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User's Guide

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HHF1000 SERIES
AIR VELOCITY/TEMPERATURE
METER

HHF1000 SERIES
Handheld Air Velocity/
Temperature Meter with Wireless
PC Communication Option

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Section 1 - Introduction

The HHF1000 series handheld air velocity/temperature meter measures and displays air velocity mass flow and air temperature of clean air flows in ducts & pipes, while producing very little pressure drop in the flow stream. The HHF1000 series can be used in research & development labs, HVAC applications, and other manufacturing processes. The sensor design is based on three RTD elements, one measures the air temperature and the other two measure the air velocity. The air velocity is measured based on the heat loss from the RTD velocity sensor as it cools down by the air flow.

The HHF1000 series offers many standard features such as dual display of air velocity & temperature, high & low alarm indications for air velocity, volume air flow measurement, USB PC interface with a Windows based PC interface software. The HHF1000 displays the air velocity in feet per minute (FPM), meter per second (m/s), miles per hour (MPH), and kilometer per hour (Km/h). The air temperature is displayed in ºF & ºC. The volume air flow is displayed in Cubic Feet per minute (CFM) and Cubic meter per minute (CMM). The sensor probe is 12" long as standard. The 304 Stainless steel sensor tubing is provided with inch marks for ease of insertion depths. The sensor probe comes in two different versions as follows:

- Fixed 12 inches long Probe
- Telescopic probe adjustable from 10 to 36 inches

The unit powers from a 9V battery or a 9Vdc adapter.

The following table shows all the models of this product:

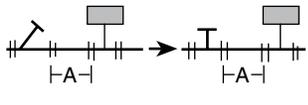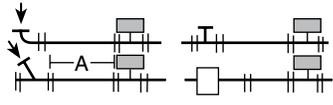| Model No.	Velocity Range FPM(m/s)	Description
HHF1001A	0 to 5000 (0 to 25.4)	Air velocity/temperature meter, Fixed probe
HHF1001R	0 to 5000 (0 to 25.4)	Air velocity/temp meter with remote Telescopic Probe
HHF1001A-W	0 to 5000 (0 to 25.4)	Air velocity/temp meter, fixed probe & wireless
HHF1001R-W	0 to 5000 (0 to 25.4)	Air velocity/temp meter, telescopic probe & wireless

Important considerations before installation

▼ NOTE:

The HHF1000 air velocity/temperature meter is not explosion proof, nor is it Intrinsically safe. Do not use for flammable or hazardous gases, or in Hazardous areas.

The HHF1000 series air velocity/temperature meter is intended for use with clean air or Nitrogen ONLY. Do not use with other gases, as it will produce an un-calibrated and non-linear display measurement. In addition, air carrying dust or oil (such as found in blower/compressor systems that utilize oil) can lead to coating of the sensor and thus inaccurate readings. Refer to the Maintenance section (page 4-3) for information on cleaning the sensor.

The HHF1000 is a bi-directional device, meaning the air flow in the forward or reverse direction provides the same readings.

Section 2 - Installation

1. Install the 9V battery in the battery compartment of the case. You can remove the battery door to get to the compartment.

2. Remove the protective cap from the sensor tip.

3. Run a length of straight pipe before and after the flow sensor probe. The amount of upstream straight pipe required depends on the type of obstruction which is immediately upstream of the flow sensor. See Table 1 (on next page) for specific requirements. Downstream of the flow sensor, in all situations, run 5 diameters of straight pipe regardless of the downstream obstruction.

4. Align the sensor probe with the air flow. Make sure the air flow is perpendicular to the sensor window. The score line on the sensor tubing is another way of aligning the sensor to the flow stream. The score line starts from the center of the sensor window and as a result it can be aligned properly.

5. One way of installing the sensor probe into a flow stream is to utilize a compression fitting such as Omega's SSLK-14-14 stainless steel compression fitting with Teflon ferrule, which allows adjustment of the insertion depth of the probe.

6. Turn on the power switch and start measuring air velocity & temperature.

Typical Piping		Recommended Straight Pipe Length "A"		Remarks
		Without Vanes	**With Vanes**	
All Fittings in Same Plane		15D	15D	Closed Branch
		20D	15D	Elbow. Tee, Branch Pipe
		25D	15D	Elbow, 2 planes
		25D	15D	Long-radius bends
Fittings in Two Planes		30D 25D	15D 15D	Elbow Long-radius bends
		40D 35D	15D 15D	Elbow Long-radius bends
Varied Section		20D	15D	Contracting Pipe
		40D	20D	Expanding Pipe
Valves		Recommend Meter Be Installed Upstream		Regulating, reducing valves Ball, check valves Shut-off valves
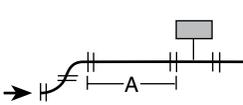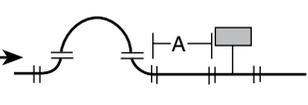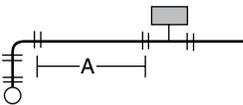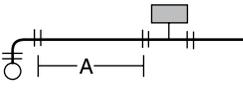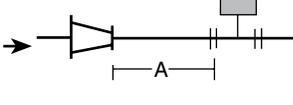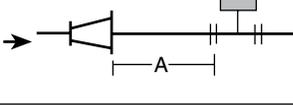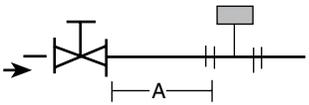
Note: Straight pipe length on the downstram side to be 5 pipe diameters minimum.
Note: D – Pipe internal diameter

Table 1. Piping Requirement

Figure 2-1 shows the general dimensions of the HHF1000 and all the controls.

Figure 2-2 shows the HHF1000 with fixed probe mount and remote telescopic probe.

DIMENSIONS mm (in)

PROBE INPUT

POWER
O ▮▮▮ I

33.27
(1.310)

AIR/TEMP PROBE CONNECTION

77.77
(3.062)

Ω OMEGA
HHF1000 SERIES

4634 FPM
128.7 °F

AIR VELOCITY/TEMPERATURE
METER

MODE

SET

°F-°C

RX
TX

DC POWER
INPUT
9V
100mA
+
-

USB
PORT

RUBBER
BOOT

KEYPAD

RUBBER
BOOT

TRANSMIT
& RECEIVE
LEDs
(WIRELESS
VERSION)

USB PC
INTERFACE

DC ADAPTER
INPUT

CASE SCREWS

FCC ID: OUR-XBEEPRO
IC #4214A-XBEEPRO
This device complies with Part 15 of the FCC
rules. Operation is subject to the following
two conditions:
1- This device may not cause harmful
interference.
2- This device must accept any interference
received, including interference that may
cause undesired operation.
Made in U.S.A.   FC△ 🗑

BACK
LABEL
(WIRELESS
VERSION)

121.41
(4.78)

