EVERGREEN TELEMETRY ™

Wrist Reporter™ User's Guide

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INTRODUCTION

The Wrist Reporter manages a wireless network of battery-powered sensors. Each sensor collects a measurement of pressure, temperature, and/or humidity, and wirelessly transmits the readings to the Wrist Reporter for display and storage.

Features of the Wrist Reporter include:

- Worn on the wrist for hands free approach to readings
- Collects a continuous stream of real-time measurements
- Statistics can be displayed and stored as part of a group

INSTRUMENT DESCRIPTION

The Wrist Reporter can display a continuous stream of real-time measurements. Readings may be stored via the Wrist Reporter keypad. Alternatively, for completely hands-free operation, a nudge against the button on the Thumbswitch accessory causes readings to be stored. Every stored reading has an associated time and date. Readings may be uploaded into an Excel spreadsheet on a PC.

ACCESSORIES

Each Wrist Reporter is packaged with the following accessories

- Velcro Wrist Strap
- Thumbswitch
- Spare Primary lithium batters for Thumbswitch
- Wall-Mounted battery charger
- USB to USB – mini cable

GETTING STARTED

This section will explain the Wrist Reporter display and common terms used within the document.

WRIST REPORTER KEYS

There are seven Wrist Reporter keys used to initiate functions and manage data within the Wrist Reporter.

1. On/Off Key: Used to power on the unit.
2. T Key: Used to control the backlight on the unit.
3. View Key: Used to move between display screen views.
4. Options key: Used to control options on the unit
5. Memory key: Used to set up the memory options
6. Select/Store key: Used for various select functions
7. Arrow Keys: Used to move between selections
8. Escape Key: Used to go back on certain functions

POWERING UP AND LINKING

To turn power on and link to sensors:

1. Turn on the Wrist Reporter by pressing the On/Off button. The Wrist Reporter displays an Evergreen Telemetry splash screen and runs a 5-second diagnostic test.
2. When the Wrist Reporter is turned on a screen will appear that says "Turn on Modules to Link". Turn on the first module. After the first module is linked you will be taken to the Link Status Screen. You can only link modules to the Wrist Reporter while you are on the Link Status Screen. To navigate there from any other screen, press "V" until you see the Link Status Screen.
3. The Wrist Reporter displays the Link Status screen and shows which sensors are now communicating with the unit. The first sensor to link will be identified as S-1 for the length of the session. The second sensor will be S-2, etc.
4. The Wrist Reporter can support up to 10 linked modules. All 10 may be sensors, or there may be a combination of sensors, Thumbswitch, and Range Extenders.
5. The Link Status Screen displays up to four modules. If more modules are linked, small arrows will appear at the left of the screen to indicate the presence of additional information. The user can display the hidden information by pressing the Arrow keys [← →].
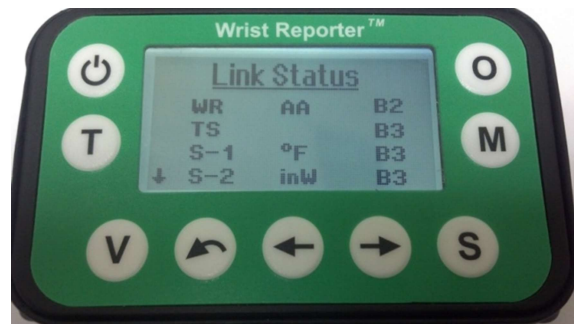
To turn the power off:

1. Turn off the sensors. NOTE: Depending on which sensor that is being used the ON/OFF switch might be a switch, rocker, or button. If it's a button, hold the button until the red LED light flashes two times to confirm the sensor is in the off state.
2. The Wrist Reporter displays the Alert Screen to show the radio has powered off. The Link Status screen will display dashes next to the sensors previously linked.
3. Turn off the Wrist Reporter by pressing the On/Off button.
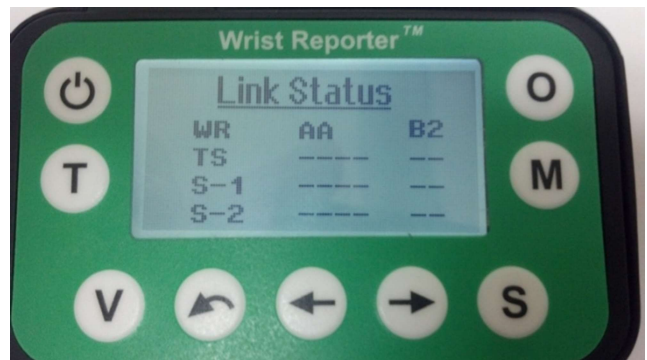
THUMBSWITCH

The Thumbswitch makes it easier to store readings. Pushing the button causes the same action as pressing S on the Wrist Reporter. It can be worn on a finger and activated by a small motion of a thumb or other finger. It eliminates the need to reach over to the Wrist Reporter with the opposite hand/arm.

When the Wrist Reporter displays TURN ON THE SENSORS, push and hold down the white button on the Thumbswitch for about 5 seconds until the red LED flashes three times, then release. The Thumbswitch will link and the Wrist Reporter will indicate that the Thumbswitch has joined the network.

During operation, the red LED blinks occasionally to indicate it is linked. Pressing the button to record a reading does not cause the red LED to blink.

To turn off the Thumbswitch, press and hold the white button for about 5 seconds until the red LED blinks twice.

TEMPERATURE SENSORS

A Temperature Sensor is composed of a Temperature Module and an interchangeable Temperature Probe. The Temperature Probe is a temperature-sensitive thermistor enclosed in a shaft or button-style probe. The Temperature Module contains the analog-to digital electronics and an RF radio transceiver. Temperature sensors display on the Link Status screen in ˚F units.

PR-T-1: The 1/16" diameter insertion probe can be inserted through a 3/8" hole in a duct and has a magnet to hold the sensor in place during readings.	
PR-T-2: Is a surface probe that is interchangeable with any Evergreen Telemetry temperature module.	
PR-T-4: Is a thick insertion probe designed for petes plugs. The handle makes it easy to get in and out of the plug.	
PR-T-5:	

Note: Some third-party temperature probes are compatible with the Evergreen Telemetry Temperature Module. For instance, temperature probes from Shortridge Instruments utilize thermistors of the same 2252-ohm material used by Evergreen Telemetry. The third-party probes can be turned into wireless temperature probes by connecting them to the Temperature Module (RM-T).

HUMIDITY SENSOR / PSYCHROMETRIC SENSOR

The Humidity Sensor measures three parameters and calculates several others. The Sensor has a 5" shaft and a magnet to hold it against the duct when inserted through a 3/8" hole. Measured are: %RH, Temp (dry bulb) and barometric pressure. Calculated are: Temp (wet bulb), dew point, enthalpy, specific volume, grains of moisture. There are two key display modes. Psychrometric Mode shows all parameters. Key Data mode shows four parameters in a quadrant format in order to optimize the size of the characters for easier viewing. The user may select the four parameters shown as follows.

