Franklin Electric

EN ENGLISH

CERUS X-DRIVE

Installation and Operation Manual

Firmware Version 1.3

franklin-electric.com

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SAFETY INSTRUCTIONS

Hazard Messages

This manual includes safety precautions and other important information in the following formats:

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate personal injury.

NOTICE

Indicates a potentially hazardous situation which, if not avoided could result in damage to equipment or other property.

IMPORTANT: Identifies information that controls correct assemblyand operation of the product.

NOTE: Identifies helpful or clarifying information.


This symbol alerts the user to the presence of dangerous voltage inside the product that might cause harm or electrical shock.


This symbol alerts the user to the presence of hot surfaces that might cause fire or personal injury

Before Getting Started

This equipment should be installed and serviced by technically qualified personnel who are familiar with the correct selection and use of appropriate tools, equipment, and procedures. Failure to comply with national and local electrical and plumbing codes and within Franklin Electric recommendations may result in electrical shock or fire hazard, unsatisfactory performance, or equipment failure.

Read and follow instructions carefully to avoid injury and property damage. Do not disassemble or repair unit unless described in this manual.

Failure to follow installation or operation procedures and all applicable codes may result in the following hazards:

⚠ WARNING

High voltages capable of causing severe injury or death by electrical shock are present in this unit.

- To reduce risk of electrical shock, disconnect power before working on or around the system. More than one disconnect switch may be required to de-energize the equipment before servicing.
- Make sure the ground terminal is connected to the motor, control enclosures, metal plumbing, and other metal near the motor or cable using wire no smaller than motor cable wires.

⚠ CAUTION

Risk of bodily injury, electric shock, or property damage.

- This equipment must not be used by children or persons with reduced physical, sensory or mental abilities, or lacking in experience and expertise, unless supervised or instructed. Children may not use the equipment, nor may they play with the unit or in the immediate vicinity.
- Equipment can start automatically. Lockout-Tagout before servicing equipment.
- This equipment produces high temperatures during normal operation. Use caution when contacting surfaces.
- Operation of this equipment requires detailed installation and operation instructions provided in this manual for use with this product. Read entire manual before starting installation and operation. End User should receive and retain manual for future use
- Keep safety labels clean and in good condition.

Product Specific Precautions

⚠ WARNING

High voltages capable of causing severe injury or death by electrical shock are present in this unit.

- Do not remove VFD cover for wiring or periodic inspections while power is applied, or the unit is in operation.
- Capacitors inside the drive can still hold lethal voltage even after power has been disconnected. ALWAYS check if DC bus charge LED is off and DC voltage on the terminals DC (+1) and DC (-) is less than 30VDC before working on VFD wiring. The DC bus capacitors may hold high-voltage charge for several minutes after the VFD power is disconnected.
- Perform wiring after VFD has been mounted. Otherwise, electric shock or bodily injury can occur.
- Do not apply power to a damaged VFD or to VFD with missing parts.
- Do not use VFD if power or motor cable is damaged.
- Do not handle the VFD or control devices with wet hands or when standing on a wet or damp surface, or in water.

⚠ CAUTION

Risk of bodily injury, electric shock, or property damage.

- Install VFD on a non-flammable surface. Do not place flammable materials nearby.
- Disconnect the input power if VFD has been damaged.
- Do not touch VFD after shutting down or disconnecting it. It can remain hot for a few minutes.
- Do not allow lint, paper, wood chips, dust, metallic chips or other foreign material into the drive.
- Some VFD parameters are set as default to automatically start VFD in some applications. Disable these parameters if automatic start is not safe for personnel or equipment.
- If restart after fault reset is selected, the VFD can start automatically after fault reset.
- If required, provide an emergency mechanical brake to prevent any hazardous conditions if VFD fails during operation.

NOTICE

Risk of damage to drive or other equipment.

- Install and wire VFD according to the instructions in this manual.
- Take protective measures against ESD (Electrostatic Discharge) before touching control boards during inspection, installation or repair.
- Do not connect power factor correction capacitors, surge suppressors, or RFI filter to the VFD output.
- Check if input power voltage is within acceptable range before applying power to VFD.
- Set correct motor data from the motor nameplate and overload protection parameters for proper motor overload protection.
- Do not modify VFD internal components and circuits.
- Power factor capacitors and generators may become overheated and damaged due to harmonics distortion created by VFD.
- The use of any disconnecting device (contactor, disconnect etc.) in motor circuit during VFD run can cause damage to VFD power components. Stop VFD before opening the motor circuit with disconnect or contactor.
- Use, if possible, an inverter rated or motor with insulation Class F or higher. For submersible pump motors, use Class B or higher. The VFD generates high frequency output pulses with spikes, which can deteriorate motor winding insulation and eventually damage the motor. The longer distance to the motor the higher amplitude of these voltage spikes will be applied to motor winding. Any cables with paralleled wires will increase the amplitude of these spikes at motor terminals.
- VFD can operate motor at frequencies higher than 50HZ or 60Hz. Verify the maximum allowed speed with motor and machinery manufacturers prior to increasing output frequency because it can overheat motor or damage machinery.

IMPORTANT:

- For asymmetric power supplies, like Corner-Grounded Delta, refer to"RFI Jumper" on page 39 for removal of RFI Jumper.
- For Open Delta Power Supply, the power supply must be treated as a single-phase input. Configure **Input Phase [SET-01]** to **1_Single Phase** and refer to "Models" on page 10 for single-phase current rating for each drive size.

PRODUCT INFORMATION

Description

The Cerus X-Drive is a variable frequency drive (VFD) designed to control and protect three phase motors in industrial, municipal, and agricultural sites. The X-Drive family offers an extensive range of amperage and configuration options, making it versatile enough for nearly any constant or variable torque application.

Industry standard application settings are pre-configured for submersible or centrifugal pumps, supply or exhaust fans, cooling towers, vacuum pumps, and constant torque, FE MagForce, and permanent magnet motors. In addition, many input/output and control options are available for application specific features, such as PID speed control, pressure control, temperature or fluid level controls, and scheduling.

Native Modbus and BACnet communication protocols allow integration with many automated control and building management systems. In addition, an optional Bluetooth communication card provides access for programming, operating, and monitoring the drive using the FE Connect for Cerus X-Drive Mobile App. Refer to "Optional Extension Cards" on page 131.

Features

Configuration

- Compatible with three-phase induction or permanent magnet motors
- Extensive selection of models available. Refer to "Models" on page 10.
- Easy setup with built-in application defaults
- Many programmable Input/Output terminal options
- Available NEMA (NEMA 1 or 3R) and UL (UL Type 1, IP21, or 4X) enclosure

Application-specific features

- Many pump specific features, including: Sleep mode, lubrication for hollow-shaft motors, pipe fill mode, broken pipe protection, screen clean
- Damper control
- Duel demand controls
- Automated scheduling
- Multi-motor and multi-drive

Operation

- Integrated HOA functionality
- Integrated display with keypad control of all functions
- Real-time fault logging with date and time stamps

Protection

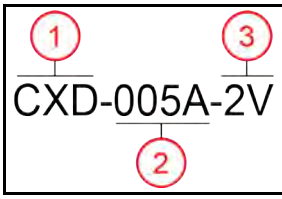
- Protection against short circuit, incorrect wiring, surges, underload, overload, overheat, undervoltage, overvoltage, phase loss, phase imbalance, output open phase, overpressure, sensor fault, etc.
- Allows motor to gradually ramp up and down, saving equipment from sudden, harsh rushes of current that can shorten its lifespan

Communication

- RS-485 communications (Modbus, BACnet) for remote control or monitoring
- Bluetooth connectivity with optional FE Connect Communications Card
- Communications for multi-drive operations—up to eight VFDs

Models

Model Number Codes



1. Product Family:
Cerus X Drive series
2. Amperage Ratings:
5 to 930 A

3. Input Voltage
2V = 200/230 V
4V = 460 V
6V = 575 V

	Frame A			Frame B			Frame C		
	SKU	Output Amp Rating		SKU	Output Amp Rating		SKU	Output Amp Rating	
		3–phase input	1–phase input		3–phase input	1–phase input		3–phase input	1–phase input
200V / 230V	CXD-005A-2V CXD-007A-2V CXD-010A-2V CXD-015A-2V CXD-021A-2V	5.0 7.5 10.0 15.0 21.0	2.5 3.7 5.0 7.5 10.5	CXD-031A-2V CXD-046A-2V CXD-061A-2V	31.0 46.0 61.0	15.5 23.0 30.5	CXD-075A-2V CXD-090A-2V CXD-105A-2V	75.0 90.0 105.0	37.5 45.0 52.5
460V	CXD-003A-4V CXD-004A-4V CXD-005A-4V CXD-008A-4V CXD-010A-4V CXD-013A-4V CXD-018A-4V	3.0 4.2 5.5 8.5 10.5 13.0 18.0	1.5 2.1 2.7 4.2 5.2 6.5 9.0	CXD-024A-4V CXD-032A-4V CXD-038A-4V	24.0 32.0 38.0	12.0 16.0 19.0	CXD-045A-4V CXD-060A-4V CXD-073A-4V	45.0 60.0 73.0	22.5 30.0 36.5
575V	CXD-003A-6V CXD-004A-6V CXD-006A-6V	3.0 4.3 6.7	1.5 2.1 3.3	CXD-009A-6V CXD-012A-6V CXD-018A-6VA CXD-024A-6V	9.9 12.1 18.7 24.2	4.9 6.0 9.3 12.1	CXD-030A-6V CXD-036A-6V CXD-045A-6V	30.0 36.0 45.0	15.0 18.0 22.5
	Frame D			**Frame E**			**Frame F**		
200V / 230V	CXD-146A-2V CXD-180A-2V	146.0 180.0	48.2 59.4	CXD-215A-2V CXD-276A-2V CXD-322A-2V	215.0 276.0 322.0	70.9 91.1 106.2			
460V	CXD-091A-4V **(DO)** CXD-110A-4V **(DO)** CXD-150A-4V CXD-180A-4V	91.0 110.0 150.0 180.0	30.0 36.3 49.5 59.4	CXD-220A-4V CXD-260A-4V	220.0 260.0	72.6 85.8	CXD-310A-4V CXD-370A-4V	310.0 370.0	102.3 122.1
575V	CXD-054A-6V CXD-067A-6V	54.0 67.0	17.8 22.1	CXD-086A-6V CXD-104A-6V CXD-125A-6V CXD-150A-6V	86.0 104.0 125.0 150.0	28.4	CXD-180A-6V CXD-220A-6V	108.0 220.0	
	Frame G			**Frame H**			**Frame H (690)**		
460V	CXD-460A-4V CXD-530A-4V	460.0 530.0	151.8 174.9	CXD-616A-4V CXD-683A-4V CXD-770A-4V CXD-930A-4V	616.0 683.0 770.0	203.1 225.4 254.1			
575V	CXD-290A-6V CXD-350A-6V	290.0 350.0					CXD-430A-6V CXD-465A-6V CXD-590A-6V CXD-675A-6V	430.0 465.0 590.0 675.0	

Applications

IMPORTANT:

- For asymmetric power supplies, like Corner-Grounded Delta, refer to "RFI Jumper" on page 39 for removal of RFI Jumper.
- For Open Delta Power Supply, the power supply must be treated as a single-phase input. Configure **Input Phase [SET-01]** to **1_Single Phase** and refer to "Models" on page 10 for single-phase current rating for each drive size.

Application	Options	Reference
Supply or Exhaust Fan	• BAS controlled • Damper • Smoke purge • Fire mode (exhaust fans only)	Refer to "Standard Operation with PID Feedback Control" on page 71 and "Damper Control (HVAC Applications)" on page 72.
Cooling Tower	• Temperature controller • Damper	Refer to "Temperature Protection or PID Control with PT-100 or PTC Sensor" on page 44 or "Damper Control (HVAC Applications)" on page 72.
Centrifugal (Surface/Booster) Pump	• Constant pressure • Constant flow • Constant level • Booster pump • Wastewater • Long pipe • Supply monitoring (2nd PID or pressure switch) • De-watering (clean screen)	Refer to "Basic VFD Configuration" on page 16, "Drive Configuration" on page 47, and "Operation" on page 67.
Submersible Pump	• Constant pressure • Dew-watering (2nd PID, well recovery timer) • Pivot/irrigation • Tank filling • Long pipe/dual acceleration • Lead-lag • Lead-lag-alternation • Jockey • Pony • Dual demand • Lubrication • Line-shaft turbine	Refer to "Basic VFD Configuration" on page 16, , "Drive Configuration" on page 47, and "Operation" on page 67.
Vacuum	• Car wash • Industrial	Refer to "Drive Configuration" on page 47 and "Operation" on page 67.
Constant Torque	• Shaker • Grinder • Crusher • Conveyor, Feeder • Mill/Roller	Refer to "Fuse and Circuit Breaker Sizing" on page 35, "Drive Configuration" on page 47, and "Specifications" on page 235.
Permanent Magnet Motor	• Submersible • FE MagForce	Refer to "Operation with Permanent Magnet Motors" on page 99.

UNPACKING AND INSPECTION

Transportation and Storage

NOTICE

Risk of damage to VFD or other equipment.

- Do not stack VFD boxes higher than standard 48 inches cube height when palleting for storage.
- Do not place heavy items on VFD.
- Do not drop VFD or subject it to hard impact.
- Dispose of VFD properly as industrial equipment waste.

The VFD should be stored in the shipping carton or crate before installation in a controlled environment that meets the following requirements:

Storage Temperature	-25 to 70 °C (-13 to 158 °F)
Location	Pollution Degree 2 Environment
Relative Humidity	95% Maximum relative humidity (non-condensing)

The performance of capacitors in the drive degrades if not charged occasionally. It is recommended to charge a stored drive every 2 years to restore the performance of the capacitors.

NOTE: If the VFD is kept in storage for longer than 2 years, when powering the drive, use an adjustable AC power source (ex. AC autotransformer) to charge the drive at 70 to 80% of the rated voltage for 30 minutes (do not run the drive). Then, charge the drive at 100% of rated voltage for an hour (do not run the drive).

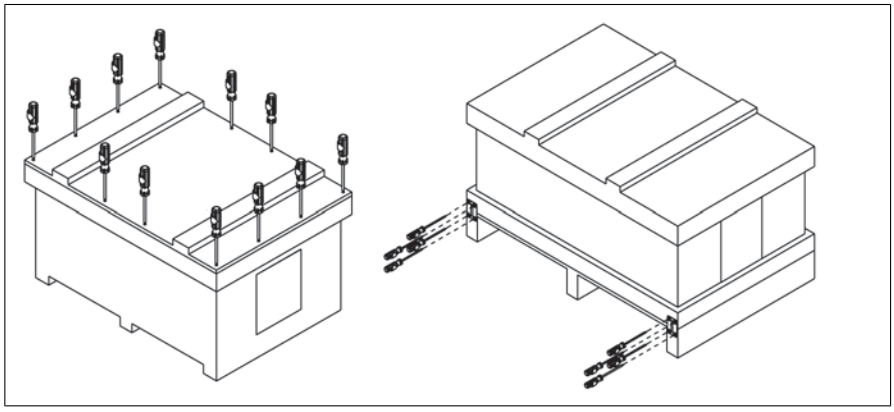
Unpacking

⚠ CAUTION

Risk of personal injury or damage to VFD or other equipment.

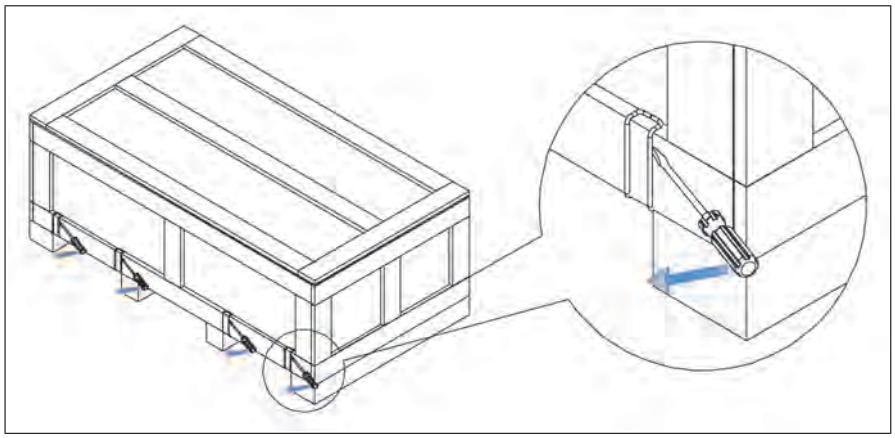
- Use suitable lifting equipment, in good condition, rated for at least 5 times the weight of the VFD.

NOTE: Refer to "Specifications" on page 235 for the weight of each drive by frame size.



1. Inspect exterior of package for shipping damage. If there is damage, notify the shipping agent and your sales representative.
2. Make sure the part number and product ratings on the identification label are correct for the application.
3. When possible, remove the VFD cover and make sure the product ratings on the nameplate match the package label.
4. The VFD comes in various forms of shipping crates. If applicable, remove the top and side fasteners from the packaging.

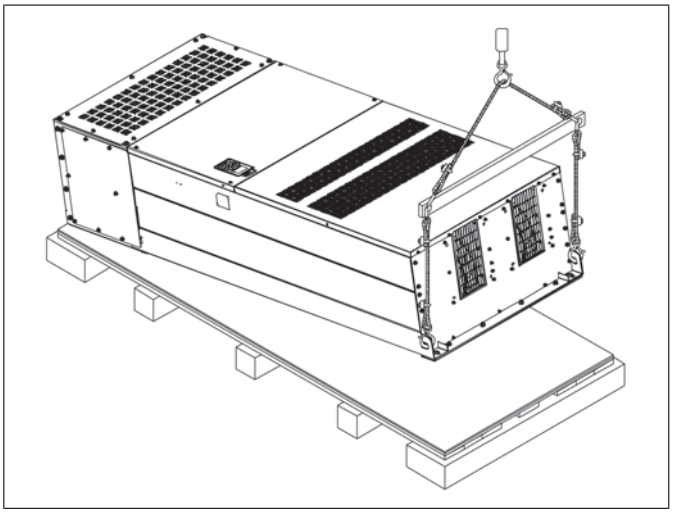
5. Some crates are secured with clips. Remove clips with a suitable prying tool.
6. Remove the crate cover, foam packing inserts, owner's manual, and any other items inside the crate.
7. Remove fasteners securing the drive to the pallet.
8. Inspect the VFD for damage.
9. Allow the drive to remain on the pallet until you are ready to install it in the permanent location. Refer to "Mounting the Drive" on page 18.



Lifting

When removing large VFDs from the pallet, use suitable lifting equipment connected to the lifting holes at the top outer edges of the unit.

Use a spreader bar the same width as the drive so the lifting cables are straight up and down.



INSTALLATION PLANNING

NOTICE

Risk of damage to VFD, or malfunction can occur.

- An incorrectly applied or installed VFD can result in system malfunction or reduction in product life as well as component damage. You must read and understand this manual thoroughly before proceeding with installation.
- Do not install a magnetic contactor or motor disconnect in the motor circuit for start/stop or emergency stop purpose. Opening the motor circuit while the VFD is running may cause VFD failure.

1	2	3	4	5	6
Plan System Goals	**Identify Options**	**Select Control Methods**	**Install VFD Hardware**	**Install Wiring**	**Program Parameters**
Intended Function • Air Handling • Fluid Circulation • Constant Pressure • Pressure Boosting • Irrigation • Dewatering • Carwashes • Conveyors • Crushers • Grinders Hardware Application • Supply Fan • Exhaust Fan • Cooling Tower • Centrifugal Pump • Submersible Pump • Vacuum Pump • Constant Torque • FE MagForce Permanent Magnet Motor	Automation • Damper Control • Sleep Mode • Timers • Scheduling • Analog Repeater Output • Dual Demand • 2nd PID Control • Hopping Carrier Protection • Shutdown • Redundancy • Broken Pipe • Fire Override • Pipe Leak • Auto Restarts Maintenance • Screen Clean • Lubrication • De-ragging • Anti-jam Multi-Motor Control • Equal Run Time • Soft Start • Lead/Lag • Rotation Multi-VFD Control • Equal Run Time • Lead/Lag • Alternation • Jockey Pump	Hand/Off/Auto • Keypad • Panel Mounted • Remote • 3–wire Control Transducer (PID) • Temperature • Pressure • Vacuum • Flow Switches • Potentiometer • Float • On/Off • Speed Control • Run by Analog Communications • BMS/PLC • Modbus • BACnet • Drive-to-drive • Bluetooth	Location • Inside • Outside Climate Control • Temperature • Moisture Distance • Wire Sizes • Filtering Requirements Measurements • Clearance • Drilling	Conduit • Routing • Separation High Voltage • Grounding • Inputs • Outputs Control Circuits • Analog Inputs • Switched Inputs • Voltage Inputs • Programmable Outputs • Communication	Basic • Application • Motor Ratings • Setpoints • Limits • Input Phases I/O Setup • Input Functions • Output Functions • Scaling Option Settings • Enable Features • Set Targets

1. Determine the appropriate options and control methods as well as how the VFD should be installed and programmed. Refer to "Operation" on page 67 for examples of how the system might be used.
2. Define and automate features that support the intended operation. These features may require specialized control methods and programming. For more details, refer to "Control Options" on page 67, "Standard Operation with an Automated Control System" on page 71, and "Protection Features" on page 91.
3. Select different methods for automating motor speed control. Refer to "Example Configurations" on page 42 for possible control setups.

4. Mount the VFD after determining the overall function of the system. Refer to "Physical Installation" on page 17 for guidelines.
5. Connect the VFD according to the selected motor application and control method(s). Refer to "Electrical Installation" on page 33 for more information.
6. Program the VFD quickly and easily for most standard operations. Refer to "Setting Operating Parameters" on page 49. Adjust additional parameters for advanced features or options that achieve the desired performance. Refer to and "Parameter Reference Tables" on page 203.

Basic VFD Configuration

The following table includes the most commonly used devices in a motor control branch operated by a VFD. Adequate peripheral devices and correct connections are essential for proper VFD operation.

	AC Power Source	Use single- or three-phase power source with voltage within the permissible range of VFD input power rating.
	MCCB, Fuses, or Franklin Electric Manual Motor Starters	Select circuit breakers or fuses in accordance with NEC and applicable local codes.
	Inline Magnetic Contactor	Do not use input power contactor for frequent starting and stopping the VFD, otherwise VFD power components can be damaged.
	AC Line Reactor or Harmonic Filter	A line reactor provides some degree of surge protection and decreases a level of harmonic distortion in the power line. It is recommended when power source kVA rating is more than 10 times higher than VFD rating. A Harmonic filter provides a higher level of harmonic mitigation. Integrated DC Chokes are included in VFD models larger than Frame C, equivalent to a 3% AC line reactor.
	EMI/RFI Filter	Install an EMI/RFI filter to decrease VFD Electromagnetic and Radio Frequency Interference with operation of sensitive electronic equipment.
	Variable Frequency Drive	Install VFD with proper orientation, ventilation, spacing etc. according to the requirements described in this manual with all necessary protective and filtering devices to provide long and reliable VFD operation.
	AC Load Reactor or Output Filter (460 V and higher)	Install a load (output) reactor or an output filter to protect motor windings if distance from VFD to a motor is in the range 45-100 feet. Install output dV/dt filter for a range of 100-1000 feet (800 feet for submersible pumps), or a sine wave filter for greater distances.
	Three Phase AC Induction Motors or Permanent Magnet Motors, including Franklin Electric pump motors	The X-Series VFD is not compatible with servomotors. Opening the motor circuit by disconnect or contactor during VFD run can damage VFD power components.

PHYSICAL INSTALLATION

Environmental Requirements

NOTICE

Risk of damage to VFD, or malfunction can occur due to improper handling, installation, or environment.

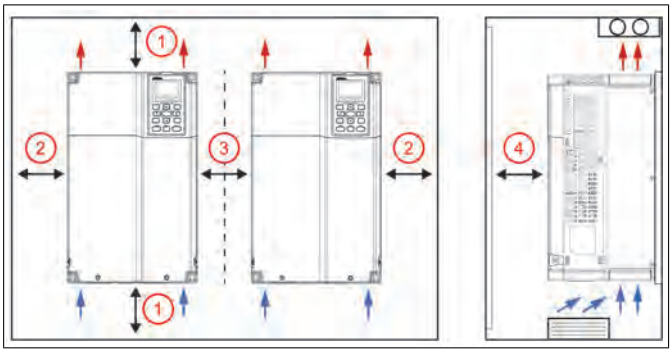
- Do not mount VFD on equipment with excessive vibration.
- Install in a location where temperature is within the range of product rating.
- Do not mount VFD in direct sunlight or near other heat sources.
- The VFD should be mounted in a Pollution Degree 2 environment. If VFD will be installed in an environment with a high probability of dust, metallic particles, mists, corrosive gas or other contaminants, the VFD must be mounted inside the appropriate electrical enclosure with proper NEMA, UL Type, or IP rating and adequate cooling.
- When two or more VFDs are installed in a ventilated enclosure, the cooling system should provide adequate airflow for all the VFDs. Do not install VFD above another heat source (another VFD, inductive reactors, etc.).

Install and use the VFD in a controlled environment that meets the following requirements:

Ambient Temperature	50 °C (122 °F) for UL Open Type/IP20 (Remove top cover) 40 °C (104 °F) in NEMA 1/UL Type 1/IP20 enclosure
Location	Pollution Degree 2 Environment.
Altitude	1000 m (3281 ft) above sea level. • De-rate current 1% per 100 m (328 ft) from 1000 to 2000 m (3281-6562 ft). • Consult Technical Support for installations above 2000 m.
Relative Humidity	95% Maximum relative humidity (non-condensing)
Vibration	1.0 mm, peak to peak value range from 2 to 13.2 Hz 0.7G-1.0G range from 13.2 to 55 Hz 1.0G range from 55 to 512 Hz.

Frame Size	Minimum Mounting Clearance mm (in)			
	1	2	3*	4
A, B, C	60 (2.4)	30 (1.2)	30 (1.2)	0
D, E, F	100 (3.9)	50 (2.0)	100 (3.9 total)	0
G	200 (7.9)	100 (3.9)	200 (7.9)	0
H	350 (13.8)	0	0	200 (7.9)

*For frame sizes D, E, and F, install a metal separator between side-by-side drives. Barrier depth must match the VFD depth.



The drive electronics are air-cooled.

- Provide enough clearance for airflow around the VFD. Refer to the table above.
- Mount VFD vertically (top up) for proper heat dissipation.
- Do not mount VFD in direct sunlight or near other heat sources.
- Do not block cooling vents or airflow with any panel components or wires.
- Prevent debris from adhering to the heat sink.

Mounting the Drive

⚠ CAUTION

Risk of bodily injury or damage to drive or other equipment.

- The drive should be mounted on a structure such as a wall or post capable of supporting the weight of the unit.
- Install VFD on a non-combustible surface.
- Ensure suitable mounting hardware is used when installing the drive.
- Do not install the drive on unreinforced drywall.
- Use suitable lifting equipment, in good condition, rated for at least 5 times the weight of the drive.

NOTE: Refer to "Specifications" on page 235 for drive weight.

The mounting location should have nearby access to the electrical supply and access to the motor wiring. Refer to "Electrical Installation" on page 33.

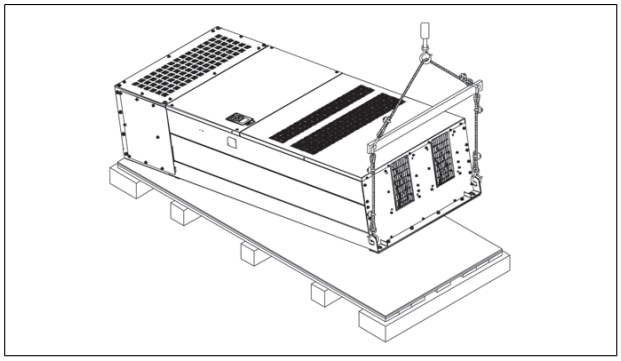
Use lag screws or bolts appropriate for supporting the weight of the drive.

1. Mount the drive using the mounting holes on the back side of the drive enclosure.
2. Screws at the top must attach to a solid structure such as a stud or brace.
3. All screw hole locations should be used to ensure the drive is securely mounted.

IMPORTANT: Do not drill holes in the drive.

When removing large drives from the pallet, use suitable lifting equipment connected to the lifting holes at the top outer edges of the drive.

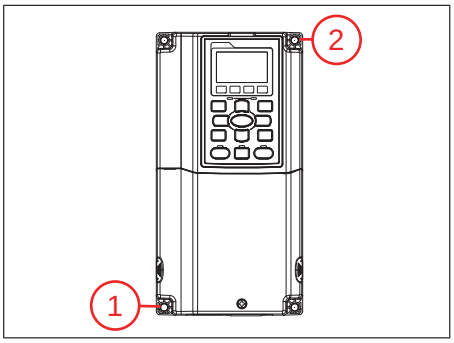
1. Use a spreader bar the same width as the drive so the lifting cables are straight up and down.
2. Slowly lift the drive from the pallet.
3. Use lifting equipment to place the drive in the desired installation location.



Mounting Frames A, B, and C

These frames have four corner mounting holes on the drive. Refer to "Drive Dimensions" on page 26 for mounting hole locations and sizes.

1. Have one person hold the drive in location while another installs the lag screws in each corner, ensuring they go into a solid stud or brace. Install the lower left lag screw first.
2. Place a level on top of the drive. When level, install the upper right corner lag screw.
3. Install the remaining two lag screws.

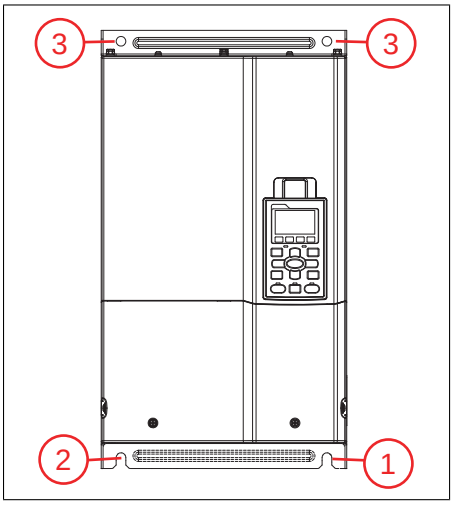


Mounting Frames D0, D, and E

These frames have four corner mounting holes on the drive. The bottom two holes are U-shaped slots, allowing the drive to be lowered onto pre-installed lag screws.

Refer to "Drive Dimensions" on page 26 for mounting hole locations and sizes.

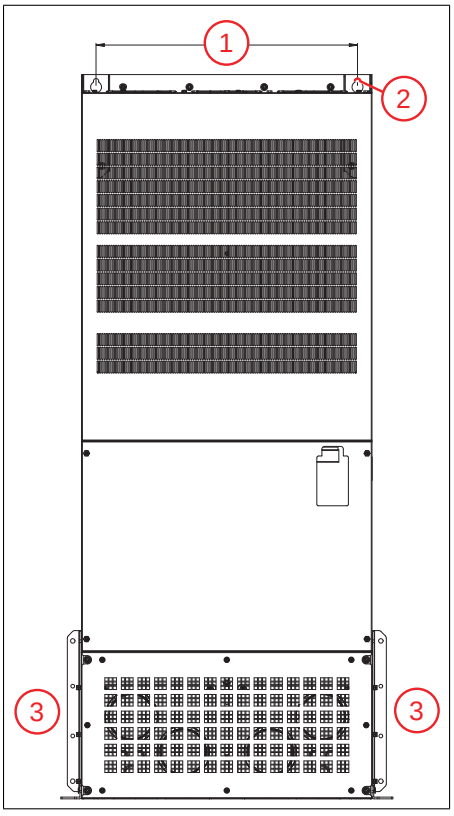
1. Install two lag screws for the bottom locations, ensuring they are level and enter a solid stud or brace.
2. Use a lifting device to lower the U-shaped mounting slots onto the bottom lag screws. The conduit box is not shown in this image to better show the bottom mounting slots.
3. Hold the drive tight against the backing board, and install the remaining two lag screws in the top mounting holes.



Mounting Frames F, G, and H

These frames include two keyhole shaped mounting holes at the top, allowing the drive to be set onto pre-installed lag screws. Refer to "Drive Dimensions" on page 26 for mounting hole locations and sizes.

1. Install two lag screws for the top locations, ensuring they are level and enter a solid stud or brace.
2. Use a properly sized lifting device to lower the top keyhole shaped mounting slots onto the lag screws.
3. Hold the drive tight against the backing board, and install the remaining lag screws in the bottom mounting holes, ensuring they enter a solid stud or brace.

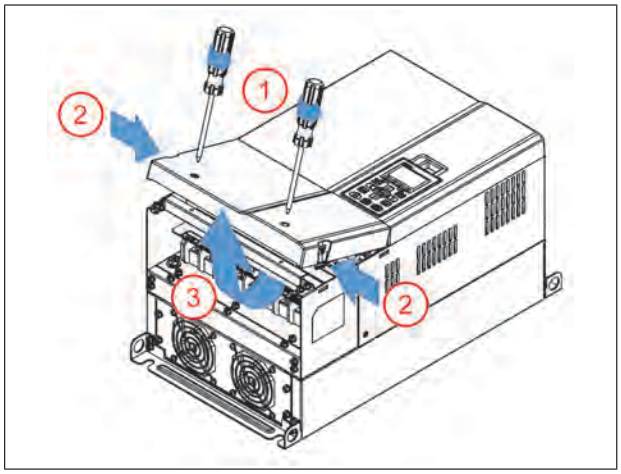


Conduit Box Installation

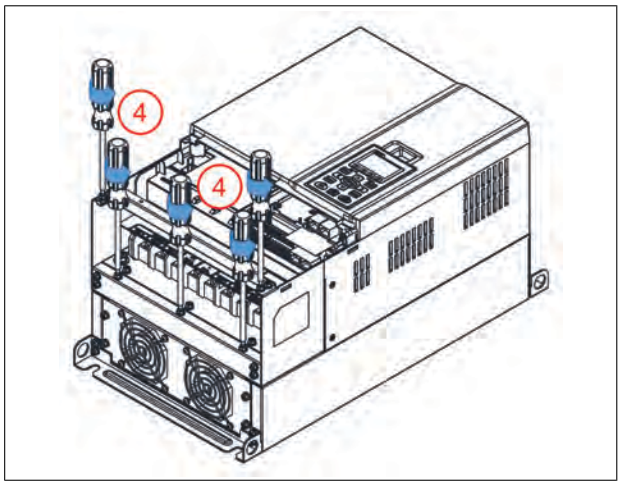
Frames A, B, and C do not require an added conduit box.

Frames D0 and D Conduit Box Installation

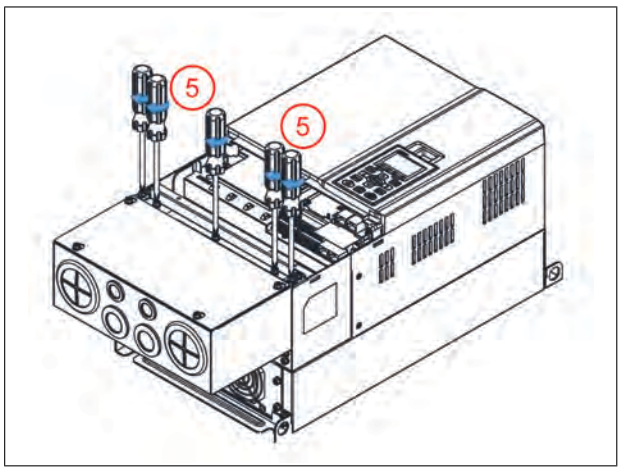
1. Loosen two lower drive cover screws.
2. Press the tabs on each side of the cover.
3. Remove the cover.



4. Remove five screws.

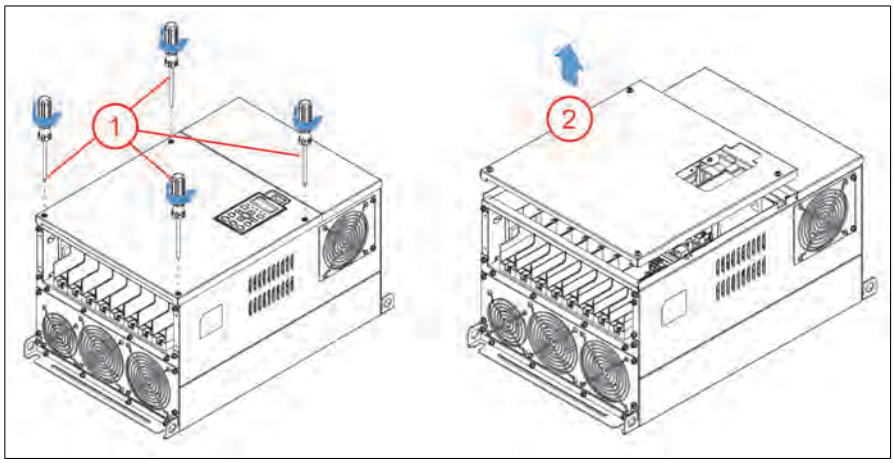


5. Install the conduit box with five screws. Tighten to a torque of 24-26 kg-cm / 20.8-22.6 in-lbs / 2.4-2.5 Nm.
6. Replace the lower drive cover and rotate to the closed position. Secure with two screws from step 1. Tighten to a torque of 12-15 kg-cm / 10.4-13 in-lbs / 1.2-1.5 Nm.

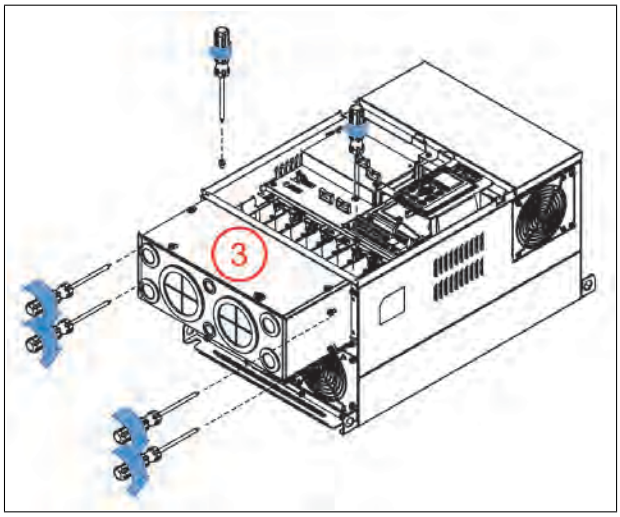


Frame E Conduit Box Installation

1. Loosen four lower drive cover screws.
2. Remove the cover.



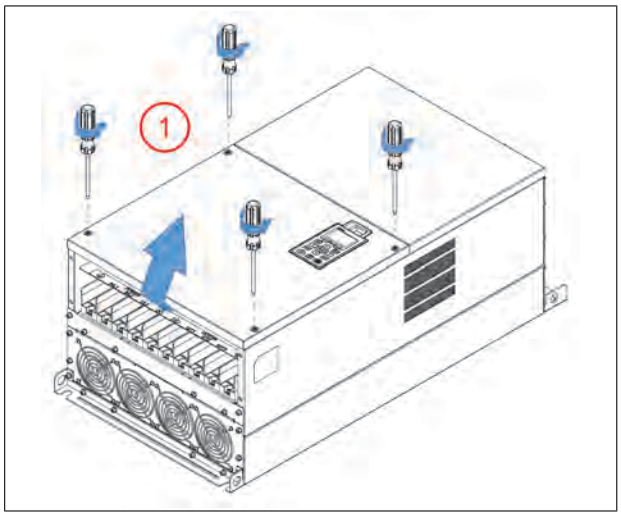
3. Install the conduit box with six screws. Tighten to a torque of 24-26 kg-cm / 20.8-22.6 in-lbs / 2.4-2.5 Nm.
4. Replace the cover and secure with screws from step 1. Tighten to a torque of 12-15 kg-cm / 10.4-13 in-lbs / 1.2-1.5 Nm.



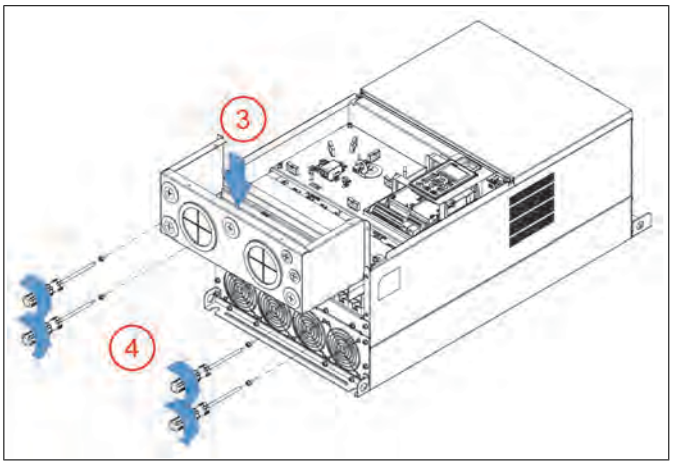
Frame F Conduit Box Installation

1. Remove four lower drive cover screws.
2. Remove the cover from the drive.

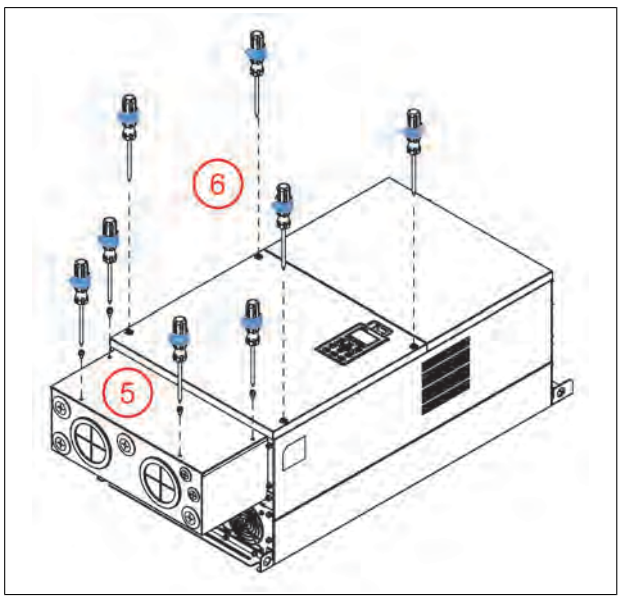
   Remove four screws from the conduit box cover.



3. Align the conduit box flanges behind the flanges of the drive bottom.
4. Secure the conduit box to the drive (flange to flange) with four screws. Tighten the screws to a torque of 24-26 kg-cm / 20.8-22.6 in-lbs / 2.4-2.5 Nm.

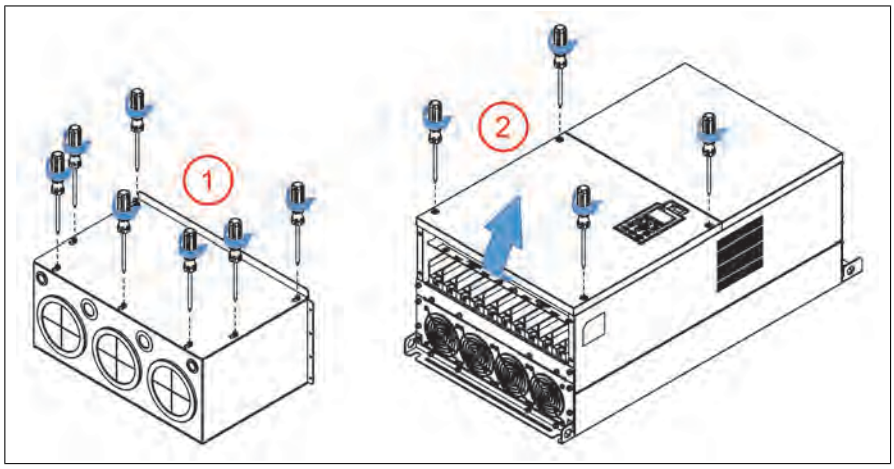


5. Install the conduit box cover using four screws from step 2. Tighten to a torque of 13-16 kg-cm / 20.8-22.6 in-lbs / 2.4-2.5 Nm.
6. Replace the cover and secure with four screws from step 1. Tighten to a torque of 12-15 kg-cm / 10.4-13 in-lbs / 1.2-1.5 Nm.



Frame G Conduit Box Installation

1. Loosen seven conduit box cover screws, slide it forward, and remove the cover.
2. Loosen four lower drive cover screws and remove the cover.



3. Remove the eight screws identified.
4. Align the conduit box with the flanges of the drive and reinstall the eight screws from step 3.

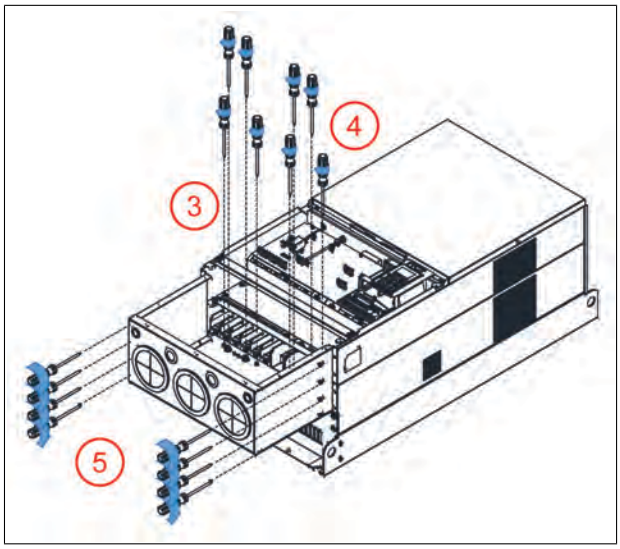
   M5 Screw torque: 24-26 kg-cm / 20.8-22.6 in-lbs / 2.4-2.5 Nm

   M8 Screw torque: 100-120 kg-cm / 86.7-104.1 in-lbs / 9.8-11.8 Nm

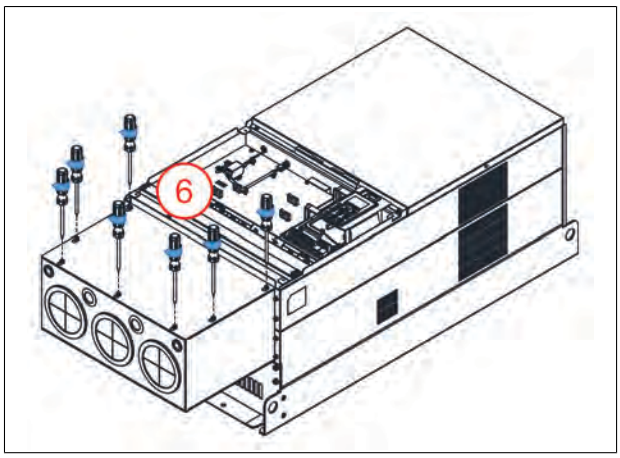
5. Secure further with eight screws.

   M5 Screw torque: 24-26 kg-cm / 20.8-22.6 in-lbs / 2.4-2.5 Nm

   M8 Screw torque: 100-120 kg-cm / 86.7-104.1 in-lbs / 9.8-11.8 Nm

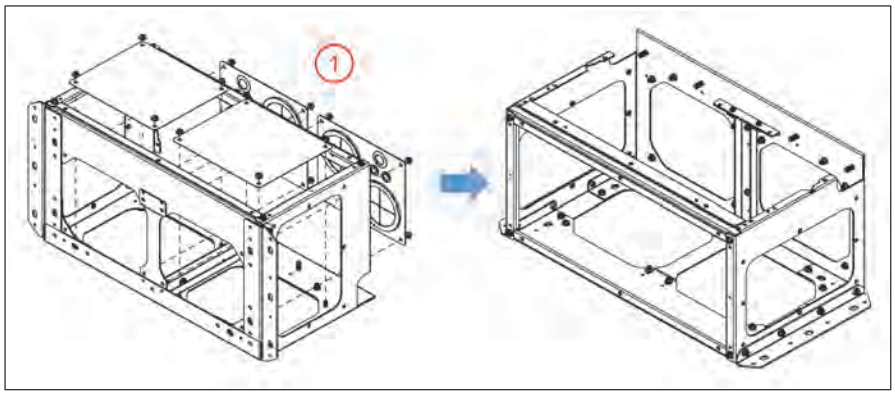


6. Set the conduit box cover on the conduit box and slide it toward the conduit knockouts. Tighten the screws to a torque of 24-26 kg-cm / 20.8-22.6 in-lbs / 2.4-2.5 Nm.
7. Place the cover back on the drive, and tighten the screws to a torque of 12-15 kg-cm / 10.4-13 in-lbs / 1.2-1.5 Nm.

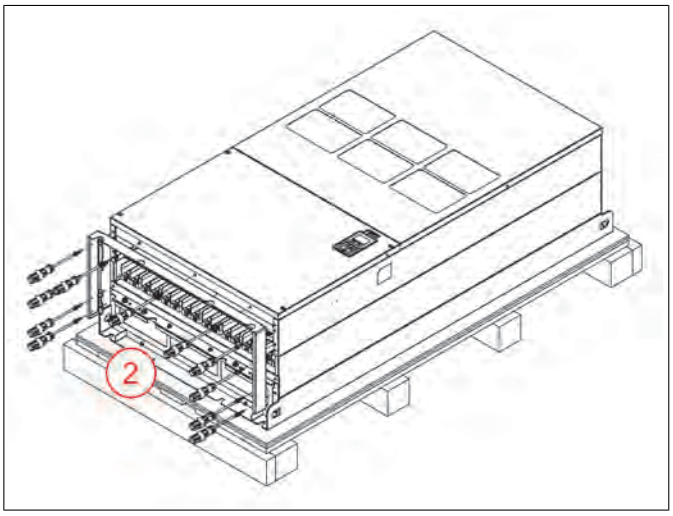


Frame H Conduit Box Installation

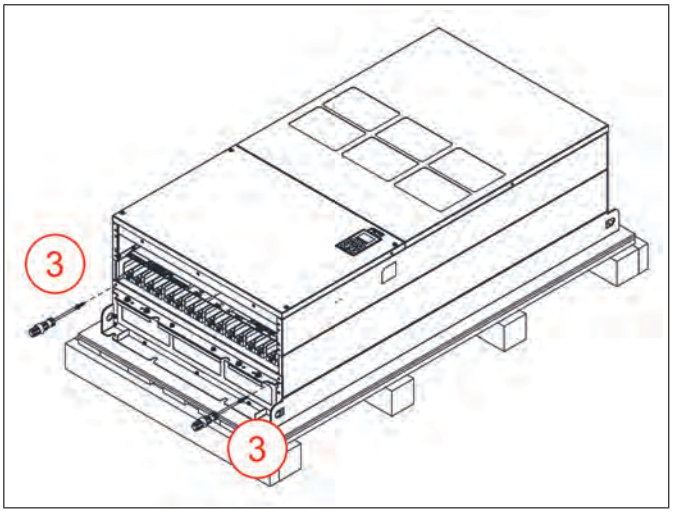
1. Remove all screws holding the covers of the conduit box kit and remove the covers.



2. Remove the screws shown from the bottom of the drive and remove the bracket.

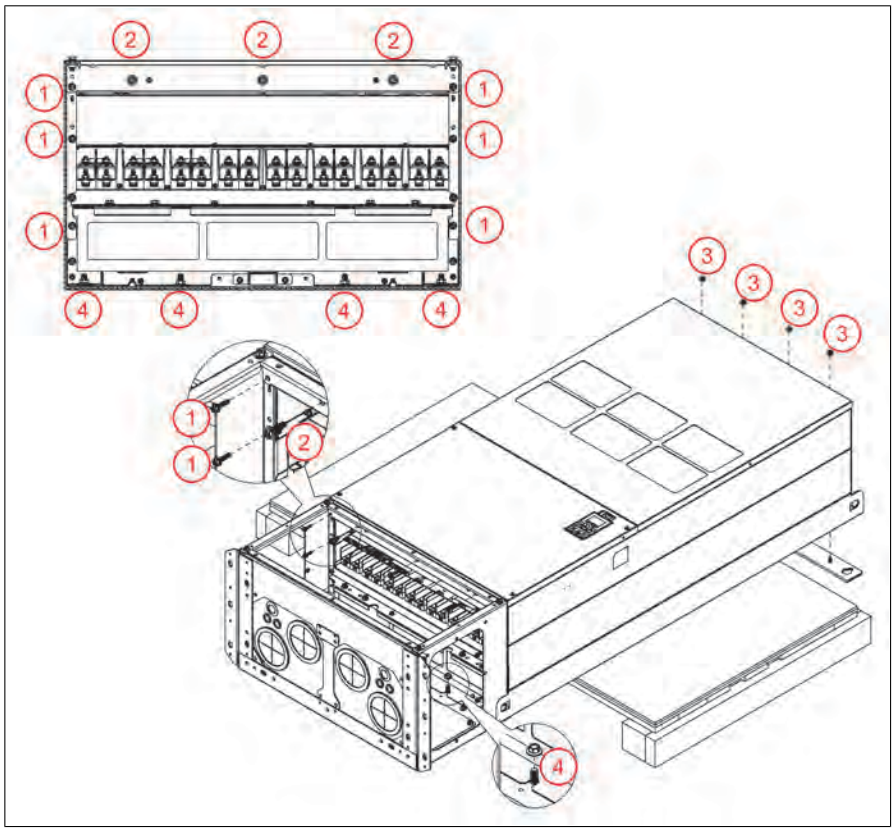


3. Fasten the M6 screws to two locations. Tighten screws to a torque of 35-45 kg-cm / 30.3-39 in-lbs / 3.4-4.4 Nm.

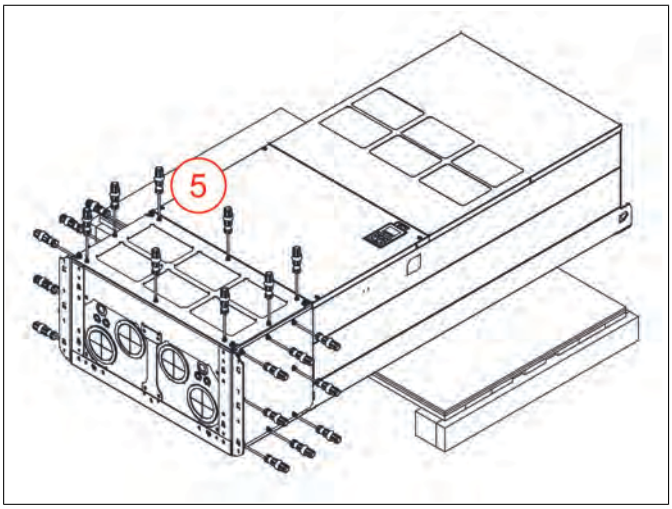


4. Install the conduit box to the drive using the following screws and nuts tightened to a torque of:

1	M6 Screws	55-65 kg-cm / 47.7-56.4 in-lbs / 5.4-6.4 Nm
2	M8 Screws	100-110 kg-cm / 86.7-95.4 in-lbs / 9.8-10.8 Nm
3	M8 Nuts	
4	M10 Nuts	250-300 kg-cm / 216.9-260.3 in-lbs / 24.5-29.4 Nm



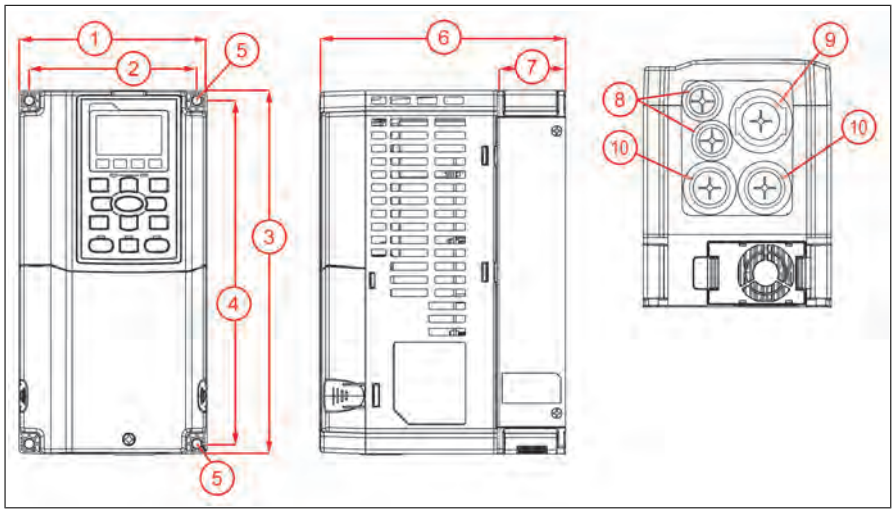
5. Replace the covers and screws removed in Step 1 to the original locations. Tighten to a torque of 35-45 kg-cm / 30.3-39 in-lbs / 3.4-4.4 Nm.



Drive Dimensions

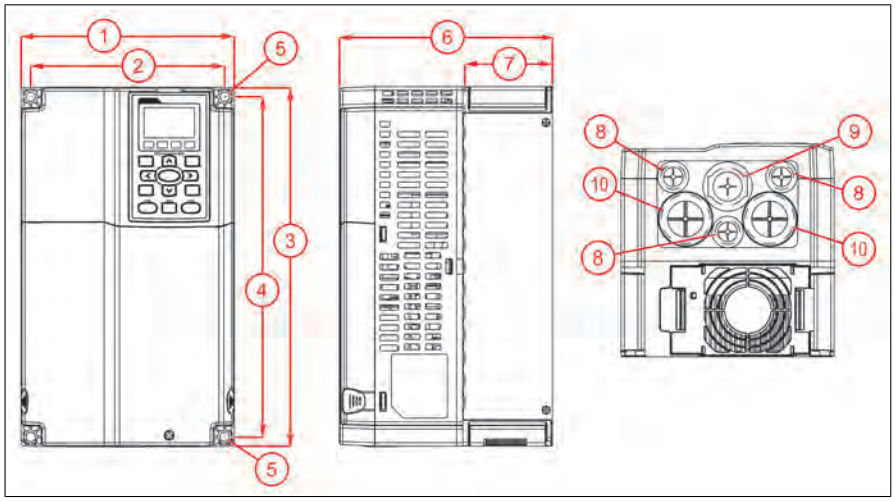
Frame A

1	130 mm (5.12 in)
2	116 mm (4.57 in)
3	250 mm (9.84 in)
4	236 mm (9.29 in)
5	6.2 mm (0.24 in)
6	170 mm (6.69 in)
7	45.8 mm (1.8 in)
8	22.2 mm (0.87 in)
9	34 mm (1.34 in)
10	28 mm (1.10 in)



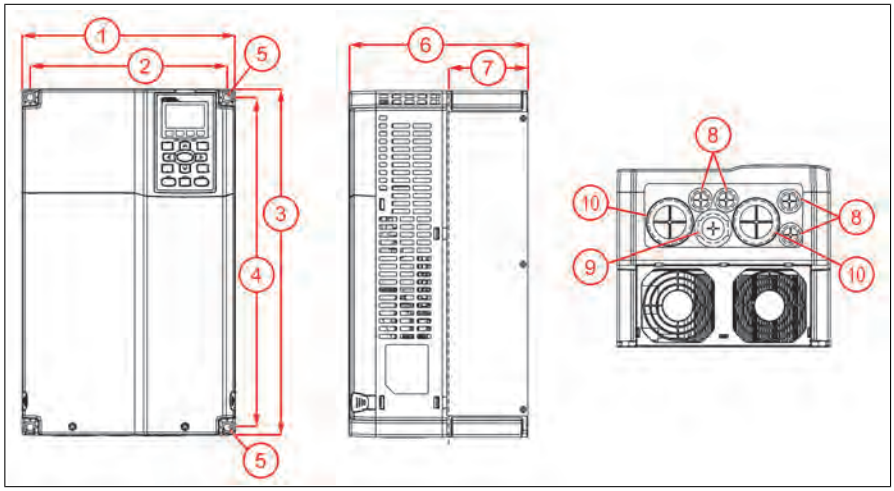
Frame B

1	190 mm (7.48 in)
2	173 mm (6.81 in)
3	320 mm (12.6 in)
4	303 mm (11.9 in)
5	8.5 mm (0.33 in)
6	190 mm (7.48 in)
7	77.9 mm (3.07 in)
8	22.2 mm (0.87 in)
9	34 mm (1.34 in)
10	43.8 mm (1.72 in)



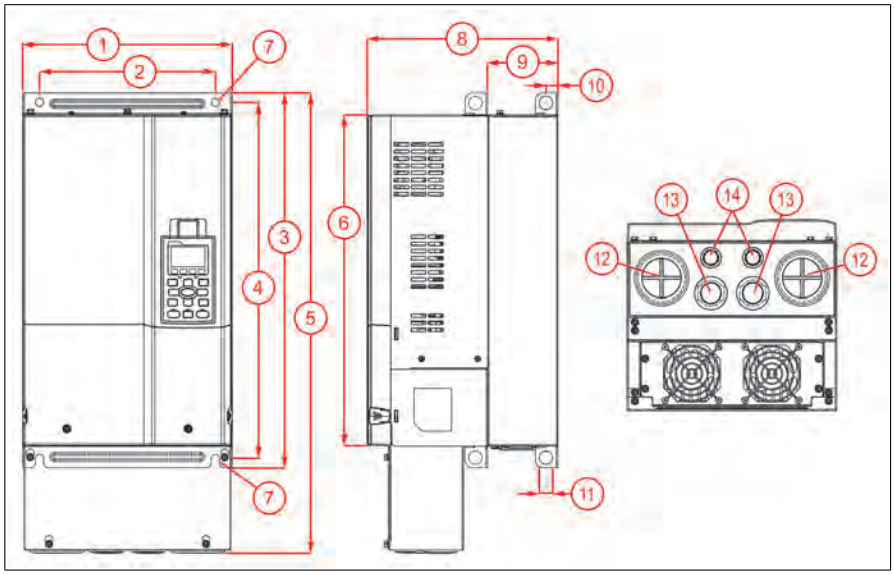
Frame C

1	250 mm (9.84 in)
2	231 mm (9.09 in)
3	400 mm (15.8 in)
4	381 mm (15 in)
5	8.5 mm (0.33 in)
6	210 mm (8.27 in)
7	92.9 mm (3.66 in)
8	22.2 mm (0.87 in)
9	34 mm (1.34 in)
10	50 mm (1.97 in)



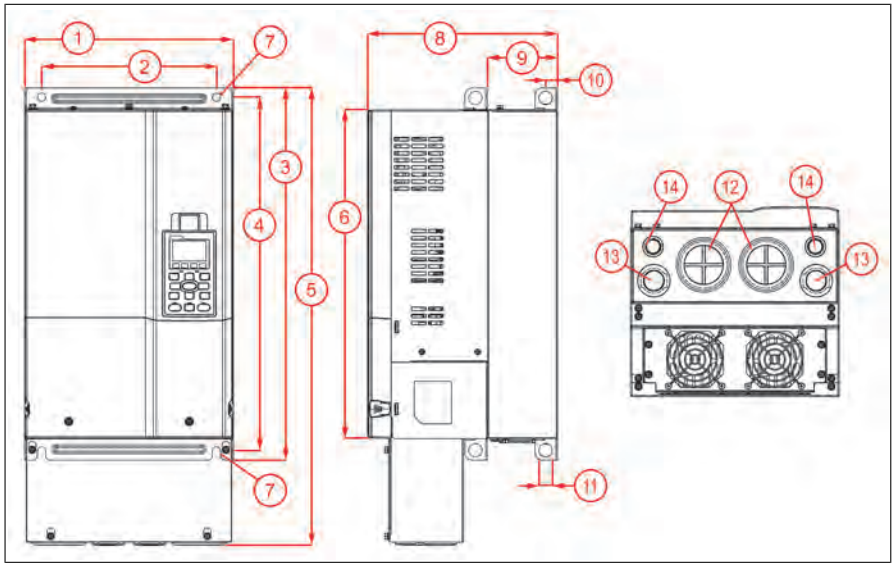
Frame DO

1	280 mm (11 in)
2	235 mm (9.25 in)
3	500 mm (19.7 in)
4	475 mm (18.7 in)
5	614.4 mm (24.2 in)
6	442 mm (17.4 in)
7	11 mm (0.43 in)
8	255 mm (10 in)
9	94 mm (3.7 in)
10	16 mm (0.63 in)
11	18 mm (0.71 in)
12	62.7 mm (2.47 in)
13	34 mm (1.34 in)
14	22 mm (0.87 in)



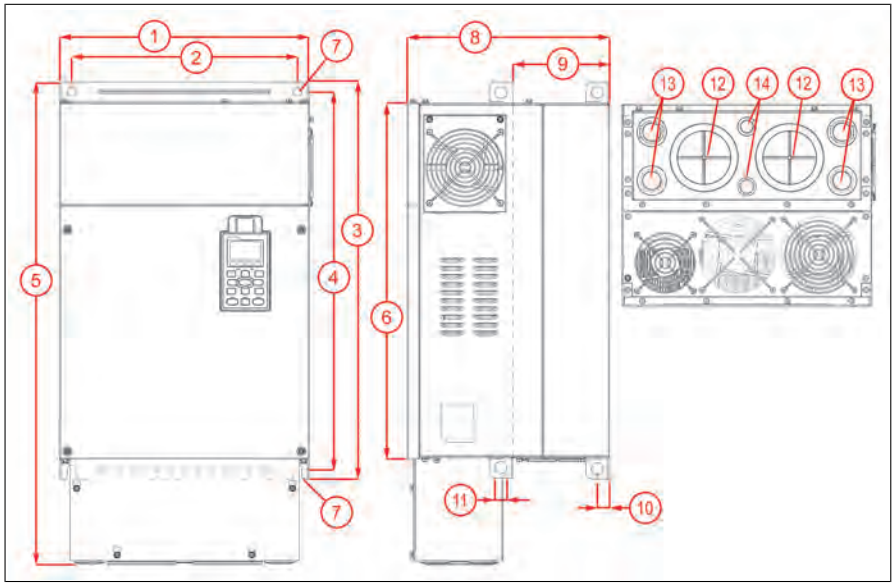
Frame D

1	330 mm (13 in)
2	285 mm (11.22 in)
3	550 mm (21.7 in)
4	525 mm (20.7 in)
5	688 mm (27.1 in)
6	492 mm (19.4 in)
7	11 mm (0.43 in)
8	275 mm (10.8 in)
9	107 mm (4.22 in)
10	16 mm (0.63 in)
11	18 mm (0.71 in)
12	76.2 mm (3 in)
13	34 mm (1.34 in)
14	22 mm (0.87 in)



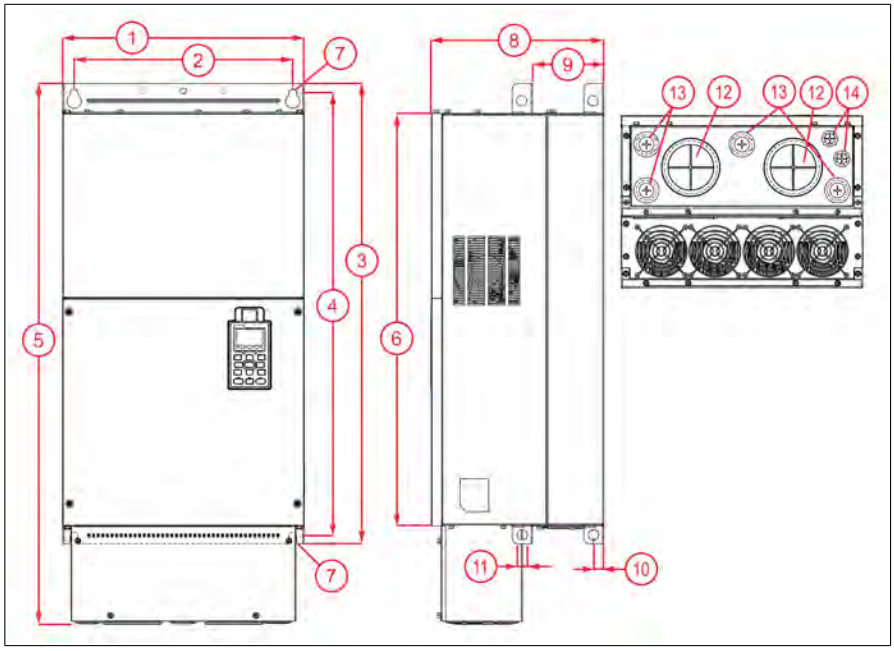
Frame E

1	370 mm (14.6 in)
2	335 mm (13.2 in)
3	589 mm (23.3 in)
4	560 mm (22 in)
5	716 mm (28.2 in)
6	528 mm (20.8 in)
7	13 mm (0.51 in)
8	300 mm (11.8 in)
9	143 mm (5.63 in)
10	18 mm (0.71 in)
11	18 mm (0.71 in)
12	92 mm (3.62 in)
13	34 mm (1.34 in)
14	22 mm (0.87 in)



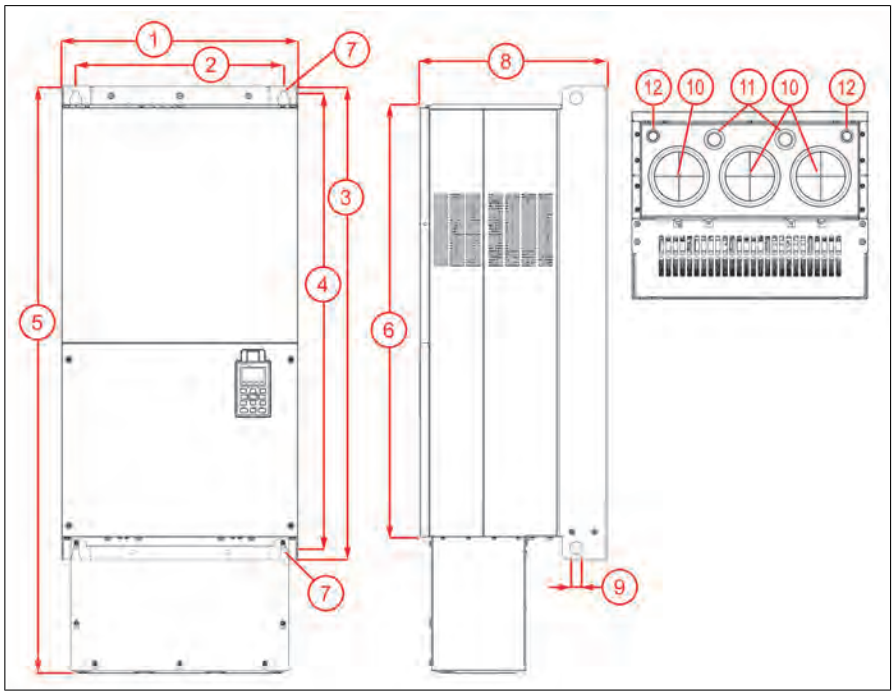
Frame F

1	420 mm (16.5 in)
2	380 mm (16 in)
3	800 mm (31.5 in)
4	770 mm (30.3 in)
5	940 mm (37 in)
6	717 mm (28 in)
7	13 mm (0.51 in)/ 25 mm (0.98 in)
8	300 mm (11.8 in)
9	124 mm (4.9 in)
10	18 mm (0.71 in)
11	18 mm (0.71 in)
12	92 mm (3.62 in)
13	35 mm (1.38 in)
14	22 mm (0.87 in)



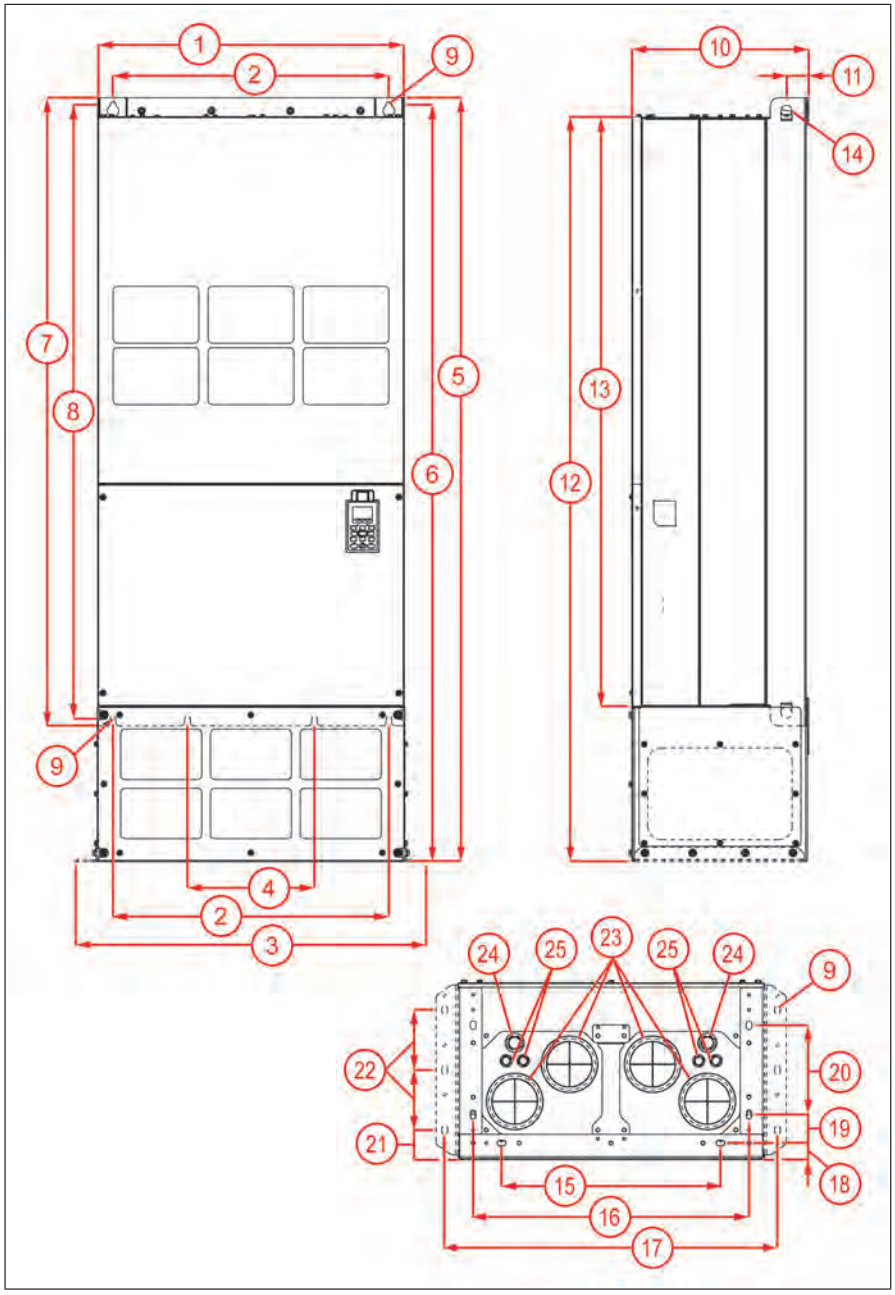
Frame G

1	500 mm (19.7 in)
2	440 mm (17.3 in)
3	1000 mm (39.4 in)
4	963 mm (38 in)
5	1240 mm (49 in)
6	914 mm (36 in)
7	13 mm (0.51 in)/ 26.5 mm (1.0 in)
8	397 mm (15.6 in)
9	27 mm (1.0 in)
10	117.5 mm (4.6 in)
11	34 mm (1.34 in)
12	22 mm (0.87 in)



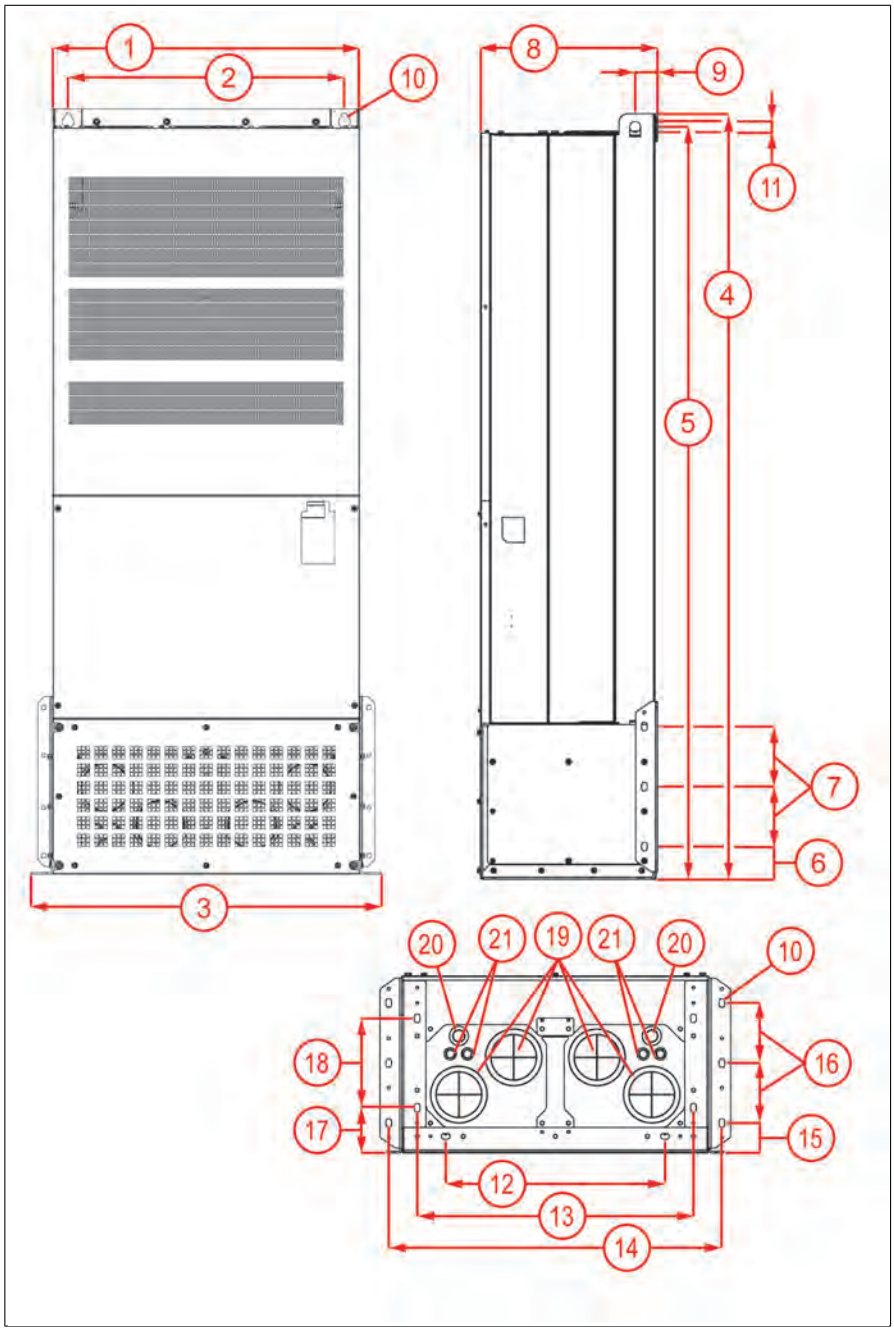
Frame H

1	700 mm (27.6 in)
2	630 mm (24.8 in)
3	800 mm (31.5 in)
4	290 mm (11.4 in)
5	1745 mm (68.7 in)
6	1729 mm (68.1 in)
7	1435 mm (56.5 in)
8	1403 mm (55.2 in)
9	13 mm (0.51 in)/ 26.5 mm (1.04 in)
10	398 mm (15.7 in)
11	45 mm (1.8 in)
12	1701 mm (67 in)
13	1347 mm (53 in)
14	25 mm (1 in)
15	500 mm (19.7 in)
16	630 mm (24.8 in)
17	760 mm (30 in)
18	38 mm (1.5 in)
19	65 mm (2.6 in)
20	204 mm (8 in)
21	68 mm (2.7 in)
22	137 mm (5.4 in)
23	117.5 mm (4.6 in)
24	34 mm (1.3 in)
25	22 mm (0.87 in)



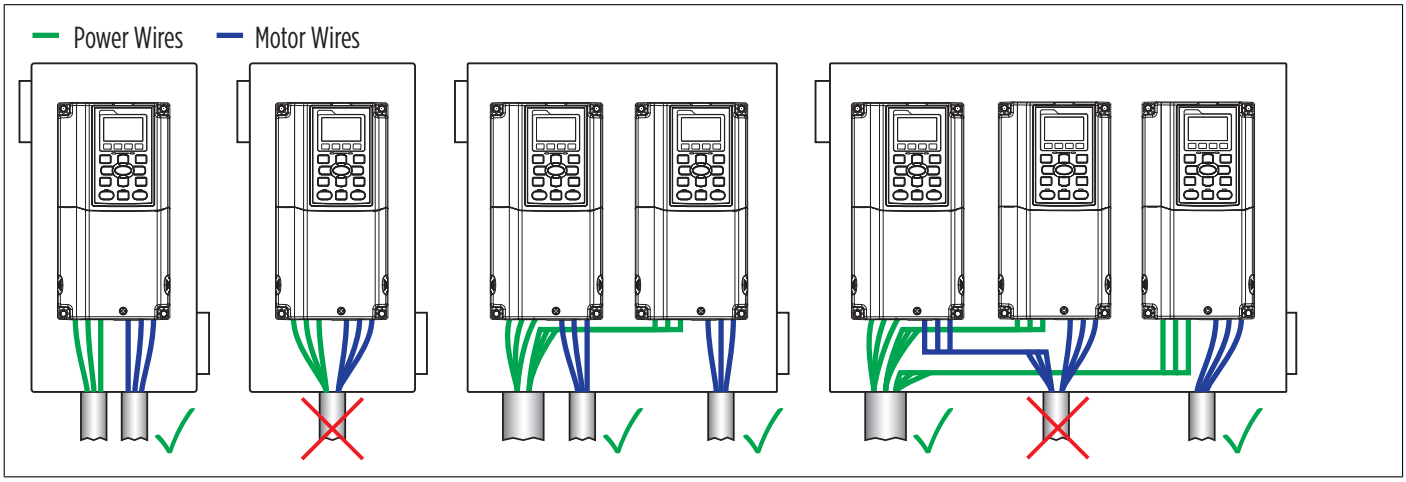
Frame H (690V)

1	700 mm (27.6 in)
2	630 mm (24.8 in)
3	800 mm (31.5 in)
4	1745 mm (68.7 in)
5	1715 mm (67.5 in)
6	42.5 mm (1.7 in)
7	109 mm (4.3 in)
8	404 mm (15.9 in)
9	51 mm (2 in)
10	13 mm (0.51 in)/ 26.5 mm (1.04 in)
11	25 mm (0.98 in)
12	500 mm (19.7 in)
13	630 mm (24.8 in)
14	760 mm (30 in)
15	68 mm (2.7 in)
16	137 mm (5.4 in)
17	103 mm (4.1 in)
18	204 mm (8 in)
19	117.5 mm (4.6 in)
20	34 mm (1.3 in)
21	22 mm (0.87 in)



ELECTRICAL INSTALLATION

Wiring Guidelines



NOTICE

Risk of damage to VFD, or malfunction can occur.

- Follow all wire routing and grounding instructions carefully. Inductive currents caused by parallel wiring, or close proximity between high voltage and control wiring can cause unexpected behaviors.
- Do not run input power and motor wires in the same conduit.
- Do not run motor wires from multiple VFDs in common conduit.
- Do not run control wiring parallel with high voltage wiring.
- Do not run VFD wiring parallel with building or facility wiring.
- Do not use aluminum wires for VFD connections.
- Do not install power factor correction capacitors, surge suppressors, or RFI filters on the VFD output.
- Do not install a magnetic contactor or disconnect in the motor circuit.
- Do not leave wire fragments, metal shavings or other metal objects inside the VFD.
- Improper splicing or damage to motor cable insulation may expose the conductor(s) to moisture and can produce motor cable failure.
- For retrofit application, check the integrity of power and motor leads. This requires measuring the insulation resistance with a suitable megohm-meter.

IMPORTANT:

- For asymmetric power supplies, like Corner-Grounded Delta, refer to "RFI Jumper" on page 39 for removal of RFI Jumper.
- For Open Delta Power Supply, the power supply must be treated as a single-phase input. Configure **Input Phase [SET-01]** to **1_Single Phase** and refer to "Models" on page 10 for single-phase current rating for each drive size.

1. Mount the drive as close as possible to the service entrance panel. Connect directly to the service entrance, not to a sub-panel.
2. Use a dedicated branch circuit for the drive. Verify that the circuit is equipped with a properly-sized circuit breaker or fuse.
3. Separate input power and motor wiring by at least 8 in. (20.3 cm).

4. Cross over other branch circuits and facility wiring at a 90° angle. If necessary to run wires in parallel, separate by at least 8 in. (20.3 cm).
5. All control wiring—sensors, switches, transducers, etc.—should be in a separate conduit routed individually, not parallel, from high voltage wiring. In addition, any shielded cables should be properly grounded.
6. Install a line reactor for VFDs in pump systems with dedicated service transformer to protect VFD from transient power surges and provide some degree of harmonics distortion mitigation.

Branch Circuit Protection

Integral solid-state short circuit protection does not provide Branch Circuit Protection. Branch Circuit Protection must be provided in accordance with the National Electrical Code (NEC) and applicable local codes or equivalent, as determined by Authorities Having Jurisdiction (AHJ). The Drive shall be protected by Listed Class J fuses, listed inverse-time circuit breakers, or Franklin Electric Manual Motor Starters.

Short-circuit current rating (SCCR): The drive is suitable for use on a circuit capable of delivering no more than 100,000 symmetrical amperes (rms) when protected by suitable Class J fuses. For rated fuse currents, refer to NEC Sec 430 and the Franklin Electric Aim Manual. When protected by a circuit breaker and placed in a panel, drive SCCR is as follows:

VFD Output Rating	SCCR (rms)
Up to 50 HP (0 to 37.3 kW)	5,000 Amperes
51 to 200 HP (39 to 149 kW)	10,000 Amperes
201 to 400 HP (150 to 298 kW)	18,000 Amperes
401 to 600 HP (299 to 447 kW)	20,000 Amperes
601 to 900 HP (448 to 671 kW)	42,000 Amperes

Fuse and Circuit Breaker Sizing

See the table below for maximum current ratings of fuses and circuit breakers per NEC.

NOTE: Follow local or regional regulations for specific requirements.

Model		Input Current (A)		Class J Fuse Size (A)	Breaker Size (A)
		Constant Torque	Variable Torque		
200V / 230V	CXD-005A-2V	3.9	6.4	15	15
	CXD-007A-2V	6.4	9.6	20	20
	CXD-010A-2V	12	15	30	30
	CXD-015A-2V	16	22	40	40
	CXD-021A-2V	20	25	50	50
	CXD-031A-2V	28	35	60	60
	CXD-046A-2V	36	50	100	100
	CXD-061A-2V	52	65	125	125
	CXD-075A-2V	72	83	150	150
	CXD-090A-2V	83	100	200	200
	CXD-105A-2V	99	116	225	225
	CXD-146A-2V	124	146	250	250
	CXD-180A-2V	143	180	300	300
	CXD-215A-2V	171	215	400	400
	CXD-276A-2V	206	276	450	450
	CXD-322A-2V	245	322	600	600
380 / 480V	CXD-003A-4V	3.5	4.3	10	10
	CXD-004A-4V	4.3	6.0	10	10
	CXD-005A-4V	5.9	8.1	15	15
	CXD-008A-4V	8.7	12.4	25	25
	CXD-010A-4V	14	16	30	30
	CXD-013A-4V	15.5	20	40	40
	CXD-018A-4V	17	22	40	40
	CXD-024A-4V	20	26	50	50
	CXD-032A-4V	25	35	60	60
	CXD-038A-4V	35	42	75	75
	CXD-045A-4V	40	50	100	100
	CXD-060A-4V	47	66	125	125
	CXD-073A-4V	63	80	150	150
	CXD-091A-4V	74	91	175	175
	CXD-110A-4V	101	110	250	250
	CXD-150A-4V	114	150	300	300
	CXD-180A-4V	157	180	300	300
	CXD-220A-4V	167	220	400	400
	CXD-260A-4V	207	260	500	500
	CXD-310A-4V	240	310	600	600
	CXD-370A-4V	300	370	600	600
	CXD-460A-4V	380	460	800	800
	CXD-530A-4V	400	530	1000	1000
	CXD-616A-4V	494	616	1200	1200
	CXD-683A-4V	555	683	1350	1350
	CXD-770A-4V	625	770	1500	1500

Model		Input Current (A)		Class J Fuse Size (A)	Breaker Size (A)
		Constant Torque	Variable Torque		
575V / 600V	CXD-003A-6V	3.1	3.8	7	7
	CXD-004A-6V	4.5	5.4	10	10
	CXD-006A-6V	7.2	10.2	15	15
	CXD-009A-6V	12.3	14.9	25	25
	CXD-012A-6V	15	16.9	32	32
	CXD-018A-6V	18	21.3	50	50
	CXD-024A-6V	22.8	26.3	63	63
	CXD-030A-6V	29	36	70	70
	CXD-036A-6V	36	43	80	80
	CXD-045A-6V	43	54	100	100
	CXD-054A-6V	54	65	100	100
	CXD-067A-6V	65	81	125	125
	CXD-086A-6V	66	84	175	175
	CXD-104A-6V	84	102	200	200
	CXD-125A-6V	102	122	250	250
	CXD-150A-6V	122	147	300	300
	CXD-180A-6V	148	178	350	350
	CXD-220A-6V	178	217	400	400
	CXD-290A-6V	222	292	450	450
	CXD-350A-6V	292	353	500	500
	CXD-430A-6V	353	454	700	700
	CXD-465A-6V	388	469	800	800
	CXD-590A-6V	504	595	1250	1250
	CXD-675A-6V	681	681	1400	1400

Wire Sizing

Size power wire to maintain a voltage drop less than 2% at VFD or motor terminals.