BATTERY COMPARTMENT
(ONE 9V SIZE BATTERY)
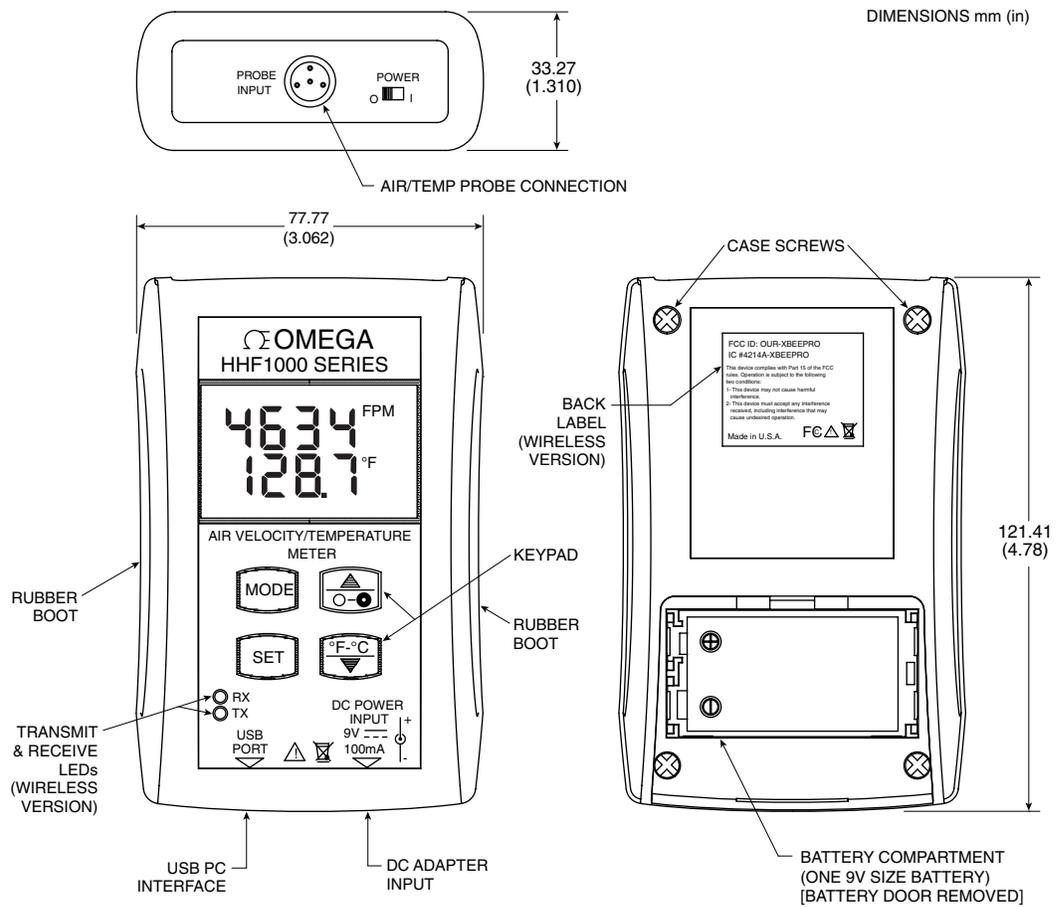[BATTERY DOOR REMOVED]

Figure 2-1. HHF1000 General Dimensions and Controls
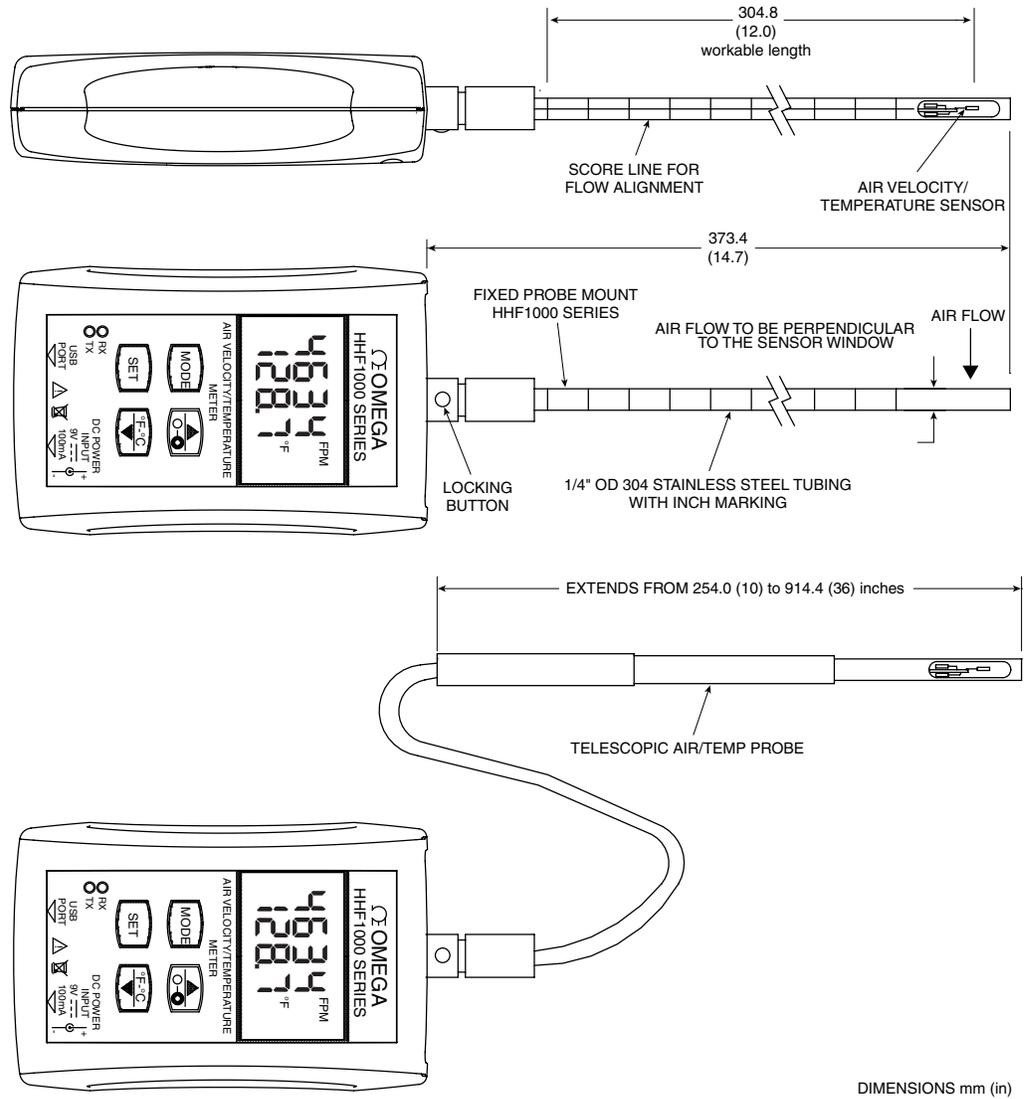
Figure 2-2. HHF1000 Fixed Probe Mount and Remote Telescopic Probe

Section 3 - Main Operation

The HHF1000 transmitter has a built-in LCD backlit display and keypad. Using the display and keypad, you can view the following parameters:

- The air velocity & air temperature in real time (Main Display)
- Maximum air velocity & temperature during the session
- Minimum air velocity & temperature during the session
- Volume air flow in Cubic feet per minute (CFM) or Cubic meter per minute (CMM)

You can view and set the following parameters from the keypad:

- High Alarm set point for air velocity
- Low Alarm set point for air velocity
- Display's response time
- Cross sectional area of the air flow duct
- Atmospheric pressure setting in millimeter of Mercury (mmHg).
- Setting the Auto Power shut off feature to ON or OFF.