Press the arrow keys to highlight one of the four quadrants. Press S to select that quadrant for change. Press the arrow keys to change the parameter displayed. Press S to confirm that parameter for that quadrant. Press the arrow keys to highlight a different quadrant for change, etc. When satisfied with the display format, press V to display measurements.

Datalogging may be performed when in the Key Parameters display mode. Press M to display Memory Options. Select Datalogging and set the conditions as appropriate.

PRESSURE MODULES / PVF AS OPTIONAL RANGE EXTENDER

The Pressure Module measures differential pressures from -10 inwc to +10 inwc. Barometric pressure is also sensed and used to automatically adjust velocity and airflow calculations for proper air density. Pressure Modules display on the Link Status screen in inwc units. The Pressure Module can convert a differential pressure to velocity or airflow.

Any pressure module will automatically act as a range extender if there are multiple sensors in use. The pressure module can also be used as a range extender. By toggling power on and off after the sensor is linked the pressure module will be put into Range Extender mode (RE-1), not it is relaying readings without taking readings of its own.

READING TIMES OF SENSOR TYPES

1. Temperature and Humidity
   a. Temperature Sensors and Humidity Sensors read and transmit every two seconds, approximately.
2. Pressure, Velocity, and Flow
   a. The Pressure Module is capable of accurately measuring pressure, velocity, or flow in less than one second. However, in many duct systems and other environments there are significant changes in levels over the course of many seconds and minutes. That is, measuring for one second may not result in a representative number.

For this reason, the Wrist Reporter offers three options for reading times: 1 second; 2 seconds; variable, in which the sensor reads high levels quickly but takes up to 6 seconds for low levels. This is the selection screen for Pressure Module reading times:
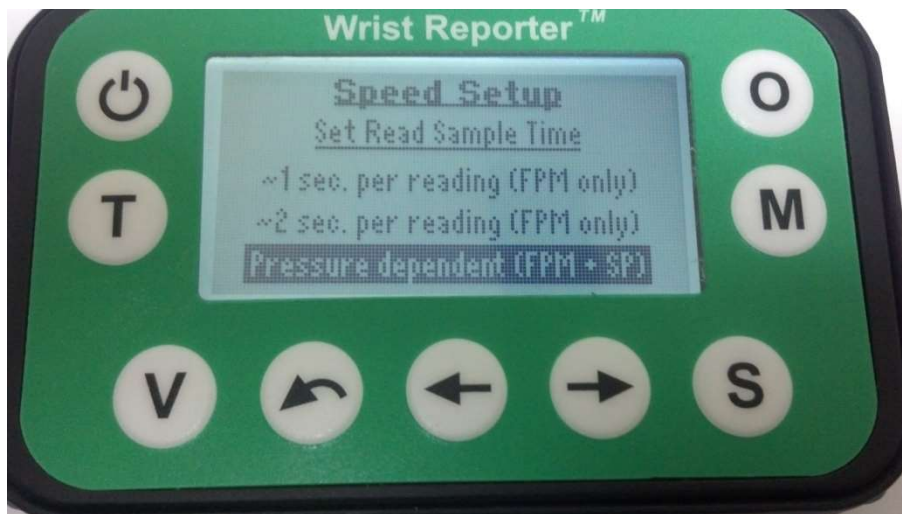
BATTERIES

WRIST REPORTER & PRESSURE MODULE: The Wrist Reporter and the Pressure Module both use a rechargeable lithium-ion battery that on a full charge provides 20 to 30 hours of operation.   A charger and charging cable are provided. To recharge a module, locate the mini-USB port on the unit and plug the recharge cable into the Wrist Reporter. Then plug the charger into a wall socket.

Note: The green LED light is displayed while the battery is charging and/or the module is drawing power.   The green LED turns off when the battery is completely charged. When the battery is 99% charged, the green light may be inconsistent.

THUMBSWITCH: The Thumbswitch battery is a 3-volt primary lithium cell (industry standard type CR2477 with custom leads) and lasts for many weeks or months. It is not rechargeable.

TEMPERATURE MODULE: The Temperature Module uses a 3-volt primary lithium cell is a ½ AA format. It has a life of about 200 hours and is not rechargeable.

To replace the primary lithium batteries of Thumbswitch or Temperature Module:

1. Locate the battery cover on the Module.
2. Remove the two screws holding the battery cover in place. Then remove the battery cover.
3. Remove the battery with caution.
4. Place the new battery in the battery cavity and align the plus and minus leads.
5. Replace the battery cover using the two screws previously removed.

REPLACEMENT BATTERIES

All kits shipped from Evergreen Telemetry include one replacement battery for the Temperature Module(right) and one replacement battery for the Thumbswitch (left). Additional batteries may be purchased from Evergreen Telemetry or from retail stores such as Radio Shack or Batteries Plus. Note that the cell battery of the Thumbswitch requires two contact leads of particular size and location. A store such as Batteries Plus can weld leads to a new battery if given the old battery for an example.

ADJUSTING THE BACKLIGHT

The backlight settings allow you to adjust the light on the unit based on whether or not you are working indoors or outdoors. Press the T key until the desired brightness is achieved. Backlight settings include: off, one-half brightness, and full brightness. The default setting is one-half brightness.

SETTING TIME AND DATE AND OTHER OPTION KEY "O" FUNCTIONS

By pressing the O key the user will first be taken to the Power Up Status screen. This screen shows you the Date/ Time, amount of available memory, the type of battery, and the role of the Wrist Reporter.

By pressing V from the Power up screen the user will be taken to the Wrist Reporter Info Screen. This screen tells you the current software Rev, radio rev, Serial number of your unit, and the model of Wrist Reporter you are using. Press the ESC key to return to the Link Status Screen.
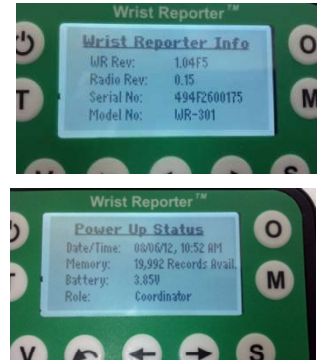
To set the time and date:

1. From the Link Status screen, press the O key to view options. The Power Up Status window is displayed.
2. Use the arrow keys (← →) to highlight the Date/Time row.
3. Press the S key to select the option. The set date and time window appears.
4. Use the arrow keys (← →) to highlight the month, day, year, hour or minutes.
5. Press the S key to select the option. The value column is highlighted.
6. Use the arrow keys (← →) to change the value.
7. Press the S key to save the time and date.

