# YHC HRV Monitoring – Installation and Wiring Guide

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## Revision History

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| 1/9/2012 | Charles Hache | Initial Revision | 1.0 |
| 1/24/2012 | Charles Hache | Revisions to sensor installation instructions | 1.1 |
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# Contents



# Project Contacts

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# Installation Support

For questions regarding the placement of sensors, contact the Project Manager.

For questions regarding the wiring of the hardware or of the hardware itself, contact the Technical Lead.

## ESD Sensitive Devices

The hardware that is being installed is very sensitive to static discharge. Before handling or touching any of the equipment, ensure that you touch a properly grounded wire or housing to discharge any accumulated charge. Carefully handle the hardware; do not touch chips and other sensitive components on the board, and try to hold the boards from their edges only.

## Electrical Installation

All the equipment and hardware must be installed according to local electrical and fire codes. Where the instructions in this manual conflict with the local codes, the local codes take precendence. Installation must be completed by a qualified electrician.

## Installation Overview

There are several physically separate systems that are wired together for the system to operate properly. The systems are outlined here, and are covered with more detail later in the document.

- The Digital Sensor Interface (DSI) and its sensors, located at the HRV
- The WattsOn and its current transducers, located at the HRV
- The Logging Computer, located at an internet line.

### *Logging Computer*

The logging computer is located in an enclosure which also houses the power transformers and network router. This enclosure must be located near an internet ethernet plugin and a 120VAC outlet.

Two cables need to be run from the logging computer to the HRV room – a CAT5 cable for communication and an 18/2 cable for power.

### *DSI*

The DSI requires an 18/2 power line and a CAT5 communication line run from the location of the logging computer. Since the WattsOn and the DSI will be close to each other, they can share the power and communication lines. Typically these wires are bussed from device to device (eg: the power and communication lines are run from the logging computer terminal blocks to the terminals on the DSI, then another set of wires are run from the terminals on the DSI to the terminals on the WattsOn).

A few extra CAT5 lines will have to be run from the DSI to sensors outside the room. Sensors located outside the room include: Outdoors temp/humidity, Indoors temp/humidity and Room CO2. Each of these require a separate CAT 5 line.

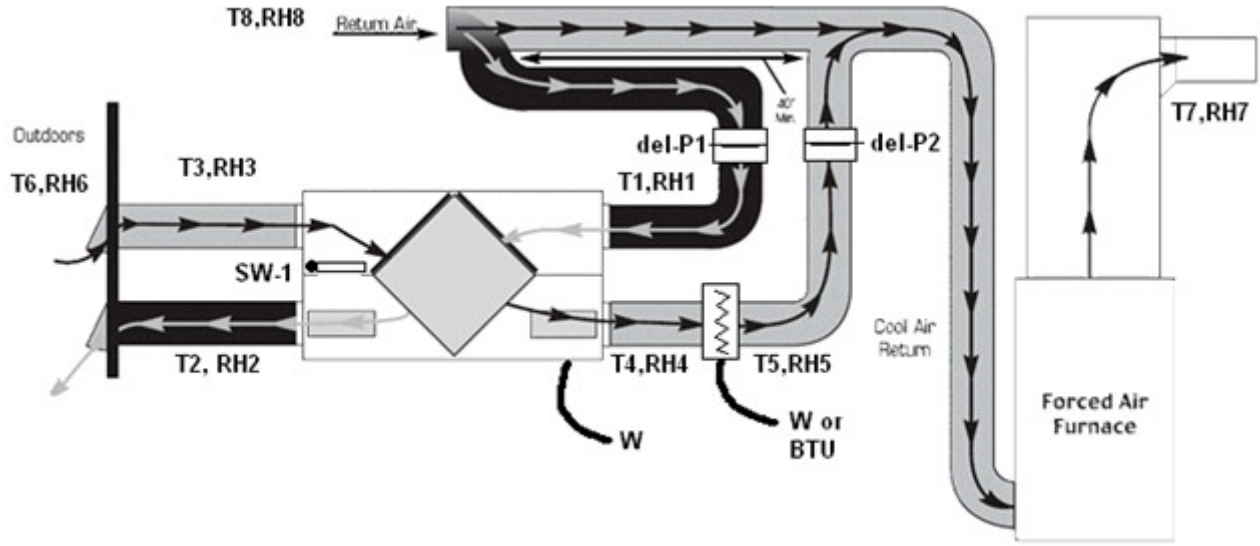
All the sensors and transducers that connect to the DSI are low voltage, and thus CAT 5 communication cable can be used.

