

RS232/485 Thermostat  
 Models TR36, TR36R  
**(Rev D Control Unit)**

INSTALLATION AND OPERATION MANUAL

**\*\*\* 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.

OPERATION

The TR36 Thermostat provides typical thermostat functions as well as the capability to send and receive information via RS232 or RS485 communications. This RS232/485 communications capability allows the thermostat's setpoint, mode and fan operation to be changed remotely. In addition, the remote systems can request status of the thermostat's temperature, setpoints, modes, and other system information.

The TR36 consists of two parts, a **Wall Display Unit (WDU)** and a **Control Unit**. The Wall Display Unit looks like a traditional thermostat and is the wall mounted user interface for the TR36. It provides display, control pushbuttons, and the temperature sensor. The WDU connects to the Control Unit by a 4 wire cable. The Control Unit connects to the HVAC system in place of a standard thermostat and provides thermostatic control of the system. In addition, the Control Unit sends and receives data and commands via the on-board RS-232 and RS-485 ports for remote control of the system.

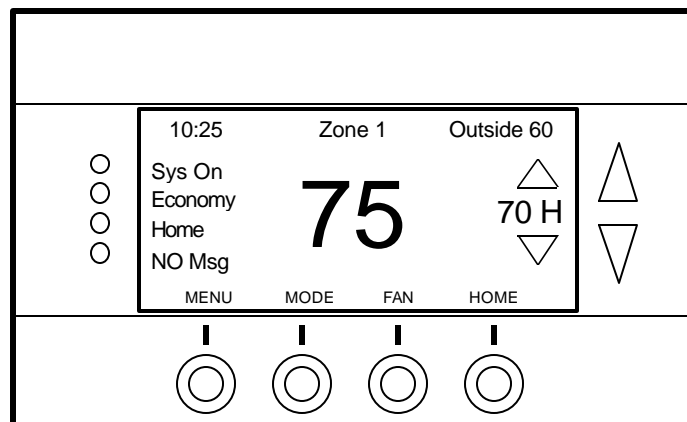
The Model TR36R is available for use with a remote temperature sensor such as the RS15.

TR36 Wall Display Unit

The WDU has a backlit LCD display, control buttons for changing the Setpoint (Up and Down), Mode (Off, Heat, Cool, Auto) and manual fan (On/Auto) functions and a digital temperature sensor. The LCD display is a multi screen display. In the default thermostat screen, it shows the current temperature, setpoint, mode and manual fan mode, time, outside temperature (if sensor attached) and other information. The remote sensor versions do not have an internal sensor and have a connection for a remote sensor, such as the RS15 wall mounted temperature sensor.

Any changes in temperature, or control button operations, are transmitted to the Control Unit. Updates in setpoint or mode can also be received by the WDU from the Control Unit. When updates are received, the screen updates its display.

TR36 WDU



## LCD Display

The LCD display is a multi-screen display and can have any number of sub screens. The default power-up screen, following the banner and version screens, is the thermostat screen. Other screens are selected by the MENU button. The current displayed screen is the active screen and any data changed locally or remotely will be updated for this screen. Standard screens include: Clock Set and System Parameters. The Clock Set screen allows the date and time to be set. The System Parameters screen allows various system parameters to be adjusted. Other screens may be present and selectable from the menu button.

Remote changes in any information on the active screen that are received from the Control Unit will be updated. Changes in screens not active will be displayed when selected again.

## Control Buttons

### SETPOINT UP and DOWN Buttons

The **UP** and **DOWN** buttons control the setpoint temperature. Pushing the **UP** or **DOWN** button once will cause the LCD display to change to show the **current setpoint temperature**. Pushing the button again (before the display switches back to current temperature) will decrement or increment the setpoint value by one degree. Pushing and holding a button down will cause the setpoint to continuously change until the button is released. After 3 seconds of no activity, the LCD display will change back to show the current temperature and the new setpoint value will be transmitted to the Control Unit.

The setpoint can be set from 40°F to 99°F ( 5°C to 37°C).

There is only **ONE** setpoint for the WDU, and it is used for both heating and cooling. The displayed setpoint shows the setpoint of the **current mode** of the system. If you change modes, this same setpoint will be used for the new mode, unless otherwise changed by local (buttons) or remote updates.

### MODE Button

The **MODE** button controls the HVAC system mode. To see what mode the HVAC is in, push the **MODE** button once and the LCD display will change to show the current mode. Pushing the **MODE** button again while the MODE is being displayed, will cause the mode and display to change to the next mode. The system mode cycles from **Off** to **Heat** to **Cool** to **Auto** and back to **Off** again with each push of the **MODE** button. Any change in the system mode is transmitted to the Control Unit.

