Variable Frequency Drive (VFD) for 50HQP072-242, 50VQP072-360 Water Source Heat Pumps (WSHP)

Supplemental Installation Instructions

CONTENTS

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes, including ANSI (American National Standards Institute) Z223.1. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

⚠ WARNING

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury.

⚠ WARNING

Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information, consult a qualified installer, service agency, or the gas supplier.

OVERVIEW

This document provides information for installing and configuring factory-provided variable frequency drives (VFD) for Carrier 50VQP and 50HQP WSHPs with the Staged Air Volume (SAV™) or duct pressure control options. Staged Air Volume (SAV) is a supply fan control arrangement that adjusts the fan speed based on the call for heating, cooling, or fan only. The duct pressure control arrangement allows the supply fan to operate to maintain a fixed duct static pressure for filter loading or air balancing purposes. Duct static pressure is detected by the factory provided, field installed duct static pressure sensor (DSS).

IMPORTANT: Carrier 50VQP and 50HQP constant volume models (without SAV™ or duct pressure control) use motors that are not VFD rated and are not compatible with VFDs. Only Carrier models ordered with the VFD duct pressure control or Staged Air Volume (SAV) options use VFD rated motors and are VFD compatible.

50VQP units with the SAV or duct pressure control option have supply fan VFDs that are factory installed, wired, and configured for the selected control method (SAV or duct pressure control). The VFD is installed in the blower section of the unit and can be accessed through the blower access panel (see Fig. 1). This guide provides information that can be useful for adjusting or servicing the supply fan VFD.

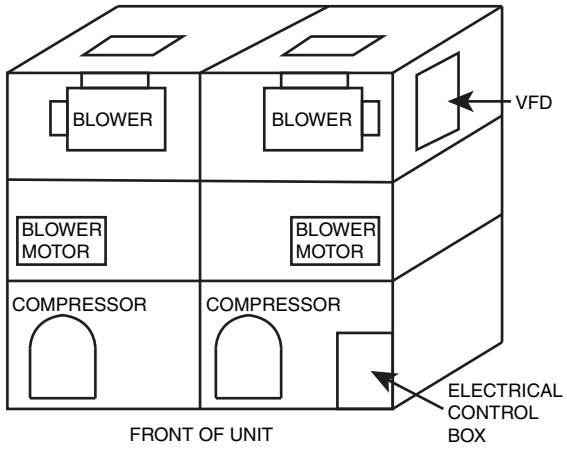


Fig. 1 — VFD Location, 50VQP Units

50HQP units with the SAV or duct pressure control option have supply fan VFDs that are factory provided, but require field installation and configuration.

This guide provides information on installing, wiring, and configuring the VFD. This information can be used in the case of a field VFD replacement or if configuration adjustment is necessary.

VFD SHIPPING STORAGE LOCATION (50HQP UNITS ONLY)

The VFD is shipped internally inside the compressor access section of the unit. The VFD is located in a cardboard box along with the manufacturer's installation manual. See Fig. 2. Inspect for shipping damage before proceeding with the VFD installation.

INSTALLING THE VFD (50HQP UNITS ONLY)

NOTE: Installation must adhere to local codes and requirements.

1. Remove the VFD from the unit shipping storage location (see Fig. 2).
2. Remove the VFD from the cardboard shipping box and locate the ABB ACH550 VFD Installation, Operation, and Maintenance Manual.
3. Follow the instructions for VFD installation in the ABB ACH550 manual.

VFD INPUT AND OUTPUT POWER WIRING AND CONNECTIONS (50HQP UNITS ONLY)

NOTE: All remote VFD field wiring must be installed per local codes and requirements.

1. Disconnect unit power and remove the electrical control box and compressor access panel. See Fig. 3.
2. Make field wiring connections between VFD input terminals (U1, V1, and W1) and Terminal Block 3 (TB3) located in the electrical control box. See Fig. 4.
3. Make field wiring connections between VFD output terminals (U2, V2, and W2) and Terminal Block 4 (TB4) located in the electrical control box. See Fig. 4.