ALERT SCREENS

The Wrist Reporter alerts the user to certain changes in the status of the Wrist Reporter and Wireless Sensing Modules.

⚠ WR Alert
Low Battery

TYPICAL ALERTS INCLUDE:

- Link Lost: no transmission from sensor in last 10 seconds
- Link Reacquired: received transmission from previously lost sensor
- New Association: new sensor in Link
- Low Battery: module battery at a critically low level
- Power Failure: module battery dead
- Sensor Turned Off: sensor switched off

DISMISS ALERT MESSAGE

Some alert messages display briefly and end automatically.

A serious alert message may continue to be displayed indefinitely until the user acknowledges the alert and dismisses the message by pressing the S key.

DATA SCREENS

There are five standard data screen views on the Wrist Reporter.

Link Status Screen: The Link Status screen displays all connected sensors, measurement units of the sensors, and their battery status. B3 means the unit is at or near full power. B0 means the battery is nearly depleted and only minutes of operation remain.
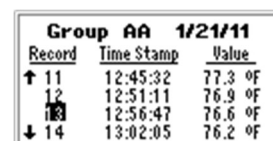
Trend Screen: The Trend screen displays the most recent sensor reading in large numbers at the upper left. As new readings are received, the Trend Screen flashes UPD (for updated) below the sensor reading. The three or four previous readings are displayed on the right of the screen.

Store/Stats Screen: The Store/Stats screen displays the most recent reading. The memory group and the sequence number within the memory group are displayed at the bottom of the screen. The minimum, maximum, and average statistics associated with the current memory group are displayed on the right of the screen.
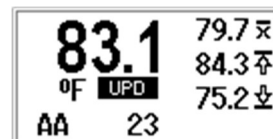
List Screen: The List screen displays a list of readings for the memory group. Each reading is listed with the time of the reading, the value, and the unit of measurement.

Split Screen: The Split Screen displays reading from multiple sensors. Two, three, or four sensors may be displayed simultaneously in the split screen format. The Split Screen view automatically replaces Trend and Store/Stats when multiple sensors are linked.

If more than four sensors are linked to the Wrist Reporter, they can be quickly and easily viewed in two Split Screens back-to-back. The first shows Sensors 1-4, and the second shows Sensors 5-8. The ESC key is used to flip back and forth between the two screens.

STORE READINGS

As the sensors readings are displayed in Store/Stats View, they may be stored in memory.   Up to 20,000 readings may be stored in up to 500 different Memory Groups.

To store readings:

1. From the Link Status screen, press the V key repeatedly to navigate to the Store/Stats window.
2. On the Store/Stats window wait for a new reading to be displayed. New readings are indicated by a black UPD (Update) box flashing below the reading. In Split Screen, new readings are indicated by a small black star flashing.
3. The current Memory Group is displayed at lower left. Memory Groups are indicated by two letters, AA through ZZ.
4. Press the S key to select the reading and store it to the memory group. The displayed Memory Group Sequence Number will increment from 1 up to a maximum of 20000, indicating that the measurement(s) was stored and where. Each stored reading has a time and date stamp.
   OR -
   Press the button on the Thumbswitch to store the reading.
5. In Split Screen, if 2, 3, or 4 readings are displayed, all of them will be stored as one record with the same time stamp.
6. If five or more readings are shown in back-to-back Split Screens as described above, pressing S to store will cause all sensor readings to be stored at the same time. Sensors 1-4 will be stored as one record, and Sensors 5-8 will be stored as a different record with the same timestamp.
7. The Wrist Reporter will not respond to a keypress store command if there has been no change in the data (no black UPD box or no black star flashing) since the last record was stored. This prevents the accidental storing of the same measurement twice.
8. When the memory is full, an alert message will be displayed and no additional readings may be stored until room in memory becomes available by deleting readings.

REVIEW READINGS

After readings have been stored on the Wrist Reporter, you can review the readings.

To review readings:

1. From the Store/Stats screen, press either Arrow Key. The review reading screen appears.
   NOTE: The display of an "r" on the window, indicates you are on the review reading screen.
2. Use the Arrow Keys (← →) to navigate through all of the readings within the memory group.

MEMORY GROUP COMMANDS

The Memory Command Screen is used to change Memory Groups and to delete stored readings. You can delete readings in a specific Memory Group or you can delete all stored readings in every group.
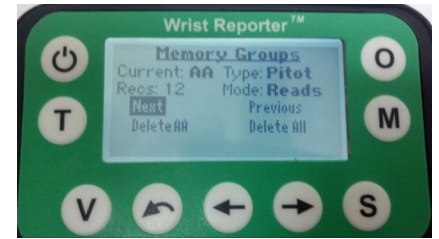
To change Memory Group

1. Press M. The Memory Group Screen appears. The current Memory Group is displayed at the upper left along with the number of readings stored in that group.

2. Use the arrow keys (← →) to highlight the Next or Previous options. Press the S key to select the option. Note: Choosing Next causes the Memory Group to increment by one, such as from AA to AB. Choosing Previous causes the Memory Group to decrement, such as from BC to BB.

3. The user may navigate through the entire memory by repeatedly pressing S to change to the Next or Previous Group.

To delete readings in all memory groups:

1. Use the arrow keys (← →) to highlight the Delete All option.
2. Press the S key to select the option. The confirmation screen appears.
3. Press V or Escape to return to the Link Status screen.

To delete readings in a particular group:

1. Navigate to the Memory Group of interest. Use the arrow keys (← →) to highlight the Delete XX option. (Note: here XX represents the Memory Group to be deleted, for instance, AB, AC, etc)
2. Press the S key to select the option. The confirmation screen appears.
3. Press V or Escape to return to Link Status screen.

DATALOGGING

It is easy and convenient to datalog with the Wrist Reporter. In this mode the Wrist Reporter continuously stores and timestamps each measurement as it is received.   The user can datalog just one sensor or up to 10 different sensors in different locations. The user can choose between three schedule options: continuous (every reading from every sensor is stored; every sensor once per minute; or every sensor once every 10 minutes.

The Wrist Reporter supports a maximum of 10 linked modules. If a Thumbswitch or Range Extender is linked, then the number of sensors that can be datalogged will be reduced.

Up to 20,000 readings may be datalogged. When the memory becomes full, storing will stop and an alert message will be displayed.

These types of readings may be datalogged: temperature, humidity, differential pressure. At a future date, velocity and airflow capability will be added.

To begin datalogging:

1. Turn on the Wrist Reporter and the sensors to be used during the datalogging session.
2. From the Link Status Screen confirm that all sensors have joined the network.
3. Press the V key to view the readings. If more than one sensor is linked, they will be displayed in Split Screen. Up to four sensors (S-1 to S-4) may be displayed on the first Split Screen and up to four more (S-5 to S-8) on the second. NOTE: Up to ten sensors may be linked simultaneously and datalogged. However, only four can be displayed in any one window.

