section 2.5**)

4) Attach power supply or install batteries.

[110.0] 4.33

[146.3] 5.76

[104.2] 4.10

[50.8] 2.00

[9.1] 0.36

[96.5] 3.80

[78.3] 3.08

[25.4] 1.00

AC POWER M8

CABLE GLAND CONNECTOR (FOR WTC & WVI ONLY)

QUICK DISCONNECT CONNECTORS

M12

M8

[44.4] 1.75

[57.1] 2.25
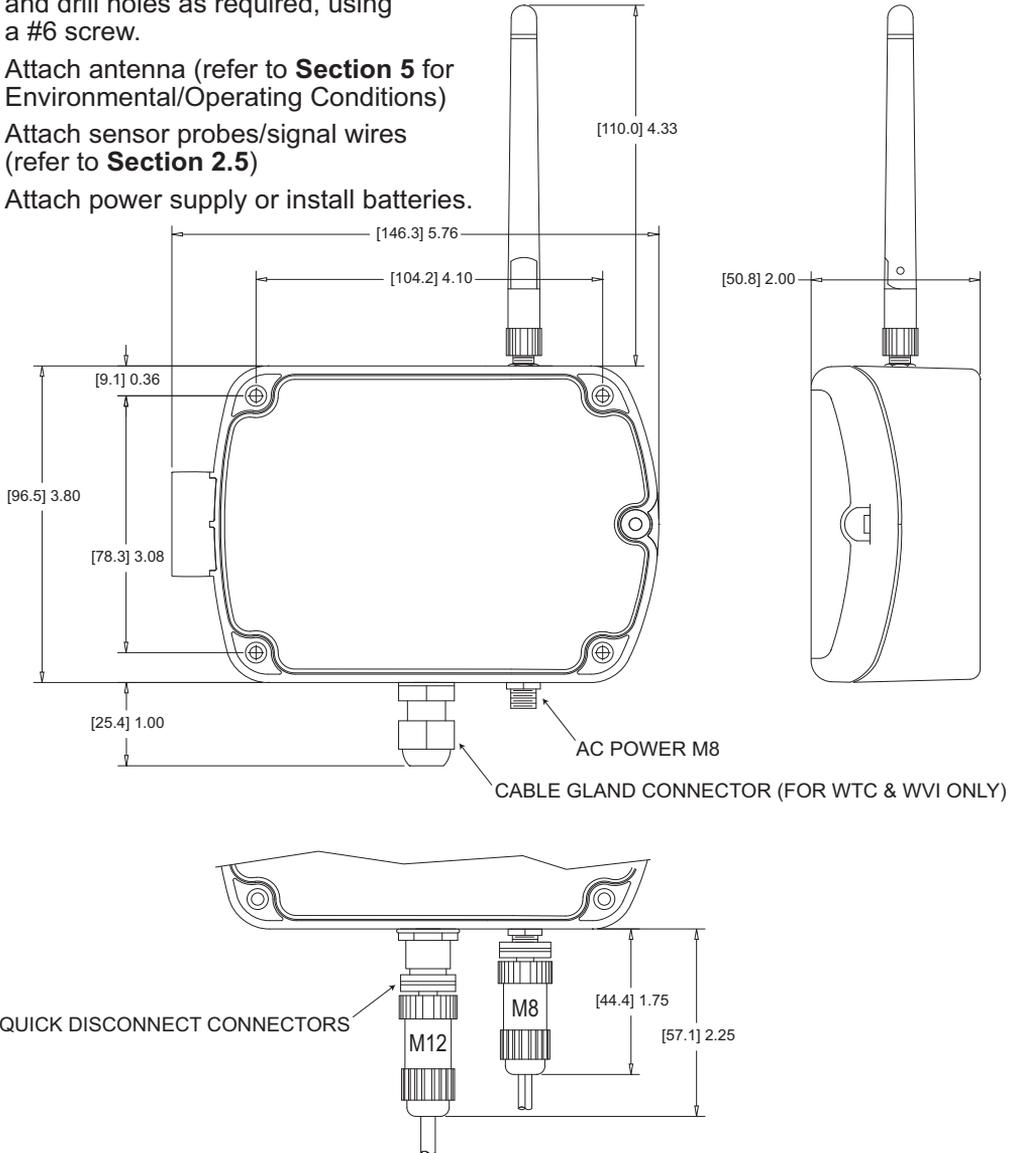
Figure 2.2 Mounting the Transmitter
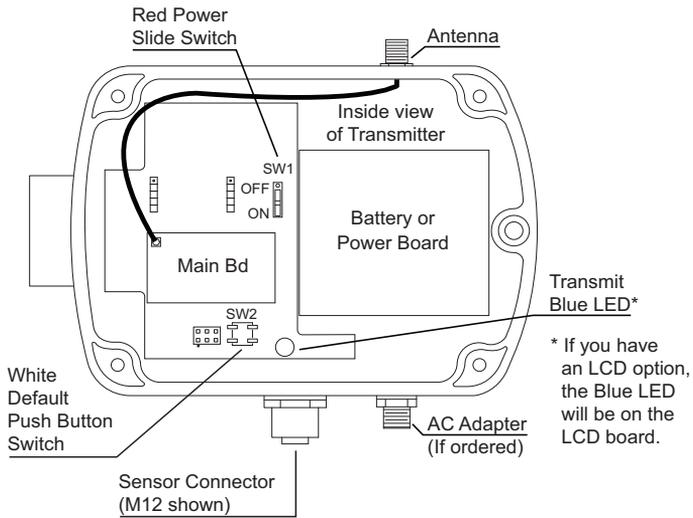
Figure 2.3 Transmitter Diagram

2.3 External Sensors/Probes for the Transmitter

FROM LEFT TO RIGHT:

1) External Temperature / Humidity Short Probe: **zTHP2**

2) External Temperature Lug Mount Probe: **zTP2**

3) External Temperature Stick Probe: **zTP1**

4) External Industrial Probe, Temperature / Humidity: **zTHP** or
Barometric Pressure / Temperature: **wBTP** or
Barometric Pressure / Temperature / Humidity: **wBTHP**

Figure 2.4 External Sensor/Probes

2.4a Disassembly - Transmitter (AC Powered)

You may need to open the unit for one of the following reasons:

- To turn on Power Switch.
- To access Default push Button.
- To mount unit to wall. Refer to **Figure 2.2a** for mounting dimensions.
- To connect or replace the AA Alkaline back-up battery, (note the polarity of battery).
- To access Thermocouple's or Analog input Terminal Block Connector.

Open Cover as shown below, by unfastening the Cover Mounting Screw.
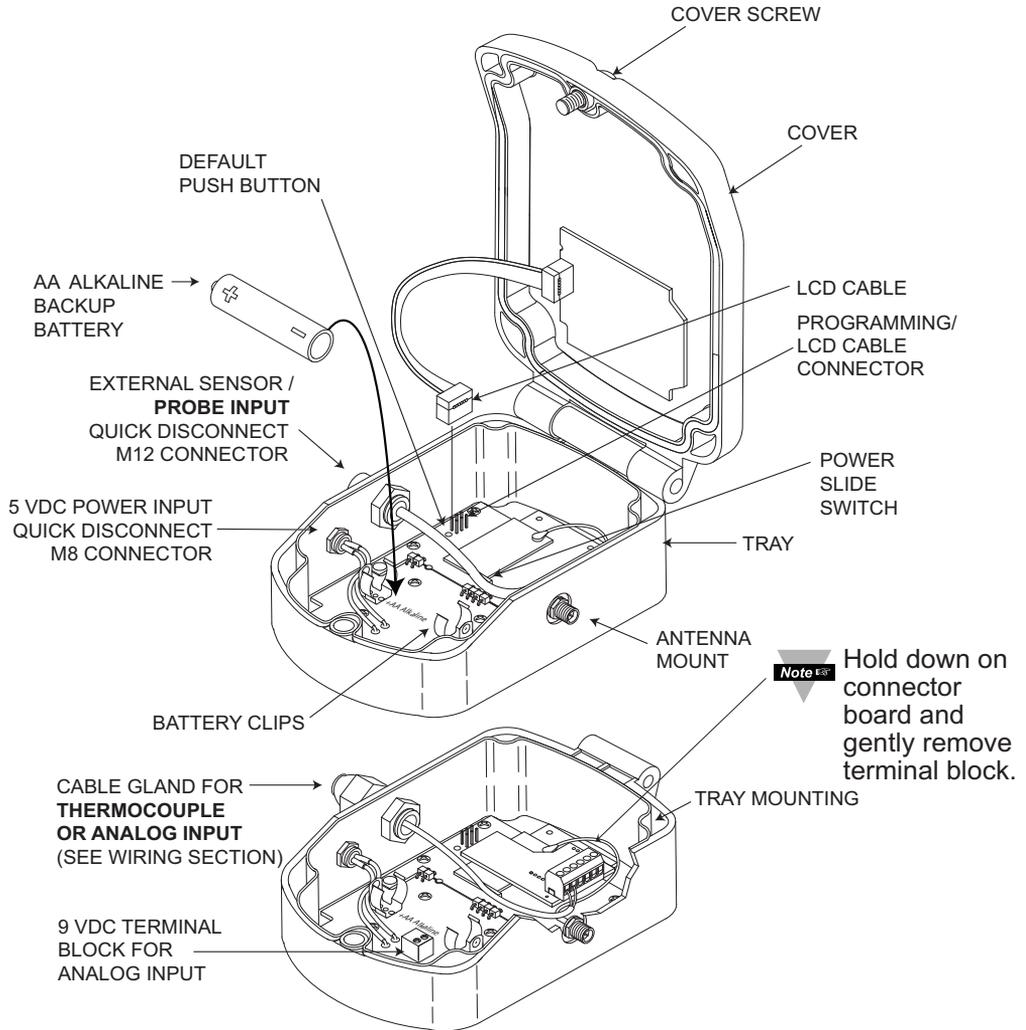
Figure 2.5a Disassembly of the Transmitter (AC Powered)

2.4b Disassembly - Transmitter (C-CELL)

You may need to open the unit for one of the following reasons:

• To turn on Power Switch.
• To access Default push Button.
• To mount unit to wall. Refer to **Figure 2.2a** for mounting dimensions.
• To connect or replace the C-CELL Alkaline battery, (note the polarity of battery).
• To access Thermocouple's or Analog input Terminal Block Connector.

Open Cover as shown below, by unfastening the Cover Mounting Screw.

COVER SCREW

COVER

DEFAULT
PUSH BUTTON

C-CELL →
BATTERIES

LCD CABLE

PROGRAMMING/
LCD CABLE
CONNECTOR

EXTERNAL SENSOR /
PROBE INPUT
QUICK DISCONNECT
M12 CONNECTOR

POWER SLIDE
SWITCH

TRAY

ANTENNA
MOUNT

BATTERY CLIPS

Note ☞ Hold down on
connector
board and
gently remove
terminal block.

CABLE GLAND FOR
**THERMOCOUPLE
OR ANALOG INPUT**
(SEE WIRING SECTION)

TRAY MOUNTING
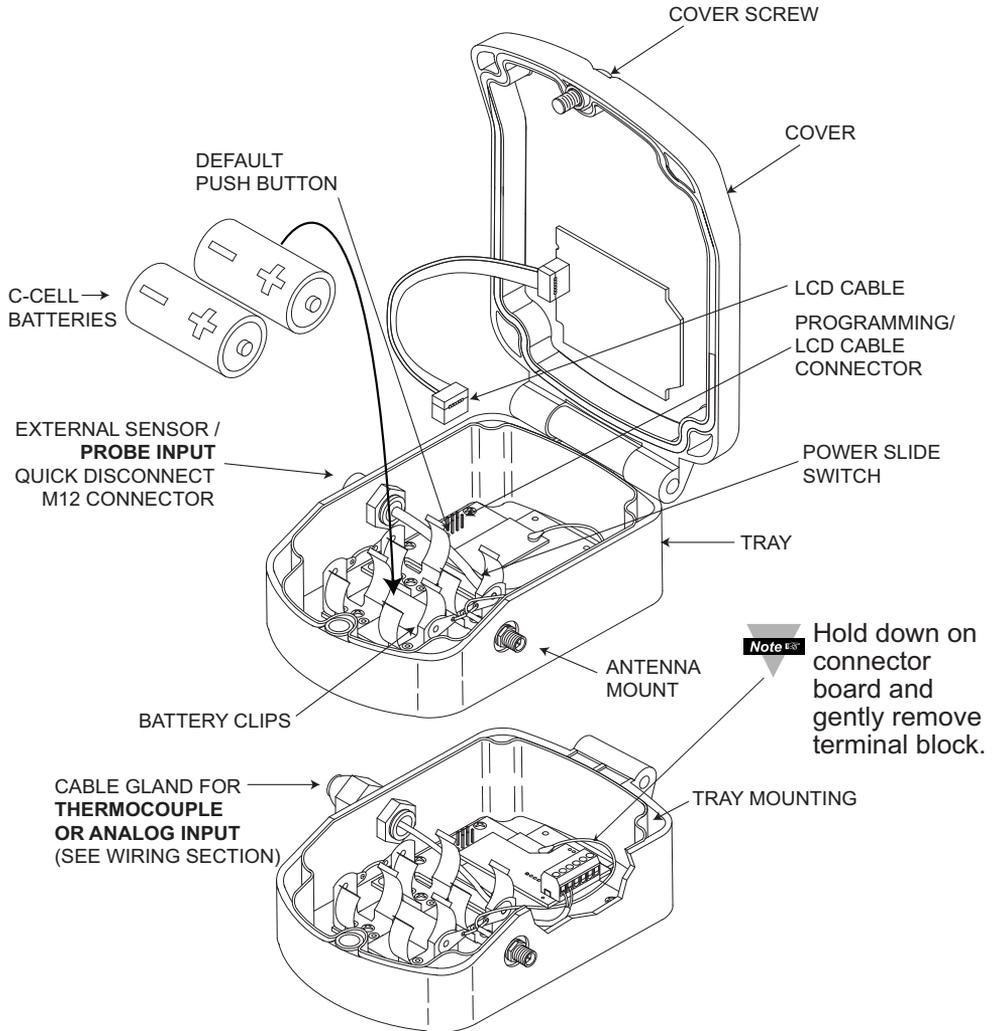
**Figure 2.5b Disassembly of the Transmitter
(C-CELL)**

10

2.5 Thermocouple and Analog Input Wiring

The figure below shows the wiring hook-up for thermocouples and analog inputs. You may install 2 thermocouples or 2 channels of analog inputs.

Example: for Type K thermocouple, connect the yellow wire to the "1 (+)" terminal (J1) and the red wire to the "2 (-)" terminal.

	ANSI Color Coding	
TYPE	Lead (-)	Lead (+)
J	Red	White
K	Red	Yellow
T	Red	Blue
E	Red	Purple
N	Red	Orange
R	Red	Black
S	Red	Black
B	Red	Gray
C	Red	White
DIN J	Red	Blue
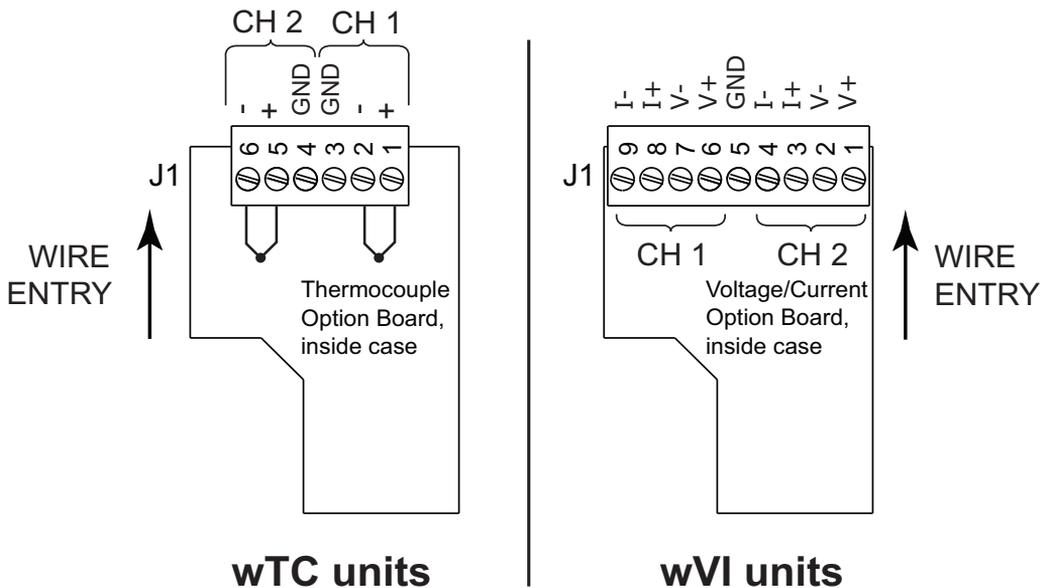
Figure 2.6 Thermocouple Wiring and Analog Wires Color Chart

PART 3

CONFIGURATION

3.1 Configuring the computer running Virtual Coordinator Software (VC)

3.1.1 Disable Power Safe Options:

The computer running Virtual Coordinator software needs to be running continuously. To do that:

a) Go to Control Panel>System and Security>Power Options.
   Choose the Power Plan>Change Plan Settings>Change Advanced Settings.
   Then choose the Hard Disk>Turn Off Hard Disk Option.
   Reduce this number from 20 to **0** (Never). Save the settings.

b) These settings may be different on Windows XP.
   Choose the Option to Never Turn Off Hard Disks and Never Put the System to Standby.
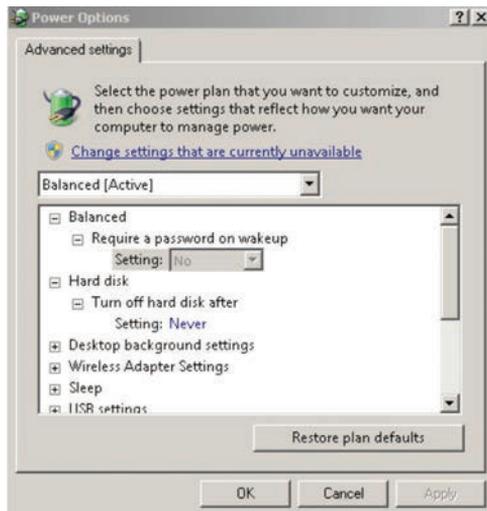
Figure 3.1 Power Options

3.1.2 Java Runtime Environment:

This PC needs to have the latest Java Runtime Environment (JRE) installed. First check the JRE installed.

Go to Control Panel and look for the icon named Java. Clicking that will start the Java Control Panel. Go to the Java tab and click on View button.

Note the Version number. It should be something like 1.6.0.x. If the version number is anything less than 1.6 then go to ***www.java.com***, download and install the latest version of JRE.

3.1.3 Firewall Exception:

This computer may have a firewall running which will block the readings sent from the sensor (transmitter) to the Virtual Coordinator Software.

Configure the firewall to allow this data to go through. Refer to **Appendix K** and **L** to configure the firewall.

3.1.4 IP Address:

If this computer is used to run the VC only and not to configure the Transmitter, then set a desired STATIC IP address.

If this PC is used for configuring the Transmitter then set up a STATIC IP address of **169.254.1.2** for AD-HOC.

Refer to **Appendix M** to configure the STATIC IP address for Windows.

Note ☞	It is recommended to have the computer running VC hard-wired to the access point/wireless router.
Note ☞	For initial setup it is recommended to place the Transmitter and the VC close to the wireless access point/wireless router. Once the configuration is done the Transmitter can be mounted to the desired location.
Note ☞	This configuration applies to Windows PC. For Linux, visit our website or read the instructions in the CD.
Tip ☞	One can also use a mobile device with a wireless (Wi-Fi) to configure the Transmitter.