NOTE: Output reactors or filters are not required for 200/230V applications.

- **Frame A:** Use only copper conductors rated for at least 75 °C and 600 V. Use cable with a 90 °C rating if ambient environment is greater than 50 °C.
- **Frame B and above:** Use only copper conductors rated for at least 75 °C and 600 V. Use cable with a 90 °C rating if ambient environment is greater than 40 °C (30 °C for models CX-061A-2V, CXD-105A-2V, or CXD-370A-4V).
- **460 and 575 V applications:** Install a load (output) reactor to protect motor windings if distance from VFD to motor is in the range 45-100 ft (13.7–30.5 m). Install output dV/dt filter for a range 100-1000 ft (13.7–304.8 m) or a sine wave filter for greater distances.
  - For submersible pumps, install the output dV/dt filter for 800 ft (243.8 m).

NOTE: For motor cable lengths for submersible pumping applications, refer to the Franklin Electric AIM Manual for wire gauge and distance information.

Wire Sizing by Frame Size

Frame	Maximum Terminal Wire Size	Torque in-lbs (Nm)
Frame A	8 AWG	17.4 (1.96)
Frame B	4 AWG	30.4 (3.43)
Frame C	1/0 AWG	69.4 (7.84)
Frame D0	2/0 AWG	69.4 (7.84)
Frame D	300 MCM or 4/0 AWG	156 (18)
Frame E	4/0 AWG*2	174 (20)

Frame	Maximum Terminal Wire Size	Torque in-lbs (Nm)
Frame F	300 MCM*2 or 4/0 AWG*2	156 (18)
Frame G, Terminals R, S, & T	250 MCM*4	156 (18)
Frame D, Terminals U, V, & T	500 MCM*2	354 (40)
Frame H	350 MCM*4	156 (18)

Suggested Maximum Motor Cable Lengths for Non-Submersible Applications

NOTE: These apply to only 460 and 575 voltage VFD ratings.

- Without output reactor: 13.7 m (45 ft)
- With output reactor: 30.5 m (100 ft)
- With dV/dt filter: 305 m (1000 ft)

Power Wiring Connections

⚠ WARNING

Contact with hazardous voltage could result in death or serious injury.

- Disconnect and lock out all power before installing or servicing equipment.
- Always check if DC bus charge LED is off and DC voltage on the terminals DC (+1) and DC (-) is less than 30VDC before working on VFD wiring. The DC bus capacitors may hold high-voltage charge for several minutes after the VFD power is disconnected.
- Connect the motor, the drive, metal plumbing, and all other metal near the motor or cable to the power supply ground terminal using wire no smaller than motor cable wires.
- All wiring must comply with the National Electrical Code and local codes.

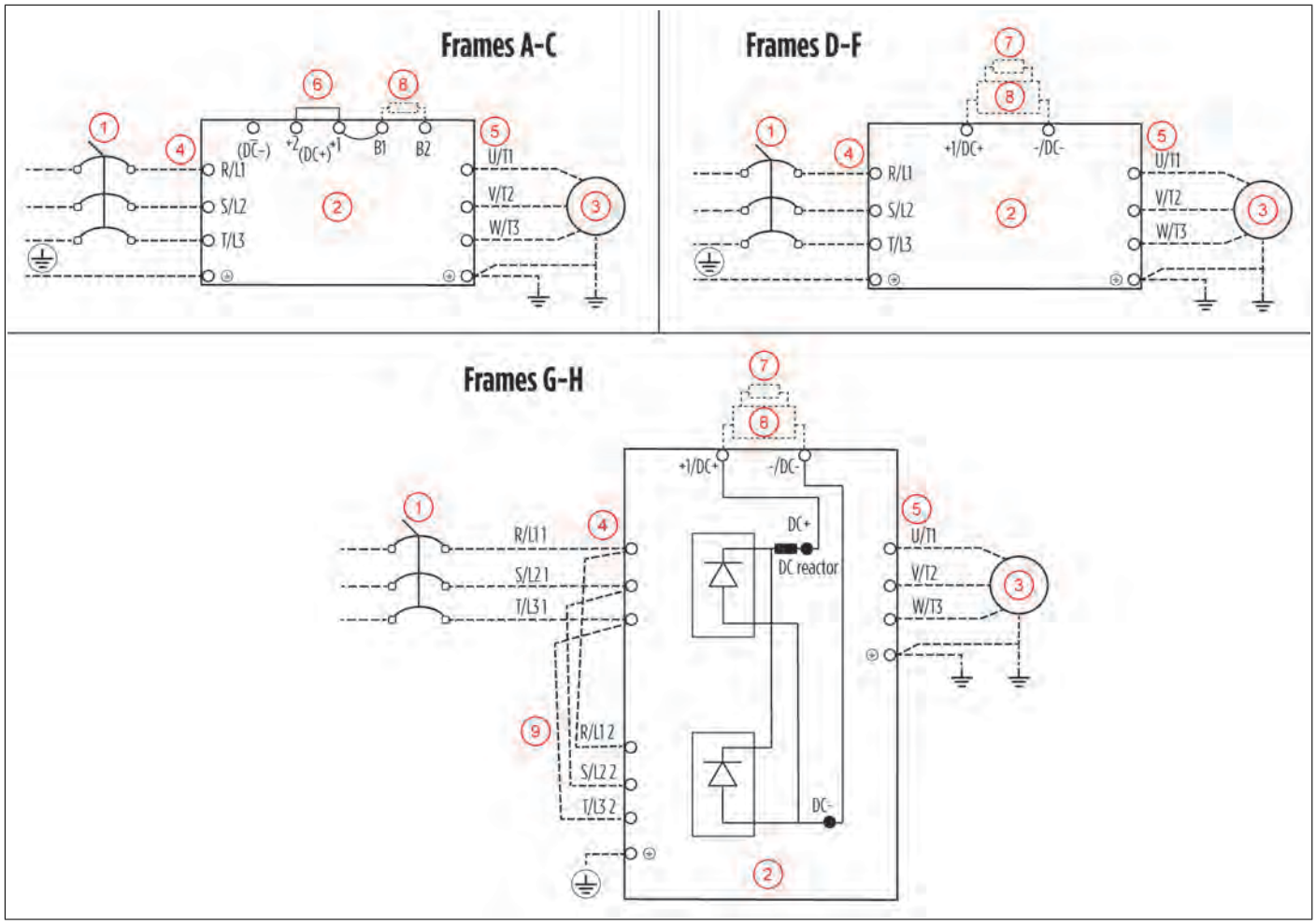
NOTICE

Risk of damage to VFD, or malfunction can occur.

- Do not connect input power to VFD output terminals U, V, and W otherwise VFD can be damaged.
- Ensure that the system is properly grounded all the way to the service entrance panel. Improper grounding may result in loss of voltage surge protection and interference filtering.
- Do not connect any wires except dynamic braking resistor to (B1) and (B2) terminals.
- Do not remove the jumper between terminals (2+) and (1+) except for dynamic braking unit or DC link choke, otherwise the VFD can be damaged.
- When using a general GFCI (Ground Fault Circuit Interrupter), select a current sensor with sensitivity of 200mA or above and not less than 0.1-second operation time to avoid nuisance tripping.

1. Use ring type terminals for the VFD power wiring.
2. Connect power line ground and motor ground wires to designated ground terminals.
3. Connect three-phase power, including Open-Delta, to the R(L1), S(L2), and T(L3) terminals.
4. Proper phase sequencing is not required for power line input connections.
   - For single-phase power, connect L1 to R and L2 to S terminals.
   - A, B, C, and D frame VFDs have single pole connections.
   - E and F frame VFDs have double-pole power terminals or lugs to accommodate 2 smaller gauge wires.
   - G frame VFDs have 4-pole connections on the input and double-pole connections on the output.
   - H frame VFDs have 4-pole power terminals.
5. Connect three-phase motor wires to the U(T1), V(T2), and W(T3) terminals.
   - Check manufacturer specifications for correct rotation of motor.

Power Wiring Diagrams



1 Branch protection, power
2 VFD
3 Motor
4 Power input terminals
5 Output to motor terminals
6 Jumper (optional DC reactor, dynamic brake or DC choke unit)
7 Optional brake resistor
8 Optional braking module
9 Short circuit plate

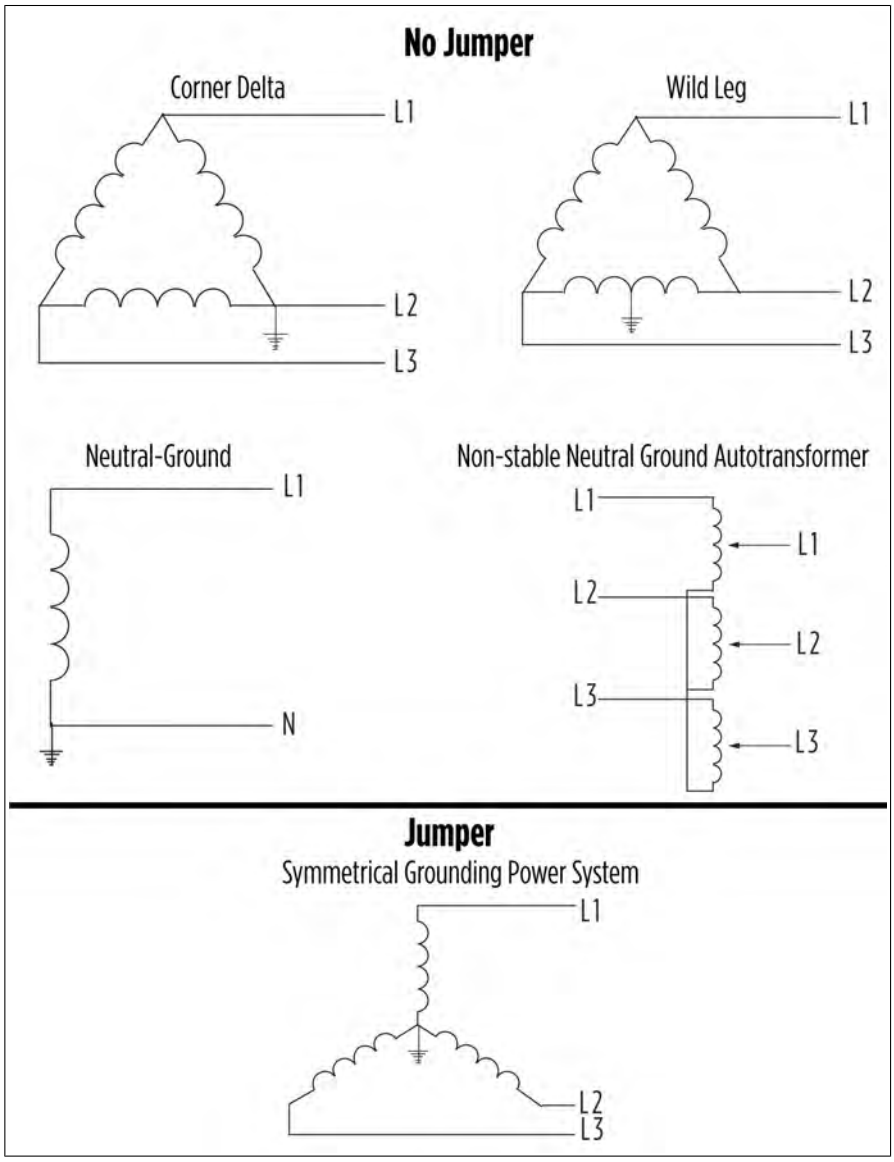
RFI Jumper

Each drive includes a pre-installed RFI jumper that connects drive varistors (e.g. MOVs) to ground.

- Remove the RFI jumper when the power distribution system is a floating ground system (IT systems) or an asymmetric ground system.

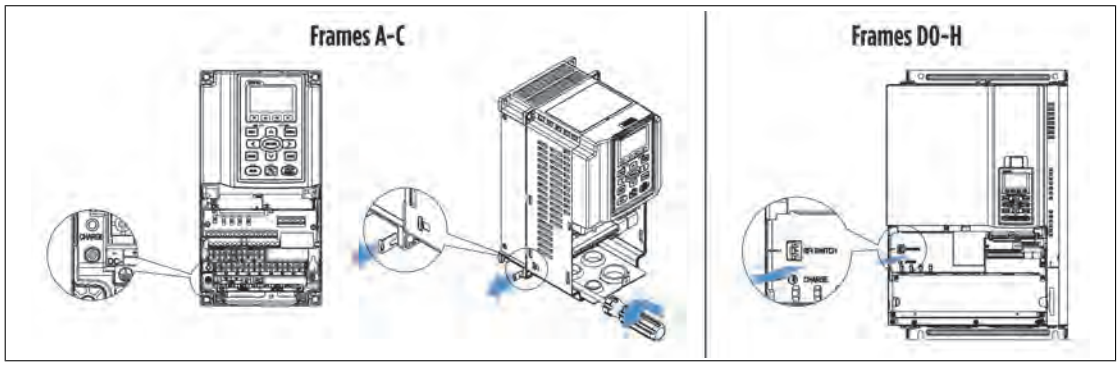
  NOTE: Removing the RFI jumper disables varistor-to-ground protection and reduces the EMC filter feature below the guaranteed EMC performance.

- Do not remove the RFI jumper in symmetrical grounding power systems.



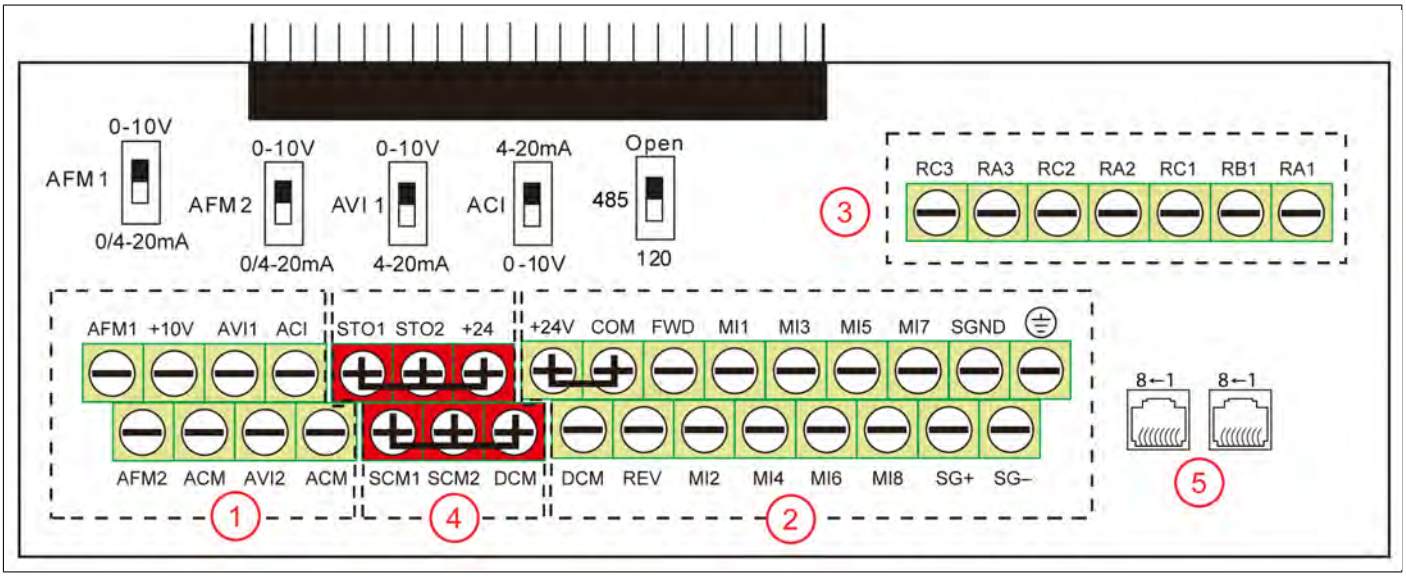
- Remove the MOV-plate to access the RFI filter.

  NOTE: To remove the MOV-plate in Frames A-C, unscrew the plate screws (torque = 6.9–8.7 in-lbs).



Control Circuit Connections

Terminal Identification



The I/O board is divided into 5 groups of terminals and connectors, plus a group of micro switches that control individual terminal configurations.

- Always insulate bare control or shield wires with shrink tubing or electrical tape to prevent short circuit.
- The ideal length of stripped wire for control terminals is 5 mm.

1. **Analog Inputs/Outputs** – These connections are used for transducers, sensors, and control systems such as a BAS, BMS, or PLC. Use shielded cable with shield connected to the ground terminal. Terminals accept 26~16 AWG (0.13~1.3mm^2) wires, and should be tightened to a torque of 1.73 in-lbs (0.19 Nm).
   - **ACI** is a 0-10 VDC or 4-20 mA input, adjustable by micro switch. Set **ACI Input Sel [IO–00]** to match the switch setting. Default = 4–20 mA.
   - **AVI1** is a 0-10 VDC or 4-20 mA input, adjustable by micro switch. Set **AVI1 Input Sel [IO–05]** to match the switch setting. Default = 0–10 V.
   - **AVI2** is a 0-10 VDC input.
     When an input source has been connected, select the appropriate terminal in either **Auto Speed Ref [SET–07], Hand Speed Ref [SET–09]**, or **PID F/B Source [SET–18]**.
   - **AFM1 & AFM2** are programmable, multi-function analog outputs. Refer to **AFMI Out Select [IO–59]** and **AFM2 Out Select [IO–61]** for options. Each output can be set by micro switch to 0-10 V (min load 5k Ω at 2 mA) or 0/4-20 mA (max load 500 Ω).
   - **+10V** terminal (with common ACM) provides a +10 VDC 50 mA power supply for input devices.
   - **ACM** terminals are the common for analog inputs, outputs, and +10 VDC power supply. All ACM terminals are connected internally.

     IMPORTANT: DCM and ACM terminals are isolated from each other and from the ground. Do not connect these terminals to earth ground, which can cause electrical noise in control circuits and unstable VFD operation.

2. **Digital Inputs & RS-485 Communication** –These connections provide input for a wide selection of switches or programmable controls. Use shielded cable or twisted wires for 24 VDC digital control circuits wiring and separate these wires from the main power and motor wiring and other high voltage circuits. Terminals accept wire sizes from 26~16 AWG (0.2~1.5mm^2), and should be tightened to a torque of 6.9 in-lbs (0.78 Nm).
   - Digital inputs are configured for NPN (Sink) mode by default, with a jumper across +24 and COM terminals. Refer to "NPN and PNP Digital Inputs Configuration" on page 45.
   - All digital inputs can be re-programmed from Normally Open to Normally Closed.
   - Digital inputs are activated by voltage 11 VDC or greater. Maximum input voltage rating is 27 VDC at 3.5 mA.
   - **MI1-MI8** are programmable, multi-function digital inputs that can be used for a variety of switching features with common terminal DCM. Refer to **MI1 Define [IO-21]** through **MI8 Define [IO-28]** for options.

     NOTE: MI1 FWD and REV behave as "No Function."

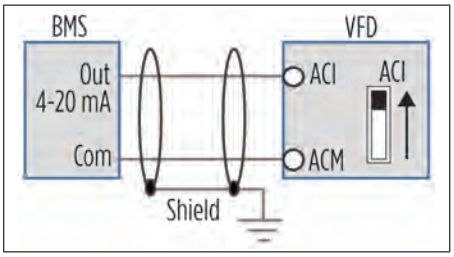
   - **FWD & REV** are dedicated Forward and Reverse run commands. If any digital input is programmed for FWD or REV, corresponding dedicated FWD or REV input is disabled automatically.
   - **SG+, SG–, & SGND** are RS485 communication terminals for PLC, Modbus, or BACnet. Use **PLC Com Type [PLC-23]** to set the com type. Termination resistance is controlled by micro switch. Set the 485 switch to the **Down** position to connect 120 Ω termination resistance for long distance or for an electrically noisy environment.
   - **+24** terminal provides 24 VDC (with DCM common) 50 mA power for digital control circuits and 150 mA for external transducers.
   - **COM** terminal is a digital inputs common. By default, it is connected by jumper to +24 to configure NPN (Sink) mode.
   - **DCM** is the internal 24 VDC power supply common.
   - Earth ground. Use this terminal to connect shield wires.

     IMPORTANT: DCM and ACM terminals are isolated from each other and from the ground. Do not connect these terminals to earth ground, which can cause electrical noise in control circuits and unstable VFD operation.

3. **Relay Outputs** – These are configurable, multi-function, dry contact relays. Refer to **Relay RA1 [IO–47]** through **Relay RA3 [IO–49]** for options. Terminals accept wire sizes from 26~16 AWG (0.2~1.5mm^2), and should be tightened to a torque of 4.3 in-lbs (0.49 Nm).
   - Relays ratings are 1.25A at 250 VAC, or 3A at 30 VDC.
   - RA1-RB1-RC1 is a single-pole, double throw relay. RA1-RC1 is N.O. (normally open), and RB1-RC1 is N.C. (normally closed).
   - RA2-RC2 and RA3-RC3 are independent single pole, single throw, normally open relays.
4. **Safety Torque Off (STO) Inputs**– These connections provide emergency stop control from an external system. By default, the inputs are closed through jumper wires, allowing the drive to run.
5. **RJ-45 Sockets**– These connections are communication terminals for PLC, Modbus, or BACnet. Use **PLC Com Type [PLC–23]** to set the Com Type. Then set both Speed Reference and Run Command to **RS485**. Both RJ-45 sockets and terminals (SG+, SG-, & SGND) are connected internally.

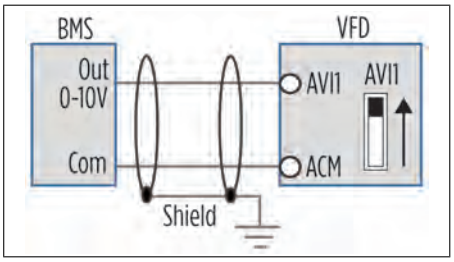
Example Configurations

4-20mA Speed Control Signal from an External BMS or PLC



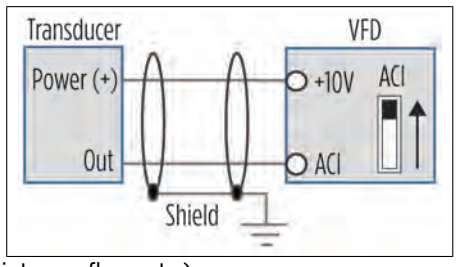
- Connect the BMS or PLC output signal to the ACI or AVI1 terminal. The ACI micro switch should be in the UP position. If using the AVI1 terminal, the AVI1 micro switch should be DOWN.
- Connect the BMS Com wire to the ACM terminal (signal ground).
- Any shield wire should be connected to Earth ground.
- Set **ACI Input Sel [IO–00]** or **AVI1 Input Sel [IO–05]** to the correct signal type.
- Set **Auto Speed Ref [SET–07]** to the chosen input.

0-10V Speed Control Signal from an External BMS or PLC



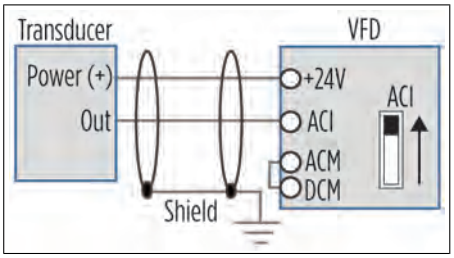
- Connect the BMS or PLC output signal to the AVI1, AVI2, or ACI terminal. The AVI1 micro switch should be in the UP position. If using the ACI terminal, the ACI micro switch should be DOWN.
- Connect the BMS Com wire to the ACM terminal (signal ground).
- Any shield wire should be connected to Earth ground.
- Set **ACI Input Sel [IO–00]** or **AVI1 Input Sel [IO–05]** to **0-10V**.
- Set **Auto Speed Ref [SET–07]** to the chosen input.

4-20mA Transducer with VFD 10 VDC Power



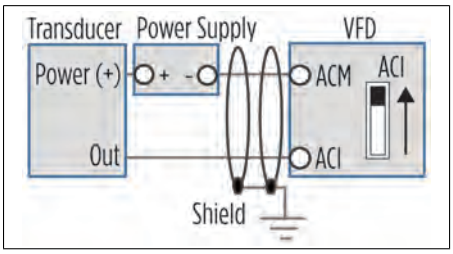
- Connect the transducer positive (Power) wire to the VFD +10V terminal.
- Connect the transducer output (Out) wire to the ACI or AVI1 terminal. The ACI micro switch should be in the UP position. If using the AVI1 terminal, the AVI1 micro switch should be DOWN.
- Any shield wire should be connected to Earth ground.
- Set **ACI Input Sel [IO–00]** or **AVI1 Input Sel [IO–05]** to the correct signal type.
- Set **Auto Speed Ref [SET–07]** to **PID Output**, set **PID F/B Source [SET–18]** to the chosen input, and set **PID F/B Unit [SET–19]** to the appropriate scale (psi, temp, flow, etc.).

4-20mA Transducer with VFD 24 VDC Power



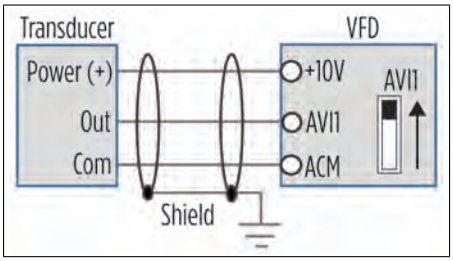
- Connect the transducer positive (Power) wire to the VFD +24V terminal.
- Connect the transducer output (Out) wire to the ACI or AVI1 terminal. The ACI micro switch should be in the UP position. If using the AVI1 terminal, the AVI1 micro switch should be DOWN.
- Use a jumper wire to connect the ACM and DCM terminals.
- Any shield wire should be connected to Earth ground.
- Set **ACI Input Sel [IO–00]** or **AVI1 Input Sel [IO–05]** to the correct signal type.
- Set **Auto Speed Ref [SET–07]** to **PID Output**, set **PID F/B Source [SET–18]** to the chosen input, and set **PID F/B Unit [SET–19]** to the appropriate scale (psi, temp, flow, etc.).

4-20mA Transducer with External 24 VDC Power



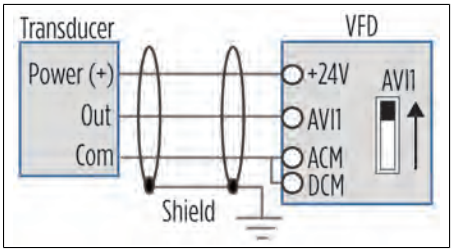
- Connect the transducer positive (Power) wire to the external source positive [+24V]. Connect the external source negative to the VFD ACM terminal.
- Connect the transducer output (Out) wire to the ACI or AVI1 terminal. The ACI micro switch should be in the UP position. If using the AVI1 terminal, the AVI1 micro switch should be DOWN.
- Any shield wire should be connected to Earth ground.
- Set **ACI Input Sel [IO–00]** or **AVI1 Input Sel [IO–05]** to the correct signal type.
- Set **Auto Speed Ref [SET–07]** to **PID Output**, set **PID F/B Source [SET–18]** to the chosen input, and set **PID F/B Units [SET–19]** to the appropriate scale (psi, temp, flow, etc.).

0-10VDC Transducer with VFD 10 VDC Power



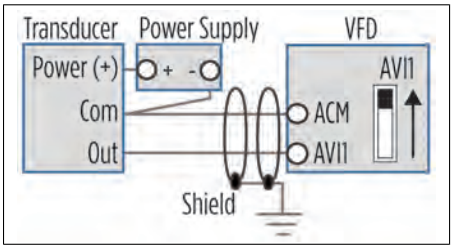
- Connect the transducer positive (Power) wire to the VFD +10V terminal.
- Connect the transducer output (Out) wire to the AVI1, AVI2, or ACI terminal. The AVI1 micro switch should be in the UP position. If using the ACI terminal, the ACI micro switch should be DOWN.
- Connect the transducer Com wire to the ACM terminal (signal ground).
- Any shield wire should be connected to Earth ground.
- Set **ACI Input Sel [IO–00]** or **AVI1 Input Select [IO–05]** to **0-10V**.
- Set **Auto Speed Ref [SET–07]** to **PID Output**, set **PID F/B Source [SET–18]** to the chosen input, and set **PID F/B Unit [SET–19]** to the appropriate scale (psi, temp, flow, etc.).

0-10VDC Transducer with VFD 24 VDC Power



- Connect the transducer positive (Power) wire to the VFD +24V terminal.
- Connect the transducer output (Out) wire to the AVI1, AVI2, or ACI terminal. The AVI1 micro switch should be in the UP position. If using the ACI terminal, the ACI micro switch should be DOWN.
- Connect the transducer Com wire to the ACM terminal (signal ground).
- Use a jumper wire to connect the ACM and DCM terminals.
- Any shield wire should be connected to Earth ground.
- Set **ACI Input Sel [IO–00]** or set **AVI1 Input Sel [IO–05]** to **0-10V**.
- Set **Auto Speed Ref [SET–07]** to **PID Output**, set **PID F/B Source [SET–18]** to the chosen input, and set **PID F/B Unit [SET–19]** to the appropriate scale (psi, temp, flow, etc.).

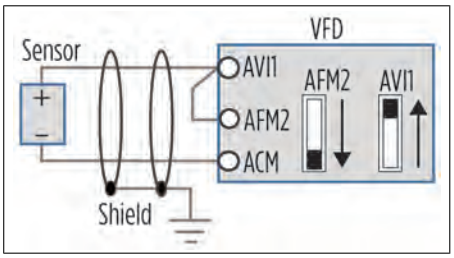
0-10VDC Transducer with External 24 VDC Power



- Connect the transducer positive (Power) wire to the external source positive [+24V].
- Connect the transducer Com wire to the external source negative.
- Connect the transducer output (Out) wire to the AVI1, AVI2, or ACI terminal. The AVI1 micro switch should be in the UP position. If using the ACI terminal, the ACI micro switch should be DOWN.
- Any shield wire should be connected to Earth ground.
- Set **ACI Input Sel [IO–00]** or **AVI1 Input Sel [IO–05]** to **0-10V**.
- Set **Auto Speed Ref [SET–07]** to **PID Output**, set **PID F/B Source [SET–18]** to the chosen input, and set **PID F/B Units [SET–19]** to the appropriate scale (psi, temp, flow, etc.).

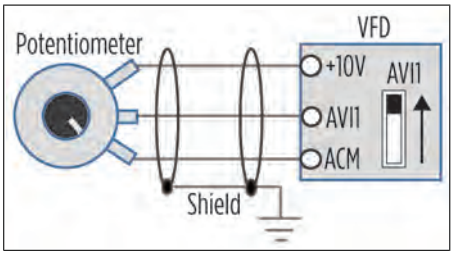
Temperature Protection or PID Control with PT-100 or PTC Sensor

- Connect the sensor Positive wire to the AFM2 terminal. Place the AFM2 micro switch in the DOWN position.
- Connect the sensor Negative wire to the ACM terminal.
- Use a jumper wire to connect the AFM2 and AVI1 terminals. The AVI1 micro switch should be in the UP position.
- Any shield wire should be connected to Earth ground.
- For PT100, set **AVI1 Input Sel [IO-05]** to **PT100 & AFM2**.
- If using PT100 for PID Feedback, Spare Sensor, or Aux Sensor, set the max value to 200 °C.



Speed Control using 0-10 VDC Potentiometer

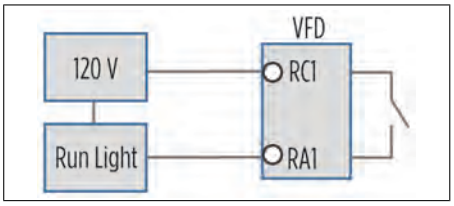
- Connect the potentiometer Positive wire to the VFD +10V terminal.
- Connect the potentiometer Output wire to the AVI1, AVI2, or ACI terminal. The AVI1 micro switch should be in the UP position. If using the ACI terminal, the ACI micro switch should be DOWN.
- Connect the potentiometer Com wire to the ACM terminal (signal ground).
- Any shield wire should be connected to Earth ground.
- Set **ACI Input Sel [IO–00]** or **AVI1 Input Sel [IO–05]** to **0-10V**.
- Set **Auto Speed Ref [SET–07]** or **Hand Speed Ref [SET–09]** to the chosen input.



Relay switching to control an external starter, contactor, or other system

- Connect the incoming power to the RC terminal.
- Wire the corresponding RA terminal to the external application.
- Set the relay control, **Relay RA1 [IO–47]**, **Relay RA2 [IO–48]**, **Relay RA3 [IO-49]**.

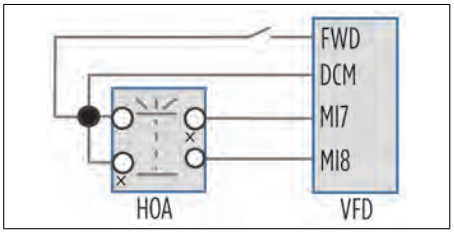
  NOTE: Illustration example uses 120 V, relay 1, and a run light application.



External HOA switch

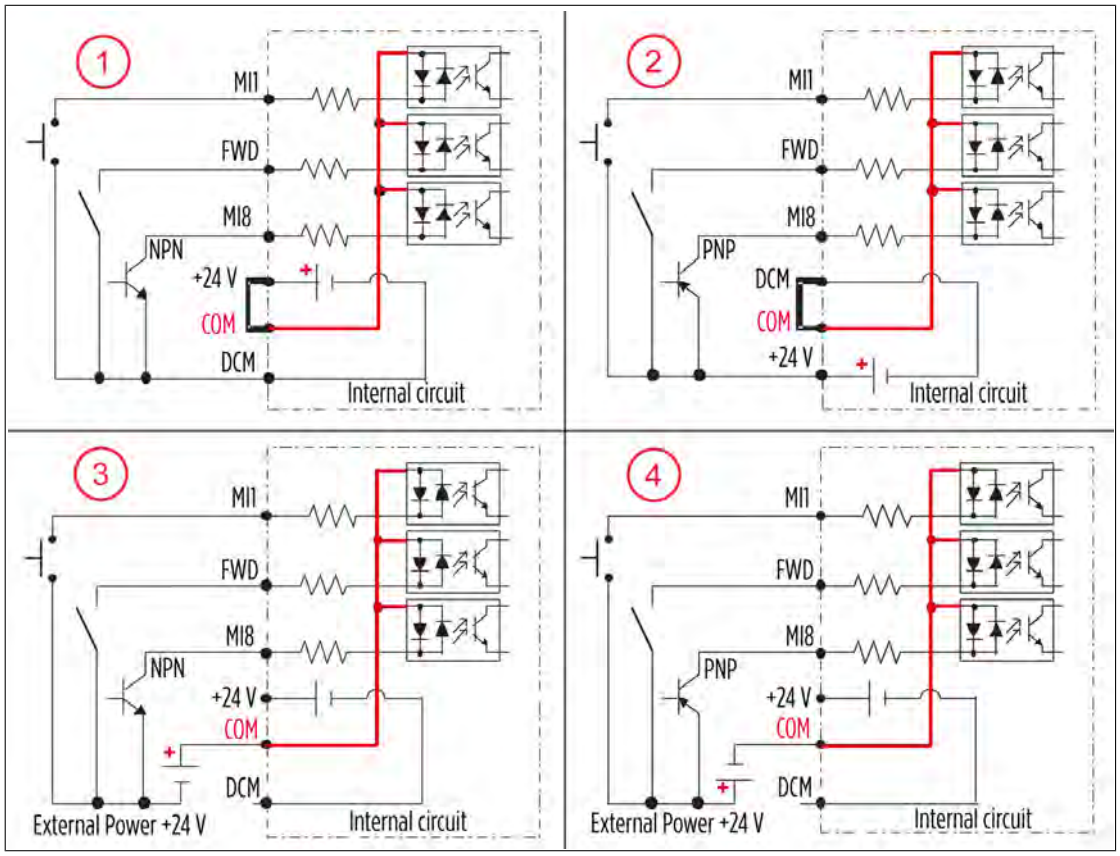
- Connect two MI terminals to DCM and the HOA switch.
- Wire a normally open run contact to DCM and FWD terminals.
- **MI1 Define [IO-21]** to **MI8 Define [IO-28]** of the two terminals should be set to **26_HOA-HAND**, and **27_HOA-AUTO**.
- Put **HOA Mode Source [SET_60]** to **Digital Input**.

  NOTE: Factory-installed drives use MI7 for Hand and MI8 for Auto.



NPN and PNP Digital Inputs Configuration

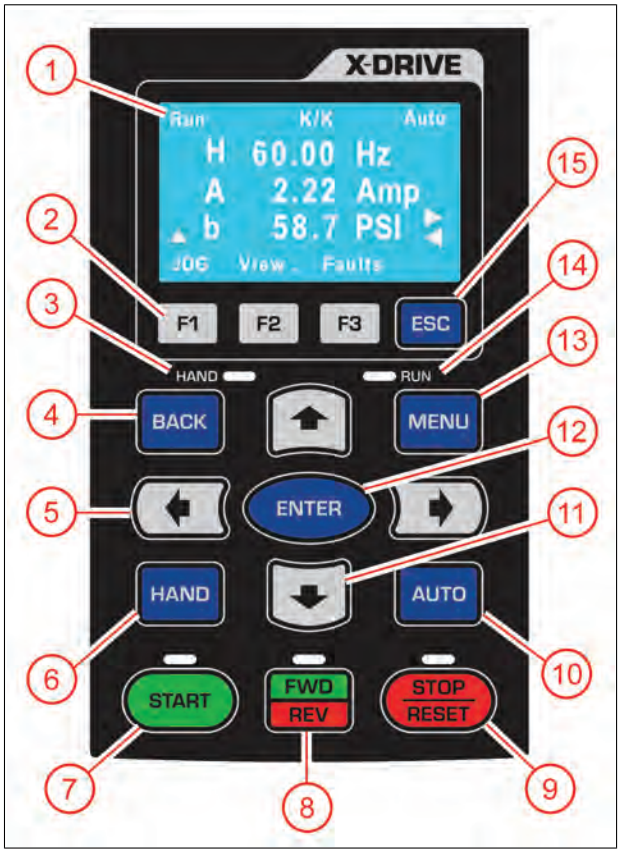
The drive control can be configured to Sink (NPN) or Source (PNP) modes by providing proper wiring and installing/removing jumper on terminals +24, COM and DCM. Four possible digital input configurations include:



1. **Sink (NPN) mode with internal 24VDC power source (Default).** Install jumper between +24 and COM terminals. Connect dry contact or NPN transistor output from external control device to desired digital input and DCM terminals. When contact is closed or transistor is in conducting state, digital input is activated by internal power supply.
2. **Source (PNP) mode with internal 24VDC power source.** Install jumper between DCM and COM terminals. Connect dry contact or PNP transistor output from external control device to desired digital input and +24 terminals. When contact is closed or transistor is in conducting state, digital input is activated by internal power supply.
3. **Sink (NPN) mode with external 24VDC power source.** Remove any jumpers between +24 and COM or DCM and CM terminals. Connect positive terminal of external power supply to COM terminal. Connect dry contact or NPN transistor output from external control device to desired digital input and negative terminal of external power supply. When contact is closed or transistor is in conducting state, digital input is activated by external power supply.
4. **Source (PNP) mode with external 24VDC power source.** Remove any jumpers between +24 and COM or DCM and CM terminals. Connect negative terminal of external power supply to COM terminal. Connect dry contact or PNP transistor output from external control device to desired digital input and positive terminal of external power supply. When contact is closed or transistor is in conducting state, digital input is activated by external power supply.

DRIVE CONFIGURATION

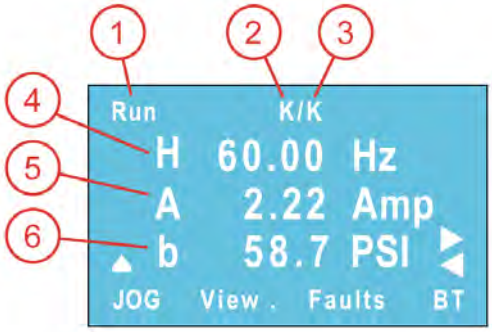
Using the Keypad



1. LCD Display Screen
2. Function Keys provide access to:
   - **F1:** Jog Function
   - **F2:** View Mode
   - **F3:** Fault History
3. The **HAND** LED indicates when the VFD is in Hand mode.
4. The **BACK** key returns display to the previous screen.
   - From the first **MENU** screen, this key displays a basic drive menu.
5. **Left and Right Arrow** keys allow navigation between parameter groups, cursor movement when setting a value, and for increment of numeric values.
6. The **HAND** key places the VFD in Hand mode when the keypad control is enabled.
7. The **START** key starts the motor when the keypad control is enabled.
   - The LED indicates that a Start command is present.
8. The **FWD/REV** key selects the motor direction when enabled. The LED lights either green or red to indicate the selection.
9. The **STOP/RESET** key stops the motor when the keypad control is enabled, or if the drive is enabled in remote mode.
   - The LED indicates that the VFD is stopped.
   - **RESET** can be used to clear some faults.
10. The **AUTO** key places the VFD in Auto mode when the keypad control is enabled.
11. **Up** and **Down** arrow keys allow navigation within a parameter group.
12. The **ENTER** key places the VFD in programming mode and confirms changes to parameters.
13. The **MENU** key provides access for editing all parameter groups.
    - Pressing **BACK** from this screen displays a basic drive menu.
14. The **RUN** LED indicates that power is being sent to the motor.
15. The **ESC** key returns the Home Screen from any menu.

Home Screen Display Options

The Home Screen displays default and user-selectable information about the operational status of the VFD. The keypad **ESC** key returns to the Home Screen from any menu.



No.	Display	Description	Range
1	Operating Status	Indicates the system actions currently active	• Run/Stop • Limit by PID 2 • Ctrl by PID 2 • Stopped by AI • Backspin Timer • Lubrication • Limit by Level • Limit by Temp • Stall
2	Command Source	Identifies the currently configured source for RUN commands	• K = Keypad • T = Terminal control • R = RS485 • O = Option board
3	Frequency Source	Identifies the currently configured source for speed (frequency) control	• K = Keypad/PID • V1 = from AV1 • V2 = from AV2 • C = from ACI • R = RS485 • O = Option board • 1-15 = Step speed • J = Jog frequency
4	Display Line 1	• Use Arrow and Enter keys to step through selections and to change setpoints. • Use **Line Display 1 [SET-57]** to permanently set the viewable parameter, cycling the power of the drive or keypad to update the display.	• H = Output Speed • F = Speed Command • P = PID Setpoint in application based units (PSI, inWC, etc.) **[SET–21]**.
5	Display Line 2	Displays motor output current	Motor amps
6	Display Line 3	• Use Arrow keys to step through choices. • Use **Line Display 23 [SET-58]** to permanently set the viewable parameter, cycling the power of the drive or keypad to update the display.	This display corresponds to choices in **[SET–58]**. Refer to "Parameter Descriptions > SET Menu" on page 203 for a complete list of options.

Navigating the Menu Screen

From home screen, press the **MENU** button to display the **Param Groups** menu.

From **Param Groups** menu, press the **BACK** button to go to the main menu:

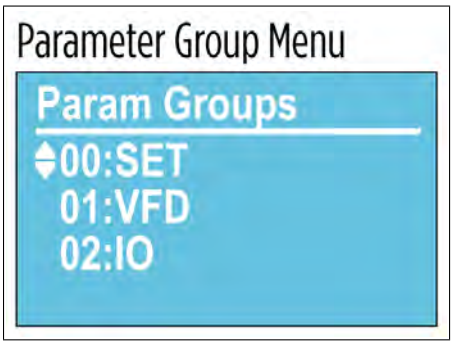
No.	Display	Description
1:	Param Groups	Access to view and edit parameters
2:	Quick Start	Step-through guide of parameters for simple setup
3:	Copy Pr	Download and upload parameters to keypad to copy to another drive
4:	Fault Record	Listing of faults and pertinent information
5:	Set Language	Change display language
6:	Set Time	Change date and time
7:	Keypad Lock	Lock keypad for unwanted access
8:	PLC	Select and start/stop PLC program
9:	Copy PLC	Download and upload PLC program to keypad to copy to another drive
10:	Displ Setup	Change brightness and contrast of keypad display

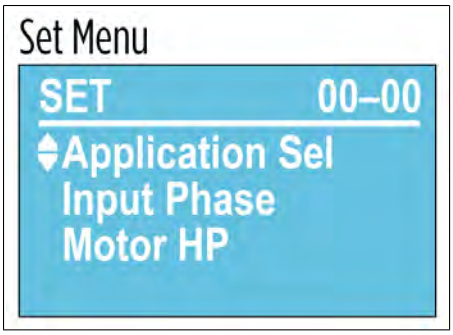
Setting Operating Parameters

Enter Required Parameters Before Starting VFD

Use the keypad to enter the following parameters for the specific installation.

1. **Application Sel [SET–00]:** Select the type of application the drive controls.
   - Related parameters automatically update their defaults.
   - The **BASIC** application provides standard VFD control with start/stop command from digital inputs and speed reference from a remote analog signal. For systems using a transducer or other control sensors, choose the relevant application type to ensure that correct defaults are set.
   - When using **FE MagForce** or other permanent magnet motor application, refer to "Operation with Permanent Magnet Motors" on page 99.
2. **Input Power Phase [SET–01]:** Verify the setting matches the type of power supply. Default = 3-phase.
3. **Motor HP [SET–02]:** Enter the rated horsepower from the motor nameplate.
4. **Motor FLA (SFA) [SET–03]:** Enter the FLA (Full Load Amps) rating from the motor nameplate, or enter SFA (Service Factor Amps) if using a submersible pump motor.
5. **Motor RPM [SET–04]:** Enter the rated motor RPM from the motor nameplate.
6. **Motor Voltage [SET–05]:** Enter the rated voltage from the motor nameplate.
7. **Motor Freq Sel [SET-06]:** Select the standard motor frequency (either 50 or 60 Hz).





Verify Default Settings

NOTE: Refer to the "Default Settings Table - SET Menu" on page 51 for a list of automatically populated settings per application.

After entering the initial parameters, check and, if necessary, adjust the following default settings to ensure expected operation.

- **Language:** Select a desired language for the display. Press the **MENU** button and then press the **BACK** button. Use the Down key to scroll to **5_Set Language**.
- **Clock:** Current time and date. This setting is used to record real-time data for faults, parameter changes, etc. To adjust, press the **MENU** button and then press the **BACK** button. Use the Down key to scroll to **6_Set Time**.

Parameter	Display name	Description
VFD-00	VFD Max Freq	The highest frequency (speed) allowable. If running a FE MagForce pump, this should be set to the calculated electrical frequency corresponding to the target pump RPM. Refer to "Setup FE MagForce Pump Motor" on page 100.
VFD-02	VFD Base Freq	This should be set to the motor nameplate frequency rating.
SET–07	Auto Speed Ref	This is the source of frequency (speed) setpoint the drive uses when in Auto mode. • When using one of the analog inputs with an automated BAS, BMS, or PLC system, be sure to configure the terminal for the correct signal type. Refer to "Terminal Identification" on page 40. • When using feedback from a sensor or transducer, select PID Output. When PID mode is selected, additional parameters must be verified for setpoints, inputs, and limits. • When set to Keypad, the drive runs at the Keypad Speed Reference (F on display).
SET–08	Auto Run Cmd	The source of RUN command when VFD is in Auto Mode—Keypad or external.
SET–09	Hand Speed Ref	The source of frequency (speed) setpoint the drive uses when in Hand mode. PID is disabled in Hand mode. Be sure to configure any selected input terminals for the correct signal type. • When set to Keypad, the drive runs at the Keypad Speed Reference (F on display).
SET–10	Hand Run Cmd	The source of RUN command when VFD is in Hand Mode—Keypad or external.
SET–11	Accel Time	The time in seconds for drive to ramp up from stop to maximum frequency. Recommended defaults are 2 seconds for submersible pump motors and 20 seconds for most other applications. Additional acceleration curves can be added for more precise control through selected frequency ranges. Refer to "Acceleration/Deceleration Control" on page 83.
SET–12	Decel Time	The time in seconds to slow down from maximum frequency to stop. Recommended defaults are 2 seconds for submersibles and 30 seconds for surface/boost pumps. This setting is only effective when **Stop Mode [SET–16]** is set to **0_Decel to Stop**. Additional deceleration curves can be added for more precise control through selected frequency ranges. Refer to "Acceleration/Deceleration Control" on page 83.
SET–13	Low Freq Limit	The lowest frequency (speed in Hz) allowed by the VFD in any mode.
SET–14	High Freq Limit	The highest frequency (speed in Hz) allowed by the VFD in any mode.
SET–17	PID Mode	Enables or disables PID control, either direct or inverse.
SET–18	PID F/B Source	The input terminal for PID Feedback source. Be sure to configure the terminal for the correct signal type.
SET–19	PID F/B Unit	Selects a measurement unit for PID feedback.
SET–20	PID F/B Max	The maximum reading of the feedback source. This is used to scale the analog signal to transducer. For example: if using a 0–200 psi transducer, the value should be 200.
SET–21	PID Set-point	The desired value for the drive to maintain in PID mode while running in Auto. This parameter can also be changed through keypad on Line-1 of the display (value P).
SET–22	PID Low Hz Limit	Minimum PID frequency output is limited to this value.
SET–23	PID High Hz Limit	Maximum PID frequency output is limited to this value.

Verify Control Terminal Settings

For each type of control hardware that has been connected to the system—sensors, switches, BAS, etc., make sure that the matching function parameters have been identified for the input terminals. For more information, refer to "Example Configurations" on page 42 or to "Parameter Descriptions > I/O Menu" on page 211.

Enter or Verify Optional Settings

If using any of the optional features available in the system, make sure that all related parameters are set for the desired operation. Refer to the application descriptions in "Operation" on page 67 for information about these features:

- **Automation features:** See "Standard Operation with an Automated Control System" on page 71.
- **Protection features:** See "Protection Features" on page 91.
- **Maintenance features:** See "Standard Operation with an Automated Control System" on page 71.
- **Communications features:** See "Communications" on page 115.
- **Multi-Motor applications:** See "Multi-Motor Configurations" on page 108.
- **Multi-Drive applications:** See "Multi-Drive Configurations" on page 109.

For more details on individual parameter settings, refer to "Parameter Reference Tables" on page 203.

Default Settings Table – SET Menu

Parameters in highlighted rows are reset when the application is changed **[SET–00]**.

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
SET-01	Input Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase	3-Phase
SET-02	Motor HP	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
SET-03	Motor FLA (SFA)	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
SET-04	Motor RPM	1750	1750	1750	1750	1750	3450	1750	1750	3600	3450
SET-05	Motor Voltage	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
SET-06	Motor Freq Sel*	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz
SET-07	Auto Speed Ref	ACI Analog	PID Output	PID Output	PID Output	PID Output	PID Output	PID Output	ACI Analog	PID Output	ACI Analog
SET-08	Auto Run Cmd	Digital Input	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad
SET-09	Hand Speed Ref	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad
SET-10	Hand Run Cmd	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad
SET-11	Accel Time	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	2 Sec	20 Sec	20 Sec	2 Sec	20 Sec
SET-12	Decel Time	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	2 Sec	30 Sec	30 Sec	2 Sec	30 Sec
SET-13	Low Freq Limit	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	30 Hz	20 Hz	0 Hz	60 Hz	40 Hz
SET-14	High Freq Limit	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	120 Hz	120 Hz
SET-15	Load Rotation	FWD Only	FWD Only	FWD Only	FWD Only	FWD Only	FWD Only	FWD Only	FWD Only	FWD & REV	FWD Only
SET-16	Stop Mode	Coast	Coast	Coast	Coast	Decel	Coast	Coast	Decel	Coast	Coast
SET-17	PID Mode	Disable	PID Direct	PID Inverse	PID Inverse	PID Direct	PID Direct	PID Direct	PID Direct	PID Direct	PID Direct
SET-18	PID F/B Source	ACI	ACI	ACI	ACI	ACI	ACI	ACI	ACI	ACI	ACI
SET-19	PID F/B Unit	inWC	inWC	inWC	°F	PSI	PSI	inWC	PSI	PSI	inWC
SET-20	PID F/B Max	1 inWC	1 inWC	1 inWC	150 °F	100 PSI	100 PSI	406.9 inWC	100 PSI	100 PSI	1 inWC
SET-21	PID Setpoint	0.5 inWC	0.5 inWC	0.5 inWC	76 °F	60 PSI	60 PSI	60 inWC	60 PSI	60 PSI	0.5 inWC
SET-22	PID Lo Hz Limit	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	30 Hz	20 Hz	20 Hz	60 Hz	40 Hz
SET-23	PID Hi Hz Limit	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	120 Hz	120 Hz
SET-24	PID P-Gain	1%	1%	1%	1%	2%	2%	1%	1%	2%	1%
SET-25	PID I-Time	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	0.5 Sec	0.5 Sec	1 Sec
SET-26	Sleep Mode	Disabled	Disabled	Disabled	Disabled	Sleep Only	Sleep Only	Disabled	Disabled	Sleep Only	Disabled
SET-27	Sleep Chk Time	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec
SET-28	Sleep Delay Time	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec
SET-29	S-Boost Value	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
SET-30	Sleep Boost Timer	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec
SET-31	Wake-Up Level	0.45 inWC	0.5 inWC	0.5 inWC	75 °F	55 PSI	55 PSI	55 inWC	55 PSI	55 PSI	0.5 inWC
SET-32	S-Bump Timer	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec
SET-33	Pipe Fill Timer	0 Min	0 Min	0 Min	0 Min	0 Min	0 Min	0 Min	0 Min	3 Min	0 Min
SET-34	Pipe Fill Exit Level	0.4 inWC	0.4 inWC	0.4 inWC	74 °F	25 PSI	25 PSI	25 inWC	25 PSI	25 PSI	0.4 inWC

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
SET-35	Pipe Fill Freq	47 Hz	47 Hz	47 Hz	47 Hz	47 Hz	47 Hz	47 Hz	47 Hz	95 Hz	95 Hz
SET-36	Broken Pipe Lvl	0 inWC	0 inWC	0 inWC	0 °F	15 PSI	15 PSI	0 inWC	0 PSI	15 PSI	0.4 inWC
SET-37	Broken Pipe Freq	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5Hz	114 Hz	114 Hz
SET-38	Broken Pipe Dly	180 Sec	180 Sec	180 Sec	180 Sec	180 Sec	180 Sec	180 Sec	180 Sec	180 Sec	180 Sec
SET-39	OverPress Set	Disabled	Disabled	Disabled	Disabled	OP AutoReset	OP AutoReset	Disabled	OP AutoReset	OP AutoReset	Disabled
SET-40	OverPress Lvl	1 inWC	1 inWC	1 inWC	80 °F	80 PSI	80 PSI	80 inWC	80 PSI	80 PSI	1 inWC
SET-41	ULD Select	By Current	By Current	By Current	By Current	By Current	By Current	By Current	By Current	By Torque	By Torque
SET-42	ULD Level	45%	45%	45%	45%	45%	70%	45%	45%	60%	45%
SET-43	ULD Frequency	30 Hz	30 Hz	30 Hz	30 Hz	30 Hz	59 Hz	30 Hz	20 Hz	60 Hz	40 Hz
SET-44	ULD Delay	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec
SET-45	ULD Recovery T	0 Min	0 Min	0 Min	0 Min	30 Min	30 Min	0 Min	0 Min	30 Min	0 Min
SET-46	ULD Recover Cnt	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
SET-47	HLD Select	By Current	By Current	By Current	By Current	By Current	By Current	By Current	By Current	By Torque	By Torque
SET-48	HLD Level	110%	110%	110%	110%	110%	110%	110%	150%	110%	110%
SET-49	HLD Frequency	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	30 Hz	20 Hz	20 Hz	60 Hz	40 Hz
SET-50	HLD Delay	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	5 Sec	2 Sec
SET-51	HLD Recovery T	0 Min	0 Min	0 Min	0 Min	0 Min	0 Min	0 Min	0 Min	0 Min	0 Min
SET-52	HLD Recover Cnt	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
SET-53	ACC ChangeFreq	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	60 Hz	0 Hz
SET-54	Second ACC	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	5 Sec	60 Sec
SET-55	Second DEC	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	5 Sec	60 Sec
SET-56	ACC/DECHyster	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	1 Hz	0 Hz	0 Hz	1 Hz	0 Hz
SET-57	Display Line 1	Freq Command	Freq Command	Freq Command	Freq Command	Freq Command	Freq Command	Freq Command	Freq Command	Freq Command	Freq Command
SET-58	Display Line 3	PID Feed-back %	PID Feed-back %	PID Feed-back %	PID Feed-back %	PID Feed-back %	PID Feedback %	PID Feed-back %	PID Feed-back %	PID Feedback %	PID Feed-back %
SET-59	Keypad Frequency	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	10 Hz	115 Hz	115 Hz
SET-60	HOA Mode Source	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad
SET-61	KPD STOP as OFF	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
SET-62	Carrier Freq	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz
SET-63	2/3-Wire Select	2-Wire Fwd/Rev	2-Wire Fwd/Rev	2-Wire Fwd/Rev	2-Wire Fwd/Rev	2-Wire Fwd/Rev	2-Wire Fwd/ Rev	2-Wire Fwd/Rev	2-Wire Fwd/Rev	2-Wire Fwd/ Rev	2-Wire Fwd/Rev

*If **Motor Freq Sel [SET-06]** is changed to 50 Hz, all output frequency related parameters are adjusted. Refer to "Default Settings Table - Frequency Defaults with 50 Hz Power" on page 63.

Default Settings Table - VFD Menu

Parameters in highlighted rows are reset when the application is changed **[SET-00]**.

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
VFD-00	VFD Max Freq	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	120 Hz	120 Hz
VFD-01	VFD Start Freq	0.50 Hz	0.50 Hz	0.50 Hz	0.50 Hz	0.50 Hz	0.50 Hz	0.50 Hz	0.50 Hz	0.50 Hz	0.50 Hz
VFD-02	VFD Base Freq	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	120 Hz	120 Hz
VFD-03	V/F Pattern	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear	Linear
VFD-04	Step Freq-1	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-05	Step Freq-2	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-06	Step Freq-3	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-07	Step Freq-4	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-08	Step Freq-5	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-09	Step Freq-6	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-10	Step Freq-7	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-11	Step Freq-8	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
VFD-12	Step Freq-9	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-13	Step Freq-10	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-14	Step Freq-11	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-15	Step Freq-12	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-16	Step Freq-13	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-17	Step Freq-14	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-18	Step Freq-15	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-19	ACC-2 Time	40 Sec	40 Sec	40 Sec	40 Sec	40 Sec	2 Sec	40 Sec	40 Sec	2 Sec	40 Sec
VFD-20	DEC-2 Time	40 Sec	40 Sec	40 Sec	40 Sec	40 Sec	2 Sec	40 Sec	40 Sec	2 Sec	40 Sec
VFD-21	ACC-3 Time	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec
VFD-22	DEC-3 Time	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec
VFD-23	ACC-4 Time	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec
VFD-24	DEC-4 Time	40 Sec	40 Sec	40 Sec	40 Sec	40 Sec	40 Sec	40 Sec	40 Sec	40 Sec	40 Sec
VFD-25	S Start Time 1	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
VFD-26	S Start Time 2	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
VFD-27	S End Time 1	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
VFD-28	S End Time 2	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
VFD-29	Skip Freq 1 High	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-30	Skip Freq 1 Low	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-31	Skip Freq 2 High	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-32	Skip Freq 2 Low	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-33	Skip Freq 3 High	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-34	Skip Freq 3 Low	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-35	VFD Duty Select	Variable Torque	Variable Torque	Variable Torque	Variable Torque	Variable Torque	Variable Torque	Variable Torque	Constant Torque	Variable Torque	Variable Torque
VFD-36	Reset Restart	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Disable	Enable	Enable
VFD-37	DC Brake CurLvl	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
VFD-38	DC Time at Run	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
VFD-39	DC Time at Stop	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
VFD-40	DC Stop Freq	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-41	Dwell T at Acc	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
VFD-42	Dwell Hz at Acc	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-43	Dwell T at Dec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
VFD-44	Dwell Hz at Dec	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
VFD-45	Hopping Carrier	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
VFD-46	ID Code	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
VFD-47	VFD Rated Amps	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
VFD-49	Firmware Version	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
VFD-50	Disp Filter A	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec
VFD-51	Disp Filter KPD	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec
VFD-52	FW Date	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
VFD-53	Jog ACC Time	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	2 Sec	20 Sec	20 Sec	2 Sec	20 Sec
VFD-54	Jog DEC Time	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	2 Sec	30 Sec	30 Sec	2 Sec	30 Sec
VFD-55	JOG Frequency	6.0 Hz	6.0 Hz	6.0 Hz	6.0 Hz	6.0 Hz	6.0 Hz	6.0 Hz	6.0 Hz	6.0 Hz	6.0 Hz
VFD-56	Zero-speed Mode	Standby	Standby	Standby	Standby	Standby	Standby	Standby	Standby	Standby	Standby
VFD-57	Power-on Start	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Disable	Enable	Enable
VFD-58	H-Carrier Pitch	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms
VFD-59	Torque Boost	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
VFD-60	V/F F-Point 1	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz
VFD-61	V/F V-Point 1	1 V	1 V	1 V	1 V	1 V	1 V	1 V	1 V	1 V	1 V
VFD-62	V/F F-Point 2	1.5 Hz	1.5 Hz	1.5 Hz	1.5 Hz	1.5 Hz	1.5 Hz	1.5 Hz	1.5 Hz	1.5 Hz	1.5 Hz
VFD-63	V/F V-Point 2	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
VFD-64	V/F F-Point 3	3 Hz	3 Hz	3 Hz	3 Hz	3 Hz	3 Hz	3 Hz	3 Hz	3 Hz	3 Hz
VFD-65	V/F V-Point 3	11 V	11 V	11 V	11 V	11 V	11 V	11 V	11 V	11 V	11 V

Default Settings Table - I/O Menu

Parameters in highlighted rows are reset when the application is changed [SET–00].

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
I0-00	ACI InputSel	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA
I0-01	ACI Loss Trip	Disable	Stop/Start	Stop/Start	Stop/Start	Trip Stop	Trip Stop	Trip Stop	Stop/Start	Stop/Start	Trip Stop
I0-02	ACI Loss Level	Below Minimum	Below Minimum	Below Minimum	Below Minimum	Below 0.5xMin	Below 0.5xMin	Below Minimum	Below Minimum	Below 0.5xMin	Below 0.5xMin
I0-03	ACI Loss Delay	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec
I0-04	ACI Filter T	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec
I0-05	AVI1 Input Sel	0-10V	0-10V	0-10V	0-10V	0-10V	0-10V	0-10V	0-10V	0-10V	0-10V
I0-06	AVI1 Loss Trip	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
I0-07	AVI1 Loss Lvl	Below Minimum	Below Minimum	Below Minimum	Below Minimum	Below 0.5xMin	Below 0.5xMin	Below Minimum	Below Minimum	Below 0.5xMin	Below 0.5xMin
I0-08	AVI1 Loss Delay	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec
I0-09	AVI1 Filter T	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec
I0-10	AVI2 FilterT	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec
I0-11	Spare Max Value	1 inWC	1 inWC	1 inWC	150 °F	200 PSI	200 PSI	200 inWC	200 PSI	200 PSI	200 inWC
I0-12	Spare AI Select	AVI1	AVI1	AVI1	AVI1	AVI1	AVI1	AVI1	AVI1	AVI1	AVI1
I0-13	F/B PT Status	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
I0-14	PID Filter Timer	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec
I0-15	PID Delay Time	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
I0-16	Limit by Level	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
I0-17	Max Limit Level	6 Feet	0.9 inWC	0.9 inWC	140 °F	50 PSI	6 Feet	50 PSI	50 PSI	6 Feet	6 Feet
I0-18	Min Limit Level	3 Feet	0.8 inWC	0.8 inWC	130 °F	40 PSI	3 Feet	40 PSI	40 PSI	3 Feet	3 Feet
10–19	Min Freq Limit	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	80 Hz	80 Hz
I0-20	DI Filter	0.005 Sec	0.005 Sec	0.005 Sec	0.005 Sec	0.005 Sec	0.005 Sec	0.005 Sec	0.005 Sec	0.005 Sec	0.005 Sec
I0-21	MI1 Define	Speed-L	None	None	None	None	None	None	None	None	None
I0-22	MI2 Define	Speed-M	None	None	None	None	None	None	None	None	None
I0-23	MI3 Define	Speed-H	None	None	None	None	None	None	None	None	None
I0-24	MI4 Define	Fault Reset	Fault Reset	Fault Reset	Fault Reset	Fault Reset	Fault Reset	Fault Reset	Fault Reset	Fault Reset	Fault Reset
I0-25	MI5 Define	E-Stop	E-Stop	E-Stop	E-Stop	E-Stop	E-Stop	E-Stop	E-Stop	E-Stop	E-Stop
I0-26	MI6 Define	XCEL-L	XCEL-L	XCEL-L	XCEL-L	XCEL-L	XCEL-L	XCEL-L	XCEL-L	XCEL-L	XCEL-L
I0-27	MI7 Define	None	None	None	None	None	None	None	None	None	None
I0-28	MI8 Define	None	None	None	None	None	None	None	None	None	None
I0-29	FO Enable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
I0-30	FO Frequency	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	115 Hz	115 Hz
I0-31	FO Fault Retry	10	10	10	10	10	10	10	10	10	10
I0-32	FO Retry Delay	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec
I0-33	FO Mode & Reset	PID Off Auto	PID On Auto	PID On Auto	PID On Auto	PID On Auto	PID On Auto	PID On Auto	PID Off Auto	PID On Auto	PID Off Auto
I0-34	FO PID S-Point	0 inWC	0 inWC	0 inWC	0 °F	0 PSI	0 PSI	0 inWC	0 PSI	0 PSI	0 inWC
I0-35	E-Stop Mode	Coast	Coast	Coast	Coast	Coast	Coast	Coast	Coast	Coast	Coast
I0-36	Damper Mode	Disable	Enable	Enable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
I0-37	Damper T-Delay	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec
I0-38	No-Flow Mode	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
I0-39	Prime Time	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec
I0-40	No-Flow Freq	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	30 Hz	20 Hz	20 Hz	60 Hz	40 Hz
I0-41	Lube/S-Clean	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
I0-42	S-Clean Timer	60 Min	60 Min	60 Min	60 Min	60 Min	60 Min	60 Min	60 Min	60 Min	60 Min

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
IO-43	Pre-Lube Timer	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec	30 Sec
IO-44	Run-Lube Timer	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
IO-45	Post-Lube Timer	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
IO-46	DI NO/NC	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.
IO-47	Relay RA1	Fault	Fault	Fault	Fault	Fault	Fault	Fault	Fault	Fault	Fault
IO-48	Relay RA2	Run	Run	Run	Run	Run	Run	Run	Run	Run	Run
IO-49	Relay RA3	FDT-4	FDT-4	FDT-4	FDT-4	FDT-4	FDT-4	FDT-4	FDT-4	FDT-4	FDT-4
IO-50	CNT Attained 0	0	0	0	0	0	0	0	0	0	0
IO-51	CNT Attained 1	0	0	0	0	0	0	0	0	0	0
IO-52	FDT-2 Freq	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	115 Hz	115 Hz
IO-53	FDT-2 Bandwdth	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz
IO-54	FDT-3 Freq	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	115 Hz	115 Hz
IO-55	FDT-3 Bandwdth	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz	2.0 Hz
IO-56	I Hi/Lo Setting	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
IO-57	FDT-4/5 Setting	3.0 Hz	3.0 Hz	3.0 Hz	3.0 Hz	3.0 Hz	3.0 Hz	3.0 Hz	3.0 Hz	3.0 Hz	3.0 Hz
IO-58	Relay NO/NC	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.
IO-59	AFM1 Out Select	Output FREQ	Output FREQ	Output FREQ	Output FREQ	Output FREQ	Output FREQ	Output FREQ	Output FREQ	Output FREQ	Output FREQ
IO-60	AFM1 Gain	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
IO-61	AFM2 Out Select	ACI %	ACI %	ACI %	ACI %	ACI %	ACI %	ACI %	ACI %	ACI %	ACI %
IO-62	AFM2 Gain	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
IO-63	AFM1 mA Select	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA
IO-64	AFM2 mA Select	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA	4-20mA
IO-65	AFM1 Filter Time	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec
IO-66	AFM2 Filter Time	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec	0.01 Sec
IO-72	FO Bypass	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
IO-73	FO Bypass Delay	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
IO-74	D-Inputs Status	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
IO-75	D-Relays Status	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
IO-76	AI Loss Freq	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	80 Hz	80 Hz

Default Settings Table – ADV Menu

Parameters in highlighted rows are reset when the application is changed **[SET–00]**.

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
ADV-00	Upper Bound Int	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ADV-01	PID Out Limit	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ADV-02	Password Input	0	0	0	0	0	0	0	0	0	0
ADV-03	Parameter Reset	None	None	None	None	None	None	None	None	None	None
ADV-05	Password Lock	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked	Unlocked
ADV-06	Acc/Dec Type	Linear Acc/ Dec	Linear Acc/ Dec	Linear Acc/ Dec	Linear Acc/ Dec	Linear Acc/ Dec	Linear Acc/Dec	Linear Acc/ Dec	Linear Acc/ Dec	Linear Acc/ Dec	Linear Acc/ Dec
ADV-07	Acc/Dec Format	Unit 0.1 sec	Unit 0.1 sec	Unit 0.1 sec	Unit 0.1 sec	Unit 0.1 sec	Unit 0.1 sec	Unit 0.1 sec	Unit 0.1 sec	Unit 0.1 sec	Unit 0.1 sec
ADV-08	Energy Saving	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
ADV-09	E—Saving Gain	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ADV-10	MMC Mode	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
ADV-11	Motor Quantity	1	1	1	1	1	1	1	1	1	1
ADV-12	Aux Motor Stop Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz
ADV-13	Alt Run Time	720 min	720 min	720 min	720 min	720 min	720 min	720 min	720 min	720 min	720 min
ADV-14	S-Start ON Delay	1 sec	1 sec	1 sec	1 sec	1 sec	1 sec	1 sec	1 sec	1 sec	1 sec
ADV-15	S-Start Off Delay	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 sec	1 sec
ADV-16	Mtr Switch Tmr	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec

DRIVE CONFIGURATION
Default Settings Table – ADV Menu

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
ADV-17	Mtr Switch Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	115 Hz	115 Hz
ADV-18	Lag Start Freq	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	114 Hz	114 Hz
ADV-19	Lag Start Delay	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec
ADV-20	Lag Start Level	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
ADV-21	Lead Freq Drop	10 Hz	10 Hz	10 Hz	10 Hz	10 Hz	10 Hz	10 Hz	10 Hz	10 Hz	10 Hz
ADV-22	MMC Decel Time	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec
ADV-23	Lag Stop Freq	35 Hz	35 Hz	35 Hz	35 Hz	35 Hz	35 Hz	35 Hz	35 Hz	70 Hz	70 Hz
ADV-24	Lag Stop Delay	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec
ADV-25	Lag Stop Level	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
ADV-26	Lead Freq Bump	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz	0.0 Hz
ADV-27	MMC Accel Time	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec
ADV-28	Power-On Delay	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec
ADV-29	Run Delay Timer	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
ADV-30	Backspin Timer	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
ADV-31	Aux Timer Type	On-Delay	On-Delay	On-Delay	On-Delay	On-Delay	On-Delay	On-Delay	On-Delay	On-Delay	On-Delay
ADV-32	Aux Timer Time	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec
ADV-33	Aux Timer Input	FWD DI	FWD DI	FWD DI	FWD DI	FWD DI	FWD DI	FWD DI	FWD DI	FWD DI	FWD DI
ADV-34	Min Run Timer	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
ADV-35	Multi-VFD Set	Single VFD	Single VFD	Single VFD	Single VFD	Single VFD	Single VFD	Single VFD	Single VFD	Single VFD	Single VFD
ADV-36	Standby Pumps	0	0	0	0	0	0	0	0	0	0
ADV-37	Multi-VFD ID	VFD-1	VFD-1	VFD-1	VFD-1	VFD-1	VFD-1	VFD-1	VFD-1	VFD-1	VFD-1
ADV-38	VLag Start Freq	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	59.5 Hz	114 Hz	114 Hz
ADV-39	VLag Start Delay	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec
ADV-40	VLag Stop Freq	35 Hz	35 Hz	35 Hz	35 Hz	35 Hz	35 Hz	35 Hz	35 Hz	70 Hz	50 Hz
ADV-41	VLag Stop Delay	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec
ADV-42	VLead/Lag ID	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
ADV-43	VLag Spd Source	PID	PID	PID	PID	PID	PID	PID	PID	PID	PID
ADV-44	VLag Set Freq	55 Hz	55 Hz	55 Hz	55 Hz	55 Hz	55 Hz	55 Hz	55 Hz	110 Hz	110 Hz
ADV-45	Alternation	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
ADV-46	Alternate TMR	24 Hour	24 Hour	24 Hour	24 Hour	24 Hour	24 Hour	24 Hour	24 Hour	24 Hour	24 Hour
ADV-47	Set VFD Ready	Ready	Ready	Ready	Ready	Ready	Ready	Ready	Ready	Ready	Ready
ADV-48	Jockey Mode	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
ADV-49	J-Start Press	0.5 inWC	0.5 inWC	0.5 inWC	75 °C	54 PSI	54 PSI	54 inWC	54 PSI	54 PSI	0.5 inWC
ADV-50	J-Start Freq	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz	100 Hz	100 Hz
ADV-51	Main Stop Freq	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	40 Hz	80 Hz	80 Hz
ADV-52	J-Start Delay	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec	20 Sec
ADV-53	Main Stop Delay	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec	5 Sec
ADV-55	AVR Select	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Enable
ADV-56	Prog-1 Setting	None	None	None	None	None	None	None	None	None	None
ADV-57	Prog-1 On Time	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01
ADV-58	Prog-1 Off Time	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01
ADV-59	Prog-1 Week Day	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected
ADV-60	Prog-2 Setting	None	None	None	None	None	None	None	None	None	None
ADV-61	Prog-2 On Time	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01
ADV-62	Prog-2 Off Time	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01
ADV-63	Prog-2 Week Day	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected
ADV-64	Prog-3 Setting	None	None	None	None	None	None	None	None	None	None
ADV-65	Prog-3 On Time	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01
ADV-66	Prog-3 Off Time	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01
ADV-67	Prog-3 Week Day	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected
ADV-68	Prog-4 Setting	None	None	None	None	None	None	None	None	None	None

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
ADV-69	Prog-4 On Time	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01
ADV-70	Prog-4 Off Time	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01	00:01
ADV-71	Prog-4 Week Day	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected	None Selected
ADV-74	Set-Point-A	0.5 inWC	0.5 inWC	0.5 inWC	76 °F	60 PSI	60 PSI	60 inWC	60 PSI	60 PSI	0.5 inWC
ADV-75	Set-Point-B	0.5 inWC	0.5 inWC	0.5 inWC	76 °F	60 PSI	60 PSI	60 inWC	60 PSI	60 PSI	0.5 inWC
ADV-76	Set-Point-AB	0.5 inWC	0.5 inWC	0.5 inWC	76 °F	60 PSI	60 PSI	60 inWC	60 PSI	60 PSI	0.5 inWC

Default Settings Table – PROT Menu

Parameters in highlighted rows are reset when the application is changed **[SET–00]**.

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
PROT-00	Decel Method	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
PROT-01	Preheat Level	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
PROT-02	Preheat Duty	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
PROT-03	LV Level	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
PROT-04	OV Stalllevel	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
PROT-05	OV StallPrevent	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard
PROT-06	SW BrakeV Lvl	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
PROT-07	OCA Level	105%	105%	105%	105%	105%	105%	120%	150%	105%	105%
PROT-08	OCN Level	105%	105%	105%	105%	105%	105%	120%	150%	105%	105%
PROT-09	Auto Timer Counter	10800	10800	10800	10800	10800	10800	10800	10800	10800	10800
PROT-10	Auto Restarts	3	3	3	3	3	3	3	3	3	3
PROT-11	Auto Retry Delay	120 Sec	120 Sec	120 Sec	120 Sec	120 Sec	120 Sec	120 Sec	120 Sec	120 Sec	120 Sec
PROT-12	OL-2 Type	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
PROT-13	OL-2 Level	120%	120%	120%	120%	120%	120%	120%	120%	120%	120%
PROT-14	OL-2 Delay	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec
PROT-16	ETH Type	Self-cooled	Self-cooled	Self-cooled	Self-cooled	Self-cooled	Self-cooled	Self-cooled	Self-cooled	Self-cooled	Self-cooled
PROT-17	ETH Delay	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec
PROT-18	OH Warn	105 °C	105 °C	105 °C	105 °C	105 °C	105 °C	105 °C	105 °C	105 °C	105 °C
PROT-19	PTC/PT100 Select	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
PROT-20	PTC Level	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
PROT-21	OPO Trip	Trip Coast Stop	Trip Coast Stop	Trip Coast Stop	Trip Coast Stop	Trip Coast Stop	Trip Coast Stop	Trip Coast Stop	Trip Coast Stop	Trip Coast Stop	Trip Coast Stop
PROT-22	OPO Delay	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec
PROT-23	OPO Current	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
PROT-24	OPO Decel	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
PROT-25	LvX Auto Reset	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Enable
PROT-26	IPO Check Time	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec
PROT-27	IPO Ripple	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
PROT-28	IPO Trip	Alarm and Decel	Alarm and Decel	Alarm and Decel	Alarm and Decel	Alarm and Decel	Alarm and Decel	Alarm and Decel	Alarm and Decel	Alarm and Decel	Alarm and Decel
PROT-29	Derating Type	Carrier by I_T	Carrier by I_T	Carrier by I_T	Carrier by I_T	Carrier by I_T	Carrier by I_T	Carrier by I_T	Carrier by I_T	Carrier by I_T	Carrier by I_T
PROT-30	PT100 Level 1	60 °C	60 °C	60 °C	60 °C	60 °C	60 °C	60 °C	60 °C	60 °C	60 °C
PROT-31	PT100 Level 2	100 °C	100 °C	100 °C	100 °C	100 °C	100 °C	100 °C	100 °C	100 °C	100 °C
PROT-32	PT100 L-1 Freq	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz
PROT-33	PT100 L-1 Delay	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec	60 Sec
PROT-34	Gnd Fault Level	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
PROT-35	Gnd Fault Delay	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
PROT-36	STO Alarm Type	STO Latching	STO Latching	STO Latching	STO Latching	STO Latching	STO Latching	STO Latching	STO Latching	STO Latching	STO Latching
PROT-37	IPF S-Search	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
PROT-38	Max IPF Time	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec	2 Sec
PROT-39	SS Current Lmt	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PROT-40	SS After Fault	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
PROT-42	SS Normal Start	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
PROT-43	Spd Search Gain	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
PROT-44	IPF Restart Dly	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
PROT-45	Fan Control	At power-up	At power-up	At power-up	At power-up	At power-up	At power-up	At power-up	At power-up	At power-up	At power-up
PROT-46	Last Flt Freq	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-47	Last Flt IGBTT	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-48	Last Flt Cap T	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-49	Last Flt MFI	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-50	Last Flt MFO	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-51	Fault-1 Record	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-52	Fault-2 Record	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-53	Fault-3 Record	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-54	Fault-4 Record	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-55	Fault-5 Record	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-56	Fault-6 Record	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PROT-57	ULD Torque Min	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
PROT-58	HLD Torque Min	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
PROT-59	RTD Wire Gauge	20 AWG	20 AWG	20 AWG	20 AWG	20 AWG	20 AWG	20 AWG	20 AWG	20 AWG	20 AWG
PROT-60	RTD Length	300 ft	300 ft	300 ft	300 ft	300 ft	300 ft	300 ft	300 ft	300 ft	300 ft
PROT-61	RTD I+ to V+	6.1 Ohms	6.1 Ohms	6.1 Ohms	6.1 Ohms	6.1 Ohms	6.1 Ohms	6.1 Ohms	6.1 Ohms	6.1 Ohms	6.1 Ohms

Default Settings Table - COMM Menu

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
Comm-00	COM1 Address	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
Comm-01	COM1 Speed	9.6 Kbps	9.6 Kbps	9.6 Kbps	9.6 Kbps	9.6 Kbps	9.6 Kbps	9.6 Kbps	9.6 Kbps	9.6 Kbps	9.6 Kbps
Comm-02	COM1 Loss	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
Comm-03	COM1 Loss Delay	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
Comm-04	COM1 Protocol	8, N, 1 RTU	8, N, 1 RTU	8, N, 1 RTU	8, N, 1 RTU	8, N, 1 RTU	8, N, 1 RTU	8, N, 1 RTU	8, N, 1 RTU	8, N, 1 RTU	8, N, 1 RTU
Comm-05	Response Delay	2 ms	2 ms	2 ms	2 ms	2 ms	2 ms	2 ms	2 ms	2 ms	2 ms
Comm-06	Main Frequency	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
Comm-07	Block Transfer 1	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-08	Block Transfer 2	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-09	Block Transfer 3	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-10	Block Transfer 4	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-11	Block Transfer 5	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-12	Block Transfer 6	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-13	Block Transfer 7	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-14	Block Transfer 8	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-15	Block Transfer 9	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-16	Block Transfer 10	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-17	Block Transfer 11	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-18	Block Transfer 12	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-19	Block Transfer 13	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-20	Block Transfer 14	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
Comm-21	Block Transfer 15	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-22	Block Transfer 16	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h	0000h
Comm-23	Com Decoding	20xx	20xx	20xx	20xx	20xx	20xx	20xx	20xx	20xx	20xx
Comm-24	BACnet MAC ID	10	10	10	10	10	10	10	10	10	10
Comm-25	BACnet Speed	38.4 Kbps	38.4 Kbps	38.4 Kbps	38.4 Kbps	38.4 Kbps	38.4 Kbps	38.4 Kbps	38.4 Kbps	38.4 Kbps	38.4 Kbps
Comm-26	Device ID Lo	10	10	10	10	10	10	10	10	10	10
Comm-27	Device ID Hi	0	0	0	0	0	0	0	0	0	0
Comm-28	Max Address	127	127	127	127	127	127	127	127	127	127
Comm-29	Password	0	0	0	0	0	0	0	0	0	0
Comm-30	Com Card ID	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
Comm-31	Com Card FW	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
Comm-32	Product code	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
Comm-33	Error code	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
Comm-34	D-Net Card Addr	1	1	1	1	1	1	1	1	1	1
Comm-35	D-Net Speed	500 Kbps	500 Kbps	500 Kbps	500 Kbps	500 Kbps	500 Kbps	500 Kbps	500 Kbps	500 Kbps	500 Kbps
Comm-36	D-Net Type	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Comm-37	M-bus IP Type	Static IP	Static IP	Static IP	Static IP	Static IP	Static IP	Static IP	StaticIP	Static IP	Static IP
Comm-38	IP Address 1	0	0	0	0	0	0	0	0	0	0
Comm-39	IP Address 2	0	0	0	0	0	0	0	0	0	0
Comm-40	IP Address 3	0	0	0	0	0	0	0	0	0	0
Comm-41	IP Address 4	0	0	0	0	0	0	0	0	0	0
Comm-42	Address Mask 1	0	0	0	0	0	0	0	0	0	0
Comm-43	Address Mask 2	0	0	0	0	0	0	0	0	0	0
Comm-44	Address Mask 3	0	0	0	0	0	0	0	0	0	0
Comm-45	Address Mask 4	0	0	0	0	0	0	0	0	0	0
Comm-46	G-way Address 1	0	0	0	0	0	0	0	0	0	0
Comm-47	G-way Address 2	0	0	0	0	0	0	0	0	0	0
Comm-48	G-way Address 3	0	0	0	0	0	0	0	0	0	0
Comm-49	G-way Address 4	0	0	0	0	0	0	0	0	0	0
Comm-50	MBus TCP Pass L	0	0	0	0	0	0	0	0	0	0
Comm-51	MBus TCP Pass H	0	0	0	0	0	0	0	0	0	0
Comm-52	MBus CardReset	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
Comm-53	MBus TCPConfig	None	None	None	None	None	None	None	None	None	None
Comm-54	MBus TCPStatus	0	0	0	0	0	0	0	0	0	0
Comm-55	Set Comm Card	0	0	0	0	0	0	0	0	0	0

Default Settings Table – PLC Menu

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
PLC-00	DI used by PLC	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PLC-01	DO used by PLC	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PLC-02	Analog by PLC	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
PLC-03	PLC Buffer 0	0	0	0	0	0	0	0	0	0	0
PLC-04	PLC Buffer 1	0	0	0	0	0	0	0	0	0	0
PLC-05	PLC Buffer 2	0	0	0	0	0	0	0	0	0	0
PLC-06	PLC Buffer 3	0	0	0	0	0	0	0	0	0	0
PLC-07	PLC Buffer 4	0	0	0	0	0	0	0	0	0	0
PLC-08	PLC Buffer 5	0	0	0	0	0	0	0	0	0	0
PLC-09	PLC Buffer 6	0	0	0	0	0	0	0	0	0	0
PLC-10	PLC Buffer 7	0	0	0	0	0	0	0	0	0	0
PLC-11	PLC Buffer 8	0	0	0	0	0	0	0	0	0	0
PLC-12	PLC Buffer 9	0	0	0	0	0	0	0	0	0	0

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
PLC-13	PLC Buffer 10	0	0	0	0	0	0	0	0	0	0
PLC-14	PLC Buffer 11	0	0	0	0	0	0	0	0	0	0
PLC-15	PLC Buffer 12	0	0	0	0	0	0	0	0	0	0
PLC-16	PLC Buffer 13	0	0	0	0	0	0	0	0	0	0
PLC-17	PLC Buffer 14	0	0	0	0	0	0	0	0	0	0
PLC-18	PLC Buffer 15	0	0	0	0	0	0	0	0	0	0
PLC-19	PLC Buffer 16	0	0	0	0	0	0	0	0	0	0
PLC-20	PLC Buffer 17	0	0	0	0	0	0	0	0	0	0
PLC-21	PLC Buffer 18	0	0	0	0	0	0	0	0	0	0
PLC-22	PLC Buffer 19	0	0	0	0	0	0	0	0	0	0
PLC-23	PLC Com Type	Modbus 485	Modbus 485	Modbus 485	Modbus 485	Modbus 485	Modbus 485	Modbus 485	Modbus 485	Modbus 485	Modbus 485
PLC-24	PLC force to 0	0	0	0	0	0	0	0	0	0	0
PLC-25	PLC Address	2	2	2	2	2	2	2	2	2	2

Default Settings Table - Option Menu

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
Option-00	M10 Define	None	None	None	None	None	None	None	None	None	None
Option-01	M11 Define	None	None	None	None	None	None	None	None	None	None
Option-02	M12 Define	None	None	None	None	None	None	None	None	None	None
Option-03	M13 Define	None	None	None	None	None	None	None	None	None	None
Option-04	M14 Define	None	None	None	None	None	None	None	None	None	None
Option-05	M15 Define	None	None	None	None	None	None	None	None	None	None
Option-06	Relay exp. RA10	None	None	None	None	None	None	None	None	None	None
Option-07	Relay exp. RA11	None	None	None	None	None	None	None	None	None	None
Option-08	Relay exp. RA12	None	None	None	None	None	None	None	None	None	None
Option-09	Relay exp. RA13	None	None	None	None	None	None	None	None	None	None
Option-10	Relay exp. RA14	None	None	None	None	None	None	None	None	None	None
Option-11	Relay exp. RA15	None	None	None	None	None	None	None	None	None	None
Option-12	Relay exp. RA16	None	None	None	None	None	None	None	None	None	None
Option-13	Relay exp. RA17	None	None	None	None	None	None	None	None	None	None
Option-14	Relay exp. RA18	None	None	None	None	None	None	None	None	None	None
Option-15	Relay exp. RA19	None	None	None	None	None	None	None	None	None	None
Option-16	Relay exp. RA20	None	None	None	None	None	None	None	None	None	None
Option-17	IO Card Type	No Card	No Card	No Card	No Card	No Card	No Card	No Card	No Card	No Card	No Card

Default Settings Table – ADV2 Menu

Parameters in highlighted rows are reset when the application is changed [SET–00].

