Fuji Electric

Instruction Manual

UL/NEMA Type 1 & Type 12

FRENIC-HVAC
Combination VFD

Safety Precautions

Read this manual thoroughly before proceeding with installation, connections (wiring), or maintenance and inspection. Ensure you have sound knowledge of the device and familiarize yourself with all safety information and precautions before proceeding to operate the drive. Refer to the ***FRENIC-HVAC*** drive Instruction Manual (INR-SI47-1707c-JE) for further safety information.

Safety precautions are classified into the following two categories in this manual.

Failure to heed the information indicated by this symbol may lead to dangerous conditions, possibly resulting in death or serious bodily injuries.

Failure to heed the information indicated by this symbol may lead to dangerous conditions, possibly resulting in minor or light bodily injuries and/or substantial property damage.

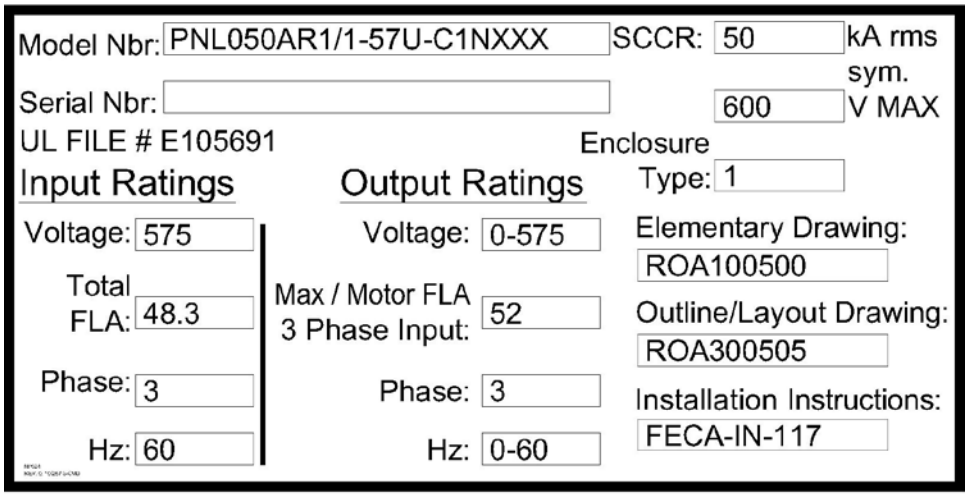
FRENIC-HVAC Combination VFD Overview

The ***FRENIC-HVAC*** Combination VFD is a packaged drive solution in a UL Type 1 or Type 12 enclosure designed for indoor HVAC applications.

Features

- UL/NEMA Type 1 or Type 12 enclosure – "slim-type" design
- Non-fusible input disconnect with padlockable through-the-door operator handle mechanically interlocked with the enclosure cover/door (motor branch circuit protection required and to be provided by others), also available is an optional input circuit breaker with padlockable through-the-door operator handle mechanically interlocked with the enclosure cover/door
- DC link reactor integral for improved power factor and harmonic mitigation up to 60 HP at 208/230V and 125 HP at 460 & 575V. External mounted within the enclosure for larger sizes.
- Integral EMC filter compliant with IEC/EN61800-3-12
- VFD mounted keypad with backlit LCD for drive set-up, troubleshooting, local operation control, maintenance indication, and operational indication. Keypad displays engineering units for easy-to-understand information.
- Keypad functions as a copy unit
- 0 to 10Vdc or 0/4 to 20mA customer supplied analog input for speed reference
- 0 to 10Vdc or 0/4 to 20mA analog output for indication (programmable)
- Run, Enable, and Fireman Override inputs
- Optional damper control output contacts
- Drive Run and Fault status output contacts
- Real Time Clock (RTC) function with alarm history for the last 10 alarms
- Enhanced automatic energy savings, reduces power consumption of both the motor *and* VFD
- Power consumption data available via VFD keypad
- Built-in PID control with sleep function & auto-tuning
- "Catch-a-spinning motor" functionality available
- Built-in communications user selectable between Modbus RTU, Metasys® N2, or BACnet, with additional communication drive options including; LonWorks® and EtherNet [including Modbus/TCP & BACnet/IP]
- UL Listed assembly per UL-508A

Panel Identification



Each ***FRENIC-HVAC*** Combination VFD has a nameplate label, like the example pictured above, which contains important information about the panel. This label is located on the inside of the hinged door or cover of the enclosure.

CAUTION

- Refer to the nameplate label to determine the panel input voltage and current requirements prior to installation and wiring.
- Refer to the nameplate label for the correct wiring diagram (Elementary Drawing).
- Sizing of field wiring conductors should be based upon the current ratings listed on the nameplate label.

Installation

CAUTION

The ***FRENIC-HVAC*** Combination VFD should be located:

- Away from flammable or combustible liquids, gases, and other materials
- Away from sources of severe dust, metal shavings, or other particulate material
- Away from corrosive liquids, spray, or mist
- Away from sources of heat
- Where the ambient temperature will remain between -10°C (14°F) and 40°C (104°F)
- Where the elevation is 3300ft or lower, above this level requires derating the current

Wall-mount panels must be mounted to a surface that is capable of supporting the weight of the panel.

Refer to the Outline/Layout drawing that shipped with the panel for required clearances.

Routing of field wiring should be planned in coordination with choosing a mounting location.

Disconnect – Motor branch circuit protection to be provided by customer/others per table on next page.

Motor Branch Circuit Protection

Hp Rating	Additional Motor Branch Circuit Protection Maximum Amp Rating & Type Required
208/230VAC, 60Hz, 3PH	
1	10A - Class J Time-Delay Fuses
2	10A - Class J Time-Delay Fuses
3	15A - Class J Time-Delay Fuses
5	25A - Class J Time-Delay Fuses
7.5	30A - Class J Time-Delay Fuses
10	50A - Class J Time-Delay Fuses
15	70A - Class J Time-Delay Fuses
20	100A - Class J Time-Delay Fuses
25	100A - Class J Time-Delay Fuses
460VAC, 60Hz, 3PH	
1	3A - Class J Time-Delay Fuses
2	6A - Class J Time-Delay Fuses
3	10A - Class J Time-Delay Fuses
5	15A - Class J Time-Delay Fuses
7.5	20A - Class J Time-Delay Fuses
10	25A - Class J Time-Delay Fuses
15	30A - Class J Time-Delay Fuses
20	50A - Class J Time-Delay Fuses
25	60A - Class J Time-Delay Fuses
30	70A - Class J Time-Delay Fuses
40	100A - Class J Time-Delay Fuses
50	100A - Class J Time-Delay Fuses
575VAC, 60Hz, 3PH	
1	3A - Class J Time-Delay Fuses
2	6A - Class J Time-Delay Fuses
3	6A - Class J Time-Delay Fuses
5	10A - Class J Time-Delay Fuses
7.5	15A - Class J Time-Delay Fuses
10	20A - Class J Time-Delay Fuses
15	25A - Class J Time-Delay Fuses
20	30A - Class J Time-Delay Fuses
25	40A - Class J Time-Delay Fuses
30	50A - Class J Time-Delay Fuses
40	70A - Class J Time-Delay Fuses
50	100A - Class J Time-Delay Fuses

Wiring Overview

The ***FRENIC-HVAC*** Combination VFD must be connected to an input power source, a motor (output power), ground, and control may be local or by using remote devices such as switches, potentiometers, etc….

WARNING

- Wiring should be performed by a qualified electrician using standard practices as specified by local and national codes.
- Always make sure the input power source is OFF before connecting or disconnecting any power input, output, or control wiring.
- Ground the panel, as specified by local and national codes, using the provided grounding lugs.
- Make sure that the input power source (phases, voltage, and current capacity) matches the requirements of the panel as stated on the nameplate.
- Never connect line voltage to the drive output terminals (U, V, and W).
- IF not using the provided conduit holes, then when making holes for conduit fittings, be sure to cover the drive and other components to protect them from metal shavings.

CAUTION

- All field wiring should be copper with a minimum insulation rating of 75°C.
- Sizing of field wiring conductors should be based upon the current ratings listed on the nameplate label, in accordance with local and national codes.