### FAN Button

The **FAN** button controls the HVAC system's manual fan. Pushing the **FAN** button once will turn the fan On and pushing it again will turn the fan to the Auto mode (OFF unless turned on by the furnace or AC). The fan icon on the LCD display will show on when the manual fan is ON and AUTO when not on in the manual mode. Changes in the fan mode will be transmitted to the Control Unit.

## Temperature Display

The WDU will normally display the current temperature from the internal digital temperature sensor or a remote sensor. The sensors have an accuracy of +/- 1°F(+/- .5°C) and a range of -67°F(-55°C) to 257°F(125°C). The WDU will display temperatures from 0°F/C to 127°F/C. Temperatures less than 0° will be displayed as 00°, temperatures over 100° will be displayed without the leading 1 (example: 102 as 02°.)

## "CF" Error Display

If the WDU is not properly wired or if communications to the Control Unit is interrupted, the LCD display will display "CF" to denote communication failure. Momentary display of "CF" caused by bad or lost data, will

clear automatically when data communication is restored. If the “CF” display stays on, check wiring for problems. A continuous “CF” display may indicate a problem with the Control Unit or the WDU itself. To verify WDU operation, replace the unit with another known good unit.

## INSTALLATION

**WDU Location.** Choose a location that best represents the temperature of the area to be controlled. Avoid locations that are subject to drafts, from doors and windows, or areas with direct sunlight exposure.

### WDU Mounting

Route the wires to the WDU through the access hole in the back of the case. Mount the WDU to the wall with the screws and anchors provided. Be sure to plug any large access hole in the wall with sealer or insulation to prevent wall drafts from affecting WDU operation.

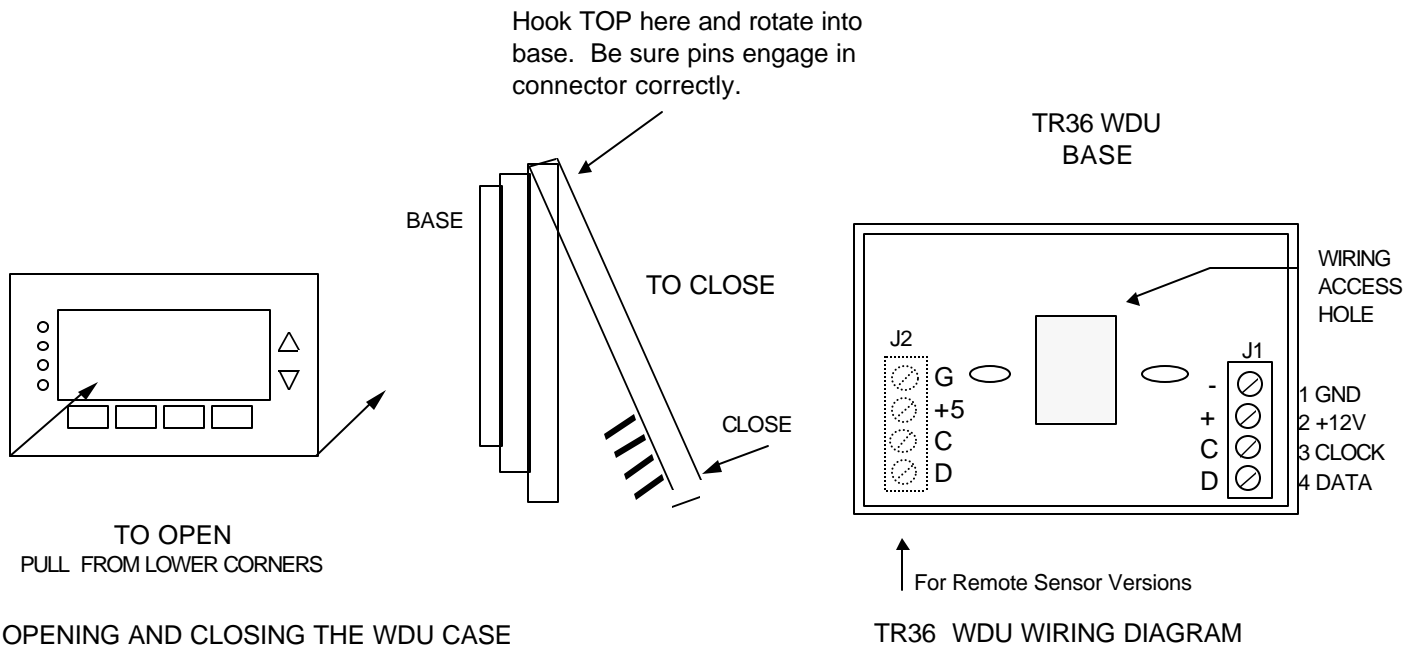
### WDU Prewiring

The recommended wiring to the WDU from the Control Unit should be a two twisted pair cable, 22 Ga minimum. In retrofit applications the existing thermostat wiring (a least 4 wires) may be adequate. However, such non-twisted wiring may be subject to interference due to adjacent high voltage wiring.