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
ADV2-00	PID D-Gain	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
ADV2-01	Sleep Ctrl By	PID Output	PID Output	PID Output	PID Output	PID Output	PID Output	PID Output	PID Output	PID Output	PID Output
ADV2-03	Mtr Brake Delay	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec
ADV2-04	AFM1 Rev Value	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V
ADV2-05	AFM2 Rev Value	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V	0-10 V
ADV2-06	AFM1 DC Lvl	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
ADV2-07	AFM2 DC Lvl	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
ADV2-08	Analog Curve	3x AIs 3-Point	3x AIs 3-Point	3x AIs 3-Point	3x AIs 3-Point	3x AIs 3-Point	3x AIs 3- Point	3x AIs 3-Point	3x AIs 3-Point	3x AIs 3-Point	3x AIs 3-Point
ADV2-09	AVI1 Low Value	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V
ADV2-10	AVI1 Low %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ADV2-11	AVI1 Mid Value	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V
ADV2-12	AVI1 Mid %	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
ADV2-13	AVI1 High Value	10 V	10 V	10 V	10 V	10 V	10 V	10 V	10 V	10 V	10 V
ADV2-14	AVI1 High %	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ADV2-15	ACI Low Value	4 mA	4 mA	4 mA	4 mA	4 mA	4 mA	4 mA	4 mA	4 mA	4 mA
ADV2-16	ACI Low %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ADV2-17	ACI Mid Value	12 mA	12 mA	12 mA	12 mA	12 mA	12 mA	12 mA	12 mA	12 mA	12 mA
ADV2-18	ACI Mid %	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
ADV2-19	ACI High Value	20 mA	20 mA	20 mA	20 mA	20 mA	20 mA	20 mA	20 mA	20 mA	20 mA
ADV2-20	ACI High %	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ADV2-21	AVI2 Low Value	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V
ADV2-22	AVI2 Low %	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ADV2-23	AVI2 Mid Value	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V	5 V
ADV2-24	AVI2 Mid %	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
ADV2-25	AVI2 High Value	10 V	10 V	10 V	10 V	10 V	10 V	10 V	10 V	10 V	10 V
ADV2-26	AVI2 High %	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
ADV2-27	dEb Offset V	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
ADV2-28	dEb Mode Select	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
ADV2-30	PID Mode Select	Serial	Serial	Serial	Serial	Serial	Serial	Serial	Serial	Serial	Serial
ADV2-31	PID Unit Format	0.01	0.01	0.01	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ADV2-32	PID Ref Source	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad	Keypad
ADV2-36	PID2 Output	None	None	None	None	None	None	None	None	None	None
ADV2-37	PID2 Type	Inverse	Inverse	Inverse	Inverse	Inverse	Inverse	Inverse	Inverse	Inverse	Inverse
ADV2-38	PID2 Set Point	0.5 inWC	0.5 inWC	0.5 inWC	76 °F	35 PSI	35 PSI	40 inWC	35 PSI	35 PSI	0.5 inWC
ADV2-39	PID2 P-Gain	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
ADV2-40	PID2 I-Time	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec
ADV2-41	PID2 Low Limit	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	30 Hz	20 Hz	20 Hz	60 Hz	60 Hz
ADV2-42	PID2 High Limit	45 Hz	45 Hz	45 Hz	45 Hz	45 Hz	45 Hz	45 Hz	45 Hz	90 Hz	90 Hz
ADV2-43	PID2 Stp Delay	120 Min	120 Min	120 Min	120 Min	120 Min	120 Min	120 Min	120 Min	120 Min	120 Min
ADV2-44	PID2 Exit Lvl	0.5 inWC	0.5 inWC	0.5 inWC	75 °F	40 PSI	40 PSI	50 inWC	40 PSI	40 PSI	0.5 inWC
ADV2-45	Dual Demand	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
ADV2-46	Pipe Leak Sel	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
ADV2-47	Last Wake Time	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only	Read Only
ADV2-48	H-H Wake Time	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec	4 Sec
ADV2-49	H-L Wake Time	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec
ADV2-50	L-L Wake Time	14 Sec	14 Sec	14 Sec	14 Sec	14 Sec	14 Sec	14 Sec	14 Sec	14 Sec	14 Sec
ADV2-51	L-H Wake Time	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec	6 Sec
ADV2-52	LD Set Point	0.5 inWC	0.5 inWC	0.5 inWC	70 °F	70 PSI	70 PSI	70 inWC	70 PSI	70 PSI	0.5 inWC

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
ADV2-53	LD Max Freq	48 Hz	48 Hz	48 Hz	48 Hz	48 Hz	48 Hz	48 Hz	48 Hz	96 Hz	96 Hz
ADV2-54	LD Timer	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec	10 Sec
ADV2-55	Clean Pump Sel	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
ADV2-56	Clean Pump Tmr	180 Min	180 Min	180 Min	180 Min	180 Min	180 Min	180 Min	180 Min	180 Min	180 Min
ADV2-58	Aux AI Select	AVI1	AVI1	AVI1	AVI1	AVI1	AVI1	AVI1	AVI1	AVI1	AVI1
ADV2-59	Aux AI Unit	Feet	inWC	inWC	°F	PSI	Feet	PSI	PSI	Feet	Feet
ADV2-60	Aux Unit Format	0.1	0.01	0.01	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ADV2-61	Aux Max Value	10 Feet	1 inWC	1 inWC	150 °F	100 PSI	100 Feet	100 PSI	100 PSI	100 Feet	10 Feet
ADV2-62	Analog Trigger	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable	Disable
ADV2-63	Trigger Source	Aux AI	Aux AI	Aux AI	Aux AI	Aux AI	Aux AI	Aux AI	Aux AI	Aux AI	Aux AI
ADV2-64	Trigger Type	Lower	Lower	Lower	Lower	Lower	Lower	Lower	Lower	Lower	Lower
ADV2-65	Trigger Level	0.5 Feet	0.5 inWC	0.5 inWC	70 °F	30 PSI	5 Feet	30 PSI	30 PSI	5 Feet	5 Feet
ADV2-66	Trigger Hyster	0.1 Feet	0.1 inWC	0.1 inWC	5 °F	5 PSI	1 Feet	5 PSI	5 PSI	1 Feet	1 Feet
ADV2-68	P-Fill Low Freq	44 Hz	44 Hz	44 Hz	44 Hz	44 Hz	44 Hz	44 Hz	44 Hz	90 Hz	90 Hz

Default Settings Table - Motor Menu

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
Motor-00	Motor A Tuning	None	None	None	None	None	None	None	None	None	None
Motor-01	Motor Rs Value	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm
Motor-02	Motor Rr Value	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm
Motor-03	Motor Lm Value	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH
Motor-04	Motor Lx Value	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH
Motor-05	Control Method	V/F	V/F	V/F	V/F	V/F	V/F	V/F	V/F	Sensorless	Sensorless
Motor-06	Motor Type	Induction	Induction	Induction	Induction	Induction	Induction	Induction	Induction	PM-IPM	PM-SPM
Motor-07	PM Poles	4	4	4	4	4	2	4	4	4	4
Motor-08	PM Inertia	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
Motor-09	PM Rs	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm	0 Ohm
Motor-10	PM Ld	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH
Motor-11	PM Lq	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH	0 mH
Motor-12	PM PG Angle	0 degree	0 degree	0 degree	0 degree	0 degree	0 degree	0 degree	0 degree	0 degree	0 degree
Motor-13	PM Ke Coeff	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V
Motor-14	Rotor Zeroing	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	1/4 FLA Current	1/4 FLA Current
Motor-15	Torque FilterT	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec	0.5 Sec
Motor-16	Slip FilterT	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec	0.1 Sec
Motor-17	Torque Cmp Gain	0	0	0	0	0	0	0	0	0	20
Motor-18	Slip Cmp Gain	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating	By VFD Rating
Motor-19	Slip DevLevel	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Motor-20	Slip DevDet T	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec	1 Sec
Motor-21	Over SlipTrip	Alarm and Run	Alarm and Run	Alarm and Run	Alarm and Run	Alarm and Run	Alarm and Run	Alarm and Run	Alarm and Run	Alarm and Run	Alarm and Run
Motor-22	Motor Hunt Gain	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Motor-24	I/F Current	40%	40%	40%	40%	40%	40%	40%	40%	40%	80%
Motor-25	PM Bandwidth HS	5 Hz	5 Hz	5 Hz	5 Hz	5 Hz	5 Hz	5 Hz	5 Hz	5 Hz	6 Hz
Motor-26	PMSVC FltrGain	1	1	1	1	1	1	1	1	1	1
Motor-27	Freq I/Fto PM	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	30 Hz	30 Hz
Motor-28	Freq PMto I/F	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	20 Hz	30 Hz	30 Hz
Motor-29	I/F fltr time	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec	0.2 Sec
Motor-30	Angle Det Pulse	1	1	1	1	1	1	1	1	1	1
Motor-31	Zero voltage T	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec	0 Sec

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
Motor-32	Injection Freq	500 Hz	500 Hz	500 Hz	500 Hz	500 Hz	500 Hz	500 Hz	500 Hz	500 Hz	500 Hz
Motor-33	Injection V	15 V	15 V	15 V	15 V	15 V	15 V	15 V	15 V	15 V	15 V
Motor-34	Run Time Min	0 min	0 min	0 min	0 min	0 min	0 min	0 min	0 min	0 min	0 min
Motor-35	Run Time Days	0 day	0 day	0 day	0 day	0 day	0 day	0 day	0 day	0 day	0 day
Motor-36	Motor PF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.96	0.96
Motor-37	PM Trq Comp I/F	20	20	20	20	20	20	20	20	50	20
Motor-38	PM Trq Comp SVC	0	0	0	0	0	0	0	0	0	0
Motor-39	DC-Tun Curr P	300	300	300	300	300	300	300	300	300	300
Motor-40	DC-Tun Curr I	50	50	50	50	50	50	50	50	50	50

Default Settings Table – Frequency Defaults with 50 Hz Power

All values given in Hertz, unless otherwise specified.

CODE	Display	Basic	Supply Fan	Exhaust Fan	Cooling Tower	Centrifugal Pump	Submersible Pump	Vacuum Pump	Constant Torque	FE MagForce	PM Motor
SET-13	Low Freq Limit	20	20	20	20	20	30	20	20	60	40
SET-14	High Freq Limit	50	50	50	50	50	50	50	50	100	100
SET-22	PID Lo Hz Limit	20	20	20	20	20	30	20	20	60	40
SET-23	PID Hi Hz Limit	50	50	50	50	50	50	50	50	100	100
SET-35	Pipe Fill Freq	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	79	79
SET-37	Broken Pipe Frequency	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	94	94
SET-43	ULD Frequency	30	30	30	30	30	49	30	20	60	40
SET-49	HLD Frequency	20	20	20	20	20	30	20	20	60	40
SET-53	ACC Change Freq	0	0	0	0	0	30	0	0	60	0
VFD-00	VFD Max Freq	50	50	50	50	50	50	50	50	100	100
VFD-02	Motor Base Freq	50	50	50	50	50	50	50	50	100	100
IO-19	Min Freq Limit	40	40	40	40	40	40	40	40	80	80
IO-30	FO Frequency	50	50	50	50	50	50	50	50	95	95
IO-40	No-Flow Freq	20	20	20	20	20	30	20	20	60	40
IO-52	FDT-2 Frequency	50	50	50	50	50	50	50	50	95	95
IO-54	FDT-3 Frequency	50	50	50	50	50	50	50	50	95	95
IO-57	FDT-4/5 Setting	3	3	3	3	3	3	3	3	3	3
ADV-17	Mtr Switch Hz	50	50	50	50	50	50	50	50	95	95
ADV-18	Lag Start Freq	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	94	94
ADV-23	Lag Stop Freq	35	35	35	35	35	35	35	35	70	50
ADV-38	VLag Start Freq	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	94	94
ADV-40	VLag Stop Freq	35	35	35	35	35	40	35	35	80	70
ADV-44	VLag Set Freq	45	45	45	45	45	45	45	45	90	90
ADV-50	J-Start Freq	40	40	40	40	40	40	40	40	80	80
ADV-51	Main Stop Freq	35	35	35	35	35	35	35	35	70	70
ADV-74	S-Point-A	.5 inWC	.5 inWC	.5 inWC	76 °F	60 PSI	60 PSI	60 inWC	60 PSI	60 PSI	.5 inWC
ADV-75	S-Point-B	.5 inWC	.5 inWC	.5 inWC	76 °F	60 PSI	60 PSI	60 inWC	60 PSI	60 PSI	.5 inWC
ADV-76	S-Point-AB	.5 inWC	.5 inWC	.5 inWC	76 °F	60 PSI	60 PSI	60 inWC	60 PSI	60 PSI	.5 inWC
ADV2–41	PID2 Low Limit	20	20	20	20	20	30	20	20	60	40
ADV2–42	PID2 High Limit	45	45	45	45	45	45	45	45	90	90
ADV2–53	LD Max Freq	48	48	48	48	48	48	48	48	96	96
Motor-27	Freq I/F to PM	20	20	20	20	20	20	20	20	30	30
Motor-28	Freq PM to I/F	20	20	20	20	20	20	20	20	30	30

INSTALLATION TESTING

Rotation Check

Start VFD in forward direction and check the motor rotation. If the motor is running backwards, disconnect power to the VFD and reverse any two motor leads to change the motor rotation.

- For submersible pumps or other applications that cannot be checked visually, rotation can be determined by evaluating performance. For example, if the system is not building the expected pressure, or the motor is running at less than 80% FLA or SFA at full speed, or if current does not go down as expected, it may be running backwards.
- Performance comparisons can also be made using the Load Rotation settings available in the drive. Refer to "Forward or Reverse Selection" on page 69.

IMPORTANT: Do not use the Load Rotation setting to correct a motor that is running backwards because of incorrect wiring.

Feedback Checks

Check the motor run current on the VFD display while running at full speed. If it is higher than motor FLA (or SFA), check motor wiring and for any mechanical problems (valves, dampers, etc.) that could create extra load on the motor shaft.

When running in PID mode, check to see that transducer feedback (i.e. pressure) matches any gauges that may be installed. If the target is not accurate, verify that the transducer scaling (Feedback Max) has been set correctly.

Performance Checks

If PID is disabled, run the system and vary speed from VFD Low Frequency Limit to VFD High Frequency Limit. Monitor output current, which should not exceed motor FLA or SFA. Check that equipment produces the proper output (air flow, water flow, etc.) at nominal speed.

If PID is enabled, run the system with constant demand. Then change demand and monitor how system pressure or temperature reaches the setpoint value. If the system responds very slowly, or very quickly with overshooting, PID parameters P-Gain and I-Time should be adjusted.

If multiple acceleration/deceleration curves have been programmed, verify that motor performs as expected.

Sleep Mode Check (Pump Applications)

All default settings related to Sleep mode have been calculated for best system performance for most applications. However, some well conditions may require a slight adjustment.

During system setup it is recommended to test the Sleep feature by closing a main valve to simulate a no-demand condition. The system should be running at normal demand, maintaining pressure setpoint, then flow should be decreased slowly until stopped.

- If the system does not enter Sleep mode, it may be necessary to increase the **PID Lo Hz Limit [SET–22]** to ensure that system pressure reaches **PID Setpoint [SET–21]** (plus boost, if enabled).
- If, during normal operation, the system enters Sleep mode, but cycles on and off rapidly as it nears the Setpoint, it may be necessary to slightly lower the **PID Lo Hz Limit [SET–22]** to prevent Sleep mode problems.

Refer to "Sleep Mode with Pressure Boost" on page 74.

OPERATION

Control Options

Hand/Auto Controls

The drive can be operated in either **HAND** or **AUTO** mode as follows:

- **HAND** mode runs the motor based on **Hand Speed Ref [SET–09]** (frequency source) and **Hand Run Cmd [SET–10]** (command source). The default for both settings are Keypad, which runs the motor at a fixed speed (Keypad Setpoint) set on the Home Screen. Both settings can be reprogrammed for external control. PID control is disabled in Hand mode.
- **AUTO** mode runs the motor based on **AUTO Speed Ref [SET–07]** (frequency source) and **AUTO Run Cmd [SET–08]** (command source). The speed reference default is set per application. The run command default is Keypad. Both settings can be reprogrammed as required.

There are several options to consider for operation of the VFD through HOA controls:

Parameter	Display Name	Description	Range
SET-60	HOA Mode Source	Selects where the Hand/Auto control comes from	• When switching modes with the keypad, the VFD stops and then starts when the **START** key is pressed. – **Keypad (Default):** The VFD Keypad HOA buttons, including **START** and **STOP**, are fully functional. • When switching modes with a DI or Comm source, the VFD starts based on the presence of a run command. – **Digital Input:** Enables HOA control through an external switch wired to two digital inputs (MI1 to MI8). These inputs should be set to **26_HOA Hand** and **27_HOA Auto** through parameters **[IO–21]** to **[IO–28]**. HOA mode is then determined in "Determining HOA Mode". – **RS485 Serial:** Enables HOA control through Modbus communications. – **Com Card:** Enables HOA control through BACNet communications. The combinations of 0x2002 bit 3 and bit 4 are defined in "Defining Bit Combinations".
SET-61	KPD STOP as OFF	Keypad STOP as OFF	When enabled, the Stop key acts as a keypad HOA OFF mode, stopping the VFD from being controlled by anything other than an External HOA. To return to Auto or Hand mode, press the corresponding key. • Disable • Enable
SET–09	Hand Speed Ref	Source of Speed Reference in Hand mode	When in Hand mode, PID is disabled and the VFD frequency is based on the following inputs: • **Keypad (Default):** VFD runs at a fixed frequency set on the Home Screen. • **RS485 Serial:** Frequency input through Modbus control. • **AVI1 Analog:** Inputs from external controller, potentiometer, or other device. • **ACI Analog:** Inputs from external controller, potentiometer, or other device. • **AVI2 Analog:** Inputs from external controller, potentiometer, or other device. • **COM Card:** Frequency input through communications protocol.

Parameter	Display Name	Description	Range
SET–10	Hand Run Command	Source of Run Command in Hand mode	VFD starts based on input from: • **Keypad (Default):** Run command from Start/Stop buttons. • **Digital Input:** Run command from digital input FWD or REV terminal. • **RS485:** Run command from RS485 interface. Keypad STOP is disabled. • **Com Card:** Run command from communications card. • **Ext HOA in Hand:** Run command from digital input **[IO-21]** ~ **[IO–28]** set to **26_HOA HAND**.
SET–07	Auto Speed Ref	Source of Speed Reference in Auto mode.	VFD runs at a frequency based on input from: • **Keypad:** VFD runs at a fixed frequency set on the Home Screen. • **Up/Down DI:** Digital input increases or decreases speed when DI terminals **[IO-21]** ~ **[IO–28]** set to **16_Up** and **17_Down**. • **AVI1 Analog:** Input from external controller, potentiometer, or other device. • **ACI Analog:** Input from external controller, potentiometer, or other device. • **AVI2 Analog:** Input from external controller, potentiometer, or other device. • **RS485 Serial:** Frequency input through Modbus control. • **COM Card:** Frequency input through communications protocol. • **PID Output:** VFD speed reference is provided by PID control based on the difference between **PID Setpoint [SET–21]** and transducer feedback values. **IMPORTANT:** When PID Mode is selected, additional parameter settings should be verified to ensure correct operation. Refer to "Standard Operation with PID Feedback Control" on page 71for more information.
SET–08	Auto Run Command	Source of Run Command in Auto mode	VFD starts based on input from: • **Keypad (Default):** Run command from **START/STOP** buttons. • **Digital Input:** Run command from digital input FWD or REV terminal. • **RS485:** Run command from RS485 interface. Keypad **STOP** is disabled. • **Com Card:** Run command from communications card. • **Ext HOA in Auto:** Run command from digital input **[IO-21]** ~ **[IO–28]** set to **27_HOA AUTO**.

Determining HOA Mode

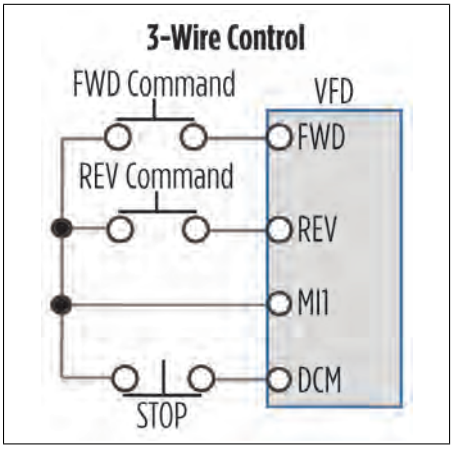
26_HOA Hand	27_HOA Auto	HOA Mode
OFF	OFF	OFF
ON	OFF	Hand
OFF	ON	Auto
ON	ON	OFF

Defining Bit Combinations

Bit 3	Bit 4	HOA Mode
0	0	No change
1	0	Hand
0	1	Auto
1	1	OFF

Forward or Reverse Selection

This feature provides the ability to change the rotation direction of a motor. There are dedicated inputs for forward and reverse. Only one input can be set to FWD and one input to REV (no overlapping). By default, FWD input is set to **FWD** and REV input to **REV**.



2/3–Wire Select [SET-63]: Selects the way rotation is changed.

- **0_2–Wire Fwd/Rev:** Activating FWD input starts VFD in forward. Activating REV input starts VFD in reverse. The VFD ignores commands if both inputs are activated.
- **1_2–Wire Fwd+Rev:** The FWD input works as a Run command and REV input is used to change rotation. The VFD starts forward when FWD input is activated and changes the rotation by REV input. When the control is set to keypad, the VFD starts with the Start button and rotation is changed by the FWD/REV button.
- **2_3–Wire F+R+Stop:** This selection provides 3–wire control feature for two-push button stations with N.O. Start button and N.C. Stop button. FWD input is forward momentarily Start input, REV is reverse Start input, and MI1 input by default becomes a 3–Wire Stop input.

  NOTE: If any DI is set to **38_FWD**, FWD, REV, and MI1 inputs is disabled as 3–Wire Start/Stop inputs and another input should be set to **11_3–Wire Stop**.

  NOTE: If MI10 input of IO expansion card is set to **FWD**, MI11 becomes REV input and MI12 is 3–Wire Stop input.

Load Rotation [SET–15]: This parameter controls whether a load can rotate in both directions or only one.

Jog Feature

The Jog feature provides the ability to activate a motor momentarily. The command can be executed using either the keypad **F1** button, or digital input set to Jog function.

- When using the keypad, the motor direction depends on the **Load Rotation [SET–15]** setting. Digital inputs can be set to either forward or reverse.
- The jog command cannot be used when the drive is running.
- When the jog command is active, other run commands are unavailable.

Parameter	Name Display	Description
VFD–55	Jog Frequency	Sets the speed the motor runs when the jog command is active.
VFD– 53	Jog ACC Time	Sets the acceleration time from 0 Hz to **[VFD–55]**.
VFD–54	Jog DEC Time	Sets the deceleration time from **[VFD–55]** to 0 Hz.
IO–21 through IO–28	FWD Jog	To execute a forward jog command externally, connect a momentary switch to one of the Digital Inputs (MI1–MI8) and set the corresponding parameter to **21_FWD Jog**.
IO–21 through IO–28	REV Jog	To execute a reverse jog command externally, connect a momentary switch to one of the Digital Inputs (MI1–MI8) and set the corresponding parameter to **22_REV Jog**.

NOTE: If an external HOA switch is set to **OFF**, the keypad **F1** button is disabled.

Step Frequencies

The VFD can be operated in a selection of up to 15 user defined pre-set frequencies (speeds) through a combination of switched digital inputs **[IO-21]** ~ **[IO-28]**. These speeds are defined through parameters **[VFD-04]** to **[VFD-18]**.

When a run command is present, selection of a step frequency overrides any previously active speed reference.

The switching combinations for step frequency selection are as follows:

Input Selection				Parameter	Step Speed
Speed L	Speed M	Speed H	Speed X		
1	0	0	0	**[VFD-04]**	Speed 1
0	1	0	0	**[VFD-05]**	Speed 2
1	1	0	0	**[VFD-06]**	Speed 3
0	0	1	0	**[VFD-07]**	Speed 4
1	0	1	0	**[VFD-08]**	Speed 5
0	1	1	0	**[VFD-09]**	Speed 6
1	1	1	0	**[VFD-10]**	Speed 7
0	0	0	1	**[VFD-11]**	Speed 8
1	0	0	1	**[VFD-12]**	Speed 9
0	1	0	1	**[VFD-13]**	Speed 10
1	1	0	1	**[VFD-14]**	Speed 11
0	0	1	1	**[VFD-15]**	Speed 12
1	0	1	1	**[VFD-16]**	Speed 13
0	1	1	1	**[VFD-17]**	Speed 14
1	1	1	1	**[VFD-18]**	Speed 15

Shutdown

The Shutdown feature uses a Digital Input signal (**MI1–MI8**) from an external source to stop VFD output in the event of an emergency. The VFD trips on Shutdown when the DI signal is activated. This function overrides all other functions and VFD cannot be started with any HOA change until stop signal is removed.

Two options are available for restarting:

- **Latching Mode [IO–21] through [IO–28]:** The Shutdown signal must be removed and the Shutdown fault must be manually reset; no auto restarts or retries are available. The VFD can then be restarted with a **RUN** command. To enable this function, connect the external emergency stop signal to one of the Digital Inputs (**MI1– MI8**) and set the corresponding parameter to **36_Shutdown Latched**.
- **Non-Latching Mode [IO–21}] through [IO–28]:** If a **RUN** command is present when the Shutdown signal is removed, the VFD restarts based on HOA mode. To enable this function, connect the external emergency stop signal to one of the Digital Inputs (**MI1–MI8**) and set the corresponding parameter to **35_Shutdown N-Latch**.

NOTE: Only one Digital Input can be set to Shutdown.

Standard Operation with an Automated Control System

In many VFD applications, including ventilation, water supply, or irrigation, motor speed is often determined by an automated system such as a BAS, BMS, or PLC. These systems provide control information to the VFD either through a communications protocol such as Modbus or BACnet, or through direct electrical connection to one of the analog input terminals.

When the drive is in **AUTO** mode, it runs the motor at a variable frequency based on information from the automation system through the input selected in **Auto Speed Ref [SET–07]**.

Standard Operation with PID Feedback Control

A PID controlled application, such as a fan system or a constant pressure pump system, uses feedback from a transducer to measure system performance against a user defined Setpoint (target) to control motor speed. The VFD can use several types of measurement, including pressure, flow, level, air volume, temperature, speed, etc.

For example:

- In a pumping application, the default measurement unit is **PSI**. As user demand (flow) causes pressure changes, the drive varies the output frequency (motor speed) to maintain pressure at the target setpoint. When the drive determines a no-demand condition, it enters Sleep mode and stops the motor.
- In a fan application, the default measurement unit is **inWC** (air pressure).

When the drive is in **AUTO** mode, it runs the motor at a variable frequency based on a comparison between the **PID Setpoint [SET–21]** and feedback from the PID transducer, up to the **PID Hi Hz Limit [SET–23]**. PID operation is disabled in **HAND** mode.

When basic setup is complete, including motor specifications, verify or set the following parameters for PID operation:

Parameter	Display Name	Description
SET-07	Auto Speed Ref	Set to **7_PID Output**.
SET-08	Auto Run Command	Select source of Run Command, either Keypad or external. If using a Digital Input (**MI1-MI8**) with a switch, set the terminal to **38_FWD** (or **39_REV**) **[IO–21] - [IO–28]**.
SET-17	PID Mode	Set to **1_PID Direct** for most PID operations.
SET-18	Feedback Source	Set to the terminal used for transducer connection. Make sure impedance is set correctly.
SET-19	PID Feedback Units	Set to the appropriate measurement unit for the transducer type.
SET-20	PID Feedback Max	Set to the maximum rating of the transducer.
SET-21	PID Setpoint	Set to the desired measurement target.
SET-24	PID P-Gain	Proportional Gain controls motor speed adjustments based on the proportional difference between the PID setpoint and PID feedback. Higher settings result in faster response. However, if the value is too high, it may cause system oscillation and instability. Used along with **PID I-TIme [SET-25]** to smooth and balance system response.
SET-25	PID I Time	Integral Time determines PID response time. Lower values increase system response to the feedback signal, which reduces overshoot, but may cause system oscillation if set too low. Greater values provide slower response, which may cause overshoot of the setpoint and oscillation of output frequency.
SET-26	Sleep Mode	This should be enabled for most pump applications, and **0_Disabled** for most HVAC applications.

Damper Control (HVAC Applications)

The VFD can provide a relay output to open a damper actuator before starting a fan motor. When Damper Control is enabled, the damper relay output is activated when the system receives a **RUN** command and the motor starts based on the following configurations:

- **With Damper Limit Switch:** If any Digital Input **[IO–21]** ~ **[IO-28]**] is set to **34_Damper Limit Sw** and the VFD receives a **RUN** command, the damper relay is activated and when the damper limit switch is closed (damper is fully open and DI is activated), the VFD starts the motor.
  If the limit switch is not closed within the **Damper Time Delay [IO–37]**, the VFD trips on Damper Fault. If at any point during run mode damper limit switch is open for more than 2 seconds, the VFD trips on Damper Fault. VFD tries to restart based on the retry number setting **[PROT–10]**.
- **Without Damper Limit Switch:** If no Digital Input is configured for a damper limit switch and the VFD receives a **RUN** command, the damper relay is activated, and when **Damper Time Delay [IO–37]** is complete, the VFD starts the motor. There is no damper fault detection because there is no damper limit switch feedback.

NOTE: If any other delay timer is set and the VFD receives a **RUN** command, the damper relay starts after the first run delay timer expires.

During run mode the damper relay stays activated. When a **STOP** command is received, the damper relay is deactivated only in VFD stop state. If stop mode is set to deceleration, the relay is deactivated after VFD reaches zero speed (0.00 Hz).

Set the following parameters to use the Damper Control function:

Parameter	Display Name	Description
IO–36	Damper Mode	Enables or disables damper mode. When enabled, the damper relay is activated before every start, including auto restarts.
IO–37	Damper T-Delay	Provides a run time delay without a damper limit switch; or, provides a Damper Fault delay for systems that include a damper limit switch. The delay should be greater than damper opening time.
IO–47 through IO–49	Damper Output Terminal	Connect the damper actuator to one of the Relay Outputs (RA1–RA3), and set the corresponding parameter to **38_Damper Output**.
IO–21 through IO–28	Damper Limit SW Terminal	If the system includes a damper limit switch, connect the switch to one of the Digital Inputs (MI1–8) and set the corresponding parameter to **34_Damper Limit SW**.
PROT-10	Auto Restarts	The number of times the VFD tries to restart after a fault.
PROT-11	Auto Retry Delay	The time delay before the VFD attempts to restart after a fault.

Fireman's Override

Fireman's Override (FO) provides the ability to force the drive to run exhaust fan to purge smoke from fire in the building by activating FO digital input. This mode is available for Basic and Exhaust fan applications.

In FO mode, if **Damper Mode [IO-36]** is enabled, the damper relay output activates, but **Damper T-Delay [IO–37]** reduces by half before VFD starts. The VFD will not monitor a Damper Switch, if present, and no damper faults will be available.

Set the following parameters to use the FO function:

Parameter	Display Name	Description
IO–21 through IO–28	FO Input Terminal	Connect the FO switch to one of the Digital Inputs (**MI1–MI8**) and set the corresponding parameter to either **32_FO with RUN Cmd** or **33_FO w/o RUN Cmd**.
IO–29	FO Enable	Enables FO in either Forward or Reverse.
IO–30	FO Frequency	Setpoint for non-PID operation during FO.
IO–31	FO Fault Retry	Number of fault resets allowed during FO.
IO–32	FO Retry Delay	Delay until restart during FO.
IO–33*	FO Mode & Reset	Sets control method and reset method during FO.
IO–34	FO PID S-Point	Setpoint for PID operation during FO.
IO–72	FO Bypass	Enables Bypass for FO.
IO–73	FO Bypass Delay	Time delay between FO becoming active and enabling relay output.

NOTE: *This parameter overrides all non-critical faults. When FO is activated, the **Auto Retry Delay [PROT-11]** is ignored and the current fault, **Auto Retry Delay [PROT-11]**, and Auto Restart counter resets.

Pump Application Features

Sleep Mode with Pressure Boost

The Sleep feature monitors pressure and frequency to detect a no-demand condition, at which point it stops the motor. The Sleep Feature also has the option to boost system pressure by a set amount before stopping.

The Sleep feature works only in Auto mode using PID. PID2 operation does not have Sleep function.

Set following parameters to control Sleep functions:

Parameter	Display Name	Description
SET–26	Sleep Mode	This setting enables or disables sleep mode and the sleep plus boost option. The default value for submersibles and surface/boost applications is **1_Sleep Only**. If a pressure boost is desired while the system is at rest, select **2_Sleep + Boost** and set a **Sleep Boost Value [SET–29]**.
SET–27	Sleep Check Time	Time delay (sleep check cycle time) before each Sleep Check procedure. Default = 10 sec.
SET–28	Sleep Delay	Delay before VFD triggers Sleep Mode when all other conditions are met. Default = 6 sec.
SET– 29	Sleep Boost Value	Value added to original setpoint to provide pressure boost—0.0 to 10.0% of **PID F/B Max [SET–20]**. Default = 3%.
SET–30	Sleep-Boost Timer	Timer that limits sleep boost duration if Sleep Boost setpoint is not reached (5 to 120 sec). Default = 10 sec.
SET–31	Wakeup Level	Sets a wakeup level for VFD to quit Sleep mode and start running—0.0 to **[SET–21]**. Default = 55 PSI.
SET–32	Sleep Bump Timer	Sets a duration time for pressure bump to increase system pressure as part of the no-demand calculation. Default = 5 sec.
IO– 38	No Flow Mode	If a flow switch is installed on one of the Digital Inputs (**MI1–MI8**) and **[IO–38]** is set to **2_Sleep**, the flow switch becomes an additional condition for sleep mode. If Sleep Delay timer has started and the flow switch opens at any time before the timer expires, the VFD immediately goes to either sleep mode (no Sleep Boost) or to Sleep Boost mode (with S-Boost enabled).

All default settings related to Sleep mode have been calculated for best system performance for most applications. However, some well conditions may require a slight adjustment.

During system setup it is recommended to test the Sleep feature by closing a main valve to simulate a no-demand condition. The system should be running at normal demand, maintaining pressure setpoint, then flow should be decreased slowly until stopped.

- If the system does not enter Sleep mode, it may be necessary to increase the **PID Lo Hz Limit [SET–22]** to ensure that system pressure reaches **PID Setpoint [SET–21]** (plus boost, if enabled).
- If, during normal operation, the system enters Sleep mode, but cycles on and off rapidly as it nears the Setpoint, it may be necessary to slightly lower the **PID Lo Hz Limit [SET–22]** to prevent Sleep mode problems.

Pipe Fill Feature

This feature automates the process of building pressure in an empty pipe system at a reduced speed before the VFD switches to PID control. This can reduce water hammer in some systems, and can also help prevent an Underload fault if the drive runs for an extended period at low pressure. The VFD must be running with PID Control in Auto mode for this feature to be active.

Set the following parameters to activate the Pipe Fill Feature:

Parameter	Display Name	Description	Action
SET–33	Pipe Fill Timer	Pipe Fill mode exit timer to switch to PID control.	• Enter a time between 0.1 and 60 minutes to allow the pipe system to fill. • If set to 0.0, Pipe Fill is disabled. • When the timer expires, the VFD cancels Pipe Fill mode and switches to PID control, regardless of whether **[SET–34]** pressure has been reached.
SET–34	Pipe Fill Exit Level	Pipe Fill mode exit pressure to switch to PID control.	• Enter a pressure setting between 0 and the **PID Set-point [SET–21]** (default = 25 psi). • During Pipe Fill mode, if pressure reaches the set value, VFD switches to PID control.
SET–35	Pipe Fill Freq	Pipe Fill mode High frequency limit setting.	• Range is between **PID Low Freq Limit [SET–22]** and **PID Hi Hz Limit [SET–23]** (default = 47 Hz). • The Pipe Fill mode frequency should be equal to or greater than **[SET–22]** +2 Hz to provide enough system pressure at the end of pipe fill mode to switch to PID control.

Upon start, if system pressure is less than **[SET–34]**, VFD ramps up to Low Freq Limit + 2 and start pipe fill mode.

- If system pressure is less than 0.5 x **[SET–34]**, the frequency reference increases at a rate of 0.5 Hz per second.
- If system pressure is equal to or greater than 0.5 x **[SET–34]** but less than 0.6 x **[SET–34]**, the frequency reference stays at the current value.
- If system pressure is equal to or greater than 0.6 x **[SET–34]** but less than **[SET–34]** setting, the frequency reference decreases at a 0.5 Hz per second rate. However, the rate is not decreased below PID Low Hz Limit **[SET–22]** +2 Hz
- If at any point system pressure is equal to or greater than **[SET–34]**, VFD will cancel Pipe Fill mode and switch to PID control.

Tank Fill, Drain, and Level Control (Analog Trigger)

This feature provides Start/Stop control or Relay output based on tank water levels. It requires a pressure transducer or tank level transducer installed in the water tank.

The VFD can use several types of measurement for motor control, including flow, level, temperature, etc. For this application, the transducer output is scaled to measure water level in feet. Trigger by analog level feature uses either PID F/B signal or Aux AI signal set in **[ADV2–58]** through **[ADV2–61]**.

NOTE: FO mode and Shutdown take priority over Analog Trigger.

Set the following parameters to activate this feature:

Parameter	Display Name	Description
ADV2–62	Analog Trigger	• **Disable:** the feature is disabled. • **Relay: ([IO-47], [IO-48],** or **[IO-49]** should be set to **17_Analog Trigger)** VFD activates selected relay in any VFD state (stop, run, fault, etc.) at the **AI Trigger Level [ADV2–65]**. It deactivates it by hysteresis value depending on the **Trigger Type [ADV2–64]**. • **Run Enable:** Enables VFD run command when HOA is in Hand or Auto mode based on Aux AI level depending on the **Trigger Type [ADV2–64]**. If VFD is set to command via terminals and run signal is present, VFD starts only when analog signal reaches ON state level based on diagrams on the next page (at or greater than for Higher, at or less than for Lower). When signal changes by Hysteresis value, VFD stops. If at any point of VFD run mode, either Enable DI or Run command is deactivated, VFD will stop. **NOTE:** This feature does not work with 3–wire (push button station) control mode selection. If HOA is in OFF position, VFD stops even if analog signal is in ON state level. • **Trip:** VFD trips based on analog level of the trigger type. When analog level reaches ON state, VFD trips on "Trip by AI" and requires reset. (Four types of reset: Keypad, Digital input, Communication, or Power cycle.) VFD can be reset only when analog signal reaches OFF state. VFD can be reset when the AI signal changes by the **Trigger Type [ADV2–64]** Hysteresis value. When the VFD is stopped, the display will show "Stop by AI" message. When analog level reaches ON state, VFD trips on Trip by AI and requires reset.
ADV2–63	Analog Trigger Source	Selects whether the trigger is a PID feedback signal or auxiliary input. • **PID Feedback:** The feature operates based on monitored PID F/B signal from the source chosen in **[SET-18]**. • **Aux Input (Default):** The feature operates based on monitored AUX AI signal from the source set in **[ADV2–58]** and scaled in parameters **[ADV2–59]** ~ **[ADV2–61]**. **IMPORTANT:** When a pressure transducer is used to measure water level, the Units selection should be **Feet**, and the sensor maximum value should be converted from psi to feet-[(n) psi x 2.31].
ADV2–64	Trigger Type	The diagrams on the next page show the difference between Lower and Higher trigger types. • **Lower:** Used to refill water into a tank to maintain at **[ADV2–65]+[ADV2–66]**. When level becomes less than **Trigger Level [ADV2–65]**, the feature is activated. When the level is equal or greater than **Trigger Level [ADV2–65] + Trigger Hysteresis [ADV2–66]**, the function is deactivated. • **Higher (Default):** Used to pump water from a tank to maintain **[ADV2–65]-[ADV2–66]**. When level becomes greater than **Trigger Level [ADV2–65]**, the function will be activated. When the level is equal to or less than **Trigger Level [ADV2–65] — Trigger Hysteresis [ADV2–66]**, the function will be deactivated.
ADV2–65	Trigger Level	The level at which the function is activated. • If **[ADV2–63]** is set to **1_Aux AI,** the range is 0.0 to **[ADV2–61]**. • If **[ADV2–63]** is set to **0_PID F/B**, the range is 0.0 to **[SET-20]**.
ADV2–66	Trigger Hysteresis	Hysteresis value is subtracted from trigger value in Higher trigger mode to determine OFF (trigger reset) state level. It is added to trigger value in Lower trigger mode. • If **[ADV2–63]** is set to **1_Aux AI**, the range is 0.0 to **[ADV2–61]**. • If **[ADV2–63]** is set to **0_PID F/B**, the range is 0.0 to **[SET-20]**.

Example

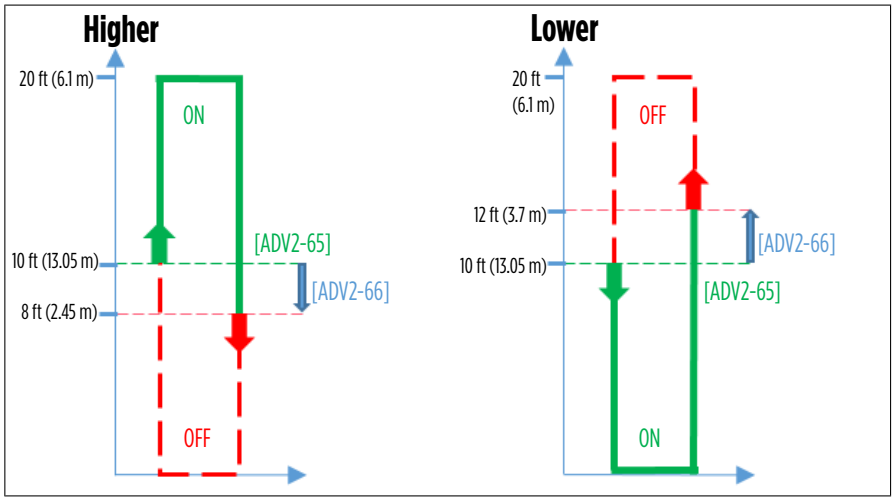
The following diagrams show how this feature might be used.

Higher: VFD starts at or above 10 feet and stops at or below 8 feet.

- **Analog Trigger [ADV2–62] = 2_ Run Enable**
- **Trigger Type [ADV2–64] = 1_ Higher**
- **Trigger Level [ADV2–65]** = 10 feet
- **Trigger Hysteresus [ADV2–66]** = 2 feet

Lower: VFD starts at or below 10 feet and stops at or above 12 feet.

- **Analog Trigger [ADV2–62] = 2_ Run Enable**
- **Trigger Type [ADV2–64] = 1_ Higher**
- **Trigger Level [ADV2–65]** = 10 feet
- **Trigger Hysteresis [ADV2–66]** = 2 feet



Frequency Limits Controlled by Water (Analog) Level

This feature changes VFD or PID high frequency limit value (whichever is set as Auto Speed Reference) based on an Aux Input value. It can be used to limit pump speed in a constant pressure system by well or tank water level to help prevent over-pumping the source. It requires an additional transducer (level or pressure) installed in the well or tank.

To enable this feature, set the following parameters:

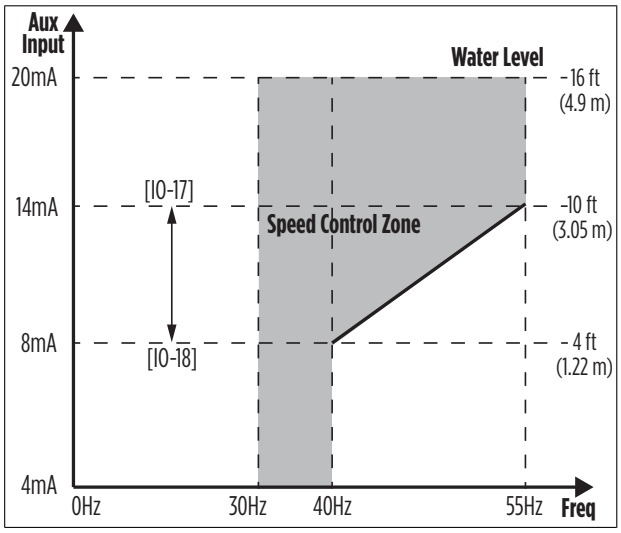
Parameter	Display Name	Description
ADV2–58	AUX AI Select	Select the analog input (**AVI1, AVI2, ACI**) with the level transducer connection. Set unit type and scaling in **[ADV2-59]** to **[ADV2-61]**. **NOTE:** It is recommended to use 4-20mA (less sensitive to electrical noise) level transducer.
IO–16	Limit by Level	This parameter enables Limit by Level feature. If Enabled, the VFD monitors the analog input set as Auto mode speed reference or PID feedback source and decrease High Frequency Limit value.
IO–17	Max Limit Level	This parameter sets the maximum value (in Aux Input units) for VFD or PID High Frequency Limit control range. At signal above this value the VFD uses original VFD or PID High Frequency limit value.
IO–18	Min Limit Level	This parameter sets the minimum value of Aux Analog input corresponding to **Min Freq Limit [IO-19]**. If AUX input signal is below this value, VFD uses **[IO-19]** value as VFD or PID High Frequency value.
IO-19	Min Freq Limit	This parameter sets Minimum value for High Frequency Limiting range corresponding to **Min Limit Level [IO-18]**. **NOTE:** VFD shows Limit by Level message when High Freq Limit is decreased by this feature.

Example

The diagram shows how pump speed might be limited by well or tank water level transducer signal.

In this example, a 4–20mA water level transducer is connected to an auciliary input and selected in **[ADV2–58]**. Transducer range is scaled to 16 feet. Limit by Level feature settings are **[IO-17]** at 10 feet (14mA), **[IO-18]** at 4 feet (8mA), and **[IO-19]** at 40 Hz. **PID Low Freq Limit [SET-22]** is 30 Hz and **PID High Freq Limit [SET-23]** is 55 Hz.

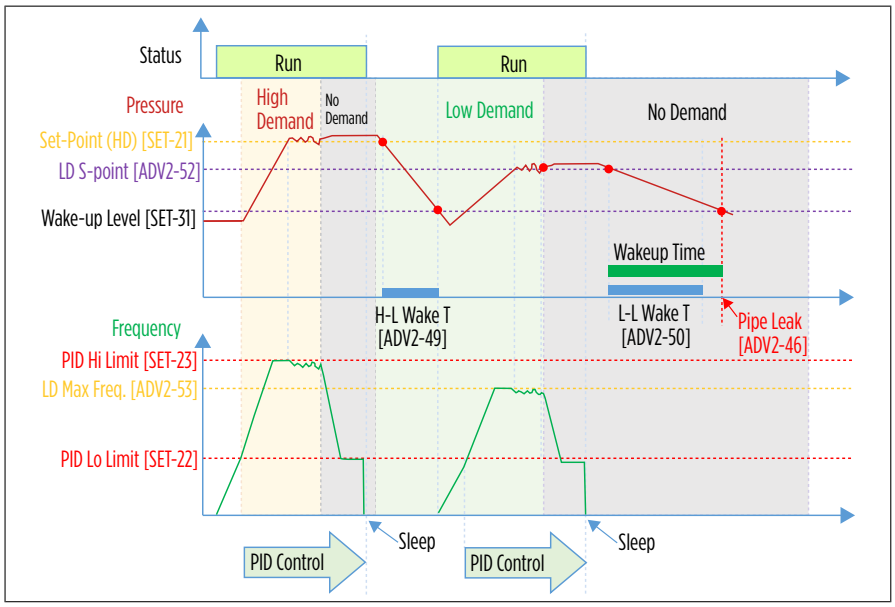
When water level stays at or above 10 feet, VFD maintains pressure with a frequency range from 30 Hz to 55 Hz. When water level drops below 10 feet, the VFD or PID High Frequency limit is decreased linearly from 55 Hz at 10 feet to 40 Hz at 4 feet water level. It water level drops below 4 feet, the frequency limit stays at 40 Hz and drive operates in the range from 30 to 40 Hz.



Dual Demand Control with Pipe Leak Protection

The Dual Demand control mode was designed for pump systems with distinct high and low demand requirements and to provide Pipe Leak protection. If the pump is sized to supply water to a high demand system such as a pivot but at some point will supply a low demand line (sprinklers or a hose), the system can be quickly over-pressurized, and the pump cycles because it is too big for this low demand system.

With Dual Demand control, the VFD determines which demand level to activate at wakeup. If the VFD is in sleep mode and the pivot system (high demand) valve is opened, the VFD wakes up in a short period of time.



If the sprinkler system (low demand) valve is opened, it takes longer to wake up the VFD. If wakeup time exceeds the wake up time setting for the current demand mode, the VFD activates pipe leak alarm or protection.

Set the following parameters to activate this feature:

Parameter	Display Name	Description
ADV2–45	Dual Demand	**1_Enabled** or **0_Disabled.** If enabled, remaining parameters should be set during system start-up.
ADV2–46	Pipe Leak Sel	**0_Disabled** or: • **1_Alarm:** An alarm message activates. • **2_Trip:** The VFD trips on Pipe Leak fault. **NOTE:** Pipe leak detection works with or without Dual Demand mode.
ADV2–47	Last Wake Time	This is a read-only value that shows how much time it took for the last VFD wake up. Wake up monitoring starts when the VFD is in sleep mode and pressure drops below Setpoint and continues until pressure is below Wake-Up Level. Once **Last Wake Time [ADV2–47]** has been determined, the following time parameters can be adjusted.
ADV2–48	H-H Wake Time	This is an adjustable setting for High to High Demand wake up time, which should be determined during system setup, after Last Wake-up Time is calculated. Recommended setting is 10–20% greater than **[ADV2–47]** value. Default = 4 seconds.

Parameter	Display Name	Description
ADV2–49	H-L Wake Time	This is an adjustable setting for High to Low Demand wake up time, which should be determined during system startup. Recommended setting is 20–30% greater than **[ADV2–47]** value for proper Pipe Leak protection operation. Default = 10 seconds.
ADV2–50	L-L Wake Time	This is an adjustable setting for Low to Low Demand wake up time, which should be determined during system startup. Recommended setting is 20–30% greater than **[ADV2–47]** value for proper Pipe Leak protection. Default = 14 seconds.
ADV2–51	L-H Wake Time	This is an adjustable setting for Low to High Demand wake up time, which should be determined during system setup, after Last Wake-up Time is calculated. Recommended setting is 10–20% greater than **[ADV2–47]** value. Default = 6 seconds.
ADV2–52	LD Setpoint	This sets the Low Demand pressure setpoint. Adjusted to lower or higher than HD (Main) pressure setpoint value to provide desired pressure and prevent overpressure trip at pump start in Low Demand situation. Default = 70.0 PSI.
ADV2–53	LD Max Freq	This is a PID High Frequency Limit setting for Low Demand. Set to a low frequency to prevent overpressure trips during run but high enough to maintain pressure at **LD Setpoint [ADV2–52]**. Default = 48.0 Hz.
ADV2–54	LD Timer	This is an adjustable setting for Low Demand mode time. When VFD determines Low Demand mode during wake-up but at any point pressure cannot reach **[ADV2–52]** setpoint within the timer, VFD switches control to High Demand mode. Default = 10 seconds. **NOTE:** If VFD trips on a fault or power is cycled during Low Demand mode, it will start in Low Demand mode after reset or power-up.

Lubrication Relay

The VFD can automatically activate a lubrication solenoid for line shaft turbine pumps. For industrial machines with an external lubrication supply, it can also activate it before starting the motor.

Use timers to enable lubrication before, during, and/or after running the motor, in any combination.

To enable the lubrication function, set the following parameters:

Parameter	Display Name	Description
I0–47 through I0–49	Lubrication Output Terminal	Use one of the Relay Outputs (RA1–RA3), and set the corresponding parameter to **41_Lube/S-Clean**.
I0–41	Lube/S-Clean	Select **1_Lubrication**.
I0–43	Pre-Lube Timer	This setting determines relay activation time after a run command is received and before the VFD starts. When the timer expires, the lubrication relay deactivates and the VFD starts the motor. If a stop command is received, or the VFD trips during Pre-lubrication, the relay deactivates.
I0–44	Run-Lube Timer	This setting determines relay activation time while the VFD is running. • When set to a value greater than 0 and less than 6000, the relay activates at VFD start and deactivates when the timer expires. If the VFD stops while the timer is active, the relay deactivates. • If the timer is set to the maximum 6000 sec, the relay activates during run mode until the VFD stops (no timing). If the VFD stops or trips, the relay deactivates.
I0–45	Post-Lube Tmr	This setting determines relay activation time after the VFD comes to a stop (0 Hz).

Screen Clean Relay

When water is pumped from a lake or pond, the suction screen requires periodic cleaning. The VFD can automate this process by providing a relay output to an external solenoid valve that discharges pressurized water to clean the screen. This feature works only in run mode in HOA Hand or Auto.

The VFD provides a one minute (non-adjustable) cleaning pulse at every start. When the cleaning pulse is done, the **S-Clean Timer [I0–42]** starts. When the timer expires, another cleaning pulse is activated. This cycle continues until the VFD stops.

To enable the Clean Screen function, set the following parameters:

Parameter	Display Name	Description
I0–47 through I0–49	Screen Clean Output Relay	Use one of the Relay Outputs (RA1–3), and set the corresponding parameter to **41_Lube/S-Clean**.
I0–41	Lube/S-Clean	Select **2_Screen Clean**.
I0–42	S-Clean Timer	Time between cleaning pulses.

Clean Pump/Anti Jam (De-ragging and impeller cleaning)

In de-watering and wastewater pump applications, the Clean Pump feature provides periodic (set by **Clean Pump Tmr [ADV2-56]**) fast ramping starts to clean the impeller. VFD ramps up to half speed and run for 5 seconds in Forward direction during VFD stop mode with a "Clean Pump" message. This prevents the accumulation settling in the pump and impeller.

NOTE: The Clean Pump feature only works in Auto mode when a run command is removed by DI, AI Trigger, or Comms (Sleep mode excluded).

The Anti-Jam feature can be used in submersible and grinding pump applications in locked impeller conditions. When enabled, it works in Auto and Hand modes, and the VFD provides automatic anti-jam function if a stall condition is detected.

- If VFD trips or stops on Overload (OL), it starts the Anti-Jam cycle after a 10-second delay.
- The Anti-jam cycle provides five 6-second and half-speed starts, three in reverse and two in forward direction with 2-second intervals. It starts in Reverse then alternates Forward and Reverse starts.
- When the Anti-Jam cycle (5 starts) is completed and the 5-second timer expires, the VFD starts the motor normally and try to run the pump. If VFD trips on OL again, it starts second Anti-jam cycle after 10-second delay.

  NOTE: If impeller is not freed during two Anti-Jam cycles, VFD trips on overload and requires reset.

  NOTE: The HLD function is disabled during Anti-Jam mode.

To enable the Clean Pump and/or Anti-Jam functions, set the following parameters:

Parameter	Display Name	Description
ADV2–55	Clean Pump Select	Set this parameter to the required cleaning function: • **1_Clean Pump:** set to enable the Clean Pump feature. • **2_Anti-Jam:** set to enable the Anti-Jam feature. • **3_Clean/Anti-Jam:** set to activate both features.
ADV2–56	Clean Pump Timer	Set this parameter to desired interval in minutes for Clean Pump starts. The timer starts at every VFD stop.
PROT-07	OCA Level	Set to desired stall level for Anti-Jam function.
PROT-08	OCN Level	

Timers

IMPORTANT: If two or more timers are activated with different time settings, the timer with the greater value overrides other timers with a similar function.

Power On Run Delay

- This timer provides run delay at VFD power-up with run command present to prevent multiple starts during power surges.
- Set the following parameter to activate this feature: **Power On Delay [ADV–28]:** Range = 0 to 6000 sec. (Default = 10 sec). When set to 0 sec, it is disabled.
- When set to a value greater than 0 and VFD is powered up in any HOA mode, the timer starts counting and VFD start is disabled until the timer expires.

Run Delay Timer (For Auto Mode)

- This timer provides a delay at every VFD start when a run command is applied. The timer takes effect before every VFD start by run command, auto-restarts, sleep wake-up, etc.

  NOTE: FO (Fireman's Override) mode disables this timer.

- Set the following parameter to activate this feature: **Run Delay Timer [ADV–29]:** Range = 0 to 6000 sec. (Default = 0 sec). When set to 0 sec, it is disabled.
- When set to value greater than 0 and VFD receives a start command, wakes up, auto resets, or restarts after a fault reset, the Start Delay timer starts counting. During timer counting, start is disabled and the VFD cannot be started in Hand or Auto mode. Stop command, Sleep mode, or tripping on a fault resets this timer.

Auto Restart Timer After Faults

- VFD provides ability to Auto-restart after time delay when tripped on fault.
- If at any time during the auto restart process the run command is removed, the timer finishes and resets the fault, but the VFD does not start until the run command is reapplied.

  NOTE: Shutdown and Fireman's Override Mode overrides the restart process.

To modify the auto restart process, work with the following parameters:

Parameter	Display Name	Description
PROT-09	Auto Timer Cntr	Sets a minimum run time for successful restart and resetting a retry counter during retry attempt. Default = 3 hours.
PROT–10	Auto Restarts	Sets the allowed number of retry attempts. Range = 0 to 10 tries. Default = 3 restarts.
PROT-11	Auto Retry Delay	Sets a time delay before the next restart attempt. Range = 0 to 6000 seconds. Default = 120 seconds.

Minimum Run Timer

- The Minimum Run timer delays VFD stop when a run command is removed. This timer is useful in vacuum pump, pressure washer and similar applications.
- Submersible motors should run for a minimum of one minute to dissipate heat build-up from starting current.
- Set the following parameter to activate this feature: **Minimum Run [ADV–34]:** Range = 0 to 6000 seconds. When set to 0 sec, it is disabled.
- When set to value greater than 0 and VFD is started in Auto mode, Minimum Run timer starts counting. During timer counting, VFD continues to run even if start command is removed.
- Shutdown feature overrides this timer.

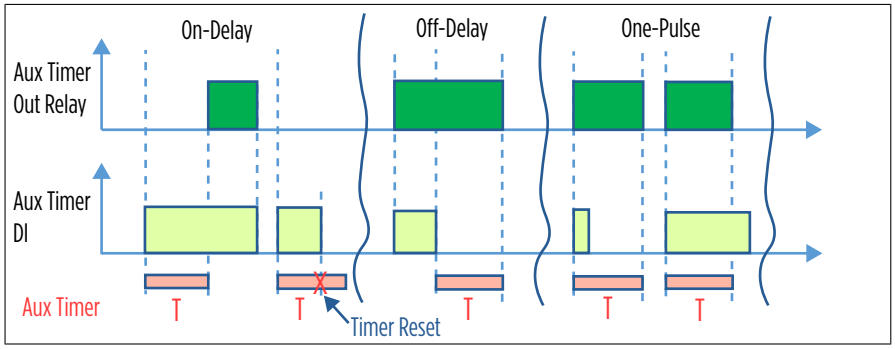
Backspin Timer

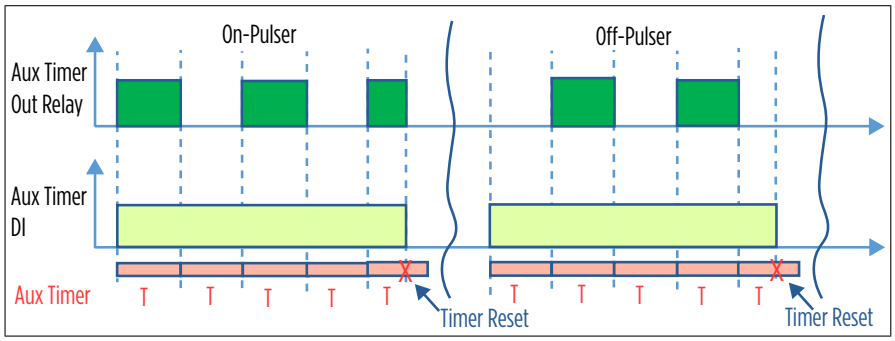
- The Backspin timer is designed to protect the VFD from tripping when starting a reverse spinning motor caused by water back-flow through a pump (no check valve) right after it was stopped.
- Set the following parameter to activate this feature: **Backspin Timer [ADV–30]:** Range = 0 to 6000 seconds. When set to 0 sec, it is disabled.
- When set to value greater than 0 and VFD stops, Backspin timer starts counting. During backspin time VFD is disabled and cannot be started in Hand or Auto mode.

Auxiliary Timer

The Aux Timer can activate a relay output based on an Aux Timer input source and Timer Type. The timer is enabled when any digital output is set to **39_Aux Timer Out**. It works in any HOA and VFD mode (stop, running, fault, sleep, etc.).

NOTE: Aux Timer operates independently of any feature or function of the drive.





Set the following parameters to activate this feature:

Parameter	Display Name	Description
IO-47 through IO-49	(multiple)	Select a relay output for Aux Timer function in one of the parameters.
ADV-31	Aux Timer Type	Five selections for functional type of Aux Timer: • **On-Delay:** The timer output relay activates when Aux Timer input is activated and timer expires and stays activated until Aux Timer input is deactivated. This is the default setting. • **Off-Delay:** The timer output relay activates when Aux Timer input is activated and deactivates when Aux Timer input is deactivated and timer expires. • **One-Pulse (on rising edge):** The timer output relay activates when Aux Timer input is activated and deactivates after timer expires no matter if input is active or not. Changing input state during timer counting does not deactivate output relay. • **On-Pulser:** The timer output relay activates when Aux Timer input is activated and, after timer expires, it is deactivated for duration of the timer. Thus timer provides symmetrical ON_OFF pulses while timer input is activated. • **Off-Pulser:** The timer output relay stays deactivated when Aux Timer input is activated and, after timer expires, it is activated for duration of the timer. Thus timer provides symmetrical OFF-ON pulses while timer input is activated.
ADV-32	Aux Timer Time	Range = 0 to 6000 seconds. Default = 10 seconds.
ADV-33	Aux Timer Input	Select the appropriate digital input or relay output as the Aux Timer input source. Default is **11_FWD DI**.

Performance Control Features

Acceleration/Deceleration Control

Standard Rates

The VFD accelerates and decelerates a motor in VFD control mode (PID is off) at a controlled rate based on the following parameters:

Parameter	Display Name	Description
SET–11	Accel Time	Time in seconds for the drive to accelerate from 0 Hz to maximum frequency.
SET– 12	Decel Time	When **Stop Mode [SET–16]** is set to Decelerate, time in seconds to slow down from maximum frequency to 0 Hz.

The defaults for these parameters are determined by the **Application [SET–00]** setting, but can be adjusted as required.

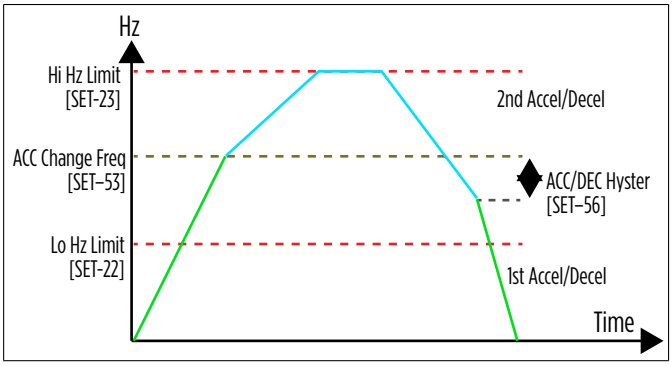
IMPORTANT: Setting acceleration or deceleration times that are too short may trigger over-current or over-voltage faults. Use of a suitable dynamic braking unit/resistor can help with short deceleration times.

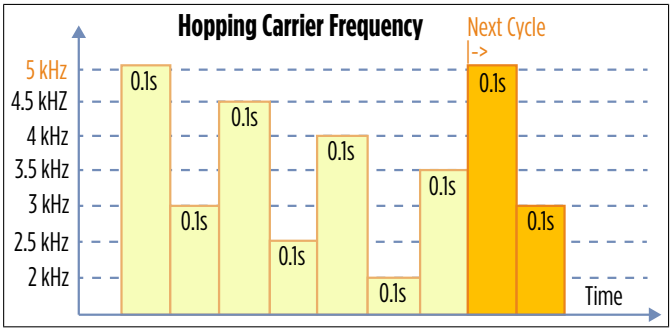
NOTE: When PID is enabled, the VFD ramps up to PID Low Freq Limit at **[SET–11]** rate and then it follows the rate calculated by PID control. During deceleration, the VFD follows PID deceleration rate down to PID Low Freq Limit and then follows **[SET–12]** rate.

Change by Frequency

Acceleration and deceleration rates can be changed when the VFD reaches a target frequency. For example: It may be desirable to start a motor quickly, as with a submersible pump, and then slow the response at higher speeds.

The VFD starts at the Standard rate and switches to **Second ACC [SET–54]** and **Second DCC [SET–55]** when it reaches **ACC Change Freq [SET–53]**. When the VFD decreases frequency below **[SET–53]**-**[SET–56]** it switches back to the Standard rates.





Set the following parameters to activate this feature:

Parameter	Display Name	Description
SET–53	ACC Change Freq	Frequency to switch from Standard acceleration/deceleration rate to second acceleration/deceleration rate.
SET–54	Second ACC	Time in seconds for drive to accelerate from 0 Hz to maximum frequency. This rate takes effect when frequency is above **[SET–53]**. Default = 60 sec.

Parameter	Display Name	Description
SET– 55	Second DEC	When **Stop Mode [SET–16]** is set to Decelerate, time in seconds to slow down from maximum frequency to 0 Hz. This rate takes effect when frequency is above **[SET–53]**. Default = 60 sec.
SET– 56	ACC/DEC Hyster	Hysteresis sets the difference between 2nd ACC/DEC rates activation and deactivation frequencies. This setting is subtracted from **[SET–53]** to delay the switch back to the **[SET–12]** rate. Default = 1.0 Hz.
VFD-45	Hopping Carrier	When enabled, VFD automatically changes carrier frequency from 2 to 5kHz (depends on the drive frame size) in predetermined offset pattern to minimize audible noise from the motor.
VFD-58	H-Carrier Pitch	Determines the running duration for each carrier frequency value.

Analog Repeater Output

Analog signal repeater provides analog output signal scaled to selected analog input in any signal format.

For example, if ACI is set to 2-10VDC and AO to **6_ACI**, it provides 0-10V or 4-20mA (whichever is selected) output scaled to 2-10V. In this case, 2V Input = 0% (0V or 4mA) output and 10V input =100% (10V or 20mA) output.

Auxiliary Analog Input

Auxiliary Analog Input (Aux AI) can be used by 2nd PID control, Trigger by Analog Level, and Freq Limit by Analog Level features. Any analog input can be set as an Aux AI and can be scaled to appropriate value in engineering units.

Set the following parameters:

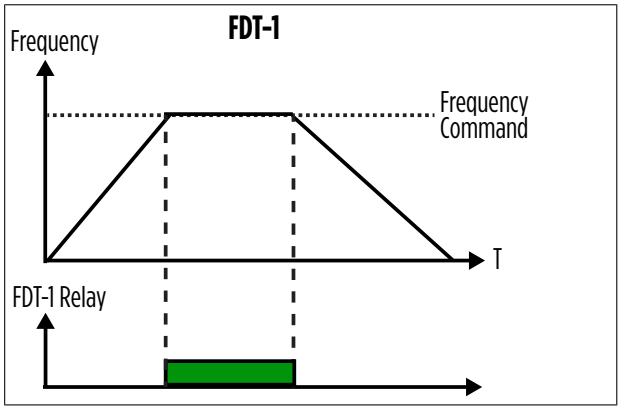
Parameter	Display Name	Description
ADV2-58	Aux AI Signal	Used for control features by analog level and 2nd PID Loop. Select AI input to designate for Aux AI. Default = AVI1.
ADV2-59	Aux AI Unit	Select the units to be measured by the AI.
ADV2-60	Aux Unit Format	Select the precision of the AI units. This can be set to whole numbers, one decimal place, or two decimal places.
ADV2-61*	Aux Max Value	The maximum value of the auxiliary input can be set from zero to 30,000.

NOTE: *If using a PT100 or PTC for Aux AI, set the maximum value to 200 °C for PT100s and T_{HIGH} for PTCs.

Frequency Detection Trigger (FDT)

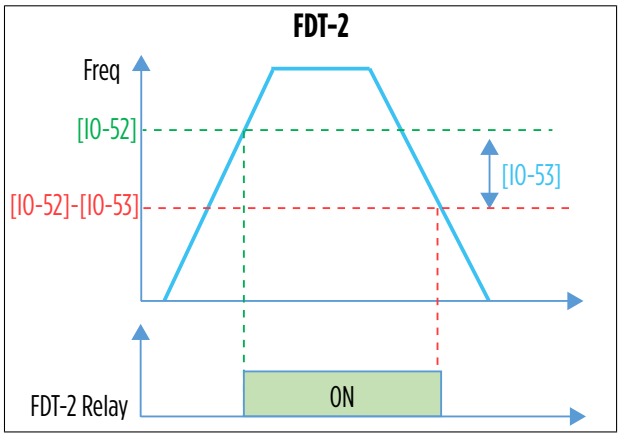
The VFD can provide a selected relay output control by five different types of frequency detection triggers (FDT1 through FDT5). The function is activated when any relay output is set to **2 to 5** in parameters **[IO-47]** ~ **[IO-49]**.

FDT-1: Select **2_FDT-1** for any relay output in **[IO-47]** ~ **[IO-49]**. It does not require any other parameters for setup. VFD activates a selected relay when output frequency equals the frequency command value.



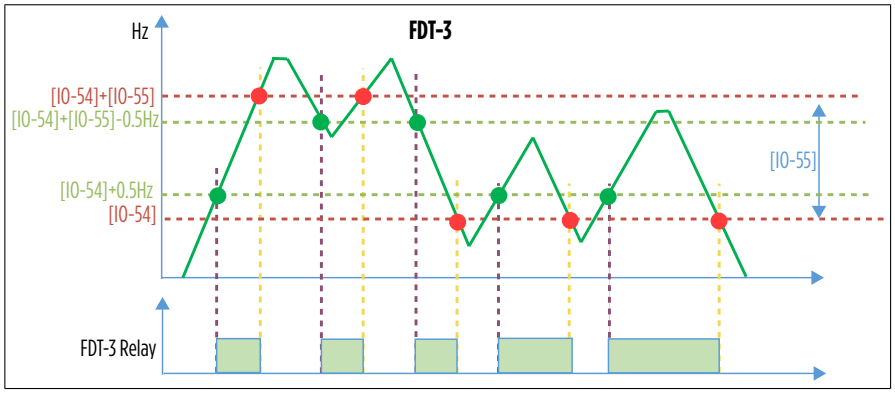
FDT-2: Select **3_FDT-2** for any relay output in **[IO-47]** ~ **[IO-49]**. It requires two following parameters for setup:

- **FDT-2 Frequency [IO-52]:** VFD activates a selected relay when output frequency is equal or greater than **[IO-52]** value.
- **FDT-2 Bandwidth [IO-53]:** VFD deactivates relay when frequency becomes less than **[IO-52]** minus **[IO-53]** value.



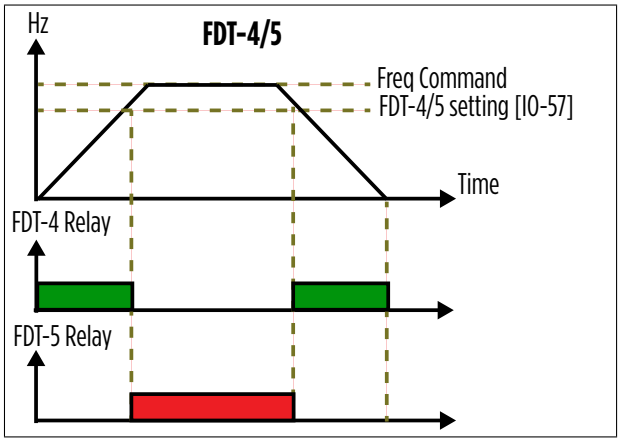
FDT-3: Select **4_FDT-3** for any relay output in **[IO-47]** ~ **[IO-49]**. It requires two following parameters for setup:

- **FDT-3 Frequency [IO-54]:** VFD activates a selected relay during acceleration between frequencies **[IO-54]** + 0.5Hz and **[IO-54]** + **[IO-55]**. VFD activates relay during deceleration between frequencies **[IO-54]** + **[IO-55]** - 0.5Hz and **[IO-54]**
- **FDT-3 Bandwidth [IO-55]:** Provides offset from **[IO-54]** to deactivate relay during acceleration.



FDT-4: VFD activates selected relay output when frequency is less than **FDT-4/5 Setting [IO-57]** value. When frequency is greater than **[IO-57]** value, VFD deactivates relay output.

- **FDT-5:** VFD activates selected relay output when frequency is greater than **FDT-4/5 Setting [IO-57]** value. When frequency is less than **[IO-57]** value, VFD deactivates relay output.
- **FDT-4/5 Setting [IO-57]:** The common frequency parameter for both FDT-4 and FDT-5 functions.



Scheduling

Create up to four scheduled VFD control events (Programs) in Auto mode. Each Program can activate one of three event types:

- **Scheduled Start/Stop (VFD Run):** This selection activates start and stop commands in Auto mode. If **Auto Run Command [SET-08]** is set to Digital Input with run command present or to **4_Ext HOA in Auto**, the VFD starts only when the VFD Run Program reaches On Time, and it stops when OFF Time is reached. If during scheduled run HOA is changed to OFF or run command is removed, VFD stops.

  NOTE: During a scheduled event, the VFD can run the motor with selected speed control (analog, PID, Comms) or with preset speeds.

- **Switch to preset frequency:** During scheduled event VFD runs motor with selected preset frequency, set in **[VFD-04]** ~ **[VFD-06]**, when running in Auto mode without PID control.
- **Switch to preset setpoint (S-Point):** During scheduled event VFD changes motor control to the selected preset setpoint, set in **[ADV-74]** ~ **[ADV-76]**, when running in Auto mode with PID control.

  NOTE: Scheduled Start/Stop and switch to PID preset Setpoint (PID Preset S-Point) commands work in Multi-VFD setup. In this instance, preset frequency commands is ignored.

NOTE: In Multi-VFD mode, program all VFDs with identical scheduling setup and synchronized clock settings.

Program 1 Parameters:

Parameter	Display Name	Description
ADV-56	Program 1 Setting	This setting selects the type of event Program 1 activates: • **0_None:** Scheduling program 1 is disabled. • **1_VFD Run:** Provides Enable/Disable status to VFD run command. If any Program is set to **1_VFD Run** and there is a Run Command in Auto Mode, the VFD starts only when the program reaches On Time **[ADV-57]** and stops when it reaches OFF time **[ADV-58]**. If the HOA is changed to OFF or run command is removed during a scheduled run, the VFD stops. • **2_Step Freq 1:** VFD runs motor with preset speed (step frequency 1), selected in **[VFD-04]** when running in Auto mode without PID control. • **3_Step Freq 2:** VFD runs motor with preset speed (step frequency 2), selected in **[VFD-05]** when running in Auto mode without PID control. • **4_Step Freq 3:** VFD runs motor with preset speed (step frequency 3), selected in **[VFD-06]** when running in Auto mode without PID control. • **5_S-Point-A:** VFD changes PID reference to **S-Point-A [ADV-74]** when in Auto mode with PID control. • **6_S-Point-B:** VFD changes motor control to **S-Point-B [ADV-75]** when in Auto mode with PID control. • **7_S-Point-AB:** VFD changes motor control to **S-Point-AB [ADV-76]** when in Auto mode with PID control.
ADV-57	Program 1 On Time	Selects when Program 1 event activates. Range = 00:01 to 24:00
ADV-58	Program 1 Off Time	Selects when the selected Program event deactivates. **NOTE:** If both on time **[ADV-57]** and off time **[ADV-58]** are set to identical values, the program is disabled.
ADV-59	Program 1 Week Day(s)	Selects which days of the week the Program is effective. For example, for 5 working days of the week, set to **_MTWTF_** and for weekends set to **S_____S**.

Program 2 Parameters:

Parameter	Display Name	Description
ADV-60	Program 2 Setting	Selects the type of event Program 2 activates. It has the same selections as **Program 1 Setting [ADV-56]**.
ADV-61	Program 2 On Time	Selects when Program 2 event activates. 00:01 setting disables this step.
ADV-62	Program 2 Off Time	Selects when Program 2 event deactivates.
ADV-63	Program 2 Week Day(s)	Selects which days of the week Program 2 is effective. **NOTE:** To schedule an event to start one day and stop on another day, use two Programs. The 1st Program ON time should be set to the desired start time and OFF time to 0:01 (inactive OFF event). The 2nd Program ON time is set to 0:01 (inactive ON event) and OFF time is set to desired stop time.

Program 3 Parameters:

Parameter	Display Name	Description
ADV-64	Program 3 Setting	Program 3 event type. It has the same selections as **Program 1 Setting [ADV-56]**.
ADV-65	Program 3 On Time	Selects when Program 3 event activates. 00:01 setting disables this step.
ADV-66	Program 3 Off Time	Selects when Program 3 event deactivates.
ADV-67	Program 3 Week Day(s)	This setting selects which days of the week Program 3 is effective.

Program 4 Parameters:

Parameter	Display Name	Description
ADV-68	Program 4 Setting	Program 4 event type. It has the same selections as **Program 1 Setting [ADV-56]**.
ADV-69	Program 4 On Time	Selects when Program 4 event activates. 00:01 setting disables this step.
ADV-70	Program 4 Off Time	Selects when Program 4 event deactivates.
ADV-71	Program 4 Week Day(s)	Selects which days of the week Program 4 is effective.

Run Command examples using one program

Example 1: Scheduled Run command is active from 5am to 1pm every Monday

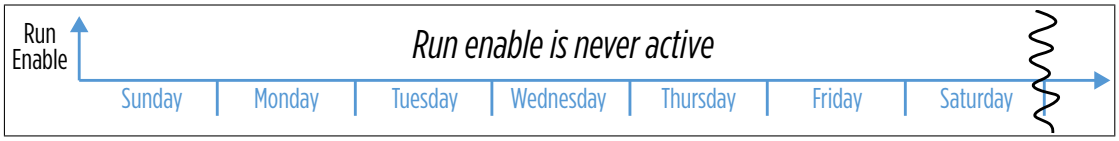
- Prog-1 Setting [ADV-56]: **1_VFD Run**
- Prog-1 On Time [ADV-57]: **05:00**
- Prog-1 Off Time [ADV–58]: **13:00**
- Prog-1 Week Day [ADV-59]: **_M_____**

Example 2: Scheduled Run command is activated on Monday 13:00 until next Monday 00:05 AM.

- Prog-1 Setting [ADV-56]: **1_VFD Run**
- Prog-1 On Time [ADV-57]: **13:00**
- Prog-1 Off Time [ADV–58]: **05:00**
- Prog-1 Week Day [ADV-59]: **_M_____**

Example 3: Run enable is never active (program is disabled).

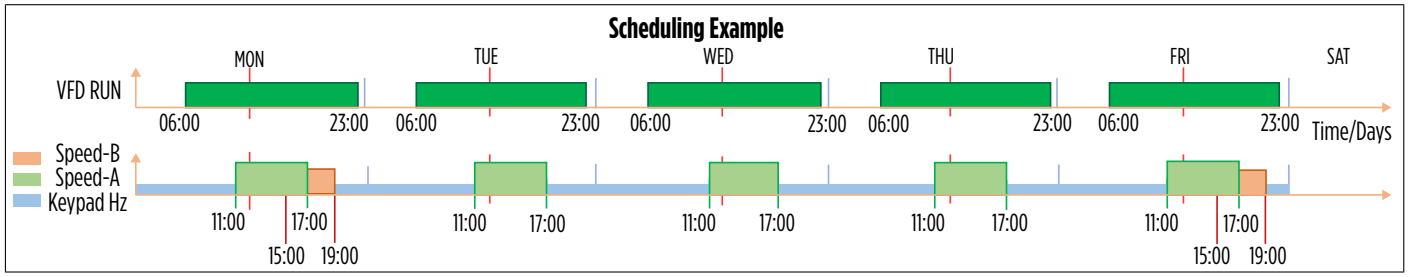
- Prog-1 Setting [ADV-56]: **1_VFD Run**
- Prog-1 On Time [ADV-57]: **13:00**
- Prog-1 Off Time [ADV–58]: **13:00**
- Prog-1 Week Day [ADV-59]: **_M_____**



Scheduling example using three programs

In this example, we want to schedule three programs to have the VFD accomplish the following:

1. Set VFD Start at 6:00 (6AM) and VFD Stop at 23:00 (11PM) during work days (Mon, Tue, Wed, Thu, Fri)
2. Have the VFD change from No-PID speed reference (keypad, analog input or Comms) every work day to preset **Step Frequency-1 [VFD-04]** from 11:00 (11AM) to 17:00 (5PM)
3. Have the VFD change from No-PID speed reference on Monday and Friday to **Step Frequency-2 [VFD-05]** from 15:00 (3PM) to 19:00 (7PM).



1st Program Parameters:

- Prog-1 Setting [ADV-56]: **1_VFD Run**
- Prog-1 On Time [ADV-57]: **06:00**
- Prog-1 Off Time [ADV–58]: **23:00**
- Prog-1 Week Day [ADV-59]: **_MTWTF_**

2nd Program Parameters:

- Prog-2 Setting [ADV–60]: **2_Step Freq-1**
- Prog-2 On Time [ADV-61]: **11:00**
- Prog-2 Off Time [ADV-62]: **17:00**
- Prog-2 Week Day [ADV–63]: **_MTWTF_**

3rd Program Paramters

- Prog-3 Setting [ADV-64]: **3_Step Freq-2**
- Prog-3 On Time [ADV-65]: **15:00**
- Prog-3 Off Time [ADV-66]: **19:00**
- Prog-3 Week Day [ADV-67]: **_M____F_**

Monitoring Functions

Home Screen Status Displays

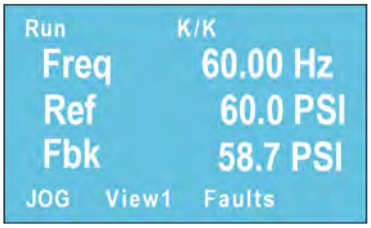
Refer to "Home Screen Display Options" on page 48 for information about the home screen displays.

View Screens

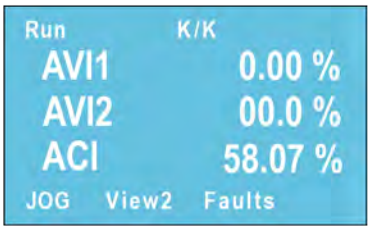
In addition to the Home Screen status information, nine predefined user information screens are available. From any menu location, press the keypad **F2** key repeatedly to cycle through the view screens.

View Screen 1:

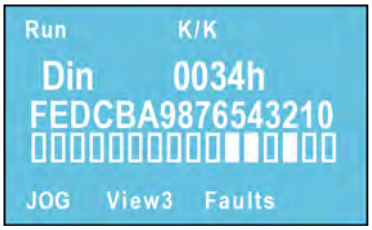
- Freq = The actual output frequency (Hz) at the time
- Ref = The PID target setpoint **[SET-21]**
- Fbk = The actual feedback level from the transducer.

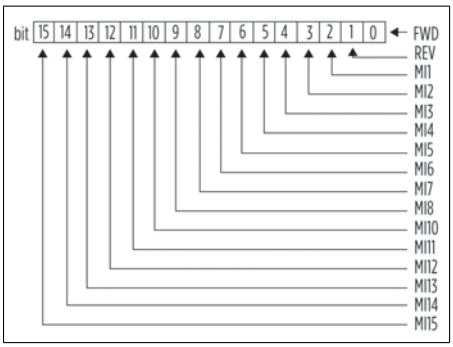


View Screen 2: This screen displays feedback from the analog inputs as a percentage.

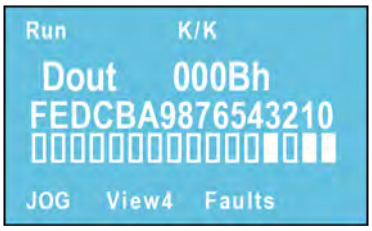


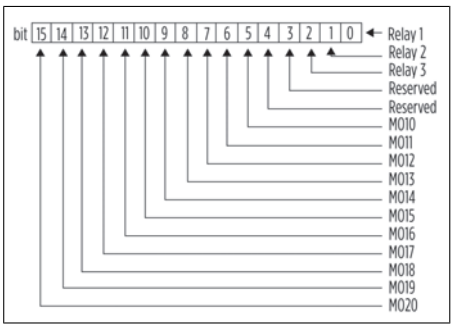
View Screen 3: This screen displays the status of the multi-function (digital) inputs in hex format. Solid boxes indicate that the input is active.





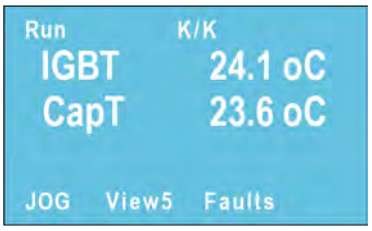
View Screen 4: This screen displays the status of the multi-function (digital) outputs in hex format. Solid boxes indicate that the output is active.





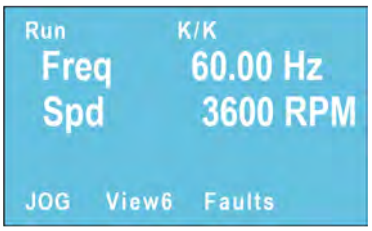
View Screen 5:

- Temperature of the IGBTs in °C
- Temperature of the capacitors in °C.



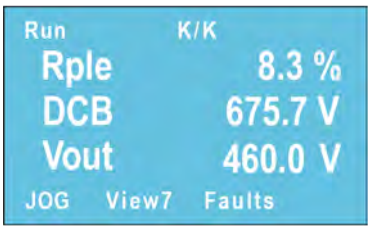
View Screen 6:

- The actual output frequency (Hz) at the time
- The actual motor speed (RPM) at the time.



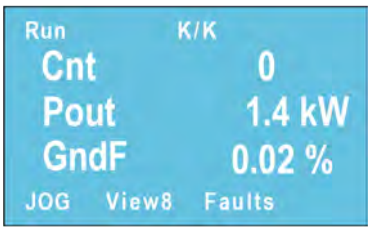
View Screen 7:

- DC-Bus voltage ripple
- DC-Bus voltage ripple
- Output voltage.



View Screen 8:

- Counter value
- Output power
- Ground fault.



View Screen 9: If an FE Bluetooth communication card has been installed, this screen displays the code for connecting with the mobile application.

Protection Features

Signal Loss Protection for Analog Inputs

Analog signal loss can be detected for signals with minimum values greater than zero (4-20mA and 2-10VDC).

NOTE: There is no signal loss protection for AVI2 input.

ACI Signal Loss

Parameter	Display Name	Description
IO–00	ACI Input Selection	Make sure input is set to the transducer's signal type.
IO–01	ACI Loss Trip	Select the drive's response to signal loss detection: • **0_Disable:** The drive has no signal loss protection. • **1_Hold Speed:** VFD runs at previous speed (2 sec before signal loss). • **2_Stop/Start:** VFD restarts when signal is present. • **3_Trip Stop:** VFD stays tripped until it is reset.
IO-02	ACI Loss Level	Set the desired signal loss trigger level: • **0_Below Minimum:** Triggered when the level is equal or less than the minimum value. – 4–20mA minimum: 3.8mA – 2–10V minimum: 1.9VDC • **1_Below 0.5xMin:** Triggered when the level is equal or less than half the range minimum value for the time selected in **ACI Loss Delay [IO-03]**. – 4–20mA minimum: 2mA – 2–10V minimum: 1VDC • **2_Redundant VFD:** Triggered when the signal is either below **1_0.5xMin** or at the transducer maximum value for the time set in **ACI Loss Delay [IO-03]**.
IO-03	ACI Loss Delay	Set the delay between signal loss detection and drive's response. Default = 1.0 sec.

AVI1 Signal Loss

Parameter	Display Name	Description
IO-05	AVI1 Input Selection	Make sure input is set to the transducer's signal type.
IO-06	AVI1 Loss Trip	Select the drive's response to signal loss detection: • **0_Disable:** The drive has no signal loss protection. • **1_Hold Speed:** VFD runs at previous speed (2 sec before signal loss). • **2_Stop/Start:** VFD restarts when signal is present. • **3_Trip Stop:** VFD stays tripped until it is reset.

Parameter	Display Name	Description
IO–07	AVI1 Loss Level	Set the desired signal loss trigger level: • **0_Below Minimum:** Triggered when the level is equal or less than the minimum value. – 4-20mA minimum: 3.8mA – 2-10V minimum: 1.9VDC • **1_Below 0.5xMin:** Triggered when the level Is equal or less than half the range minimum value for the time selected in **AVI1 Loss Delay [IO-08]**. – 4-20mA minimum: 2mA – 2-10V minimum: 1VDC • **2_Redundant VFD:** Triggered when the signal is either below **1_0.5xMin** or at the transducer maximum value for the time set in **AVI1 Loss Delay [IO-08]**.
IO-08	AVI1 Loss Delay	Set the delay between signal loss detection and drive's response. Default = 1.0 sec.