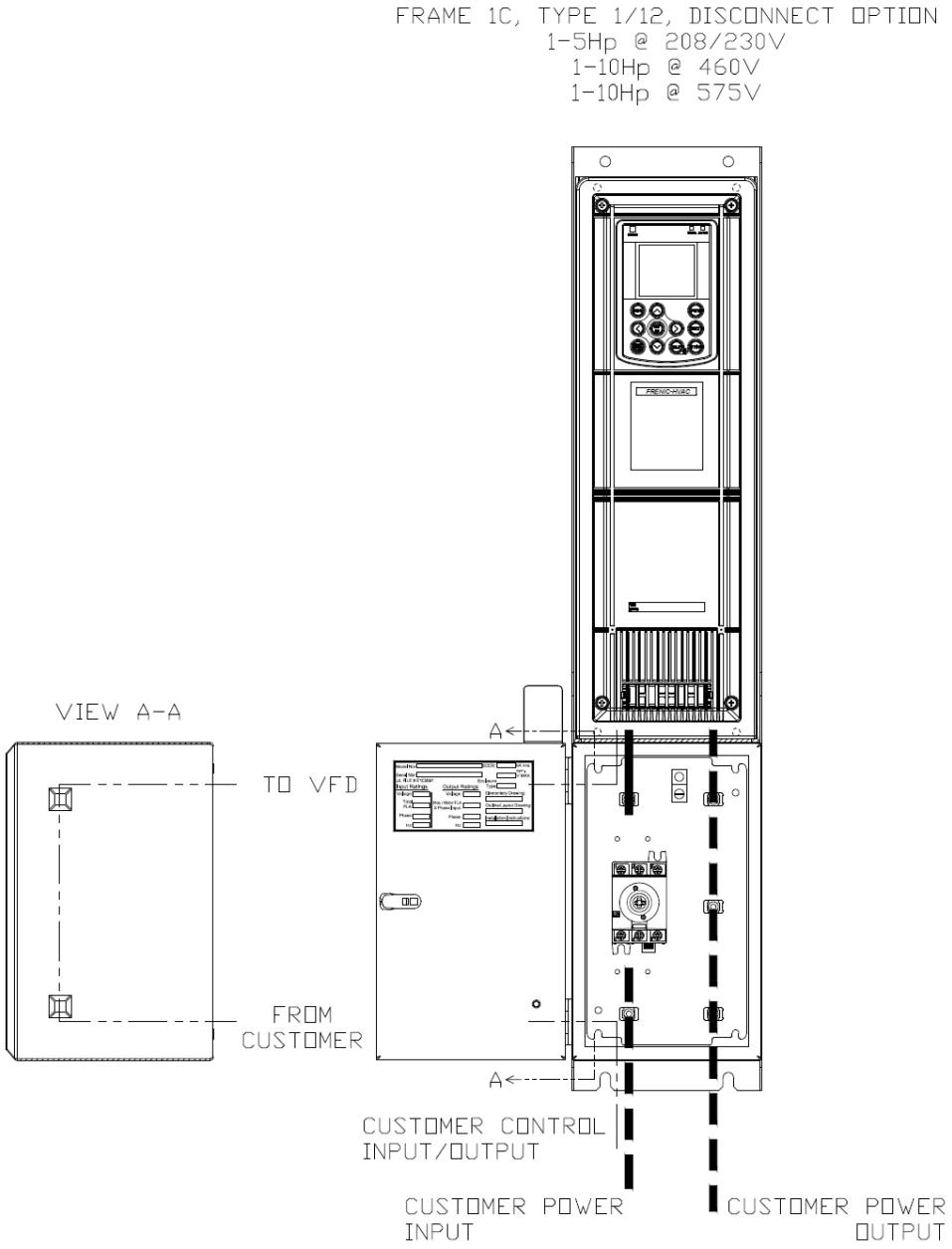
Refer to the Elementary diagram that shipped with this panel and the torque table in this Instruction Manual.

Refer to the diagrams on the following pages for general component layout and for general routing of power input, power output (motor connections), and control wiring for your panel. Power input wiring should be routed away from power output wiring, and both should enter the panel from separate conduit. Control wiring should be routed away from power wiring, and should enter the panel from separate conduit.

Refer to the following section **Control Wiring** for descriptions of the control connections.

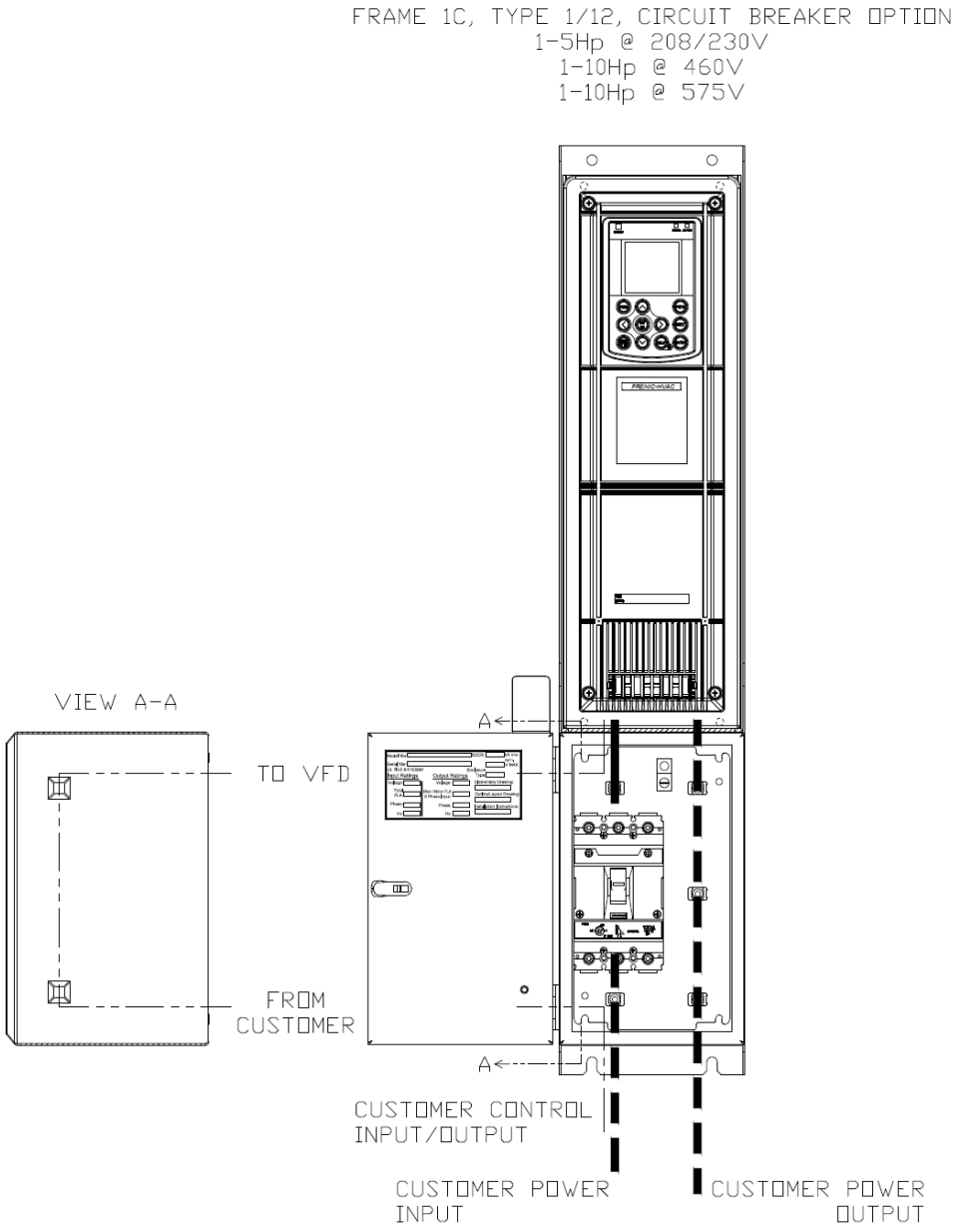
Wiring Overview (cont'd)

UL/NEMA Type 1 & 12 (Typical Wire Routing)



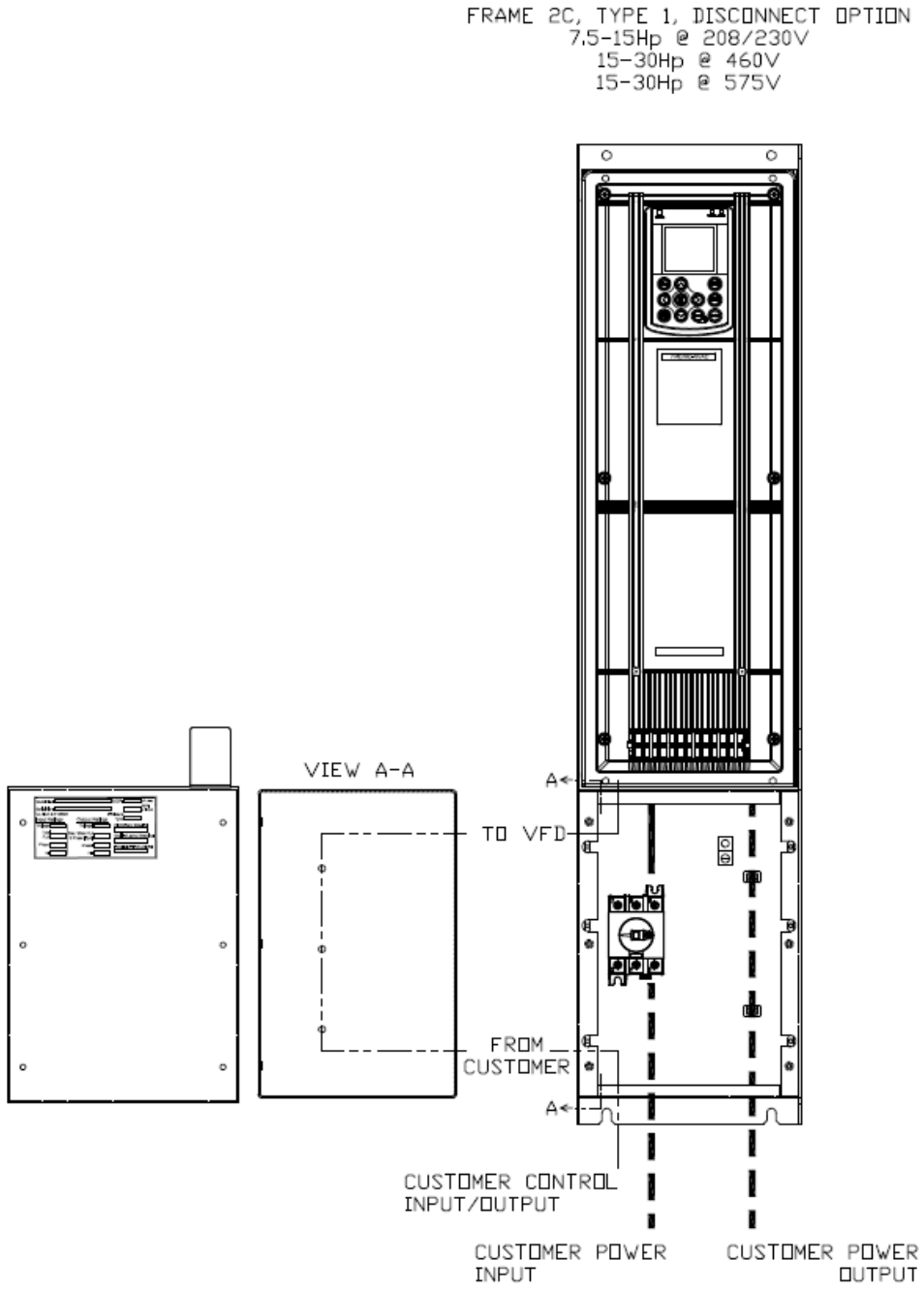
Wiring Overview (cont'd)

