



# Wiring Diagrams

Units Produced After October 31, 2003  
(Including Accessories)

## WIRING DIAGRAM INDEX

UNIT 38AKS	ELECTRICAL CHARACTERISTICS (V-Ph-Hz)	SCHEMATIC DIAGRAM FIG.	COMPONENT ARRANGEMENT FIG.	LABEL DIAGRAM NO.
028-044	208/230-3-60 460-3-60 575-3-60	2	3	38AK501477-4
	230-3-50 346-3-50 380-3-60 400-3-50	4	5	38AK501475-4

Typical Field Wiring — Electronic Programmable Thermostat, Liquid Line Solenoid Valves, and Power . . . . . Fig. 6  
Time Delay Relay Wiring . . . . . Fig. 7  
Hot Gas Bypass Wiring . . . . . Fig. 8  
Motormaster V Head Pressure Control Wiring . . . . . Fig. 9, 10

Pressure Transducer Location . . . . . Fig. 11  
38AKS Schematic Diagram . . . . . Fig. 12

NOTE: *Italics* denote 60 Hz export units (not for sale in USA).

### SAFETY CONSIDERATIONS

Installation, start-up, and servicing of this equipment can be hazardous due to system pressures, electrical components, and equipment location (roofs, elevated structures, etc.)

Only trained, qualified installers and service mechanics should install, start up, and service this equipment.

When working on the equipment, observe precautions in the literature, tags, stickers, and labels attached to the equipment, and any other safety precautions that apply.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use care in handling, rigging, and setting bulky equipment.
- Use care in handling electronic components.

	<b>ELECTRIC SHOCK HAZARD</b> Open all remote disconnects before servicing this equipment.
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### OPERATION

**IMPORTANT:** Before initial start-up and before restarting unit after a prolonged shutdown, compressor crankcase heater should be energized for 24 hours.

**Control Module (CM)** — The unit control module (Fig. 1) is located in the control section of the control box. The control module performs several functions. On power up the Power LED (DS1) will flash continuously 1/4 second on, 1/4 second off. The module starts a 3-minute compressor on delay timer. This delay can be bypassed by pressing the reset switch for at least 1/2 second. The Status LED (DS3) must be flashing or the reset switch will not function.

On a call for cooling the module checks (7 seconds) for valid Y signal; checks that the 3-minute delay has elapsed or

been overridden by the reset switch; and also checks the status of the HPS/COTP (high-pressure switch/compressor overtemperature protection switch). If no alarms are detected no delays are active the module will energize the compressor contactor relay. A timer is started to provide a minimum 3 1/2-minute compressor run period.

NOTE: COTP is not used on 38AKS028-044 units.

During the compressor run time the module continuously checks the HPS/COTP status. A change in this status will immediately shut down the unit and display the alarm. Power must be cycled to restore normal control operation.

During the first 60 seconds of operation the OPS (oil pressure switch) state is monitored but ignored. After this time if the OPS is open the unit will be shut down. Alarm LED (DS2) displays the state of the OPS. A double blink (two 1/4-second blinks, 1 second off) indicates the OPS is open. If the OPS opens during operation and remains open for longer than 60 seconds the module will lock out unit operation and display the alarm. Power must be cycled to restore normal control operation.

The LPS (low-pressure switch) is monitored during a call for cooling. During the first 2 1/2 minutes of operation the state of the LPS is ignored. Alarm LED (DS2) displays the state of the LPS. A single blink (1/4 second on, 1 second off) indicates that the LPS is open. If the LPS remains open after 2 1/2 minutes or opens later during the call for cooling the module shuts down the unit. The compressor 3-minute on delay is started and the cycle repeats. If the call for cooling remains and this LPS cycle is repeated 3 times the module will lock out and display the alarm. Power must be cycled to restore normal control operation.

When the call for cooling is satisfied and the compressor has run for at least 3 1/2 minutes the module shuts the unit down. The control module restarts the compressor 3-minute on delay timer.

**Time-Delay Relay (TDR) (Standard on 230, 346-3-50)** — This solid-state delay-on-make relay is factory set for a 1-second delay. The number 1 DIP switch is set to the ON position, and all the other DIP switches are set to the OFF position. Once the control relay (CR) is energized, the compressor contactor C1 is powered, and the first set of compressor windings is energized. After the 1-second time delay, contactor C1A is powered and the second set of compressor windings is energized (part-wind start).

**Sequence of Operation** — When the space thermostat calls for cooling, the no. 1 condenser fan and compressor start after CM valid signal time delay of 7 seconds. If an optional airflow switch is used, compressor and no. 1 condenser fan do not start until sufficient indoor airflow has closed the switch. After 7 seconds, the compressor starts and the liquid line solenoid valve for solenoid drop control opens. The crankcase heater is deenergized. If the head pressure reaches 260 psig (1792 kPa) the second condenser fan starts. (Fan no. 3 (38AKS044 only) starts if outdoor ambient air rises above 80 F [26.7 C]).

If cooling demand is low, suction pressure at the compressor drops. As the pressure drops, the compressor unloads 1 or 2 banks of cylinders as required. If cooling demand is high and 2-stage operation is used, the second stage of the thermostat activates the capacity control liquid line solenoid which activates the second stage evaporator coil. The compressor cylinders load or unload in response to compressor suction pressure to meet evaporator load.

Two and a half minutes after compressor starts, the LPS bypass is deactivated. If the LPS trips during the first 2½ minutes of operation, the compressor remains operational. If the LPS trips after 2½ minutes, the compressor operation is interrupted and the compressor cannot restart until the 3½-minute CM anti-short cycle timer expires.

As the space cooling load is satisfied, the second stage of the thermostat opens, causing the CM to close the field-supplied capacity control liquid line solenoid valve to deactivate the second stage coil. The compressor adjusts the number of active cylinders to meet the new load. When the space temperature is satisfied, the first stage of the thermostat opens and the control relay opens. This closes the solenoid drop control valve. The compressor stops and the crankcase heater is energized preventing refrigerant from migrating to the compressor during the off cycle. The CM anti-short cycling timer is energized and runs for approximately 3 minutes. During this time, the compressor is not able to restart.