If the unit has wireless PC communication capability, you can view and set the following parameters:

- Turn the Wireless Radio on or off.
- View the data transmission interval in seconds. You can change this parameter from the End Device Configuration software.
- View the unit ID address. You can change this parameter from the End Device Configuration software.

The wireless version communicates with the UWTC-REC1 wireless receiver. You can transmit air velocity and air temperature data to the UWTC-REC1 and be able to display and graph data on the TC central software application.

Changing Display Engineering Units - You can change the air velocity Engineering unit display from Feet per minute (FPM) to meter per second (m/s), miles per hour (MPH), and kilometers per hour (Km/h) from the keypad (Press SET key). You can change the Temperature display from °F to °C or vise versa by pressing the Down key.

Turn On Display Backlight - You can turn the LCD backlight on or off by pressing the UP key. The backlight will turn off after 10 seconds if the UP key is not pressed again.

High & Low Alarm Set Points - You can set and enable the high & low alarm set points for the air velocity as shown in the keypad flow chart. When in the alarm condition, the HAL or LAL icon will flash on the LCD.

Display Volume Air Flow - The unit calculates volume air flow by multiplying the air velocity by the cross sectional area of the pipe or the duct. The cross sectional area can be set in the display menu as shown in the keypad flow chart in square inches units. The volume air flow is shown in Cubic feet per minute or Cubic meter per minute when air temperature is displayed in Degrees C.

Auto Power Shutoff – You can turn on the auto power shutoff feature (Default is ON) to save battery life. If no keys are pressed for 5 minutes, the unit will shut down to save battery life. Pressing any key will turn the unit back on.

Table 2 shows the Keypad Functional Flow Chart.

Operation	Press **MODE**	Press **SET**	Press **▼ °F-°C**	Press **▲ ○-●**
Real Time	Go to Max Mode	FPM → m/s ↓ Km/h ← MPH	°F → °C or vice versa	Turn On/off LCD Light
Display Max Vel. & Temp MAX Icon	Go to Min Mode	_____	_____	Reset Max, Min, Velocity & Temperature
Display Min Vel. & Temp MIN Icon	Go to Volume Air Flow Mode	_____	_____	Same
Display Vol. Flow In CFM or CMM	Go to High Alarm Mode Velocity	_____	_____	_____
Display High Alarm Velocity Set Point	Go to Low Alarm Mode Velocity	Enable/Disable High Alarm, HAL Icon when enabled	Increment high Alarm Set Point	Decrement high Alarm Set Point
Display Low Alarm Velocity Set Point	Go to Display Response Time Mode	Enable/Disable Low Alarm. LAL Icon When Enabled	Increment Low Alarm Set Point	Decrement Low Alarm Set Point
Display LCD Response time	Go to Cross Sec. Area Mode	_____	Increment Response Time	Decrement Response Time
Display Cross Sectional Area Sq In	Go to Atmos. Press. Mode	_____	Increment Cross Sec. Area	Decrement Cross Sec. Area
Display AtPr & mmHg Icon	Go to Power Shutoff Mode	_____	Increment Atmospheric Pressure	Decrement Atmospheric Pressure
Display Power Shutoff	Go to Real Time Mode OR Go to Radio Mode (Wireless)	Turn On/off	_____	_____
Display Radio Mode	Go to Time Interval Transmission	Turn On/off	_____	_____
Display Time Interval Transmission	Go to Transmission Unit ID	_____	_____	_____
Display Transmitter Unit ID	Go to Real Time Mode	_____	_____	_____

Table 2. Keypad Functional Flow Chart

NOTE:

The HHF1000 air velocity/temperature meter saves the
following parameters in the non-volatile memory, so
removing the power will not affect these settings:
High & Low alarm air velocity set points & status (On or
Off) Display Response time in msec, Cross sectional area in
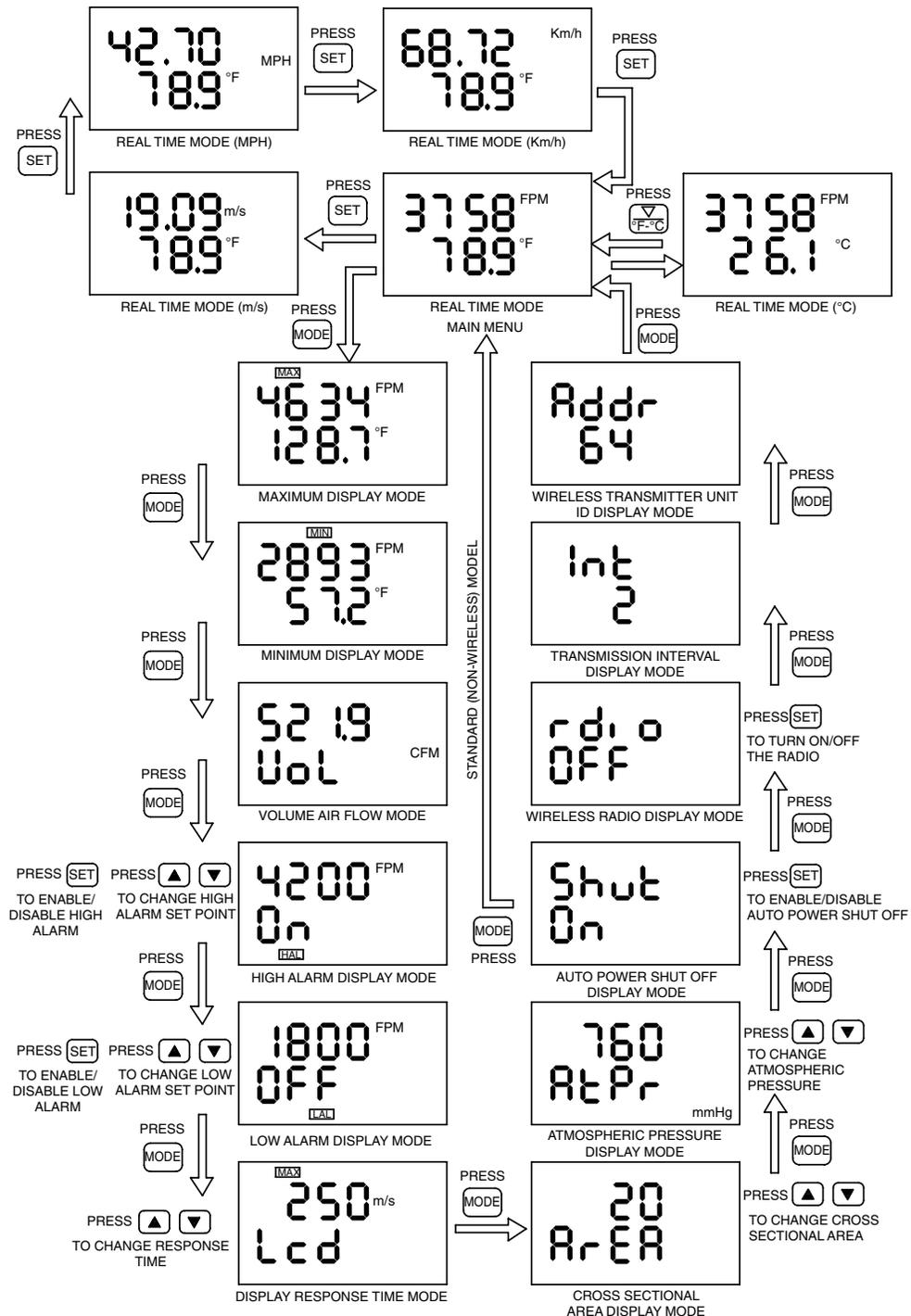Square inches, Atmospheric Pressure in mmHg

Figure 3-1. Display Functional Flow Chart

Section 4 - PC Interface

The HHF1000 series comes with a Windows based user application. This application runs on Windows XP, Vista, and Seven. It allows you to perform the following functions:

- Monitor and display the air velocity and temperature in real time, including line graph of the two channels.