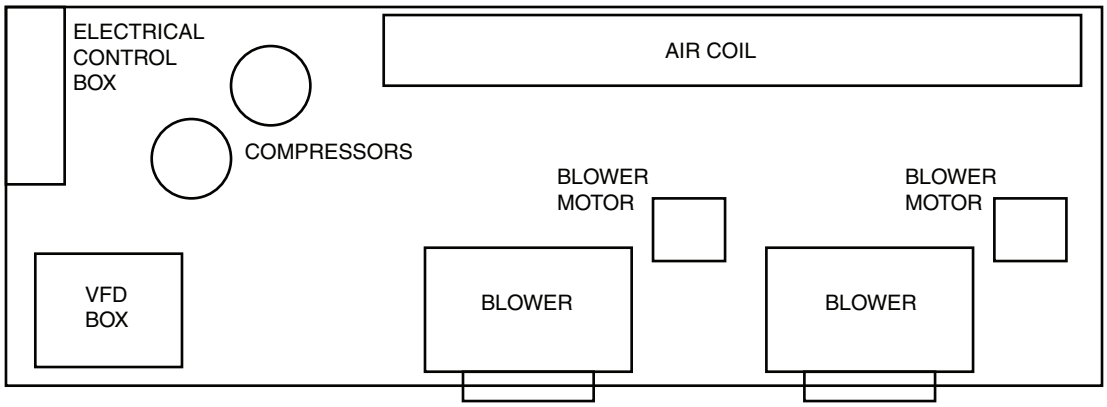


Fig. 2 — Remote VFD Shipping Location, 50HQP Units

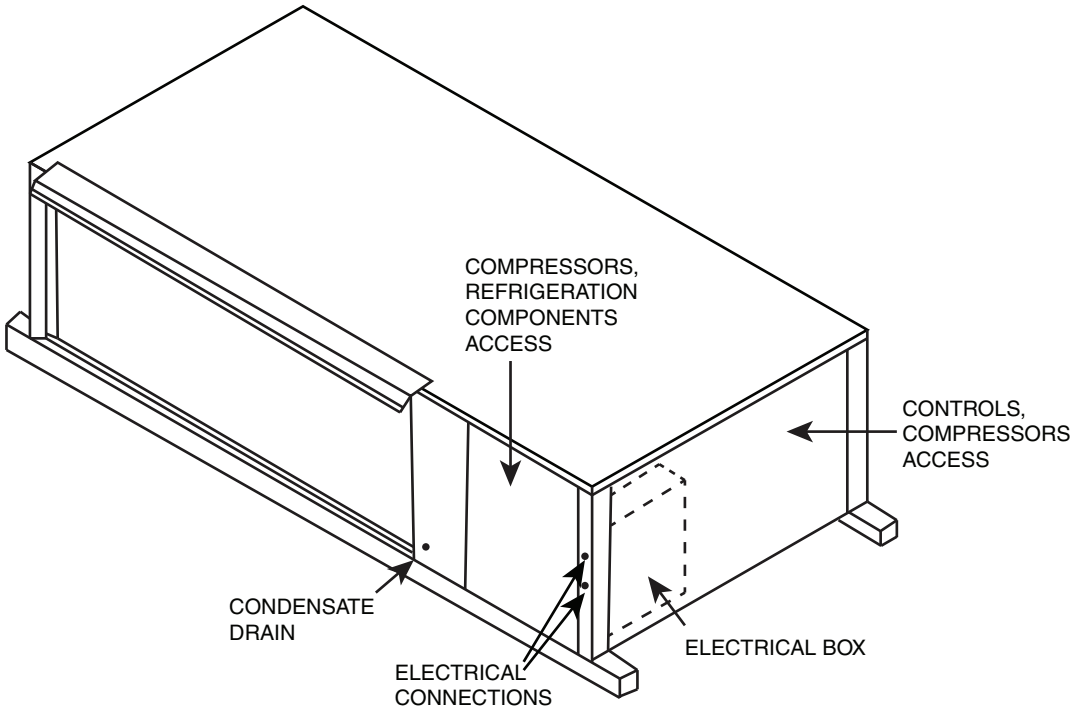


Fig. 3 — Electrical Control Box Location, 50HQP Units

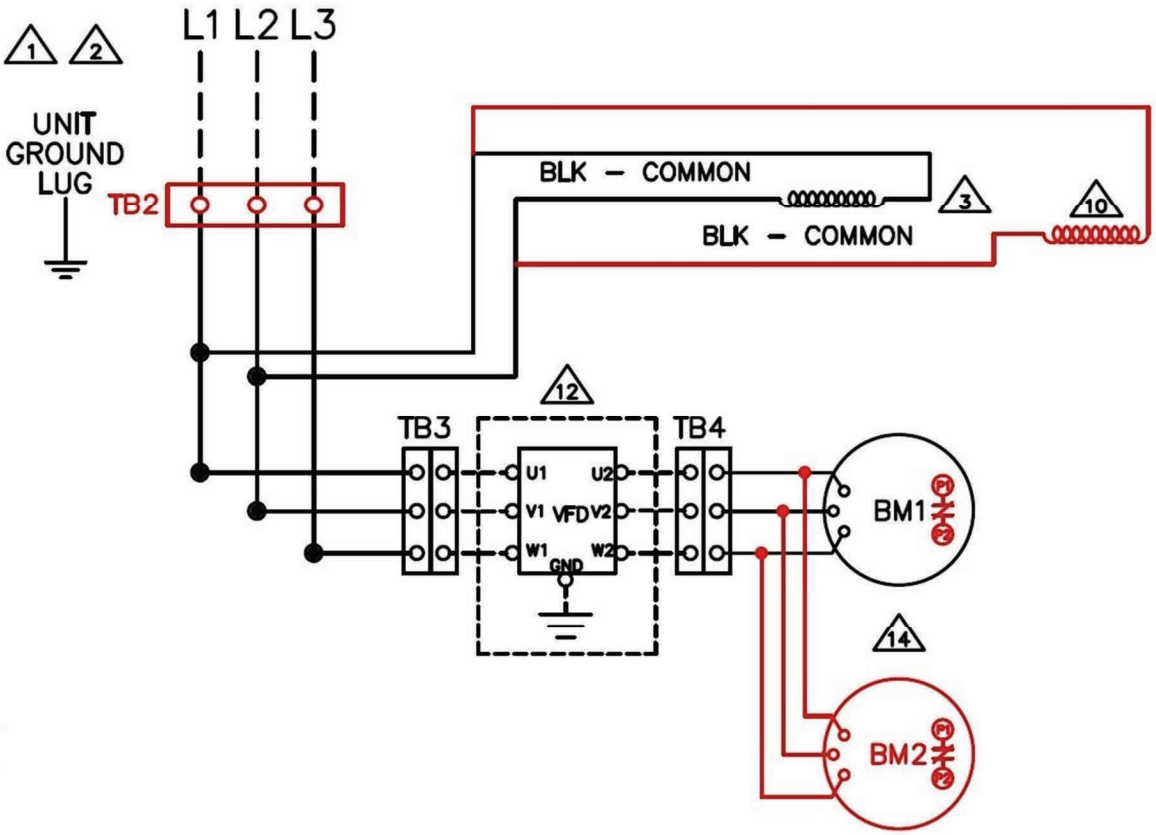


Fig. 4 — VFD Input and Output Power Connections, 50HQP Units

DUCT PRESSURE VFD CONTROL AND LOW VOLTAGE CONNECTIONS (50HQP UNITS ONLY)

NOTE: All remote VFD field wiring must be installed per local codes and requirements.

1. Disconnect unit power and remove the electrical control box and compressor access panel. See Fig. 3.
2. Make field wiring connections between VFD control terminals AI1 (terminal #2), AGND (terminal #3) and 24V (terminal #10) and the remote Duct Static Sensor (DSS) located in the supply airflow ductwork. See Fig. 5.
3. Make field wiring connections between VFD control terminals 24V (terminal #10), DI1 (terminal #13), DI3 (terminal #15) and Terminal Block 5 (TB5) located in the electrical control box. See Fig. 5.

See Fig. 6 and 7 for typical wiring diagrams, VFD for Duct Static Pressure Control.

