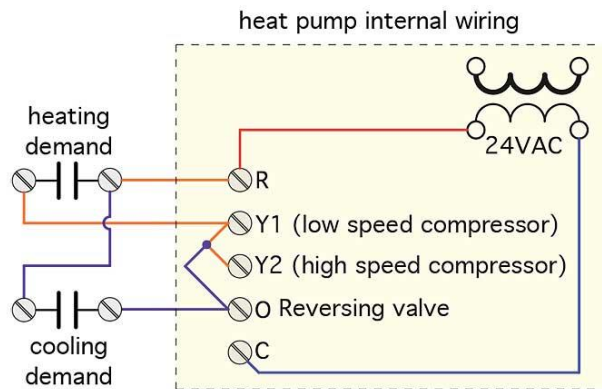


Mixed modes

The Glitch:

An installer is trying to wire up a two-stage heat pump for heating and cooling operation. In heating mode, the heat pump needs to run at full capacity. For cooling operation, the heat pump needs to run on lower (2/3) capacity. This requires the following control logic: For full capacity heating, it's necessary to pass 24 VAC from the (R) terminal of the heat pump to both the (Y1) and (Y2) terminals of the heat pump. For lower capacity cooling, it's necessary to pass 24 VAC from the heat pump's (R) terminal to its (Y1) and its reversing valve terminal (O). The heating and cooling demands are provided by separate normally open contacts. The wiring installed is shown in Figure 1.

Can you determine if the wiring schematic below will accomplish the necessary control functions, and if not, what need to be changed?



The Fix:

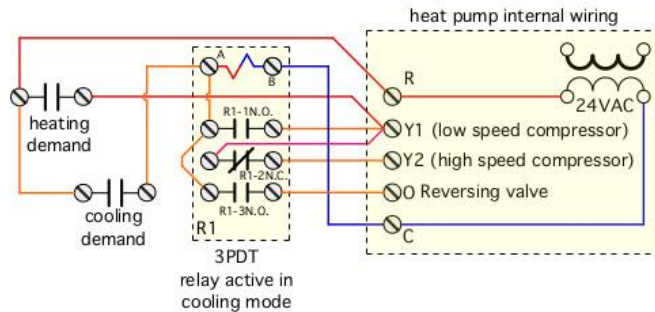
There are two problems with this wiring:

The reversing valve will be energized in both heating and cooling modes.

The heat pump will be on high capacity in both heating and cooling modes.

To achieve the desired control logic, it's necessary to use a relay between the heating and cooling demand contacts and the heat pump wiring. There likely are multiple ways to "hardwire" this control logic. The wiring shown in Figure 2 uses a three pole, double pole (3PDT) relay that is energized in cooling mode.

I like to use Dayton brand 5X840 relays for these applications. They're reasonably priced industrial quality relays with 24 VAC coils and contacts rated for line voltage up to 10 amps. That's high enough to run most circulators in residential and light commercial systems, or, in many cases, just switch 24 VAC control circuits. Although there are many applications where only one set of contacts is required, having three isolated double throw contacts often come in handy, as you'll see in this application. The wiring for this relay is shown in Figure 2.



HEATING MODE: When the heating demand contact closes, 24 VAC from the (R) terminal passes to the (Y1) terminal. From (Y1) 24 VAC also passes through the normal closed relay contact (R1-2 N.C.) to energize the (Y2) terminal. The heat pump is now running in full capacity heating mode.

COOLING MODE: When the cooling demand contact closes, 24 VAC from the (R) terminal of the heat pump passes to the (A) terminal of the relay. This is one side of the 24 VAC relay coil. The other side of the coil (B) connects to the (C) common terminal of the heat pump. With the relay coil energized, all three sets of contacts move. The normally open contact (R1-1N.O.) closes to send 24 VAC to the (Y1) terminal of the heat pump. The normally closed relay contact (R1-2 N.C.) opens to prevent 24 VAC from reaching the (Y2) terminal. This keeps the heat pump in lower capacity mode. The normally open contact (R1-3 N.S.) closes to send 24 VAC to the (O) terminal of the heat pump, energizing the reversing valve for cooling mode operation. The heat pump is now operating in lower capacity cooling mode.

Most relay sockets have numbers on the terminals that match up with numbers on the relay. The terminal connections to the contacts and coil are also printed on the side of most relays. Be sure to match up the terminal number with the associated poles and contacts.