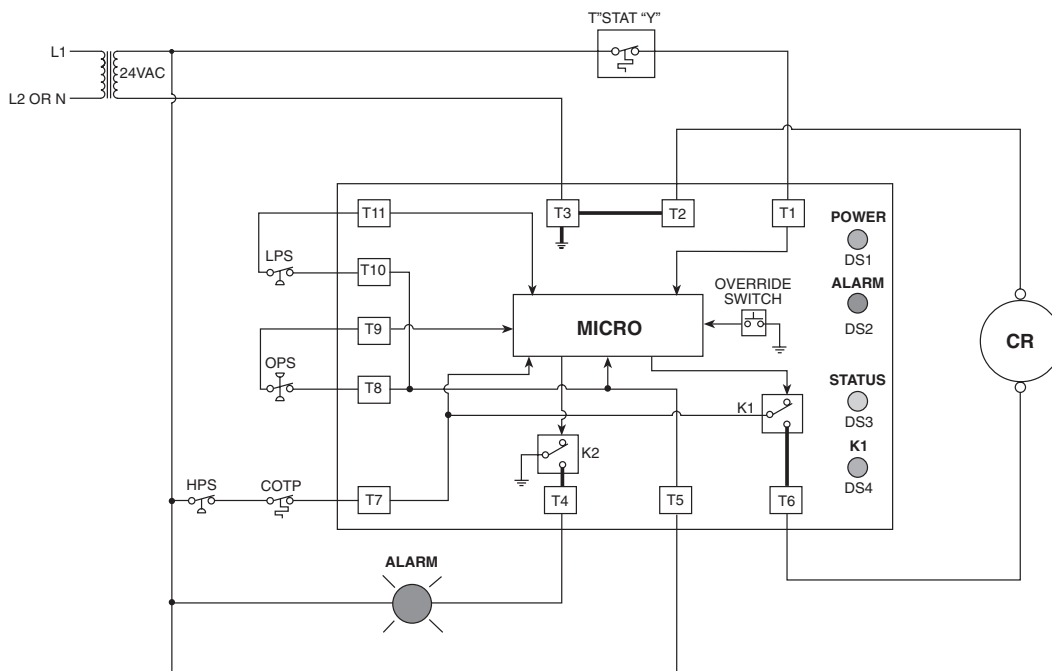
**GENERAL** — Figures 2-6 show liquid line solenoid valves to incorporate solenoid drop refrigerant control on the condensing units. The power schematics of the label diagrams show 06E triple-voltage compressor wiring and 06E discrete-voltage compressor wiring. A triple-voltage compressor (06E---3--) can be applied on a 208/230-v, 400-v, or 460-v (not available with part winding start) supply system. Discrete-voltage compressors are required for 575-v or 460-v systems requiring part winding start. (Discrete-voltage compressors are special-order items for 460-v units.)

**LEGEND (Fig. 1-6)**

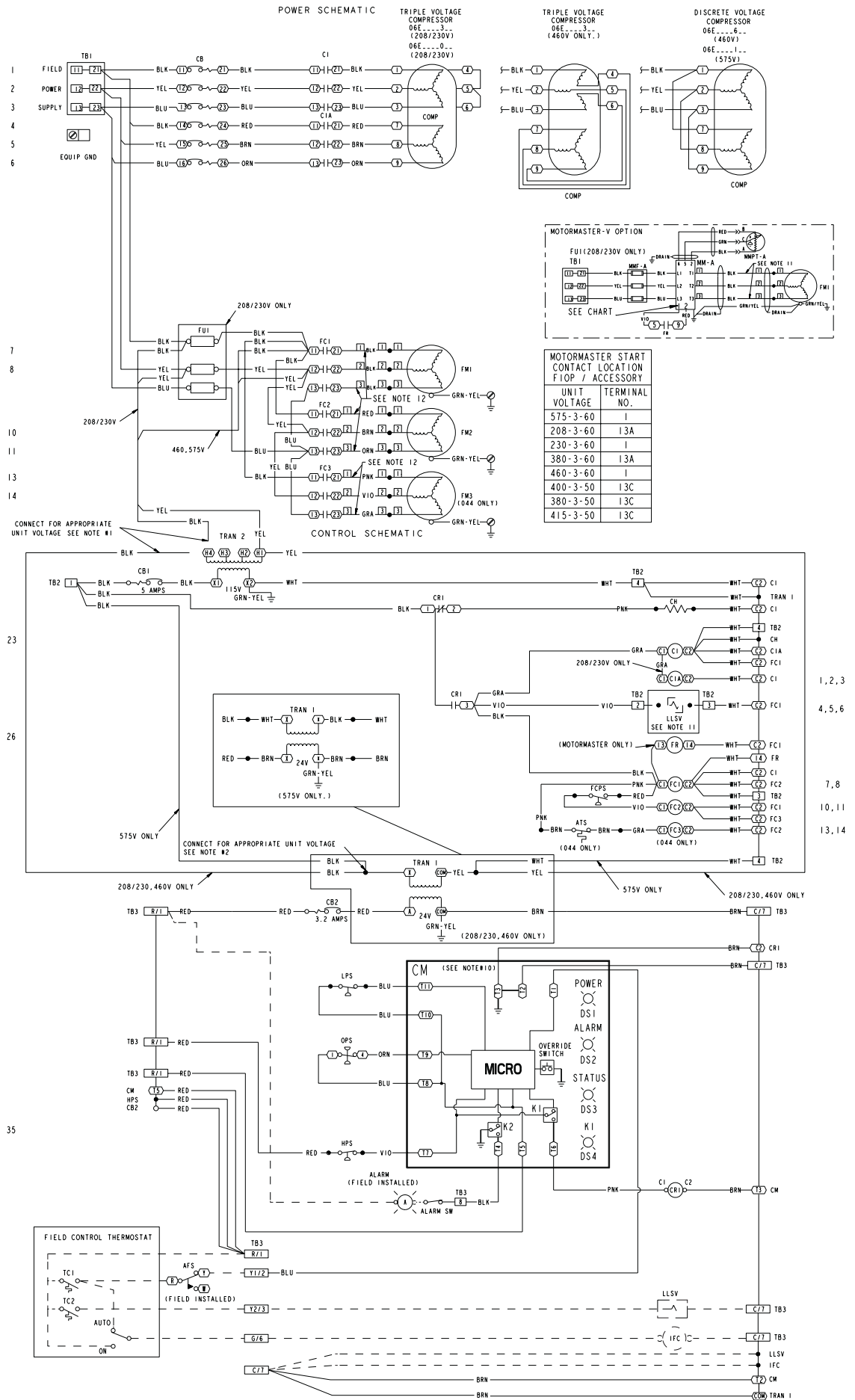
- AFS** — Airflow Switch
- ATS** — Air Temperature Switch
- C** — Contactor, Compressor
- CB** — Circuit Breaker
- CH** — Crankcase Heater
- CM** — Control Module
- CMR** — Control Module Relay
- COMP** — Compressor
- COTP** — Compressor Overtemperature Protection Switch
- CR** — Control Relay
- EQUIP** — Equipment
- FC** — Fan Contactor
- FCPS** — Fan Cycling Pressure Switch
- FIOP** — Factory-Installed Option

