

# INSTALLATION INSTRUCTIONS

DNLOWAMB015A00, DNLOWAMB016A00 and DNLOWAMB017A00

Accessory Low Ambient Motor Controller For Models PGS240, 300 and PGE240

These instructions must be read and understood completely before attempting installation.

## CONTENTS

SAFETY CONSIDERATIONS .....	1
INTRODUCTION .....	1,2
Pre-Installation .....	2
INSTALLATION .....	2-6
Step 1 — Install Field-Fabricated Wind Baffles .....	2
Step 2 — Mounting and Electrical Connections for Motor Controller .....	3
208/230-V UNITS	
460,575-V UNITS	
Step 3 — Configure Motor Controller .....	6
Step 4 — Test Motor Controller .....	6
START-UP .....	6,7
Drive Programming .....	6
TROUBLESHOOTING .....	8,9
Fault Lockout .....	8
EPM Chip .....	8
Loss of CCN Communications .....	8

## Safety Considerations

Installation, start-up, and servicing of air-conditioning equipment can be hazardous due to system pressure, moving parts, and electrical components.

Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit or accessory, and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves.



## WARNING

### ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch. Tag disconnect switch with suitable warning label.

## INTRODUCTION

This book contains instructions for the installation, start-up, and troubleshooting of the Low Ambient Motor Controller on large rooftop units with a capacity range of 20 to 25 tons.

The Low Ambient Motor Controller is a motor speed control device which adjusts condenser fan motor speed in response to declining liquid refrigerant pressure. A properly applied Motor Controller extends the operating range of air-conditioning systems and permits operation at lower outdoor ambient temperatures.

Table 1 shows the ambient temperature at which the units operate.

Table 1 - Minimum Outdoor-Air Operating Temperature

TEMPERATURE OPERATING LIMITS — F° (C°)			
Unit	Standard Unit	Unit with Low Ambient Kit	Unit with Motor Controller
PGS240, 300 PGE240	40 (4)	25 (-4)	-20 (-29)

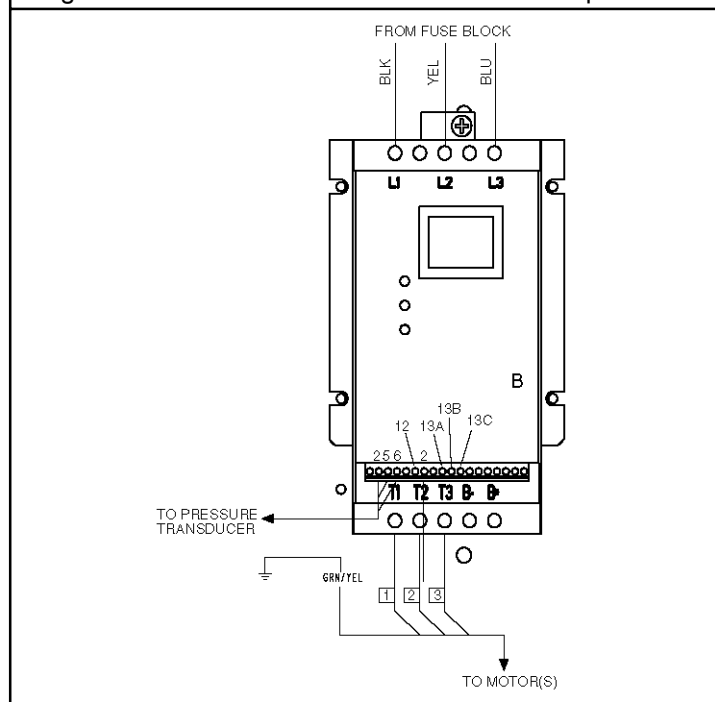
To operate these units to the ambient temperatures listed, a Motor Controller (Fig. 1) must be added. Field-fabricated and installed wind baffles are also required for all units (refer to Step 1). The Motor Controller permits operation of the unit to an ambient temperature of -20 F (-29 C). The control regulates the speed of 3-phase fan motors that are compatible with the control. These motors are factory installed.

See Tables 2 and 3 for the Motor Controller accessory package usage and contents. Table 4 shows applicable voltages and motors. Replacement of motor or fan blade **IS NOT REQUIRED ON CURRENT PRODUCTION UNITS** since the control is compatible with the factory-installed fan motors. Only field wiring control is required.

Table 2 — Motor Controller Package Usage

Unit	Voltage	Item Description
PGS240, 300 PGE240	208/230	DNLOWAMB015A00
	460	DNLOWAMB016A00
	575	DNLOWAMB017A00

