

Large Rooftop Units 20-25 Tons Accessory Low Ambient Operation Motormaster® V Control

Cancels: IIK 551A-240-2 IIK 558F-240-1
12/1/03

Installation Instructions

Part Numbers: CRLOWAMB015A00, CRLOWAMB016A00, CRLOWAMB017A00

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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 technicians should install, start up, and service this equipment.

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

⚠ WARNING

Open all remote disconnects before servicing this equipment. Electrical shock could result in personal injury.

INTRODUCTION

This book contains instructions for the installation, start-up, and troubleshooting of the Motormaster V (MMV) control on large rooftop units with a capacity range of 20 to 25 tons.

The Motormaster V control is a motor speed control device which adjusts condenser fan motor speed in response to declining liquid refrigerant pressure. A properly applied Motormaster V control 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 MMV Control
20-25 Tons	40 (4)	25 (-4)	-20 (-29)

To operate these units to the ambient temperatures listed, Motormaster V controls (Fig. 1) must be added. Field-fabricated and installed wind baffles are also required for all units (refer to Step 1). The Motormaster V control 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 Motormaster V control 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 — Motormaster V Control Package Usage

UNIT	VOLTAGE	ITEM DESCRIPTION
20-25 Tons (48/50TJ024,028, 48/50TM025, 579F240,300, 580F240)	208/230	CRLOWAMB015A00
	460	CRLOWAMB016A00
	575	CRLOWAMB017A00

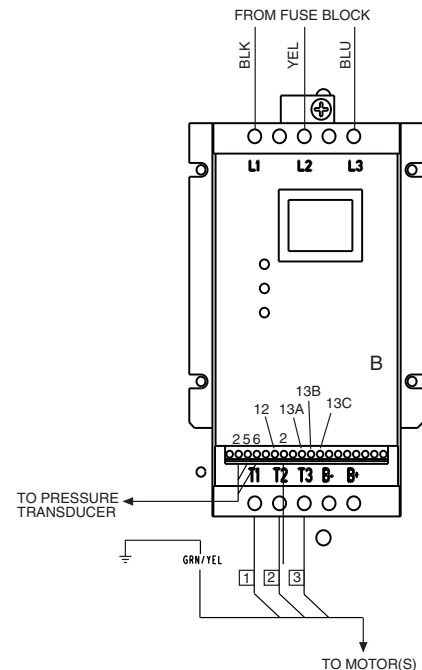


Fig. 1 — Motormaster® V Control

Table 3 — Motormaster® V Control Package Contents

ITEM	CRLOWAMB015A00	CRLOWAMB016A00	CRLOWAMB017A00
Controller 230-V 5 Hp	HR46TN004	—	—
Controller 460-V 5 Hp	—	HR46TN005	—
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 1/4-14 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

*Motormaster V compatible motors, P/N HD52AK654 for 208/230, 460 v and P/N HD52GE576 for 575 v, are installed in units with serial numbers 2801F and later. For units with serial numbers before 2801F, motor changeout is required prior to installing the Motormaster V control package.

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

To avoid the possibility of electrical shock, open all disconnects before installing or servicing this accessory.

Wind baffles must be field fabricated for all units to ensure proper cooling cycle operation at low-ambient temperatures with Motormaster V controls. 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