- FM** — Fan Motor
- FR** — Fan Relay
- FU** — Fuse
- GND** — Ground
- HPS** — High-Pressure Switch
- IFC** — Indoor Fan Contactor
- LLSV** — Liquid Line Solenoid Valve
- LPS** — Low-Pressure Switch
- NEC** — National Electrical Code
- OPS** — Oil Pressure Switch
- TB** — Terminal Block
- TC** — Thermostat, Cooling
- TDR** — Time-Delay Relay
- TRAN** — Transformer

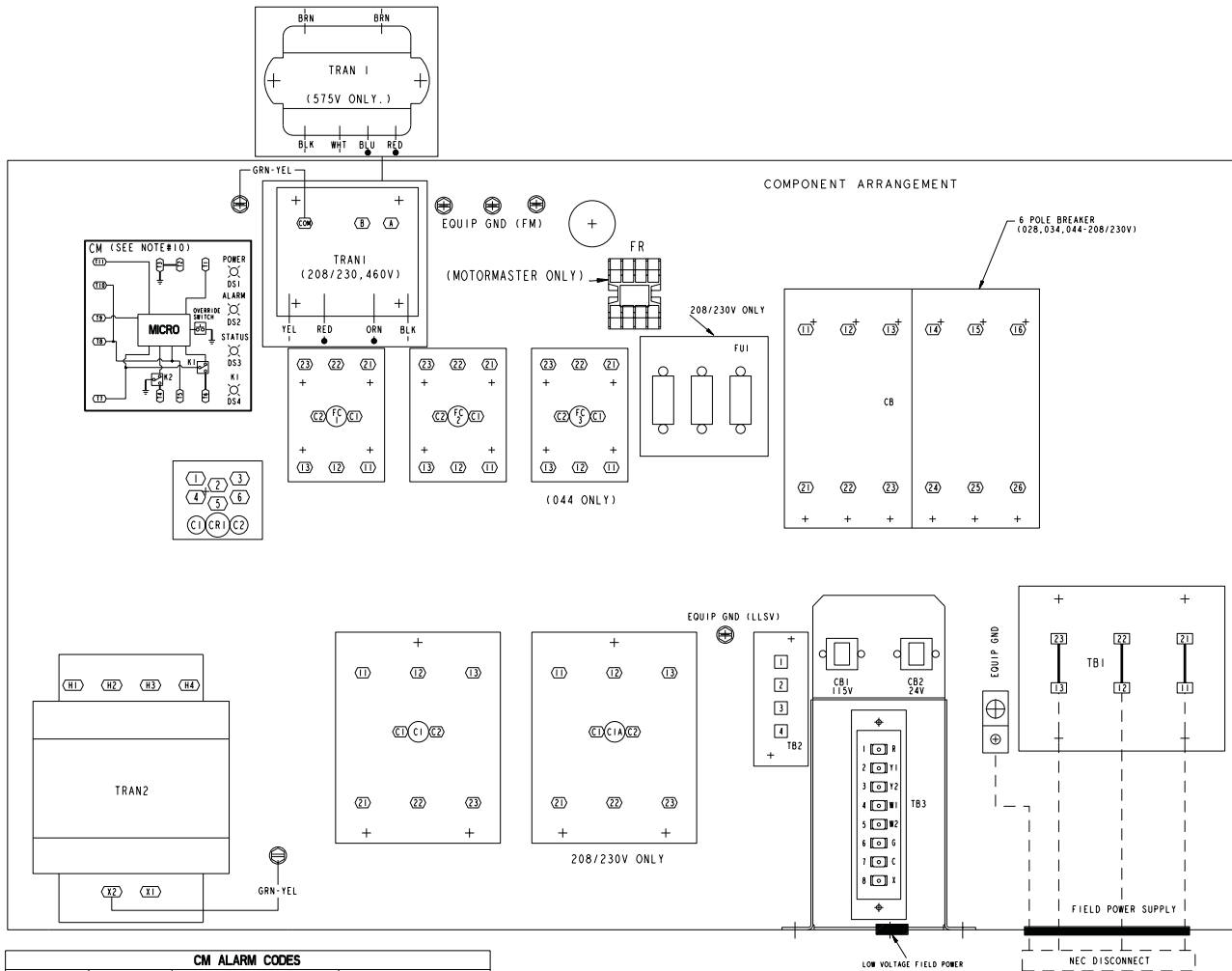
- Terminal Block Connection
- Marked Terminal
- Unmarked Terminal
- Marked Splice
- Unmarked Splice
- Factory Wiring
- Field Control Wiring
- Field Power Wiring
- Indicates common potential. (Does not represent wiring.)



**Fig. 1 — Generic Control Module Wiring**

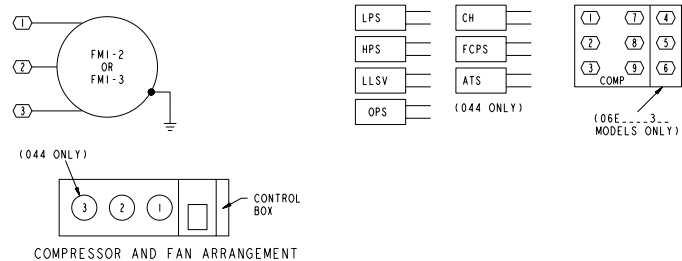


**Fig. 2 — Wiring Schematic — 38AKS 208/230-3-60, 460-3-60, 575-3-60**



CM ALARM CODES				
LED	NUMBER OF BLINKS *	TIME (sec)		STATUS
		ON	OFF	
<b>DS1 POWER LED</b>				
	1	1/4	1/4	NORMAL OPERATION
		STEADY		LOCKOUT STATE
<b>DS2 ALARM LED</b>				
		STEADY		HPS OR COTP OPEN
	1	1/4	1	LPS OPEN
	2	1/4	1	OPS OPEN
	3	1/4	1	LPS/OPS OPEN
<b>DS3 STATUS LED</b>				
		STEADY	STEADY	NO CALL FOR COOLING
				COOLING
	1	1/4	1/4	3 MIN. CMP DELAY
<b>DS4 "KI" LED</b>				
		STEADY		RELAY KI CLOSED

\* - MULTIPLE BLINKS ARE A SERIES OF ON/OFF FLASHES OF EQUAL DURATION FOLLOWED BY 1 SECOND OFF.