Figure 1 - Motor Controller for Low Ambient Operation



**Table 3 — Motor Controller Package Contents**

ITEM	DNLOWAMB015A00	DNLOWAMB016A00	DNLOWAMB017A00
Motor Controller 230-V 5 Hp	HR46TN004	—	—
Motor Controller 460-V 5 Hp	—	HR46TN005	—
Motor Controller 575-V 5 Hp	—	—	HR46TN006
Screw 8B-18-3/8 in.	AL56AU165 (13)	AL56AU165 (9)	AL56AU165 (9)
Terminal Block	HY84FE003		
Support Bracket	50TJ501126		
Snap Bushing (1-3/4 in.)	HY93NH091		
Harness Assembly	50TJ401133	50TJ401132	50TJ401132
Screw 1-14 x 7/8 in.	AL82AR309 (4)		
Harness Assembly	50TJ401135	50TJ401134	50TJ401134
Fuse Block	HY11UT035		
Fuse 15A, KTK-R, Class CC	—	—	HY10KB151 (3)
Fuse 20A, KTK-R, Class CC	—	HY10KB200 (3)	—
Fuse 30A, KTK-R, Class CC	HY10KB300 (3)	—	—
Transducer	HK05YZ007		
Cable Assembly	30GT415784		
Wire Tie	HY76TB123 (5)		
Wire Tie	HY76TB035 (2)		
Relay	HN61KK035		
Screw	AK92AB126 (4)	AK92AB126 (2)	AK92AB126 (2)
Wire 15 in. Long	(2)		
Wire 47 in. Long	(2)		
Wire Connector	HY89SB030 (2)		
Snap Bushing (7/8 in.)	HY93NH060		

**Table 4 — Applicable Voltages and Motors**

Voltage	Compatible Motor*
208/230-3-60	HD52AK654
460-3-60	HD52AK654
575-3-60	HD52GE576

Pre-Installation — Inspect the contents of this accessory package before installing. File a claim with the shipper if you find shipping damage or if a part is missing.

## INSTALLATION:

### Step 1 — Install Field-Fabricated Wind Baffles

## ⚠ WARNING

### ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch. Tag disconnect switch with suitable warning label.

Wind baffles must be field fabricated for all units to ensure proper cooling cycle operation at low-ambient temperatures with Motor Controllers. See Fig. 2 for baffle details. Use 20-gage (1 mm) galvanized sheet metal, or similar corrosion-resistant material for the baffles. Use field-supplied screws to attach baffles to unit. Screws should be 1/4-in. (6.3 mm) diameter or larger. Drill required screw holes for mounting baffles.

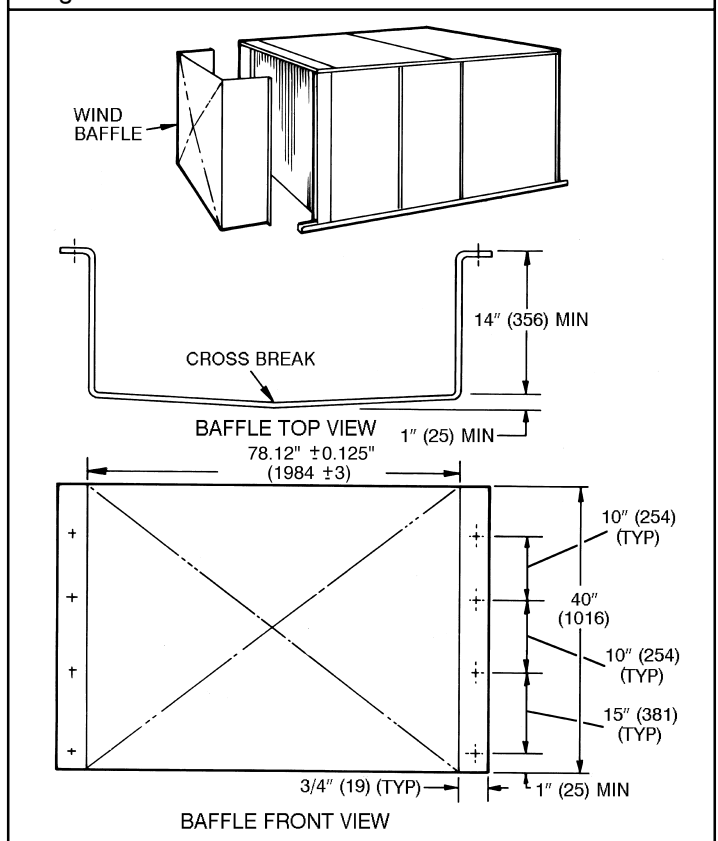
## ⚠ CAUTION

### PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in property damage.

To avoid damage to refrigerant coils, and electrical components, use extreme care when drilling screw holes and screwing in fasteners.

**Figure 2 - Wind Baffle Details**



## Step 2 — Mounting and Electrical Connections for Motor Controller

### 208-230 V Units

1. Remove the inner and outer access panels to the control box area, the panel to the area left of the control box and both compressor access panels.
2. Mount supplied Motor Controller Terminal Block (MMTB) approximately 4 1/2 in. from control box top as shown in Fig. 3.
3. Remove the 2 blue “piggy-back” wires from fuse 3 and connect to the number 3 terminal on the terminal block. Refer to Fig. 3 and 4.
4. Remove 2-pole Outdoor Fan Contactor (OFC) as shown in Fig. 5.

**NOTE:** Leave wires connected at this time because they will be removed in Step 6.

5. Remove supplied Motor Controller Fuse block (MMF) from controller/bracket assembly and install in the same location where the 2-pole contactor was removed in step 4.
6. On the 2-pole contactor, remove the black wire from terminal 11 and the yellow wire from terminal 13. Connect wires to MMTB, the black wire to terminal 1 and the yellow wire to terminal 2. Remove the remaining blue wires from fuse 3 and install them on terminal 3 of MMTB.
7. Remove the black and yellow wires from 2-pole contactor terminals 21, 23, and fuses 1 and 2.
8. Connect the 3-conductor wire harness from fuses 1, 2 and 3 to the line side of the new fuse block.
  - a. Black wire to fuse 1 and terminal 1 of the new fuse block.
  - b. Yellow wire to fuse 2 and terminal 2 of the new fuse block.
  - c. Blue wire to fuse 3 and terminal 3 of the new fuse block.
9. Use the supplied self-tapping screws and attach controller/bracket assembly in the upper left corner below the control box. Locate the bracket against the bottom of the control box and flush with the left side.

