



Model TR65 RS485 Thermostat



Installation Manual

DCN: 140-02165-01

4/20/12

*** IMPORTANT NOTICE ***

DO NOT USE THIS PRODUCT FOR BUILDING FREEZE PROTECTION! YOU ARE ADVISED TO INSTALL A MECHANICAL FREEZE PROTECTION DEVICE ON YOUR SYSTEM FOR THIS PURPOSE.

TR65 Thermostat Installation

The TR65 thermostat is a two part thermostat with a Wall Display Unit (WDU) and a HVAC Control Unit.

TR65 Wall Display Unit



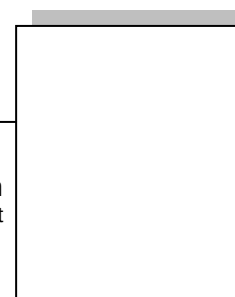
Model: TS65

TR65 HVAC Control Unit



Model: ZCV1

HVAC System



4 Wire
Thermostat wire or
Cat 5 wire

5 Wire
minimum
Thermostat
wire

Install the TR65 Wall Display Unit (WDU) on the wall in the traditional thermostat location. The HVAC Control Unit is typically installed at the HVAC mechanical system location, but it can be installed anywhere in the wiring between the WDU and the HVAC system.

Wiring

Retrofit installations

The Wall Display Unit replaces the traditional thermostat. The existing thermostat wiring can be used (4 wires required). Install the TR65 WDU at the thermostat end and simply cut the cable at the desired location of the HVAC Control Unit and connect it in the line. 4 wires are required between the WDU and HVAC Control Unit and typically 5 wires are required between the HVAC Control Unit and the HVAC system. Heat Pump and Multistage systems may require additional wires between the HVAC Control Unit and the HVAC System. Consult your HVAC system wiring diagram.

New Construction

For new installations, prewire the thermostat location back to the mechanical HVAC system with either thermostat wire, 5 conductor, (18-20ga) or Cat 5 cabling. The TS65 WDU wires to the HVAC Control Unit with this cable. The HVAC Control Unit wires to the HVAC system with thermostat wiring, typically 5 wire, 18-20Ga. Heat Pump and Multistage systems may require additional wires between the HVAC Control Unit and the HVAC System. Consult your HVAC system wiring diagram.



BEFORE REMOVING THE OLD THERMOSTAT! Write down connections!

Be sure to write down the existing wiring connections to the old thermostat. Label the wires with the thermostat connection. Refer to these when connecting the HVAC Control Unit to the HVAC system.

Old Thermostat Terminal Marking	Typical Wire Color	Your Wire Color
C or B (24V common)	Blue or Black	
R (or RH for split heating systems)	Red from heating system	
RC (for split cooling systems)	Red from cooling system	
G	Green	
W or W1	White	
W2	Brown	
Y or Y1	Yellow	
Y2	Black or Blue	
O (heat pump system only)	Orange	
B (heat pump system only)	Brown or Blue	

Caution: Thermostat wiring color codes are not standardized beyond simple 5 wire systems. Do not rely on the color of the wire to determine function. Check it and write it down!

Wall Display Unit Installation

For retrofit installations, install the WDU at the existing thermostat location. You may reuse the existing thermostat wiring (4 wires required).

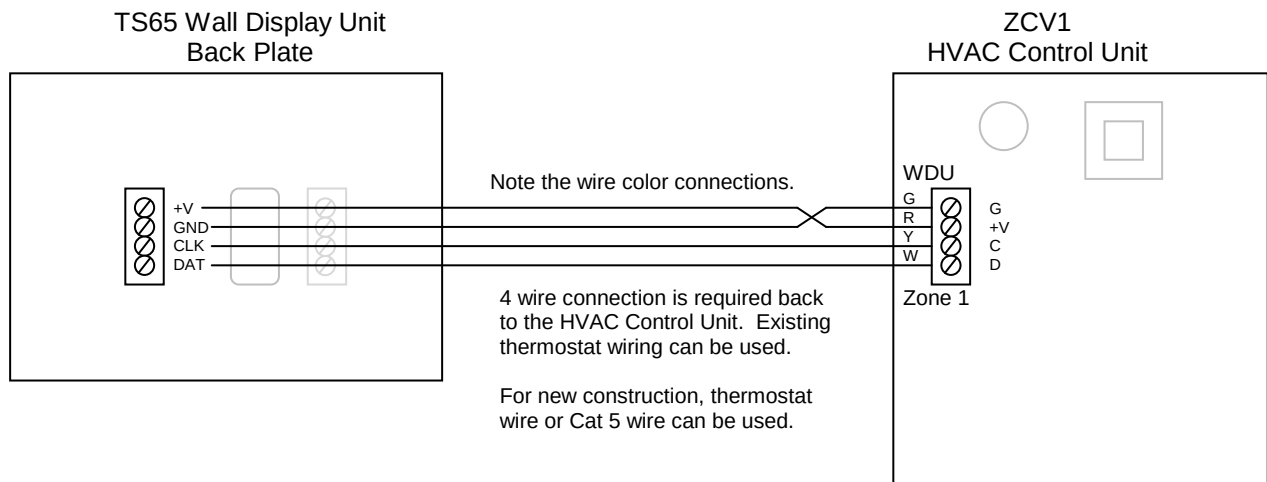
For new installations, be sure to locate the WDU in a location for best temperature sensing in the area to be controlled. Avoid these locations:

- Outside walls
- Drafty locations
- Direct sunlight exposure
- Near HVAC vents
- Corners or behind doors

Install the WDU

- Mark the location of the installation holes
- Install the screw anchors
- Run wiring through the back plate
- Install the back plate on the wall with the screws provided.
- Connect wiring to terminals. **CAUTION!** Double check your wiring. Mis-wiring the WDU can result in damage to the unit.
- Write down the terminal wiring colors for connecting the WDU cable on the HVAC Control Unit end.