- Display the air velocity and temperature in different Engineering units

- Change the upper and lower values for the two channels from auto, to manual. or logarithmic scale.

- Change the chart time base from 1 minute to 10 minutes, and one hour.

- Save the air velocity and temperature data to a file.

- Print the air velocity and temperature graphs to a printer.

Operation

- Install the user application.

- Connect the USB cable provided between the HHF1000 and the PC. For wireless version, make sure the radio is turned off.

- When the HHF1000 is connected to the PC for the first time, the PC recognizes the unit and it looks for the USB drivers. The necessary drivers are on the same CD.

The "Found new hardware wizard" program will open. Select "Install from the specific location" option and select the program CD where the drivers are located.

You are now ready to run the application. When the application is run, it establishes communication with the HHF1000 meter, and a "Go" button will show up on the Main window. Clicking the "Go" button will start the data logging session.

If the application can not establish communication, it will show an error message box, and the "Find" button will flash. Please check for the following:

- The meter is connected to a USB port of the PC

- Go to Settings menu and check the COM port number. Make sure you are using the right COM port on your PC. Choose 9600 for COM Baud Rate. You can check the connected COM port by opening the Device Manager (From the system properties) and review all the COM ports.

- Click the "Find" button, and the program should be able to establish communication. The "Find" button will change to "Go".

- Click the "Go" button, and the program will start to log data in real time. The display update is every 250 msec.

Figure 4-1 shows the Main window after logging some data. The main window shows the following:

- Display of line graph and digital values of air velocity and temperature in real time.

- Display high & low alarm lines and values for velocity

- Display response time in msec, volume air flow in CFM, cross sectional area in square inches, and the atmospheric pressure in mmHg.

- High & low alarm LED indicators for the velocity channel. The LED indicator will turn red when in alarm condition.

- Communication LED indicator. This is a flashing Green LED indicator to show good communication. If there is no communication, this LED will not flash.
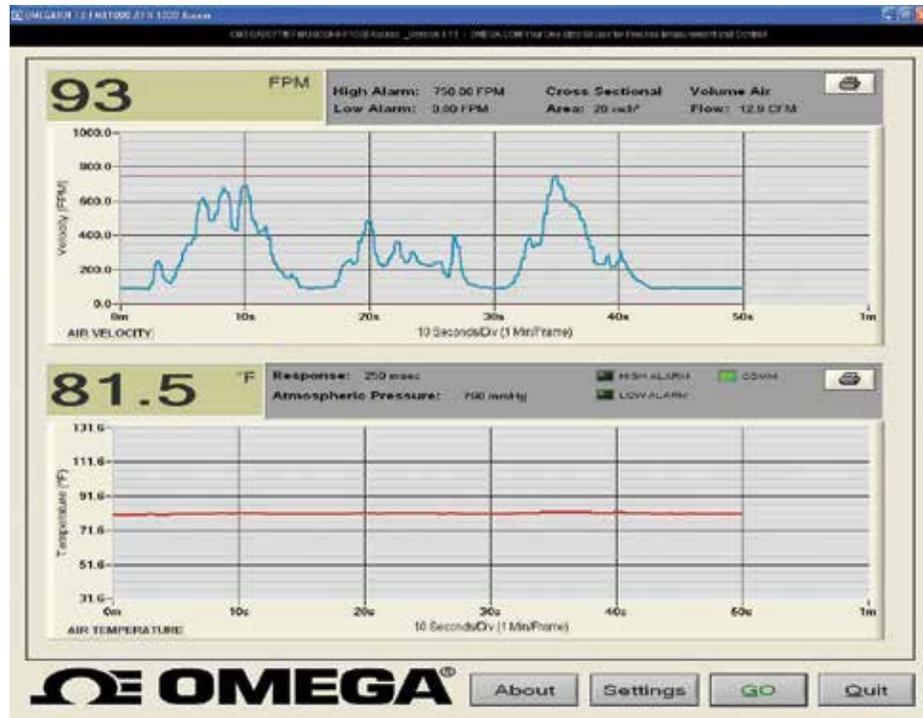
Figure 4-1. Main Window Screen

You can save the logged data into a data file. This file can be imported into Excel spread sheet for further analysis. Figure 4-2 shows a typical data file. You can save up to 144,000 sets of velocity and temperature data.

Figure 4-2. Typical Data File Screen

Figure 4-3 shows the Settings menu. You can set the following parameters:

- COM port number on your PC.
- Baud rate selection (9600 or 115200) Select 9600 for the HHF1001/ HHF1001W.
- Turn the audible indicator on/off.
- Engineering units for air velocity and temperature
- Select chart time base from 1 minute per frame (screen), 10 minutes, or one hour.
- Select manual, auto, or logarithmic scale of the air velocity or temperature. This function allows the user to set the Y scale for the air velocity and temperature to any value within its range.
- Select Save to file, History viewer, and Maximize start up.

When the "Save to File" is selected (Default), the program asks if you would like to save the data to a file when you stop the data logging, Figure 4-2 shows a typical data file saved.
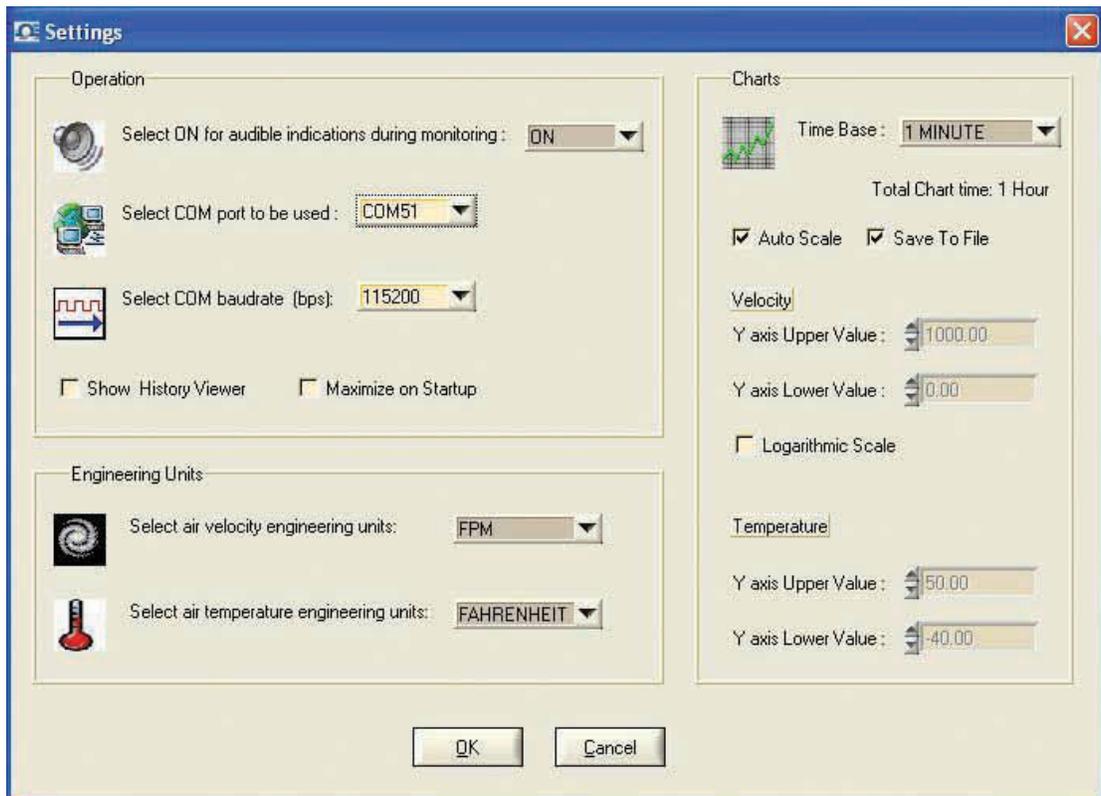
Figure 4-3. Settings Menu Screen