Figure 3 - Terminal Block Mounting

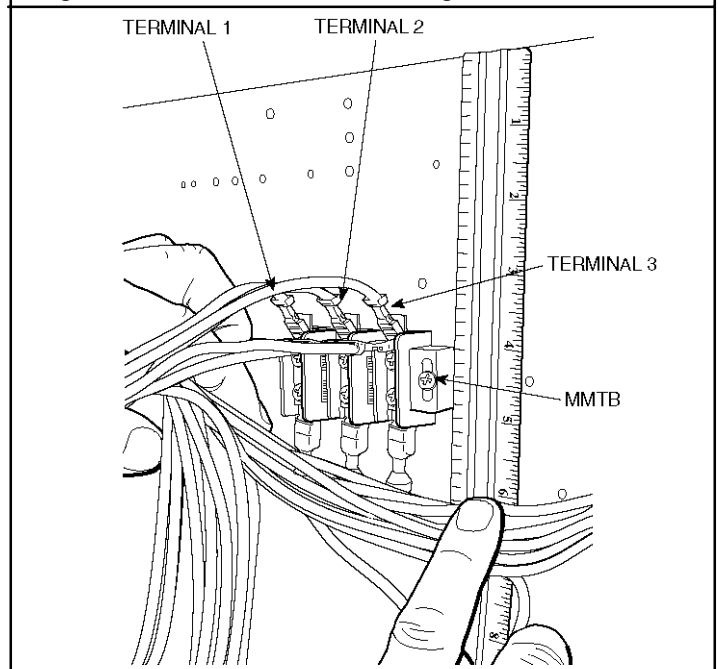


Figure 4 - “Piggy-back” Wires

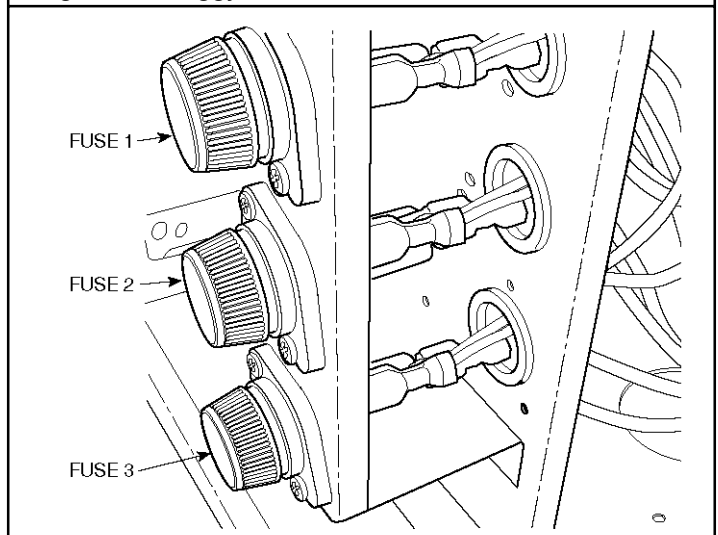
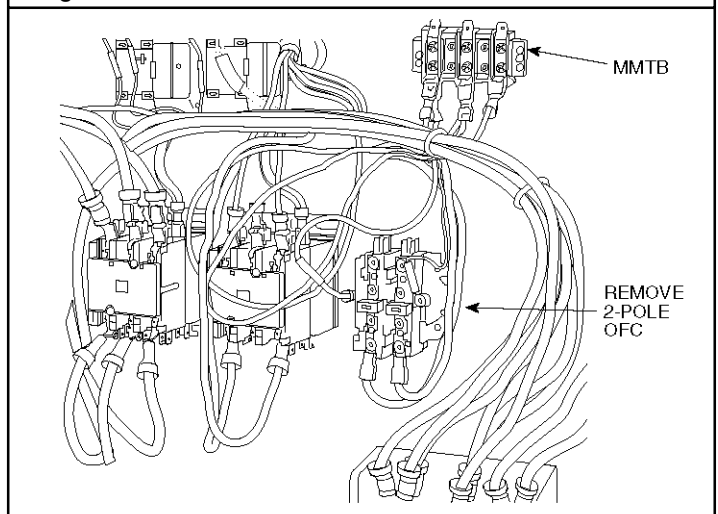