### *WattsOn Power Meter*

The WattsOn power meter requires an 18/2 power line and a CAT5 communication line. These can be bussed from the DSI.

For the measurement of a power line, the WattsOn requires a connection from the line itself to read the voltage, and two connections from a current transducer on the line to read the current. This will be covered in more detail later.

## Installation Detail




*Drawing 1: Typical HRV Sensor Installation Locations*

Drawing 1 shows the typical installation locations for the sensors. In detail, the Tx,RHx sensors are integrated sensing units for temperature and humidity (see ITAH – Integrated Temperature and Humidity Sensing). The del-Px sensors are differential pressure sensors across flow collars (see Pressure Sensors). The SW-1 output is a digital output for the defrost cycle (see Defrost Input). The W and W or BTU items represent power monitoring for blower motors and/or heaters (see WattsOn Power Monitor). Finally there is an indoor air-quality sensor (not pictured) (see CO2 Sensor).

### *Logging Computer*

The logging computer enclosure must be mounted in a safe and secure location near an available Ethernet internet connection and a 120VAC power outlet.

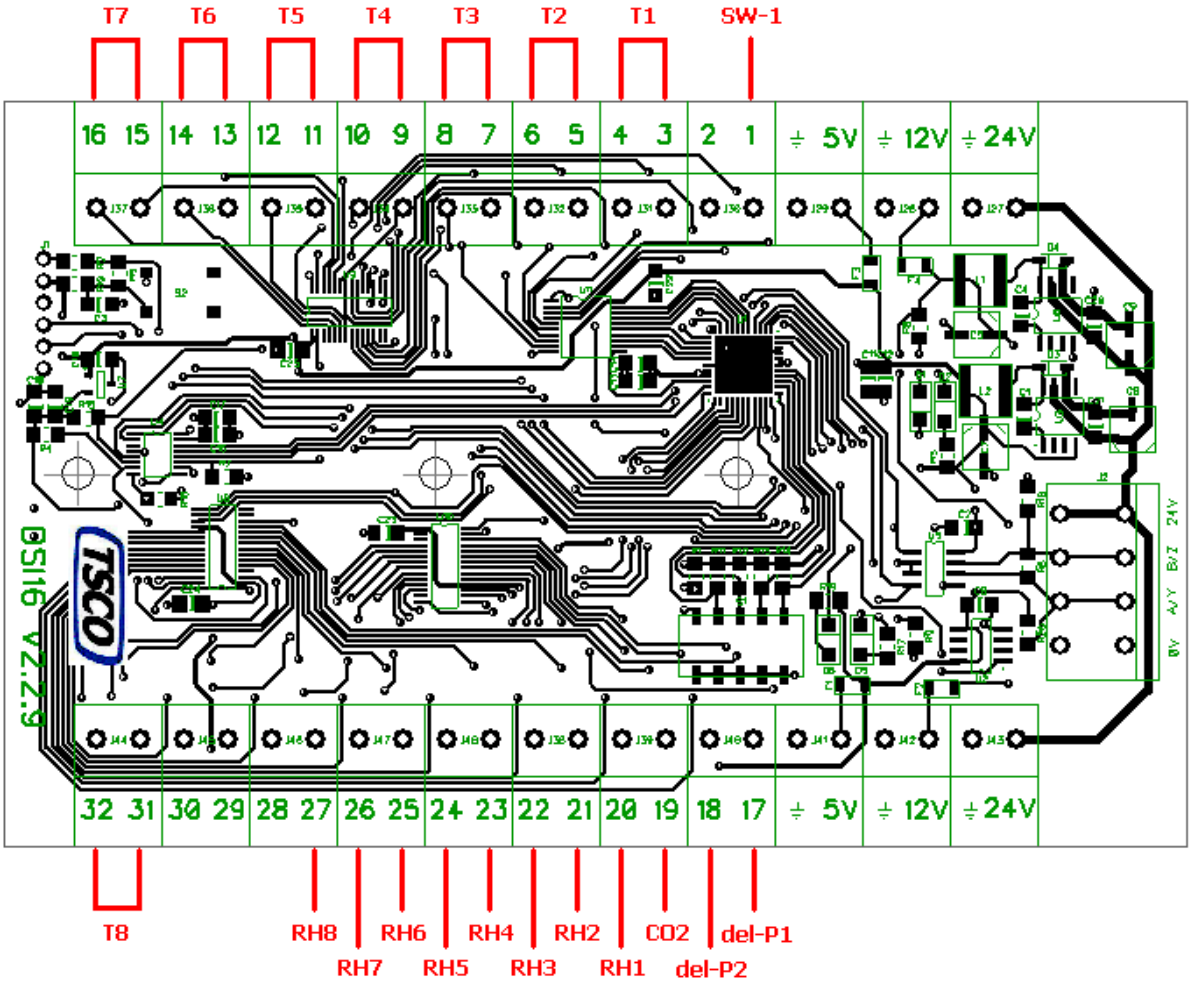
Once the enclosure is secure, an internet Ethernet line must be run into the enclosure and connected to the WAN port of the router. A 120VAC power cord in the enclosure must be run to the power plug. Keep the AC line unplugged until the installation is complete.

