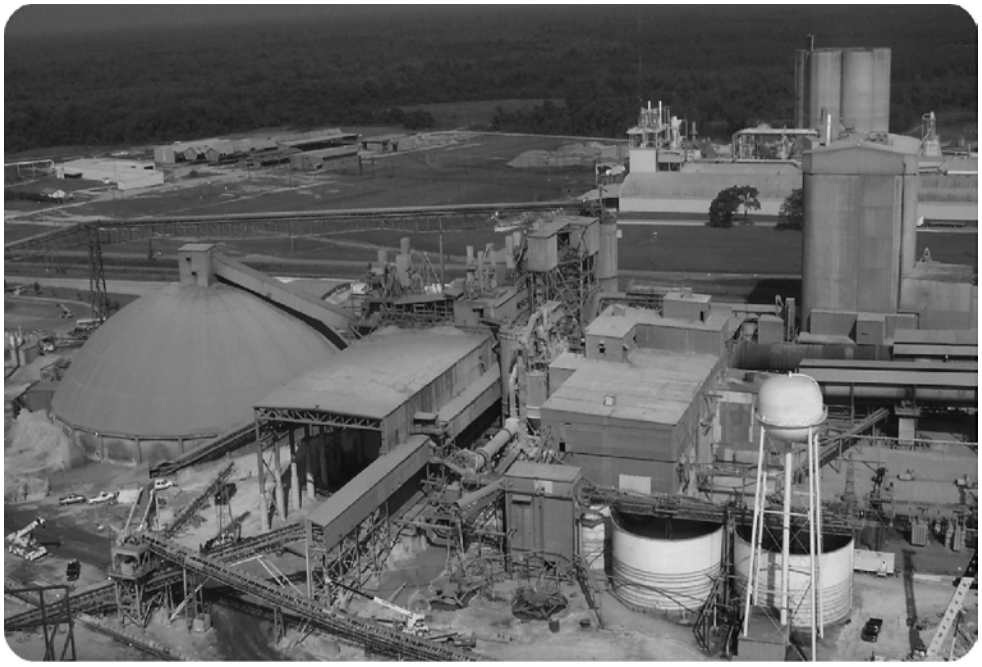
User Manual

Allen-Bradley

PowerFlex 6000 Medium Voltage Variable Frequency Drive

Catalog Number 6000G



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Rockwell Automation

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Chapter 3

Setup and Operation

Chapter 4

Parameters and Function Codes

Chapter 5

Preventative Maintenance and Component Replacement

Introduction

This document provides procedural information for managing daily or recurring tasks involving PowerFlex® 6000 medium voltage variable frequency drives.

Who Should Use This Manual

This manual is intended for use by personnel familiar with operating medium voltage and solid-state variable speed drive equipment. The manual contains material that enables operation and regular maintenance of the drive system.

What Is Not in This Manual

This manual provides information specific to maintaining the PowerFlex 6000 medium voltage variable frequency drive. It does not include topics such as:

- Dimensional and electrical drawings that are generated for each customer's order
- Spare parts lists compiled for each customer's order

Please refer to the following documents for additional product detail or instruction relating to PowerFlex 6000 drives:

- PowerFlex 6000 Medium Voltage Variable Frequency Drive Installation Manual, publication 6000-IN006; instructions for installing the drive, dimensions, requirements, and wiring information.
- PowerFlex 6000 Medium Voltage Variable Frequency Drive Shipping and Handling Manual, publication 6000-IN008: instructions for shipping and handling a Medium Voltage variable frequency drive and related equipment.
- PowerFlex 6000 Medium Voltage Variable Frequency Drive Firmware, Parameter, and Troubleshooting Manual, publication 6000-TD004. This document provides detailed information on drive features, parameters, and troubleshooting faults.

Rockwell Automation provides the site- and installation-specific electrical and design information for each drive during the order process cycle. If they are not available on site with the drive, contact Rockwell Automation.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
PowerFlex 6000 Medium Voltage Variable Frequency Drive Installation Manual, publication 6000-IN006	Provides instructions for installing the drive, dimensions, requirements, and wiring information.
PowerFlex 6000 Medium Voltage Variable Frequency Drive Shipping and Handling Manual, publication 6000-IN008	Provides instructions for shipping and handling a Medium Voltage variable frequency drive and related equipment.

Resource	Description
PowerFlex 6000 Medium Voltage Variable Frequency Drive Parameter Manual, publication 6000-TD004	Provides detailed information on drive features, parameters, and troubleshooting faults.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, https://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at https:/www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

General Precautions

ATTENTION: This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference Allen-Bradley publication 8000-4.5.2, "Guarding Against Electrostatic Damage" or any other applicable ESD protection handbook.

ATTENTION: An incorrectly applied or installed drive can result in component damage or a reduction in product life. Wiring or application errors, such as, undersizing the motor, incorrect or inadequate AC supply, or excessive ambient temperatures may result in malfunction of the system.

ATTENTION: Only personnel familiar with the PowerFlex 6000 Adjustable Speed Drive (ASD) and associated machinery should plan or implement the installation, startup and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: Only qualified personnel with the correct PPE (Personal Protective Equipment) should service the equipment. Be sure to follow the safety procedures and local regulations to disconnect the high voltage. After waiting for 15 minutes, open the cabinet door and verify the absence of medium voltage on the input, output, and power cell terminals with a high-voltage detector that is properly rated for the line and motor voltages. All LED lights on the power cells must be off and the drive be grounded with portable grounding cables on the input and output before servicing. Failure to follow the safety procedures can result in severe injury or death.

Service and Support

Commissioning Support

After installation, Rockwell Automation is responsible for commissioning activities for the PowerFlex 6000 product line. Contact your local Rockwell Automation sales representative to arrange commissioning.

Rockwell Automation support includes, but is not limited to:

- quoting and managing product on-site startups
- quoting and managing field modification projects
- quoting and managing customer in-house and on-site product training

The user or its representatives are responsible for pre-commissioning activities to prepare the drive for commissioning. Failure to complete these activities before the commissioning process will delay the startup of the drive. See the Pre-commissioning Checklist in the PowerFlex 6000 Medium Voltage Variable Frequency Drive Installation Manual, publication 6000-IN006.

Product Environmental Information

Rockwell Automation maintains current product environmental information on its website at:
https://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page

Notes:

Introduction

Around the world, Allen-Bradley® PowerFlex® medium voltage drives from Rockwell Automation have built a reputation for providing efficient and reliable motor control for industry's most demanding applications. From the hardware designed to help optimize production to the power of networked control platforms, users can quickly and easily gain access to valuable information from their systems. Better information leads to higher asset availability, reduced energy and maintenance costs, and asset and personnel protection - all resulting in an increased return on your investment and real bottom-line savings. No matter where your applications are located - and whether your requirements are simple or complex, count on PowerFlex medium voltage drives for the optimal solution.

Safety Considerations

SHOCK HAZARD: Energized industrial control equipment can be dangerous. Severe injury or death can result from electrical shock, burn, or unintended actuation of control equipment. Hazardous voltages may exist in the drive cabinet even with the input circuit breaker in the off position. If it is necessary to work in the vicinity of energized equipment, the safety-related work practices that are outlined in Electrical Safety requirements for Employee Work places must be followed. Before attempting any work, verify that the system has been locked out and tested to have no potential.

Lockout and tagout the device feeding power to the input of the drive before performing any drive maintenance or component replacements. After the input device cabinet doors are opened, immediately test the outgoing power cables feeding the drive with a live-line tool (hot stick) while wearing high-voltage gloves. Repeat the live-line tool (hot stick) testing at the drive incoming line power cable connections to verify that medium voltage is not present. Pay special attention to any capacitors connected to medium voltage that can retain a charge for a period of time. Only after the drive equipment has been verified as isolated and de-energized can subsequent work be performed. Even though the input to the drive may be open, it is still possible for hazardous voltage to be present.