Transducer Redundancy

Transducer Redundancy allows two transducers to be wired to the VFD analog inputs and monitored simultaneously. The main transducer works as PID feedback, while the other is a spare (reserve). If the reading from main transducer is abnormal, the reserved one replaces the main transducer.

With transducer redundancy, the VFD can detect transducer failure at low and maximum signal and switch to the spare transducer.

For the spare transducer, it is recommended to use one with a range 1.5x or 2x larger than the main transducer. For example, if the main transducer is 0-100PSI, the spare transducer can be 0-150PSI or 0-200PSI. This decreases the chance of both transducers being damaged by hydraulic surges.

If the main transducer reads a smaller value than the spare transducer with a difference more than 8% of the main's max value, the VFD switches the PID feedback source to the spare transducer to decrease chance of over pressurizing the system.

When VFD uses spare transducer as PID F/B source and both transducers read abnormal values, the VFD trips on Signal Loss fault.

NOTE: All other VFD features that use values as a percentage of the maximum feedback value (F/B Max) always use the main transducer's range.

Parameter	Display Name	Description
SET-18	PID F/B Source	Selects the analog input terminal for PID Feedback source for the main pressure transducer. Select ACI or AVI1 input.
IO–00 or IO-05	ACI Input Selection or AVI1 Input Selection	In the appropriate parameter (ACI or AVI1), make sure input is set to the correct signal for the type of main transducer.
IO-12	Spare AI Selection	Selects the analog input terminal for PID Feedback source for the spare pressure transducer. Select ACI or AVI1 input.
IO-11	Spare Max Value	Set to the spare transducer max range value.
SET-19	PID F/B Unit	Select the units for the feedback signal, used for **PID F/B Max [SET-20]** and **Spare Max Value [IO-11]**.
IO-02 or IO-07	ACI Loss Level or AVI1 Loss Level	Set both parameters to **2_Redundant** to allow the VFD to set the maximum value and minimum feedback value to disable the main transducer and activate the spare transducer. • In Spare Transducer Mode if the main transducer reading becomes normal, VFD continues running with the spare transducer until power is cycled.
IO-03 or IO-08	ACI Loss Delay or AVI1 Loss Delay	Duration the ACI or AVI1 signal is in a loss condition before initiating an ACI or AVI1 Loss Trip operation.

Motor Temperature Protection with PT100 or PTC Sensor

PT100 and PTC (Positive Temperature Coefficient) sensors relay motor temperature readings to the VFD, which, depending on its programming, can protect the motor by lowering output frequency, stopping operation, etc. Two sensors of the same type (PTC or PT100) can be connected and operate simultaneously. In this case, only one sensor needs to reach the specified temperature level to trigger motor protection.

If using a PT100 or PTC for PID Feedback or Aux AI, set the maximum value to 200 °C for PT100s and T_{HIGH} for PTCs in **PID F/B Max [SET-20]** and **Aux Max Value [ADV2-61]**, respectively.

PT100 Sensor

To enable PT100 Motor Temperature Protection, install the sensor directly into the motor. Then refer to "3–Wire" on page 93 or "4–Wire PT100 Wiring" on page 93 and "Parameters" on page 93.

NOTE: For both 3-wire and 4-wire PT100 sensors only connect the paired wires. Leave all other wires open. Refer to "Temperature Protection or PID Control with PT-100 or PTC Sensor" on page 44.

3–Wire PT100 Wiring

Signal	Wires	Terminals	
		AVI1: PT100 & AFM2	ACI: PT100 & AFM1
V-	N/A	-	
I-	Green	ACM	
V+	White	AFM2 (dip switch 0-20mA)	AFM1 (dip switch 0-20mA)
I+	Brown	Open (no connection)	
	Jumper	AFM2 to AVI1 (dip switch 0–10V)	AFM1 to AVCI (dip switch 0–10V)

4–Wire PT100 Wiring

Signal	Wires	Terminals	
		AVI1: PT100 & AFM2	ACI: PT100 & AFM1
V-	White	-	
I-	White/Blue	ACM	
V+	Red/Blue	AFM2 (dip switch 0-20mA)	AFM1 (dip switch 0-20mA)
I+	Red	Open (no connection)	
	Jumper	AFM2 to AVI1 (dip switch 0–10V)	AFM1 to AVCI (dip switch 0–10V)

Parameters

Parameter	Display Name	Description
IO-00 or IO-05	ACI Input Sel or AVI1 Input Sel	In the appropriate parameter (ACI or AVI1), set to **4_PT100 & AFM1** or **4_PT100 & AFM2**, respectively.
PROT-30	PT100 Level 1	Set temperature level for initial detection. When the sensor detects the motor temperature above this setting for the duration entered into **[PROT-33]**, the VFD refers to **[PROT-32]** for response.
PROT-33	PT100 L-1 Delay	Enter the time delay between a high motor temperature detection and the VFD's response.
PROT-32	PT100 L-1 Freq	Select the fall-back output frequency once a high temperature level **[PROT-30]** is sensed for a predetermined length of time **[PROT-33]**. **NOTE:** If the motor temperature falls below **PT100 Level 1 [PROT-30]**, the drive returns to normal operation.
PROT-31	PT100 Level 2	Set temperature level for the highest threshold. When the sensor detects the motor temperature above this setting, it refers to **[PROT-19]** for VFD response.
PROT-19	PTC/PT100 Sel	Select the VFD response to sensing the motor temperature selected in **[PROT-31]**.
PROT-59	RTD Wire Gauge	Select the sensor's wire gauge.

Parameter	Display Name	Description
PROT-60	RTD Length	Enter the wire distance from the sensor to the drive.
PROT-61	RTD I+ to V+	Displays the calculated resistance value of both wires between I+ to V+ wires. Use ohmmeter to verify I+ to V+ resistance. Remove wires from drive before making measurement. Adjust **[PROT-60]** to match ohmmeter resistance measurement with **[PROT-61]** resistance.

PTC Sensor

1. Connect a 2-wire PTC sensor between an analog output (either AFM1 or AFM2) and an analog input (ACI or AVI1).
2. Set the analog output DIP switch to 0-20 mA.
3. Set the analog input DIP switch to 0-10 V.
4. Adjust the following parameters:

Parameter	Display Name	Description
IO-00 or IO-05	ACI Input Sel or AVI1 Input Sel	In the appropriate parameter (ACI or AVI1), set to **3_PTC**.
IO-59 or IO-61	AFM1 Out Select or AFM2 Out Select	In the appropriate parameter (AFM1 or AFM2), set to **9_Constant Output**.
IO-63 or IO-64	AFM1 mA Select or AFM2 mA Select	In the appropriate parameter (AFM1 or AFM2), set to **0_0-20 mA**.

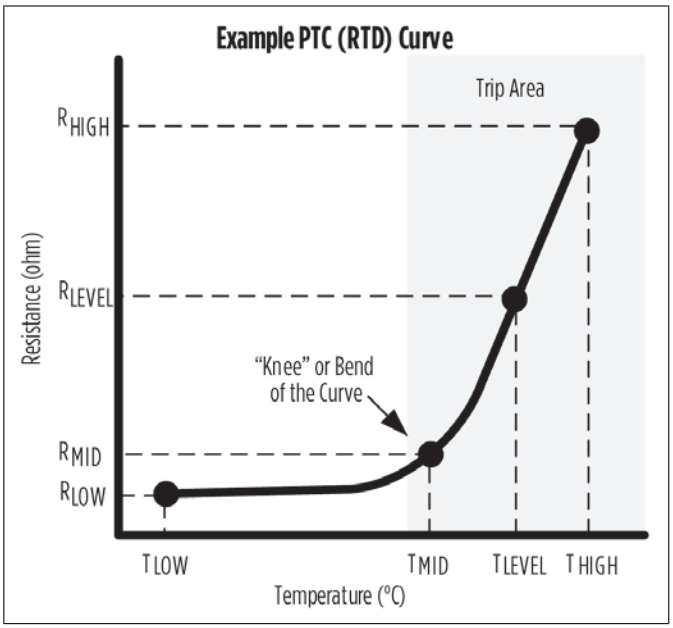
Set the PTC Curve

Use the PTC manufacturer's specifications and PTC Curve for the following.

1. Choose the highest temperature on the curve that the sensor will detect, based off of the intended motor application.

   NOTE: R_{HIGH} must be larger than 500 ohms and less than 100,000 ohms

   - T_{HIGH}= Highest temperature
   - R_{HIGH}= Highest resistance
2. Locate the "knee" or bend of the curve and determine the corresponding temperature and resistance.
   - T_{MID}= Middle temperature
   - R_{MID}= Middle resistance
3. Choose the lowest temperature on the curve that the sensor will detect.
   - T_{LOW}= Lowest temperature
   - R_{LOW}= Lowest resistance



Calculations for Analog Input PTC Curve Parameters

ACI Input	AVI1 Input	Calculation
ACI Low % [ADV2-16]	AVI1 Low % [ADV2-10]	T_{LOW} / T_{HIGH} * 100%
ACI Mid % [ADV2-18]	AVI1 Mid % [ADV2-12]	T_{MID} / T_{HIGH} * 100%
ACI High % [ADV2-20]	AVI1 High % [ADV2-14]	100%
ACI Low Value [ADV2-15]	AVI1 Low Value [ADV2-09]	R_{LOW} * I_{DC}
ACI Mid Value [ADV2-17]	AVI1 Mid Value [ADV2-11]	R_{MID} * I_{DC}
ACI High Value [ADV2-19]	AVI1 High Value [ADV2-13]	R_{HIGH} * I_{DC}

NOTE: I_{DC} = 10V /R_{HIGH}

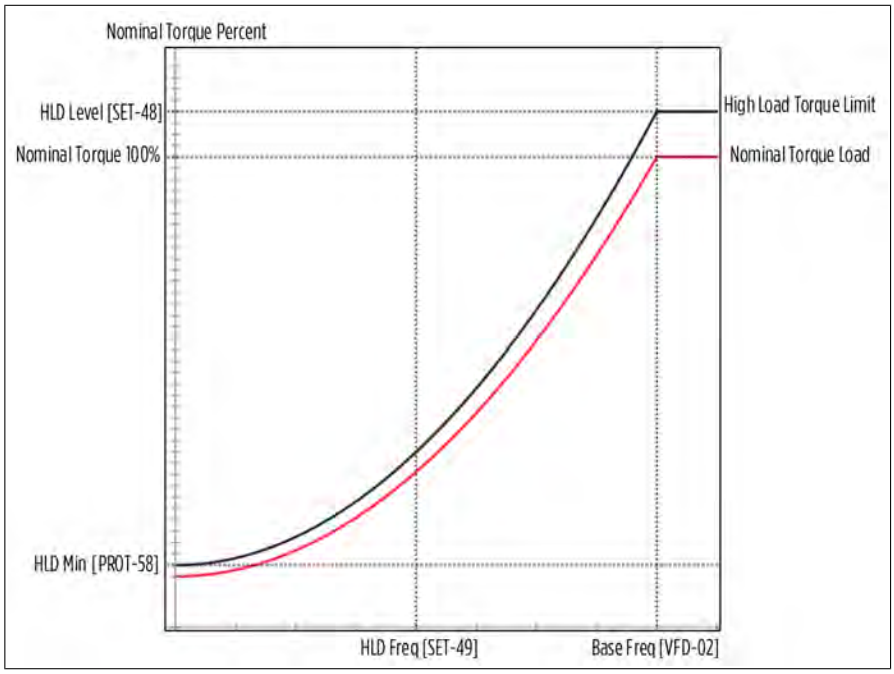
Adjust Parameters

Parameter	Display Name	Description
ADV2-06 or ADV2-07	AFM1 DC Lvl or AFM2 DC Lvl	In the appropriate parameter (AFM1 or AFM2), set the maximum current for the sensor. To determine the maximum current, perform the following calculation: • **I_{DC}/0.020 A * 100%** – I_{DC}=10V/R_{HIGH} – 0.020 A is the high amperage from the analog output DIP switch setting (0-20 mA) – The calculation multiplies by 100% to convert to a percentage; the VFD reads DC Lvl as a percentage.
PROT-20	PTC Level	Set the PTC Level as determined by the following calculation: • **T_{LEVEL}/T_{HIGH} * 100%** – T_{LEVEL}=Trip Level temperature
PROT-19	PTC/PT100 Level	Select the VFD's response to the PTC trip level temperature (consult "Parameter Descriptions > PROTECTION Menu" on page 221).

High Load Detection

High Load Detection (HLD) protects the VFD and equipment against damage from an over-torque condition by either:

- **HLD by Current:** The VFD trips when current is above **HLD Level [SET-48]** with frequency equal to or greater than **HLD Freq [SET-49]** for a duration of **HLD Delay [SET-50]**.
- **HLD by Torque:** The VFD calculates a High Load Torque Limit curve across the full frequency range based on motor parameters, VFD Base Frequency, and HLD settings. The VFD then trips when torque rises above this curve with frequency equal to or greater than **HLD Freq [SET-49]** for a duration of **HLD Delay [SET-50]**. This feature is primarily used for centrifugal loads such as centrifugal pumps or fans. It is not recommended for progressive cavity pumps or constant torque loads.



To enable High Load Detection, adjust the following parameters:

Parameter	Display Name	Description
SET–47	HLD Select	**0_Disabled**, **1_By Current**, or **2_By Torque**.
PROT–58	HLD Min Torque	Only if using HLD by Torque, set minimum torque level percentage at 0 Hz. Default = 10%.
SET–48	HLD Level	For HLD by Current, set as a percentage of motor FLA (SFA) (default = 110%). For HLD by Torque, set as a percentage of nominal torque at base frequency. If all conditions are met, VFD trips above this level.
SET–49	HLD Frequency	Set minimum frequency for HLD by Current or Torque detection.
SET–50	HLD Delay	Range = 0 to 360 seconds. When timer expires, if current or torque is still above limits and frequency is still above **[SET–49]**, VFD trips based on **[SET–47]**.
SET–51	HLD Recovery Time	0 to 720 min (default = 0 min). If timer is set to value greater than 0 minutes, VFD restarts after timer expires. If set to 0 and the VFD trips, manual or remote reset is required (no auto retries).

If the VFD trips the first time on high load, it restarts after the Recovery timer expires. If VFD trips again, the timer value doubles. The VFD continues restart attempts, doubling the timer value until it reaches 720 minutes (12 hours). Then every restart is in 720 min. **HLD Recover Cnt [SET–52]** displays the countdown before the next restart attempt.

When the VFD finally runs without tripping for 180 seconds, the recovery timer is reset to original setting. It waits for original **[SET–51]** time value at next high load trip. If the run command is removed, or HOA is set to **OFF** , the high load feature is canceled and the **[SET–51]** timer is reset to its original time.

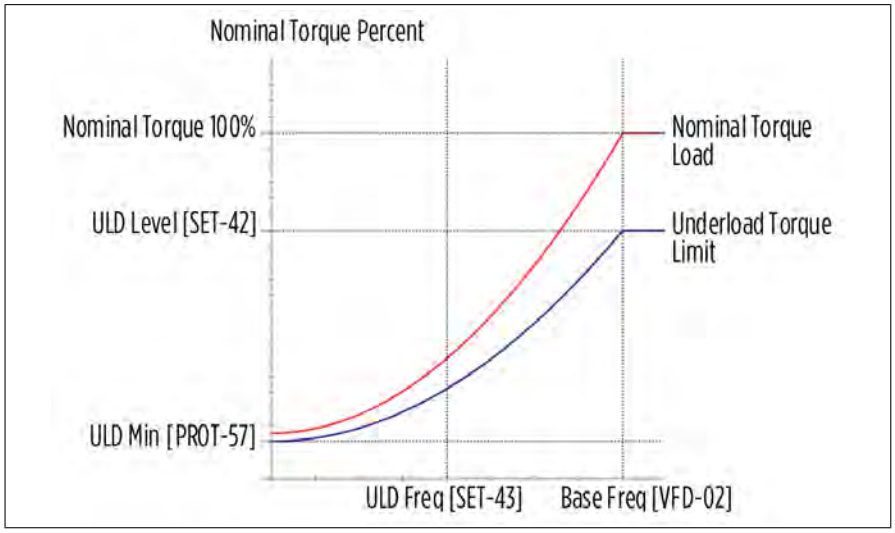
Fine Tune Setting for HLD by Torque

1. Verify accuracy of **Motor FLA (SFA) [SET–03]**, **Motor Voltage [SET–05]**, and **VFD Base Freq [VFD–02]**. These values determine nominal torque.
2. Adjust **HLD Frequency [SET–49]** to be equal to minimum operational frequency **Low Freq Limit [SET–13]** or **PID Lo Hz Limit [SET–22]**.
3. Run motor at minimum frequency and verify water movement for pump or air movement for fans.
4. While running the motor at minimum frequency, determine whether VFD trips on HLD:
   - If system trips on HLD using default **HLD Level [SET–48]**, increase level by 3% until system does not trip.
   - If system does NOT trip using default **HLD Level [SET–48]**, decrease the level by increments of 3% until system trips, then increase back by 3%.
5. If nuisance tripping occurs, increase **HLD Min Torque [PROT–58]** by increments of 1%.
6. Adjust **HLD Delay [SET–50]** to duration acceptable for operation.

Underload Protection (Dry Well or Belt Loss)

Underload Detection (ULD) monitors motor current and frequency to protect against conditions such as a dry well, broken pump, or broken drive belt. Two options are available:

- **ULD by Current:** When the current reading is less than set value and speed is equal to or greater than set value, the VFD trips on ULD.
- **ULD by Torque:** The VFD calculates an Underload Torque Limit curve across the full frequency range based on motor parameters, VFD Base Frequency, and ULD settings. The VFD then trips when torque falls below this curve with frequency equal to or greater than **ULD Freq [SET-43]** for a duration of **ULD Delay [SET-44]**. This feature is primarily used for centrifugal loads such as centrifugal pumps or fans. It is not recommended for progressive cavity pumps or constant torque loads.



To enable Underload Protection, adjust the following parameters:

Parameter	Display Name	Description
IO–39	Prime Time	Some pump applications require time for the pump to self-prime before the load stabilizes. This setting adds a 0 to 6000 second delay before the VFD starts monitoring for Underload or No-Flow conditions, which protects against nuisance faults. The delay operates at any VFD start, in both Hand and Auto modes, including Run, Wake, Restart, or Reset commands.
SET–41	ULD Select	**0_Disable**, **1_By Current**, or **2_By Torque**.
PROT–57	ULD Min Torque	If using ULD by Torque, set minimum torque level percentage at 0 Hz. Default is 10%.
SET–42	ULD Level	For ULD by Current, set as a percentage of motor FLA (SFA) (default is 45%). For ULD by Torque, set as a percentage of nominal torque at base frequency. If all conditions are met, VFD trips below this level.
SET–43	ULD Frequency	Set minimum frequency for ULD by Current or Torque detection.

Parameter	Display Name	Description
SET–44	ULD Delay	Range = 1 to 360 seconds (default = 2 sec). When timer expires, if current is still below **ULD Level [SET–42]** or torque is still below ULD Torque Limit curve and frequency is still above **ULD Frequency [SET–43]**, VFD trips based on **ULD Select [SET–41]**.
SET–45	ULD Recovery Time	0 to 720 min (default = 30 min). If timer is set to value greater than 0 minutes, VFD restarts after timer expires. If set to 0 and the VFD trips, manual or remote reset is required (no auto retries).

For dry well protection, **ULD Recovery T [SET-45]** should be long enough to allow the well to be filled. If VFD trips the first time on Underload, it restarts after the Recovery timer expires. If VFD trips again, the timer value doubles. The VFD continues restart attempts, doubling the timer value until it reaches 720 minutes (12 hours). Then every restart will be in 720 min. **ULD Recover Cnt [SET–46]** displays the countdown before the next restart attempt.

When VFD finally runs without tripping for 180 sec, the recovery timer resets to original setting. Then, at next underload trip, VFD waits for well fill for **ULD Recovery T [Set–45]** time value.

If the run command is removed, or HOA is set to OFF, the Underload feature is canceled and the **ULD Recovery T [Set– 45]** timer is reset to its original setting.

Fine Tune Settings for ULD by Torque

1. Verify accuracy of **Motor FLA (SFA) [SET–03]**, **Motor Voltage [SET–05]**, and **VFD Base Freq [VFD–02]**. These values determine nominal torque.
2. Adjust **ULD Frequency [SET–43]** to be equal to minimum operational frequency **[SET–13]** or **[SET–22]**.
3. Run motor at minimum frequency and verify water movement for pump or air movement for fans.
4. While running the motor at minimum frequency, determine whether VFD trips on ULD:
   - If system trips on HLD using default **ULD Level [SET–42]**, decrease level by 3% until system does not trip.
   - If system does NOT trip using default **ULD Level [SET–42]**, increase the level by increments of 3% until system trips, then decrease back by 3%.
5. If nuisance tripping occurs, lower **ULD Min Torque [PROT–57]** by increments of 1%.
6. Adjust **ULD Delay [SET–44]** to duration acceptable for operation.
7. Adjust **ULD Recovery Time [SET–45]** to a duration that fills up the well enough to allow motor to run minimum time before another ULD trip.

Overpressure

The Overpressure feature stops the VFD when PID feedback exceeds a set value in either Hand or Auto. To enable this feature, adjust the following parameters:

Parameter	Display Name	Description
SET–39	OverPress Set	**0_Disable**, **1_OP Trip**, or **2_OP Auto Reset**. • When enabled, if PID Feedback exceeds **OverPress Level [SET–40]**, the VFD trips on Overpressure fault. • **1_OP Trip:** Manual or remote reset is required. If **Reset Restart [VFD–36]** is enabled and a run command is present, the VFD restarts when reset. • **2_OP Auto Reset:** The VFD restarts when PID feedback falls below **Wake-Up Level [SET–31]** and a run command is still present.
SET–40	OverPress Level	Overpressure trigger level in PID feedback units, 0.0 to **PID F/B Max [SET-20]**.

No Flow Protection

The VFD can monitor a system flow switch to provide pump protection and more reliable sleep mode operation.

Parameter	Display Name	Description
IO–21 through IO–28	Flow Switch Terminal	Connect the flow switch to one of the Digital Inputs (MI1–MI8) and set the corresponding parameter to **37_Flow Switch**.
IO–38	No Flow Mode	**0_Disabled**, **1_Trip**, or **2_Sleep**.
IO–39	Prime Time	Some pump applications require time for the pump to self-prime before the load stabilizes. This setting adds a delay before the VFD starts monitoring for Underload or No-Flow conditions, which protects against nuisance faults. The delay operates at any VFD start, in both Hand and Auto modes, including Run, Wake, Restart, or Reset commands.
IO–40	No Flow Freq	Range = **Low Freq Limit [SET-13]** to **High Freq Limit [SET-14]** or **PID Lo Hz Limit [SET-22]** to **PID Hi Hz Limit [SET-23]**.

When **No Flow Mode [IO–38]** is set to **1_Trip** and the VFD runs at a frequency greater than **No-Flow Freq [IO–40]** longer than **Prime Time [IO–39]** with the flow switch contact open, the VFD trips on No Flow Fault.

When **No Flow Mode [IO–38]** is set to **2_Sleep**, the flow switch becomes an additional condition for sleep mode. When VFD runs with PID control and determines that all sleep mode conditions are met and the flow switch is open during Sleep delay, VFD goes into sleep mode.

Broken Pipe Protection (for Pump Applications)

The VFD has the ability to detect a broken pipe in the system. The VFD must be running with PID Control in Auto mode for this feature to be active.

To enable this feature, adjust the following parameters:

Parameter	Display Name	Description
SET–36	Broken Pipe Level	0.0 to **PID F/B Max [Set–20]**. Setting of 0.0 disables the feature. When pressure falls below this level and VFD continues to run above **Broken Pipe Freq [Set–37]**, **Broken Pipe Delay [SET-38]** starts.
SET–37	Broken Pipe Freq	**PID Low Hz Limit [Set–22]** to **PID High Hz Limit [Set–23]**.
SET–38	Broken Pipe Delay	The timer provides a delay for triggering a Broken Pipe fault. **NOTE:** Manual or remote reset is required.

Stall Prevention

This feature protects the motor and equipment from over-torque damage. Set a desired stall level in parameters **OCA Level [PROT-07]** (at acceleration) and **OCN Level [PROT-08]** (at steady speed).

When motor current reaches Stall level either during acceleration or at steady speed, VFD decreases output frequency to maintain motor current below Stall level.

ADVANCED APPLICATION OPTIONS

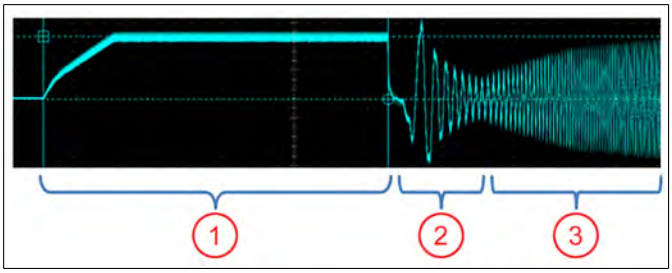
Operation with Permanent Magnet Motors

Permanent magnet (PM) motors are different than induction motors in that PM motors have magnets installed in the rotor. A PM motor is more efficient than an induction motor because the PM motor does not need power to magnetize the rotor. Therefore, a PM motor uses less electrical power to create the same mechanical power.

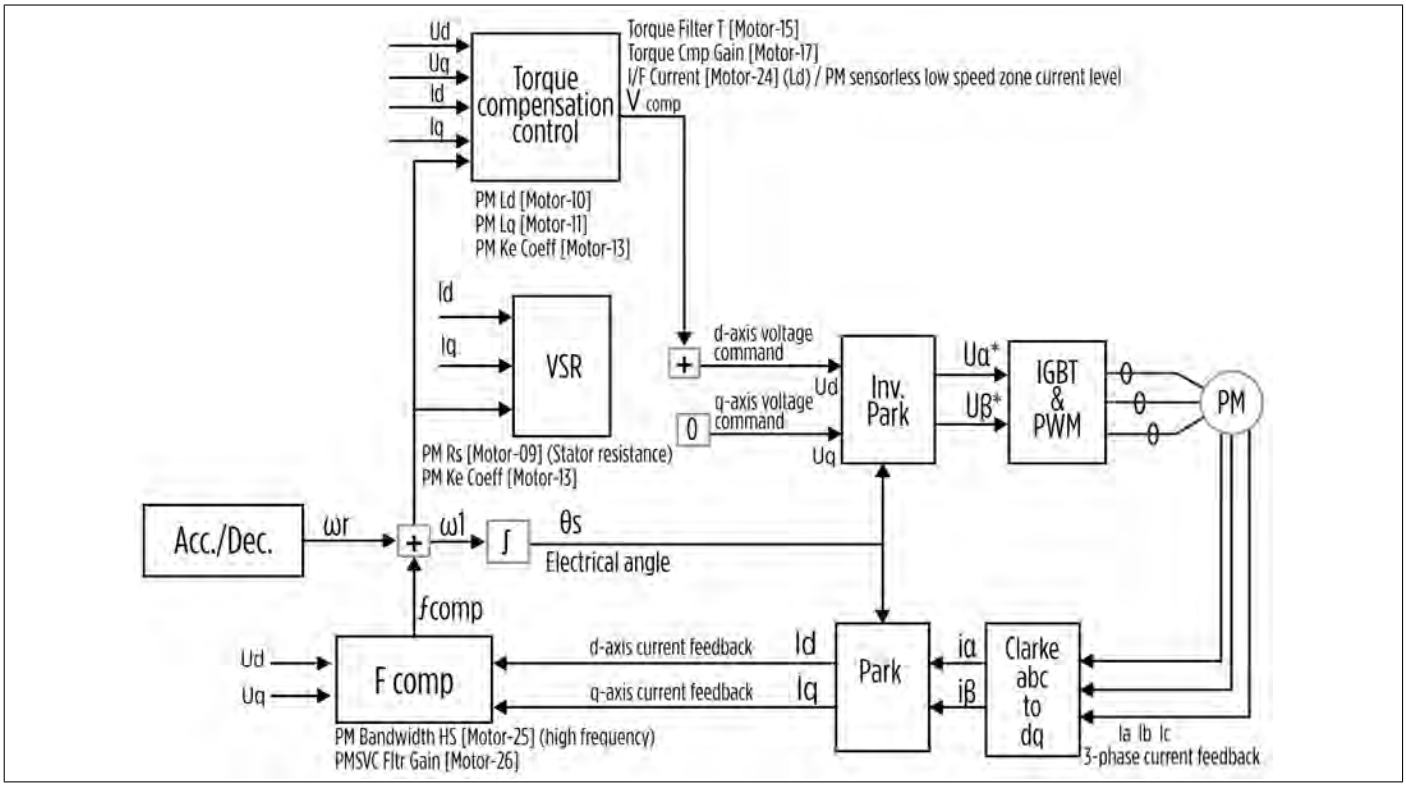
X-Drive can operate both IPM and SPM motors. Internal PM motors (IPM) have the magnets installed in the rotor laminations rather than on the surface of the laminations, which are called surface PM motors (SPM).

The X-Drive controls PM motors using Sensorless Vector Control (SVC). SVC can also be used to control induction motors. SVC is different than scalar (VF) mode in that the drive uses feedback of the 3-phase current to regulate current at startup and adjust frequency of operation for torque compensation.

PM SVC operation has a sequence of three steps:



1. DC Alignment – A DC current and voltage is applied to the motor to align the rotor to the magnetic poles. This alignment requires 3 seconds.
2. I/F Control – A controlled current start of the motor is performed. This technique provides higher starting torque than VF mode.
3. Advance V/F Control – With the motor started, it can run sensor-less. Frequency compensation stabilizes the current load. Torque compensation adjusts output voltage to correct for torque control.



Setup FE MagForce Pump Motor

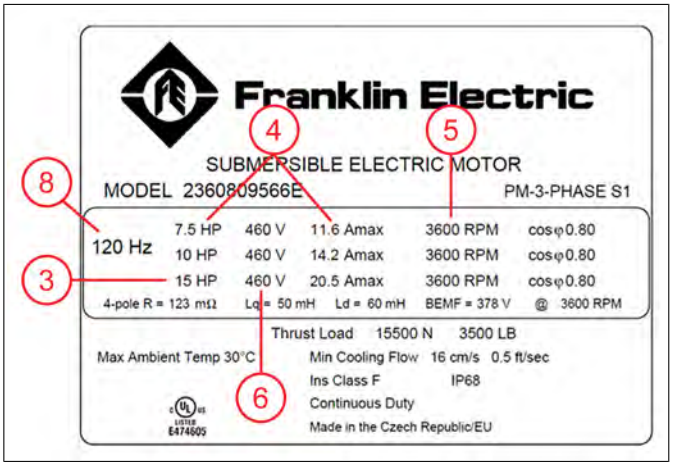
Franklin Electric MagForce motors use an internal permanent magnet motor (IPM) design with 4-pole construction and synchronous speed. This means the electrical frequency is the same speed as the shaft speed with no slip in the rotor. Since the motor has 4 poles, the electrical frequency running the motor needs to be twice that of a 2-pole motor for same desired RPM.

Pump RPM	Electrical Frequency
3600	4 x 3600 / 120 = 120 Hz
3450	4 x 3450 / 120 = 115 Hz
3525	4 x 3525 / 120 = 117.5 Hz
3000	4 x 3000 / 120 = 100 Hz
2850	4 x 2850 / 120 = 95 Hz
2938	4 x 2938 / 120 = 98 Hz

FE MagForce motors are rated to operate up to 3600 RPM in North America or 3000 RPM in the EU, and not to exceed the maximum SFA rating of the motor. To run pumps at their rated speed, use the pump RPM calculation "Poles x RPM / 120 = Electrical Frequency (Hz)" in order to set the **VFD Max Freq [VFD–00]**.

Basic Setup

IMPORTANT: If the VFD has been used in a previous application, the drive parameters should be completely reset using **Parameter Reset [ADV–03]**, option **4_Reset all Param**.



1. **Application [SET–00]:** Set to option **8_FE MagForce**. This selection assumes the use of a 4-pole, 3-phase PM motor running at 120 Hz and automatically updates all relevant parameters to the proper defaults.

   IMPORTANT: The FE MagForce application should only be used with Franklin Electric MagForce motors. Do not use this selection with other permanent magnet motors.

2. **Input Phase [SET–01]:** Verify that the setting matches the type of power supply. Default = 3-phase.
3. **Motor Horsepower [SET–02]:** Enter the maximum rated horsepower from the motor nameplate.
4. **Motor FLA (SFA) [SET–03]:** Set to the current rating on the nameplate associated with the power rating of the pump.
5. **Motor RPM [SET–04]:** Enter the rated motor RPM from the motor nameplate.
6. **Motor Voltage [SET–05]:** Enter the rated voltage from the motor nameplate.
7. **VFD Max Freq [VFD–00]:** The highest frequency allowable. This should be set to the calculated electrical frequency corresponding to the target pump RPM in the table above.
8. **VFD Base Freq [VFD–02]:** Set to the motor nameplate frequency rating.
9. **Carrier Freq [SET–62]:** Set to 4 kHz for sine filters and 2 kHz for dV/dt filters.

Permanent Magnet Specific Parameters

For FE MagForce applications, the drive automatically sets:

- **Control Method [Motor–05]:** This should be **2_Sensorless** Vector Control.
- **Motor Type [Motor–06]:** This should be **2_PM-IPM**.
- **Motor Poles [Motor–07]:** This should be **4** for a FE MagForce motor.
- **PM Inertia [Motor–08]:** This value is automatically calculated.

Motor Specific Parameters

For FE MagForce applications, the drive automatically sets:

- **PM R_s [Motor-09]:** Motor stator resistance.
- **PM L_d [Motor-10]:** Motor inductance d-axis.
- **PM L_q [Motor-11]:** Motor inductance q-axis.
- **PM K_e Coeff [Motor-13]:** Motor parameter Ke (Vphase, rms / krpm).

Autotune Characteristic Parameters

For FE MagForce applications, autotune is not needed. However, if the drive consistently exceeds the motor current specification during DC Alignment and I/F control, then an autotune may be needed. Refer to "Autotune Characteristic Parameters" on page 102.

Tune Motor Control

For FE MagForce applications, no adjustments are needed for DC alignment, I/F control, or PM control. Refer to "Tune motor control – DC Alignment" on page 102, "Tune Motor Control — I/F Control" on page 103, and "Tune motor control — PM Control" on page 103.

Setup Non-Franklin Electric PM Motors

The X-Drive can be programmed to operate general purpose permanent magnet motors through the following procedure:

Basic Setup

IMPORTANT: If the VFD has been used in a previous application, the drive parameters should be completely reset using **Parameter Reset [ADV–03]**, option **4_Reset all Param**.

1. **Application [SET–00]:** Set to option **9_PM Motor**. This selection assumes the use of a 4-pole, 3-phase PM motor running at 120 Hz and automatically updates all relevant parameters to the proper defaults.

   IMPORTANT: Do not use the FE MagForce selection with non-Franklin Electric permanent magnet motors.

2. **Input Phase [SET–01]:** Verify that the setting matches the type of power supply. Default = 3-phase.
3. **Motor Horsepower [SET–02]:** Enter the maximum rated horsepower from the motor nameplate.
4. **Motor FLA (SFA) [SET–03]:** Enter the rated motor FLA, found on the motor nameplate.
5. **Motor RPM [SET–04]:** Enter the rated motor RPM from the motor nameplate.
6. **Motor Voltage [SET–05]:** Enter the rated voltage from the motor nameplate.
7. **VFD Max Freq [VFD–00]:** The highest frequency (speed) allowable.
8. **VFD Base Freq [VFD–02]:** This should be set to the motor nameplate frequency rating.
9. **Carrier Freq [SET–62]:** This should be set to 4 kHz for sine filters and 2 kHz for dV/dt filters. Carrier frequency should be at least 1.5 times the resonant frequency of the filter.

Permanent Magnet Specific Parameters

Enter motor parameters unique to the installation:

- **Control Method [Motor–05]:** This should be **2_Sensorless** Vector Control.
- **Motor Type [Motor–06]:** Set to **1_PM-SPM** or **2_PM-IPM**.
- **Motor Poles [Motor–07]:** Set the number of poles in the motor. (Poles = Base Freq x 120 / RPM.)
- **PM Inertia [Motor–08]:** If unknown, use the value calculated by the drive.

Motor Specific Parameters

Input motor characteristic parameters. If any motor characteristic parameters are unknown besides **PM PG Angle [Motor-12]**, then an autotune is required to measure these values.

NOTE: If any of the following are unknown, leave blank.

- **PM R_s [Motor-09]:** Motor stator resistance.
- **PM L_d [Motor-10]:** Motor inductance d-axis.
- **PM L_q [Motor-11]:** Motor inductance q-axis.
- **PM PG Angle [Motor-12]:** Motor offset angle.
- **PM K_e Coeff [Motor-13]:** Motor control coefficient.

Autotune Characteristic Parameters

1. If a sine filter is connected to output of drive, either disconnect the capacitors or remove sine filter between drive and motor cable so that the motor cable is directly connected to the drive. Make sure all power to the drive is disconnected before changing wiring.
2. Set **Motor A-Tuning [Motor-00]** to **3_PM Rotating** or **4_PM No-Rotation**. If a load is on the motor and cannot be removed, then a "no-rotation" option should be selected. Remove load from the motor to then use "Rotating."
   a. An autotune "no-rotation" outputs high frequency into the motor to calculate the motor impedance values but not the Ke Coeff.
   b. An autotune with rotation does the same as "no-rotation" and then turns the rotor of the motor to calculate the Ke Coeff (Vphase, rms / krpm).
3. Start Autotune by initiating a start command.
4. Once Autotune is complete, the drive populates PM characteristic parameters.
5. If using a sine filter, reconnect filter between drive and motor cable.

Tune motor control – DC Alignment

Parameter	Display Name	Description
Motor-24	I/F Current	Percentage of nominal motor current **[SET-03]** used to regulate output current during DC current during PM DC Alignment.
Motor-39	DC-Tun Curr P	Proportional gain value regulating DC current during DC Alignment of PM motor.
Motor-40	DC-Tun Curr I	Integral gain regulating DC current during DC Alignment of PM motor.

The DC Alignment process rarely needs adjusting. However, if the motor is not aligning properly, the user may detect unexpected high current loads or an unusual rumbling sound at low frequency. This might occur when the motor leads are very long (> 3000 ft) or high load prevents motor movement. In this case, start by increasing the **I/F Current [Motor-24]**, and then **DC-Tun Curr P [Motor-39]** if necessary.

Tune Motor Control — I/F Control

Parameter	Display Name	Description
Motor-24	I/F Current	Percentage of nominal motor current **[SET-03]** used to regulate AC current during I/F Control.
Motor-27	Freq I/F to PM	When increasing frequency, the frequency to switch modes from I/F mode to PMSVC mode.
Motor-28	Freq PM to I/F	When decreasing frequency, the frequency to switch modes from PMSVC mode to I/F mode.
Motor-29	I/F Fltr Time	Low-pass filter time of current being commanded from **I/F Current [Motor-24]**.

The drive regulates current level at **I/F Current [Motor-24]** as frequency ramps up to **Freq I/F to PM [Motor-27]**. Once above this frequency, the Advance V/F Control becomes active. Ramping down to **Freq PM to I/F [Motor-28]** switches out of Advance V/F Control to **I/F Current [Motor-24]** regulation. The current regulation averages current value base on **I/F fltr time [Motor-29]**.

If the motor load does not rotate up to **Freq I/F to PM [Motor-27]**, the I/F Current needs to increase. If the I/F Current is at maximum without load rotating, reduce I/F current to below 100% and set acceleration rate to a higher value. If more torque is required, increase **Carrier Frequency [SET-62]**.

Tune motor control — PM Control

Parameter	Display Name	Description
Motor-15	Torque Filter T	Response time in controlling torque to motor.
Motor-17	Torque Cmp Gain	Gain value for output voltage increase to compensate for voltage drop on stator resistance at high motor loads in torque compensation function. For PM motors, max value is 5000. Setting this parameter to 0 removes I/F control and disable stability.
Motor-25	PM Bandwidth HS	Allowable frequency bandwidth around desired frequency in order to adjust operating frequency to prevent vibrations in motor operation.
Motor-26	PMSVC Fltr Gain	Gain value in adjusting the operating frequency from the desired frequency to prevent vibrations in motor operation.
Motor-37	PM Trq Comp I/F	PM Torque Compensation in I/F Mode.
Motor-38	PM Trq Comp SVC	PM Torque Compensation in SVC Mode (Advance V/F Control).

IMPORTANT: PM Trq Comp I/F [Motor-37] and **PM Trq Comp SVC [Motor-38]** are only operable in FE MagForce application. PM Motor Application uses **Torque Cmp Gain [Motor-17]**.

The drive outputs nominal voltage based on desired frequency. Frequency compensation (stabilizer) is quickly adjusting the desired frequency to prevent overcurrent or high voltage on DC bus. The torque compensation control is adjusting output voltage to ensure rotor magnetization is at correct level for desired torque with respect to operating frequency. Increase the switching frequency by at least 1.5 times the resonant frequency of the sine filter.

PM motors can be unstable with no loads at high frequencies. If there is a light or no load, increase the **Torque Cmp Gain [Motor-17]** until stability is achieved. If a more precise output frequency is desired, lower the **PM Bandwidth HS [Motor-25]**.

Duplex Pump Configurations

Jockey Pump Control

A Jockey pump system consists of high HP Main pump and low HP Jockey pump. The VFD that controls the main pump provides constant pressure control with PID loop for that pump and start signal via communication or relay output for Jockey pump. The jockey pump can be controlled by starter, soft-starter or another VFD.

The jockey is started by the main VFD relay output (RA1, RA2, or RA3) if a relay output is set to **48_ Jockey Pump [IO–47]** to **[IO-49]**, or through RS-485 communications if it is controlled by another VFD. Refer to "Multi-Drive Configurations" on page 109 for more information about controlling a jockey with a separate VFD.

1. When the system is in Auto mode with pressure equal to or less than **Wake-Up Level [SET-31]** (from Sleep feature), the main pump starts first and maintains system pressure. Then:
   - If demand drops low, jockey pump starts, and main pump stops.
   - If demand becomes highest, jockey starts and runs together with main pump.
2. When the system is in Auto mode with pressure greater than **Wake-Up Level [SET-31]** but less than **J-Start Press [ADV–49]**, jockey starts first.
3. When the system is in Auto mode with pressure greater than **J-Start Press [ADV–49]**, both jockey and main pumps are off.

At low demand, when the main pump's speed is less than **Main Stop Freq [ADV–51]** and system pressure is at Setpoint for **J-Start Delay [ADV–52]**, jockey starts and, after a two second delay, the main pump stops. The VFD uses **J-Start Press [ADV–49]** and **S-Boost Value [SET-29]** (Sleep feature) for jockey start/stop control.

During Jockey pump run, if system pressure becomes:

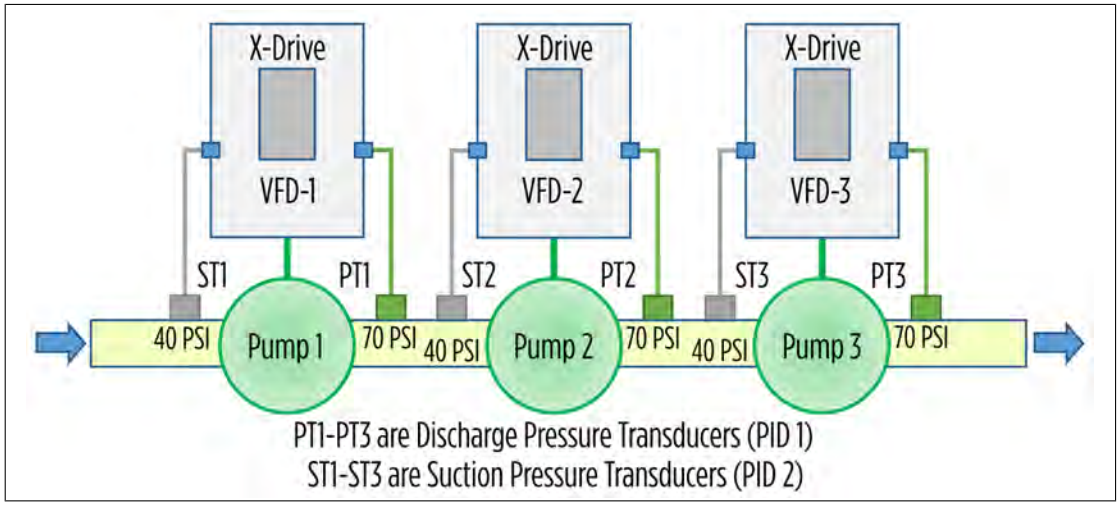
1. Equal to or greater than **S-Boost Value [SET-29]**, jockey pump stops.
2. Less than **Wake-Up Level [SET-31]** for two seconds, the main pump starts and after **J-Start Delay [ADV-52]** system pressure is:
   - Below or at Setpoint and main VFD speed is greater than **J-Start Freq [ADV-50]** for two seconds, jockey continues to run helping main pump to maintain pressure setpoint.
   - At or above Setpoint and main VFD speed is less than **J-Start Freq [ADV–50]** and greater than **Main Stop Freq [ADV-51]** for two seconds, jockey stops, and main pump alone maintains pressure setpoint.
   - At or above Setpoint and less than Boost Pressure and main VFD speed is less than **Main Stop Freq [ADV–51]** for **Main Stop Delay [ADV-53]**, main pump stops, and jockey continues to run until pressure is greater than **S-Boost Value [SET-29]**.
   - Equal to or greater than **S-Boost Value [SET-29]** for two seconds, both main and jockey pumps stop.

To enable jockey pump control, adjust the following parameters:

Parameter	Display Name	Description
ADV–48	Jockey Mode	This setting enables or disables the feature.
ADV–49	J-Start Press	Pressure setpoint for jockey start when all other conditions have been met. Range = 10% of **PID Setpoint [SET-21]** to **PID Setpoint [SET-21]**. Default = 54 PSI.
ADV–50	J-Start Freq	Jockey starts when main pump is running above this frequency and all other conditions are met. Range = **PID Lo Hz Limit [SET–22]** to **PID Hi Hz Limit [SET–22]**.
ADV–51	Main Stop Freq	Main pump stops if it runs below this frequency. Jockey continues to run until pressure settings are met. Range = **PID Lo Hz Limit [SET–22]** to **PID Hi Hz Limit [SET–22]**.
ADV–52	J-Start Delay	Time delay before jockey starts once all conditions are met. Range = 1 to 6000 seconds. Default = 20 sec.
ADV–53	Main Stop Delay	Time delay before main pump stops once all conditions are met. Range = 1 to 6000 sec. Default = 5 sec.

Dual PID Loop Control

Balancing Pressure in Large Systems Using Multiple Pumps



Booster pumps connected in series in long pipe systems and controlled by VFDs can be set for automatic pressure balancing without the need for communication.

Each pump has its own VFD with suction (ST) and discharge (PT) pressure transducers. When there is a long distance between pumps, the discharge pressure at any one pump is typically greater than the suction pressure at the next pump.

- The discharge side is programmed as a standard constant pressure PID loop (PID 1). Refer to "Standard Operation with PID Feedback Control" on page 71.
- The suction side transducer is installed and programmed as an auxiliary input in inverse mode (PID 2).

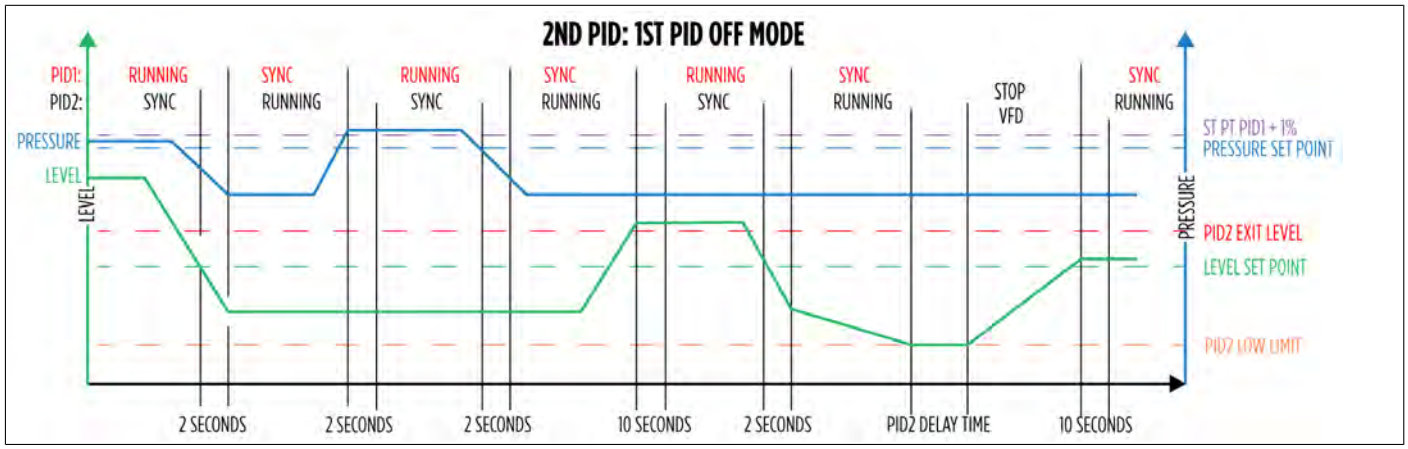
When suction pressure of PID 2 is at or above its setpoint **[ADV2–38]**, normal VFD operation is maintained using the PID 1 loop.

When pump 1 suction pressure drops below PID 2 setpoint because of inadequate water supply, PID 1 High Freq Limit is decreased to reduce flow, prevent cavitation, and prolong pumping time. The pump 1 discharge pressure drops and VFD2 decreases its High Freq Limit and VFD3, etc. will follow. In this way, all pumps act the same without any communication between them.

To enable this feature, set the following parameters:

Parameter	Display Name	Description
ADV2–58	AUX AI Select	Select the terminal (**AVI1, AVI2, ACI**) with the PID 2 transducer connection. Set unit type and scaling in **[ADV2-59]** to **[ADV2-61]**.
ADV2–36	PID2 Output	Set this parameter to **1_Limit 1st PID**.
ADV2–37	PID2 Type	Set this parameter to **1_PID Inverse** for this application.
ADV2–38	PID2 Setpoint	Desired suction pressure.
ADV2–39	PID2 P-Gain	Set the proportional gain value for PID2 operation. Default = 30%.
ADV2–40	PID2 I-Time	Set the integral gain value for PID2 operation. Default = 1 second.
ADV2–41	PID2 Low Limit	Set the minimum frequency for PID2 output. Range = **[SET–22]** to **[ADV2–42]**.
ADV2–42	PID2 High Limit	Set the maximum frequency for PID2 output. Range = **[ADV2–41]** to **[SET–23]**.

Using Dual PIDs to Control Output when Pumping from a Tank or Well



Dual PID control can be used to protect a pumping system from a low water condition when using a tank or well as the water source.

The VFD uses a pressure transducer (PID 1) on the discharge side of the pump and a level transducer (PID 2) in the tank. Both PIDs run simultaneously but only one at a time provides speed reference to VFD.

- The discharge side is programmed as a standard constant pressure PID loop. Refer to "Standard Operation with PID Feedback Control" on page 71.
- The level transducer is installed and programmed as an Auxiliary input in inverse mode (PID 2).

When the tank level reading of PID 2 is at or above **PID2 Set Point [ADV2–38]**, normal VFD operation is maintained using the PID 1 loop.

When level reading is less than PID 2 setpoint for 2 seconds, VFD frequency reference is switched from PID 1 loop to PID 2. When level stays less than **PID2 Set Point [ADV2–38]**, PID 2 output is decreased to **PID 2 Low Limit [ADV2–41]**. If water level increases and approaches **PID2 Set Point [ADV2–38]**, the VFD speed is increased.

If level setpoint is maintained but frequency is not high enough to pressurize the system up to **[SET–21]** + 1%, the VFD frequency is controlled by PID 2 output. During PID 2 operation, if system pressure is equal to or greater than **[SET–21]** + 1% for 2 seconds, the VFD switches speed reference from PID 2 to PID 1.

When running on PID 2, there are two parameters to switch back to PID 1 or stop VFD:

1. **PID2 Exit Level [ADV2–44]:** If PID2 level reading becomes greater than this setting for 10 seconds, VFD switches speed reference from PID 2 back to PID 1.
2. **PID Stop Delay [ADV2–43]:** If VFD has been running at **PID 2 Low Limit [ADV2–41]** and cannot maintain the level setpoint for this time setting, VFD stops with the message "Low Level" displayed on the screen.
   - During Low Level stop or at power-up, if level reading is greater than **[ADV2-38]** but less than **[ADV2-44]** for 10 seconds, VFD starts running with PID 2 output as speed reference.
   - During Low Level stop or at power-up, if level reading is equal to or greater than **[ADV2-44]** for 10 seconds, VFD starts running with PID 1 output as speed reference.

To enable this feature, set the following parameters:

Parameter	Display Name	Description
ADV2–58	AUX AI Select	Select the terminal (**AVI1, AVI2, ACI**) with the PID 2 transducer connection. Set unit type and scaling in **[ADV2-59]** to **[ADV2-61]**.
ADV2–36	PID2 Output	This setting selects feature options: • **1_1st PID Off:** When PID2 falls below level setpoint, VFD control is switched from PID 1 to PID 2.
ADV2–37	PID2 Type	This parameter should be set to **1_Inverse** for this application.
ADV2–38	PID2 Setpoint	Desired tank water level to switch PID control.
ADV2–39	PID2 P-Gain	Default = 30%
ADV2–40	PID2 I-Time	Default = 1 second.
ADV2–41	PID2 Low Limit	Set the minimum frequency for PID2 output. Range = **[SET–22]** to **[ADV2–42]**.
ADV2-42	PID2 High Limit	**[ADV2–41]** to **[SET–23]**.
ADV2–43	PID2 Stp Delay	Time to stop VFD when running on **PID2 Low Limit [ADV2-41]**.
ADV2–44	PID2 Exit Level	If feedback value is greater than **[ADV2–44]** for 10 seconds, then operation switches from PID 2 to PID 1.

Multi-Motor Configurations

Several multi-motor configurations are available:

- Equal Run Time
- Soft Start Mode
- Lead-Lag
- Run Time Alt
- Rotate Lead

Multi-Motor (MMC) Relay Control for Pump Applications

The multi-motor configuration for constant pressure systems provides control for up to 4 pump motors (8 with optional I/O board) in a Lead, Lag configuration.

The VFD controls speed of the Lead pump using its own PID feedback loop and the VFD motor output. If the Lead pump cannot maintain setpoint pressure, the VFD uses relay outputs to trigger Lag pumps through a starter, soft-starter, or another VFD. Relay output function (**[IO–47]**, **[IO-48]**, or **[IO–49]**, etc.) should be set to **47_MMC Out**. The lowest number relay set to MMC will be Lag 1.

This feature does not provide an alternation or Lead pump replacement in case of pump or VFD failure.

To enable Lead, Lag Relay Control, set the following parameters:

Parameter	Display Name	Description
ADV–10	MMC Mode	Set to **3_Lead-Lag**.
ADV–18	Lag Start Freq	When the lead pump runs above this frequency, it sets the first condition for starting a Lag pump. Range = **Lag Stop Freq [ADV–23]** to **PID Hi Hz Limit [SET–23]**. Default = 59.5 Hz.
ADV–19	Lag Start Delay	Sets a delay time to start Lag pump when both frequency and pressure conditions are met. Default = 10 sec.
ADV–20	Lag Start Level	Sets a percentage of **PID F/B Max [SET–20]** to calculate "MMC Below Setpoint" as the second condition for starting a Lag pump. Range = 0.1 to 10%. Default = 2%. **NOTE:** "MMC Below Setpoint" = **[SET–21] – {[SET–20] x [ADV–20]/100}**.
ADV–21	Lead Freq Drop	Output frequency drop value with **[ADV–22]** at Lag pump start to prevent system overpressure condition. Default = 10 Hz.
ADV–22	MMC Decel Time	Sets the deceleration time for the **[ADV–21]** frequency drop. Default = 2 sec.
ADV–23	Lag Stop Freq	When the Lead runs below this frequency, it sets the first condition for stopping Lag pumps. Default = 35 Hz.
ADV–24	Lag Stop Delay	Sets a delay time to stop Lag pump when both frequency and pressure conditions are met. Default = 4 sec.
ADV–25	Lag Stop Level	Sets a percentage of **PID F/B Max [SET–20]** (frequency) to calculate "MMC Below Setpoint" as the second condition for stopping a Lag pump. Default = 0.3%. **NOTE:** MMC At Setpoint = **[SET–21] + {[SET–20] x [ADV–25]/100}**.
ADV–26	Lead Freq Bump	Output frequency increase value with **[ADV–27]** at Lag pump stop to prevent system underpressure condition. Range = 0 to **[SET–23]***0.4. Default = 0 Hz.
ADV–27	MMC Accel Time	Sets the acceleration time for the **[ADV–26]** frequency bump. Default = 2 sec.

Lag Pump Start sequence: If the Lead motor runs at a speed equal or greater than **[ADV–18]** with system pressure less than "MMC Below Setpoint" for **[ADV–19]** delay, VFD decreases output frequency by **[ADV–21]** value for **[ADV–22]** time then activates relay output to start the first Lag Pump in sequence. After a non-adjustable 1 sec delay, VFD changes **[SET–23]** to its original value and checks for Lag Start/Stop conditions. If demand is still high, VFD repeats Lag Start sequence for additional Lag pumps.

Lag Pump Stop sequence: If the Lead motor runs at a speed equal or less than **[ADV–23]** with system pressure equal or greater than "MMC BelowSetpoint" for **[ADV–24]** delay, VFD increases output frequency by **[ADV–26]** value for **[ADV–27]** time then deactivates relay output to stop the first Lag Pump. After a non-adjustable 1 sec delay, VFD changes **[SET–22]** to its original value and checks for Lag Start/Stop conditions. If demand is still low, VFD repeats Lag Stop sequence for additional Lag pumps. If all Lag pumps are stopped, VFD checks for Sleep Mode conditions.

If the VFD run command is removed during MMC operation, all Lag pump relays deactivate in sequence with a 1 sec delay between each relay. The delay will protect from voltage surges in the power line when Lag pumps stop. VFD then stops the Lead based on the selected method (Decel or Coast).

If the VFD trips on a fault during MMC operation, VFD immediately deactivates all Lag pump relays and coasts to stop.

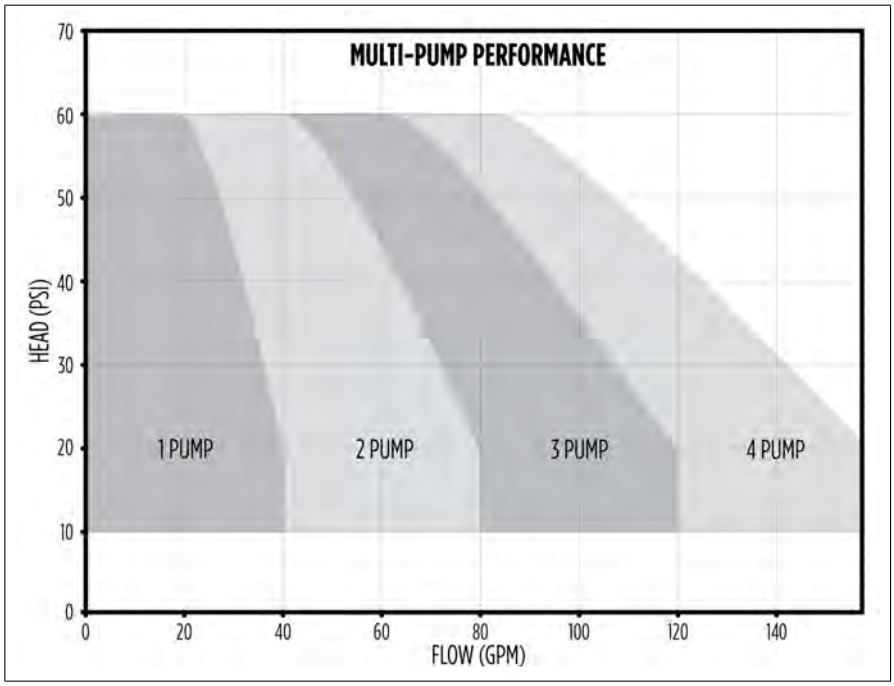
Multi-Drive Configurations

Multi-Pump Application

The use of multiple pumps and drives has the advantage of increases efficiency at both very low and very high flow rates, as compared to a single pump sized to accommodate typical usage. A single pump may not be able to supply the complete flow range and is likely to be inefficient at the ends of the range.

In contrast, a series of pumps/drives that operate at a high efficiency at low flow rates can maximize effectiveness across the full spectrum of demand. The Lead pump starts first to supply minimal usage. Then, as additional flow is needed, Lag pumps start in order of their sequential ID number.

Additional pumps/drives can be added as standby units to ensure full operation in case of fault or maintenance of one of the primary units. The X-Drive system can support up to eight pumps and drives.



Method of Operation

⚠ CAUTION

Risk of bodily injury or equipment damage. A pressurized system can cause a pump to deadhead.

- To prevent this, size the pump to be able to withstand additional head equivalent to the regulating pressure of the system.

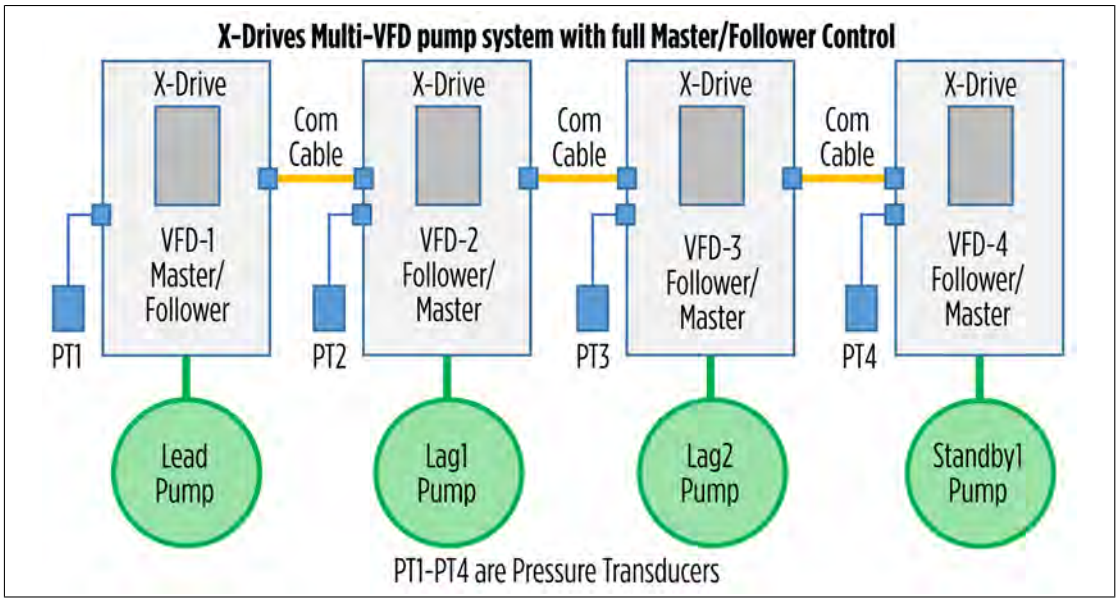
The communication between VFDs provides Master/Follower control and Lead-Lag sequence switching which allows pumps to alternate. The pump system can be set with brown box VFDs, separately enclosed VFDs, or multiple VFDs enclosed in one industrial enclosure. For complete redundancy, each VFD requires a pressure transducer in order to operate in PID mode and to provide full Master/Follower control.

If not every VFD in the system has pressure transducer feedback, the system can be set to run those VFDs as Followers only at preset, fixed Lag Speed (no PID control).

The multi-pump application operates as a constant pressure system using PID feedback control.

Each drive is assigned a sequential ID number, and an initial role. Roles can be alternated, but to be included in the alternation cycle, each drive requires its own transducer.

VFD Role Definitions for Multi-Drive Operation



NOTE: For proper system operation each VFD should have active run command and HOA switch in Auto mode and all VFDs should have identical control parameter settings.

1. **Master:** The drive that controls starting of the overall system and activating each pump.
   - The Master is always the VFD with the lowest ID. In addition, the **Set VFD Ready [ADV–47]** parameter must be set to **0_Ready**.
   - If the Master loses communication to the system, the remaining VFD with the lowest ID takes over as Master. For this reason, the best practice is to program all drives with the same parameter settings.
   - The overall system becomes active when the Master is in Auto.
   - The Master monitors its own transducer, along with the Lead drive frequency to determine when to start or stop remaining drives.
   - The Master can also function in any of the other roles.
2. **Lead:** The Lead VFD operates in PID mode using its transducer as feedback to control the speed.
   - If the drive is set to operate at a fixed frequency, it cannot function as a Lead.
   - Assignment of the Lead drive can be assigned to other drives on a rotating basis.

     IMPORTANT: Since the Lead role can change, each drive needs its own transducer; or, the system could have a single transducer with analog splitters to feed each drive. Set each drive to the same setpoint. If a change in setpoint is needed, update the setting on all the drives.

3. **Lag:** A Lag drive becomes active when the Master determines that the setpoint cannot be met by the Lead.
   - **VLag Spd Source [ADV–43]** sets the Lag drive to run either on its own PID or at a fixed frequency. For a Lag drive to be alternated to a Lead, set to PID mode.

     NOTE: If a Lag is operating in PID mode, it could possibly run at a higher frequency than the Lead at times as the overall system balances itself.

4. **Standby:** A Standby drive is not part of the Lead/Lag control sequence, but it can be a Master. One or more Standby drives serve as spares to replace a Lead or Lag in a faulty or deactivated condition, and are added at the end of the sequence of drives.
5. **Jockey:** A Jockey is used to maintain system pressure in a low flow situation. Refer to "Jockey Pump Control" on page 104.
   - In a multi-drive system, the Jockey VFD ID is always the last one in the sequence and does not change roles during system alternation.
   - During normal operation with high demand, the Jockey functions like the last ID Lag if required to maintain pressure. It is the last to start and the first to stop.
   - During low demand operation, the Lead drive acts as the Main for regular Jockey control.

Sequence Assignment

The system rotates drive roles through the network based on the parameter **Alternation [ADV–45]**. There are three possible scenarios:

1. **Alternation–Disabled:** Use this setting when the system primarily operates at a low flow rate and uses the Lag pumps as backups when needed.
   - In this case, the Lead pump could be sized for efficiency at a lower flow rate and would always be the first to start.
   - The Lead/Master would regulate the pressure of the system using its own PID sensor.
   - The Lag pumps could be sized differently and could either use their own PID or be set to run at a specific frequency.
2. **Alternation–Timer:** Use this setting to rotate the Lead role to distribute wear on a system with continuous operation.
   - In this case, the roles would be rotated after running for a specific time, set in **Alternation TMR [ADV–46]**.
   - In addition to balancing usage, this practice would help ensure the proper functioning of Lag units that might otherwise be idle for extended periods.
   - The best practice would be to size and program all pumps/drives the same.
3. **Alternation–Master Power–Up:** For a system that is stopped and started on a periodic basis, such as a manufacturing plant, rotate system roles to maintain consistent performance.
   - In this case, the Lead changes each time the system is activated (Master is power cycled).

NOTE: In all cases, the Master is the drive with the lowest ID number **[ADV–37]**. If the Master faults, is switched to **Hand**, or is set to **1_Skip** it in **Set VFD Ready [ADV–47]**, the role is shifted to the drive with the next lowest ID. If there is a break in communication, the lowest ID on any remaining functional network assumes the Master role.

Example Rotation Pattern

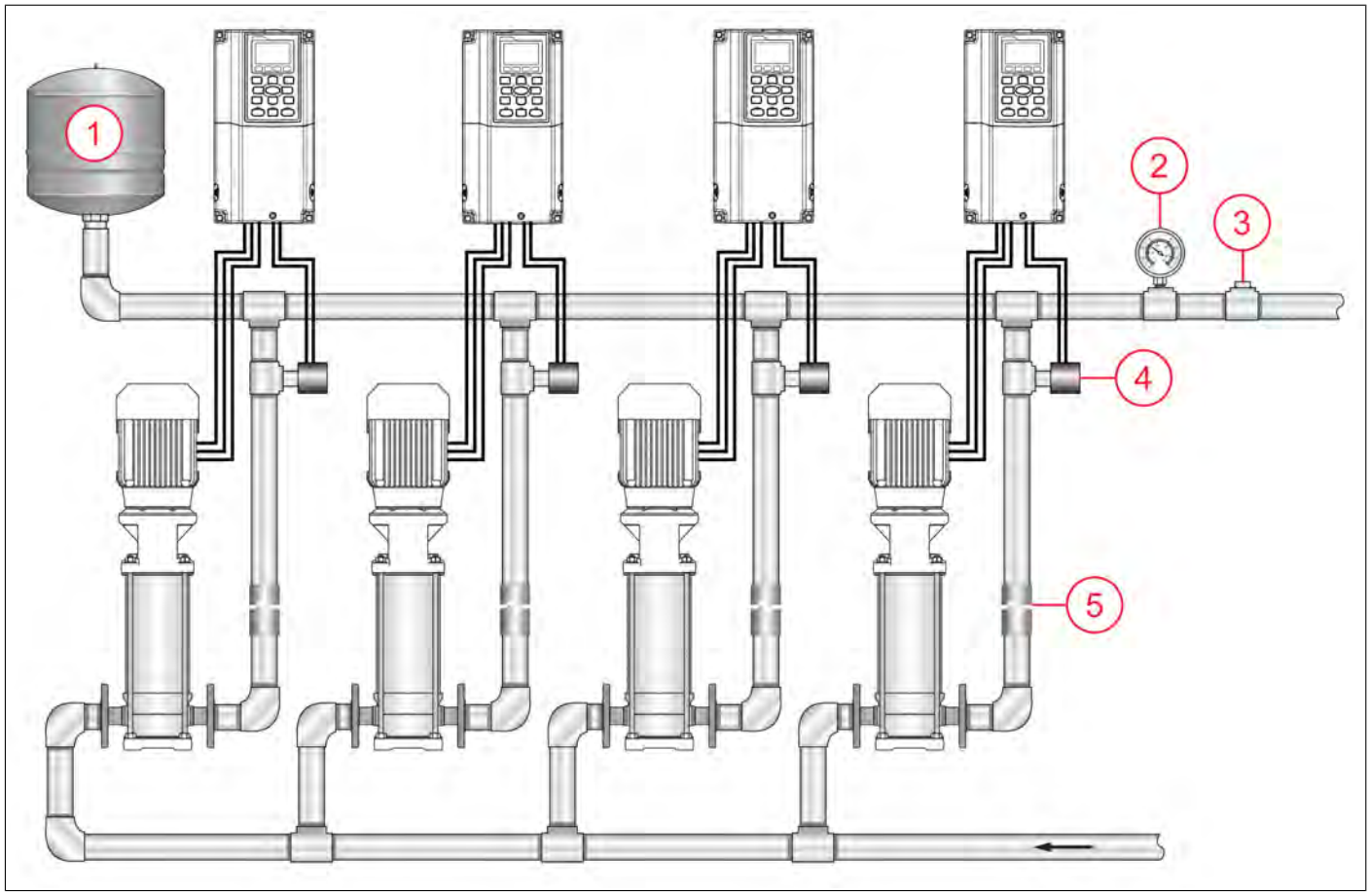
Event	VFD 1	VFD 2	VFD 3	VFD 4	VFD 5
System Start	Master/Lead	Lag 1	Lag 2	Lag 3	Standby 1
First Alternation	Master/Standby 1	Lead	Lag 1	Lag 2	Lag 3
Second Alternation	Master/Lag 3	Standby 1	Lead	Lag 1	Lag 2
VFD 1 Fault — Underload	Master/ (Fault)	Lag 3	Lead	Lag 1	Lag 2
Next Alternation	Master/ (Fault)	Lag 2	Lag 3	Lead	Lag 1

Fault Handling

If a fault occurs on a Lead or Lag drive, the Master remove the drive from the sequence, rotates the Lead/Lag roles of the remaining drives, and initiates a start command for the next drive in sequence.

If any drive detects an Over Pressure, Broken Pipe, or Pipe Leak fault, it communicates the condition to the Master, which then stops operation of the entire system. All other faults are local to an individual drive.

Installation and Setup



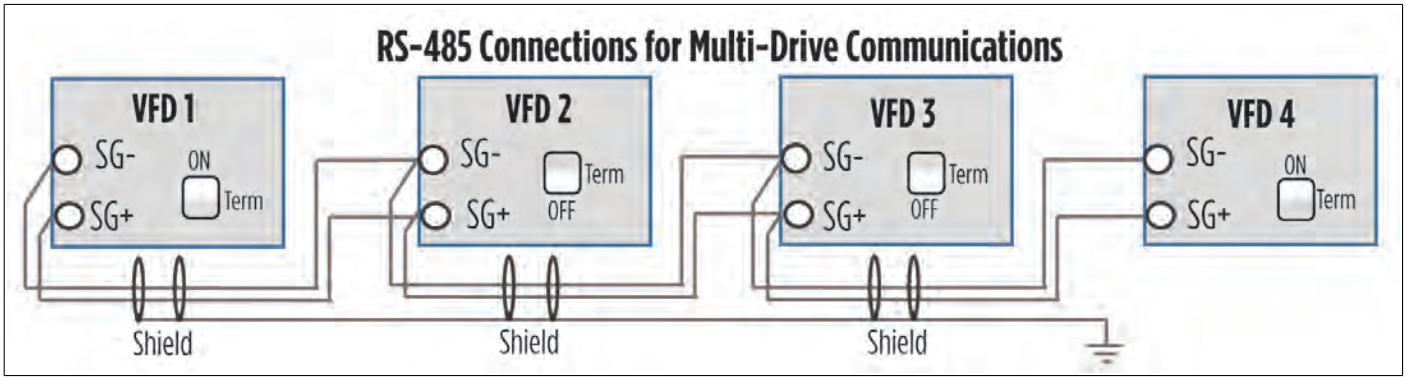
1 Pressure Tank 2 Pressure Gauge 3 Pressure Relief Valve 4 Pressure Transducer 5 Check Valve

Configuration

Each pump in the system should be controlled by its own drive, using its own PID feedback loop. Refer to "VFD Role Definitions for Multi-Drive Operation" on page 110.

- All drives using PID should be programmed to the same Setpoint **[SET–21]**.

Communications



Communication can be established via standard CAT-5 cables and RJ-45 ports or via shielded cables and VFD terminals SG+ and SG-. Wiring for communications should be from drive to drive in a chain, as shown above.

- The termination DIP switches should be **ON** (up) on both ends of the network.
- The shield wires should be connected together and grounded on one end only.

Multi-Drive Parameter Programming

Set the following parameters to enable a multi-drive network. Because the Master could change, the best practice is to set all drives the same.

Parameter	Display Name	Description
ADV–35	Multi-VFD Set	Defines the number of drives in the system, including Lead, Lag, Standby, and Jockey. Default= **0_Single VFD** where one VFD controls one pump. MMC mode is available with this selection.
ADV–36	Standby Pumps	Defines the number of Standby pumps/drives that are assigned. The maximum entry is equal to the total number of drives less the Lead and less the Jockey (if enabled).
ADV–37	Multi-VFD ID	Assigns a unique identification number to each drive in the system. IDs must be sequential without gaps. The Master only recognizes numbers up to the **[ADV–35]** total. If a Jockey is used, assign it to the highest ID.
ADV–38	VLag Start Freq	When Lead is running at a higher frequency than **[ADV–38]** and system pressure is less than **Setpoint [SET–21]** – 2% for the duration of **VLag Start Delay [ADV–39]**, then Master commands Lag 1 drive to start. If more Lag drives are available, a Lag Run Timer starts. If conditions are still not met, the next Lag drive is started.
ADV-39	VLag Start Delay	Sets a delay time to start Lag pump(s) when both frequency and pressure conditions are met. Range = 0 to 600 sec. Default= 10 sec.
ADV–40	VLag Stop Freq	When Lead is running at a lower frequency than **[ADV–40]** and system pressure is equal to or greater than **Setpoint [SET–21]** – 2% for the duration of **VLag Stop Delay [ADV–41]**, then Master commands Lag 1 drive to stop (first start—first stop). If more Lag drives are running, if conditions are met after Lag Run Timer, the next Lag drive is stopped.
ADV-41	VLag Stop Delay	Sets delay time to stop Lag pump when both frequency and pressure. Range = 0 to 600 sec. Default= 5 sec.
ADV–42	VLead/Lag ID	Set this value to the initial role of each drive in the network (Lead, Lag #, Standby #, or Jockey). Settings can be changed by the Master during the alternation cycle. **NOTE:** During initial setup, if **Multi-Pump ID [ADV-37]** is set to number greater than 0, **ADV-42** is automatically set to Lag with that number. Then it can be changed to Standby if the system has Lead-Lag-Standby setup.
ADV–43	VLag Spd Source	For each drive, this setting determines whether the drive uses **0_PID mode** or **1_Lag Set Frequency** when assigned as a Lag.

Parameter	Display Name	Description
ADV–44	VLag Set Freq	Frequency the drive uses if running as a Lag with a range from **PID Freq Low Limit [SET-22]** to **PID Freq Max Limit [SET-23]**. Default= 55.00Hz.
ADV–45	Alternation	Determines if and how the Lead role is rotated through the network, either by a set time interval or whenever the Master power is cycled. Default = **0_Disable**. **NOTE:** If Master power was cycled quicker than next VFD master detection delay or the whole system power is cycled, after system normal power-up it alternates.
ADV–46	Alternate TMR	Determines the length of time before the Lead alternates if **[ADV–45]** is set to **1_Timer**.
ADV–47	VFD Ready	Determines, for each drive, whether or not the drive can be used as the Master. The **1_Skip It** selection removes the drive from the Lead/Lag sequence, but it can be used as a Master.

COMMUNICATIONS

FE Connect for Cerus X-Drive Mobile Application

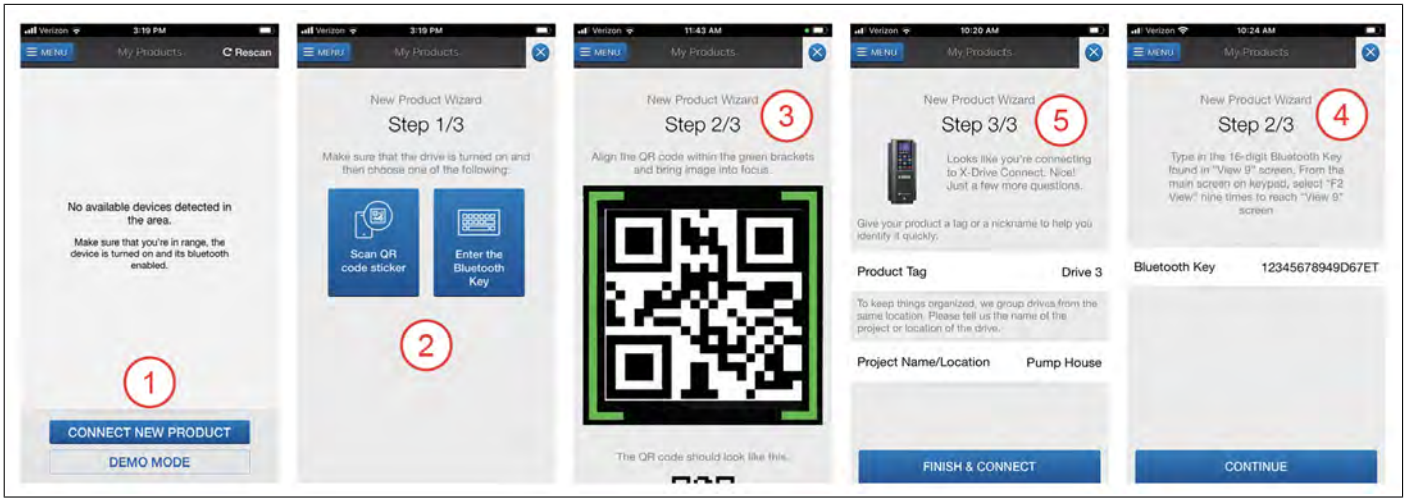
The FE Connect app for X-Drive is an intuitive way to wirelessly configure and control your VFD. It provides features such as:

- Simple, application-based setup for quick and easy startup
- Informational dashboard for visual monitoring of system performance
- Mobile control mode for easy Hand mode operation
- In-app troubleshooting with fault time and date logging
- Email system logs directly to FE support

In your mobile device's app store, search for FE Connect. Locate and install the X-Drive specific version.

NOTE: To use the app, you must install and configure an accessory X-Drive FE Connect Bluetooth communication card in the VFD. Refer to "Optional Extension Cards" on page 131.

Setup Bluetooth Connection



1. Install FE Connect to mobile device. See "FE Connect for Cerus X-Drive Mobile Application" on page 115.
2. From the Home screen, tap **Connect New Product**.
3. On the **New Product Wizard** screen, tap either **Scan QR Code Sticker** or **Enter the Bluetooth Key**.
4. If using the scanning tool, center the QR code on the Bluetooth card in the screen.
5. If using the Bluetooth key, press the **F2** button on the drive keypad nine times to display the BT Card Name screen. Enter the Key number shown into the app.
6. Enter a Name and Location to identify the drive within the app.
7. Tap **Finish & Connect** to complete the connection.

   NOTE: If multiple drives are installed in same location, refer to the **BT** icon in bottom right of keypad to identify the drive in which the app is paired.

Using the Mobile App

Use the following procedure to program an X-Drive that has been paired with the app.

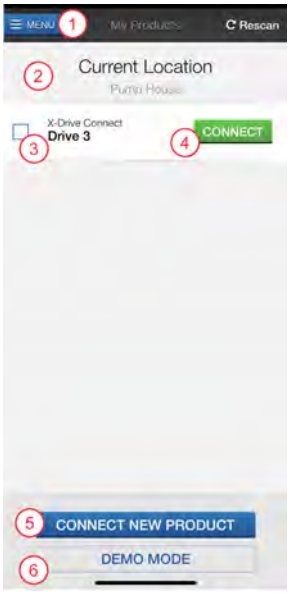
1. On the **My Products** screen, tap the name of the desired drive to connect to the device and enter the Dashboard.
2. Tap the **MENU** button for a list of options to navigate between screens.
3. Tap **Setup** to change VFD settings.
   - For new installation, start commissioning guide by selecting **MOTOR APPLICATION**.
   - For existing installation, change individual parameters by selecting **All Settings**.

   From here, program and verify all drive settings. Refer to "Setting Operating Parameters" on page 49.

Navigating the Mobile App

My Products Screen

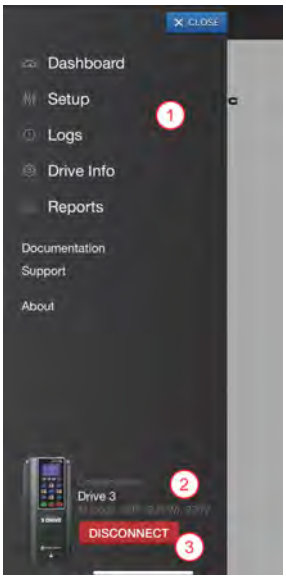
1. **Menu Button:** takes user to Menu navigation screen. Refer to "Menu Screen" on page 116.
2. Listing of past drives which the app was connected.
3. By selecting the drive's check box, you can remove the drive from the list.
4. **Connect button:** connect to detected drive within the area.
5. **Connect New Product button:** use to pair new drive to the mobile app.
6. **Demo Mode button:** used to test the app before connecting to a drive.



Menu Screen

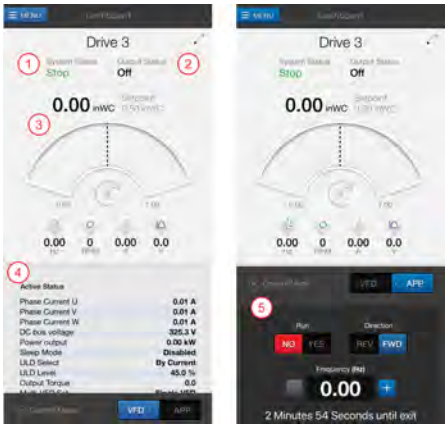
1. List of other screens.
2. Drive ID code that identifies the power and voltage rating.
3. **Disconnect button:** disconnects the app from the drive.

   NOTE: Once a drive is disconnected, the My Products screen appears.



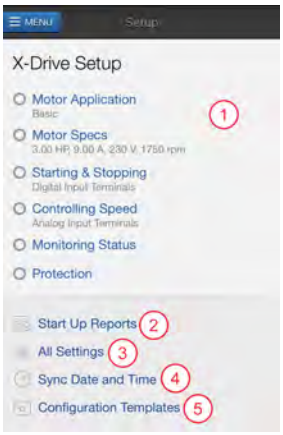
Dashboard Screen

1. Active System Status
2. Active Output Status
3. Analog gauge showing output frequency or feedback value in PID mode.
4. Monitoring values, digital and analog inputs, and relays and analog outputs.
5. Control mode window to force running in app mode



Setup Screen

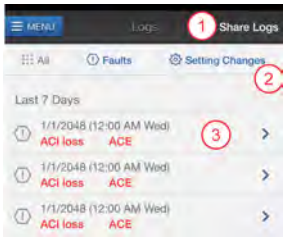
1. Commissioning guide to setup parameters
2. **Start-up reports:** to capture active status and parameters in a pdf.
3. **All Settings:** provides listing of all parameters that can be individually changed.
4. **Sync Date & Time:** to update drive to match phone
5. **Configuration Templates:** to create a file with all parameters of the drive, which can be loaded onto another drive via current phone or shared to another phone.



Logs Screen

The log screen shows a list of faults with a time/date stamp.

1. **Share Logs button:** press to share faults via email or store to phone
2. **Setting Changes:** sort logs by All, Faults, or Setting Changes
3. Select individual faults for specific data and a troubleshoot guide



Drive Info Screen

1. Provides firmware and hardware information
2. **Check for Bluetooth Updates:** allows updating Bluetooth option card firmware

Reports Screen

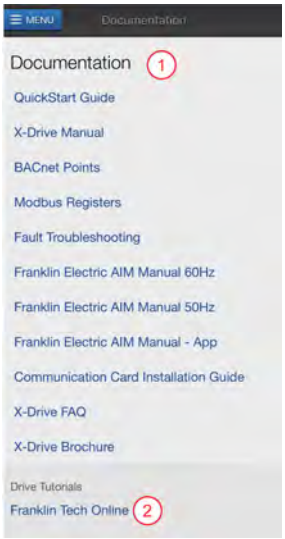
1. View reports for current location
2. **Generate New Reports:** creates reports with option of including Form 2207 for pumping applications

   NOTE: This screen can be viewed when disconnected from the drive.

Documentation Screen

1. List of documents pertinent to product and commissioning
2. **Franklin Tech Online:** Link to online video tutorial on Franklin Tech Online

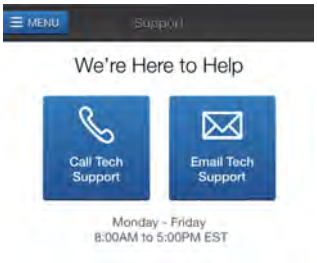
   NOTE: This screen can be viewed when disconnected from the drive.



Support Screen

Grants direct telephone or email support.

NOTE: This screen can be viewed when disconnected from the drive.



About Screen

1. **Features Overview:** provides brief description of the app
2. **Terms of Use:** the legal compliance in using the apps

NOTE: This screen can be viewed when disconnected from the drive.

Modbus Communication

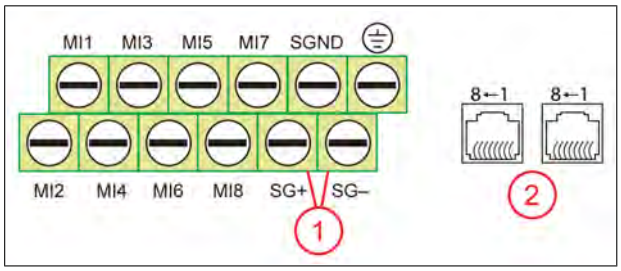
The VFD can be controlled and monitored through the Modbus RTU protocol over an RS-485 connection. Modbus follows a simple client-server model. Server devices perform data read/write requests which are issued from a client device such as a Programmable Logic Controller (PLC) or Building Management System (BMS). Assignable addresses for server devices range from an address of 1 to a theoretical maximum of 247.

As a server device, the VFD communicates all data using only 16-bit holding registers. Addressing for the registers is partitioned into blocks that are multiples of 100 to group functionally similar data. If the drive is configured to accept commands via remote communications, it can be commanded to start, stop, run at a specified output frequency, target a setpoint in PID control, and reset faults.

For Modbus addresses, refer to "ModBus Commands and Data Addresses" on page 121.

X-Drive Configuration for Modbus

Use the X-Drive's internal COM1 Port to connect to a Modbus network. COM1 can be accessed either through terminals SG+ and SG– (1) or through one of the RJ45 connectors (2). RJ45 pins 4 and 5 are connected in parallel with SG+ and SG– and pins 3 and 6 are parallel with SGND and Ground.