4. Press the M key to view the Memory Commands.
5. Use the arrow keys (← →) to highlight the Datalog option and press S.
6. The Wrist Reporter will offer the user three options for store schedule. The user should use the arrow keys to highlight, and press S to select, one of these three options:
   a. Shortest: Store every reading from every sensor;
   b. 1 minute between stored readings, every sensor;
   c. 10 minutes between stored readings, every sensor.
7. The Start Datalog screen will display. NOTE: If you have selected the Datalog option accidentally, press the ESC key to discontinue process.
8. A datalog must begin in an empty Memory Group.   If necessary, the Wrist Reporter displays an Alert and forces an advance to the next available Memory Group.
9. Press the S key to begin the Datalog process. The Datalog screen is displayed. The Datalog screen displays the increasing number of records, a list of all sensors sending readings to the Wrist Reporter, and the most recent reading from each sensor.
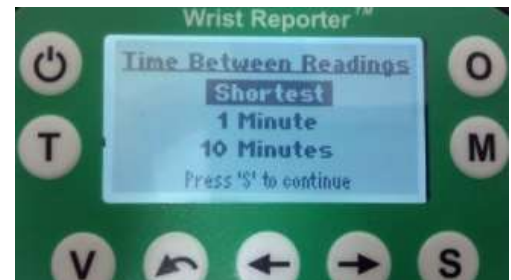
To stop datalogging and review:

1. While the unit is in the Datalog process, press the S key to stop the datalog. The List View displays all records with the time, date, sensor node number, value, and units.
2. Use the arrow keys ($\leftarrow$ $\rightarrow$) to navigate the list of readings. You can also use the ESC key to move from the first record to the last record or vice-versa. This operation may take many seconds if there are thousands of readings.
3. If a record in List View has multiple associated measurements the record is noted at the left with a small cross symbol. For instance, a humidity sensor may record dry bulb temperature and dew point temperature as well as relative humidity percent. All three measurements, including the time, date, and units, constitute one record. Navigate to this type of record using the arrow keys and then press the S key to select the record. Split Screen will display in Review Mode (a small "r" is shown at the right of the record sequence number) showing all readings associated with that record.

CONNECT AND UPLOAD

The Wrist Reporter can be connected to a computer to upload the stored readings into Excel spreadsheets on a personal computer.

In order to upload the data to a computer, the user must have the necessary application software installed on their computer. The application software is provided in the Wrist Reporter Kit as a CD-ROM. When the CD-ROM is you can open the folder to view the files inside. Open the "Read Me" file to learn the process for installing the upload software to your computer. Once the software is installed you will be ready to upload.

To upload data:

1. Open the application called "ET Wrist Reporter".
2. Click the "Connect to WR" button.
3. Carefully follow the instructions for connecting to Wrist Reporter.
4. Click the "Upload Records" button.
5. Next you will be asked where you would like to save the files to. By just pressing "OK" the files will save to the Desktop by default. Files will be named with the group name then the date they were stored. For example, a file name of "AA-120619" indicates that this file was from Memory Group AA and the first reading was stored on June 19, 2012.
6. If desired you can create and name a destination folder to receive the uploaded files.
7. Proceed to upload the data. The application program creates a spreadsheet for each Memory Group, ie., AA, AB, AC, etc. Initially these spreadsheets are in a format called CSV, for Comma-Separated Values. However, the spreadsheets may be saved at any time in an Excel .xls format. From that type of spreadsheet, the user can perform any of the common operations, including graphing or copying to other spreadsheets or word processing files.

DATTALOGGING TO EXCEL, IN REAL TIME

The Wrist Reporter (Model 401 only) is connected to a PC via a USB port. The Wrist Reporter maintains a network of wireless sensors. A PC-based application is provided to govern the schedule for storing readings and their placement in the proper cells.

- In using it the first time Internet access may be required to load the proper Microsoft support files and driver software. This program uses Microsoft's .NET program support so the required .NET files have to be installed on your PC. The program may either try to download them from Microsoft's web site or pop up an error message that will require going to Microsoft's web site to download the support: http://www.microsoft.com/en-us/download/details.aspx?id=42643
- You also need the Silicon Labs CP2102 driver installed. You may have previously installed this driver for use with our Wrist Reporter Data Uploader. If not, visit this site and select the correct "Download VCP" link to download (free) and install the version that is suitable for your PC / operating system: http://www.silabs.com/products/mcu/pages/usbtouartbridgevcpdrivers.aspx
- You will aslo need the executable file (Excel Datalogger 140728.et) located on the USB drive.

Unpacking the program:

1. On the Desktop or other convenient directory, create a new folder named WristReporter Excel Dataloader.
2. Move the attached file into this new WristReporter folder.
3. The installation program has the name "Excel Datalogger 140728.et" Make this program an executable by selecting it and using the Rename command to change the file extension from .et to .exe.

Using the program:

1. Double click on the "Excel Datalogger 140728.exe" file to start the program.
2. Follow the on-screen instructions.
3. Sensors can be named.
4. Sensors always read on their own schedule. Temperature Sensors read every two seconds, approximately. Humidity Sensors read every 3-4 seconds, approximately. Users can set the reading duration of Pressure Sensors to 1 or 2 seconds, or variable depending on the level of pressure. The setting of duration should be done one at a time, before a datalog session is begun.
    a. The user can control the storing of readings in various ways: Readings can be stored asynchronously on their own schedule; Readings can be stored synchronously on a schedule determined by the user; Readings can be stored synchronously by pressing "S".
5. The user manually starts and stops the datalog.
6. After stopping the datalog, the Excel file can be saved to the desired folder. The Wrist Reporter and sensors can be powered off.

- If you experience problems with the Wrist Reporter unit or any of the sensors, turn off all the sensors and then the Wrist Reporter unit. Then turn the Wrist Reporter back on, followed by all sensors including the thumbswitch if you are using one.   This ***power cycle*** resets all of the microprocessors and also creates a new wireless survey of the environment. In this case, the Wrist Reporter unit will choose a new frequency channel with stronger links to the other sensors.
- The Wrist Reporter and the sensors have a practical range between 50-100 feet. The range obtained in any particular environment involves many factors. For instance a range of 300 feet has been obtained on a street with no visible obstacles, while some buildings have prevented the range from exceeding 40 feet. Sufficiently thick obstacles and absorbent objects including the human body and water tanks have been observed to reduce the range achieved. If you continue to experience problems with short ranges, try power cycling the Wrist Reporter and sensors.
- If needed, you can also use a range extender to increase the range between the sensors and the Wrist Reporter. The range extender can be placed half way between the Wrist Reporter and the sensors and will receive and retransmit all readings from the sensor. Multiple range extenders can be used to extend the range as needed and they display on the Link Status screen as an RE.
- The standard pressure module will act as a range extender in the case you are using more than one pressure module the signal will automatically be relayed to the Wrist Reporter. Or once the pressure module it turned on you can quickly cycle power off and then back on and the pressure module will go into a range extender mode which means it will no longer take its own readings and instead only relay readings from other sensors to the Wrist Reporter.