Table 1 - Line-to-Ground Short-circuit Specifications

Attribute	Value
Line-to-Ground short-circuit current	31.5 kA
Incoming circuit breaker withstand current short time	4 s
Ik	≥ 31.5 kA

Opening time	40...60 ms
Breaking time	50...75 ms
Inrush current	Inverter input current x 4 or Inverter input current x 5

See national and local safety guidelines for detailed procedures on how to isolate the equipment from hazards safely.

ATTENTION: The national and local electrical codes outline provisions for safely installing and working on electrical equipment. Installation must comply with specifications regarding wire type, conductor sizes, branch circuit protection, and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

Environmental Conditions

- Elevation above sea level must be less than 1000 m (3250 ft)(1).
- Ambient air temperature must be between 0...40 °C (32...104 °F)(2).
- Relative humidity must be less than 95%, noncondensing.
- Operation Vibration limited to 3M3(a) per IEC60721-3-3.
- G2 rating with 60% humidity – Storage, Transport, and Operation – as per ISA 71.04-2013.
- The drive must be installed indoors; there must be no dripping water or other fluids in the room.
- Cooling air must be clean without significant concentrations of sand, corrosive or conductive dust, or explosive gas. The drive must be installed in a Pollution Degree 2 environment as per IEC 61800-5.
- Free from significant vibration.
- The drive must be anchored on a level floor. Please refer to the dimension drawing for the anchor point sizes and locations.

For the equipment to operate in conditions other than those specified, consult the local Rockwell Automation Sales Office.

How it Works

Cascaded "H" Bridge (CHB) Topology

The proven CHB topology combines an integrally mounted phase shifting isolation transformer and series-connected power modules for each phase. In addition to stepping down the input voltage, the isolation transformer also provides two other principal functions:

- Mitigate common mode voltage stress so motors with standard insulation levels can be used.

(1) Options are available for operation up to 5000 m.a.s.l. However, these must be stated at the time of order and cannot be retrofitted in the field.

(2) Options are available for ambient temperatures up to 50 °C. However, these must be stated at the time of order and cannot be retrofitted in the field.

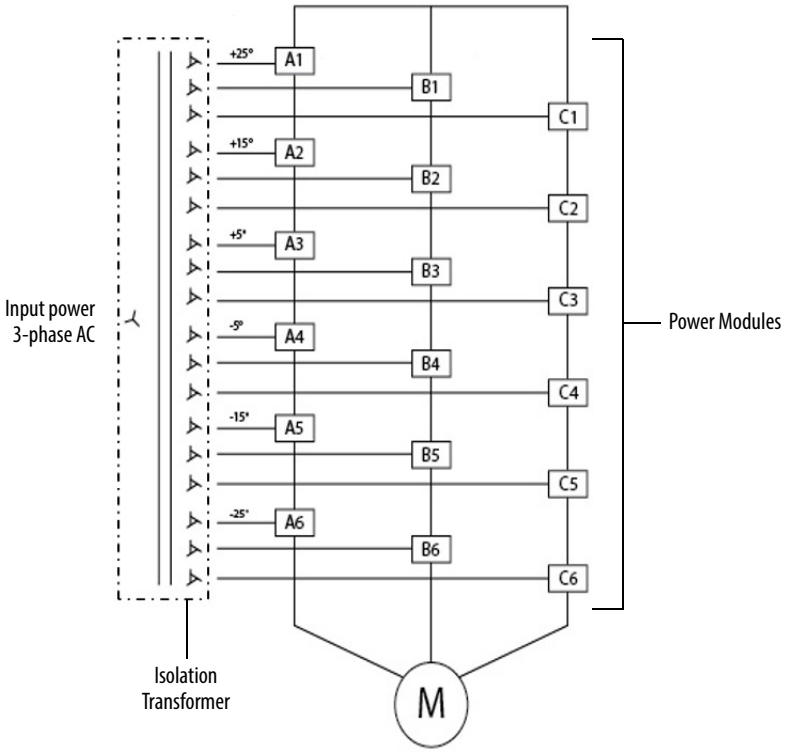
- Reduce Total Harmonic Distortion (THD), due to the phase shifting of its secondary windings, so input side harmonics don't negatively impact the plant or utility power grid.

A number of identical low voltage power modules are series-connected (cascaded) together to produce the medium voltage levels that are required to operate the motor.

The voltage step for each module is relatively small and a Pulse Width Modulation (PWM) switching pattern is used so output harmonics and torque pulsations at the motor are minimal, even at lower speeds. This technology is very motor friendly so standard motors can be used for new applications and it also is ideal for retrofitting existing motors. This also allows for the motor cable lengths that are required for most applications, without the requirement for output filtering.

This power module concept makes maintenance quick and easy. Each module has powerful built-in diagnostics to identify and isolate a module needing replacement, in the unlikely event of a failure. This minimizes power module replacement time, so process uptime is maximized.

Figure 1 - 6.6 kV Example Power Structure



Simplified Electrical Diagrams

Figure 2 - 2300V / 2400V / 3300V(18 Pulse - 9 Power Modules)

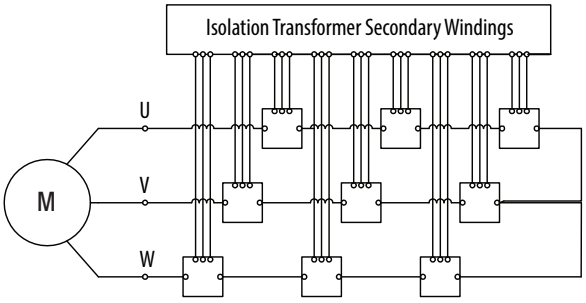


Figure 3 - 4000V / 4160V (24 Pulse - 12 Power Modules)

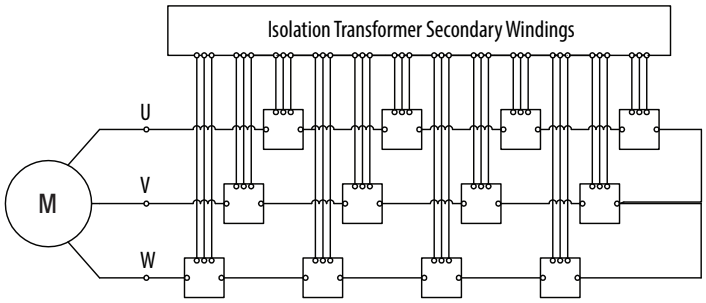


Figure 4 - 6000V (30 Pulse - 15 Power Modules)

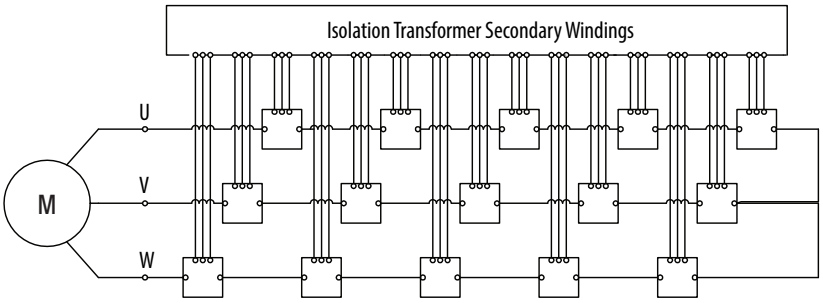


Figure 5 - 6300V / 6600V /6900V (36 Pulse - 18 Power Modules)

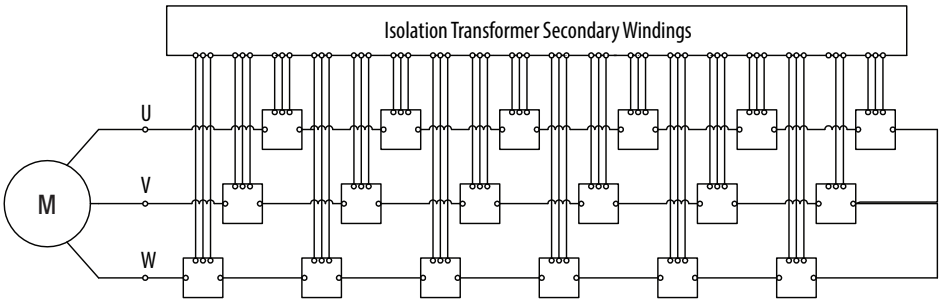


Figure 6 - 10000V (48 Pulse - 24 Power Modules)