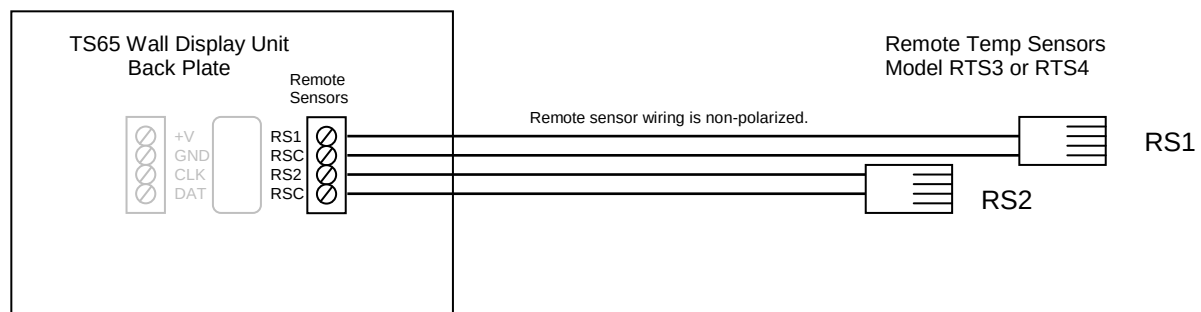
WDU Wiring to HVAC Control Unit



Remote Sensor Connection (on the Wall Display Unit)

Two remote sensors can be connected to the TR65 Wall Display Unit.

- Sensor RS1 will replace the internal sensor
- Sensor RS2 will be averaged with the internal sensor or Sensor RS1 if attached
- Use only RCS 10K Thermistor style sensors



HVAC Control Unit Installation

Location and Mounting

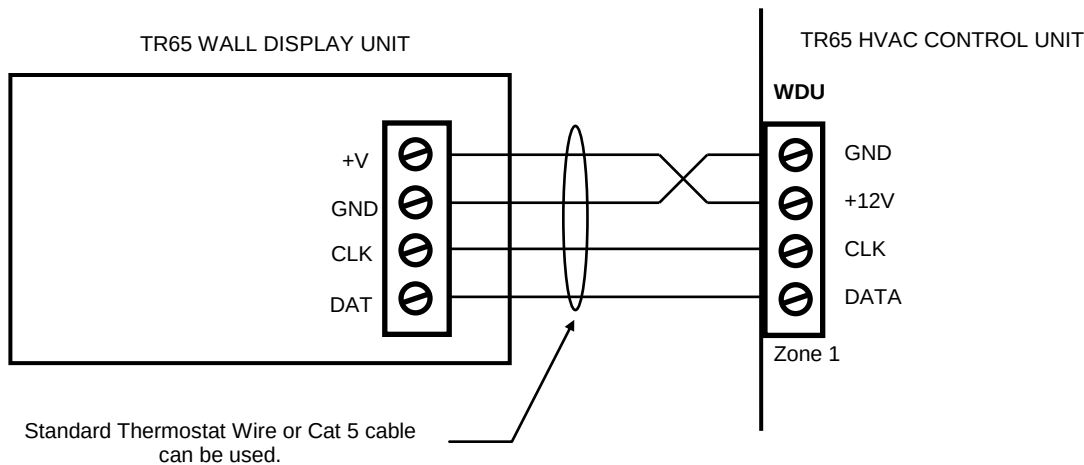
Install the HVAC Control Unit in a protected, convenient, indoor location near the HVAC system or in a service accessible area such as an equipment closet or garage.

Mount the HVAC Control Unit in a vertical position on a wall or sturdy structural member. The unit may be mounted on the HVAC system but care should be taken to avoid hot burner sections or high vibration areas.

Wall Display Unit Connection

Wire specification: 4 conductor, 18/20Ga thermostat wire or 22Ga twisted pair or Cat 5 wire (preferred)

Connect the Wall Display Unit to the HVAC Control Unit by four wires. In retrofit applications, the existing thermostat wiring may be used, however, for best results and in new construction, a Category 5 twisted pair cable is recommended.