Maintenance

Except for intermittent removal of the sensor from the line for cleaning, there is no routine maintenance for the HHF1000. If the sensor probe becomes coated with dust, blow the dust away with clean air. If the sensor probe is coated with sticky material, clean it with water or alcohol (Ethanol) using an artist's brush.

Calibration

Each HHF1000 is individually calibrated in a NIST traceable wind tunnel. For calibration certification or calibrating to a new air flow range, the unit must be returned back to the factory.

Section 5 - Wireless PC Communications

The HHF1000 offers wireless PC communication on some of its models (HHF1001x-W). The unit has a built-in wireless module and it can transmit air velocity and air temperature in real time to our UWTC-REC1 wireless receiver.

The UWTC-REC1 then sends the incoming data to the PC. You can monitor and log the data from the TC central software application. Figure 5-1 shows the HHF1000 & UWTC-REC1 wireless system. Figure 5-2 (on next page) shows the wireless receiver general & mounting dimensions. Figure 5-3 (on next page) shows the FCC warning label of the HHF1000 wireless transmitter.
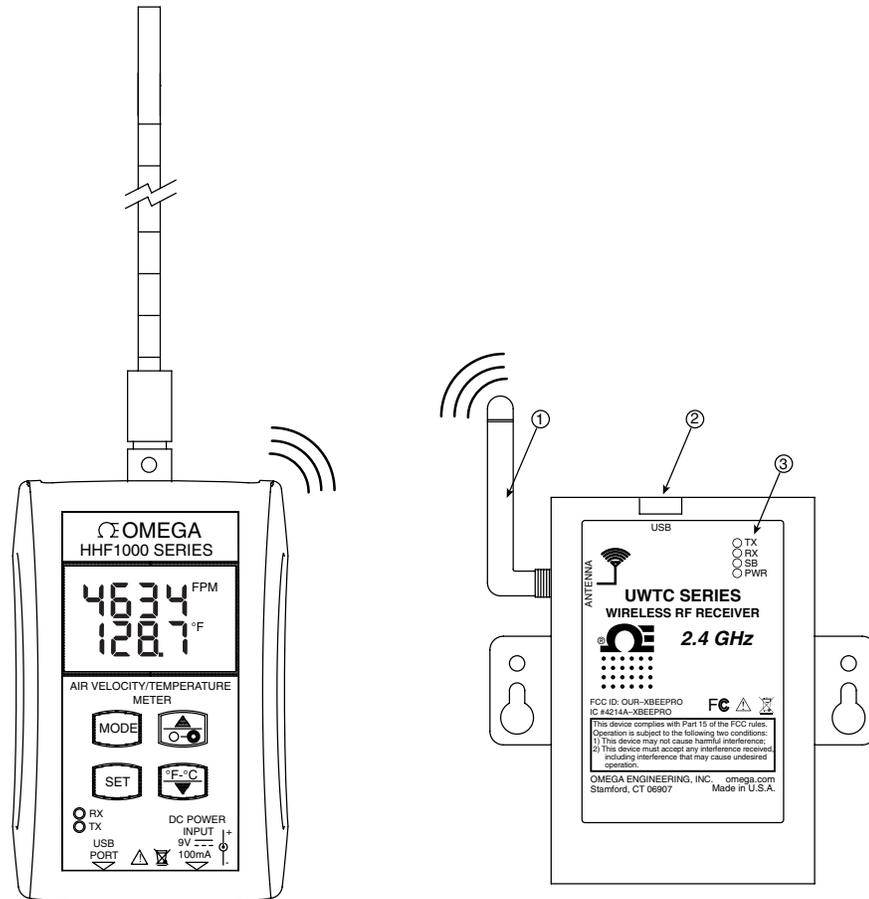

Figure 5-1. HHF1000 and UWTC-REC1 Wireless System

(1) Antenna

(2) USB PC Connector

(3) Indicator Lights as follows:

Transmit (TX) Green indicator light - The top green indicator light marked "TX" on the front of the receiver will only blink when the receiver is connected to your PC and you initialize your measurement software. After the receiver establishes communication with the program, the light will no longer blink. Note this may happen very fast and will not be noticeable.

Receiver (RX) red indicator light - The red indicator light marked "RX" on the front of the receiver will blink each time the receiver receives incoming data from one of the wireless transmitters.

Standby (SB) yellow indicator light - The yellow indicator light marked "SB" on the front of the receiver will blink continuously during normal operation. This indicates that the receiver is in Standby mode and is waiting for incoming data from the wireless transmitter.

Power (PWR) Green indicator light is for power indication.
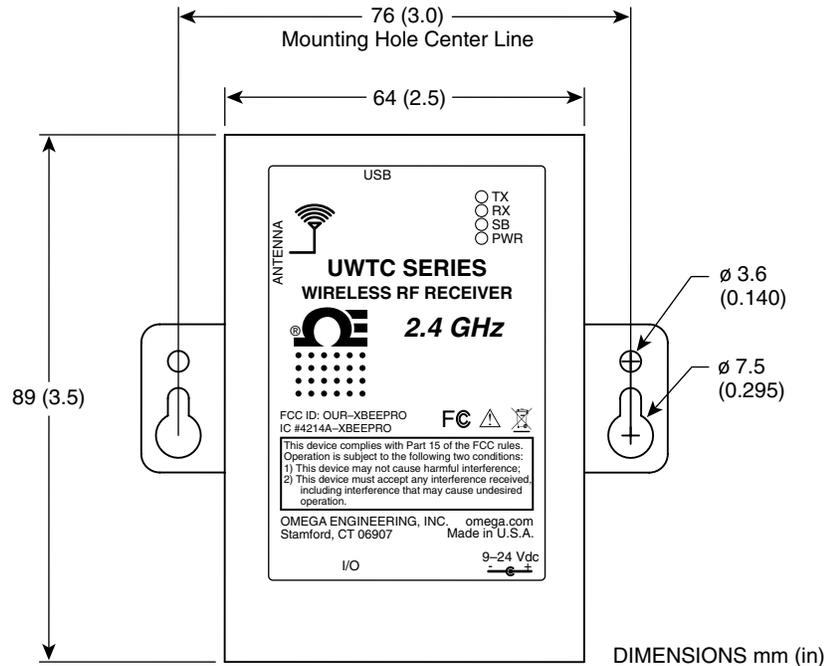
Figure 5-2. General And Mounting Dimensions

Figure 5-3. FCC Warning Label

The HHF1000 series comes with an additional Windows based user application. This program, TC Central, is used to monitor and log air velocity and air temperature wirelessly from the HHF1000 device. In addition, from the "Tools" menu, you can select "Configure End Device...", to Run the End Device Configuration Wizard. You can set the unit ID (Transmitter Address) and data transmission interval using this feature.