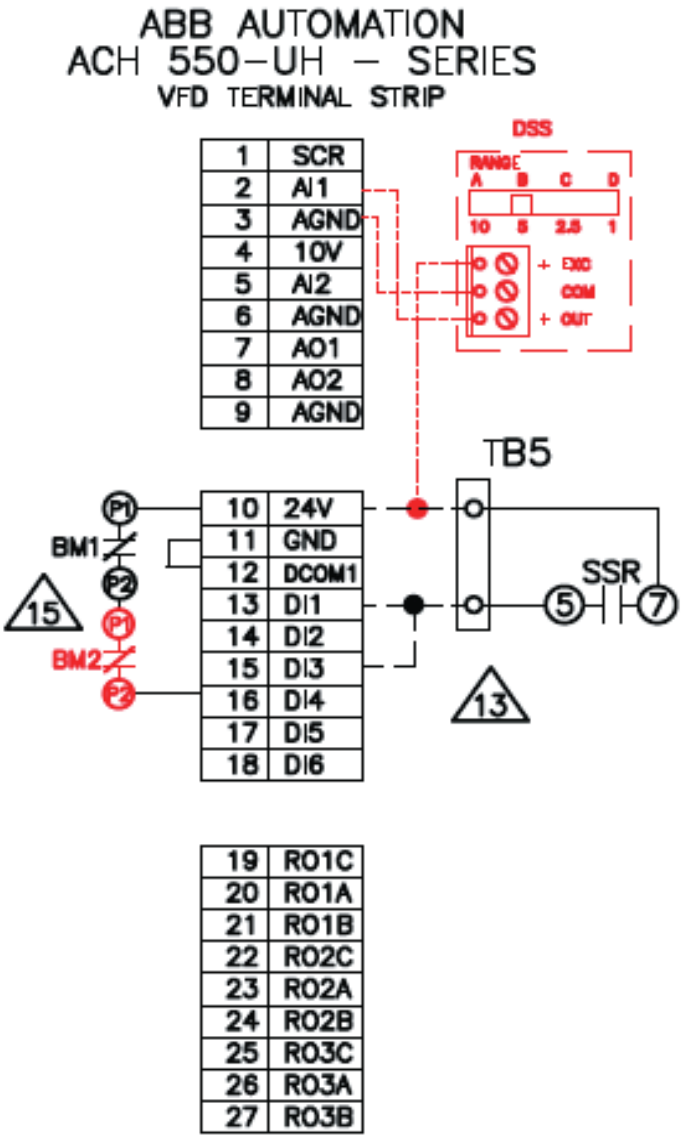
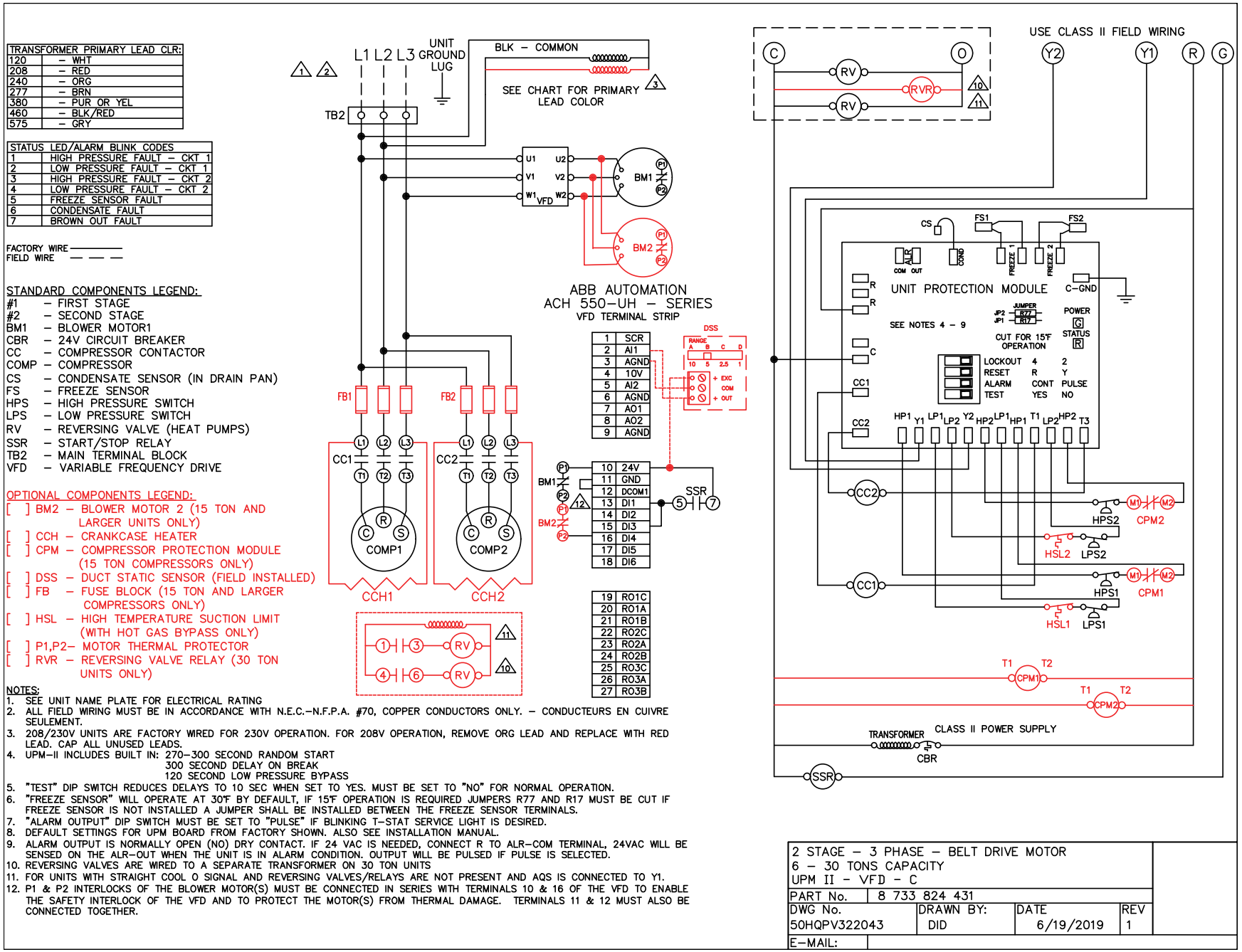


Fig. 5 — Duct Pressure VFD Control and Low Voltage Connections, 50HQP Units



NOTES:
1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.–N.F.P.A. #70, COPPER CONDUCTORS ONLY. – CONDUCTEURS EN CUIVRE SEULEMENT.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE ORG LEAD AND REPLACE WITH RED LEAD. CAP ALL UNUSED LEADS.
4. UPM–II INCLUDES BUILT IN: 270–300 SECOND RANDOM START
   300 SECOND DELAY ON BREAK
   120 SECOND LOW PRESSURE BYPASS
5. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
6. "FREEZE SENSOR" WILL OPERATE AT 30°F BY DEFAULT, IF 15°F OPERATION IS REQUIRED JUMPERS R77 AND R17 MUST BE CUT IF FREEZE SENSOR IS NOT INSTALLED A JUMPER SHALL BE INSTALLED BETWEEN THE FREEZE SENSOR TERMINALS.
7. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T–STAT SERVICE LIGHT IS DESIRED.
8. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
9. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R TO ALR–COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR–OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
10. REVERSING VALVES ARE WIRED TO A SEPARATE TRANSFORMER ON 30 TON UNITS
11. FOR UNITS WITH STRAIGHT COOL O SIGNAL AND REVERSING VALVES/RELAYS ARE NOT PRESENT AND AQS IS CONNECTED TO Y1.
12. P1 & P2 INTERLOCKS OF THE BLOWER MOTOR(S) MUST BE CONNECTED IN SERIES WITH TERMINALS 10 & 16 OF THE VFD TO ENABLE THE SAFETY INTERLOCK OF THE VFD AND TO PROTECT THE MOTOR(S) FROM THERMAL DAMAGE. TERMINALS 11 & 12 MUST ALSO BE CONNECTED TOGETHER.