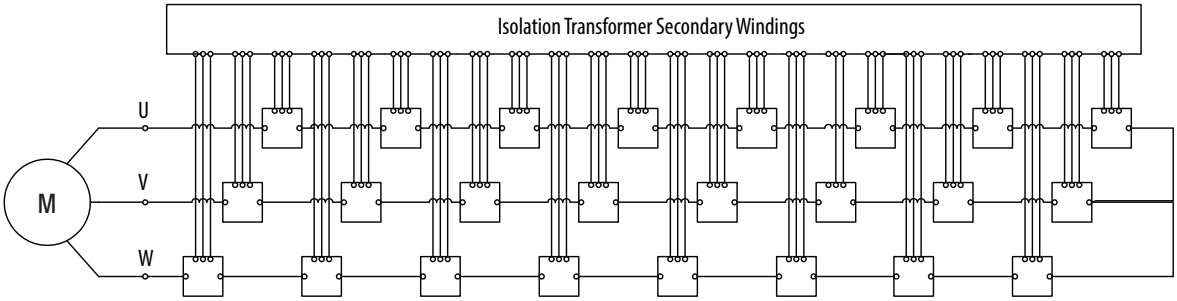


Figure 7 - 11000V (54 Pulse - 27 Power Modules)

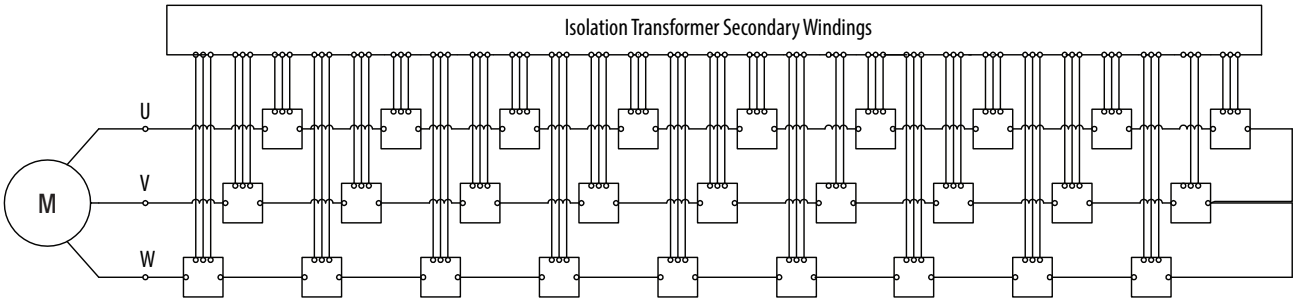


Figure 8 - Connectivity Overview

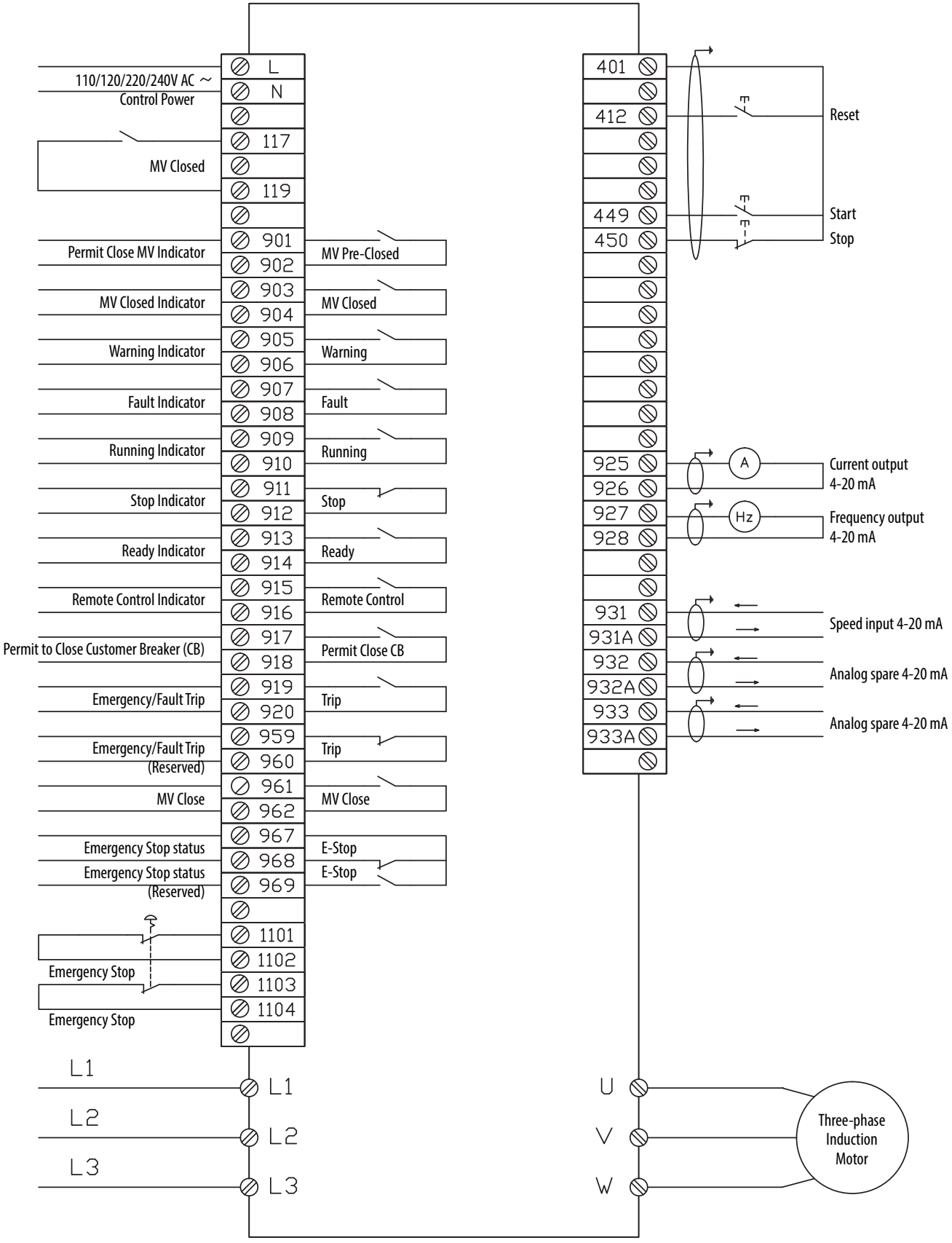
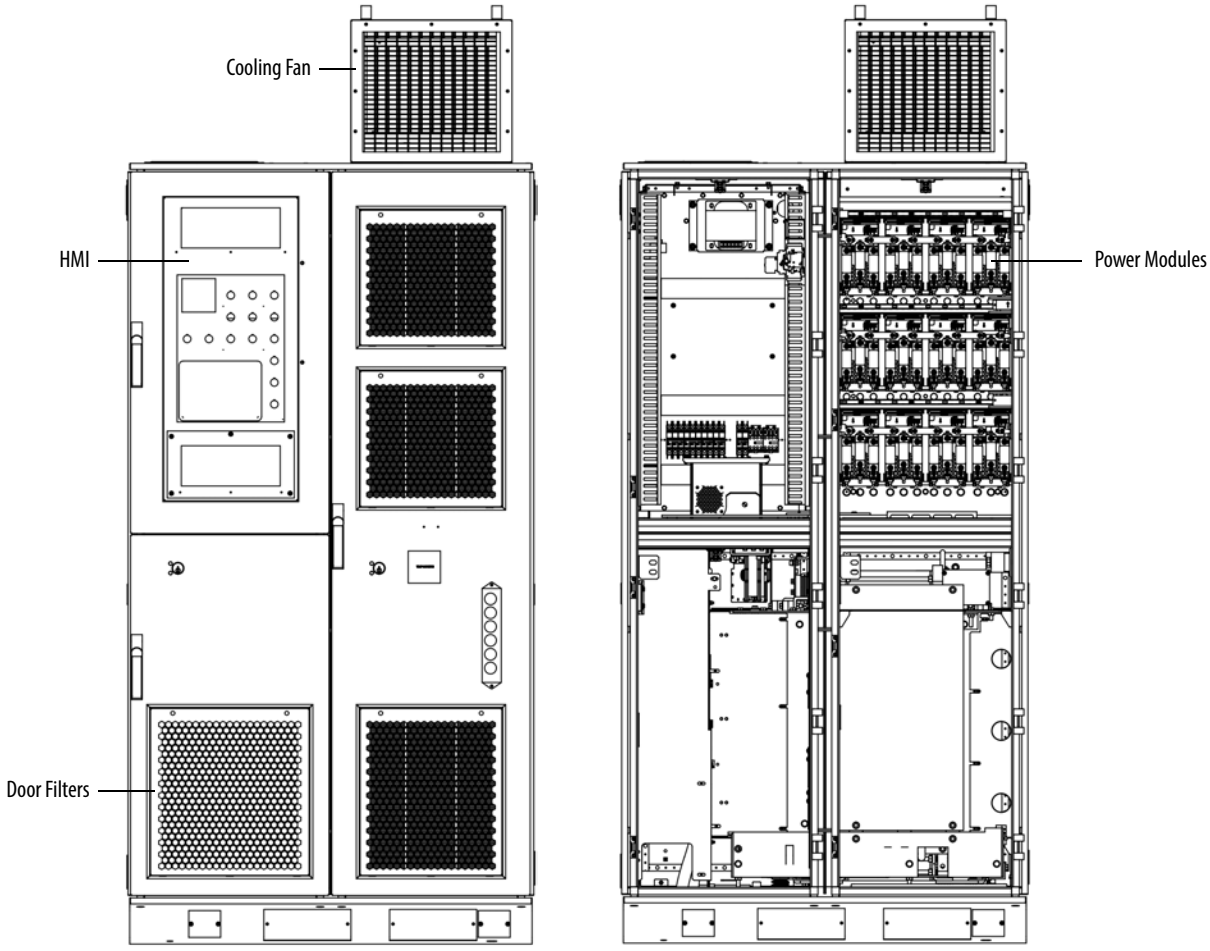