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

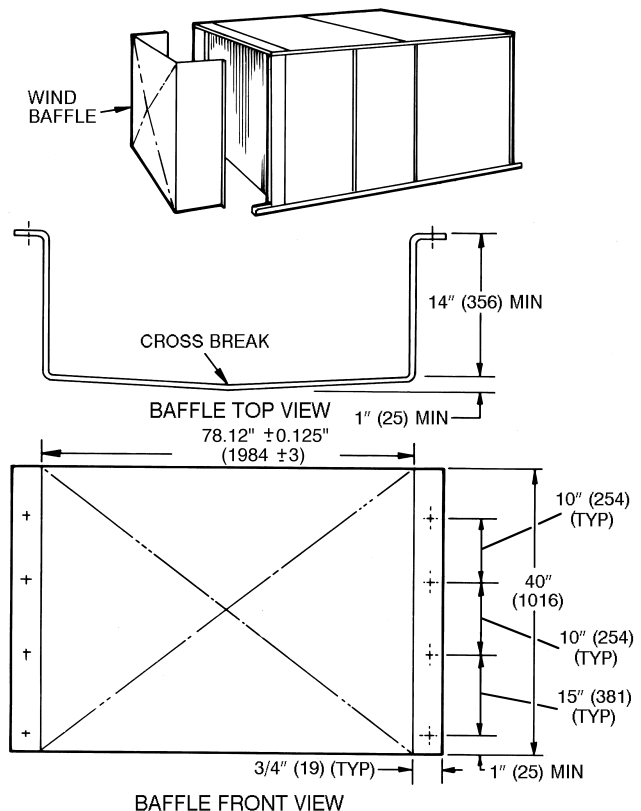


Fig. 2 — Wind Baffle Details

Step 2 — Mounting and Electrical Connections for Motormaster® V Control

⚠ WARNING

To avoid possibility of 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.

⚠ 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.

⚠ WARNING

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

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 Motormaster Terminal Block (MMTB) approximately 4½ 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 Motormaster 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.