A CAT5 and an 18/2 cable must now be run from the terminal blocks in the enclosure to the HRV room where the DSI and WattsOn will be located. The CAT5 connects to the RS485 terminal blocks (A/Y and B/Z), and the 18/2 to the 24VDC Power terminal blocks. See Appendix A for wiring information.

## *Digital Sensor Interface (DSI)*

The DSI comes in a small plastic enclosure that must be mounted securely in a location that will allow for easy running of the cables for all the sensors, communication, and power.

Once secured, bring in the CAT5 and 18/2 lines from the logging computer, and connect the lines to the appropriate terminals. See Appendix A for wiring information.




*Drawing 2: DSI - With labeled sensor inputs*

The sensors can now be installed and wired into the DSI. Consult Drawing 1 for the locations of the sensors. Once the sensors are in place, the CAT5 wires must be run back to the DSI and connected in accordance with Drawing 2.

In drawing 2, the terminals that each sensor must be connected to are identified. For example, the T3,RH3 sensor shown in Diagram 1 (the Fresh Air Intake) must be wired such that the temperature leads connect to terminals #7 and #8 (note for temperatures the order of the wires in the terminals does not matter), and the humidity sensing lead connects to terminal #22.

Some of the sensors require power to operate. These include the humidity sensors, the

pressure sensors, and the CO2 sensor. The DSI offers extra terminals for ground, as well as for +5, +12, and +24VDC. Use these terminals to provide the power to the sensors.

For ease of installation, the DSI can be unscrewed from its enclosure. This often makes the terminal connections easier to make.

## ITAH – Integrated Temperature and Humidity Sensing

The Integrated Temperature and Humidity (ITAH) sensing board consists of a resistive temperature sensor and a low voltage humidity sensor. The total current of the board is less than 1 mA, so CAT5 can be used for power as well as signal connections.

Each temperature and humidity sensing board is pre-calibrated and configured. Each board is labeled with its designation (eg: T3,RH3), and must be installed in the appropriate location and wired to the appropriate terminals. Swapping the locations or wiring of boards will invalidate the data collected from the system.

There are 5 connections to make on each ITAH:

- TEMP – these two terminals connect to one pair of the Tx terminals identified in the DSI wiring diagram. The order of the two wires does not matter.
- GND – this is the ground connection from one of the DSI ground terminals: ⏚
- OUT – this is the signal for the humidity sensor, and must be wired to one of the identified RHx terminals on the DSI.
- V+ – this is a +5VDC terminal and it can be wired with CAT5 to one of the +5V terminals on the DSI.

Wiring notes:

- Use one twisted pair of the CAT5 for the temperature leads to minimize noise (ie: do not use one wire from one pair, and another wire from another pair).
- For all sensors, keep the wiring as short as practical.