5.1 End Device Configuration

The wireless transmitter (HHF1001x-W) has the following default settings:

Data Transmission time interval: 2 seconds

Unit ID Address: 01

You can change the transmission interval and the unit ID address of the wireless transmitter using this software application. Connect the wireless transmitter to the PC USB port with the cable provided. Run the End device configuration software. The software will recognize the transmitter and allows the settings to be changed. You can set the data transmission interval from 1 to 60 seconds. You can have up to 48 wireless transmitters sending data to one wireless receiver. Figure 5-4 shows the End Device Configuration software establishing communication with HHF1000. Figure 5-5 shows the Options menu where you can change the Unit ID and the data sampling rate.

Figure 5-4. Establishing Communication With HHF1000 Screen
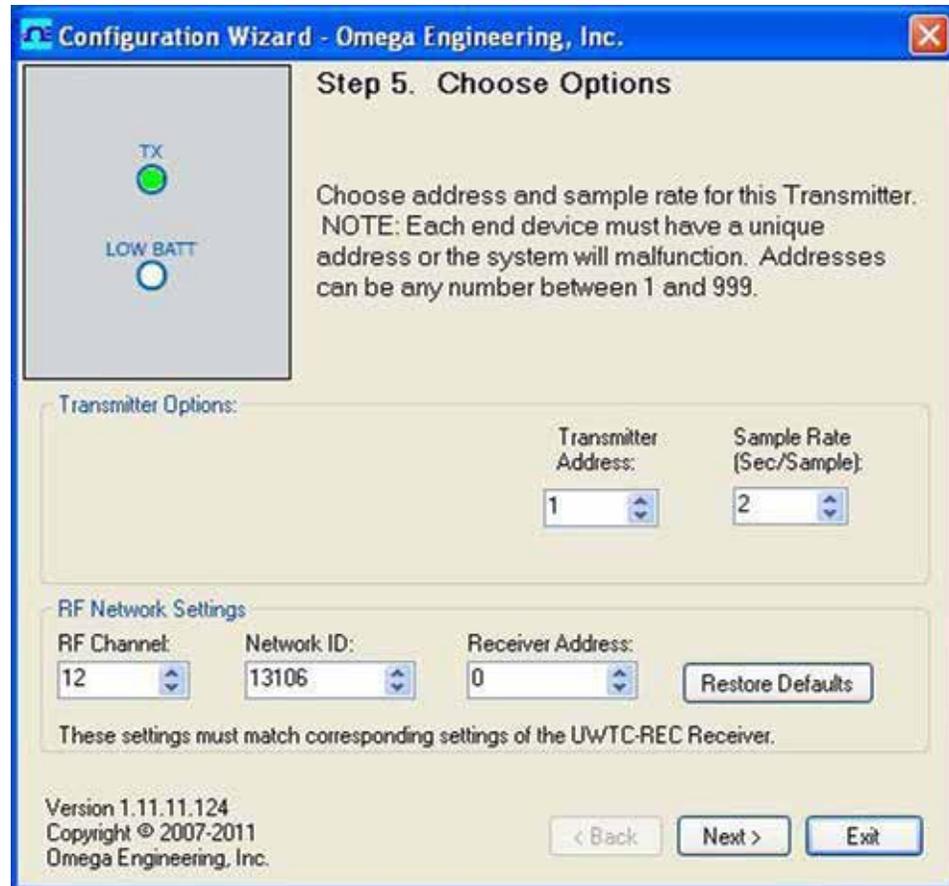
Figure 5-5. Options Menu Screen

NOTE:

The wireless transmitter (HHF1001X-W) will not transmit when connected to the USB port of a PC. You must disconnect the transmitter from the PC for wireless transmission.

NOTE:

1. If the sensor probe is disconnected, or any sensor failure, the red LED blinks 3 times every 15 seconds.
2. If there is an RF communication failure, the red LED blinks once every 15 seconds.
3. If there is a sensor failure and RF communication failure at the same time, the red LED blinks 4 times every 15 seconds.

5.2 TC Central

Once the wireless transmitter is set using the end device configuration software, connect the wireless receiver (UWTC-REC1) to the PC USB port. Then run the TC central software. The software will recognize and connect to the wireless receiver. You can now monitor and log air velocity and air temperature from the wireless transmitter (HHF1001x-W).

Figure 5-6 shows the main menu where air velocity, air temperature, and wireless signal strength are displayed in real time. Please note that since the HHF1000 is set for unit ID #1, it is displayed under Address 0001.

You can configure the left and the right Y Axis for air velocity and temperature by clicking the options button. Figure 5-7 shows the configuration of the Y Axis. You can chart and log data in real time. Simply click on the chart tab from the main menu.

After configuring the Y Axis, click on the start button from the chart tab menu. It will take you to the Data Plotting/Logging Menu selection as shown in Figure 5-8. In this menu, you can select chart sampling rate, line colors, plotting on left and right axis, and the location of the data file. After you are done, click OK to go back to the plotting screen. You will see the air velocity and air temperature plots in real time as shown in Figure 5-9.

You can view the data log by clicking the Data Log tab. Figure 5-10 shows the data log screen.