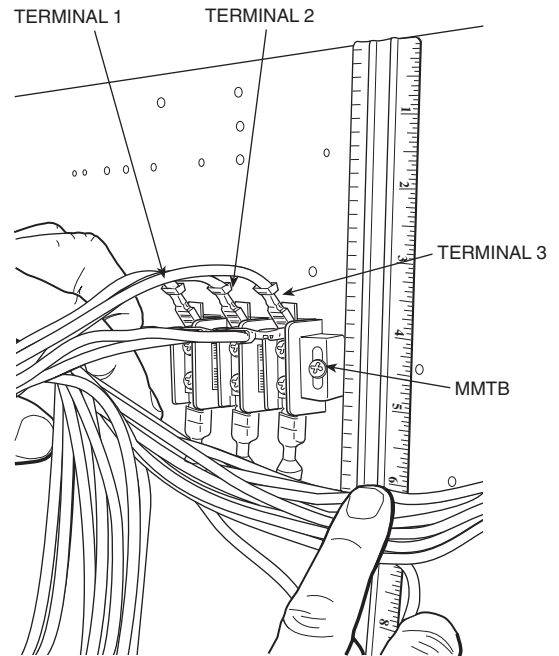


Fig. 3 — Terminal Block Mounting

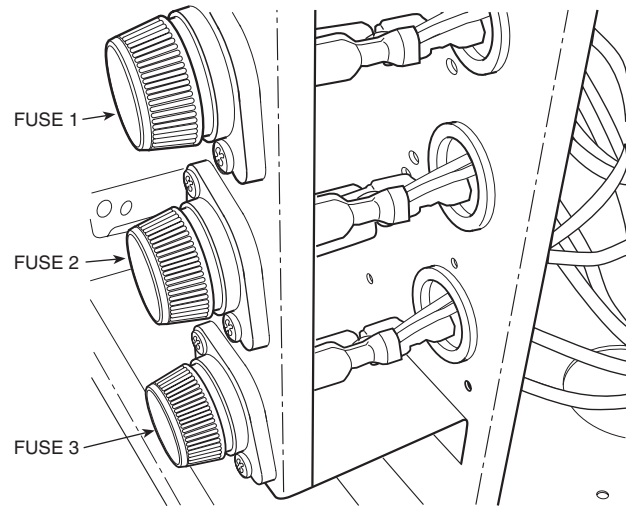


Fig. 4 — “Piggy-back” Wires

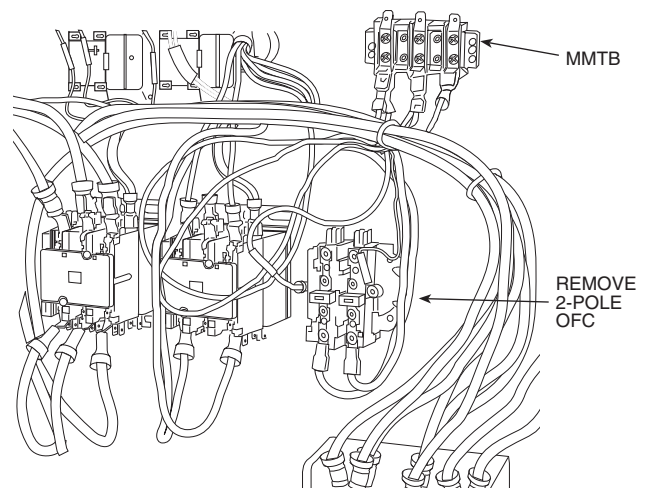


Fig. 5 — 2-Pole OFC

10. Remove one of the 1³/₄ 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 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.

