

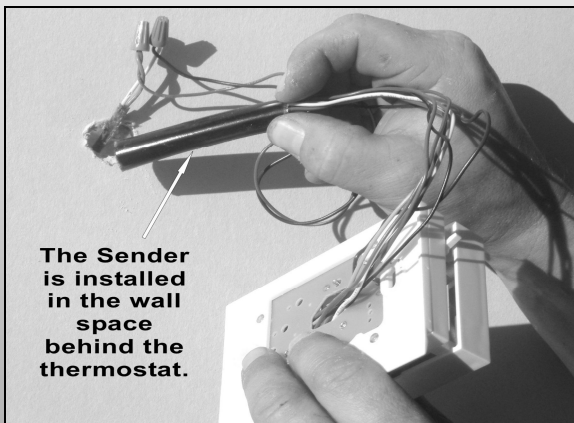
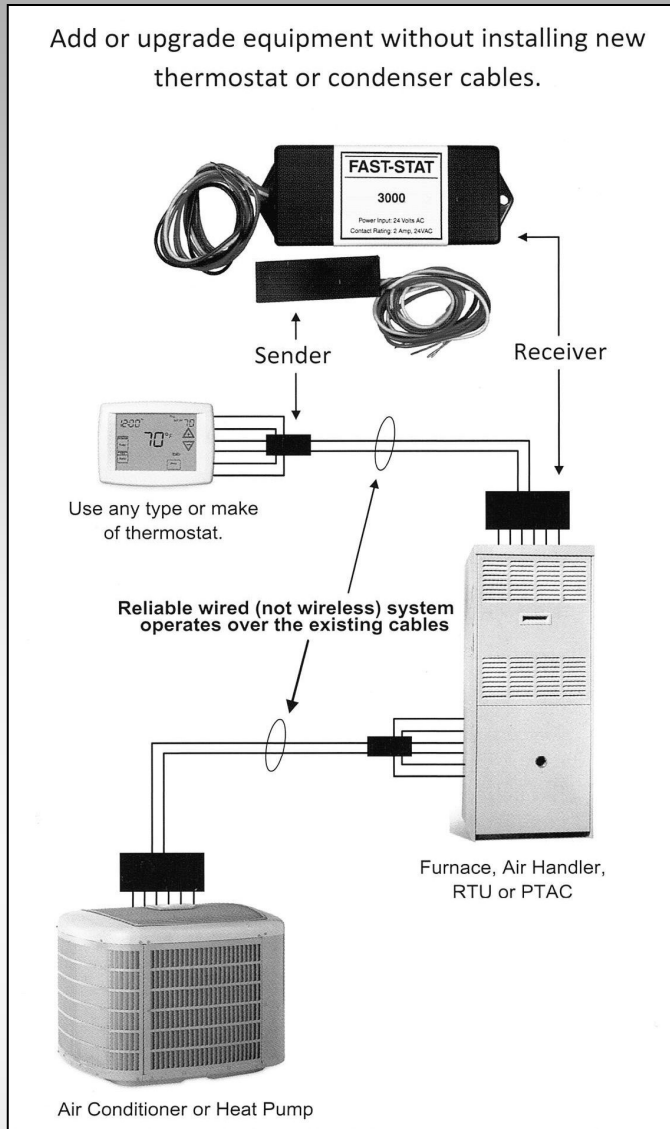
HVAC Wiring Solutions

❖ How to add or upgrade residential & commercial equipment without installing new cables.

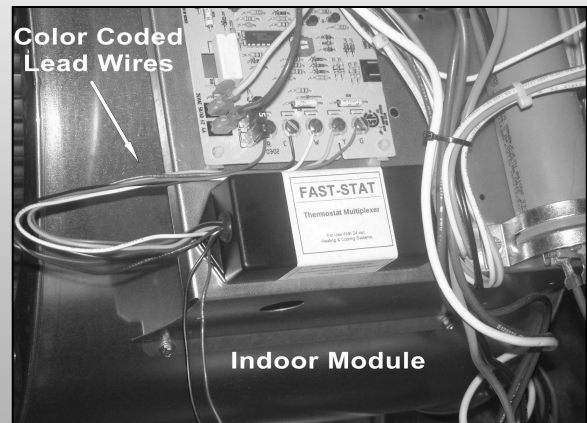
❖ How to test & repair cables.

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General Instructions



When used at a thermostat, the Sender wires are connected to the thermostat and thermostat cable. The Sender is inserted into the wall space behind the thermostat. The thermostat is then mounted to the wall, as usual.



The Receiver is installed at the indoor or outdoor unit. It is then connected to the thermostat or condenser cable and the control board.

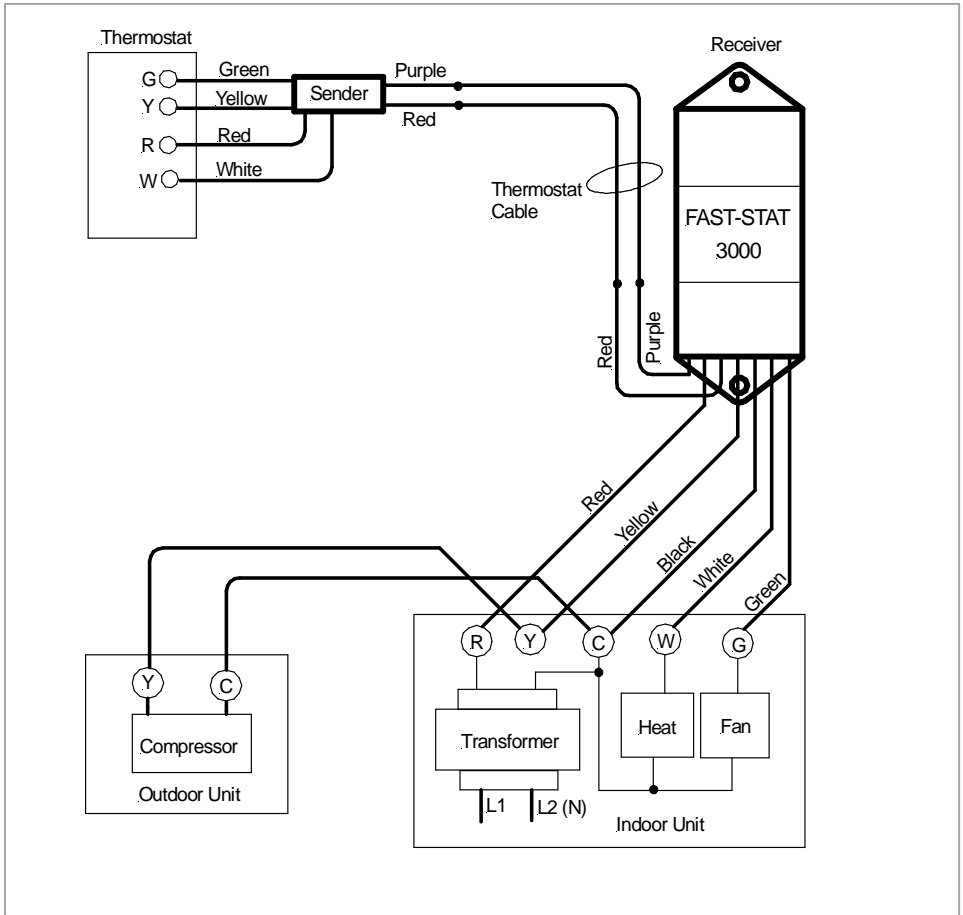
Air Conditioning – Gas furnace with built-in fan relay

Project: Adding a single-stage air conditioner to a heating system with a 2-wire thermostat cable.

Problem: Not enough wires between the thermostat and indoor unit.

Solution: Use a Model 3000 to make a 2-wire thermostat cable into a 4-wire cable.

Details: Install the Sender into the wall space behind the thermostat. Connect 2 wires from the Sender to the thermostat cable and the other 4 wires to the thermostat. Install the Receiver in the indoor unit near the control board. Connect 2 wires from the Receiver to the thermostat cable, 2 wires to transformer power (R & C) and the remaining 3 wires to the fan (G), condenser (Y) and heat (W) connections.



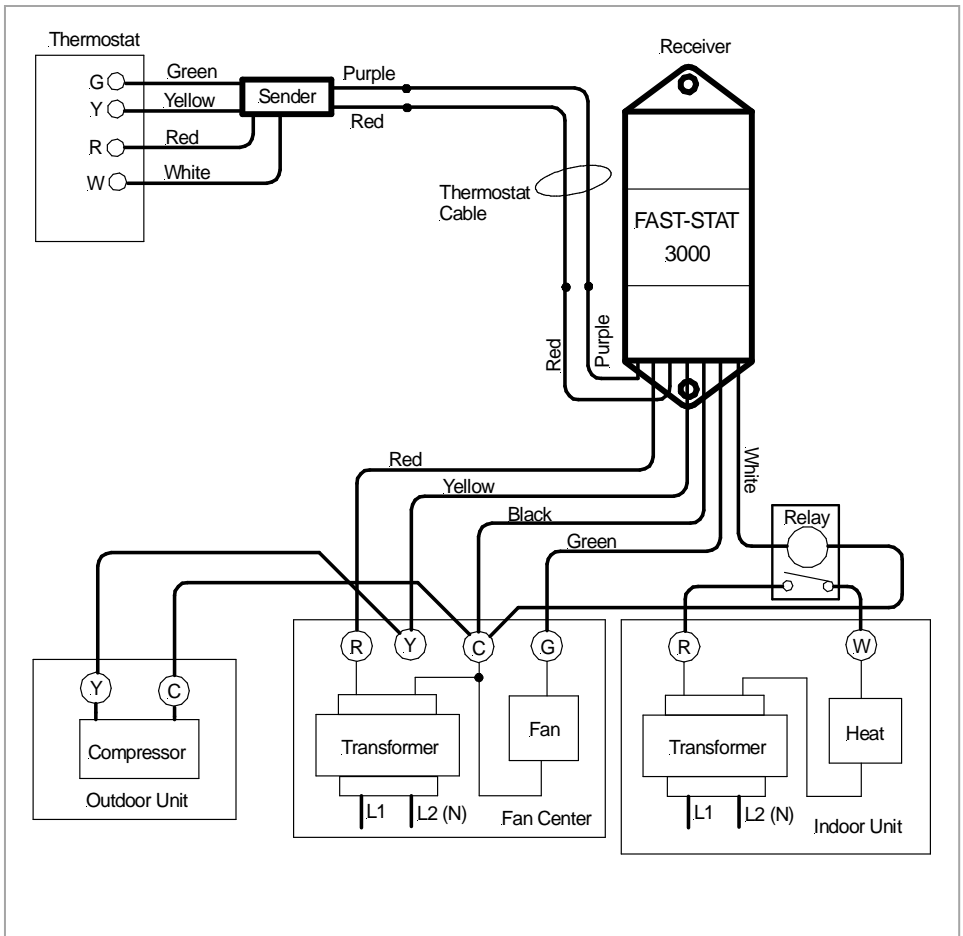
Air Conditioning – Gas furnace without built-in fan relay

Project: Adding a single-stage air conditioner to a heating system with a 2-wire cable.

