# ADRES
# Automated Demand Response and Energy Savings System Installation Manual for the HVAC Controller

**Version 1.8**

*Winn Energy Controls, Inc.*

## Section Description Page

### 1.0 Installation Guide for the ADRES HVAC Controller



### 2.0 Wiring Diagrams

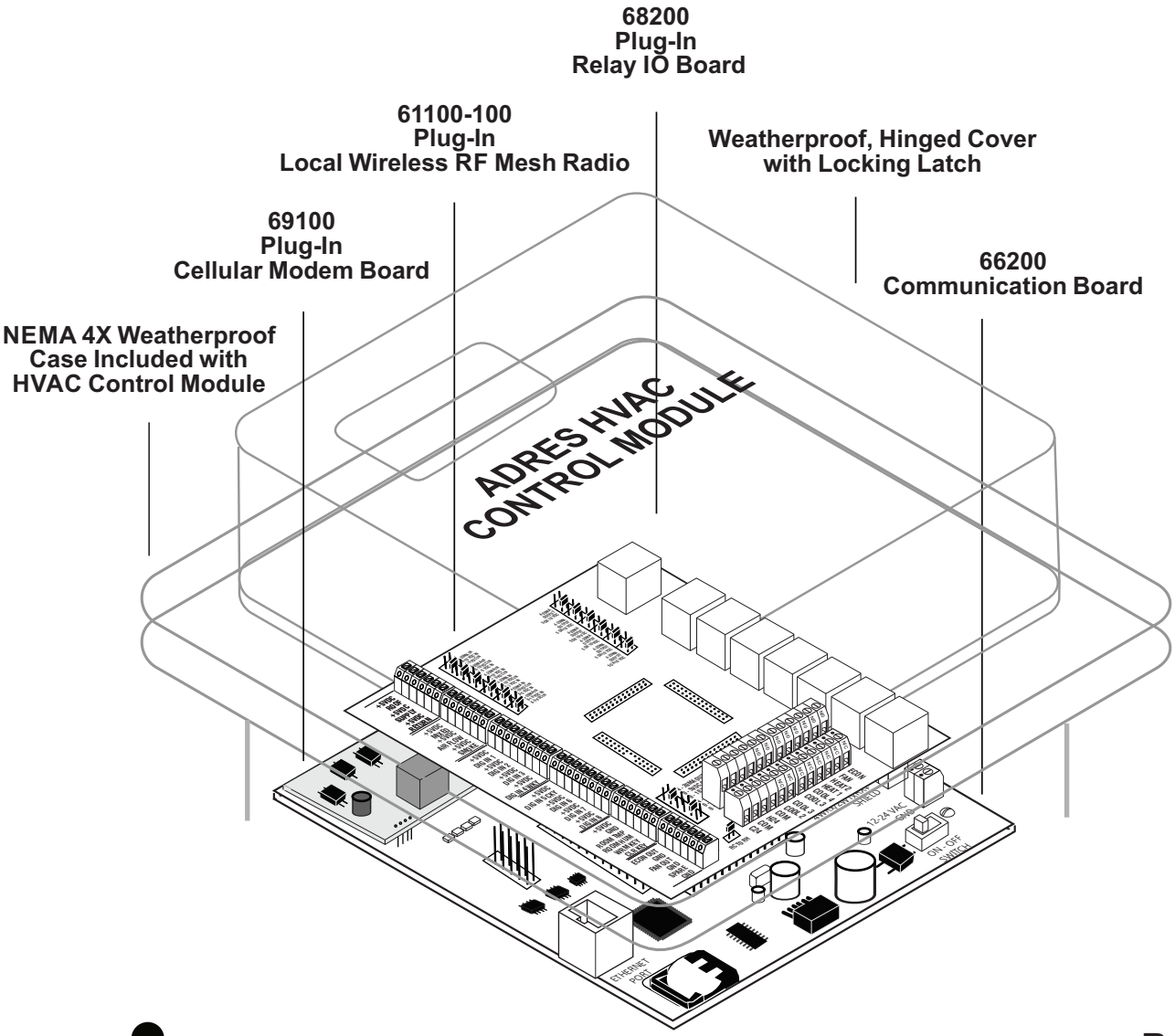
# Introduction to the ADRES HVAC Control

## Introduction

This manual describes the installation and wiring of the ADRES HVAC control module series which are supplied in NEMA 4X type enclosures. The 66200 Communication board can be powered by 12 to 24 VAC or 12 to 24 VDC. The 66200 Communication Board has four two row headers that receive a plug-in Relay Input / Output board 68100. The 66200 board also will receive an optional plug-in Cellular Modem board (69100) and local wireless RF radio board (61200). The part numbers of compatible boards are shown in Table 1.

| Table 1 | 12-24 VAC / VDC |
|---|---|
| ADRES Communication Board | 66200-100 |
| ADRES Communication Board | 66200-400 |
| Relay IO Board | 68200-100 |
| Relay IO Board | 68200-200 |
| Relay IO Board | 68200-200 |
| Cellular Modem, Winn Wireless | 69100-100 |
| Cellular LTE Modem, Winn Wireless | 70100-100 |
| Local Wireless RF Mesh Radio | 61100-100 |

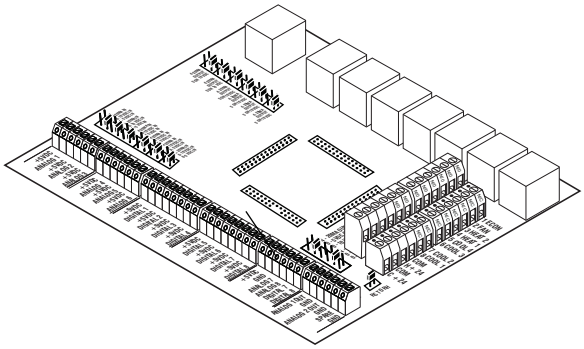
Table 1. Part numbers for compatible Components.




Reference
IG 01

## Compatible Components

The 68100 HVAC Relay IO board plugs on to the Communication board and provides the wiring interface and controls and monitors practically any single, two or up to four-stage cooling and heating system.



68200-x00
HVAC Relay IO Board

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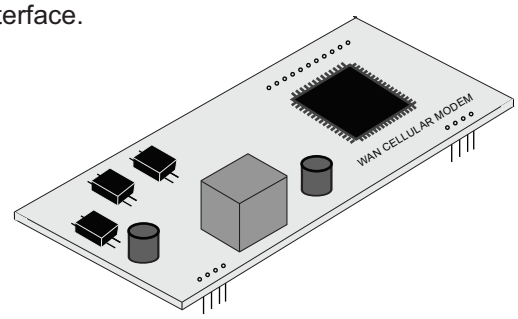
69100-100
Plug-In Cellular WAN Modem

The 69100-100 Plug-In Cellular Modem provide the Wide Area Network (WAN) connection to the ADRES controls to the Internet. The WAN Modem allows the ADRES controls to be monitored and controlled from a remote Server through the Internet Web browser interface.

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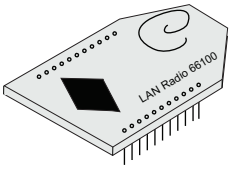
61100-100
Plug-In Local LAN Radio

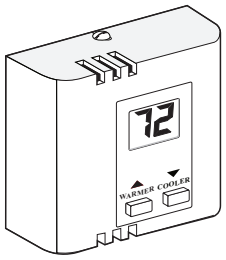
The 61100-100 Plug-In Local Radio Modem provides the wireless communication network between each ADRES module within the building and the Cellular Modem connection. The LAN Radio modem allows the ADRES controls to communicate locally between themselves and the Cellular modem.




## Temperature Sensors

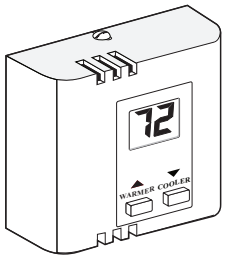
A variety of Room Temperature Sensors can be used with the HVAC Control module to monitor indoor space temperature, humidity, display temperature and provide limited control over the heating and cooling set-point temperatures.

43021-400



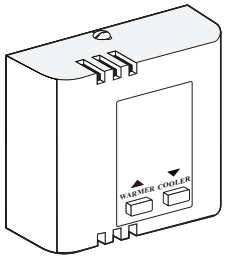

The 43021-400 Room Temperature Sensor includes a thermistor type temperature sensor, humidity sensor, a digital thermometer with LCD display and Warmer and Cooler keys for changing set-point temperatures.

43021-300



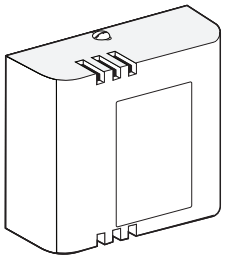

The 43021-300 Room Temperature Sensor includes a thermistor type temperature sensor, a digital thermometer with LCD display and Warmer and Cooler keys for changing setpoint temperatures.

43021-200



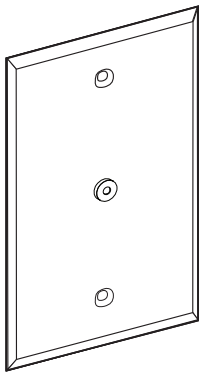

The 43021-200 Room Temperature Sensor includes a thermistor type temperature sensor and Warmer and Cooler keys for changing setpoint temperatures.

43021-100



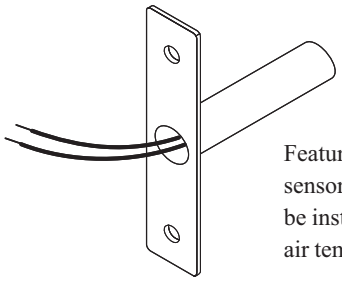
The 43021-100 Room Temperature Sensor has a thermistor type temperature sensor for monitoring space temperature.

**Reference**
IG 02



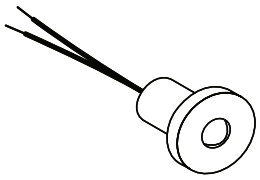
43102-100

The 43102 Room Temperature Sensor features an internal thermistor temperature sensor in a white, single wide, switch plate that can be attached to an electrical box or directly to a wall.



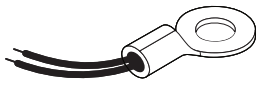
43103-100

Features an internal thermistor temperature sensor in a 3/8-inch diameter tube that can be installed in the duct to measure supply air temperature.



43104-100

Features an internal thermistor temperature sensor in a 3/8-inch diameter flanged, plastic bushing that can be installed in single-gang switch or in the NEMA enclsoure to measure room temperature or outdoor air temperature.



43105-100

Features an internal thermistor temperature sensor in a copper lug that can be used to measure supply or outdoor temperature.

# ADRES Communication Board P/N 66200 Features

## Communication Board P/N 66200 Features

1. **Replaceable Clock Battery**
   Replaceable Clock Battery to maintain Day / Date / Time.

2. **Ethernet Port (RJ45)**
   Optional Ethernet Port (RJ 45) for Internet access through Cellular modem.

3. **Non Volatile Memory**
   Non volatile memory for up to three months of all program settings and historical performance and energy / demand consumption data.

4. **Plug-In Cellular Modem Board**
   Plug-in Cellular WAN modem to provide ADRES system access to remote server, OpenADR2.0 and web browser software interface.

5. **LED Status Lights**
   LED status lights to indicate system running and operational status.

6. **Plug-In Local Wireless Radio Board**
   Plug-in wireless local area network radio to provide on-site communication between ADRES modules.