TAB applications are faster, easier, and safer with the Wrist Reporter and wireless sensors. The following sections show how to set up the Wrist Reporter and wireless modules for faster, easier, and safer TAB.

The Wrist Reporter offers a variety of options for speed of reading and method of correcting air density for temperature. The first sections will assume a default setting for each of these. Then in a later section we will explore the optional settings for reading speed and temperature.

SELECTING THE DESIRED MEASURMENT MODE

The key sensor for these applications is the Pressure Module.   The Pressure Module automatically measures barometric pressure for air density measurement. The user can choose a suitable method for adjusting air density for temperature when measuring velocity or airflow.

With the Wrist Reporter displaying Link Status, and no sensors linked, turn on a Pressure Module and watch as it become S-1. Then press S or V to display the Probe Selection Screen. In this window the user presses the Arrow Keys to highlight the desired measurement mode: Differential Pressure, Pitot Tube Velocity, Foil-Type Probe Velocity (calibrated to Shortridge probe), Velocity-Averaging Grid (calibrated to Shortridge grid), and Capture Hood (calibrated to Shortridge hood)

Probe Mode Selection Screen

AIRFLOW WITH A CAPTURE HOOD FROM SHORTRIDGE

The Evergreen Telemetry approach makes the hood lighter by 2 pounds, or 20%. Instead of 10 pounds, the hood with sensor will weigh only eight.

1. Remove the digital meter from its normal mounting position. Install the two adhesive-backed Velcro pads as shown in the photo. Install the corresponding Velcro pads on the bottom of the Evergreen Pressure Module. The magnet can be installed on the upper right to support the Evergreen Temperature Module.
2. Attach the Evergreen Telemetry Pressure Module to the hood base using the provided flaps extension cable and tubing.
3. While on the Probe Mode Selection Screen, select "Hood CFM".
4. Select whether you want to View Readings if you would like to view individual readings and decide which ones you want to store. Or select Running Average if you would like to take an average of multiple readings over time.
5. Select the reading speed as described elsewhere.
6. Select the method of adjusting the temperature to correct air density as described elsewhere. Options include the default of 70F, or setting the air temperature manually, or adjusting the air temperature automatically based on the Temperature Module that you link as Sensor S-2. When the Wrist Reporter powers up, it defaults to an air temperature setting of 70F. If the user manually sets the air temperature, the Wrist Reporter will maintain that set point until it is turned off.
7. If you select Option 2 the Trend Screen will be displayed.   At the upper left is the current reading. Previous readings are displayed along the right column, giving an indication of flow changes. The position of the flaps is displayed as open or closed. Regardless of flaps position, this screen does not display backpressure compensated readings.
8. Press "V" to display Store/Stats. As with other measurement modes, the current reading is shown at the upper left in large numbers. At the right are the average, minimum, and maximum readings of the current Memory Group. In addition, this screen in Flow Mode displays the sum of the stored readings at the lower right. This facilitates a survey of an area to find out the total supply air or total return area of multiple diffusers. The position of the flaps is displayed as open or closed. Regardless of flaps position, this screen does not display backpressure compensated readings.
9. Press "V" to display the only format used for backpressure compensation. Always begin with the flaps open. The uncompensated, flaps-open flow readings are continuously shown at the upper left. Under the value the units are shown as CF:u. Whenever you are ready with a good seal at the diffuser, close the flaps. The Wrist Reporter will lock in the uncompensated value

and begin showing a continuous series of compensated values at the lower left. Under the value is shown the units, CF:c. Whenever satisfied, open the flaps. The Wrist Reporter locks in the backpressure compensated number at the lower left. Then, in order to provide a convenient reference, it slides the two readings to the right and signifies that they are the previous readings with a small "p" beneath the numbers. Then the Wrist Reporter begins a new reading by displaying continuous flaps-open uncompensated flow values at the upper right. You can easily compare the current reading to the previous reading that was locked in at the right. Close the flaps to continue the sequence of readings.
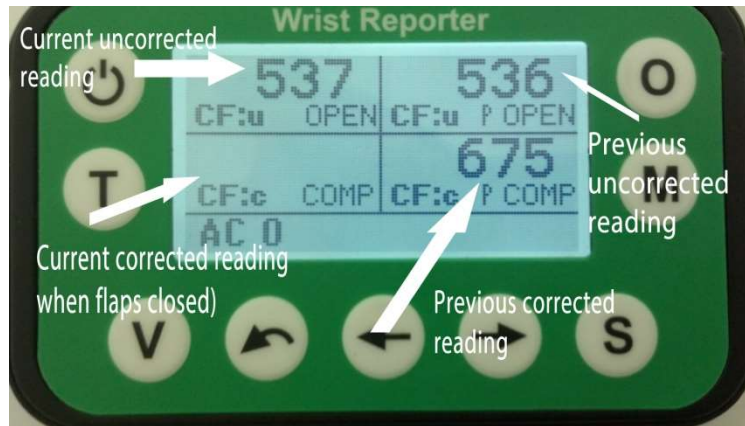
10. A compensated reading may be stored when continuous backpressure compensated readings are being displayed at the lower left. Whenever satisfied, press "S" or press the Thumbswitch to record the two values. A small "s" will be shown beneath the two values to indicate they have been stored. In addition, the sequence number next to the Memory Group letters will increment.

11. Press V to display the Flow Summary.   There is a column for uncompensated readings and a column for compensated readings. In each column are listed the number of stored readings of that type, sum, average, max, and min.

12. Press V to display the List Screen. There is a list of stored readings showing their sequence number in the Memory Group, the time and date of reading, and the reading value.

VELOCITY TRAVERSE WITH PITOT TUBE OR FOIL-TYPE PROBE

There are two ways to connect a velocity probe, Pitot or foil-type, to the Pressure Module.

VELOCITY GRIP.

The Velocity Grip is for performing a traverse with one hand. The Pressure Sensing Module and Wrist Reporter are both mounted on the Grip handle. There are thumbswitches on the handle for controlling the Wrist Reporter. You can change the view of the data and you can store a reading to make it part of the traverse statistics.