Problem: Not enough wires between the thermostat and indoor unit.

Solution: Use a Model 3000 to make a 2-wire thermostat cable into a 4-wire cable. A fan center and a relay are required for this installation.

Details: Install the fan center according to the manufacturer's instructions. Install the Sender into the wall space behind the thermostat. Connect 2 wires from the Sender to the thermostat cable and the other 4 wires to the thermostat. Install the Receiver in the indoor unit. Connect 2 wires from the Receiver to the thermostat cable, 2 wires to the fan center transformer power (R & C) and 2 wires to the fan center fan (G) & condenser (Y) connections. The Receiver white wire is connected to a relay. The relay is used to control heat (W). The relay is used to isolate the two transformers from each other. The 120 volt wiring for the fan is not shown – see the fan center instructions.



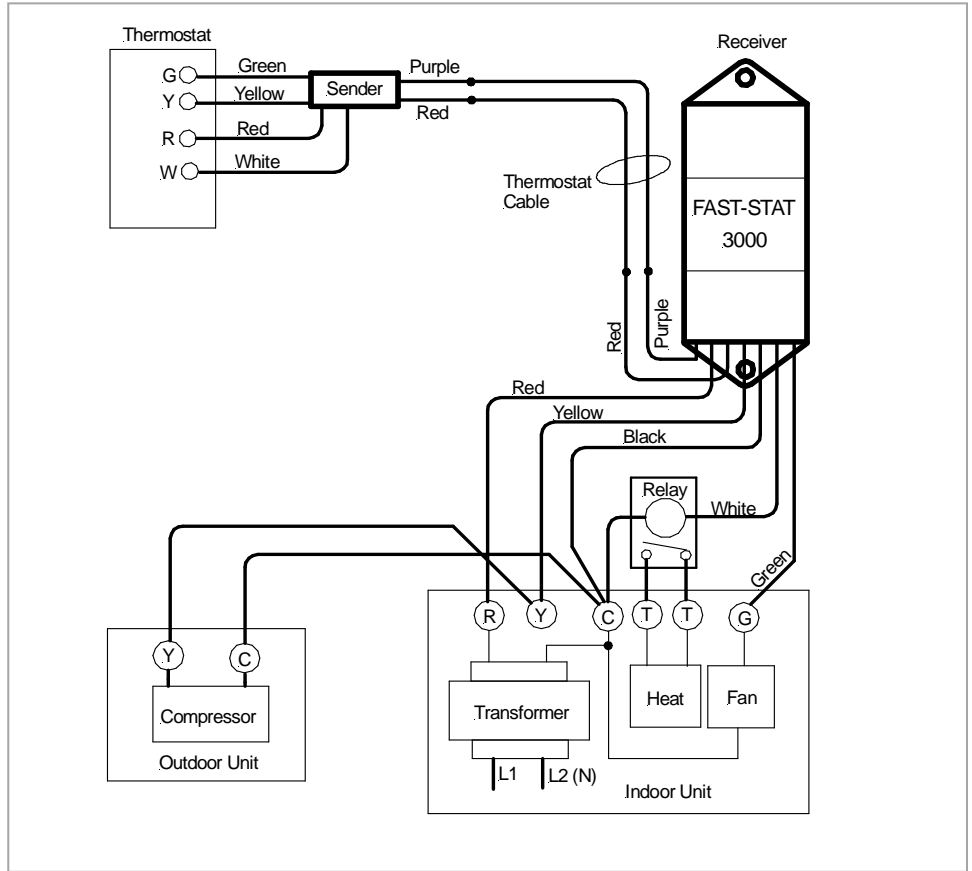
Air Conditioning – Oil furnace with built-in fan relay

Project: Adding a single-stage air conditioner to a heating system with a 2-wire cable.

Problem: Not enough wires between the thermostat and indoor unit.

Solution: Use a Model 3000 to make a 2-wire thermostat cable into a 4-wire cable. A relay may be required for this installation.

Details: Install the Sender into the wall space behind the thermostat. Connect 2 wires from the Sender to the thermostat cable and the other 4 wires to the thermostat. Install the Receiver in the indoor unit near the control board. Connect 2 wires from the Receiver to the thermostat cable, 2 wires to transformer power (R & C) and 2 wires to the fan (G), condenser (Y) connections. Install a relay and connect the Receiver white wire to it. The relay is used to complete the circuit between the T1 & T2 terminals on a call for heat. If the furnace has one “W” terminal instead of 2 – “T” terminals then the relay is not required and the white wire is then directly connected to the “W” terminal.



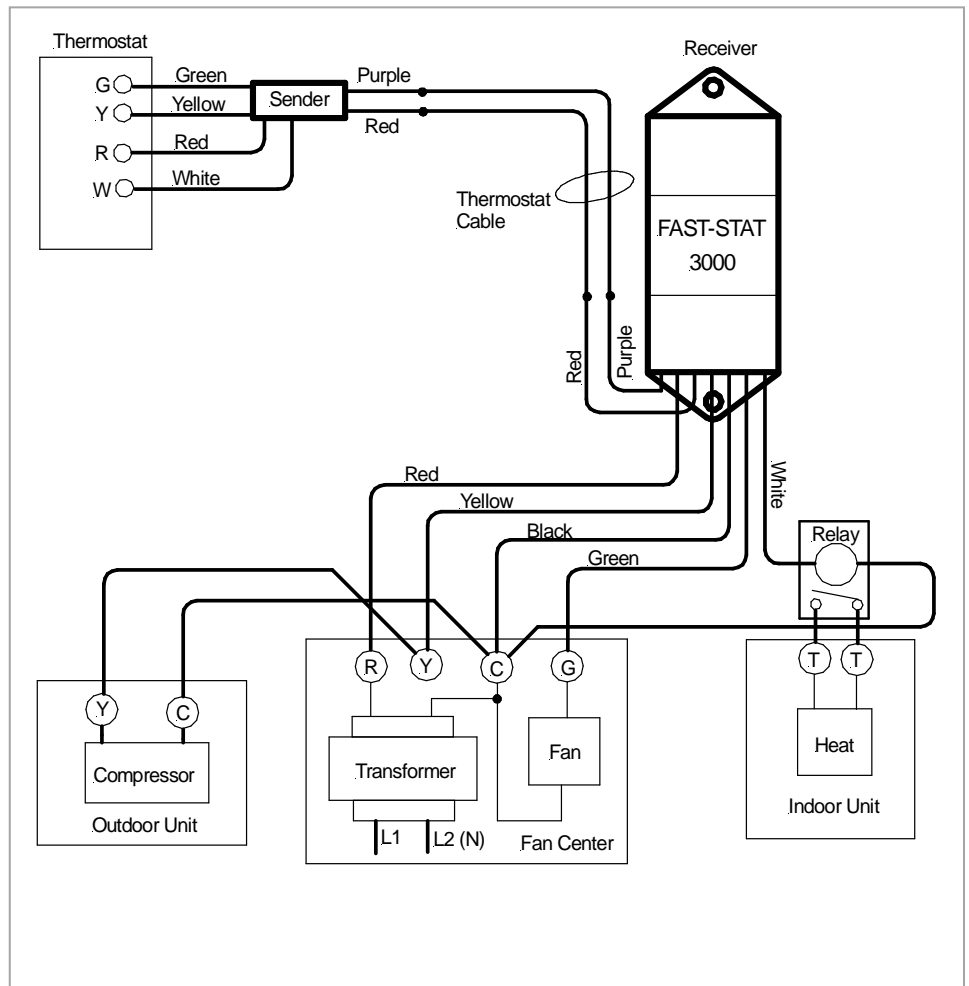
Air Conditioning – Oil furnace without built-in fan relay

Project: Adding a single-stage air conditioner to a heating system with a 2-wire cable.

Problem: Not enough wires between the thermostat and indoor unit.

Solution: Use a Model 3000 to make a 2-wire thermostat cable into a 4-wire cable. A fan center and a relay are required for this installation.

Details: Install the fan center according to the manufacturer’s instructions. Install the Sender into the wall space behind the thermostat. Connect 2 wires from the Sender to the thermostat cable and the other 4 wires to the thermostat. Install the Receiver in the indoor unit. Connect 2 wires from the Receiver to the thermostat cable, 2 wires to the fan center transformer power (R & C) and 2 wires to the fan center fan (G) & condenser (Y) connections. The Receiver white wire is connected to a relay. The relay is used to control heat (W). The 120 volt wiring for the fan is not shown – see fan center instructions.



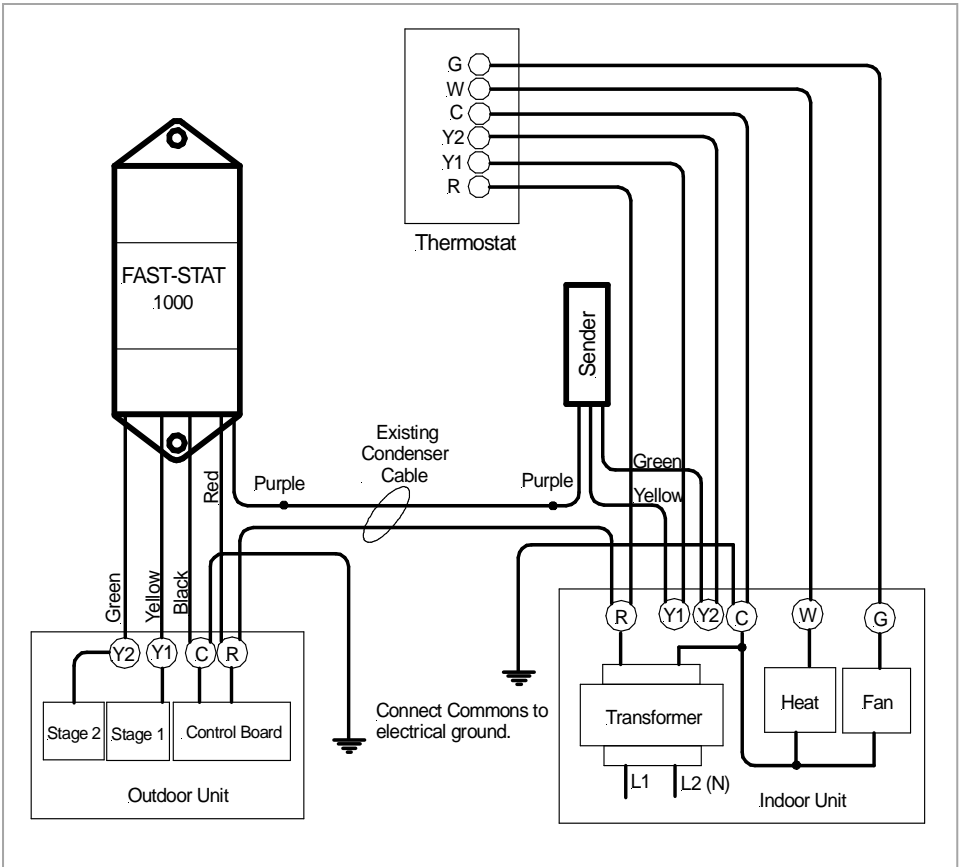
Air Conditioning – Adding wires between the indoor & outdoor units.