### WDU To Control Unit Wiring

Wiring the WDU is simply connecting the four wire cable from the Control Unit to the WDU terminal block. Two wires are for data and two are for power. WDU power is 12VDC and provided by the Control Unit.

**CAUTION: DO NOT MISWIRE THE POWER AND DATA LINES...DAMAGE WILL RESULT!!!  
CHECK YOUR WIRING BEFORE APPLYING POWER...**



### Remote Sensor Version

Model TR36R has an addition connector, J2, on the WDU base for connection of an external remote temperature sensor. Follow the wiring diagram with the remote sensor to connect to the WDU.

## TR36 CONTROL UNIT

### STANDARD HEATING/COOLING HVAC SYSTEMS OPERATION

In the **HEAT** mode, the heating system will be turned on at one deg below the setpoint and will turn off at the setpoint. In the **COOL** mode, the cooling system will be turned on at one deg above the setpoint and will turn off at the setpoint. In the **AUTO** mode, the current heating or cooling operating mode will operate as usual with the one deg setpoint control. In order for the system to change operating mode from heating to cooling, the temperature must rise two deg above the setpoint. On subsequent calls after a change over has occurred, the system will operate normally with the one deg setpoint control. This changeover difference of two deg on the first call helps to prevent the system from overshooting and oscillating between heating and cooling. Changes from cooling to heating works similarly, with the two deg changeover difference being two deg below the setpoint.

**STANDARD GAS/ELECTRIC MODE SELECTION.** To set the Control Unit for standard GAS/ELECTRIC operation, leave the dipswitch SW1-1 set to OFF (default setting).

**FAN MODE SELECTION.** Normally, GAS heating systems DO NOT require fan calls along with the heat call due to thermostat fan operation in the furnace and dipswitch SW1-2 should be set to OFF (default setting) for standard fan operation. Electric and hydronic heating systems generally DO require that a fan call be generated along with the heat call and dipswitch SW1-2 should be set to ON position for fan with heat operation. Be sure to check your HVAC system's requirements.

### HEAT PUMP HVAC SYSTEMS OPERATION

The heat pump system mode works similarly to the standard systems. Normal heating/cooling calls and auto changeover function the same as standard systems. The major difference is the second stage heat. Heat pump systems use the compressor for the primary heating/cooling source. During conditions of high heating requirements, additional heat stages, usually electric strip heaters, may be used. These second stages of heating will be turned on when the current temperature falls four deg below the current setpoint and will turn off when the difference is reduced to two deg below the current setpoint.

**HEAT PUMP MODE SELECTION.** To set the Control Unit for Heat Pump operation, set the STD/HP dipswitch SW1-1 to ON.

**FAN MODE SELECTION.** For normal Heat Pump Operation, set the FAN/HEAT selection dipswitch, SW1-2, to OFF for standard fan operation,

**CHANGE OVER SELECTION.** Heat pump systems change from heating to cooling by reversing the direction of Freon flow in the system. This change over is controlled by the change over (sometimes referred to as reversing valve) output from the Control Unit. Most heat pump systems are designed to work normally in the heating mode and require a change over output for cooling. Set SW1-3 to OFF (default) for this type system. Check your HVAC system requirements for correct settings. If your system requires change over with heating, set SW1-3 to ON. After the change over relay output is first activated, it will stay on continuously even when there is no call until it is turned off by changing to the opposite mode. This prevents continuously cycling of the reversing valve with each call as a system generally stays in either the heating or cooling mode for extended periods.

### REMOTE OPERATION

The TR36 has both RS-232 and RS-485 interfaces that allow remote commands generated by other systems to be received by the TR36. These remote commands can change the setpoint, temperature and mode of the system or may request current status of temperature, setpoint and mode. Remote commands received by the TR36 are decoded to a new setpoint or a new mode and are sent to the TS15 to update its display. Whenever new commands are received, the TS15 will switch it's display to show the updated information for three seconds and then return to the current temp display.

RS-232 connections are point to point and the controller is directly connected to a dedicated port on the remote system. RS-485 connections are a twisted pair multi-drop network that can have up to 32 (256 with low power 485 transceiver chip installed) devices connected to one pair of wires. The TR36 Control Unit is addressable as systems 1 to 16 via dip switch SW1.

The TR36 uses a communications format of 9600 baud, no parity, 8 data bits and 1 stop bit.

## REMOTE COMMANDS

Refer to the RS-232/485 Message format document, DN:150-00225, for detailed information on remote commands to communicate with the TR36 thermostat.