Standard thermostat Wire color code

Ground: Green
12VDC: Red
Clock: Yellow
Data: White

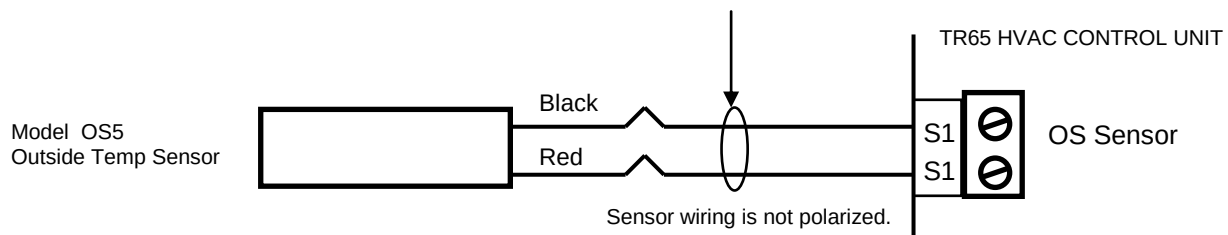
Preferred Cat 5 Wire color code

Ground: Brown pair (twisted together)
12VDC: Blue Pair
Clock: Green Pair
Data: Orange Pair

CAUTION! Do not mis-wire the Wall Display Units – damage may result. Check the wiring before applying power to the HVAC Control Unit.

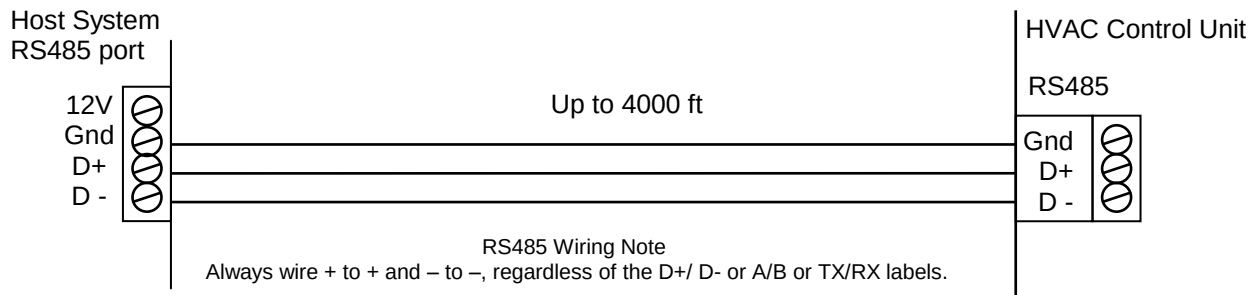
Outside Temp Sensor Connection (on the HVAC Control Unit)

Wire specification: 2 conductor, 22Ga twisted pair or Cat 3/5 wire (preferred)



RS485 Network Connection

The RS485 communications port is a 2 wire (D+ and D –) plus ground, half-duplex network connection. Wiring options are direct to a host com port or wired to a RCS RS485 hub to allow star or homerun wiring.

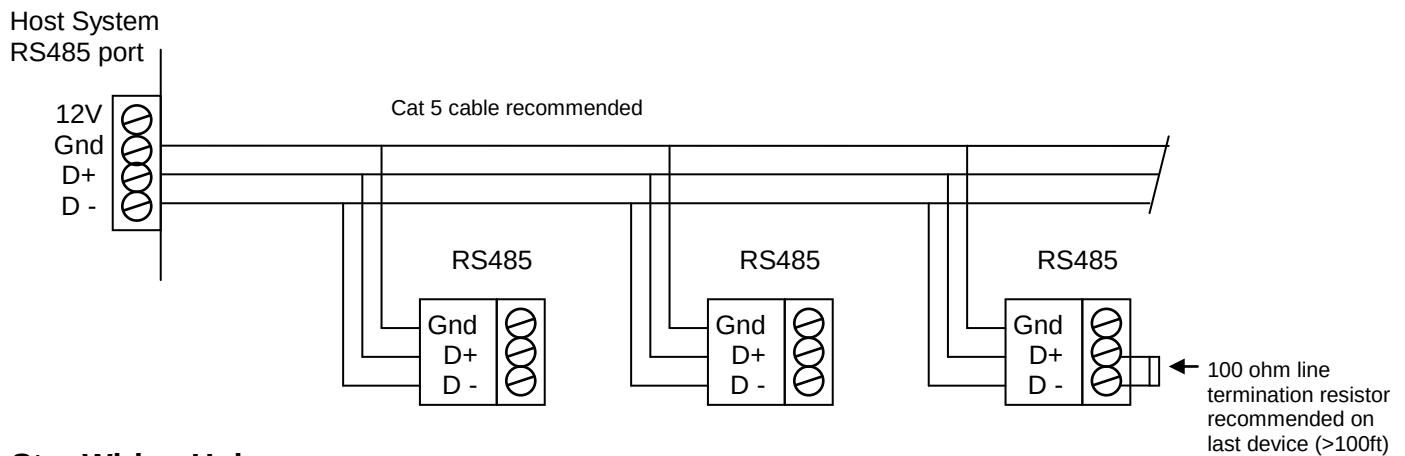


RS485 Wiring Methods

The HVAC Control Unit can be wired by three methods:

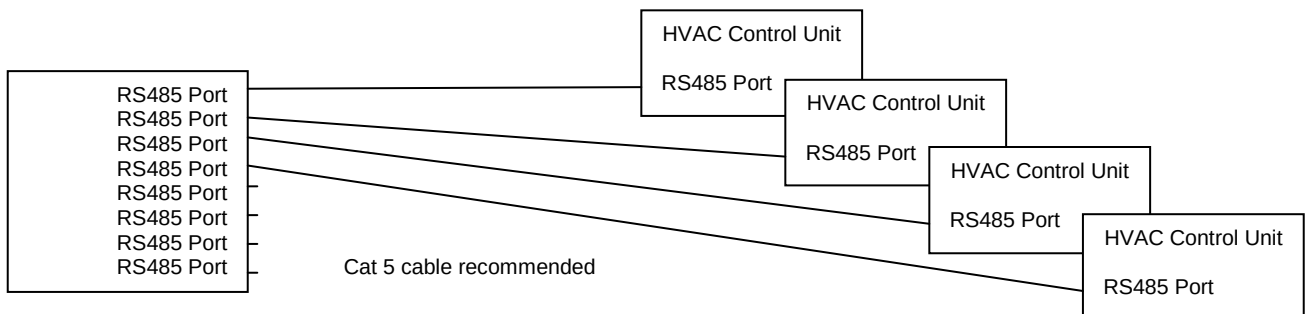
1. Direct connection to RS485 Host com ports (as above)
2. Multi-drop (daisy chained) to other thermostats/devices
3. Homerun wired to an RCS Star Wiring Hub.

Multi-drop Wiring



Star Wiring Hub

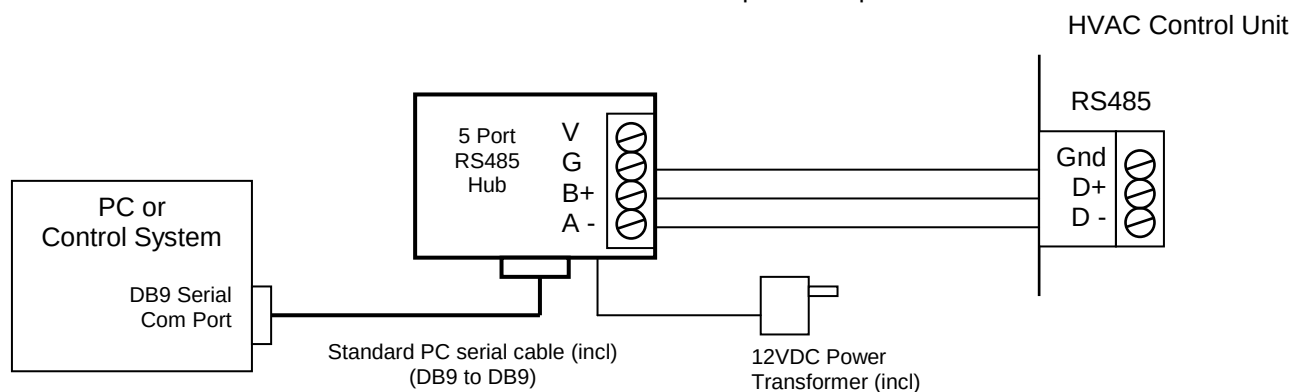
CommStar Model CS308 or
Model 8AH485 8 Channel Star RS485 Hub



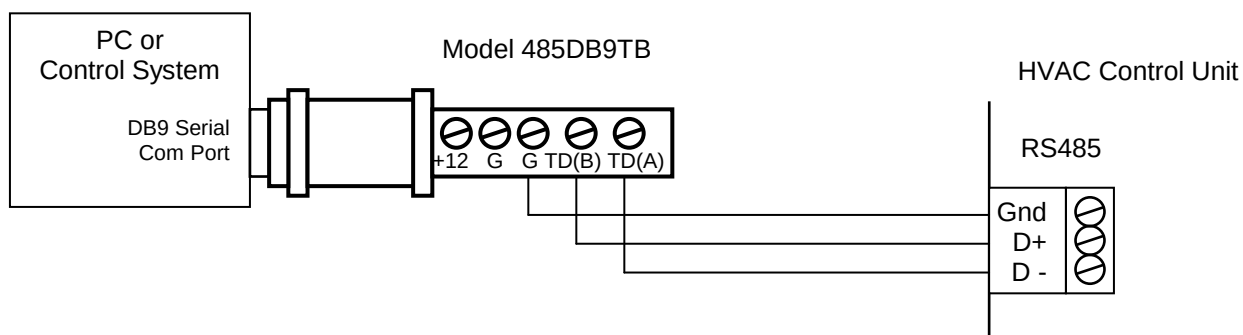
Each TR65 HVAC Control Unit is homerun wired to the Star Wiring Hub

Connecting to RS232 Communications Ports

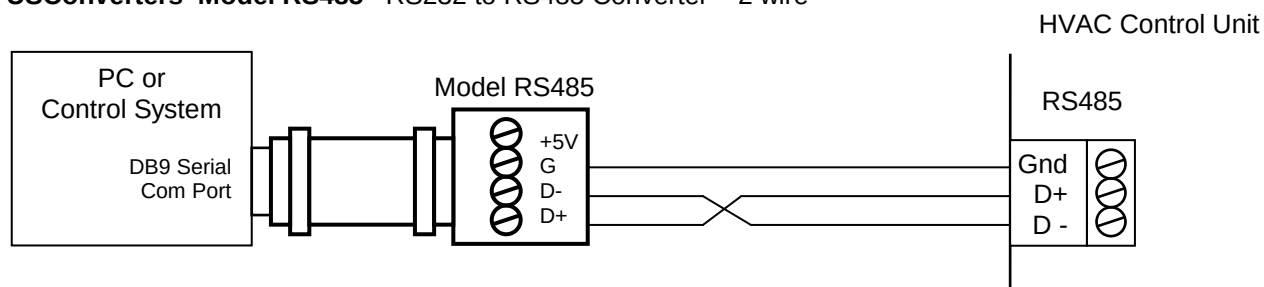
RCS Model 485PB 5-Port RS232 to RS485 Converter with power outputs.