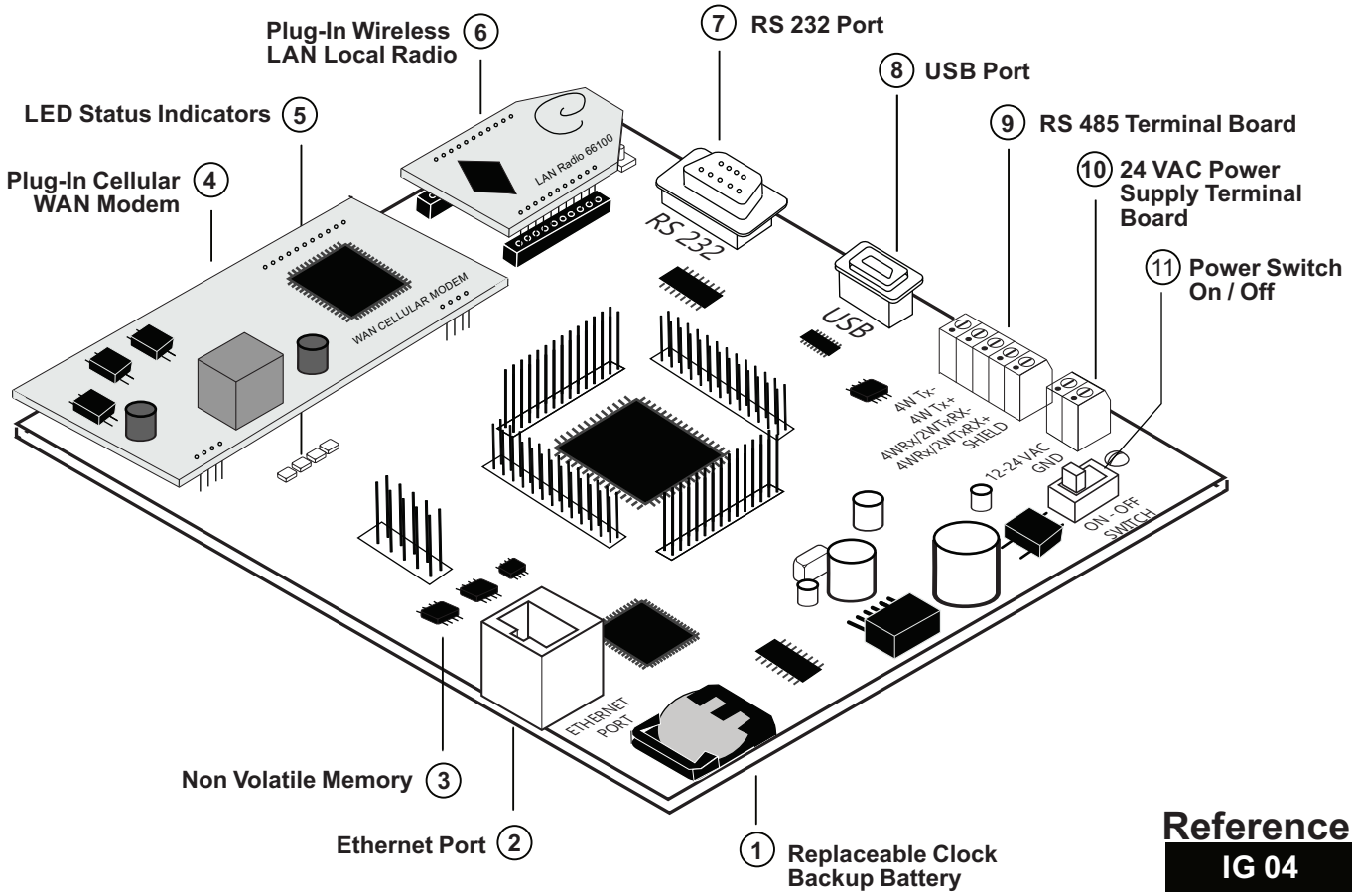
7. **RS 232 Port (DB 9)**
   Jumper selectable RS 232 serial port through the DB 9 connector. Typically used for local programming through PC with EnergyPro software.

8. **USB Port**
   USB port typically used for local programming through PC with EnergyPro software.

9. **RS 485 Port (2 Wire or 4-Wire)**
   Terminal board to land optional hardwired RS 485 communication between ADRES control modules.

10. **12 to 24 VAC or VDC Power Terminal Board**
    Terminal board to land the external 12 - 24 VAC or VDC power supply.

11. **Power Switch On / Off**
    Power Switch to turn On or Off the power to the ADRES HVAC Control Module.




**Reference**
**IG 04**

# ADRES Relay Input / Output Board P/N 66800 Features

Relay IO Board P/N 68200 Features

1. **Analog Inputs (Temperatures, Air Flow, Smoke)**
   Analog Temperature Sensor Inputs including roof, supply, return, economizer, airflow and smoke..

2. **Analog Input Sensor Selector Jumpers**
   Select by Jumper from 4-20 ma, 0-5 VDC or 0-10 VDC Senosr Input Cellular modem.

3. **Digital Inputs Terminal Board**
   Three digital pulse counting inputs for Sub-metering.

4. **Analog Sensor Voltage or Current Jumpers**
   Isolates the Motherboard from other controls further down in the daisey chain. Used when programming the unit address.

5. **Room Temperature Sensor Inputs**
   Terminal Board for Room Temperature Sensor Inputs.

6. **Analog Outputs**
   Analog Outputs to Control Variable Frequency Indoor Fan and Modulating Economoizer.

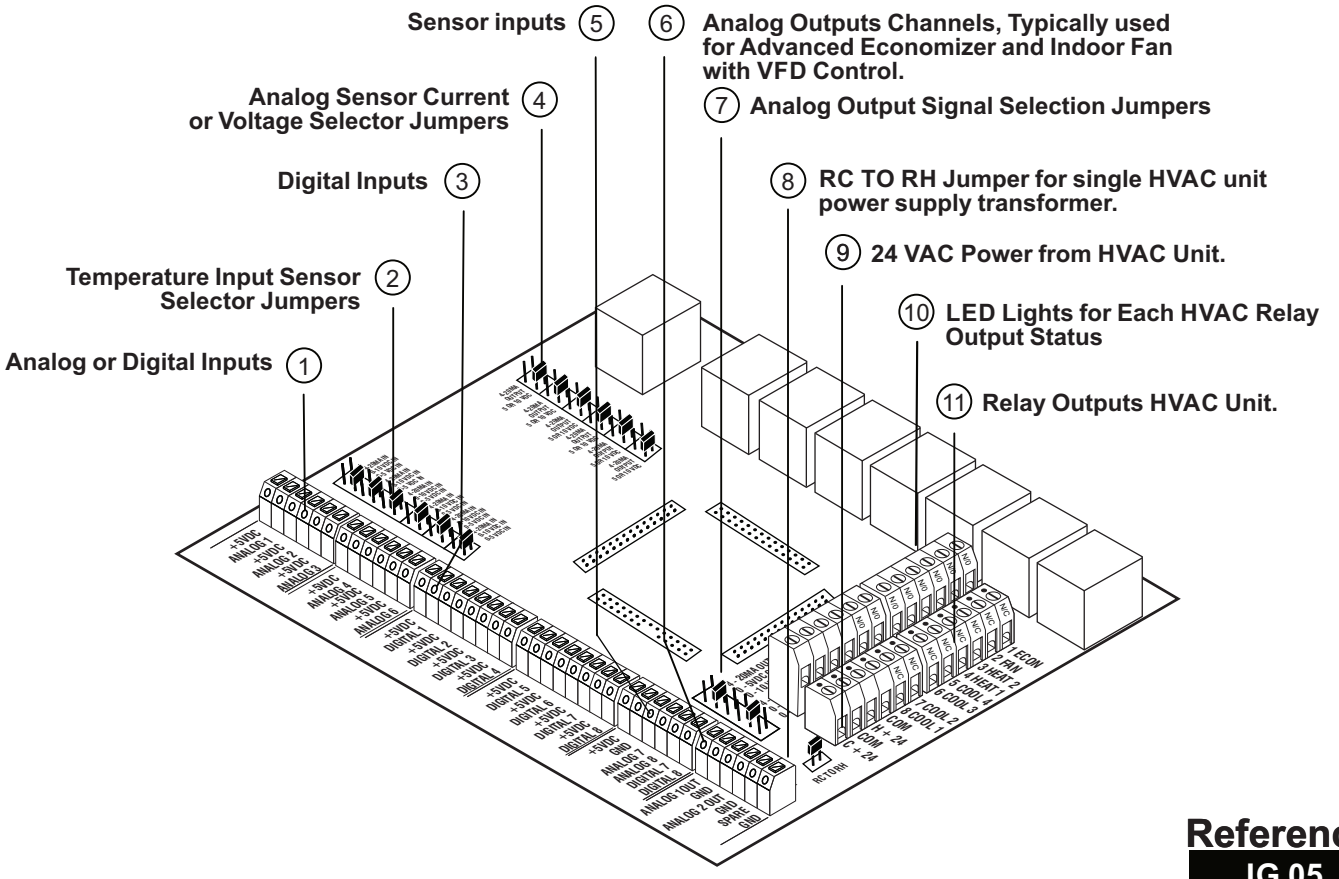
7. **Analog Output Selection Jumpers**
   The Analog Output selection jumpers are used to select the output signal desired, 4-20 ma current, 0-5 VDC or 0-10 VDC voltage.

8. **RC to RH Jumper**
   Jumper RC to RH when the HVAC unit has only a single control transformer. Default is jumpered.

9. **HVAC Unit 24 VAC Tstat Power**
   Terminal board to land the 24 VAC HVAC unit system power supply for Tstat.

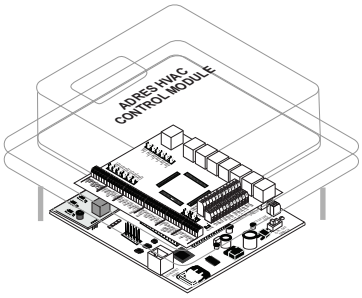
10. **LED Lights Track Relay Output Status**
    Individual LED lights track each relay output status. Green is off and Red is On.

11. **Relay Outputs to HVAC Unit**
    Terminal board to land the HVAC unit thermostat control output relays.




**Reference**
**IG 05**

# Installation Overview for the ADRES HVAC Control




One ADRES HVAC Control Module is required for each HVAC system. The ADRES control module can be programmed to operate with most heating and air conditioning systems. The module is programmed from a PC computer via either a USB or RS232 port.

Once programmed, the operating parameters are stored in non-volatile memory (unaffected by power outages) and controls the HVAC system independently. Energy usage data is stored in the control module and can be accessed via the Remote Server or a PC

## Compatible Systems

The HVAC control module can be programmed to operate with single, two or four-stage, packaged or split, gas/electric or heat pump systems. Optional outputs are provided for an advanced economizer control and a variable frequency drive indoor fan.

## Temperature Sensors

The HVAC control module has temperature sensors for room, supply, return, economizer mixed, roof or outdoor temperature. The room temperature sensor is part of the Room Temperature Sensor and describe later in this manual. The supply air temperature sensor should be located in the the supply air duct or plenum. Be sure the sensor is not to close to the heat exchanger or indoor coil.

The return air temperature sensor should be mounted close to the HVAC unit in the return ductwork or prior to the economizer. The economizer mixed temperature sensor should be mounted after the economizer and return air dampers. The outdoor or rooftop temperature sensor should be located in a shaded area so that it tracks the outdoor temperature. This sensor is used to determine when an economizer is activated and to compute the heating and cooling degree days.

## Communications

A plug-in wireless local RF radio is provided for normal wireless networked communication through the embedded cellular modem. A USB and serial RS232 port is provided for local programming / testing operations with a PC computer. Optionally, the unit can be hardwired to the RS485 port on the communication board.

## Wiring to the Room Temperature Sensor

Each HVAC control module is connected to a Room Temperature Sensor (RTS) using the existing thermostat wiring. The RTS contains a temperature sensor, an optional humidity sensor, optional local temperature display and two keys for adjusting the setpoint temperature.

The RTS provides limited adjustment over the setpoint temperature. The amount of adjustment is programmed into the HVAC control module and is defaulted at three degrees for two hours.

## Control Wiring

The wiring of the HVAC control module and the HVAC system are shown in the detailed wiring diagrams in Section 2.0 of this manual.

A separate 24VAC 20VA transformer is recommended to provide power for each individual control module.

## Mechanical Installation

The HVAC control module is installed on the outside of the HVAC system enclosure using four sheet metal screws. The control module should be positioned high enough so that it is not subject to water from plugged drains or rain damage.

Single or multiple “seal-tite” conduit runs can be made between the control module and the HVAC unit. 24 VAC power and 24 VAC HVAC control cables should be run separate from the low voltage sensor and thermostat wiring.

**Reference**
**IG 06**

## Before You Install the ADRES Control System

There are a number of options that should be selected before you install the ADRES HVAC control system and connect it to an HVAC unit. The list below should help guide you through these options.