Project: Replacing a single-stage A/C with a 2-stage A/C.

Problem: Not enough wires between the indoor and outdoor units.

Solution: Use a Model 1000 to make a 2-wire thermostat cable into a 4-wire cable.

Details: Install the Sender at the furnace / air handler. Connect the Sender green wire to the furnace Y2 terminal, the yellow wire to the Y1 terminal and the purple wire to the Receiver purple wire using one of the wires in the existing condenser cable. Use the other condenser cable wire to connect “R” from the indoor unit to the outdoor unit “R” connection. Install the Receiver in the outdoor unit and connect the green wire to “Y2”, the yellow wire to “Y1”, the black wire to “C”, and the red wire to “R”. At both the indoor and outdoor units install a jumper between the “C” connections and electrical ground.



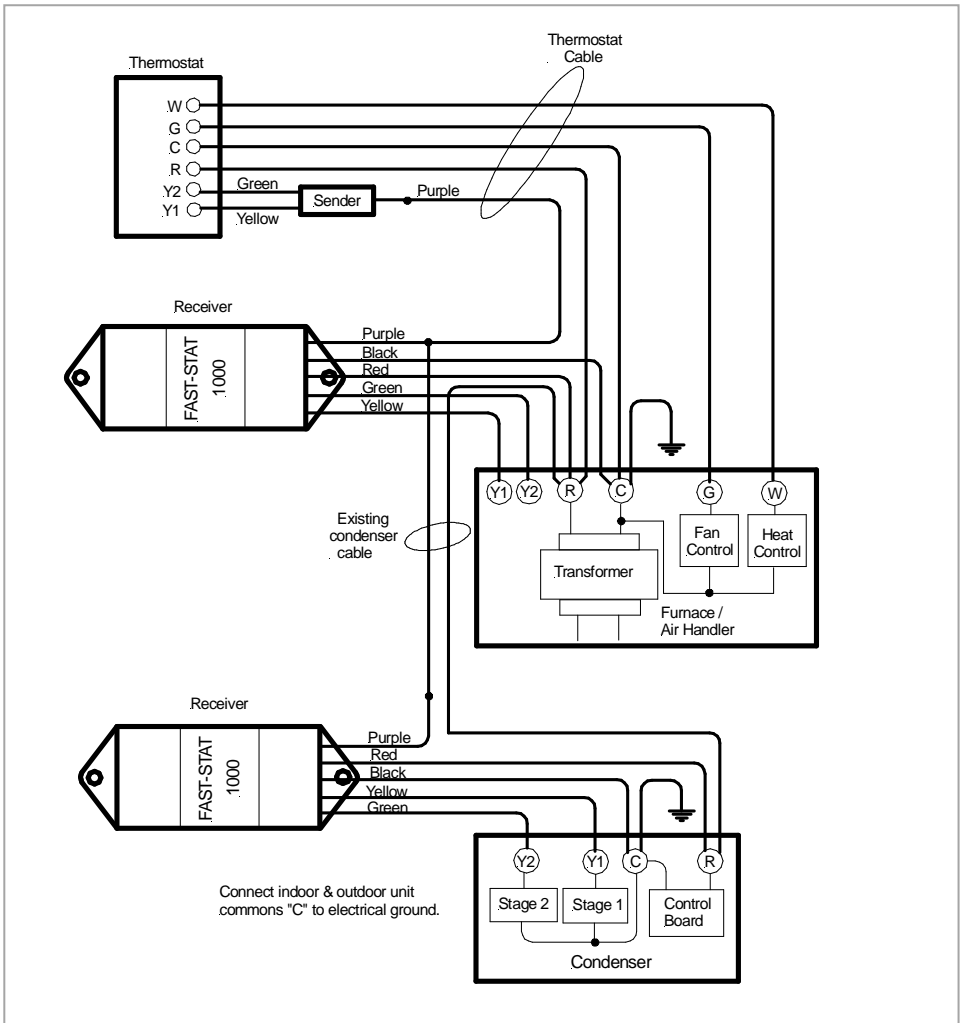
Air Conditioning – Adding wires between the t-stat, indoor & outdoor units.

Project: Replacing a single-stage A/C with a 2-stage A/C.

Problem: Not enough wires between the thermostat and indoor unit and also between the indoor and outdoor units.

Solution: Use 2 - Model 1000's.

Details: Install the Sender at the thermostat. Connect the Sender green wire to the Y2 terminal, the yellow wire to the Y1 terminal and the purple wire to the Receiver purple wire using one of the wires in the thermostat cable. Install one receiver at the indoor unit to control the fan speed. Use one of the condenser cable wires to connect the purple of one receiver to the purple wire of the other receiver. Use the other condenser cable wire to connect “R” from the indoor unit to the outdoor unit “R” connection. Install the Receiver in the outdoor unit and connect the green wire to “Y2”, the yellow wire to “Y1”, the black wire to “C”, and the red wire to “R”. At both the indoor and outdoor units install a jumper between the “C” connections and electrical ground.



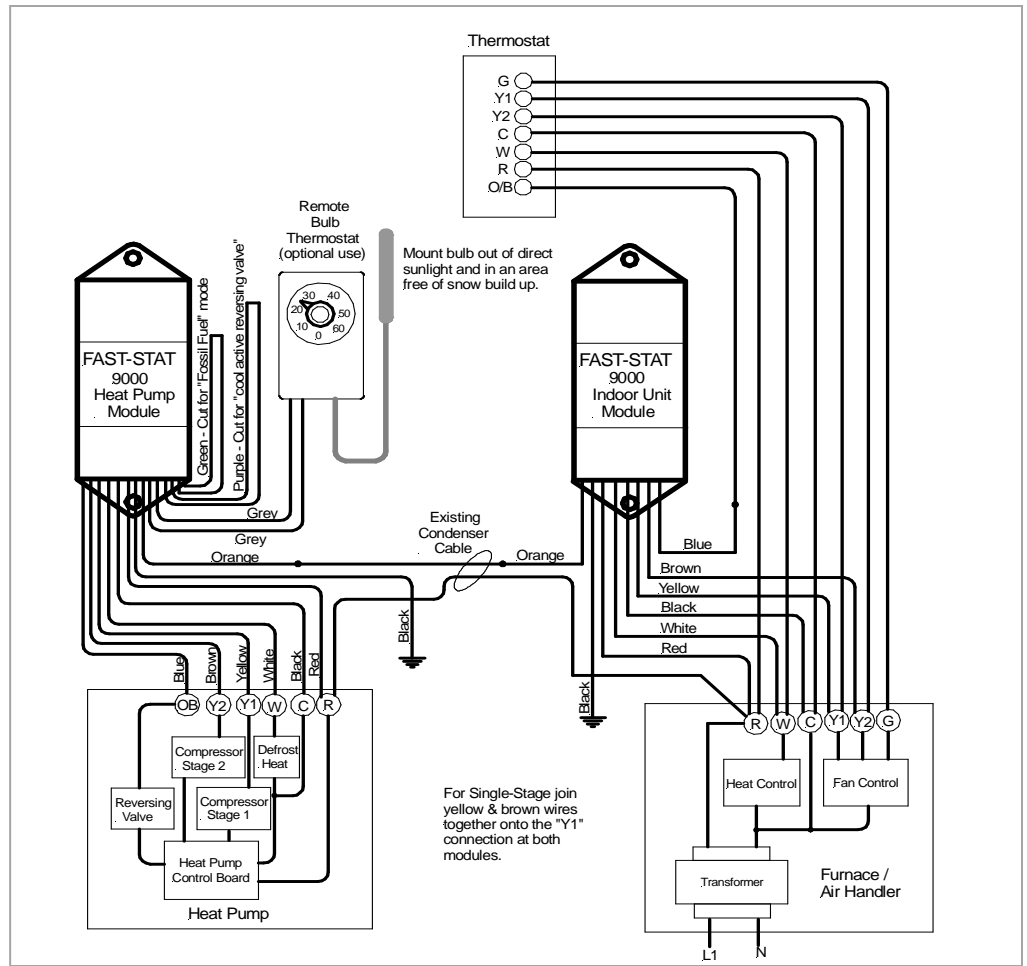
Heat Pumps – Adding wires between the indoor & outdoor units.

Project: Replacing an A/C with a single or 2-stage heat pump.

Problem: Not enough wires between the indoor unit and the outdoor unit.

Solution: Use a Model 9000.

Details: Install the Indoor Unit Module at the indoor unit. Connect yellow to Y1, brown to Y2, blue to O/B, white to W, & Red to R. Connect one Black to C & the other black to ground. Connect the orange wire to the orange wire of the outdoor unit module using one of the wires in the existing condenser cable. Use the other condenser cable wire to connect "R" from the indoor unit to the outdoor unit "R" connection. Install the Outdoor Unit Module in the outdoor unit and connect yellow to Y1, brown to Y2, blue to O/B, white to W, & red to R. Connect one Black to C & the other black to ground. If the built-in dual fuel controller is not used, then leave the grey, green, & purple wires as they are.