3.2 Installing Virtual Coordinator Software

Find the **setup.exe** in the accompanying CD or on the web.

Double click that to install it.

The setup process is typical to any Windows program and asks you to choose the installation path and whether it is a new installation or an upgrade. You must have the Administration Rights to the PC when installing the VC.

Now go to Start>All Programs>Newport>Virtual Coordinator Manager.

Click on Install Services *twice* and wait until it prompts you to reboot the PC.

Reboot the PC to start all the services of Virtual Coordinator.

Once the PC reboots, open up a web browser like Internet Explorer, type in your PC's IP address and a Virtual Coordinator web page should show up.

This means that the Virtual Coordinator web-server is running.

3.3 Configuring the Transmitters

Attach the antenna.

3.3.1 Connecting Sensors

Connect the sensors: digital probes, thermocouples, or analog inputs.

The digital probes for temperature, humidity, and barometric pressure use a NEMA 4, IP65 M12 connector.

Thermocouple wires and analog voltage & current wires thread through the NEMA 4, IP65 cable gland to the J1 terminals as shown in **Figure 2.6**.

3.3.2 Battery Installation

Install batteries or connect the AC adapter (depending on model), you will need to open the transmitter's cover, refer to **Figure 2.5**.

3.3.3 Using Factory Default Setup

There are two modes of setting up your Transmitter: using factory default or AD-HOC (refer to **Section 3.3.4** and **3.3.5**).

If your computer does NOT have a wireless Ethernet Adapter, you can configure your Access Point to the following settings:

- SSID: wseries
- Authentication: Open
- DHCP: Enabled
- IP Address: **192.168.1.1**
  (or your Access Point default settings, as it may be different ie. 192.168.1.200)
- Subnet Mask: **255.255.255.0**

Change your Access Point to Default Settings.

Connect VC to Access Point and assign STATIC IP to VC (PC's IP Address).

Connect Transmitter to VC

Change settings of Transmitter in VC.

Note☞ You must make sure the changes are correct, otherwise, you cannot go back to Transmitters factory default settings.

Transmitter Factory Defaults Settings

- SSID: wseries
- Authentication: Open
- DHCP: Enabled
- VC IP address: **192.168.1.10**

3.3.4 Powering ON the Transmitter

⚠ **IMPORTANT**
The first time you power on the transmitter, you must follow this sequence or risk corrupting the firmware. If the firmware gets corrupted, the unit must be returned to the factory to have the firmware reinstalled.

3.3.3.1 Make sure the red power switch is OFF. See diagram in **Figure 2.3**

3.3.3.2 Install two C-cell batteries, or connect AC adapter and install backup AA battery.

3.3.3.3 Press and hold white reset button (labeled "SW2").

3.3.3.4a. While continuing to press the white reset button, slide the red power switch ("SW1") to ON.

3.3.3.4b. Do not release the white reset button until the blue LED comes on solid (not blinking). For the AD-HOC to synch with the PC usually takes 2-3 minutes.

3.3.3.5. The transmitter is now in AD-HOC mode for initial wireless configuration.

3.3.5 AD-HOC Mode Using a Windows PC or iOS (iPhone/iPad)

You can use a PC or an iOS device to configure your Transmitter. While in AD-HOC mode, Transmitters with an LCD display will show the last 4 characters of its Mac address (part of SSID) on the display.

Figure 3.2 AD-HOC mode

3.3.6 Finding the Transmitter

For the AD-HOC to synch with the PC it usually takes 2-3 minutes after the Transmitter is powered ON. For iOS Devices it is much quicker, a few seconds. Check the Wireless Network on the PC or Wireless Settings/Wi-Fi on the iOS device that is used to configure the Transmitter

This configuration software for wireless networks will show a network TXABCD (ABCD are the last four characters in the MAC address of the Transmitter).

The Transmitter which is in AD-HOC mode is running this wireless network. Connect to this network by double clicking it. Once connected it should show the status CONNECTED.

Figure 3.3
Wndows PC Wi-Fi Settings

Figure 3.4
iPhone Wi-Fi Settings

Start up a web browser and type in the IP address of *http://169.254.1.1* and you should see a webpage for Initial Configuration. Enter the settings here. Refer to **Figure 3.4.**

3.3.7 Initial Configuration

This is the only page in the Transmitter's Web server needed to initially configure the Transmitter. Later one can make changes in the Transmitter through the VC if needed. Write down the settings on the access point/wireless router such as SSID, Channel, Authentication, Passphrase/Default Key/No Key, IP address. Enter these on the Transmitter's Configuration page.

Initial Configuration
Firmware Version:: "X.XX"

802.11 Configuration

Access Point SSID	
Channel	Auto ∨
Authentication	WPA2-PSK ∨
Passphrase	
Default Key	key 1 ∨
Key 1	
Key 2	
Key 3	
Key 4	

TCP/IP Network Configuration

DHCP	☐
MAC Address	00:03:34:00:59:90
IP Address	169.254.1.1
Netmask	255.255.0.0
Gateway Address	0.0.0.0

Virtual Coordinator

Virtual Coordinator IP	192.168.0.0
Communication Protocol	UDP
Virtual Coordinator Port	50002

Transmitter

Update Period	10 seconds
Mode (UDP Only)	Power save Enabled ∨

[Save Changes] [Reset]

Reboot device with saved settings and go to run mode.
After click on the Reboot button, please wait few seconds [Reboot]
and check with Virtual coordinator

Figure 3.5 Transmitter's Embedded Web Server

3.3.7.1 Access Point SSID

This is the name that the access point/wireless router is broadcasting on your Wi-Fi wireless network. In order for the Transmitter to associate itself with the access point, enter the access point's SSID.

• SSID restricted characters include **? " $ [ ] \ + ;**
• SSID cannot begin with **!** or **#**.
• The length of SSID is 1 to 32 characters.

3.3.7.2 Channel

This is the Wi-Fi channel on which the access point is accepts connections. If not sure what channel to use, simply select Auto.

3.3.7.3 Authentication

This is the security method which the access point is using for connections. Choose the desired security based on the present access point settings.

> **Tip** ☞ Use WPA2-PSK for the most secure connection. No security can be used to conserve battery power. WPA2-PSK Enterprise is not supported

3.3.7.4 Passphrase

If the authentication is WPA2-PSK, then enter a passphrase here.

• Passphrase restricted characters include **" ;**
• The minimum characters that can be used for Passphrase/WPA2 is 8, maximum is 63.

3.3.7.5 Default Key

This is the password if authentication is WEP-128.

• WEP KEY can only use the following characters: **a b c d e f 0 1 2 3 4 5 6 7 8 9**
• WEP KEY must be a length of 26 characters.

3.3.7.6 DHCP

Check this option if the Transmitter will receive a Dynamic IP address from a DHCP server.

> **Note** ☞ For initial configuration, it is recommended to use DHCP for assigning IP Address to the Transmitter. The IP address can be made STATIC from the Virtual Coordinator after the Transmitter starts communicating with it.

3.3.7.7 IP Address

Assign a STATIC IP address.

3.3.7.8 Netmask

Assign a subnet mask associated with the STATIC IP address.

3.3.7.9 Gateway Address

This could be the IP address of your access point or wireless router which the Transmitter is associating with.

3.3.7.10 Virtual Coordinator IP

Assign the IP address of the PC on which the VC is installed.

3.3.7.11 Communication Protocol

This is the protocol used to communicate with the VC. Either TCP or UDP protocol can be selected. UDP is default and uses less battery power.

3.3.7.12 Virtual Coordinator Port

Readings from the sensor (Transmitter) are sent to the VC using this port number.

Use the default UDP protocol and port **50002** unless this port is already used on the VC. If TCP protocol is used change this port number to 50006.

Note ☞ Architecturally, it is recommended to use UDP protocol. TCP protocol is not very well suited for this type of application.

3.3.7.13 Update Period   Enter the Transmitter's reading transmission frequency in seconds.

3.3.7.14 Save and Reboot

Click "Save Changes". Verify the settings and then click "Reboot". The webpage should say that the Transmitter is rebooted.

If your Transmitter has a display, you should now be able to see the sensor readings on the display.

Note ☞ The Transmitter stays in AD-HOC mode for a few minutes and then goes to sleep to conserve battery. So the step to put the device into AD-HOC mode and to configure it using a web page needs to be done together.

Note ☞ Also during this time, it is recommended to set the "Update Period" to the default (10 seconds). Once the Transmitter and the VC are communicating properly, the "Update Period" can be changed to the desired value.

3.4 Getting the Readings

If the PC used to configure the Transmitter is the same as the one running the VC, then change its IP address to the STATIC IP address set for the VC. Start a new browser and enter ***http://<IP address of PC running virtual coordinator>***

If using a different PC, go to the PC running VC. Open up a web browser and enter ***http://<IP address of virtual coordinator>***

Click the button that says readings. Enter the user name as "**user**" and the password as "**12345678**". You should be able to see the readings.
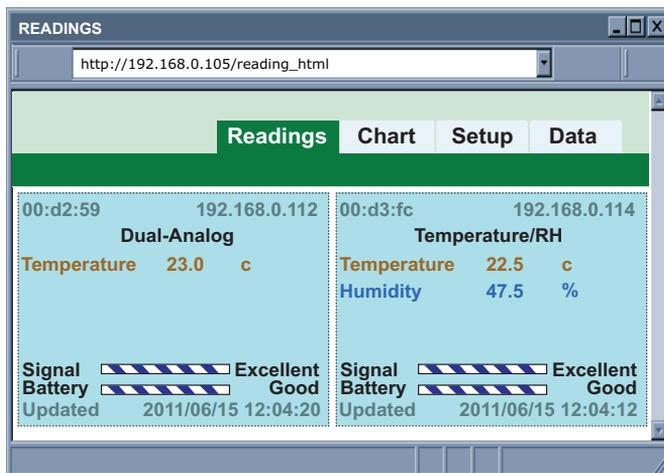
Fig 3.6: Transmitter Readings

PART 4
VIRTUAL COORDINATOR OPERATIONS

4.1 Virtual Coordinator

Once the Virtual Coordinator and its Services are installed and the computer is rebooted, you can access the VC using an Internet Browser.

Simply, type the IP address of the computer on which the VC is installed in your browser and you will see the Home Page of the VC as shown in below.

> **Note** ☞ The IP address for the VC is the same as the IP address of the computer on which the VC is installed.
>
> If the computer has more than one IP address, use the IP address that is on the same network as the Access Point.

> **Note** ☞ The VC can be accessed from the same computer on which it's installed or it can be access from a different computer on or outside the local network.

Figure 4.1 Virtual Coordinator Home Page

4.2 Setup Menu

This menu has all the configuration options for the Virtual Coordinator and the Transmitters. The Setup menu is secured with a username and a password as shown in **Figure 4.2.** The default username is **admin** and the default password is **00000000**.

> Note☞ The username and password can be changed or disabled. See the Security menu for details.
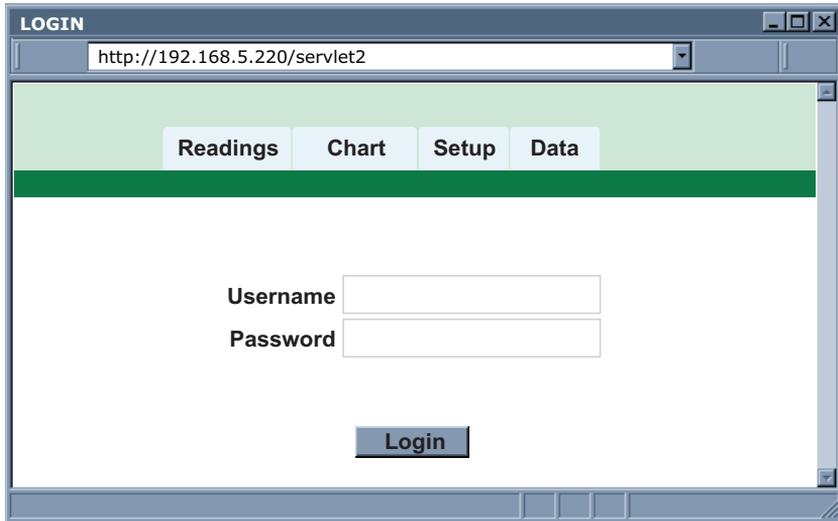
Figure 4.2 Virtual Coordinator Log In Page

4.3 TX Configuration – Network

Once the username and password are entered a set of menu selections will appear starting with the TX (Transmitter) Configuration menu under the Network tab. This page has all the network settings for each Transmitter selected from the top right pull down menu. For Example, in **Figure 4.3** the selected Transmitter is TXd259.

> Note☞ The default name for a Transmitter is TX followed by the last 4 characters of the Transmitter's MAC address (i.e. TXd259).

> Note☞ Cookie feature must be enabled for the web browser.
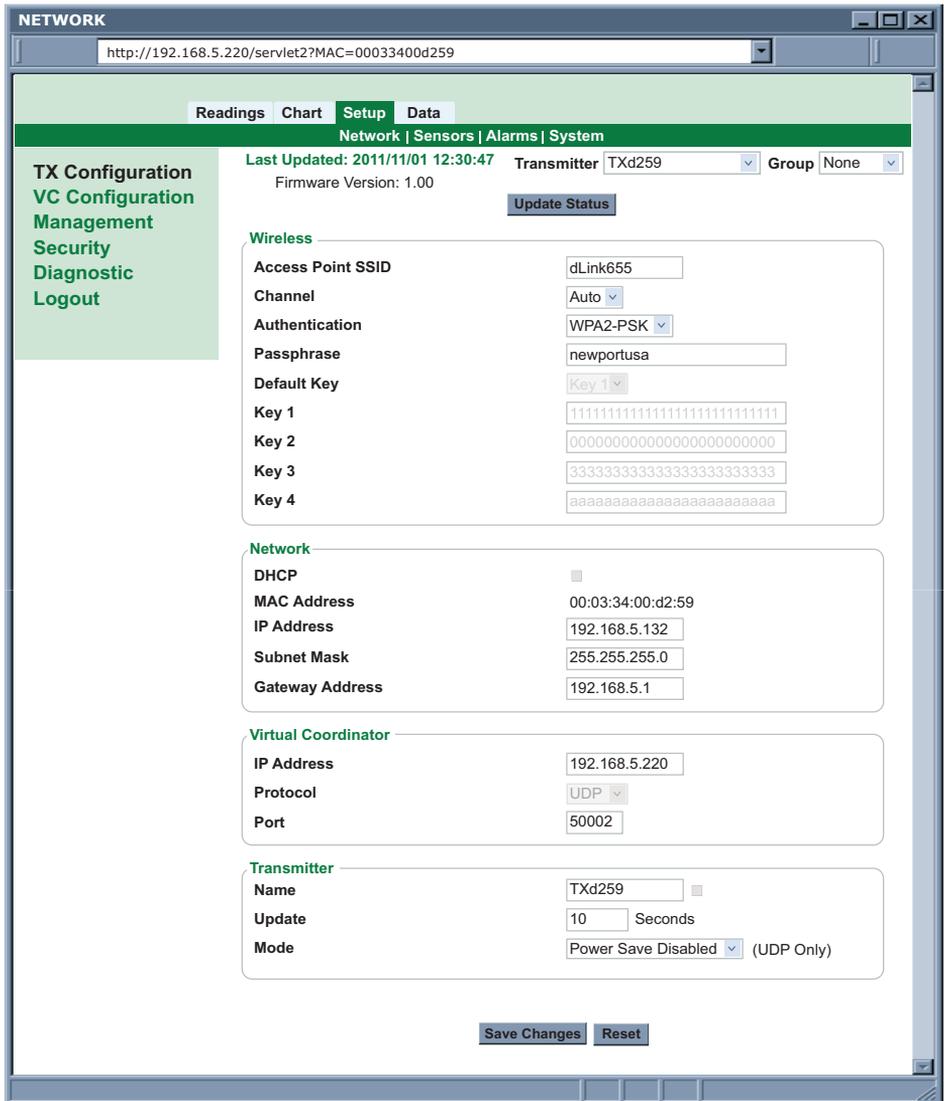
Figure 4.3 TX Configuration Setup – Network Page

4.3.1 Last Updated
This is the date and the time which the Transmitter status was last updated.

Note ☞ The date and the time come from the computer on which the Virtual Coordinator is installed.

4.3.2 Firmware Version
This is the version of firmware for this Transmitter.

4.3.3 Transmitter
Pull down menu of available Transmitters.

4.3.4 Group
Pull down menu of available Groups of Transmitters.

4.3.5 Update Status
Once this button is clicked the Virtual Coordinator will refresh the Transmitter's settings within the next transmission cycle. To get the page back click on the TX Configuration again.

4.3.6 TX Configuration – Wireless

4.3.6.1 Access Point SSID
This is the name that your access point is broadcasting on the Wi-Fi network. In order for a Transmitter to associate itself with the access point you must enter the access point's SSID.

• SSID restricted characters include   **? " $ [ ] \ + ;**
• SSID cannot begin with **!** or **#**.
• The length of SSID is 1 to 32 characters.

4.3.6.2 Channel
This is the Wi-Fi channel on which your access point is accepting connections. If you're not sure what channel to use, simply select Auto.
In USA - Only 11 channels are used.

4.3.6.3 Authentication
This is the security method which your access point is using for connections.
Choice of: None, WPA2-PSK, WEP-128.

4.3.6.4 Passphrase
This is the password for WPA2-PSK authentication.
• See section **3.3.7.4**.

4.3.6.5 Default Key
This is the password for WEP-128 authentication. The default key set in Transmitter Configuration must match the Access Point's settings, for example, both use key 1.
• See section **3.3.7.5**.

▼ Note☞   Consult with your IT department if you do not know the security parameters.

4.3.7 TX Configuration – Network

4.3.7.1 DHCP
You can check this option if you want the Transmitter to receive an IP address from a DHCP server.

▼ Note☞   To conserve battery power it's strongly recommended to use a STATIC IP address (DHCP un-checked) for your Transmitter.

4.3.7.2 MAC Address
This is a read-only field displaying the Transmitter's MAC address.

4.3.7.3 IP Address
This is where a static IP address is assigned to the Transmitter.

4.3.7.4 Subnet Mask
This is the subnet mask associated with the STATIC IP address.

4.3.7.5 Gateway
This should be the IP address of your access point or wireless router which the transmitter is associating with.

4.3.8 TX Configuration – Virtual Coordinator

4.3.8.1 IP Address
This is the IP address of the computer on which the Virtual Coordinator is running. If the computer has more than one IP address use the IP address that's interfaced with the access point on a wired or wireless network.

Note☞ You need to make sure that the IP address for the Virtual Coordinator will not change; otherwise, the Transmitter will not retain its connection with the Virtual Coordinator. For this reason using a STATIC IP address for the Virtual Coordinator is strongly suggested. If using DHCP for the Virtual Coordinator IP, reserve the assigned IP Address in the DHCP Server table to ensure the Virtual Coordinator always gets the same IP Address.

4.3.8.2 Protocol
This is the protocol used to communicate with the Virtual Coordinator. Either TCP or UDP protocol can be selected.

Note☞ Architecturally, UDP protocol is recommended. TCP protocol is not suitable for this type of application.

4.3.8.3 Port
This is the TCP or UDP port on which the Virtual Coordinator accepts connections. For the UDP protocol the default port is 50002 and for the TCP protocol the default port is 50006.

Note☞ If the default port number of 50002 or 50006 is not available, then use another number, and change the setting in the Virtual Coordinator Manager.