## INSTALLATION

### LOCATION AND MOUNTING

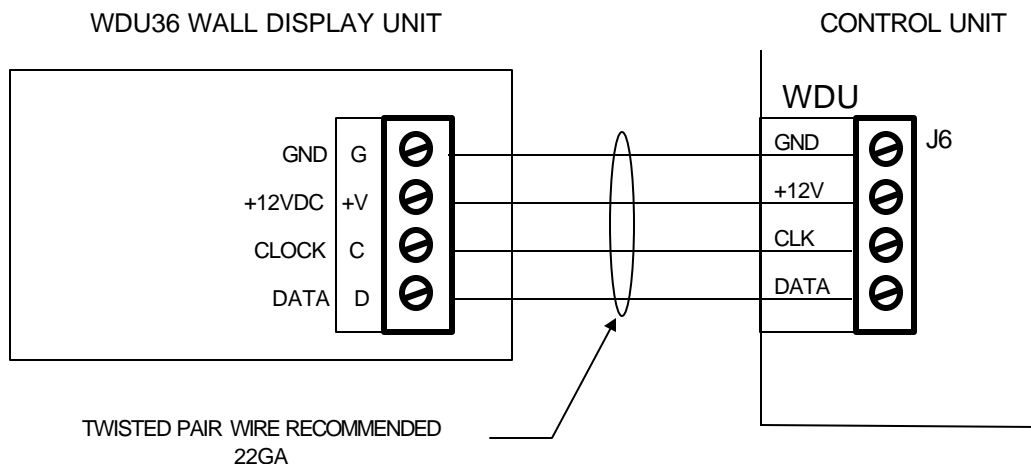
Install the Control Unit in a protected, convenient, INDOOR location near the HVAC system or in a service accessible area such as an equipment closet or garage.

Mount the 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 the hot burner section or high vibration areas.

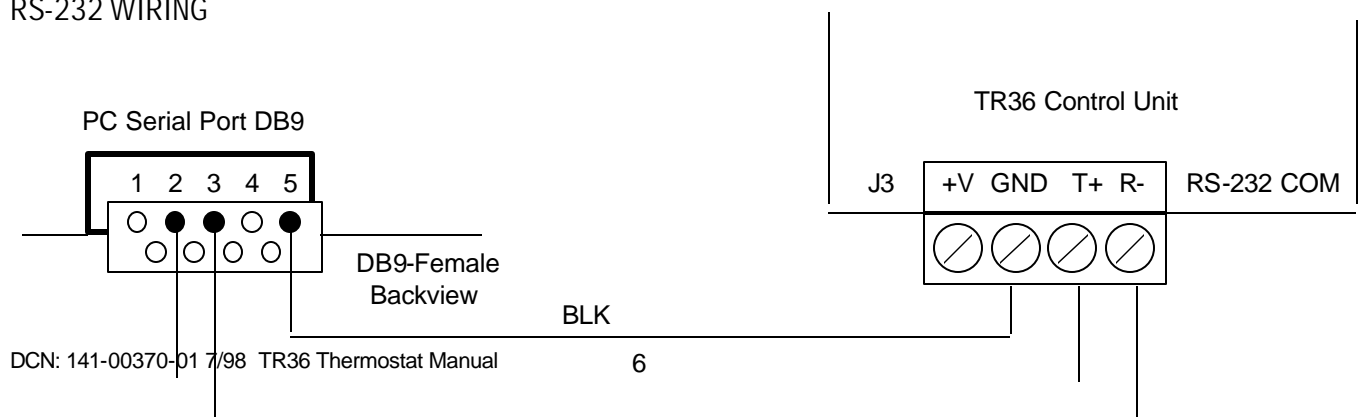
## WIRING

### WIRING TO THE WALL DISPLAY UNIT

The Control Unit connects to the WDU36 Wall Display Unit by four wires. In retrofit applications, the existing thermostat wiring may be used, however, for best results and in new construction, a 22Ga two twisted pair cable is recommended.