UL/NEMA Type 1 & 12 (Typical Wire Routing)



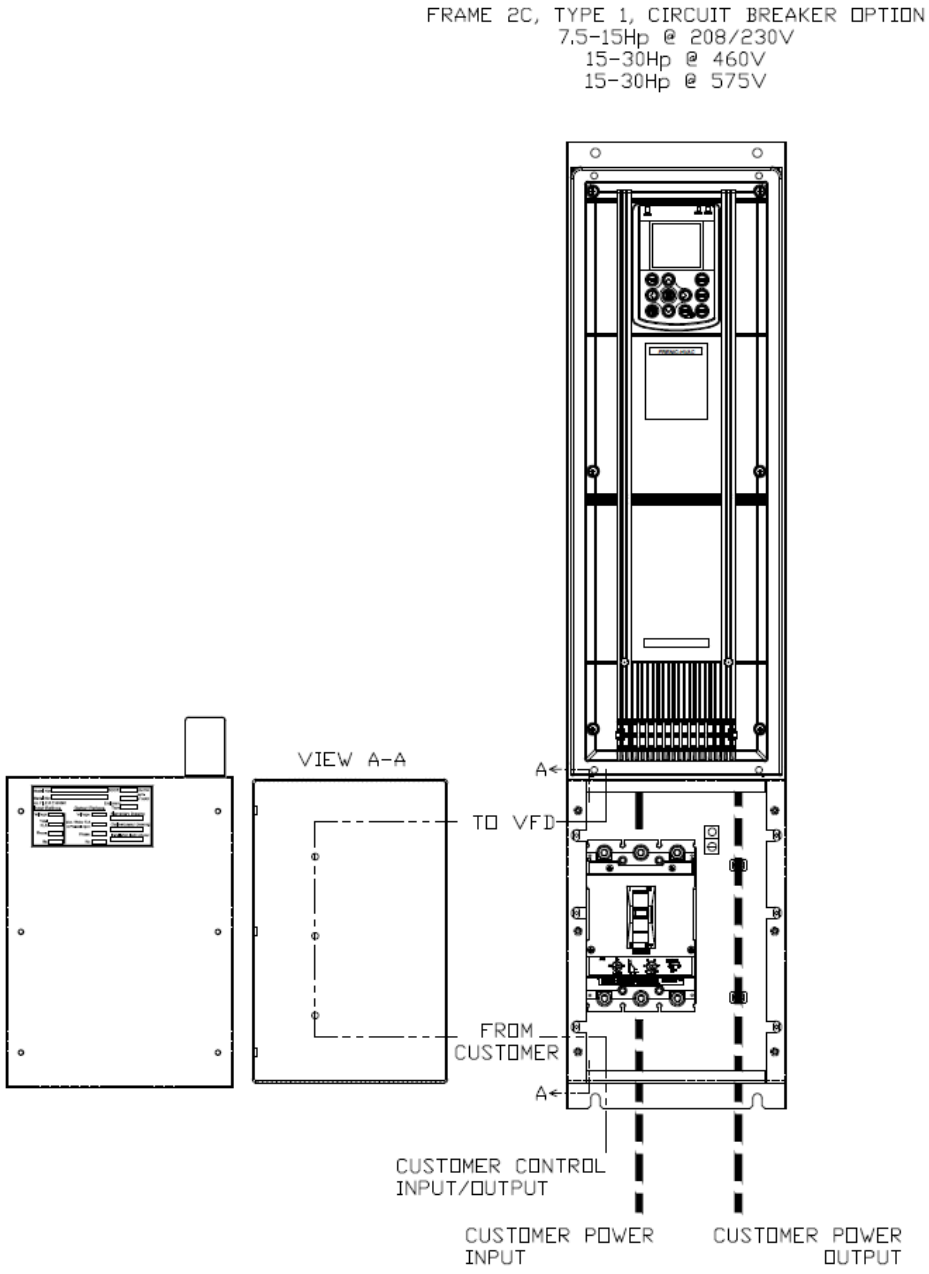
Wiring Overview (cont'd)

UL/NEMA Type 1 (Typical Wire Routing)



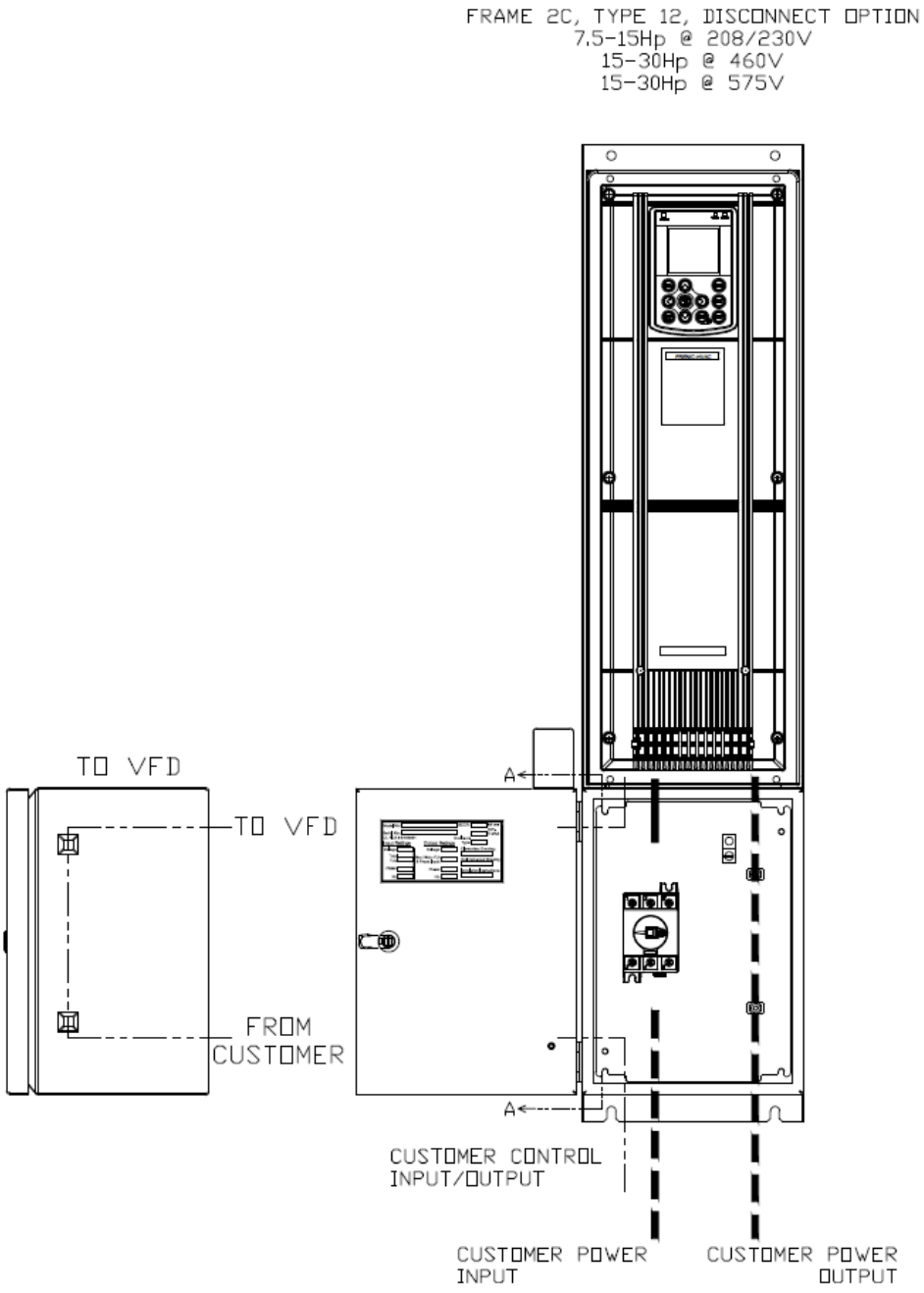
Wiring Overview (cont'd)

UL/NEMA Type 1 (Typical Wire Routing)