4.3.9 TX Configuration – Transmitter

4.3.9.1 Name
This is the name of the Transmitter that will appear on the Virtual Coordinator's web pages. The default name for a Transmitter is TX followed by the last 4 characters of the Transmitter's MAC address (i.e. TXd202).

4.3.9.2 Update

This is the Transmitter's data transmission frequency in seconds.

Note Depending on your update rate, your data files can become very large. For example: if you select Continuous which is about 3 readings per second. One week can equal 1,814,400 readings or 1 year can equal 94,348,800 readings.

4.3.9.3 Mode

There are three options; Power Save Disabled (for TCP and UDP), Power Save Enabled (for UDP only), and Continuous (for UDP only with thermocouple and analog Transmitters). The Power Save feature will help to reduce the Transmitter's battery power consumption. If it's enabled the Transmitter will not associate with the access point (or wireless router) every time it wakes up and transmits the data. The first time the Transmitter associated with the access point when the connection was established, this will be sufficient for the future transmissions.

Note If your Update rate is 10 seconds or less, use Power Save <u>Enabled</u>.
If your Update rate is 10 to 60 sec. you can use Power Save Enabled or Disabled.
If your Update rate is more than 60 sec., use Power Save <u>Disabled</u>, since your access point may disconnect due to inactivity.
If you manually power recycle the transmitter, and if the update rate is more than 5 minutes, you may need to power recycle twice.

Note If the Power Save mode is enabled the Signal Strength will only be updated if there is a packet loss.

The Continuous mode is available for thermocouple and analog Transmitters only. Once it's selected the Transmitter will transmit a maximum of three readings per second. This can be seen in the log file and the TCP command-line-interface for that Transmitter.

Note To save changes done to the TX Configuration page you must click on the Save Changes button followed by the Confirm button.

4.4 TX Configuration – Sensors

This page contains the sensor parameters for each Transmitter. Simply, select the Transmitter from the list on the top right as shown in **Figure 4.4** and once the changes are applied click on the Save Changes button followed by the Confirm button. Fields are described below.

Figure 4.4 Sensors Page for Temperature, Barometric Pressure, and Humidity

4.4.1 TX Configuration – General

4.4.1.1 Active

If checked the Transmitter's readings will be displayed and charted on the Virtual Coordinator pages. Inactive device will not be shown but data collected remains in VC's installation directory. To reactivate a device simply power cycle the transmitter and it will be activated again.

4.4.1.2 Group

The Transmitters can be organized on different groups for viewing, readings, chart downloading, data, configuration and command line interface.

> **Tip** ☞ Once a Group is selected, use the drop down menu for the Group next to the Transmitter drop down menu to view/edit sensor settings.

4.4.2 TX Configuration – Sensor Input Type

Depending on your sensor type the title may be Temperature, Barometric Pressure, Humidity, Channel 1 and 2, or Temperature 1 and 2.

4.4.2.1 Unit

This determines the units of measurement for that particular sensor. Examples are % for humidity, F or C for temperature, and hPa, inHg, or mmHg for barometric pressure.

Note☞   Once the unit of measurement is selected it will be a global change throughout the Virtual Coordinator as well as on the LCD display.

4.4.2.2 Adjust by

If it's determined that the reading is slightly off, this field can be used to adjust the reading. The options are Offset and Scale & Offset.

Using the Offset method you can manually assign a numerical value to adjust the reading. For example if the actual reading is 55 where it should be 54 you can enter -1 in the Offset field.

The Scale & Offset method uses two points to adjust the reading within the entire range.

For example, if at the lower point the actual reading is 10 where it should be 12 and at the higher point the actual reading is 200 where it should 195, here is how the numbers are entered.

The adjusting numbers can be positive or negative.

Reading Low	10.0	Ref. Low	12.0
Reading High	200.0	Ref. High	195.0

Note☞   The adjusting values must be assigned after the unit of measurement (i.e. C or F) is selected. If the unit is changed, you must readjust the values for a correct result.

Note☞   The latest readings are displayed to the right of the Sensors web page to make the adjustment easier if needed.

4.4.2.3 Analog Input

Analog Input: Choices for analog input signals are 100mV, 1V, 10V and 20mA, or disabled. Select the proper measurement range to maximize resolution and accuracy. If a particular channel is not used, it should be disabled to optimize power consumption.
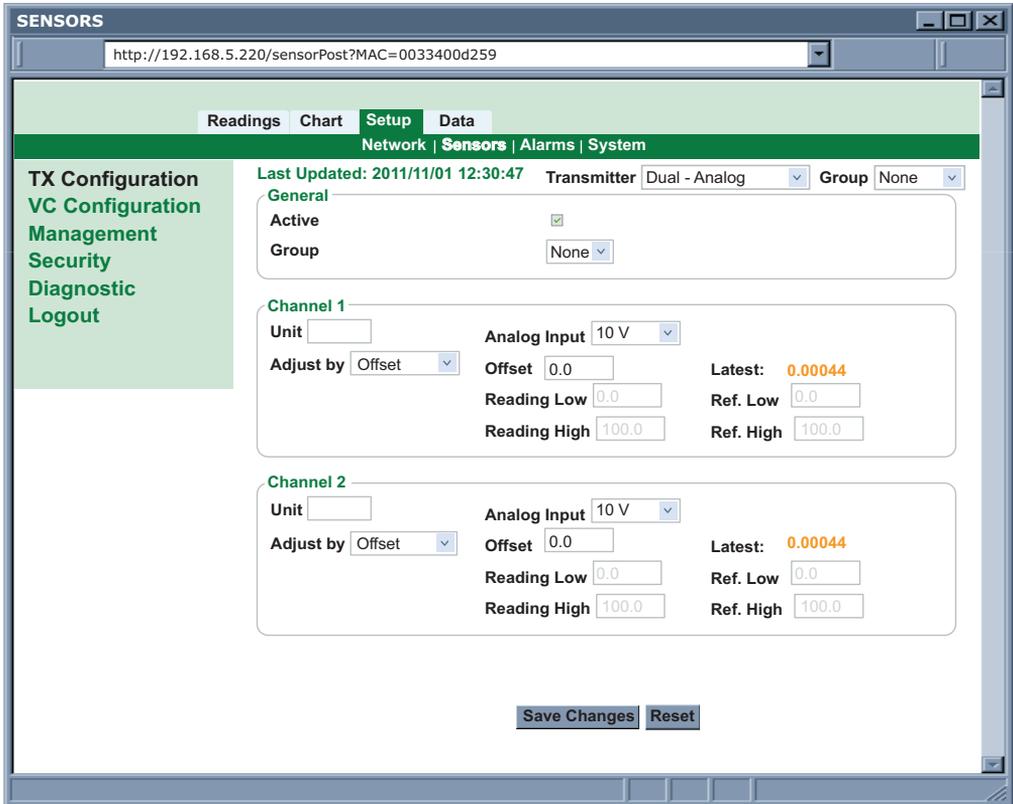
Figure 4.5 Sensors Page – For Analog Input

4.4.2.4 TC Type

This exists only for thermocouple Transmitters as shown in **Figure 4.6**. This provides a list of thermocouple types to select from. The types are J, K, T, E, R, S, B, C, N, and DINJ. If Disabled is selected the Virtual Coordinator will display Disabled for that TC input. The default is K Type. For the list of thermocouple types and their range and accuracy see **Section 6**.

4.4.2.5 Cold Junction Compensation

This exists only for thermocouple Transmitters as shown in **Figure 4.6**. This option will allow you to adjust (calibrate) the thermocouple reading in reference to 0°C environment. Select Channel 1 or Channel 2 and follow instructions to perform cold junction compensation for the selected thermocouple channel.

Note☞   A correct TC Type must be selected before doing cold junction compensation.

Note☞   To save changes done to the TX Configuration page you must click on the Save Changes button followed by the Confirm button.

Figure 4.6 Sensors Page – For Thermocouple Input

4.5 TX Configuration – Alarms

The Virtual Coordinator can send an email if an alarm condition is met. For each Transmitter there are a set of alarm events shown in **Figure 4.7** and described below.

Note ☞ A Transmitter can be selected from the top right drop-down menu.

Note ☞ In order to send email alarms you must configure the SMTP settings on the Management page.

Figure 4.7 TX Configuration Setup – Alarms Page

Note ☞ You must check the box for each event and click on Save Changes button.

4.5.1 Temperature Events

The options are High, Low, and High/Low. If High is selected the High field must be given a value (higher than that value is an alarm condition). If Low is selected the Low field must be given a value (lower than that value is an alarm condition). If High/Low is selected the High and Low fields must be given values (outside the band is an alarm condition).

Note ☞ There is a Message box under each event. The text content typed inside the box will be included in the body of the received email.

4.5.2 Barometric Pressure Events
The same as Temperature defined above.

4.5.3 Humidity Events
The same as Temperature defined above.

4.5.4 Channel 1 and Channel 2 Events
The same as Temperature defined above.

4.5.5 Temperature 1 and Temperature 2 Events
The same as Temperature defined above.

4.5.6 Lost Signal Events
If the Virtual Coordinator does not receive signals from the Transmitter it will send an email alarm and "Lost" will be displayed on the Readings page for that Transmitter.

4.5.7 Probe Disconnected Events
If the probe attached to the Transmitter is disconnected that is considered as an alarm condition.

4.5.8 Low Battery Events
Once the batteries inside the Transmitter get low an alarm will be emailed. The Transmitter will still be operating for some time (depending on the transmission frequency) before the batteries are completely drained.

4.6 TX Configuration – System
The firmware inside the Transmitters can be upgraded using the Virtual Coordinator's built-in FTP server. The System menu is the interface to that FTP server that wirelessly sends the new firmware files to the Transmitter selected from the top right drop-down menu. Fields are described below.

Note☞ The new firmware should be placed in your Virtual Coordinator's directory at "Virtual Coordinator\ftpserver\res\home\public" before the firmware upgrade is initiated. Refer to the web for step by step instructions.

Note☞ It takes about two minutes for a complete firmware upgrade. You can start firmware upgrade on one Transmitter and then move to the next ones.

4.6 TX Configuration – System (continued)

Figure 4.8 TX Configuration Setup – System Page

4.6.1 FTP Server IP
This is the IP address of the computer on which the Virtual Coordinator is installed. You can simply type the same IP address that you accessed the Virtual Coordinator on that browser.

4.6.2 Port
This is the port number for the FTP connection. The default FTP port number is 21.

4.6.3 User Name / Password
For the FTP server inside the Virtual Coordinator to connect to the FTP client inside the Transmitter a user name and password are needed. The default user name is **upgrade** and the default password is **12345678**.

> *Note☞* You can always use a different FTP server by simply providing the above parameters for that FTP server.

4.7 VC Configuration

This page has the configuration settings for the Virtual Coordinator shown in **Figure 4.9**. Fields are described below.
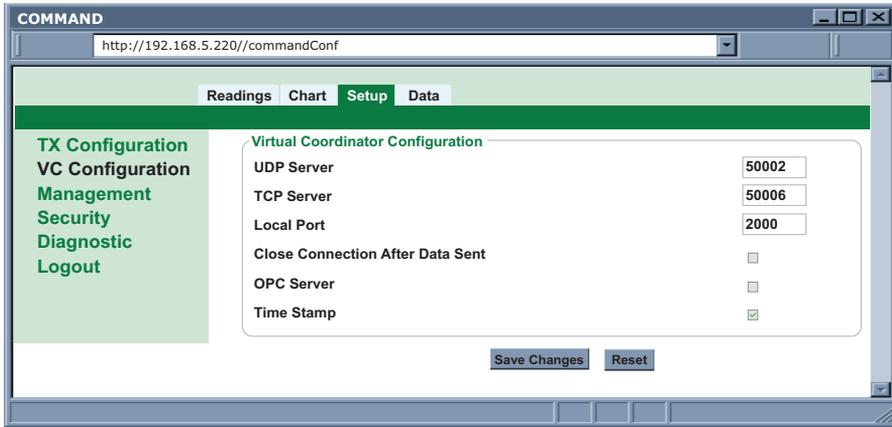
Figure 4.9 VC Configuration Page

4.7.1 UDP Server

This is the UDP port number on which the Virtual Coordinator receives data from the Transmitter. The default UDP port is 50002. This UDP port is also configured on the Transmitter.

4.7.2 TCP Server

This is the TCP port number on which the Virtual Coordinator receives data from the Transmitter. The default TCP port is 50006. This TCP port is also configured on the Transmitter.

> **Note☞** If you change the UDP or the TCP port number on the Virtual Coordinator you must also change it on the Transmitter. Both TCP and UDP servers are running at one time and the Transmitter sends data using TCP or UDP based on the protocol selected.

4.7.3 Local Port

This is the TCP port number on the Virtual Coordinator to which different commands can be sent to get data from one or group of Transmitters. The commands can be used by third party software to get the data from the VC. See **Appendix F** for complete list of commands.

4.7.4 Close Connection After Data Sent

If checked, once the Virtual Coordinator responds back with data, it will close the TCP connection that had been made from a network host. This feature should be used if data acquisition software expects data to be ended by closing TCP connection from the client.

4.7.5 OPC Server

This option should be checked only when the OPC server is used.

> **Note☞** You will need to change the Transmitter's "label" to be 000, 001, 002.... Refer to the web for instructions on configuring the OPC server for wSeries Products.

4.7.6 Time Stamp
If checked the Virtual Coordinator will respond to the commands starting with date and time.

4.8 Management
The Virtual Coordinator can send an email if an alarm condition is met. This page provides the SMTP (Simple Mail Transfer Protocol) settings needed to generate emails (**Figure 4.10**). For the actual alarm events for each Transmitter refer to **Section 4.5**. Fields are described below.

Figure 4.10 Management Page

4.8.1 Enabled
If checked the SMTP is enabled on the Virtual Coordinator.

4.8.2 SMTP Server
This field specifies the IP Address or name of the SMTP server.

Note☞ You must have an email server (SMTP server) in order to receive emails generated by the Virtual Coordinator.

4.8.3. SMTP Server Port
This specifies the TCP port used by the SMTP Server. You need to change it according to instructions provided by your SMTP service provider.

4.8.4. Security

This is the authentication type the email server may require. The options are SSL and TLS. The default is None.

4.8.5. Username / Password

If authentication is required a username and a password must be entered.

▼ **Note** ☞   Username and password are case-sensitive.

4.8.6. From

This is a text field and could be a name, a location, or an email address.

4.8.7. To

This field specifies the email addresses of the recipients. It can take up to 412 alphanumeric characters. Email addresses should be separated by <u>a comma and a space</u>. For example: **aaa@bbb.com**, **ccc@ddd.com**

▼ **Tip** ☞   Check each email individually, if one email is wrong none of the other emails will go through.

4.8.8. Subject

This field specifies the subject of the email. Emails for all the alarms will have this common subject line. Example of a subject would be "Temperature Alarm".

4.8.9. Reminder Interval

This will force an email to be resent if the alarm condition is still met. The minimum value is 1 minute and if it's set to 0 the Virtual Coordinator will not send a reminder.

4.8.10. Transmission Delay

If there is an alarm condition the Virtual Coordinator will not send an email until this delay period is expired. If it's set to 0 emails will be sent immediately once the alarm condition is met.

4.9. Security

This page provides security and access settings for the Virtual Coordinator.
Fields are described below.
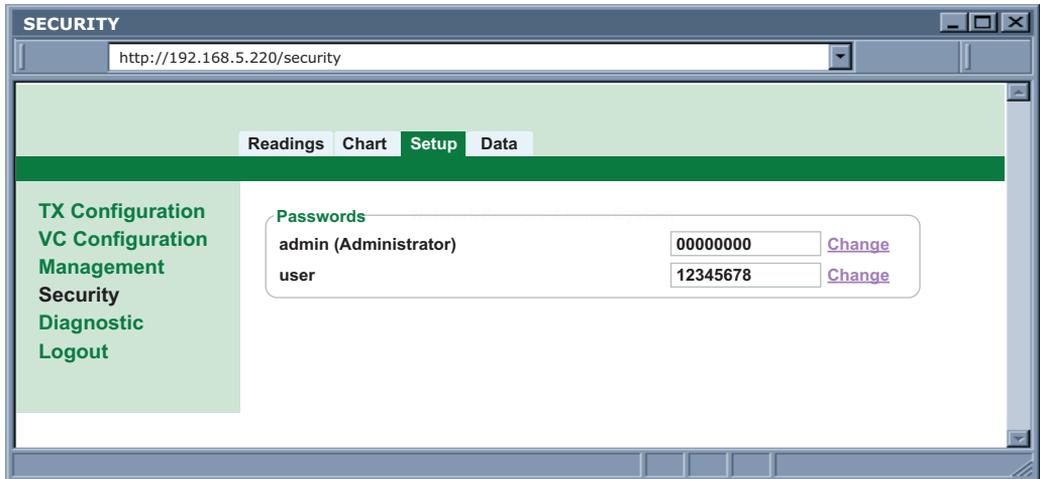
Figure 4.11 Security Page

4.9.1 Admin

A username and a password can be set for someone who is authorized to access all the menus and pages within the Virtual Coordinator. The default username is **admin** and the default password is **00000000**.

⚠ **Caution:** When you disable the admin password but have user password enabled, the user can access the VC.

4.9.2 User

A username and a password can be set for someone who is authorized to access Readings, Chart, and Data menus only; the Setup menu cannot be accessed. The default username is **user** and the default password is **12345678.**

4.10. Diagnostics

This page provides diagnostic information regarding power, signal, etc. for all the Transmitters. Fields are described below.
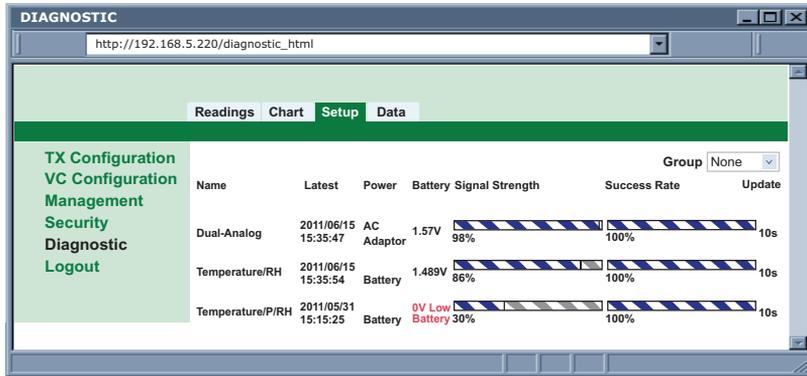
Figure 4.12 Diagnostic Page

4.10.1 Name
This is the Transmitter's name.

4.10.2 Latest
This is the last date/time the Virtual Coordinator received a packet from the Transmitter.

4.10.3 Power
This indicates whether the Transmitter is powered by an AC adapter or battery. Transmitters with AC adapter have battery back-up.

4.10.4 Battery
This indicates the voltage level in the battery. Transmitters with AC adapter have battery back-up; therefore, their voltage level is also displayed. A new alkaline battery regardless of its type (AA or C-cell) has about 1.59 volts.

Note ☞ The two C-cell batteries in battery-powered Transmitters are wired in parallel; therefore, the combined voltage level is the same as a single battery.

4.10.5 Signal Strength
This is the strength of the radio signal; the higher the signal strength is the better communication would be between the Transmitter and the Access Point.

Note ☞ With a Signal Strength of over 20% you have a stable wireless communication. If the Signal Strength falls below 20% and stays for a long period of time you should check the Transmitter for distance and interference.

Note ☞ If the Power Save mode is enabled the Signal Strength will only be updated if there is a packet loss.