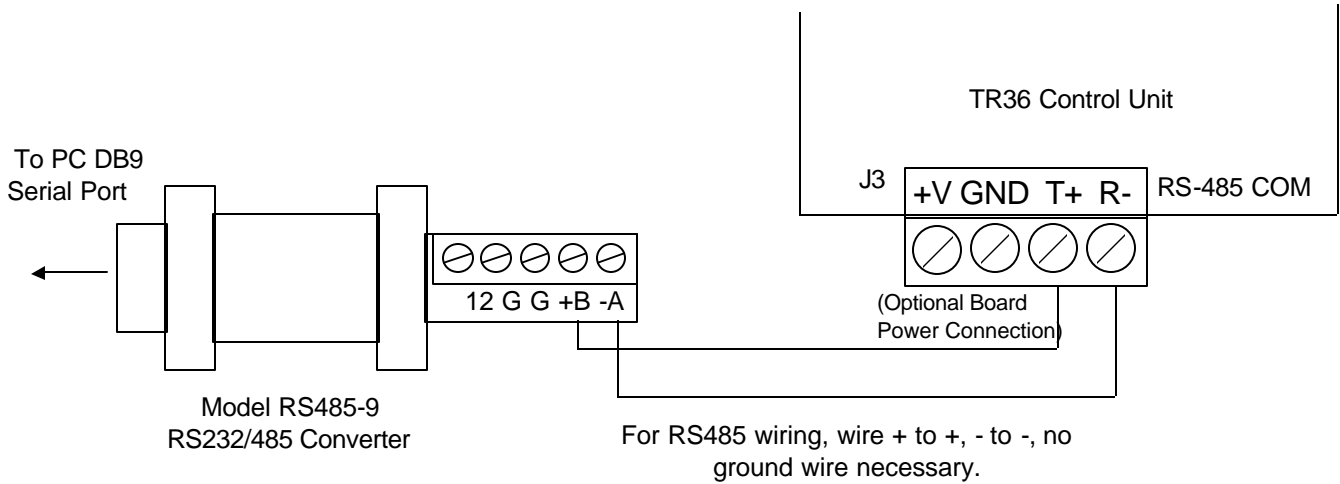
### RS-232 WIRING



RED

GRN

### RS-485 WIRING

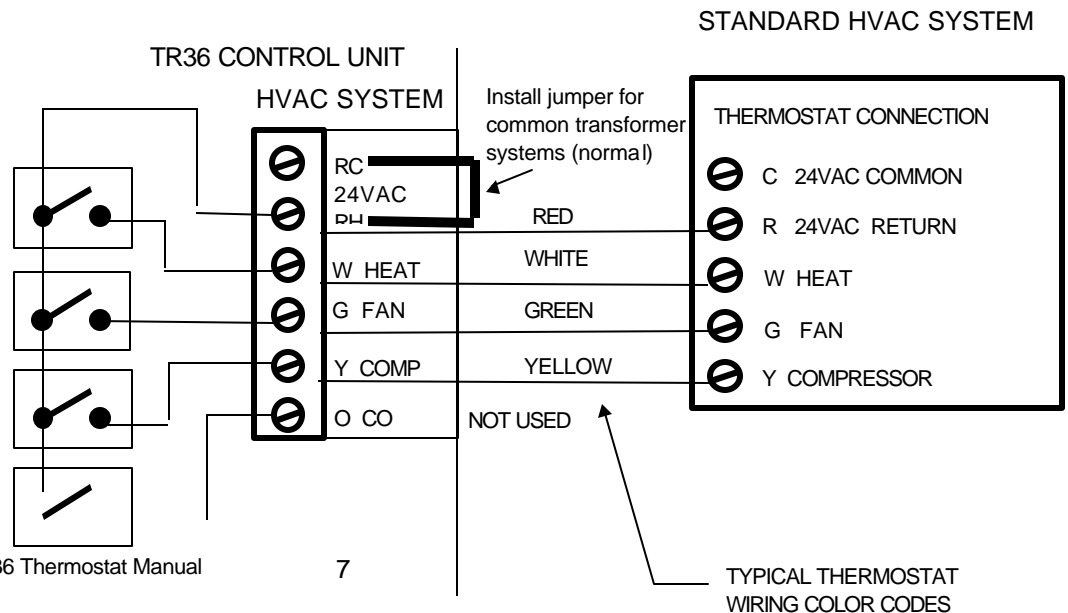


### HVAC SYSTEM CONNECTION

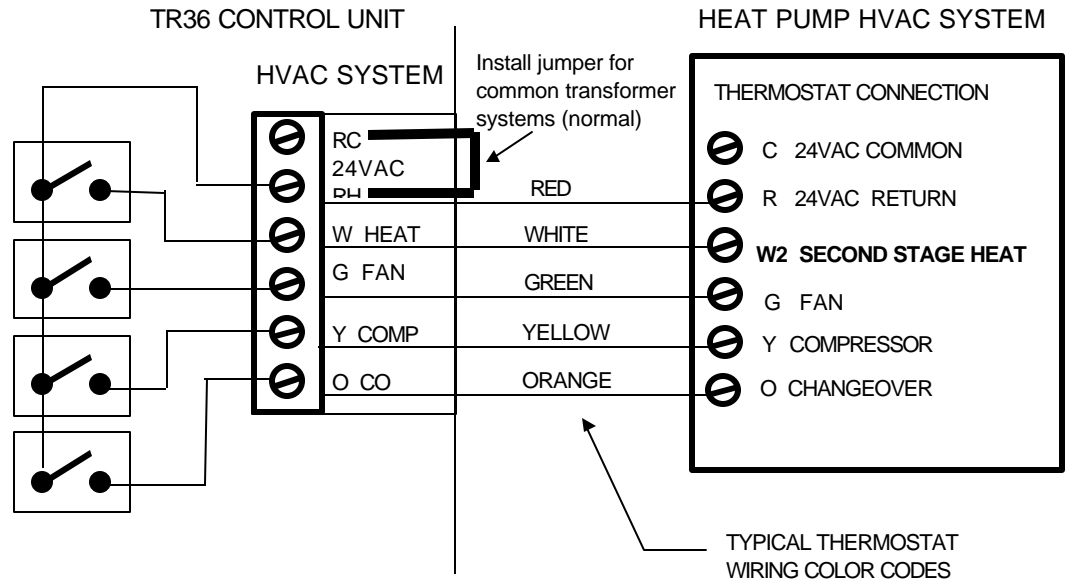
Electrically, the Control Unit looks like a standard thermostat to your HVAC system. All connections to the HVAC systems are made at the normal thermostat connection on the HVAC unit.