The X-Drive can also communicate with a Modbus network through Ethernet if an accessory Ethernet Communication card is installed in the VFD. Refer to "Optional Extension Cards" on page 131.

Communication Parameters Setup

Parameter	Display Name	Description
PLC–23	PLC Com Type	Set to **0_Modbus 485**. This enables Modbus on COM1 with the format RTU 8, N, 1. When Modbus is enabled, BACnet communication, and PLC communication are disabled on COM1.
Comm–00	COM1 Address	If the AC motor drive is controlled by RS-485 serial communication, the communication address for this drive must be set via this parameter and each AC motor drive's communication address must be different.
Comm–01	COM1 Speed	This parameter is for selecting the RS485 communication transmission speed. Set 4.8K, 9.6K, 19.2K, 38.4K, 57.6K and 115.2K. **NOTE:** If the value is not one of these 6 types, it is replaced by 9.6K.
Comm–02	COM1 Loss	Sets the action when communication errors occur.
Comm–03	COM1 Loss Delay	Setting for communication timeout detection.
Comm–04	COM1 Protocol	RS485 Protocol: Data Bits - Parity - Stop Bits - Message Format.
Comm–05	Response Delay	Duration VFD waits before responding to received communication.
Comm–06	Main Frequency	When **Auto Speed Ref [SET-07]** is set to RS485 Interface, the last frequency command is stored in this parameter. After rebooting from an abnormal turn-off or momentary power loss, the VFD continues operation with last frequency.

System Parameters Setup

Parameter	Display Name	Description
SET–60	HOA Mode Source	Set to **2_RS485 Serial**. This enables Modbus to switch between Hand and Auto modes.
SET-07	Auto Speed Ref	Set to **5_RS485 Serial**. This enables Modbus to control the speed when in Auto mode.
SET-08	Auto Run Cmd	Set to **2_RS485 Serial**. This enables Modbus to initiate a Run Command in Auto mode.
SET-09	Hand Speed Ref	Set to **1_RS485 Serial**. This enables Modbus to control the speed when in Hand mode.
SET-10	Hand Run Cmd	Set to **2_RS485 Serial**. This enables Modbus to initiate a Run Command in Hand mode.

ModBus Commands and Data Addresses

ModBus	Display Name
8192	Run Command
8193	Frequency Command
8194	Fault/Control Command
8448	Error Code
8449	Operation Status
8450	Frequency Command Value
8451	Output Frequency
8452	Output Current
8453	DC-Bus Voltage
8454	Output Voltage
8455	Multi-Step Speed
8456	Reserved
8457	Counter Value
8458	Power Factor Angle
8459	Torque
8460	Motor Speed
8461	Reserved
8462	Reserved
8463	Output Power
8470	Multi-Function Display
8475	Maximum Operating Frequency
8479	Decimal Portion of Output Current
8704	Output Current
8705	Counter Value
8706	Output Frequency
8707	DC-Bus Voltage
8708	Output Voltage
8709	Power Angle
8710	Motor Power
8711	Motor Speed
8712	Torque
8713	Reserved
8714	PID Feedback Value
8715	AVI1 Input Value Percentage
8716	ACI Input Value Percentage
8717	AVI2 Input Value Percentage
8718	IGBT Temperature
8719	Ambient Temperature
8720	Digital Input Status
8721	Digital Output Status
8722	Multi-Step Speed Being Executed
8723	CPU Pin Status for Digital Inputs
8724	CPU Pin Status for Digital Outputs
8725	Reserved
8726	Reserved
8727	Reserved

ModBus	Display Name
8728	Reserved
8729	Counter Overload Time Percentage
8730	GFF Percentage
8731	DC Bus Ripple
8732	PLC Register D1043 Data
8733	Reserved
8734	User Page Display
8735	Output Value of Output Frequency Coefficient Calculation
8736	Number of Motor Revolutions While Running
8737	Operating Position of the Motor
8738	VFD Cooling Fan Speed
8739	Control Mode
8740	Carrier Frequency Status
8741	Reserved
8742	Drive Status
8743	Reserved
8744	Reserved
8745	Power
8746	AVI1–PT100
8747	ACI-PT100
8748	Reserved
8749	Reserved
8750	PID Reference Value
8751	PID Offset Value
8752	PID Output Frequency
8753	Hardware ID
8754	U-phase Current
8755	V-phase Current
8756	W-phase Current
8759	Aux Analog Input
8762	Torque %
9729	Digital Input Status
9730	Digital Input Status Continued
9793	Digital Output Status
9825	AVI1 Proportional Value
9826	ACI Proportional Value
9827	AVI2 Proportional Value
9835	Expansion Card AI10 Percentage
9836	Expansion Card AI11 Percentage
9856	AO1 %
9857	AO2 %
9889	AFM1 Output Proportional Value
9890	AFM2 Output Proportional Value
9899	Expansion Card AO10 Percentage
9900	Expansion Card AO11 Percentage

Building a Modbus Control Command Number Scheme

If all the values of the register are known, it is possible to write a specific number scheme based on the separated bits.

NOTE: These directions are only for the simple editing and building of a number scheme. A slightly deeper understanding of the scheme is needed to keep only some of the setting values while applying the others.

Operation Command (8192 decimal)

To build the number for the operation command, pick one value from each of the six selection tables below. Then sum the choices together to create the final number to be loaded to the register.

Selection 1: Run Command

Option	Value
No Function	0
Stop	1
Run	2
JOG+Run	3

Selection 2: Direction

Option	Value
No Function	0
FWD	8
REV	16
Change Direction	24

Selection 3: Acceleration / Deceleration Time

Option	Value
1st Accel / Decel Time	0
2nd Accel / Decel Time	64
3rd Accel / Decel Time	128
4th Accel / Decel Time	192

Selection 5: Enable Speed Selection

Option	Value
Not Enabled	0
Enabled	4096

Selection 4: Speed Selection

Option	Value
Main Speed	0
1st Speed	256
2nd Speed	512
3rd Speed	768
4th Speed	1024
5th Speed	1280
6th Speed	1536
7th Speed	1792
8th Speed	2048
9th Speed	2304
10th Speed	2560
11th Speed	2816
12th Speed	3072
13th Speed	3328
14th Speed	3584
15th Speed	3840

Selection 6: Control Command Selection

Option	Value
No Function	0
Operation command controlled by PU	8192
Operation command by parameter setting	16384
Switch between PU and parameter setting	24576

Example 1

Selection	Option	Value
Command	Run	2
Direction	FWD	8
Accel Time	2nd Accel	64
Speed Selection	Main Speed	0
Enable Speed	Not Enabled	0
Control Command Selection	No Function	0
Final Register Number:		2+8+64+0+0+0 = **74**

Example 2

Selection	Option	Value
Command	Stop	1
Direction	REV	16
Accel Time	3rd Accel	128
Speed Selection	3rd Speed	768
Enable Speed	Enabled	4096
Control Command Selection	No Function	0
Final Register Number:		1 + 16 + 128 + 768 + 4096 + 0 = **5009**

Example 3

Selection	Option	Value
Command	JOG+Run	3
Direction	FWD	8
Accel Time	2nd Accel	64
Speed Selection	1st Speed	256
Enable Speed	Enabled	4096
Control Command Selection	No Function	0
Final Register Number:		3 + 8 + 64 + 256 + 4096 + 0 = **4427**

Frequency Command (8193 decimal)

For a value for the frequency command, enter the desired frequency x 100.

- For example: to enter a frequency of 60.00 Hz, enter 60000.
- The minimum value is 0, where the maximum is 65535.

Fault Reset (8194 decimal)

To build the number for the VFD Fault/Control command, pick one value the table to create the number to be loaded to the register.

Option	Value
Disable	0
EF Active (external fault)	1
Reset Fault	2
b.b. Active	4
HAND-ON/LOC-ON command	8
AUTO-ON/REM-ON command	16
Fire-Mode ON	32

Keypad Function (8197 decimal)

To build the number for the keypad function command, pick one value from each of the two selection tables below. Then sum the choices together to create the final number to be loaded to the register.

Selection 1: Parameter Management

Option	Value
Start to Copy Write parameters	3
Copy failed	4
Copy completed	5
Start to Copy Read of All parameters	8
Low Byte No Function	255

Selection 2: Multi-language

Option	Value
No Selection	0
English	256
Spanish	512
French	768
German	1024
Italian	1280

PID Reference (8202 decimal)

To build the number for the PID reference command, enter the desired value.

- Minimum entry = 1
- Maximum entry = 65535

Read-Only Values

Operation Status (8449 decimal)

To read the number:

1. Pick the value in Selection 1 that is closest to the register number without going over.
2. Subtract the value.
3. Repeat picking the values in the other selections that are closest to resulting number without going over until final value is 0.

Selection 1:

Option	Value
Factory parameters opened	32
Operation command Controlled by external terminal	128
Main Freq. Controlled by communication	256
Main Freq. Controlled by external terminal(AI)	512
Operation command Controlled by Communication	1024
Parameters been locked	2048
AC drive run	4096
Jog command	8192

Selection 2: REV Command

Option	Value
REV LED Off, FWD LED On (Forward)	0
REV LED Blink, FWD LED On (Reverse to Forward)	8
REV LED On, FWD LED Blink (Forward to Reverse)	16
REV LED On, FWD LED Off (Reverse)	24

Selection 3: Run Command

Option	Value
RUN LED Off, STOP LED On	0
RUN LED Blink, STOP LED On	1
RUN LED On, STOP LED Blink	2
RUN LED On, STOP LED Off	3
JOG Active	4

Example

Register number = **273**

1. Selection 1 closest value = 256 (**Operation commanded Controlled by Communication**)
2. 273 — 256 = **17**
3. Selection 2 closest value = 16 (**REV LED On, FWD LED Blink (Forward to Reverse)**)
4. 17 — 16 = **1**
5. Selection 3 value = 1 (**RUN LED Blink, STOP LED On**)
   - 1 — 1 = **0**

Error and Warning Codes (8448 & 8472 decimal)

- To read the number, pick the value that is closest to number without going over.
  - For Error Codes, the minimum value is 1 and the maximum value is 255.
  - For Warning Codes, the minimum value is 256 and the maximum value is 65280.
- Subtract the value.
- Repeat picking the value that is closest to number without going over until final value is 0.

Action Indicators (8473 decimal)

To read the number:

1. Pick the value in Selection 1 that is closest to the register number without going over.
2. Subtract the value.
3. Repeat picking the values in the other selections that are closest to resulting number without going over until final value is 0.

Selection 1: HOA Mode

Option	Value
HOA mode OFF	8192
HOA mode HAND-ON	16384
HOA mode AUTO-ON	32768

Selection 2: Additional Action State Options

Option	Value
Operation command Controlled by external terminal	128
Main Freq. Controlled by communication	256
Main Freq. Controlled by external terminal(AI)	512
Operation command Controlled by Communication	1024
Parameters been locked	2048
Copy Command enable	4096

Selection 3: REV Command

Option	Value
REV LED Off, FWD LED On (Forward)	0
REV LED Blink, FWD LED On (Reverse to Forward)	8
REV LED On, FWD LED Blink (Forward to Reverse)	16
REV LED On, FWD LED Off (Reverse)	24

Selection 4: Run Command

Option	Value
RUN LED Off, STOP LED On	0
RUN LED Blink, STOP LED On	1
RUN LED On, STOP LED Blink	2
RUN LED On, STOP LED Off	3
JOG	4

Example

Register number = **16530**

1. Selection 1 closest value = 16384 (**HOA mode HAND-ON**)
2. 16530 — 16384 = **146**
3. Selection 2 closest value = 128 (**Operation command Controlled by external terminal**)
4. 146 — 128 = **18**
5. Selection 3 closest value = 16 (**REV LED On, FWD LED Blink (Forward to Reverse)**)
6. 18 — 16 = **2**
7. Selection 4 closest value = 2 (**RUN LED On, STOP LED Blink**)
8. 2 — 2 = **0**

BACnet Communication

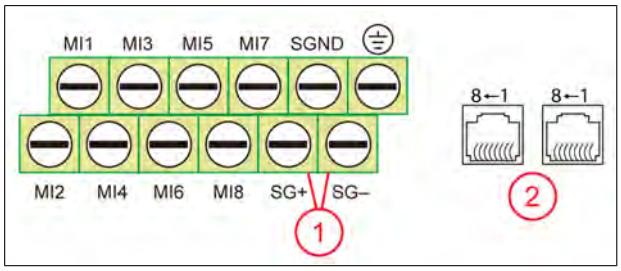
The VFD can be controlled and monitored through the BACnet MS/TP protocol over an RS-485 connection. The VFD operates as an MS/TP master device, for which the protocol can support addressing for up to 128 master devices in a single MS/TP network.

BACnet conveys control and monitoring data as a collection of BACnet objects. The X-Drive BACnet protocol supports 3 object types: Device, Analog Value (AV), and Binary Value (BV). The Read Property and Write Property services can be used to interface to these objects. If the drive is configured to accept commands via remote communications, it can be commanded to start, stop, run at a specified output frequency, target a setpoint in PID control, and reset faults.

X-Drive Configuration for BACnet

Use the X-Drive's internal COM1 Port to connect to a BACnet network. COM1 can be accessed either through terminals SG+ and SG– (1) or through one of the RJ45 connectors (2). RJ45 pins 4 and 5 are connected in parallel with SG+ and SG– and pins 3 and 6 are parallel with SGND and Ground.

To enable BACnet communications, set the following parameters:



Communication Parameters Setup

Parameter	Display Name	Description
PLC-23	PLC Com Type	Set to **1_BACnet**. This enables BACnet on COM1 with the format RTU 8, N, 1. When BACnet is enabled, Modbus communication, and PLC communication are disabled on COM1.
Comm-24	BACnet MAC ID	Set to BACnet's MS/TP station number. Default = 10. Range = 0 to 127.
Comm-25	BACnet Speed	Set to the BACnet communication baud rate. Default = 38400. Range = 9600, 19200, 38400, or 76800 bps.
Comm-26 & Comm-27	Device ID Lo & Device ID Hi	The combination of these two parameters is the Device Object Identifier. **[Comm–26]** is usually set as the unique device number in the trunk. **[Comm– 27]** is usually set to the trunk or building floor number. Refer to "BACnet Device ID Setup" on page 127.
Comm-28	Max Address	This is the maximum number of Master nodes available in the trunk. Communications are faster if the setting is equal or close to the actual number of Master devices.
Comm-29	Password	Enter the BACnet password. If setup is successful, the keypad displays 8888.

System Parameters Setup

Parameter	Display Name	Description
SET-60	HOA Mode Source	Set to **2_RS485 Serial**. This enables BACnet to switch between Hand and Auto modes.
SET-07	Auto Speed Ref	Set to **5_RS485 Serial**. This enables BACnet to control the speed when in Auto mode.
SET-08	Auto Run Cmd	Set to **2_RS485 Serial**. This enables BACnet to initiate a Run Command in Auto mode.
SET-09	Hand Speed Ref	Set to **1_RS485 Serial**. This enables BACnet to control the speed when in Hand mode.
SET-10	Hand Run Cmd	Set to **2_RS485 Serial**. This enables BACnet to initiate a Run Command in Hand mode.

BACnet Device ID Setup

The BACnet Device Object Identifier is the combination of **Device ID Lo [Comm-26]** and **Device ID Hi [Comm-27]**, used as a unique device number in the trunk. It must be within a range of 0 to 4194303.

The calculation of the BACnet Device ID is **[Comm-27]** *1000 + **[Comm-26]**.

NOTE: If user sets value outside of range, then device ID value is set to maximum value, which is 4,194,303.

Parameter Setup:

Parameter	Display Name	Description
Comm-26	Device ID Lo	A unique device number in the trunk. Range = 0 to 999
Comm 27	Device ID Hi	Set to the trunk or building floor number. Range = 0 to 4194.

For example, to set a Device ID of 789888:

- The lower three digits are **Device ID Lo [Comm-26]**; therefore, **[Comm-26]** = 888.
- The upper digits are **Device ID Hi [Comm-27]**; therefore, **[Comm-27]** = 789.

BACnet Objects

Commandable Analog Value Objects

Object Number	R/W	Object Name	Object Description	Unit
AV 000	RW	Reserved	-	-
AV 001	RW	FreqRefValue	Frequency Reference Value	Hz
AV 002 through AV 010	RW	Reserved	-	-
AV 011 through AV 026	RW	Block Transfer	Block transfer mapping 1 to 16	Dependent

Status Analog Value Objects (Read Only)

Object Number	R/W	Object Name	Object Description	Unit
AV 027 through AV 030	R	Reserved	-	-
AV 031	R	Output Frequency	Output Frequency Value	Hz
AV 032 through AV 034	R	Reserved	-	-
AV 035	R	Output Torque	Output Torque	%
AV 036 through AV 038	R	Reserved	-	-
AV 039	R	Status Word	VFD Status Word from BV 16 through BV 31	-
AV 040	R	Reserved	-	-
AV 041	R	Drive Type Code	Drive Type Code	-
AV 042	R	Warning Code	Warning/Alarm Code	-
AV 043	R	Error Code	Error/Fault Code	-
AV 044	R	Output Current	Output/Motor Current	Amperes
AV 045	R	DC Bus Voltage	DC Bus Voltage	VDC
AV 046	R	Output Voltage	Output Voltage	VAC
AV 047	R	Count Value	Accumulated TRG DI Counter Value	-
AV 048	R	Power Factor	Output Power Factor	-
AV 049	R	Output Power	Output Power	kW
AV 050	R	IGBT Temperature	IGBT Temperature	°C
AV 051	R	Caps Temperature	DC Bus Capacitors Temperature	°C
AV 052	R	Carrier Frequency	Actual Carrier Frequency	kHz
AV 053	R	PID F/B Value	PID Feedback Value	%
AV 054	R	Overload Rate	Overload Value	%
AV 055	R	GND Fault Level	Ground Fault Trip Level	%
AV 056	R	DC Bus Ripples	DC Bus Ripples Amplitude	Volts

Object Number	R/W	Object Name	Object Description	Unit
AV 057	R	Fan Speed	VFD Cooling Fan Speed	%
AV 058	R	Motor Speed	Actual Motor Speed	RPM
AV 059	R	kWh	Kilowatts per hour	kWh
AV 060	R	Step Frequency	Step Frequency ID number	-
AV 061	R	AVI1 Input Value	AVI1 Analog Input Reading	%
AV 062	R	ACI Input Value	ACI Analog Input Reading	%
AV 063	R	AVI2 Input Value	AVI2 Analog Input Reading	%
AV 064	R	Digital IN Status	Digital Inputs Status **[IO-46]**	-
AV 065	R	Digital OUT Status	Digital Outputs Status **[IO-58]**	-
AV 066	R	CPU DI Pin Status	CPU Pins from Digital INs Status	-
AV 067	R	CPU DO Pin Status	CPU Pins to Digital OUTs Status	-
AV 068	R	PLC D1043 Status	PLC Register D1043 Status	-
AV 070	R	ULD Recover Counter	**[SET-46]** ULD Recover Counter Display	-
AV 071	R	HLD Recover Counter	**[SET-52]** HLD Recover Counter Display	-

Commandable Binary Value Objects

Object Number	R/W	Object Name	Object Description
BV 000	RW	Freq Active CMD	0_Frq CMD=0Hz 1_Frq CMD=FreqRefValue
BV 001	RW	FWD/REV CMD	0_Forward 1_Reverse
BV 002	RW	Reserved	-
BV 003	RW	Stop CMD	0_None 1_Stop (Decelerate to 0Hz)
BV 004	RW	Hold SPD	0_None 1_Stay at Current Frequency
BV 005	RW	Reserved	-
BV 006	RW	Q-Stop CMD	0_None 1_Quick Stop
BV 007	RW	Power Out CMD	0_Power OFF (Coast to Stop) 1_Power ON (Run)
BV 008 through BV 014	RW	Reserved	-
BV 015	RW	Reset	0_None 1_Reset Fault

Status Binary Value Objects

Object Number	R/W	Object Name	Object Description
BV 016	R	At CMD Freq	0_Out Frq ? CMD Frq1_Out Frq = CMD Frq
BV 017	R	Direction	0_Forward 1_Reverse
BV 018	R	Warning	0_None 1_Warning Active
BV 019	R	Error/Fault	0_None 1_Error/Fault Active
BV 020 through BV 021	R	Reserved	-
BV 022	R	Q-Stop Mode	0_No QSTOP 1_Occur QSTOP
BV 023	R	SerovPower STATE	0_Power Off 1_Power On
BV 024 through BV 031	R	Reserved	-
BV 032	R	ULD Fault	0_No Fault 1_Under Load Triggered (ULD)
BV 033	R	HLD Fault	0_No Fault 1_High Load Triggered (HLD)
BV 034	R	Broken Pipe	0_ No Fault 1_ Broken Pipe Fault
BV 035	R	Pipe Leak	0_ No Fault 1_ Pipe Leak Fault
BV 036	R	Signal Loss	0_ No Fault 1_ Signal Loss Fault
BV 037	R	Overpressure	0_ No Fault 1_ Overpressure Fault
BV 038	R	Damper Fault	0_ No Fault 1_ Damper Fault
BV 039	R	No-Flow Fault	0_ No Fault 1_ No-Flow Fault
BV 040	R	Fireman's Override	0_ Normal Mode 1_ Fireman's Override Mode
BV 041	R	Shutdown Mode	0_ Normal Mode 1_ Shutdown Mode
BV 042	R	Pipe Fill Mode	0_ Normal Mode 1_ Pipe Fill Mode
BV 043	R	Sleep Mode	0_ Normal Mode 1_ Sleep Mode
BV 044	R	HOA in OFF	0_ HOA not in OFF 1_ HOA is in OFF
BV 045	R	HOA in Auto	0_ HOA not in Auto 1_ HOA is in Auto
BV 046	R	HOA in Hand	0_HOA not in Hand 1_ HOA is in Hand
BV 047	R	Stopped by AI Level	0_Normal Control 1_Stopped by Analog Input Level
BV 048	R	Frequency Limit by AI	0_Normal Freq. Limit 1_ Freq. Limit by Analog Input Level

ACCESSORIES

Optional Extension Cards

⚠ WARNING

Contact with hazardous voltage could result in death or serious injury.

- Disconnect and lock out all power before installing or servicing equipment.
- Use extreme caution and take necessary safety measures if opening the cover at any time while drive is powered.

A selection of accessory extension cards is available to add additional functionality to the X-Drive, including:

CMC-FECBT01 X-Drive FE Connect Communication Card: This card adds Bluetooth communication to the drive, providing the ability to program, control, and monitor the VFD using the X-Drive FE Connect mobile application. When the card is installed, and the drive is powered on, parameter **Com Card ID [Comm-30]** should identify **13_FELE BT Card**. Refer to "FE Connect for Cerus X-Drive Mobile Application" on page 115 to connect the mobile app to the drive.

CMC-EIP01 Ethernet Communication Card: This card support Ethernet IP and Modbus TCP protocols. To install the card into the VFD, refer to "Extension Card Installation" on page 133 and "Setup Optional Ethernet Communication Card" on page 136. Refer to "Modbus Communication" on page 120 for additional parameters and configuration information.

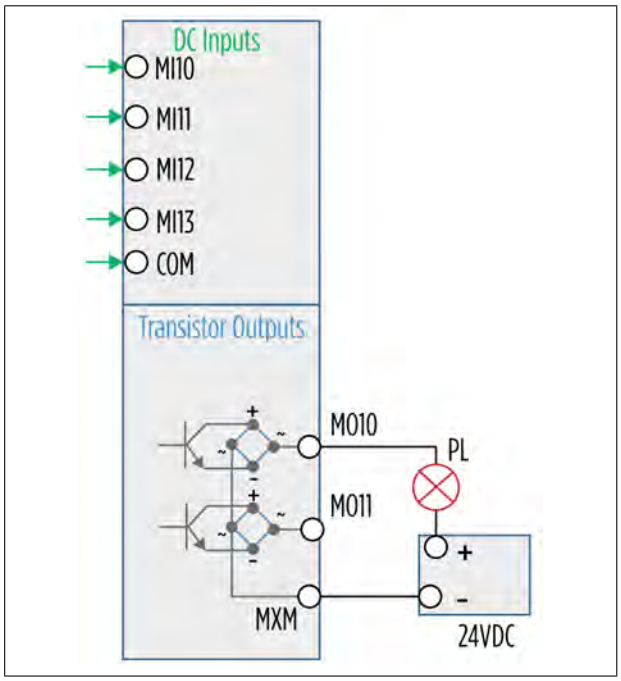
Once configured, the LED Indicators give the status of the network, parameters, and VFD power:

LED	Light Status	Indication	Required Action
NS	Green & red alternate	Network self-test mode	None
	Solid green	CIP connection established	None
	Blinking green	No CIP connection at power-on	None
	Solid red	IP duplicate / conflict	Check IP Settings
	Blinking red	COMMS loss / Time-out	Check COMMS setting
	OFF	No connection to network	Check network connection
MS	Green & red alternate	Drive in self-test mode	None
	Solid green	Parameters are set	None
	Blinking green	Parameters are not yet set	Finish setting parameters
	Solid red	VFD hardware failure	Check with FE support
	Blinking red	VFD/COMMS card error	Check parameters setting
	OFF	No power	Check if VFD is powered
Power	ON	Power is normal	None
	OFF	No power	Check if VFD is powered
Link	ON	Transmit/receive is normal	None
	OFF	No connection to network	Check network connection

EMC-D42A Extension DC I/O Card: This card adds four Digital Inputs, (**MI10–MI13**) with COM common terminal and two polarity insensitive Transistor Outputs with MXM common terminal.

MI10–MI13 inputs functionality is programmable through parameters **[Option–00]** to **[Option-03]**. Ratings are the same as VFD inputs MI1–MI8. The COM terminal should be connected the same way as VFD COM terminal. For default VFD DIs configuration it should be connected to +24V terminal.

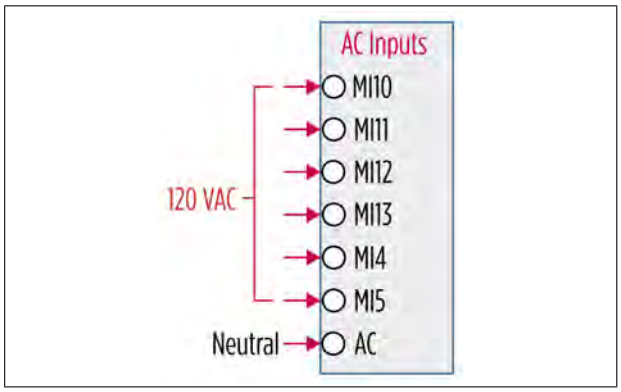
MO10–MO11 outputs functionality is programmable through **[Option–00]** to **[Option-03]**. Ratings are 48 VDC at 50 mA maximum. The MXM terminal should be connected to the common terminal of external power source and **MO10** and **MO11** to the load (Example: PL pilot light on the diagram).



EMC-611A Extension AC Input Card: This card adds six Digital Inputs, (**MI10–MI15**) with AC common terminal (Neutral).

MI10–MI13 inputs functionality is programmable through parameters **[Option–00]** to **[Option-05]**.

Ratings are 100-130VAC, 47-63Hz, 27k impedance. Response time for ON is 10ms and for OFF is 20ms.

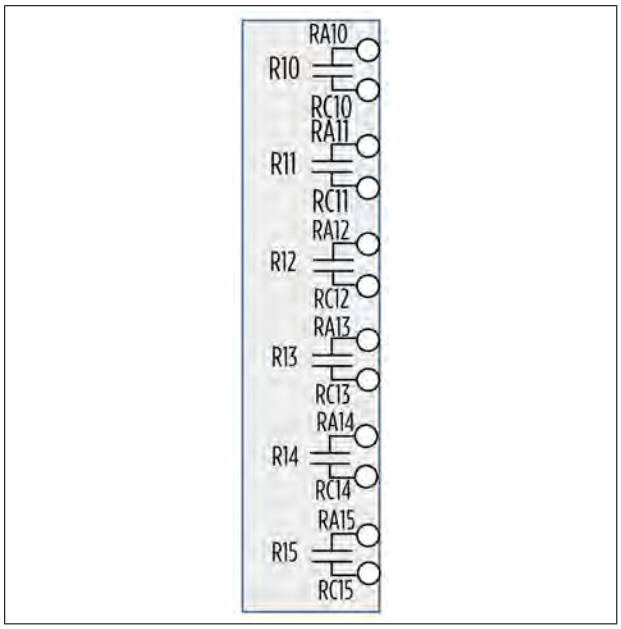


EMC-R6AA Extension Relay Card: This card adds six Relay Outputs, R10–R15 with SPST (single-pole singlethrow) form A (N.O.) contacts.

R10–R15 relay functionality is programmable through parameters **[Option–06]** to **[Option-16]**.

Contact ratings for:

- Resistive load 3A at 250VAC and 5A at 30VDC
- Inductive load (COS 0.4) 1.2A at 250VAC and 2A at 30VDC



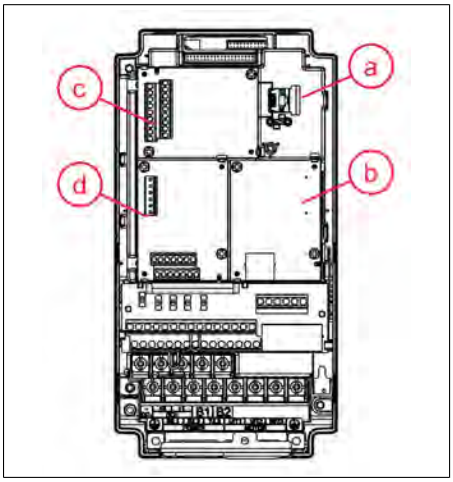
Extension Card Installation

⚠ WARNING

Risk of bodily injury or damage to drive or other equipment. Contact with hazardous voltage could result in death or serious injury.

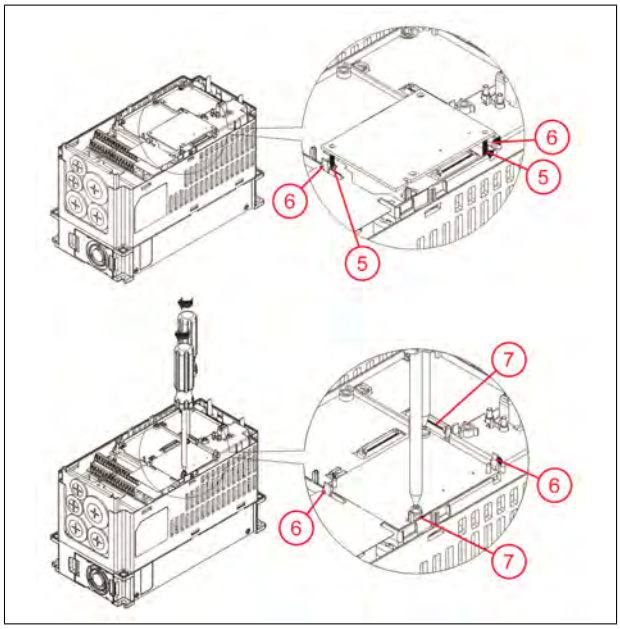
- Disconnect and lock out all power before installing or servicing equipment.
- Capacitors inside the drive can still hold lethal voltage even after power has been disconnected. ALWAYS check if DC bus charge LED is off and DC voltage on the terminals DC (+1) and DC (-) is less than 30VDC before working on VFD wiring. The DC bus capacitors may hold high-voltage charge for several minutes after the VFD power is disconnected.
- Extension cards cannot be replaced with power applied. Damage to VFD may occur.

1. Remove power from the drive and wait until voltage has safely discharged from the DC bus.
2. Remove the digital keypad.
3. Remove the front cover. Refer to "Frame Covers" on page 134.
4. Locate slot for card installation.
   a. RJ 45 socket for digital keypad
      - For a CMC-EIP01 Ethernet Communication Card, connect the communication cable to this port.
   b. Communications card slot: Bluetooth or Ethernet
   c. Input/Output extension card slot
   d. Not currently used



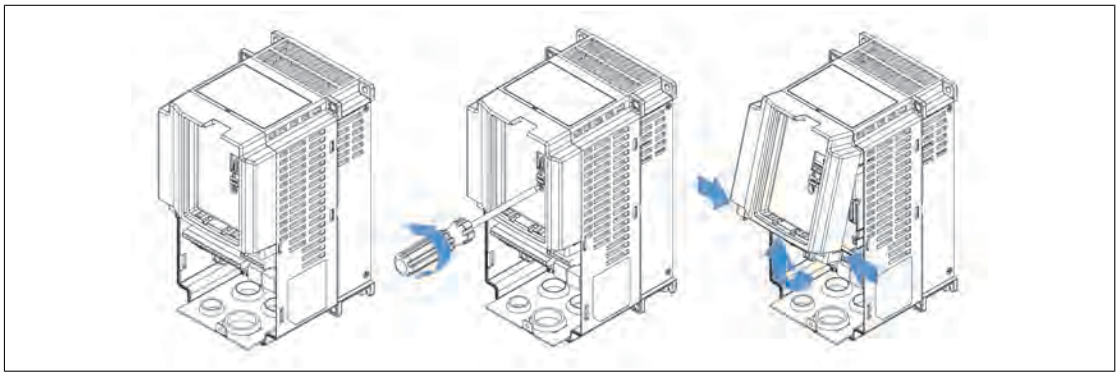
5. Align holes in card over the positioning pins.
6. Press down on the card until retaining clips snap into place.
7. When clips are secure, install retaining screws and tighten to a torque of 6-8 kg-cm / 5.2-7 in-lbs / .59-.79 Nm.

   IMPORTANT: Once an extension card has been installed, it must be activated to be recognized by the system. The activation procedure differs depending on the type of card. For more information, refer to "Optional Extension Cards" on page 131.

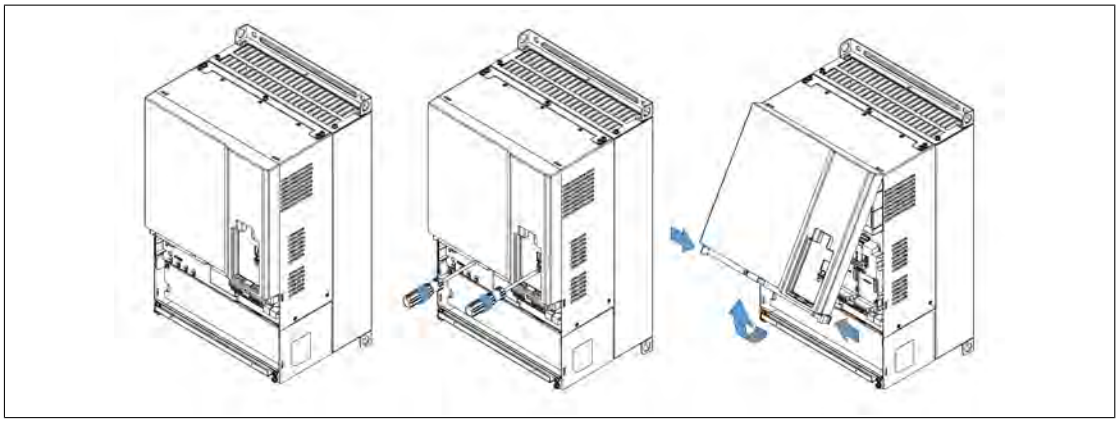


Frame Covers

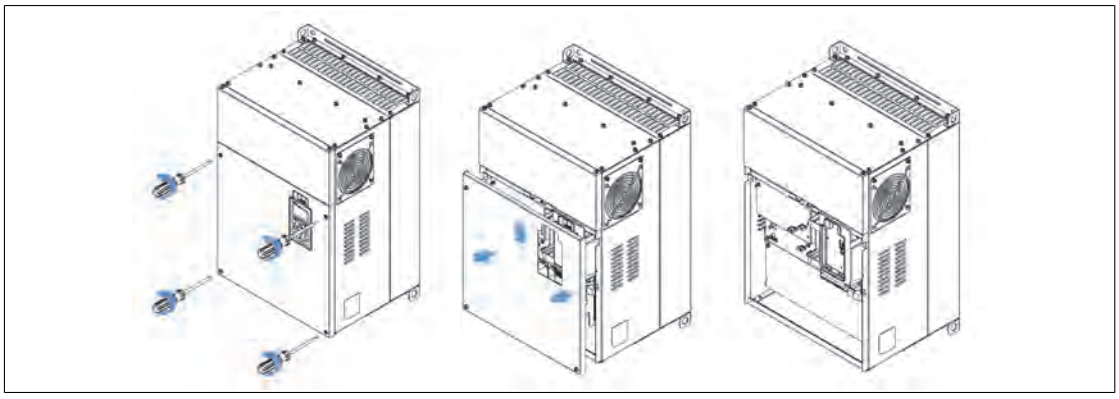
Frame A through C



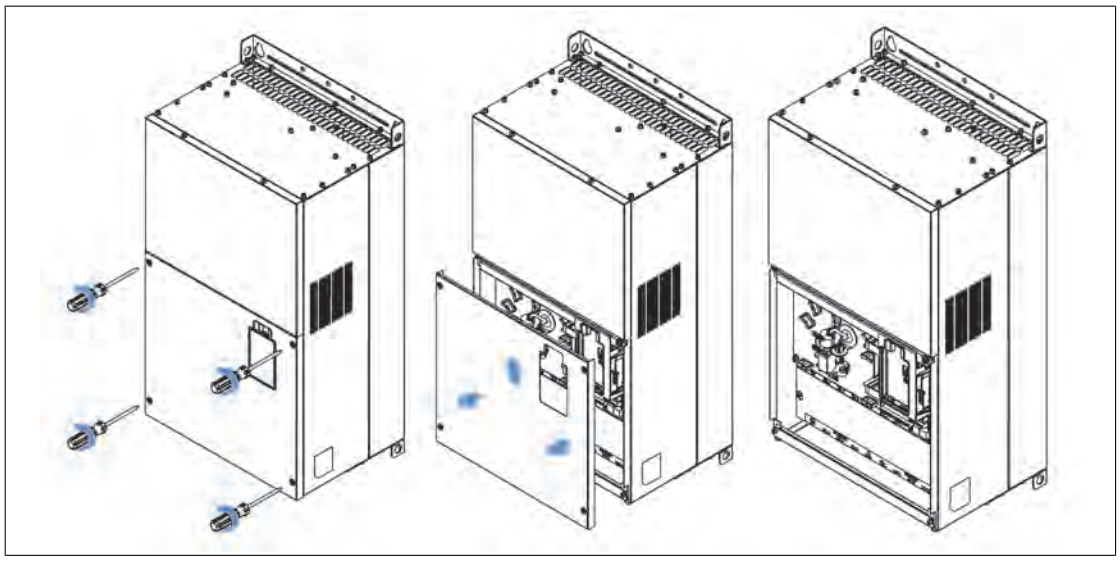
Frame D



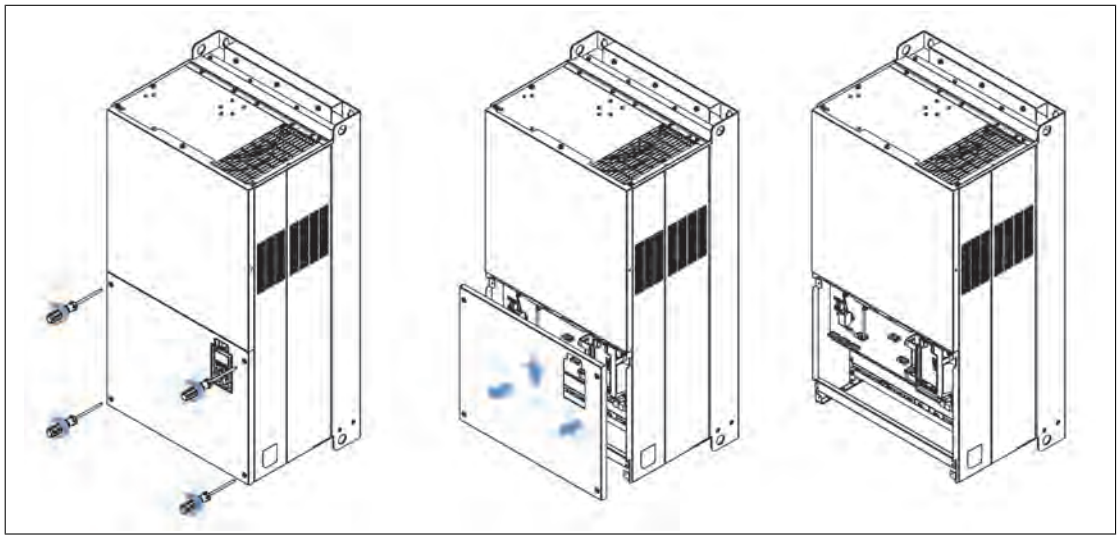
Frame E



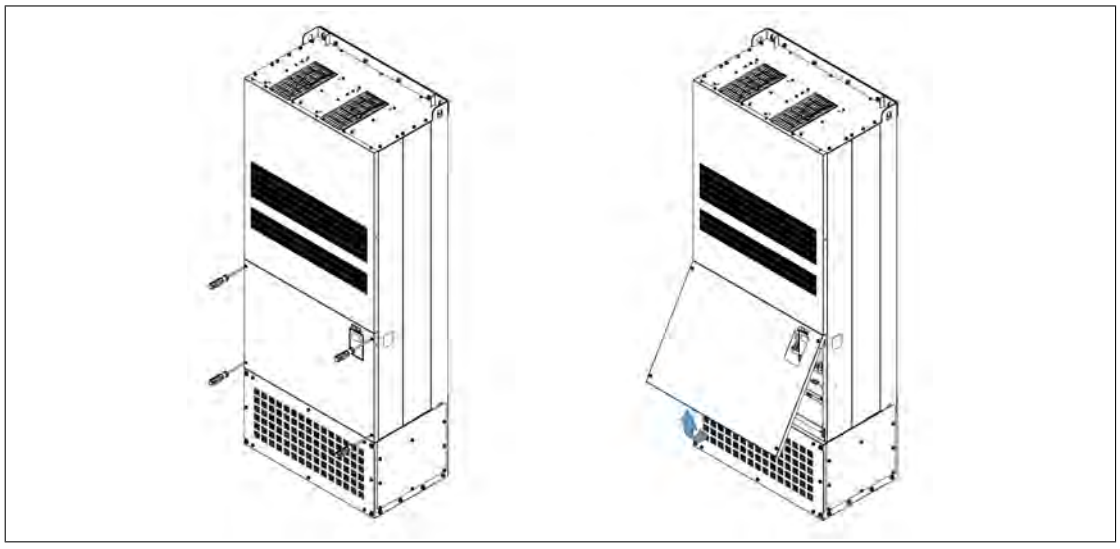
Frame F



Frame G



Frame H



Setup Optional Ethernet Communication Card

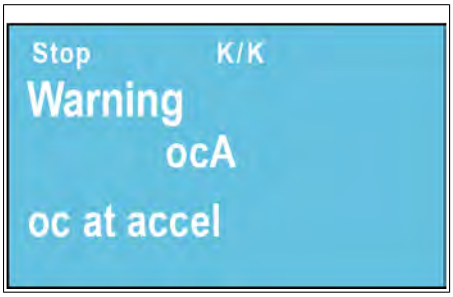
1. Install the card following the instructions in "Extension Card Installation" on page 133.
2. Verify card detection.
   - Check **Com Card ID [Comm–30]** to determine whether a Communications Card has been installed and recognized by the drive. A value of **0_No Com Card** indicates that a card has not been detected.
   - To activate the card in the drive, set **Comm Card [Comm–55]** to **2h (bit 1 on)**. This detects the installed card and automatically change **[Comm–30]** to **5_Ethernet/IP**.
3. Download card values to the drive.
   - Set **MBus Card Reset [Comm–52]** to **1_Enable**. This populates default values from the card into the appropriate drive parameters. For example:
     – IP Address: 192.168.1.5 to **[Comm–38]** to **[Comm-41]**
     – Address Mask: 255.255.255.0 to **[Comm–42]** to **[Comm-45]**
     – Gateway Address: 192.168.1.1 to **[Comm–46]** to **[Comm-49]**

     NOTE: When complete, **[Comm–52]** automatically returns to **0_Disable**.
4. Adjust settings as required for the network and upload to card.
   - Use **[Comm–38]** to **[Comm-49]** to set each address segment.
   - When complete, set **MBus TCP Config [Comm–53]** to **2_I-net Par On**. This loads the new addresses to the card, enabling communication with the network.

MAINTENANCE

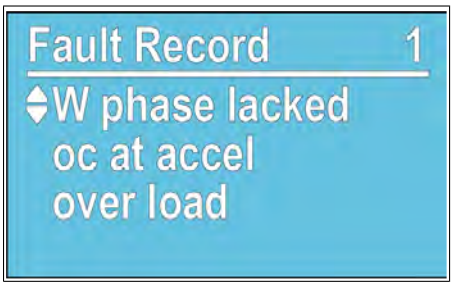
Troubleshooting

Error Messages: When the drive detects a fault or warning, an error message displays on the screen showing the current problem condition. In some cases the fault can be cleared by pressing the **STOP/RESET** button.



Fault Records: In addition, the drive records up to 30 of the most recent faults. These can be accessed by pressing the **F3** key. Use the arrow keys to scroll through the list. For more information about a selected fault, press the **ENTER** key to display details about the occurrence, including date, time, output frequency, output current, and other related data.

NOTE: Fault records can also be located through **[PROT-51]** to **[PROT-56]**, or by pressing **MENU**, **BACK**, or **DOWN**, or **FAULT**.



Diagnostic Fault Codes

Fault Display	Description	
ACE (48) ACI loss	Analog current input loss, including all 4-20 mA and 2-10V signals.	
Action and Reset		
Action Level	When the analog input is below **ACI Loss Level [IO-02]** (only detects 4-20 mA and 2-V inputs).	
Action time	After **ACI Loss Delay [IO-03]**	
Related parameters	**ACI Loss Trip [IO-01]**; **ACI Loss Level [IO-02]**; **ACI Loss Delay [IO-03]**	
Reset method	Auto	When **[IO-01]** is set to **1_Hold Speed** or **4_At AI Loss Freq**, action is Warning. When signal is > 4 mA > 2V, fault clears.
	Manually	When **[IO-01]** is set to **3_Trip Stop**, action is Fault and must be reset.
Reset condition	Immediately	
Recorded	When **[IO-01]** is set to **3_Trip Stop**, Fault is recorded.	
Possible Causes	**Corrective Action**	
• Loose or broken connection • Sensor failure • Drive failure	• Check the ACI wiring • Check if the ACI signal is less than 4mA (2V)	
Fault Display	**Description**	
ACE (88) AVI loss	Analog voltage input loss (2-10V signal)	

Action and Reset		
Action level	When the analog input is below **AVI1 Loss Level [IO-07]** (only detects 2-10V inputs)	
Action time	After **Loss Delay [IO-08]**	
Related parameters	**AVI1 Loss Trip [IO-06]**; **AVI1 Loss Level [IO-07]**; **AVI1 Loss Delay [IO-08]**	
Reset method	Auto	When **[IO-06]** is set to **1_Hold Speed**, **2_Stop/Start**, or **4_At Loss Freq** action is Warning. When signal is > 2V, fault clears.
	Manually	When **[IO-06]** is set to **3_Trip Stop**, action is Fault and must be reset.
Reset condition	Immediately	
Recorded	When **[IO-06]** is set to **3_Trip Stop**, Fault is recorded	
Possible Causes		**Corrective Action**
• Loose or broken connection • Sensor failure • Drive failure		• Check the AVI1 and AVI2 wiring • Check if the AVI1 or AVI2 signal is less than 2V (4mA)
Fault Display	**Description**	
ATJM (188) Anti-Jam Failed	Impeller or pump is clogged after Anti-jam operation.	
Action and Reset		
Action level	Anti-jam operation occurs twice (10 cycles) and then on next start an OL, OL3 or EOL fault occurs.	
Action time	Immediately at startup after Anti-jam operation.	
Related Parameters	**[ADV2-55]** selects Anti-jam operation.	
Reset method	Manually	
Reset condition	Fault/Warning is determined by **[ADV2-55]**.	
Recorded	Yes	
Possible Causes		**Corrective Action**
• Impeller or pump is clogged with debris • Load is larger than motor • Bad motor		• Remove debris impeller/pump • Replace and resize motor • Attempt to start motor without impeller/pump. If problem persists, replace motor

Fault Display	Description
AUE (40) **AUE 1** (142) **AUE 2** (143) **AUE 3** (144) **AUE 4** (148) Auto tuning error	 No feedback current Motor phase loss No load current Leakage inductance Error during motor auto tuning.
Action and Reset	
Action level	Hardware detection
Action time	Immediately
Related parameters	**VFD Max Freq [VFD-00]**; **VFD Base Freq [VFD-02]**; **Motor FLA (SFA) [SET-03]**; **Motor Voltage [SET-05]**; **Accel Time [SET-11]**; **Decel Time [SET-12]**
Reset method	Manually
Reset condition	Immediately
Recorded	Yes
Possible Causes	**Corrective Action**
• **STOP** pressed during tuning • Incorrect motor capacity • Accel/Decel time to short • Incorrect motor wiring • Locked rotor or motor error • Sine-filter installed	• Restart tuning. • Check motor capacity and parameter settings. • Check cabling between drive and motor. • If sine-filter is installed, remove filter for auto-tuning.
Fault Display	**Description**
bF (60) Braking fault	Brake transistor error (for models with built-in brake transistor)
Action and Reset	
Action level	Hardware detection
Action time	Immediately
Reset method	Manually
Reset condition	Immediately
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware error • EMI interference	• Check wiring and grounding for possible interference. • If error still exists after **RESET**, please call technical support.
Fault Display	**Description**
BKPI (180) Broken Pipe	Broken pipe detected in the system. The VFD must be using PID Control in Auto mode for this feature to be active
Action and Reset	
Action level	When pressure is below level and speed is above frequency setting
Action time	After **Broken Pipe Dly [SET-38]**
Related parameters	**Broken Pipe Level [SET-36]**; **Broken Pipe Freq [SET-37]**; **Broken Pipe Delay [SET-38]**
Reset method	Manually
Reset condition	Immediately, after piping has been repaired
Recorded	Yes
Possible Causes	**Corrective Action**
• Pipe broken or hole in tubing between pump and sensor • Pump sized too small • Parameters set incorrectly • Check valve above pump stuck close	• Fix break, hole, or leak in piping • Replace pump with larger one • Review functionality and change parameters for broken pipe • Unclog check valve

Fault Display	Description
CAdE (106) CAN bus Add Err	CANopen station address error
Action and Reset	
Action level	Software detection
Action time	Immediately
Reset method	Manually
Recorded	Yes
Possible Causes	**Corrective Action**
• Incorrect address setting	• Reset address

Fault Display	Description
CardiBTc (181) Internal BT	Bluetooth card error
Action and Reset	
Action level	Hardware detection
Action time	Immediately
Reset method	Manually
Related parameters	**Comm Card ID [Comm-30]**
Possible Causes	**Corrective Action**
• Improper card installation • Card ID not set • Hardware failure	• Check card installation. • Verify **[Comm-30]**. • Replace card.

Fault Display	Description
CbFE (104) **CFrE** (107) CAN bus off	 CANopen bus off error CANopen memory error
Action and Reset	
Action level	• When CANopen card is not installed or communication errors exist • If control board firmware is updated, the FRAM internal data is not changed and fault occurs
Action time	Immediately
Reset method	Manually
Reset condition	Cycle the power
Recorded	Yes
Possible Causes	**Corrective Action**
• CANopen card not installed • CANopen speed incorrect • EMI Interference • Communication cable broken • Firmware update	• Check Comm card installation • Check communications settings • Check wiring and grounding for possible interference • Make sure communication circuit is wired in series • For CFrE error, reset parameters and station address

Fault Display	Description
cd1 (33) Ias sensor Err	U-phase current detection error when power is ON
Action and Reset	
Action level	Hardware detection
Action time	Immediately
Reset method	Cycle the power
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware failure	• If error still exists after power cycle, please call Technical Support.

Fault Display	Description
cd2 (34) Ibs sensor Err	V-phase current detection error when power is ON
Action and Reset	
Action level	Hardware detection
Action time	Immediately
Reset method	Cycle the power
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware failure	• If error still exists after power cycle, please call Technical Support.
Fault Display	**Description**
cd3(35) Ics sensor Err	W-phase current detection error when power is ON
Action and Reset	
Action level	Hardware detection
Action time	Immediately
Reset method	Cycle the power
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware failure	• If error still exists after power cycle, please call Technical Support.
Fault Display	**Description**
CE2 (55) PC Err address **CE1** (54) PC Err command **CE3** (56) PC Err data **CE4** (57) PC slave fault	Data address is illegal Communication command is illegal Data value is illegal Data is written to read-only address
Action and Reset	
Action level	When the function code is not 03, 06, 10, or 63
Action time	Immediately
Related parameters	**[Comm-02]**
Reset method	Manually
Reset condition	Immediately
Recorded	No
Possible Causes	**Corrective Action**
• Incorrect communication command from the master unit • Malfunction caused by interference • Different communication setting from the master unit • Disconnection or bad connection of the cable	• Check if the communication command is correct. • Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. • Check if the setting for **[Comm-02]** is the same as the setting for the master unit. • Check the cable and replace it if necessary.

Fault Display	Description
CE10 (58) PC time out	Modbus transmission time-out occurs
Action and Reset	
Action level	When the communication time exceeds the detection time for **[Comm-03]** time-out
Action time	**[Comm-03]**
Related parameters	**[Comm-02]**
Reset method	Manually
Reset condition	Immediately
Recorded	Yes
Possible Causes	**Corrective Action**
• The upper unit does not transmit the communication command within **[Comm-03]** setting time • Malfunction caused by interference • Different communication setting from the master unit • Disconnection or bad connection of the cable	• Check if the master unit transmits the communication command within **[Comm-03]**. • Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. • Check if the setting for **[Comm-02]** is the same as the setting for the master unit. • Check the cable and replace it if necessary.
Fault Display	**Description**
cF1 (30) EEPROM write err	Internal memory cannot be programmed.
Action and Reset	
Action level	Firmware internal detection
Action time	Immediately
Reset method	Press **RESET** key; Reset all parameters to default; If error still exists, please call Technical Support.
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware failure	• If condition still exists after power restart, please call Technical Support.
Fault Display	**Description**
cF2 (31) EEPROM read err	Internal memory cannot be read.
Action and Reset	
Action level	Firmware internal detection
Action time	Immediately
Reset method	Press **RESET** key; Reset all parameters to default; If error still exists, please call Technical Support.
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware failure	• If condition still exists after power restart, please call Technical Support.

Fault Display	Description
CGdE (101) Guarding T-out	CANopen guarding error.
Action and Reset	
Action level	When CANopen Node Guarding detects that one of the followers does not respond.
Action time	Time set by upper unit.
Reset method	Manually
Reset condition	The upper unit sends a reset package to clear the fault
Recorded	Yes
Possible Causes	**Corrective Action**
• Guarding time is too short • EMI Interference • Faulting communication cable	• Increase guarding time and detection times. • Verify wiring and grounding of communication circuit. • Make sure communication circuit is wired in series. • Use CANopen cable or add terminating resistance.
Fault Display	**Description**
CHbE (102) Heartbeat T-out	CANopen heartbeat error.
Action and Reset	
Action level	When CANopen Heartbeat detects that one of the followers does not respond.
Action time	Time set by upper unit.
Reset method	Manually
Reset condition	The upper unit sends a reset package to clear the fault
Recorded	Yes
Possible Causes	**Corrective Action**
• Heartbeat time is too short • EMI Interference • Faulting communication cable	• Increase heartbeat time. • Verify wiring and grounding of communication circuit. • Make sure communication circuit is wired in series. • Use CANopen cable or add terminating resistance.
Fault Display	**Description**
CIdE (105) CAN bus Index Err	CANopen index error
Action and Reset	
Action level	Software detection
Action time	Immediately
Reset method	Manually
Reset condition	Upper unit sends a reset package to clear this fault
Recorded	Yes
Possible Causes	**Corrective Action**
• Incorrect index setting	• Reset index

Fault Display	Description	
dEb (62) Dec Energy back	Deceleration energy backup error. When **[ADV2-28]** is not disabled and power is off or momentarily off, VFD displays dEb during accel./decel. stop.	
Action and Reset		
Action level	**[ADV2-28]** is enabled and DC bus voltage is lower than VFD dEb rating.	
Action time	Immediately	
Related parameters	**dEb Mode Select [ADV2-28]**; **dEb Offset V [ADV2-27]**	
Reset method	Auto	When **[ADV2-28]** is set to **2_AutoDec/Restart**, VFD resets fault when power is restored.
	Manually	When **[ADV2-28]** is set to **1_Auto Dec/Stop**, VFD can be reset when frequency is 0 Hz.
Reset condition	Stable power is restored	
Recorded	Yes	
Possible Causes		**Corrective Action**
• Unstable power source • Power is off • Other large loads in power system		• Check power supply capacity • Separate other large loads

Fault Display	Description	
DPR (177) Damper Fault	Motor does not start because of damper error.	
Action and Reset		
Action level	Damper limit switch has not closed in time to start motor; or, switch has opened for more than 2 seconds while motor is running.	
Action time	After delay timer	
Related parameters	**Damper Mode [IO-36]**; **Damper T-Delay [IO-37]**; **Damper Output Terminal [IO-47]** to **[IO-49]**; **Damper Limit SW Terminal [IO-21]** to **[IO-28]**	
Reset method	Manually or Automatically if in Auto mode and Auto Restart is enabled.	
Reset condition	Damper and relay switch functioning properly	
Recorded	Yes	
Possible Causes		**Corrective Action**
• Damper is not opening • Limit switch failure • Incorrect wiring • Incorrect settings		• Check limit switch connections and function • Check damper relay connections and damper function • Verify all damper related parameters

Fault Display	Description	
EF (49) External Fault	Drive stops based on signal from an external device.	
Action and Reset		
Action level	When a multi-function input terminal (MI1 to MI8) is set to **10_Ext Trip Terminal** and the contact is closed, the AC motor drive stops output based on **[IO-35]** setting.	
Action time	Immediately	
Related parameters	**Ext Trip Mode [IO-35]**; **[IO-21]** to **[IO-28]**	
Reset method	Manually	
Reset condition	After external error has been corrected.	
Recorded	Yes	
Possible Causes		**Corrective Action**
• Multi-function input terminal that is set to external fault has been activated.		• Deactivate input terminal with function set to external fault • Check Normally Open / Normally Closed settings for DI **NO/NC [IO-46]**

Fault Display	Description
EF1 (50) Emergency stop	Drive has been stopped through an external switch
Action and Reset	
Action level	When a multi-function input terminal (MI1 to MI8) is set to emergency stop and the contact is closed, the AC motor drive stops output and the motor coasts to stop.
Action time	Immediately
Related parameters	**MI1 [IO-21]** to **MI8 Define [IO-28]**
Reset method	Manually
Reset condition	After external error has been corrected.
Recorded	Yes
Possible Causes	**Corrective Action**
• Multi-function input terminal that is set to emergency stop has been activated.	• Deactivate input terminal with function set to emergency stop • Check Normally Open / Normally Closed settings **DI NO/NC [IO-46]**

Fault Display	Description
EoL1 (22) Thermal relay 1	Electronics thermal relay 1 protection. The drive coasts to stop once it activates.
Action and Reset	
Action level	Start counting when output current > 105% of motor 1 rated current
Action time	**[PROT-17]** (if the output current is larger than 105% of motor 1 rated current again within 60 sec, the counting time reduces and is less than **[PROT-17]**)
Related parameters	**[PROT-16]** and **[MOTOR-17]**
Reset method	Manually
Reset condition	Reset in 5 sec. after the fault is cleared
Recorded	Yes
Possible Causes	**Corrective Action**
• Motor shaft lock • The load is too large • V/F voltage is too high • Overload during low-speed operation. When using a general motor, even it operates below rated current, an overload may still occur during low-speed operation. • When using VFD dedicated motors, **[PROT-16]** =0 (electronic thermal relay selection motor 1 = inverter motor) • Incorrect value of electronic thermal relay **[PROT-17]** • The maximum motor frequency is set too low • Torque compensation is too large • Motor fan error • Unbalanced three-phase impedance of the motor	• Remove the shaft lock. • Reduce the load and increase the motor capacity. • Adjust settings for V/F curve, especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed). • Decrease low-speed operation time. Replace the drive with a dedicated to VFD model. Increase the motor capacity. • **[PROT-16]** = 1 electronic thermal relay selection motor 1 = standard motor (with fan on the shaft). • Reset to the correct motor rated current and **[PROT-17]**. • Reset to the correct motor rated frequency. • Adjust the torque compensation (refer to **[MOTOR-17]**) until the current reduces and the motor does no stall. • Check the status of the fan, or replace the fan. • Replace the motor.

Fault Display	Description	
FANL (91) FAN PWR lost	Lost power to drive cooling fan.	
Action and Reset		
Action level	Hardware detection	
Action time	Immediately	
Reset method	Attach fan and cycle power	
Reset condition	N/A	
Recorded	Yes	
Possible Causes	**Corrective Action**	
• Fan not connected • Broken fan wire • Damaged fan	• Check that fan connector has correctly mated with drive connection. • Check wires going to fan. If broken, replace fan. • Check fan works by power cycling the drive. If fan does not run for 5 seconds at initial turn-on, replace fan.	
Fault Display	**Description**	
Fire (74) Override	A fault is occurring during Fireman's Override	
Action and Reset		
Action level	Fault occurring Fireman's Override operation. If a fault that enables Bypass, then it stays in fire alarm for **[IO-73]** and then Bypass is enable. If a fault that can be reset, then drive attempt to reset fault during **[IO-73]** time. If fault is still present, then Bypass is enabled.	
Action time	Immediately	
Related parameters	**[IO-31]**; **[IO-32]**; **[IO-73]**	
Reset method	Drive attempts to restart motor after **FO Retry Delay [IO-32**] for number of retries based on **FO Fault Retry [IO-31]**	
Reset condition	Auto	If secondary fault can be cleared
	Manually	If number of fault retries reaches **FO Fault Retry [IO-31]** for duration of **FO Retry Delay [IO-32]**
Recorded	Yes	
Possible Causes	**Corrective Action**	
• A secondary fault is present • Too many faults during FO Retry Delay • FO mode initiated prematurely causing secondary fault	• View fault log to identify active fault. • Review fault log to diagnosis system issues. • Review FO mode setup including digital input assignments.	
Fault Display	**Description**	
FStp (90) Force Stop	Keypad forces PLC to Stop	
Action and Reset		
Action level	When **[SET-61]** = 1, STOP button on the keypad is valid. When giving the **STOP** command during the PLC operation, FStp fault activates.	
Action time	Immediately	
Related parameters	**[SET-61]**	
Reset method	Manually	
Reset condition	Immediately	
Recorded	Yes	
Possible Causes	**Corrective Action**	
• **[SET-61]** = 1: keypad **STOP** button is valid • Press **STOP** button during PLC operation	• Check if it is necessary to set **[SET-61]** = 0, so the keypad **STOP** button is invalid • Verify the timing of **STOP** function	

Fault Display	Description
GFF (4) Ground Fault	One of the output terminals to motor is short-circuited. **NOTE:** Ground Fault protection is to protect the VFD and not designed to protect the user.
Action and Reset	
Action level	When output current exceeds **[PROT-34]**
Action time	After **Gnd Fault Delay [PROT-35]**
Related parameters	**Gnd Fault Level [PROT-34]**; **Gnd Fault Delay [PROT-35]**
Reset method	Manually or Automatically if in Auto mode and Auto Restart is enabled.
Reset condition	5 seconds after fault is corrected
Recorded	Yes
Possible Causes	**Corrective Action**
• Motor failure • Broken motor cable • Capacitance cable and ground • EMI Interference • Drive failure	• Check motor and wiring with meg-ohm meter. • If cable exceeds 100 m (328 ft) decrease carrier frequency. • Verify grounding of communication circuit. • Ensure separation of communication circuits and high-voltage wiring. • Check whether the IGBT power module is damaged.
Fault Display	**Description**
Hd0 (36) cc HW error	Current clamp hardware protection
Action and Reset	
Action level	Hardware detection
Action time	Immediately
Reset method	Cycle the power
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware failure	• If condition still exists after power restart, please call Technical Support.
Fault Display	**Description**
Hd1 (37) oc HW error	oc hardware protection error when power is ON
Action and Reset	
Action level	Hardware detection
Action time	Hd1 acts immediately when the drive detects the fault
Reset method	Power-off
Reset condition	N/A
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware failure	• If condition still exists after power cycle, please call Technical Support.
Fault Display	**Description**
Hd2 (38) ov HW error	Over-voltage hardware protection error when power is ON
Action and Reset	
Action level	Hardware detection
Action time	Hd2 acts immediately when the drive detects the fault
Reset method	Power-off
Reset condition	N/A
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware failure	• If condition still exists after power cycle, please call Technical Support

Fault Display	Description
Hd3 (39) occ HW error	Protection error of occ IGBT short-circuit detection when power is ON
Action and Reset	
Action level	Hardware detection
Action time	Hd3 acts immediately when the drive detects the fault
Reset method	Power-off
Reset condition	N/A
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware failure	• If condition still exists after power cycle, please call Technical Support.
Fault Display	**Description**
HLD (176) High Load	Protects the VFD and equipment against damage from an over-torque condition.
Action and Reset	
Action level	Current or Torque is above HLD Level [SET-48] and HLD Frequency [SET-49]
Action time	HLD Delay [SET-50]
Related parameters	Refer to High Load Detection in the owner's manual.
Reset method	Manually or Automatically. Refer to High Load Detection in the owner's manual.
Reset condition	Correct overloading condition
Recorded	Yes
Possible Causes	**Corrective Action**
• Motor and/or pump misalignment • Dragging motor and/or pump • Motor and/or pump locked • Abrasives in pump • Excess motor cable length	• Amperage is above MAX AMPS at minimum frequency. • Remove and repair or replace as required. • Reduce motor cable length. Adhere to Maximum Motor Cable Length table. • For FE MagForce application, verify motor model selection, pump load, and max amps.
Fault Display	**Description**
IctE (111) InrCom Time Out	Internal communication time-out
Action and Reset	
Action level	When internal communication between follower and master is abnormal
Action time	Immediately
Reset method	Automatically
Reset condition	When communication is re-established
Recorded	Yes
Possible Causes	**Corrective Action**
• EMI Interference • Communication cable broken	• Check Comm card installation. • Check communications settings. • Check wiring and grounding for possible interference.

Fault Display	Description
LvA (11) Lv at accel	DC bus low voltage during acceleration
Action and Reset	
Action level	DC bus voltage is lower than **LV Level [PROT-03]** during acceleration
Action time	Immediately
Related parameters	**LV Level [PROT-03]**
Reset method	Manually or Automatically if in Auto mode and Auto Restart is enabled
Reset condition	Reset when DC bus voltage is higher than **[PROT-03]** + 30 V (Frame A–D) / 40 V (Frame E and below)
Recorded	Yes
Possible Causes	**Corrective Action**
• Power voltage changes • Load is too large • Improper wiring at +1 and +2 • Generator voltage dips	• Check if the input voltage is normal. • Check for possible sudden load. • Adjust setting of **[PROT-03]**. • Check DC reactor connection. • If powered by a generator, increase the throttle. • If powered by a generator, replace generator with large one.

Fault Display	Description
Lvd (12) Lv at decel	DC bus low voltage during deceleration
Action and Reset	
Action level	DC bus voltage is lower than **LV Level [PROT-03]** during deceleration
Action time	Immediately
Related parameters	**LV Level [PROT-03]**
Reset method	Manually or Automatically if in Auto mode and Auto Restart is enabled
Reset condition	Reset when DC bus voltage is higher than **[PROT-03]** + 30 V (Frame A–D) / 40 V (Frame E and below)
Recorded	Yes
Possible Causes	**Corrective Action**
• Power-off • Power voltage changes • Start up the motor with large capacity • Sudden load • DC bus	• Improve power supply condition. • Adjust voltage to the power range of the drive. • Check the power system. Increase the capacity of power equipment. • Reduce the load and increase the drive capacity. • Install DC reactor.

Fault Display	Description
Lvn (13) Lv at normal SPD	DC bus low voltage at constant speed
Action and Reset	
Action level	DC bus voltage is lower than **LV Level [PROT-03]** at constant speed
Action time	Immediately
Related parameters	**LV Level [PROT-03]**
Reset method	Manually or Automatically if in Auto mode and Auto Restart is enabled
Reset condition	Reset when DC bus voltage is higher than **[PROT-03]** + 30 V (Frame A–D) / 40 V (Frame E and below)
Recorded	Yes
Possible Causes	**Corrective Action**
• Power voltage changes • Sudden load changes • Improper wiring at +1 and +2	• Check if the input voltage is normal. • Check for possible sudden load. • Adjust setting of **[PROT-03]**. • Check DC reactor connection. • If powered by a generator, increase the throttle. • If powered by a generator, replace generator with large one.

Fault Display	Description
LvS (14) Lv at Stop	DC bus low voltage at stop
Action and Reset	
Action level	DC bus voltage is lower than **LV Level [PROT-03]** at constant speed
Action time	Immediately
Related parameters	**LV Level [PROT-03]**
Reset method	Manually or Automatically if in Auto mode and Auto Restart is enabled and depending on voltage recovery level
Reset condition	Voltage recovery +500 ms
Recorded	Yes
Possible Causes	**Corrective Action**
• Incorrect drive model • Power voltage change • Hardware failure	• Check if the input voltage is normal. • Check for possible sudden load. • Adjust setting of **[PROT-03]**. • Check DC reactor connection. • Cycle the power. If error still exists, please call Technical Support. • If powered by a generator, increase the throttle. • If powered by a generator, replace generator with large one.
Fault Display	**Description**
MVWS (183) M-VFD Wrong Set	Wrong settings of Multi-VFD. Settings of follower (this drive) is different from the master.
Action and Reset	
Action level	**[ADV-35]**, **[ADV-36]**, **[SET-07]**, and **[SET-17]** different than master drive. To identify master drive, set **[SET-58]** to **23_Commu Role**. On screen, 0 = No Role, 1 = Master, and 2 = Follower.
Action time	Immediately
Related parameters	**[ADV-35]**; **[ADV-36]**; **[SET-07]**; **[SET-17]**
Reset method	Automatically
Reset condition	Immediately
Recorded	Yes
Possible Causes	**Corrective Action**
• Wrong parameter values for **[ADV-35]**, **[ADV-36]**, **[SET-07]**, and **[SET-17]** • Multiple masters on network	• Verify settings match master drive. To identify master drive, set **[SET-58]** to **23_Commu Role**. On screen, 0=No Role, 1=Master, and 2=Follower. • If network has multiple masters, make sure each drive on network has unique **Mulit-VFD [ADV-37]** and that value is equal or less than **Multi-VFD Set [ADV-35]**. • If network has multiple masters, check communication wiring between drives and replace wiring as needed.
Fault Display	**Description**
MVWV (184) M-VFD Wrong Ver	Wrong software version of drive operating Multi-VFD. Software version of follower (this drive) is different from the master.
Action and Reset	
Action level	**[VFD-49]** different than master drive. To identify master drive, set **[SET-58]** to **23_Commu Role**. On screen, 0=No Role, 1=Master, and 2=Follower.
Action time	Immediately
Related parameters	**[VFD-49]**
Reset method	Reprogram drive
Reset condition	Immediately
Recorded	Yes
Possible Causes	**Corrective Action**
• Drive has different firmware VFD-49 than master	• Reprogram drive with same firmware as master. To identify master drive, set **[SET-58]** to **23_Commu Role**. On screen, 0=No Role, 1=Master, and 2=Follower. • Replace drive with one that has matching firmware. • Remove drive from network and operate independent.

Fault Display	Description
NOFL (178) No Flow(I)	Flow switch has detected no movement of fluid.
Action and Reset	
Action level	Multi-function Input set to No Flow function is activated. Detection occurs after motor runs above min frequency for duration of **Prime Time [IO-39]** and above **No-Flow Freq [IO-40]**. **No-Flow Mode [IO-38]** sets operation as **1_Trip** or **2_Sleep** where additional condition of **No-Flow [IO-38]** has to be met to incur sleep mode.
Action time	Once detection occurs, MI has to be active for 5 secs.
Related parameters	**[IO-38]** through **[IO-40]**; **[IO-20]** through **[IO-28]**; **[IO-46]**
Reset method	Manually
Reset condition	MI becomes deactivated
Recorded	Yes

Possible Causes	Corrective Action
• No water (dry well) • No-flow switch is Normally Closed (closed when water is moving) • Nuisance tripping • Water flow is too low • Pump has not finished filling pipe with water	• Refill cistern or wait for well to fill with water. • Change **DI NO/NC [IO-46]** for designated input to NC. • Review installation instructions with No-Flow Switch which include installing on long straight pipes (no turns) and orientation (horizontal). • Calibrate flow switch. • Increase Prime Time.

Fault Display	Description
ocA (1) Oc at accel	Output current exceeds 2.4 times of rated current during acceleration
Action and Reset	
Action level	240% of rated current
Action time	Immediately
Related parameters	**[ADV-06]**; **[PROT-07]**; **[PROT-39]**; **[PROT-42]**; **[MOTOR-05]**; **[MOTOR-17]**
Reset method	Manually
Reset condition	Reset in 5 sec after the fault is cleared
Recorded	Yes

Possible Causes	Corrective Action
• Acceleration time is too short • Short circuit at motor output due to poor insulation wiring • Check for possible burnout or aging insulation of the motor • The load is too large • Impulsive change of the load • Use special motor or motor with larger capacity than the drive • Use ON/OFF controller of an electromagnetic contactor at the output (U/V/W) of the drive • V/F curve setting error • Torque compensation is too large • Malfunction caused by interference • The motor starts when in free run • Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault) • Incorrect combination of control mode and used motor • The length of motor cable is too long • Hardware failure • Check if the setting for stall prevention is correct	• Increase the acceleration time. • Increase the acceleration time of S curve. • Set auto-acceleration and auto-deceleration parameter **[ADV-06]**. • Set over-current stall prevention function **[PROT-07]**. • Replace the drive with a larger capacity model. – Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power. – Check the motor insulation value with megger. Replace the motor if the insulation is poor. – Check if the output current during the whole working process exceeds the AC motor drive's rated current. If yes, replace the AC motor drive with a larger capacity model. – Reduce the load or increase the capacity of AC motor drive. – Check the motor capacity (the rated current on the motor's nameplate should be less than rated current of the drive). – Check the action timing of the contactor and make sure it is not turned ON/OFF when the drive outputs the voltage. – Adjust V/F curve setting and frequency/voltage. When the fault occurs, and the frequency voltage is too high, reduce the voltage. – Adjust the torque compensation (refer to **[MOTOR-17]**) until the output current reduces and the motor does not stall. – Verify the wiring of the control circuit and wiring/grounding of the main circuit to prevent interference. – Enable the speed tracking during start-up of **[PROT-42]**. – Correct the parameter settings for speed tracking. • Start the speed tracking function. • Adjust the maximum current for **[PROT-39]** speed search tracking. – Check the settings for **[MOTOR-05]**. – Increase AC motor drive's capacity. Install AC reactor(s) on the output side (U/V/W). – The ocA occurs due to short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter: B1 corresponds to U, V and W; DCcorresponds to U, V and W; corresponds to U, V and W. If short circuit occur, call Technical Support. – Set the stall prevention to the proper value.

Fault Display	Description
occ (5) Short Circuit	Short-circuit is detected between upper bridge and lower bridge of the IGBT module
Action and Reset	
Action level	Hardware protection
Action time	Immediately
Reset method	Manually
Reset condition	Reset in 5 sec. after the fault is cleared
Recorded	Yes
Possible Causes	**Corrective Action**
• IGBT Error • Short-circuit detecting circuit error	• Check the motor wiring. • Cycle the power, if occ still exists, contact technical support.

Fault Display	Description
ocd (2) Oc at decel	Output current exceeds 2.4 times of rated current during deceleration.
Action and Reset	
Action level	240% of rated current
Action time	Immediately
Related parameters	**[ADV-06]**; **[PROT-07]**; **[MOTOR-17]**
Reset method	Manually
Reset condition	Reset in 5 sec after the fault is cleared
Recorded	Yes
Possible Causes	**Corrective Action**
• Deceleration time too short • Check if the mechanical brake of the motor activates too early • Short-circuit at motor output due to poor insulation wiring • Check for possible burnout or aging insulation of the motor • The load is too large • Impulsive change of the load • Use special motor or motor with larger capacity than the drive • Use ON/OFF controller of an electromagnetic contactor at the output (U/V/W) of the drive • V/F curve setting error • Torque compensation is too large • Malfunction caused by interference • The length of motor cable is too long • Hardware error • Check if the setting of stall prevention is correct	• Increase the deceleration time. • Increase the deceleration time of S-curve. • Set auto-acceleration and auto-deceleration parameter **[ADV-06]**. • Set over-current stall prevention function **[PROT-07]**. • Replace the drive with a larger capacity model. – Check the action timing of the mechanical brake. – Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power. – Check the motor insulation value with megger. Replace the motor if the insulation is poor. – Check if the output current during the whole working process exceeds the AC motor drive's rated current. If yes, replace the AC motor drive with a larger capacity model. – Reduce the load or increase the capacity of AC motor drive. – Check the motor capacity (the rated current on the motor's nameplate should the rated current of the drive). – Check the action timing of the contactor and make sure it is not turned ON/OFF when the drive outputs the voltage. – Adjust V/F curve settings and frequency/voltage. When the fault occurs, and the frequency voltage is too high, reduce the voltage. – Adjust the torque compensation (refer to **[MOTOR-17]**) until the output current reduces and the motor does not stall. – Verify the wiring of the control circuit and wiring/grounding of the main circuit to prevent interference. – Increase AC motor drive's capacity Install AC reactor(s) on the output side (U/V/W). – The ocd occurs due to short circuit or ground fault at the output side of the drive. – Check for possible short circuits between terminals with the electric meter: B1 corresponds to U, V and W; DC- corresponds to U, V and W; Earth Ground corresponds to U, V and W. If short circuits occur, call Technical Support. – Set the stall prevention to the proper value.

Fault Display	Description
ocn (3) oc at normal SPD	Output current exceeds 2.4 times of the rated current during constant speed.
Action and Reset	
Action level	240% of rated current
Action time	Immediately
Reset method	Manually
Reset condition	Reset in 5 sec after the fault is cleared
Recorded	Yes

Possible Causes	Corrective Action
• Short-circuit at motor output due to poor insulation wiring • Check for possible shaft lock, burnout or aging insulation of the motor • Impulsive change of the load • Use special motor or motor with larger capacity than the drive • Use ON/OFF controller of an electromagnetic contactor at the output (U/V/W) of the drive • V/F curve setting error • Over-torque offset value too high • Torque compensation is too large • Malfunction caused by interference • The length of motor cable is too long • Hardware failure	• Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power. • Troubleshoot the motor shaft lock. Check the motor insulation value with megger. Replace the motor if the insulation is poor. • Reduce the load or increase the capacity of AC motor drive. • Check motor capacity (the rated current on the motor's nameplate should be the rated current of the drive). • Check the action timing of the contactor and make sure it is not turned ON/OFF when the drive outputs the voltage. • Adjust V/F curve settings and frequency/voltage. When the fault occurs, and the frequency voltage is too high, reduce the voltage. • Adjust over-torque offset value (refer to **[MOTOR-17]** for torque compensation gain), until the output current is reduced and not motor stall. • Adjust the torque compensation (refer to **[MOTOR-17]** for torque compensation gain) until the output current reduces and the motor does not stall. • Verify the wiring of the control circuit and wiring/grounding of the main circuit to prevent interference. • Increase the AC motor drive's capacity. Install AC reactor(s) on the output side (U/V/W). • The ocn occurs due to short circuit or ground fault at the output side of the drive. Check for possible short circuit between terminals with the electric meter: B1 corresponds to U, V and W; DC- corresponds to U, V, and W; Earth Ground corresponds to U, V, and W. • If short circuits occur, call Technical Support.

Fault Display	Description
OcS (6) oc at stop	Over-current or hardware failure in current detection at stop. Cycle the power after ocS occurs. If the hardware failure occurs, the display shows cd1, cd2 or cd3.
Action and Reset	
Action level	240% of rated current
Action time	Immediately
Reset method	Manually
Reset condition	Reset in 5 sec after the fault is cleared
Recorded	Yes

Possible Causes	Corrective Action
• Malfunction caused by interference • Hardware failure	• Verify the wiring of the control circuit and wiring/grounding of the main circuit to prevent interference. • Check if other error code such as cd1–cd3 occur after cycling the power. If yes, contact technical support.

Fault Display	Description
oH1 (16) IGBT over heat	IGBT temperature exceeds the protection level
Action and Reset	
Action level	When IGBT is higher than the [PROT-18] overheating protection level, oH1 error occurs instead of oH1 warning.
Action time	100 ms
Related parameters	OH Warning [PROT-18] and Fan Control [PROT-45]
Reset method	Manually or Automatically if in Auto mode and Auto Restart is enabled.
Reset condition	IGBT temperature is 10 °C below error level.
Recorded	Yes
Possible Causes	**Corrective Action**
• Ambient temperature too high • VFD size does not match load • Direct sunlight • Obstruction of flow	• Ensure that the ambient temperature falls within the specified temperature range. • Make sure heat sink is not obstructed. Check if the fan is operating. • Check if there is enough ventilation clearance for the drive. • Reduce load. • Replace drive with a larger capacity model. • Remove from direct sunlight.
Fault Display	**Description**
oH2 (17) CAP over heat	Capacitance temperature causes heat-sink overheating.
Action and Reset	
Action level	Temperature error level depends on VFD model
Action time	100 ms
Reset method	Manually or Automatically if in Auto mode and Auto Restart is enabled.
Reset condition	Capacitance temperature is 10 °C below error level.
Recorded	Yes
Possible Causes	**Corrective Action**
• Ambient temperature too high • VFD size does not match load • Unstable power	• Ensure that the ambient temperature falls within the specified temperature range. • Make sure heat sink is not obstructed. Check if the fan is operating. • Check if there is enough ventilation clearance for the drive.

Fault Display	Description	
oH3 (24) Motor over heat	Motor overheating (PTC/PT100). Fault treatment acts according to **[PROT-19]**	
Action and Reset		
Action level	PTC value > **[PROT-20]** or **[PT100]** > **[PROT-31]**	
Action time	Immediately	
Related parameters	Fault treatment acts according to **[PROT-19]**	
Reset method	Auto	If **[PROT-19]** = 0, then oH3 is a "Warning"
	Manually	If **[PROT-19]** = 1 or 2, oH3 is a "Fault"
Reset condition	Immediately	
Recorded	Yes, when **[PROT-19]** = 1 or 2	
Possible Causes	**Corrective Action**	
• Motor shaft lock • The load is too large • Ambient temperature is too high • Motor cooling system error • Motor fan error • Operate at low-speed too long • Accel./Decel. time and working cycle are too short • V/F voltage is too high • Motor rated current does not match motor nameplate • PTC is improperly set and wired • Incorrect setting for stall prevention • Unbalanced three-phase impedance of the motor • Harmonics are too high	• Remove the shaft lock. • Reduce the load and increase the motor capacity. • Change the installed place if there are heating devices in the surroundings. Install/ add cooling fan or air conditioner to lower the ambient temperature. • Check the cooling system to make it work normally. • Replace the fan. • Decrease low-speed operation time. Replace the motor with a dedicated to VFD model. Increase the motor capacity. • Increase the setting values for accel./decel. time. • Adjust settings for V/F curve, especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed). • Reset to the correct motor rated current. • Check the connection between PTC thermistor and the heat protection. • Set the stall prevention to the proper value. • Replace the motor. • Use remedies like filters to reduce harmonics.	

Fault Display	Description	
oL (21) Overload	Excessive drive output current	
Action and Reset		
Action level	Based on overload curve and derating curve	
Action time	When the load is higher than the protection level and exceeds allowable time, the oL protection activates	
Reset method	Manually	
Reset condition	Reset in 5 sec. after the fault is cleared	
Recorded	Yes	
Possible Causes	**Corrective Action**	
• Motor and/or pump misalignment • Dragging motor and/or pump • Motor and/or pump locked • Abrasives in pump • Excess motor cable length	• Amperage is above MAX AMPS at minimum frequency. • Remove and repair or replace as required. • Reduce motor cable length. Adhere to Maximum Motor Cable Length table. • For FE MagForce application, verify motor model selection, pump load, and max amps.	

Fault Display	Description	
OL-2 (27) Overload 2	When output current exceeds **OL-2 Level [PROT-13]** and exceeds over-load detection time **[PROT-14]**, and when **[PROT-12]** is set to **2** or **4**, the OL-2 error displays.	
Action and Reset		
Action level	When **[PROT-12]** = **2** or **4**, ot2 is a "Fault", and the fault is recorded	
Action time	**[PROT-14]**	
Related parameters	**[PROT-12]**	
Reset method	Auto	When **[PROT-12]** = **1** or **3**, OL2 is a "Warning" The warning is automatically cleared when the output current < (**[PROT-13]** - 5%)
	Manually	When **[PROT-12]** = **2** or **4**, OL2 is a "Fault" and the fault is recorded
Reset condition	Immediately	
Recorded	Yes	
Possible Causes	**Corrective Action**	
• Motor and/or pump misalignment • Dragging motor and/or pump • Motor and/or pump locked • Abrasives in pump • Excess motor cable length	• Amperage is above MAX AMPS at minimum frequency. • Remove and repair or replace as required. • Reduce motor cable length. Adhere to Maximum Motor Cable Length table. • For FE MagForce application, verify motor model selection, pump load, and max amps.	

Fault Display	Description
oL3 (87) Derating Error	Overload protection at low frequency with high current.
Action and Reset	
Action level	Drive is operating below 15 Hz with high current
Action time	Immediately
Related parameters	**Carrier Frequency [SET-62]** and all motor parameters
Reset method	Manually
Reset condition	Immediately
Recorded	Yes

Possible Causes	Corrective Action
• Drive is too small for application • Ambient temperature is too high • Motor parameters incorrect	• Check heat dissipation of drive location • Check all motor parameter settings • Lower the **Carrier Frequency [SET-62]**

Fault Display	Description	
OPHL (82) U phase lacked **OPHL** (83) V phase lacked **OPHL** (84) W phase lacked	U phase output phase loss V phase output phase loss W phase output phase loss	
Action and Reset		
Action level	**[PROT-23]**	
Action time	**[PROT-22]** **[PROT-24]**: Use this setting first if there is DC braking function before using **[PROT-22]**	
Related parameters	Fault/Warning operation dependent on **[PROT-21]**	
Reset method	Manually	
Reset condition	Immediately	
Recorded	Yes	
Possible Causes	**Corrective Action**	
• The three-phase impedance of motor is unbalanced • The motor is wired incorrectly • Damaged motor cable • Using a single-phase motor • The current sensor is damaged • The drive capacity is much larger than the motor capacity	• Replace the motor. • Check motor wiring. • Check the motor cable condition and replace if needed. • Choose a three-phase motor. • Check the flat cable of the control board. Re-do the wiring and test again if the flat cable is loose. If the fault still exists, call Technical Support. Verify that the three-phase current is balanced via a current clamp meter. If it is balanced and the OPHL fault still exists, call Technical Support. • Make sure the capacity of the drive and motor match to each other.	
Fault Display	**Description**	
OPRS (174) Overpressure (M)	System exceeds pressure limit	
Action and Reset		
Action level	PID Feedback is greater than **OverPress Level [SET-40]**. Operation set by **OverPress Set [SET-39]**	
Action time	Immediately	
Related parameters	**[SET-39]** and **[SET-40]**	
Reset method	Auto	If **OverPress Set [SET-39]** = **2_OP Auto Reset**, reset automatically when pressure is less than **Wake-Up Level [SET-31]**
	Manually	If **OverPress Set [SET-39]** = **1_OP Trip**, requires manual reset
Reset condition	If reset automatically, pressure must be less than **Wake-Up Level [SET-31]**	
Recorded	Yes	
Possible Causes	**Corrective Action**	
• System pressure is too high • Nuissance tripping • Trips when system is at a low pressure • Trips at wrong level	• Check for closed valves in system. • Increase analog input filter (**[IO-04]**, **[IO-09]**, or **[IO-10]**). • Check wiring and voltage to sensor. Confirm pressure reading from keypad display to secondary gauge. • Check **[SET-19]** units, **PID F/B Max [SET-20]**, and **OverPress Level [SET-40]**.	

