

Hoffman Controls

Installation & Operating Instructions

706-HPFS(TB) Series

VariFlow™ Furnace Fan Speed Controller

General Description

The VariFlow™ 706-HPFS (TB)1 time-based control automatically varies system air flow to the space before and after each heating or cooling cycle. The Controller adjusts airflow by modulating blower fan speed as the AC compressor & Electric Heat cycles On and Off. Should Manual Fan or Defrost Cycle be called for, VariFlow™ will be disengaged and normal system operation will occur.

An ideal balance of air temperature and airflow precludes drafts and significantly reduces stratified (layered) air. When applied to Heat Pump systems, the Control ensures normal blower fan operation during the "Heat" & "Cool" modes of operation.

The Controller may be used with a single or two speed blower motor when in the Heating and Cooling modes.

Professional installation by HVAC technicians is recommended.

Important Note: It is the responsibility of the installer/ technician to evaluate each system and ensure a complete understanding of normal operation prior to beginning installation. Unique features or methods of operation must be taken into consideration. Contact the system manufacturer as needed. For 706-HPFS VariFlow™ technical assistance call HCC at 1-888-422-1190 (Toll Free).

CAUTION



Modern Heat Pump installations (indoor unit) could utilize 3 or 4 speed motors powered by "smart" control boards. Each of the motor speeds may be individually energized during normal operation. The 706-HPFS VariFlow™ is designed to operate ONLY in systems where a maximum of 2 motor speeds are employed. Otherwise the potential for more than one speed being energized at one time exists which will ultimately damage the motor.

Note: The purpose of the 706-HPFS VariFlow™ is to provide ramp-down over time to a minimum speed blower motor operation. Controller wiring must be installed to monitor for requirements of Heat or Cooling to ensure desired operation at the end of and between each Heating or Cooling cycle.

System Evaluation

Evaluating a Heat Pump for VariFlow™

Although the function of a Heat Pump can be simply stated, the variations in the design by manufacturers of newer equipment can be complex in nature.

Depending on the age of an existing Heat Pump installation, many variations of control and functions can also exist. Therefore, developing a definitive schematic for connecting VariFlow™ to the many variations that exist for Heat Pumps is not practical.

Heat Pumps control compressor operation in a Direct Acting (Cooling) or Reverse Acting (Heating) mode via a "changeover" valve. Depending on the manufacturer, most designs allow the "changeover" valve to function in the Heating Mode de-energized. Some Heat Pumps, may however, elect to energize the valve in the Heating Mode. VariFlow™ only controls the indoor blower when the blower would otherwise not be functioning. Therefore, the "changeover" valve has no effect on VariFlow™, and should not be monitored for any reason.

Single Speed & Two Speed Blower Motor Applications

When single speed or two speed blower motor operations are encountered, wiring requirements differ slightly: It is the responsibility of the installer/ technician to evaluate each system and ensure a complete understanding of normal operation prior to beginning installation.

Because indoor blower operation may have single speed or two speed motors, two variations of the Installation Instructions are necessary. Heat Pump indoor blower motors are predominately single speed. VariFlow™ is not applicable, and should not be used, when more than two (2) speeds are used in the operation of the indoor blower motor of a Heat Pump system.

Energizing blower motors with VariFlow™ falls into two categories.

- Single Speed Blower Motors - may be controlled with a SPST relay.
- Two Speed Blower Motors - could have a relay with NO & NC contacts* mechanically linked, or two NO contacts**.

*The NO/NC relay type could typically operate the motor on Medium Speed for Heating with NC contact and High Speed for Cooling with the NO contact.

**If two NO contacts are provided, one or the other contact would be energized at any one time, but never both contacts at the same time.

VariFlow™ HPFS (Heat Pump Fan Speed) Flying Lead Wiring Instructions

When making the required VariFlow™ wiring connections, refer to the Typical Wiring Schematic in this document to assure that the appropriate colored wires are being correctly connected. Properly wired, VariFlow™ controllers do not change or disrupt any of the units normal control functions. VariFlow's wiring connections are located at various points paralleling the existing manufacturers control schematic functions. Paralleling the units existing control functions will only operate the blower when the blower is otherwise not functioning.

When a Heating or Cooling Cycle is required, the presence of 24 V AC at the Fan Relay(s) and/or Electric Heating Relay, precludes the operation of VariFlow™ but initiates the start of, and ending of, the variable speed ramp immediately and uninterrupted. Should a Heating or Cooling Cycle be initiated before the end of a ramp down cycle the resulting command will allow normal control function to resume immediately.