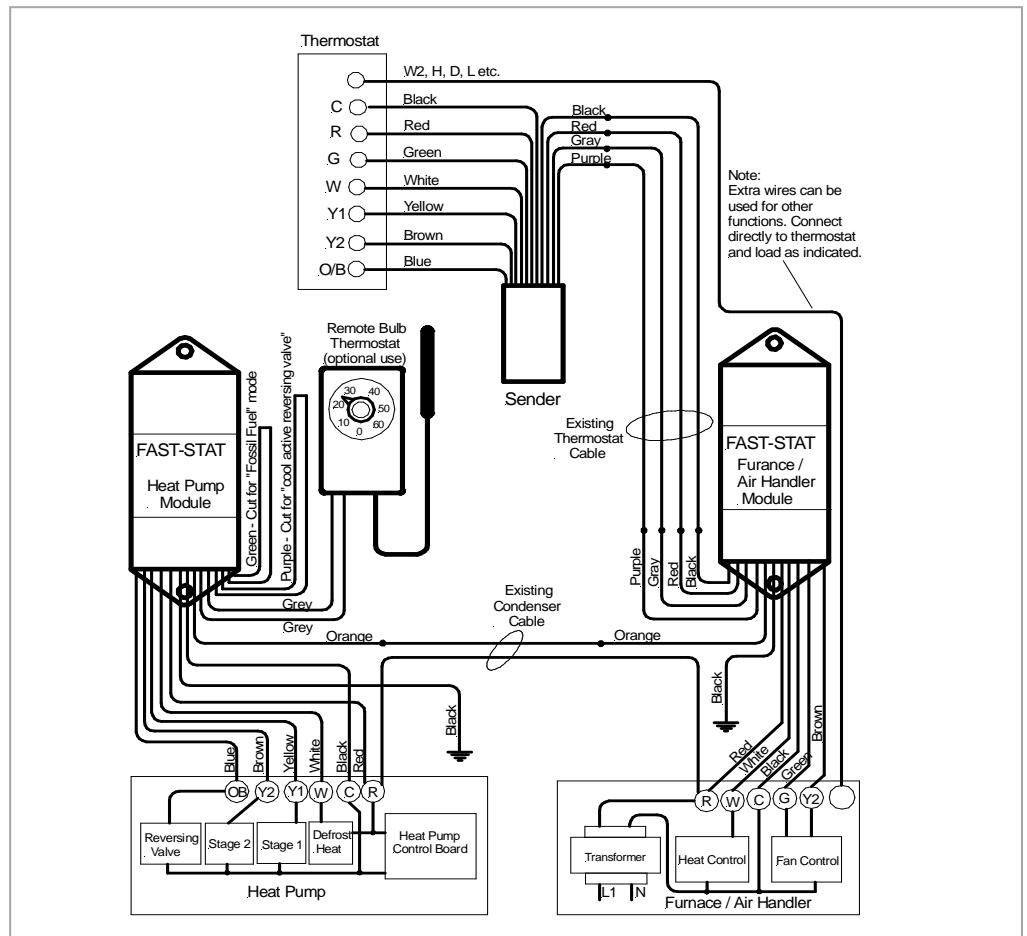
Heat Pumps – adding wiring between the t-stat, indoor & outdoor units

Project: Replacing an A/C with a single or 2-stage heat pump.

Problem: Not enough wires between the thermostat, indoor unit and the outdoor unit.

Solution: Use a Model 7000. A 4-wire thermostat & a 2-wire condenser cable is required.

Details: Connect the Sender and install it in the wall space behind the thermostat. Install the Furnace/ Air Handler and Heat Pump Modules as shown below. Connect one Black wire to C & the other black to ground at both modules. For single-stage use join the yellow & brown wires together onto the "Y" connections. If the built-in dual fuel controller is not used, then leave the grey, green, & purple wires as they are.



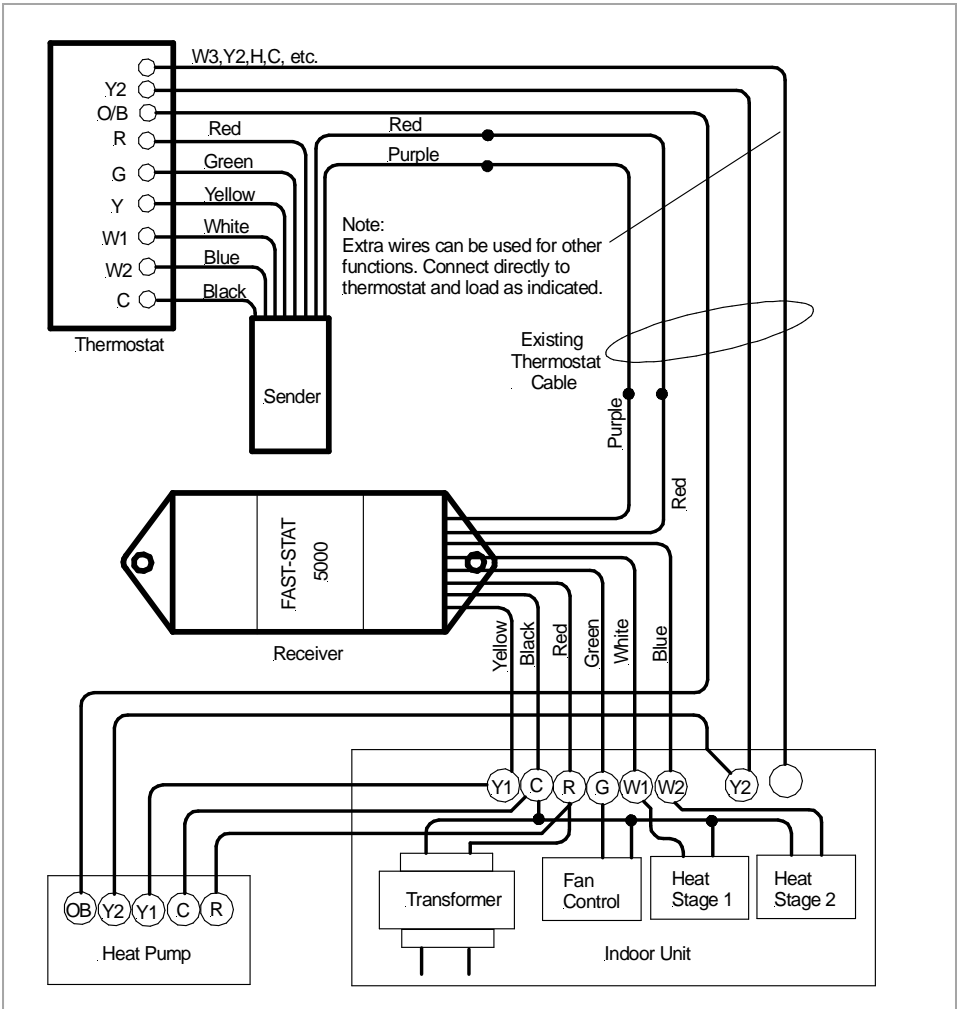
Heat Pumps – adding wiring between t-stat and indoor unit

Project: Replacing an A/C with a single or 2-stage heat pump.

Problem: Not enough wires between the thermostat and the indoor unit.

Solution: Use a Model 5000.

Details: The drawing below is for a “fossil-fuel” connection. The heat pump is shut off when the thermostat W1 and/or W2 is on. Connect the Sender and install it in the wall space behind the thermostat. Install the Receiver in the Furnace/ Air Handler and connect as shown below. For supplemental heat operation (heat pump stays running when W1 and/or W2 is on) a relay would need to be added at the Receiver to provide power to Y1 when W1 and/or W2 is on. For a single stage furnace or strip heater, join the white and blue wires together onto the “W” connections.



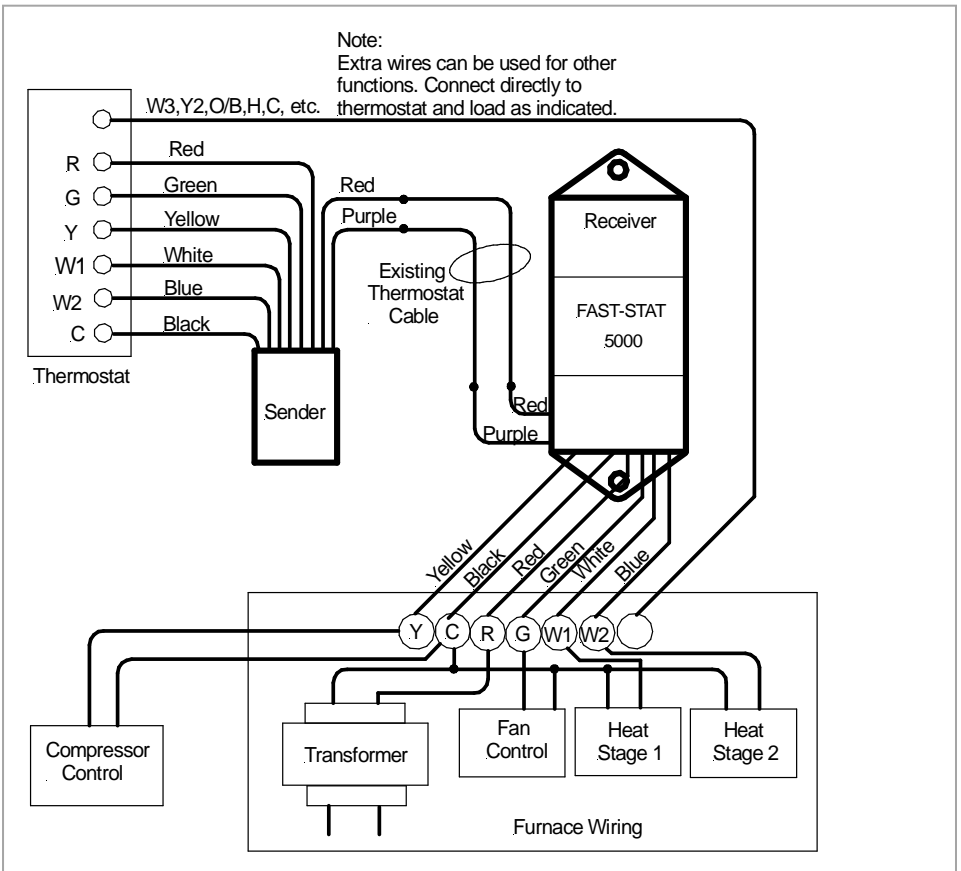
Furnaces – 2-stage heat with single-stage cool

Project: Installing a 2-stage furnace with a single-stage air conditioner.

Problem: Not enough wires between the thermostat and indoor unit.

Solution: Use a Model 5000. Requires a minimum of a 2-wire thermostat cable.

Details: Install the Sender at the thermostat and the Receiver at the indoor unit. Connect wires as shown below. Extra thermostat cable wires can be used for other functions such as Y2 etc.