Figure 5 - 2 Pole OFC



10. Remove one of the 1<sup>3</sup>/<sub>4</sub> in. knockouts in the bottom of the control box and insert the supplied snap bushing in the hole. Route the 6-wire harness from the MMV controller/bracket assembly through the hole. Attach the insulated terminals of the black, yellow and blue wire (labeled MMTB) to the corresponding terminals on the terminal block. Connect the other 3 insulated terminals labeled FU1, FU2 and TB1-23 to the load side of MMF, terminals 1, 2 and 3 respectively.
11. Attach the un-insulated terminals labeled MMV-T1, MMV-T2 and MMV-T3 to the MMV load side and the remaining 3 un-insulated terminals to the line side of the MMV control (black to L1, yellow to L2 and blue to L3).
12. Install the accessory relay next to the fuse block installed in Step 5. See Fig. 6.
13. Remove the wires from the coil side of the 2-pole contactor and install on the coil side of the new relay, terminals 13 and 14.
14. Connect one end of the 47 in. long black wire to terminal 1 on the MMV control input terminal strip. Connect the other end to terminal 1 on the relay base. Connect one end of the accessory brown wire to terminal 2 on the MMV control input terminal strip. Connect the other end to terminal 5 on the relay base. Terminals 1 and 5 are NO (Normally Open) relay contacts.
15. Install the fuses in the new fuse block.
16. Attach supplied pressure transducer to liquid line service port as shown in Fig. 7. Route the transducer cable on the basepan and attach to the motor base plate using the supplied ring wire ties and self-tapping screws. Next, route the cable through the bulkhead with the existing wiring harness. Last, insert the 7/8 in. snap bushing in the hole on the side of the control box and route the transducer cable through the control box to the MMV control as shown in Fig. 8.
17. Attach red, green and black wires from transducer sensor cable to MMV terminal block 6, 5 and 2 respectively according to Fig. 9. Remove the ground lug and ground wire from the bracket and re-attach in combination with the transducer shield drain wire. Attach the other end of the ground wire to the unit ground lug inside the control box.
18. Using the remaining wire ties "dress" the wires going to the terminal block, MMV transducer wires and MMV harness.