Fig. 6 — VFD for Duct Static Pressure Control - Complete C Package

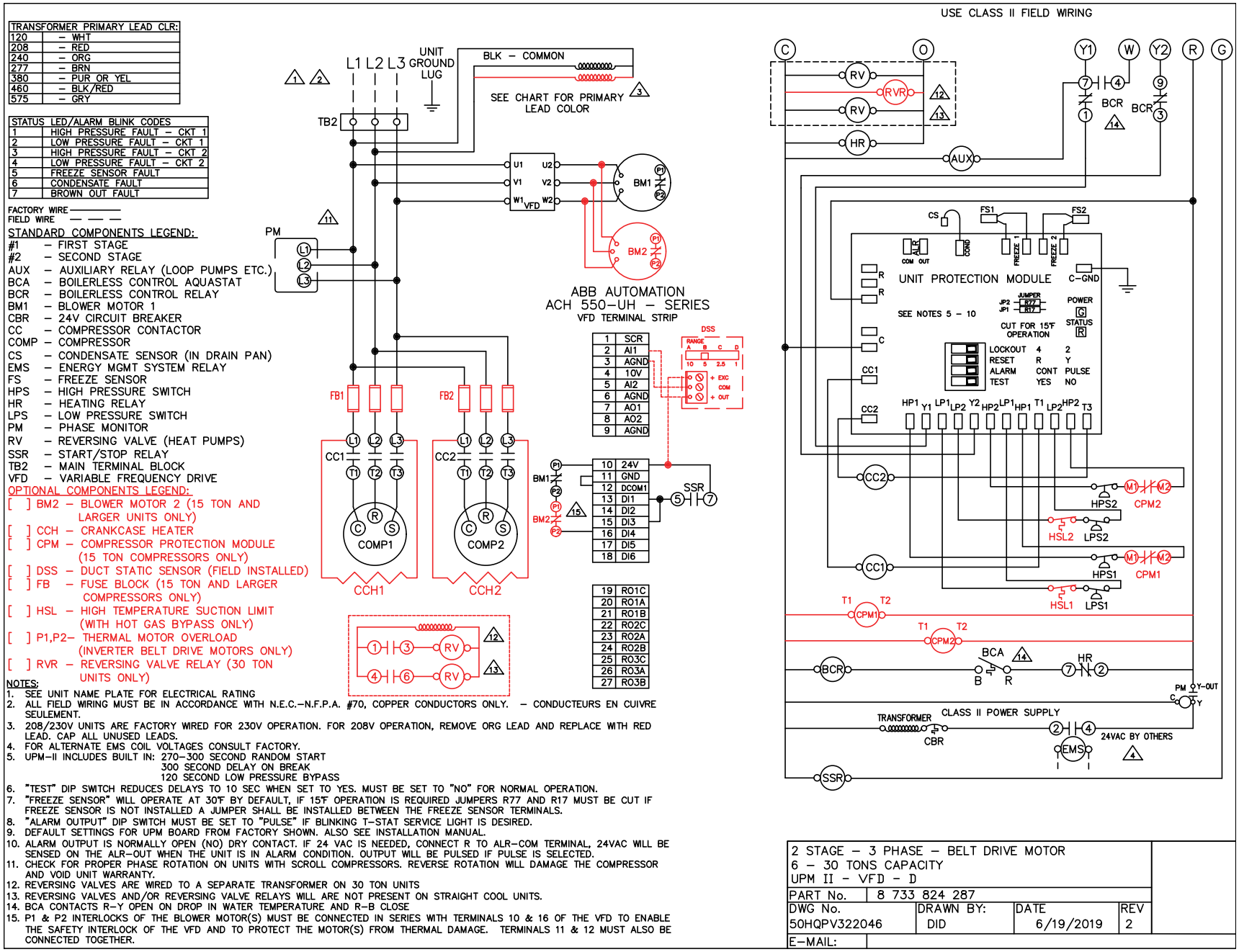


Fig. 7 — VFD for Duct Static Pressure Control - Deluxe D Package

DUCT PRESSURE VFD PROGRAMMING PARAMETERS (ALL UNITS)

In duct pressure control mode, the supply fan will operate to maintain a fixed static pressure set point (point 4011) as read by the duct static pressure sensor (DSS).

Table 1 lists the factory default duct static pressure control VFD programming parameters, which require field configuration and adjustment based on the application requirements.

Table 1 — Duct Pressure VFD Programming Parameters

GROUP NUMBER	PARAMETER NUMBER	DESCRIPTION	VALUE
98	9802	Communication Protocol Selector	NS — Factory Default*
99	9902	Application Macro	HVAC Default
	9904	Motor control Mode	Scalar
	9905	Motor Nominal Voltage	Refer to Motor Nameplate†
	9906	Motor Nominal Current	Refer to Motor Nameplate†
	9907	Motor Nominal Frequency	Refer to Motor Nameplate†
	9908	Motor Nominal Speed	Refer to Motor Nameplate†
	9909	Motor Nominal Power	Refer to Motor Nameplate†
10	1001	EXT1 Commands	DI1 — Start/Stop
	1002	EXT2 Commands	COMM
	1003	Direction	Forward
11	1103	REF1 Select	AI-1
	1104	REF1 Minimum	0Hz at 60Hz/ 0Hz at 50Hz
	1105	REF 1 Maximum	60 Hz at 60Hz / 50 Hz at 50Hz
	1106	REF2 Select	PID1OUT
12	1201	Constant Speed Select	NOT SEL
	1202	Constant Speed 1	60Hz
13	1301	Minimum AI-1	0%
	1302	Maximum AI-1	100%
	1303	Filter AI-1	1 Sec
	1304	Minimum AI-2	20%
	1305	Maximum AI-2	100%
	1306	Filter AI-2	1 Sec
14	1401	Relay Output 1	Ready
	1402	Relay Output 2	Run
	1403	Relay Output 3	Fault (Inverted)
16	1601	Run Enable	DI-1
	1608	Start Enable 1	DI-4
	1609	Start Enable 2	N/A
20	2002	Minimum Fan Speed	0 rpm
	2003	Maximum Current	1800 rpm
	2007	Minimum Frequency	0Hz
	2008	Maximum Frequency	60Hz
21	2101	Start Function	3 (SCALAR FLYST)
	2102	Stop Function	Coast
22	2202	Accelerate Time	30 Seconds
	2203	Decelerate Time	30 Seconds
26	2605	Volt/ Freq Ratio	Square
	2606	Switching Frequency	4Khz
	2607	Switching Frequency Control	ON
30	3006	Motor Thermal Time	1050s
	3007	Motor Load Curve	100%
	3008	Zero Speed Load	70%
	3009	Break Point Frequency	35Hz
	3010	Stall Function	NOT SEL
	3011	Stall Frequency	20 Hz
	3012	Stall Time	20 Sec
	3017	Earth Fault	Enabled

Table 1 — Duct Pressure VFD Programming Parameters(cont)

GROUP NUMBER	PARAMETER NUMBER	DESCRIPTION	VALUE
31	3101	Number of Retries	5
	3102	Trial Time	30 Sec
	3103	Delay Time	6 Sec
	3104	AR Overcurrent	Enabled
	3105	AR Overvoltage	Enabled
	3106	AR Under voltage	Enabled
	3107	AR AI<Minimum	Disabled
	3108	AR External Fault	(0) Disabled
34	3401	Signal Parameter 1	Output Freq
	3402	Signal 1 Minimum	0
	3403	Signal 1 Maximum	60/ 50 (Maximum motor operating Hertz)
	3404	Output 1 DPS Form	0
	3405	Output 1 DSP Unit	% SP
	3406	Output 1 Minimum	0
	3407	Output 1 Maximum	100
	3408	Signal Parameter 2	Current (Motor Current Measure by the Drive)
	3409	Signal 2 Minimum	0
	3410	Signal 2 Maximum	FLA + 15% A
	3411	Output 2 DPS Form	0
	3412	Output DSP Unit	A (2)
	3413	Output 2 Minimum	0
	3414	Output 2 Maximum	FLA + 15% A
	3415	Signal Parameter 3	AI-1
	3416	Signal 3 Minimum	0
	3417	Signal 3 Maximum	10
	3418	Output 3 DPS Form	0
	3419	Output DSP Unit	V (2)
	3420	Output 3 Minimum	0
	3421	Output 3 Maximum	10
40	4001	Gain	2.5
	4002	Integration Time	3 Sec
	4005	Error Value Inver	NO
	4006	Units	INWC (Inches of water column)
	4007	Display Format	x.xxx
	4009	100% Value	0.5
	4010	Setpoint Select	Internal
	4011	Internal Setpoint	0.25**
	4012	Setpoint Minimum	0V
	4013	Sepoint Maximum	10V
	4027	PID1 Parameter Set	SET1

* Change to BACnet if drive integration is required.
† Refer to motor name plate.
** To be adjusted in the field according to the static pressure requirements.