### Program the Address

Each control module is programmed with an address so that data can be read from a specific control without affecting others. See the EnergyPro software manual for detailed instructions. Default address is 01 for the HVAC control module.

### Program the Type of System

Each HVAC control module should be programmed for the type of system it is controlling. Default is Gas/Electric.

### Program the Economizer Enabled/Disabled and Economizer On Temperature

The economizer has to be enabled and the On temperature set if an economizer is being controlled by the HVAC control module.

### Cellular Modem

If a 69100-100 internal Cellular Modem is used in the Commboard, the HVAC Control module will automatically recognize the cellular modem.

### Program the Alarm Options

Each control module has an alarm capability that can display alarm messages on the EPWeb remote server. See your EPWeb Software User's Guide for detailed instructions. Default is all alarms disabled, alarm delay = 15 minutes.

### Select the Type of Communications

Most ADRES systems are equipped with the Cellular WAN modem and in the first ADRES controller and the plug-in wireless local radio option in each ADRES including the ADRES with the Cellular Modem. If a hard-wired configuration is desired, the various control modules can be configured in a variety of configurations as shown in Wiring Diagrams WD01.

### Select the Operating Power

The HVAC control modules can be supplied to operate on 12 to 24 VAC or VDC. Typically use the existing HVAC Unit’s 24 VAC control transformer.

## Installing the NEMA Enclosure

The NEMA 4X enclosure can be installed indoors or outdoors at the HVAC system. Four mounting holes are provided for #10 screws. If the unit is installed on the HVAC system, be sure to verify that the mounting screws will not damage the HVAC unit. The NEMA case is pre-formed with conduit knockouts on the bottom of the box for routing the wiring as shown in Wiring Diagram WD19.

## Power Wiring

Wiring Diagram WD07 illustrates the wiring for both 12 to 24 VAC or VDC operation. The standard 24 VAC 40 VA rated transformer should be located within the HVAC unit's enclosure and its high voltage primary wiring should be insulated according to local code.

## Room Temperature Sensor Wiring

Wiring Diagram WD08 illustrates the wiring of the Room Temperature Sensor using a 43021-400 RTS. The GND, HUM, WRM and CLR wires may be omitted if only a temperature sensor is being used.

## Supply, Return and Economizer Mixed Air Temperature Sensors Wiring

Wiring Diagram WD09 illustrates the wiring of the supply air temperature sensor. The sensors are not polarized and either wire may be connected to either terminal. The supply sensor should be mounted downstream of the heating heat exchanger. The Return sensor should be mounted in the return duct close to the HVAC unit. The Economizer “mixed” temperature should be mounted between the economizer damper and after the return damper.

## Roof Air Temperature Sensor Wiring

Wiring Diagram WD09 illustrates the wiring of the outdoor or roof air temperature sensor. The sensors are not polarized and either wire may be connected to either terminal. The 43104-100 may be used and will slip into one of the 3/8-inch diameter holes in the NEMA enclosure and can be secured with silicone adhesive.

## HVAC System Wiring

Wiring Diagram WD11 shows the function of each output terminal on the HVAC Relay IO board P/N 68200 and their state during calls for heating and cooling with different types of equipment.

Wiring Diagrams WD12 through WD15 illustrate the HVAC system wiring for a variety of systems.

## Communication Between Control Modules

Each HVAC control module can communicate with the other HVAC control modules through the plug-in wireless local radio mesh network. One HVAC control module can be equipped with a plug-in wireless Cellular modem for Internet communication to the Winn remote server using the Internet Web Browser. Local communication can be established between a PC running the EnergyPro application and either the USB or RS232 ports on the communication board. Alternatively, the HVAC control modules can be hardwired using the RS485 port on each control module.

Wiring Diagrams WD01 through WD05 illustrate the connection of the first ADRES Commboard in a string to an MCU, Modem or PC Computer. Wiring Diagram WD06 illustrates the connection between adjacent HVAC control modules.

## System Startup and Test

After each HVAC control module has been installed and connected to the HVAC system, you should verify that the system is operating properly. The following steps should be helpful in commissioning and testing.

### ● Check Power Wiring

Turn the power breakers On and measure the DC voltage between the +5VDC terminal and any GND terminal. It should measure +5VDC ±5%. Measure the DC voltage between the +12VDC terminal and any GND terminal. It should measure 12VDC ±5%.

Measure the DC voltage between the +5VDC terminal and the sheet metal (earth ground), it should measure approximately 0VDC. If you measure 5VDC there is a short between signal GND and earth ground and you will have to find and remove the short.

### ● Check Communication to each HVAC Control

You can verify the communication to each HVAC control module first through the USB or Rs232 froincoming or Master RS232 communications wiring by plugging an MCU into the 4-pin MCU Test Connector (see WD05) of the previous Motherboard and setting the Master switch to PROG.

Press the Energy Test key, select Y to Test Status Y/N? and select the address of the unit you are testing. The LCD will display the Test Day and Test Days if the communications is operating properly. This also checks the "Slave" communications from the previous unit.

If the LCD display shows RS232 ERROR the communications has not been established. Check that the wiring is correct and the address has been properly set. See the Operations Manual for instructions for setting the address.

### ● Check Sensor Wiring

You can read the various temperature sensors using the MCU or the PC computer with the EnergyPro software. See the Operations manuals for instructions. You can also measure the DC voltages at the sensor terminals. Table 1 shows the voltage you should measure between the temperature sensor terminals for different temperatures.

| Temperature | Between ROOM SNR and +5VDC Terminals | Between SUPPLY SENSOR Terminals | Between ROOF SENSOR Terminals |
|---|---|---|---|
| 60F | 3.89VDC | 3.89VDC | 3.89VDC |
| 65F | 3.78VDC | 3.78VDC | 3.78VDC |
| 70F | 3.66VDC | 3.66VDC | 3.66VDC |
| 75F | 3.54VDC | 3.54VDC | 3.54VDC |

Table 2. The nominal voltages measured at sensor terminals.

The voltages shown in Table 2 may vary somewhat and the polarity is not important. If you measure 0 or +5VDC there is a short (0VDC), an open connection (+5VDC), or a missing sensor (+5VDC).

### ● Check HVAC Wiring

The HVAC system wiring can be verified using the EPWeb to force a call for heating and observe that the correct LEDs on the Relay IO board are On. Repeat this same procedure for the cooling system. To verify economizer operation, disconnect the outdoor temperature sensor (temperature will read 09) and force a call for cooling. Observe that the correct LEDs on the Relay IO oard are On.

## Toll Free Helpline

If you have questions concerning the installation or operation of the ADRES controls, please call:

(858) 274-1330.

**Reference**
**IG 08**

# Power Wiring for the ADRES HVAC Control Module

## Connecting 12 to 24 VAC or VDC Power to the Communication Board.

### Description

The 66200 Communication board can be powered by either a 12 to 24 VAC or 12 to 24 VDC power supply. For most all HVAC applications a standard 24 VAC 40 VA control transformer is recommended.

### Communication Board 66200-100

A 24 VAC control transformer should be installed within the high voltage area in the HVAC system, or it can be mounted externally to the system, provided it meets all applicable wiring codes. The transformer should have a minimum rating of 20VA. The 24 VAC output should be isolated from the high voltage primary.

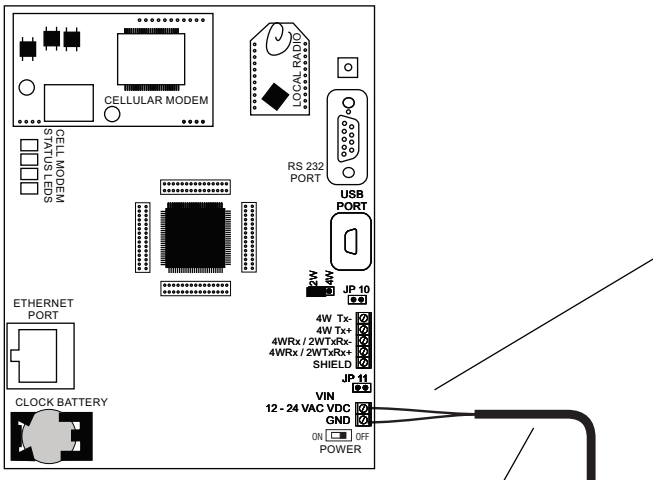
The primary should be connected to a fused power source and the 24 VAC secondary connected to the 24 VAC terminals on the Communication board using AWG20 or larger wire.

**APPROVED TRANSFORMERS**

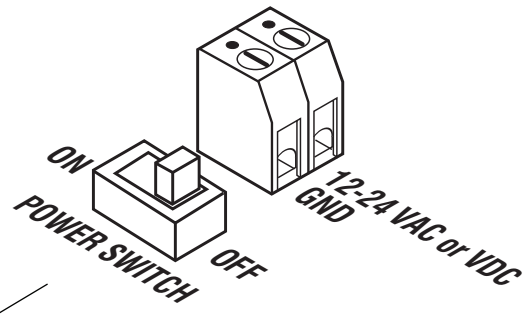
| Model Number | Manufacturer | Available From | Input Rating | Output Rating |
|---|---|---|---|---|
| 43320-020 | Winn | Winn | 120/240VAC | 24VAC,40VA |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

### Communication Board 66100-XXX

The Communication board operates from 12 to 24 VAC or VDC supplied by the customer. Wiring for the power is shown below.




PN 66200 Communication Board with NEMA 4X Case




20 Gauge, 2-conductor Thermostat Wire or Belden Cable

### Power On/Off Switch

A switch is provided on the Communication Board for controlling all power to the Modem, HVAC Relay IO and Communication boards. Whenever wiring is changed or a board removed or installed, the power should be turned off at the HVAC Unit disconnect switch.

***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

**Reference**
WD 01

# Local Programming through USB Port on Communication Board

## Using a PC Computer to Provide On-Site Programming of ADRES HVAC Control Module.

### Description

A PC computer with the EnergyPro software can be used to locally program, monitor and control a number of HVAC control boards. A standard USB cable can be connected between the PC computer USB port and the ADRES communication board USB port. Alternatively, a straight through serial cable can be connected between the ADRES DB9 communication port and a serial port on the PC as shown below.

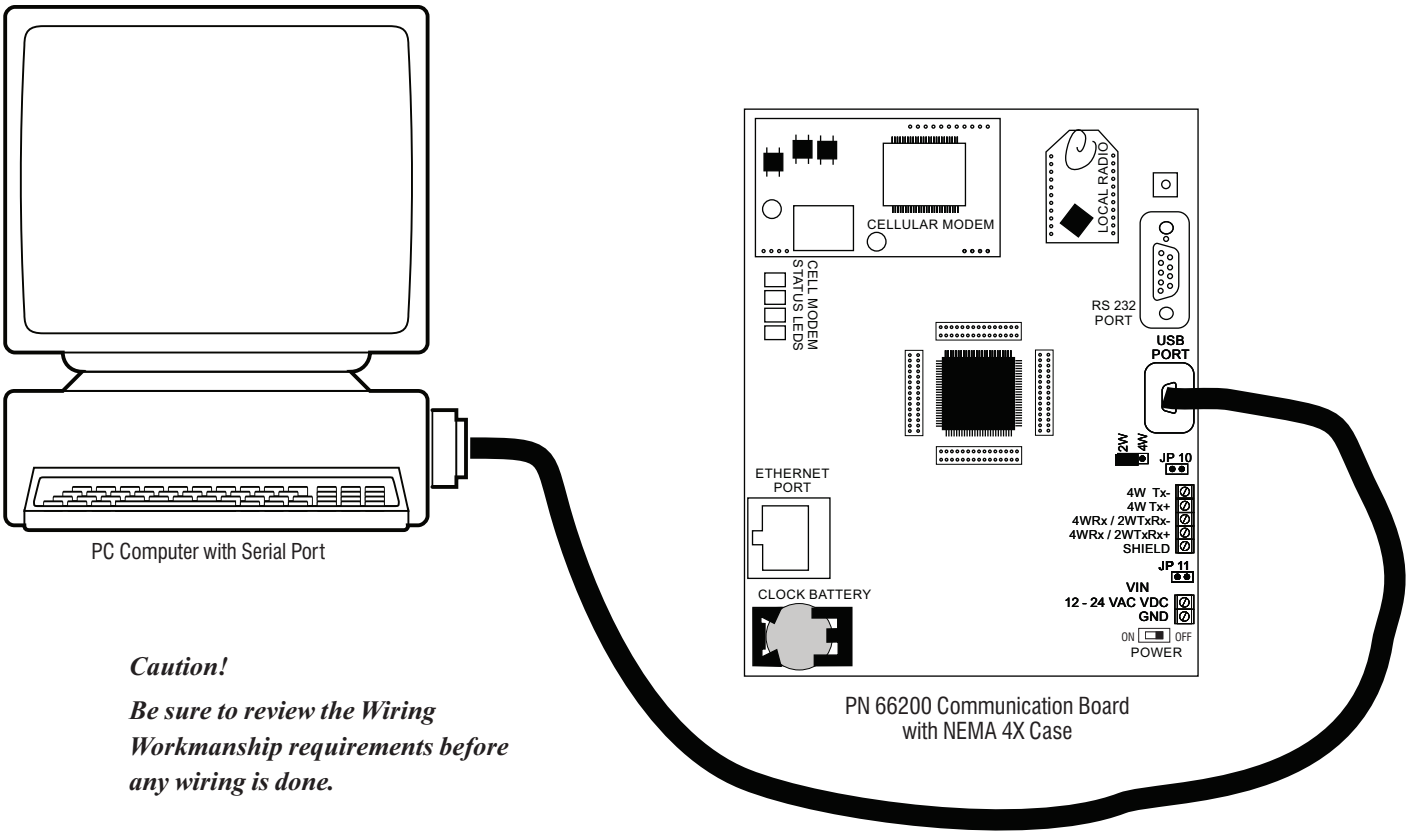
The EnergyPro software User's Guide shows how to select and initialize a serial port in the PC computer and verify the integrity of the communications.