4.10.6 Success Rate

A low success rate indicates a longer data delay, shorter battery lifetime and high network traffic.

Note ☞   If the Success Rate is 100% that indicates that there is no packet loss. Having Success Rates of less than 100% is normal since the Transmitter will retransmit the lost packets.

4.10.7 Update

This is the Transmitter's data transmission frequency in seconds. For example, if it's set to 5 seconds then it means that the Transmitter will transmit data every 5 seconds. The Transmitter is in sleep mode when it's not transmitting.

4.11 Logout

Once the Logout option is clicked the user will be logged out from the VC. The user will be logged out automatically by closing the browser or by no longer browsing (active data readings, chart, sensor setup and diagnostics will keep login session active).

4.12 Readings

This page displays the readings from all the Transmitters. Up to 12 Transmitters can be displayed on each page. To see more Transmitters on the next pages click on **Next** at the bottom right side of the page. **Figure 4.13** describes the fields.
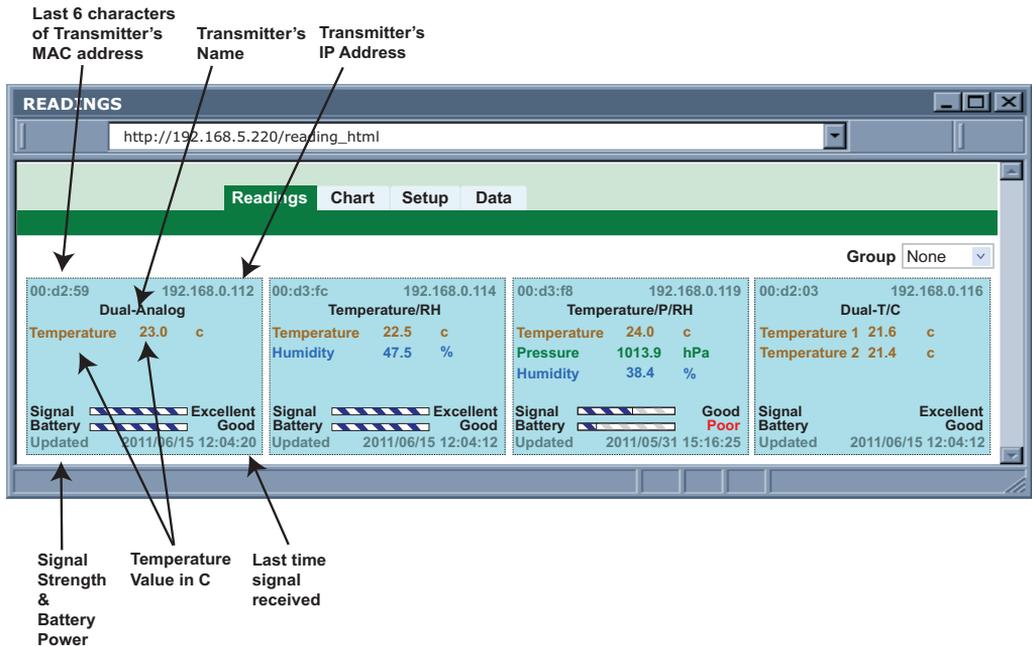
Figure 4.13 Readings Page

4.13 Chart

This page charts the readings for each Transmitter in real-time as well as the recorded data. Select a Transmitter from the list on the top right as shown in **Figure 4.14** and the charting will start with a default one-minute period.

> Note☞ Along the chart line there are pointers that would display time-stamped sensor readings once they're pointed with the mouse.
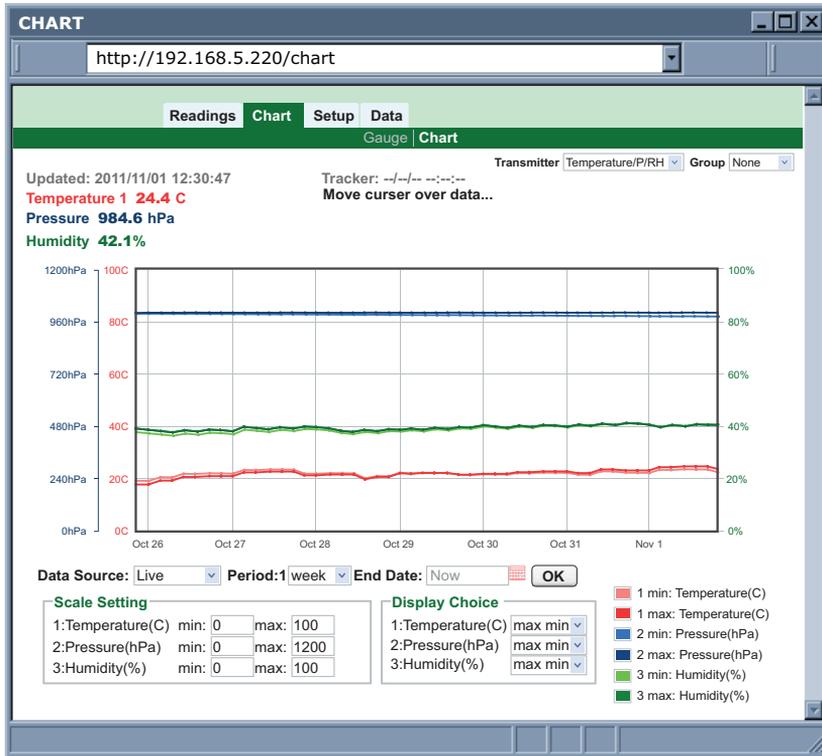
Figure 4.14 Chart Readings Page

4.13.1 Data Source

The options are Live and Recorded. If Live is selected the real-time data will be charted as a function of time period. If Recorded option is selected the past saved data will be charted per selected time period. A click on the OK button is needed to execute the change.

4.13.2 Period

This determines the time period in which the live or recorded data is charted. A click on the OK button is needed to execute the change.

4.13.3 End Date

This field is active only in Recorded mode. Once it's active a date can be selected to chart the recorded data up to that date, which would be the end of the chart. The End Date can be chosen from a calendar where the word "choose" is located. A click on the OK button is needed to execute the change. Selecting an End Date is mandatory to chart recorded data.

Note ☞ It's always important to first select a desired chart Period before picking an End Date.

4.13.4 Scale Setting

This section allows changing the upper and lower values for the x axis on the graph. Simply, put the numbers in the min. and max. boxes and the axis limits will change accordingly.

4.13.5 Display Choice

In cases where there are less points used to create a chart than what the actual collected points are choices are given to chart the minimum and maximum (min max), only minimum (min), or only maximum (max) points for any given period. In the case of min max there could be two charts; one representing all the maximum readings and the other one representing all the minimum readings. This could happen if there are sudden and continuous changes with any of the sensor readings.

Note ☞ Once you leave the chart page for a Transmitter all the settings will get saved.

4.13.6 Gauge

This page illustrates the readings in gauge format. Once the Show Setting box is checked you will be able to scale the gauge with the Start and End reading values as well as defining the Red Range as shown in **Figure 4.15**. Click on the Save Settings button to save new settings.

Note ☞ For Analog Gauges you can eliminate the extra digits by changing the Settings:

Start: 0   End: 60

Figure 4.15 Gauge Readings Page

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4.14 Data

Data from all the active Transmitters gets recorded in the same computer on which the Virtual Coordinator is installed. The Data page has options to retrieve currently recorded data as well as the data that was recorded in the past called Archived Recorded Data as shown in **Figure 4.16**. Every time the Transmitter is rebooted the current recorded data file moves into the archived recorded data and a new log file will be generated under the current recorded data.

▼
Note ☞ The name of the data file in the Archived Recorded Data is based on the date and the time the data file was moved into the Archived Recorded Data which is the same as when the Transmitter was rebooted.
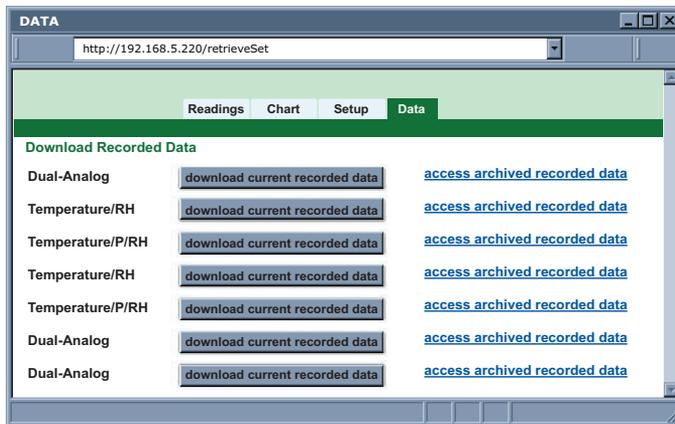
Figure 4.16 Data Page

All the recorded data files are in .csv (Comma Separated Value) format and can be easily imported into a spreadsheet program like Excel.

Figure 4.17 .csv Recorded Data Files

PART 5
ENVIRONMENT / OPERATING CONDITIONS

The transmitter is designed to be fixed mounted and operated in a clean and dry environment. Care should be taken to prevent the components of your wireless system from being exposed to moisture, toxic chemicals, extreme cold or hot temperature that are outside the specification listed in this manual.

The following is a list of basic good practice you should apply when operating this Wireless System.

1. Do not operate the wireless device in flammable or explosive environments.

2. Do not use the wireless device in medical, nuclear or any other critical application where failure can cause damage or harm.

3. Always operate the wireless device within the recommended environmental limits specified in this manual.

4. Do not operate your wireless device with a battery or AC adapter other than what's supplied or specified in this manual or on the battery compartment label.

5. Keep each wireless device at least 8 inches (20 cm) from other radio transmitters, antennas, and people.

6. The FCC approval for this device specifies the specific antenna supplied with this device.

5.1 General Deployment Guidelines

1. Position the Access Point in a central location. When multiple Transmitters are in operation, position your the Access Point in a central space if possible in equal distance to each Transmitter.

2. Test your system before permanent mounting. Try to move the devices to different location around and mounting angles to determine what installation achieves the best signal strength before permanently mounting the Transmitter.

Note ☞ For best performance signal strength should not go below 20-25%.

3. Move your system components higher off the floor and away from exterior walls. The closer the Transmitter/Access Point are, the greater the interference and lose of signal strength will be.

4. Maintain a line-of-sight between antennas and keep Fresnel zone free of obstruction. See **Figure 5.2.**

5. Maintain a constant ambient temperature environment. Exposing your system components to extreme cold or hot temperatures, or sudden changes in ambient conditions will have an effect on the performance of your system.

6. As a general rule in buildings, head height or above is preferred. On the other hand, Transmitter stays close to the floor may have their range reduced by 50% to 90%.

5.1 General Deployment Guidelines (continued)

7. Where possible, try to ensure an uninterrupted line-of-sight between nodes. Avoid obscuring objects (e.g. metal pillars, posts, sign) near the antenna. A close object obscures a wider range of solid angle.

8. It is important to understand that the environment may change over time due to new equipment or machinery being installed, building construction, etc. If new obstacles exist between your Transmitter and Access Point, antenna angle may need to be re-adjusted and/or the unit has to be relocated.

9. A Wi Fi wireless network will not work under water. Wet condition (e.g. in heavy rainfall) may exhibit some degradation. In most cases, water droplets on or close to the antenna are more serious than the rain itself. Humidity can affect radio performance as well.

10. Reduced performance scenario:

   a. A large building may have few obstructions between nodes but large amount of metallic paneling that cause reflections.

   b. A small domestic installation may have numerous brick walls between nodes in individual rooms.

   c. An office building may have metalized dry-wall partitions together with mezzanine ceilings.
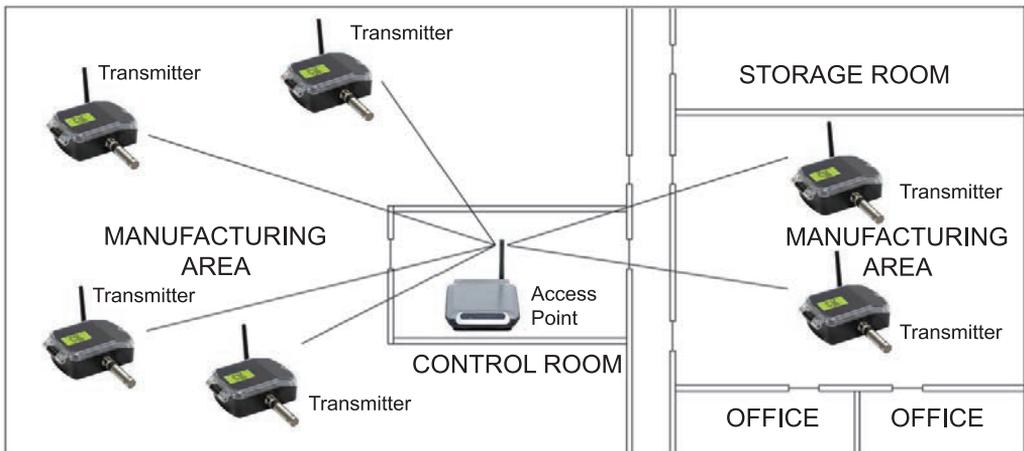
Figure 5.1 Operation in Buildings

▼ *Note* ☞ Data is sent through radio signal at 2.4 GHz. Radio signals are electromagnetic waves, hence the signal becomes weaker the further it travels.

While radio waves can penetrate some solid materials like a wall, they can diminish more than when a direct line-of-sight between the transmitting and receiving antenna exist.

Therefore, it is generally a good idea to place the Access Point at the center while Transmitters are located about the same distance away from it. If possible, keeping clearance around the line of site will improve performance as well.

5.2 With Line-of-Sight

When installing your Transmitter it is important to position your device in such a way to optimize the antenna location within what's known as the "Fresnel Zone". The Fresnel Zone can be thought of as a football-shaped invisible tunnel between two locations that provides a path for RF signals between your Transmitter and your Access Point.

ACCESS POINT ANTENNA

TRANSMITTER ANTENNA
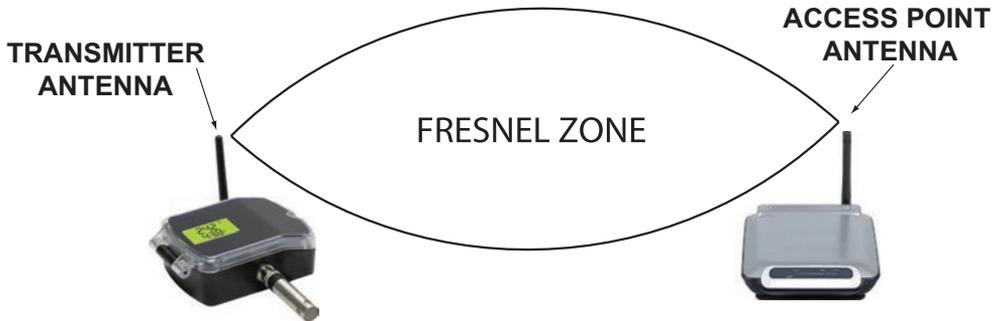
FRESNEL ZONE

Figure 5.2 Fresnel Zone

In order to achieve maximum range, the football-shaped path in which radio waves travel must be free of obstructions. Obstacles in the path (especially metal) will decrease the communication range between your Transmitter and Access Point. Also, if the antennas are mounted just barely off the ground or below the ceiling, over half of the Fresnel zone ends up being obstructed resulting in significant reduction in range. Below is the calculated radius of the football-shaped tunnel for different distance range:

Distance (feet)	Radius (feet)
100	3.2
200	4.5
300	5.5

It is recommended that within the tunnel of the above radius, at least 60% of space is free of obstruction.

Since signal reaches destination directly in a line-of-sight situation, it is important to adjust antenna properly to achieve maximum performance. Antenna for the Access Point and Transmitter should be perpendicular to the plane where Access Point and Transmitter is located.

5.3 Without Line-of-Sight

When line-of-sight is not possible, signal penetrates and is reflected by different objects to reach the destination. Therefore, it is important to learn about how these materials would affect signal propagation. Depending on the thickness, moisture content and angle of incidence, a wall may allow between 1% and 25% of the radio power to pass through. Metal panel or metalized glass window will not allow much radio power to pass through. Signal will be reflected if the panel is a mirror. Some radio power may propagate through small holes in the panel or around metal edges through the process of diffraction.

Material Type	Possible Signal Reduction
Wood, Plaster, Sheetrock, Fiberglass Uncoated Glass w/out Metal	0 to 10%
Brick, Pressboard	5 to 35%
Reinforced Concrete	10 to 90%
Metal Walls, Metal Doors, Elevators, Metal Piping, Metal Stair Cases, Metal Mesh, Metal Screening	90 to 100%

Figure 5.3 Materials in Buildings

In a non-line-of-sight situation at 2.45 GHz, it is possible to move the receive antenna only 1 to 1 1/2" (3 to 4 cm) and see signal strength varies from 6 dB to -20 dB due to multiple signal reflection path. Therefore, there should be about 20 dB path loss margin to take signal fading into account.

5.4 Casing and Closure Around the Antenna

1. Metallic structure should be kept at least 0.8" (2 cm), although 2.4" (6 cm) is recommended away from the antenna.

2. Any casing that encloses the antenna should be plastic. In addition, it is also wise to avoid plastic case with dark fillers or colorants.

5.5 Fine Adjustment in Performance

1. To avoid interference from Wi-Fi / IEEE 802.11, one could consult the figure below to choose the best channel through the Configuration web page. Channels 1,6 and 11 are non-overlapping in the United States and 1, 7 and 13 are non-overlapping in Europe.
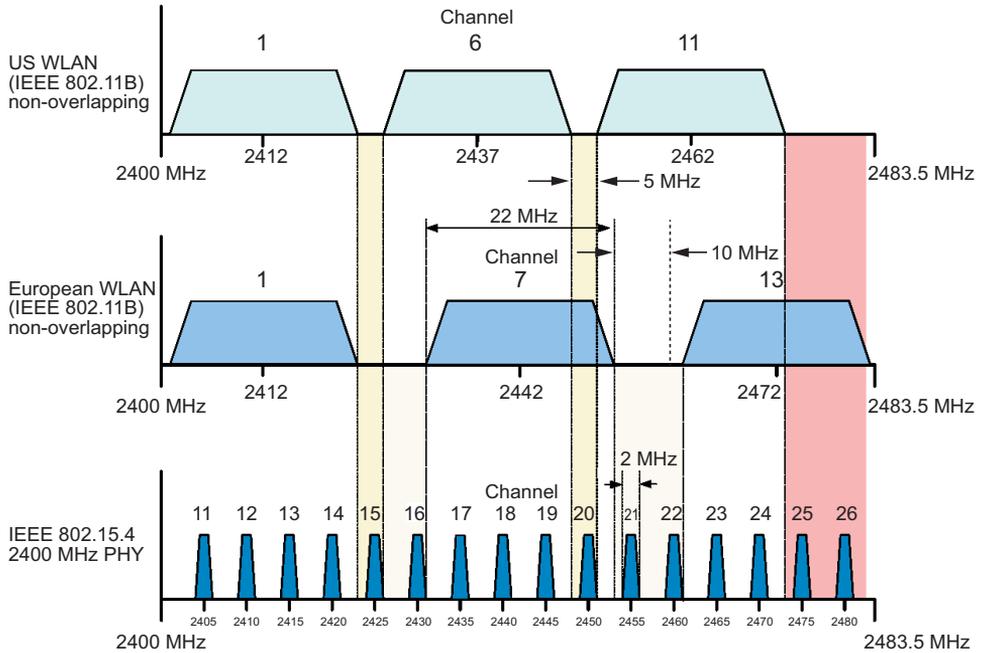
Figure 5.4 Channels

2. It is possible that Wi-Fi devices experience interference from IEEE 802.15.4 and Bluetooth devices and certain microwave ovens. Therefore, it is worth locating nodes as far as possible to minimize effect. Note that international radio regulations which govern radio equipment ensure that cell phones use their allocated band only. It is highly unlikely that cell phones will interfere with Wi-Fi equipment.