Slide the static pressure port of the probe down through the vertical hole at the front of the Velocity Grip handle. Attach rubber hoses to the total pressure port and the static pressure port. Hoses cut to appropriate sizes and shapes are provided as part of the Velocity Grip TAB Kit. As shown in the photo, the straight hose is for total pressure and the hose with the 90° elbow is for static pressure. The straight total pressure hose will fit through the hole in the back of the Grip handle. Then snap the velocity probe shaft down into the groove in the handle where it will be held tightly by the spring plunger. Attach the Pressure Sensing Module pressure ports to the appropriate hose.

NO GRIP HANDLE--DIRECT ATTACHMENT OF PRESSURE MODULE TO VELOCITY PROBE

Sometimes wires, pipes, or other obstructions make it cumbersome to use the Velocity Grip handle to manipulate the velocity probe. Instead, the Pressure Sensing Module may be connected directly to the velocity probe using short hoses. Short tubes as shown nearby eliminate the long, dangling hoses tubes common with traditional instruments, which sometimes catch on ladders and other obstacles. Also, long hoses can swing during measurements and affect the accuracy of low-velocity readings.

SCREEN VIEWS FOR VIEWING AND CONTROL OF PITOT OR FOIL VELOCITY

Optional Parameter Setup Screen: This screen allows you to input various factors so that the Wrist Reporter can calculate CFM for you. The arrow keys will be your primary form of navigation on this page. Highlight the parameter you would like to change and then press the "S" key. Next use the arrow keys to select the correct temperature/shape/size of duct and press the "S" key to store the proper setting. Escape returns you to the main decision screen. After inputting your settings you are ready to start reading.

The air temperature set by the user will remain in effect until the Wrist Reporter is turned off, when it will return to the default value of 70F. If the user moves to a different duct system with a different air temperature, he should return to this setup process to adjust the temperature setting.

The duct shapes currently available are round and rectangular. Oval ducts will be added at a future date. The duct size may be adjusted to the nearest tenth of an inch.

This screen may be skipped by pressing V if the user does not desire a CFM calculation and wants to quickly proceed to measuring velocity.

Pitot/Air Foil Comprehensive Screen

A. Latest reading in feet per minute along with average, min, and max of stored readings.
B. Static pressure in inches of water column along with average, min, and max of stored readings.
C. Current memory group and the number of stored readings in that group.
D. From top to bottom: Temperature, barometric pressure, air density in pounds per cubic foot, and current square footage of the duct.
E. Converted average of feet per minute to cubic feet per minute of stored readings

Velocity Store/Stats Screen: Shows latest reading in large numbers in the center of the screen. Average maximum and minimum are shown on the right side of the screen. Group and number of stored readings can be seen on the bottom left and average CFM is displayed on the bottom right.

Velocity list view screen: Shows reading number on the left along with each reading time stamp and the reading in FPM. Use the Right and Left Arrow keys to scroll down and view more readings.

Pitot and Air Foil modes

1. While on the Probe Mode Selection Screen select Pitot/ Air Foil.
2. Select whether you want to View Readings if you would like to view individual readings and decide which ones you want to store. Or select Running Average if you would like to take an average of multiple readings over time.
3. Select the reading speed as described elsewhere.
4. Enter temperature as well as duct size and shape (entering duct size and shape is not completely necessary)
5. Press V to begin reading.
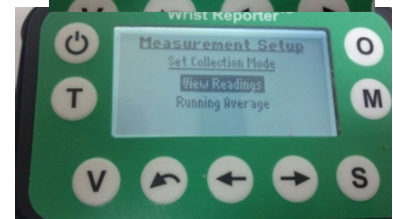
Grid Velocity Mode

1. While on the Probe Mode Selection Screen select the option called "Grid Vel".
2. Select whether you want to View Readings if you would like to view individual readings and decide which ones you want to store. Or select Running Average if you would like to take an average of multiple readings over time.
3. Select the reading speed as described elsewhere.
4. Enter temperature manually if you are not using a temperature probe.
5. Press V
6. You are now reading in Grid mode.

Differential Pressure

1. When you are on the Probe Mode Selection Screen select the option labeled "Diff Press"

2. Select whether you want to View Readings if you would like to view individual readings and decide which ones you want to store. Or select Running Average if you would like to take an average of multiple readings over time.
3. Select the reading speed as described elsewhere.
4. The Wrist Reporter will begin showing differential pressure in the Trend Screen which will show the reading and units on the left side of the screen, as well as the three previous readings on the left side of the screen.
5. By pressing "V" you will go to the Store/Trend Screen. This shows you the most recent reading in the top left with the units of measurement underneath. The bottom of this screen shows what memory group the user is in and how many readings they have stored. The statistics associated with that memory group are shown on the right and include average, highest, and lowest readings.
6. If two or more Pressure Modules are linked to the Wrist Reporter, the 4-way Split Screen automatically appears.

SETTING THE TEMPERATURE FOR AIR DENSITY ADJUSTMENT

You can select the temperature for air density adjustment in three different ways;

- Use the default setting of 70°F
- Manually enter the temperature
- Use a temperature sensor to automatically detect the temperature.

Note that barometric pressure is automatically measured by the Pressure Module and factored into velocity and flow calculations.

To manually set the temperature used for density adjustment:

1. Turn on the Wrist Reporter. Wait for the screen to display "Turn on Modules to Link".
2. Turn on the Pressure/Velocity module sensor. The Wrist Reporter displays the Link Status screen indicating the Pressure/Velocity module is connected.
3. Press the V key. The Wrist Reporter displays Probe Mode Selection.
4. Use the arrow keys to select the Pitot or Foil options depending on which instrument you are using. The bottom of this window displays the current temperature setting.
5. Press the O key to display the Temp Setting screen.
6. Use the arrow keys to change the temperature one digit at a time. Use the S key to accept each digit and move to the next. Continue to repeat until the temperature is set.
7. Press the S key to return to the Probe Mode Selection screen and check that Pitot is highlighted and the temperature matches the temperature you just entered.

To use the Temperature Sensor for density adjustment.

1. Turn on the Wrist Reporter. Wait for the screen to display "Turn on Modules to Link".
2. Turn on the Pressure/Velocity module sensor. The Wrist Reporter displays the Link Status screen indicating the Pressure/Velocity module is connected.
3. Turn on the Temperature sensor. The Wrist Reporter displays the Link Status screen indicating the temperature sensor is connected by displaying an S-2.
4. Press the V key. The Wrist Reporter displays Probe Mode Selection.
5. Use the arrow keys to select the Pitot or Foil options depending on which instrument you are using. The bottom of this window displays the current temperature setting.

6. Check that an S-2 is displayed next to the temperature which indicates the temperature is being automatically adjusted based on the reading from the temperature sensor.