After plugging in either the USB or Rs232 cable to the ADRES control module into the PC computer's USB or serial port, connect the cables as follows:

| At the PC Connector | At the ADRES Connector | Function |
|---|---|---|
| USB | USB mini | USB Communications to ADRES |
| RS-232 Male | RS-232 Female | RS-232 Communications to ADRES |

### Wiring Materials Required

1. USB to USB mini cable.




PC Computer with Serial Port

PN 66200 Communication Board with NEMA 4X Case

***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

# Using a PC Computer to Provide On-Site Programming of ADRES HVAC Control Module.

## Description

A PC computer with the EnergyPro software can be used to locally program, monitor and control a number of HVAC control boards. A standard serial RS 232 cable (straight through) can be connected between the PC computer USB port and the ADRES communication board RS 232 DB 9 port. Alternatively, a USB cable can be connected between the ADRES USB communication port and a USB port on the PC as shown below.

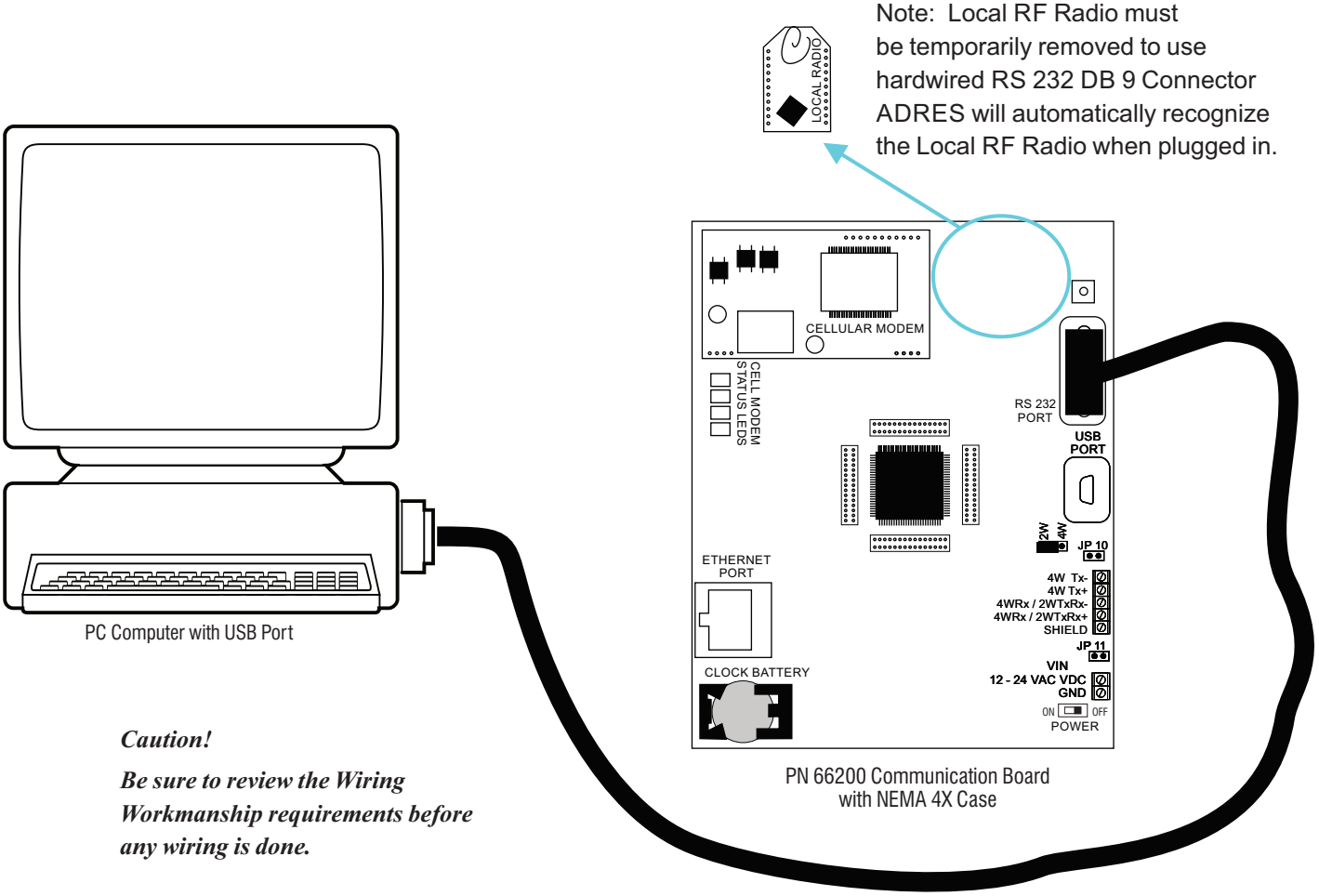
The EnergyPro software User's Guide shows how to select and initialize a serial port in the PC computer and verify the integrity of the communications.

After plugging in either the RS 232 cable to the ADRES control module into the PC computer's USB or serial port, connect the cables as follows:

| At the PC Connector | At the ADRES Connector | Function |
|---|---|---|
| USB | USB mini | USB Communications to ADRES |
| RS-232 Male | RS-232 Female | RS-232 Communications to ADRES |

## Wiring Materials Required

1. RS 232 Serial Cable (Straight Through).




***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

# ADRES Communication to Ethernet Enabled Devices

## The ADRES Controller can communication to an Ethernet addressable Device or Local Network.

### Description

The ADRES Controller with Cellular Modem can use its Ethernet port to communicate to Ethernet enabled device or devices connected to the ADRES Ethernet port.

The ADRES will provide a local IP address to the connected device or devices and allow remote communication to these devices.

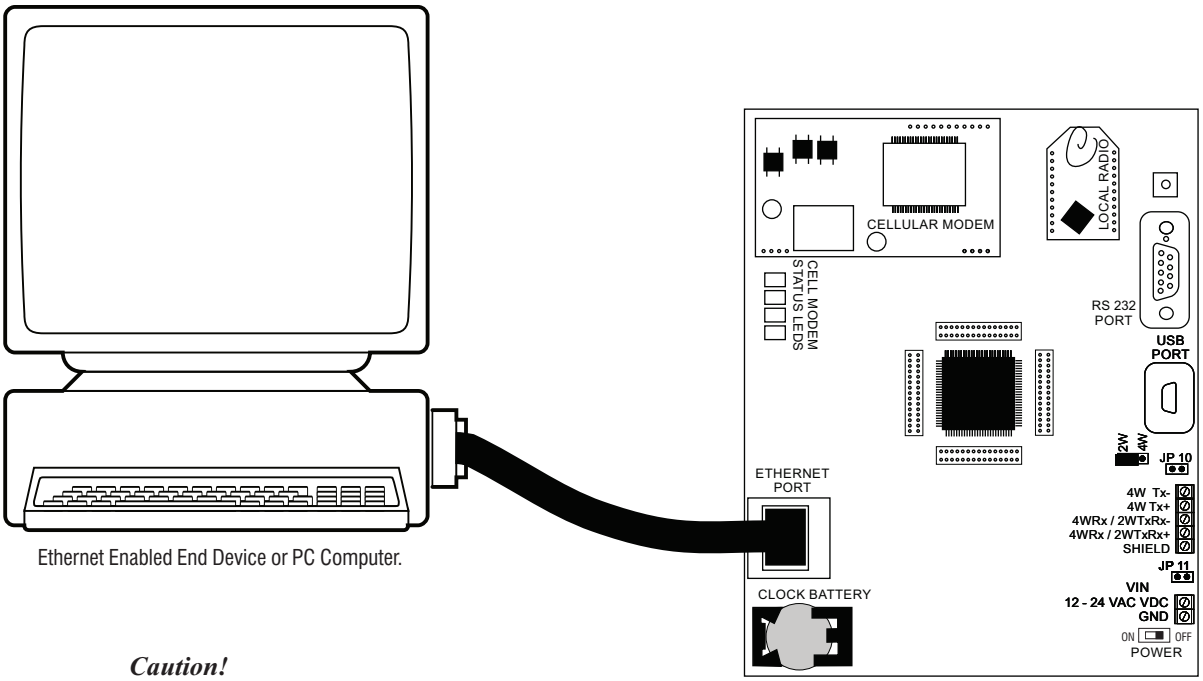
The ADRES controller can also use an Ethernet enabled submeter to read meter data directly and report via the EPWeb server HMI interface.

After plugging in an Ethernet cable between the ADRES Ethernet port and the End Device and its Ethernet Port, The ADRES can provide remote access to the device or devices using a Ethernet switch.

| ADRES Ethernet Port | End Device Ethernet Port | Function |
|---|---|---|
| Ethernet Cable | Ethernet Cable | Ethernet to Local Device (s) |
| | | |

### Wiring Materials Required

1. Standard RJ 45 Ethernet Cable.




Ethernet Enabled End Device or PC Computer.

PN 66200 Communication Board with NEMA 4X Case

***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

# ADRES RS-485 Communication Wiring Between Comm Board

## ADRES Hardwired Comm Board to Comm Board Communication Connections

### Description

The ADRES Communication between ADRES modules can be connected in a RS-485 daisy chain as shown below. Each ADRES Control board on the Comm board is programmed with a different address so that only that Comm board accepts the data being sent on the RS485 data lines and only that Comm board responds. Certain commands can be sent to all ADRES controller and only the ADRES Control board with address 01 will respond with an acknowledgement.