Installation

Note: It is recommended that as each instruction below is reviewed, that the Typical Wiring Schematic, Fig. 3, be simultaneously examined. This procedure will assist the installer in determining the correct location for attaching each wire, even though the schematic is “typical”, and may not be representative of the actual schematic of the unit being wired.

Line Voltage Connections, 208-230V AC (Black, Blue, & Red Wires)

CAUTION: Verify that all power to the indoor blower section of the control panel has been disconnected.

- 1. BLACK WIRE** – Locate a suitable terminal or junction on L1 for permanently connecting this wire to Line Voltage.
- 2. BLUE WIRE** – Locate a suitable terminal or junction on L2 for permanently connecting this wire to Line Voltage.
- 3a. RED WIRE – Single Speed Blower Motors.** Connect the RED Wire to the load side of the NO Relay that energizes the blower motor. Or, use a wire nut to connect the RED wire, between the contact and the motor. This connection will provide control of the single speed motor by VariFlow™ when the motor is not energized, bypassing the relay, when Heating and Cooling modes are not functioning.
- 3b. RED WIRE – Two Speed Blower Motors.** Locate the motors Medium Speed lead, and follow this lead back to the first terminal of a control mechanism or relay that provides power from L1. Connect the RED Wire to a suitable terminal at that juncture. Or, use a wire nut to connect the RED wire between the relay’s contact and the motor, both methods will bypass the relay when Heat and Cool modes are not functioning. See Figure 4 for example locations.

Note: 3a. VariFlow™ controls the Single Speed Blower Motor for Heating and Cooling.

3b. VariFlow™ controls the Medium Speed Blower of a Multi Speed Motor for Heating and Hi Speed for Cooling.

Low Voltage Connections, 24V AC (Yellow, Green, & Orange Wires)

- 4. YELLOW WIRE** – Locate a suitable terminal or junction on the common side of the 24 V AC transformer. This would be the opposite side of the 24 VAC transformer that is providing power to the Thermostat. ***This connection is to provide the 24 V AC power common for the GREEN & ORANGE wires that will be monitoring the Heating and Cooling modes of operation.***
- 5a. GREEN WIRE – Single Speed Blower Motors.** Locate the Blower Motor Relay. Connect the GREEN wire to the terminal on the Fan Relay coil that is receiving 24 V AC power from the Thermostat. This connection will indicate that 24 V AC exists for the purpose of operating the blower in both the Heating and Cooling modes. ***This blower motor relay should always energize with the Compressor or Electric Heater when conditioned air, for either the Heating or Cooling function is required. Utilizing the GREEN wire on a single speed motor function eliminates the need for using the ORANGE wire for heating described in 6a) below.***
- 5b. GREEN WIRE – Two Speed Blower Motors.** Locate Blower Motor Fan Relay coil that is receiving 24 V AC power that

energizes the High Speed Winding of the Blower Motor for the Cooling Mode. Connect the Green wire to the “hot” side of this relay, indicating that the Cooling Speed is required. ***Using the GREEN wire on the relay requiring the high speed for cooling will assure proper flow of air for the Cooling Cycle.*** See Figure 3 for example locations.

CAUTION



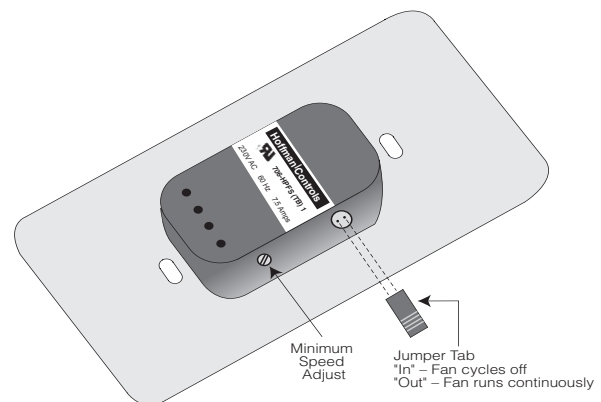
Integrated Heat Pump Controls - When two separate control Relays are provided for each of the two Motor Speeds, two 24 V AC signals will be required of the manufacturers control system to operate VariFlow™. Therefore both Green and Orange must be connected to their respective Blower Motor relays.