Figure 6 - 3 Pole OFC

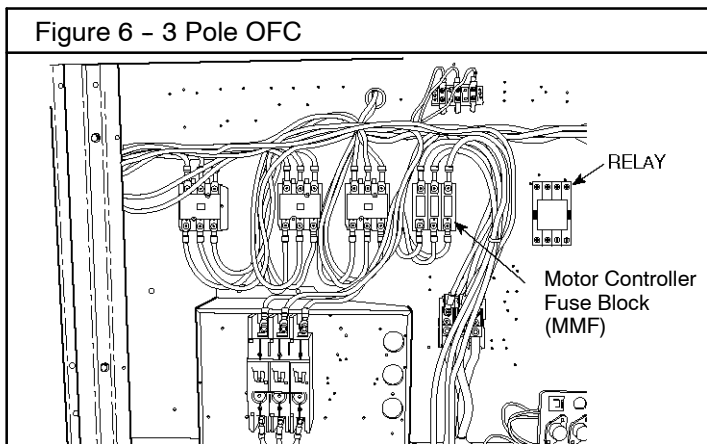


Figure 7 - Transducer Location

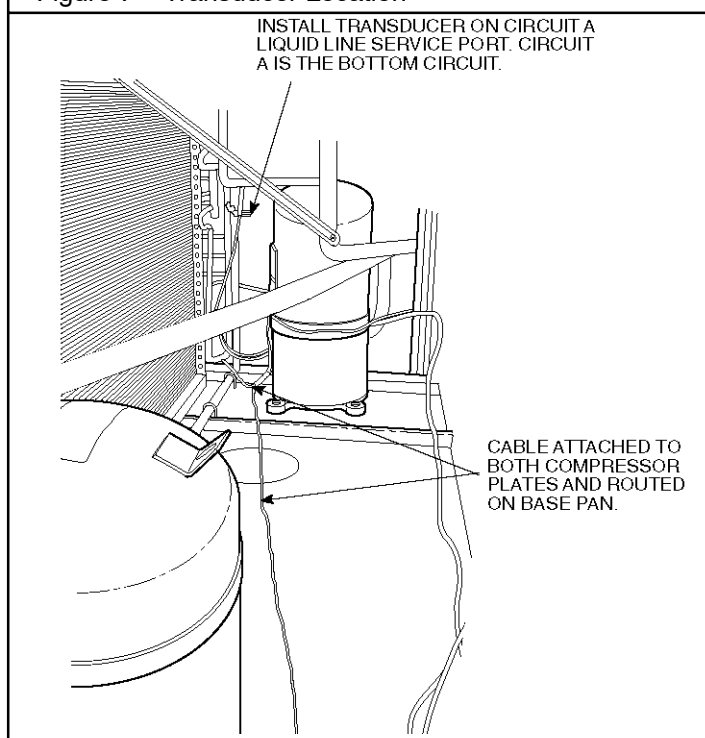


Figure 8 - Transducer Cable Routing

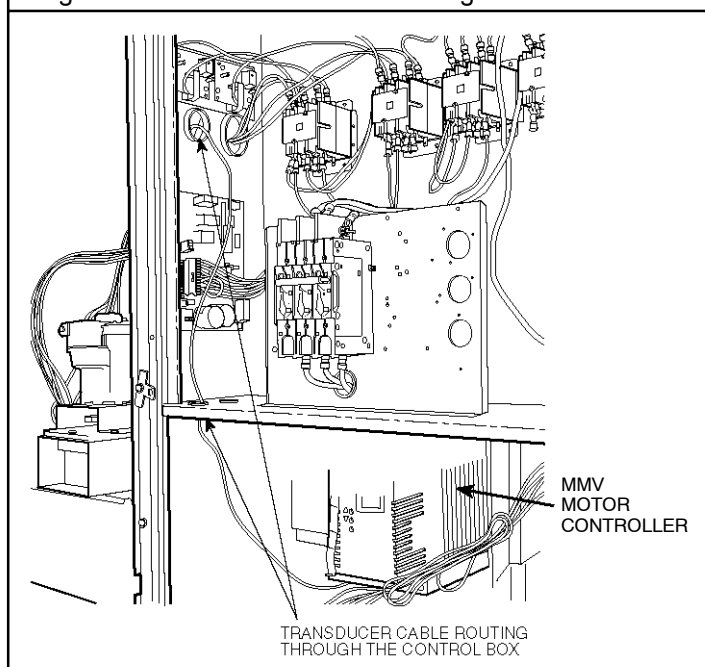
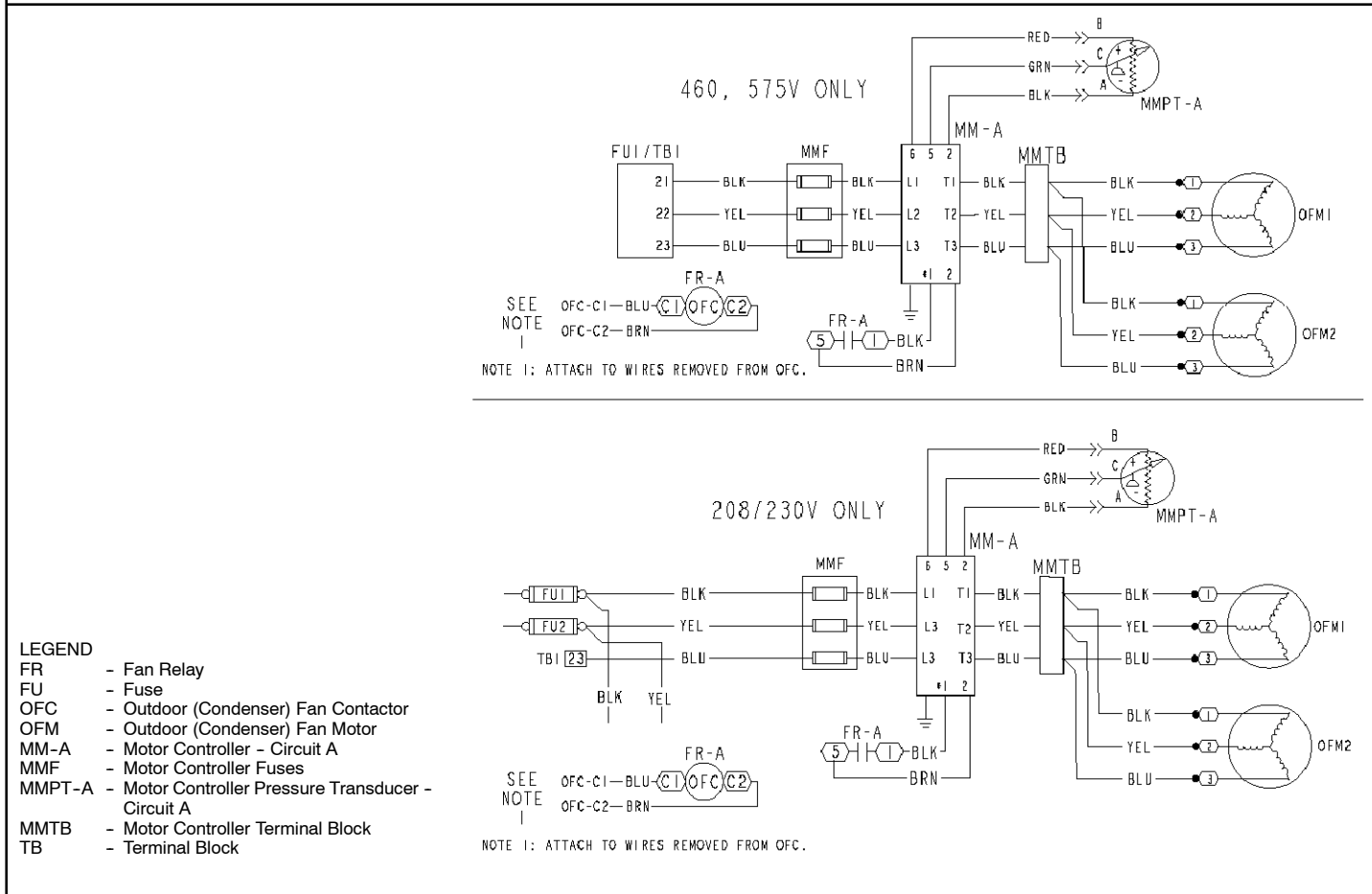