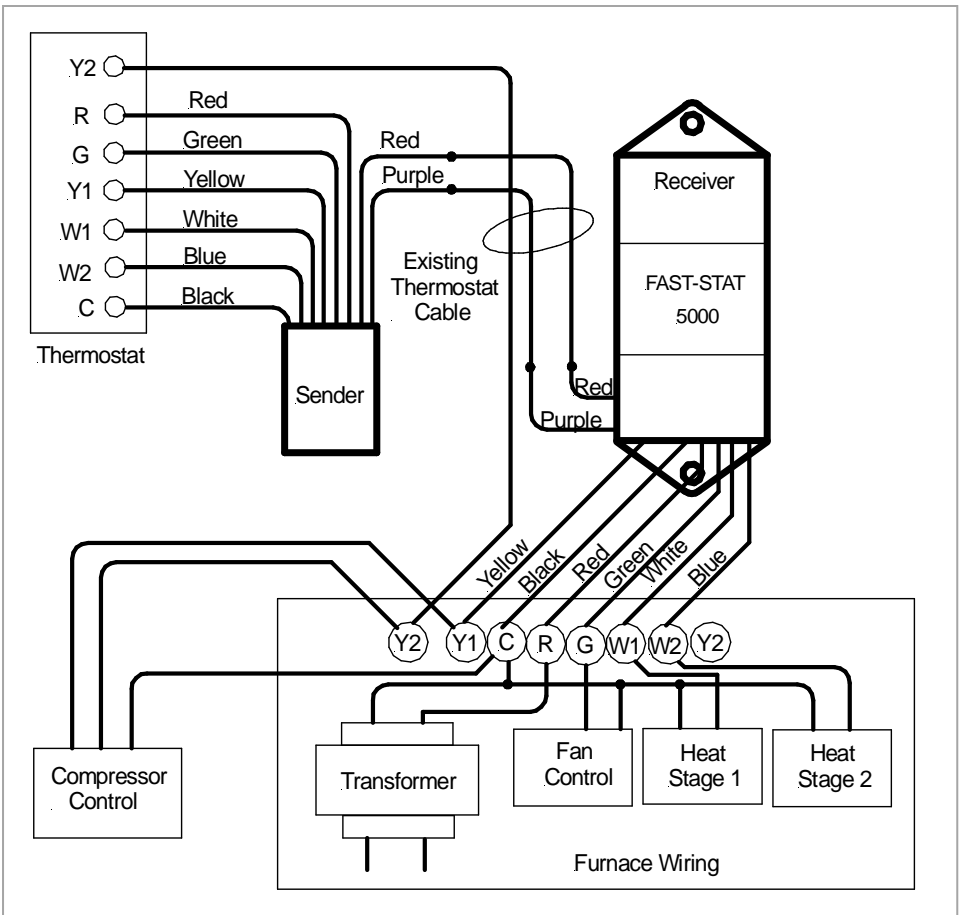
Furnaces – 2-stage heat & cool

Project: Installing a 2-stage furnace with a 2-stage air conditioner.

Problem: Not enough wires between the thermostat and indoor unit.

Solution: Use a Model 5000. Requires a minimum of a 3-wire thermostat cable for this application.

Details: Install the Sender at the thermostat and the Receiver at the indoor unit. Connect wires as shown below.



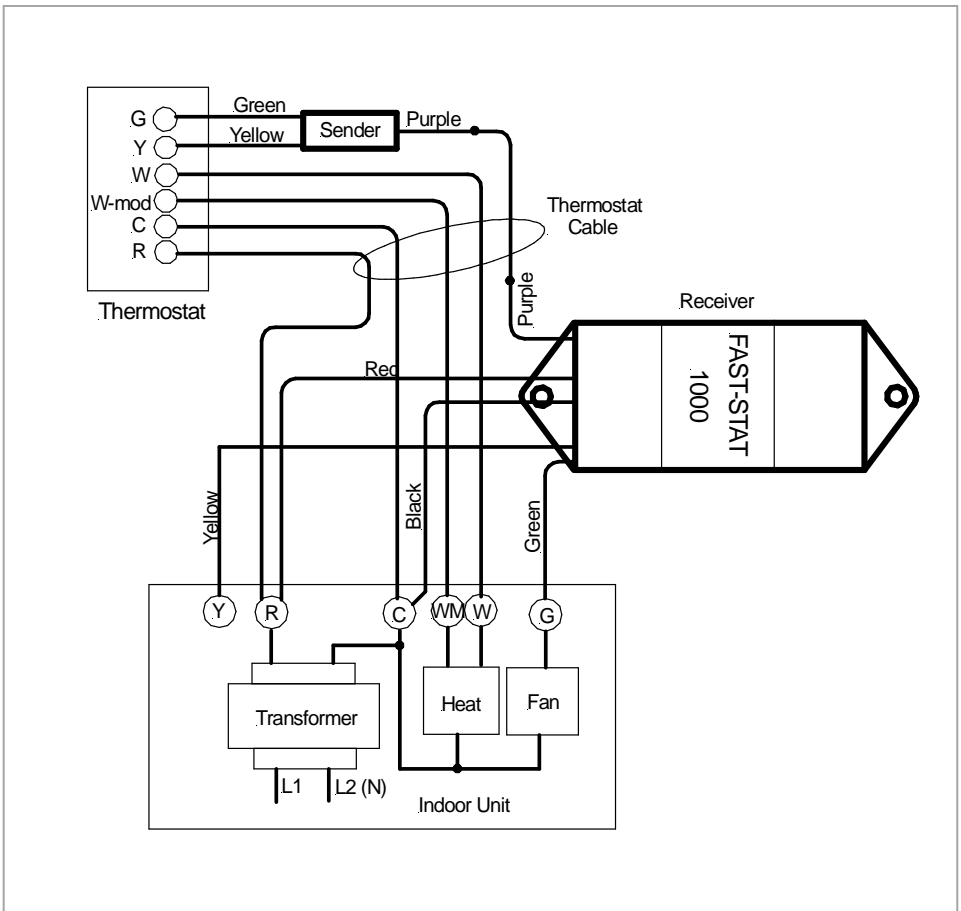
Furnaces – modulating gas valve

Project: Installing a furnace with a modulating gas valve.

Problem: Not enough wires between the thermostat and indoor unit.

Solution: Use a Model 1000.

Details: By combining the Fan “G” and Compressor “Y” together on one wire, a wire is made available for use to connect the modulating gas valve connection to the thermostat.



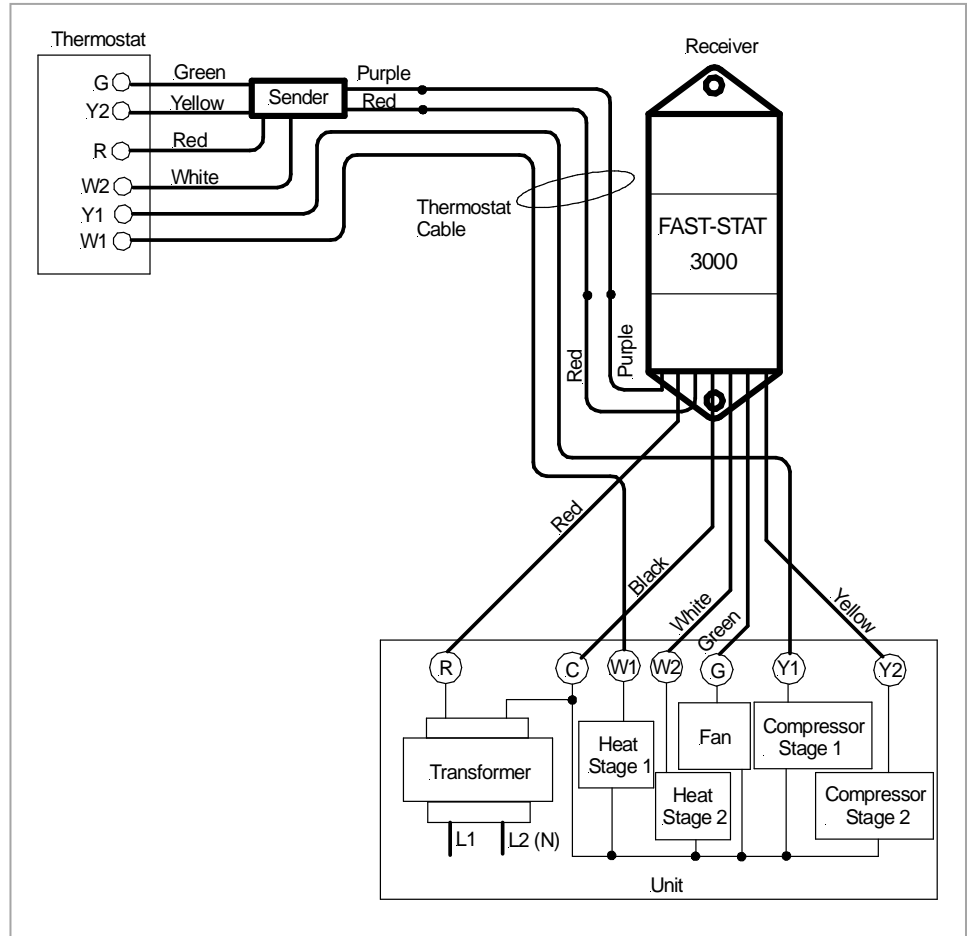
Roof Top Units & PTAC's

Project: Upgrading a RTU or PTAC.

Problem: Not enough wires between the thermostat and unit.

Solution: The Model to use depends on the number of additional wires that are required. To add one more wire use a Model 1000. To add two wires use a Model 3000. To add four wires use a Model 5000. More than one FAST-STAT wiring extender can be used on the same system. For example, with a 4-wire cable a Model 1000 and a Model 3000 could both be used if needed.

Details: Connect the Sender and install it in the wall space behind the thermostat. Install the Receiver in the RTU/PTAC. In the example below, a Model 3000 is used to add 2-stage heating and 2-stage cooling control to a unit using a 4-wire cable.



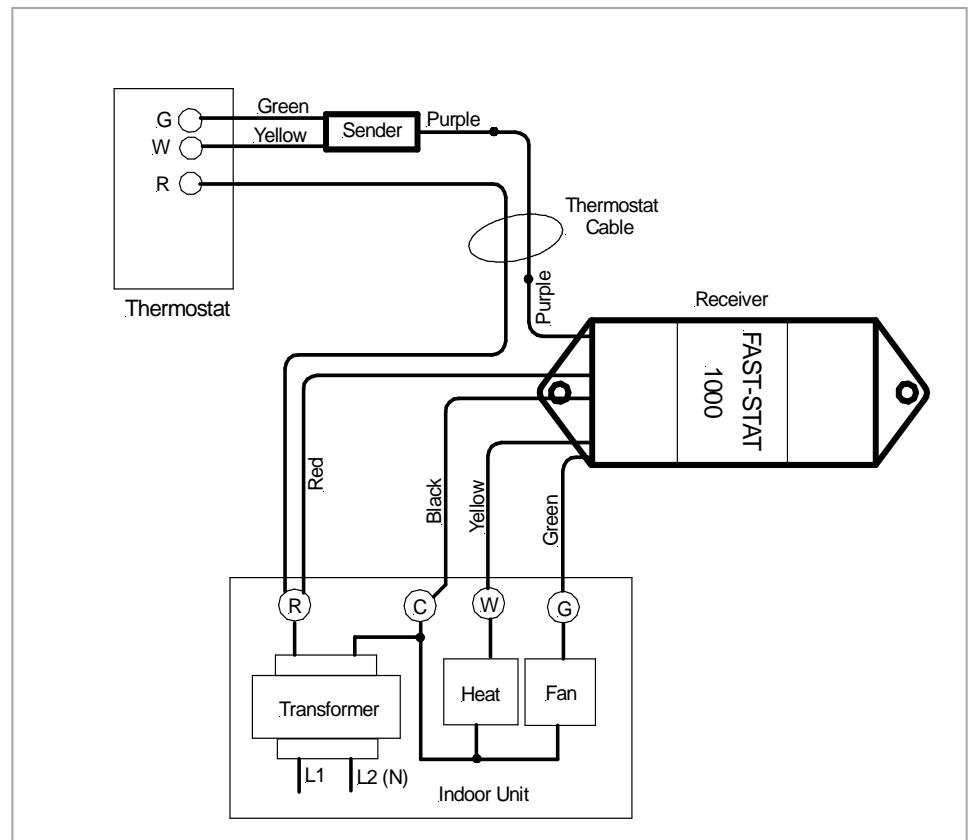
Thermostats – adding manual fan control

Project: Adding manual fan control with a 2-wire cable.