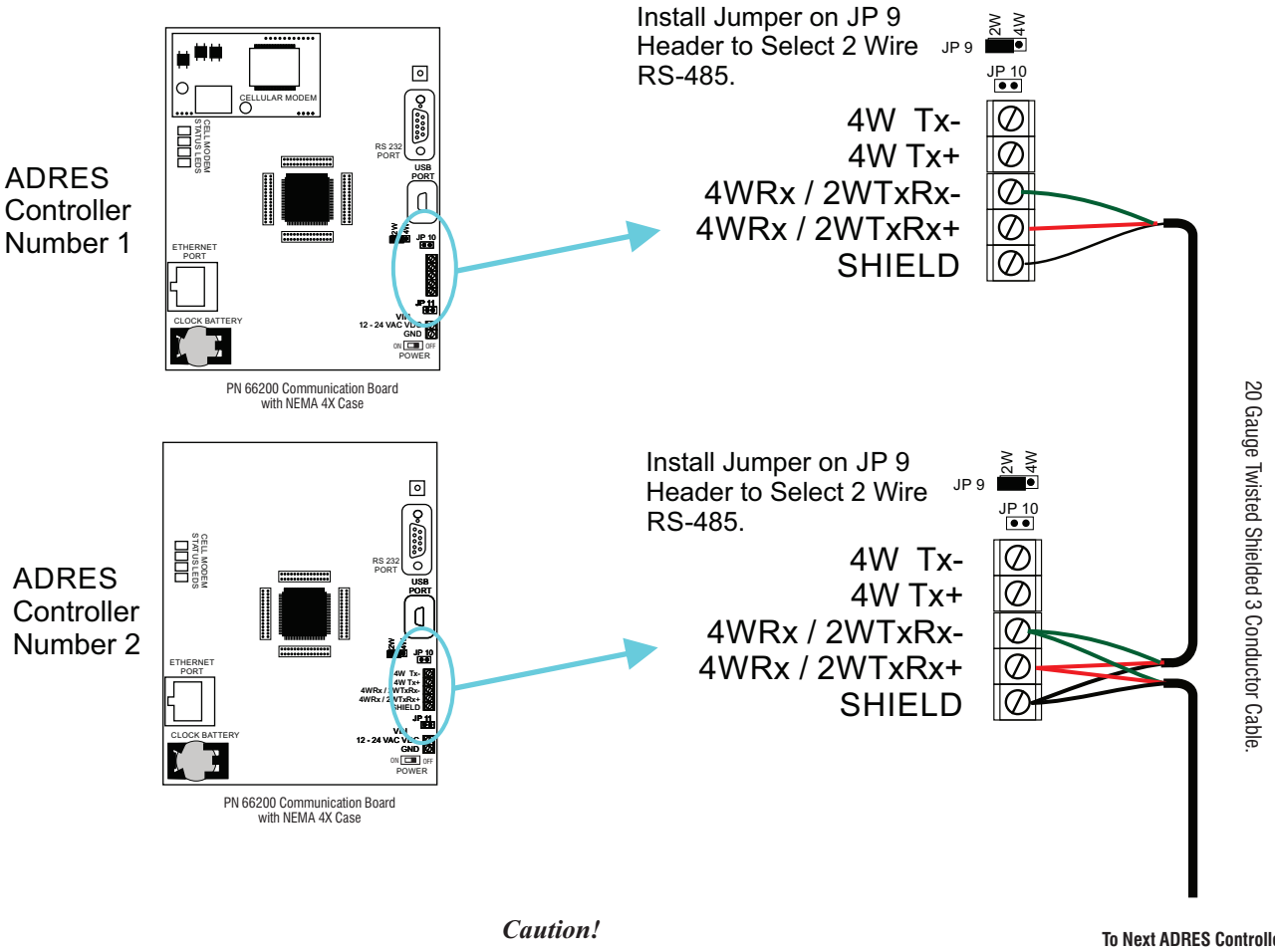
The backup power wiring is only required if a common backup power source is being used.

After mechanically installing the NEMA cases with the Comm boards, connect the communications RS-485 wires between Comm Boards as follows;

| At the first Comm Board | At the next Comm Board | Wire Color | Function |
|---|---|---|---|
| SHIELD | SHIELD | BLK | Signal Ground |
| 2WTxRx+ | 2WTxRx+ | RED | RS-485 2-Wire |
| 2WTxRx - | 2WTxRx - | GRN | RS-485 2-Wire |
| | | | |
| | | | |

### Wiring Materials Required

1. Belden Wire, 3 Conductor, AWG20 twisted and shielded.




***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

**Reference**
WD 05

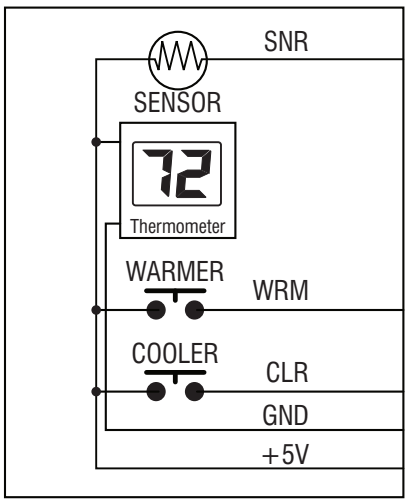
# Room Temperature Sensor Wiring for the 68200 Relay IO Board

## Description

The Room Temperature Sensor is available in different configurations. All include a thermistor type temperature sensor, keys for adjusting the setpoint temperature and optionally a humidity sensor and thermometer with an LCD display.

The sensor should be located on a wall where it will accurately sense the space temperature. Use the same good practices as when installing a conventional thermostat. The schematic of the Room Temperature Sensor is shown below.

Schematic



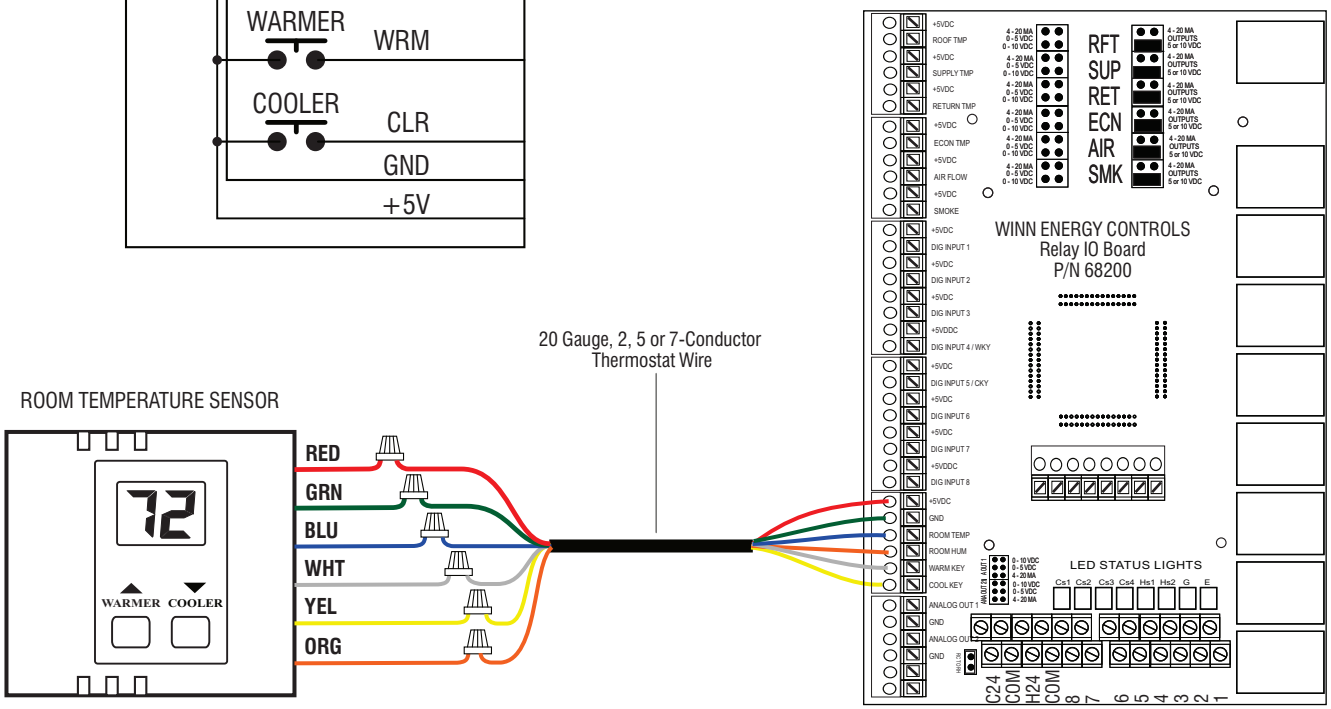

Using an appropriate sized wire nut, connect the wires to the wires on the Room Temperature Sensor (RTS). Connect the corresponding wires to the 68200 Relay IO Board as shown below.

| At the RTS | To Relay IO Terminal | Wire Color | Function |
|---|---|---|---|
| GND | GND | GRN | Signal Ground |
| +5VDC | +5VDC | RED | +5VDC Power from Relay Board |
| SNR | ROOM TMP | BLU | Thermistor Output |
| WRM | WRM KEY | WHT | Warmer Key |
| CLR | CLR KEY | YEL | Cooler Key |
| HUM | ROOM HUM | ORG | Humidity Sensor |

The GND, HUM, WRM KEY and CLR KEY wires do not have to be connected if only a temperature sensor is being used.

## Wiring Materials Required

1. Thermostat Wire, 2 or 5-Conductor, AWG20.




P/N 68200
Relay I/O Board

***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

**Reference**
WD 06

# Supply and Roof Air Temperature Sensor Wiring for the 68200 Relay I/O Board

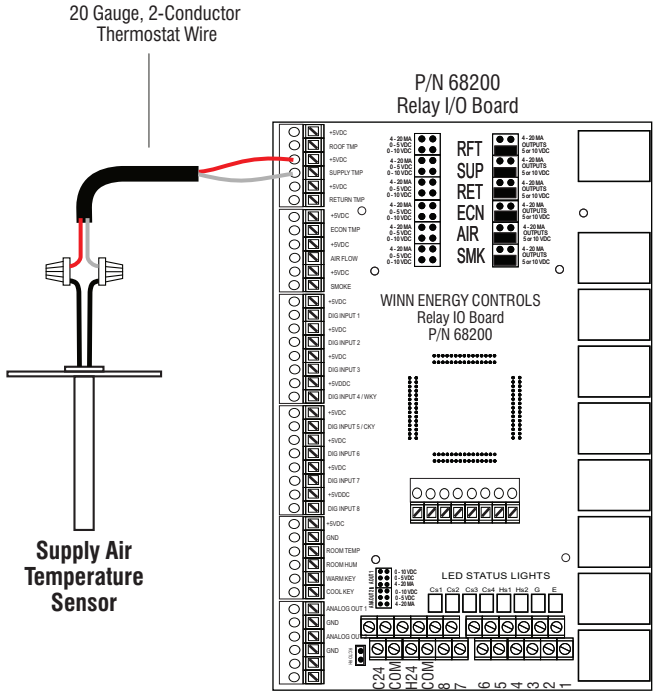
## Description, Supply Air Temperature Sensor

The supply air sensor should be installed so that it senses the temperature of the the HVAC unit's supply air and not the temperature of the mechanical structure. Be careful not to locate it too close to the coil or the heat exchanger.

After mechanically installing the sensor, use appropriate sized wire nuts to connect the two wires of a 2-conductor thermostat cable to the wires on the temperature sensor. Connect the corresponding wires at the 68200 Relay I/O board as shown below.

| At the Sensor | To Relay I/O Terminal Board | Wire Color | Function |
|---|---|---|---|
| SNR | SUPPLY SENSOR | WHT | Thermistor Output |
| SNR | +5 VDC | RED | +5 VDC |

The SUPPLY SENSOR terminals are not polarized and either wire can be connected to either terminal.




## Wiring Materials Required

1. Thermostat Wire, 2-Conductor, AWG20.

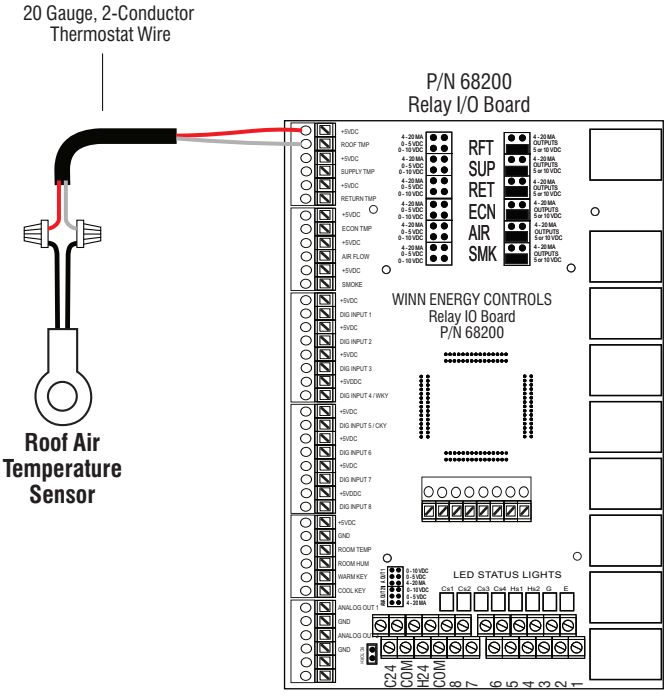
## Description, Roof Temperature Sensor

The roof or outdoor temperature sensor should be installed so that it senses the outdoor air temperature. Be careful not to locate it in direct sunlight or on heated surfaces.