Selecting Preferred Speed

The Evergreen Wrist Reporter allows the user to specify what speed they would like the pressure modules to read at. The ~1 sec. per reading option is the fastest speed followed by ~2 sec. per reading. The pressure dependent option will automatically vary the speed based on the level of the pressure (or velocity or flow) of the reading; higher pressures will be measured in about one second, while very low pressures will require six seconds. This setting will give the most representative and consistent results when the pressure is not perfectly constant.

REPLACING AN INCORRECT TRAVERSE READING

The user may need to replace a traverse reading that is incorrect. From the Store/Stats Screen,

1. Use the arrow keys to get into Review mode and to move to the record to be replaced.
2. Press the 'O' key to go to a replacement select screen.
3. Press the 'S' key to go into Replace mode or the ESC key to return to Review mode.
4. Once in Replace mode Readings will update normally.
5. Pressing the 'S' will replace the record with the current reading, update the statistics and automatically return to Review mode positioned on the record with the new replacement value.
6. Pressing ESC will exit Review mode or you can use the arrow keys to move to another record.

	CH – 8D	CH-15D	CH -3#
Includes Skirt/Frame	14"x 14" x 24" 14" x 14" x 12"	2' x 2'	2' x 2'
Extension Pole	2 – 4'	2 – 4'	2 – 4'
Carrying Case	24"x19"x10"x15#	27"x27"x9"x23#	27"x27"x9"x19#

COMMON OPTIONAL SKIRTS AND FRAMES (CUSTOM SIZES AVAILIBLE, CONSULT FACTORY)

	CH-8D	CH-15D	CH-3#
8x24" BIO		x	X
14x14x12"	x		
14x14x24"	x		
14x14x34"		x	X
16x16"		x	X
1x2'	x	x	x
2x2'	x	X	Consult Factory
2x4'		X	x
1x4'		X	x
1x5'		X	x
1x6'		X	
3x3'		X	

This section uses the Three Pounder (ET-3#) as an example. (CH-15D and CH-8D are similar)

1. Turn on and link the Pressure Module to the Wrist Reporter. Press S for Setup and move the cursor to Hood CFM. Press S.
2. Move cursor to ET-3# and press S.
3. Perform the normal setup for parameters such as temperature and reading time. When flow is low, allow 6 or 8 seconds for more consistent readings.
4. The Three Pounder comes with two powerful tools that affect the Reading Factors. We'll set those in the following window. Use the cursor to select the appropriate option, then press S. Two selections are made in this one window.
5. Flow Plates allow the user to reduce the area cross-section for fast, accurate readings at lower flows.   Ranges are:
    a. No Plate; 200 to 3000 CFM.
    b. Plate 1.1 sq ft; 80 to 800 CFM…
    c. Plate 0.3 sq ft; 30 to 200 CFM.
6. The names of plates refer to the open area of the slots. Fast, accurate readings happen when air velocity is about 100 CFM or higher. Therefore, when using Plate 0.3 Sq Ft, the lower range would be 100 x 0.3 = 30 CFM.
7. The Bellmouth Belt can eliminate about 95% of the flow resistance normally associated with return / exhaust mode readings.
8. The Reading window shows both uncorrected and corrected readings. Also shown are the selected options for Plate and Belt.
9. When readings are stored, the Wrist Reporter captures and displays both the Uncorrected and Corrected readings.

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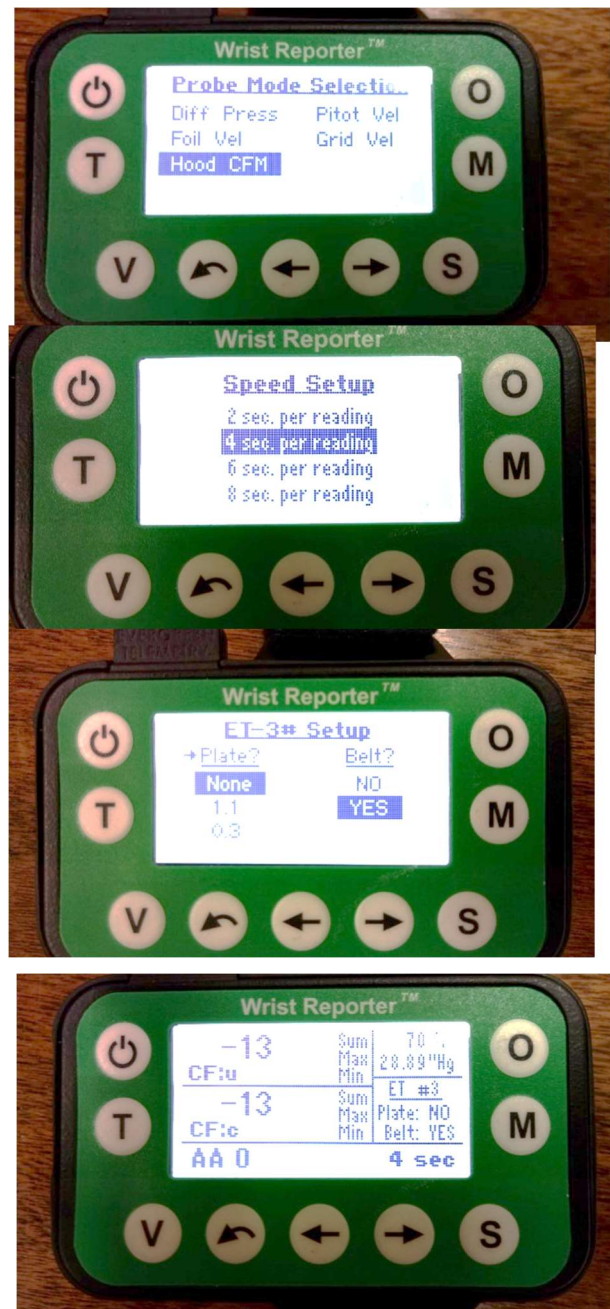
- Different sticks for different modes
    - Normal, flexible
    - High-Volume Exhaust Mode, stiff to keep skirt taut
- Flow Range Plates (pat.pend.)
    - No plate: 200 to 3000 CFM
    - Plate 1.1 sq. ft.: 90 to 900 CFM (can leave this installed for most grilles)
    - Plate 0.3 sq. ft.: 30 to 200 CFM
- Return / Exhaust Mode requires Bellmouth Belt™(pat. pend.) for resistance reduction
    - Future option for no-Belt measurements
- Wrist Reporter setup window for inputting Plate & Belt.
- Large skirts coming soon. 1x4 & 2x4
    - Use standard Skirt Frame Assembly FA-101.
    - Long, stiff sticks will be labeled.
- Skirt frame foam is field-replaceable.
- Magnets optional. Reduce gap by pulling up on skirt while securing.
- Handle varieties
    - Short
    - 2-4' extension
    - Longer extensions online from Rubbermaid
    - Build your own—adapter provided.
    - 20-degree adapter for sidewalls.