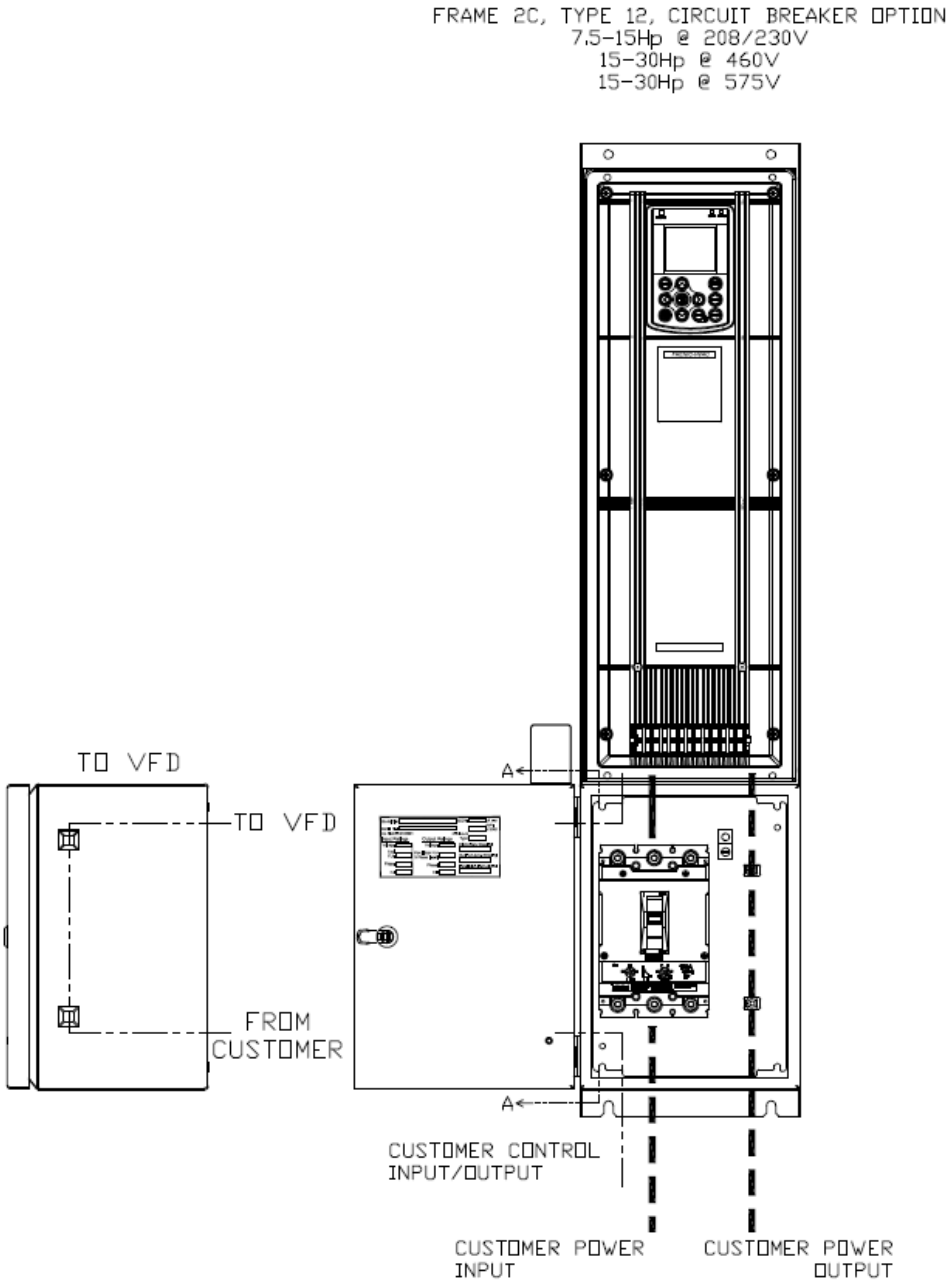
Wiring Overview (cont'd)

UL/NEMA Type 12 (Typical Wire Routing)



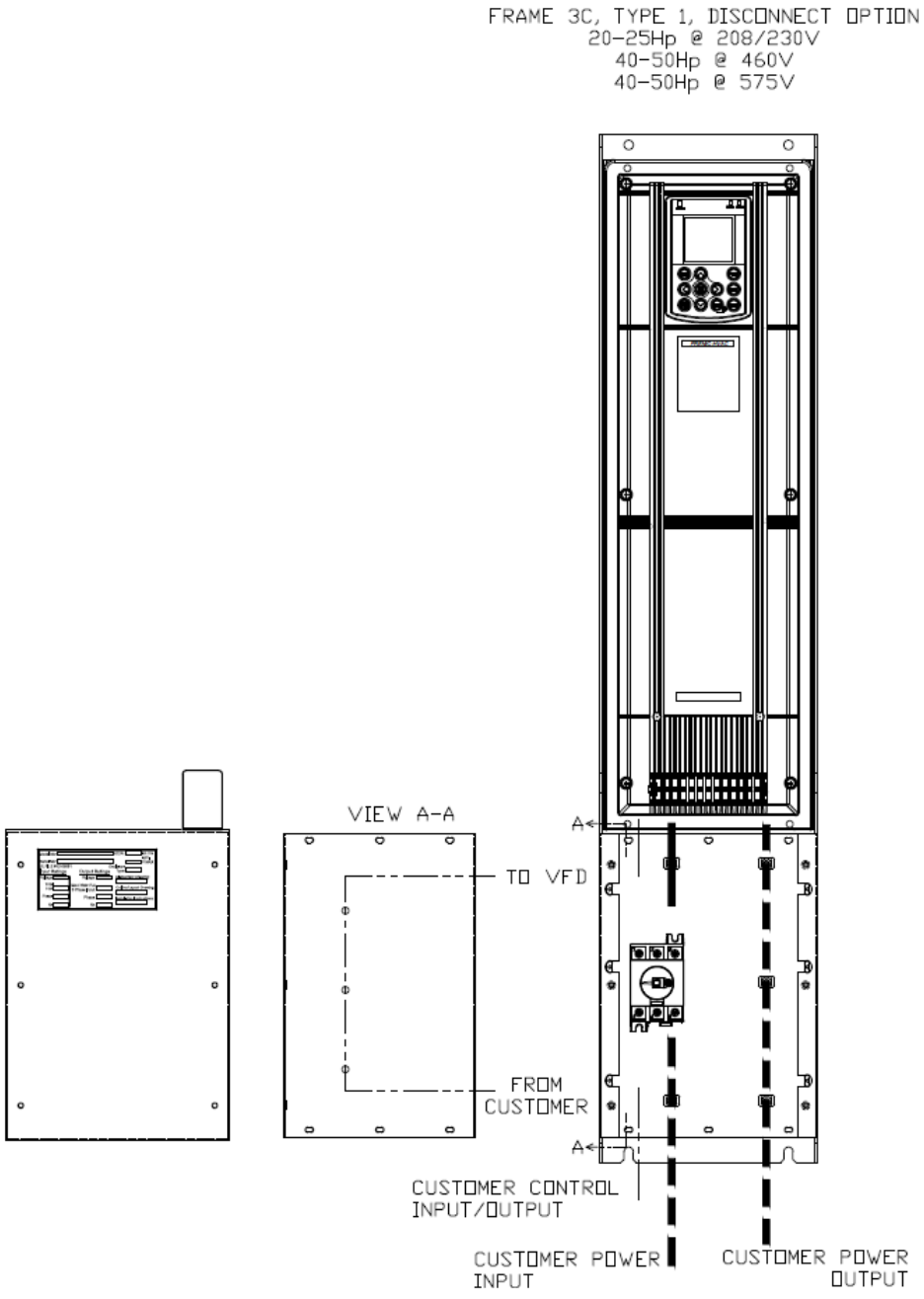
Wiring Overview (cont'd)

UL/NEMA Type 12 (Typical Wire Routing)



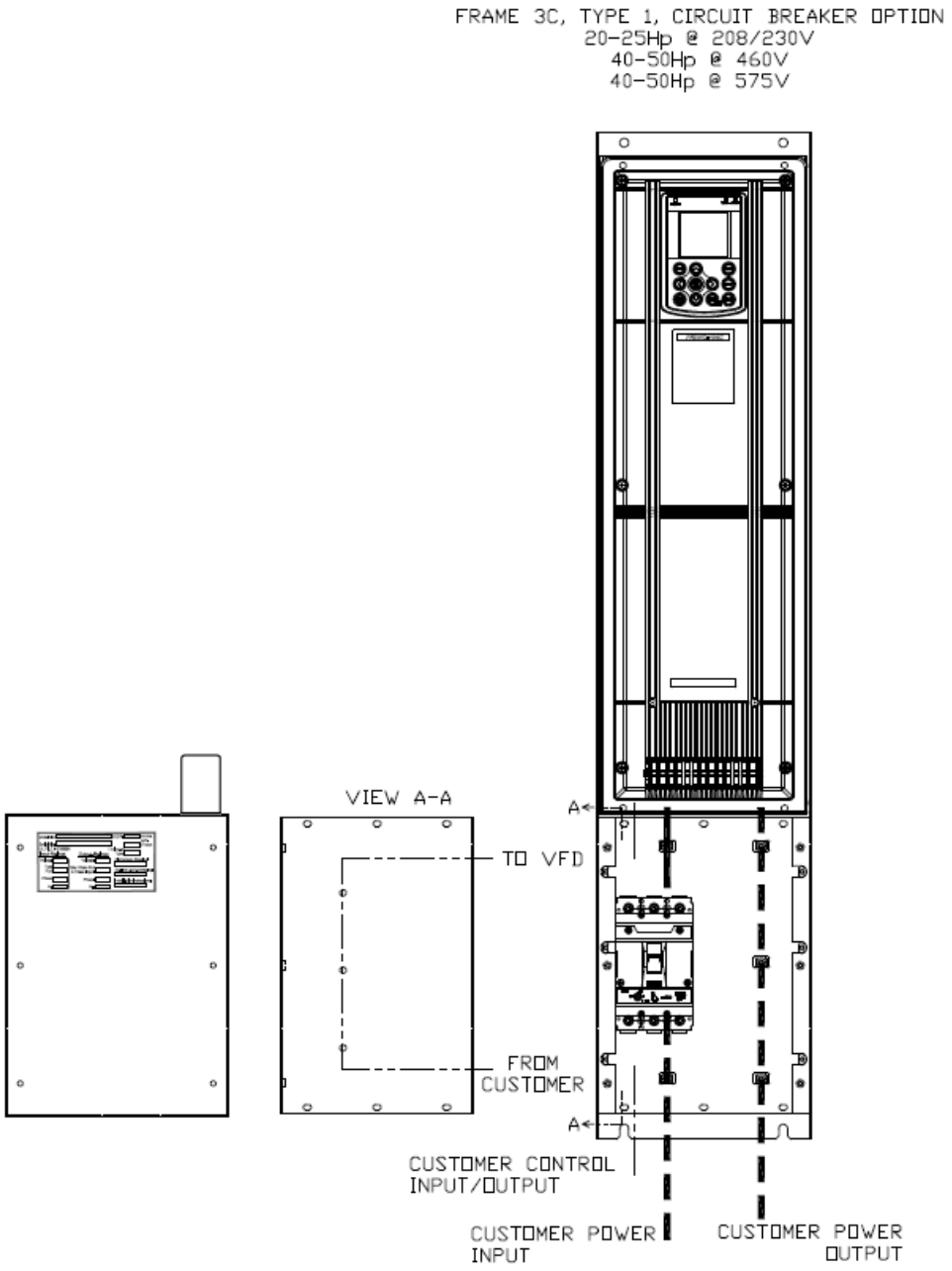
Wiring Overview (cont'd)