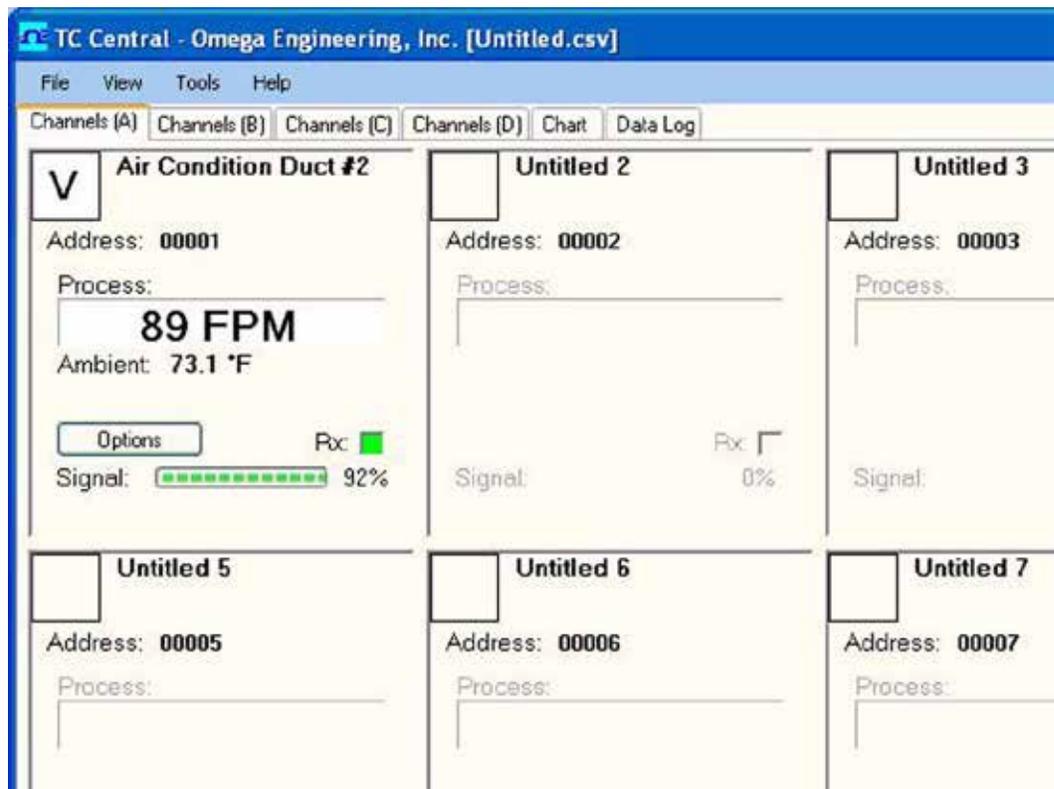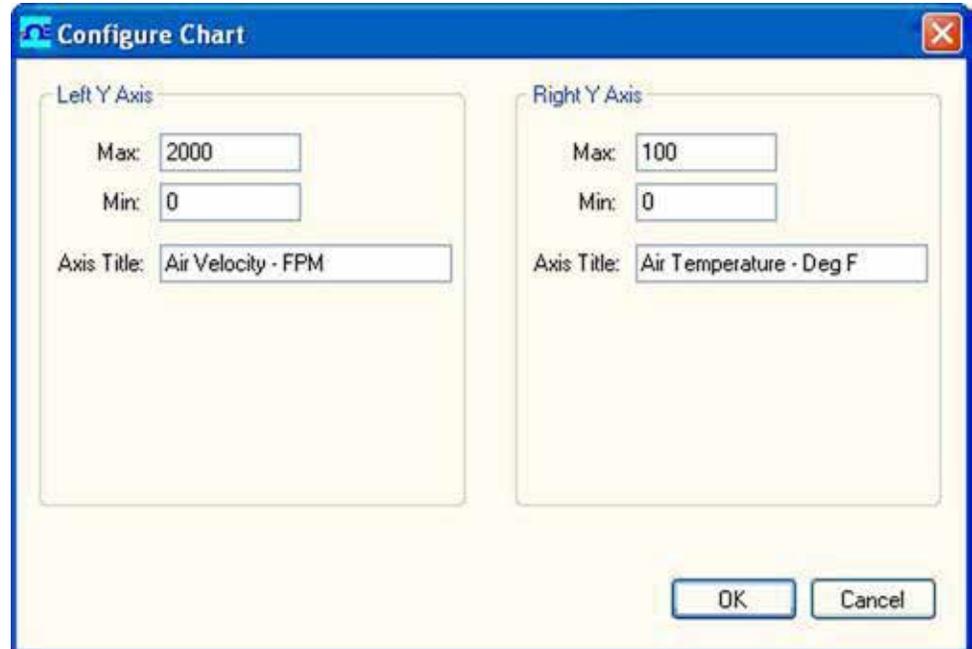**Figure 5-6. TC Central Main Menu Screen**
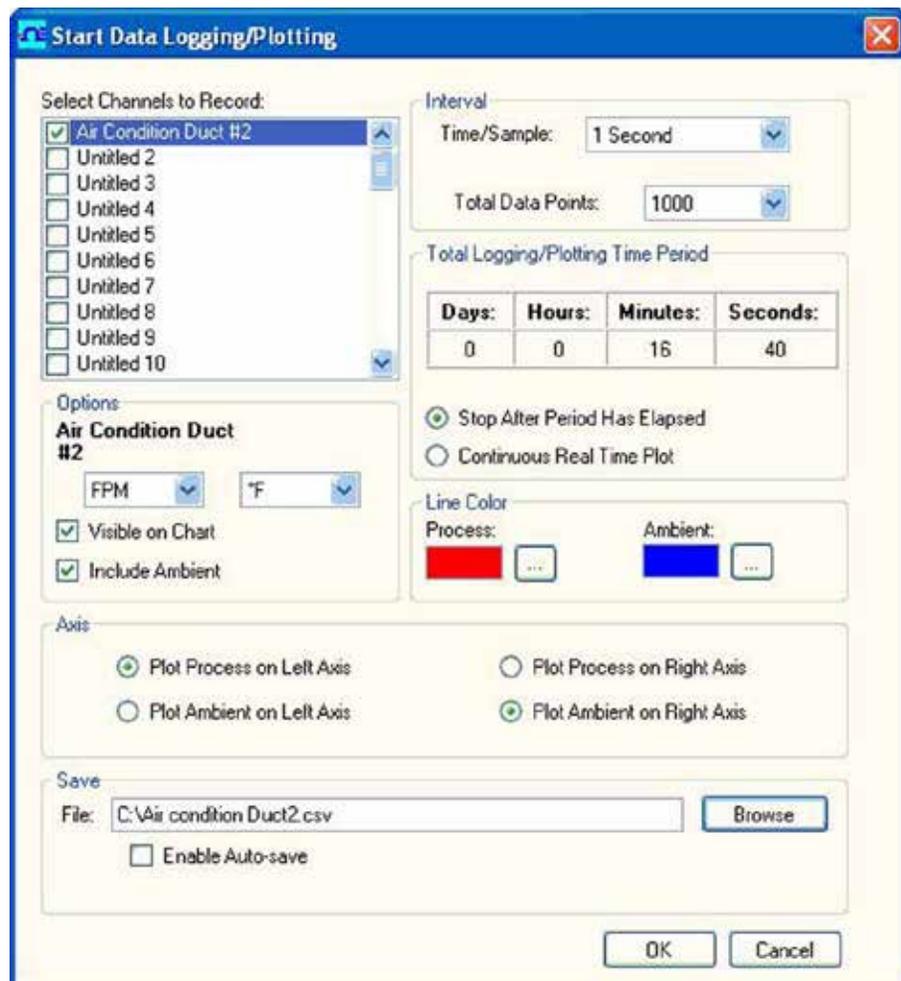
Figure 5-7. Y Axis Configuration Screen