B&B Electronics Model 485DB9TB RS232 to RS485 Converter - 2 wire



USConverters Model RS485 RS232 to RS485 Converter – 2 wire



Connecting to USB Ports

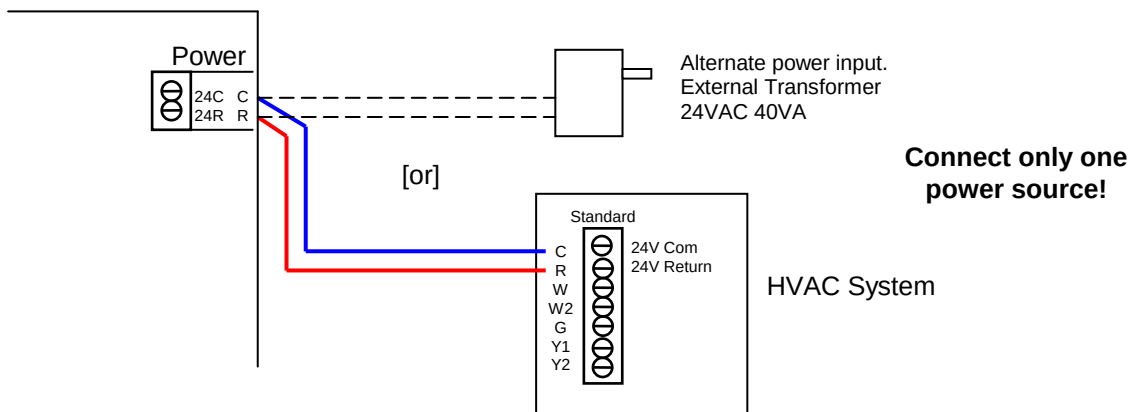
Several companies make USB to RS485 Converters.

B&B Electronics
Model 485USBTB-2W

USConverters
Model US485MIO
Model USB485CAB

Power Connection

The TR65 HVAC Control Unit requires 24VAC power. Power is provided from the HVAC system or by an external transformer (not supplied). Do NOT connect the HVAC system power if you are connecting an external power transformer.



Vent Damper Wiring

Wire specification:

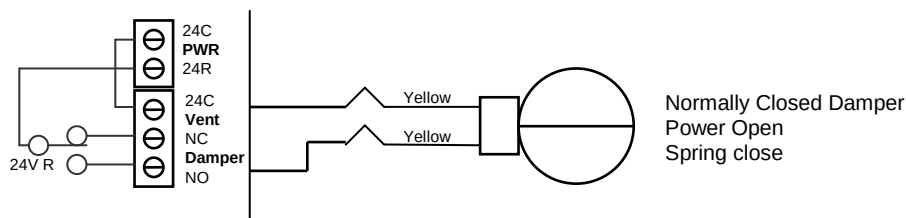
RD Series dampers: requires 2 conductor cable
RDM Series dampers: requires 3 conductor cable
Recommended wire: 18/20GA thermostat wire

Dampers

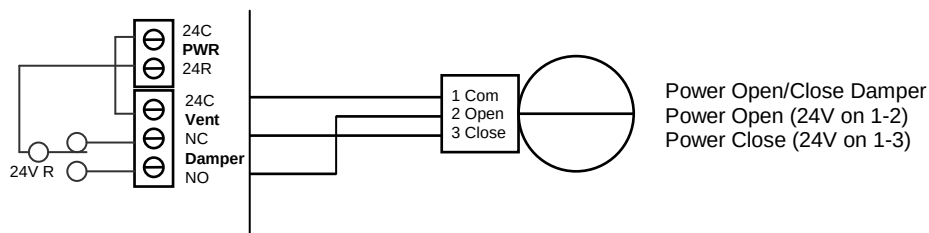
Vent Damper output supports either two wire (normally closed, power open/spring return) or three wire dampers (power open, power close).

The vent damper output is 24VAC, 1 A max.