Figure 9 - PowerFlex 6000 Principal Components

All-in-One Design (A-Frame)

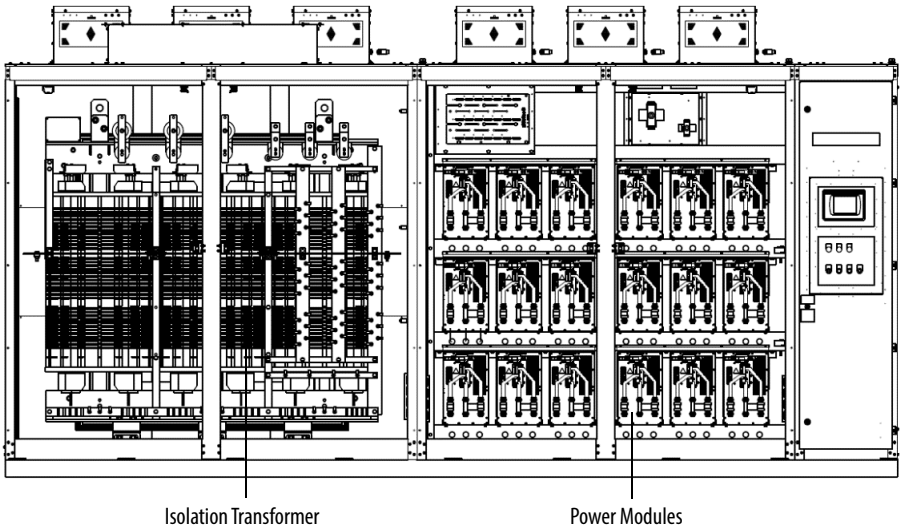


In-Line Design (B-Frame and H-Frame)

See Elevation Drawings on page 21 for details.

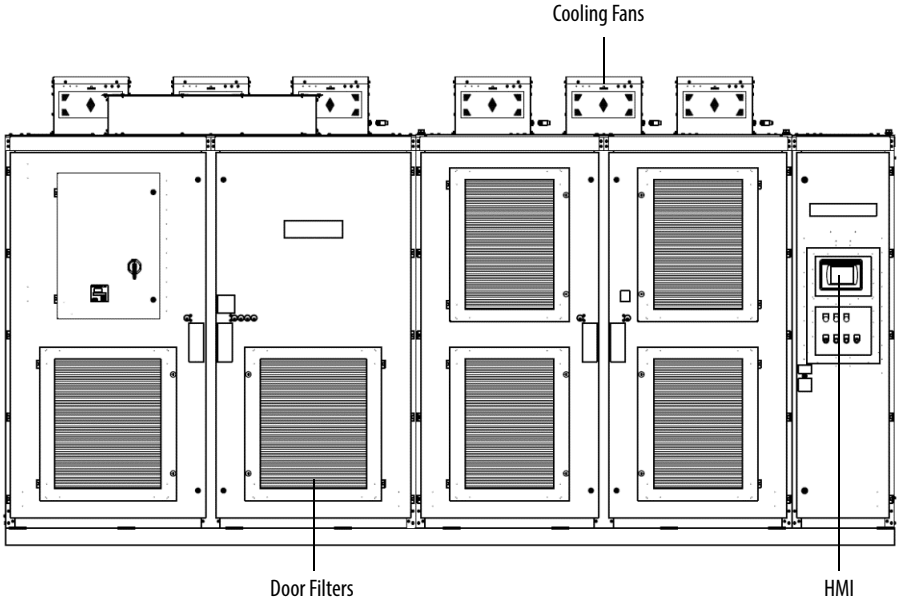
Generous space for terminating incoming line cables
Generous space for terminating outgoing load cables
Integrally mounted Multi-pulse Isolation Transformer (3 wires in & 3 wires out) ensures low line side harmonics and high input power factor
Cabinet ships in two sections to minimize shipping and handling issues (for H-Frame and B-Frame drives only)
All Power Modules are identical to minimize spare parts
All Power Modules are designed for easy removal and replacement to minimize MTTR
Power Module has a PWM pattern to reduce output harmonics
Optional Power Module bypass feature ensures critical process reliability
All MV doors are electrically interlocked with input switching device
All MV doors are interlocked with mechanical interlocking device (optional)

H-Frame



Isolation Transformer Temperature Monitor
All door filters can be changed while the drive is running
All cooling fans are internally powered by a dedicated winding in the Isolation Transformer – no separate fan power supply is needed from customer
All MV doors are lockable
Intuitive, easy-to-use, color touch screen HMI
Many communication modules are available, such as EtherNet/IP and PROFIBUS DP
Automatic switchover (no trip) to internally supplied control power if customer-supplied single-phase control power is lost
Online UPS supplied as standard to support ultra long control power loss ride-through capability
Available with redundant fan with automatic switchover for increased uptime
Available with NEMA Type 1/IP31 or IP42 enclosure.