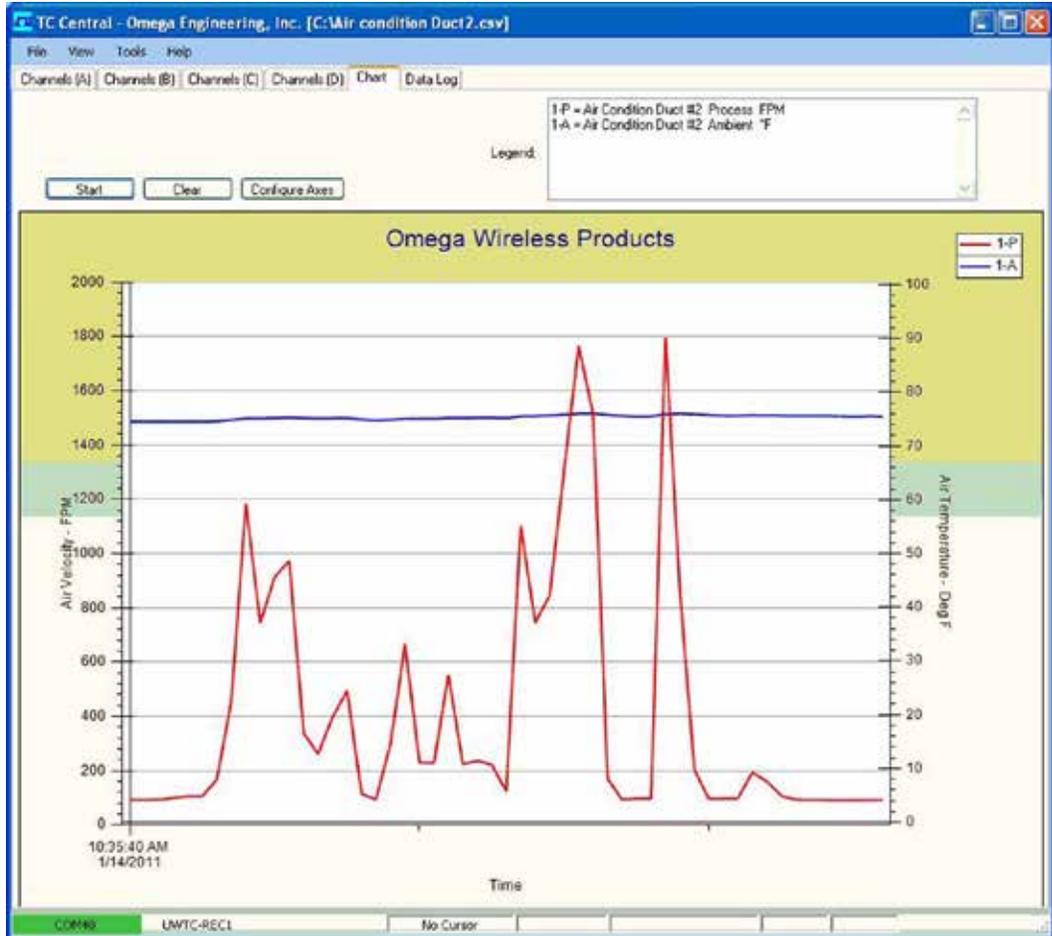
Figure 5-8. Data Plotting/Logging Menu Selection Screen

Figure 5-9. Air Velocity/Temperature Plot In Real Time Screen

Figure 5-10. Data Log Screen

Section 6 - Specifications

GENERAL
Range
Air Velocity:	0-5000 FPM (0 to 25.4 m/sec)
Air Temperature:	-40 to 93ºC (-40 to 199ºF)

Accuracy
Air Velocity:	1.5% Full scale
Air Temperature:	0.5% Full scale

Display Resolution
Air Velocity:	1 FPM, 0.01 m/s, 0.01 MPH, 0.01 Km/h
Air Temperature:	0.1 Degree

Sensor Probe
Standard:	6.3 OD x 305 mm (1⁄4 OD x 12") – workable length 304 Stainless Steel
Remote Telescopic:	6.3 OD x Adjustable from 254 to 914mm (1/4 OD x 10 to 36") – 304 Stainless Steel

Velocity/Temperature Sensor:	One 100 ohms RTD, Two 1000 ohms RTD
Response Time:	250 msec default - 0 to 90% Display Final value (Programmable from 250 msec to 2 seconds)
Calculated Air Velocity Values:	Maximum & Minimum, 250 msec response time
Calculated Temperature Values:	Maximum & Minimum, 250 msec response time
Calculated Volume Air Flow:	Displays in cubic feet per minute (CFM) or cubic meters per minute (CMM)
Cross Sectional Area:	20 Sq-Inches default Programmable from 1 to 400 Sq-Inches via keypad
High Alarm Set Point, Velocity:	Maximum range default – Programmable via keypad
Low Alarm Set Point, Velocity:	Minimum Range default – Programmable via keypad
High & Low Alarm Indication:	HAL or LAL icon flashes on the display
Alarm Deadband:	25 FPM
Power:	9V Lithium Battery, or ac adapter
Battery Life:	6 Hours, continuous
Low Battery Indication	BAT Icon on the LCD

AC Adapter:
	100 to 240 Vac, 50-60 Hz UL, CE, FCC Marking
Output Voltage:	9V @ 1.7A
Output Plug (Female):	Center positive, coax 2.0/5.5/10mm

Operating Ambient Temperature
Sensor Probe:	-40 to 93ºC (-40 to 199ºF)
Meter:	0 to 50ºC (32 to 122ºF)

Operating Relative Humidity:	0 to 95% RH without condensation

Meter Case:	ABS Plastic
PC Interface:	USB , 9600 baud rate, 8 bit data No parity, 1 stop bit
General Dimensions (Case):	121.4 L x 77.7 W x 33.2 mm D (4.78 x 3.06 x 1.31")
Weight:	300g (0.66 lbs)

WIRELESS PC INTERFACE

Wireless Transmitter, HHF1001x-W

RF Transmitter Carrier:	ISM 2.4GHz. Direct sequence spread spectrum, License free worldwide (US, Canada, and Europe)
RF Power Output:	10 dBm (10 mW)

RF Range
   Indoor/Urban:
   Outdoor/Line of Sight:
	
	Up to 40m (130')
	Up to 120m (400')

LED Indicators:	Green TX LED (Transmit), Red RX LED (Receive)
Data Transmission Interval:	2 seconds default, Settable from 1 to 60 seconds through End Device Configuration software
Unit ID Address:	Default is 1. Settable from 1 to 48 through End Device Configuration software

Wireless Receiver, UWTC-REC1

Power:	USB +5V Powered, 300 mA max.
USB Compatibility:	USB 1.1, USB 2.0
LED Indicators:	TX (transmit) RX (receive) SB (Standby) PWR (USB Power)
Radio Frequency (RF):	ISM 2.4 GHz, direct sequence spread (US, Canada, and Europe)
Protocol:	IEEE 802.15.4
Cable Type:	USB 4P(A) Male to USB Mini 5P(B) Male
Ambient Operating Conditions:	-10 to 70°C, 0-95% Relative Humidity (Non-condensing)

Section 7 - Approvals, Regulatory Compliance

FCC (Domestic Use: USA & Canada)

(USA) FCC ID: OUR-XBEEPRO (CANADA) IC #4214A-EXBEEPRO

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
1.) This device may not cause harmful interference.
2.) This device must accept any interference received, including interference that may cause undesired operation.

▼ WARNING:

To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm or more should be maintained between this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended. This transmitter must not be co-located in conjunction with any other transmitter or antenna.

7.1 Environment/Operating Conditions

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

7.1.1 Operating Conditions

The following is a list of basic good practice you should apply when operating your wireless system.

• Never operate your wireless device outside the recommended environmental limits specified in this manual.

• Never operate your wireless device in flammable or explosive environments.

• Never use your wireless device in medical, nuclear or other dangerous applications where failure can cause damage or harm.

• No co-location with other radio transmitters is allowed. By definition, co-location is when another radio device or it's antenna is located within 20 cm of your transmitter and can transmit simultaneously with your unit.

• Never install receiver/transmitters within 20 cm or less from each other.

• Never install and/or operate your transmitter/receiver closer than 20 cm to nearby persons.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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