Figure 9 – Transducer Wiring Schematic



## 460 V and 575 V Units

- Remove the inner and outer access panels to the control box area, the panel to the area left of the control box and both compressor access panels.
- Mount accessory terminal block (MMTB) approximately 4 1/2 in. from control box top as shown in Fig. 3.
- Remove Outdoor-Fan Contactor (OFC) wires from pins 11, 12 and 13 and attach to terminals 1, 2 and 3 respectively on MMTB. See Fig. 3.
- Remove the outdoor-fan contactor but leave the wires attached to it. They will be removed and installed on the new fuse block.
- Install the accessory fuse block (MMF) in the same location where the contactor was removed. See Fig. 6.
- Remove the wires from terminal 21, 22, and 23 of the outdoor-fan contactor and connect them to the line side of MMF.
- Use the supplied self-tapping screws and attach controller/bracket assembly in the upper left corner below the control box. Locate the bracket against the bottom of the control box and flush with the left side.
- Remove one of the 1 3/4 in. knockouts in the bottom of the control box and insert the supplied snap bushing in the hole. Route the 6-wire harness from the MMV controller/bracket assembly through the hole. Attach the insulated terminals of the black, yellow, and blue wire (labeled MMTB) to the corresponding terminal on MMTB. Connect the other 3 insulated terminals labeled FU1/TB1-21, FU1/TB-22, FU1/TB-23 to the load side of MMF, terminals 1, 2, and 3 respectively.
- Attach the uninsulated harness terminals labeled MMV-T1, MMV-T2 and MMV-T3 to the MMV load side and the remaining 3 uninsulated terminals to the line side of the MMV control (black to L1, yellow to L2 and blue to L3).
- Install the accessory relay next to the location where the OFC was removed. See Fig. 6.
- Remove the wires from the coil side of the OFC and install them on the coil side of the new relay, terminal 13 and 14.
- Connect one end of the 47 in. long black wire to terminal 1 on the MMV control input terminal strip. Connect the other end to terminal 1 of the relay base. Connect one end of the accessory brown wire to terminal 2 on the MMV control input terminal strip. Connect the other end to terminal 5 on the relay base. Terminals 1 and 5 are NO (Normally Open) relay contacts.
- Install fuses in the fuse block.

14. Attach supplied pressure transducer to liquid line service port as shown in Fig. 7. Route the transducer cable on the basepan and attach to the motor base plate using the supplied ring wire ties and self-tapping screws. Next, route the cable through the bulkhead with the existing wiring harness. Last, insert the 7/8 in. snap bushing in the hole on the side of the control box and route the transducer cable through the control box to the MMV control as shown in Fig. 8.
15. Attach red, green and black wires from transducer sensor cable to MMV terminal block 6, 5 and 2 respectively according to Fig. 9. Remove the ground lug and ground wire from the bracket and re-attach in combination with the transducer shield drain wire. Attach the other end of the ground wire to the unit ground lug inside the control box.
16. Using the remaining wire ties "dress" the wires going to the terminal block, MMV transducer wires and MMV harness.

### Step 3 — Configure Motor Controller

The Motor Controller is configured for an operation mode of internal Pressure Independent (PI) control and 0 to 5V feedback by the jumper which is already installed on TB1-TB2. No additional programming is required. Note that the pressure transducer must be attached for proper configuration. See Table 5.

**Table 5 - Configuration Table**

Mode	Nominal Voltage	Control Input (Pin 5)	Start Jumper	Set Point Jumper
1	208 230 460 575	Internal Pi Control, 0-5v feedback	TB1-TB2	None

### START-UP

When the system calls for cooling, the fan contactor will be energized to power the Motor Controller electronic control. The LED will display the speed of the motor. The display range will be 8 to 60 Hz. The Motor Controller electronic control will start the condenser fan when the compressor engages. The control will adjust the fan speed to maintain approximately 135 psig liquid line pressure. Above that pressure, the fan should operate at full speed.

The Motor Controller uses a 0 to 5 vdc signal input from a pressure transducer attached to the liquid line service valve gage port on circuit A. The pressure transducer is connected to terminals 2, 5 and 6 on the controller. The Motor Controller is configured by jumper wires and sensor input types. No field programming is required. If Motor Controller does not function properly, the information provided below can be used to program and troubleshoot the drive.

Drive Programming — Table 6 shows all program parameters for each of the operating modes. Refer to troubleshooting section below before attempting to change programming in the Controller.

#### TO ENTER PASSWORD AND CHANGE PROGRAM VALUES:

1. Press MODE. Upper right decimal point blinks. Display reads "00".

2. To enter the PROGRAM mode to access the parameters, press the MODE button. This will activate the PASSWORD prompt (if the password has not been disabled). The display will read "00" and the upper right-hand decimal point will be blinking.
3. Use the UP and DOWN buttons to scroll to the password value (the factory default password is "111") and press the MODE button. Once the correct password value is entered, the display will read "P01", which indicates that the PROGRAM mode has been accessed at the beginning of the parameter menu (P01 is the first parameter).

NOTE: If the display flashes "Er", the password was incorrect, and the process to enter the password must be repeated.

4. Press MODE to display present parameter setting. Upper right decimal point blinks. Use UP and DOWN to scroll to the desired parameter number.
5. Once the desired parameter number is found, press the MODE button to display the present parameter setting. The upper right-hand decimal point will begin blinking, indicating that the present parameter setting is being displayed, and that it can be changed by using the up and down buttons. Use UP and DOWN to change setting. Press MODE to store new setting.
6. Press MODE to store the new setting and also exit the PROGRAM mode. To change another parameter, press the MODE key again to re-enter the PROGRAM mode (the parameter menu will be accessed at the parameter that was last viewed or changed before exiting). If the MODE key is pressed within two minutes of exiting the PROGRAM mode, the password is not required to access the parameters.
7. After two minutes, the password must be entered in order to access the parameters again.