H-Frame



Standards Compliance

Technical specifications and relevant standards in the manufacture, testing, and acceptance of equipment are included below. The AC drive has been tested per applicable requirements of the following standards:

Standard Number	Standard Description
UL	347A Medium Voltage Power Conversion Equipment Preliminary Standard
CSA	C22.2 No. 274-13 Adjustable Speed Drives
ANSI	Instrument Transformers C57.13
NEC	National Electric Code
OSHA	Occupational Safety & Health Act
IEC 60034-17	Rotating Electrical Machines Part 17, Cage Induction Motors When Fed from Converters
IEC 60146	Semiconductor Converters General Requirements
IEC 60204-11	Safety of machinery Electrical Equipment of machines-Part 11: requirements of HV equipment for voltages above 1000V AC or 1500V DC and not exceeding 36 kV
IEC 60529	Degrees of Protection provided by enclosures
IEC 61800-3	Adjustable speed electric power drive systems - Part 3 EMC requirements and specific test methods
IEC 61800-4	Adjustable speed electric power drive systems - Part 4 Rating specification for AC power drive systems above 1000V AC and not exceeding 35 kV
IEC 61800-5-1	Adjustable speed electric power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
IEC 60076	Electric Power Transformer
IEC 60038:1983	IEC Standard Voltages
IEEC C57.18.10-1998	IEEE Standard Practices and Requirements for Semiconductor Power Rectifier Transformers
IEEC C57.12.01-1998	IEEE Standard General Requirements for Dry-Type Distribution and Power Transformers
IEEE C57.12.91-1995	IEEE Standard Test Code for Dry-Type Distribution and Power Transformers
IEEE 519-1992	IEEE Practices and Requirements for Harmonic Control in Electrical Power Systems

Notes:

Drive System Layout

All PowerFlex 6000 power modules that are designed as front connection. For a drive amperage rating ≤350 A (304 A for heavy duty), a fixed-mounted power module design is supplied. Fixed-mounted modules are shipped installed in the drive.

For a drive amperage rating of >350 A (304 A for heavy duty), power modules are shipped separately, therefore site installation and cable connection is needed. In this case, a lifting cart is supplied for power cell replacement.

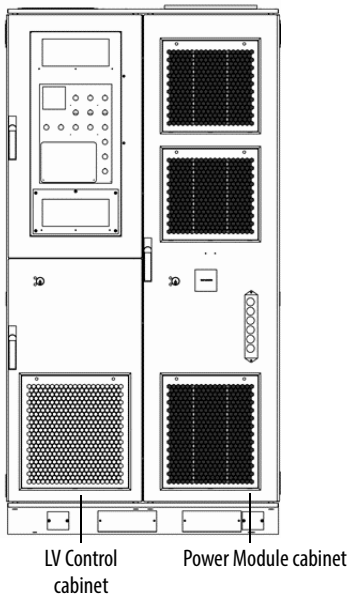
The PowerFlex 6000 drive is shipped in two sections, the Isolation Transformer cabinet and the Power Module/LV Control cabinet, unless it is an A-Frame drive, which is shipped in one single cabinet. See the PowerFlex 6000 Medium Voltage Variable Frequency Drive Shipping and Handling Manual, publication 6000-IN008.

Elevation Drawings

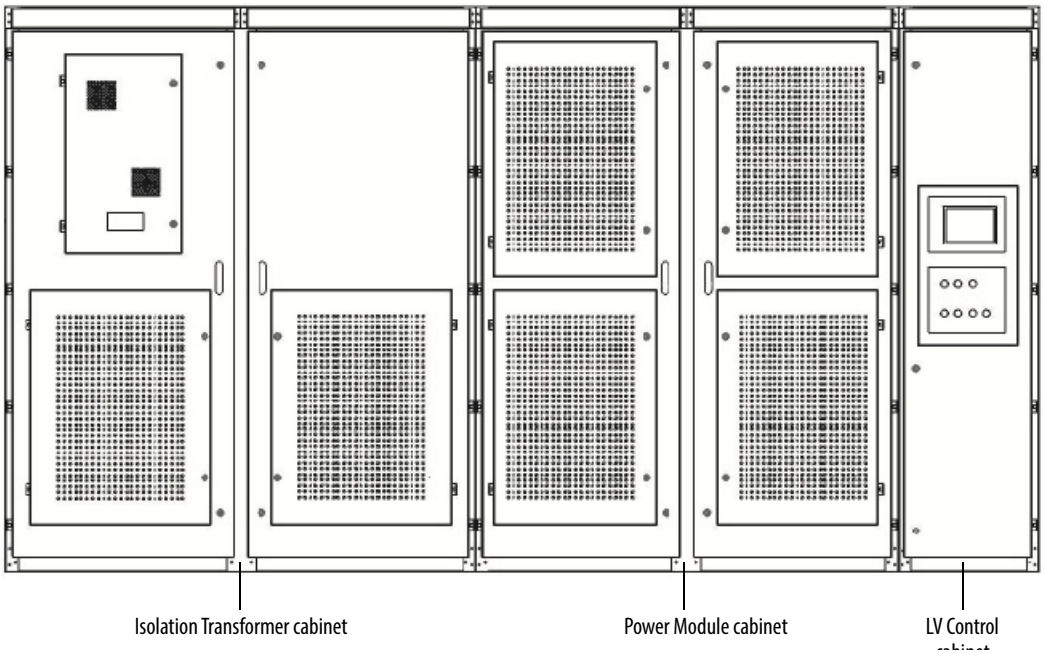
Depending on the drive rating, the system layout may be different.

Figure 10 - Drive Configurations

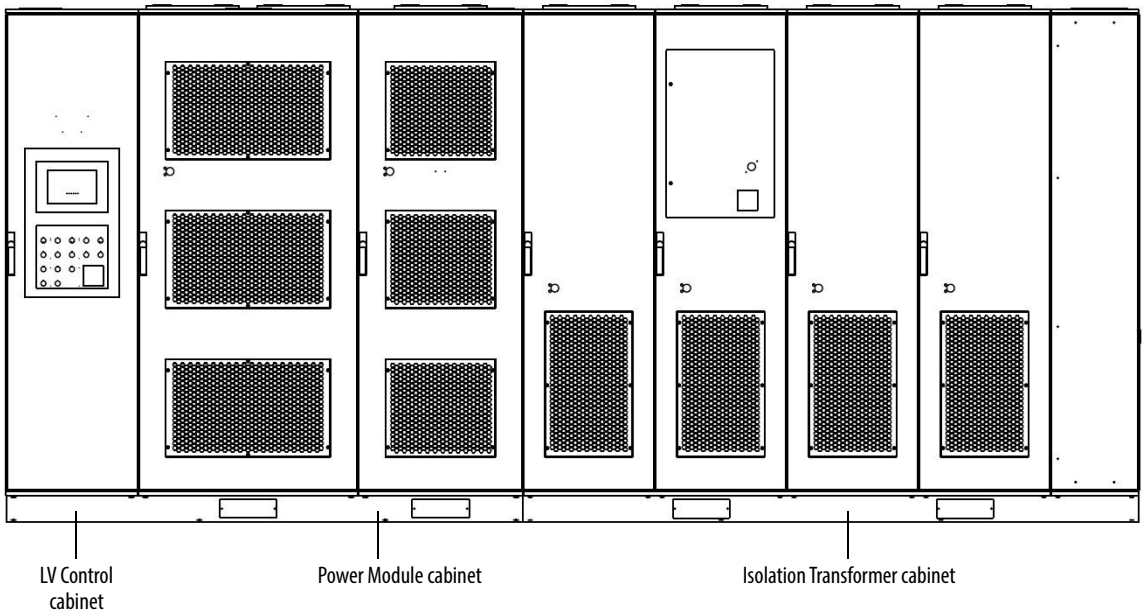
A-Frame



H-Frame



B-Frame



Isolation Transformer Cabinet

The following drawings show the different configurations available for each drive frame.