Fault Display	Description	
OrP (15) Phase lacked	Phase loss of power input	
Action and Reset		
Action level	DC bus is lower than **[PROT-06]** and DC bus ripple is higher than **[PROT-27]**	
Action time	Immediately	
Related parameters	**[PROT-28]** determines fault function. **[PROT-26]** is period between checks.	
Reset method	Manually	
Reset condition	Immediately reset when DC bus is higher than **[PROT-06]**	
Recorded	Yes	
Possible Causes	**Corrective Action**	
• Phase loss of input power • Single phase power input to three-phase model • Power voltage changes • Loose wiring terminal of input power • The input cable of three-phase power is cut off • Input power voltage changes too much • Unbalanced three-phase of input power	• Correctly install the wiring of the main circuit power. • Choose the model whose power matches the voltage. • If the main circuit power works normally, verify the main circuit. Cycle the power after checking the power, if OrP error still exists, call Technical Support. • Tighten the terminal screws according to the torque described in the user manual. • Wire correctly. Replace the cut off cable. • Verify the setting value for **IPO Check Time [PROT-26]** and **IPO Ripple [PROT-27]**. • Check the power three-phase status.	
Fault Display	**Description**	
oSL (63) Over slip error	On the basis of the maximum slip limit set via **[MOTOR-19]**, the speed deviation is abnormal. When the motor drive outputs at constant speed, F > H or F < H exceeds the level set via **[MOTOR-19]**, and it exceeds the time set via **[MOTOR-20]**, oSL shows. oSL occurs in induction motors only.	
Action and Reset		
Action level	100% of **[MOTOR-19]** = the maximum limit of the slip frequency	
Action time	**[MOTOR-20]**	
Related parameters	Fault/Warning based on **[MOTOR-21]**	
Reset method	Auto	**[MOTOR-21]** = 0 is a warning. When the motor drive outputs at constant speed, and F > H or F < H does not exceed the level set via **[MOTOR-19]** anymore
	Manually	When **[MOTOR-21]** = **1** or **2**, oSL is an error
Reset condition	Immediately	
Recorded	**[MOTOR-21]** = **1** or **2**, oSL is “Fault” and is recorded	
Possible Causes	**Corrective Action**	
• Any of the motor parameters may be incorrect • Overload • Improper setup of feature	• Verify the motor parameters. • Decrease the load. • Verify the settings of **[MOTOR-18]** through **[MOTOR-21]**.	

Fault Display	Description
ovA (7) ov at accel	DC bus over-voltage during acceleration. When ovA occurs, the drive closes the gate of the output, the motor runs freely, and the display shows an ovA error.
Action and Reset	
Action level	230V models: 410 VDC 460V models: 820 VDC 575V models: 1116 VDC 690V models: 1318 VDC
Action time	Immediately act when DC bus voltage is higher than the level
Reset method	Manually
Reset condition	Reset only when DC voltage is lower than 90% of the over-voltage level
Recorded	Yes

Possible Causes	Corrective Action
• Acceleration is too slow • The setting for stall prevention level is smaller than no-load current • Power voltage is too high • ON/OFF switch action of phase-in capacitor in the same power system • Regenerative voltage of motor inertia • Acceleration time is too short • Motor ground fault • Incorrect wiring of brake resistor or brake unit • Malfunction caused by interference	• Decrease the acceleration time. Use brake unit or DC bus. Replace the drive with a larger capacity model. • The setting for stall prevention level should be larger than no-load current. • Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes. • If the phase-in capacitor or active power supply unit acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor. • Use over-voltage stall prevention function **[PROT-04]**. Use auto-acceleration and auto-deceleration setting **[ADV-06]**. Use a brake unit or DC bus. • Check if the over-voltage warning occurs after acceleration stops. When the warning occurs, do the following: – Increase the acceleration time – Set **[PROT-04]** for over-voltage stall prevention – Increase setting value for **[VFD-26]** S-curve acceleration arrival time 2 • The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault. • Check the wiring of brake resistor and brake unit. • Verify the wiring of the control circuit and wiring/grounding of the main circuit to prevent interference.

Fault Display	Description
ovd (8) ov at decel	DC bus over-voltage during deceleration. When ovd occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ovd error.
Action and Reset	
Action level	230V models: 410 VDC 460V models: 820 VDC 575V models: 1116 VDC 690V models: 1318 VDC
Action time	Immediately act when DC bus voltage is higher than the level
Related parameters	**[SET-12]**; **[VFD-22]**; **[VFD-24]**; **[SET-55]**; **[PROT-04]**; **[ADV-06]**; **[VFD-37]**
Reset method	Manually
Reset condition	Reset only when DC bus voltage is lower than 90% of the over-voltage level
Recorded	Yes

Possible Causes	Corrective Action
• Deceleration time is too short, causing too large regenerative energy of the load • The setting for stall prevention level is smaller than no-load current • Power voltage is too high • ON/OFF switch action of phase-in capacitor in the same power system • Motor ground fault • Incorrect wiring of brake resistor or brake unit • Malfunction caused by interference	• Increase the setting value of **[SET-12]**, **[VFD-22]**, **[VFD-24]**, and **[SET-55]** (deceleration time). • Connect brake resistor, brake unit or DC bus on the drive. • Reduce the brake frequency. • Replace the drive with a larger capacity model. • Use S-curve acceleration/deceleration. • Use over-voltage stall prevention **[PROT-04]**. • Use auto-acceleration and auto-deceleration **[ADV-06]**. • Adjust braking level **[VFD-37]** or the bolt position of the brake unit. – The setting for stall prevention level should be larger than no-load current. – Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes. – If the phase-in capacitor or active power supply unit acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor. – The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault. – Check the wiring of brake resistor or brake unit. – Verify the wiring of the control circuit and wiring/grounding of the main circuit to prevent interference.

Fault Display	Description
ovn (9) ov at normal SPD	DC bus over-voltage at constant speed. When ovn occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ovn error.
Action and Reset	
Action level	230V models: 410 VDC 460V models: 820 VDC 575V models: 1116 VDC 690V models: 1318 VDC
Action time	Immediately act when DC bus voltage is higher than the level
Related parameters	**[VFD-37]** and **[PROT-04]**
Reset method	Manually
Reset condition	Reset only when DC bus voltage is lower than 90% of over-voltage level
Recorded	Yes

Possible Causes	Corrective Action
• Impulsive change of the load • The setting for stall prevention level is smaller than no-load current • Regenerative voltage of motor inertia • Power voltage is too high • ON/OFF switch action of phase-in capacitor in the same power system • Motor ground fault • Incorrect wiring of brake resistor or brake unit • Malfunction caused by interference	• Connect brake resistor, brake unit or DC bus to the drive. • Reduce the load. • Replace to drive with a larger capacity model. • Adjust braking level **[VFD-37]** or bolt position of the brake unit. – The setting of stall prevention level should be larger than no-load current. – Use over-voltage stall prevention function **[PROT-04]**. Use a brake unit or DC bus. – Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes. – If the phase-in capacitor or active power supply unit acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor. – The ground short-circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault. – Check the wiring of brake resistor or brake unit. – Verify the wiring of the control circuit and wiring/grounding of the main circuit to prevent interference.

Fault Display	Description
ovS (10) ov at stop	Over-voltage at stop
Action and Reset	
Action level	230V models: 410 VDC 460V models: 820 VDC 575V models: 1116 VDC 690V models: 1318 VDC
Action time	Immediately act when DC bus voltage is higher than the level
Reset method	Manually
Reset condition	Reset only when DC bus voltage is lower than 90% of over-voltage level
Recorded	Yes

Possible Causes	Corrective Action
• Power voltage is too high • ON/OFF switch action of phase-in capacitor in the same power system • Incorrect wiring of brake resistor or brake unit • Malfunction caused by interference • Hardware failure in voltage detection • Motor ground fault	• Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes. • If the phase-in capacitor or active power supply unit activates in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor. • Check the wiring of brake resistor or brake unit. • Verify the wiring of the control circuit and wiring/grounding of the main circuit to prevent interference. • Check if other error code such as cd1–cd3 occur after cycling the power. If yes, return to the factory for repair. • The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault.

Fault Display	Description
Pcod (52) Password error	Entering the wrong password three consecutive times
Action and Reset	
Action level	Entering the wrong password three consecutive times
Action time	Immediately
Reset method	Manually
Reset condition	Power-off
Recorded	Yes

Possible Causes	Corrective Action
• Incorrect password input through **[ADV-02]**	• Input the correct password after rebooting the motor drive. To reset a forgotten password, input 9999 and press **ENTER** twice within 10 seconds. If more than 10 seconds passes, try again. The parameter settings return to the default when the “Input 9999” process is finished.

Fault Display	Description
PILF (187) Pipe Leak Fault	Pipe leak detected in sleep mode where wake-up time is longer than **[ADV2-48]**, **[ADV2-49]**, **[ADV2-50]**, and **[ADV2-51]**. Wake-up time is duration from pressure setpoint to wakeup level.
Action and Reset	
Action level	Pressure drops for a duration longer than wake-up time between PID setpoint **[ADV2-52]** or and wakeup level
Action time	Longer than **[ADV2-48]**, **[ADV2-49]**, **[ADV2-50]**, and **[ADV2-51]**
Related parameters	**[ADV2-46]** through **[ADV2-51]**
Reset method	Fault/Warning is determined by **[ADV2-46]**
Reset condition	Manually
Recorded	Yes
Possible Causes	**Corrective Action**
• Leak in pipe after pressure sensor • System is low flow causing long delay to reach wakeup level	• Pressurize pipe and then check for leaks • Increase wake times **[ADV2-48]** through **[ADV2-51]**. Run system between different load demands and record **Last Wake Time [ADV2-47]** for each run. Set wake times larger than recorded value.

Fault Display	Description
RoPd (89) Rotor Pos. Error	Rotor position detection error protection
Action and Reset	
Action level	Software detection
Action time	Immediately
Reset method	Manually
Reset condition	Immediately
Recorded	Yes
Possible Causes	**Corrective Action**
• Motor cable is abnormal or broken • Motor coil error • Hardware failure • Drive's current feedback line error	• Check cable and replace as needed. • Replace motor. • IGBT broken. Call Technical Support. • Cycle the power. If RoPd still occurs during operation, call Technical Support.

Fault Display	Description
ryF (64) MC Fault	Electric valve switch error when executing Soft Start
Action and Reset	
Action level	Hardware detection (Frame D and above)
Action time	Immediately
Reset method	Manually
Reset condition	Reset when the electric value switch is correctly closed
Recorded	Yes
Possible Causes	**Corrective Action**
• The input power is abnormal • Malfunction caused by interference • Hardware failure	• Check if the power is shut down during the drive operation. • Check if the three-phase input power is normal. • Verify the wiring/grounding of the main circuit to prevent interference. • Cycle the power after checking the power. If ryF error still exists, call Technical support.

Fault Display	Description
S1 (73) S1-emergy stop	Emergency stop for external safety
Action and Reset	
Action level	Hardware detection
Action time	Immediately
Reset method	Manually
Reset condition	Reset only after S1 error is cleared
Recorded	Yes
Possible Causes	**Corrective Action**
• The switch action of S1 and SCM (OPEN) • S1 and SCM short circuit lines are not connected • Malfunction caused by interference • Hardware failure • Poor connection of the IO card • The IO card does not match the version of the control board	• Reset the switch and cycle the power. • Re-connect the short circuit lines. • Verify the wiring/grounding of the main circuit, control circuit and encoder to prevent interference. • If S1 fault still exists after cycling the power, please return to the factory for repair. • Check if the PIN of IO card is broken. • Check if the IO card connects to the control board correctly, and if the screws are tightened well. • For incorrect version, contact Technical Support.

Fault Display	Description
SfLk (112) PMLess ShaftLock	The drive has RUN command with output frequency, but the permanent magnetic motor does not turn
Action and Reset	
Action level	Software detection
Action time	3 sec.
Reset method	Manually
Reset condition	Immediately
Recorded	Yes
Possible Causes	**Corrective Action**
• Improper setting of the speed observer bandwidth • Motor shaft lock • Motor error (e.g. demagnetization)	• Increase the setting value. • Remove causes of the motor shaft lock. • Replace the motor with a new one.

Fault Display		Description
SHDN (179) Shutdown		Shutdown detected on Multi-function input
Action and Reset		
Action level		Multi-function Input set to Shutdown N-Latch or Shutdown Latched
Action time		Immediately
Related parameters		**[IO-20]** through **[IO-28]**; **[IO-46]**
Reset method	Auto	Shutdown N-Latch (not latch)
	Manually	Shutdown Latch
Reset condition		Deactivate MI corresponding to Shutdown Latch and Shutdown N-Latch
Recorded		Yes
Possible Causes		**Corrective Action**
• External device activating shutdown • Nuisance tripping • External shutdown switch is Normally Closed circuit (no shutdown with switch closed)		• Reset external device causing shutdown • Adjust DI filter **[IO-20]** • Set MI to NC with **DI NO/NC [IO-46]**

Fault Display	Description	
STL1 (72) STO Loss 1 **STL2** (77) STO Loss 2 **STL3** (78) STO Loss 3	Safe Torque Off Loss 1: STO1–SCM1 internal loop detection error Safe Torque Off Loss 2: STO2–SCM2 internal loop detection error Safe Torque Off Loss 3: STO1–SCM1 and STO2–SCM2 internal loop detection error	
Action and Reset		
Action level	Hardware detection	
Action time	Immediately	
Reset method	Cycle the power	
Reset condition	N/A	
Recorded	Yes	
Possible Causes		**Corrective Action**
• Short circuit lines are not connected • Hardware failure • Bad connection of the IO card • The IO card does not match the version of the control board		• Connect the short circuit line. After you make sure all the wiring is correct, if fault still exists after cycling the power, please return to the factory for repair. • Check if the PIN of IO card is broken. • Check if the IO card connects to the control board correctly, and if the screws are tightened well. • For incorrect version, contact Technical Support.
Fault Display	**Description**	
STO (76) STO	Safety Torque Off function active	
Action and Reset		
Action level	Hardware detection	
Action time	Immediately	
Reset method	Auto	When **[PROT-36]** = **1** and after STO error is cleared
	Manually	When **[PROT-36]** = **0** and after STO error is cleared
Reset condition	Reset only after STO error is cleared	
Recorded	Yes	
Possible Causes		**Corrective Action**
• The switch action of STO1/SCM1 and STO2/SCM2 (OPEN) • Poor connection of the IO card • The IO card does not match the version of the control board		• Reset the switch (ON) and cycle the power. • Check if the PIN of IO card is broken. • Check if the IO card connects to the control board correctly, and if the screws are tightened well. • For incorrect version, contact Technical Support.
Fault Display	**Description**	
tH1o (18) Thermo 1 open **tH2o** (19) Thermo 2 open	IGBT hardware failure in temperature detection Hardware failure in capacitor temperature detection	
Action and Reset		
Action level	NTC broken or wiring failure	
Action time	When the IGBT temperature is higher than the protection level and detection time exceeds 100 ms	
Reset method	Manually	
Reset condition	Immediately	
Recorded	Yes	
Possible Causes		**Corrective Action**
• Hardware failure		• Wait for 10 minutes, and then cycle the power. If fault still exists, call Technical Support.

Fault Display	Description
TPAI (182) Trip by AI	Analog Input or PID Feedback has exceeded threshold
Action and Reset	
Action level	**Trigger Source [ADV2-63]** reach threshold set by **[ADV2-64]** through **[ADV2-66]**
Action time	Immediately
Related parameters	**[ADV2-62]** through **[ADV2-66]**
Reset method	Manually once trigger source reaches acceptable level
Reset condition	For **Trigger Type [ADV2-64]** = **0_Lower**, trigger source has to decrease to **[ADV2-65]** minus **[ADV2-66]**. For **Trigger Type [ADV2-64]** = **1_Higher**, trigger source has to increase to **[ADV2-65]** plus **[ADV2-66]**.
Recorded	Yes

Possible Causes	Corrective Action
• Trigger source has reached threshold • Nuisance tripping • Fault reset too quickly • Fault does not reset • Cannot adjust settings to correct value	• Adjust trigger source to acceptable value. • Increase the filter time on analog input signal with **[IO-04]**, **[IO-09]**, or **[IO-10]**. Increase the **Trigger Hysteresis [ADV2-66]**. • Increase the **Trigger Hysteresis [ADV2-66]**. • Check settings **[ADV2-62]** through **[ADV2-66]**. • If using **Trigger Source [ADV2-63]** = **0_FIB F/B** (PID Feedback), compare **Trigger Level [ADV2-65]** to PID Setpoint to make sure operation is as intended. If using **Trigger Source [ADV2-63]** = **1_Aux AI**, check Aux AI setup with parameters **[ADV2-58]** through **[ADV2-61]**.

Fault Display	Description
TRAP (93) CPU Trap 0 error	CPU instruction error
Action and Reset	
Action level	Hardware detection
Action time	Immediately
Reset method	Cycle the power
Recorded	Yes

Possible Causes	Corrective Action
• Hardware failure • EMI Interference • CPU in infinite loop	• Check wiring and grounding for possible interference • If error cannot be reset, please call Technical Support

Fault Display	Description
ULD (175) Underload (M)	Dry well (belt loss). No load on motor.
Action and Reset	
Action level	Current or Torque is below **ULD Level [SET-42]** and above **ULD Frequency [SET-43]**
Action time	**ULD Delay [SET-44]**
Related parameters	Refer to “Underload Protection (Dry Well or Belt Loss)”
Reset method	Manually or Automatically. Refer to “Underload Protection (Dry Well or Belt Loss)”
Reset condition	Correct overloading condition
Recorded	Yes

Possible Causes	Corrective Action
• Over-pumped well • Broken shaft or coupling • Blocked screen, worn pump • Air/gas locked pump • X-Drive not set properly for pump end • Underload Sensitivity setting incorrect	• Frequency near maximum with load less than **ULD Level [SET-42]**. • System is drawing down to pump inlet (out of water). • High static, light loading pump - reset **ULD Level [SET-42]** if not out of water. • Check pump rotation, reconnect if necessary for proper rotation. • Air/gas locked pump - if possible, set deeper in well to reduce. • Verify **Motor FLA [SET-03]** (SFA) setting is correct. For FE MagForce application, make sure **[SET-03]** matches pump load’s rated current.

Fault Display	Description
WDTT (71) Watchdog	Watchdog error
Action and Reset	
Action level	Hardware detection
Related parameters	N/A
Reset method	Cycle the power
Reset condition	N/A
Recorded	Yes
Possible Causes	**Corrective Action**
• Hardware interference	• Verify the wiring of the control circuit and wiring/grounding of the main circuit to prevent interference. • If the WDTT fault still exists, please call Technical Support.

Diagnostic Warning Codes

Warning Display	Description	
ACILoss (12) **AVILoss** (138) Analog Loss	Analog current input loss, including all 4-20 mA and 2-10V signals	
Action and Reset		
Action condition	When the analog input is below **ACI Loss Level [IO-02]** (only detects 4-20 mA and 2-V inputs).	
Action time	After **ACI Loss Delay [IO-03]**	
Related parameters	**ACI Loss Trip [IO-01]**; **ACI Loss Level [IO-02]**; **ACI Loss Delay [IO-03]**	
Reset method	Auto	When **[IO-01]** is set to Hold or Dcel of **4_At AI Loss Freq**, action is Warning. When signal is > 4 mA > 2V, fault clears.
	Manually	When **[IO-01]** is set to **3_Trip Stop**, action is Fault and must be reset.
Reset condition	Immediately	
Recorded	When **[IO-01]** is set to **3_Trip Stop**, Fault is recorded.	
Possible Causes	**Corrective Action**	
• Loose or broken connection • Sensor failure • Drive failure	• Check the ACI wiring. • Check if the ACI signal is less than 4mA (2V).	

Warning Display	Description	
ApDx (127) App Disconnected	App disconnected from X-Drive	
Action and Reset		
Action condition	Software check	
Action time	Immediately	
Reset method	Automatically	
Reset condition	Wait 3 seconds	
Recorded	N/A	
Possible Causes	**Corrective Action**	
• App has disconnected from VFD • Phone is out of range from VFD • Phone stopped transmitting Bluetooth	• Open app and reselect VFD from **'My Products'** page. • Move phone closer to VFD especially if VFD is within metal enclosure. • Check phone's Bluetooth settings. FE BT Option card is not listed in the phone's Bluetooth device pairing list.	

Warning Display	Description	
BTFW (126) BT FW Incompat	Bluetooth firmware incompatible with X-Drive firmware. X-Drive firmware must be at least version 1.2.	
Action and Reset		
Action condition	Software check	
Action time	Immediately	
Related parameters	**Firmware Version [VFD-49]**	
Reset method	N/A	
Reset condition	N/A	
Recorded	N/A	
Possible Causes	**Corrective Action**	
• VFD firmware not at least version 1.2 • Improper communication	• Replace or update VFD with at least 1.2 firmware • Check card installation	

Warning Display	Description
CAdn (41) CAN/S Address	CANopen station address error (only supports 1–127)
Action and Reset	
Action condition	CANopen station address error
Action time	Immediately displays when the fault is detected
Reset method	Manually
Reset condition	**[ADV-03]** = 7
Recorded	When **[SET-08]** does not equal 3, CAdn is a "Warning" and is not recorded
Possible Causes	**Corrective Action**
• Incorrect setting of CANopen station address	• Disable CANopen • Reset CANopen (**[SET-07]** = 7) • Reset CANopen station address
Warning Display	**Description**
CbFn (39) CAN/S Bus Off	CANopen BUS off error
Action and Reset	
Action condition	Hardware: When CANopen card is not installed, CbFn fault occurs. Software: Too much interference on BUS. When the CAN_H and CAN_L communication cable is short, the master receives wrong package, and CbFn fault occurs.
Action time	Immediately displays when the fault is detected
Reset method	Manually
Reset condition	Cycle the power
Recorded	When **[SET-08]** does not equal 3, CbFn is a warning and isn't recorded.
Possible Causes	**Corrective Action**
• Check if the CANopen card is installed • Check if the CANopen speed is correct • Malfunction caused by interference • Communication cable is broken or bad connected	• Make sure the CANopen card is installed. • Reset CANopen speed • For interference: – Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. – Make sure the communication circuit is wired in series. – Use CANopen cable or add terminating resistance. • Check or replace the communication cable.

Warning Display	Description
CE1 (1) Comm. Error 1 **CE2** (2) Comm. Error 2 **CE3** (3) Comm. Error 3 **CE4** (4) Comm. Error 4	RS-485 Modbus illegal function code RS-485 Modbus illegal data address RS-485 Modbus illegal data value RS-485 Modbus data is written to read-only address
Action and Reset	
Action condition	CE1: When the function code is not 03, 06, 10 and 63 CE2: When the input data address is incorrect CE3: When the length of communication data is too long CE4: When the data is written to read-only address
Action time	Immediately
Related parameters	**[Comm-02]**
Reset method	Automatically when drive receives the correct function code
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• Incorrect communication command from upper unit • Malfunction caused by interference • Different communication setting from the upper unit • Disconnection or bad connection of the cable	• Check if the communication command is correct. • Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. • Check if the setting for **[Comm-02]** is the same as the setting for the upper unit. • Check the cable and replace it if necessary.
Warning Display	**Description**
CE10 (5) Comm. Error 10	RS-485 Modbus transmission time-out
Action and Reset	
Action condition	CE10: When **[Comm-10]** = 0 and the motor drive keeps running and the time has exceeded **[Comm-03]**
Action time	**[Comm-03]**
Related parameters	**[Comm-02]**
Reset method	Automatically
Reset condition	When drive receives the correct function code
Recorded	N/A
Possible Causes	**Corrective Action**
• The upper unit does not transmit the communication command within **[Comm-03]** setting time • Malfunction caused by interference • Different communication setting from the upper unit • Disconnection or bad connection of the cable	• Check if the upper unit transmits the communication command within the setting time for **[Comm-03]**. • Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. • Check if the setting for **[Comm-02]** is the same as the setting for the upper unit. • Check the cable and replace it if necessary.

Warning Display	Description
CFrn (42) CAN/S FRAM fail	CANopen memory error
Action and Reset	
Action condition	When the user updates firmware version of the control board, the FRAM internal data does not change, then CFrn fault occurs.
Action time	Immediately act when the fault is detected
Reset method	Manually
Reset condition	**[ADV-03]** = 7
Recorded	When **[SET-08]** does not equal 3, CFrn is a warning and isn't recorded.
Possible Causes	**Corrective Action**
• CANopen internal memory error	• Disable CANopen • Reset CANopen (**[SET-07]** = 7) • Reset CANopen station address

Warning Display	Description
CGdn (36) Guarding T-out	CANopen guarding time-out 1
Action and Reset	
Action condition	When CANopen Node Guarding detects that one of the followers does not response, the CGdn error displays. The upper unit sets factor and time during configuration.
Action time	The time that upper unit sets during configuration
Reset method	Manually
Reset condition	The upper unit sends a reset package to clear this fault
Recorded	N/A
Possible Causes	**Corrective Action**
• The guarding time is too short, or less detection times • Malfunction caused by interference	• Increase the guarding time (Index 100C) and detection times. • Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. Make sure the communication circuit is wired in series. Use CANopen cable or add terminating resistance.

Warning Display	Description
CHbn (37) Heartbeat T-out	CANopen heartbeat error
Action and Reset	
Action condition	When CANopen Heartbeat detects that one of the followers does not response, the CHbn error shows. The upper unit sets the confirming time of producer and consumer during configuration.
Action time	The upper unit sets the confirming time of producer and consumer during configuration.
Reset method	Manually
Reset condition	The upper unit sends a reset package to clear this fault
Recorded	No
Possible Causes	**Corrective Action**
• The heartbeat time is too short • Malfunction caused by interference • Communication cable is broken or bad connection	• Increase heartbeat time (Index 1016) • Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. Make sure the communication circuit is wired in series. Use CANopen cable or add terminating resistance. • Check or replace the communication cable.

Warning Display	Description
CIdn (40) CAN/S Idx exceed	CANopen Index error
Action and Reset	
Action condition	CANopen communication Index error
Action time	Immediately displays when the fault is detected
Reset method	Manually
Reset condition	Upper unit sends a reset package to clear this fault
Recorded	When **[SET-08]** does not equal 3, CIdn is a warning and isn't recorded.
Possible Causes	**Corrective Action**
• Incorrect setting of CANopen index	• Reset CANopen Index (**[ADV-03]** = 7)
Warning Display	**Description**
CPL0 (91) Copy PLC Mode Rd **CPL1** (92) Copy PLC Mode Wt	Copy PLC Read mode error Copy PLC write mode error
Action and Reset	
Action condition	When copy PLC read mode with incorrect process
Action time	Immediately
Reset method	Manually
Reset condition	Directly resets
Recorded	N/A
Possible Causes	**Corrective Action**
• When copy PLC mode and the process is incorrect	• Cycle the power and copy PLC mode again
Warning Display	**Description**
CPLF (95) Copy PLC Func	KPC-CC01 Copy PLC function should be executed when PLC is off
Action and Reset	
Action condition	Software detection
Action time	Immediately
Reset method	Manually
Reset condition	Directly resets
Recorded	N/A
Possible Causes	**Corrective Action**
• PLC function is enabled when KPC-CC01 is running copy PLC	• Disable PLC function first, then run the PLC copy function again
Warning Display	**Description**
CPLP (90) Copy PLC Pass Wd	Copy PLC password error.
Action and Reset	
Action condition	PLC password is incorrect
Action time	Immediately
Reset method	Manually
Reset condition	Directly resets
Recorded	N/A
Possible Causes	**Corrective Action**
• PLC password is incorrect	• Reset and enter correct PLC password

Warning Display	Description
CPLS (94) Copy PLC Pass Size	Copy PLC Capacity size error
Action and Reset	
Action condition	Software detection
Action time	Immediately
Reset method	Manually
Reset condition	Directly resets
Recorded	N/A
Possible Causes	**Corrective Action**
• The PLC copied to the drive exceeds the allowable capacity	• Check if the copied PLC program is for the drive • Use drive PLC program with correct capacity
Warning Display	**Description**
CPLt (96) Copy PLC TimeOut	Copy PLC time out
Action and Reset	
Action condition	Software detection
Action time	Immediately
Reset method	Manually
Reset condition	Directly resets
Recorded	N/A
Possible Causes	**Corrective Action**
• KPC-CC01 is removed while copying PLC program	• The KPC-CC01 cannot be removed during the PLC copy process
Warning Display	**Description**
CPLv (93) Copy PLC Version	Copy PLC version error.
Action and Reset	
Action condition	Software detection
Action time	Immediately
Reset method	Manually
Reset condition	Directly resets
Recorded	N/A
Possible Causes	**Corrective Action**
• Incompatible PLC program is copied to the drive	• Check if the copied PLC program is for the X-Drive. • Use the correct PLC program.
Warning Display	**Description**
CPtn (46) CAN/S protocol	CANopen protocol format error
Action and Reset	
Action condition	The follower detects that data from the upper unit cannot be recognized, and then shows CPtn warning
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	Upper unit sends a reset package to clear the warning
Recorded	N/A
Possible Causes	**Corrective Action**
• The upper unit sends incorrect communication packet	• Make sure the master sends the packet based on CANopen DS301 standard command format.

Warning Display	Description
CSbn (44) CAN/S Buf over	CANopen SDO receives register overflow
Action and Reset	
Action condition	The upper unit sends too much SDO and causes buffer overflow
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	The upper unit sends a reset package to clear the warning.
Recorded	N/A
Possible Causes	**Corrective Action**
• Too much SDO from the upper unit	• Check if the master sends too much SDO command. Make sure the master sends SDO command according to the command format.

Warning Display	Description
CSdn (43) CAN/S SDO T-out	SDO transmission time-out (only shows on master station)
Action and Reset	
Action condition	When the CANopen master transmits SDO command, and the Follower response “time-out”, CSdn warning occurs.
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	When the master resends a SDO command and receives the response, the warning clears.
Recorded	N/A
Possible Causes	**Corrective Action**
• Follower is not connected • The synchronize cycle is set too short • Malfunction caused by interference • Disconnection or bad connection of the communication cable	• Connect follower and CANopen BUS. • Increase the synchronization time • For interference: – Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. – Make sure the communication circuit is wired in series. – Use CANopen cable or add terminating resistance. • Check the status of the cable, or replace the cable.

Warning Display	Description
dAvE (18) Deviation Warn	Over speed deviation warning
Action and Reset	
Action condition	N/A
Action time	N/A
Reset method	Automatically
Reset condition	After the drive stops
Recorded	N/A
Possible Causes	**Corrective Action**
• Improper parameter setting for the slip error • Improper setting for ASR parameter and acceleration/deceleration • Accel./ Decel. time is too short • Motor locked • Incorrect parameter setting of torque limit • Malfunction caused by interference	• Reset ASR parameters. Then set proper accel./ decel. time. • Reset proper accel./ decel. time. • Remove the causes of motor locked. • Check the active timing of the system. • Adjust to proper setting value. • Verify wiring of the control circuit, and wiring/grounding of the main circuit to prevent interference.

Warning Display	Description
dEb (123) Dec. Energy back	Deceleration energy backup
Action and Reset	
Action condition	Software detection
Action time	N/A
Related parameters	0: Disable 1: dEb with auto accel./decel., the output frequency notes return after power reply. 2: dEb with auto accel./decel., the output frequency returns after power reply. 3: dEb low-voltage control, then increase to 350 VDC / 700 VDC and decelerate to stop. 4: dEb high-voltage control of 350 VDC / 700 VDC and decelerate to stop
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• Instantaneous power off or low voltage and unstable/ sudden heavy load of the power that cause the voltage drop • Unexpected power off	• Check the power consumption
Warning Display	**Description**
EC3F (87) ExCom Mail fail	Mail warning: Alarm mail is sent when the communication card establishes alarm conditions
Action and Reset	
Action condition	Communication card establishes alarm conditions
Action time	Immediately
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• Communication card establishes alarm conditions	• No actions necessary
Warning Display	**Description**
ECbF (73) ExCom Bus off	The communication card detects too much errors in the BUS, then enters the BUS-OFF status and stop communicating
Action and Reset	
Action condition	When the drive detects BUS-off (for DeviceNet)
Action time	Immediately
Reset method	Cycle the power
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• Poor connection of the cable • Bad quality of the cable	• Re-connect the cable. • Replace the cable.

Warning Display	Description
ECbY (88) ExCom Busy	Communication card busy: too much packets are received
Action and Reset	
Action condition	Software detction
Action time	N/A
Reset method	Manually
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• Communication packets are too much for the communication card to process	• Reduce communication packets.

Warning Display	Description
ECCb (89) ExCom Card break	Communication card break off warning
Action and Reset	
Action condition	Communication card break off
Action time	The time between communication card break off and ECCb displays: 1. EtherNet/IP: 3 sec. 2. Modbus TCP: 3 sec. 3. DeviceNet: 1 sec. 4. PROFIBUS: 1 sec. 5. EtherCAT: 0.1 sec.
Reset method	Automatically
Reset condition	After communication card is re-installed
Recorded	N/A
Possible Causes	**Corrective Action**
• Communication card break off	• Re-install communication card

Warning Display	Description
ECCFF (75) ExCom Facty def	Factory default setting error
Action and Reset	
Action condition	Factory default setting error
Action time	Immediately
Reset method	Cycle the power
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• Factory default setting error	• Use DCISoft to reset to the default value.

Warning Display	Description
ECCS (82) ExCom Inr CRC	Checksum error for communication card and the drive
Action and Reset	
Action condition	Software detection
Action time	N/A
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• Noise interference	• Verify wiring of the control circuit, and wiring/grounding of the main circuit to prevent interference.

Warning Display	Description
ECEF (80) ExCom Link Fail	Ethernet cable is not connected
Action and Reset	
Action condition	Hardware detection
Action time	Immediately
Reset method	Manually
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• Ethernet cable is loose • Bad quality of Ethernet cable	• Re-connect the cable • Replace the cable
Warning Display	**Description**
ECid (70) ExCom ID failed	Duplicate MAC ID error Node address setting error
Action and Reset	
Action condition	Duplicate MAC ID error or node address setting error
Action time	N/A
Related parameters	**[Comm-34]**
Reset method	Correct the setting and cycle the power
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• The setting address exceeds the range (0–63) • The speed setting exceeds the range • The address is duplicated with other nodes on the BUS	• Check the address setting of the communication card **[Comm-34]** • Standard: 0–2; Non-standard: 0–7 • Reset the address
Warning Display	**Description**
ECiF (76) ExCom Inner err	Serious internal error
Action and Reset	
Action condition	Internal memory saving error
Action time	Immediately
Reset method	Cycle the power
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• Noise interference • The memory is broken	• Verify wiring of the control circuit, and wiring/grounding of the main circuit to prevent interference. Cycle the power. • Reset to the default value and check if the error still exists. If yes, replace the communication card.

Warning Display	Description
ECio (77) ExCom IONet brk	IO connection break off
Action and Reset	
Action condition	IO connection between the communication card and the master is broken off
Action time	Immediately
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• The cable is loose • Incorrect parameter setting for master communication	• Re-install the cable • Check the setting for master communication parameter
Warning Display	**Description**
ECiP (86) ExCom IP fail	IP setting error
Action and Reset	
Action condition	Software detection
Action time	Immediately
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• IP conflict • DHCP IP configuration error	• Reset IP • MIS check if DHCP Server works normally
Warning Display	**Description**
ECLv (71) ExCom pwr loss	Low voltage of communication card
Action and Reset	
Action condition	The 5V power that drive provides to communication card is to low
Action time	Immediately
Reset method	Re-power
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• The card is loose • The 5V power that drive provides to communication card is to low	• Make sure the communication card is well inserted. • If 5v power is too low: – Switch the communication card to other X-Drives and observe if there is ECLv warning shown. If yes, replace with a new communication card; if not, replace the drive. – Use another communication card to test if the ECLv warning has shown as well. If not, replace the card; if yes, replace the drive.

Warning Display	Description
ECnP (74) ExCom No power	There is no power supply on the DeviceNet
Action and Reset	
Action condition	There is no power supply on the DeviceNet
Action time	Immediately
Reset method	Re-power
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• The drive detects that DeviceNet has no power	• Check if the cable and power is normal. If yes, return to the factory for repair.

Warning Display	Description
ECo0 (84) ExCom MTCP over	Modbus TCP exceeds maximum communication value
Action and Reset	
Action condition	Hardware detection
Action time	Immediately
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• The Master communication value is more than the allowable quantity of the communication card • The upper unit is online without communicating, and does not break off the Modbus TCP link, causes occupy connection • A new Modbus TCP connection is built every time when the upper unit is connected to the communication card, which caused occupy connection	• Reduce Master communication value • Revise program of upper unit, the communication should be break off when it is not used for a long time • Revise program of upper unit: use the same Modbus TCP connection when connected to the same communication card

Warning Display	Description
ECo1 (85) ExCom EIP over	Ethernet/IP exceeds maximum communication value
Action and Reset	
Action condition	Hardware detection
Action time	Immediately
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• The Master communication value is more than the allowable quantity of the communication card • The upper unit is online without communicating, and does not break off the Modbus TCP link, causes occupy connection • A new Modbus TCP connection is built every time when the upper unit is connected to the communication card, which caused occupy connection	• Reduce Master communication value • Revise program of upper unit, the communication should be break off when it is not used for a long time • Revise program of upper unit: use the same Modbus TCP connection when connected to the same communication card

Warning Display	Description
ECPi (79) ExCom Conf data	Profibus configuration data error
Action and Reset	
Action condition	N/A
Action time	N/A
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• The GSD file is incorrect	• Get the correct GSD file from the software.
Warning Display	**Description**
ECPP (78) ExCom Pr data	Profibus parameter data error
Action and Reset	
Action condition	N/A
Action time	N/A
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• The GSD file is incorrect	• Get the correct GSD file from the software
Warning Display	**Description**
ECrF (83) ExCom Rtn def	Communication card returns to the default setting
Action and Reset	
Action condition	Communication card returns to the default setting
Action time	N/A
Reset method	Automatically
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• Communication card is returning to default setting	• No actions necessary
Warning Display	**Description**
ECto (81) ExCom Intr T-out	Communication time-out for communication card and the upper unit
Action and Reset	
Action condition	N/A
Action time	N/A
Reset method	Automatically
Reset condition	CMC-EC01: resets when the communication with the upper unit is back to normal
Recorded	N/A
Possible Causes	**Corrective Action**
• Communication card is not connected with the upper unit • Communication error of the upper unit	• Check if the connection of the communication cable is correct • Check if the communication of the upper unit is normal

Warning Display	Description
ECtt (72) ExCom Test Mode	Communication card is in the test mode
Action and Reset	
Action condition	Immediately
Action time	N/A
Reset method	Cycle the power and enter the normal mode
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• Communication command error	• Cycle the power
Warning Display	**Description**
ictn (101) InrCOM Time Out	Internal communication time-out
Action and Reset	
Action condition	When **[PLC-23]** = (-1) – (-10) (no -9) and the internal communication between Master and Follower is abnormal.
Action time	Immediately
Related parameters	**[PLC-23]** and **[Comm-02]**
Reset method	Automatically
Reset condition	The warning clears when the communication is back to normal condition
Recorded	N/A
Possible Causes	**Corrective Action**
• Malfunction caused by interference • Different communication conditions with the upper unit • Communication cable break off or not connected well	• Verify wiring/grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. • Check if the setting for **[Comm-02]** is the same as the setting for upper unit • Check the cable status or replace the cable
Warning Display	**Description**
LBLV (128) Limit by Level	High frequency limit is being limited by Aux AI
Action and Reset	
Action condition	When Aux AI is less than **Max Limit Level [IO-17]**, max frequency is limited. The max frequency ramps down linearly when Aux AI is between **Max Limit Level [IO-17]** and **Min Limit Level [IO-18]**, where **Min Freq Limit [IO-19]** corresponds with **Min Limit Level [IO-18]**.
Action time	Immediately
Related parameters	**[IO-16]** through **[IO-19]**
Reset method	Automatically
Reset condition	Increase Aux AI above **Max Limit Level [IO-17]**
Recorded	N/A
Possible Causes	**Corrective Action**
• Aux AI signal is changing • Max Freq changing too quickly with change of Aux AI	• Review system monitoring. Set **Limit by Level [IO-16]** to **0_Disable**. • Decrease **Min Limit Level [IO-18]** or increase **Min Freq Limit [IO-19]**.

Warning Display	Description
MVNC (131) M-VFD No Commu	For Multi-drive operation, this VFD can not connect to others.
Action and Reset	
Action condition	This drive can not detect other drives.
Action time	Immediately
Related parameters	**[ADV-35]**, **[ADV-36]**, and **[ADV-37]**
Reset method	Automatically once parameters are set correctly
Reset condition	Immediately; May require power cycle of system once parameters have been adjusted.
Recorded	N/A
Possible Causes	**Corrective Action**
• Communication line broken • Multiple VFDs with the same **Multi-VFD ID [ADV-37]**	• Check wiring between drives and replace as needed. • Check **Multi-VFD ID [ADV-37]** on each drive to make sure each drive has a unique value and that it is less than **Multi-VFD Set [ADV-35]**.

Warning Display	Description
oH1 (9) Over heat 1 Warn	The AC motor drive detects over-heating of IGBT
Action and Reset	
Action condition	The AC motor drive detects over-heating of IGBT, and over the protection level of oH1 warning. When **[PROT-18]** is higher than the IGBT over-heating level, the drive shows oH1 error without displaying oH1 warning.
Action time	When IGBT temperature is higher than **[PROT-18]**
Related parameters	[PROT-18]
Reset method	Automatically
Reset condition	The drive resets when IGBT temperature is lower than oH1 warning level minus (–) 5 °C
Recorded	N/A
Possible Causes	**Corrective Action**
• Ambient temperature or temperature inside the cabinet is too high, or there is obstruction in the ventilation hole of the control cabinet • Check if there is any obstruction on the heat sink or if the fan is running • Insufficient ventilation space • Check if the drive matches the corresponded loading • The drive has run 100% or more of the rated output for a long time	• Check the ambient temperature. Regularly inspect the ventilation hole of the control cabinet. Change the installed place if there are heating objects, such as braking resistors, in the surroundings. Install/ add cooling fan or air conditioner to lower the temperature inside the cabinet. • Remove the obstruction or replace the cooling fan. • Increase ventilation space of the drive. • Decrease loading. Decrease the carrier. Replace with a drive with larger capacity. • Replace with a drive with larger capacity.

Warning Display	Description
oH2 (10) Over heat 2 Warn	The drive has detected over heat of the board-level component
Action and Reset	
Action condition	oH2 error level minus (–) 5 °C
Action time	The oH2 warning occurs when the board-level component temperature is higher than oH2 warning level
Reset method	Automatically
Reset condition	The drive resets when IGBT temperature is lower than oH1 warning level minus (–) 5 °C
Recorded	N/A
Possible Causes	**Corrective Action**
• Ambient temperature or temperature inside the cabinet is too high, or there is obstruction in the ventilation hole of the control cabinet • Check if there is any obstruction on the heat sink or if the fan is running • Insufficient ventilation space • Check if the drive matches the corresponded loading	• Check the ambient temperature. Regularly inspect the ventilation hole of the control cabinet. Change the installed place if there are heating objects, such as braking resistors, in the surroundings. Install/ add cooling fan or air conditioner to lower the temperature inside the cabinet. • Remove the obstruction or replace the cooling fan. • Increase ventilation space of the drive. • Decrease loading. Decrease the carrier. Replace with a drive with larger capacity.
Warning Display	**Description**
oH3 (22) Motor Over Heat	Motor over-heating warning. The AC motor drive detects the temperature inside the motor is too high
Action and Reset	
Action condition	PTC input level > **[PROT-20]** (default = 50%) or PT100 input level > **[PROT-31]** (default = 7 V)
Action time	Immediately
Related parameters	**[PROT-19]** For PTC: When **[PROT-19]** = 0 and when the temperature is equal to or less than **[PROT-20]**, the oH3 warning automatically clears. When **[PROT-19]** = 0, it automatically resets. For PT100: When **[PROT-19]** = 0 and when the temperature is < **[PROT-30]**, the oH3 warning automatically clears. If the temperature is between **[PROT-30]** and **[PROT-31]**, the frequency outputs according to the operating frequency setting for **[PROT-06]** to **[PROT-58]**.
Reset method	Automatically
Reset condition	For PTC: When the temperature is equal or less than **[PROT-20]**, the oH3 warning automatically clears For PT100: When the temperature is < **[PROT-30]**, the oH3 warning automatically clears.
Recorded	N/A

Warning Display	Description
OL-2 (21) OL-2	Overload 2 warning
Action and Reset	
Action condition	**[PROT-13]**
Action time	**[PROT-14]**
Related parameters	**[PROT-12]** = 1 or 3
Reset method	Automatically
Reset condition	When output current < (**[PROT-13]** – 5%), the Ot2 warning clears
Recorded	N/A

Possible Causes	Corrective Action
• Incorrect parameter setting • Mechanical error (e.g. mechanical lock due to over-torque) • The load is too large • Accel./ Decel. time and working cycle is too short • V/F voltage is too high • The motor capacity is too small • Over-load during low-speed operation • The torque compensation is too large • Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault)	• Configure the settings for **[PROT-13]** and **[PROT-14]** • Remove the causes of malfunction. • Decrease the loading. Replace with a motor with larger capacity. • Increase the setting values for **[SET-11]** and **[SET-12]** • Adjust the V/F curve (Motor 2, **[VFD-03]**), especially the setting value for the mid-point voltage (if the mid-point voltage is set too small, the load capacity decreases at low-speed). • Replace with a motor with larger capacity. • Decrease the loading during low-speed operation. Increase the motor capacity. • Adjust the torque compensation value (**[Motor-17]**) until the output current decreases and the motor does not stall. • Correct the parameter settings for speed tracking. Start speed tracking function. Adjust the maximum current for **[PROT-39]** speed tracking.

Warning Display	Description
OPHL (28) Output PHL Warn	Output phase loss
Action and Reset	
Action condition	**[PROT-23]**
Action time	N/A
Related parameters	**[PROT-21]**
Reset method	Set **[PROT-21]** = **0_Alarm and Run** and stop the drive
Reset condition	Immediately
Recorded	N/A

Possible Causes	Corrective Action
• Unbalanced three-phase impedance of the motor • Check if the wiring is incorrect • Check if the motor is a single-phase motor • Check if the current sensor is broken • If capacity of the drive is larger than the motor	• Replace the motor. • Check the cable. Replace the cable. • Choose a three-phase motor. • Check if the control board cable is loose. If yes, reconnect the cable and run the drive to test. If the error still occurs, return to the factory for repair. Check if the three-phase current is balanced with a current clamp meter. If the current is balanced and the OPHL error still shows on the display, return to the factory for repair. • Choose the matches capacity of the drive and motor.

Warning Display	Description
oSL (24) Over Slip Warn	Over slip warning. By using the maximum slip as the base, when the drive outputs at constant speed, and the F > H or F < H exceeds **[Motor-19]** level and **[Motor-20]** setting time, 100%
Action and Reset	
Action condition	When the drive outputs at constant speed, and F > H or F < H exceeds **[Motor-19]**
Action time	**[Motor-20]**
Related parameters	**[Motor-21]** = 0
Reset method	Automatically
Reset condition	When **[Motor-21]** = 0 and when the drive outputs at constant speed, and F > H or F < H no longer exceeds **[Motor-19]**
Recorded	N/A
Possible Causes	**Corrective Action**
• Motor parameter is incorrect • Load is too large • Check if the settings for **[Motor-19]** and **[Motor-20]** are properly set	• Check the motor parameter. • Decrease the loading. • Check the parameter settings for oSL protection.
Warning Display	**Description**
oSPD (17) Over Speed Warn	Over speed warning
Action and Reset	
Action condition	The encoder feedback speed
Action time	N/A
Reset method	Automatically
Reset condition	When drive stops, warning clears
Recorded	N/A
Possible Causes	**Corrective Action**
• Improper setting for FOC bandwidth of speed observer • Improper bandwidth setting for ASR speed controller • Incorrect motor parameter setting • Malfunction caused by interference	• Decrease setting value for FOC bandwidth of speed observer. • Increase the bandwidth setting for ASR speed controller. • Reset motor parameter and run parameter tuning. • Verify wiring of the control circuit, and wiring/grounding of the main circuit to prevent interference.

Warning Display	Description
ot1 (20) Over Torque 1	Over-torque 1 warning
Action and Reset	
Action condition	**[SET-48]**
Action time	**[SET-50]**
Related parameters	**[SET-47]** = **1** or **3**
Reset method	Automatically
Reset condition	When input current < (**[SET-48]** – 5%), the Ot1 warning automatically clears
Recorded	N/A
Possible Causes	**Corrective Action**
• Incorrect parameter setting • Mechanical error (e.g. mechanical lock due to over-torque) • The load is too large • Accel./ Decel. time and working cycle is too short • V/F voltage is too high • The motor capacity is too small • Over-load during low-speed operation • The torque compensation is too large • Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault)	• Configure the settings for **[SET-48]** and **[SET-50]** again. • Remove the causes of malfunction. • Decrease the loading. Replace with a motor with larger capacity. • Increase the setting values for **[SET-11]** and **[SET-12]** (accel./ decel. time). • Adjust the settings for **[VFD-02]** – to be **01** to **08** (V/F curve), especially the setting value for the midpoint voltage (if the mid-point voltage is set too small, the load capacity decreases at low-speed). • Replace with a motor with larger capacity. • Decrease the loading during low-speed operation. Increase the motor capacity. • Adjust the torque compensation value **[Motor-17]** until the output current decreases and the motor does not stall. • Correct the parameter settings for speed tracking. Start the speed tracking function. Adjust the maximum current for **[PROT-39]** speed tracking.

Warning Display	Description
PCAd (67) CAN/M Address	CANopen Master station address error
Action and Reset	
Action condition	When the CANopen master detects an incorrect or repeated station address from the Follower, the PCAd warning displays.
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	The warning clears when reset the station address and run the program again.
Recorded	N/A
Possible Causes	**Corrective Action**
• When the CANopen master detects an incorrect or repeated station address from the follower	• Set the correct follower station address.

Warning Display	Description
PCbF (62) CAN/M bus off	CANopen Master BUS off
Action and Reset	
Action condition	When the CANopen master detects error packets more than 255 during the BUS off detection, or when the CANopen card is not installed, the PCbF warning displays. If the BUS cable is not connected, the drive does not receive issues packet, and the PCbF warning does not display.
Action time	Immediately displays when the fault is detected
Reset method	Cycle the power
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• Malfunction caused by interference • Communication cable is broken or bad connected	• For interference: – Verify wiring/grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. – Make sure the communication circuit is wired in series. – Use CANopen cable or add terminating resistance. • Check or replace the communication cable.
Warning Display	**Description**
PCCt (64) CAN/M Cycle Time	CANopen Master cycle time-out
Action and Reset	
Action condition	When the transmitted packet from CANopen master exceeds the maximum allowable quantity in a certain time, the PCCt warning displays.
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	The warning clears when changing the configuration and re-executing the program.
Recorded	N/A
Possible Causes	**Corrective Action**
• When the transmitted packet from CANopen master exceeds the maximum allowable quantity in a certain time	• Increase the time setting of D1090 synchronization cycle
Warning Display	**Description**
PCGd (61) CAN/M Guard err	CANopen Master guarding error
Action and Reset	
Action condition	When CANopen Master Node Guarding detects that one of the Followers does not response, the PCGd warning displays.
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	Check if the program is correct and re-download the program. If the fault does not exist, the warning clears.
Recorded	N/A
Possible Causes	**Corrective Action**
• Follower is not connected or CANopen BUS cable is not connected • Malfunction caused by interference • Communication cable is broken or badly connected	• Connect the Follower and CANopen BUS • For interference: – Verify wiring/grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. – Make sure the communication circuit is wired in series. – Use CANopen cable or add terminating resistance. • Check or replace the communication cable.

Warning Display	Description
PCnL (63) CAN/M Node Lack	CANopen Master node error
Action and Reset	
Action condition	When the CANopen master configures different setting nodes from the actual nodes, the PCnL warning displays.
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	When connect BUS to the original follower or change the configured node numbers to meet the actual node quantity, the warning clears.
Recorded	N/A
Possible Causes	**Corrective Action**
• The configured node quantity is different from the actual nodes • Communication cable is broken or bad connected	• Connect BUS to the original follower, or change the configured node numbers to meet the actual node quantity. • Check or replace the communication cable.
Warning Display	**Description**
PCSd (66) CAN/M Sdo Tout	CANopen Master SDO time-out
Action and Reset	
Action condition	When the CANopen master sends a SDO command and the BUS is too busy to transmit the command
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	The warning clears when the SDO transmits normally.
Recorded	N/A
Possible Causes	**Corrective Action**
• When the CANopen master transmits a SDO command, and does not receive feedback from the Follower within 1 sec.	• Check if the Follower responds within 1 second.
Warning Display	**Description**
PCSF (65) CAN/M SDO over	CANopen Master SDO overflow
Action and Reset	
Action condition	When the CANopen master transmits too much SDO that causes buffer overflow, the PCSF warning displays
Action time	Immediately displays when the fault is detected
Reset method	Cycle the power or stop the PLC and run the PLC again
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• Internal PLC transmits too much SDO at once	• The PLC program needs to confirm receiving the SDO feedback data before sending another SDO command.

Warning Display	Description
PCTo (68) CAN/M T-Out	When the drive receives an incorrect packet, it means that there is interference or the command from the upper unit does not meet the CANopen command format.
Action and Reset	
Action condition	N/A
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	The warning clears after receives another normal packet
Recorded	N/A
Possible Causes	**Corrective Action**
• Malfunction caused by interference • The command from the upper unit does not meet the CANopen format	• For interference: – Verify wiring/grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance. – Make sure the communication circuit is wired in series. – Use CANopen cable or add terminating resistance. • If the command does not meet the format, call Technical Support.

Warning Display	Description
PHL (19) Phase Loss Warn	Input phase loss warning
Action and Reset	
Action condition	One of the phases outputs less than **[PROT-23]**
Action time	**[PROT-22]**
Related parameters	**[PROT-21]** = 0
Reset method	Automatically
Reset condition	After the drive stops
Recorded	N/A
Possible Causes	**Corrective Action**
• Phase loss of the input power • Single phase power input on a three-phase model • The power voltage has changed • Loose wiring terminal of input power • Check if the input cable of three-phase power is broken • The voltage of input power has changed • Unbalance three-phase of the input power	• Verify wiring of the main circuit. • Use the model with voltage that matches the power. • If the power of main circuit works well, check if the MC of the main circuit is broken. Cycle the power after verifying the power is normal. If PHL still occurs, return to the factory for repair. • Tighten the terminal screws with the torque listed in the user manual. • Check setting for **IPO Check Time [PROT-26]** and **IPO Ripple [PROT-27]**. • Check the status of three-phase power.

Warning Display	Description
PID (11) PID FBK Error	PID feedback loss (warning for analog feedback signal; works only when PID enables)
Action and Reset	
Action condition	When the analog input is lower than 4 mA (only detects analog input of 4–20 mA)
Action time	N/A
Reset method	Automatically
Reset condition	Immediately reset
Recorded	Yes
Possible Causes	**Corrective Action**
• Loose or broken PID feedback wiring • Feedback device malfunction • Hardware error	• Tighten the terminals again. Replace with a new cable. • Replace with a new feedback device. • If the PID error still occurs after checking all the wiring, return to the factory for repair.

Warning Display	Description
PILA (139) Pipe Leak Alarm	Pipe leak detected in sleep mode where wake-up time is longer than **[ADV2-48]**, **[ADV2-49]**, **[ADV2-50]**, and **[ADV2-51]**. Wake-up time is duration from pressure setpoint to wakeup level.
Action and Reset	
Action condition	Pressure drops for a duration longer than wake-up time between PID setpoint (**[ADV2-52]** or and wakeup level)
Action time	Longer than **[ADV2-48]**, **[ADV2-49]**, **[ADV2-50]**, and **[ADV2-51]**
Related parameters	**[ADV2-46]** through **[ADV2-51]**
Reset method	Fault/Warning is determined by **[ADV2-46]**
Reset condition	Manually
Recorded	Yes
Possible Causes	**Corrective Action**
• Leak in pipe after pressure sensor • System is low flow causing long delay to reach wakeup level	• Pressurize pipe and then check for leaks. • Increase wake times **[ADV2-48]** to **[ADV2-51]**. Run system between different load demands and record **Last Wake Time [ADV2-47]** for each run. Set wake times larger than recorded value.

Warning Display	Description
PLCr (58) PLC MCR error	PLC MCR command error
Action and Reset	
Action condition	The MC command is detected during PLC operation, but there is no corresponded MCR command.
Action time	Immediately
Reset method	Check if the program is correct and re-download the program.
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• The MC command is continuously used for more than 9 times	• Check and reset the program, then re-download the program.

Warning Display	Description
PLdA (52) Data defect	Data error during PLC operation
Action and Reset	
Action condition	The program detects incorrect write-in address when decoding the program source code and downloading the PLC program (e.g. the address has exceeded the range), then PLdA warning acts.
Action time	Immediately
Reset method	Automatically
Reset condition	Check if the program is correct and re-download the program. If the fault does not exist, the warning clears.
Recorded	N/A
Possible Causes	**Corrective Action**
• During PLC operation, the external Modbus has written/read incorrect data to internal PLC program	• Check if the upper unit transmits the correct command.

Warning Display	Description
PLdF (59) Download fail	PLC download fail
Action and Reset	
Action condition	PLC download fail due to momentary power loss during the downloading, when power is ON again, warning shows.
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	Check if the program is correct and re-download the program. If the fault does not exist, the warning clears.
Recorded	N/A
Possible Causes	**Corrective Action**
• PLC download is forced to stop, so the program write-in is incomplete	• Check if there is any error in the program and re-download the PLC program

Warning Display	Description
PLEd (57) No end command	PLC end command is missing
Action and Reset	
Action condition	The “End” command is missing until the last command is executed, the PLEd warning shows
Action time	Immediately
Reset method	Check if the program is correct and re-download the program.
Reset condition	If the fault does not exist, the warning automatically clears.
Recorded	N/A
Possible Causes	**Corrective Action**
• There is no “END” command during PLC operation	• Disable PLC • Remove PLC program (**[ADV-03]** = 6) • Enable PLC • Re-download PLC program

Warning Display	Description
PLFF (55) **PLFn** (53) Function defect	Function code error during PLC operation PLC download function code error
Action and Reset	
Action condition	The program detects incorrect command (unsupported command) during PLC operation or downloading.
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	Check if the program is correct and re-download the program. If the fault does not exist, the warning clears.
Recorded	N/A
Possible Causes	**Corrective Action**
• The PLC runs an incorrect command during operation • Unsupported command has used while downloading the program	• When starting the PLC function and there is no program in the PLC, the PLFF warning shows. This is a normal warning. Please download the program. • Check if the firmware of the drive is the old version. If yes, contact Technical Support.

Warning Display	Description
PLod (50) Opposite defect	PLC download error warning
Action and Reset	
Action condition	During PLC downloading, the program source code detects incorrect address (e.g. the address exceeds the range).
Action time	Immediately
Reset method	Check if the program is correct and re-download the program.
Reset condition	If the fault does not exist, the warning automatically clears.
Recorded	N/A
Possible Causes	**Corrective Action**
• Incorrect component number is found when downloading the PLC program	• Use the correct component number.

Warning Display	Description
PLor (54) Buf overflow	PLC register overflow
Action and Reset	
Action condition	When PLC runs the last command and the command exceeds the maximum capacity of the program, the PLor warning shows.
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	Check if the program is correct and re-download the program. If the fault does not exist, the warning clears.
Recorded	N/A
Possible Causes	**Corrective Action**
• The program detects source code error during PLC operation	• Disable PLC • Delete PLC program (**[ADV-03]** = 6) • Enable PLC • Re-download PLC program

Warning Display	Description
PLrA (47) RTC Adjust	PLC (RTC) is not adjusted
Action and Reset	
Action condition	When using RTC function for PLC program, the PLC detects unreasonable RTC time
Action time	Immediately
Reset method	Automatically or Manually
Reset condition	Cycle the power
Recorded	N/A
Possible Causes	**Corrective Action**
• When using RTC function for PLC program, and the drive is power off over 7 days or KPC-CC01 does not connect to the drive for a long time, the RTC time is different with the internal calculated time when reconnect the keypad to the drive. • KPC-CC01 does not adjust the RTC time • PLC detects unreasonable RTC time • Replaced a KPC-CC01	• Stop the PLC program and restart it. Adjust the RTC time and cycle the power. • Adjust the RTC time and cycle the power. • Stop the PLC program and restart it. Cycle the power.

Warning Display	Description
PLrt (49) Keypad RTC TOut	PLC (RTC) error
Action and Reset	
Action condition	N/A
Action time	N/A
Reset method	Automatically
Reset condition	Cycle the power
Recorded	N/A
Possible Causes	**Corrective Action**
• KPC-CC01 is not connected to the control board while using the RTC function	• Do not remove the KPC-CC01 keypad while using RTC function.

Warning Display	Description
PLSF (60) Scan time fail	PLC scan time exceeds the maximum allowable time
Action and Reset	
Action condition	The PLC scan time exceeds the maximum allowable time (400 ms)
Action time	Immediately
Reset method	Check if the program is correct and re-download the program
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• The PLC scan time exceeds the maximum allowable time (400ms)	• Check if the source code is correct and re-download the program.

Warning Display	Description
PLSn (56) Check sum error	PLC checksum error
Action and Reset	
Action condition	PLC checksum error is detected after power on, then PLSn warning shows
Action time	Immediately displays when the fault is detected
Reset method	Automatically
Reset condition	Check if the program is correct and re-download the program. If the fault does not exist, the warning clears.
Recorded	N/A
Possible Causes	**Corrective Action**
• The program detects checksum error during PLC operation	• Disable PLC • Remove PLC program (**[ADV-03]** = 6) • Enable PLC • Re-download PLC program

Warning Display	Description
PLSv (51) Save mem defect	Data error during PLC operation
Action and Reset	
Action condition	The program detects incorrect written address (e.g. the address has exceeded the range) during PLC operation
Action time	Immediately
Reset method	Check if the program is correct and re-download the program
Reset condition	Automatically
Recorded	N/A
Possible Causes	**Corrective Action**
• An incorrect written address is detected during PLC operation	• Make sure the write-in address is correct and re-download the program.

Warning Display	Description
SE1 (7) Save Error 1	Keypad COPY error 1: Keypad copy time-out
Action and Reset	
Action condition	The keypad does not transmit the COPY command to the drive, and does not transmit any data to the drive again in 10 ms at the time you copy the parameters to the drive.
Action time	10 ms
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• Communication connection error • Keypad error • Control board error	• The causes of error are mostly communication problems between the keypad and control board. Potential causes include communication signal interference and the unacceptable communication command to the Follower. Check if the error occurs randomly, or only occurs when copying certain parameters (the error displays on the upper right corner of the copy page). If you cannot clear the error, please contact Technical Support.
Warning Display	**Description**
SE2 (8) Save Error 2	Keypad COPY error 2: parameter writing error
Action and Reset	
Action condition	The parameters incorrectly at the time you copy parameters to the drive. For example, you copy the new firmware version with added parameters to the drive with old firmware version.
Action time	N/A
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• Add new parameters to the new firmware version • Malfunction caused by interference	• SE2: In this stage, the copied data has been transmitted to the Follower. The Follower compares and processes the copied data, and then saves the data to the Data ROM. During the process, the data error (should be attribution error) may occur, or the data cannot be saved to EEPROM. At this time, the warning occurs. It is suggested to check the status of Data ROM and remove the error causes first. If you cannot clear the error, please contact Technical Support. • Verify the wiring and grounding of the main circuit, control circuit and the encoder for effective anti-interference performance.
Warning Display	**Description**
SE3 (30) Copy Model Err	Keypad COPY error 3: copy model error
Action and Reset	
Action condition	"SE3" warning occurs when different drive identity codes are found during copying parameters.
Action time	Immediately act when the error is detected
Reset method	Manually
Reset condition	N/A
Recorded	N/A
Possible Causes	**Corrective Action**
• Keypad copy between different power range drives	• It is mainly to prevent parameter copies between different HP/models.

Warning Display	Description
SpdR (105) Est-Speed REV	Estimated speed is in a reverse direction with motor actual running direction
Action and Reset	
Action condition	Software detection
Action time	N/A
Reset method	Manually
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• The motor runs in reverse direction at start • The difference between motor parameter measured Rr and Rs value is too large • Insufficient output torque is dragged to the reverse direction by the load.	• Check if the motor is hold when started, or start the motor with speed source. • Normally the Rr value of IM is Rs × 0.7. If there is much difference of the measured value (e. g. Rr = Rs × 0.3), proceed the motor parameter auto-tuning again. • Increase the output torque.

Warning Display	Description
tUn (25) Auto tuning	Parameter auto-tuning is processing.
Action and Reset	
Action condition	When running **[Motor-00]** motor parameter auto-tuning
Action time	N/A
Reset method	Automatically
Reset condition	When auto-tuning is finished and no error occurs.
Recorded	N/A
Possible Causes	**Corrective Action**
• The motor parameter is running autotuning	• When the auto-tuning is finished, the warning automatically clears.

Warning Display		Description
uC (13) Under Current		Low current
Action and Reset		
Action condition		**[SET-42]**
Action time		**[SET-44]**
Related parameters		**[SET-41]**
Reset method	Auto	"Warning" occurs when **[SET-41]** = 3. "Warning" clears when the output current is > (**[SET-42]** + 0.1 A).
	Manually	"Error" occurs when **[SET-41]** = 1 and 2. Drive needs to be reset manually.
Reset condition		Immediately
Recorded		Does not record when **[SET-41]** = 3 and uC displays "Warning"
Possible Causes		**Corrective Action**
• Broken motor cable • Improper setting for the low current protection • Low load		• Exclude the connection issue of the motor and its load. • Set the proper settings for **[SET-42]**, **[SET-44]** and **[SET-41]**. • Check the loading status. Make sure the loading matches the motor capacity.

Warning Display	Description
Vivd (130) VFD-N Invalid	For Multi-drive operation, at least one follower is connected but the settings on the follower are invalid compared to the master (this drive).
Action and Reset	
Action condition	A follower settings of **[ADV-35]**, **[ADV-36]**, **[SET-07]**, and **[SET-17]** different than master drive (this drive). To identify master drive, set **[SET-58]** to **23_Commu Role**. On screen, 0=No Role, 1=Master, and 2=Follower.
Action time	Immediately
Related parameters	**[ADV-35]**, **[ADV-36]**, **[SET-07]**, and **[SET-17]**
Reset method	Automatically once parameters are set correctly
Reset condition	Immediately; May require power cycle of system once parameters have been adjusted.
Recorded	N/A
Possible Causes	**Corrective Action**
• Wrong parameter values for **[ADV-35]**, **[ADV-36]**, **[SET-07]**, and **[SET-17]** • Multiple masters on network	• Verify settings match master drive. To identify master drive, set **[SET-58]** to **23_Commu Role**. On screen, then 0=No Role, 1=Master, and 2=Follower. • If network has multiple masters, make sure each drive on network has unique **Mulit-VFD ID [ADV-37]** and that value is equal or less than **Multi-VFD Set [ADV-35]**. • If network has multiple masters, check communication wiring between drives and replace wiring as needed.
Warning Display	**Description**
Vlos (129) VFD-N Lost	For Multi-drive operation, at least one follower is disconnected from the master (this drive)
Action and Reset	
Action condition	The number of drives detected are less than **Multi-VFD Set [ADV-35]**. This warning only occurs on the master drive. To identify master drive, set **[SET-58]** to **23_Commu Role** then 0=No Role, 1=Master, and 2=Follower.
Action time	Immediately
Related parameters	**[ADV-35]**, **[ADV-36]**, and **[ADV-37]**
Reset method	Automatically once parameters are set correctly
Reset condition	Immediately; May require power cycle of system once parameters have been adjusted
Recorded	N/A
Possible Causes	**Corrective Action**
• Communication line broken • Multiple VFDs with the same **Multi-VFD ID [ADV-37]**	• Check wiring between drives and replace as needed. • Check **Multi-VFD ID [ADV-37]** on each drive to make sure each drive has a unique value and that it is less than **Multi-VFD Set [ADV-35]**.
Warning Display	**Description**
VnAT (132) VFD HOA not Aut	For Multi-drive operation, this VFD is not in Auto mode. This drive does not operate in multi-drive operation with this warning present.
Action and Reset	
Action condition	**Multi-VFD Set [ADV-35]** is not **0_Single VFD** and mode set to **HAND** or **OFF**.
Action time	Immediately
Related parameters	**Multi-VFD Set [ADV-35]**
Reset method	Automatically once set **[ADV-35]** to **0_Single VFD** or change mode to **AUTO**.
Reset condition	Immediately
Recorded	N/A
Possible Causes	**Corrective Action**
• This drive is in **HAND** or **OFF** mode • This drive has Multi-drive operation enabled	• Use **HOA Mode Source [SET-60]** to change mode to **AUTO**. • Change **Multi-VFD Set [ADV-35]** to **0_Single VFD** to disable Multi-drive operation.

Fan Replacement

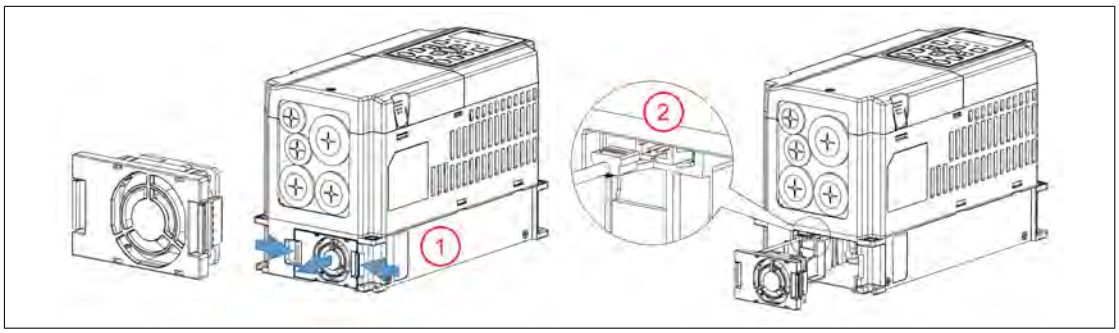
⚠ WARNING

Risk of bodily injury or damage to drive or other equipment. Contact with hazardous voltage could result in death or serious injury.

- Disconnect and lock out all power before installing or servicing equipment.
- Do not attempt to replace fans until power has been removed and 10 minutes have passed to allow internal voltage to discharge.
- Fans cannot be replaced with power applied. Damage to VFD may occur.

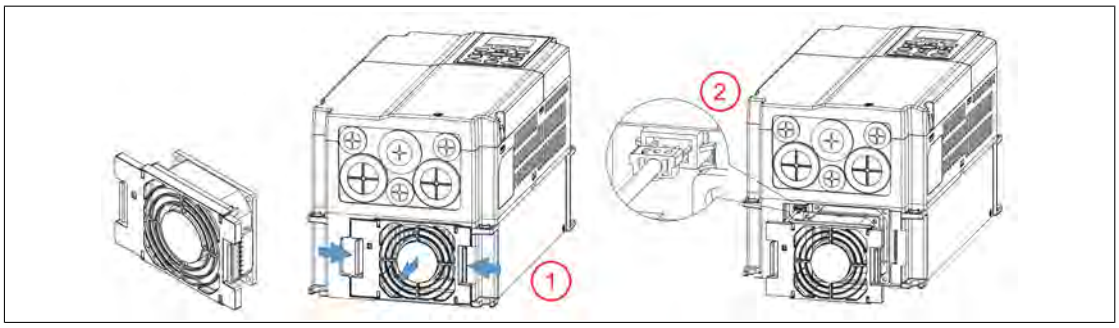
Refer to "Replacement Components List" on page 247 for fan part numbers.

Frame A Heat Sink Fan



1. Press the tabs on both sides of the fan to release and slide out the fan.
2. Disconnect the power connector before completely removing the fan.

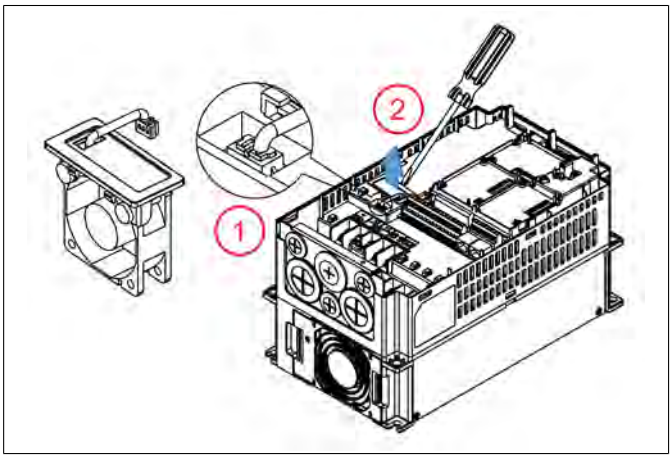
Frame B Heat Sink Fan



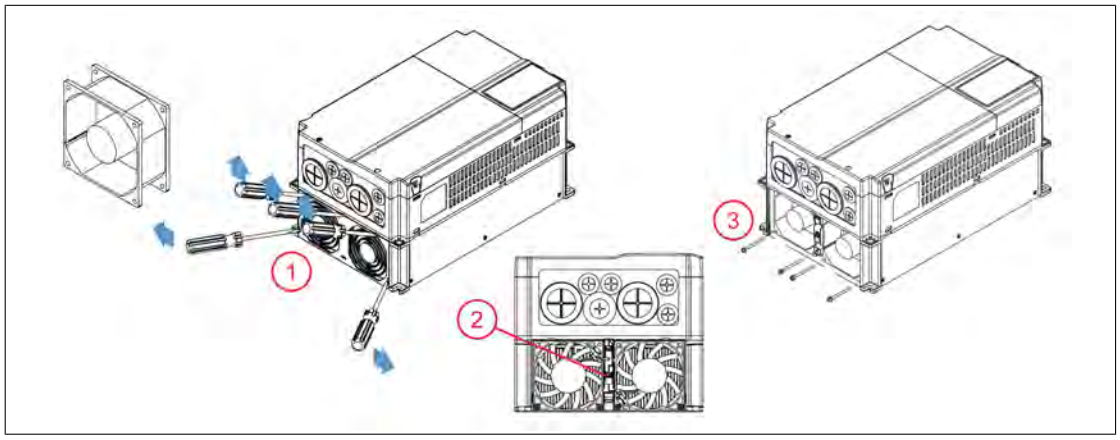
1. Press the tabs on both sides of the fan to release and slide out the fan.
2. Disconnect the power connector before completely removing the fan.

Frame B and C Capacitor Fan

1. Disconnect fan power connector.
2. Lift the fan out using a flathead screwdriver.



Frame C Heat Sink Fan

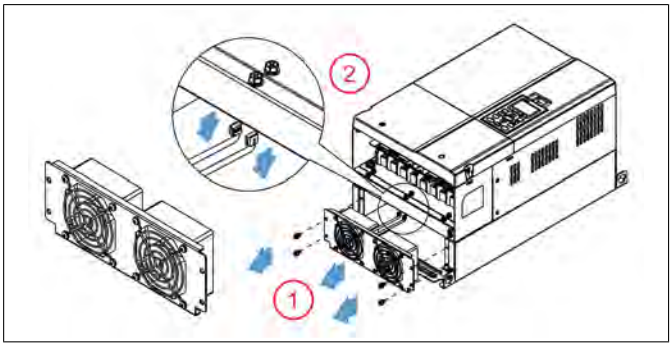


NOTE: Some Frame C models use one fan and some use two.

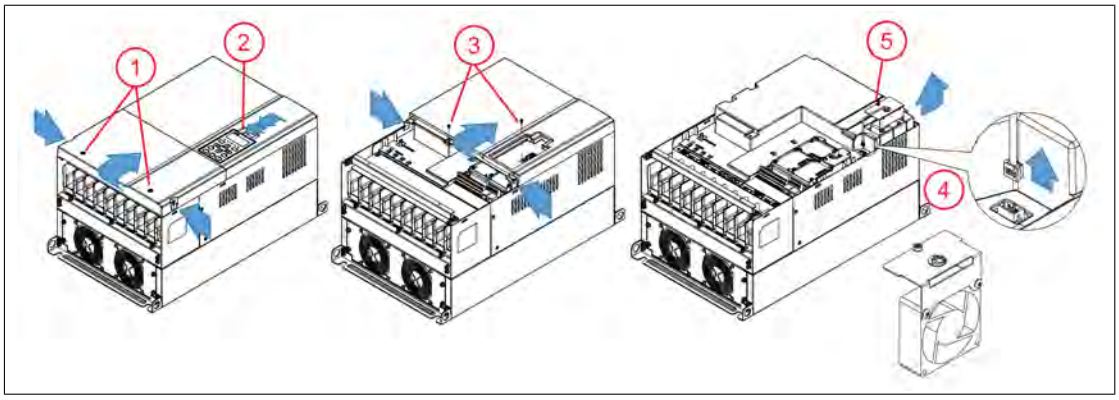
1. Before removing fans, remove the cover using a flathead screwdriver.
2. Disconnect fan power connectors.
3. Remove screws and remove fans. When replacing screws, tighten to a torque of 8.67 to 10.4 in-lbs (0.98 to 1.18 Nm).
4. When installing new fans, make sure label faces the inside of the drive.

Frame D Heat Sink Fan

1. Remove four screws to release and slide out the fan assembly. When replacing screws, tighten to a torque of 20.8 to 22.1 in-lbs (2.35 to 2.5 Nm).
2. Disconnect the power connectors before completely removing the fan.



Frame D Capacitor Fan

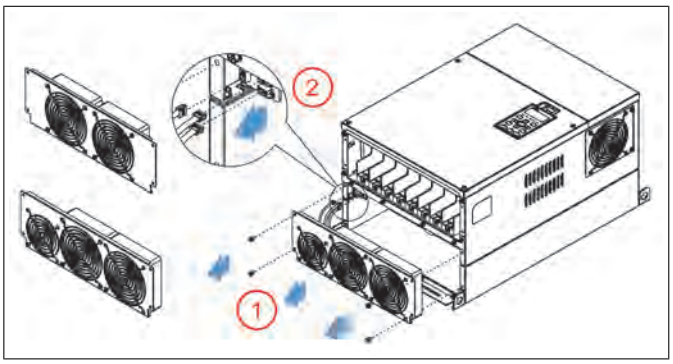


1. Remove two screws and press the tabs on both sides to remove the lower cover. When replacing screws, tighten to a torque of 10.4 to 13 in-lbs (1.18 to 1.47 Nm).
2. Press the top of the keypad and remove the keypad.
3. Remove two screws and press the tabs on both sides to remove the upper cover. When replacing screws, tighten to a torque of 5.2 to 6.9 in-lbs (0.59 to 0.78 Nm).
4. Disconnect fan power connector.
5. Remove one screw and pull out the fan. When replacing the screw, tighten to a torque of 8.9 to 10.4 in-lbs (1.0 to 1.18 Nm).

Frame E Heat Sink Fan

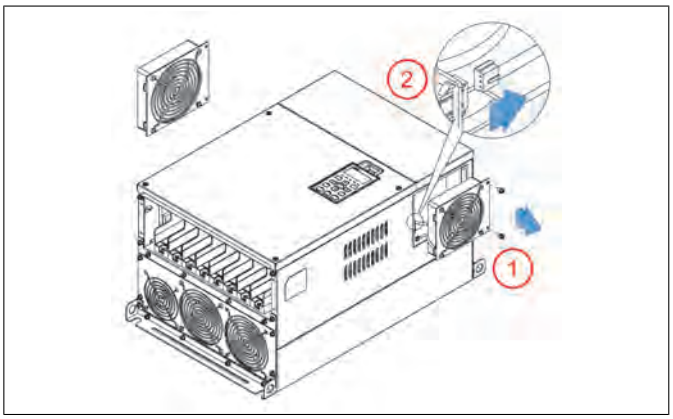
NOTE: Frame E models use multiple heat sink fan styles. Order the correct part when replacing the fan.

1. Remove four screws to release and slide out the fan assembly. When replacing screws, tighten to a torque of 20.8 to 22.1 in—lbs (2.35 to 2.5 Nm).
2. Disconnect the power connectors before completely removing the fan.



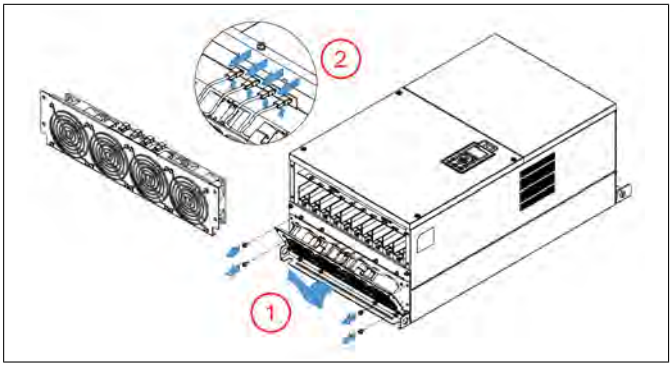
Frame E Capacitor Fan

1. Remove four screws to release and slide out the fan assembly. When replacing screws, tighten to a torque of 20.8 to 22.1 in-lbs (2.35 to 2.5 Nm).
2. Disconnect the power connectors before completely removing the fan.

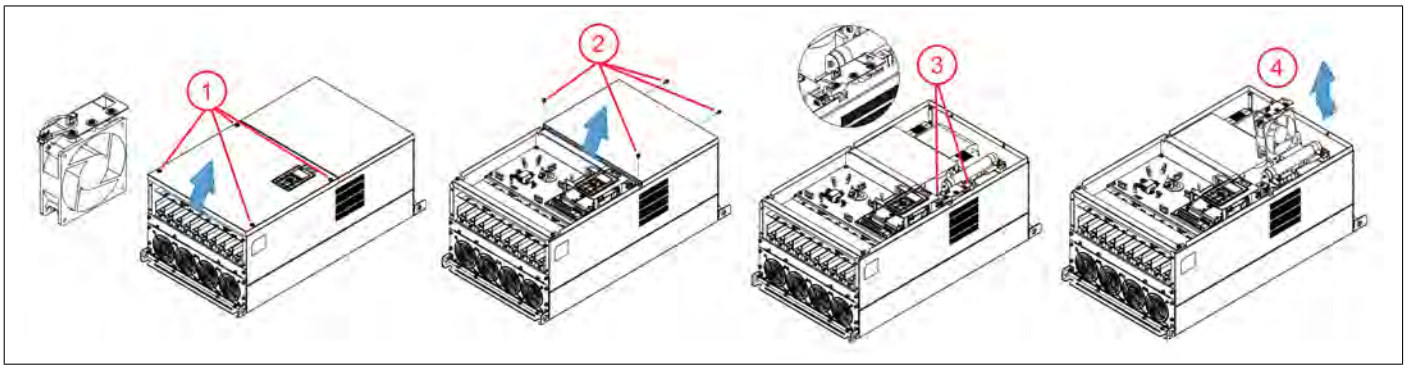


Frame F Heat Sink Fan

1. Remove four screws to release and slide out the fan assembly. When replacing screws, tighten to a torque of 10.4 to 13 in-lbs (1.18 to 1.47 Nm).
2. Disconnect the power connectors before completely removing the fan.

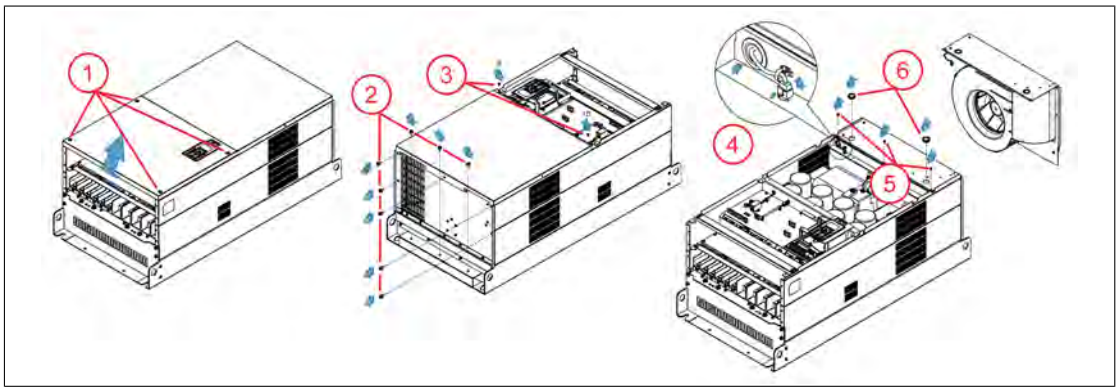


Frame F Capacitor Fan



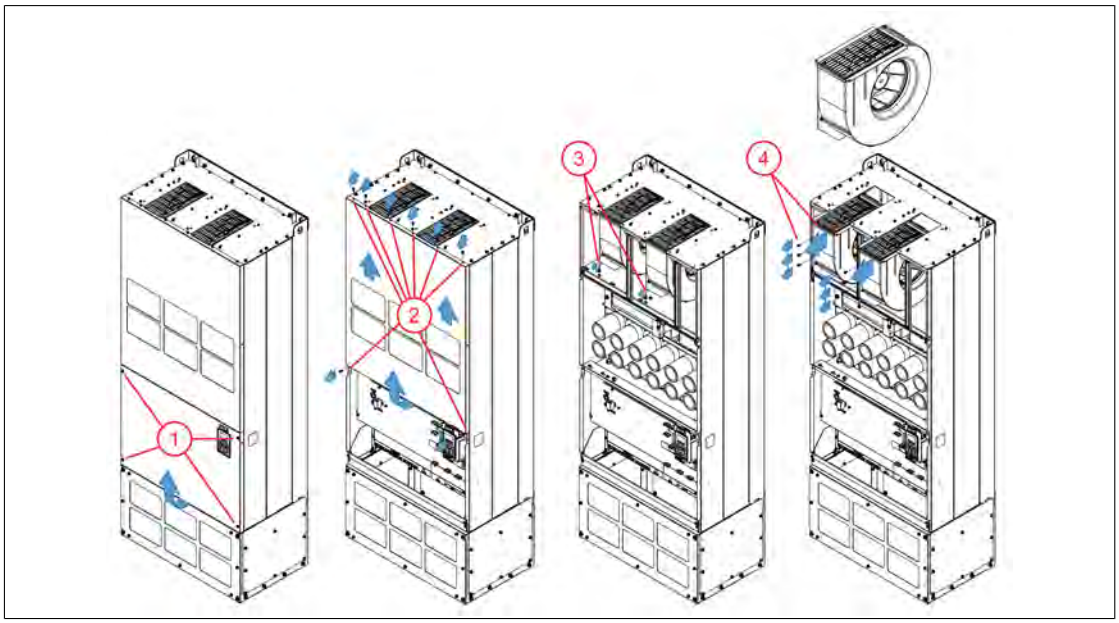
1. Remove four screws and remove the lower cover. When replacing screws, tighten to a torque of 10.4 to 13 in-lbs (1.18 to 1.47 Nm).
2. Remove four screws and remove the upper cover. When replacing screws, tighten to a torque of 20.8 to 22.1 in-lbs (2.35 to 2.5 Nm).
3. Disconnect fan power connector and remove three screws. When replacing the screw, tighten to a torque of 20.8 to 22.1 in-lbs (2.35 to 2.5 Nm).
4. Pull out the fan.

Frame G Heat Sink Fan



1. Remove four screws and remove the lower cover. When replacing screws, tighten to a torque of 10.4 to 13 in-lbs (1.18 to 1.47 Nm).
2. Remove eight screws from the top cover. When replacing screws, tighten to a torque of 30 to 34.5 in-lbs (3.4 to 3.9 Nm).
3. Remove two screws from the bottom of the upper front cover. When replacing screws, tighten to a torque of 12 to 14 in-lbs (1.37 to 1.57 Nm).
4. Remove upper front cover.
5. Release clip and disconnect fan power connector.
6. Remove three screws from fan. When replacing the screws, tighten to a torque of 12 to 14 in-lbs (1.37 to 1.57 Nm).
7. Remove protective covers and pull out the fan by placing fingers through the lifting holes.

Frame H Heat Sink Fan



1. Remove four screws and remove the lower front cover. When replacing screws, tighten to a torque of 12 to 14 in-lbs (1.37 to 1.57 Nm).
2. Remove eight screws and remove the upper front cover. When replacing screws, tighten to a torque of 20.8 to 22.1 in-lbs (2.35 to 2.5 Nm).
3. Disconnect two fan power connectors.
4. Remove three screws from each fan and pull out the fans. When replacing the screws, tighten to a torque of 20.8 to 22.1 in-lbs (2.35 to 2.5 Nm).

PARAMETER REFERENCE TABLES

Parameter Descriptions > SET Menu

AR = Adjustable while Running.