- 6a. ORANGE WIRE – Single Speed Blower Motors.** The instruction in 5a above precludes the use of the ORANGE wire for Single Speed Blower Motors since the GREEN wire monitors both the Heating and Cooling mode of the same relay. Use a wire nut to cap off this unused connection.
- 6b. ORANGE WIRE – Two Speed Blower Motors.** If the Orange wire in the instruction 6a above cannot be used for energizing the relay for the medium speed for heating, locate the wire from the thermostat that feeds 24 V AC power to the Relay for the first stage of Electric Heat. This could be the second stage of Heating where the compressor would be the first stage of heating. Connect the ORANGE wire to a suitable terminal or juncture on the “hot” side of this relay for indicating that 24V AC exists for operating the blower when the first stage of Electric Heat is energized. See Figure 3 for example locations.

CAUTION: With the control wiring completed, reconnect power to the indoor blower section of the control panel.

Control Adjustment and Programming

- Minimum Speed Adjust does not normally require additional adjustment and should only be attempted if a tachometer is available for monitoring fan speed.
- Programming Tab is left in place for blower shutoff at end of ramp-down. **Tab is to be removed if continuous run at minimum speed is desired at the end of ramp-down.**



Note: Store "Jumper Tab" for future use if not used.

Minimum Speed Adjust and Program Locations
Figure 1

- See Figure 1 for Minimum Speed Adjust and Program Tab Locations.

Normal Operation

Cool: When the system calls for cooling, 24 V AC is applied between the Green and Yellow (common) leads. Once the cooling cycle is complete, including any system delays, 24 V AC is removed from the Green lead. The control will now begin the 6 minute ramp-down using the hi or medium speed of the blower motor. Operation at the end of ramp-down is the same as described for heating.

Heat: When the system calls for heat, 24 V AC is applied between the Orange and Yellow (common) leads which initiates a 10 second ramp-up of the blower motor if a delay on start is available. Any call for full speed blower operation will override the parallel connected 706-HPFS VariFlow™ control output resulting in full speed blower operation.

As soon as 24 V AC is removed from the Orange lead and any system delays have been accomplished, the 6 minute ramp-down will begin. At the end of the 6 minute period, the blower will either continue to operate at minimum speed or shut off depending on the option that has been selected. If the optional Remote Switch/Wiring Harness (Part Number 100-0020-000) has been installed, the operation will depend on the selector switch position. See figure 2 for HPFS Fan Speed Operation.

Special Operating Instructions

1. To obtain the features and benefits of improved comfort and increased system efficiency when using VariFlow™:

Always operate Thermostat Fan Switch in "AUTO" position when heating or cooling is required.

Operating fan in "ON" position overrides VariFlow™ Furnace Fan Speed function and prevents the function of variable air flow.

2. Motor design characteristics may effect the noise of the fan motor as speeds approach 400 RPM ±. The noise/hum is a function of the motor design, not the Controller's operation. If motor noise is objectionable:
 - Line blower compartment or return air duct with 1/2" high density duct liner, or
 - Reset minimum speed to higher RPM to eliminate objectionable noise.

Recalibrating Minimum Speed

706-HPFS Series Controllers are furnished with a field adjustable Minimum Speed setpoint. The Minimum Speed has been factory set at mid-range to provide approximately 450± RPM. Minimum Speed varies with each installation based on the motor make, design, loading, static pressure and/or torque characteristics.

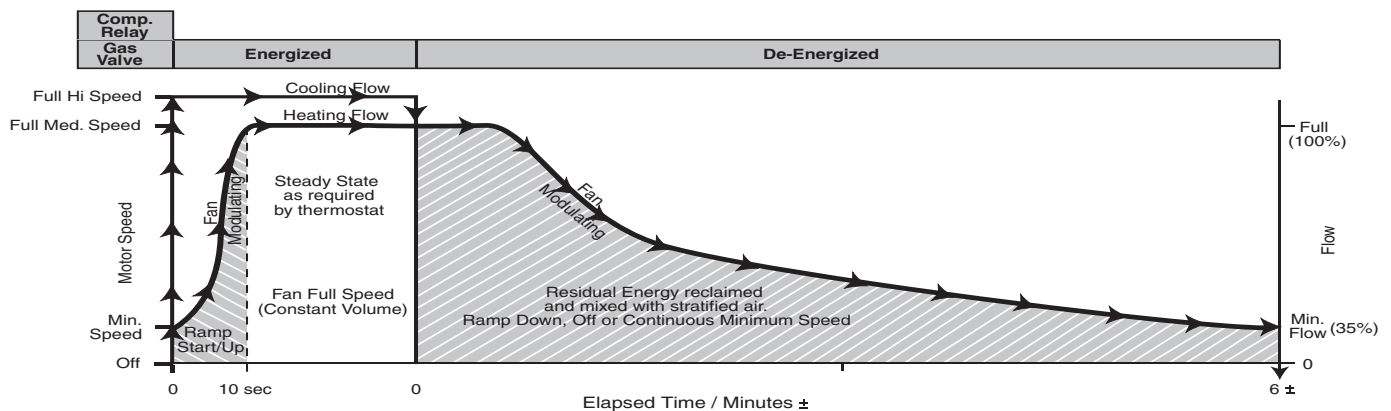
Changing the Minimum Speed **is not recommended** unless the installer is able to verify actual final RPM with a Tachometer.