UL/NEMA Type 1 (Typical Wire Routing)



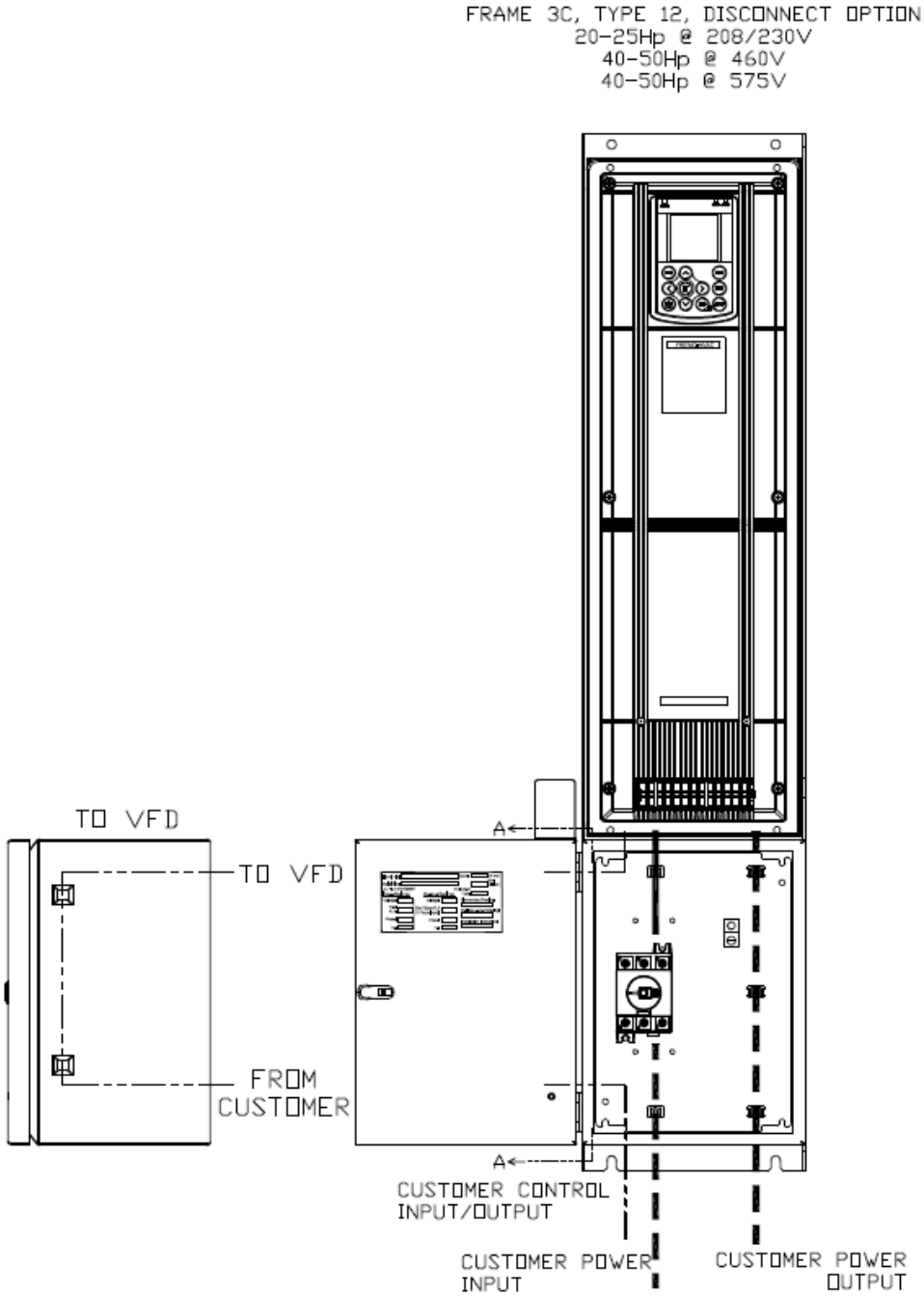
Wiring Overview (cont'd)

UL/NEMA Type 1 (Typical Wire Routing)



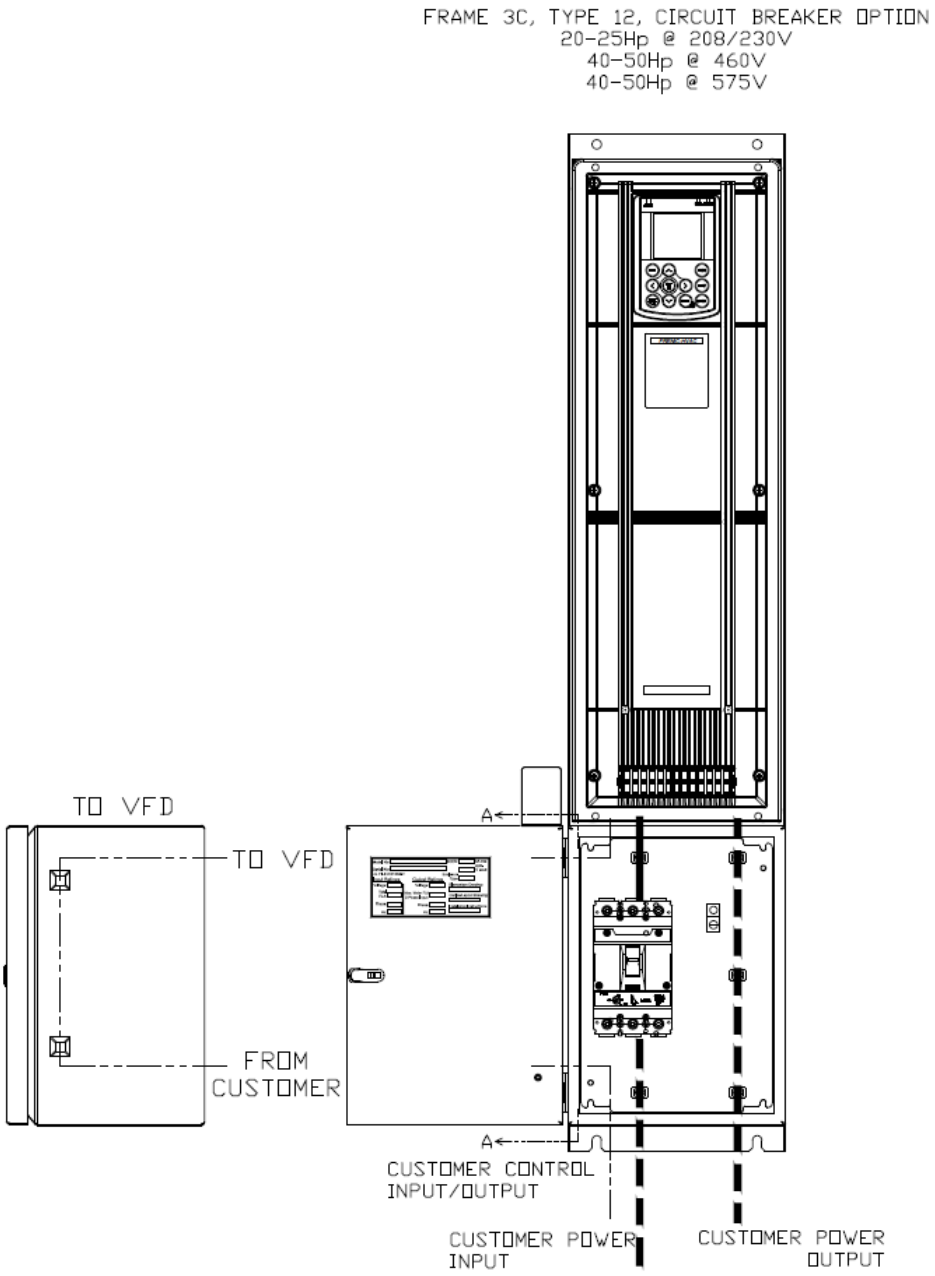
Wiring Overview (cont'd)

UL/NEMA Type 12 (Typical Wire Routing)



Wiring Overview (cont'd)

UL/NEMA Type 12 (Typical Wire Routing)



Wiring Overview (cont'd)

Power Wiring (Motor Leads)

The customer power output (motor leads) wiring connects directly to the U, V, and W terminals on the drive. The following picture shows wiring connections that are available on ***FRENIC-HVAC*** drives:

** Note **

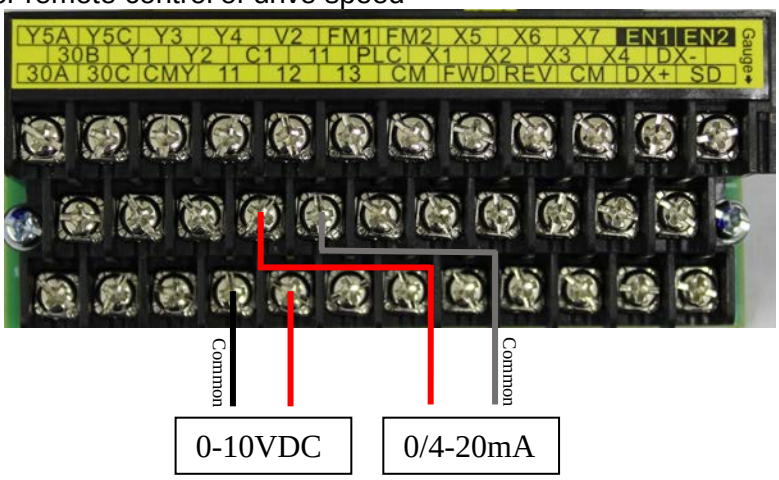
*The enable jumpers (PLC to EN1 & EN2) have been removed from the following pictures for clarity of illustration. **DO NOT** remove these jumpers unless specific use of these terminals is required for the application. Please reference the FRENIC-HVAC User's Manual (24A7-E-0069*) for details on utilizing EN1 & EN2 terminals.*

Control Wiring

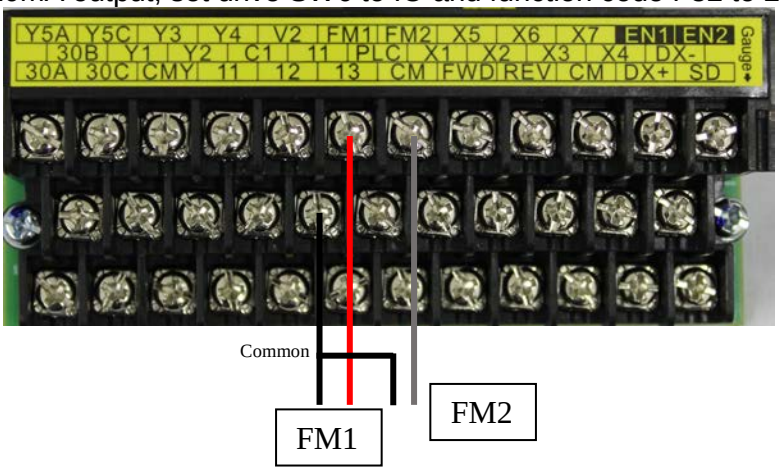
All control wiring connects directly to the control terminal board on the drive. The following pictures show typical control wiring connections that are available on ***FRENIC-HVAC*** drives.

Description of Control Connections

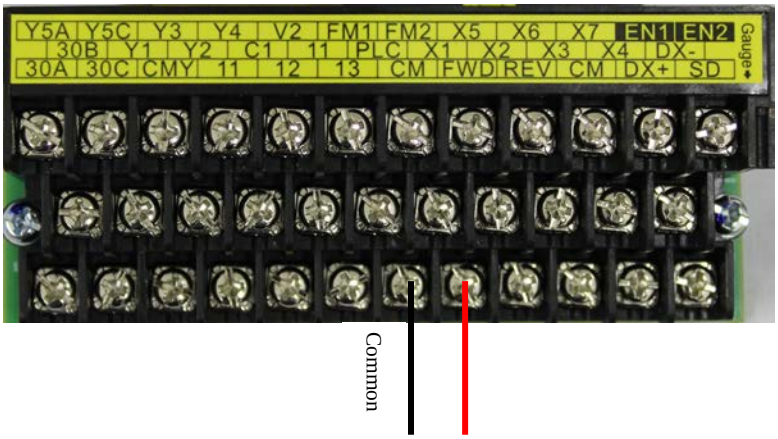
- **Analog speed reference** *input:*
  - VFD terminals 11 & 12 for 0-10VDC *OR*
  - VFD terminals 11 & C1 for 0/4-20mA
  - Used for remote control of drive speed



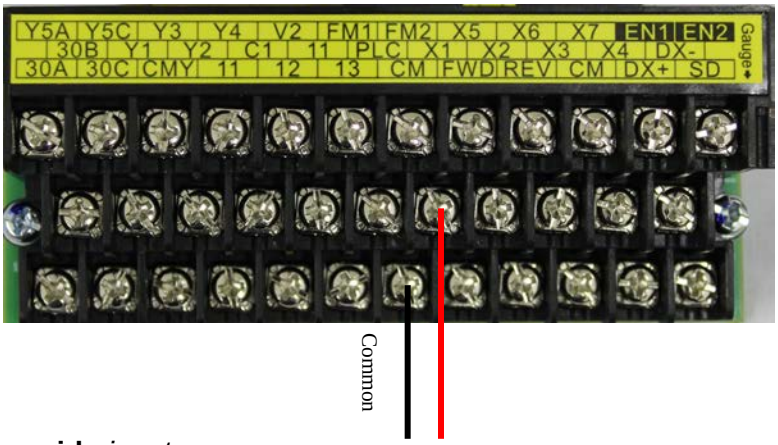
- **Analog monitor** *output:*
  - VFD terminals 11 & FM1 for 0-10VDC
  - Drive function code F31 sets signal function, default is output frequency
  - For 0-10VDC output, set drive SW4 to VO and function code F29 to 0
  - For 4-20mA output, set drive SW4 to IO and function code F29 to 1
  - For 0-20mA output, set drive SW4 to IO and function code F29 to 2
  - VFD terminal 11 & FM2 for 0/4-20mA
  - Drive function code F35 sets signal function, default is output frequency
  - For 0-10VDC output, set drive SW6 to VO and function code F32 to 0
  - For 4-20mA output, set drive SW6 to IO and function code F32 to 1
  - For 0-20mA output, set drive SW6 to IO and function code F32 to 2



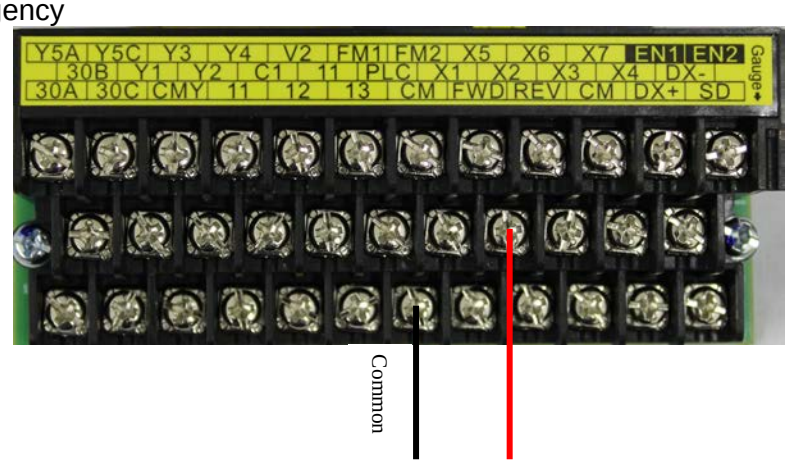
- **Run** *input:*
  - VFD terminals CM & FWD
  - Must be closed to run combination VFD



- **Enable** *input:*
  - VFD terminals CM & X1
  - Must be closed to run combination VFD



- **Fireman override** *input:*
  - VFD Terminals CM & X2
  - Can be programmed to provide manual override of the Run input, and motor overload relay, allowing the ***FRENIC-HVAC*** to operate in the event of an emergency



- **Drive Run** *output:*
  - VFD terminals Y5A & Y5C for NO contacts rated for 0.3A @ 250VAC max & 0.5A @ 48VDC
  - Used for monitoring drive run status

- **Drive Fault** *output:*
  - VFD terminals 30A & 30C for NO contacts rated for 0.3A @ 250VAC max & 0.5A @ 48VDC
  - VFD terminals 30B & 30C for NC contacts rated for 0.3A @ 250VAC max & 0.5A @ 48VDC
  - Used for monitoring drive fault status

See the ***FRENIC-HVAC Instruction Manual*** - INR-SI47-1707c-JE for additional information regarding the drive control connections.

Control Wiring (cont'd)

Options

- **Damper Control** *output:*
  - VFD relay card terminals 1A & 1C for NO contacts rated for 0.3A @ 250VAC max & 0.5A @ 48VDC
  - Used to control the position of a damper valve in coordination with drive operation

- **Programmable Relay 2A** *output:*
  - VFD relay card terminals 2A & 2C for NO contacts rated for 0.3A @ 250VAC max & 0.5A @ 48VDC
  - Provides a dry-contact output equivalent to the drive output signal Y4, which is user-selectable
- **Programmable Relay 2B** *output:*
  - VFD relay card terminals 2B & 2C NC contacts rated for 0.3A @ 250VAC max & 0.5A @ 48VDC
  - Provides a dry-contact output equivalent to the drive output signal Y4, which is user-selectable

Field Wiring Torque and Wire Size Values for HVAC Combination VFD 208/230V

<table>
<tr><th>HP</th><th>Non-Fusible Disconnect 'DISC'</th><th>Circuit Breaker 'CB'</th><th>Terminal Blocks 'VFD Terminals'</th></tr>
<tr><td>1</td><td rowspan="4">26.5 lb.in
14-4 AWG</td><td>31.9 lb.in
14-10 AWG</td><td rowspan="8">6.2 lb.in
18 AWG</td></tr>
<tr><td>2</td><td rowspan="2">39.9 lb.in
8 AWG</td></tr>
<tr><td>3</td></tr>
<tr><td>5</td><td>47.8 lb.in
6-3 AWG</td></tr>
<tr><td>7.5</td><td>55.7 lb.in
2-1 AWG</td></tr>
<tr><td>10</td><td rowspan="4">39.8 lb.in
14-1 AWG</td><td>36.2 lb.in
14 AWG</td></tr>
<tr><td>15</td><td rowspan="2">47.8 lb.in
12-10 AWG</td></tr>
<tr><td>20</td></tr>
<tr><td>25</td><td>133.6 lb.in
8-2/0 AWG</td></tr>
</table>

Note: Wire ranges provided indicate conductor sizes that the device terminal or lug will accept. Follow local and national codes for proper conductor sizing. See the ***FRENIC-HVAC Instruction Manual-*** INR-SI47-1707c-JE for additional information.