After mechanically installing the sensor, use appropriate sized wire nuts to connect the two wires of a 2-conductor thermostat cable to the wires on the temperature sensor. Connect the corresponding wires at the 68200 Relay I/O board as shown below.

| At the Sensor | To Relay I/O Terminal Board | Wire Color | Function |
|---|---|---|---|
| SNR | ROOF SENSOR | WHT | Thermistor Output |
| SNR | +5 VDC | RED | +5 VDC |

The ROOF SENSOR terminals are not polarized and either wire can be connected to either terminal.




## Wiring Materials Required

1. Thermostat Wire, 2-Conductor, AWG20.

***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

**Reference**
WD 07

# Return and Mixed Air Temperature Sensor Wiring for the 68200 Relay I/O Board

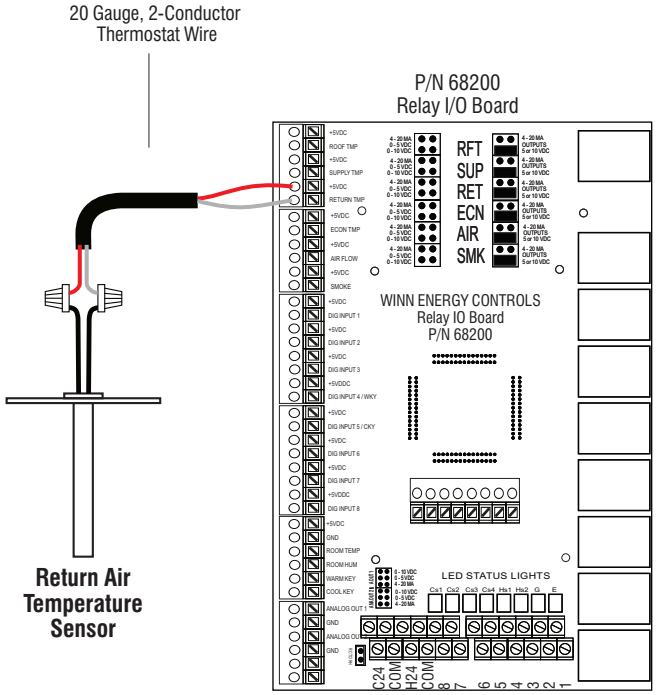
## Description, Return Air Temperature Sensor

The return air sensor should be installed so that it senses the temperature of the HVAC unit's return air from the conditioned space. Be careful not to locate it close to the coil or the heat exchanger.

After mechanically installing the sensor, use appropriate sized wire nuts to connect the two wires of a 2-conductor thermostat cable to the wires on the temperature sensor. Connect the corresponding wires at the 68200 Relay I/O board as shown below.

| At the Sensor | To Relay I/O Terminal Board | Wire Color | Function |
|---|---|---|---|
| SNR | RETURN SENSOR | WHT | Thermistor Output |
| SNR | +5 VDC | RED | +5 VDC |

The RETURN SENSOR terminals are not polarized and either wire can be connected to either terminal.




## Wiring Materials Required

1. Thermostat Wire, 2-Conductor, AWG20.

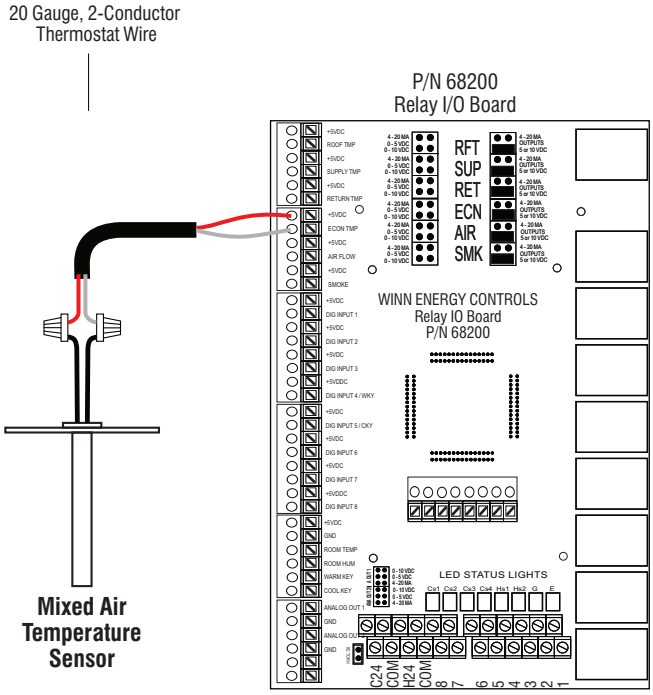
## Description, Mixed Temperature Sensor

The mixed temperature sensor should be installed so that it senses the blended temperature of the return and outdoor air after the economizer damper.

After mechanically installing the sensor, use appropriate sized wire nuts to connect the two wires of a 2-conductor thermostat cable to the wires on the temperature sensor. Connect the corresponding wires at the 68200 Relay I/O board as shown below.

| At the Sensor | To Relay I/O Terminal Board | Wire Color | Function |
|---|---|---|---|
| SNR | ECON SENSOR | WHT | Thermistor Output |
| SNR | +5 VDC | RED | +5 VDC |

The MIXED SENSOR terminals are not polarized and either wire can be connected to either terminal.




## Wiring Materials Required

1. Thermostat Wire, 2-Conductor, AWG20.

***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

**Reference**
WD 08

# Outdoor Humidity and Air Flow Sensor Wiring for the 68200 Relay I/O Board

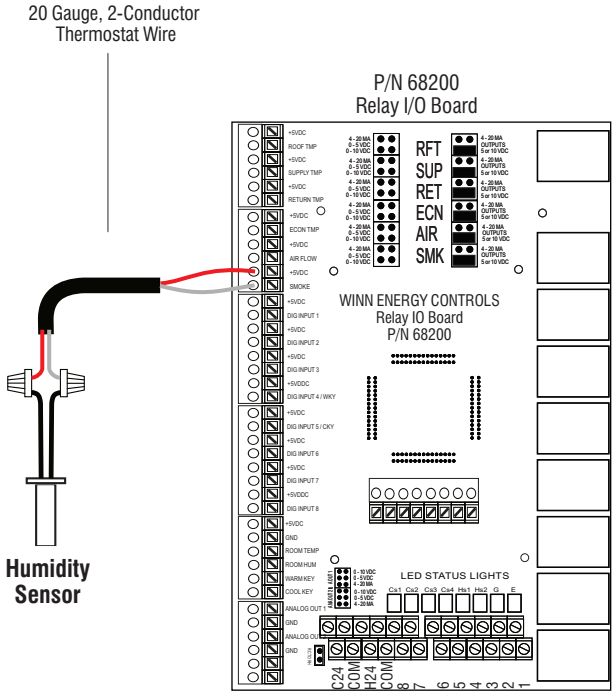
## Description, Outdoor Humidity Sensor

The outdoor humidity sensor should be installed so that it senses the outdoor humidity adjacent to the roof temperature sensor. Be careful not to locate it too close to an exhaust fan or roof vent.

After mechanically installing the humidity sensor, use appropriate sized wire nuts to connect the two wires of a 2-conductor thermostat cable to the wires on the humidity sensor. Connect the corresponding wires at the 68200 Relay I/O board as shown below.

| At the Sensor | To Relay I/O Terminal Board | Wire Color | Function |
|---|---|---|---|
| SNR | HUMID | WHT | Humidity Sensor Output |
| SNR | +5 VDC | RED | +5 VDC |

The HUMIDITY SENSOR terminals are polarized and must be connected as shown.




### Wiring Materials Required

1. Thermostat Wire, 2-Conductor, AWG20.

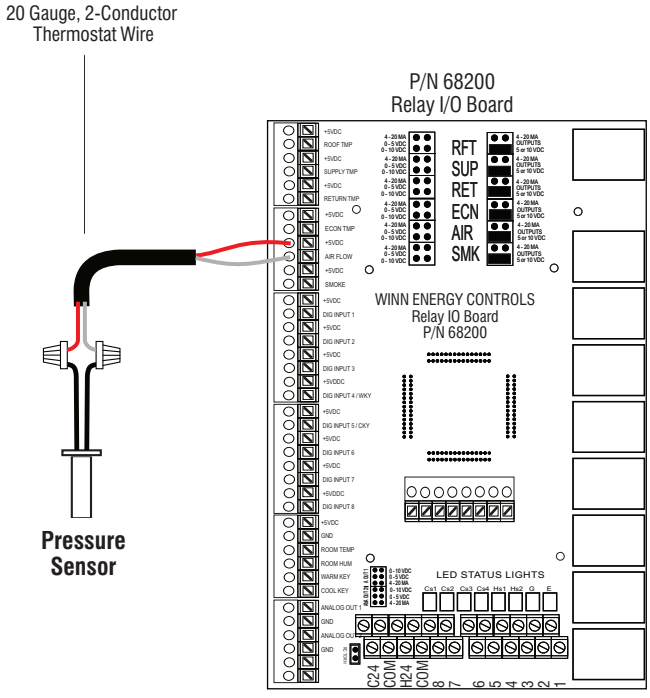
## Description, Indoor Air Flow Pressure Sensor

The indoor air flow sensor can be either pressure sensor or a flow sail switch. A pressure sensor must be used if the advanced digital economizer control with the Analog Output 1 used to modulate the economizer damper.

After mechanically installing the sensor, use appropriate sized wire nuts to connect the two wires of a 2-conductor thermostat cable to the wires on the temperature sensor. Connect the corresponding wires at the 68200 Relay I/O board as shown below.

| At the Sensor | To Relay I/O Terminal Board | Wire Color | Function |
|---|---|---|---|
| SNR | AIR FLOW | WHT | Pressure Sensor Output |
| SNR | +5 VDC | RED | +5 VDC |

The PRESSURE SENSOR terminals are polarized and must be connected as shown.




### Wiring Materials Required

1. Thermostat Wire, 2-Conductor, AWG20.

***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

**Reference**
WD 09

# Economizer and Indoor Fan Modulation Wiring for the 68200 Relay I/O Board

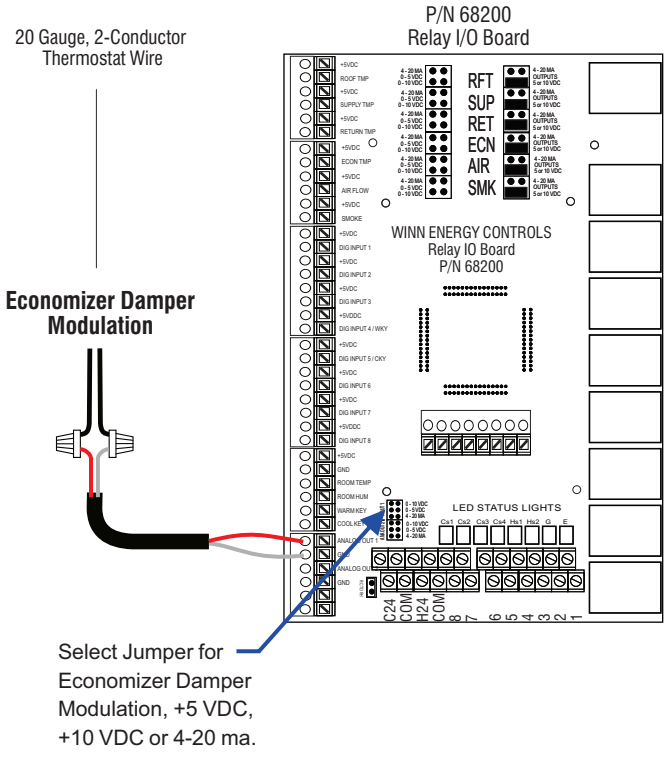
## Description, Economizer Damper Modulation

The Analog Output 1 is to be used to modulate the economizer damper to meet the mixed temperature set-point. The output is jumper selectable to modulate either +5 VDC, +10 VDC or 4-20 ma to match the requirements of the economizer damper.