CODE	Mod Bus	AR	Display Name	Range	Description
SET-00	0000	N	Application Sel	0_Basic 1_Supply Fan 2_Exhaust Fan 3_Cooling Tower 4_Centrif Pump 5_Submers Pump 6_Vacuum 7_Constant Torque 8_FE MagForce 9_PM Motor	Mechanical application the VFD is running; should be set first during VFD programming. Selection automatically adjusts many default parameters to common values for the application. Additional adjustments may be required for optimum performance. Refer to the application descriptions in "Applications" on page 11 for more information. **IMPORTANT:** Whenever the application is changed, many default parameters are changed. Be sure to verify settings to ensure proper operation. Refer to the Default Settings tables in "Default Settings Table - SET Menu" on page 51.
SET-01	0001	N	Input Phase	0_Three-Phase 1_Single-Phase	The VFD is capable of using a 3-Phase or Single-Phase input power source, but should be de-rated for Single-Phase input power.
SET-02	0002	N	Motor HP	0.5~655 HP	Default is set based on VFD rating. User should enter the rated motor HP, found on the motor nameplate.
SET-03	0003	N	Motor FLA (SFA)	1/10 of max capacity~999.9 Full Load Amperage	Default is set based on VFD rating. User should enter the rated motor FLA, found on the motor nameplate. If **[SET-00]** is set to **5_Submersible**, enter the SFA rating from the motor nameplate. All internal overload protection features for the VFD and motor are calculated based on the value in this parameter.
SET-04	0004	N	Motor RPM	0~3600 RPM	Rated Motor RPM from motor nameplate when running at nameplate frequency.
SET-05	0005	N	Motor Voltage	230V: 0 to 255 V 460V: 0 to 510 V 575V: 0 to 637 V 690V: 0 to 720 V	Rated voltage of the motor, found on the motor nameplate. The VFD can produce output voltage equal to or less than input power voltage.
SET-06	0006	N	Motor Freq Sel	0_50Hz 1_60Hz	Motor rated frequency. If **Motor Freq Sel [SET-06]** is changed to 50 Hz, all output frequency related parameters are adjusted. Refer to "Default Settings Table - Frequency Defaults with 50 Hz Power" on page 63.
SET-07	0007	N	Auto Speed Ref	0_Keypad 1_Up/Down DI 2_AVI1 Analog 3_ACI Analog 4_AVI2 Analog 5_RS485 Serial 6_Com Card 7_PID Output	Source of speed reference when in Auto mode. 0_Keypad input. 1_Digital Input when DI terminal **[IO-21]** to **[IO-28]** set to **Up** and **Down**. 2, 3, & 4_Analog input from BMS, PLC, Potentiometer or other control device. 5_RS-485 Interface 6_Communications card control. 7_PID output. When PID mode is selected, additional parameters must be verified for setpoints, inputs, and limits.
SET-08	0008	N	Auto Run Cmd	0_Keypad 1_Digital Input 2_RS485 Serial 3_Com Card 4_Ext HOA in Auto	Source of Run Command in Auto mode. 0_Keypad: Run command from Start/Stop button. 1_Digital Input: Run command from digital input **[IO-21]** to **[IO-28]** set to **38_FWD** or **39_REV**. If direction is set here, then dedicated FWD input is disabled. Keypad STOP is disabled. 2_RS485 Serial: Run command from RS485 interface. Keypad STOP is disabled. 3_Com Card: Run command from communications card. This does not include CANopen card. 4_External HOA in Automatic: Run command from digital input **[IO-21]** to **[IO-28]** set to **27_HOA-AUTO** (when HOA is in Auto position).
SET-09	0009	N	Hand Speed Ref	0_Keypad 1_RS485 Serial 2_AVI1 Analog 3_ACI Analog 4_AVI2 Analog 5_Com Card	Source of speed reference when in Hand mode. 0_Keypad input. 1_RS-485 Interface 2, 3, 4_Analog input from BMS, PLC, Potentiometer or other control device. 5_Communications card control. When in Hand mode, PID is disabled.

CODE	Mod Bus	AR	Display Name	Range	Description
SET-10	0010	N	Hand Run Cmd	0_Keypad 1_Digital Input 2_RS485 Serial 3_Com Card 4_Ext HOA in Hand	Source of Run Command in Hand mode. 0_Keypad: Run command from Start/Stop button. 1_Digital Input: Run command from digital input **[IO-21]** to **[IO-28]** set to **38_FWD** or **39_REV**. If direction is set here, then dedicated FWD input is disabled. Keypad STOP is disabled. 2_RS485 Serial: Run command from RS485 interface. Keypad STOP is disabled. 3_Com Card: Run command from communications card. This does not include CANopen card. 4_Ext HOA in Hand: Run command from digital input **[IO-21-28]** set to **26_HOA HAND** (when HOA is in Hand position).
SET-11	0011	Y	Accel Time	0 to 6000.0 sec	Time in seconds for the drive to accelerate from 0 Hz to maximum frequency. Default depends on **Application [SET-00]** and VFD HP rating.
SET-12	0012	Y	Decel Time	0 to 6000.0 sec	When Stop Mode is set to Decelerate, time in seconds to slow down from maximum frequency to 0 Hz. Default depends on **Application [SET-00]** and VFD HP rating.
SET-13	0013	Y	Low Freq Limit	0.0 to **[SET-14]** (Hz)	The lowest frequency (speed) allowable. If speed control falls below setting, motor continues to run at this limit.
SET-14	0014	N	High Freq Limit	**[SET-13]** to **[VFD-00]** (Hz)	The highest frequency (speed) allowable. If speed control signal goes higher, motor continues to run at this limit.
SET-15	0015	N	Load Rotation	0_FWD & REV 1_FWD Only 2_REV Only	Allows the motor to run in the forward and reverse direction. Setting it to a specific direction can prevent injury or damage to equipment.
SET-16	0016	N	Stop Mode	0_Decel to stop 1_Coast to stop 2_DC Brake	Determines how the motor is stopped when a STOP command is initiated. 0_Decel to stop: VFD decelerates frequency to zero frequency and then stops. 1_Coast to stop: VFD stops producing output instantly and motor spins down freely until it stops. 2_DC Brake: VFD injects DC current to the motor windings during deceleration after a stop command is received and the output frequency is below VFD-40 setting. DC injection brake provides a faster stop for the motor, but it generates heat in the motor winding and depending on settings in parameters **[VFD-37-39]** and braking duty cycle the motor can be overheated.
SET-17	0017	N	PID Mode	0_Disable 1_PID Direct 2_PID Inverse	PID control allows the VFD to maintain a process value (pressure, temperature, etc.) by varying the output frequency based on the difference between a set point and actual feedback value. 1_Direct: Output decreases if feedback becomes greater than a set-point. 2_Inverted: Output increases if feedback becomes greater than a set-point.
SET-18	0018	N	PID F/B Source	0_ACI 1_AVI1 2_AVI2	Selects an analog input terminal for PID Feedback source.
SET-19	0019	N	PID F/B Unit	0_PSI 1_inWC 2_Feet 3_F 4_CFM 5_GPM 6_% 7_Cust 8_inHg 9_m 10_mBar 11_Bar 12_kPa 13_C 14_LPM 15_CMH	Measurement unit selection for feedback signal.
SET-20	0020	N	PID F/B Max	0.0 to 32767	PID feedback transducer maximum range
SET-21	0021	Y	PID Set-point	0.0 to **[SET-20]** (**[SET-19]** Unit)	Set the desired value for PID (pressure, temperature, GPM, etc.).
SET-22	0022	Y	PID Lo Hz Limit	**[SET-13]** to **[SET-23]** (Hz)	Low frequency limit in PID mode. PID Low Frequency is limited by **Low Frequency [SET-13]** and **PID High Frequency [SET-23]**.

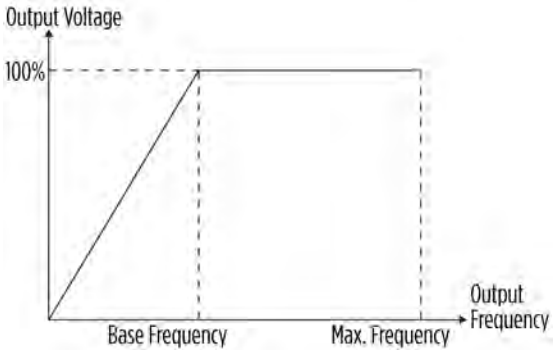
CODE	Mod Bus	AR	Display Name	Range	Description
SET-23	0023	N	PID Hi Hz Limit	**[SET-22]** to **[SET-14]** (Hz)	High frequency limit in PID mode. PID High Frequency is limited by **High Frequency [SET-14]** and **PID Low Frequency [SET-22]**.
SET-24	0024	Y	PID P-Gain	0 to 100%	Proportional-Gain determines PID control sensitivity. Greater values provide more sensitivity. However, if set too high, the system may create an output frequency oscillation and instability. Used along with **PID I-TIme [SET-25]** to smooth and balance system response.
SET-25	0025	Y	PID I Time	0.0 to 100 sec	Integral-Time determines PID response time. Lower values increase system response to the feedback signal, which reduces overshoot, but may cause system oscillation if set too low. Greater values provide slower response, which may cause overshoot of the setpoint and oscillation of output frequency.
SET-26	0026	Y	Sleep Mode	0_Disabled 1_Sleep Only 2_Sleep+Boost	Sleep Mode selection for pressure controlled systems, such as pumping applications. 2_Sleep+Boost increases the process control value (pressure) before going to sleep.
SET-27	0027	Y	Sleep Chk Time	5 to 120 sec	Time delay (sleep check cycle time) before each Sleep Check process.
SET-28	0028	Y	Sleep Delay	0 to 3000 sec	Delay before VFD triggers Sleep Mode state when all other conditions are met.
SET-29	0029	Y	S-Boost Value	0 to 10%	Sleep Boost Value: Value added to original setpoint to provide a pressure boost before entering sleep.
SET-30	0030	Y	S-Boost Timer	5 to 120 sec	Sleep Boost Timer: Limits duration of sleep boost operation if Sleep Boost setpoint is not reached.
SET-31	0031	Y	Wake-Up Level	0.0 to **[SET-21]** (**[SET-19]** Unit)	Sets a wakeup level for VFD to exit Sleep mode and start running.
SET-32	0032	Y	S-Bump Timer	5 to 120 sec	Sleep Bump Timer: Sets a duration time for pressure bump to increase system pressure.
SET-33	0033	Y	Pipe Fill Timer	0.0 to 60 min	Pipe Fill mode exit timer to switch to PID mode. If set to 0.0 min, pipe fill is disabled.
SET-34	0034	Y	P-Fill Exit Lvl	0.0 to **[SET-21]** (**[SET-19]** Unit)	If feedback reaches **[SET-34]** value, VFD switches from pipe fill mode to PID control mode.
SET-35	0035	Y	Pipe Fill Freq	**[SET-22]** to **[SET-23]** (Hz)	VFD varies the output frequency from **[ADV2-68]** to **[SET-35]** trying to maintain 60% of **[SET-34]** value.
SET-36	0036	Y	Broken Pipe Lvl	0.0 to **[SET-21]** (PSI)	If VFD runs above **[SET-37]** frequency for **[SET-38]** delay with system pressure below **[SET-36]**, it trips on Broken Pipe fault. If **[SET-36]** is set to 0, this protection is disabled.
SET-37	0037	Y	Broken Pipe Frq	**[SET-22]** to **[SET-23]** (Hz)	If VFD is running above this speed with pressure below **[SET-36]**, Broken Pipe Delay timer starts.
SET-38	0038	Y	Broken Pipe Dly	0 to 6000 sec	If Broken Pipe Delay timer runs longer than this setting, VFD trips on Broken Pipe fault.
SET-39	0039	Y	OverPress Set	0_Disabled 1_OP Trip 2_OP Auto Reset	Overpressure protection settings OP Trip: When tripped on overpressure, VFD requires a reset. OP Auto Reset: occurs when pressure drops below **Wake-up Level [SET-31]**.
SET-40	0040	Y	OverPress Level	0.0 to **[SET-20]** (**[SET-19]** Unit)	Level the process signal (pressure) reaches to cause an overpressure condition.
SET-41	0041	N	ULD Select	0_Disabled 1_By Current 2_By Torque	Underload Detection protects against conditions such as a dry well, broken pump, or broken drive belt. Refer to "Underload Protection (Dry Well or Belt Loss)" on page 96.
SET-42	0042	Y	ULD Level	15 to 115%	Underload Level set as a percentage of FLA (SFA). If current is below this level and frequency is above **ULD Frequency [SET-43]** for longer than **ULD Delay [SET-44]** timer, VFD trips on ULD.
SET-43	0043	Y	ULD Frequency	**[SET-22]** to **[SET-23]** (Hz)	If motor runs above ULD Frequency, VFD compares operating current with **ULD Level [SET-42]** to detect a ULD condition.
SET-44	0044	Y	ULD Delay	0 to 360 sec	Underload Delay timer before trip.
SET-45	0045	Y	ULD Recovery T	0 to 720 min	Underload Recovery Time. VFD restarts from ULD trip after this time. If it trips again, time is doubled up to 720 min. If set to 0, fault must be manually reset.
SET-46	0046	N	ULD Recover Cnt	0 to 720 min	Decrementing counter of recovery time from an ULD trip before VFD attempts to restart motor (Read Only).
SET-47	0047	N	HLD Select	0_Disabled 1_By Current 2_By Torque	High Load Detection protects the VFD and motor against damage from an overtorque condition. Refer to "High Load Detection" on page 95.

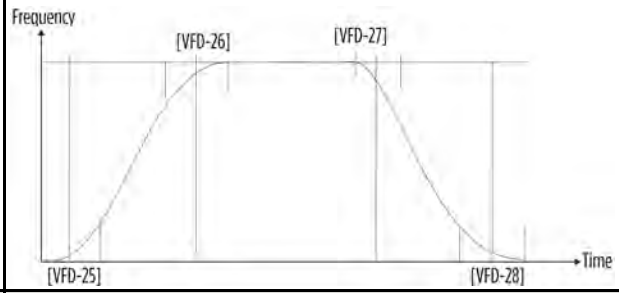
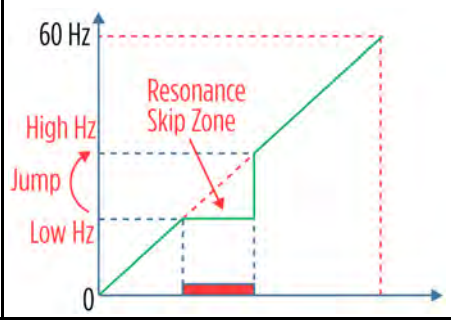
CODE	Mod Bus	AR	Display Name	Range	Description
SET-48	0048	Y	HLD Level	75 to 200%	High Load Detection level, set as a percentage of FLA (SFA). If current is above this level and frequency is above **HLD Frequency [SET–49]** for longer than **HLD Delay [SET–50]** timer, VFD trips on HLD.
SET-49	0049	Y	HLD Frequency	**[SET-22]** to **[SET-23]** (Hz)	If motor runs above HLD Frequency, VFD compares operating current with **HLD Level [SET–48]** to detect an HLD condition.
SET-50	0050	Y	HLD Delay	0 to 360 sec	High Load Delay timer before trip.
SET-51	0051	Y	HLD Recovery T	0 to 720 min	High Load Detection Recovery Time: VFD restarts from HLD trip after this time. If it immediately trips again, time is doubled up to 720 min. If set to 0, fault must be manually reset.
SET-52	0052	Y	HLD Recover Cnt	0 to 720 min	High Load Detection Recovery Count: Decrementing counter of recovery time from a HLD trip before VFD attempts to restart motor (Read Only).
SET-53	0053	Y	ACC Change Freq	0.0 to **[SET-14]** (Hz)	Frequency to switch from main accel/decel rate to second accel/decel rate.
SET-54	0054	Y	Second ACC	0 to 6000 sec	Time in seconds for drive to accelerate from 0 Hz to maximum frequency. Second acceleration occurs when frequency is above **ACC Change Freq [SET-53]**. For example, submersibles have to be accelerated up to 30hz in 1 second but they can accelerate from 30hz to 60hz much slower. So, we would adjust **[SET-53]** to 30hz and the drive would follow the **[SET-11]** ACC time up to 30hz and the **[SET-54]** ACC time above 30hz.
SET-55	0055	Y	Second DEC	0 to 6000 sec	When Stop Mode is set to Decelerate, time in seconds to slow down from maximum frequency to 0 Hz. Second deceleration occurs when frequency is above **ACC Change Freq [SET-53]**. VFD returns to main DEC time when frequency is below **[SET-53]** - **[SET-56]**.
SET-56	0056	Y	ACC/DEC Hyster	0.0 to **[SET-53]** (Hz)	When 2nd ACC/DEC time is activated and frequency drops below **[SET-53]** - **[SET-56]**, VFD switches to main ACC/DEC time.
SET-57	0057	Y	Display Line 1	0_Freq Command 1_Output Frequency 2_Multi-Fn Display 3_Output Current	Sets the parameter to display on the first line of keypad. **NOTE:** Power-cycle the drive or detach/reattach keypad for display to update.
SET-58	0058	Y	Display Line 3	0_Output Current (A) 1_Counter value (c) 2_Output Freq (H) 3_DC-Bus Voltage (u) 4_Output Voltage (E) 5_Output Power (P) 6_Motor Speed (r) 7_PID Feedback % (b) 8_AVI1 Value (1) 9_ACI Value (2) 10_AVI2 Value (3) 11_IGBT Temp °C (i) 12_CAP Temp °C (c) 13_D-Inputs Status (i) 14_D-Out Status (o) 15_Ground Flt Lvl (G) 16_DC Bus Ripple (r) 17_PLC Data D1043 (C) 18_Fan Speed (F) 19_VFD Status (6) 20_kWh Display (J) 21_PID Set-point (L) 22_Aux Analog Input 23_Commu Role 24_This VFD Status 25_Pump Role 26_Network Status 27_Session Status 28_Active VFD Num 29_Active Lag Num 30_Active Stdby Num	Sets the parameter to display on third line of keypad. The new selection is shown when VFD power is cycled or keypad is disconnected and reconnected again.
SET-59	0059	Y	Keypad Freq	0.0 to **[VFD-00]** (Hz)	The keypad frequency setting.

CODE	Mod Bus	AR	Display Name	Range	Description
SET-60	0060	Y	HOA Mode Source	0_Keypad 1_Digital Input 2_RS485 Serial 3_Com Card	Sets the input that selects between Hand-Off-Auto modes
SET-61	0061	N	KPD STOP as OFF	0_Disable 1_Enable	When enabled, the **STOP** key acts as an OFF position on keypad HOA and stops the VFD in all Hand and Auto Run CMD modes except an External HOA. When VFD is stopped by **STOP** key, to return to Auto or Hand mode press the **HAND** or **AUTO** key.
SET-62	0062	N	Carrier Freq	2.0 to 15.0 kHz Varies by VFD rating	VFD switching frequency. Higher frequencies create more precise wave forms, but generate higher heat. Lower frequencies run cooler, but could potentially cause audible noise, which can be eliminated by adjusting this carrier frequency during stop.
SET-63	0063	N	2/3-Wire Select	0_2-Wire Fwd/Rev 1_2-Wire Fwd+Rev 2_3-Wire F+R+Stop	0_ FWD input provides forward run command and REV input provides areverse run command. VFD ignores the command if both inputs are activated. 1_ FWD input provides forward run command and REV input changes the rotation. 2_ FWD input provides forward run command, REV input changes the rotation, and Stop stops the drive

Parameter Descriptions > VFD Menu

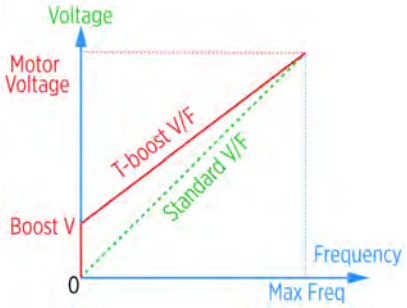
AR = Adjustable while Running.

CODE	Mod Bus	AR	Display Name	Range	Description
VFD-00	0256	N	VFD Max Freq	0 to 599 Hz	The highest frequency (speed) allowable when running a motor. If running a FE MagForce pump, this should be set to the calculated slip frequency corresponding to the target pump RPM. Refer to "Setup FE MagForce Pump Motor" on page 100.
VFD-01	0257	N	VFD Start Freq	0 to 10 Hz	Frequency the VFD initially starts to output.
VFD-02	0258	N	VFD Base Freq	3 to 599 Hz	Set to the motor nameplate frequency rating. VFD provides full output voltage at this frequency. 
VFD-03	0259	N	V/F Pattern	0_Linear 1_1.5 Power 2_Squared 3_V/F Curve 1 4_V/F Curve 2 5_V/F Curve 3 6_V/F Curve 4 7_V/F Curve 5 8_V/F Curve 6 9_V/F Curve 7 10_V/F Curve 8 11_V/F Curve 9 12_V/F Curve 10 13_V/F Curve 11	0_V/F curve determined by **[VFD-60]** to **[VFD-65]** 1_V/F curve to the power of 1.5 2_V/F curve to the power of 2 (square). 3_60 Hz, full voltage at 50 Hz 4_72 Hz, full voltage at 60 Hz 5_50 Hz, decrease gradually with cube 6_50 Hz, decrease gradually with square 7_60 Hz, decrease gradually with cube 8_60 Hz, decrease gradually with square 9_50 Hz, medium starting torque 10_50 Hz, high starting torque 11_60 Hz, medium starting torque 12_60 Hz, high starting torque 13_90 Hz, full voltage at 60 Hz

CODE	Mod Bus	AR	Display Name	Range	Description
VFD-03 (Cont.)	0259	N	V/F Pattern	14_V/F Curve 12 15_V/F Curve 13	14_120 Hz, full voltage at 60 Hz 15_180 Hz, full voltage at 60 Hz
VFD-04	0260	Y	Step Freq-1	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-05	0261	Y	Step Freq-2	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-06	0262	Y	Step Freq-3	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-07	0263	Y	Step Freq-4	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-08	0264	Y	Step Freq-5	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-09	0265	Y	Step Freq-6	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-10	0266	Y	Step Freq-7	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-11	0267	Y	Step Freq-8	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-12	0268	Y	Step Freq-9	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-13	0269	Y	Step Freq-10	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-14	0270	Y	Step Freq-11	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-15	0271	Y	Step Freq-12	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-16	0272	Y	Step Freq-13	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-17	0273	Y	Step Freq-14	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-18	0274	Y	Step Freq-15	0.0 to **[SET-14]** (Hz)	Preset Frequency command determined by digital inputs.
VFD-19	0275	Y	ACC-2 Time	0.0 to 600 Sec	VFD switches to ACC/DEC2 when DI set to **XCEL-L** is activated.
VFD-20	0276	Y	DEC-2 Time	0.0 to 600 Sec	VFD switches to ACC/DEC2 when DI set to **XCEL-L** is activated.
VFD-21	0277	Y	ACC-3 Time	0.0 to 600 Sec	VFD switches to ACC/DEC3 when DI set to **XCEL-M** is activated.
VFD-22	0278	Y	DEC-3 Time	0.0 to 600 Sec	VFD switches to ACC/DEC3 when DI set to **XCEL-M** is activated.
VFD-23	0279	Y	ACC-4 Time	0.0 to 600 Sec	VFD switches to ACC/DEC4 when DIs set to **XCEL-L** and **XCEL-M** are activated. **NOTE:** Do not overlap skip frequency ranges.
VFD-24	0280	Y	DEC-4 Time	0.0 to 6000 Sec	VFD switches to ACC/DEC4 when DIs set to **XCEL-L** and **XCEL-M** are activated.
VFD-25	0281	Y	S Start Time 1	0.0 to (variable) sec	ACC S-Curve Start starting Time-1 
VFD-26	0282	Y	S Start Time 2	0.0 to (variable) sec	ACC S-Curve Start ending Time-2
VFD-27	0283	Y	S End Time 1	0.0 to (variable) sec	DEC S-Curve End starting Time-1
VFD-28	0284	Y	S End Time 2	0.0 to (variable) sec	DEC S-Curve End ending Time-2
VFD-29	0285	N	Skip Freq1 High	0.0 to 599 Hz	Used to bypass mechanical system resonance frequencies. If the received speed reference is in the skip zone, VFD runs at **Low Skip Freq** until speed reference is at or above **High Skip Freq**. Then, speed is ramped up based on acceleration time. 

CODE	Mod Bus	AR	Display Name	Range	Description
VFD-30	0286	N	Skip Freq1 Low	0.0 to 599 Hz	Low frequency in skip zone 1.
VFD-31	0287	N	Skip Freq2 High	0.0 to 599 Hz	High frequency in skip zone 2.
VFD-32	0288	N	Skip Freq2 Low	0.0 to 599 Hz	Low frequency in skip zone 2.
VFD-33	0289	N	Skip Freq3 High	0.0 to 599 Hz	High frequency in skip zone 3.
VFD-34	0290	N	Skip Freq3 Low	0.0 to 599 Hz	Low frequency in skip zone 3.
VFD-35	0291	N	VFD Duty Select	0_Variable Torque 1_Constant Torque	0_Variable Torque (Light Duty) 1_Constant Torque (Normal Duty) **VFD Rated Amps [VFD-47]** and **Over-Current levels [PROT-07 - PROT-08]** are affected by this setting.
VFD-36	0292	Y	Reset Restart	0_Disable 1_Enable	The VFD automatically initiates operation once fault is cleared and run command is received.
VFD-37	0293	Y	DC Brake CurLvl	0.0 to 100%	Level of DC Brake Current output to the motor during start-up and stopping.
VFD-38	0294	Y	DC Time at Run	0.0 to 60 sec	Duration of the DC Brake current after a run command to apply DC current to motor to force stop motor for a stable start.
VFD-39	0295	Y	DC Time at Stop	0.0 to 60 Sec	Duration of the DC Brake current after a stop command to apply DC current to the motor in order to force stop the motor.
VFD-40	0296	Y	DC Stop Freq	0.0 to **[SET-23]** (Hz)	Frequency when DC Brake begins during deceleration.
VFD-41	0297	Y	Dwell T at Acc	0.0 to 600 Sec	When output frequency reaches **[VFD-42]** during acceleration, VFD holds output at **[VFD-42]** for **[VFD-41]** timer duration. When timer expires, VFD continues acceleration.
VFD-42	0297	Y	Dwell Hz at Acc	0.0 to **[SET-23]** (Hz)	VFD holds output frequency at **[VFD-42]** during Dwell Timer
VFD-43	0299	Y	Dwell T at Dec	0.0 to 600 Sec	When output frequency reaches **[VFD-44]** during deceleration, VFD holds output at **[VFD-44]** for **[VFD-43]** timer duration. When timer expires, VFD continues deceleration.
VFD-44	0300	Y	Dwell Hz at Dec	0.0 to **[SET-23]** (Hz)	VFD holds output frequency at **[VFD-44]** during Dwell Timer
VFD-45	0301	Y	Hopping Carrier	0_Disable 1_Enable	When enabled, VFD automatically changes carrier frequency from 2 to 5kHz (Depends on the drive frame size) in a predetermined offset pattern to minimize audible noise from the motor. **[VFD-58]** determines a duration of each frequency segment.
VFD-46	0302	N	ID Code	0_None 4_1 HP (0.75kW), 230V 5_1 HP (0.75kW), 460V 6_2 HP (1.5kW), 230V 7_2 HP (1.5kW), 460V 8_3 HP (2.2kW), 230V 9_ 3HP (2.2kW), 460V 10_5 HP (3.7kW), 230V 11_5 HP (3.7kW), 460V 12_7.5 HP (5.5kW), 230V 13_7.5 HP (5.5kW), 460V 14_10 HP (7.5kW), 230V 15_10 HP (7.5kW), 460V 16_15 HP (11kW), 230V 17_15 HP (11kW), 460V 18_20 HP (15kW), 230V 19_20 HP (15kW), 460V 20_25 HP (18.5kW), 230V 21_25 HP (18.5kW), 460V 22_30 HP (22kW), 230V 23_30 HP (22kW), 460V 24_40 HP (30kW), 230V 25_40 HP (30kW), 460V 26_50 HP (37kW), 230V 27_50 HP (37kW), 460V 28_60 HP (45kW), 230V 29_60 HP (45kW), 460V 30_75 HP (55kW), 230V 31_75 HP (55kW), 460V 32_100 HP (75kW), 230V 33_100 HP (75kW), 460V	Displays the identity code of the VFD (Read Only). CXD-005A-2V CXD-003A-4V CXD-007A-2V CXD-004A-4V CXD-010A-2V CXD-005A-4V CXD-015A-2V CXD-008A-4V CXD-021A-2V CXD-013A-4V CXD-031A-2V CXD-018A-4V CXD-046A-2V CXD-024A-4V CXD-061A-2V CXD-032A-4V CXD-075A-2V CXD-038A-4V CXD-090A-2V CXD-045A-4V CXD-105A-2V CXD-060A-4V CXD-146A-2V CXD-073A-4V CXD-180A-2V CXD-091A-4V CXD-215A-2V CXD-110A-4V CXD-276A-2V CXD-150A-4V

CODE	Mod Bus	AR	Display Name	Range	Description
VFD-46 (Cont.)	0302	N	ID Code	34_125 HP (90kW), 230V 35_125 HP (90kW), 460V 37_150 HP (110kW), 460V 39_175 HP (132kW), 460V 41_215 HP (160kW), 460V 43_250 HP (185kW), 460V 45_300 HP (220kW), 460V 47_375 HP (280kW), 460V 49_425 HP (315kW), 460V 51_475 HP (355kW), 460V 53_536 HP (400kW), 460V 93_5.5 HP (4.0kW), 460V 505_2.0HP (1.5kW), 575V 506_3.0HP (2.2kW), 575V 507_5.0HP (3.7kW), 575V 508_7.5HP (5.5kW), 575V 509_10HP (7.5kW), 575V 510_15HP (11kW), 575V 511_20HP (15kW), 575V 613_30HP (22kW), 690V 614_40HP (30kW), 690V 615_50HP (37kW), 690V 616_60HP (45kW), 690V 617_75HP (55kW), 690V 618_100HP (75kW), 690V 619_125HP (90kW), 690V 620_150HP (110kW), 690V 621_175HP (132kW), 690V 622_215HP (160kW), 690V 626_425HP (315kW), 690V 628_536HP (400kW), 690V 629_600HP (450kW), 690V 631_745HP (560kW), 690V 632_840HP (630kW), 690V 686_265HP (200kW), 690V 687_333HP (250kW), 690V	CXD-322A-2V CXD-180A-4V CXD-220A-4V CXD-260A-4V CXD-310A-4V CXD-370A-4V CXD-460A-4V CXD-530A-4V CXD-616A-4V CXD-683A-4V CXD-770A-4V CXD-010A-4V CXD-003A-6V CXD-004A-6V CXD-006A-6V CXD-009A-6V CXD-012A-6V CXD-018A-6V CXD-024A-6V CXD-030A-6V CXD-036A-6V CXD-045A-6V CXD-054A-6V CXD-067A-6V CXD-086A-6V CXD-104A-6V CXD-125A-6V CXD-150A-6V CXD-180A-6V CXD-350A-6V CXD-430A-6V CXD-465A-6V CXD-590A-6V CXD-675A-6V CXD-220A-6V CXD-290A-6V
VFD-47	0303	N	VFD Rated Amps	(Variable)	Current rating of drive with respect to Light Duty and Normal Duty **[VFD- 35]** (Read Only).
VFD-49	0305	N	Firmware Version	(Variable)	VFD software version (Read Only).
VFD-50	0306	Y	Disp Filter A	0.001 to 65.535 sec	Minimizes the current fluctuation displayed by digital keypad.
VFD-51	0307	Y	Disp Filter KPD	0.001 to 65.535 sec	Minimizes the display value fluctuation displayed by digital keypad.
VFD-52	0308	N	FW Date	(Variable)	VFD software version date (Read Only).
VFD-53	0309	Y	JOG ACC Time	0.0 to (variable) sec	Acceleration time in jog operation to increase frequency to jog frequency.
VFD-54	0310	Y	JOG DEC Time	0.0 to (variable) sec	Deceleration time in jog operation to decrease frequency to 0Hz.
VFD-55	0311	Y	JOG Frequency	0.0 to 600 Hz	Frequency commanded for jog operation.
VFD-56	0312	N	Zero-speed Mode	0_Standby 1_Hold by DC Brake 2_Min Frequency	When commanded frequency is less than frequency min: 0_VFD stays at 0Hz. 1_Apply DC Brake by minimium voltage 2_VFD runs motor at minimium frequency.
VFD-57	0313	Y	Power-on Start	0_Disable 1_Enable	When enabled, VFD automatically initiates operation after powered-on with run command.
VFD-58	0314	Y	H-Carrier Pitch	2 to 100 ms	A time setting for duration of each frequency segment in Hopping Carrier cycle.

CODE	Mod Bus	AR	Display Name	Range	Description
VFD-59		N	V/F Tq Boost	0.0 to 15.0%	Torque Boost value with the range of 0.0% to 15.0% of motor rated voltage. If it is set to 0.0%, the torque boost is disabled. **NOTE:** Torque boost works only when **[VFD-03]** is set to a fixed V/F curve 0_ Linear, 1_1.5 Power or 2_Squared. 
VFD-60	0316	N	V/F F-Point 1	Variable (Hz)	Custom V/F curve 1st frequency point.
VFD-61	0317	N	V/F V-Point 1	Variable (V)	Custom V/F curve 1st voltage point.
VFD-62	0318	N	V/F F-Point 2	Variable (Hz)	Custom V/F curve 2nd frequency point.
VFD-63	0319	N	V/F V-Point 2	Variable (V)	Custom V/F curve 2nd voltage point.
VFD-64	0320	N	V/F F-Point 3	Variable (Hz)	Custom V/F curve 3rd frequency point.
VFD-65	0321	N	V/F V-Point 3	Variable (V)	Custom V/F curve 3rd voltage point.

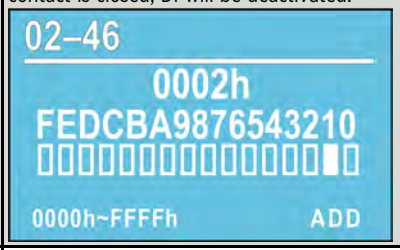
Parameter Descriptions > I/O Menu

AR = Adjustable while Running.

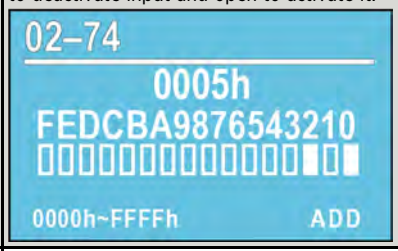
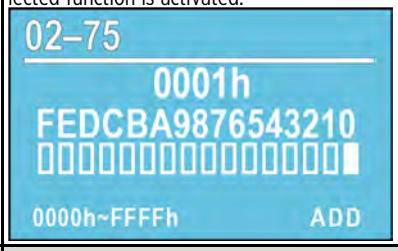
CODE	Mod Bus	AR	Display Name	Range	Description
IO-00	0512	N	ACI Input Sel	0_0-10V 1_0-20mA 2_4-20mA 3_PTC 4_PT100 & AFM1 5_2–10V	Selects the format of the input signal expected at the ACI input terminals based on the type of control device to be connected—transducer, sensor, controller, etc. This setting must correspond with ACI micro switch.
IO-01	0513	Y	ACI Loss Trip	0_Disable 1_Hold Speed 2_Stop/Start 3_Trip Stop 4_At AI Loss Freq	Selects operation when ACI signal is lost. 1_VFD runs at previous speed (2 sec before signal loss) 2_VFD will restart when signal is restored 3_VFD will stay tripped until reset 4_VFD runs at frequency set in **[IO-76]**
IO-02	0514	Y	ACI Loss Level	0_Below Minimum 1_Below 0.5xMin 2_Redundant	Selects level for determining ACI signal loss. Redundant should be used when two transducers Main and Spare are used for PID feedback. **NOTE:** AI Loss is disabled if min value settings is 0 V or 0 mA.
IO-03	0515	Y	ACI Loss Delay	0 to 3600 sec	Duration the ACI signal is in a loss condition before initiating an ACI Loss Trip operation.
IO-04	0516	Y	ACI Filter T	0 to 20 Sec	ACI time filter for noisy analog signal.
IO-05	0517	Y	AVI1 Input Sel	0_0-10V 1_0-20mA 2_4-20mA 3_PTC 4_PT100 & AFM1 5_2–10V	Selects the format of the input signal expected at the ACI input terminals based on the type of control device to be connected—transducer, sensor, controller, etc. This setting must correspond with AVI1 micro switch.
IO-06	0518	Y	AVI1 Loss Trip	0_Disable 1_Hold Speed 2_Stop/Start 3_Trip Stop 4_At AI Loss Freq	Selects operation when AVI1 signal is lost. 1_VFD runs at previous speed (2 sec before signal loss) 2_VFD will restart when signal is restored 3_VFD will stay tripped until reset 4_VFD runs at frequency set in **[IO-76]**

CODE	Mod Bus	AR	Display Name	Range	Description
IO-07	0519	Y	AVI1 Loss Lvl	0_Below Minimum 1_Below 0.5xMin 2_Redundant	Selects level for determining AVI1 signal loss.
IO-08	0520	Y	AVI1 Loss Delay	0 to 3600 sec	Duration the AVI1 signal is in a loss condition before initiating an AVI1 Loss Trip operation.
IO-09	0521	Y	AVI1 Filter T	0.00 – 20.00 sec	AVI1 time filter for noisy analog signal. The delay time helps buffer interference that could cause error in the signal input. Longer times improve signal confirmation, but the response time is delayed.
IO-10	0522	Y	AVI2 Filter T	0.00 – 20.00 sec	AVI2 time filter for noisy analog signal. The delay time helps buffer interference that could cause error in the signal input. Longer times improve signal confirmation, but the response time is delayed.
IO-11	0523	N	Spare Max Value	0 to 60000	Maximum range of spare transducer
IO-12	0524	N	Spare AI Select	0_AVI1 1_ACI 2_AVI2	Analog input for spare transducer
IO-13	0525	Y	F/B PT Status	0_Main PT On 1_Spare PT On	F/B PT Status is Feedback Pressure Transducer Status. 0_Main pressure transducer provides feedback reading 1_Spare pressure transducer is providing feedback reading
IO-14	0526	Y	PID Filter Time	0.1 to 300.0 sec	PID feedback signal time filter for noisy analog signal. The delay time helps buffer interference that could cause error in the signal input. Longer times improve signal confirmation, but the response time is delayed.
IO-15	0527	Y	PID Delay Time	0.0 – 35.0 sec	Time delay for frequency command.
IO-16	0528	Y	Limit by Level	0_Disable 1_Enable	When enabled, VFD will monitor analog input set as Auto mode speed reference or PID F/B source and it will decrease High Frequency Limit value.
IO-17	0529	Y	Max Limit Level	0.0 to 20.0 mA	Sets Aux Analog input maximum value (in Aux Input units) corresponding to VFD or PID High Frequency limit.
IO-18	0530	Y	Min Limit Level	0.0 to 20.0 mA	Sets Minimum value of Aux Analog input corresponding to **Min Freq Limit [IO-19]**.
IO-19	0531	Y	Min Freq Limit	0.0 to **High Freq Limit [SET–14]** for V/F control 0.0 to **PID Hi Hz limit [SET–23]** for PID control	Sets Minimum value for High Frequency Limiting range corresponding to **Min Limit Level [IO-18]** signal level.
IO-20	0532	Y	DI Filter	0.000 to 30.000 sec	Response time of digital input terminals (**MI1–MI8**). The delay time helps buffer interference that could cause error in the signal input. Longer times improve signal confirmation, but the response time is delayed.
IO-21	0533	Y	MI1 Define	0_No Function 1_Speed-L 2_Speed-M 3_Speed-H 4_Speed-X 5_Fault Reset 6_Jog Speed 7_Hold Speed 8_XCEL-L 9_XCEL-M 10_Ext. Trip 11_3-Wire Stop 12_AVI1 Analog Spd 13_ACI Analog Spd 14_AVI2 Analog Spd 16_Up 17_Down 18_PID Disable 19_CLR CNT 20_Input CNT (MI6) 21_FWD Jog 22_REV Jog 25_E-Stop 26_HOA-HAND 27_HOA-AUTO	MI1 Default = Speed-L 1_Multi-step speed command 1 2_Multi-step speed command 2 3_Multi-step speed command 3 4_Multi-step speed command 4 5_Use to reset fault after cause is corrected 6_Changes speed in jog mode to value set in [VFD-55] 7_When active, VFD will hold current speed 8_ACC/DEC time will be changed to [VFD-19] and [VFD-20] 9_ACC/DEC time will be changed to [VFD-21] and [VFD-22] 10_Trips VFD by external protective device and requires reset 11_Stop input for 3-Wire control, MI1 by default 12_In non-PID mode, changes speed reference to AVI1 13_In non-PID mode, changes speed reference to ACI 14_In non-PID mode, changes speed reference to AVI2 16_Increases speed reference when [SET-07] is set to (1) 17_Decreases speed reference when [SET-07] is set to (1) 18_Disables PID and switches speed reference to keypad 19_Clears pulse counter accumulated value (MI6 only) 20_Pulse counter input (MI6 only) 21_Jog Command Forward 22_Jog Command Reverse 25_VFD stops by Emergency Stop device (requires reset) 26_External HOA Hand position contact 27_External HOA Auto position contact

CODE	Mod Bus	AR	Display Name	Range	Description
IO-21 (Cont.)	0533	Y	MI1 Define	28_Drive Enabled 29_PLC mode bit 0 30_PLC mode bit 1 32_FO w/o RUN Cmd 33_FO with RUN Cmd 34_Damper Limit Sw 35_Shutdown N-Latch 36_Shutdown Latched 37_Flow Switch 38_FWD 39_REV 40_Aux Motor-1 OFF 41_Aux Motor-2 OFF 42_Aux Motor-3 OFF 43_Aux Motor-4 OFF 44_Aux Motor-5 OFF 45_Aux Motor-6 OFF 46_Aux Motor-7 OFF 47_All Aux Mtr Off 48_Set-Point-A 49_Set-Point-B	28_Enables and disables the drive (not a run command) 29_ PLC Function Disable 29 and 30=(0) or Run 29= (1) 30_ PLC Function Disable 29 and 30=(0) or Stop 30= (1) 32_VFD will start in FO Mode by FO DI (No Run Command) 33_VFD will start in FO Mode by FO DI and Run Command 34_When damper is closed, Damper LSW DI is activated 35_Activates Shutdown. When inactive, VFD operates normally 36_Activates Shutdown. Requires reset to operate normally 37_Detects water or air flow by Flow Switch 38_Provides an option to replace the dedicated FWD input 39_Provides an option to replace the dedicated REV input 40_Aux Motor-1 in MMC mode is off sequence 41_Aux Motor-2 in MMC mode is off sequence 42_Aux Motor-3 in MMC mode is off sequence 43_Aux Motor-4 in MMC mode is off sequence 44_Aux Motor-5 in MMC mode is off sequence 45_Aux Motor-6 in MMC mode is off sequence 46_Aux Motor-7 in MMC mode is off sequence 47_All Aux Motors in MMC mode are off sequence 48_Preset Set-Point-A for PID control 49_Preset Set-Point-B for PID. (If 48 and 49 ON=S-point-AB)
IO-22	0534	Y	MI2 Define	See **[IO-21]**	MI2 Default = Preset Speed-M
IO-23	0535	Y	MI3 Define	See **[IO-21]**	MI3 Default = Preset Speed-H
IO-24	0536	Y	MI4 Define	See **[IO-21]**	MI4 Default = Fault Reset
IO-25	0537	Y	MI5 Define	See **[IO-21]**	MI5 Default = Emergency Stop
IO-26	0538	Y	MI6 Define	See **[IO-21]**	MI6 Default = XCEL-L (ACC-2/ DEC-2 Time)
IO-27	0539	Y	MI7 Define	See **[IO-21]**	No Function
IO-28	0540	Y	MI8 Define	See **[IO-21]**	No Function
IO-29	0541	N	FO Enable	0_Disable 1_FWD Operation 2_REV Operation	Enables Fireman's Override mode in either forward or reverse.
IO-30	0542	Y	FO Frequency	**[SET-13]** to **[SET-14]** (Hz)	Preset frequency for non-PID Fireman's Override mode.
IO-31	0543	Y	FO Fault Retry	0 to 10	Number of auto-retries during fault in Fireman's Override mode
IO-32	0544	Y	FO Retry Delay	0 to 6000 sec	Delay of auto-retries during fault in Fireman's Override mode
IO-33	0545	N	FO Mode & Reset	0_PID Off Manual 1_PID Off Auto 2_PID On Manual 3_PID On Auto	Sets control method and reset method for Fireman's Override mode. For example, **1_PID Off Auto**: FO mode no-PID and auto return to normal operation.
IO-34	0546	Y	FO PID S-Point	0 to 100%	PID Setpoint in Fireman's Override mode (when **[IO-33]** is **2** or **3**)
IO-35	0547	Y	Ext. Trip Mode	0_Coast to stop 1_Decel Stop	Determines how the motor is stopped when an Emergency STOP or External Trip command is initiated. 0_Coast to stop: VFD stops the output instantly and motor free runs until it comes to a complete standstill. 1_Decel to stop: VFD decelerates frequency to minimum output frequency and then stops.
IO-36	0548	Y	Damper Mode	0_Disable 1_Enable	Enables damper control feature, requires to set relay output to Damper Output
IO-37	0549	Y	Damper T-Delay	0 to 6000 sec	Provides a run time delay without a damper limit switch; or, provides a Damper Fault delay for systems that include a damper limit switch. The delay should be greater than damper opening time.
IO-38	0550	Y	No-Flow Mode	0_Disabled 1_Trip 2_Sleep	The VFD can monitor a system flow switch to provide pump protection and more reliable sleep mode operation. If any digital input is set to **37_Flow Switch** in parameters **[IO-21] ~ [IO-28]** and VFD runs longer than time set in **[IO- 39]** at frequency above setting in **[IO-40]** with open Flow Switch, VFD will trip on No Flow fault.
IO-39	0551	Y	Prime Time	1 to 6000 sec	Duration motor runs until No Flow or Underload protection becomes active.
IO-40	0552	Y	No-Flow Freq	0.0 to (variable) Hz	0.0 to **High Freq Limit [SET–14]** for V/F control 0.0 to **PID Hi Hz limit [SET–23]** for PID control

CODE	Mod Bus	AR	Display Name	Range	Description
IO-41	0553	Y	Lube/S-Clean	0_Disabled 1_Lubrication 2_Screen Clean	Select **1_Lubrication** for machines requiring external lubrication control via solenoid or **2_Screen Clean** for actuating a solenoid to clear the suction screen.
IO-42	0554	Y	S-Clean Timer	0.0 – 600.0 min	Screen Clean Timer: Determines a time period before next 1-minute cleaning pulse.
IO-43	0555	Y	Pre-Lube Timer	0 to 6000 sec	Determines Pre-lubrication time before VFD starts.
IO-44	0556	Y	Run-Lube Timer	0 to 6000 sec	Lube relay will be activated at VFD start (run state) and after timer expires it will be deactivated.
IO-45	0557	Y	Post-Lube Timer	0 to 6000 sec	Lube relay is activated and post-lube timer starts when VFD stops (reaches 0.00Hz) whether it coasts to stop or decelerates.
IO-46	0558	Y	DI NO/NC	0000h - FFFFh	Digital Input Normally Open/Normally Closed: Sets the digital inputs numbered in hex format to either N.O. or N.C. configuration. The configuration is in binary format Bit0, Bit1, Bit2, etc. corresponding to FWD, REV, DI1, DI2, etc. from the right to the left. Empty box indicates that Relay is N.O. and solid box that it is N.C. Example below shows Hex value=2 and solid box (N.C. contact configuration) for Bit1 DI (Rev). If contact wired to DI Rev is open, DI is activated. When contact is closed, DI will be deactivated. 
IO-47	0559	Y	Relay RA1	0_No Function 1_Run 2_FDT-1 3_FDT-2 4_FDT-3 5_FDT-4 6_FDT-5 7_Drive Ready 8_Fault 9_VFD Overheat 10_DC Brake 11_PID F/B Loss 12_Counter Done 13_Pre-Count Done 14_Alarm 15_FWD CMD 16_REV CMD 17_Analog Trigger 19_Overcurrent 2 20_High Load 21_Under Load 22_Fireman O-ride 23_Bypass 24_Motor-1 Out 25_Motor-2 Out 26_Motor-3 Out 27_Motor-4 Out 28_Motor-5 Out 29_Motor-6 Out 30_Motor-7 Out 31_Pipe Leak 32_Preheat Output 33_Steady 34_Pre-PID 35_Sleep 36_Speed Search 37_Pipe Broken	RA1 Default = Fault 1_During Run Mode 2_When frequency reference value is achieved 3_On above **[IO-52]** freq and Off below **[IO-52]** - **[IO-53]** freq 4_On above **[IO-54]** freq and Off below **[IO-54]** + **[IO-55]** freq 5_On up to FDT-4/5 freq 6_On above FDT-4/5 freq 7_When drive is powered and ready (no faults) 8_When drive has tripped on any fault 9_When VFD temperature reaches trip level 10_When DC injection brake is activated 11_When PID feedback source signal value is abnormal 12_When pulse counter achieves the counter set-value 13_When pulse counter achieves pre-count value 14_When alarm is triggered by any alarm condition 15_When VFD operates in Forward direction 16_When VFD operates in Reverse direction 17_When analog signal reaches a trigger level 19_When VFD trips on Overcurrent 2 20_HLD triggered 21_ULD triggered 22_When Fireman's Override mode is activated 23_When drive switches from Soft-Start mode to Bypass 24_When Motor-1 is enabled in MMC control 25_When Motor-2 is enabled in MMC control 26_When Motor-3 is enabled in MMC control 27_When Motor-4 is enabled in MMC control 28_When Motor-5 is enabled in MMC control 29_When Motor-6 is enabled in MMC control 30_When Motor-7 is enabled in MMC control 31_Pipe Leak protection is triggered 32_VFD provides Motor Preheat output 33_VFD provides steady freq output 34_VFD is in Pipe Fill mode 35_VFD is in Sleep mode 36_VFD is in Speed Search mode 37_Pipe Broken protection is triggered

CODE	Mod Bus	AR	Display Name	Range	Description
IO-47 (Cont.)	0559	Y	Relay RA1	38_Damper Output 39_Aux Timer Out 40_Overpressure 41_Lube/S Clean 42_ACI Loss 43_AVI1 Loss 44_Hand Mode 45_Auto Mode 47_MMC Out 48_Jockey Pump 49_At High Current 50_At Low Current	38_When Damper motor output is activated 39_Auxiliary timer output 40_Overpressure is triggered 41_When Lube or Screen Clean solenoid output is activated 42_When ACI analog input signal loss is detected 43_When AVI1 analog input signal loss is detected 44_When VFD control is in Hand mode 45_When VFD control is in Auto mode 47_Aux motor start output in MMC control 48_Jockey pump start output 49_When current reaches High Current trigger level 50_When current is below Low Current trigger level
IO-48	0560	Y	Relay RA2	See **[IO-47]**	RA2 Default = Run
IO-49	0561	Y	Relay RA3	See **[IO-47]**	RA3 Default = FDT-4
IO-50	0562	Y	CNT Attained 0	0 to 65500	Active increment counter triggered by MI6 when **[IO-26]** is set to **20_Input CNT**. After completion of counting, the relay output becomes active if **[IO-47]**, **[IO-48]**, or **[IO-49]** is set to **13_PreCount Done**. The relay becomes active for 1 msec. The counter then returns to 0. When the display shows c5555, the drive has counted 5,555 times. If display shows c5555*, it means that real counter value is between 55,550 to 55,559.
IO-51	0563	Y	CNT Attained 1	0 to 65500	Increment counter triggered by MI6 when **[IO-26]** is set to **20_Input CNT**. After completion of counting, the relay output becomes active if **[IO-47]**, **[IO–48]**, or **[IO–49]** is set to **12_Count Done**. The relay stays active for same number of counts then becomes inactive. The cycle then repeats.
IO-52	0564	Y	FDT-2 Frequency	0.0 to 600 Hz	Relay is activated when during ACC frequency is above **[IO-52]**. Relay will be deactivated when frequency is below (**[IO-52]** - **[IO-53]**).
IO-53	0565	Y	FDT-2 Bandwidth	0.0 to 600 Hz	This is the hysteresis value to deactivate the relay.
IO-54	0566	Y	FDT-3 Frequency	0.0 to 600 Hz	VFD will activate a selected relay during acceleration between frequencies **[IO-54]** + 0.5Hz and **[IO-54]** + **[IO-55]**. VFD will activate relay during deceleration between frequencies **[IO-54]** + **[IO-55]** - 0.5Hz and **[IO-54]**.
IO-55	0567	Y	FDT-3 Bandwidth	0.0 to 600 Hz	Bandwidth for relay activation points
IO-56	0568	Y	I Hi/Lo Setting	0 to 150%	When any relay is set to **(49)_At High Current** in **[IO-47]** ~ **[IO–49]** and motor current is at or above **[IO-56]** set level (% of FLA), corresponding relay will be activated. When any relay is set to **50_At Low Current** in **[IO-47]** ~ **[IO–49]** and motor current is below **[IO-56]** set level (% of FLA), corresponding relay will be activated.
IO-57	0569	Y	FDT-4/5 Setting	0.0 to 60 Hz	Frequency setting for FDT-4 and FDT-5 functions. With FDT-4, relay is activated at frequencies below **[IO-57]**. With FDT-5, relay is activated at frequencies above **[IO-57]**.
IO-58	0570	Y	Relay NO/NC	0000h - FFFFh	Relay Normally Open/Normally Closed: Sets the relay outputs numbered in hex format to either N.O. or N.C. configuration. The configuration is in binary format Bit0, Bit1, Bit2, etc. corresponding to RA1, RA2, etc. from right to left. Empty box indicates that Relay is N.O. and solid box that it is N.C. Example below shows solid box (N.C. contact configuration) for Bit0 DO (RA1). The physical N. O. contact of RA1 relay is always closed (relay is activated) until the selected function in **[IO-47]** ~ **[IO-49]** is activated, then contact will be open. 

CODE	Mod Bus	AR	Display Name	Range	Description
IO-59	0571	Y	AFM1 Out Select	0_Output FREQ 1_Output AMP (rms) 2_Output Voltage 3_DC Bus Voltage 4_Power Factor 5_Power 6_AVI1 % 7_ACI % 8_AVI2 % 9_Constant Output	Defines functionality of Analog Output 1 (AFM1).
IO-60	0572	Y	AFM1 Gain	0 to 500%	Adjusts the analog voltage level output of AFM1.
IO-61	0573	Y	AFM2 Out Select	See **[IO-59]**	Defines functionality of Analog Output 2 (AFM2).
IO-62	0574	Y	AFM2 Gain	0 to 500%	Adjusts the analog voltage level output of AFM2.
IO-63	0575	Y	AFM1 mA Select	0_0-20mA output 1_4-20mA output	Selects current range of AFM1 output.
IO-64	0576	Y	AFM2 mA Select	0_0-20mA output 1_4-20mA output	Selects current range of AFM2 output.
IO-65	0577	Y	AFM1 Filter Time	0 to 20 Sec	Noise filtering of AFM1 output.
IO-66	0578	Y	AFM2 Filter Time	0 to 20 Sec	Noise filtering of AFM2 output.
IO-72	0584	Y	FO Bypass	0_Disable 1_Enable	Enables Bypass for Fireman's Override mode
IO-73	0585	Y	FO Bypass Delay	0 to 6550 sec	Time delay to switch to Fireman's Override bypass
IO-74	0586	N	D-Inputs Status	0000h - FFFFh	Digital Inputs State: Displays status of digital inputs numbered in hex format. The input status is in binary format. Empty box indicates that N.O. DI is deactivated and solid box that it is activated. It shows DIs FWD, REV, DI1, DI2... status from the right to the left Bit0=1, Bit1=2, Bit3=4, Bit4=8, Bit5=16, etc. Example below shows hex value=5 and solid boxes (activated) for Bit0 (value=1) DI (FWD) and Bit2 (value=4) DI (DI1). The contacts wired to those inputs should be closed to deactivate input and open to activate it. 
IO-75	0587	N	D-Relays Status	0000h - FFFFh	Displays status of digital outputs (DOs) numbered in hex format. The output status is in binary format. Empty box indicates that output Relay is deactivated and solid box that it is activated. It shows DOs RA1, RA2...status from the right to the left Bit0, Bit1, Bit2, Bit3, etc. Example below shows hex value=1 and solid box (activated) for Bit0 (RA1). The N.O. contact of RA1 relay is closed until selected function is activated. 
IO-76	0588	Y	AI Loss Freq	Freq Low Limit to Freq High Limit	When **[IO-01]** or **[IO-06]** is set to **4_At AI Loss Freq** and signal loss is detected, VFD will run at **[IO-76]** frequency.

Parameter Descriptions > ADVANCE Menu

AR = Adjustable while Running.

CODE	Mod Bus	AR	Display Name	Range	Description
ADV-00	0768	Y	Upper Bound Int	0 to 100%	Upper limit for the integral gain (I), which limits the output frequency. Upper Limit Freq = **VFD Max Freq Main [VFD-00] x Upper Bound Int [ADV-00]**. Too large integral value will cause a slow response to sudden load changes. This could cause motor stall or machine damage.
ADV-01	0769	Y	PID Out Limit	0 to 110%	Maximum PID command limit. Percentage of Maximum Output Frequency **[VFD-00]**.
ADV-02	0770	Y	Password Input	0 to 65535	Password protect from modifying parameters.
ADV-03	0771	N	Parameter Reset	0_No Function 1_Write protect 2_——————— 3_Reset KWH 4_Reset all Param 5_Reset M Run Time	Select stored data to be reset or enable Write protection.
ADV-05	0773	Y	Password Lock	0_Unlocked 1_Locked	When setting password protection for the first time, set password in **Password Input [ADV-02]** and then **Password Lock [ADV-05]** becomes **1_Locked**. To permanently disable password protection, unlock parameters by entering password in **Password Input [ADV-02]** and then set **Password Lock [ADV-05]** to **0_Unlocked**. If drive is unlocked by a password and password lock is not set to **0_Unlocked**, the next reboot of the VFD will lock the VFD again.
ADV-06	0774	Y	Acc/Dec Type	0_Linear Acc/Dec 1_Auto Acc/L-Dec 2_L-Acc/Auto Dec 3_Auto Acc/Dec 4_Lin, Auto Stall	Provides automated acceleration and deceleration with stall prevention. 0_Linear Acc/Dec: Accelerates and decelerates according to the setting of **[SET-11] ~ [SET-12]** and **[VFD-19] ~ [VFD-24]**. 1_Auto Acc/L-Dec: Auto detects the load torque and accelerates for the fastest acceleration time and smoothest start current. Deceleration is linear according to setting of **[SET-11] ~ [SET-12]** and **[VFD-19] ~ [VFD-24]**. 2_L-Acc/Auto Dec: Linear acceleration according to setting **[SET-11] ~ [SET-12]** and **[VFD-19] ~ [VFD-24]**. Auto detects the load re-generation and stops the motor smoothly with the fastest decel time. 3_Auto Acc /Dec: Auto detects load for smoothest operation for acceleration and deceleration. 4_Lin, Auto Stall: Stall prevention by auto accel./decel being limited by **[SET-11] ~ [SET-12]** and **[VFD-19] ~ [VFD-24]**.
ADV-07	0775	N	Acc/Dec Format	0_Unit 0.01 sec 1_Unit 0.1 sec	Precision of acceleration and deceleration time.
ADV-08	0776	Y	Energy Saving	0_Disabled 1_Enabled	When the output frequency is constant, the output voltage will auto decrease to decrease power consumption.
ADV-09	0777	Y	E-Saving Gain	10 to 1000%	Determines speed of adjusting output voltage in relationship to load reduction. If the motor oscillates or has a quick temperature rise, the value should be increased.
ADV-10	0778	N	MMC Mode	0_Disabled 1_Equal Run Time 2_Soft Start mode 3_Lead-Lag 4_Run Time Alt 5_Rotate Lead	Type of operation for Multi-Motor Control. **NOTE:** 3_Lead-Lag is the most common multi-pump control mode.
ADV-11	0779	N	Motor Quantity	1 (default) to 7	Number of motors in MMC relay control setup. Limit is 3 without I/O card. When I/O card is installed, selections 1 to 7 are available.
ADV-12	0780	N	Aux Mtr Stop Hz	0 to **[SET-23]**	Auxiliary Motor Stop Hertz: When output frequency is less than value and remains for duration of **[ADV-15]**, motors will be shut down one by one.
ADV-13	0781	N	Alt Run Time	0 to 60000 min	Duration of running a motor before switching to another motor.
ADV-14	0782	N	S-Start ON Dly	0 to 3600 sec	Delay time before switching motor from VFD to power line.
ADV-15	0783	N	S-Start Off Dly	0 to 3600 sec	Delay time before switching motor from power line to VFD.
ADV-16	0784	Y	Mtr Switch Tmr	0 to 3600 sec	When timer expires, the system will start preparing to switch motors.
ADV-17	0785	Y	Mtr Switch Hz	**[SET-22]** to **[SET-23]** (Hz)	When the output frequency reaches value, the system will start preparing to switch motors.

CODE	Mod Bus	AR	Display Name	Range	Description
ADV-18	0786	Y	Lag Start Freq	**[ADV-23]** to **[SET-23]**	Running above this frequency is one of the conditions for starting Lag pump. Lag Start Frequency parameter is used for **[ADV-10]** selection **3_Lead-Lag MMC** control. Default= 59.50Hz.
ADV-19	0787	Y	Lag Start Delay	0 to 600 sec	Sets a delay time to start Lag pump when both frequency and pressure conditions are met.
ADV-20	0788	Y	Lag Start Level	0.1 to 10%	Sets percentage of **PID F/B Max [SET-20]** value to determine MMC Below Setpoint level for Lag pump starting. This parameter is used for **[ADV-10]** selection **3_Lead-Lag MMC** control.
ADV-21	0789	Y	Lead Freq Drop	0.0 to **[SET-23]** (Hz)	PID High Frequency Limit drop value with **MMC Decel Time [ADV-22]** at Lag pump start to prevent system overpressure condition. This parameter is used for **[ADV-10]** selection **3_Lead-Lag MMC** control.
ADV-22	0790	Y	MMC Decel Time	0 to 600 Sec	Sets deceleration time for PID High Frequency limit value change from **High Freq Limit [SET-23]** to (**[SET-23]** - **[ADV-21]**) at Lag pump start. This parameter is used for **[ADV-10]** selection **3_Lead-Lag MMC** control.
ADV-23	0791	Y	Lag Stop Freq	**[SET-22]** to **[ADV-18]** (Hz)	Running below this frequency is one of the conditions for stopping Lag pump. This parameter is used for **[ADV-10]** selection **3_Lead-Lag MMC** control.
ADV-24	0792	Y	Lag Stop Delay	0 to 600 sec	Sets delay time to stop Lag pump when both frequency and pressure conditions are met. This parameter is used for **[ADV-10]** selection **3_Lead-Lag MMC** control.
ADV-25	0793	Y	Lag Stop Level	0.1 to **[ADV-20]** (%)	Sets percentage value of **PID F/B Max [SET-20]** value to determine MMC At Setpoint level for Lag pump stopping. This parameter is used for **[ADV-10]** selection **3_Lead-Lag MMC** control.
ADV-26	0794	Y	Lead Freq Bump	0.0 to (**[SET-23]***0.4 Hz)	PID Low Freq Limit increase value with **MMC Accel Time [ADV-27]** at Lag pump stop to prevent system underpressure condition. This parameter is used for **[ADV-10]** selection **3_Lead-Lag MMC** control.
ADV-27	0795	Y	MMC Accel Time	0 to 600 sec	Sets acceleration time for PID Low Frequency limit value change from **PID Low Freq Limit [SET-22]** to (**PID Low Freq Limit [SET-22] + [ADV-26]**) at Lag pump stop.
ADV-28	0796	Y	Power-On Delay	0 to 6000 sec	This timer provides run delay at VFD power-up with run command present to prevent multiple starts during power surges.
ADV-29	0797	Y	Run Delay Timer	0 to 6000 sec	This timer provides a delay at every VFD start when run command is applied. Timer starts before every VFD start by run command, auto-restarts, fault reset, sleep wake-up, etc. FO (Fireman's Override) mode will disable this timer.
ADV-30	0798	Y	Backspin Timer	0 to 6000 sec	Duration after stop state that the drive disables output. Protects drive from motor backspinning due to column of water backflowing through pump.
ADV-31	0799	Y	Aux Timer Type	0_On-Delay 1_Off-Delay 2_One-Pulse 3_On-Pulser 4_Off-Pulser	Activates relay output based on selected Aux Timer input source and Timer Type. Aux Timer will be enabled when any digital output is set to Aux Timer Out. 0_On-Delay: When selected timer input is activated, the timer output relay will be activated when timer expires. It will stay activated until Aux Timer input is deactivated. This is the default setting. 1_Off-Delay: When selected timer input is activated, the Aux Timer output will be activated. When Aux Timer input is deactivated, the timer will start counting and its output will be activated when timer expires. 2_One-Pulse (on rising edge): When selected timer input is activated, the Aux Timer output will be activated for duration of the Aux Timer whether input is still active or not. 3_On-Pulser: When Aux Timer input is activated, the timer output will be activated for duration of Aux Timer. Then timer output will be deactivated for Aux Timer duration. Then timer output will be activated for Aux Timer duration again. Aux Timer will provide symmetrical pulses until its input is deactivated. 4_Off-Pulser: When Aux Timer input is activated, the timer output will stay inactive for duration of Aux Timer. Then timer output will be activated for Aux Timer duration. Then timer output will be deactivated for Aux Timer duration again. Aux Timer will provide symmetrical pulses until its input is deactivated. **NOTE: NOTE:** Aux Timer does not use **DI NO/NC [IO-46]** settings.
ADV-32	0800	Y	Aux Timer Time	0 to 6000 sec	Active or Inactive duration of relay.

CODE	Mod Bus	AR	Display Name	Range	Description
ADV-33	0801	Y	Aux Timer Input	0_D-Input MI1 1_D-Input MI2 2_D-Input MI3 3_D-Input MI4 4_D-Input MI5 5_D-Input MI6 6_D-Input MI7 7_D-Input MI8 8_D-Output R1 9_D-Output R2 10_D-Output R3 11_FWD DI 12_REV DI	Selects source to initiate Aux Timer operation. Default is **11_FWD DI**.
ADV-34	0802	Y	Min Run Timer	0 to 6000 sec	Once drive starts motor, the motor continuously runs for this length of time even though a stop command is present.
ADV-35	0803	N	Multi-VFD Set	0_Single VFD 1_2 VFDs 2_3 VFDs 3_4 VFDs 4_5 VFDs 5_6 VFDs 6_7 VFDs 7_8 VFDs	This setting defines the number of drives in the system, including Lead, Lag, Standby, and Jockey.
ADV-36	0804	N	Standby Pumps	0 to 6	Defines the number of Standby pumps/drives that will be assigned. The maximum entry is equal to the total number of drives less the Master and less the Jockey (if enabled).
ADV-37	0805	N	Multi-VFD ID	0_VFD-1 1_VFD-2 2_VFD-3 3_VFD-4 4_VFD-5 5_VFD-6 6_VFD-7 7_VFD-8	This setting is used to assign a unique identification number to each drive in the system. IDs must be sequential without gaps. The Master will only recognize numbers up to the **Multi-VFD Set [ADV-35]** total. If a Jockey is used, it must be assigned to the highest ID.
ADV-38	0806	Y	VLag Start Freq	0.0 to **PID Lo Hz Limit [SET-22]** V/F control 0.0 to **PID Hi Hz limit [SET-23]** for PID control	When Lead is running at a higher frequency than **VLag Start Freq [ADV-38]** and Master pressure is less than 95% of Setpoint for the duration of **VLag Start Dly [ADV-39]**, then Master will command the next Lag drive to start. The values of these settings on the Master are used and not the other drives. However, because the Master could change, the best practice is to set all drives the same.
ADV-39	0807	Y	VLag Start Dly	0 to 600 sec	Duration pressure below 95% of Setpoint before starting next lag drive.
ADV-40	0808	Y	VLag Stop Freq	0.0 to **PID Lo Hz Limit [SET-22]** V/F control 0.0 to **PID Hi Hz limit [SET-23]** for PID control	When Lead is running at a lower frequency than **[ADV-40]** and Master pressure is greater than 98% of Setpoint for the duration of **VLag Stop Dly [ADV-41]**, then Master will command the last Lag drive to stop. The values of these settings on the Master are used and not the other drives.
ADV-41	0809	Y	VLag Stop Delay	0 to 600 sec	Duration pressure above 98% of Setpoint before stopping last lag drive.
ADV-42	0810	N	VLead/Lag ID	0_Lead 1_Lag-1 2_Lag-2 3_Lag-3 4_Lag-4 5_Lag-5 6_Lag-6 7_Lag-7 8_Standby-1 9_Standby-2 10_Standby-3 11_Standby-4 12_Standby-5 13_Standby-6 14_Jockey	This value identifies the role of each drive in the network (Lead, Lag #, Standby #, Jockey, or Skip) and is assigned by the Master (Read Only). Skip removes the VFD from Multi-VFD control sequence but it can still work as Master if **[ADV-47]** is set to 0.
ADV-43	0811	N	VLag Spd Source	0_PID 1_Lag Set Freq	For each drive, this setting determines whether the drive will use PID mode or Lag Set Frequency when assigned as a Lag.

CODE	Mod Bus	AR	Display Name	Range	Description
ADV-44	0812	Y	VLag Set Freq	0.0 to **PID Lo Hz Limit [SET-22]** V/F control 0.0 to **PID Hi Hz limit [SET-23]** for PID control	Frequency the drive will use if running as a Lag with **Lag Speed [ADV-43]** set to **1_Lag Set Frequency**.
ADV-45	0813	N	Alternation	0_Disable 1_Timer 2_Master Power-Up	On the Master, this setting determines if and how the Lead role will be rotated through the network. If enabled, the Lead can be alternated either at a set time interval, or whenever the Master power is cycled.
ADV-46	0814	Y	Alternate TMR	0 to 600 Hr	On the Master, this setting determines the length of time before the Lead alternates if **[ADV-45]** is set to **1_Timer**. **NOTE:** When Alternation Timer is set to 0.0 hrs, the system alternates every 1 minute.
ADV-47	0815	N	Set VFD Ready	0_Ready 1_Skip it	For each drive, this setting determines whether or not the drive is available to function as a Master.
ADV-48	0816	N	Jockey Mode	0_Disable 1_Enable	This setting enables or disables the Jockey feature.
ADV-49	0817	Y	J-Start Press	**[SET-21]** to **[SET-21]**	Pressure setpoint for jockey start when all other conditions have been met.
ADV-50	0818	Y	J-Start Freq	**[SET-22]** to **[SET-23]**	Jockey starts when main pump is running above this frequency and all other conditions have been met.
ADV-51	0819	Y	Main Stop Freq	**[SET-22]** to **[SET-23]**	Main pump will stop if it runs below this frequency. Jockey will continue to run until pressure settings have been met.
ADV-52	0820	Y	J-Start Delay	1 to 65535 sec	Time delay before jockey starts when all conditions have been met.
ADV-53	0821	Y	Main Stp Delay	1 to 65535 sec	Time delay before main pump starts when all conditions have been met.
ADV-55	0823	Y	AVR Select	0_Enable AVR 1_Disable AVR 2_Disable AVR Dec	Auto Voltage Regulation Select automatically regulates the drive output voltage to the motor rated voltage.
ADV-56	0824	N	Prog-1 Setting	0_None 1_VFD Run 2_Step Freq 1 3_Step Freq 2 4_Step Freq 3 5_S-Point-A 6_S-Point-B 7_S-Point-AB	Sets Program #1 operation to Run/Stop control, Speed, or Set-point.
ADV-57	0825	N	Prog-1 On Time	0 to 2400	Program #1 activation of Run/Stop control, Speed, or Set-point.
ADV-58	0826	N	Prog-1 Off Time	0 to 2400	Program #1 deactivation of Run/Stop control, Speed, or Set-point.
ADV-59	0827	N	Prog-1 Week Day	0000h to 007Fh	Day(s) of the week for Program #1 to operate. Binary day representation SMTWTFS = 127 (007FH in Hexadecimal).
ADV-60	0828	N	Prog-2 Setting	See **[ADV-56]**	Sets Program #2 operation to Run/Stop control, Speed, or Set-point.
ADV-61	0829	N	Prog-2 On Time	0 to 2400	Program #2 activation of Run/Stop control, Speed, or Set-point.
ADV-62	0830	N	Prog-2 Off Time	0 to 2400	Program #2 deactivation of Run/Stop control, Speed, or Set-point.
ADV-63	0831	N	Prog-2 Week Day	0000h to 007Fh	Day(s) of the week for Program #2 to operate. Binary day representation SMTWTFS = 127 (007FH in Hexadecimal).
ADV-64	0832	N	Prog-3 Setting	See **[ADV-56]**	Sets Program #3 operation to Run/Stop control, Speed, or Set-point.
ADV-65	0833	N	Prog-3 On Time	0 to 2400	Program #3 activation of Run/Stop control, Speed, or Set-point.
ADV-66	0834	N	Prog-3 Off Time	0 to 2400	Program #3 deactivation of Run/Stop control, Speed, or Set-point.
ADV-67	0835	N	Prog-3 Week Day	0000h to 007Fh	Day(s) of the week for Program #3 to operate. Binary day representation SMTWTFS = 127 (007FH in Hexadecimal).
ADV-68	0836	N	Prog-4 Setting	See **[ADV-56]**	Sets Program #4 operation to Run/Stop control, Speed, or Set-point.
ADV-69	0837	N	Prog-4 On Time	0 to 2400	Program #4 activation of Run/Stop control, Speed, or Set-point.
ADV-70	0838	N	Prog-4 Off Time	0 to 2400	Program #4 deactivation of Run/Stop control, Speed, or Set-point.
ADV-71	0839	N	Prog-4 Week Day	0000h to 007Fh	Day(s) of the week for Program #4 to operate. Binary day representation SMTWTFS = 127 (007FH in Hexadecimal).
ADV-74	0842	Y	S-Point-A	0 to **[SET-20]**	Activate this parameter by setting a DI (digital input) **[IO-21]** to **[IO-28]** to **48_Set-point-A** or in Scheduling program.

CODE	Mod Bus	AR	Display Name	Range	Description
ADV-75	0843	Y	S-Point-B	0 to **[SET-20]**	Activate this parameter by setting a DI (digital input) **[IO-21]** to **[IO-28]** to **49_Set-point-B** or in Scheduling program.
ADV-76	0844	Y	S-Point-AB	0 to **[SET-20]**	Activate this parameter by setting a DI (digital input) **[IO-21]** to **[IO-28]** to **48_Set-point-A** and **49_Set-point-B** or in Scheduling program.

Parameter Descriptions > PROTECTION Menu

AR = Adjustable while Running.

CODE	Mod Bus	AR	Display Name	Range	Description
PROT-00	1024	N	Decel Method	0_Normal 1_Over Fluxing 2_Traction Energy	0_VFD follows **Deceleration time [SET-12]** 1_VFD prevents DC bus Over voltage by over-fluxing the motor at **[PROT-14]** voltage. The Decel time can be longer than **[SET-12]** value. 2_VFD prevents DC Bus Over voltage by changing output frequency and voltage. The Decel time can be longer than **[SET-12]** value.
PROT-01	1025	Y	Preheat Level	0 to 100%	Percentage of nominal current applied to the motor as DC voltage to heat the VFD and motor. Slowly increase the percentage to reach the sufficient preheating temperature.
PROT-02	1026	Y	Preheat Duty	0 to 100%	Sets output current cycle of preheating, which corresponds to 0-10 seconds. 0% - no output current 50% - 5 seconds OFF and 5 seconds ON 100% - continuous output current
PROT-03	1027	Y	LV Level	(Varies with VFD rating)	Sets the Low Voltage (Lv) level. Recommended setting is motor voltage minus 10%. If incoming power varies too much, the setting may need to be 15% less than motor voltage. If DC bus voltage drops to Lv level, the VFD stops output to the motor withmotor free run to stop. If fault occurs during acceleration, deceleration, constant speed, or stop, then fault indication is LvA, Lvd, Lvn, and LvS, respectively. Manual reset is required. To enable auto restart after a momentary power loss, consult **[PROT-37]** and **[PROT-38]** for VFD handling of fault. The hysteresis recovery level is based on VFD frame size and VFD voltage rating.
PROT-04	1028	Y	OV Stall level	(Varies with VFD rating)	Set Over Voltage Stall Level. If braking unit or braking resistor is connected, set level to 0 to disable.
PROT-05	1029	Y	OV Stall Prevent	0_Standard 1_Advanced	Set Over-Voltage Stall Prevention operation. 0_Standard: Frequency maintains during deceleration. 1_Advanced: Frequency increases during acceleration, deceleration, or constant speed.
PROT-06	1030	Y	SW Brake V Lvl	(Variable)	Sets the DC-bus voltage at which the DC Brake is activated. Defaults are based on VFD Rating.
PROT-07	1031	Y	OCA Level	0 to 130%	Set Over-Current during Acceleration level. Value is based on VFD's rated current and selection of **[VFD-35]** for Light Duty or Normal Duty.
PROT-08	1032	Y	OCN Level	0 to 130%	Over Current during normal running level: Set Over-Current during Operation level. Value is based on VFD's rated current and selection of **[VFD-35]** for Light Duty or Normal Duty.
PROT-09	1033	Y	Auto Timer Cntr	0 to 60000	If VFD does not trip during this timer, VFD will reset the counter of number of auto restarts.
PROT-10	1034	Y	Auto Restarts	0 to 10	Number of auto restart attempts after fault. When VFD trips on a fault, the counter will decrement by one and the **[PROT-11]** timer will start. When the timer expires, VFD will start the motor again. If the fault occurs again, this cycle repeats until the counter equals zero, at which point reset is required. If the VFD starts and continues to run for 10 minutes, the restart counter will stay at the current value. If the VFD continues to run without fault for six hours, the counter will reset. Shutdown will override Restart.

CODE	Mod Bus	AR	Display Name	Range	Description
PROT-11	1035	Y	AutoRetry Delay	10 to 6000 sec	Time delay before VFD attempts restart after fault. FO Mode overrides Retry Delay. When FO is activated, current fault, retry delay, and restart counter will be reset. If Run command is removed with timer active, timer will finish and fault will be reset.
PROT-12	1036	Y	OL-2 Type	0_Disable 1_Alarm at Speed 2_Trip at Speed 3_Alarm at Run 4_Trip at Run	Select Overload Detection operation. Setting **1** and **2** protects from Overload once VFD reaches constant speed. Setting **3** and **4** protects from Overload throughout run of the motor.
PROT-13	1037	Y	OL-2 Level	10 to 200%	Set Overload Detection level with respect to the rated current of the VFD.
PROT-14	1038	Y	OL-2 Delay	0.0 to 60 sec	Duration output current exceeds the overload detection level causing an Overload condition. The hysteresis for the Overload condition is 5% of detection level.
PROT-15	1039	Y	OCA/OCN ACC/DEC	0_ACC/DEC-1 1_ACC/DEC-2 2_ACC/DEC-3 3_ACC/DEC-4	Over Current during Acceleration / Over Current during Normal Running Acceleration Time / Deceleration Time When over-current condition OCA or OCN is detected, VFD will change ACC/DEC rate to selected rate.
PROT-16	1040	Y	ETH Type	0_Disable 1_Self-Cooled 2_Force-Cooled	Set type of motor for Electronic Thermal Relay protection. For **1_Self-Cooled**, the motor rated current percentage level is 40% at 0Hz and linear increases to 100% at motor rated frequency.
PROT-17	1041	Y	ETH Delay	30 to 600 sec	Sets time the output current is higher than 150% before tripping on electronic thermal overload. The overload level with respect to time is based on I^2t curve.
PROT-18	1042	Y	OH Warning	0.0 to 110.0 °C	Set Heat Sink Over Heat Warning level. When temperature exceeds 110 °C, the drive stops with an IGBT over-heat fault. Cooling fan is activated when temperature reaches 15 °C less than value. The cooling fan deactivates for 35 °C less than value.
PROT-19	1043	Y	PTC/PT100 Sel	0_Alarm and Run 1_Trip Decel Stop 2_Trip Coast Stop 3_Disabled	Set operation when PTC, PT100, or KTY84 exceed level 2.
PROT-20	1044	Y	PTC Level	0.0 to 100.0%	Set detection level of PTC. The corresponding value for 100% is the analog input maximum value.
PROT-21	1045	Y	OPO Trip	0_Alarm and Run 1_Trip Decel Stop 2_Trip Coast Stop 3_Disabled	Output Phase Open Trip: Select operation for Output Phase Loss.
PROT-22	1046	Y	OPO Delay	0.000 to 65.535 sec	Duration of output phase loss until operation occurs.
PROT-23	1047	Y	OPO Current	0.00 to 100.00%	Set level of output phase loss.
PROT-24	1048	Y	OPO Decel	0.000 to 65.535 sec	DC Brake Time of output phase loss.
PROT-25	1049	Y	LvX Auto Reset	0_Disable 1_Enable	Low Voltage Extension of faults Auto Reset: Set low voltage fault operation to auto reset. Once DC bus voltage returns, the VFD clears fault and restarts motor.
PROT-26	1050	Y	IPO Check Time	0.0 to 600.00 sec	Input Phase Open Check Time: Set how often to check for input phase loss.
PROT-27	1051	Y	IPO Ripple	(Varies with VFD rating)	An input phase loss is detected when DC bus ripple is higher than IPO Ripple for duration of **IPO Check Time [PROT-26]** plus 30 seconds.
PROT-28	1052	Y	IPO Trip	0_Alarm and Decel 1_Alarm and Coast	Operation when input phase loss is detected.
PROT-29	1053	Y	Derating Type	0_Carrier by I_T 1_Limit Current 2_Limit Carrier	Set how the VFD derates itself. 0_Limit the carrier wave to reach max load current and temperature. 1_Limit the current to use max carrier frequency. 2_Limit the carrier wave to reach max load current and temperature except when output current is the derating ratio x 130% of output current in light load.
PROT-30	1054	Y	PT100 Level 1	-20.0 to 99.9 °C	Level the PT100 reaches for duration for **PT100 L-1 Delay [PROT-33]** causing drive to back frequency down to **PT100 L-1 Freq [PROT-32]**.
PROT-31	1055	Y	PT100 Level 2	60.1 to 200 °C	Level the PT100 reaches causing **PTC Select [Prot-19]** operation.
PROT-32	1056	Y	PT100 L-1 Freq	0.0 to 599 Hz	Frequency the VFD reduces to after reaching **PT100 Level 1 [PROT-30]** for duration of **PT100 L-1 Delay [PROT-33]**.
PROT-33	1057	Y	PT100 L-1 Delay	0 to 6000 sec	Duration PT100 has to be above **PT100 Level 1 [PROT-30]** to cause frequency reduction to **PT100 L-1 Freq [PROT-32]**.

CODE	Mod Bus	AR	Display Name	Range	Description
PROT-34	1058	Y	Gnd Fault Level	0.0 to 6553.5%	Percentage of light-load current that current phase unbalance has to reach for duration of **Gnd Fault Delay [Prot-35]** for ground fault to occur.
PROT-35	1059	Y	Gnd Fault Delay	0.0 to 6553.5 sec	Duration of current phase unbalance for ground fault to occur.
PROT-36	1060	Y	STO Alarm Type	0_STO Latching 1_STO Non-Latch	0_When VFD triggers STO protection it will require reset. 1_When STO is triggered and then connection restored, VFD will be ready to operate.
PROT-37	1061	Y	IPF S-Search	0_Disable 1_At Last Freq 2_At Min Freq	Speed search treatment after Instantaneous Power Failure (IPF).
PROT-38	1062	Y	Max IPF Time	0.0 to 20.0 sec	Max Instantaneous Power Failure Time: Duration power loss has to occur for output to be turned off (coast stop).
PROT-39	1063	Y	SS Current Lmt	20 to 200%	Speed Search Current Limit: Following a momentary power loss, the drive will start speed search operation if the output current is greater than **[PROT-39]** value.
PROT-40	1064	Y	SS After Fault	0_Disable 1_At Last Freq 2_At Min Freq	Speed search operation after fault,
PROT-42	1066	Y	SS Normal Start	0_Disable 1_At Max Freq 2_At Start Freq 3_At Min Freq	Speed search operation at normal start.
PROT-43	1067	Y	Spd Search Gain	1 to 200%	Speed search gain: Voltage gain percentage for speed search operation. Reduce value if overload or over-current fault occurs.
PROT-44	1068	Y	IPF Restart Dly	0.0 to 5.0 sec	Delay for restart after an Instantaneous Power Failure. Set value high enough to allow residual regeneration voltage to disappear.
PROT-45	1069	Y	Fan Control	0_At Power-Up 1_Delayed Stop 2_During Run 3_By Temperature 4_Disabled	Determines operation of fan. It is not recommended to set to **4_Disabled** since this will reduce performance of drive. 3_Starts fan at 60 °C
PROT-46	1070	Y	Last Flt Freq	0.00 to 599.00 Hz	Output frequency at last fault (Read Only)
PROT-47	1071	Y	Last Flt IGBTT	-3277 to 3276.7 °C	IGBT temperature at last fault (Read Only)
PROT-48	1072	Y	Last Flt Cap T	-3277 to 3276.7 °C	Capacitance temperature at last fault (Read Only)
PROT-49	1073	Y	Last Flt MFI	0000h to FFFFh	Status of Multi-function input terminals at last fault (Read Only)
PROT-50	1074	Y	Last Flt MFO	0000h to FFFFh	Status of Multi-function output terminals at last fault (Read Only)
PROT-51	1075	Y	Fault-1 Record	0 to 65535	First register of fault listing. (Read Only)
PROT-52	1076	Y	Fault-2 Record	0 to 65535	Second register of fault listing. (Read Only)
PROT-53	1077	Y	Fault-3 Record	0 to 65535	Third register of fault listing. (Read Only)
PROT-54	1078	Y	Fault-4 Record	0 to 65535	Fourth register of fault listing. (Read Only)
PROT-55	1079	Y	Fault-5 Record	0 to 65535	Fifth register of fault listing. (Read Only)
PROT-56	1080	Y	Fault-6 Record	0 to 65535	Sixth register of fault listing. (Read Only)
PROT-57	1081	Y	ULD Torque Min	5% to **[SET-42]**	Sets minimum torque level % at 0Hz when using Underload Torque.
PROT-58	1082	Y	HLD Torque Min	**[PROT-57]** to **[SET-48]**	Sets minimum torque level % at 0Hz when using High load Torque.
PROT-59	1083	Y	RTD Wire Gauge	0_0.5 mm^2 1_0.75 mm^2 2_1.0 mm^2 3_20 AWG 4_18 AWG 5_16 AWG	Select the sensor's wire gauge.
PROT-60	1084	Y	RTD Length	1 to 5000 ft	Enter the wire distance from the sensor to the drive.
PROT-61	1085	N	RTD I+ to V+	0 to 65535 Ohms	Displays the calculated resistance value of both wires between I+ to V+ wires.

Parameter Descriptions > COMM Menu

AR = Adjustable while Running.

CODE	Mod Bus	AR	Display Name	Range	Description
Comm-00	1280	Y	COM1 Address	1 to 254	RS485 address of VFD.
Comm-01	1281	Y	COM1 Speed	4.8 to 115.2 Kbps	RS485 baud rate. All devices on RS485 communication must have the same baud rate.
Comm-02	1282	Y	COM1 Loss	0_Alarm and Run 1_Trip Decel Stop 2_Trip Coast Stop 3_Disabled	Select operation when communication is lost.
Comm-03	1283	Y	COM1 Loss Delay	0.0 to 100.0 sec	Duration of communication loss before initiating operation.
Comm-04	1284	Y	COM1 Protocol	1_7, N, 2 for ASCII 2_7, E, 1 for ASCII 3_7, O, 1 for ASCII 4_7, E, 2 for ASCII 5_7, O, 2 for ASCII 6_8, N, 1 for ASCII 7_8, N, 2 for ASCII 8_8, E, 1 for ASCII 9_8, O, 1 for ASCII 10_8, E, 2 for ASCII 11_8, O, 2 for ASCII 12_8, N, 1 for RTU 13_8, N, 2 for RTU 14_8, E, 1 for RTU 15_8, O, 1 for RTU 16_8, E, 2 for RTU 17_8, O, 2 for RTU	RS485 Protocol: Data Bits - Parity - Stop Bits - Message Format
Comm-05	1285	Y	Response Delay	0.0 to 200.0 ms	Duration VFD waits before responding to received communication.
Comm-06	1286	N	Main Frequency	0.00 to 599.00 Hz	When **Auto Speed Ref [SET-07]** is set to **5_RS485 Interface**, the last frequency command is stored in this parameter. After rebooting from an abnormal turn-off or momentary power loss, the VFD will continue operation with last frequency. (Read Only)
Comm-07	1287	Y	Block Transf 1	0000h to FFFFh	Block transfer allows selection of a group of parameters for transfer through communication code 03H.
Comm-08	1288	Y	Block Transf 2	0000h to FFFFh	See **[Comm-07]**
Comm-09	1289	Y	Block Transf 3	0000h to FFFFh	See **[Comm-07]**
Comm-10	1290	Y	Block Transf 4	0000h to FFFFh	See **[Comm-07]**
Comm-11	1291	Y	Block Transf 5	0000h to FFFFh	See **[Comm-07]**
Comm-12	1292	Y	Block Transf 6	0000h to FFFFh	See **[Comm-07]**
Comm-13	1293	Y	Block Transf 7	0000h to FFFFh	See **[Comm-07]**
Comm-14	1294	Y	Block Transf 8	0000h to FFFFh	See **[Comm-07]**
Comm-15	1295	Y	Block Transf 9	0000h to FFFFh	See **[Comm-07]**
Comm-16	1296	Y	Block Transf 10	0000h to FFFFh	See **[Comm-07]**
Comm-17	1297	Y	Block Transf 11	0000h to FFFFh	See **[Comm-07]**
Comm-18	1298	Y	Block Transf 12	0000h to FFFFh	See **[Comm-07]**
Comm-19	1299	Y	Block Transf 13	0000h to FFFFh	See **[Comm-07]**
Comm-20	1300	Y	Block Transf 14	0000h to FFFFh	See **[Comm-07]**
Comm-21	1301	Y	Block Transf 15	0000h to FFFFh	See **[Comm-07]**
Comm-22	1302	Y	Block Transf 16	0000h to FFFFh	See **[Comm-07]**
Comm-23	1303	N	Com Decoding	0_20xx 1_60xx	Select address starting range for communication via RS485 and Communication Card.
Comm-24	1304	N	BACnet MAC ID	0 to 127	BACnet address of VFD.
Comm-25	1305	N	BACnet Speed	9.6 to 76.8 Kbps	BACnet baud rate.
Comm-26	1306	N	Device ID Lo	0 to 65535	BACnet Device ID Low.
Comm-27	1307	N	Device ID Hi	0 to 63	BACnet Device ID High.