For reference, here are the common names for the sensor locations

| | | | |
|---|---|---|---|
| T1,RH1 | HRV Stale air intake | T2,RH2 | HRV Stale air exhaust |
| T3,RH3 | HRV Fresh air intake | T4,RH4 | HRV Fresh air exhaust |
| T5,RH5 | Post-heat fresh air | T6,RH6 | Outdoors |
| T7,RH7 | Post-furnace fresh air | T8,RH8 | Indoors |

### *Installation*

For exposed ITAH sensors (eg: Indoor and Outdoor sensors) the ITAH board should be located within a vented enclosure. The enclosure can be screwed to a surface as required. The ITAH board within can be secured either with screws or double sided tape/foam.

Two of the sensor boards must be located outside of the HRV room – one must be located outside of the building (the Outdoors sensor, T6,RH6), and the other must be located within some common area within the building (the Indoors sensor, T8,RH8). The reason is that the HRV room's temperature can fluctuate as the unit is running, and may not be representative of what the actual building occupants are experiencing.

For ITAH sensors located within the ventilation, an enclosure is not required. These sensors and wiring should be secured with double-sided tape or double-sided sticky foam and zip ties.

For ITAH sensors located oustide of the ventilation (Indoors and Outdoors ITAH sensors), they should be secured within the provided plastic enclosures, and the enclosures can be secured at the installation location.

Note that while these sensors are robust, they should not be placed in locations where they may experience extreme heat. If a sensor is being installed near a heater, ensure there is an adequate distance between the heat source and the sensor. The sensor should not be installed in locations where the temperature may exceed 85C (185F).

Note for all installations: it is critical for accuracy that the bead for temperature sensing and the circular opening on the humidity sensor are not blocked or covered.

## Pressure Sensors

There are two pressure sensors to install per HRV. One pressure sensor measures the pressure across a flow collar installed in the incoming air vent, and the other measures the pressure across a flow collar for the outgoing air vent. Each pressure sensor requires a CAT5 cable to be run to the DSI.

### *Installation*

To wire up a pressure sensor, connect the 15-36VDC terminal on the sensor to the +24V terminal on the DSI. Connect the ground from the sensor to a ground terminal (⏚) on the DSI. Finally connect the output terminal from the sensor to the appropriate terminal on the DSI (terminal #17 for the outgoing air vent, terminal #18 for the incoming air vent).

The sensors have mounting holes to be used for screwing them to a surface. Locate the sensors to minimize the length of tubing required to go from the sensor barbs to the barbs on the flow collars.

With the sensors mounted, connect the tubing. The barb marked LOW on the sensor must connect to the low pressure port on the flow collar, and the barb marked HI must connect to the high pressure port. The barbs on the sensor use 1/4" tubing.

## Defrost Input

The DSI has a terminal (terminal #1) that is reserved for a defrost-active input. The DSI expects a GND connection to this terminal when the defrost is active, and a floating (unconnected) signal otherwise (the terminal has a built-in pullup resistor).

The method to connect to the DSI is dependent on the HRV. The following are some cases that may be encountered:

### *Defrost Cycle Cases*

#### Dry contact output

The HRV may have a dry contact output, meaning that it has a relay that is typically open, but when the defrost is active the relay closes and allows current to flow through it. The relay is dry-contact, meaning that there is no voltage present on either contact, regardless of if the relay is open or closed. When the relay is closed, there is continuity between the contacts.

This case requires simple connections. First run a signal wire from a GND terminal on the DSI to one of the contacts of the relay. Run the other relay contact to the defrost terminal on the DSI, terminal #1. When the relay is triggered, the terminal will be shorted to ground, and when the relay is not triggered the input will be floating (and held high by the internal pullup resistor).

#### Voltage output

The HRV may have a power output that indicates if the unit is in defrost or not. If this is the case, then a relay will need to be used to get the proper voltage to the DSI.

This method requires a relay with a coil voltage equal to the voltage on the HRV's output (not included). The current required for the coil must not exceed the current available on the ouput. The relay's coil will be connected to the output and the output's voltage reference (which could be the neutral line for an AC voltage, or to a DC Ground from the HRV for DC outputs – see the HRV manual).