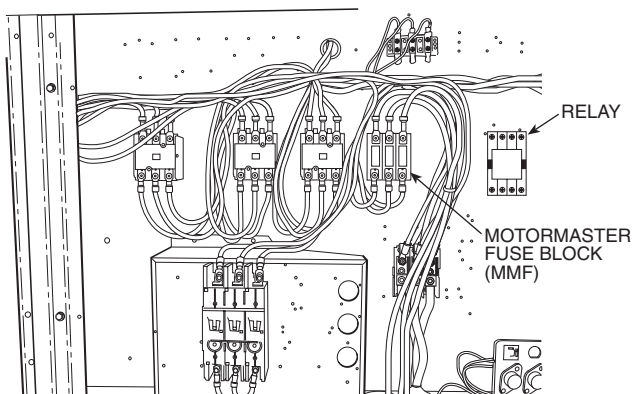


Fig. 6 — 3-Pole OFC

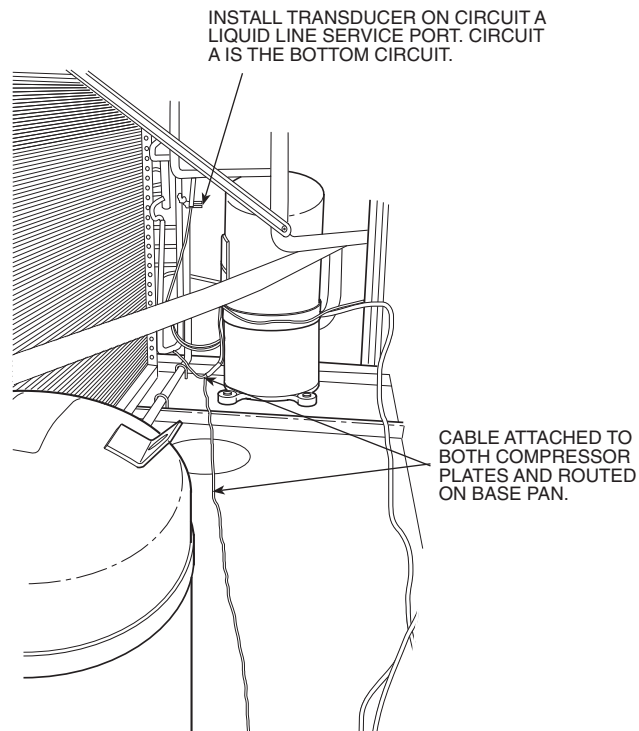


Fig. 7 — Transducer Location

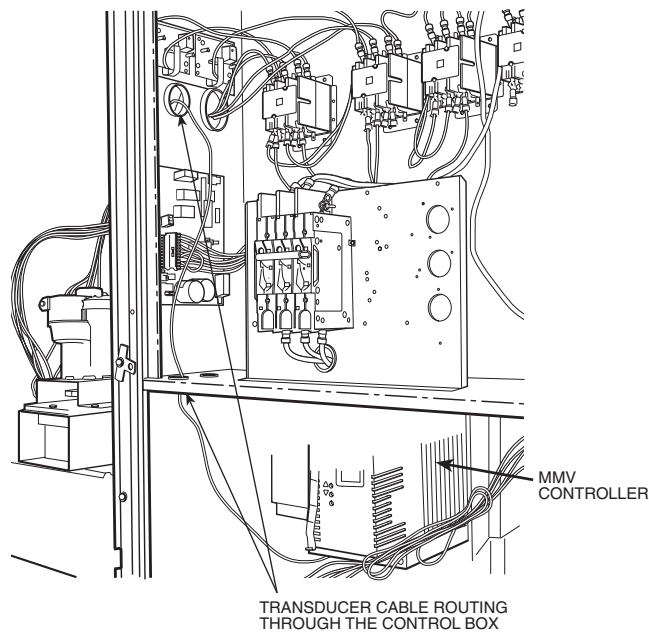


Fig. 8 — Transducer Cable Routing

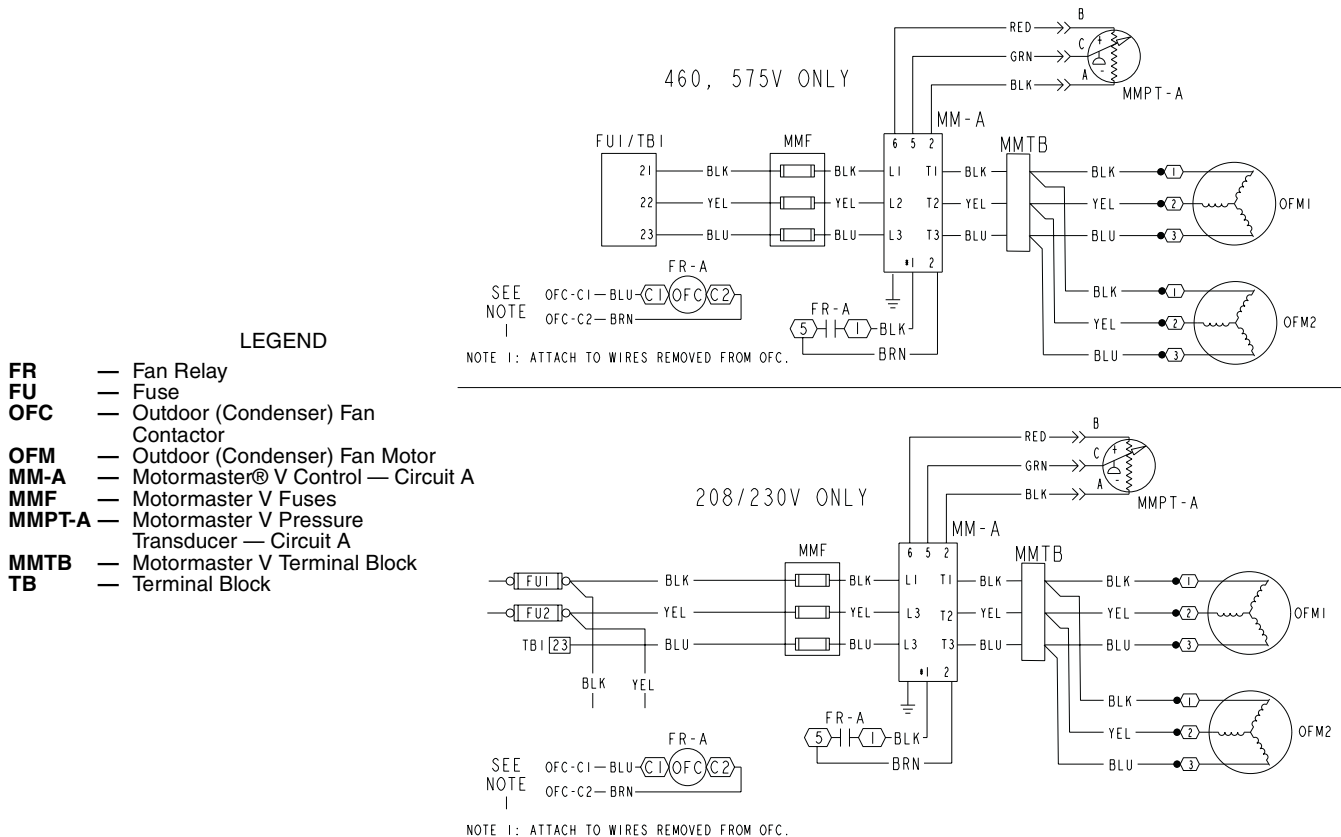


Fig. 9 — Transducer Wiring Schematic

460,575-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 accessory terminal block (MMTB) approximately 4¹/₂ in. from control box top as shown in Fig. 3.
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.
4. Remove the outdoor-fan contactor but leave the wires attached to it. They will be removed and installed on the new fuse block.
5. Install the accessory fuse block (MMF) in the same location where the contactor was removed. See Fig. 6.
6. Remove the wires from terminal 21, 22, and 23 of the outdoor-fan contactor and connect them to the line side of MMF.
7. 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.
8. Remove one of the 1³/₄ 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.

9. 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).
10. Install the accessory relay next to the location where the OFC was removed. See Fig. 6.
11. 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.
12. 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.
13. 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 Motormaster® V Control —

The Motormaster V 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

Step 4 — Test Motormaster V Control — To test the control and motor, jumper Y1 to run the compressor on circuit A. The Motormaster V electronic control adjusts the fan speed based on the liquid pressure input. Ensure that fans are rotating clockwise (as viewed from above). If rotation is backward, lockout all power then swap 2 leads AFTER the Motormaster control.

START-UP

When the system calls for cooling, the fan contactor will be energized to power the Motormaster V electronic control. The LED will display the speed of the motor. The display range will be 8 to 60 Hz. The Motormaster V 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 Motormaster V control 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 controller is configured by jumper wires and sensor input types. No field programming is required. If 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 Motormaster V control.

⚠ CAUTION

It is strongly recommended that the user NOT change any programming without consulting Carrier service personnel. Unit damage may occur from improper programming.

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 controller must see a change in P48 **while start jumper is removed**. Select Mode 1, as referenced in Table 5.