STAGED AIR VOLUME (SAV™) VFD CONTROL AND LOW VOLTAGE CONNECTIONS (50HQP UNITS ONLY)

NOTE: All remote VFD field wiring must be installed per local codes and requirements.

1. Disconnect unit power and remove the electrical control box and compressor access panel. See Fig. 3.
2. Make field wiring connections between VFD control terminals 24V (terminal #10), DI1 (terminal #13), DI2 (terminal #14), DI3 (terminal #15) and Terminal Block 5 (TB5) located in the electrical control box. See Fig. 8.

See Fig. 9-11 for typical wiring diagrams.

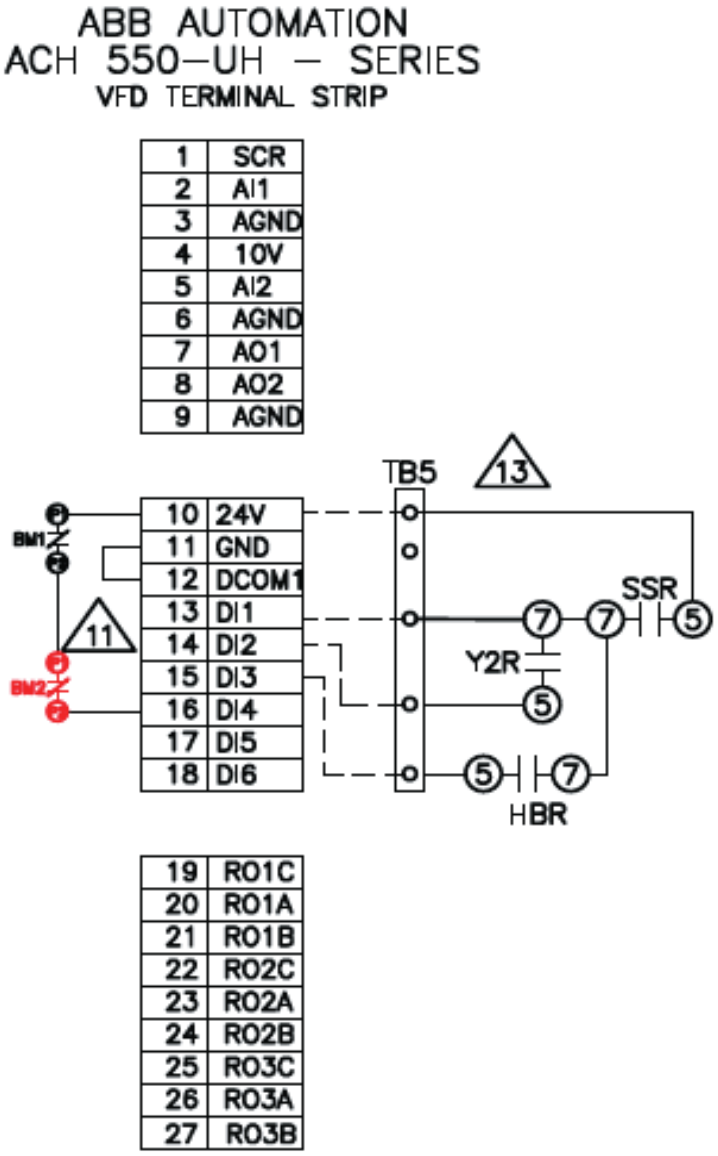


Fig. 8 — SAV™ VFD Control and Low Voltage Connections, 50HQP Units

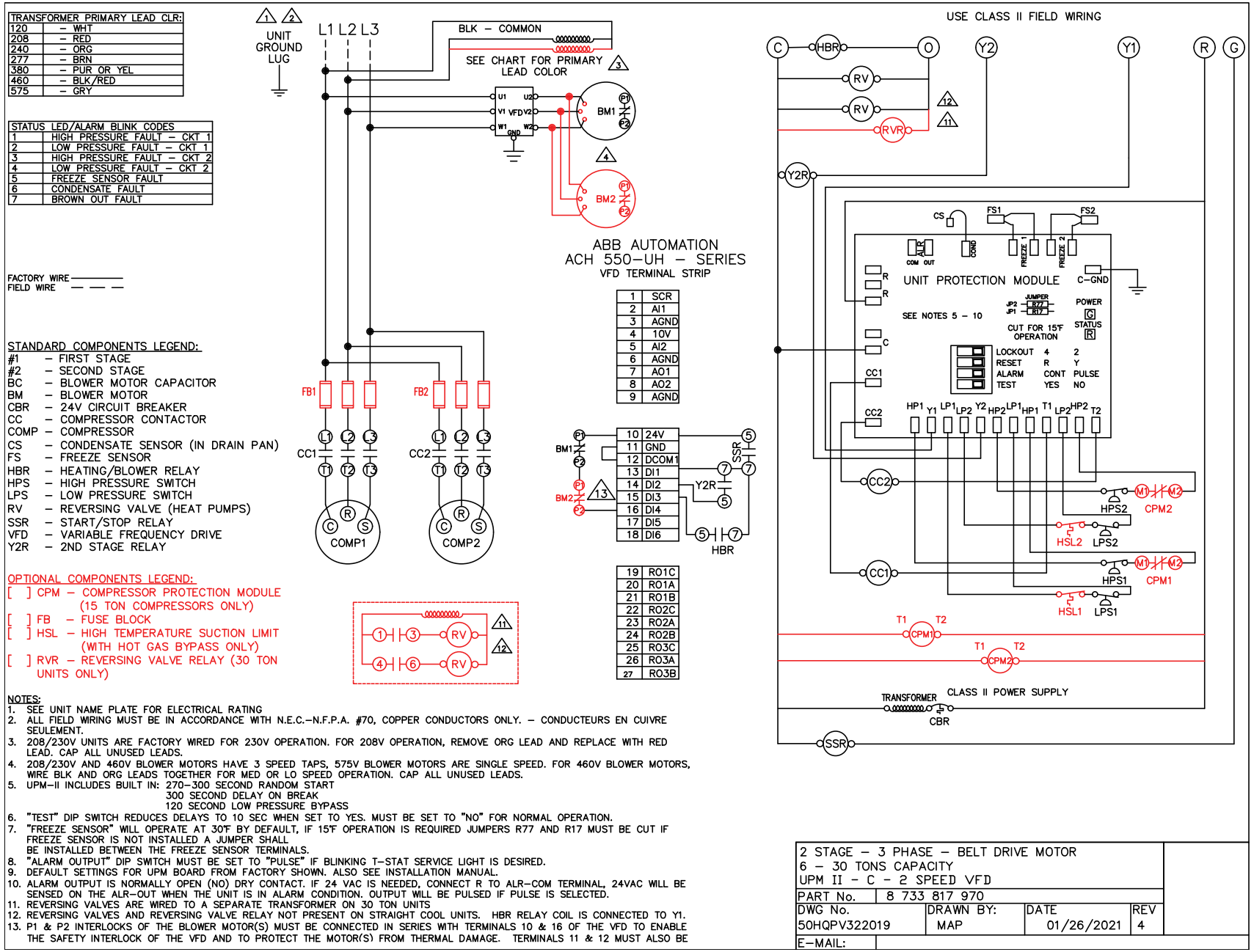
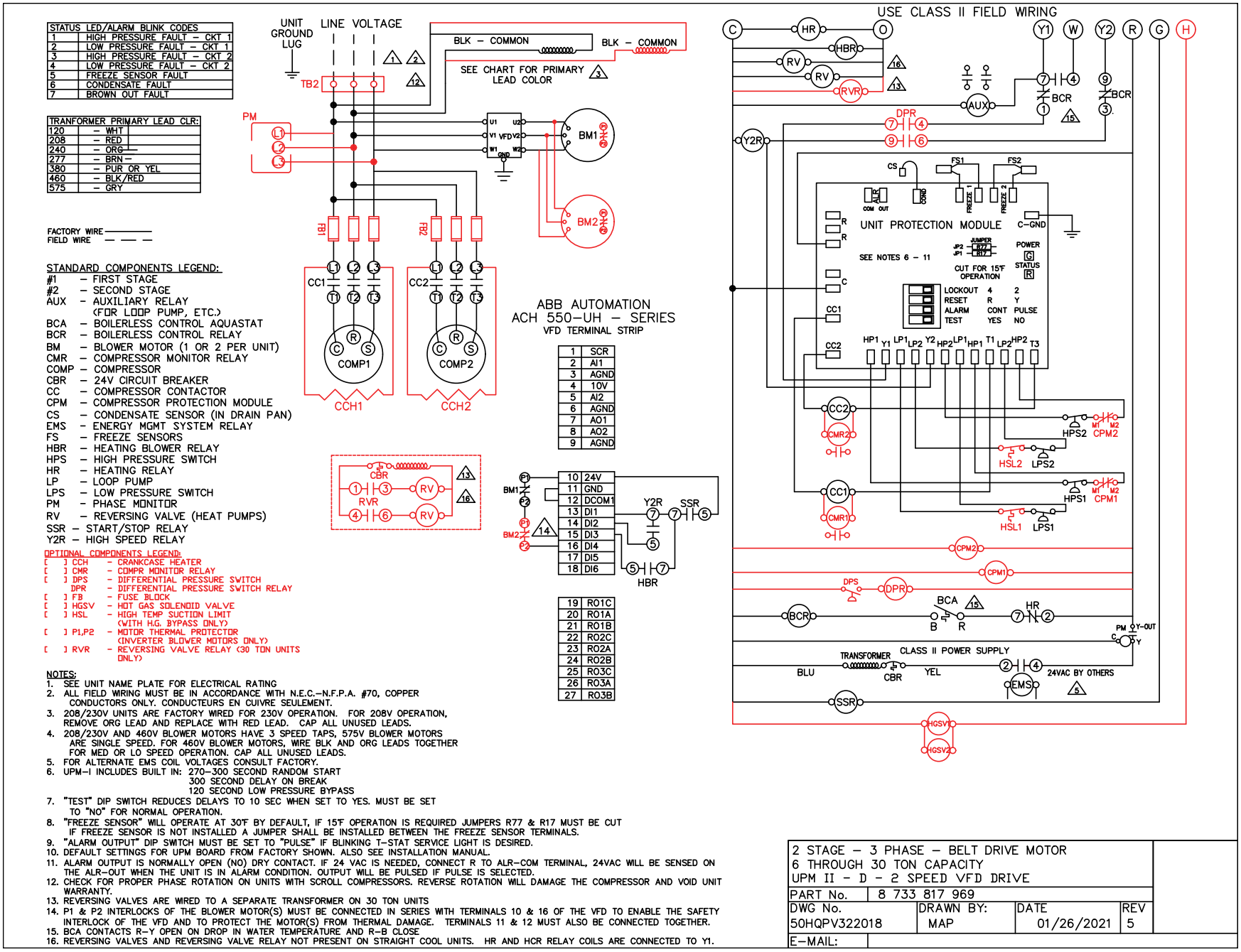


Fig. 9 — VFD for 2-Speed Fan Control - Complete C Package



NOTES:
1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.–N.F.P.A. #70, COPPER CONDUCTORS ONLY. CONDUCTEURS EN CUIVRE SEULEMENT.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE ORG LEAD AND REPLACE WITH RED LEAD. CAP ALL UNUSED LEADS.
4. 208/230V AND 460V BLOWER MOTORS HAVE 3 SPEED TAPS, 575V BLOWER MOTORS ARE SINGLE SPEED. FOR 460V BLOWER MOTORS, WIRE BLK AND ORG LEADS TOGETHER FOR MED OR LO SPEED OPERATION. CAP ALL UNUSED LEADS.
5. FOR ALTERNATE EMS COIL VOLTAGES CONSULT FACTORY.
6. UPM–I INCLUDES BUILT IN: 270–300 SECOND RANDOM START