**Fig. 3 — Component Arrangement — 38AKS 208/230-3-60, 460-3-60, 575-3-60**

**NOTES FOR FIG. 2 AND 3**

1. Connect TRAN2 to terminal H3 for 230 V, H4 for 460 V, and H2 for 575 V units. If 208/230 V units are run with a 208 V power supply connect to terminal H2.
2. Connect TRAN1 to ORN lead for 230 V, BLK lead for 460 V, and WHT lead for 575 V units. If 208/230 V units are run with a 208 V power supply connect to RED lead.
3. Compressor and fan motors thermally protected. Three-phase motors protected against primary single phasing conditions.
4. Replacement of original wires must be with Type 90° C wire or its equivalent.
5. Line # indicates location of contacts, [##,##] signifies single-pole double-throw contacts, # signifies a normally closed contact, # signifies a normally open contact.
6. Factory wiring is in accordance with National Electrical Code (NEC). Field modifications or additions must be in compliance with all applicable codes.
7. Wiring for field power supply must be rated 60° C. Use copper, copper-clad aluminum or aluminum conductors.
8. Terminals G/6, Y2/3 & C/7 of TB3 are for class 2 (24 V) field external interlock connections. Class 1 field interlock contacts must have minimum rating of 180 VA, 220 V, 50/60 Hz pilot duty. Class 2 field interlock contacts must have minimum rating of 70 VA, 24 V, 50/60 Hz pilot duty.
9. Control module internal illustrated to indicate components orientational sequence. All items illustrated are theoretically represented as internal to component.
10. The factory-supplied LLSV drop control is shipped with the 38AKS unit but field installed at the indoor unit.
11. To change fan rotation, interchange fan motor connections 1 and 3.

POWER SCHEMATIC

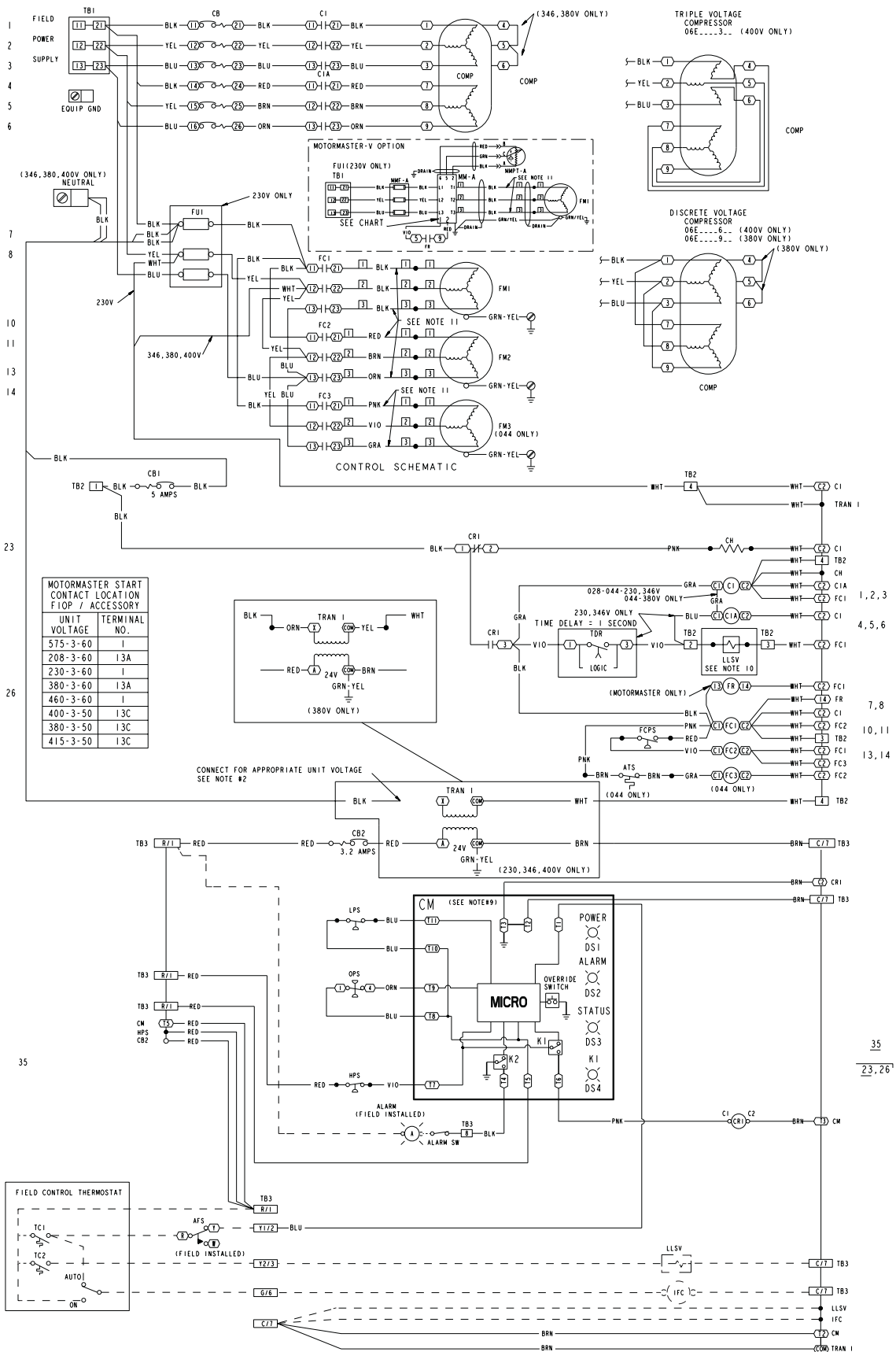
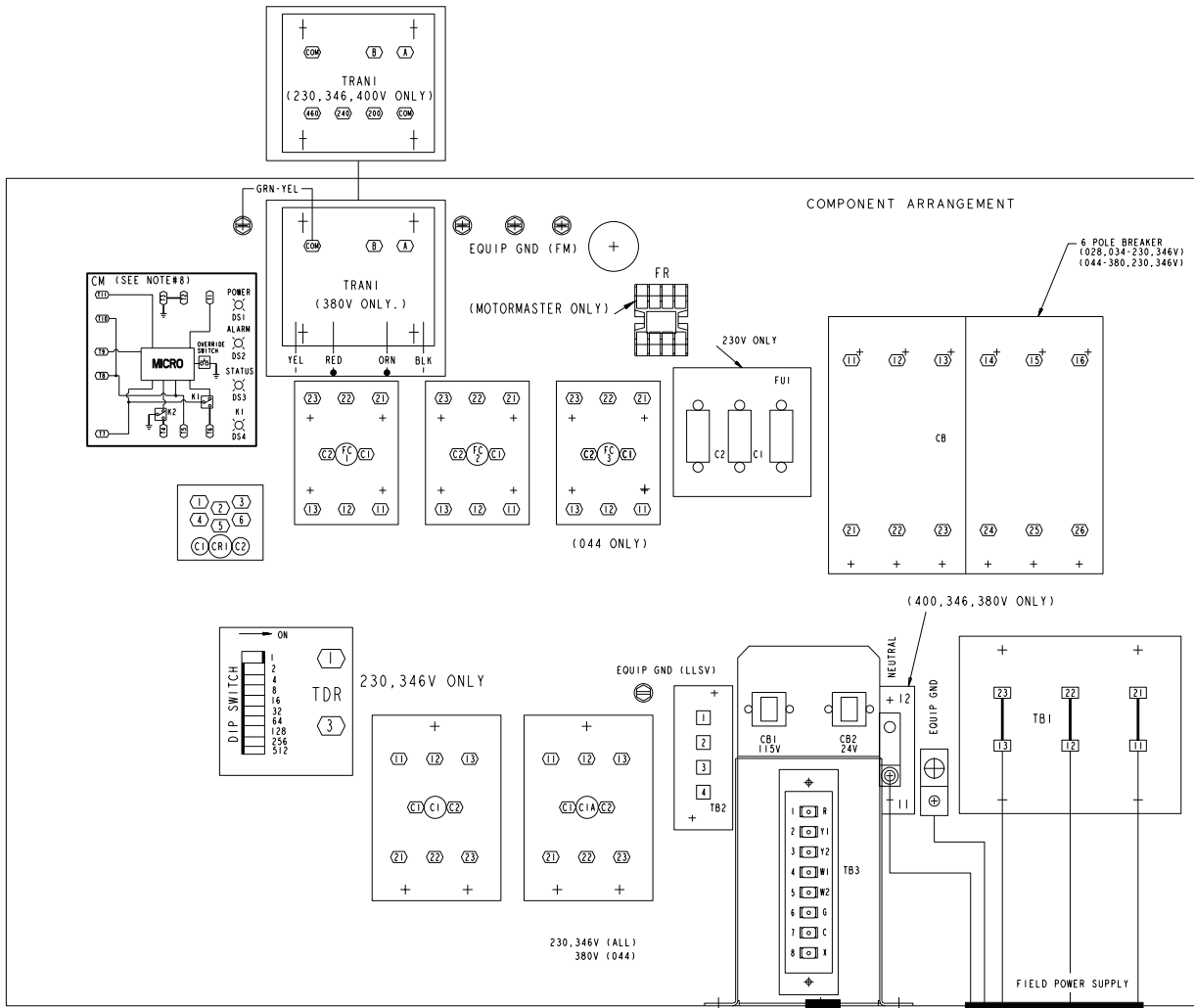