Once the relay is installed, continue with the instructions for the Dry Contact Output case, using the contacts on the newly installed relay.

#### No output available

It is possible that there is no output to indicate the defrost cycle. In this case, the terminal on the DSI may be left disconnected.

## CO2 Sensor

CAT5 cable can be used for the power and signal for the CO2 sensor. There are 3 connections to make on each board:

- Black identified terminal (center) – This is the ground connection to the DSI.
- Red identified terminal (right) – This is the +5VDC connection to the DSI.
- Unidentified terminal (left) – This is the signal of the sensor, connected to the CO2 terminal on the DSI (terminal #19)

### *Installation*

The CO2 sensor's housing should be installed in a common location within the building, where the measurements it makes can be representative of the air quality as it affects the occupants. A single CAT5 cable run back to the DSI is required to power the sensor and return the measurements back to the DSI. The housing can be screwed into place.

## *WattsOn Power Monitor*

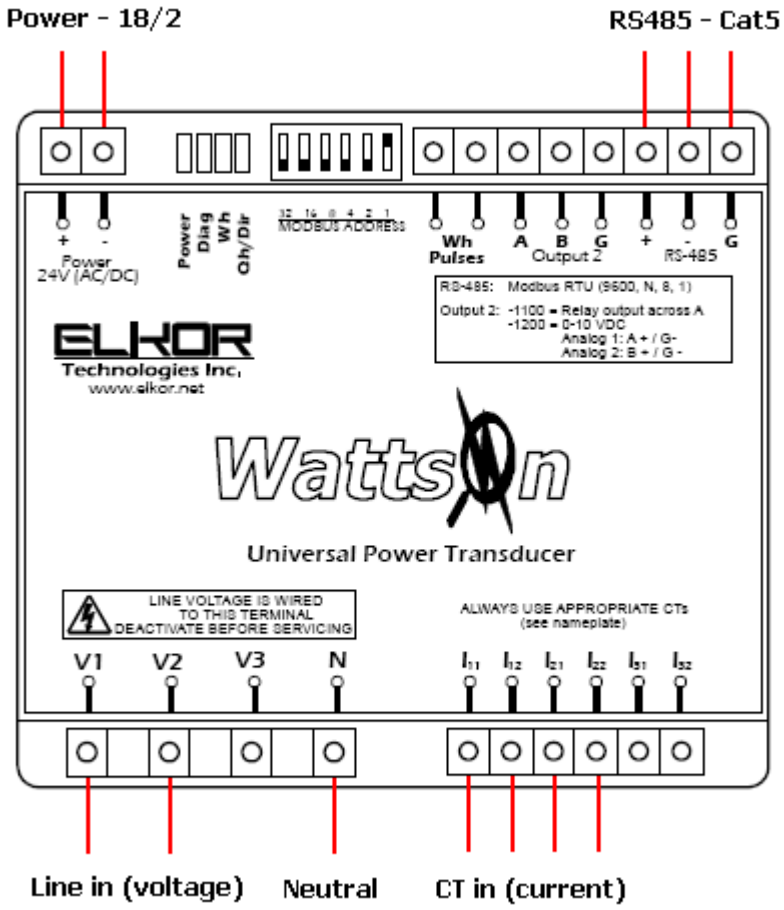
The WattsOn Universal Power Transducer acts as a stand-alone measurement device. The WattsOn enclosure should be mounted as close to the power feed to the HRV (and the HRV post heater, if applicable) as possible.

Once secure, the WattsOn has several connections that must be made (see Drawing 3). Connect the 18/2 power cable to the + and – terminals at the top left, and the CAT5 communication cables to the +,-, and G, RS485 terminals. See Appendix A for wiring information.