Problem: Not enough wires between the thermostat and indoor unit.

Solution: Use a Model 1000.

Details: Connect the Sender and install it in the wall space behind the thermostat. Install the Receiver in the Furnace/ Air Handler and connect as shown below.



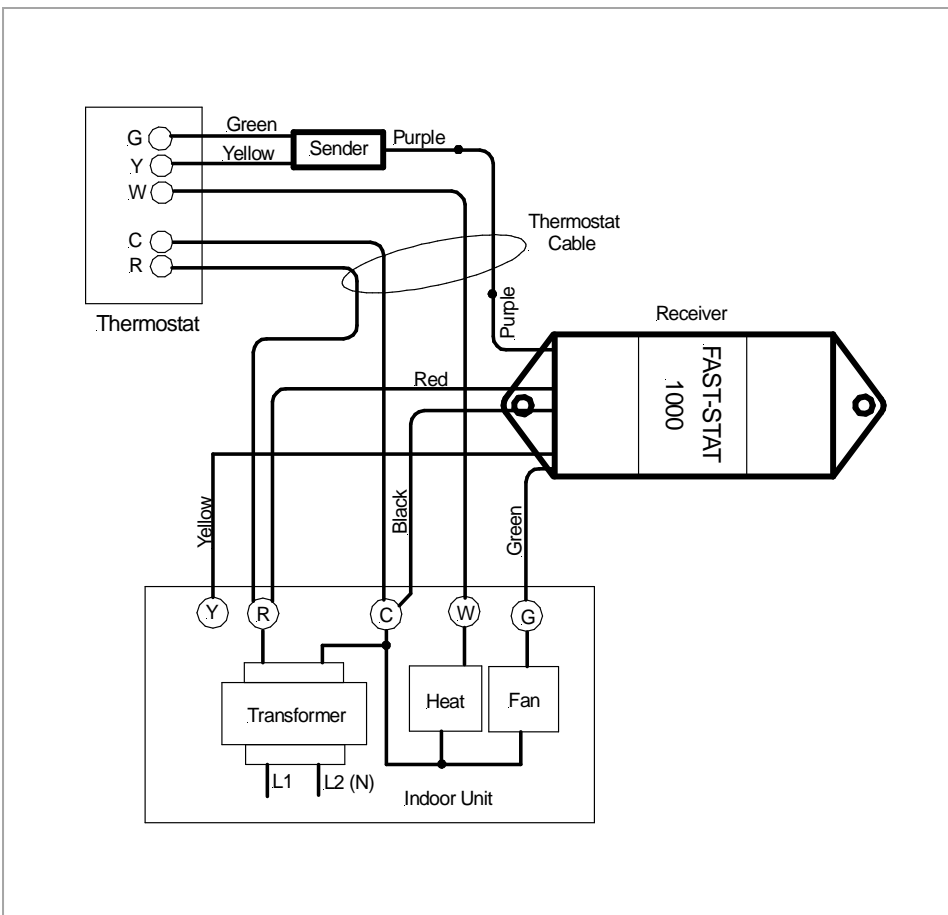
Thermostats – installing a powered thermostat

Project: Installing a powered thermostat with a 4-wire cable.

Problem: Not enough wires between the thermostat and the indoor unit.

Solution: Use a Model 1000.

Details: By combining the Fan “G” and Compressor “Y” together on one wire, a wire is made available for use to connect the common connection to the thermostat.



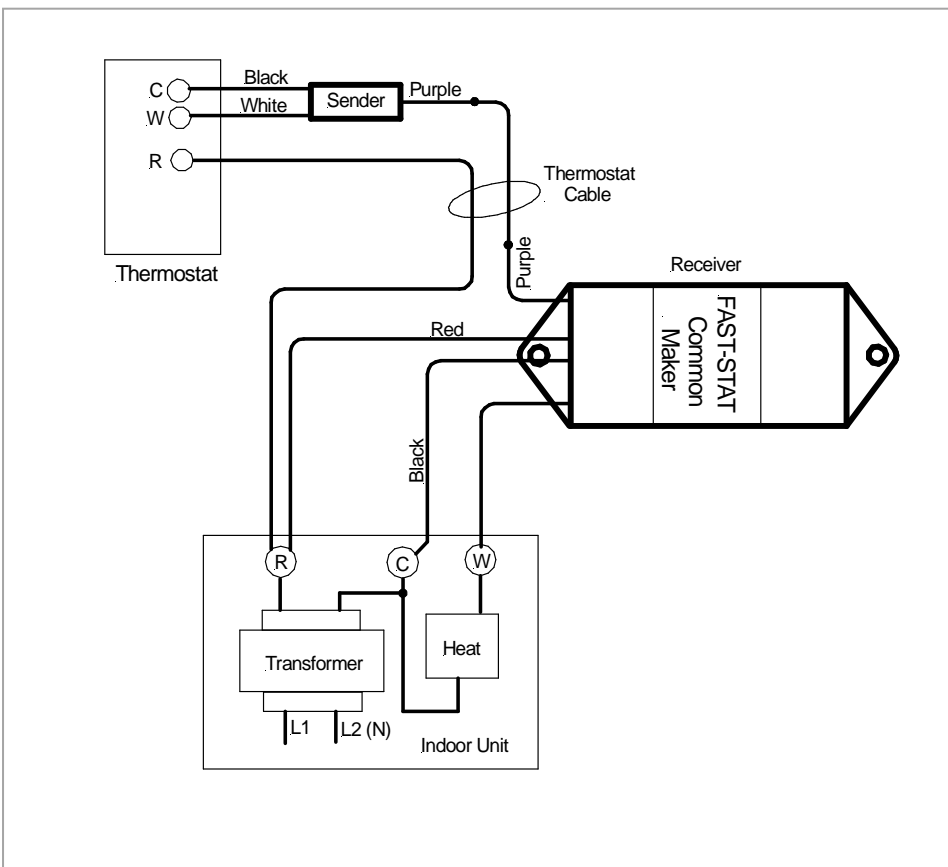
Thermostats - Installing a powered thermostat with a 2-wire cable.

Project: Installing a powered thermostat with a 2-wire cable.

Problem: Not enough wires between the thermostat and the indoor unit.

Solution: Use a Common Maker. (This is a special order product)

Details: The Sender of the Common Maker creates a common connection with only a 2-wire cable. Connect as shown below.



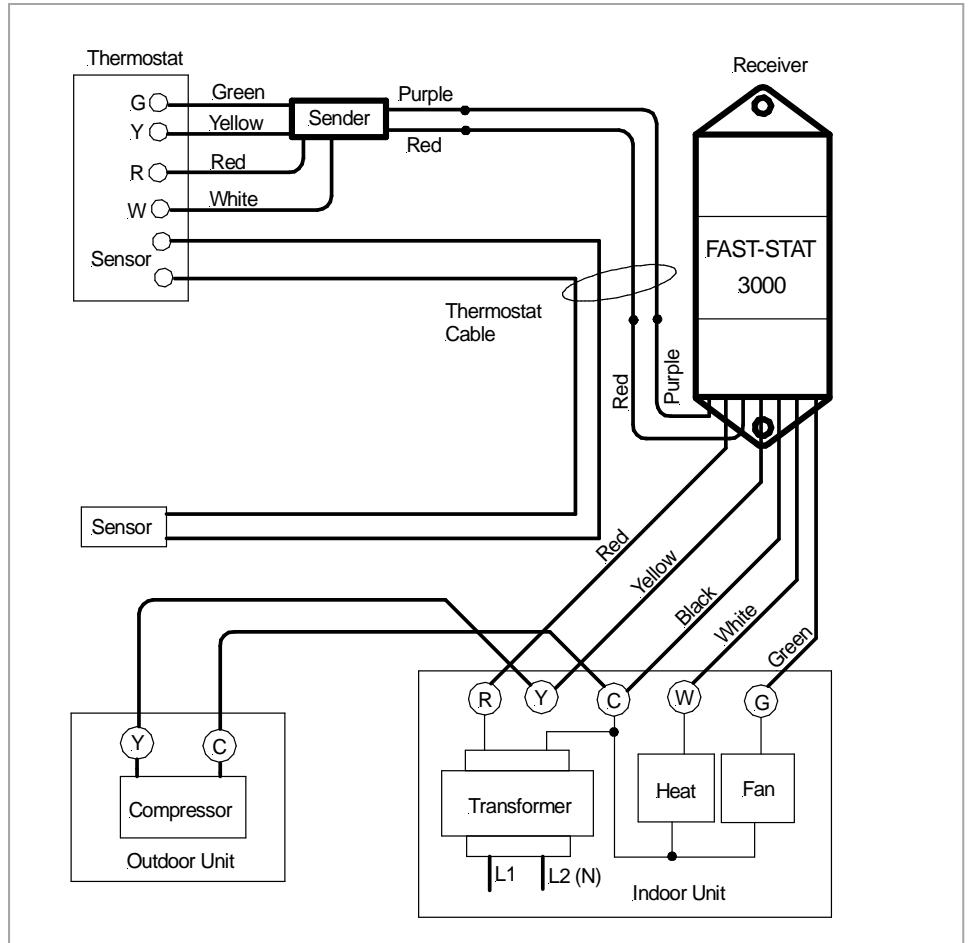
Thermostats – adding an outdoor temperature sensor

Project: Wiring for an outdoor temperature sensor.

Problem: Not enough wires between the thermostat and the indoor unit.

Solution: Use a Model 3000. A 4-wire thermostat cable is required.

Details: The Model 3000 is used to combine R, G, Y & W together on two wires. This provides two wires that can be used to connect the outdoor air temperature sensor.