   300 SECOND DELAY ON BREAK
   120 SECOND LOW PRESSURE BYPASS
7. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
8. "FREEZE SENSOR" WILL OPERATE AT 30°F BY DEFAULT, IF 15°F OPERATION IS REQUIRED JUMPERS R77 & R17 MUST BE CUT IF FREEZE SENSOR IS NOT INSTALLED A JUMPER SHALL BE INSTALLED BETWEEN THE FREEZE SENSOR TERMINALS.
9. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T–STAT SERVICE LIGHT IS DESIRED.
10. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
11. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R TO ALR–COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR–OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
12. CHECK FOR PROPER PHASE ROTATION ON UNITS WITH SCROLL COMPRESSORS. REVERSE ROTATION WILL DAMAGE THE COMPRESSOR AND VOID UNIT WARRANTY.
13. REVERSING VALVES ARE WIRED TO A SEPARATE TRANSFORMER ON 30 TON UNITS
14. P1 & P2 INTERLOCKS OF THE BLOWER MOTOR(S) MUST BE CONNECTED IN SERIES WITH TERMINALS 10 & 16 OF THE VFD TO ENABLE THE SAFETY INTERLOCK OF THE VFD AND TO PROTECT THE MOTOR(S) FROM THERMAL DAMAGE. TERMINALS 11 & 12 MUST ALSO BE CONNECTED TOGETHER.
15. BCA CONTACTS R–Y OPEN ON DROP IN WATER TEMPERATURE AND R–B CLOSE
16. REVERSING VALVES AND REVERSING VALVE RELAY NOT PRESENT ON STRAIGHT COOL UNITS. HR AND HCR RELAY COILS ARE CONNECTED TO Y1.