Refer to the following HVAC wiring information for the type of HVAC system, standard or heat pump, that the TR36 is being connected to. Refer to your HVAC system's documentation for specific information on its thermostat connections.

### STANDARD GAS/ELECTRIC HVAC SYSTEM WIRING



## HEAT PUMP HVAC SYSTEM WIRING



## POWER

The Control Unit requires 12VDC, 200ma max. Power is provided by an external transformer or power source at either terminal strip J1 for wires or jack J2 for plug-in transformers (Caution, center ground plug-ins only). 12VDC power can also be provided to the control unit on J3 positions 1 and 2, for network powered applications.

## SYSTEM CHECKOUT

It is strongly recommended that you hook-up and run a simple bench test before installing this controller. Not only will this save you time in system checkout but will also familiarize you with the TR36 operation.

## QUICK TEST

NOTE: Before power up, set the dipswitch, SW1, to ALL OFF.

1. Connect a Wall Display Unit to the Control Unit with a short (18 inch) 4 wire cable.
2. Connect the 12VDC transformer to the Control Unit.
3. Plug the transformer into a 110v outlet and apply power to the Control Unit. Verify Power LED is ON.
4. Verify the WDU36 display comes on and shows the current temperature.
  - a. If no display or a "CF" display is shown on the WDU36, **double check your wiring.**
  - b. Do not proceed until the current temperature is displayed on the WDU. Try swapping WDU's.
5. With the current temperature displayed on the WDU, we have verified communication between it and the Control Unit is OK. Any problems will result in a "CF" (Communications Failure) display on the WDU.
6. Press the Fan button on the WDU. The Control Unit Fan LED and relay should turn on.
7. Press the Fan button again. The Fan LED and relay should turn off.
8. Press the Mode button until the WDU is showing "Heat" for Heat Mode.
9. Press the Setpoint Up button until the setpoint is above the current temperature. The Heat LED and relay should come on.
10. Press the Mode button until the WDU is showing "OFF". The Heat LED and relay will turn OFF.

11. Press the Mode button until the TS15 is showing "Cool" for Cool Mode.
12. Press the Setpoint Down button until the setpoint is below the current temperature. The Cool and Fan LEDs and relays should turn on.
13. Press the mode button until the WDU is showing "OFF" for OFF Mode.
14. All LEDs and relays should turn off.
15. When you have successfully completed all these tests, you have verified that the Control Unit and the WDU are working and communicating correctly.

### RS-232 QUICK TEST with a PC

1. With the Control Unit and WDU connected as above, proceed with connecting the TR36's RS-232 connection to a PC serial port COM1.
2. Load the RS232 Demo Program on the PC (refer to the Demo Program instructions)
3. Start the Demo Program
4. Temperature and Setpoint should appear on the PC Display
5. Change setpoint on the PC screen and the WDU should change to show the new setpoint.
6. Change setpoint on the WDU and the PC screen should update to show the new setpoint.
7. Push the FAN button on the WDU and the FAN led should light and the PC display should change to show the FAN function active.
8. Click on the Fan OFF button on the PC and the FAN led should go out on the Control Unit and WDU.
9. If the TR36 responds properly to these RS-232 commands, proceed with installation.