The following procedure is required to recalibrate the Minimum Speed setpoint (see minimum Speed Adjust, figure 1).

1. Set Thermostat system switch to "Off". Set Fan switch to "Auto".
2. Remove panels to gain access to 706-HPFS Controller.
3. Engage "Door Switch" to provide power.
4. Remove Minimum Speed Jumper Tab from Controller, if Jumper is installed. Disregard this instruction if Jumper Tab has been removed.
5. Motor should run at continuous Minimum Speed.
6. Insert 1/8" miniature slotted screwdriver in potentiometer, turn:
 - CW to increase Minimum Speed.
 - CCW to decrease Minimum Speed.
7. Measure RPM to assure a Minimum Speed of adjust to not less than 400 RPM for sleeve bearing motors or 200 RPM for ball bearing motors.
8. Reinstall Jumper Tab to "cycle off fan" at end of "Ramp Down". Disregard this instruction if "continuous Minimum Speed" is desired.
9. Replace panels to reactivate "Door Switch" if used.

Auxiliary Equipment

If auxiliary equipment (i.e., a Humidifier) is hooked to the heat speed of the blower motor, its operation will be impaired once the 706-HPFS VariFlow™ is installed and operating. The reduced voltage to the blower motor would be applied to the auxiliary equipment circuit causing erratic operation. All auxiliary equipment **MUST NOT BE** connected to any power provided to the motor by the VariFlow™ control.