2 STAGE – 3 PHASE – BELT DRIVE MOTOR 6 THROUGH 30 TON CAPACITY UPM II – D – 2 SPEED VFD DRIVE			
PART No.	8 733 817 969		
DWG No. 50HQPV322018	DRAWN BY: MAP	DATE 01/26/2021	REV 5
E–MAIL:			

Fig. 10 — VFD for 2-Speed Fan Control - Deluxe D Package

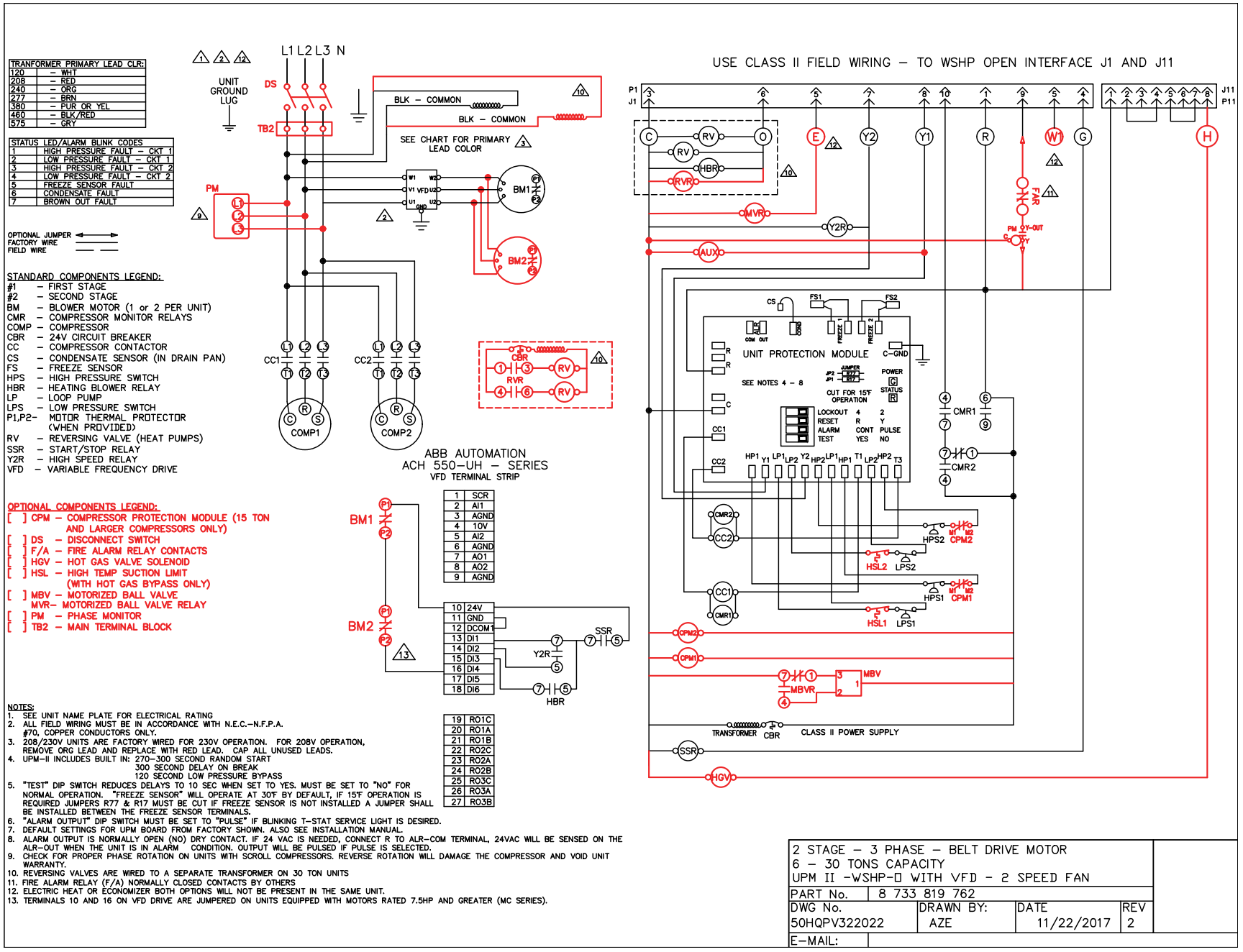
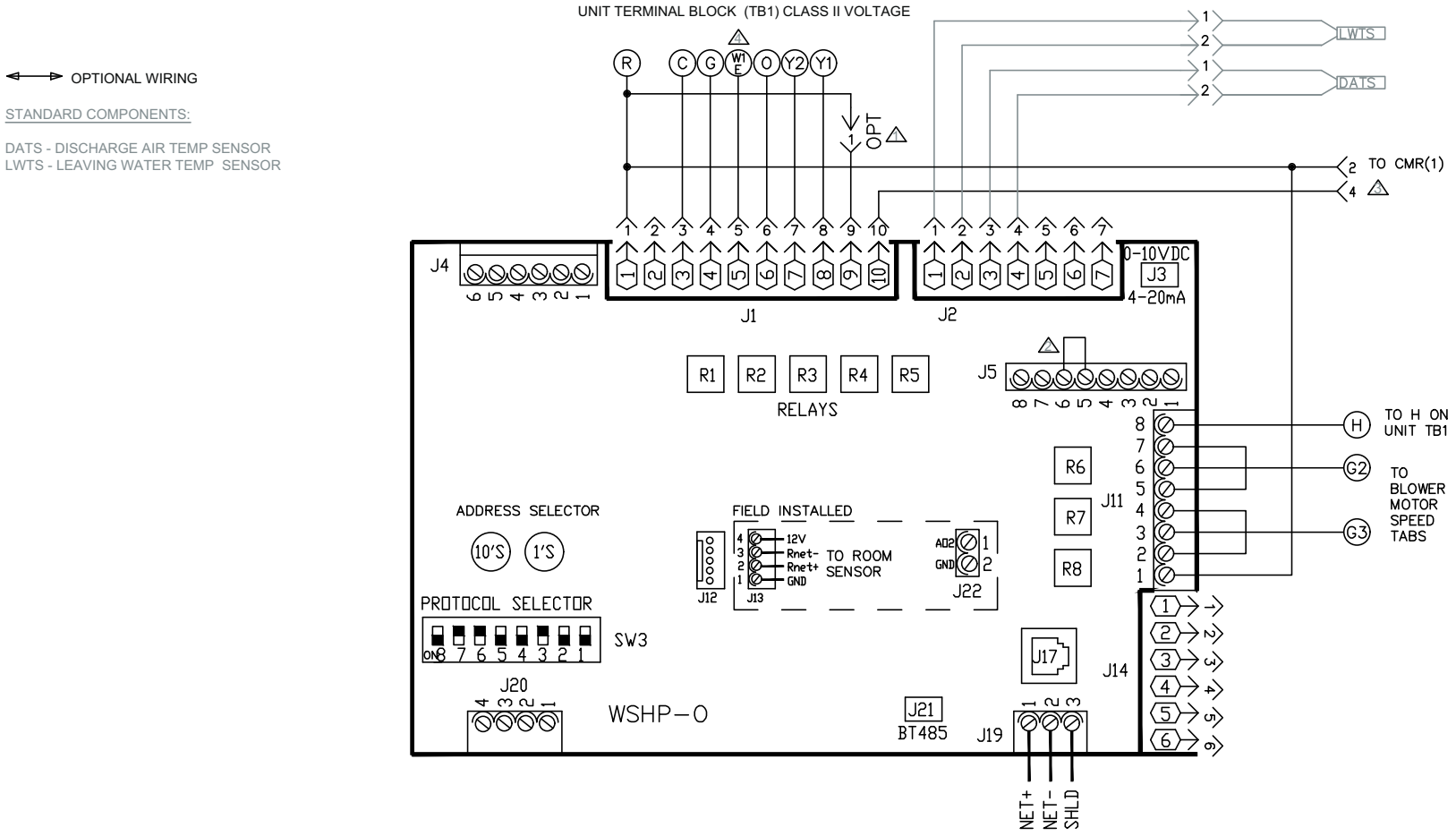