Fig. 4 — Wiring Schematic — 38AKS 230-3-50, 346-3-50, 380-3-60, 400-3-50



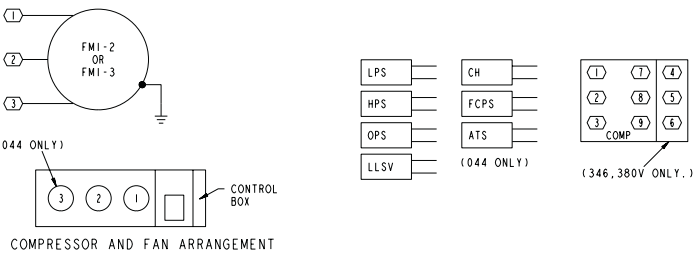
CM ALARM CODES				
LED	NUMBER OF BLINKS *	TIME (sec)		STATUS
		ON	OFF	
<b>DS1 POWER LED</b>				
	1	$\frac{1}{4}$	$\frac{1}{4}$	NORMAL OPERATION
		STEADY	$\frac{1}{4}$	LOCKOUT STATE
<b>DS2 ALARM LED</b>				
		STEADY		HPS OR COTP OPEN
	1	$\frac{1}{4}$	1	LPS OPEN
	2	$\frac{1}{4}$	1	OPS OPEN
	3	$\frac{1}{4}$	1	LPS/OPS OPEN
<b>DS3 STATUS LED</b>				
		STEADY	STEADY	NO CALL FOR COOLING
				COOLING
	1	$\frac{1}{4}$	$\frac{1}{4}$	3 MIN. CMP DELAY
<b>DS4 "KI" LED</b>				
		STEADY		RELAY KI CLOSED

\* - MULTIPLE BLINKS ARE A SERIES OF ON/OFF FLASHES OF EQUAL DURATION FOLLOWED BY 1 SECOND OFF.

**Fig. 5 — Component Arrangement — 38AKS 230-3-50, 346-3-50, 380-3-60, 400-3-50**

**NOTES FOR FIG. 4 AND 5**

- Connect to TRAN1 240 V terminal for 400 and 230 V units, 200 V terminal for 346 V units or ORN lead for 380 V units.
- Compressor and fan motors thermally protected. Three phase motors protected against primary single phasing conditions.
- Replacement of original wires must be with Type 90° C wire or its equivalent.
- Line # indicates location of contacts,  $\overline{\#}, \#$  signifies single-pole double-throw contacts, # signifies a normally closed contact, # signifies a normally open contact.
- Factory wiring is in accordance with National Electrical Code (NEC). Field modifications or additions must be in compliance with all applicable codes.
- Wiring for field power supply must be rated 60° C. Use copper, copper-clad aluminum or aluminum conductors.
- Terminals G/6, Y2/3 & C/7 of TB3 are for class 2 (24 V) field external interlock connections.  
Class 1 field interlock contacts must have minimum rating of 180 VA, 220 V, 50/60 Hz pilot duty.  
Class 2 field interlock contacts must have minimum rating of 70 VA, 24 V, 50/60 Hz pilot duty.
- Control module internal illustrated to indicate components orientational sequence. All items illustrated are theoretically represented as internal to component.
- The factory-supplied LLSV drop control is shipped with the 38AKS unit but field installed at the indoor unit.
- To change fan rotation, interchange fan motor connections 1 and 3.