Field Wiring Torque and Wire Size Values for HVAC Combination 460V

	'DISC'	'CB'	'VFD Terminals'
1	26.5 lb.in '14-4 AWG	31.9 lb.in 14-10 AWG	6.2 lb.in 18 AWG
2			
3		39.9 lb.in 8 AWG	
5		47.8 lb.in 6-3 AWG	
7.5			
10		55.7 lb.in 2-1 AWG	
15			
20	39.8 lb.in 14-1 AWG	36.2 lb.in 14 AWG	
25			
30		47.8 lb.in 12-10 AWG	
40		133.6 lb.in 8-2/0 AWG	
50			

Note: Wire ranges provided indicate conductor sizes that the device terminal or lug will accept. Follow local and national codes for proper conductor sizing. See the ***FRENIC-HVAC Instruction Manual -*** INR-SI47-1707c-JE for additional information.

Field Wiring Torque and Wire Size Values for HVAC Combination 575V

<table>
<tr><th>HP</th><th>Non-Fusible Disconnect
'DISC'</th><th>Circuit Breaker
'CB'</th><th>Terminal Blocks
'VFD Terminals'</th></tr>
<tr><td>1</td><td rowspan="6">26.5 lb.in
'14-4 AWG</td><td rowspan="6">31.9 lb.in
14-10 AWG

39.9 lb.in
8 AWG

47.8 lb.in
6-3 AWG

55.7 lb.in
2-1 AWG</td><td rowspan="11">6.2 lb.in
18 AWG</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
<tr><td>5</td></tr>
<tr><td>7.5</td></tr>
<tr><td>10</td></tr>
<tr><td>15</td><td rowspan="5">39.8 lb.in
14-1 AWG</td></tr>
<tr><td>20</td></tr>
<tr><td>25</td><td rowspan="4">36.2 lb.in
14 AWG

47.8 lb.in
12-10 AWG

133.6 lb.in
8-2/0 AWG</td></tr>
<tr><td>30</td></tr>
<tr><td>40</td></tr>
<tr><td>50</td></tr>
</table>

Note: Wire ranges provided indicate conductor sizes that the device terminal or lug will accept. Follow local and national codes for proper conductor sizing. See the ***FRENIC-HVAC Instruction Manual -*** INR-SI47-1707c-JE for additional information.

BASIC Combination VFD STARTUP

CAUTION

- Make sure all power and control wiring is completed before proceeding.
- As with all electrical equipment installations, insure all safety/wiring instructions have been followed in accordance with this product's manuals and local and national codes.

1. Energize panel by turning circuit breaker/disconnect switch to the 'ON' position.
2. Set drive parameters for the connected motor (Refer to the drive instruction manual). Set drive speed control to 'Local' by pressing and holding the 'Help/REM/LOC' button for 3-5 seconds on the drive keypad.
3. Push the 'FWD' button on the keypad to energize the drive. Use the Up/Down keys in conjunction with the Left/Right keys to change the drive speed as necessary.
4. Set the speed at 5Hz.
5. Check that the motor rotates in the correct direction. To change, refer to the **Troubleshooting** section in this manual.
6. Allow motor to run at full speed for a sufficient time to insure any overloads are properly set. Adjust, if necessary. Measure and record motor FLA if required.
7. Push the 'Stop' button on the keypad and allow the motor to come to a complete stop. Change any additional parameters as necessary per the application. Set drive speed control to 'Remote' by pressing and holding the 'Help/REM/LOC' button for 3-5 seconds on the drive keypad.
8. De-energize panel.
9. Record startup data for future reference.

Setting up Local Control

Also refer to the following section ***Programming the FRENIC-HVAC Combination VFD*** *and the* ***FRENIC-HVAC*** *drive Instruction Manual (*INR-SI47-1707c-JE*) for more information.*

The ***FRENIC-HVAC*** Combination VFD was intended to be integrated into a building automation system and controlled by remote signals. If these signals are not available, the combination VFD can be set up to be operated locally. Follow these steps to set the panel up for local operation:

1. Use HELP/REM/LOC button.

The HVAC Combination VFD can now be operated directly using the drive keypad.

COMMON PARAMETER SETTINGS

*Also refer to the **FRENIC-HVAC** drive's User's Manual (*24A7-E-0069**) located on the CD provided as part of the documentation package for additional information.*

Factory-set drive parameters and settings

These parameters and settings are pre-set from the factory for the combination VFD to be operational. If, for some reason, the drive parameters are reinitialized, these parameters must be reset for correct panel operation.

Drive function codes:

- F01 = 3
- F02 = 1
- F31 = 0
- F32 = 0
- F35 = 0
- E01 = 1007
- E02 = 134
- E22 = 55 (If damper control option is provided)
- E24 = 0
- E27 = 99
- H08 = 1
- H96 = 1
- H118 = 60

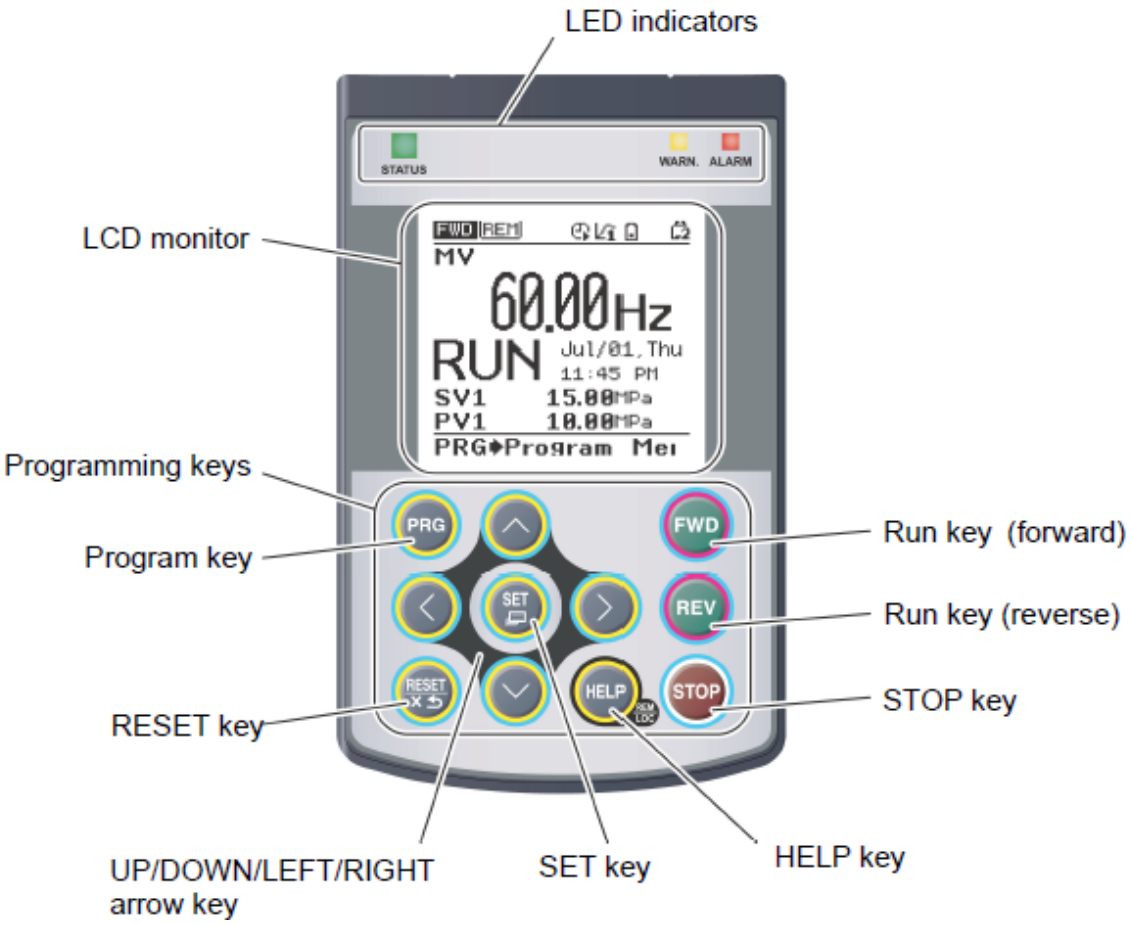
Drive Switches:

- SW1 set to SINK
- SW5 set to C1

*Note: The above parameters are stored in the VFD keypad in KP1 location. Refer to the Instruction Manual for further details for copying the function code settings to and from the keypad.