Fig. 11 — VFD for 2-Speed Fan Control with WSHP Open



⚠1 J1-9 USED TO CONNECT FIRE ALARM RELAY OR PHASE MONITOR OPTIONS

⚠2 FACTORY JUMPER IS INSTALLED ON J5-5 AND J5-6 IF CONDENSATE FLOAT SWITCH (NC) IS NOT PRESENT

⚠3 FOR 2-STAGE UNITS, CONNECT CMR CONN ACROSS PINS 4 AND 6 OF CMR1 WITH SIGNAL CMR-4 GOING TO PIN 4 AND SIGNAL CMR-2 GOING TO PIN 6.

⚠4 ELECTRIC HEAT (W1) OR ECONOMIZER (E). BOTH OPTIONS WILL NOT BE PRESENT IN THE SAME UNIT

Fig. 11 — VFD for 2-Speed Fan Control with WSHP Open (cont)

SAV™ VFD PROGRAMMING PARAMETERS (ALL UNITS)

In SAV control mode, the supply fan will operate based on the call for cooling or heating. When there is a call for fan only or stage 1 cooling, the supply fan will operate at 40 Hz (parameter 1206). When there is a call for second stage cooling or any heating call, the supply fan will operate at 60 Hz (parameter 1202). Table 2 lists the factory default SAV VFD programming parameters, which require field configuration.

Table 2 — SAV™ VFD Programming Parameters

GROUP NUMBER	PARAMETER NUMBER	DESCRIPTION	VALUE
98	9802	Communication Protocol Selector	NS — Factory Default*
99	9902	Application Macro	HVAC Default
	9904	Motor control Mode	Scalar
	9905	Motor Nominal Voltage	Refer to Motor Nameplate†
	9906	Motor Nominal Current	Refer to Motor Nameplate†
	9907	Motor Nominal Frequency	Refer to Motor Nameplate†
	9908	Motor Nominal Speed	Refer to Motor Nameplate†
	9909	Motor Nominal Power	Refer to Motor Nameplate†
10	1001	EXT1 Commands	DI1 - Start/Stop
	1002	EXT2 Commands	COMM
	1003	Direction	Forward
11	1103	REF1 Select	AI-1
	1104	REF1 Minimum	0Hz at 60Hz/ 0Hz at 50Hz
	1105	REF 1 Maximum	60 Hz at 60Hz / 50 Hz at 50Hz
	1106	REF2 Select	PID1OUT
12	1201	Constant Speed Select	DI1, DI2, DI3
	1202	Constant Speed 1	60Hz
	1203	Constant Speed 2	0Hz
	1204	Constant Speed 3	60Hz
	1205	Constant Speed 4	0Hz
	1206	Constant Speed 5	40Hz
	1207	Constant Speed 6	0Hz
	1208	Constant Speed 7	60Hz
13	1301	Minimum AI-1	0%
	1302	Maximum AI-1	100%
	1303	Filter AI-1	1 Sec
	1304	Minimum AI-2	20%
	1305	Maximum AI-2	100%
	1306	Filter AI-2	1 Sec
14	1401	Relay Output 1	Ready
	1402	Relay Output 2	Run
	1403	Relay Output 3	Fault (Inverted)
16	1601	Run Enable	DI-1
	1608	Start Enable 1	DI-4
	1609	Start Enable 2	N/A
20	2002	Minimum Fan Speed	0 rpm
	2003	Maximum Current	1800 rpm
	2007	Minimum Frequency	0Hz
	2008	Maximum Frequency	60Hz
21	2101	Start Function	3 (SCALAR FLYST)
	2102	Stop Function	Coast
22	2202	Accelerate Time	30 Seconds
	2203	Decelerate Time	30 Seconds
26	2605	Volt/Freq Ratio	Square
	2606	Switching Frequency	4Khz
	2607	Switching Frequency Control	ON

Table 2 — SAV™ VFD Programming Parameters (cont)

GROUP NUMBER	PARAMETER NUMBER	DESCRIPTION	VALUE
30	3006	Motor Thermal Time	1050s
	3007	Motor Load Curve	100%
	3008	Zero Speed Load	70%
	3009	Break Point Frequency	35Hz
	3010	Stall Function	NOT SEL
	3011	Stall Frequency	20 Hz
	3012	Stall Time	20 Sec
	3017	Earth Fault	Enabled
31	3101	Number of Retries	5
	3102	Trial Time	30 Sec
	3103	Delay Time	6 Sec
	3104	AR Overcurrent	Enabled
	3105	AR Overvoltage	Enabled
	3106	AR Under voltage	Enabled
	3107	AR AI<Minimum	Disabled
	3108	AR External Fault	(0) Disabled
34	3401	Signal Parameter 1	Output Freq
	3402	Signal 1 Minimum	0
	3403	Signal 1 Maximum	60/ 50 (Maximum motor operating Hertz)
	3404	Output 1 DPS Form	0
	3405	Output 1 DSP Unit	% SP
	3406	Output 1 Minimum	0
	3407	Output 1 Maximum	100
	3408	Signal Parameter 2	Current (Motor Current Measure by the Drive)
	3409	Signal 2 Minimum	0
	3410	Signal 2 Maximum	FLA + 15% A
	3411	Output 2 DPS Form	0
	3412	Output DSP Unit	A (2)
	3413	Output 2 Minimum	0
	3414	Output 2 Maximum	FLA + 15% A
	3415	Signal Parameter 3	AI-1
	3416	Signal 3 Minimum	0
	3417	Signal 3 Maximum	10
	3418	Output 3 DPS Form	0
	3419	Output DSP Unit	V (2)
	3420	Output 3 Minimum	0
	3421	Output 3 Maximum	10
40	4001	Gain	2.5
	4002	Integration Time	3 Sec
	4005	Error Value Inver	NO
	4006	Units	INWC (Inches of water column)
	4007	Display Format	x.xxx
	4009	100% Value	0.5
	4010	Setpoint Select	Internal
	4011	Internal Setpoint	0.25**
	4012	Setpoint Minimum	0V
	4013	Sepoint Maximum	10V
	4027	PID1 Parameter Set	SET1

* Change to BACnet if drive integration is required.
† Refer to motor name plate.
** To be adjusted in the field according to the static pressure requirements.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

Catalog No. 04-53500287-01 Printed in U.S.A. Form 50HQP-VQP-5SI Pg 16 4-21 Replaces: 50HQP-VQP-3SI