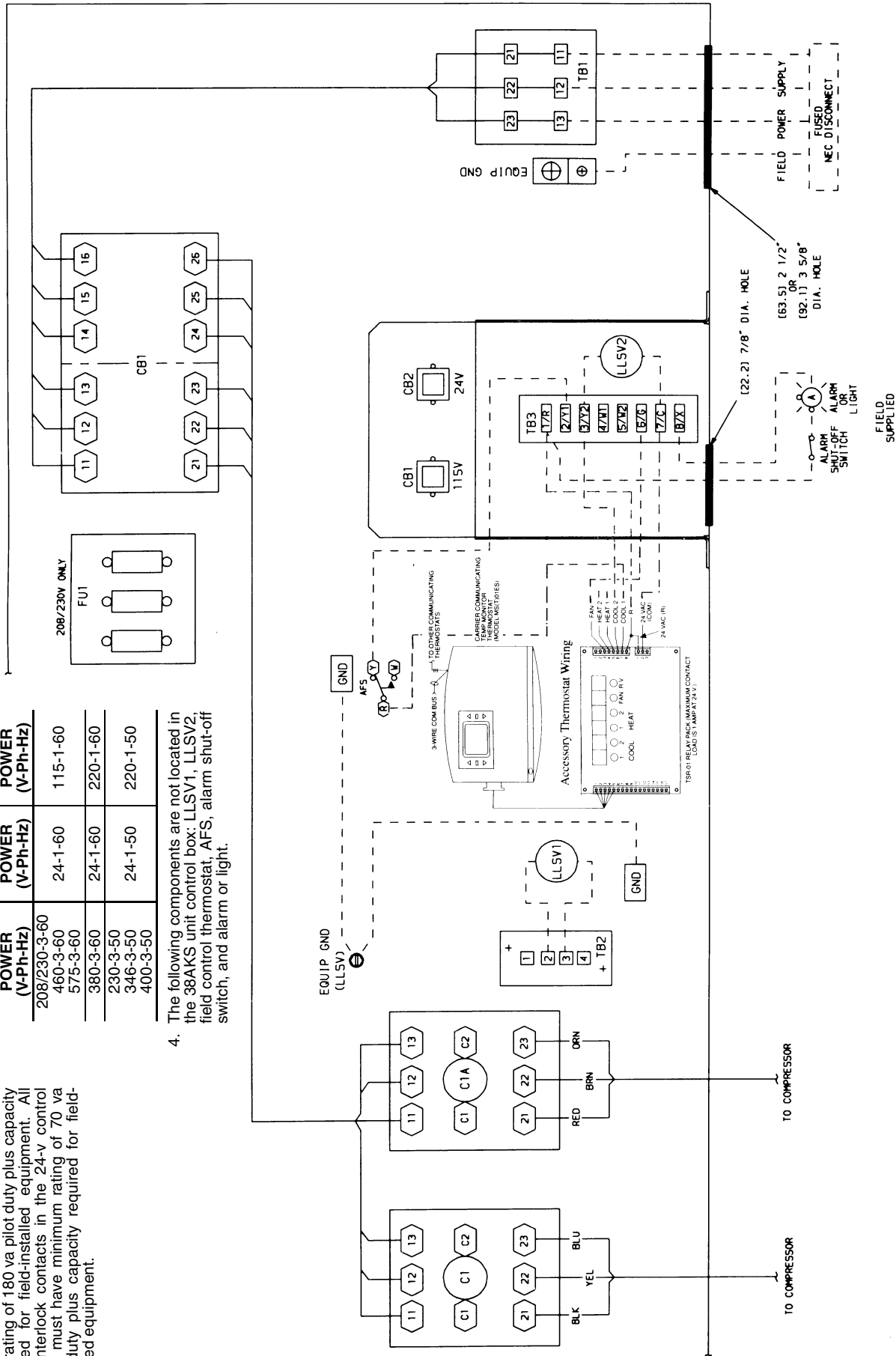
**NOTES:**

1. Factory wiring in accordance with the NEC. Any field modifications or additions must be in compliance with all applicable codes.
2. All field interlock contacts must have minimum rating of 180 va pilot duty plus capacity required for field-installed equipment. All field interlock contacts in the 24-v control circuit must have minimum rating of 70 va pilot duty plus capacity required for field-installed equipment.

3. For internal unit wiring, refer to Fig. 2-5 or unit wiring label diagram. Power for TB1 and TB2 follows:

UNIT POWER (V-Ph-Hz)	TB1 POWER (V-Ph-Hz)	TB2 POWER (V-Ph-Hz)
208/230-3-60	24-1-60	115-1-60
460-3-60	24-1-60	115-1-60
575-3-60	24-1-60	220-1-60
380-3-60	24-1-60	220-1-60
230-3-50	24-1-50	220-1-50
346-3-50	24-1-50	220-1-50
400-3-50	24-1-50	220-1-50

4. The following components are not located in the 38AKS unit control box: LLSV1, LLSV2, field control thermostat, AFS, alarm shut-off switch, and alarm or light.



**Fig. 6 — Typical Field Wiring — Electronic Arrangement Thermostat, Liquid-Line Solenoid Valves, and Power**

## ACCESSORY WIRING

**Field-Installed Accessories** — Ordering numbers for field-installed accessories are listed on product price pages. For field installation of these accessories, see the installation instructions supplied with the accessories, in addition to the following instructions. Refer to the wiring labels for complete unit wiring schematics and location of control box components.

**PART WINDING START** — Order part number HN67ZA001.

**NOTE:** All units have standard across-the-line compressor start. The availability of part winding start is shown below:

380, 575 V, 60 Hz units require special order to change circuit breakers and contactors.

460 V, 60 Hz and 400 V, 50 Hz units require special order to change circuit breakers, and contactors and can not use triple voltage compressor.

208/230 V, 60 Hz units can be field modified to part winding start by adding a time delay-relay (part no. HN67ZA001).

230, 346 V, 50 Hz units part winding start factory-installed as standard equipment.

**Installation** — Pre-drilled holes for time delay relay are located in lower left corner of control box, below control relay TR1. Use two no. 6B-20 screws to fasten time-delay relay to control box. Remove gray (GRA) wire between C1 terminal of compressor contactor coils C1 and C1A. Wire time delay relay HN67ZA001 between C1 terminal of compressor contactor coils C1 and C1A and install jumper on center terminals. See Fig. 7.

**HOT GAS BYPASS** (38AKS028-044, 60 Hz and 50 Hz) — Order part number 30GA900161 (115 v) or 30GA900171 (230 v).

See Fig. 8 and install as follows:

### Wiring

1. Install a field-supplied relay (Carrier Part Number HN61KK324 or any relay with a 24-v coil and normally closed contacts, rated for 20 va at 125 vac inductive load). Mount relay in the 38AKS control box.
2. **115-v:**
  - a. Add a wire (field-supplied) between TB2 [2] and HGR [4].
  - b. Wire one leg of hot gas bypass pilot solenoid to HGR [6].
  - c. Run other wire on hot gas pilot solenoid to TB2 [3].