TO CHANGE PASSWORD — Enter the current password then change P44 to the desired password.

TO RESET FACTORY DEFAULTS — To recognize a factory reset, the MMV Motor Controller must see a change in P48 **while start jumper is removed**. Select Mode 1, as referenced in Table 5.

1. Remove power from Controller.
2. Remove start jumper and then apply power to Controller.
3. Enter PROGRAM mode by entering password.
4. Scroll to P48 by using UP and DOWN and then press MODE. One of the 12 mode numbers will appear. (Only Mode 1 is used for these units.)
5. Restore factory defaults by changing the value in P48 using UP and DOWN and then storing the value by pressing MODE.
6. Press MODE again to re-display the value of P48.
7. Change the value of P48 to the desired factory default mode using UP and DOWN then press MODE. Motor Controller is now restored to factory settings.
8. Remove power from Controller.
9. Reinstall start jumper matching the mode selected in the above steps and re-apply power to drive.

**Table 6 — Program Parameters for the Operating Mode**

Parameters	Description	Mode 1
P01	Line Voltage: 01 = low line, 02 = high line	01
P02	Freq: 01 = 4kHz, 02 = 6 kHz, 03 = 8kHz	01
P03	Startup mode: flying restart	06
P04	Stop mode: coast to stop	01
P05	Standard Speed source: 01 = keypad, 04 = 4-20mA (NO PI), 05 = R22, 06 = R134a	05
P06	TB-14 output: 01 = none	01
P08	TB-30 output: 01 = none	01
P09	TB-31 Output: 01 = none	01
P10	TB-13A function sel: 01 = none	01
P11	TB-13B function sel: 01 = none	01
P12	TB-13C function sel: 01 = none	01
P13	TB-15 output: 01 = none	01
P14	Control: 01 = Terminal strip	01
P15	Serial link: 02 = enabled 9600,8,N,2 with timer	02
P16	Units editing: 02 = whole units	02
P17	Rotation: 01 = forward only, 03 = reverse only	01
P19	Acceleration time: 10 sec	10
P20	Deceleration time: 10 sec	10
P21	DC brake time: 0	0
P22	DC BRAKE VOLTAGE 0%	0
P23	Min freq = 8 Hz ~ 100 – 160 rpm	8
P24	Max freq	60
P25	Current limit: (%)	125
P26	Motor overload: 100	100
P27	Base freq: 60 or 50 Hz	60
P28	Fixed boost: 0.5% at low frequencies	0.5
P29	Accel boost: 0%	0
P30	Slip compensation: 0%	0
P31	Preset spd #1: speed if loss of control signal	57
P32	Preset spd #2: 0	0
P33	Preset spd #3: 0	0
P34	Preset spd 4 default — R22 setpoint. TB12-2 open	18.0
P35	Preset spd 5 default — R134a setpoint. TB12-2 closed	12.6
P36	Preset spd 6 default	0
P37	Preset spd 7 default	0
P38	Skip bandwidth	0
P39	Speed scaling	0
P40	Frequency scaling 50 or 60 Hz	60
P41	Load scaling: default (not used so NA)	200
P42	Accel/decel #2: default (not used so NA)	60
P43	Serial address	1
P44	Password: 111	111
P45	Speed at min signal: 8 Hz; used when PID mode is disabled and 4-20mA input is at 4 mA	8
P46	Speed at max feedback: 60 or 50 Hz. Used when PID disabled and 4-20mA input is at 20 mA	60
P47	Clear history? 01 = maintain. (set to 02 to clear)	01
P48	Program selection: Program 1 – 12	01
P61	PI Mode: 05 = reverse, 0-5V, 01 = no PID	05
P62	Min feedback = 0 (0V * 10)	0
P63	Max feedback = 50 (5V * 10)	50
P64	Proportional gain = 4%	4
P65	Integral gain = .2	.2
P66	PI accel/decel (setpoint change filter) = 5	5
P67	Min alarm	0
P68	Max alarm	0

## TROUBLESHOOTING

Troubleshooting the Controller requires a combination of observing system operation and VFD display information.

If the liquid line pressure is above the set point and the VFD is running at full speed, this is a normal condition. The fan **CANNOT** go any faster to maintain set point.

The MMV also provides real time monitoring of key inputs and outputs. The collective group is displayed through parameters P50–P56 and all values are read only. These values can be accessed without entering a password.

**NOTE:** The Motor Controller transducer is attached to circuit A. If circuit A compressor power is interrupted (overload, high pressure cutout, etc.) the outdoor fans will operate at a reduced speed resulting from erroneous low pressure readings. This process may cause a high pressure safety cutout on circuit B compressor. If only circuit B is capable of operating for a temporary period of time because of a circuit A problem, the transducer will have to be moved to the circuit B service port until circuit A can be repaired. Once the problem is repaired, move the transducer back to circuit A for proper unit operation.

Press MODE twice and P50 will appear.

Press MODE again to display value.

To scroll to P51–P56 from P50, use UP and DOWN keys then press MODE to display the value.