After mechanically installing the economizer damper, use appropriate sized wire nuts to connect the two wires of a 2-conductor thermostat cable to the wires on the economizer damper. Connect the corresponding wires at the 68200 Relay I/O board as shown below.

| At the Sensor | To Relay I/O Terminal Board | Wire Color | Function |
|---|---|---|---|
| SNR | ANA OUT 1 | WHT | Economizer Damper Modulation |
| SNR | +5 VDC | RED | +5 VDC, +10 VDC, 4-20 ma |

The ANALOG OUTPUT 1 terminals are polarized and must be connected as shown.



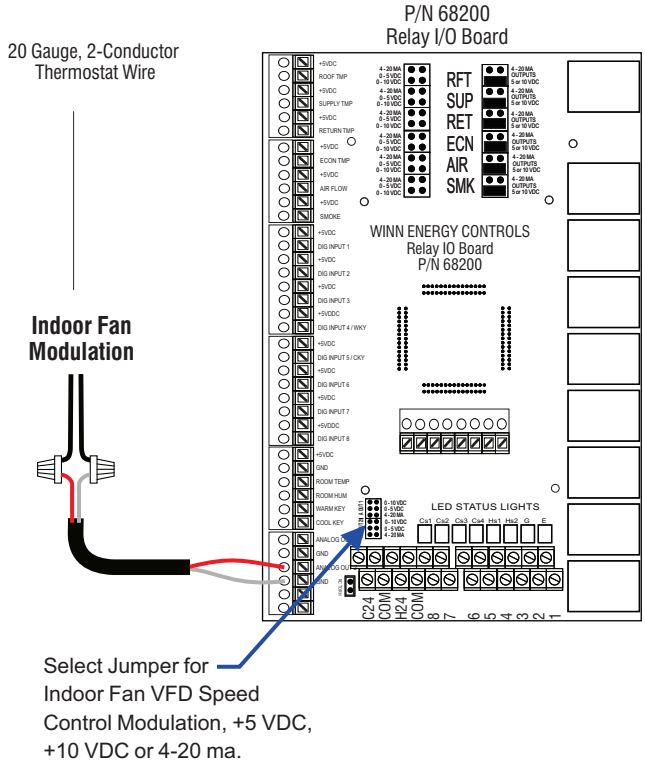

## Description, Indoor Fan Speed Modulation

The indoor fan speed can be modulated using the Analog Output control. The speed modulation is automatically adjusted to meet the Duct Pressure set-point using the air pressure sensor.

After mechanically installing the sensor, use appropriate sized wire nuts to connect the two wires of a 2-conductor thermostat cable to the wires on the temperature sensor. Connect the corresponding wires at the 68200 Relay I/O board as shown below.

| At the Sensor | To Relay I/O Terminal Board | Wire Color | Function |
|---|---|---|---|
| SNR | ANA OUT 2 | WHT | Indoor Fan VFD Speed Control |
| SNR | +5 VDC | RED | +5 VDC, +10 VDC or 4-20 ma. |

The ANALOG OUTPUT 2 terminals are polarized and must be connected as shown.




***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

**Reference**
WD 10

# Digital and Pulse Input Wiring for the 68200 Relay I/O Board

## Description, Digital Signal Input

The Digital Inputs channels 4 through 8 are available to support only a digital input signal. Each channel can be utilized with a dry contact to send +5VDC and when the digital signal contact is closed, the +5VDC will be read on the channel input.

Use appropriate sized wire nuts to connect the two wires of a 2-conductor twisted shielded or thermostat cable to the wires on the digital input signal. Connect the corresponding wires at the 68200 Relay I/O board as shown below on the available digital input channel.

| At the Sensor | To Relay I/O Terminal Board | Wire Color | Function |
|---|---|---|---|
| SNR | DIG IN 4 - 8 | WHT | Digital Signal Monitoring Only |
| SNR | +5 VDC | RED | +5 VDC |

The DIGITAL INPUT terminals are not polarized and either wire can be connected to either terminal.

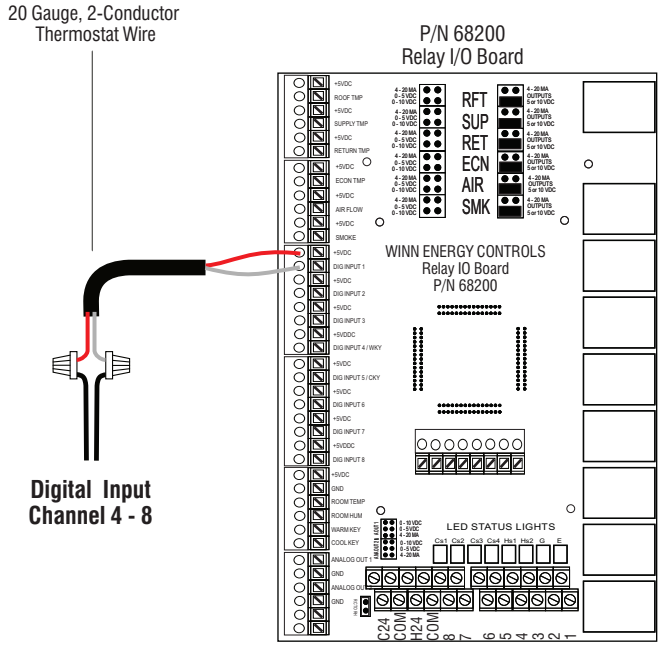
## Description, Digital Pulse Counting Input

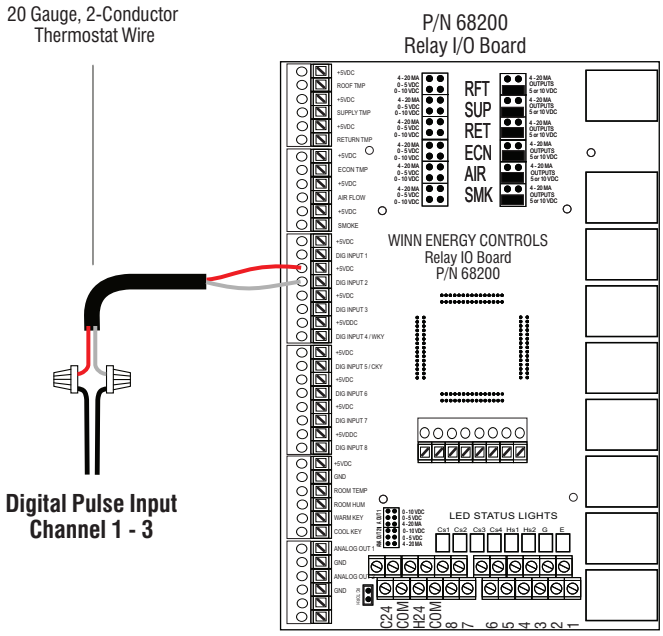
The Digital Pulse Inputs channel 1 through 3 are available to support a pulse digital input signal. Each channel can be utilized with a dry contact to send +5VDC and when the digital signal contact is closed, the +5VDC will be read on the channel input. Typically used for submetering.

After mechanically installing the submeter, use appropriate sized wire nuts to connect the two wires of a 2-conductor thermostat cable to the wires on the temperature sensor. Connect the corresponding wires at the 68200 Relay I/O board as shown below.

| At the Sensor | To Relay I/O Terminal Board | Wire Color | Function |
|---|---|---|---|
| SNR | DIG IN 1 - 3 | WHT | Pulse or Digital Input Monitoring |
| SNR | +5 VDC | RED | +5 VDC |

The PULSE DIGITAL INPUT terminals are not polarized and either wire can be connected to either terminal.




***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

**Reference**
WD 11

# HVAC Terminal Wiring for the ADRES Relay I/O Board

| Relay I/O Board Terminal | Type of HVAC System Selected | | |
|---|---|---|---|
| | **Gas/Electric System** | **Heat Pump with O-Type Valve** | **Heat Pump with B-Type Valve** |
| **RH** | **Provides 24VAC to the W1 Control Relay**<br>Connect RH to the R terminal of the heating system. Connect RH/RC to the R terminal at the HVAC system for HVAC systems with one transformer for both heating and cooling.. | **Provides 24VAC to the W1 Control Relay**<br>Heat Pumps have only one transformer and RH and RC should be connected together and to the R terminal at the HVAC system. | **Provides 24VAC to the W1 Control Relay**<br>Heat Pumps have only one transformer and RH and RC should be connected together and to the R terminal at the HVAC system. |
| **RC** | **Provides 24VAC to the W2,Y1, Y2, G and E Control Relays**<br>Connect RC to the R terminal of the cooling system. Connect RH/RC to the R terminal at the HVAC system for HVAC systems with one transformer for both heating and cooling.. | **Provides 24VAC to the W2,Y1, Y2, G and E Control Relays**<br>Heat Pumps have only one transformer and RH and RC should be connected together and to the R terminal at the HVAC system. | **Provides 24VAC to the W2,Y1, Y2, G and E Control Relays**<br>Heat Pumps have only one transformer and RH and RC should be connected together and to the R terminal at the HVAC system. |
| **C** | **Provides a common or return for 24VAC RH and RC and for the LEDs and filters on the Motherboard.**<br>Connect C terminal to the common side of the HVAC 24VAC transformer(s) in the HVAC system which is normally indicated as C or sometimes as X. | **Provides a common or return for 24VAC RH and RC and for the LEDs and filters on the Motherboard.**<br>Connect C terminal to the common side of the HVAC 24VAC transformer in the HVAC system which is normally indicated as C or sometimes as X. | **Provides a common or return for 24VAC RH and RC and for the LEDs and filters on the Motherboard.**<br>Connect C terminal to the common side of the HVAC 24VAC transformer in the HVAC system which is normally indicated as C or sometimes as X. |
| **W1** | **Controls the first stage heating and will be activated (24VAC) when ther is a call for first stage heating.**<br>Connect W1 terminal to the terminal controlling stage 1heating which is normally indicated as W or W1. | **Controls the O-Type Reversing Valve and will be activated (24VAC) when there is a cooling call.**<br>Connect W1 terminal to the terminal controlling the O-Type reversing valve which is normally indicated as O. | **Controls the B-Type Reversing Valve and will be activated (24VAC) when there is a heating call.**<br>Connect W1 terminal to the terminal controlling the B-Type reversing valve which is normally indicated as B. |
| **W2** | **Controls the second stage heating and will be activated (24VAC) when ther is a call for second stage heating.**<br>Connect W2 terminal to the terminal controlling stage 2 heating which is normally indicated as W2. | **Controls the second stage auxillary heating and will be activated (24VAC) when there is a call for second stage heating.**<br>Connect W2 terminal to the terminal controlling stage 2 heating which is normally indicated as W2. | **Controls the second stage auxillary heating and will be activated (24VAC) when there is a call for second stage heating.**<br>Connect W2 terminal to the terminal controlling stage 2 heating which is normally indicated as W2. |
| **Y1** | **Controls the first stage cooling and will be activated (24VAC) when ther is a call for first stage cooling.**<br>Connect Y1 terminal to the terminal controlling the stage 1 compressor which is normally indicated as Y or Y1. | **Controls the compressor and will be activated (24VAC) when there is a call for first stage heating or cooling.**<br>Connect Y1 terminal to the terminal controlling the stage 1 compressor which is normally indicated as Y or Y1. | **Controls the compressor and will be activated (24VAC) when there is a call for first stage heating or cooling.**<br>Connect Y1 terminal to the terminal controlling the stage 1 compressor which is normally indicated as Y or Y1. |
| **Y2** | **Controls the second stage cooling and will be activated (24VAC) when ther is a call for second stage cooling.**<br>Connect Y2 terminal to the terminal controlling the stage 2 compressor which is normally indicated as Y2. | **Controls the second stage cooling and will be activated (24VAC) when ther is a call for second stage cooling.**<br>Connect Y2 terminal to the terminal controlling the stage 2 compressor which is normally indicated as Y2. | **Controls the second stage cooling and will be activated (24VAC) when ther is a call for second stage cooling.**<br>Connect Y2 terminal to the terminal controlling the stage 2 compressor which is normally indicated as Y2. |
| **G** | **Controls the indoor fan and will be activated (24VAC) when there is a call for cooling or the fan turned on for ventilation.**<br>Connect G terminal to the terminal controlling the indoor fan which is normally indicated as G. | **Controls the indoor fan and will be activated (24VAC) when there is a call for heating, cooling or the fan turned on for ventilation.**<br>Connect G terminal to the terminal controlling the indoor fan which is normally indicated as G. | **Controls the indoor fan and will be activated (24VAC) when there is a call for heating, cooling or the fan turned on for ventilation.**<br>Connect G terminal to the terminal controlling the indoor fan which is normally indicated as G. |
| **E** | **Controls the economizer damper and will be activated (24VAC) when there is a call for economizer cooling.**<br>Connect E terminal to the terminal controlling the economizer damper. | **Controls the economizer damper and will be activated (24VAC) when there is a call for economizer cooling.**<br>Connect E terminal to the terminal controlling the economizer damper. | **Controls the economizer damper and will be activated (24VAC) when there is a call for economizer cooling.**<br>Connect E terminal to the terminal controlling the economizer damper. |

# HVAC Unit Wiring for the ADRES HVAC Control Module

## Typical Wiring of a Gas Furnace with Electric Air Conditioning.

### Description

The wiring diagram below is typical of a two-stage gas/electric system.