RD Series 2 Wire Dampers



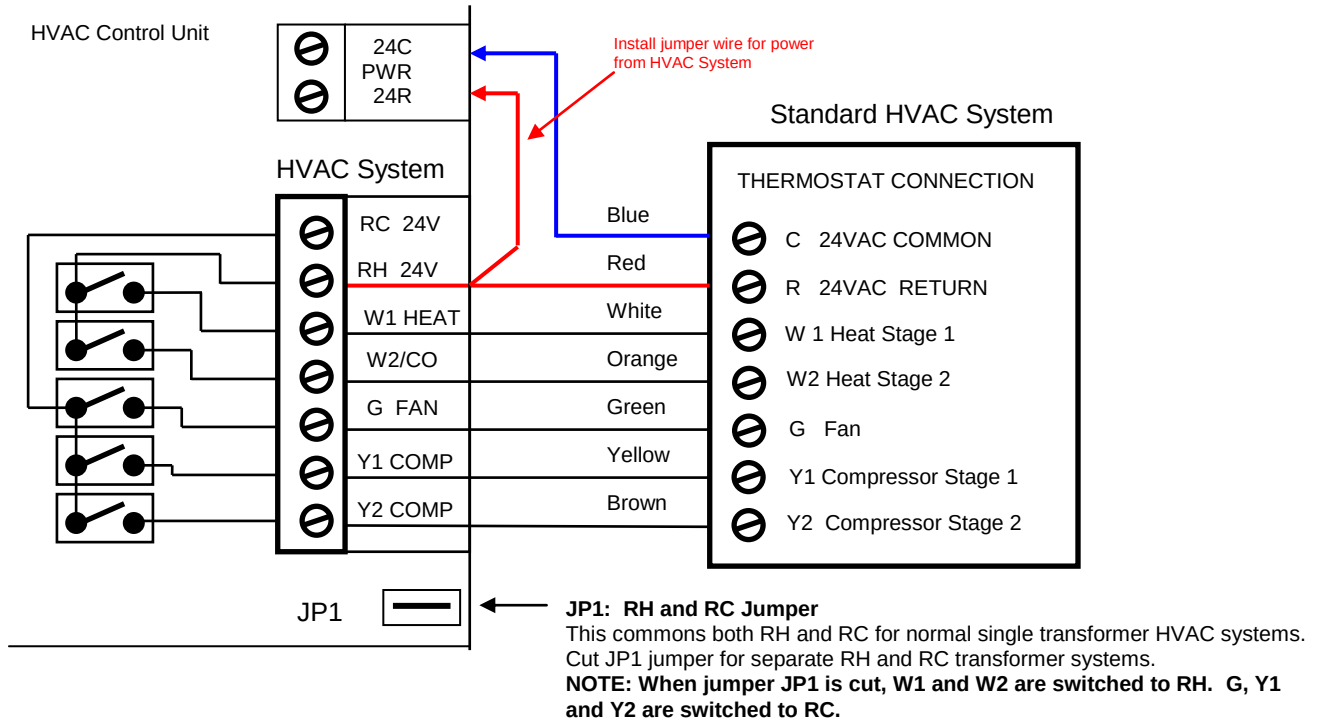
RDM Series 3 Wire Dampers



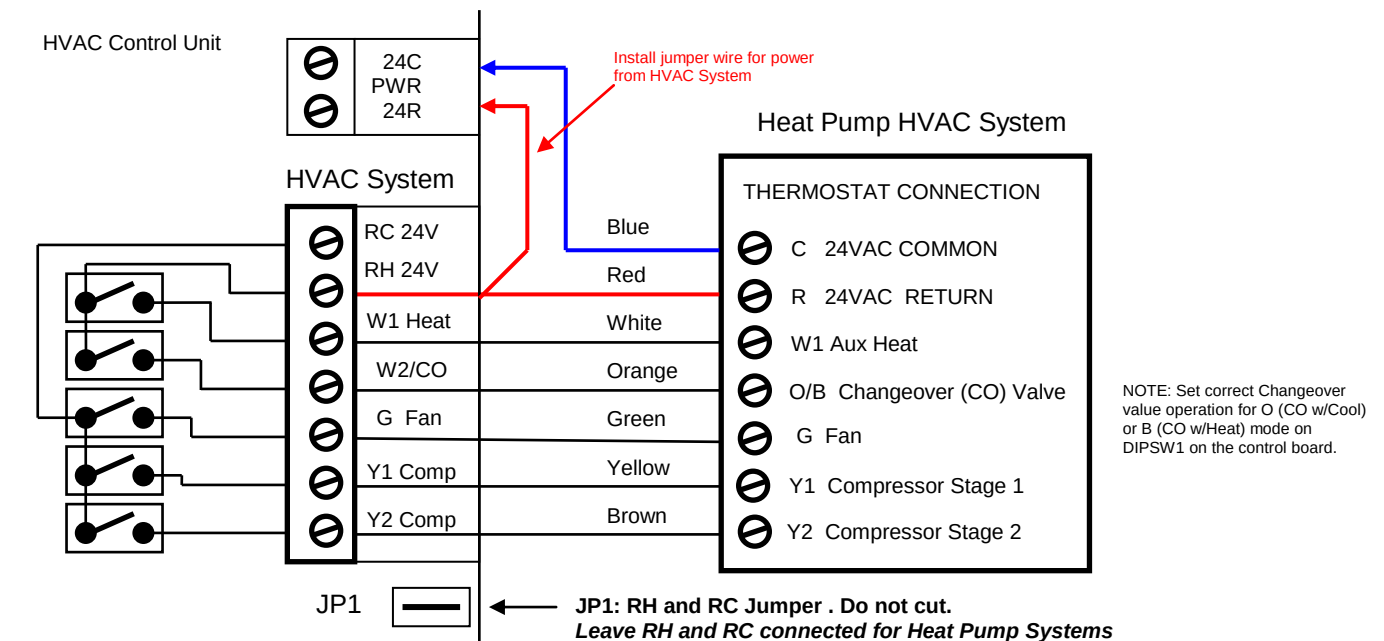
HVAC System Connection

The TR65 HVAC Control Unit connects to the HVAC system like a standard thermostat.