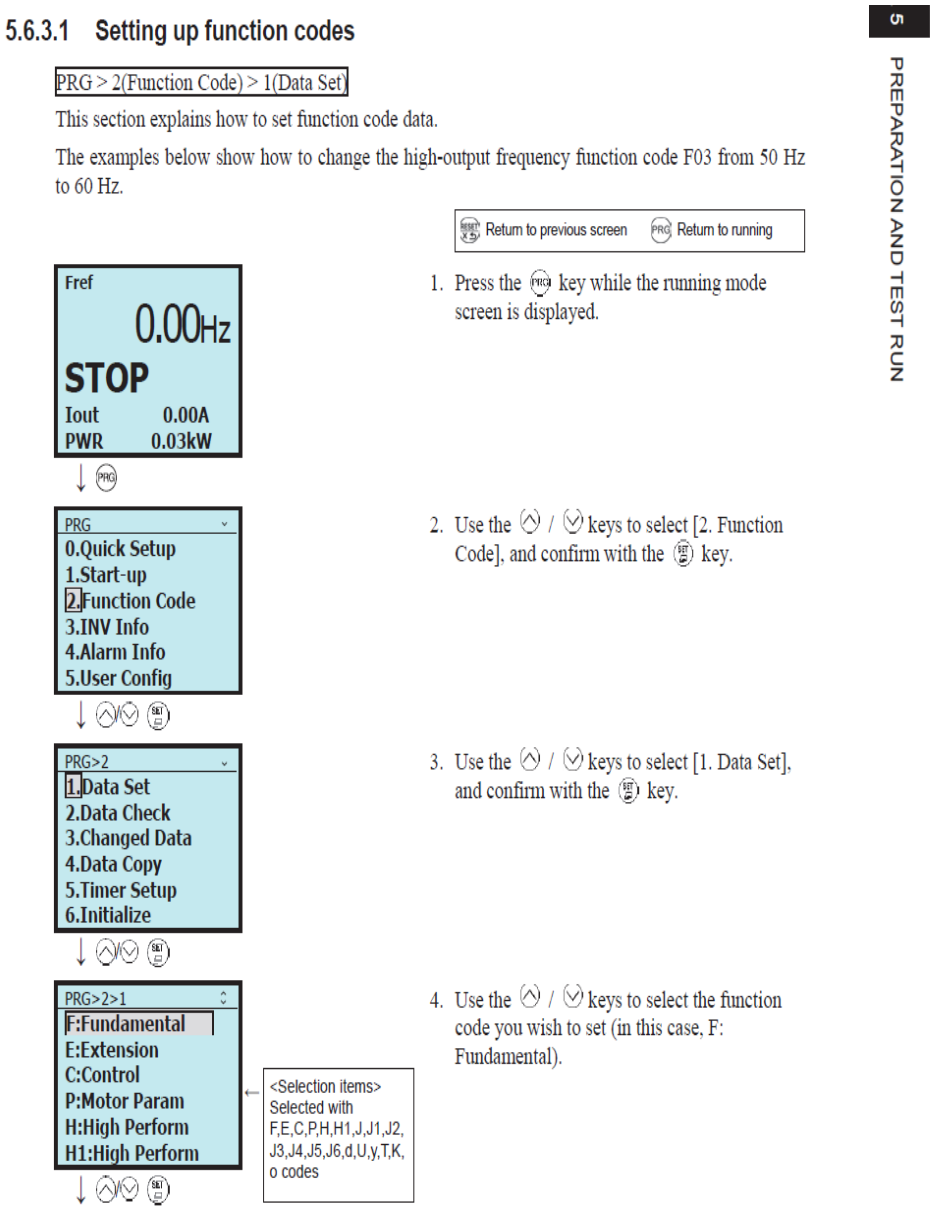
Programming the *FRENIC-HVAC* Combination VFD

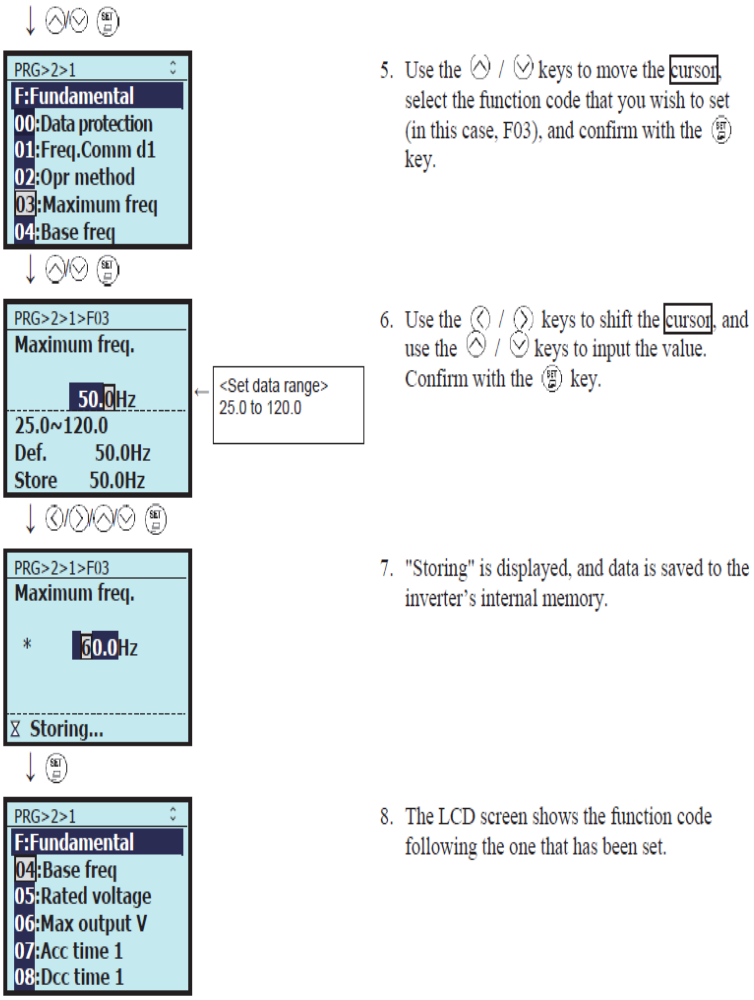
*Also refer to Chapter 5 in the **FRENIC-HVAC** drive's User's Manual (*24A7-E-0069**) for more information.*



Programming the *FRENIC-HVAC Combination VFD*
(cont'd)

To set drive parameters using the keypad, first make sure the drive is stopped. Parameters cannot be changed while the drive is running. To enter the programming menu, press the Program Key (PRG) on the keypad. To return to the previous screen, press (RESET) or to completely exit programming from any menu press (PRG). To select a menu item, use the (UP) and (DOWN) keys on the keypad, then press the (SET) key to go to that screen. Refer to the diagram below for an example of navigating the menu:





Function code settings can be changed using the (UP) and (DOWN) keys on the keypad. Pressing (SET) saves the changes, while pressing (RESET) discards the changes, and both return to the previous menu.

The most frequently modified parameters can be accessed in the 'Quick-Setup' menu (item 0 on the programming menu screen). All parameters can be accessed by opening the 'Function Code' menu (item 2 on the programming menu screen), then opening 'Data Set' (item 1 on the PRG>2 menu screen).

Recommended user-set drive parameters

*These parameters are all in the **FRENIC-HVAC** drive Quick-Setup menu for easy access.*

- F07 Acceleration Time
- F08 Deceleration Time
- F10/F11 Electronic Overload
- F14 Restart Settings. Refer to drive instruction manual
- F26 Motor Sound (carrier frequency)
- P02 Motor Capacity (HP)
- P03 Motor FLA
- P04 Motor Tuning. Refer to drive instruction manual

OPERATION

Operator Controls

The ***FRENIC-HVAC Combination VFD*** includes the following controls for local operation and monitoring:

- Main power Disconnect/Circuit Breaker
- Drive keypad

The ***FRENIC-HVAC Combination VFD*** includes the following controls for remote operation and monitoring:

- Analog speed reference *input*
- Analog monitor *output*
- Run *input*
- Enable *input*
- Fireman's override *input*
- Drive Fault *output*
- Drive Run *output*
- Damper control *output – optional*

MAINTENANCE

Periodic Maintenance

The following items require periodic inspection and maintenance:

- Fans should be checked for proper operation and filters cleaned and/or replaced on a schedule that suits local ambient conditions.
- Power wiring connections should be checked and re-torqued every six months.
- Refer to the ***FRENIC-HVAC*** drive Instruction Manual (INR-SI47-1707c-JE) for drive maintenance requirements and schedule.
- Removal of the fans requires depressing the retaining clip and lifting the assembly out of its location and unplugging the connector. For the 30Hp model, the nut on the side of the retaining clip needs removed. When finished, reinstall the nut and torque it to 55-58 lb.in.
- Refer to the pictures on page 34 for the procedure to re-installing the front cover of the VFD to prevent damage to the gasket.

1-5Hp @ 208/230V & 1-10Hp @ 460V & 575V

7.5-15Hp @ 208/230V & 15-30Hp @ 460V & 575V

Remove this nut for ease of fan removal. Reinstall after servicing the fan and torque to 55-58 lb.in.

20-25Hp @ 208/230V & 40-50Hp @ 460V & 575V

- To replace the front cover of the VFD, #1 angle the bottom of the VFD faceplate at a 45 degree angle and place the front edge on the VFD and then #2 slide the cover down toward the gasket making sure not to damage the gasket.

- #3 with the bottom securely against the gasket, angle the top of the front cover onto the VFD and tighten the screws.

TROUBLESHOOTING

FRENIC-HVAC Drive

For drive-specific issues, refer to the ***FRENIC-HVAC*** drive instruction manual (INR-SI47-1707c-JE).

Motor Rotation

- Problem: Motor turns in incorrect direction.
  Solution: Swap two of the three motor output connections.

For Additional Support Please Call
1-888-900-3854