### **P50: FAULT HISTORY**

#### **P51: SOFTWARE version**

#### **P52: DC BUS VOLTAGE** — in percent of nominal.

Usually rated input voltage x 1.4

#### **P53: MOTOR VOLTAGE** — in percent of rated output voltage

#### **P54: LOAD** — in percent of drives rated output current rating

#### **P55: VDC INPUT** — in percent of maximum input: 100% will indicate full scale which is 5 V

#### **P56: 4–20 mA INPUT** — in percent of maximum input. 20% = 4 mA, 100% = 20 mA

**Fault Lockout** — If a fault lockout (LC) has occurred, view the fault history in P50 to find the last fault. Once P50 is displayed, use the arrow keys to scroll through the last 8 faults. Any current faults or fault codes from the fault history can be analyzed using Table 7.

### **TO DISABLE AUTOMATIC CONTROL MODE AND ENTER MANUAL SPEED CONTROL:**

1. Change P05 to '01-keypad'.
2. Push UP and DOWN arrow key to set manual speed.
3. Set P05 to proper value to restore automatic control according to Table 6.

**TO PROVIDE MANUAL START/STOP CONTROL** — With power removed from VFD, remove start command jumper and install a switch between the appropriate start terminals as required in Table 5.

**EPM Chip** — The drive uses a electronic programming module (EPM) chip to store the program parameters. This is an EEPROM memory chip and is accessible from the front of the VFD. It should not be removed with power applied to the VFD.

**Loss of CCN Communications** — Network communications with external control systems can be affected by high frequency electrical noise generated by the Controller. Ensure unit is well grounded to eliminate ground currents along communication lines.

If communications are lost only while Motor Controller is in operation, order a signal isolator (CEAS420876-2) and power supplies (CEAS221045-01, 2 required) for communication line.



**Table 7 — Fault Codes**

The drive is programmed to automatically restart after a fault and will attempt to restart three times after a fault (the drive will not restart after CF, cF, GF, F1, F2–F9, or Fo faults). If all three restart attempts are unsuccessful, the drive will trip into FAULT LOCKOUT (LC), which requires a manual reset.

CODE	DESCRIPTION	RESET METHOD	PROBABLE CAUSE	CORRECTIVE ACTION
<b>AF</b>	High Temperature Fault	Automatic	Ambient temperature is too high; Cooling fan has failed (if equipped).	Check cooling fan operation.
<b>CF</b>	Control Fault	Manual	A blank EPM, or an EPM with corrupted data has been installed.	Perform a factory reset using Parameter 48 – PROGRAM SELECTION. See Drive Programming section.
<b>cF</b>	Incompatibility Fault	Manual	An EPM with an incompatible parameter version has been installed.	Either remove the EPM or perform a factory reset (Parameter 48) to change the parameter version of the EPM to match the parameter version of the drive.
<b>F1</b>	EPM Fault	Manual	The EPM is missing or damaged.	Install EPM or replace with new EPM.
<b>F2—F9 Fo</b>	Internal Faults	Manual	The control board has sensed a problem	Consult factory.
<b>GF</b>	Data Fault	Manual	User data and factory defaults in the EPM are corrupted.	Restore factory defaults by toggling P48 to another mode. Then set P48 to desired mode to restore all defaults for that mode. See Drive Programming section. If that does not work, replace EPM.
<b>HF</b>	High DC Bus Voltage Fault	Automatic	Line voltage is too high; Deceleration rate is too fast; Overhauling load.	Check line voltage — set P01 appropriately.
<b>JF</b>	Serial Fault	Automatic	The watchdog timer has timed out, indicating that the serial link has been lost.	Check serial connection (computer). Check settings for P15. Check settings in communication software to match P15.
<b>LF</b>	Low DC Bus Voltage Fault	Automatic	Line voltage is too low.	Check line voltage — set P01 appropriately.
<b>OF</b>	Output Transistor Fault	Automatic	Phase to phase or phase to ground short circuit on the output; Failed output transistor; Boost settings are too high; Acceleration rate is too fast.	Reduce boost or increase acceleration values. If unsuccessful, replace drive.
<b>PF</b>	Current Overload Fault	Automatic	VFD is undersized for the application; Mechanical problem with the driven equipment.	Check line voltage – set P01 appropriately. Check for dirty coils. Check for motor bearing failure.
<b>SF</b>	Single-phase Fault	Automatic	Single-phase input power has been applied to a three-phase drive.	Check input power phasing.
<b>Drive display = ‘---’ even though drive should be running</b>	Start Contact is Not Closed	Automatic	Start contact is missing or not functioning.	Check fan relay.
<b>VFD flashes “---” and LCS</b>	Start Contact is Not Closed	Automatic	Start contact not closed.	Check FR for closed contact.
<b>VFD flashes 57 (or 47) and LCS</b>	Speed Signal Lost	Automatic	Speed signal lost. Drive will operate at 57 (or 47) Hz until reset or loss of start command. Resetting requires cycling start command (or power).	Transducer signal lost. Check VDC signal between TB5 and TB2. Should be in range of 0.5V to 4.5V. 5VDC output should be present between TB6 and TB2.

**LEGEND**

**EPM** — Electronic Programming Module  
**FR** — Fan Relay  
**LCS** — Loss of Control Signal  
**VFD** — Variable Frequency Drive