Standard Gas/Electric HVAC System Wiring



Heat Pump HVAC System Wiring



HVAC SYSTEM SETUP

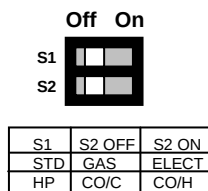
The TR65 must be configured for the correct HVAC system type. This is done by setting the dipswitch, SW1, on the HVAC Control Unit.

You must know what type of HVAC system you have to correctly setup the thermostat. Determine the following before you install the TR65. Check your HVAC system manual to verify.

- HVAC System Type: Standard Gas, Electric or Heat Pump system.
- HVAC System Fan Type: Gas or Electric
- Heat Pump System Changeover valve Type: Changeover with cooling or changeover with heating.

For retrofit installations, the original thermostat settings and wiring may be clues to the proper settings. If you are not sure, consult the HVAC system manual or contact a qualified service technician.

Setup Dipswitch SW1



Setting SW1 correctly is required for proper system operation.

Switch S1: System Type

Off: Standard gas/electric HVAC system (default)

On: Heat Pump System

Switch S2: S2 function is dependent on the setting of S1

If S1= Standard system

Then S2 = Fan Type

Off: Gas heating system (default)

On: Electric heating system

If S1= Heat Pump system

Then S2 = Changeover valve type (CO)

Off: CO/C Change over with cooling (default)

On: CO/H Change over with heating

Any change to the SW1 settings requires the HVAC Control Unit to be power cycled (Off/On).

You can view and confirm the system setup in the Wall Display Unit's Main Menu "Thermostat Info" screen.

Additional setup options and operational preferences are available in the "User Settings" and "Installer Settings" menus accessed from the Wall Display Unit.

Refer to the "Installer Settings" document from details of these optional settings.

SYSTEM CHECKOUT

It is strongly recommended that you hook-up and run a simple bench test before installing the TR65 thermostat. Not only will this save you time in system checkout but will also familiarize you with the TR65 operation.

Quick Test

NOTE: Before power up, set the dipswitch, DIPSW1, to ALL OFF.

1. Connect the Wall Display Unit to the WDU input on the HVAC Control Unit with a 3 foot 4 wire cable.
2. Connect a 24VAC transformer to the HVAC Control Unit Power Input connector.
3. Plug the transformer into a power outlet
4. Verify Status LED is **flashing**.
5. Verify the WDU display comes on and shows the current temperature.
 - a. If no display or a "CF" display is shown on the WDU, **double check your wiring**.
 - b. Do not proceed until the current temperature is displayed on the WDU and communications between it and the HVAC Control Unit is OK. Any problems will result in a "CF" (Communications Failure) display on the WDU.
6. Press the WDU Fan button on the WDU. The HVAC Control Unit Fan LED and relay should turn on.
7. Press the WDU Fan button again. The Fan LED and relay should turn off.
8. Press the WDU Mode button until Heat Mode is selected.
9. Press the Setpoint Up button until the setpoint is above the current temperature. The Heat LED and relay should come on. (after any MOT delays, check WDU system status LED label)
10. Press the Mode button until OFF mode is selected. The Heat LED and relay will turn OFF.
11. Press the Mode button until Cool mode is selected.
12. Press the Setpoint Down button until the setpoint is below the current temperature. The Y1 and G (Fan) LEDs and relays should turn on. (after any MOT delays, check WDU system status LED label)
13. Press the mode button until OFF mode is selected.
14. All LEDs and relays should turn off.
15. When you have successfully completed these tests, you have verified that the basic thermostat functions are working correctly.
16. **BEFORE INSTALLING THE THERMOSTAT, SET THE DIPSWITCH, SW1, TO THE CORRECT CONFIGURATION FOR YOUR HVAC SYSTEM TYPE.**

Communications Test with a PC

1. With the TR65 connected as above, proceed with connecting the HVAC Control Unit's RS485 port to a PC serial port (COM1) using a RS232 to RS485 converter (RCS Model 485DBTB or eqv).

Note: If you are not using an RCS RS485 to RS232 converter, be sure that your converter supports automatic Send Data Control (required).

2. Confirm the thermostat address is 1 in the Thermostat Info screen. This is the default address. If not, change in the Installer Settings/Network Settings menu item
3. Start Hyperterm terminal emulator program in Windows/Accessories/Communications/Hyper Terminal.
4. Set Hyperterm communications parameters for COM1 to 9600 baud, no parity, 8 data bits, 1 stop bit and NO flow control.
5. **Set CAPS lock on (Commands are case sensitive).**
6. Send the Request for Status command R=1.
Type "A=1 R=1" followed by the carriage return (cr).
7. Thermostat should respond with the R=1 status response showing temp, setpoint, mode and fan.
(A=00 O=1 Z=1 T=xx(current temp) SP=70 SPH=70 SPC= 74 M=0 F=0)
8. Set Mode to Heat. Type "A=1 M=H (cr)".
9. WDU should change to show the new mode is "Heat".
10. Set heat setpoint to 78 degrees. Type "A=1 SPH=78 (cr)"
11. WDU should change to show a setpoint update of "Heating Setpoint 78".
12. If the WDU responds properly to these commands, proceed with final installation.