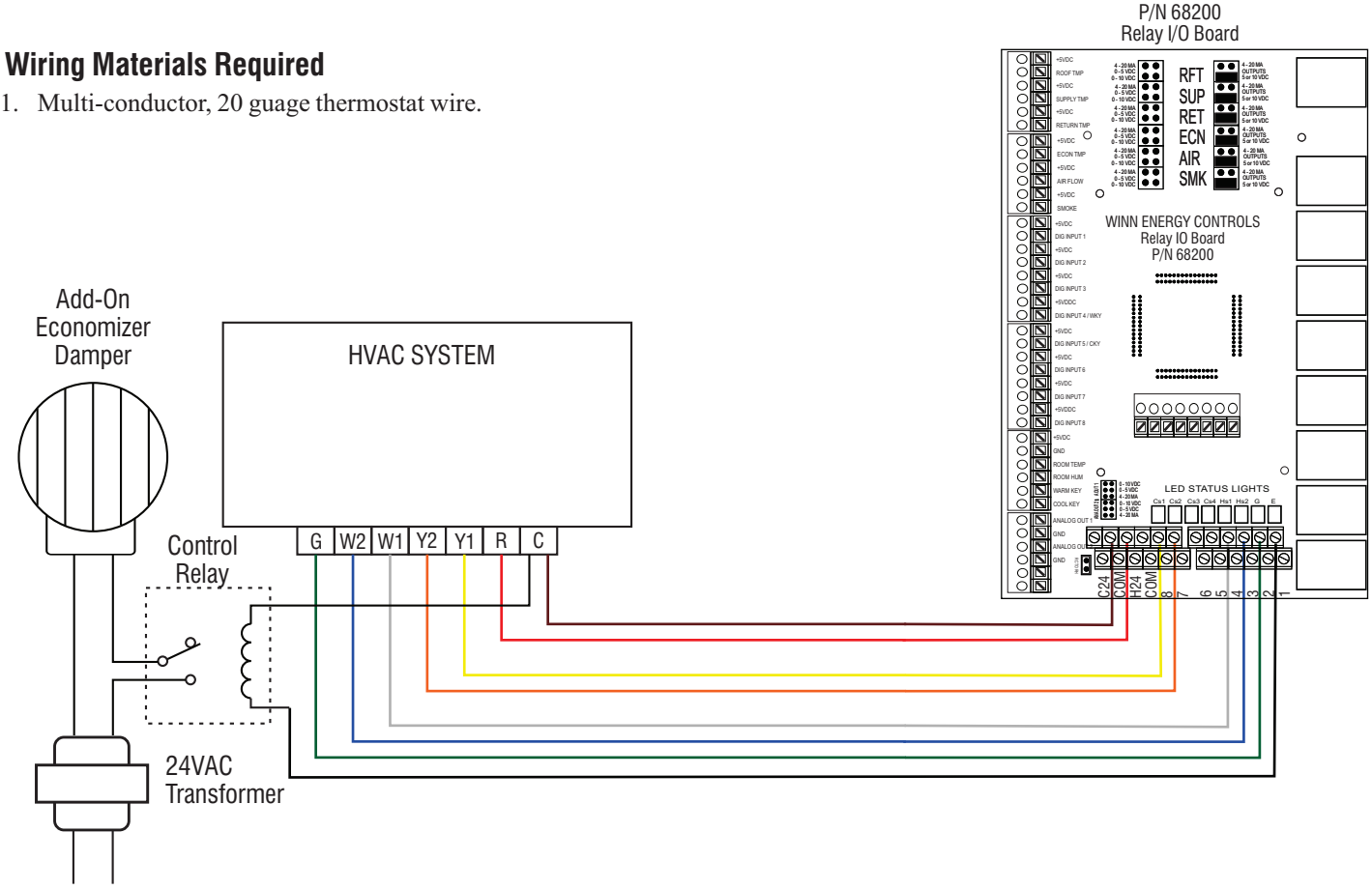
The E terminal at the Relay I/O board is used to control an add-on economizer. A relay and transformer must be added to control the economizer's motorized damper. If a line voltage motorized damper is used, the transformer is not required.

### HVAC System Wiring

| At the HVAC System | To Relay IO Board HVAC Terminal | Wire Color | Function |
|---|---|---|---|
| R | RH and RC | RED | 24VAC |
| C | C | BRN | 24VAC Common |
| W1 | W1 | WHT | Stage 1 Heating Control |
| W2 | W2 | BLU | Stage 2 Heating Control |
| Y1 | Y1 | YEL | Stage 1 Cooling Control |
| Y2 | Y2 | ORG | Stage 2 Cooling Control |
| G | G | GRN | Indoor Fan Control |
| E | E | BLK | Economizer Control Relay |

### Wiring Materials Required

1. Multi-conductor, 20 guage thermostat wire.




***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

**Reference**
WD 13

# HVAC Unit Wiring for the ADRES HVAC Control Module

## Typical Wiring of a Two Stage Heat Pump with an O-Type Valve.

### Description

The wiring diagram below is typical of a two-stage heat pump Type O system.

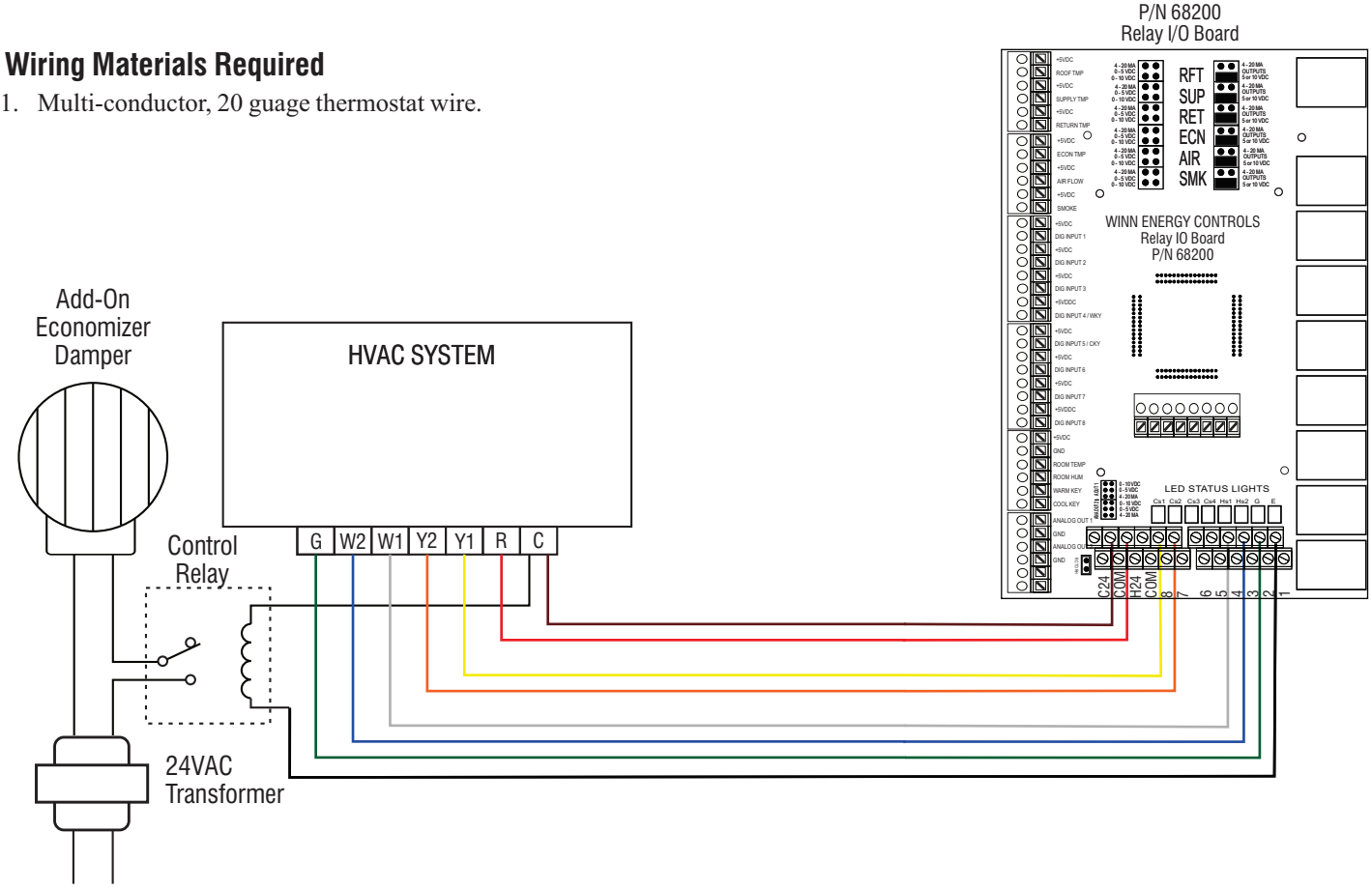
The E terminal at the Relay I/O board is used to control an add-on economizer. A relay and transformer must be added to control the economizer's motorized damper. If a line voltage motorized damper is used, the transformer is not required.

### HVAC System Wiring

| At the HVAC System | To Relay IO Board HVAC Terminal | Wire Color | Function |
|---|---|---|---|
| R | RH and RC | RED | 24VAC |
| C | C | BRN | 24VAC Common |
| O | Hs1 | ORG | Reversing Valve Control |
| W2 | Hs2 | BLU | Stage 2 Heating Control |
| Y1 or Y | Y1 | YEL | Stage 1 Cooling Control |
| G | G | GRN | Indoor Fan Control |
| E | E | BLK | Economizer Control Relay |

### Wiring Materials Required

1. Multi-conductor, 20 guage thermostat wire.




***Caution!***

***Be sure to review the Wiring Workmanship requirements before any wiring is done.***

**Reference**
**WD 14**

### Safety First

Before you perform any wiring be sure you turn Off the power breaker for the system. Failure to do so can result in personal injury and damage to the ADRES controls.

### Local Electrical Codes

All wiring should meet all applicable electrical codes including any permit requirements.

### Professional Installers

Only professional, experienced and qualified technicians should install these controls.

### Approved Materials

Where applicable, only UL approved wire and supplies shall be used in the installation of these controls. Use only the size and type wire specified in the Wiring Diagrams.

### Stripping and Installing Wires

The insulation on wires that are installed in the terminals on the control boards should be stripped about 1/4-inch being careful not to damage the conductor.

Insert the stripped conductor into the terminal and secure it with the screw. Always check that the wire is secure by gently tugging on it.

### Insulation Damage Cause Shorts

The insulation on wires can be cut by sharp sheet metal and cause the conductor to short to earth ground. This provides a path for electrical damage during lightning strikes and can cause damage to the equipment.

### Securing the NEMA Enclosure

The NEMA enclosure should be secured so that it cannot be damaged by technicians on the roof or be damaged by vibration. An unsecured NEMA enclosure can pose a personal hazard and potential damage to the equipment.

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