CODE	Mod Bus	AR	Display Name	Range	Description
Comm-28	1308	N	Max Address	0 to 127	BACnet max address.
Comm-29	1309	N	Password	0 to 65535	BACnet password.
Comm-30	1310	N	Com Card ID	0_No Com Card 1_DevNet Slave 2_P-bus DP Slave 3_CANopen S/M 4_Mbus-TCP Slave 5_E-Net/IP Slave 13_FELE BT Card	Identification of installed communication card. (Read Only)
Comm-31	1311	N	Com Card FW	0 to 65535	Firmware version of communication card. (Read Only)
Comm-32	1312	N	Product code	0 to 65535	Part number of communication card. (Read Only)
Comm-33	1313	N	Error code	0 to 65535	Error status of communication card. (Read Only)
Comm-34	1314	Y	D-Net Card Addr	(Variable)	DeviceNet or address of VFD.
Comm-35	1315	Y	D-Net Speed	0_125 Kbps 1_250 Kbps 2_500 Kbps 3_1 Mbps	DeviceNet baud rate.
Comm-36	1316	Y	D-Net Type	0_Standard 1_Special	0_Standard: DeviceNet Standard is when **D-Net Speed [Comm-35]** is set to 125Kbps, 250Kbps, and 500Kbps in standard speeds. 1_Special: DeviceNet Special is for other speeds similar to CANopen.
Comm-37	1317	Y	M-bus IP Type	0_Static IP 1_DHCP	Set the Modbus TCP IP manually with Static IP or automatically by host control with DHCP.
Comm-38	1318	Y	IP Address 1	0 to 65535	First (most significant) octet of IP address. (0-255) XXX.—.—.—
Comm-39	1319	Y	IP Address 2	0 to 65535	Second octet of IP address. (0-255) —.XXX.—.—
Comm-40	1320	Y	IP Address 3	0 to 65535	Third octet of IP address. (0-255) —.—.XXX.—
Comm-41	1321	Y	IP Address 4	0 to 65535	Fourth (least significant) octet of IP address. (0-255) —.—.—.XXX
Comm-42	1322	Y	Address Mask 1	0 to 65535	First (most significant) octet of Mask address. (0-255) XXX.—.—.—
Comm-43	1323	Y	Address Mask 2	0 to 65535	Second octet of Mask address. (0-255) —.XXX.—.—
Comm-44	1324	Y	Address Mask 3	0 to 65535	Third octet of Mask address. (0-255)
Comm-45	1325	Y	Address Mask 4	0 to 65535	Fourth (least significant) octet of Mask address. (0-255) —.—.—.XXX
Comm-46	1326	Y	G-way Address 1	0 to 65535	First (most significant) octet of Gateway address. (0-255) XXX.—.—.—
Comm-47	1327	Y	G-way Address 2	0 to 65535	Second octet of Gateway address. (0-255)
Comm-48	1328	Y	G-way Address 3	0 to 65535	Third octet of Gateway address. (0-255)
Comm-49	1329	Y	G-way Address 4	0 to 65535	Fourth (least significant) octet of Gateway address. (0-255)
Comm-50	1330	Y	MBus TCP Pass L	0 to 99	Communication card password for Modbus TCP (Low word)
Comm-51	1331	Y	MBus TCP Pass H	0 to 99	Communication card password for Modbus TCP (High word)
Comm-52	1332	Y	MBus Card Reset	0_Disable 1_Reset	Sets the communication card to default values for Modbus TCP.
Comm-53	1333	Y	MBus TCP Config	0 to 65535	Once IP address parameters are set, then set **Modbus TCP Config [Comm-53]** to **1: Internet Parameters** to load parameters. Once login password is set, then set Modbus TCP Config to **2: Login Password** to load password.

CODE	Mod Bus	AR	Display Name	Range	Description
Comm-54	1334	N	MBus TCP Status	0 to 65535	When the communication card is set with a password, this bit is enabled. When the password is cleared, this bit is disabled.
Comm-55	1335	N	SET Comm Card	0 to 65535	Enables an optional Ethernet/IP card, which disables Bluetooth. Set bit 1 to ON to enable the Ethernet card. Set to OFF to disable the card and allow Bluetooth. 

Parameter Descriptions > PLC Menu

CODE	Mod Bus	Display Name	Range	Description
PLC-00	1536	DI used by PLC	0 to 65535	Status of PLC external input terminal.
PLC-01	1537	DO used by PLC	0 to 65535	Status of PLC external output terminal.
PLC-02	1538	Analog by PLC	0 to 65535	Status of PLC external analog output terminals.
PLC-03	1539	PLC Buffer 0	0 to 65535	Used for PLC or HMI programming.
PLC-04	1540	PLC Buffer 1	0 to 65535	Used for PLC or HMI programming.
PLC-05	1541	PLC Buffer 2	0 to 65535	Used for PLC or HMI programming.
PLC-06	1542	PLC Buffer 3	0 to 65535	Used for PLC or HMI programming.
PLC-07	1543	PLC Buffer 4	0 to 65535	Used for PLC or HMI programming.
PLC-08	1544	PLC Buffer 5	0 to 65535	Used for PLC or HMI programming.
PLC-09	1545	PLC Buffer 6	0 to 65535	Used for PLC or HMI programming.
PLC-10	1546	PLC Buffer 7	0 to 65535	Used for PLC or HMI programming.
PLC-11	1547	PLC Buffer 8	0 to 65535	Used for PLC or HMI programming.
PLC-12	1548	PLC Buffer 9	0 to 65535	Used for PLC or HMI programming.
PLC-13	1549	PLC Buffer 10	0 to 65535	Used for PLC or HMI programming.
PLC-14	1550	PLC Buffer 11	0 to 65535	Used for PLC or HMI programming.
PLC-15	1551	PLC Buffer 12	0 to 65535	Used for PLC or HMI programming.
PLC-16	1552	PLC Buffer 13	0 to 65535	Used for PLC or HMI programming.
PLC-17	1553	PLC Buffer 14	0 to 65535	Used for PLC or HMI programming.
PLC-18	1554	PLC Buffer 15	0 to 65535	Used for PLC or HMI programming.
PLC-19	1555	PLC Buffer 16	0 to 65535	Used for PLC or HMI programming.
PLC-20	1556	PLC Buffer 17	0 to 65535	Used for PLC or HMI programming.
PLC-21	1557	PLC Buffer 18	0 to 65535	Used for PLC or HMI programming.
PLC-22	1558	PLC Buffer 19	0 to 65535	Used for PLC or HMI programming.
PLC-23	1559	PLC Com Type	-12_PLC Control -10_Internal Master -8_Internal Slave8 -7_Internal Slave7 -6_Internal Slave6 -5_Internal Slave5 -4_Internal Slave4 -3_Internal Slave3 -2_Internal Slave2 -1_Internal Slave1 0_Modbus 485 1_BACnet	Setup PLC controller for single VFD or with multiple VFDs. Select communication protocol for com port.

CODE	Mod Bus	Display Name	Range	Description
PLC-24	1560	PLC force to 0	0 to 65535	Defines reset value of the frequency command before PLC scans time sequence. Bit0 Before PLC scan, set up PLC target frequency=0. Bit1 Before PLC scan, set up PLC target torque=0. Bit2 Before PLC scan, set up the speed limit of torque control mode=0.
PLC-25	1561	PLC Address	1 to 254	Address of PLC with respect to communication link.

Parameter Descriptions > Option Menu

AR = Adjustable while Running.

CODE	Mod Bus	AR	Display Name	Range	Description
Option-00	1792	N	M10 Define	0_No Function 1_Speed-L 2_Speed-M 3_Speed-H 4_Speed-X 5_Fault Reset 6_Jog Frequency 7_Hold Speed 8_XCEL-L 9_XCEL-M 10_Ext. Trip 11_3-Wire Stop 12_AVI1 Analog Spd 13_ACI Analog Speed 14_AVI2 Analog Spd 16_Up 17_Down 18_PID Disable 19_CLR CNT 20_Input CNT (MI6) 21_FWD Jog 22_REV Jog 25_E-Stop 26_HOA-HAND 27_HOA-AUTO 28_Drive enabled 29_PLC mode bit 0 30_PLC mode bit 1 32_FO with RUN Cmd 33_FO w/o RUN Cmd 34_Damper Limit Sw 35_Shutdown N-Latch 36_Shutdown Latched 37_Flow Switch 38_FWD 39_REV 40_Aux Motor-1 OFF 41_Aux Motor-2 OFF 42_Aux Motor-3 OFF 43_Aux Motor-4 OFF 44_Aux Motor-5 OFF 45_Aux Motor-6 OFF	MI1 Default = Speed-L 1_Multi-step speed command 1 2_Multi-step speed command 2 3_Multi-step speed command 3 4_Multi-step speed command 4 5_Use to reset fault after cause is corrected 6_Changes speed in jog mode to value set in **[VFD-55]** 7_When active, VFD will hold current speed 8_ACC/DEC time will be changed to **[VFD-19]** and **[VFD-20]** 9_ACC/DEC time will be changed to **[VFD-21]** and **[VFD-22]** 10_Trips VFD by external protective device and requires reset 11_Stop input for 3-Wire control. MI12 by default. 12_In non-PID mode, changes speed reference to AVI1 13_In non-PID mode, changes speed reference to ACI 14_In non-PID mode, changes speed reference to AVI2 16_Increases speed reference when **[SET-07]** is set to (1) 17_Decreases speed reference when **[SET-07]** is set to (1) 18_Disables PID and switches speed reference to keypad 19_Clears pulse counter accumulated value (MI6 only) 20_Pulse counter input (MI6 only) 21_Jog Command Forward 22_Jog Command Reverse 25_VFD stops by Emergency Stop device (requires reset) 26_External HOA Hand position contact 27_External HOA Auto position contact 28_Enables and disables the drive (not a run command) 29_ PLC Function Disable 29 and 30=(0) or Run 29= (1) 30_ PLC Function Disable 29 and 30=(0) or Stop 30= (1) 32_VFD will start in Fireman's Override Mode by FO DI and Run Command 33_VFD will start in Fireman's Override Mode by FO DI (No Run Command) 34_When damper is closed, Damper LSW DI is activated 35_Activates Shutdown. When inactive, VFD operates normally 36_Activates Shutdown. Requires reset to operate normally 37_Detects water or air flow by Flow Switch 38_Provides an option to replace the dedicated FWD input 39_Provides an option to replace the dedicated REV input 40_Aux Motor-1 in MMC mode is off sequence 41_Aux Motor-2 in MMC mode is off sequence 42_Aux Motor-3 in MMC mode is off sequence 43_Aux Motor-4 in MMC mode is off sequence 44_Aux Motor-5 in MMC mode is off sequence 45_Aux Motor-6 in MMC mode is off sequence

CODE	Mod Bus	AR	Display Name	Range	Description
Option-00 (Cont.)	1792	N	M10 Define	46_Aux Motor-7 OFF 47_All Aux Mtr OFF 48_S-Point-A 49_S-Point-B	46_Aux Motor-7 in MMC mode is off sequence 47_All Aux Motors in MMC mode are off sequence 48_Preset Set-Point-A for PID control 49_Preset Set-Point-B for PID (If 48 and 49 ON=S-point-AB)
Option-01	1793	N	M11 Define	See **[Option-00]**	Defines functionality of input MI11 on I/O extension card.
Option-02	1794	N	M12 Define	See **[Option-00]**	Defines functionality of input MI12 on I/O extension card.
Option-03	1795	N	M13 Define	See **[Option-00]**	Defines functionality of input MI13 on I/O extension card.
Option-04	1796	N	M14 Define	See **[Option-00]**	Defines functionality of input MI14 on I/O extension card.
Option-05	1797	N	M15 Define	See **[Option-00]**	Defines functionality of input MI15 on I/O extension card.
Option-06	1798	N	Relay exp. RA10	0_No Function 1_Run 2_FDT-1 3_FDT-2 4_FDT-3 5_FDT-4 6_FDT-5 7_Drive ready 8_Fault 9_VFD Overheat 10_DC Brake 11_PID F/B Loss 12_Counter Done 13_Pre-Count Done 14_Alarm 15_FWD CMD 16_REV CMD 17_Analog Trigger 19_Overcurrent 2 20_High Load 21_Under Load 22_Fireman O-ride 23_Bypass 24_Motor-1 Out 25_Motor-2 Out 26_Motor-3 Out 27_Motor-4 Out 28_Motor-5 Out 29_Motor-6 Out 30_Motor-7 Out 31_Pipe Leak 32_Preheat Output 33_Steady 34_Pre-PID 35_Sleep 36_Speed Search 37_Pipe Broken 38_Damper Output 39_Aux Timer Out 40_Overpressure 41_Lube/S-Clean 42_ACI Loss 43_AVI1 Loss 44_Hand Mode 45_Auto Mode 47_MMC Out 48_Jockey Pump	RA1 Default = Fault 1_During Run Mode 2_When frequency reference value is achieved 3_On above **[IO-52]** freq and Off below **[IO-52]** - **[IO-53]** freq 4_On above **[IO-54]** freq and Off below **[IO-54]** + **[IO-55]** freq 5_On up to FDT-4/5 freq 6_On above FDT-4/5 freq 7_When drive is powered and ready (no faults) 8_When drive has tripped on any fault 9_When VFD temperature reaches trip level 10_When DC injection brake is activated 11_When PID feedback source signal value is abnormal 12_When pulse counter achieves the counter set-value 13_When pulse counter achieves pre-count value 14_When alarm is triggered by any alarm condition 15_When VFD operates in Forward direction 16_When VFD operates in Reverse direction 17_When analog signal reaches a trigger level 19_When VFD trips on Overcurrent 2 20_HLD triggered 21_ULD triggered 22_When Fireman's Override mode is activated 23_When drive switches from Soft-Start mode to Bypass 24_When Motor-1 is enabled in MMC control 25_When Motor-2 is enabled in MMC control 26_When Motor-3 is enabled in MMC control 27_When Motor-4 is enabled in MMC control 28_When Motor-5 is enabled in MMC control 29_When Motor-6 is enabled in MMC control 30_When Motor-7 is enabled in MMC control 31_Pipe Leak protection is triggered 32_VFD provides Motor Preheat output 33_VFD provides steady frequency output 34_VFD is in Pipe Fill mode 35_VFD is in Sleep mode 36_VFD is in Speed Search mode 37_Pipe Broken protection is triggered 38_When Damper motor output is activated 39_Auxiliary timer output 40_Overpressure is triggered 41_When Lube or Screen Clean solenoid output is activated 42_When ACI analog input signal value is abnormal 43_When AVI1 analog input signal loss is detected 44_When VFD control is in Hand mode 45_When VFD control is in Auto mode 47_Aux motor start output in MMC control 48_Jockey pump start output

CODE	Mod Bus	AR	Display Name	Range	Description
Option-06 (Cont.)	1798	N	Relay exp. RA10	49_At High Current 50_At Low Current	49_When current reaches High Current trigger level 50_When current is below Low Current trigger level
Option-07	1799	N	Relay exp. RA11	See **[Option-06]**	Defines functionality of output relay RA11 on I/O extension card.
Option-08	1800	N	Relay exp. RA12	See **[Option-06]**	Defines functionality of output relay RA12 on I/O extension card.
Option-09	1801	N	Relay exp. RA13	See **[Option-06]**	Defines functionality of output relay RA13 on I/O extension card.
Option-10	1802	N	Relay exp. RA14	See **[Option-06]**	Defines functionality of output relay RA14 on I/O extension card.
Option-11	1803	N	Relay exp. RA15	See **[Option-06]**	Defines functionality of output relay RA15 on I/O extension card.
Option-12	1804	N	Relay exp. RA16	See **[Option-06]**	Defines functionality of output relay RA16 on I/O extension card.
Option-13	1805	N	Relay exp. RA17	See **[Option-06]**	Defines functionality of output relay RA17 on I/O extension card.
Option-14	1806	N	Relay exp. RA18	See **[Option-06]**	Defines functionality of output relay RA18 on I/O extension card.
Option-15	1807	N	Relay exp. RA19	See **[Option-06]**	Defines functionality of output relay RA19 on I/O extension card.
Option-16	1808	N	Relay exp. RA20	See **[Option-06]**	Defines functionality of output relay RA20 on I/O extension card.
Option-17	1809	N	IO Card Type	0_No Card 1_EMC-BPS01 4_EMC-D611A 5_EMC-D42A 6_EMC-R6AA	Defines I/O card type.

Parameter Descriptions > ADVANCE 2 Menu

AR = Adjustable while Running.

CODE	Mod Bus	AR	Display Name	Range	Description
ADV2-00	2048	N	PID D-Gain	0.00 to 1.00 sec	Differential gain value for PID operation.
ADV2-01	2049	Y	Sleep Ctrl By	0_PID Output 1_PID F/B	0_Referenced to PID Output in Hz 1_Referenced to PID Feedback value in %
ADV2-03	2051	Y	Mtr Brake Delay	0.000 to 65.000 sec	Delay after start command when the corresponding multi-function output terminal (**10_DC Brake**) will be OFF.
ADV2-04	2052	Y	AFM1 Rev Value	0_0-10 V 1_0 V 2_5-0 V	0_0-10V: AFM1 output is 0-10V when in **REV**. 1_0V: AFM1 output is 0V when in **REV**, 0-10V in **FWD** direction. 2_5-0V: AFM1 output is 5-0V when in **REV**, 5-10V in **FWD** direction.
ADV2-05	2053	Y	AFM2 Rev Value	0_0-10 V 1_0 V 2_5-0 V	0_0-10V: AFM2 output is 0-10V when in **REV**. 1_0V: AFM2 output is 0V when in **REV**, 0-10V in **FWD** direction. 2_5-0V: AFM2output is 5-0V when in **REV**, 5-10V in **FWD** direction.
ADV2-06	2054	Y	AFM1 DC Lvl	0.00 to 100.00%	Used with **Multi-Function Output [IO-59]** set to **2_Output voltage**. Output provides constant voltage 0 to 100% corresponding to 0-10V.
ADV2-07	2055	Y	AFM2 DC Lvl	0.00 to 100.00%	Used with **Multi-Function Output [IO-61]** set to **2_Output voltage**. Output provides constant voltage 0 to 100% corresponding to 0-10V.
ADV2-08	2056	Y	Analog Curve	0_Regular Curve 1_AVI1 3-Point 2_ACI 3-Point 3_AVI1+ACI 3Point 4_AVI2 3-Point 5_AVI1+AVI2 3Point 6_ACI+AVI2 3-Point 7_3x AIs 3-Point	The analog input signal can be set up for linear curve or 3-point (piecewise) curve corresponding voltage/current input to frequency output. If using AVI1, **[ADV2-09]** < **[ADV2-11]** < **[ADV2-13]**. If using ACI, **[ADV2-15]** < **[ADV2-17]** < **[ADV2-19]**. If using AVI2, **[ADV2-21]** < **[ADV2-23]** < **[ADV2-25]**. The output frequency will become 0% when the analog input value is lower than low point setting.
ADV2-09	2057	Y	AVI1 Low Value	(Variable)	Lowest analog input value for AVI1 that corresponds to frequency output of **[ADV2-10]**. **[ADV2-09]** < **[ADV2-11]** < **[ADV2-13]**
ADV2-10	2058	Y	AVI1 Low %	-100 to 100%	Frequency output corresponding to **[ADV2-09]** input.
ADV2-11	2059	Y	AVI1 Mid Value	(Variable)	Middle analog input value for AVI1 that corresponds to frequency output of **[ADV2-12]**.
ADV2-12	2060	Y	AVI1 Mid %	-100 to 100%	Frequency output corresponding to **[ADV2-11]** input.

CODE	Mod Bus	AR	Display Name	Range	Description
ADV2-13	2061	Y	AVI1 Hi Value	(Variable)	Highest analog input value for AVI1 that corresponds to frequency output of **[ADV2-14]**.
ADV2-14	2062	Y	AVI1 High %	-100 to 100%	Frequency output corresponding to **[ADV2-13]**.
ADV2-15	2063	Y	ACI Low Value	(Variable)	Lowest analog input value for ACI that corresponds to frequency output of **[ADV2-16]**. **[ADV2-15]** < **[ADV2-17]** < **[ADV2-19]**
ADV2-16	2064	Y	ACI Low %	-100 to 100%	Frequency output corresponding to **[ADV2-15]** input.
ADV2-17	2065	Y	ACI Mid Value	(Variable)	Middle analog input value for ACI that corresponds to frequency output of **[ADV2-18]**.
ADV2-18	2066	Y	ACI Mid %	-100 to 100%	Frequency output corresponding to **[ADV2-17]** input.
ADV2-19	2067	Y	ACI High Value	(Variable)	Highest analog input value for ACI that corresponds to frequency output of **[ADV2-20]**.
ADV2-20	2068	Y	ACI High %	-100 to 100%	Frequency output corresponding to **[ADV2-19]**.
ADV2-21	2069	Y	AVI2 Low Value	0.00 to 10.00 V	Lowest analog input value for AVI2 that corresponds to frequency output of **[ADV2-22]**.
ADV2-22	2070	Y	AVI2 Low %	-100 to 100%	Frequency output corresponding to **[ADV2-21]** input.
ADV2-23	2071	Y	AVI2 Mid Value	0.00 to 10.00 V	Middle analog input value for AVI2 that corresponds to frequency output of **[ADV2-24]**.
ADV2-24	2072	Y	AVI2 Mid %	-100 to 100%	Frequency output corresponding to **[ADV2-23]** input.
ADV2-25	2073	Y	AVI2 High Value	0.00 to 10.0 V	Highest analog input value for AVI2 that corresponds to frequency output of **[ADV2-26]**.
ADV2-26	2074	Y	AVI2 High %	-100 to 100%	Frequency output corresponding to **[ADV2-25]**.
ADV2-27	2075	Y	dEb Offset V	0.0 to 200.0 V	Decel Energy Backup Error (dEb) Offset Voltage that the DC Bus reduces by to initiate dEb operation. Varies by VFD Rating.
ADV2-28	2076	Y	dEb Mode Select	0_Disable 1_Auto Dec/Stop 2_AutoDec/Restart	Select Decel Energy Backup Error (dEb) operation when DC Bus voltage drops by **[ADV2-27]**. This feature is used to detect power loss.
ADV2-30	2078	Y	PID Mode Select	0_Serial P, I, D 1_Parallel P, I, D	0_Serial: VFD uses conventional PID control structure. 1_Parallel: Proportional, Integral, and Derivative gains are independent.
ADV2-31	2079	N	PID Unit Format	0_1 1_0.1 2_0.01	Select precision of PID operation.
ADV2-32	2080	N	PID Ref Source	0_Keypad 1_AVI1 Analog 2_ACI Analog 3_AVI2 Analog 4_RS-485	Select source of PID setpoint.
ADV2-36	2084	Y	PID2 Output	0_No 1_Limit 1st PID 2_1st PID off	Used for Dual PID loop control. Default is No Limit. 0_ PID2 is disabled. 1_Limit 1st PID, 2nd PID output frequency will become a 1st PID High Frequency Limit value. 2nd PID will vary its output based on the **[ADV2-38]** setpoint and Aux Ai signal values. 2_1st PID (in direct mode) maintains system pressure and 2nd PID (in inverse mode) monitors tank or well level. Both PIDs are running simultaneously but only one at a time provides speed reference to VFD.
ADV2-37	2085	Y	PID2 Type	0_Direct 1_Inverse	Used for Dual PID loop control. 0_Direct: When feedback value is less than setpoint, then output increases. 1_Inverse: When feedback value is less than setpoint, then output decreases. This is the default setting.
ADV2-38	2086	Y	PID2 Set Point	0 to **[ADV2-61]**	PID2 target value for desired suction pressure.
ADV2-39	2087	Y	PID2 P-Gain	0.0 to 100.0%	Proportional gain value for PID2 operation.
ADV2-40	2088	Y	PID2 I-Time	0.00 to 100.00 sec	Integral gain value for PID2 operation.
ADV2-41	2089	Y	PID2 Low Limit	**[SET-22]** to **[ADV2-42]**	Minimum frequency for PID2 output.
ADV2-42	2090	N	PID2 High Limit	**[ADV2-41]** to **[SET-23]**	Maximum frequency for PID2 output.
ADV2-43	2091	Y	PID2 Stp Delay	0.0 to 6000.0 min	Duration PID2 output is less than **[ADV2-41]** to fault causing "Low Level." Only used if **[ADV2-36]** set to **2_1st PID off**.
ADV2-44	2092	Y	PID2 Exit Lvl	0 to **[ADV2-61]**	If feedback value is greater than **[ADV2-44]** for 10 seconds, then operation switches from PID2 to PID1. Only used when **[ADV2-36]** set to **2_1st PID off**.

CODE	Mod Bus	AR	Display Name	Range	Description
ADV2–45	2093	Y	Dual Demand	0_Disabled 1_Enabled	With Dual Demand control, VFD will determine by wakeup time what demand level is in the system.
ADV2–46	2094	Y	Pipe Leak Sel	0_Disabled 1_P-Leak Alarm 2_P-Leak Trip	If wakeup time exceeds **H-H Wake Time [ADV2-48]** or **L-L Wake Time [ADV2-50]**, VFD will activate Pipe Leak alarm or protection if activated.
ADV2–47	2095	Y	Last Wake Time	0 to 6000 sec	Display duration from setpoint (High demand or Low Demand) to wakeup level.
ADV2–48	2096	Y	H-H Wake Time	0 to 6000 sec	(High to High Demand) is an adjustable setting for High to High Demand wake up time, which should be determined during system startup. It is recommended to set time in this parameter to 10-20% greater value than **[ADV2-47]** shows for proper Pipe Leak protection operation. Default = 4 sec
ADV2–49	2097	Y	H-L Wake Time	0 to 6000 sec	(High to Low Demand) is an adjustable setting for High to Low Demand wake up time, which should be determined during system startup. It is recommended to set time in this parameter to 20-30% greater value than **[ADV2-47]** shows for proper Pipe Leak protection operation. Default = 10 sec.
ADV2–50	2098	Y	L-L Wake Time	0 to 6000 sec	(Low to Low Demand) is an adjustable setting for Low to Low Demand wake up time, which should be determined during system startup. It is recommended to set time in this parameter to 20-30% greater value than **[ADV2-47]** shows for proper Pipe Leak protection operation. Default = 14 sec.
ADV2–51	2099	Y	L-H Wake Time	0 to 6000 sec	(Low to High Demand) is an adjustable setting for Low to High Demand wake up time, which should be determined during system startup. It is recommended to set time in this parameter to 10-20% greater value than **[ADV2-47]** shows to compensate for any future system changes. Default = 6 sec.
ADV2-52	2100	Y	LD Set Point	0 to (variable)	Low Demand Set Point: Adjustable setting for Low Demand pressure setpoint from 0 to **PID F/B Max [SET-20]** x 0.95. It can be adjusted to lower or higher than HD (Main) pressure set-point value to provide desired pressure and prevent overpressure trip at pump start in Low Demand situation. Default = 70.0 PSI.
ADV2-53	2101	Y	LD Max Freq	**[SET-23]** to **[SET-22]**	PID High Frequency Limit setting for Low Demand. Adjust to lower frequency setting to prevent overpressure trips during run but enough to maintain pressure at LD Set-point. Default = 48.00 Hz.
ADV2-54	2102	Y	LD Timer	0 to 600 sec	Adjustable setting for Low Demand mode time. When VFD determines Low Demand mode during wake-up but at any point pressure cannot reach **[ADV2-52]** set-point within **[ADV2-54]** timer, VFD will switch control to High Demand mode. Default = 10 sec.
ADV2-55	2103	Y	Clean Pump Sel	0_Disabled 1_Clean Pump 2_Anti-Jam 3_Clean/Anti-Jam	1_Clean Pump: Provide periodic **[ADV2-56]** fast ramping starts to clean impeller. 2_Anti-Jam: If lock rotor condition is detected, VFD periodically (5 seconds) starts motor for 1 second in reverse direction to unjam impeller. VFD performs this twice with 30 seconds wait time. If impeller is not freed, VFD trips on overload.
ADV2-56	2104	Y	Clean Pump Tmr	0.0 to 6000.0 min	Set periodic interval for initiating Clean Pump starts.
ADV2-58	2106	N	Aux AI Select	0_AVI1 1_ACI 2_AVI2	Aux AI signal will be used for control features by analog level and 2nd PID Loop. Select AI input to designate for Aux AI. The default is AVI1.
ADV2-59	2107	N	Aux AI Unit	0_PSI 1_inWC 2_Feet 3_°F 4_CFM 5_GPM 6_% 7_Cust 8_inHg 9_m 10_mBar 11_Bar 12_kPa 13_°C 14_LPM 15_CMH	Select units of Aux AI.

CODE	Mod Bus	AR	Display Name	Range	Description
ADV2-60	2108	N	Aux Unit Format	0_1 1_0.1 2_0.01	Select precision of Aux AI.
ADV2-61	2109	N	Aux Max Value	0 to 30000 (unit)	Set max value of Aux AI.
ADV2-62	2110	N	Analog Trigger	0_Disable 1_Relay 2_Run Enable 3_Trip	0_ Feature disabled 1_VFD will activate selected relay in any VFD state at the **AI Trigger Level [ADV2-65]** and deactivate by hysteresis value depending on the **Trigger Type [ADV2-64]**. 2_Enables VFD run command when HOA is in Hand or Auto mode based on Aux AI level depending on the **Trigger Type [ADV2-64]**. 3_ When it is set to Trip and signal reaches trigger level depending on **Trigger Type [ADV2-64]** selection, VFD will trip and will require reset. VFD can be reset when AI signal changed by **Trigger Hysteresis [ADV2-66]** value.
ADV2-63	2111	N	Trigger Source	0_PIB F/B 1_Aux AI	This setting selects what will be the trigger for a tank fill, drain, or level control (analog trigger). 0_The trigger will be standard PID loop feedback value 1_The trigger will be an auxiliary input
ADV2-64	2112	N	Trigger Type	0_Lower 1_Higher	0_ The Trigger by AI function will be triggered if AI signal is less than **Trigger Level [ADV2-65]**. 1_The function will be triggered if AI signal is greater than **[ADV2-65]**.
ADV2-65	2113	Y	Trigger Level	0.0 to **[ADV2-61]**	Sets the desired target when the analog will be triggered. If **[ADV2-63]** is set to **1_Aux AI**, the range is 0.0 to **[SET-20]**. If **[ADV2-63]** is set to **0_PID F/B**, the range is 0.0 to **[ADV2-61]**.
ADV2-66	2114	Y	Trigger Hyster	0.0 to **[ADV2-61]**	Hysteresis value is subtracted from trigger value in Higher trigger mode to determine OFF (trigger reset) state level. It is added to trigger value in Lower trigger mode. Its range is from 0 to **PID F/B Max [SET-20]** or **Aux Max Value [ADV2-61]**.
ADV2-68	2116	Y	P-Fill Low Freq	**[SET-22]** to **[SET-35]**	Pipe fill low frequency limit.

Parameter Descriptions > Motor Menu

AR = Adjustable while Running.

CODE	Mod Bus	AR	Display Name	Range	Description
Motor-00	2304	N	Motor A-Tuning	0_None 1_IM Rotating 2_IM No-Rotation 3_PM Rotating 4_PM No-Rotation	Performs a motor test to measure the motor characteristics. Select motor type Induction Motor (IM) or Permanent Magnet (PM) motor and if the motor is allowed to rotate during auto-tune operation without load on the motor shaft.
Motor-01	2305	N	Motor Rs Value	0.0 to 65.535 Ohm	Induction Motor rotor resistance
Motor-02	2306	N	Motor Rr Value	0.0 to 65.535 Ohm	Induction Motor stator resistance
Motor-03	2307	N	Motor Lm Value	0.0 to 6553.5 mH	Induction Motor rotor inductance
Motor-04	2308	N	Motor Lx Value	0.0 to 6553.5 mH	Induction Motor stator inductance
Motor-05	2309	N	Control Method	0_V/F 1_———— 2_Sensorless	Determines the control method of the motor as either a volts to frequency relationship (Induction Motor) or Sensor-less Vector Control (SVC) (Permanent Magnet).
Motor-06	2310	N	Motor Type	0_Induction Motor 1_PM- SPM 2_PM- IPM	Identifies the type of motor being used. 1_PM-SPM: Surface Permanent Magnet Motor 2_PM-IPM: Interior Permanent Magnet Motor
Motor-07	2311	N	Motor Poles	0 to 65535	Identifies the number of poles in Permanent Magnet Motor.
Motor-08	2312	N	PM Inertia	0.0 to 6553.5 Kg*cm^2	Identifies the inertia in Permanent Magnet Motor. This value is automatically calculated.
Motor-09	2313	N	PM Rs	0.0 to 65.535 Ohm	Permanent Magnet Motor stator resistance.
Motor-10	2314	N	PM Ld	0.0 to 655.35 mH	Permanent Magnet Motor inductance d-axis.
Motor-11	2315	N	PM Lq	0.0 to 655.35 mH	Permanent Magnet Motor inductance q-axis.
Motor-12	2316	Y	PM PG Angle	0 to 360 degree	Permanent Magnet Motor offset angle.

CODE	Mod Bus	AR	Display Name	Range	Description
Motor-13	2317	Y	PM Ke Coeff	0.0 to 6553 v	Coefficient for optimal PM motor control
Motor-14	2318	Y	Rotor Zeroing	0_Disabled 1_1/4 FLA Current 2_Hi Freq Inject 3_Pulse Inject	Permanent Magnet Motor rotor initial angle position detection method. Recommendation: "2" for IPM; "3" for SPM. If there is a bad effect, then set as "1".
Motor-15	2319	Y	Torque Filter T	0.001 to 10.000 sec	Response time in controlling torque to motor.
Motor-16	2320	Y	Slip Filter T	0.001 to 10.000 sec	Response time in controlling slip compensation.
Motor-17	2321	Y	Torque Cmp Gain	0 to 10*	Gain value for output voltage increase to compensate for voltage drop on stator resistance at high motor loads in torque compensation function. * For PM motors max value is 5000.
Motor-18	2322	Y	Slip Cmp Gain	0.00 to 10.00	Gain value for output frequency increase to provide slip compensation at high motor loads
Motor-19	2323	Y	Slip Dev Level	0.0 to 100.0%	Slip percentage level to cause over slip trip. Setting of **0** is No Detection.
Motor-20	2324	Y	Slip Dev Det T	0.0 to 10.0 sec	The duration that the slip percentage has to be at before causing over slip trip.
Motor-21	2325	Y	Over Slip Trip	0_Alarm and Run 1_Alarm and Decel 2_Alarm and Coast 3_Disabled	Operation when over slip trip occurs.
Motor-22	2326	Y	Motor Hunt Gain	0 to 10000	Gain value in detecting shaft speed of a synchronous motor. A sudden load change can cause shaft speed to fluctuate.
Motor-24	2328	Y	I/F Current	0 to 150%	Percentage of nominal motor current **[SET-03]** used to regulate AC output current during I/F control and DC current during PM DC Alignment.
Motor-25	2329	Y	PM Bandwidth HS	0.00 to 600.00 Hz	Allowable frequency bandwidth around desired frequency in order to adjust operating frequency to prevent vibrations in motor operation.
Motor-26	2330	Y	PMSVC Fltr Gain	0.00 to 655.35	Gain value in adjusting the operating frequency from the desired frequency to prevent vibrations in motor operation.
Motor-27	2331	Y	Freq I/F to PM	0.00 to 599.00 Hz	When increasing frequency, the frequency to switch modes from I/F mode to PMSVC mode.
Motor-28	2332	Y	Freq PM to I/F	0.00 to 599.00 Hz	When decreasing frequency, the frequency to switch modes from PMSVC mode to I/F mode.
Motor-29	2333	Y	I/F fltr time	0.0 to 6.0 sec	Low-pass filter time of current being commanded from **I/F Current [Motor-24]**.
Motor-30	2334	Y	Angle Det Pulse	0.0 to 3.0	Value is a multiplier of nominal motor current which is magnitude of pulse during the angle detection. This is only used when **Rotor Zeroing [Motor-14]** is set to **2_Hi Freq Inject** or **3_Pulse Inject**.
Motor-31	2335	Y	Zero voltage T	0.000 to 60.000 sec	Duration the output is 0V to establish a static startup. Once the system is at a static startup, the VFD can accurately estimate angles. This parameter is applicable when **SS Normal Start [PROT-42]** is not set to **0_Disable**.
Motor-32	2336	Y	Injection Freq	0 to 1200 Hz	Frequency used to determine angle of motor during High Frequency Injection. Injection Frequency should be at least 100Hz larger than motor's nominal frequency. Carrier frequency should be 10 times larger than Injection Frequency.
Motor-33	2337	Y	Injection V	0.0 to 200.0 V	Voltage used to determine angle of motor during High Frequency Injection.
Motor-34	2338	N	Run Time Min	0 to 1439 min	Minutes of the motor run time. Less than 60 seconds is not recorded.
Motor-35	2339	N	Run Time Days	0 to 65535 day	Days of the motor run time.
Motor-36	2340	N	Motor PF	0.00 to 1.00	Power Factor value from motor nameplate
Motor-37	2341	N	PM Trq Comp I/F	0 to 5000	PM Torque Compensation in I/F Mode
Motor-38	2342	N	PM Trq Comp SVC	0 to 5000	PM Torque Compensation in SVC Mode
Motor-39	2343	N	DC-Tun Curr P	0 to 65535	Gain value regulating DC current during DC Alignment of PM motor.
Motor-40	2344	N	DC-Tun Curr I	0 to 65535	Integral gain regulating DC current during DC Alignment of PM motor.

SPECIFICATIONS

Common Specifications

Control Specifications

Specification	Details
Cooling Method	Forced air cooling by internal fans
Short Circuit Rating	The drive is suitable for use on a circuit capable of delivering not more than 100,000 symmetrical amperes (rms) when protected by suitable Class J fuses.
Agency Approvals	UL and cUL listed, CE, marked.
Control Method	Pulse Width Modulation (PWM) with V/F and SVC (Sensorless Vector Control) for IM and PM motors.
Frequency Setting Resolution	Digital Reference: 0.01 Hz (Below 100 Hz), 0.1 Hz (Over 100 Hz) Analog Reference: [Max. output frequency] x 0.03/60Hz (±11 bit)
Frequency Accuracy	Digital: ± 0.01 % of Max. Output Frequency. Analog: ± 0.1% of Max. Output Frequency.
V/F Control Curve	Linear curve, 1.5 power curve, square curve, 13 preset curves, and 4 point adjustable curve
Overload Capacity	Variable Torque: 120% of VFD rated current for 1 minute during every 5 minutes of operation. Constant Torque: 120% of VFD rated current for 1 minute during every 5 minutes of operation and 160% for 3 seconds during every 25 seconds of operation.
Starting Torque	Up to 150% or higher at 0.5 Hz (Torque Accuracy ± 5%).
Torque Limit (Stall level)	Variable Torque: Max. 130% torque current; Constant Torque: Max. 160% torque current

Operation Specifications

Specification	Details
Operation Method	Keypad / Terminals / RS-485 BACnet or Modbus Communication / Optional Modbus TCP/IP & Ethernet IP
Frequency Setting	Two Analog Inputs 0- 10VDC/4-20mA and One AI 0-10VDC. Digital Input select, Keypad, or Communication
Input Start Signal	Forward, Reverse, and Jog (some features can start and stop VFD based on analog signal)
Digital Inputs	8 programmable digital inputs can be set to any selection from long list of functions.
Multi-Step (Inputs)	Up to 17 Speeds can be set, including Jog by Programmable Digital Inputs.
Accel/Decel Time and Presets (Inputs)	0.00- 600.00/0.0- 6000.0 seconds. Three ACC/DEC preset values switched by digital inputs or one by frequency. Additional adjustable Accel/Decel S-Curve pattern.
Emergency Stop (Inputs)	Ext. Trip and Shutdown immediately interrupt VFD output in any control method.
Jog (Inputs)	Jog Operation with adjustable Jog frequency
Fault Reset (Inputs)	Resets VFD via keypad, digital input, or communication. Some critical faults must be reset by recycling power.
Safety Inputs	SCM and STO terminals for safety circuit wiring.
Three Multi-Function Relays Output Signals	One relay with Form C: 250VAC 3A/30VDC, 3A (resistive) 1.2A (inductive) contact; Two relays with Form A: 250VAC 1.2A/30VDC 3A (resistive) 1.2A (inductive). Each relay can be programmed to any selection from the functions list.
Two Analog Outputs	Selections: Output Frequency, Output Current, Output Voltage, Output kW, DC Link Voltage, Power Factor, AVI1, ACI, AVI2 AI signal level, and constant output. Both outputs are 0-10VDC scalable from 10 to 200%.
General Operation Functions	DC Braking, Frequency Limit, Jump Frequencies, 2nd ACC/DEC, Auto Restart, Auto-Tuning, PID w/sleep, Flying Start, Speed Search, DC Braking, Slip Compensation, Motor Pre-heat, Temperature Foldback, Damper Control, Fireman's Override, Shutdown, Power-on Delay, Run Delay, Minimum Run Timer, PM Motor and FE MagForce Control and Auto-Tuning, trigger by Analog Level, Frequency High Limit by Analog Leve, Analog Repeater Output, Current Foldback, Scheduling, Single or three-phase input, Auxiliary Timer, HOA Source selection, Keypad as OFF mode, 2/3-Wire Run Command, Hopping Carrier Frequency
Pump Operation Functions	Sleep Mode with Pressure Boost, Pipe Fill, PID, Overpressure, ULD (Underload), HLD (High Load), Broken Pipe, Backspin Timer, MMC, Lubrication, Screen Clean, No-Flow Protection, Pump Prime Time, Clean Pump, Anti-jam, Multi-VFD, Jockey, Dual Demand, Pipe Leak Detection, 2nd PID Operation, PT100/PTC Protection, Transducer Redundancy

Protection Specifications

Specification	Details
VFD Fault Trips	Over Voltage, Low Voltage, Over Current, Overload, Short Circuit, Ground Fault, VFD Overheat, Input Phase Loss, Output Phase Open, CPU Communication Error, Signal Loss, Hardware Fault, Overpressure, Damper, No Flow, Trip by AI, various Multi-VFD, Pipe Leak, Anti-Jam, etc.
VFD Alarm	Stall Prevention at ACC and DEC, Overload, Thermal Sensor Fault, Capacitors High Temperature, Signal Loss, Overpressure, Underload, High Load, Pipe Leak, various Multi-VFD setup, App Disconnect, Limit by Level, etc.
Overcurrent	200/208/230/460VAC Variable Torque: At 185% of VFD rated current 200/208/230/460VAC Constant Torque: At 240% of VFD rated current Current clamp: Variable Torque: 130- 135%, Constant Torque 170- 175% 575VAC models: At 225% VFD rated current Current clamp: Variable Torque: 128- 141%, Constant Torque: 170- 175%
Overvoltage	230VAC models: At 410VDC DC bus voltage 460VAC models: At 820VDC DC bus voltage 575VAC models: At 1016VDC DC bus voltage
Fault History	Keypad provides 6 fault records. VFD logs 30 faults.

Environment Specifications

Specification	Details
Operating Temperature	NEMA 1: -10 °C ~ 40 °C (14 °F ~ 104 °F), Open Type: -10 °C ~ 50 °C (14 °F ~ 122 °F)
Storage Temperature	-25 °C ~ 70 °C (-13 °F ~ 158 °F)
Ambient Humidity	Up to 95% RH (Non-Condensing)
Altitude	Normal up to 3,300 ft (1,000 m). At altitude up to 2,000 m, de-rate by 1% of rated current or lower 0.5 °C of temperature for every 100 m above 1,000 m. Maximum altitude for Corner Grounded TN system is 2,000 m. For application over 2,000 m, please contact Technical Support.
Vibration and Impact	1 mm peak to peak value from 2 Hz to 13.2Hz; 0.7G- 1.0G from 13.2 Hz to 55 Hz; 1.0G from 55 Hz to 512 Hz. Comply with IEC 60068-2-6 and IEC/EN60068-2-27.
Environmental Conditions	Pollution degree 2. No Corrosive Gas, Combustible Gas, Oil Mist or Dust. IEC60721-3-3/ IEC60364-1/ IEC60664-1.

200~230V Class 1~125HP (0.75~90kW)

Model (CXD-xxx-2V) UL Type 1[1]		005A	007A	010-A	015A	021A	031A	046A	061A	075A	09-0A	105A	146-A	180A	215-A	276A	322-A
Frame Size		A					B			C			D		E		
Input Ratings	Voltage	200 (-15%) to 240 VAC (+10%)															
	Frequency	50/60 Hz (± 5%)															
	Current — Variable Torque	6.4	9.6	15	22	25	35	50	65	83	100	116	146	180	215	276	322
	Current — Constant Torque	3.9	6.4	12	16	20	28	36	52	72	83	99	124	143	171	206	245
Output Ratings	Carrier Freq	2.0 - 15.0 kHz								2.0 - 10.0 kHz					2.0 - 9.0kHz		
	Voltage[2]	200 ~ 240 VAC [2]															
	Frequency	0.01 ~ 599 Hz													0.01 ~ 400 Hz		
Efficiency		98%															
Power Factor		>0.98															
Weight kg (lbs.)		2.6 ± 0.3 (5.8 ± 0.7)					5.4 ± 1 (11.9 ± 2.2)			9.8 ± 1.5 (21.6 ± 3.3)			38.5 ± 1.5 (84.9± 3.3)		64.8 ± 1.5 (142.9 ± 3.3)		
DC Choke		None											Built-in 3%				

Model (CXD-xxx-2V) UL Type 1[1]		005A	007A	010-A	015A	021A	031A	046A	061A	075A	09-0A	105A	146-A	180A	215-A	276A	322-A
Frame Size		A					B			C			D		E		
VFD Ratings with 3-Phase Input Power																	
Variable Torque Motor[3]Ratings	Max Amps	5	7.5	10	15	21	31	46	61	75	90	105	146	180	215	276	322
	Capacity [kVA]	2	3	4	6	8.4	12	18	24	30	36	42	58	72	86	110	128
	Max HP @ 200 V Surface Motor	1	1.5	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100
	Max HP @ 208 V Surface Motor	1	1.5	2	3	5	7.5	10	20	25	30	30	50	60	75	100	100
	Max HP @ 230 V Surface Motor	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125
	Max HP @ 200 V 4" Submersible	.75	1.5	2	3	5	7.5	-	-	-	-	-	-	-	-	-	-
	Max HP @ 230 V 4" Submersible	1	1.5	2	3	5	7.5	-	-	-	-	-	-	-	-	-	-
	Max HP @ 200 V 6" Submersible	-	-	-	-	5	7.5	10	15	20	25	30	40	40	60	-	-
	Max HP @ 230 V 6" Submersible	-	-	-	-	5	7.5	10	20	20	25	30	40	50	60	-	-
Constant Torque Motor[3] Ratings	Max Amps	3	5	8	11	17	25	33	49	65	75	90	120	146	180	216	255
	Capacity [kVA]	1.2	2	3.2	4.4	6.8	10	13	20	26	30	36	48	58	72	86	20
	Max HP @ 200 V	.5	1	2	3	3	5	10	15	20	20	25	40	50	60	60	75
	Max HP @ 230 V	.5	1	2	3	5	8	10	15	20	25	30	40	50	60	75	100
VFD Ratings with 1-Phase Input Power																	
Variable Torque Motor Ratings	Max Amps	2.5	3.75	5	7.5	10.5	15.5	23	30.5	37.5	45	52.5	48.1	59.4	70.9	91	106.-2
	Max HP @ 200 V Surface Motor	.5	.75	1	1	2	3	5	7.5	10	10	15	10	15	20	25	30
	Max HP @ 208 V Surface Motor	.5	.75	1	2	2	3	5	7.5	10	10	15	15	20	25	30	30
	Max HP @ 230 V Surface Motor	.5	.75	1	2	3	5	7.5	10	10	15	15	10	20	25	30	40
	Max HP @ 200 V 4" Submersible	-	.5	.5	1.5	2	3	5	7.5	-	-	-	-	-	-	-	-
	Max HP @ 230 V 4" Submersible	-	.5	1	1.5	2	3	5	7.5	-	-	-	-	-	-	-	-
	Max HP @ 200 V 6" Submersible	-	-	-	-	-	-	5	7.5	10	10	10	10	15	20	25	30
	Max HP @ 230 V 6" Submersible	-	-	-	-	-	-	5	7.5	10	10	15	15	20	20	25	33
Constant Torque Motor Ratings	Max Amps	1.5	2.5	4	5.5	8.8	12.5	16.5	24.5	32.5	37.5	45	39.6	48.2	59.4	71	84.2
	Max HP @ 200 V	0.25	.5	.75	1	2	3	3	5	10	10	10	10	10	15	20	25
	Max HP @ 230 V	0.25	.5	.75	1	2	3	5	7.5	10	10	15	10	15	20	25	30

1. UL Type 1 kit comes with UL Open Type VFD which are Frame D and larger.
2. The VFD cannot produce output voltage greater than input voltage.
3. Variable torque (VT) motor rating based on a 120% overload for 1 minute. Constant Torque (CT) motor rating based on 120% overload for 1 minute and 160% overload for 3 seconds.

460V Class 1~75HP (5.5~55kW)

Model (CXD-xxx-4V) UL Type 1[1]		003A	004A	005A	008A	010A	013A	018A	024A	032A	038A	045A	060A	073A	091A	110-A
Frame Size		**A**							**B**			**C**			**D0**	
Input Ratings	Voltage	380 (- 15%) ~ 480 VAC (+ 10%)														
	Frequency	50/60 Hz (± 5%)														
	Current — Variable Torque	4.3	6	8.1	12.4	16	20	22	26	35	42	50	66	80	91	110
	Current — Constant Torque	3.5	4.3	5.9	8.7	14	15.5	17	20	26	35	40	47	63	74	101
Output Ratings	Carrier Freq	2.0 - 15.0kHz										2.0 - 10.0kHz				
	Voltage[2]	3-phase, 380 ~ 480 VAC [3]														
	Frequency	0.01 ~ 599 Hz														
Efficiency		98%														
Power Factor		>0.98														
Weight kg (lbs.)		2.6 ± 0.3 (5.8 ± 0.7)							5.4 ± 1 (11.9 ± 2.2)			9.8 ± 1.5 (21.6 ± 3.3)			27 ± 1 (59.5 ± 2.2)	
DC Choke		None													Built-in 3%	
VFD Ratings with 3-Phase Input Power																
Variable Torque Motor[3]Ratings	Max Amps	3	4.2	5.5	8.5	10.5	13	18	24	32	38	45	60	73	91	110
	Capacity [kVA]	2.4	3.3	4.4	6.8	8.4	10.4	14.3	19	25	30	36	48	58	73	88
	Max HP @ 460 V Surface Motor	1.5	2	3	5	5	7.5	10	15	20	25	30	40	50	60	75
	Max HP @ 460 V 4″ Submersible	1	2	3	5	5	5	10	10	15	-	-	-	-	-	-
	Max HP @ 460 V 6″ Submersible	-	-	-	-	5	7.5	10	15	20	20	25	30	40	50	60
	Max HP @ 460 V 8″ Submersible	-	-	-	-	-	-	-	-	-	-	-	40	50	60	75
Constant Torque Motor[3] Ratings	Max Amps	1.7	3	4	6	9	10.5	12	18	24	32	38	45	60	73	91
	Capacity [kVA]	2.2	2.4	3.2	4.8	7.2	8.4	10.4	14.3	19	25	30	36	48	58	73
	Max HP @ 460 V	.75	1.5	2	3	5	5	7.5	10	15	20	25	30	40	50	60

Model (CXD-xxx-4V) UL Type 1[1]		003A	004A	005A	008A	010A	013A	018A	024A	032A	038A	045A	060A	073A	091A	110-A
Frame Size		A							B			C			D0	
VFD Ratings with 1-Phase Input Power																
Variable Torque Motor Ratings	Max Amps	1.5	2.1	2.75	4.25	5.25	6.5	9	12	16	19	22.5	30	36.5	30	36.3
	Max HP @ 460 V Surface Motor	.5	1	1	2	3	3	5	7.5	10	10	15	20	25	20	25
	Max HP @ 460 V 4″ Submersible	.5	.5	1	2	2	3	5	5	7.5	10	10	15	-	-	-
	Max HP @ 460 V 6″ Submersible	-	-	-	-	-	-	5	5	7.5	10	10	15	20	15	20
	Max HP @ 460 V 8″ Submersible	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constant Torque Motor Ratings	Max Amps	0.8	1.5	2	3	4.5	5.3	6	9	12	16	19	22.5	30	24.1	30
	Max HP @ 460 V	0.25	.5	.75	1.5	2	3	3	5	7.5	10	10	15	20	20	20

1. UL Type 1 kit comes with UL Open Type VFD which are Frame D and larger.
2. The VFD cannot produce output voltage greater than input voltage.
3. Variable torque (VT) motor rating based on a 120% overload for 1 minute. Constant Torque (CT) motor rating based on 120% overload for 1 minute and 160% overload for 3 seconds.

460V Class 100~675HP (75~500kW)

Model (CXD-xxx-4V) UL Type 1[1]		150A	180A	220A	260A	310A	370A	460A	530A	616A	683A	770A
Frame Size		D		E		F		F		H		
Input Ratings	Voltage	380 (-15%) ~ 480 VAC (+10%)										
	Frequency	50/60 Hz (± 5%)										
	Current — Variable Torque	150	180	220	260	310	370	460	530	616	683	770
	Current — Constant Torque	114	157	167	207	240	300	380	400	494	555	625
Output Ratings	Max Carrier Freq	2.0–10.0 kHz	2.0 - 9.0kHz									
	Voltage[2]	3-phase, 380 ~ 480 VAC [3]										
	Frequency	0.01 ~ 599 Hz										
Efficiency		98%										
Power Factor		>0.98										
Weight kg (lbs.)		38.5 ± 1.5 (84.9 ± 3.3)		64.8 ± 1.5 (142.9 ± 3.3)		86.5 ± 1.5 (190.7 ± 3.3)		134 ± 4 (295.4 ± 8.9)		228 (635)		
DC Choke		Built-in 3%										

SPECIFICATIONS
575~690V Class 1~150HP (1.5~175kW)

Model (CXD-xxx-4V) UL Type 1[1]		150A	180A	220A	260A	310A	370A	460A	530A	616A	683A	770A
Frame Size		D		E		F		F		H		
VFD Ratings with 3-Phase Input Power												
Variable Torque Motor [3]Ratings	Max Amps	150	180	220	260	310	370	460	530	616	683	770
	Capacity [kVA]	120	143	175	207	247	295	367	422	491	544	613
	Max HP @ 460 V Surface Motor	100	150	150	200	250	300	350	450	500	550	600
	Max HP @ 460 V 4" Submersible	-	-	-	-	-	-	-	-	-	-	-
	Max HP @ 460 V 6" Submersible	-	-	-	-	-	-	-	-	-	-	-
	Max HP @ 460 V 8" Submersible	100	100	150	200	-	-	-	-	-	-	-
Constant Torque Motor [3] Ratings	Max Amps	110	150	180	220	260	310	370	460	550	616	683
	Capacity [kVA]	88	120	143	175	207	247	295	367	438	491	544
	Max HP @ 460 V	75	100	150	150	200	250	300	350	450	500	550
VFD Ratings with 1-Phase Input Power												
Variable Torque Motor Ratings	Max Amps	49.5	59.4	72.6	85.8	102.3	122.1	151.8	174.9	203.3	225.4	254.1
	Max HP @ 460 V Surface Motor	30	40	50	60	75	75	100	125	150	150	200
	Max HP @ 460 V 4" Submersible	-	-	-	-	-	-	-	-	-	-	-
	Max HP @ 460 V 6" Submersible	30	40	40	50	60	-	-	-	-	-	-
	Max HP @ 460 V 8" Submersible	-	-	40	50	60	75	100	125	125	150	175
Constant Torque Motor Ratings	Max Amps	36.3	49.5	59.4	72.6	85.8	102.3	122.1	151.9	181.5	203.3	225.4
	Max HP @ 460 V	30	40	50	60	60	75	100	125	150	150	200

1. UL Type 1 kit comes with UL Open Type VFD which are Frame D and larger.
2. The VFD cannot produce output voltage greater than input voltage.
3. Variable torque (VT) motor rating based on a 120% overload for 1 minute. Constant Torque (CT) motor rating based on 120% overload for 1 minute and 160% overload for 3 seconds.

575~690V Class 1~150HP (1.5~175kW)

Model (CXD-xxx-6V) UL Type 1[1]		003A	004A	006A	009A	012A	018A	024A	030A	036A	045A	054A	067A	086A	104A	125A	150A
Frame Size		A			B				C			D		E			
Input Ratings	Voltage	525 (-15%) ~ 600 VAC (+10%)							525 (-15%) ~ 690 VAC (+10%)								
	Frequency	50/60 Hz (± 5%)															
	Current — Variable Torque	3.8	5.4	10.4	14.9	16.9	21.3	26.3	36	43	54	51	64	84	12	122	147
	Current — Constant Torque	3.1	4.5	7.2	12.3	15	18	22.8	29	36	43	45	54	66	84	102	122
Output Ratings	Max Carrier Freq	2.0 - 15.0kHz							2.0 - 9.0kHz								
	Voltage[2]	3-phase, 525 ~ 600 VAC[2]															
	Frequency	0.01 ~ 599 Hz															
Efficiency		97%			98%				97%								
Power Factor		>0.98															
Weight kg (lbs.)		3 ± 0.3 (6.6 ± 0.7)			4.8 ± 1 (10.6 ± 2.2)				10 ± 1.5 (22 ± 3.3)			39 ± 1.5 (86 ± 3.3)		61 ± 1.5 (134.5 ± 3.3)			

Model (CXD-xxx-6V) UL Type 1[1]		003A	004A	006A	009A	012A	018A	024A	030A	036A	045A	054A	067A	086A	104A	125A	150A
Frame Size		**A**			**B**				**C**			**D**		**E**			
DC Choke		None										Built-in 3%					
VFD Ratings with 3-Phase Input Power																	
Variable Torque Motor[3] Ratings	Max Amps	3	4.3	6.7	9.9	12.1	18.7	24.2	30	36	45	54	67	86	14	125	150
	Capacity [kVA]	3	4.3	6.7	9.9	12.1	18.6	24.1	36	43	54	65	80	103	124	149	179
	Max HP @ 575 V Surface Motor	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150
	Max HP @ 575 V 4″ Submersible	1.5	2	3	5	7.5	10	15	-	-	-	-	-	-	-	-	-
	Max HP @ 575 V 6″ Submersible	-	-	-	7.5	7.5	10	20	25	25	30	40	50	60	-	-	-
	Max HP @ 575 V 8″ Submersible	-	-	-	-	-	-	-	-	-	-	40	50	75	75	100	100
Constant Torque Motor[3] Ratings	Max Amps	2.5	3.6	5.5	8.2	10	15.5	20	24	30	36	45	54	67	86	104	125
	Capacity [kVA]	2.5	3.6	5.5	8.2	10	15.4	19.9	29	36	43	54	65	80	103	124	149
	Max HP @ 575 V	1.5	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125
VFD Ratings with 1-Phase Input Power																	
Variable Torque Motor Ratings	Max Amps	1.5	2.15	3.35	4.95	6.05	9.35	12.1	15	18	22.5	17.82	22.11	28.3	-	-	-
	Max HP @ 575 V Surface Motor	.75	1	2	3	3	7.5	10	10	15	20	15	20	25	-	-	-
	Max HP @ 575 V 4″ Submersible	.5	1	2	3	3	5	7.5	10	10	15	-	-	-	-	-	-
	Max HP @ 575 V 6″ Submersible	-	-	-	-	-	5	7.5	10	10	15	10	15	20	-	-	-
	Max HP @ 575 V 8″ Submersible	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constant Torque Motor Ratings	Max Amps	1.25	1.8	2.75	4.1	5	7.7	9.95	10	12	15	18	14.8	17.8	-	-	-
	Max HP @ 575 V	.5	1	2	3	3	5	7.7	7.5	10	10	15	10	15	-	-	-

1. UL Type 1 kit comes with UL Open Type VFD which are Frame D and larger.
2. The VFD cannot produce output voltage greater than input voltage.
3. Variable torque (VT) motor rating based on a 120% overload for 1 minute. Constant Torque (CT) motor rating based on 120% overload for 1 minute and 160% overload for 3 seconds.

575~690V Class 150~700HP (160~522kW)

Model (CXD-xxx-6V) UL Type 1[1]		180A	220A	290A	350A	430A	465A	590A	675A
Frame Size		**F**		**G**		**H**			
Input Ratings	Voltage	525 (-15%) ~ 690 VAC (+10%)							
	Frequency	50/60 Hz (± 5%)							
	Current — Variable Torque	178	217	292	353	454	469	595	681
	Current — Constant Torque	148	178	222	292	353	388	504	681
Output Ratings	Max Carrier Freq	2.0 - 9.0kHz							
	Voltage[2]	3-phase, 525 ~ 690 VAC[2]							
	Frequency	0.01 ~ 599 Hz							
Efficiency		97%		98%					
Power Factor		>0.98							
Weight kg (lbs.)		88± 1.5 (194± 3.3)		135 ± 4 (297.6 ± 8.8)		243 ± 5 (535.7 ± 11)			
DC Choke		Built-in 3%							
VFD Ratings with 3-Phase Input Power									
Variable Torque Motor[3] Ratings	Max Amps	180	220	290	350	430	465	590	675
	Capacity [kVA]	215	263	347	418	494.5	534.7	678.5	776
	Max HP @ 575 V Surface Motor	150	200	250	350	400	450	500	750
	Max HP @ 575 V 8″ Submersible	125	175	200	-	-	-	-	-
Constant Torque Motor[3] Ratings	Max Amps	150	180	220	290	350	385	465	675
	Capacity [kVA]	179	215	239	347	402.5	442.7	534.7	776
	Max HP @ 575 V	150	150	200	250	350	400	450	750

1. UL Type 1 kit comes with UL Open Type VFD which are Frame D and larger.
2. The VFD cannot produce output voltage greater than input voltage.
3. Variable torque (VT) motor rating based on a 120% overload for 1 minute. Constant Torque (CT) motor rating based on 120% overload for 1 minute and 160% overload for 3 seconds.

De-Rating Charts

When selecting the best drive for the application, consider factors such as carrier frequency, ambient temperature, altitude, etc. Use the following equation to select the most suitably rated drive:

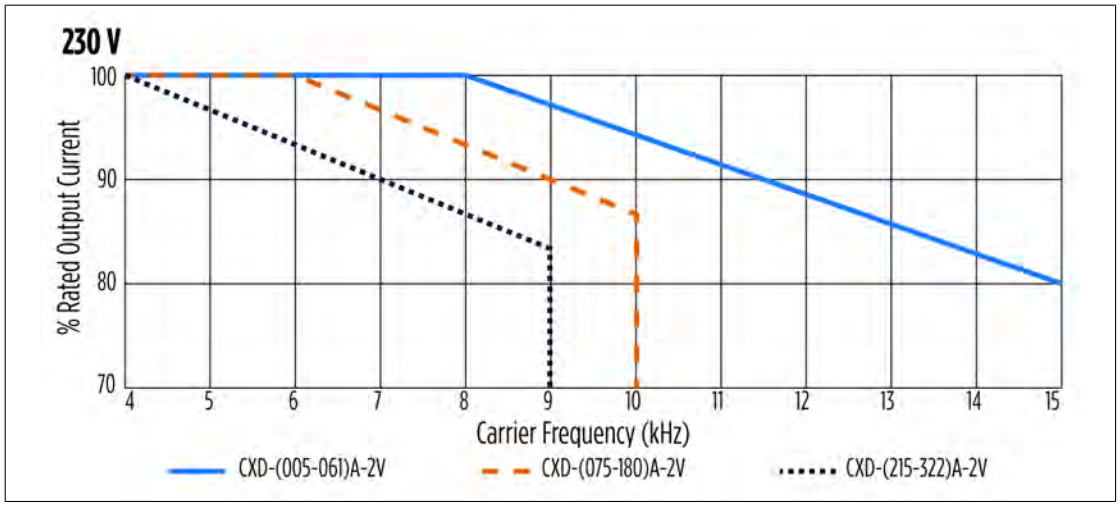
Actual rated current for the application (A) =

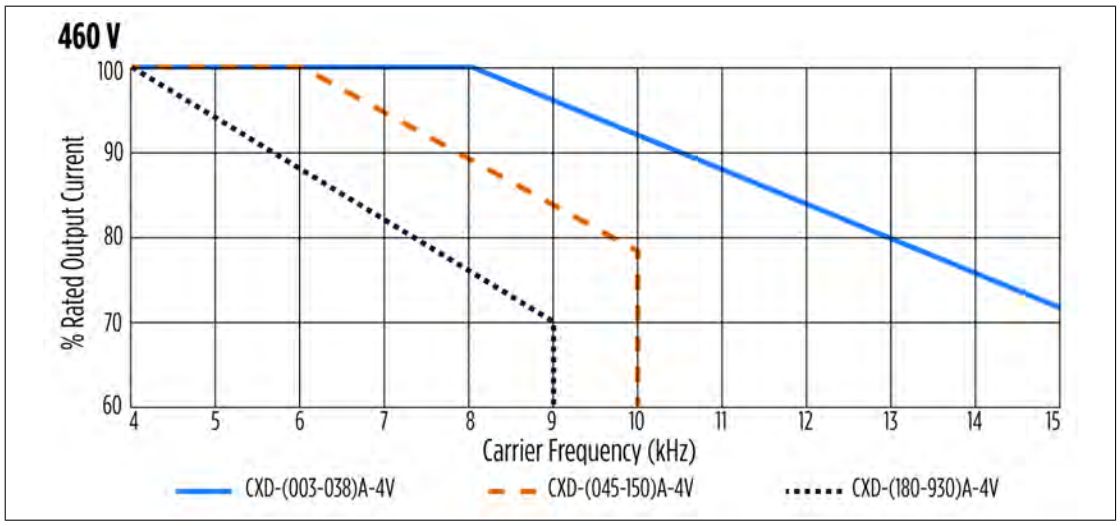
(A) Rated output current (consult motor specifications)
x (A) Ambient temperature rated derating (see "Ambient Temperature De-Rating" on page 245)
x (%) Altitude rated derating (see "Altitude Derating" on page 246)
x (%) Carrier frequency rated derating (see "Carrier Frequency De-Rating" on page 243)

NOTE: For information on V/F Pattern, refer to **[VFD-03]** in "Parameter Descriptions > VFD Menu" on page 207.

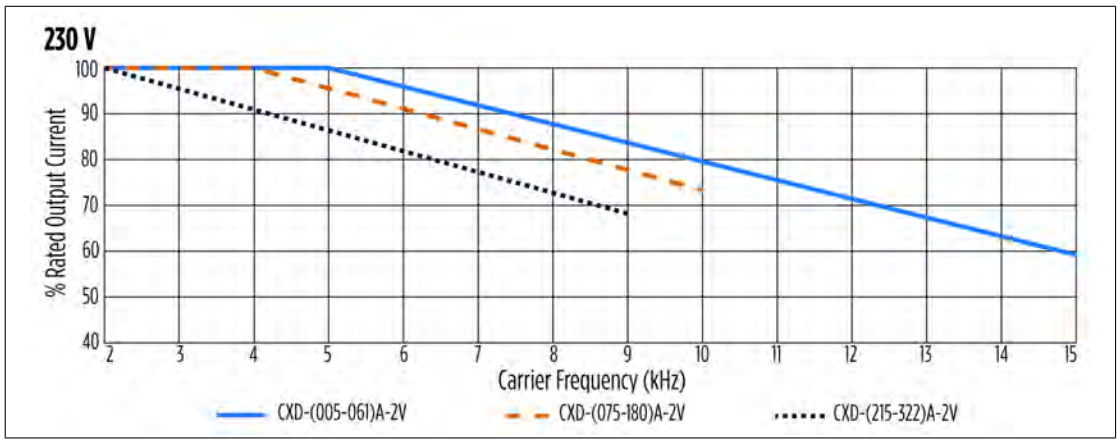
Carrier Frequency De-Rating

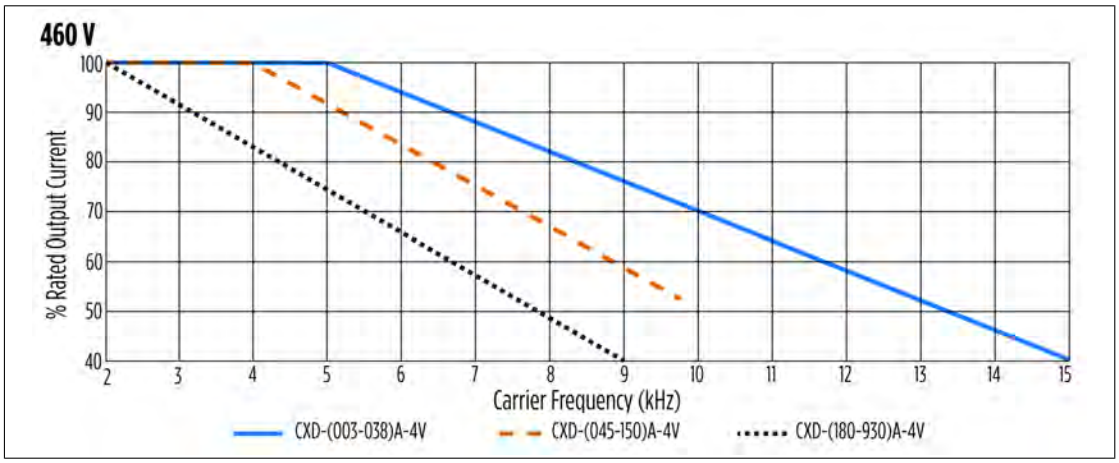
230 V / 460 V Induction Motor with VF or SVC Control



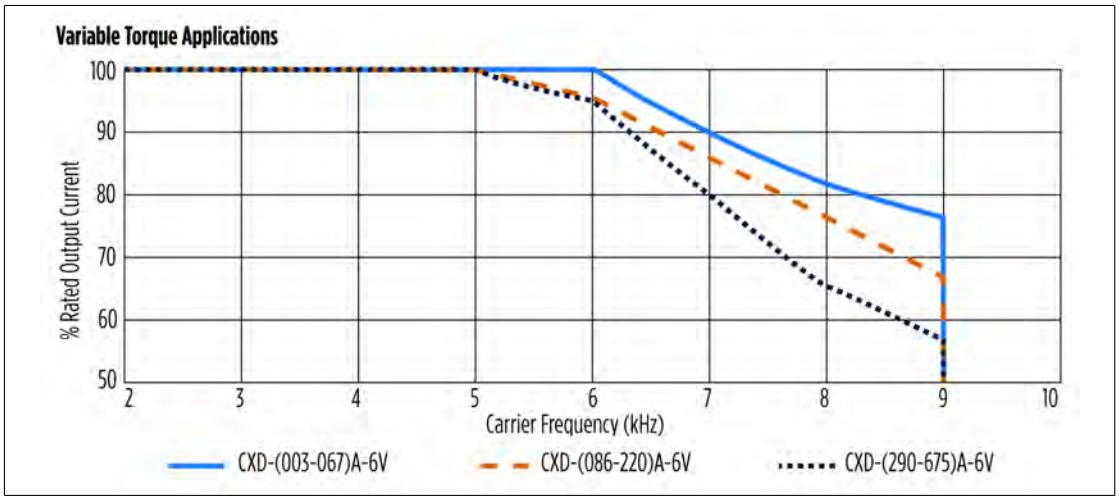


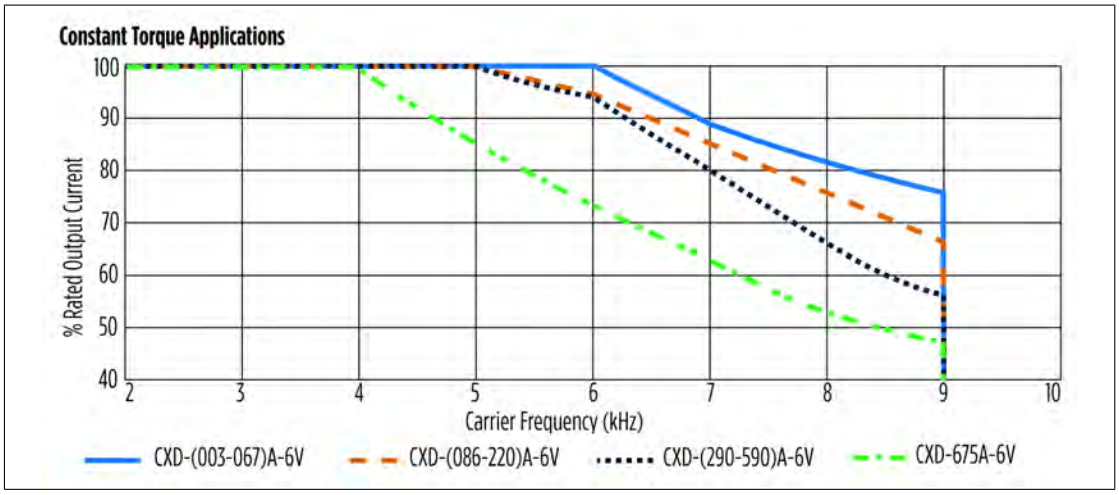
230 V / 460 V Permanent Magnet Motor with SVC Control (FE MagForce)



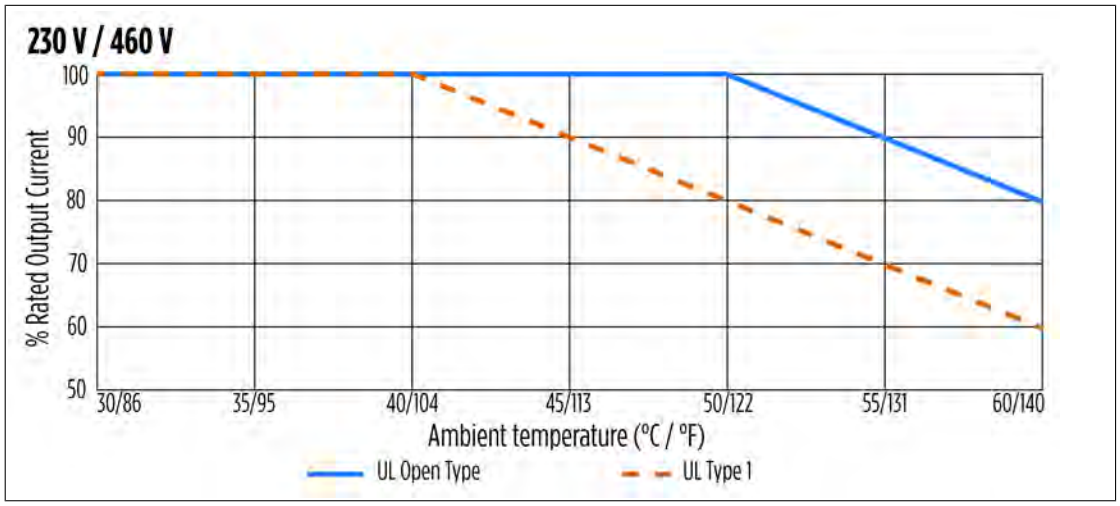


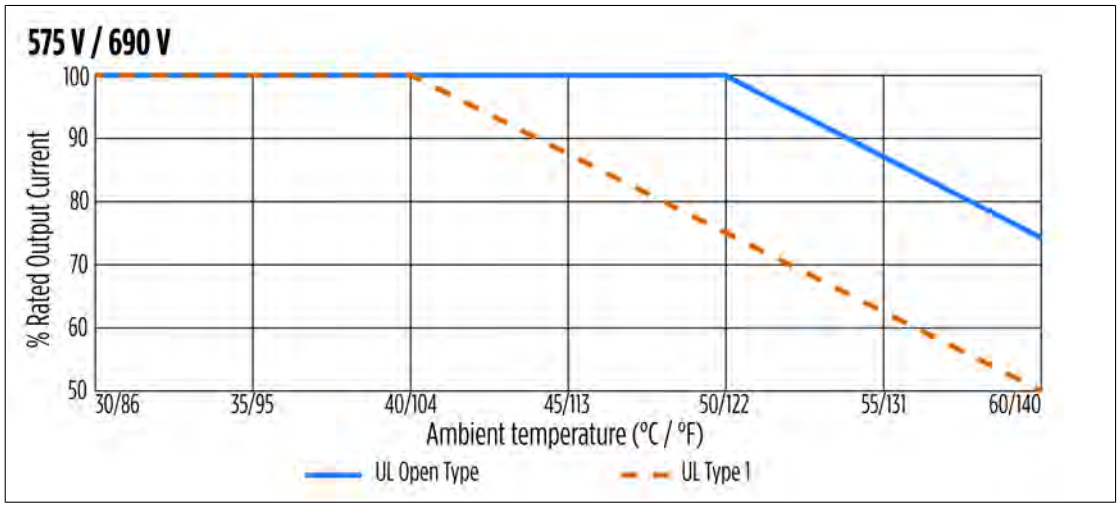
575 V Induction Motor with VF or SVC Control





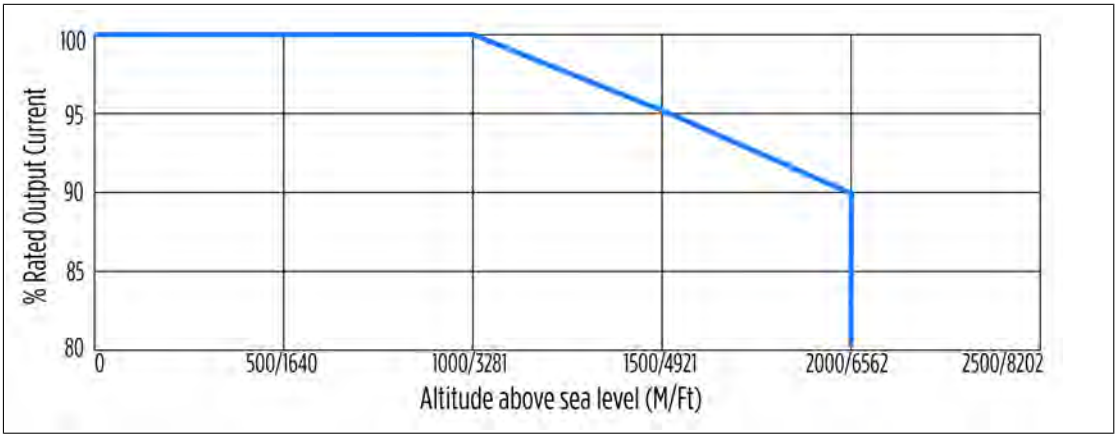
Ambient Temperature De-Rating





UL Protection Level	Ambient Temperature	Current
UL Type 1 IP20	-10 °C - 40 °C	Operate drive at rated current
	>40°C - 60 °C	Decrease 2% rated current for 1 °C temperature increase
	60 °C	Maximum temperature allowable; do not exceed
UL Open Type IP20	-10 °C - 50 °C	Operate drive at rated current
	>40°C - 50 °C	Decrease 2% rated current for 1 °C temperature increase
	60 °C	Maximum temperature allowable; do not exceed

Altitude Derating



Altitude	Current
0–1000 m	Operate drive at rated current
1000–2000 m	For every 100 m increase: Either 1) decrease rated current by 1%, or 2) lower the temperature by 0.5 °C
2000 m	Maximum altitude allowable; do not exceed

Maximum Frequency Output

Induction Motor Max Frequency

Minimum Carrier Frequency Requirement	Maximum Operation Frequency
2k	200 Hz
3k	300 Hz
4k	400 Hz
5k	500 Hz
6k	599 Hz

Max Frequency By Models

VFD models	Maximum Operation Frequency
230V; 55kw +	200 Hz*
460V; 90kw +	300 Hz*
575V & 690 V	599 Hz

*The carrier frequency should be set at least to 4k.

Replacement Components List

Description	Models			Quantity	Part Number
	2V	4V	6V		
VFD Keypad *	All			1	CXD-KPD
Remote Keypad Mounting Bracket	All			1	MKC-KPPK
Control Board *	All 2V & 4V models		-	1	5503352903
	-		All 6V models	1	5503354103
I/O Board	All			1	5503005701
FE Connect Communication Card	All			1	10000004840
Ethernet Communication Card	All			1	CMC-EIP01
Extension DC I/O Card	All			1	EMC-D42A
Extension AC Input Card	All			1	EMC-611A
Extension Relay Card	All			1	EMC-R6AA
Male to Male Keypad Connector**	All			1	3072357401
Heat Sink Cooling Fan	CXD-010A-2V CXD-015A-2V CXD-021A-2V	CXD-005A-4V CXD-008A-4V CXD-010A-4V CXD-013A-4V	CXD-004A-6V CXD-006A-6V	1	MKC-AFKM
	-	CXD-018A-4V	-	1	MKCB-AFKM2
	CXD-031A-2V	CXD-024A-4V	CXD-009A-6V CXD-012A-6V CXD-018A-6V CXD-024A-6V	1	MKC-BFKM1
	CXD-046A-2V	CXD-032A-4V CXD-038A-4V	-	1	MKC-BFKM2
	CXD-061A-2V	-	-	1	MKC-BFKM3
	-	CXD-045A-4V CXD-060A-4V CXD-073A-4V	-	1	MKC-CFKM
	CXD-075A-2V CXD-090A-2V CXD-105A-2V	-	-	2	MKC-CFKM
	-	-	CXD-030A-6V CXD-036A-6V CXD-045A-6V	1	MKC-CFKM1
	-	CXD-091A-4V CXD-110A-4V	-	1	MKC-D0FKM
	CXD-146A-2V CXD-180A-2V	CXD-150A-4V CXD-180A-4V	CXD-054A-6V CXD-067A-6V	1	MKC-DFKM
	-	-	CXD-086A-6V CXD-104A-6V CXD-125A-6V CXD-150A-6V	1	MKC-EFKM3
	CXD-215A-2V CXD-276A-2V	-	-	1	MKC-EFKM1
	CXD-322A-2V	CXD-220A-4V CXD-260A-4V	-	1	MKC-EFKM2
	-	CXD-310A-4V CXD-370A-4V	CXD-180A-6V CXD-220A-6V	1	MKC-FFKM
	-	CXD-460A-4V CXD-530A-4V	CXD-290A-6V CXD-350A-6V	1	MKC-GFKM
	-	CXD-616A-4V CXD-683A-4V CXD-770A-4V	-	2	MKC-HFKM
	-	-	CXD-430A-6V	2	MKC-HFKM1
	-	-	CXD-465A-6V CXD-590A-6V CXD-675A-6V	3	MKC-HFKM1

IMPORTANT: *If replacing a keypad or control board for an X-Drive with firmware version 1.2, both the keypad and the control board must be replaced together. Be sure to notify your sales representative.

**Included with CXD-KPD.

Applicable Standards

1. UL508C – UL/cUL
2. CE
   a. Low Voltage
      - EN61800-5-1
   b. EMC
      - EN61000-3-12
      - IEC61000-6-2
      - IEC61000-4-2
      - IEC61000-4-4
      - IEC61000-4-6
      - EN61800-3
      - IEC61000-6-4
      - IEC61000-4-3
      - IEC61000-4-5
      - IEC61000-4-8
3. C-Tick
4. ROHS

GLOSSARY

Term	Definition
4-20mA	The range for analog current input
A	Ampere(s)
AI	Analog Input: Hardware interfaces that accept non-digital (analog) signals.
ACI	Analog Current Input: Terminal block
ACM	Analog Common: Terminal block, reference for analog outputs
AFM 1	Analog Multi-Function Output #1: Terminal block
ASCII	American Standard Code for Information Interchange
AVI	Analog Voltage Input: terminal block
AWG	American Wire Gauge: A standardized measurement of wire diameters important for determining current-carrying capacity.
BACnet	Building Automation Controls Network
BAS	Building Automation System: A computer-based control system that controls and monitors a building's mechanical and electrical equipment.
BMS	Building Management System: A computer-based system that controls and monitors a building's mechanical and electrical equipment.
CANopen	Controller Area Network, the Open Communication Solution Dissemination Project
CFM	Cubic feet per minute
CMH	Cubic meters per hour
COM	Common: pull-up resistance reference to digital inputs
Com Card	Communications Card
DC	Direct current
DCM	Digital Common: Reference for digital inputs
D-Input	Digital Input
D-Output	Digital Output
DevNet	Development Network
DI	Digital Input
EMI	Electromagnetic Interference: See RFI.
F/B	Feedback
FDT	Frequency Detection
FE, FELE	Franklin Electric
FLA	Full Load Amperes: The nameplate amperage rating of the motor when it is running at its designed horsepower and on the motors designed voltage.
FO	Fireman's Override
FWD	forward
GFCI	Ground Fault Circuit Interrupter: A fast-acting circuit breaker designed to shut off electric power in the event of a ground-fault within as little as 1/40 of a second.
GPM	Gallons per Minute: A unit of volumetric flow rate in the United States.
HLD	High Load Detection
HMI	Human Machine Interface: An interface that permits interaction between a human and a machine, such as a display and keyboard.
HOA	Hand/Off/Automatic switching: A three-terminal power semiconductor device used as an electronic switch to synthesize complex waveforms with pulse-width modulation in a variable-frequency drive (VFD).
HP	Horsepower
Hz	Hertz
I	Current
I/F	Current divided by frequency
IGBT	Insulated Gate Bipolar Transistor
inHG	inches of Mercury: Unit of measure for pressure
inWC	inches of Water Column: Unit of measure for pressure
IP	Internet Protocol or International Protection rating when used as protection measures for motors, electrical devices, and motors.
Kbps	kilobites per second

Term	Definition
kPa	kilo-pascals: Unit of measure for pressure
kW	kilowatt(s)
LPM	liters per minute
LV	Low Voltage
mA	milliampere(s)
mBar	millibar(s): Unit of measure for pressure
Mbps	Megabits per second
MCCB	Molded Case Circuit Breaker: An MCCB provides protection by combining a temperature sensitive device with a current sensitive electromagnetic device.
MI1	Multi-function Input #1
MMC Mode	Multi-Motor Control Mode
NEC	National Electrical Code: A regionally adoptable standard for the safe installation of electrical wiring and equipment in the United States.
NEMA	National Electrical Manufacturer Association: The largest trade association of electrical equipment manufacturers in the United States. NEMA publishes more than 700 standards for electrical enclosures, motors and magnet wire, AC plugs and receptacles, etc.
NC (N.C., N/C)	Normally Closed
NO (N.O., N/O)	Normally Open
PID	Proportional Integral Derivative: A control loop feedback mechanism used in applications requiring continuously modulated control.
PLC	Programmable Logic Controller: A digital computer used for automation of typically industrial electromechanical processes.
PM	Permanent magnet motor
PSI	Pounds per square inch
PWM	Pulse Width Modulation: A modulation technique used to control the power supplied to electrical devices, especially for motor speed control.
REV	reverse
RFI	Radio Frequency Interference: A disturbance generated by an external source that affects an electrical circuit by electromagnetic induction, electrostatic coupling, or conduction.
RMS	Root Mean Square: Refers to the most common mathematical method of defining the effective voltage or current of an AC wave.
RPM	Revolutions per minute
RTU	Remote Terminal Unit: A Modbus RS-485 connection following a simple client-server model.
SCM1	STO1 Common
SFA	Service Factor Amperes: The amount of a periodic overload at which a motor can operate without overload or damage.
SG+	Signal + : for RS485 communication
SG-	Signal - : for RS485 communication
SGND	Signal Ground: Reference for SG+ and SG-
STO1	Safe Torque Off - Safety Level 1
SVC	Sensorless Vector Control
TCP	Transmission control protocol
ULD	Underload Detection
V	Voltage
VAC	Voltage Alternating Current
VDC	Voltage Direct Current
V/F, VF	Volts/Frequency
VFD	Variable Frequency Drive: A type of adjustable-speed drive used in electro-mechanical drive systems to control AC motor speed and torque by varying motor input frequency and voltage.
XCEL-L	Acceleration/Deceleration (Accel/Decel) - Low bit
XCEL-M	Acceleration/Deceleration (Accel/Decel) - Mid bit

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