3. In some cases, a short RF cable may be used to connect an antenna to your device. Please note that RF extension cables will always add some loss to the transmitting signal strength. The longer the cable the more signal will be lost over that cable. Therefore, the length of the cable should be kept as short as possible. Also, note that use of any other antenna other then what's shipped with your device will void FCC and CE regulatory compliance.

PART 6 SPECIFICATIONS

SENSOR SPECIFICATIONS

RELATIVE HUMIDITY
Accuracy/Range:
wTHP, wTHP2, wBTHP   ±2% for 10 to 90%;
                                           ±3% for 5 to 10% and 90 to 95%;
                                           ±4% for 0 to 5% and 95 to 100%

Hysteresis: ±1% RH
Non-linearity: ±3%
Repeatability: ±0.1%
Resolution: 0.1%

TEMPERATURE
Accuracy/Range*:
wTHP, wTHP2   ±0.5°C for 5 to 45°C (±0.9°F for 41 to 113°F);
                                           up to ±1.5°C for -40 to 5°C and 45 to 124°C
                                           (up to ±2.7°F for -40 to 41°F and 113 to 255°F)

Accuracy/Range*:
wTP1, wTP2   ±0.5°C for 10 to 85°C (±0.9°F for 50 to 185°F);
                                           ±1°C for -40 to 10°C and 85 to 125°C
                                           (±1.8°F for -40 to 50°F and 185 to 257°F)

Accuracy/Range*:
wBTHP   ±0.5°C for 5 to 45°C (±0.9°F for 41 to 113°F);
                                           up to ±1.5°C for -40 to 5°C and 45 to 85°C
                                           (up to ±2.7°F for -40 to 41°F and 113 to 185°F)

Accuracy/Range*:
wBTP   ±0.8°C @ 25°C (±1.5°F @ 77ºF)
                                           ±4°C for -40 to 85°C (±7.2°F for -40 to 185ºF)

*Note: extended temperature ranges are for External Probes only.

Resolution: 0.1ºC

BAROMETRIC PRESSURE
Accuracy/Range:
wBTP, wBTHP   ±2 mbar for 300 to 1100 mbar @ 0 to 50ºC
                                           ±6 mbar for 300 to 1100 mbar @ -40 to 85ºC
Resolution: 0.1 mbar

ANALOG VOLTAGE & CURRENT INPUT (wVI)
Voltage Input: Differential: bipolar; ±100 mV, ±1 V, ±10 V
Input Impedance: 38 K ohm for voltage
Current Input: Differential: bipolar; ±20 mA (5 ohm load)
Accuracy: ±0.1% Full Range @ 25ºC
Reading Rate: Periodic (1 sample/update) or continuous
                                           (3 samples/second)

THERMOCOUPLE INPUT (wTC)

Temperature Range & Accuracy:	Refer to Thermocouple Chart
Temperature Stability:	0.08°C/°C
Temperature Coefficient:	±25 ppm/°C
Thermocouple Cold End Tracking:	0.1°C/°C
Thermocouple Lead Resistance:	100 ohm max.
Thermocouple Type (ITS 90):	J, K, T, E, R, S, B, C, N, L
Warm-Up to Rated Accuracy:	30 minutes
Reading Rate:	Periodic (1 sample/update) or continuous (3 samples/second)

Table 6.1

THERMOCOUPLE CHART			
	Input Type	**Range**	**Accuracy**
J	Iron - Constantan	-210 to 760°C / -346 to 1400°F	0.5°C / 0.9°F
K	CHROMEGA®- ALOMEGA®	-230 to -180°C / -180 to 1372°C -382 to -292°F / -292 to 2502°F	1.0°C / 0.5°C 1.8°F / 0.9°F
T	Copper - Constantan	-240 to -180°C / -180 to 400°C -400 to -292°F / -292 to 752°F	1.0°C / 0.5°C 1.8°F / 0.9°F
E	CHROMEGA®- Constantan	-250 to -220°C / -220 to 1000°C -418 to -364°F / -364 to 1832°F	1.0°C / 0.5°C 1.8°F / 0.9°F
R	Pt / 13%Rh-Pt	310 to 1768°C 590 to 3214°F	1.0°C 1.8°F
S	Pt / 10%Rh-Pt	400 to 1768°C 752 to 3214°F	1.0°C 1.8°F
B	30%Rh-Pt / 6%Rh-Pt	470 to 1050ºC / 1050ºC to 1820ºC 878 to 1922ºF / 1922 to 3308ºF	2.0ºC / 1.0ºC 3.6ºF / 1.8ºF
C	5%Re-W / 26%Re-W	0 to 450°C / 450 to 790ºC 790 to 2280°C / 32 to 842°F 842 to 1454°F / 1454 to 4136°F	1.0°C / 0.5°C 1.0°C / 1.8°F 0.9°F / 1.8°F
N	Nicrosil - Nisil	-200 to -120°C / -120 to 1300°C -328 to -184°F / -184 to 2372°F	1.0°C / 0.5°C 1.8°F / 0.9°F
L	J DIN	-200 to 900°C / -328 to 1652°F	0.5°C / 0.9°F

METER SPECIFICATIONS

Supported Protocols

Transmitter:	TCP/IP, UDP, ARP, ICMP, DHCP, HTTP and FTP
Supported Protocols VC:	TCP/IP, UDP, HTTP, FTP, SMTP and Telnet

WIRELESS COMMUNICATION

Standard:	IEEE 802.11 b/g
Frequency:	2.4 GHz (2402~2483.5 MHz)
Range:	60m (200ft) indoor line-of-site or more depending upon sensitivity, data rate, wireless access point, and environmental considerations
Radio Power Output Level (Class 1):	91.4 mW EIRP (19.6 dBm EIRP)
Modulation:	802.11b compatibility: DSSS (CCK-11, CCK-5.5, DQPSK-2, DBPSK-1); 802.11g: OFDM (default)
Channels:	1–13; Channel 14 for Japan use only and is not certified
Channel Spacing (Bandwidth): **Transmission Rate (over the air):**	20 MHz, refer to manual **802.11b:** 1 to 11 Mbps **802.11g:** 6 to 54 Mbps

Table 6.2 Data Rate and Sensitivity

Data Rate	Sensitivity
54 Mbit/s	-70 dBm
48 Mbit/s	-72 dBm
36 Mbit/s	-77 dBm
24 Mbit/s	-79 dBm
18 Mbit/s	-82 dBm
12 Mbit/s	-82 dBm
9 Mbit/s	-87 dBm
6 Mbit/s	-89 dBm
11 Mbit/s	-84 dBm
5.5 Mbit/s	-87 dBm
2 Mbit/s	-89 dBm
1 Mbit/s	-90 dBm

POWER

Power Input:	5 Vdc
Consumption:	0.7W max
Safety Qualified AC Power Adapter (included):	
Nominal Output:	5 Vdc @ 0.6 A
Input:	100 to 240 Vac, 50/60 Hz
Back-up Alkaline Battery:	One AA 1.5 Vdc, supplied

POWER (wSeries-CCELL)

Alkaline Battery:	Two C-CELL 1.5 Vdc, supplied
Lifetime:	Estimate of 2.4 years (wTC/wVI) and 4.3 years (wTxxP/wBxxP) with frequency of 1 reading per 1 minute, refer to **Table 6.3** and **6.4**.

Table 6.3 Overall: Estimated Alkaline Battery Lifetime

Update Rate	C Cell units	AA back-up / AC units
Continuous* (wTC,wVI)	2 weeks	2 days
10 seconds* (default)	9.6 to 20.5 months	4 weeks
1 Minute	2.4 to 7 years	3.6 to 9.6 months
2 Minutes	4.3 to 7 years	6 months to 1.5 years

*Power Save mode

Note☞ Battery life is dependent on environmental conditions and transmitter settings, and will be adversely impacted by loss of connection with access point.

Table 6.4 Individual Models: Estimated C-CELL Battery Lifetime
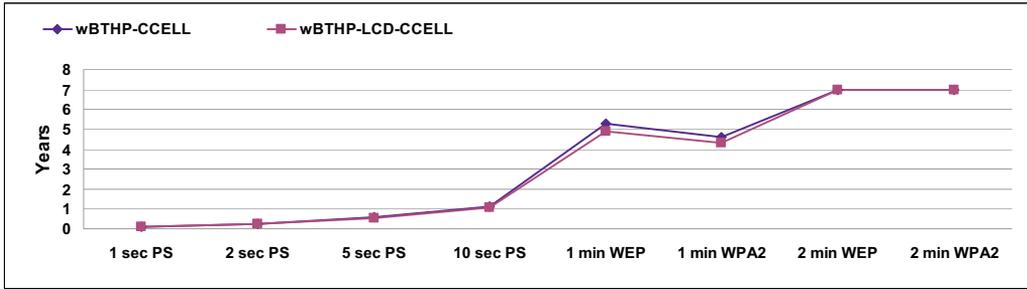
Update Rate/Mode	1 sec PS	2 sec PS	5 sec PS	10 sec PS	1 min WEP	1 min WPA2	2 min WEP	2 min WPA2
wBTHP-CCELL	1.4 months	2.7 months	6.8 months	13.5 months	5.3 years	4.6 years	7 years	7 years
wBTHP-LCD-CCELL	1.3 months	2.7 months	6.6 months	13.1 months	4.9 years	4.3 years	7 years	7 years
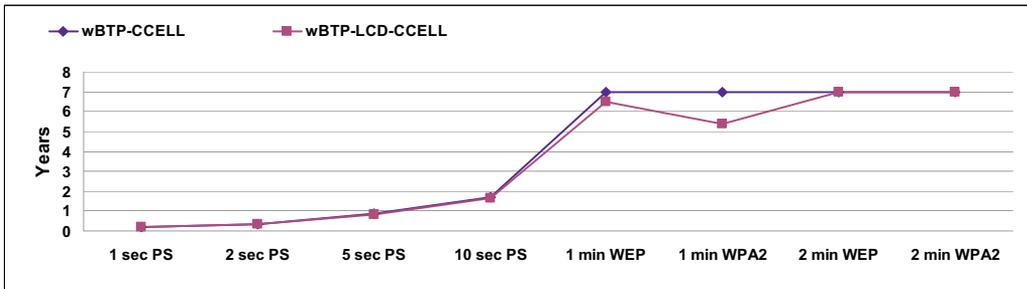
Update Rate/Mode	1 sec PS	2 sec PS	5 sec PS	10 sec PS	1 min WEP	1 min WPA2	2 min WEP	2 min WPA2
wBTP-CCELL	2.1 months	4.2 months	10.4 months	20.5 months	7 years	7 years	7 years	7 years
wBTP-LCD-CCELL	2 months	4 months	9.9 months	19.5 months	6.5 years	5.4 years	7 years	7 years
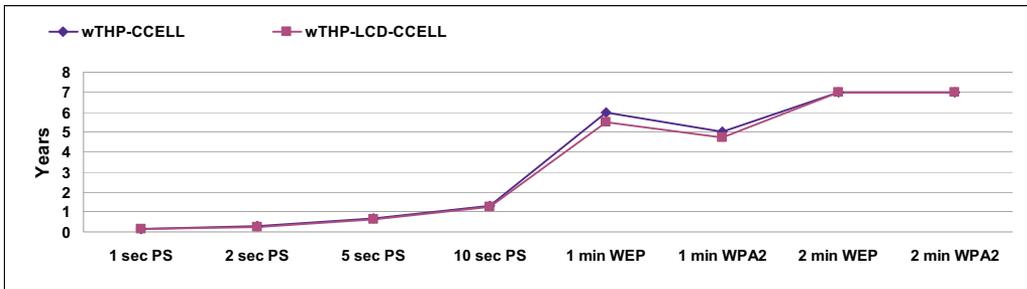
Update Rate/Mode	1 sec PS	2 sec PS	5 sec PS	10 sec PS	1 min WEP	1 min WPA2	2 min WEP	2 min WPA2
wTHP-CCELL	1.6 months	3.2 months	7.9 months	15.7 months	6 years	5 years	7 years	7 years
wTHP-LCD-CCELL	1.6 months	3.1 months	7.7 months	15.1 months	5.5 years	4.7 years	7 years	7 years

Note☞ 7 years is the shelf life of the battery.

Table 6.4 Individual Models: Estimated C-CELL Battery Lifetime (continued)
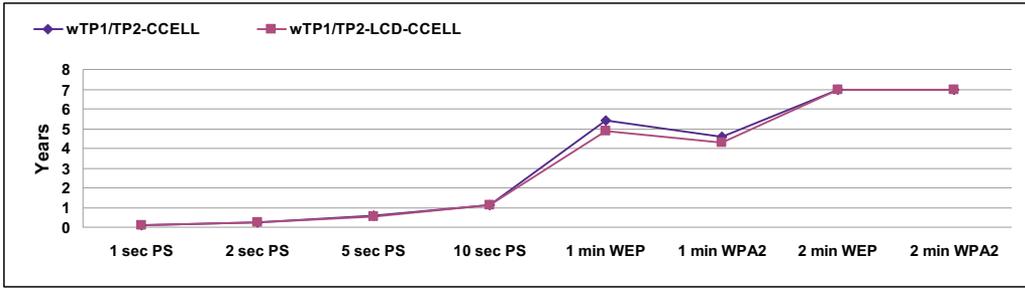
Update Rate/Mode	1 sec PS	2 sec PS	5 sec PS	10 sec PS	1 min WEP	1 min WPA2	2 min WEP	2 min WPA2
wTP1/TP2-CCELL	1.4 months	2.8 months	6.9 months	13.6 mont hs	5.4 years	4.6 years	7 years	7 years
wTP1/TP2-LCD-CCELL	1.3 months	2.7 months	6.7 months	13.2 mont hs	4.9 years	4.3 years	7 years	7 years
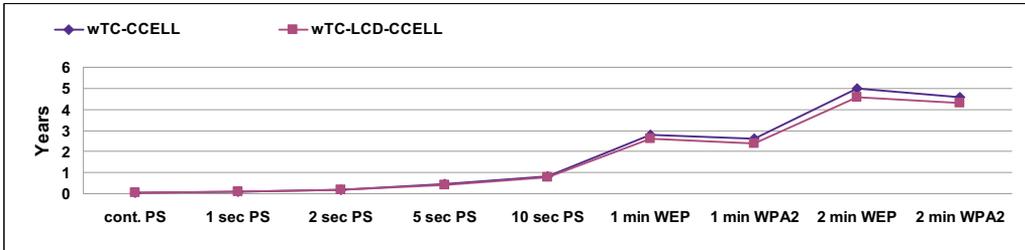
Update Rate/Mode	cont. PS	1 sec PS	2 sec PS	5 sec PS	10 sec PS	1 min WEP	1 min WPA2	2 min WEP	2 min WPA2
wTC-CCELL	0.5 months	1.1 months	2.2 months	5.3 months	9.9 months	2.8 years	2.6 years	5 years	4.6 years
wTC-LCD-CCELL	0.6 months	1.1 months	2.2 months	5.2 months	9.6 months	2.6 years	2.4 years	4.6 years	4.3 years
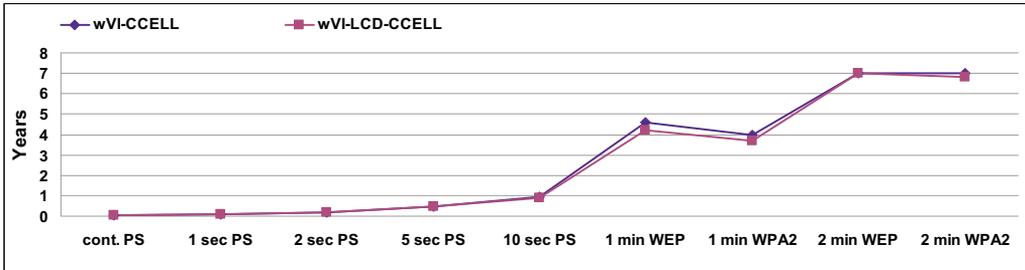
Update Rate/Mode	cont. PS	1 sec PS	2 sec PS	5 sec PS	10 sec PS	1 min WEP	1 min WPA2	2 min WEP	2 min WPA2
wVI-CCELL	0.5 months	1.1 months	2.3 months	5.7 months	11.2 months	4.6 years	4.0 years	7 years	7 years
wVI-LCD-CCELL	0.6 months	1.1 months	2.2 months	5.5 months	10.8 months	4.2 years	3.7 years	7 years	6.8 years

Note☞ 7 years is the shelf life of the battery.

SAFETY & REGULATORY COMPLIANCE

Safety: EN60950-1
Safety Requirement under article 3.1.a of the R&TTE

EMC: EN 301 489-1
Electromagnetic compatibility article 3.1.b of the R&TTE

EN 301 489-17
Electromagnetic compatibility article 3.1.b of the R&TTE

EN 55022, Class B, (CISPR 22)

Radio: EN 300 328
Spectrum article 3(2) of the R&TTE

FCC: Part 15C, Class DTS Intentional radiator tested for 15.205, 15.209, 15.247(a)(2), 15.247(b)(3), 15.247(d), 15.247(e), 15.247(i), 15.31(e)(See **Appendix H**).

GENERAL

Operating Temperature: -10 to 55ºC (14 to 131ºF), 90% RH non-condensing
  AC Power Adapter: 0 to 40ºC (32 to 104ºF)

Dimensions: 96.5H x 146.3W x 50.8D mm (3.8 x 5.76 x 2"),
not including connectors or antenna. See **Section 2.0**

Protection: Weatherproof with NEMA4/IP65 rated casing

Table 6.5 Table of Wireless Transmitters

wTP1	Temperature sensor with stick probe
wTP2	Temperature sensor with lug mount probe
wTHP	Temperature and humidity sensor
wTHP2	Temperature and humidity sensor, short probe
wBTHP	Barometric pressure, temp and humidity sensor
wBTP	Barometric pressure and temperature sensor
wTC	Dual thermocouple inputs
wVI	Analog input

Options include AC power, C-CELL battery or LCD.

APPENDIX A   GLOSSARY

User of this manual should be familiar with following definitions:

IEEE 802.11b has a maximum raw data rate of 11Mbits/sec.

IEEE 802.11g hardware is backward compatible to 802.11b hardware. It has a maximum through put of 54Mbits/sec.

ARP (Address Resolution Protocol) is a protocol for mapping an Internet Protocol address (IP address) to a physical machine address that is recognized in the local network. For example, the IP address in use today is an address that is 32-bits long. In an Ethernet local area network, however, addresses for attached devices are 48-bits long. (The physical machine address is also known as a Media Access Control or MAC address.) A table, usually called the ARP cache, is used to maintain a correlation between each MAC address and its corresponding IP address. ARP provides the protocol rules for making this correlation and providing address conversion in both directions.

Ethernet is a network protocol defined by the IEEE 802.3 standard. Ethernet-based networks use MAC Address rather then IP Address to exchange data between computers. By using ARP and adding TCP/IP support, Ethernet devices may be connected as part of the Internet. An Ethernet LAN typically uses coaxial cable or special grades of twisted pair wires. The most commonly installed Ethernet systems are called 10BASE-T and provide transmission speeds up to 10 Mbps. Devices are connected to the cable and compete for access using a Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol.

IP (Internet Protocol) is the method or protocol by which data is sent from one computer to another on the Internet.