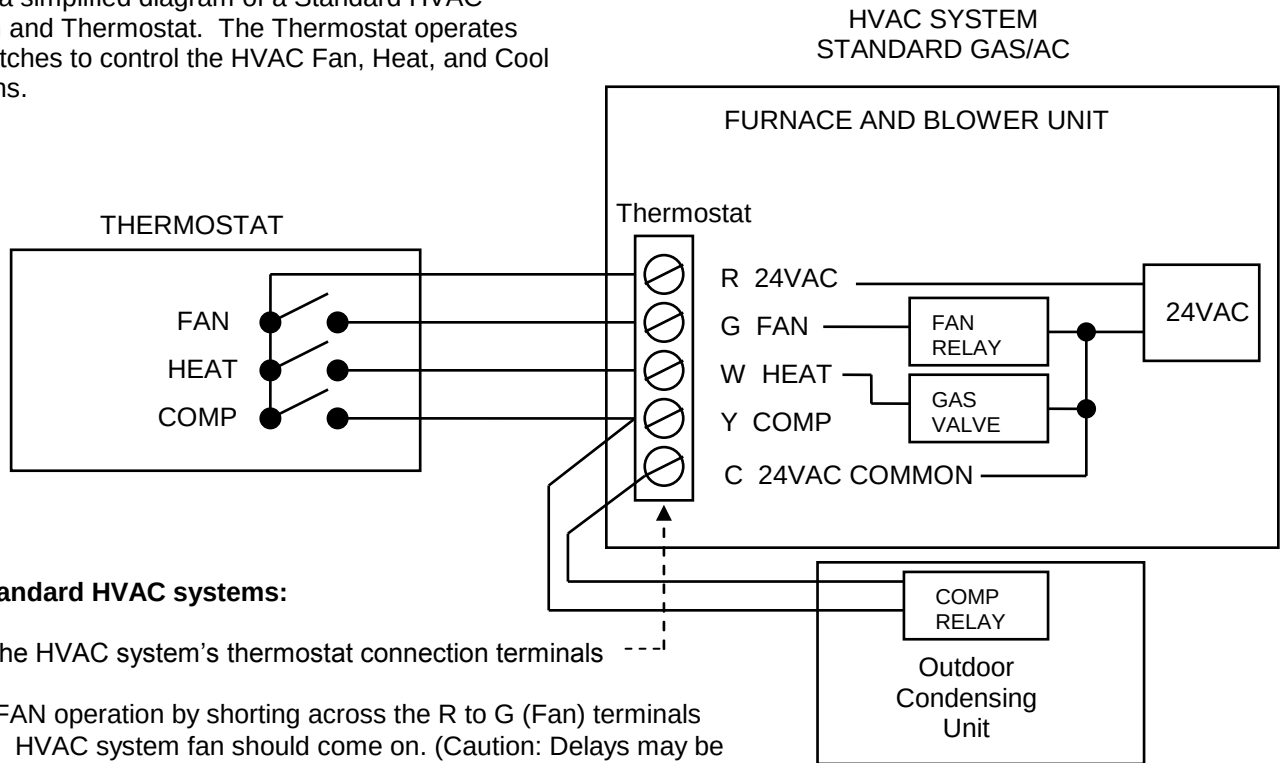
HVAC SYSTEM QUICK TEST

In the event that you have difficulty with the TR65 controlling the HVAC system, you can perform the following quick test to confirm that the HVAC system is working correctly.

The TR65 HVAC Control Unit connects to the HVAC system at the **normal thermostat connections** on the HVAC unit. Standard thermostat control of the HVAC systems consist of contact closures in the thermostat. You can verify that your HVAC system is working correctly by duplicating these contact closures by shorting across the proper terminals on the HVAC systems thermostat connection. Refer to the following HVAC system example.

HVAC SYSTEM EXAMPLE

This is a simplified diagram of a Standard HVAC System and Thermostat. The Thermostat operates like switches to control the HVAC Fan, Heat, and Cool functions.



For Standard HVAC systems:

Go to the HVAC system's thermostat connection terminals

Verify FAN operation by shorting across the R to G (Fan) terminals

- HVAC system fan should come on. (Caution: Delays may be part of normal start up cycle, check HVAC system's manual)
- If not check HVAC system power and fuses.
- If power is OK, HVAC system is NOT working correctly.

Verify HEAT operation by shorting across R to W (Heat) terminals (A Fan call is not necessary for gas furnaces)

- Heating operation should start. (Caution: Delays may be part of normal start up cycle, check HVAC System's manual)
- If not, check wiring, check 24VAC power is on R terminal. (measured across R to C).
- If power is OK, HVAC system is NOT working correctly.

Verify COOL operation by shorting across R to Y (Compressor) and R to G (Fan) terminals

- Cooling operation should start. (Caution: Short Cycle Protection 5 minute delays are normal between calls and may delay start)
- If not, check wiring, check 24VAC power is on R terminal (measured across R to C)
- If power is OK, HVAC system is NOT working correctly.

If any of these checks fail, the HVAC system is not working correctly. Call an HVAC professional.

Heat Pump Systems are similar, but have an additional output for the changeover valve. The basic fan and heating test are the same.

Wiring Diagram

HVAC Control Unit Model ZCV1 Rev K

Wall Display Unit Model TS65