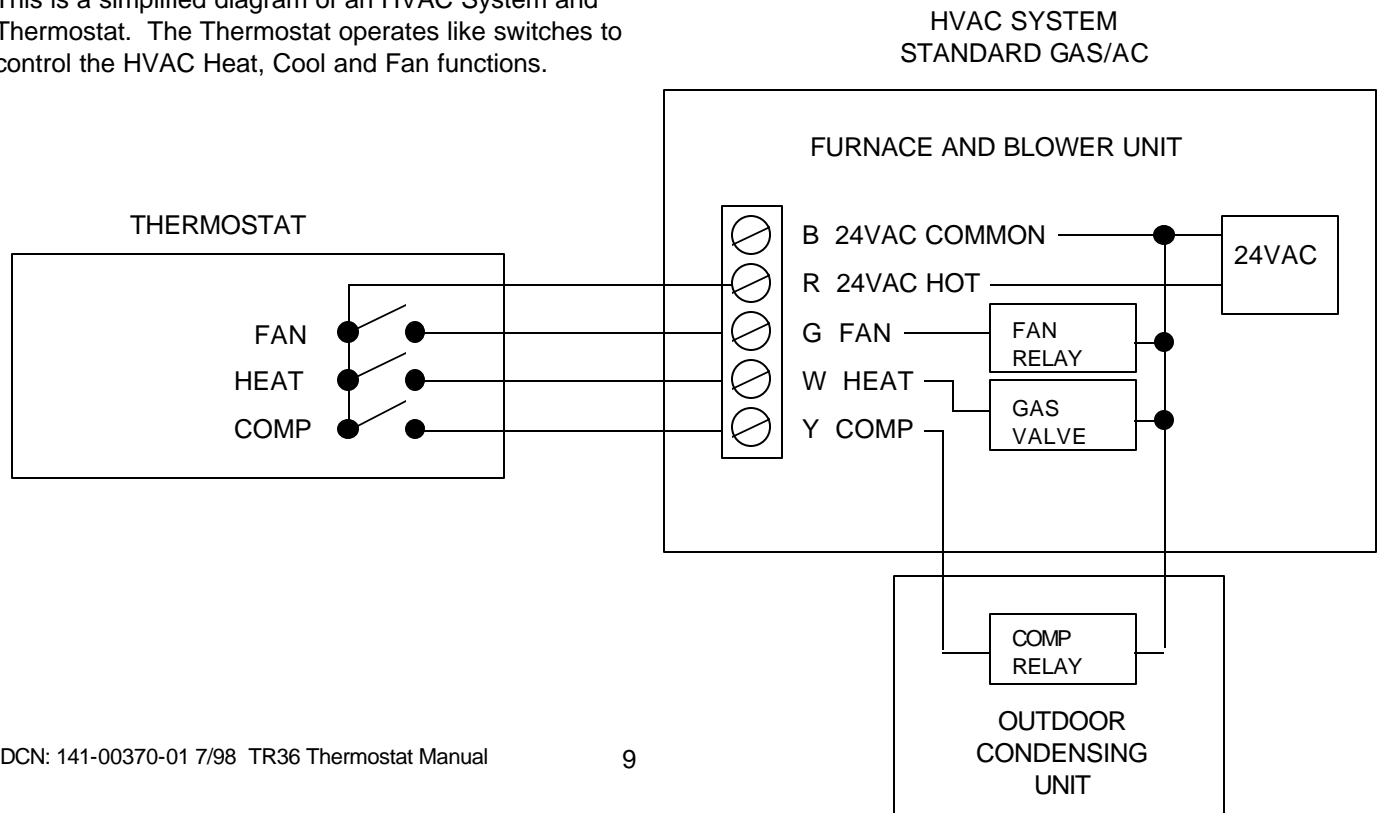
It is recommended that you install the TR36 and then rerun these quick tests BEFORE you connect the Control Unit to the HVAC system. You will be confident that the TR36 is working correctly before you attempt to interface the HVAC system.

### HVAC SYSTEM QUICK TEST

The TR36 Control Unit connects to the HVAC system at the normal thermostat connections on the HVAC unit. Standard thermostat control of 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 system. Refer to the following HVAC system example.

### HVAC SYSTEM EXAMPLE

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



Since the thermostat interface is simple switch closures, if you have difficulty with the Control Unit and HVAC interface you can always verify HVAC system operation by shorting across the HVAC system terminals as follows:

For Standard HVAC systems:

FAN operation: Short across R and G (Fan) terminals.

HEAT operation: Short across R and W (Heat) terminals (Fan is not usually necessary for gas furnaces).

COOL operation: Short across R and Y (Compressor) and G (Fan) terminals.

For Heat Pump systems (with Change Over for cooling):

FAN operation: Short across R and G terminals.

HEAT Stage 1 operation: Short across R and Y (Compressor) and G (Fan) terminals.