Figure 11 - Isolation Transformer Cabinet, 70 A, A-Frame

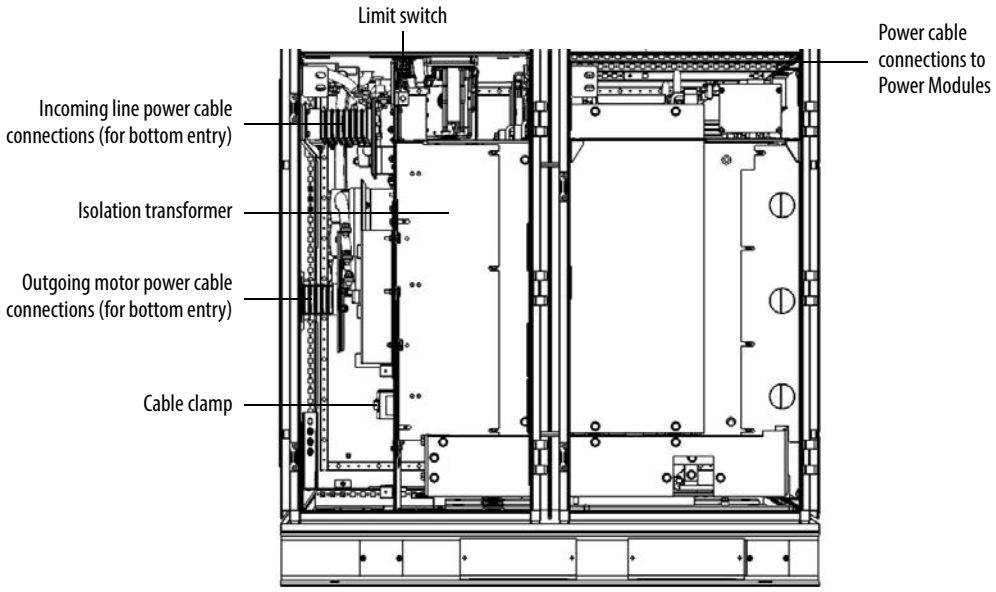


Figure 12 - Isolation Transformer Cabinet,140/215 A, A-Frame

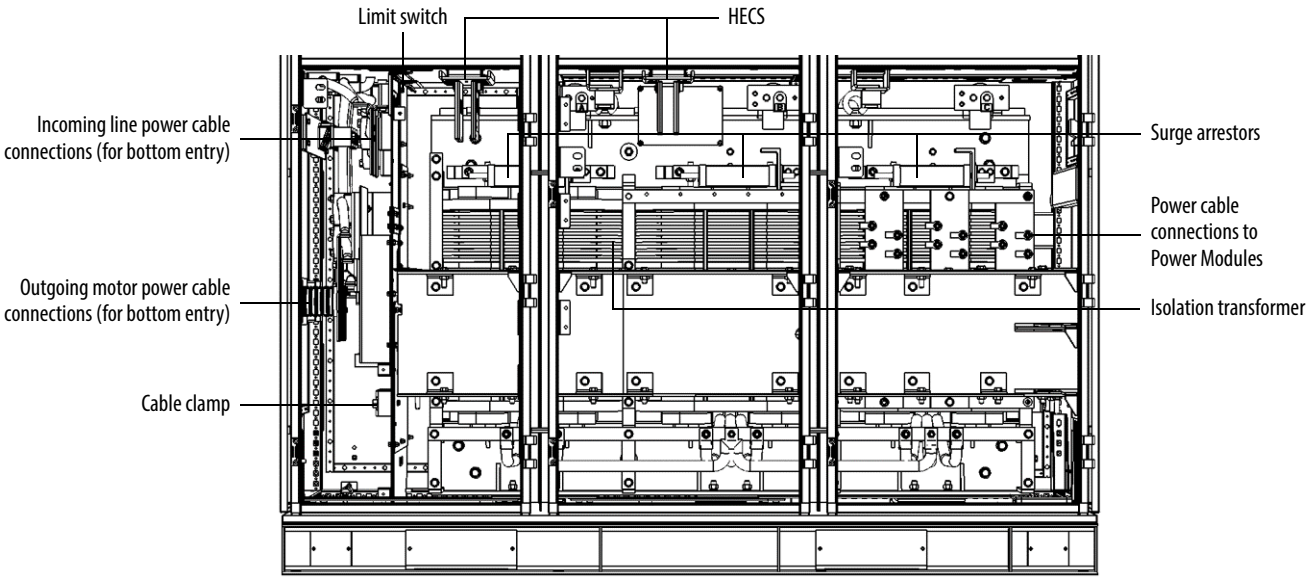


Figure 13 - Isolation Transformer Cabinet, H-Frame (Junction cabinet not applied)

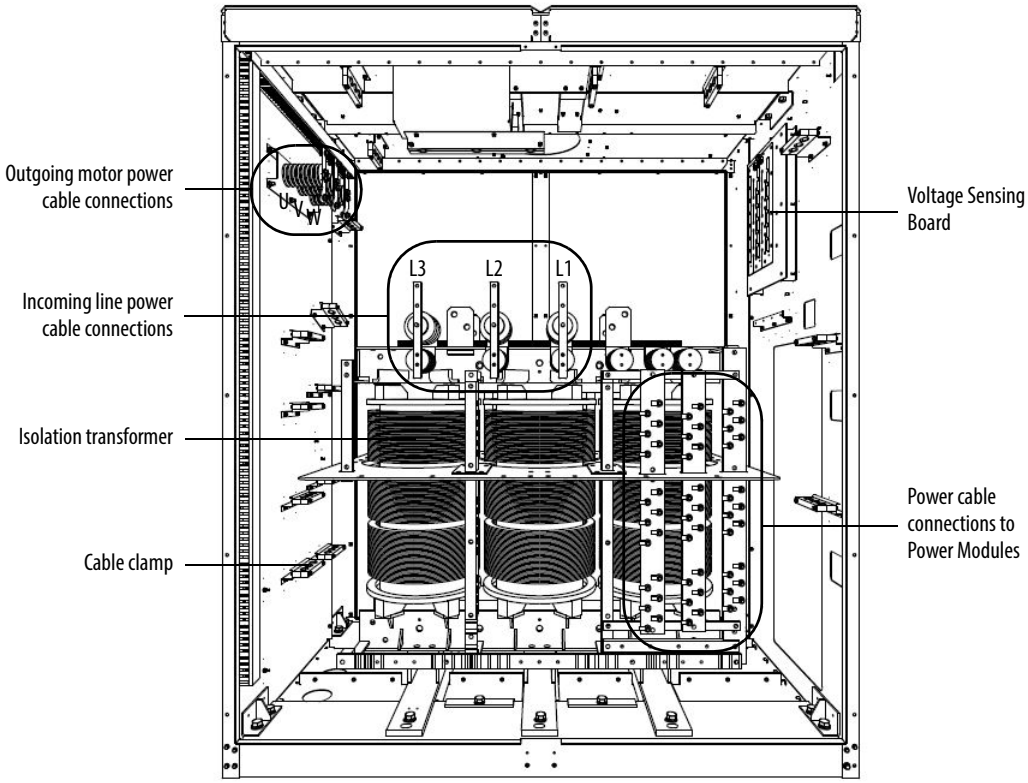


Figure 14 - Isolation Transformer Cabinet, B-Frame (Junction cabinet not applied)