OTHER NEW WR FEATURES (REQUIRES SOFTWARE REVISION 1.04XM OR NEWER)

- Reading time selection for flow: 2, 4, 6, 8 seconds
- Flow window always shows / stores Uncorrected, Corrected.
- Flow window shows Min, Max, Sum. No average.
- Metric mode. Press O. Press O. Cursor and S to select.
- Can display one pressure and one flow simultaneously.

THREE POUND CAPTURE HOOD ASSEMBLY

1. Attach the skirt bottom to the averaging grid by inserting the aluminum arm tips through the skirt grommets.

2. Insert the Center Support Pole into the top Shaft Coupler and rotate it until it locks in place.

3. Assemble the skirt by installing four Skirt Support Sticks. The bottom ends of the sticks are inserted into the holes on the Stick Mount and the Stick Tips poke through the grommets in each corner near the top of the skirt.

4. Place the Pressure Module into the neoprene pocket and attach the hoses from the center manifold of the averaging grid. The white hose is for the + port and the black is for the – port.

5. There are several options for bottom connection. Shown below are Short Handle and Extension Pole 2-4'.

6. Magnets should be oriented so they are flat and parallel to the ceiling above. The optional magnet pocket can be removed from the Velcro strips if the ceiling strips are non-ferrous.

7. Flow Adjust Plates are installed as necessary at the bottom of the hood. They lie flat against the averaging grid. An o-ring holds the center in place. The outside edge of the plate is overlapped by the bottom elastic tube inside the skirt bottom. Rotate the plate as required to center the averaging grid arms in the slots.

8. The Bellmouth Belt is installed as necessary for return / exhaust measurements at the bottom of the hood by aligning the grommets with those of the skirt.

CORRECTED FLOW READINGS WITH CH-15D

The Wrist Reporter displays suggested corrections for backpressure based on experimental readings in a controlled lab environment where airflows were confirmed with a NIST-traceable duct traverse. The amount of correction varies depending on the reading range. Supply air usually requires a correction of 5% or less. Return air / exhaust readings may require correction by 10% or more.

The sequence of photos below show Wrist Reporter displays for Exhaust Mode. Note that exhaust mode will always display a negative sign. That indicates proper orientation of the tubes between the grid and the Sensor. If no negative sign is seen, the proper factors for Exhaust / Return air are not being implemented and the readings will be in error.

The first display in the sequence shows the uncorrected reading CF:u and the air density factors. If readings have been stored, there will also be statistics.		
The second display shows CF:u and corrected value CF:c.		
If readings have been stored, List View shows the number and time of the reading, as well as CF:u.		
Use the arrow keys to move the cursor to cover a particular stored reading. Press S to Select that reading. The display will show CF:u and CF:c for that reading.		

CH-15D HOOD HANDLE

The aluminum handle provides a "one-piece" feel, with no sense of wobble. The center grip has the same diameter as bicycle handle bars. There are many, many types of off- the-shelf handle grips; a technician can personalize his handle by selecting the one that gives the best fit, function, and "feel". The handle height and location helps minimize the carrying case size.

CH-15D PRESSURE MODULE HOLDER

The Pressure Module (S-PVF-1) Holder is attached to the base.

CH -15D CROSS BRACE & ACME THREAD POLE CONNECTOR

The pole connector is mounted centrally to the hood base, optimizing the balance and handling when the hood is used with an extension pole or hood stand. The pole connector has a standard Acme thread that is identical to most off-the-shelf paint roller components. Each hood comes with a 2-4' extension pole. There are a wide variety of compatible poles available at most hardware stores.

The top photo below is of the Kennedy Space Center.
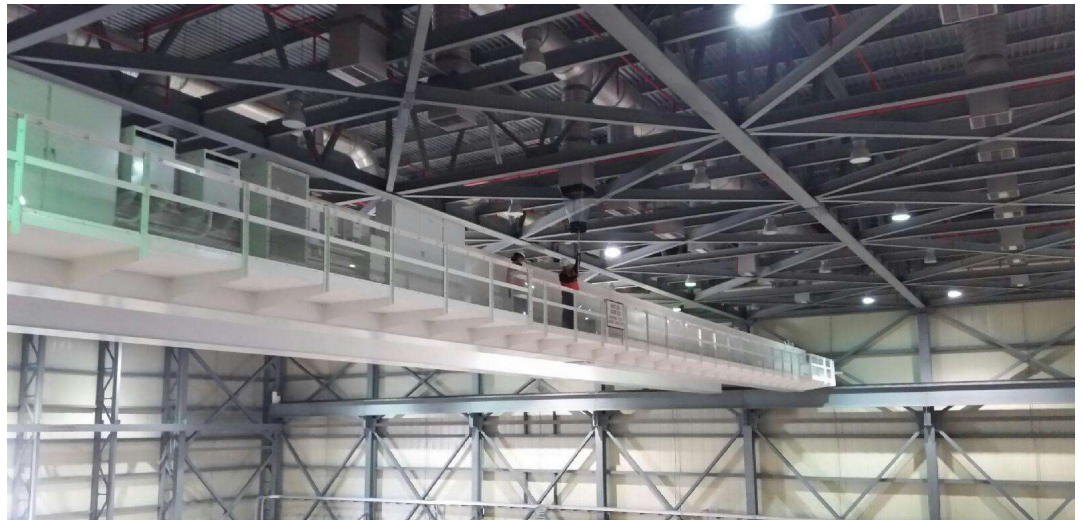
The bottom photo shows a typical retail sales aisle.

The new frame assembly for large skirts is stiffer and lighter than the previous generation. The corners are permanently welded for strength and stiffness—there are no moving parts to fail. There are fewer components than in the traditional system, and they are easier to place and connect. For all junctions, there is a common type of connecting bridge. Four corner pieces make up the fundamental form, a 1x4' frame. There is a 12" extension segment for converting the fundamental form to a 2x4' (install extension segments at the two ends), or a 1x5' (install the extension segments at the sides).

At each junction the connecting bridge fits onto four threaded inserts. Only the two closest to the junction need be secured by nuts—the other two function as guide pins. In addition to the traditional brass knurled nut, the user has the option of plastic wing nuts. Lock washers are provided to help keep the nuts from loosening.

CAPTURE HOOD CARRYING CASE OPTIONS

Hard Case 26x25x10", no wheels.   For CH-15D or ET-3#

Hard Case 26x25x10", wheels & telescoping handle.   For CH-15D or ET-3#

Hard Case 24x19x10", suitcase style.   For CH-8D.   (Can also be used for CH-15D with collapsible 2x2' frame assembly)