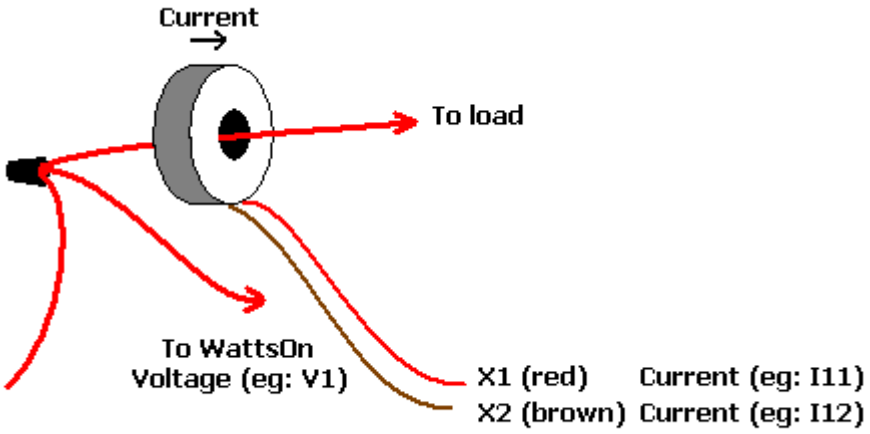
Consider each line that is to be monitored. The line will need to be cut. The MCTA current transformer is then slipped onto the line, such that the white side of the transformer is facing towards the load that is to be monitored. Now a wire must be run from one of the $V_x$ (voltage) terminals on the WattsOn to the point where the cut was made. The three wire ends can be maretted together (in other words, the cut line is put back together, and the line to the WattsOn is spliced in). See Drawing 4 for a detail of this.

The spliced wire going to the WattsOn is connected to one of the V connections, for example V1. The Current Transformer's connections are connected to the corresponding current terminals (eg $I_{11}$ and $I_{12}$). Note that the polarity for the current transformer matters – the X1 lead of the current transformer (the red lead) must connect to an $I_{x1}$ terminal, while the X2 lead (brown) must connect to an $I_{x2}$ terminal. Finally the neutral line must be connected to the N terminal on the WattsOn.

For this installation the terminals $I_{11}$, $I_{12}$, and V1 are to be used for the monitoring of the HRV power line, and terminals $I_{21}$, $I_{22}$, and V2 are to be used for the monitoring of the post-HRV heater line, if applicable.




*Drawing 3: WattsOn Required Connections. Image © 2010, Elkor Technologies*




*Drawing 4: Current Transformer Detail*

## Powering On

Once all the connections have been made and all enclosures and sensors are properly installed and secured, the system can be powered on.

Apply the 120VAC to the logging computer enclosure. The lights on the network router should turn on, and the computer should start. A few moments after starting, the computer emits a beep to indicate that it has started. Wait for the computer to power up completely (1-2 minutes)

Ensure on the front of the router that the Internet and Port 1 lights are lit. Ensure on the logging computer that the lights on the Ethernet jack are lit.

Check the DSI. There should be two solid green lights to indicate power. Also check the WattsOn – again there should be a light to indicate power.

It is also possible to verify the communications between the logging computer and the DSI. The logging computer is set to communicate with the DSI every 60 seconds; when this happens the TX/RX LEDs on the DSI (the red and the green LEDs near the switches) will blink for a brief moment. If the DSI is watched for few minutes and these LEDs are seen to blink, then the communication is verified.

Once the system is confirmed running, notify the Technical Lead to verify that it is connected to the server properly.

# Appendix A: Wiring

## *Terminal Blocks*

### Logging Computer

The logging computer has a label identifing the terminal blocks. The terminal blocks are arranged as follows, from left to right. Also included in the following table is the cable type that should be used.

| **CAT5 – To HRV Room** | | | **18/2 – To HRV Room** | | **18/2 (Occupied by logger)** | |
|---|---|---|---|---|---|---|
| Data - | Data + | Ground | Ground | +24VDC | Ground | +24VDC |
| TB #1 | TB #2 | TB #3 | TB #4 | TB #5 | TB #6 | TB #7 |

## *Colours*

Typical installations use the following colour code. This information is replicated on a label in the logging computer enclosure.

## *RS485 CAT5 Colour Coding*

| Wire Colour | Description | DSI Marking | WattsOn Marking |
|---|---|---|---|
| Green-White | Data + | A/Y | + |
| Green | Data - | B/Z | - |
| Brown | Ground | 0V | G |

## *Power 18/2 Colour Coding*

| Wire Colour | Description | DSI Marking | WattsOn Marking |
|---|---|---|---|
| Red | 24VDC | 24V | + |
| Black | Ground | 0V | - |