IP address (Internet Protocol address) is a 32-bit number that identifies each sender or receiver of information that is sent in packets across the Internet.

IP Netmask is a 32-bit pattern of bits used to determine which part of the IP address is the network portion and which part is the host portion.

MAC (Media Access Control) Address is your computer's unique hardware number. When you're connected to the Internet from your computer, a correspondence table relates your IP address to your computer's physical (MAC) address on the LAN.

Ping is a utility that tests the network connectivity. It is used to determine if the host is capable of exchanging information with another host.

Port number/Socket number is a way to identify a specific process to which an Internet or other network message is to be forwarded when it arrives at a server. It is a predefined address that serves as a route from the application to the Transport layer or from the Transport layer to the application of the TCP/IP system.

Sockets are a method for communication between a client program and a server program in a network and defined as "the endpoint in a connection". Information transferred across the Internet primarily occurs between sockets.

SMTP Simple Mail Transfer Protocol is an Internet standard for electronic mail (email) transfer across the Internet. SMTP clients usually use SMTP to send email messages by specifying the SMTP server. The email server uses SMTP to both send and receive email messages.

SNMP Simple Network Management Protocol is a network monitoring protocol to monitor devices connected to an Ethernet Network.

TCP/IP (Transmission Control Protocol/Internet Protocol) is the basic communication language or protocol of the Internet. When you are set up with direct access to the Internet, your computer is provided with a copy of the TCP/IP program just as every other computer that you may send messages to or get information from also has a copy of TCP/IP. TCP/IP often is used as a general term to indicate generic access to the Internet.

UDP/IP (User Datagram Protocol/Internet Protocol) is the TCP/IP standard protocol that allows an application program on one machine to send a datagram to an application program on another. The UDP can be either in Broadcast or Directed form. The Broadcast UDP transmits data to every node on the same network. The Directed UDP transmits data to one node only.

WEP (Wired Equivalent Privacy) a security algorithm for IEEE 802.11 wireless networks. Provides data confidentiality comparable to that of a traditional wired network. Recognizable by the key of 10 or 26 hexadecimal digits, is widely in use and is often the first security choice presented to users by router configuration tools.

WPA Wi-Fi Protected Access and WPA2 Wi-Fi Protected Access II WPA2 provides stronger data protection and network access control. WPA2-PSK (Pre-shared key) mode encrypts the network traffic using a 256 bit key. This key can be entered as a passphrase of 8 to 63 printable ASCII characters.

	WPA	WPA2
Enterprise Mode (Business, Government, Education)	• Authentication: IEEE 802.1X/EAP • Encryption: TKIP/MIC	• Authentication: IEEE 802.1X/EAP • Encryption: AES-CCMP
Personal Mode (SOHO, Home/Personal)	• Authentication: PSK • Encryption: TKIP/MIC	• Authentication: PSK • Encryption: AES-CCMP

Appendix B   IP Address

An IP address is a unique 32-bit address assigned to a computer and includes:

- A network ID number identifying a network.
- A host ID number identifying a computer on the network.

All IP addresses have been divided into three smaller groups (classes) A, B and C

- **Class A** addresses have 8-bits of network ID and 24-bits of host ID. They can support a large number of hosts, approximately 2 = 16,777,216 computers per network.

    The IP addresses range in binary from 00000001.xxxxxxxx.xxxxxxxx.xxxxxxxx
                                         to 01111111.xxxxxxxx.xxxxxxxx.xxxxxxxx

    The IP addresses range in decimal from 1.x.x.x to 127.x.x.x

    Class A network ID's support a very large number of hosts.

- **Class B** addresses have 16-bits of network ID and 16-bits of host ID. They can support approximately 2^{16} = 65,536 computers per network.

    The IP addresses range in binary from 10000000 00000000.xxxxxxxx.xxxxxxxx
                                         to 10111111 11111111.xxxxxxxx.xxxxxxxx

    The IP addresses range in decimal from 128.0.x.x to 191.255.xxx.xxx

    Class B network ID's support a medium number of hosts.

- **Class C** addresses have 24-bits of network ID and 8-bits of host ID. They can support approximately 2^8 = 256 computers per network.

    The IP addresses range in binary from 11000000.00000000.00000000.xxxxxxxx
                                         to 11011111.11111111.11111111.xxxxxxxx

    The IP addresses range in decimal from 192.0.0.xxx to 223.255.255.xxx

    Class C network ID's support a small number of hosts.

Note ☞
The rest of the addresses are divided into two classes, D and E.
Class D networks are not assigned to the host. They are used for multicasting. The address range from 224.x.x.x to 239.x.x.x

Class E networks are experimental or reserved addresses.
The address range from 240.x.x.x to 247.x.x.x

Appendix C   IP Netmask

IP Netmask or Subnet Mask is a 32-bit pattern of ones and zeros used to determine network portion of an IP address from the host portion of the IP address. Subnet mask is a network ID that is created by borrowing bits from host portion of IP address and using them as part of a network ID. The table below shows a default subnet mask for address Classes A, B, and C. Each bit that is set to "1" in the subnet mask corresponds to the bit in the IP address that is to be used as the network ID. Each bit that is set to "0" in the subnet mask corresponds to a bit in the IP address that is to be used as the host ID.

Address Class	Mask Binary Value	Mask Decimal Value or Dotted Notation
Class A	11111111 00000000 00000000 00000000	255.0.0.0
Class B	11111111 11111111 00000000 00000000	255.255.0.0
Class C	11111111 11111111 11111111 00000000	255.255.255.0

If your network requires more network ID's, you can extend the default subnet mask to include additional bits from the host ID. This allows for additional network ID's within the network. The table below shows some examples of subnet masks and bits moved from the hosts ID to create a new subnet.

Mask Dotted Notation	Mask Binary	Mask Bits
	Class A	
255.0.0.0 (Default)	11111111 00000000 00000000 00000000	0
255.192.0.0	11111111 11000000 00000000 00000000	2
255.224.0.0	11111111 11100000 00000000 00000000	3
255.240.0.0	11111111 11110000 00000000 00000000	4
255.248.0.0	11111111 11111000 00000000 00000000	5
255.252.0.0	11111111 11111100 00000000 00000000	6
255.254.0.0	11111111 11111110 00000000 00000000	7
255.255.0.0	11111111 11111111 00000000 00000000	8
255.255.128.0	11111111 11111111 10000000 00000000	9
255.255.192.0.0	11111111 11111111 11000000 00000000	10
....	. . . .	.
255.255.255.252	11111111 11111111 11111111 11111100	22
	Class B	
255.255.0.0 (Default)	11111111 11111111 00000000 00000000	0
255.255.192.0	11111111 11111111 11000000 00000000	2
....	. . . .	.
255.255.255.252	11111111 11111111 11111111 11111100	14
	Class C	
255.255.255.0 (Default)	11111111 11111111 11111111 00000000	0
255.255.255.192	11111111 11111111 11111111 11000000	2
....	. . . .	.
255.255.255.254	11111111 11111111 11111111 11111100	6

To determine the number of valid hosts ID's remaining after subnetting, use the following equation: $2^n - 2$, where n is the number of octet digits left after the subnet mask.

Appendix D   ASCII Chart

ASCII Char	Dec	Hex	Binary No Parity	ASCII Char	Dec	Hex	Binary No parity
NUL	00	00	00000000	@	64	40	01000000
SOH	01	01	00000001	A	65	41	01000000
STX	02	02	00000010	B	66	42	01000010
ETX	03	03	00000011	C	67	43	01000011
EOT	04	04	00000100	D	68	44	01000100
ENQ	05	05	00000101	E	69	45	01000101
ACK	06	06	00000110	F	70	46	01000110
BEL	07	07	00000111	G	71	47	01000111
BS	08	08	00001000	H	72	48	01001000
HT	09	09	00001001	I	73	49	01001001
LF	10	0A	00001010	J	74	4A	01001010
VT	11	0B	00001011	K	75	4B	01001011
FF	12	0C	00001100	L	76	4C	01001100
CR	13	0D	00001101	M	77	4D	01001101
SO	14	0E	00001110	N	78	4E	01001110
SI	15	0F	00001111	O	79	4F	01001111
DLE	16	10	00010000	P	80	50	01010000
DC1	17	11	00010001	Q	81	51	01010001
DC2	18	12	00010010	R	82	52	01010010
DC3	19	13	00010011	S	83	53	01010011
DC4	20	14	00010100	T	84	54	01010100
NAK	21	15	00010101	U	85	55	01010101
SYN	22	16	00010110	V	86	56	01010110
ETB	23	17	00010111	W	87	57	01010111
CAN	24	18	00011000	X	88	58	01011000
EM	25	19	00011001	Y	89	59	01011001
SUB	26	1A	00011010	Z	90	5A	01011010
ESC	27	1B	00011011	[	91	5B	01011011
FS	28	1C	00011100	\	92	5C	01011100
GS	29	1D	00011101	]	93	5D	01011101
RS	30	1E	00011110	^	94	5E	01011110
US	31	1F	00011111	_	95	5F	01011111
SP	32	20	00100000	`	96	60	01100000
!	33	21	00100001	a	97	61	01100001
"	34	22	00100010	b	98	62	01100010
#	35	23	00100011	c	99	63	01100011
$	36	24	00100100	d	100	64	01100100
%	37	25	00100101	e	101	65	01100101
&	38	26	00100110	f	102	66	01100110
'	39	27	00100111	g	103	67	01100111
(	40	28	00101000	h	104	68	01101000
)	41	29	00101001	i	105	69	01101001
*	42	2A	00101010	j	106	6A	01101010
+	43	2B	00101011	k	107	6B	01101011
,	44	2C	00101100	l	108	6C	01101100
-	45	2D	00101101	m	109	6D	01101101
.	46	2E	00101110	n	110	6E	01101110

/	47	2F	00101111	o	111	6F	01101111
0	48	30	00110000	p	112	70	01110000
1	49	31	00110001	q	113	71	01110001
2	50	32	00110010	r	114	72	01110010
3	51	33	00110011	s	115	73	01110011
4	52	34	00110100	t	116	74	01110100
5	53	35	00110101	u	117	75	01110101
6	54	36	00110110	v	118	76	01110110
7	55	37	00110111	w	119	77	01110111
8	56	38	00111000	x	120	78	01111000
9	57	39	00111001	y	121	79	01111001
:	58	3A	00111010	z	122	7A	01111010
;	59	3B	00111011	{	123	7B	01111011
<	60	3C	00111100	|	124	7C	01111100
=	61	3D	00111101	}	125	7D	01111101
>	62	3E	00111110	~	126	7E	01111110
?	63	3F	00111111	DEL	127	7F	01111111

ASCII Control Codes

ASCII Char	Dec	Hex	Ctrl Key Equiv.	Definition	ASCII Char	Dec	Hex	Ctrl Key Equiv.	Definition
NUL	00	00	Crtl @	Null Character	DC1	17	11	Crtl Q	Data Control 1 - XON
SOH	01	01	Crtl A	Start of Header	DC2	18	12	Crtl R	Data Control 2
STX	02	02	Crtl B	Start of Text	DC3	19	13	Crtl S	Data Control 3 - XOFF
ETX	03	03	Crtl C	End of Text	DC4	20	14	Crtl T	Data Control 4
EOT	04	04	Crtl D	End of Transmission	NAK	21	15	Crtl U	Negative Acknowledge
ENQ	05	05	Crtl E	Inquiry	SYN	22	16	Crtl V	Synchronous Idle
ACK	06	06	Crtl F	Acknowledge	ETB	23	17	Crtl W	End of Trans Block
BEL	07	07	Crtl G	Bell	CAN	24	18	Crtl X	Cancel
BS	08	08	Crtl H	Back Space	EM	25	19	Crtl Y	End of Medium
HT	09	09	Crtl I	Horizontal Tabulation	SUB	26	1A	Crtl Z	Substitute
LF	10	0A	Crtl J	Line Feed	ESC	27	1B	Crtl [	Escape
VT	11	0B	Crtl K	Vertical Tabulation	FS	28	1C	Crtl \	File Separator
FF	12	0C	Crtl L	Form Feed	GS	29	1D	Crtl]	Group Separator
CR	13	0D	Crtl M	Carriage Return	RS	30	1E	Crtl |	Record Separator
SO	14	0E	Crtl N	Shift Out	US	31	1F	Crtl _	Unit Separator
SI	15	0F	Crtl O	Shift In	SP	32	20		Space
DLE	16	10	Crtl P	Data Link Escape					

Appendix E   TCP/IP COMMAND-LINE-INTERFACE

The Virtual Coordinator responds to TCP connections made to its port 2000. From anywhere on the network, data acquisition programs that support TCP/IP protocol or applications like Telnet can establish a TCP port connection to the Virtual Coordinator using its IP address and port 2000. The IP address of the Virtual Coordinator is the same as the IP address of the PC on which the Virtual Coordinator is installed. The default local port 2000 can be changed in the Virtual Coordinator if needed (see VC Configuration **Section 4.7**). Once the TCP connection is established, the commands listed below can be used to query the Virtual Coordinator for real-time data from any or all the Transmitters. The commands sent to and the responses back from the Virtual Coordinator are all in ASCII format.

▼
Note☞ Once you leave the chart page for a Transmitter all the settings will get saved.

Commands	*Descriptions*
ERDALL	Collects readings from the Virtual Coordinator for all the Transmitters.

Example: This is the response to ERDALL command for 4 transmitters.

2011/07/22 12:06:57	TXd461	22.3 C		
2011/07/22 12:06:47	TXd201	22.0 C	24.0 C	
2011/07/22 12:06:43	TX5a86	22.2 C	47.0 %	
2011/07/22 12:06:57	TXd4e4	21.8 C	1010.5 hPa	48.6 %
└ Date	└ Time	└ Transmitter Name └Temperature	└ Barometric Pressure	└ Humidity

ERDBxxxxxx Collects readings from the Virtual Coordinator for a single Transmitter. xxxxx would be the Transmitter's name.
Example: This is the response to ERDBTXd4e4 command.

2011/07/22 12:07:16   TXd4e4   21.8 C   1010.5 hPa   48.6 %

ERDRxxxxxx# Collects readings from the Virtual Coordinator for a specific sensor of a single transmitter. xxxxxx would be the Transmitter's name and # would be the first (c), second (d), or third (e) sensor reading.

Example: This is the response from the Virtual Coordinator to the command ERDRTXd4e4c for the temperature reading of transmitter TXd4e4.

2011/07/22 13:59:17   TXd4e4   21.8 C

ERDGx   Collects readings from the Virtual Coordinator for a group of transmitters where x is the letter for that group (A, B, C,….). To put the Transmitters in a group, see **Section 4.4**
Example: This is the response from the Virtual Coordinator to the command ERDGA where A is a group with three Transmitters.

2011/07/22 14:41:58   TXd4e5   22.1 C   1007.6 hPa   49.2 %
2011/07/22 14:42:00   TXd503   21.9 C   50.9 %
2011/07/22 14:41:55   TXd4ae   21.7 C   21.7 C

▼
Note☞ The commands are not case-sensitive and should be sent followed be a carriage return

Appendix F   ASCII / TELNET COMMANDS TABLE

Table F.1 ASCII/Commands Table

Command	Device / Group ID	Description (see notes below if *)	Example
ERD	ALL	Get all sensor readings	ERDALL
ERDB	Device Label	Get sensor readings of an Transmitter	Get reading for sensor txd430: ERDBtxd430
ERDR	Device Label: Reading/parameter: a-s *1	Get individual reading or parameter	Get the first temp. reading for sensor txd430: ERDRtxd430c
ERDG	Group Label: A-Z; ALL	Get sensor readings of a group / groups of sensors	Get readings for all group B: ERDGB
EQNF	Device Label	Get label, status and firmware version of an Transmitter	Get label for sensor txd430: EQNFtxd430
EQNG	Group Label: A-Z, ALL	Get label, status and firmware, version of a group/all groups of sensors	Get label for all sensors: EQNGALL
EQPE	Device Label	Get sleep period, battery voltage, signal strength, success of an Transmitter	Get sleep period for sensor txd430: EQPEtxd430
EQPG	Group Label: A-Z	Get sleep period, battery voltage, signal strength, success, of a group / all groups of sensors	Get sleep period, of group B: EQPGB

*1 Refer to **Table F.3**

An example of the status of an Transmitter

Command: **EQNF003**

Response: **2011/08/02 17:51:08 003 00000000 1.00**

003 is the label for the Transmitter.

"00000000" is the bitmap representation of the internal state. The meaning for each bit is described below (bit 7 starts from the left).

1.00 is version of the firmware in the Transmitter

Table F.2   Status of the device

Bit 7 shows if the sensor is plugged into the Transmitter. '1' means there is no sensing device detected.	**Bit 4** not used.
Bit 6 shows if the communication to the Transmitter is lost. '1' means there has not been any data received from that particular Transmitter for 1 minute or 4 times the update rate, whichever is a longer time interval.	**Bit 3** not used. **Bit 2** not used. **Bit 1** shows the source of power supply to the Transmitter. '1' means it's powered by an adapter and '0' means it's powered by batteries.
Bit 5 not used.	**Bit 0** not used.

Table F.3 Reading/parameter for ERDR commands

Options (lower case)	Reading/parameter
a	Sequence number (Always 1, as timestamp is used for sequence number)
b	Device type
c	reading / error message
d	reading / error message
e	reading / error message
f	not used
i	Update rate
j	Battery voltage (no decimal point)
k	Signal strength
l	Success rate
q	Name (Label)
r	Status (see previous table)
s	Firmware version

Option Chart for sensor reading order		
c	d	e
Temp		
Temp	RH	
Temp	Pressure	
Temp	Pressure	RH
Temp TC	Temp TC	
Analog	Analog	

* See option chart for sensor reading order

Table F.4 Connector/Transmitter Types

Model	Description	Type#
wTP1	Temperature sensor with stick probe	16
wTP2	Temperature sensor with lug mount probe	16
wTHP	Temperature and humidity sensor	15
wTHP2	Temperature and humidity sensor, short probe	15
wBTHP	Barometric pressure, temp and humidity sensor	13
wBTP	Barometric pressure and temperature sensor	9
wTC	Dual thermocouple inputs	20
wVI	Analog input, Channels Enabled	24
wVI	Analog input, Channel 1 Enabled	25
wVI	Analog input, Channel 2 Enabled	26

Appendix G   HTTPget Program

This is a DOS-based TCP socket connection program used to query real-time data from the Virtual Coordinator. Simply, download this single httpget.exe file from our web site and place it somewhere in your computer's hard drive. At the DOS prompt where the httpget.exe is residing a command string can be sent to the Virtual Coordinator to receive real-time data. The figure below demonstrates the HTTPget command strings.