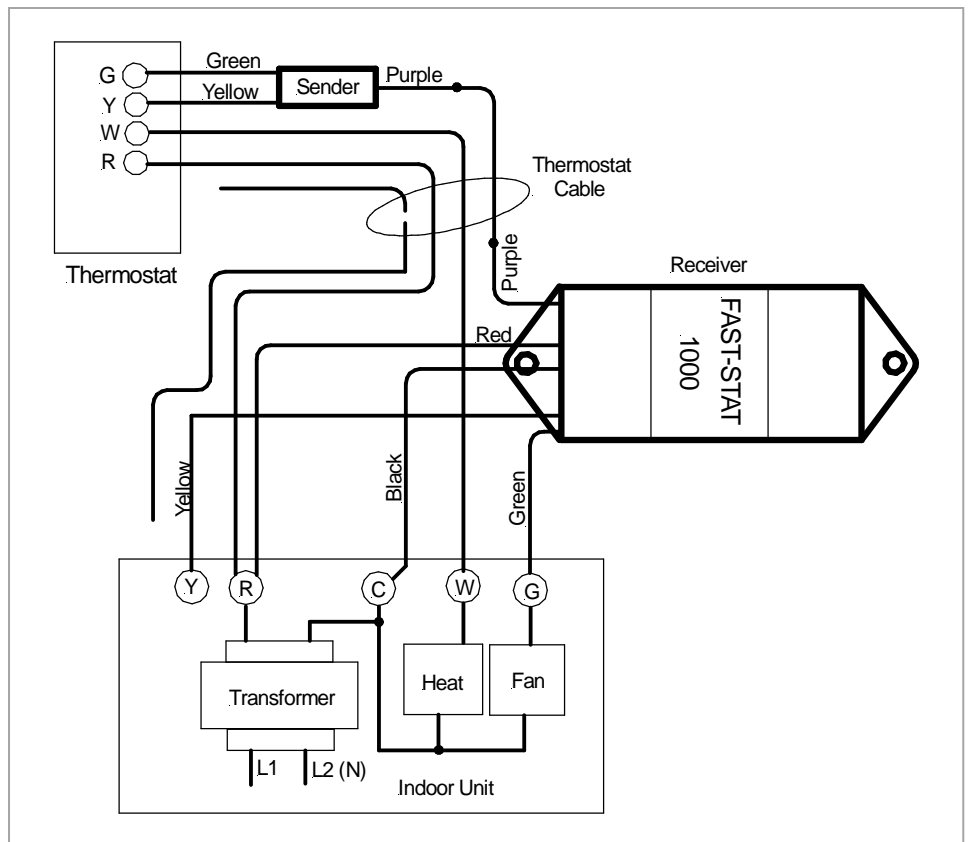


Cable Repair Example

Project: Repairing a cable with 1 broken wire.

Solution: Use a Model 1000.

Details: The wire that was used for “Y” has been cut and no longer functions. A Model 1000 is used to combine G & Y together on 1 wire. The 3-wire cable now operates as a 4-wire cable again.



How To Test a Cable

Step 1

Disconnect the cable from the thermostat and indoor unit terminals.

Step 2

Make a chart similar to the example. List each wire in order from L to R & top to bottom. The last column is always “Grd” which stands for “Ground”.

Step 3

At the indoor unit, set meter to ohms and measure from test wire to each other wire. Using the chart as an example, measure from red to white, red to green, red to black & red to ground. Once a row is completed move down to next row. Record the results in the left side square for each wire. The blacked-out squares do not need to be tested. Good wires should read “infinity” when tested this way. Once completed do step 4.

Step 4

At one end of the cable join together the red & white wires together. Go to the other end of the cable and measure the ohms. Repeat this for all the wires in the row. When completed, move down to the next row and repeat. Good wires will always have a 1 to 50 ohms reading. Record the results in right side square for each wire.

Notes

In the chart examples “in” stands for “infinity”. Any reading above 100K ohms could be considered the same as infinity. The actual ohms measured will depend on cable length.

Repairing Cables

General Rules

1. Wires shorted to ground can only be used for Common “C” connections. Some equipment might not function properly with a grounded common.
2. Any wires shorted together can still be used, however they must be used as one single wire. Reliability might be an issue if the wire breaks later on. If a nail or screw has gone through the cable and has shorted two or more wires together, there is no way to determine to what degree the copper wires have been damaged. Any subsequent movement of the cable might cause the wire to break where the nail/screw is.
3. Wires that test as broken or open cannot be used.

Problem: Two wires are shorted together on a 4-wire cable.

Solution: If two wires out of a 4-wire cable are shorted together then the cable is used as if it is a 3-wire cable. To repair this cable a Model 1000 could be used to provide 4-wire control again.

Problem: Three wires are shorted together on a 4-wire cable.

Solution: This cable is used as if it was a 2-wire. If it is a thermostat cable then a Model 3000 could be used to provide 4-wire control for most applications. If it is a condenser cable then a Model 1000 or 3000 could be used.

Problem: All the wires are shorted together on a cable.

Solution: If it is a thermostat cable then the cable would need to be replaced. If it is a condenser cable a Model 1000, 3000 or 9000 could be used depending if the outdoor unit was an air conditioner or heat pump and whether is it single or 2-stage unit. A transformer would need to be installed in the outdoor unit as part of the repair.

Problem: The cable has been spliced and the color coding is different for each cable used.

Solution: Follow steps 1-3 above on “How to test a cable”. Do this to make sure that there are no shorts or grounded wires. Replace “Step 4” with the following:

- A) Pick one wire in the cable and connect it to ground.
- B) Go to the other end of the cable and test each wire for resistance (ohms) to ground. One wire in the cable should provide a reading of 1 to 50 ohms. This is the “mate” for the wire that is grounded. Write down this result.
- C) Go back to the grounded wire and remove the connection to ground. Connect another wire to ground. Repeat step B above and this step (step C) until all the wires have been tested.

When completed you will have a list that indicates how the cable wire colors have been paired. If a “mate” for a wire cannot be found then it was not connected when the splice was made or has become damaged. In either case the wire cannot be used.

	Red	White	Green	Black	Grd
Red					
White					
Green					
Black					

Example: Results of a good cable

	Red	White	Green	Black	Grd
Red		in 8	in 7	in 8	in
White			in 8	in 6	in
Green				in 7	in
Black					in

Example: White is broken (open circuit)

	Red	White	Green	Black	Grd
Red		in in	in 9	in 8	in
White			in in	in in	in
Green				in 8	in
Black					in

Example: Green is shorted to ground

	Red	White	Green	Black	Grd
Red		in 8	in 7	in 8	in
White			in 8	in 6	in
Green				in 7	5
Black					in

Example: Black & Red are shorted together

	Red	White	Green	Black	Grd
Red		in 7	in 7	8 8	in
White			in 8	in 6	in
Green				in 7	in
Black					in

How FAST-STAT Works – Model 1000

Function: Multipurpose wiring extender

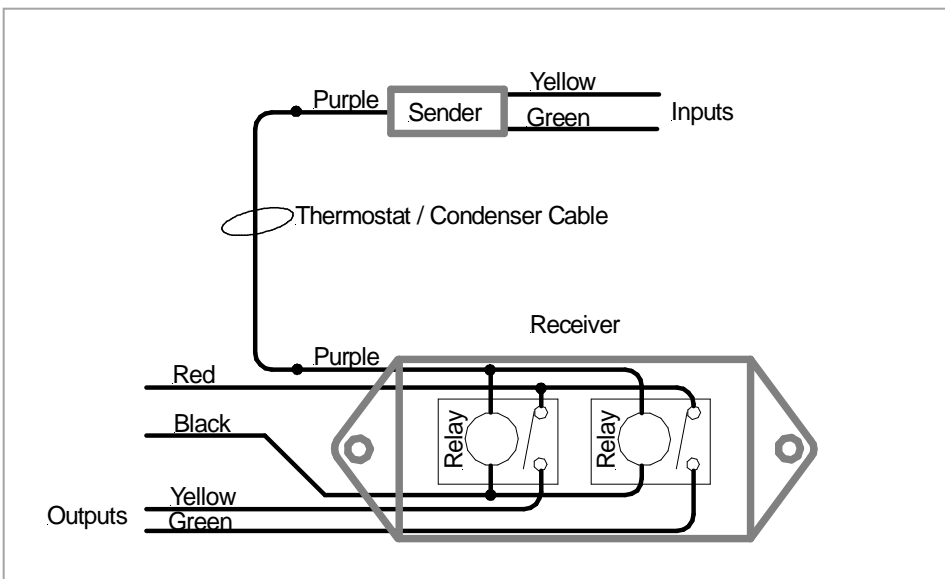
Application Examples:

- 2-stage air conditioning
- Adding manual fan control
- Installing a powered thermostat
- Cable repair.



How It Works

- A 24 volt input on the Sender yellow wire causes a 24 volt output on the Receiver yellow wire.
- A 24 volt input on the Sender green wire causes a 24 volt output on the Receiver green wire.
- The yellow & green channels are independent. Either one can be on or off without affecting the other channel.
- The Receiver needs to have 24 volt power applied to the red and black wires in order to operate.



How FAST-STAT Works – Model 3000

Function: Multipurpose wiring extender

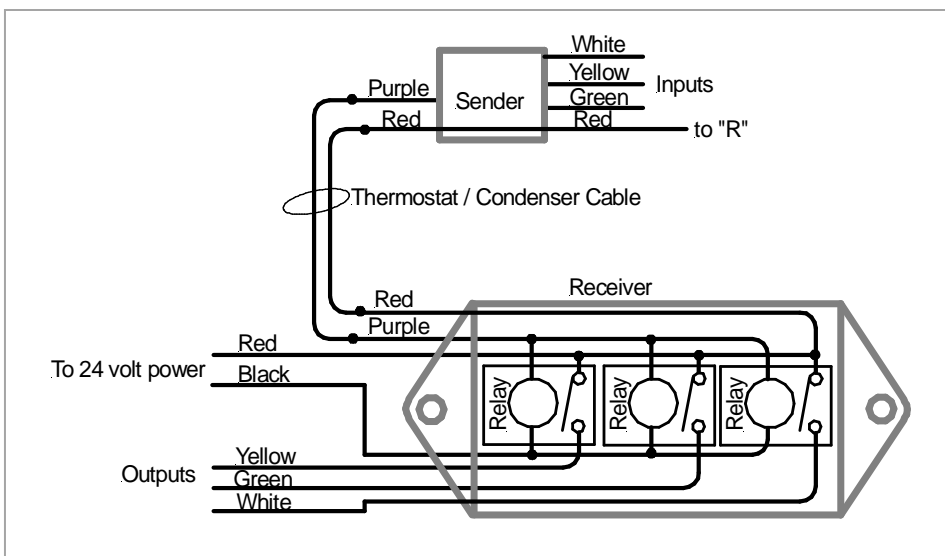
Application Examples:

- 2-stage air conditioning
- Adding Air Conditioning
- Heat Pump Conversions
- Cable repair.



How It Works

- A 24 volt input on the Sender green wire causes a 24 volt output on the Receiver green wire.
- A 24 volt input on the Sender yellow wire causes a 24 volt output on the Receiver green and yellow wires.
- The yellow & green channels are independent of the white channel. Either one can be on or off without affecting the other channel.
- The Receiver needs to have 24 volt power applied to the red and black wires in order to operate.