VariFlow™ HPFS Furnace Fan Speed Operation

Figure 2

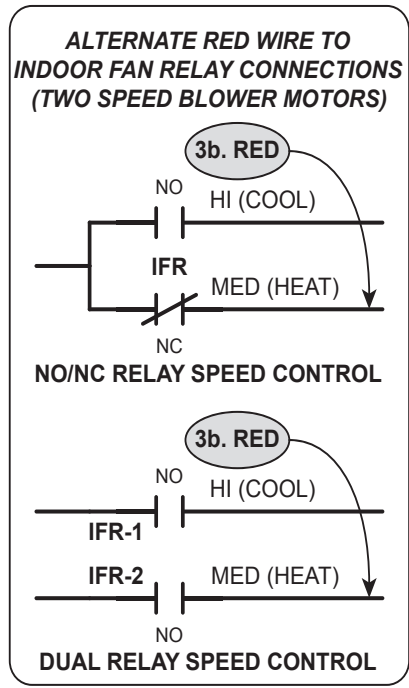
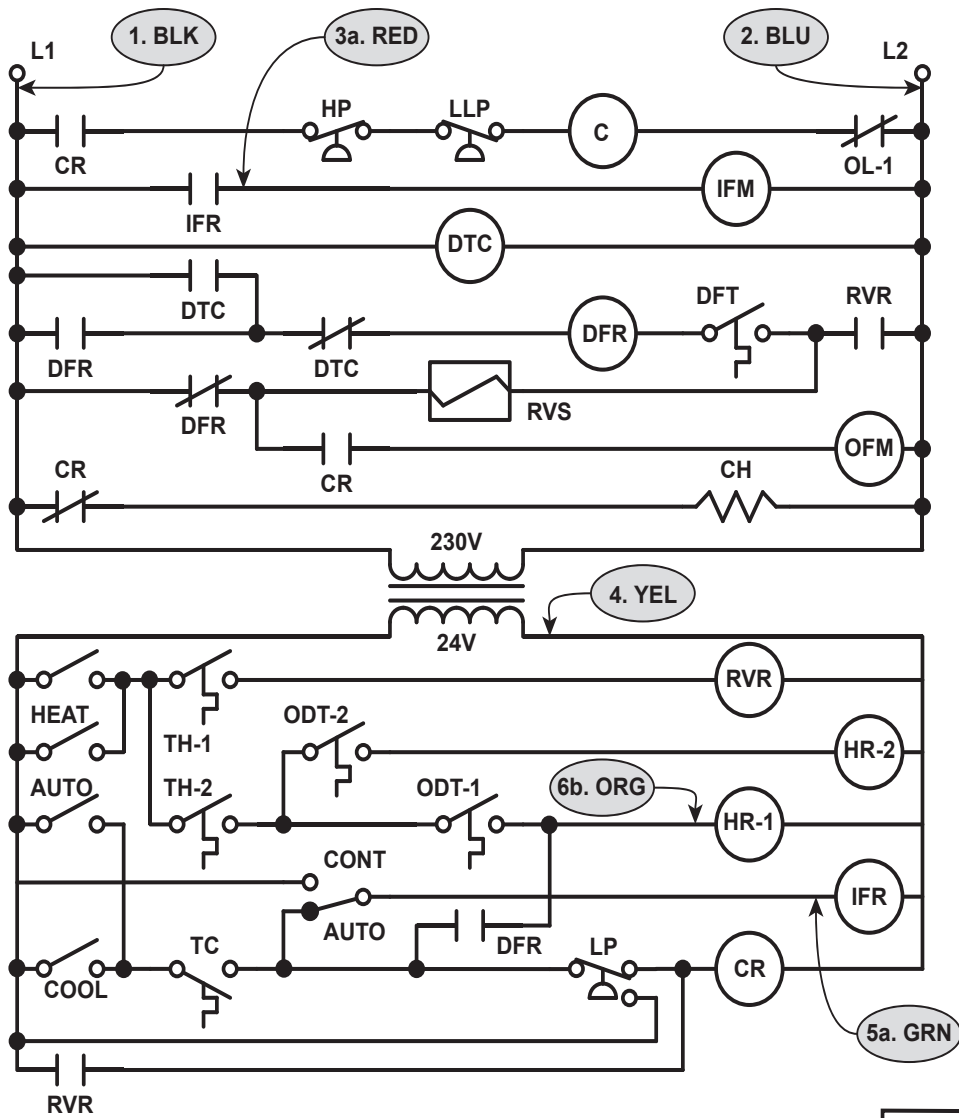
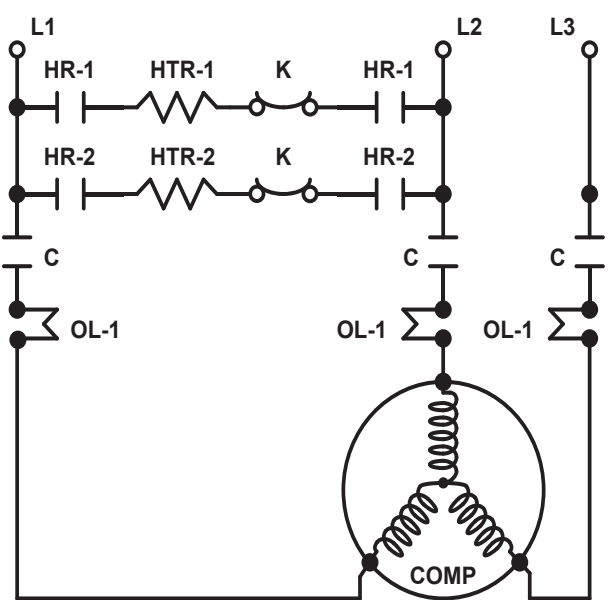


Figure 4



Typical Wiring Schematic for Single Speed Blower Motors, 3 Phase Compressor
Figure 3

- CR = CONTROL RELAY
- HP = HIGH PRESSURE SWITCH
- LLP = LIQUID LINE PRESSURE
- C = COMPRESSOR CONTACTOR
- OL-1 = OVERLOAD
- IFR = INDOOR FAN RELAY
- IFM = INDOOR FAN MOTOR
- DTC = DEFROST TIMER CONTACTS
- DFR = DEFROST RELAY
- DFT = DEFROST THERMOSTAT
- RVR = REVERSING VALVE RELAY
- RVS = REVERSING VALVE SOLENOID
- OFM = OUTDOOR FAN MOTOR
- CH = CRANKCASE HEATER
- TH-1 = THERMOSTAT HEAT STAGE 1
- TH-2 = THERMOSTAT HEAT STAGE 2
- ODT 1&2 = OUTDOOR THERMOSTATS
- HR 1&2 = HEAT RELAY 1&2
- TC = THERMOSTAT COOLING
- LP = LOW PRESSURE SWITCH
- HTR 1&2 = HEAT ELEMENTS 1&2

Hoffman|Controls