HTTPget Command Strings
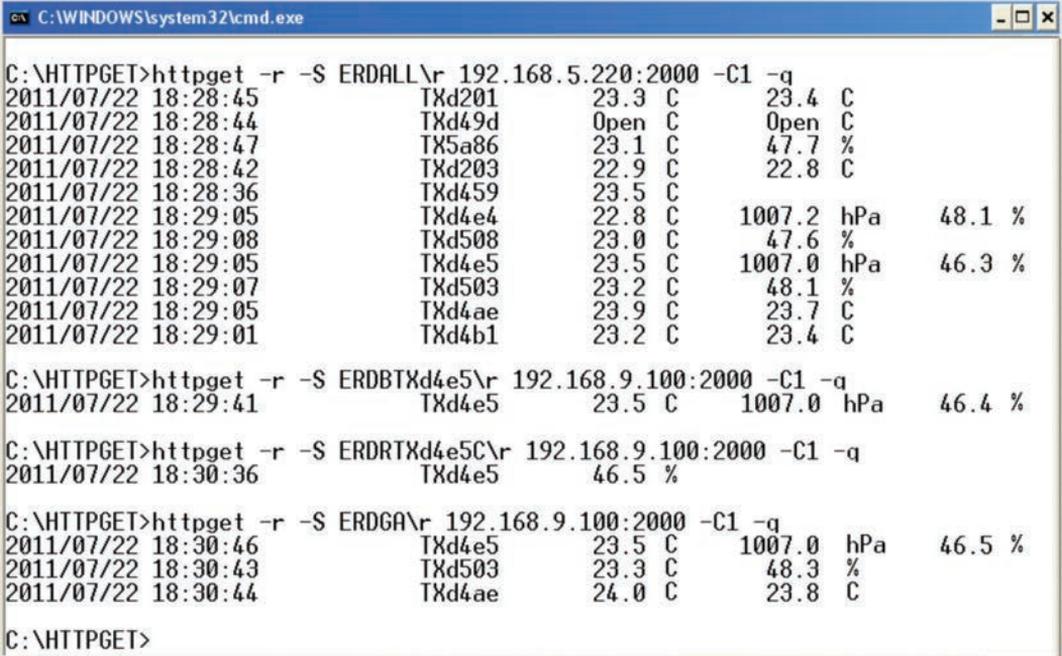
```
C:\WINDOWS\system32\cmd.exe                                              _ □ ×

C:\HTTPGET>httpget -r -S ERDALL\r 192.168.5.220:2000 -C1 -q
2011/07/22 18:28:45              TXd201        23.3  C         23.4  C
2011/07/22 18:28:44              TXd49d        Open  C         Open  C
2011/07/22 18:28:47              TX5a86        23.1  C         47.7  %
2011/07/22 18:28:42              TXd203        22.9  C         22.8  C
2011/07/22 18:28:36              TXd459        23.5  C
2011/07/22 18:29:05              TXd4e4        22.8  C       1007.2  hPa      48.1  %
2011/07/22 18:29:08              TXd508        23.0  C         47.6  %
2011/07/22 18:29:05              TXd4e5        23.5  C       1007.0  hPa      46.3  %
2011/07/22 18:29:07              TXd503        23.2  C         48.1  %
2011/07/22 18:29:05              TXd4ae        23.9  C         23.7  C
2011/07/22 18:29:01              TXd4b1        23.2  C         23.4  C

C:\HTTPGET>httpget -r -S ERDBTXd4e5\r 192.168.9.100:2000 -C1 -q
2011/07/22 18:29:41              TXd4e5        23.5  C       1007.0  hPa      46.4  %

C:\HTTPGET>httpget -r -S ERDRTXd4e5C\r 192.168.9.100:2000 -C1 -q
2011/07/22 18:30:36              TXd4e5        46.5  %

C:\HTTPGET>httpget -r -S ERDGA\r 192.168.9.100:2000 -C1 -q
2011/07/22 18:30:46              TXd4e5        23.5  C       1007.0  hPa      46.5  %
2011/07/22 18:30:43              TXd503        23.3  C         48.3  %
2011/07/22 18:30:44              TXd4ae        24.0  C         23.8  C

C:\HTTPGET>
```

Appendix H   Troubleshooting

Once you apply the steps described in **Section 3** and if you still cannot see the Transmitter on your VC check the following items:

Blue LED
The Blue LED on the Transmitter blinks every time it transmits data. If the Blue LED is solid on it then means that it's trying to connect and transmit data to the access point with no success.

Java Runtime Environment (JRE)
Make sure that the Java Runtime Environment (JRE) is running on the PC on which the VC is installed. If the Java Runtime is not installed on the computer the VC will not display readings from the Transmitters. Should be 32-bit Java version 1.6 or higher.

Wireless Connection
If you plan to connect on a wireless LAN make sure that the wireless connection on your computer on which the VC is installed is linked to the correct access point. You may want to connect to the same access point to which the Transmitter is connected. You can verify that by looking at the Wireless Connection Manager on your computer.

Wired LAN
If your computer is on a wired LAN on which the correct access point is also connected, make sure that you can reach the access point from your computer. This can be accomplished by "pinging" the IP address of the access point.

Firewall
Make sure that the firewall is off or the exceptions are added properly.
Refer to **Appendix K and L**.

Back to AD-HOC Mode
If you cannot find anything wrong with your computer wireless connection and the access point, then there is a chance that the Transmitter was not configured correctly. To reconfigure the Transmitter you must put the Transmitter back into the AD-HOC mode. Refer to **Section 3.3.3** step by step.
You can now follow the Transmitter's Initial Configuration **Section 3.3.6**.

Access Point/Wireless Router:
In general, the latest/newest access Points are better than older ones. Also, check to see if your access point has the latest firmware installed.

Appendix H   Troubleshooting (continued)

FIREWALL FAQs:

Question 1: My firewall is ON and I unchecked the exception for port 50002 but still the readings are seen on the webpage?
Solution: Go to Control panel->Administrative tools->Services and restart the Windows Firewall /Internet Connection sharing service.

Question 2: My firewall is ON and I removed the exception for port 50002 but still the readings are seen on the webpage?
Solution: Same as Question 1.

Question 3: My firewall is ON and I removed the exception for port 50002 but still the readings are seen on the webpage and I tried solution 1?
Solution: In Internet explorer go to http://update.microsoft.com and do the express upgrade to make sure that all the needed patches and service packs are installed. Then try Solution 1.

IMPORTANT NOTES: *Refer to each section listed below for additional details.*

CONFIGURATION:

IP Address
• It is recommended to have the computer running VC hard-wired to the access point/wireless router.

• For initial setup it is recommended to place the Transmitter and the VC close to the wireless access point/wireless router. Once the configuration is done the Transmitter can be mounted to the desired location.

• This configuration applies to Windows PC. For Linux, visit our website or read the instructions in the CD.

• One can also use a mobile device with a wireless (Wi-Fi) to configure the Transmitter.

Powering ON the Transmitter

IMPORTANT: The first time you power on the transmitter, you must follow this sequence or risk corrupting the firmware. If the firmware gets corrupted, the unit must be returned to the factory to have the firmware reinstalled.

• Make sure the red power switch is OFF.

• Install two C-cell batteries, or connect AC adapter and install backup AA battery.

• Press and hold white reset button (labeled "SW2").

• While continuing to press the white reset button, slide the red power switch ("SW1") to ON.

• Do not release the white reset button until the blue LED comes on solid (not blinking). For the AD-HOC to synch with the PC usually takes 2-3 minutes.

• The transmitter is now in AD-HOC mode for initial wireless configuration

Access Point SSID, Passphrase, Default key

• SSID, see section **3.3.7.1**.
• Passphrase, see section **3.3.7.4**.
• Default Key, see section **3.3.7.5**

Authentication

• Use WPA2-PSK for the most secure connection.

• No security can be used to conserve battery power.

DHCP

• For initial configuration, it is recommended to use DHCP for assigning IP Address to the Transmitter. The IP address can be made STATIC from the Virtual Coordinator after the Transmitter starts communicating with it.

Virtual Coordinator Port

• Architecturally, it is recommended to use UDP protocol. TCP protocol is not very well suited for this type of application.

Save and Reboot

• The Transmitter stays in AD-HOC mode for a few minutes and then goes to sleep to conserve battery. So the step to put the device into AD-HOC mode and to configure it using a web page needs to be done together.

• Also during this time, it is recommended to set the "Update Period" to the default (10 seconds). Once the Transmitter and the VC are communicating properly, the "Update Period" can be changed to the desired value.

VIRTUAL COORDINATOR OPERATIONS:

Virtual Coordinator

• The IP address for the VC is the same as the IP address of the computer on which the VC is installed.

• If the computer has more than one IP address, use the IP address that is on the same network as the Access Point.

• The VC can be accessed from the same computer on which it's installed or it can be access from a different computer on or outside the local network.

Setup Menu

• The username and password can be changed or disabled. See the Security menu for details.

TX Configuration – Network

• The default name for a Transmitter is TX followed by the last 4 characters of the Transmitter's MAC address (i.e. TXd259).

• Cookie feature must be enabled for the web browser.

Last Updated

• The date and the time come from the computer on which the Virtual Coordinator is installed.

Network – Wireless

Access Point SSID

• See section **3.3.7.1**.

Network – Network

DHCP

• To conserve battery power it's strongly recommended to use a STATIC IP address (DHCP un-checked) for your Transmitter.

Network – Virtual Coordinator

IP Address

• You need to make sure that the IP address for the Virtual Coordinator will not change; otherwise, the Transmitter will not retain its connection with the Virtual Coordinator. For this reason using a STATIC IP address for the Virtual Coordinator is strongly suggested. If using DHCP for the Virtual Coordinator IP, reserve the assigned IP Address in the DHCP Server table to ensure the Virtual Coordinator always gets the same IP Address.

Port

• If the default port number of 50002 or 50006 is not available, then use another number, and change the setting in the Virtual Coordinator Manager.

Network – Transmitter

Update

• Depending on your update rate, your data files can become very large. For example: if you select Continuous which is about 3 readings per second. One week can equal 1,814,400 readings or 1 year can equal 94,348,800 readings.

Mode

• If your Update rate is 10 seconds or less, use Power Save Enabled.
If your Update rate is 10 to 60 sec. you can use Power Save Enabled or Disabled.
If your Update rate is more than 60 sec., use Power Save Disabled, since your access point may disconnect due to inactivity.
If you manually power recycle the transmitter, and if the update rate is more than 5 minutes, you may need to power recycle twice.

• If the Power Save mode is enabled the Signal Strength will only be updated if there is a packet loss.

TX Configuration – Sensors

Group

• Once a Group is selected, use the drop down menu for the Group next to the Transmitter drop down menu to view/edit sensor settings.

TX Configuration – Sensor Input Type

Unit

• Once the unit of measurement is selected it will be a global change throughout the Virtual Coordinator as well as on the LCD display.

Adjust by

• The adjusting values must be assigned after the unit of measurement (i.e. C or F) is selected. If the unit is changed, you must readjust the values for a correct result.

• The latest readings are displayed to the right of the Sensors web page to make the adjustment easier if needed.

Cold Junction Compensation

• A correct TC Type must be selected before doing cold junction compensation.

TX Configuration – Alarms

• A Transmitter can be selected from the top right drop-down menu.

• In order to send email alarms you must configure the SMTP settings on the Management page.

• You must check the box for each event and click on Save Changes button.

Temperature Events

• There is a Message box under each event. The text content typed inside the box will be included in the body of the received email.

TX Configuration – System

• The new firmware should be placed in your Virtual Coordinator's directory at "Virtual Coordinator\ftpserver\res\home\public" before the firmware upgrade is initiated. Refer to the web for step by step instructions.

• It takes about two minutes for a complete firmware upgrade. You can start firmware upgrade on one Transmitter and then move to the next ones.

Username / Password

• You can always use a different FTP server by simply providing the above parameters for that FTP server.

VC Configuration

TCP Server

• If you change the UDP or the TCP port number on the Virtual Coordinator you must also change it on the Transmitter. Both TCP and UDP servers are running at one time and the Transmitter sends data using TCP or UDP based on the protocol selected.

OPC Server

• You will need to change the Transmitter's "label" to be 000, 001, 002.... Refer to the web for instructions on configuring the OPC server for wSeries Products.

Management

SMTP Server

• This specifies the TCP port used by the SMTP Server. You need to change it according to instructions provided by your SMTP service provider.

Username / Password

• Username and password are case-sensitive.

To

• Check each email individually, if one email is wrong none of the other emails will go through.

Security

Admin

Caution: When you disable the admin password but have user password enabled, the user can access the VC.

Diagnostics

Battery

The two C-cell batteries in battery-powered Transmitters are wired in parallel; therefore, the combined voltage level is the same as a single battery

Signal Strength

• With a Signal Strength of over 20% you have a stable wireless communication. If the Signal Strength falls below 20% and stays for a long period of time you should check the Transmitter for distance and interference.

• If the Power Save mode is enabled the Signal Strength will only be updated if there is a packet loss.

Success Rate

• If the Success Rate is 100% that indicates that there is no packet loss. Having Success Rates of less than 100% is normal since the Transmitter will retransmit the lost packets.

Chart

• Along the chart line there are pointers that would display time-stamped sensor readings once they're pointed with the mouse.

End Date

• It's always important to first select a desired chart Period before picking an End Date.

Display Choice

• Once you leave the chart page for a Transmitter all the settings will get saved.

Gauge

• For Analog Gauges you can eliminate the extra digits by changing the Settings: Start: 0 End: 60

Data

• The name of the data file in the Archived Recorded Data is based on the date and the time the data file was moved into the Archived Recorded Data which is the same as when the Transmitter was rebooted.

ENVIRONMENT / OPERATING CONDITIONS:

Refer to complete section for important notes.

SPECIFICATIONS:

Power

• Battery life is dependent on environmental conditions and transmitter settings, and will be adversely impacted by loss of connection with access point.

• 7 years is the shelf life of the battery.

Appendix I   Warnings and Regulatory Information

⚠️ In order to comply with FCC radio frequencies (RF) exposure limits, dipole antennas should be located at a minimum 7.9" (200mm) or more from the body of all persons.

This device complies with part 15 rules. Operation is subject to the following two conditions:
1) this device may not cause harmful interference, and

2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits of a Class B 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 residential environment. This equipment generates, uses, and radiates radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference. However, there is no guarantee that interference will not occur. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one of the following measures:
  • Reorient or relocate the receiving antenna.
  • Increase separation between the equipment and receiver.
  • Connect the equipment to an outlet on a circuit different from which the receiver is connected.
  • Consult dealer or an experienced radio/TV technician.

CE ⓘ The following alert sign indicates that there are restrictions on usage of the equipment in regards to power limitations on Equivalent Isotropic Radiated Power (EIRP) levels in the European Community.

The following are user restrictions:

  • Wideband Data Transmission Systems on the band 2400 – 2483.5 MHz in Europe is limited to a Maximum of 10 mW EIRP (10 dBm EIRP) for Direct Sequence Spread Spectrum (DSSS). See Annex 3 of ERC/REC 70-03, decision ERC/DEC/ (01)07.

  • Europe limits the isotropic radiated power (EIRP) to less than -10 dBm (100mW) for any combination of power level and intended antenna.

  However, wideband data transmission systems, including RLANs, belong to sub-clause 22, (2400 - 2454 MHz), and when the equipment can operate at 100mW across the whole frequency band (2400 – 2483.5 MHz) they are not considered a Class 1 device.

  Devices can be operated in the EU without restrictions indoors, but can not be operated outdoors in France, in the whole band, until further notice.

  Devices must be marked with the alert sign CE ⓘ accordingly to inform the consumer, some countries might have other restrictions.
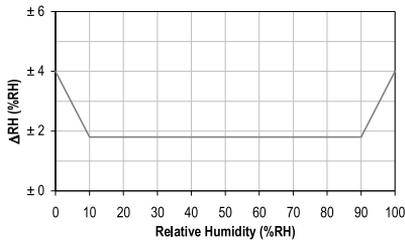
  Device Class 1, sub-clause 22
  2400 – 2483.5 MHz 10mW EIRP *
  2400 – 2454 MHz 100mW EIRP

  *If operating from 2454 to 2483.5 MHz at 100mW, then they are not Class 1, but Class 2.
   More information can be found at *www.ero.dk/rtte*
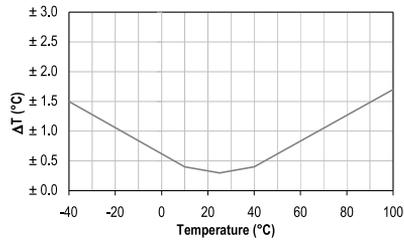
Appendix J   Sensor Information

## J.1 Accuracy

Figure J.1
RH Accuracy Chart

Figure J.2
Temperature Accuracy Chart

Accuracies are tested at Manufacture's Outgoing Quality Control at 25°C (77°F) and 3.3V. Values exclude hysteresis and non-linearity, and is only applicable to noncondensing environments.

J.2 Operating Conditions

Sensor works stable within recommended normal range – see Figure. Long term exposures to conditions outside normal range, especially at humidity >80%RH, may temporarily offset the RH signal (+3% RH after 60h). After return to normal range it will slowly return towards calibration state by itself. See **Section J.4** "Reconditioning Procedure" to accelerate eliminating the offset. Prolonged exposure to extreme conditions may accelerate aging.
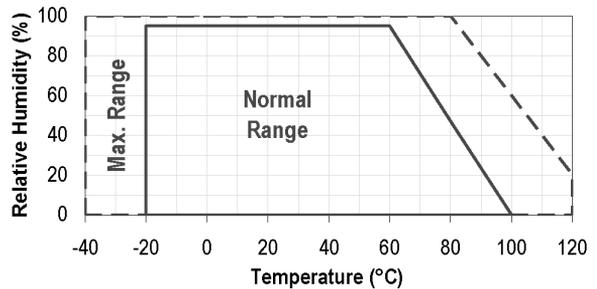
Figure J.3 Normal Range

J.3 Storage Conditions and Handling Instructions

It is of great importance to understand that a humidity sensor is not a normal electronic component and needs to be handled with care.

Chemical vapors at high concentration in combination with long exposure times may offset the sensor reading. For these reasons it is recommended to store the sensors in original packaging including the sealed ESD bag at following conditions: Temperature shall be in the range of 10°C – 50°C (0 – 80°C for limited time) and humidity at 20 – 60%RH (sensors that are not stored in ESD bags). For sensors that have been removed from the original packaging we recommend to store them in ESD bags made of PE-HD8.

In manufacturing and transport the sensors shall be prevented of high concentration of chemical solvents and long exposure times. Out-gassing of glues, adhesive tapes and stickers or out-gassing packaging material such as bubble foils, foams, etc. shall be avoided. Manufacturing area shall be well ventilated.

Appendix J Sensor Information (continued)

J.4 Reconditioning Procedure

As stated above extreme conditions or exposure to solvent vapors may offset the sensor. The following reconditioning procedure may bring the sensor back to calibration state:

Baking: 100 – 105°C at < 5%RH for 10h

Re-Hydration: 20 – 30°C at ~ 75%RH for 12h.

(75%RH can conveniently be generated with saturated NaCl solution. 100 – 105°C correspond to 212 – 221°F, 20 – 30°C correspond to 68 – 86°F)

J.5 Temperature Effects

Relative humidity reading strongly depends on temperature. Therefore, it is essential to keep humidity sensors at the same temperature as the air of which the relative humidity is to be measured. In case of testing or qualification the reference sensor and test sensor must show equal temperature to allow for comparing humidity readings.

The packaging of sensor is designed for minimal heat transfer from the pins to the sensor. Still, if the sensor shares a PCB with electronic components that produce heat it should be mounted in a way that prevents heat transfer or keeps it as low as possible. Furthermore, there are self-heating effects in case the measurement frequency is too high.

J.6 Light

The sensor is not light sensitive. Prolonged direct exposure to sunshine or strong UV radiation may age the housing.

J.7 Materials Used for Sealing / Mounting

Many materials absorb humidity and will act as a buffer increasing response times and hysteresis. Materials in the vicinity of the sensor must therefore be carefully chosen. Recommended materials are: Any metals, LCP, POM (Delrin), PTFE (Teflon), PE, PEEK, PP, PB, PPS, PSU, PVDF, PVF. For sealing and gluing (use sparingly): Use high filled epoxy for electronic packaging (e.g. glob top, underfill), and Silicone.