1. Remove power from Motormaster V control.
2. Remove start jumper and then apply power to Motormaster V control.
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. Motormaster V control is now restored to factory settings.
8. Remove power from Motormaster V control.
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 = 4 kHz, 02 = 6 kHz, 03 = 8 kHz	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 Motormaster® V control 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 Motormaster V 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** — Last 8 faults
- **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 — Carrier Comfort Network (CCN) communications with external control systems can be affected by high frequency electrical noise generated by the Motormaster V control. Ensure unit is well grounded to eliminate ground currents along communication lines.

If communications are lost only while Motormaster V control is in operation, order a signal isolator (CEAS420876-2) and power supplies (CEAS221045-01, 2 required) for the CCN 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
AF	High Temperature Fault	Automatic	Ambient temperature is too high; Cooling fan has failed (if equipped).	Check cooling fan operation.
CF	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.
cF	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.
F1	EPM Fault	Manual	The EPM is missing or damaged.	Install EPM or replace with new EPM.
F2—F9 Fo	Internal Faults	Manual	The control board has sensed a problem	Consult factory.
GF	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.
HF	High DC Bus Voltage Fault	Automatic	Line voltage is too high; Deceleration rate is too fast; Overhauling load.	Check line voltage — set P01 appropriately.
JF	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.
LF	Low DC Bus Voltage Fault	Automatic	Line voltage is too low.	Check line voltage — set P01 appropriately.
OF	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.
PF	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.
SF	Single-phase Fault	Automatic	Single-phase input power has been applied to a three-phase drive.	Check input power phasing.
Drive display = '---' even though drive should be running	Start Contact is Not Closed	Automatic	Start contact is missing or not functioning.	Check fan relay.
VFD flashes "---" and LCS	Start Contact is Not Closed	Automatic	Start contact not closed.	Check FR for closed contact.
VFD flashes 57 (or 47) and LCS	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