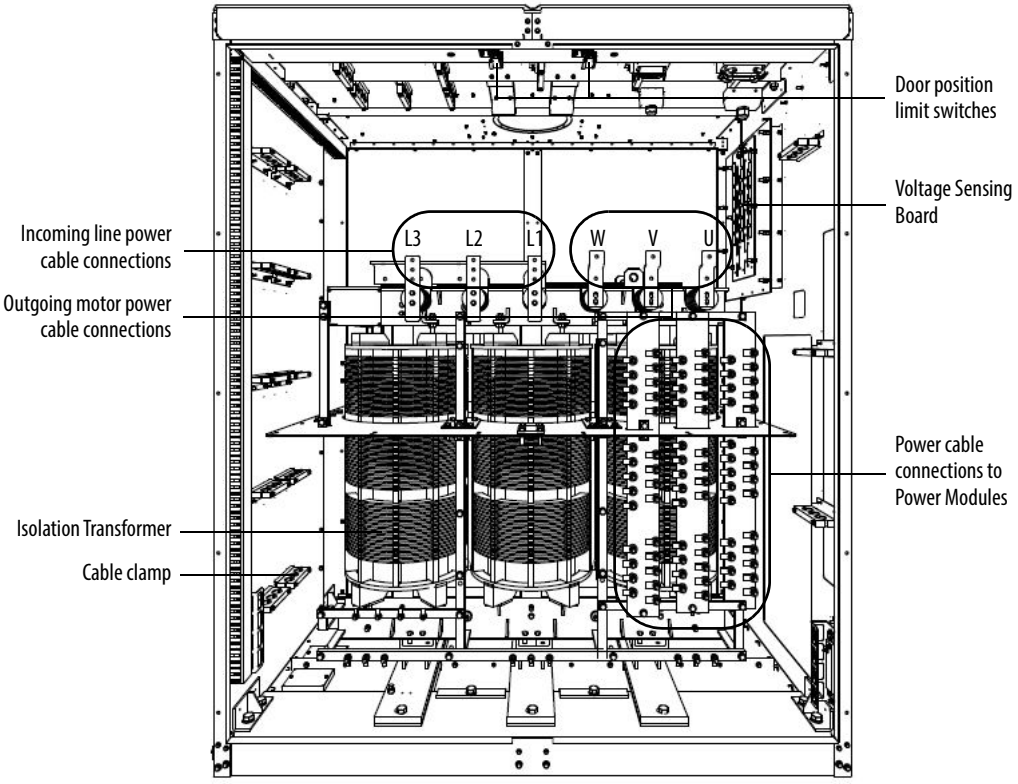
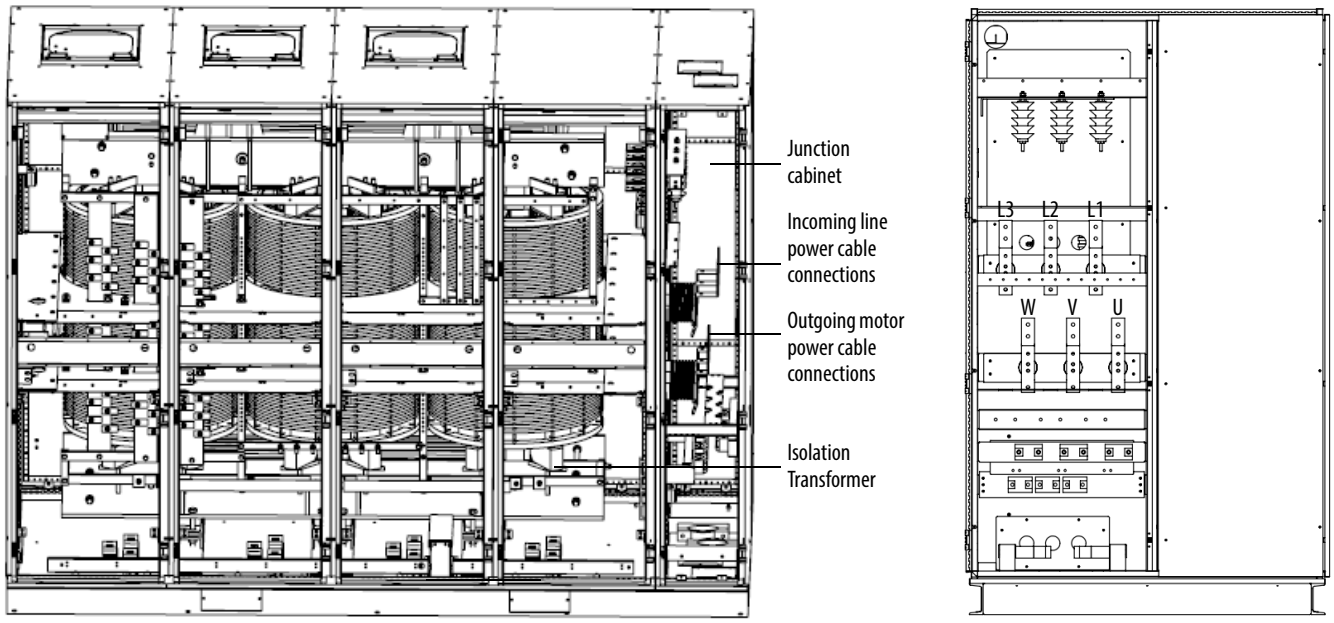


Figure 15 - Isolation Transformer Cabinet, B-Frame (Junction cabinet applied for cable connection)



Front View

Side View

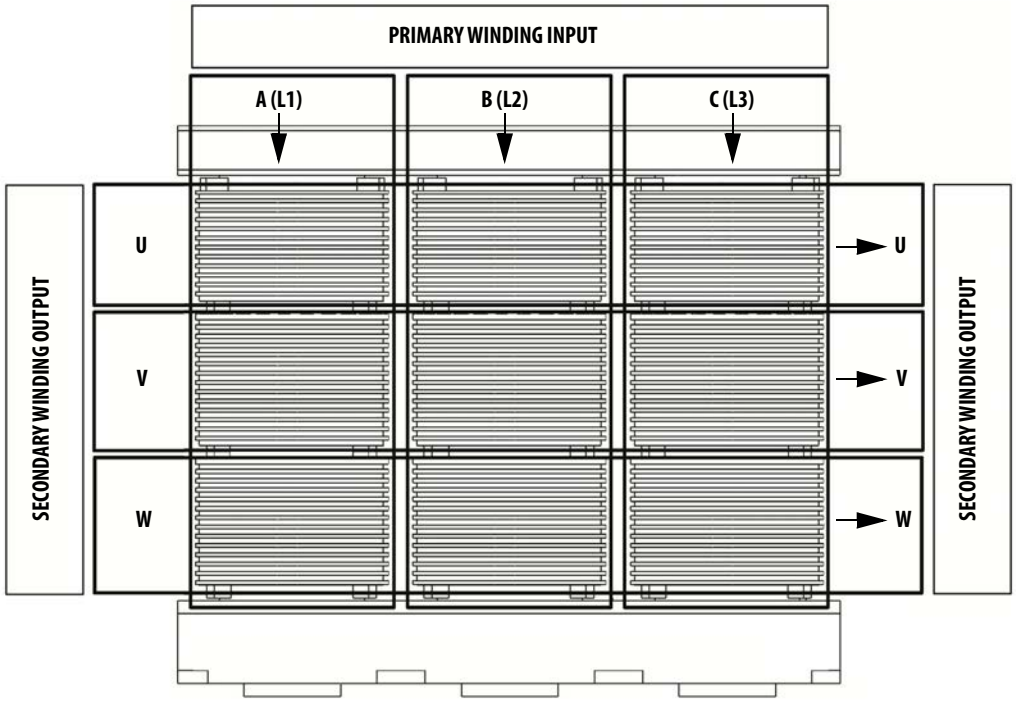
Isolation Transformer

The primary winding of the isolation transformer is rated for the voltage of the distribution system. It is connected to the distribution system by the incoming line power cables. The secondary windings of the isolation transformer are connected to the inputs of the power modules. The secondary low voltage winding is to feed the low voltage power modules.

There are between 9 and 27 three-phase secondary side windings, dependent on the motor voltage requirements from 2.3...11 kV. The phase relationship between the secondary windings is optimized to provide the highest reduction of line side harmonics.

The isolation transformer's three-phase primary coils are oriented A, B, and C from left to right, as viewed from the front. The secondary windings are also divided into three principal sections from top to bottom. The upper third are to feed the power modules in the U output phase. The middle third are to feed the power modules in the V output phase. The bottom third are to feed the power modules in the W output phase (Figure 16).

Figure 16 - Isolation Transformer Primary and Secondary Winding Orientation



The secondary windings are brought out to corresponding vertical isolated stand-offs on the body of the transformer (orientated U, V, and W from left to right as viewed from the front).

The U/W/V phase interconnections to the isolation transformer secondary windings are all on the front of the isolation transformer. The power cable connections to the power modules are made at the factory.

For H-Frame and B-Frame drives, the field power cable connections need to be made at the isolation transformer secondary winding termination points because the isolation transformer cabinet and power module cabinet are shipped separately (see publication 6000-IN008).

For A-Frame drives, the field power cable connections are already terminated when the drive arrives at the site.