How FAST-STAT Works – Model 5000

Function: Multipurpose wiring extender

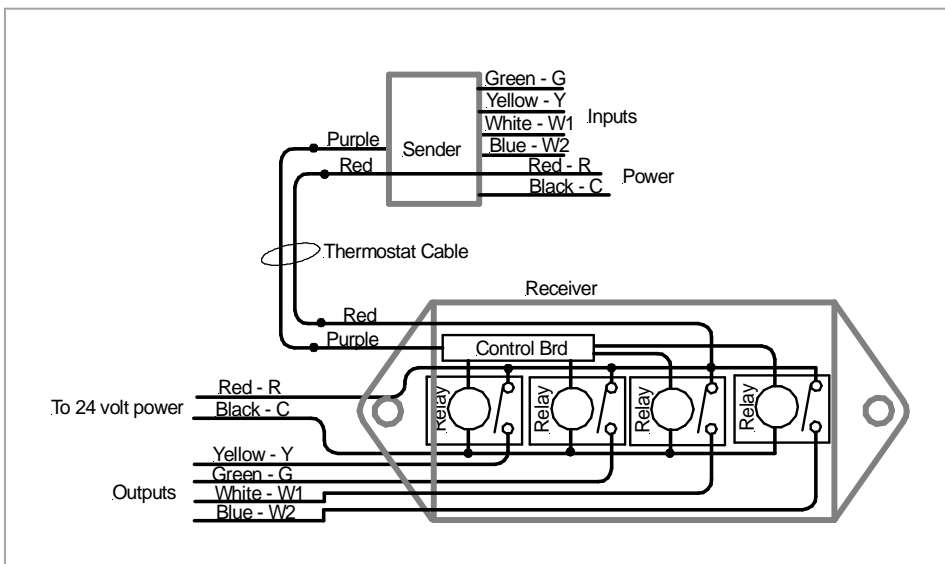
Application Examples:

- 2-stage heating
- Installing a powered thermostat
- Cable repair.



How It Works

- A 24 volt input on the Sender green wire causes a 24 volt output on the Receiver green wire.
- A 24 volt input on the Sender yellow wire causes a 24 volt output on the Receiver green and yellow wires.
- A 24 volt input on the Sender white wire causes a 24 volt output on the Receiver white wire. The voltage output of the green & yellow wires will shut off when the white wire output is on.
- A 24 volt input on the Sender blue wire causes a 24 volt output on the Receiver white and blue wires.



How FAST-STAT Works – Model 7000

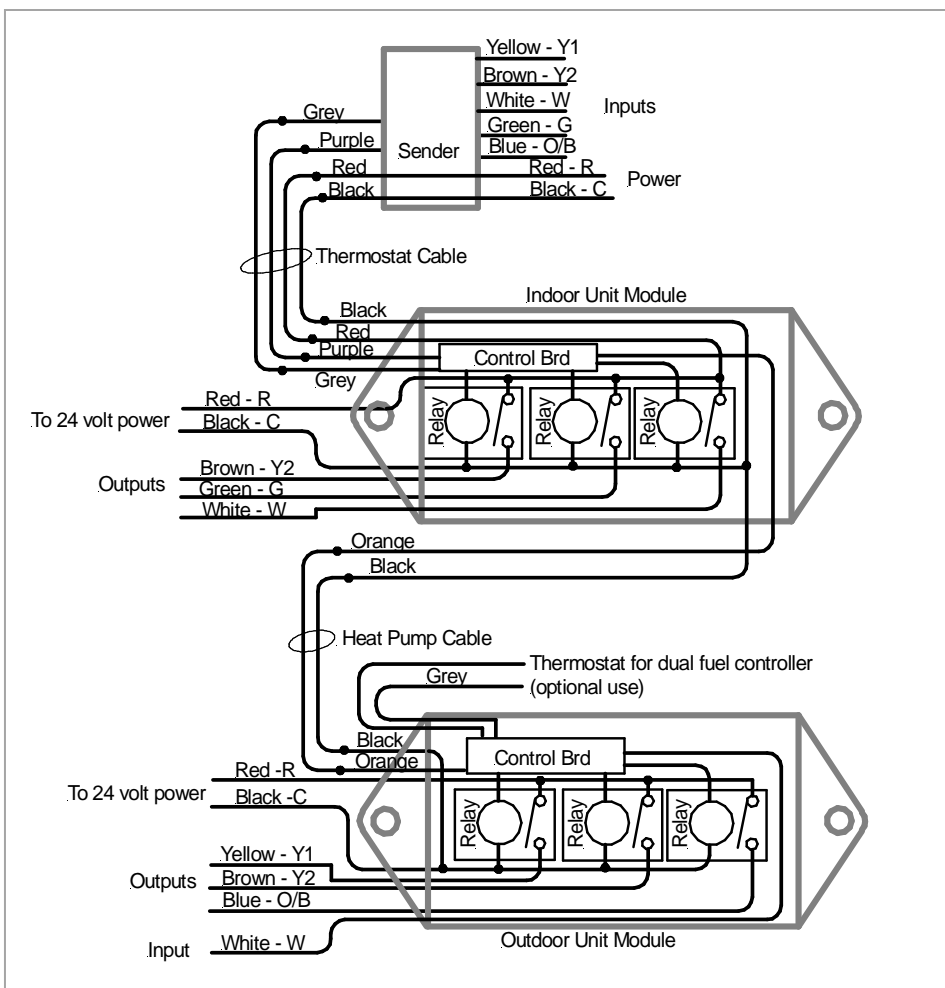
Function: Air conditioner to heat pump conversions

- Single or 2-stage units
- Built-in dual fuel controller
- 4-wire thermostat & 2-wire heat pump cable required



How It Works

- A 24 volt input on any of the Sender input wires causes a 24 volt output on the corresponding wires at the indoor & outdoor modules.
- The dual fuel (fossil fuel kit) allows for connections for a thermostat located at the heat pump. When the temperature falls to the thermostat set point, the compressor will shut off and start the indoor unit or keep the compressor running while strip heaters are switched on at the indoor unit. The installer selects which mode of operation is needed.



How FAST-STAT Works – Model 9000

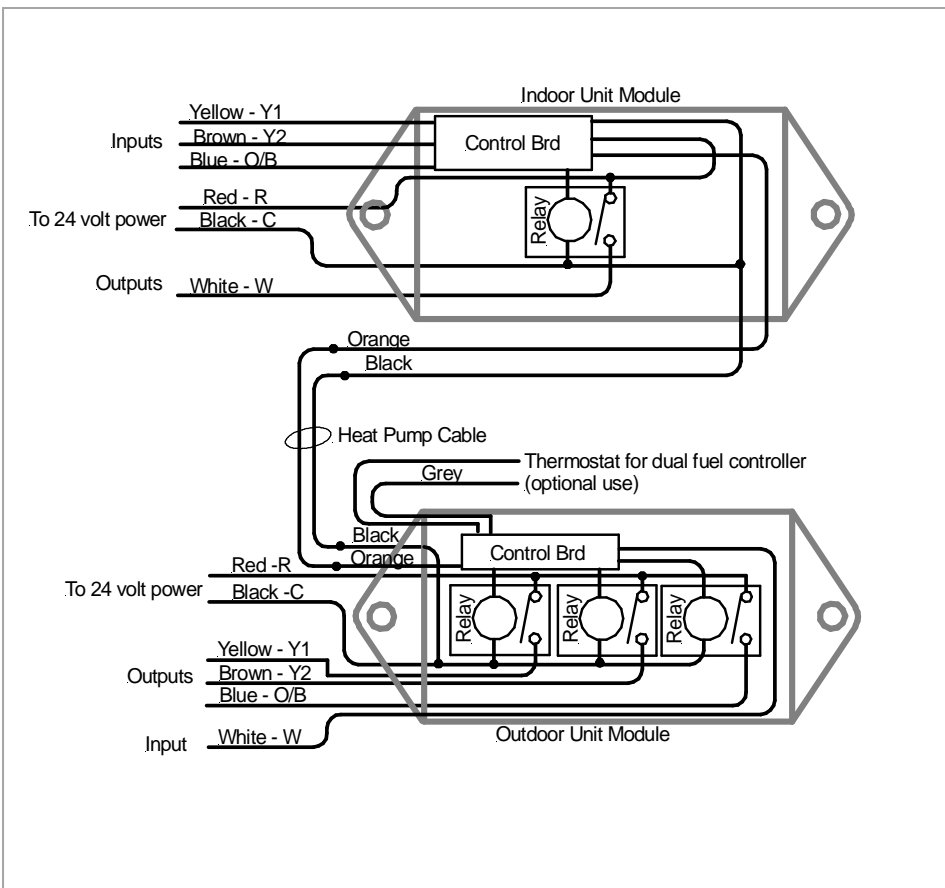
Function: Air conditioner to heat pump conversions

- Single or 2-stage units
- Built-in dual fuel controller
- 2-wire heat pump cable required



How It Works

- A 24 volt input on any of the Indoor Module input wires causes a 24 volt output on the corresponding wires at the Outdoor Module.
- The dual fuel (fossil fuel kit) allows for connections for a thermostat located at the heat pump. When the temperature falls to the thermostat set point, the compressor will shut off and start the indoor unit or keep the compressor running while strip heaters are switched on at the indoor unit. The installer selects which mode of operation is needed.



The diagram is for a 2-transformer installation. By connecting a black wire at each module to ground, the 2nd wire in the heat pump cable can be used to send transformer power “R” outside which eliminates the need for a transformer at the heat pump.

Frequently Asked Questions

What is the maximum distance between the Sender and Receiver?

Generally, you can expect the wiring extender to work with distances up to 500 feet. The actual distance depends on the transformer. A transformer with a low output voltage (20 – 23 volts) may not provide for the maximum distance.

Can I use more than 1 FAST-STAT in the same building?

Yes, you can use as many as you want. FAST-STAT wiring extenders do not “listen” to radio frequencies and they are not affected by them. Also, they do not generate signals that would affect other electronic devices.

How close together can they be located?

They can be located side by side if desired. It is a good idea to leave a 1 inch gap between them to aid in cooling.

Can they be used in metal buildings?

Yes, metal structures do not affect them.

The transformer has a voltage output over 30 volts. Will this cause a problem?

The maximum transformer voltage should not exceed 30 volts. If it does, then reliable operation could not be expected. The transformer voltage should be between 20 to 30 volts for proper operation.

The Sender is warm when operating. Is this normal?

It is normal that the Senders of the FAST-STAT models 3000, 5000 & 7000 produce heat in some modes of operation. For this reason it is recommended that the Sender lead wires be left as long as possible so that the Sender will be as far as possible from the thermostat once installed. If the Sender is close to the thermostat, the heat from the Sender could affect operation of the thermostat. The Senders produce less than 1 watt of heat, however this is enough to affect the thermostat if they are close together.

What other products are available?

There is a Model 7000X and a 9000X which are for single-stage heat pumps. The dual fuel controller is removed from these models. These models are used for larger projects and provide a cost savings. There is also a Common Maker model used to provide a common connection to a thermostat when there is only a 2-wire thermostat cable. The 7000X, 9000X & Common Maker are special order products.