### 24-v:

- a. Connect a field-supplied wire between TB3 [Y2] and the L1 side of HGR coil.
- b. Connect a field-supplied wire between TB3 [C] and the L2 side of HGR coil.

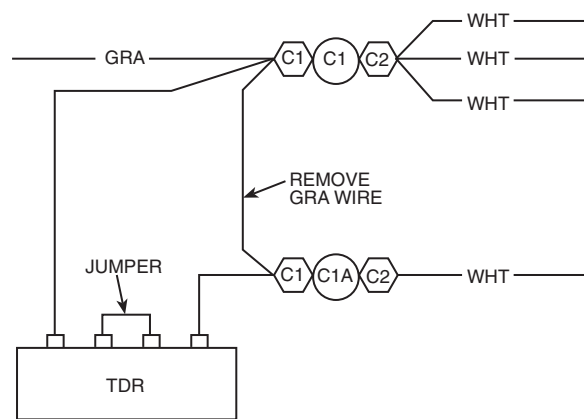
### Piping

**IMPORTANT:** When applying Part Numbers 30GA900161 and -171 to split systems, locate the hot gas bypass valve in the condensing unit (NOT at the fan coil). Sweat the pilot solenoid valve directly to the 3/8-in. ODF external equalizer port on the hot gas bypass valve.

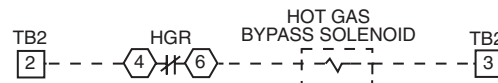
**LOW AMBIENT HEAD PRESSURE FAN CONTROL** — For 208/230-volt units, order part number 30GT-911---077; for 380, 400, or 460-volt units, order part number

30GT-911---078; for 575-volt units order part number 30GT-911---079.

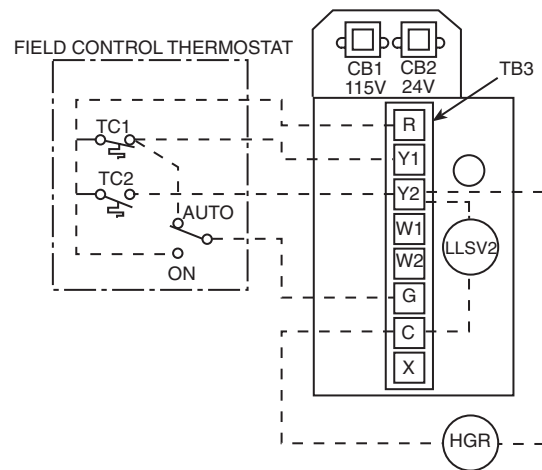
The Motormaster® V control (Fig. 9) permits unit operation to an ambient temperature of -20 F (-29 C). The control regulates the speed of 3-phase fan motors that are compatible with the control. These motors are factory-installed on 60 Hz units, but must be field-installed on 50 Hz units.



**Fig. 7 — Time Delay Relay Wiring**



**115-V CIRCUIT**

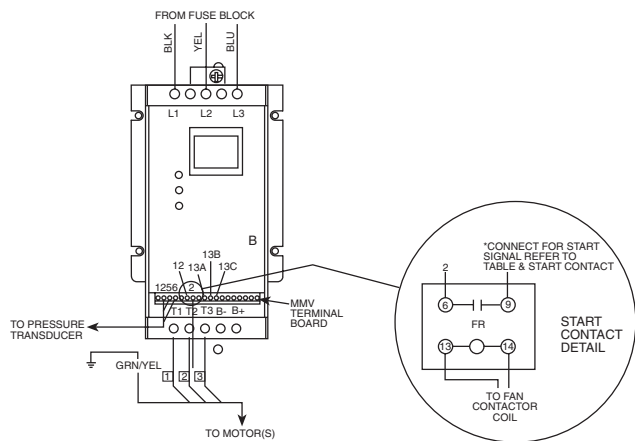


**24-V CIRCUIT**

### LEGEND

- CB** — Circuit Breaker
- HGR** — Hot Gas Relay
- LLSV** — Liquid Line Solenoid Valve
- TB** — Terminal Board
- TC** — Thermostat, Cooling

**Fig. 8 — Hot Gas Bypass Control Wiring Schematics**



**Fig. 9 — Motormaster® V Control**

**⚠ WARNING**

To avoid electric shock and personal injury open and tag all electrical disconnects before installing or servicing unit.

**⚠ WARNING**

Hazard of electric shock! Wait three minutes after disconnecting incoming power before servicing drive. Capacitors retain charge after power is removed.

Refer to Fig. 10 for the proper mounting locations for the controller, relay, fuse box and fuses. Use the 8 x 3/4-in. screws provided with the Motormaster V kit to mount controls and fuse blocks to the control box. Use 10 x 1/2-in. screws to mount the relay.

Install the pressure transducer in the proper location on the liquid line. See Fig. 11.

Install a field-supplied Schrader port and valve into the liquid line near the liquid line valve on each circuit. Mount pressure transducer on this valve.

NOTE: Ensure that the liquid line valve is not backseated or the pressure transducer will not read correctly.

**⚠ CAUTION**

To avoid damage to the small terminals on the Motormaster V control, use care when tightening the compression terminals and use the proper size screwdriver.

**⚠ CAUTION**

DO NOT connect incoming AC power to Motormaster V output terminals T1, T2, and T3! Severe damage to the control will result.

The required electrical connections for the Motormaster V control are for incoming power, outgoing power, and control signals. All required wires are provided in each kit.