Out-gassing of these materials may also contaminate the sensor (see **Section J.3**). Therefore try to add the sensor as a last manufacturing step to the assembly, store the assembly well ventilated after manufacturing or bake at 50°C for 24h to outgas contaminants before packing.

Appendix K   Firewall Settings for Windows XP and Vista

Firewall protects a computer from external attacks. They typically restrict connections to all the ports on a computer that an external program can connect to. But there are times when you need to allow external programs to send data to your PC. To do that, you add exceptions to the firewall. This involves opening up only certain ports. Ports are of type UDP or TCP.

K.1 First go to Control Panel and click the icon of Windows Firewall. In case of Windows Vista, the icon is under System and Security.

Figure K.1 Control Panel

K.2 In General tab, Make sure that the firewall is "ON" and the checkbox for "Don't allow exceptions" is unchecked.
Now, click the "Exceptions" tab.

Figure K.2 General Tab

K.3 Click the button that says "Add Port" to add a UDP/TCP port.

Figure K.3 Exceptions

K.4 Add the UDP port first that is used for Transmitter data to the Virtual Coordinator.
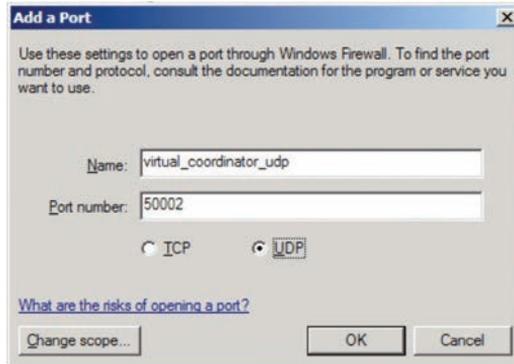
Figure K.4 Add a Port - TCP

Similarly add TCP ports for 50006 (TCP port for transmitter data), 2000 (command server), 21 (ftp port for firmware upgrade), 80 (TCP type for web server).
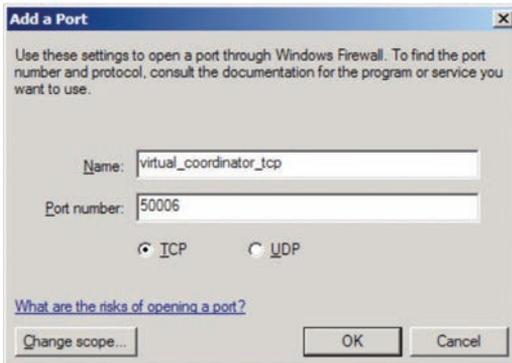
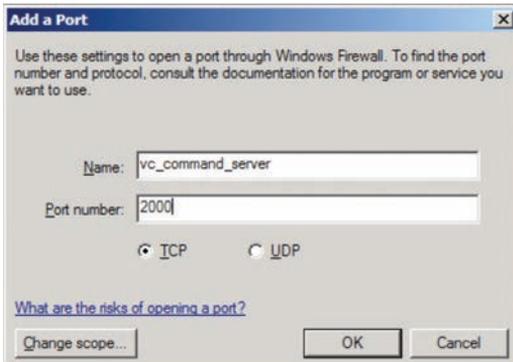**Figure K.5 Add a Port - TCP**
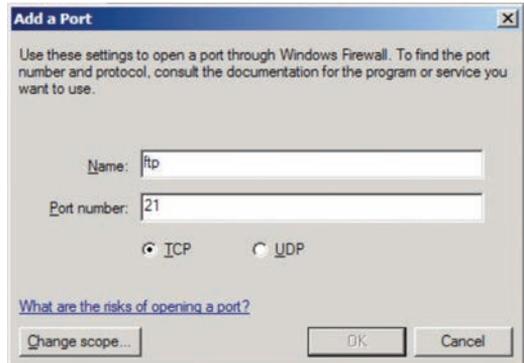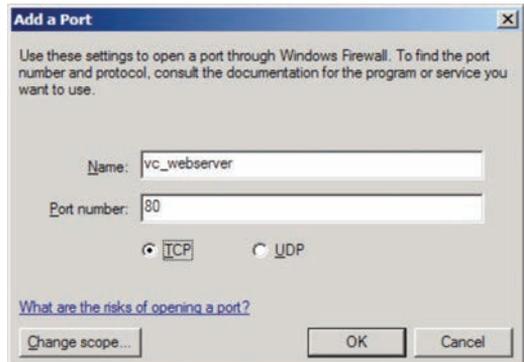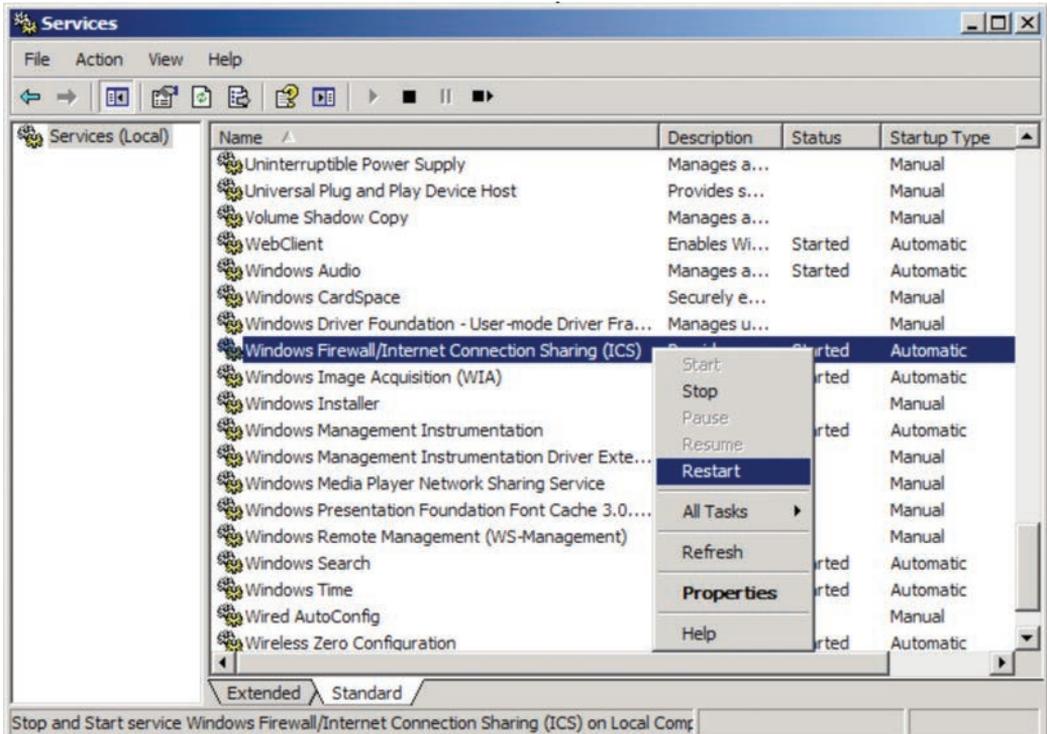

Figure K.6 Add a Port - TCP

Figure K.7 Add a Port - TCP

Figure K.8 Add a Port - TCP

K.5 Restart the Windows Firewall service. Go to Control Panel->Administrative tools->Services. Locate the Windows Firewall/Internet Connection Sharing service and restart it. For Windows Vista the name of the service is Windows Firewall only.

Figure K.9 Services

Appendix L   Firewall Settings for Windows 7 and Server 2008

Firewall protects a computer from external attacks. They typically restrict connections to all the ports on a computer that an external program can connect to. But there are times when you need to allow external programs to send data to your PC. To do that, you add exceptions to the firewall. This involves opening up only certain ports. Ports are of type UDP or TCP.

L.1 First go to Control Panel and click the icon of System and Security.   Choose the Windows Firewall.

Figure L.1 System and Security

Figure L.2 Windows Firewall

Click the option to Turn Windows Firewall ON or OFF.

Figure L.3 Turn Windows Firewall ON or OFF

L.2 Turn ON the firewall and check the option to Notify when Firewall blocks a program.
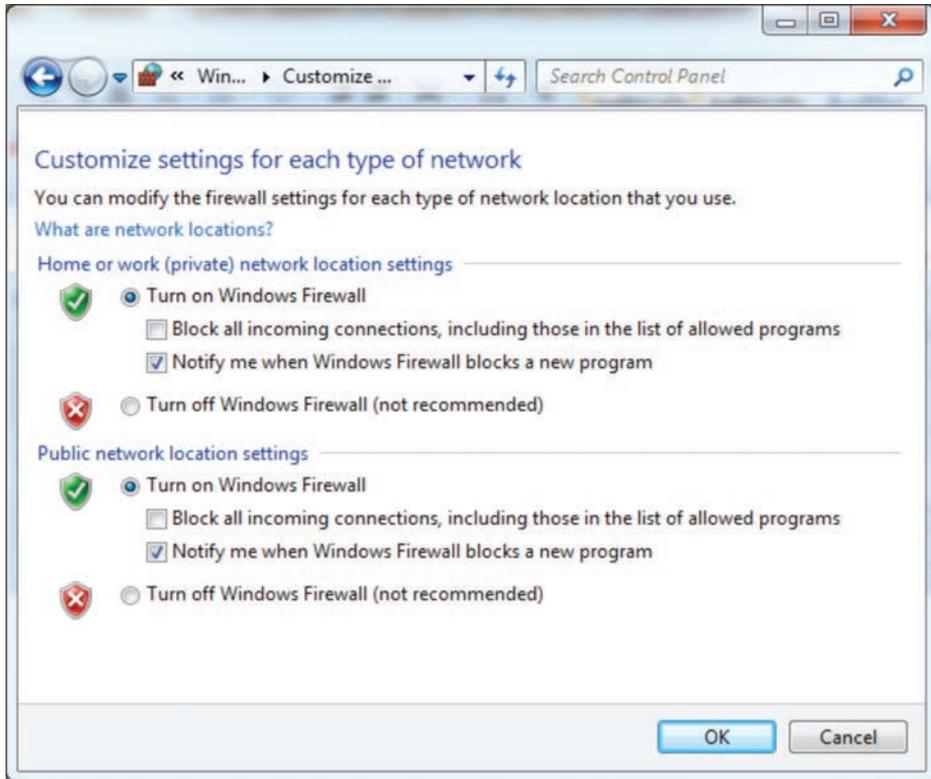
Figure L.4 Turn Windows Firewall ON

L.3 Go to Advanced settings to open the desired ports.

Figure L.5 Windows Firewall - Advanced Settings

Then choose the section of Inbound Rules. The exceptions apply to Inbound Rules (incoming connections to the PC). Choose the New Rule link on the right side under the tab Actions.
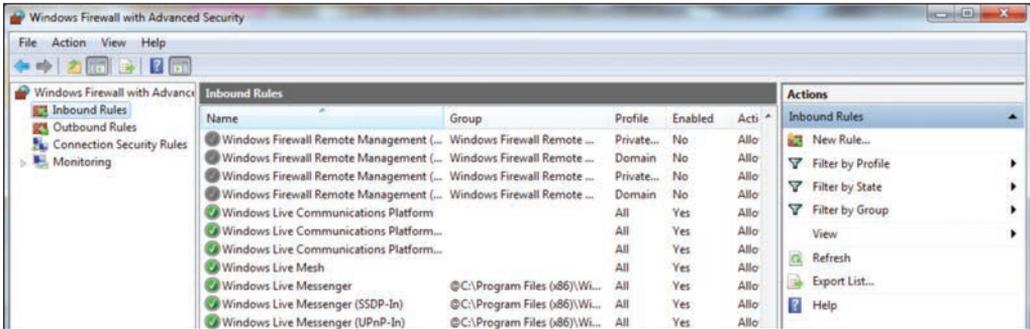
Figure L.6 Windows Firewall - Inbound Rules

Choose the option to create a rule for a particular port and click Next.

Enter the port number 50006 (or whatever is the port for TCP data communication between transmitter and Virtual coordinator) and choose type of TCP.
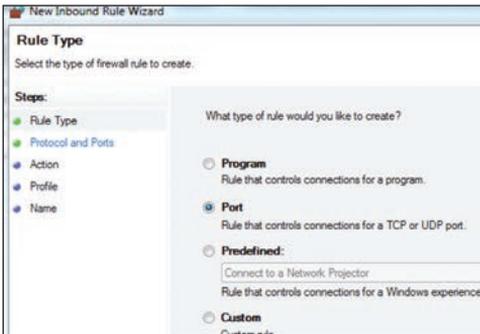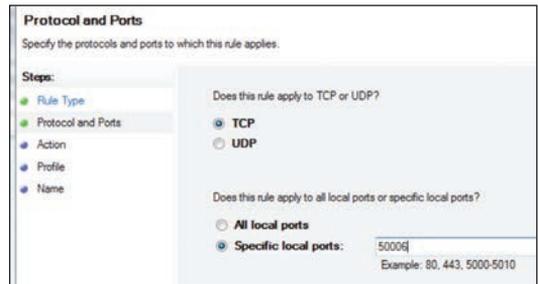
Figure L.7 Windows Firewall - Rule Type

Figure L.8 Windows Firewall - Protocol and Ports

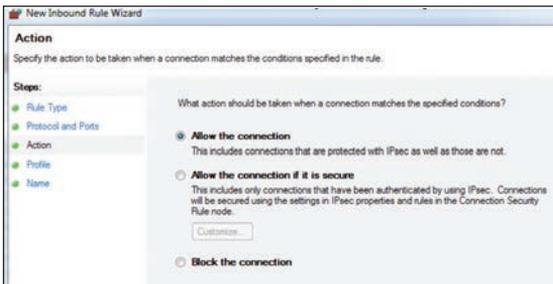Choose Allow the connection. We are allowing data from this port.

Then choose the profile for Domain, Private and Public networks.

Figure L.9 Windows Firewall - Action

Figure L.10 Windows Firewall - Profile

Give a name for the rule. We give "virtual_coordinator_TCP" port.

Figure L.11
Windows Firewall -Name

L.4 Now do the same thing for UDP based port 50002.

Figure L.12
Windows Firewall -Protocol and Ports

Figure L.13
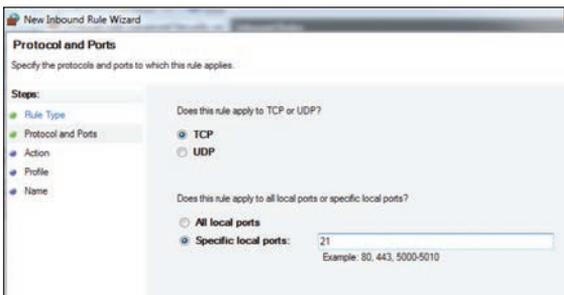**Windows Firewall - Name**

Then for FTP firmware upgrade port 21.

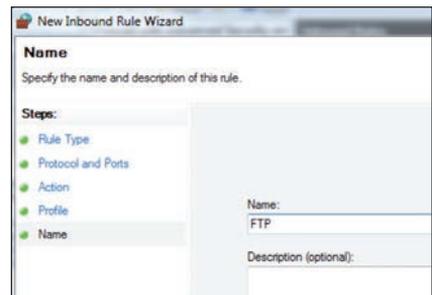**Figure L.14**
Windows Firewall -Protocol and Ports

Figure L.15
Windows Firewall - Name

Add the port 2000 for command server as well.

Figure L.16
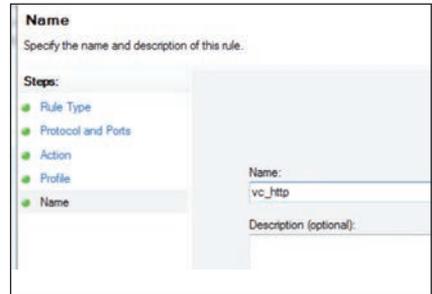**Windows Firewall -Protocol and Ports**

Figure L.17
Windows Firewall - Name

Finally add the HTTP(Web) server port

Figure L.18
Windows Firewall - Protocol and Ports

Figure L.19
Windows Firewall - Name

L.5 Now all the rules have been added to the inbound rules. The Virtual coordinator should be accessible from all other computers and get the readings.

Figure L.20 Windows Firewall - Inbound Rules

L.6 You can enable, disable or change the properties of the rule by right click it.
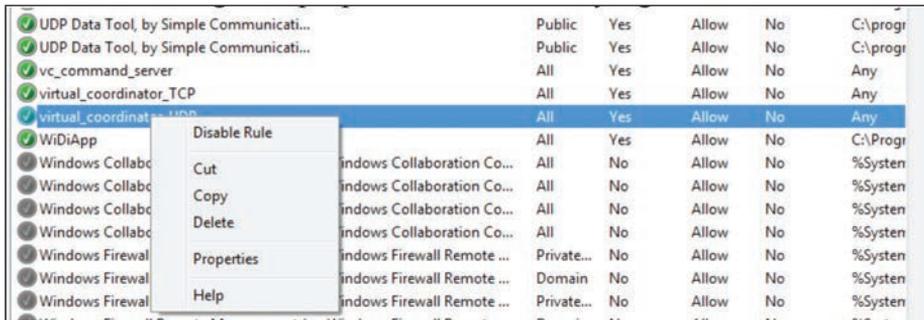

Figure L.21 Windows Firewall - Rules

Appendix M   Configuring STATIC IP Address for Windows

Every active device connected to the TCP/IP network must have a unique IP address. This IP address is used to establish a connection to the VC.

Every computer using TCP/IP should have a unique 32-bit address which is divided into two portions, the network ID and the host ID.

For instance, every computer on the same network uses the same network ID. At the same time, all of them have a different host ID. For more details about the IP address see **Appendix B**.

M.1 Changing TCP/IP Properties on Your Computer

Go to your computer's **Control Panel** then **Network Connections**.
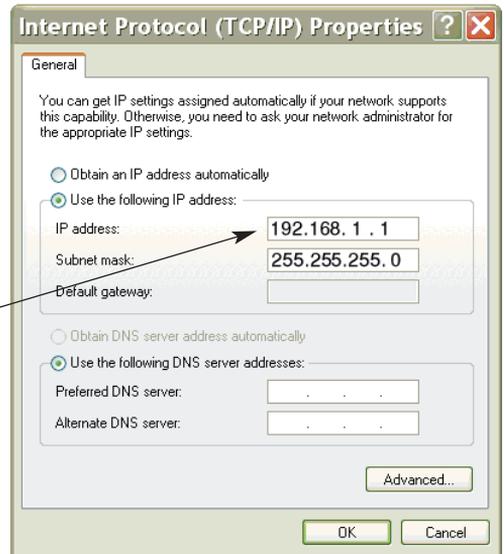
Pick the network with the proper Ethernet card. Right click and choose **Properties.**
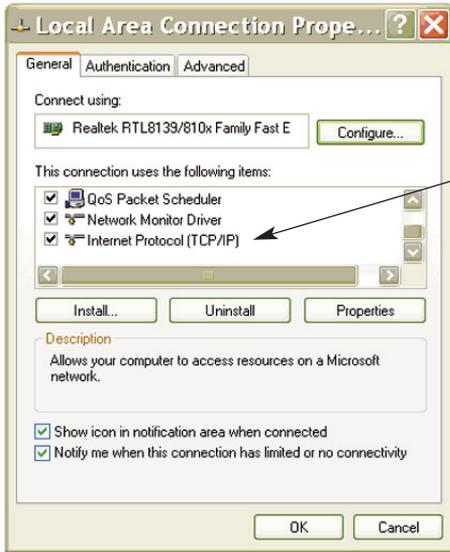
Look for **Internet Protocol,** click on it and press **Properties**

Figure M.1 Network Connections

It is recommended to setup a STATIC IP address here so that the Transmitter will be able to send its data to the VC correctly

Figure M.2 Network Connections

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