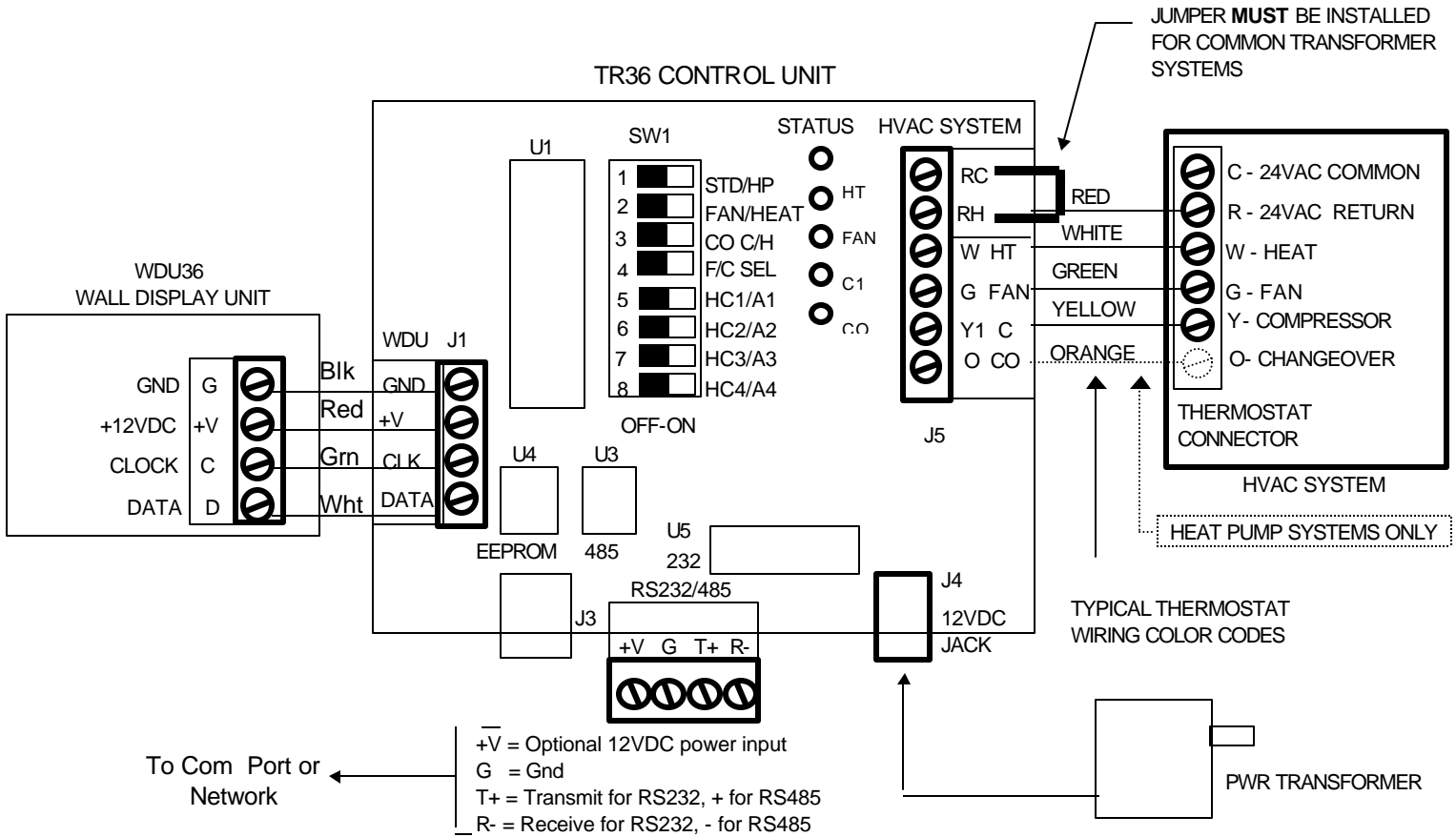
HEAT Stage 2 operation: Short across R and W (Heat Strips) and G (Fan) terminals.

COOL operation: Short across R and Y (Compressor) and O (Change Over) and G (Fan) terminals.

If the Control Unit output LEDs are ON and you suspect you are not getting an output from the relays, perform the above shorting test to verify that the HVAC system is working OK. If the HVAC system responds correctly to the shorted terminals, then the output relay is suspect.

## WIRING DIAGRAM

### TR36 THERMOSTAT W/RS232 & RS485 I/O



#### DIPSWITCH SW1 CONFIGURATION

SW1-1 Standard/Heat Pump HVAC System. Set to correct HVAC system type. STD=OFF, HP=ON

SW1-2 Standard Fan or Fan with Heat. For Gas heat set to OFF, For Electric heat set to ON.

SW1-3 Changeover with Heat or Cool. For Heat Pump HVAC systems only. Set to correct mode for Changeover Valve (Reversing Valve). Changerover in Cool mode = OFF, Changeover in Heat mode = ON

SW1-4 F° or C° Select. Set to mode desired. F°=OFF, C°=ON

SW1-5-8 Address Select 0-15. Set to Address for RS232/485 Communications.  
 Binary coded address. SW1-5 is LSB. SW1-8 is MSB  
 0 = OFF, 1 = ON

ADDRESS 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SW1-5	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
SW1-6	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
SW1-7	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1
SW1-8	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Address "0" is reserved for the host system