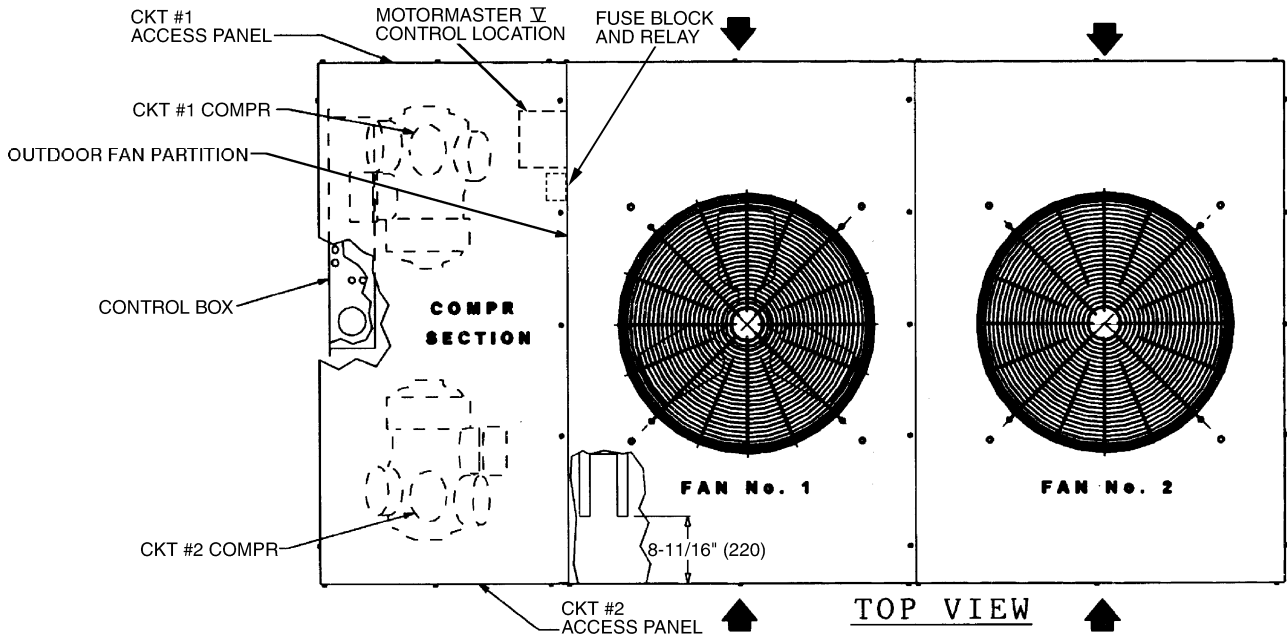
Follow these wiring instructions and refer to Fig. 12:

1. Mark the shielded cable from FM1 to FC1 at Motormaster V controller location. The cable will be cut at this point, so be sure to allow enough slack to reach the Motormaster V controller and fuse block.
2. In the area marked, cut the cover off of the cable. Cut each individual wire and mark both ends for identification. Mark wires 1, 2 and 3.
3. Strip the ends of the wires coming from FC-1, and attach them to one side of the fuse block.
4. Install the 10-in. black, yellow and blue wires from the fuse block to the Motormaster V terminal block (L1, L2 and L3). The BLK, YEL, and BLU wires are on the same fuse as wires 1, 2 and 3, and are on Motormaster V terminals L1, L2 and L3, respectively.
5. Install the other end of the cut wires (on the FM side) into the Motormaster V terminal block T1, T2 and T3 terminals.
6. Ground shield with the ground wire from each side of the cut shielded cable.
7. Remove wires from FC-1, T1/T2/T3 and connect at FU1 (or TB1 if FU1 not used).
8. Attach the sensor cable to the pressure transducer and route it to the controller. Ensure that the cable is separated from all sharp edges. Trim the lengths of the cable as desired, but ensure that shield drain wire is used.
9. Attach the RED, GRN and BLK wires from the sensor cables to the Motormaster V control terminal block positions 6, 5 and 2, respectively. Attach shield drain wire to the panel where the Motormaster V is mounted.
10. Attach VIO and the RED wires from FR-1 fan relay terminals 5 and 9 to Motormaster control. The RED wire connects at terminals 2, the VIO wire to the terminal listed in Table 1. Repeat for circuit B using VIO and RED wires.
11. Attach GRA and the RED wires to FR-1 terminals 13 and 14. Attach the other ends to FC-1 terminals C1 and C2. Repeat for circuit B using VIO and RED wires.

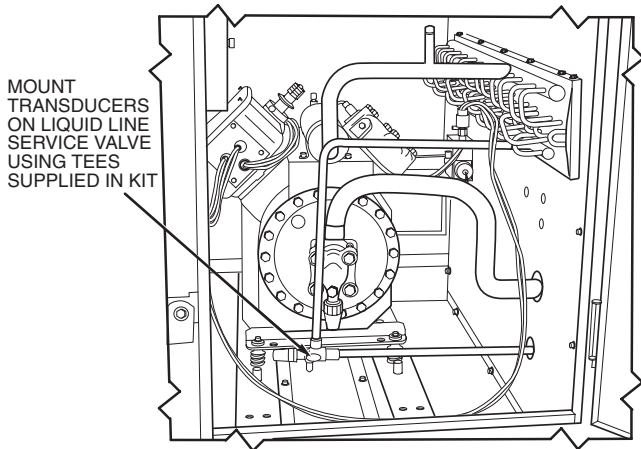
**Table 1 — Motormaster V Configuration Table**

MODE	NOM VOLTAGE	Hz	CONTROL INPUT (PIN 5)	START CONTACT	SETPOINT JUMPER	REFRIGERANT
1	208*/230/460/575	60	Internal PI control, 0-5V feedback	TB1-TB2	None	R-22
2	208*/380	60	Internal PI control, 0-5V feedback	TB13A-TB2	None	
3	230	50	Internal PI control, 0-5V feedback	TB13B-TB2	None	
4	380/415	50	Internal PI control, 0-5V feedback	TB13C-TB2	None	
9	208*/230/460/575	60	Internal PI control, 0-5V feedback	TB1-TB2	TB12-TB2	R-134a
10	208*/380	60	Internal PI control, 0-5V feedback	TB13A-TB2	TB12-TB2	
11	230	50	Internal PI control, 0-5V feedback	TB13B-TB2	TB12-TB2	
12	380/415	50	Internal PI control, 0-5V feedback	TB13C-TB2	TB12-TB2	

\*At 208 v, the drive can run in either mode.

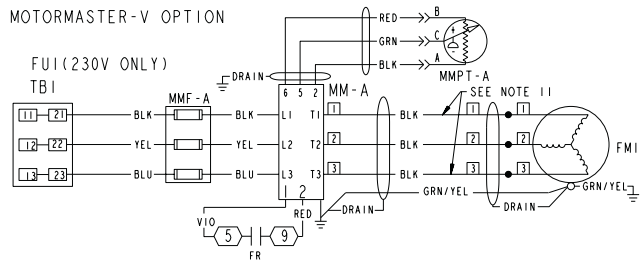


**Fig. 10 — Motormaster® V Control Location; 38AKS028-044**



COMPRESSOR END, RIGHT-SIDE ACCESS DOOR

**Fig. 11 — 38AKS028-044 Pressure Transducer Location**



- LEGEND**
- FM** — Fan Motor
  - MM** — Motormaster Control
  - MMF** — Motormaster Fuse Block
  - MMPT** — Motormaster Pressure Transducer
  - TB** — Terminal Block

**Fig. 12 — 38AKS028-044 Schematic Diagram**