Isolation Transformer Temperature Monitor

A discrete transformer temperature monitor is mounted on the LV door in the isolation transformer cabinet. There are two types of transformer temperature monitors, and the type that is used depends on the drive rating. Three temperature sensors are embedded in the isolation transformer. The monitor can be set to indicate an alarm condition or a trip condition, dependent on the temperature detected.

Figure 17 - Isolation Transformer Temperature Monitors

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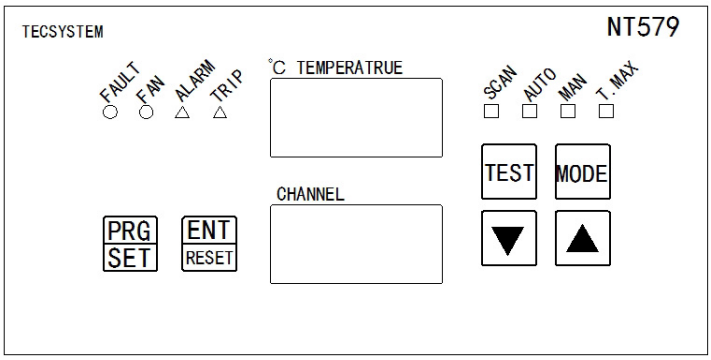

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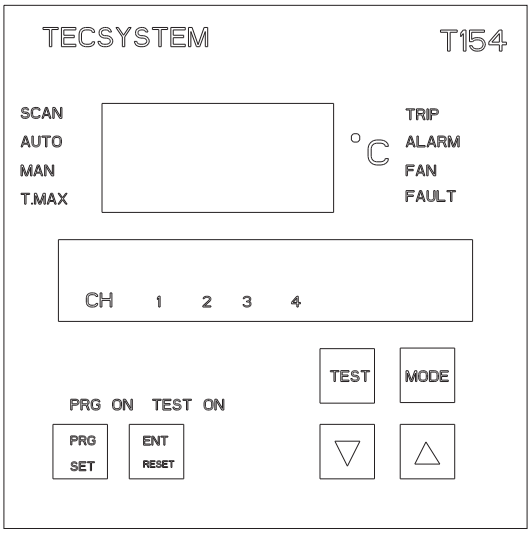


A separate user manual from the manufacturer is included in the documentation package.

Top-mounted Cooling Fan(s)

The top-mounted cooling fan(s) deliver reliable cooling of the isolation transformer. They ensure the air is exhausted from the cabinet by creating an induced draft.

Incoming Line Power Cable Connections

There are five types of incoming and outgoing MV power cable routing for PowerFlex 6000 drives, see Figure 11, Figure 12, Figure 13, Figure 14, and Figure 15. When the Junction cabinet is not applied, the incoming line cables connect to the line side terminals in the Isolation Transformer cabinet. Incoming line cables can be routed inside through the top or bottom of the Isolation Transformer cabinet.

When the Junction cabinet is applied, the incoming line cables connect to the terminals inside the Junction cabinet. If it is an A-Frame drive, the cables can be connected to the terminals in the transformer cabinet for bottom incoming, or the cables can be connected to the terminals behind the control cabinet for top incoming (using top or side access).

See the PowerFlex 6000 Medium Voltage Variable Frequency Drive Installation Instructions, publication 6000-IN006 for additional details.

Outgoing Motor Cable Connections

When the Junction cabinet is not applied, the outgoing motor cables connect to the cable stand-off assembly on the cabinet side sheet or the cable stand-off that is mounted on the Isolation Transformer, depending on the different configuration or drive rating.

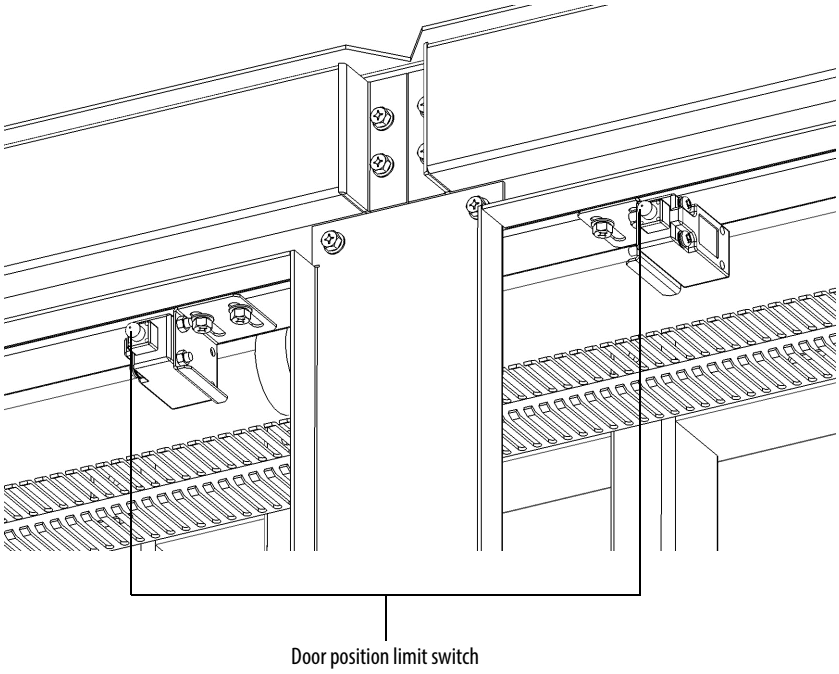
When the Junction cabinet is applied, the outgoing motor cables connect to the terminals inside the Junction cabinet. Outgoing motor cables can be routed inside through the top or bottom of the cabinet system. Generous working space is provided. See the PowerFlex 6000 Medium Voltage Variable Frequency Drive Shipping, Handling, and Installation Instructions, publication 6000-IN006 for additional details.

Door Position Limit Switch

Each cabinet door that allows access to medium voltage components is lockable and also has a Guardmaster® safety limit switch. If the cabinet door is opened when the input switching device feeding power to the drive is closed, the input device will be tripped off.

ATTENTION: The door position interlock is a safety feature. It must not be used solely as a part of the plant operation process to verify that the drive has been disconnected from input medium voltage. Keep the medium voltage doors locked as standard practice. If access to the medium voltage rated cabinets is required, always go to the input device feeding the drive to verify if it is open. Lock out and tagout the input device before performing any work on the drive or bypass units.

Figure 18 - Door Position Limit Switch Location



Interlocking

Each cabinet door that allows access to medium voltage components is lockable. Access to the medium voltage areas of the drive is restricted by the use of key interlocking for safety.

At installation, the key interlocking is set up so that access to the medium voltage compartments of the equipment can only be made when the upstream power is locked in the off position. Additionally, the key interlocking prohibits the upstream power being applied until the medium voltage drive's access doors have been closed and locked shut. It is the responsibility of the installer to verify that the key interlocking is installed properly to the upstream equipment.

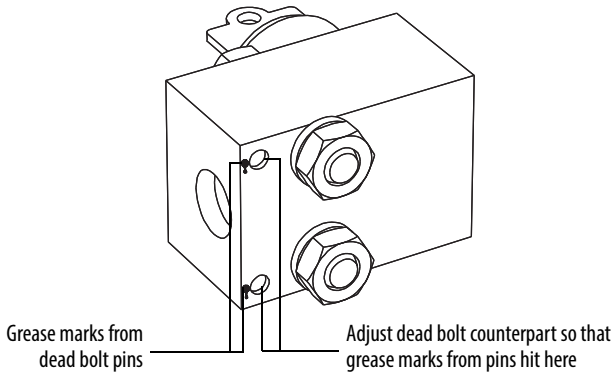
To use the key interlocking safety feature:

1. The circuit breaker must be in the closed state and the circuit breaker lock must be locked using interlocking key "KA".
2. Remove key "KA" and insert it into the key interlock that is located on the right door of the isolation transformer cabinet.
3. Rotate key "KA" to unlock key "KB". You can now remove key "KB".

Interlocking key "KB" is used to open the left door of the isolation transformer cabinet, or the left and right doors of the power module cabinet.

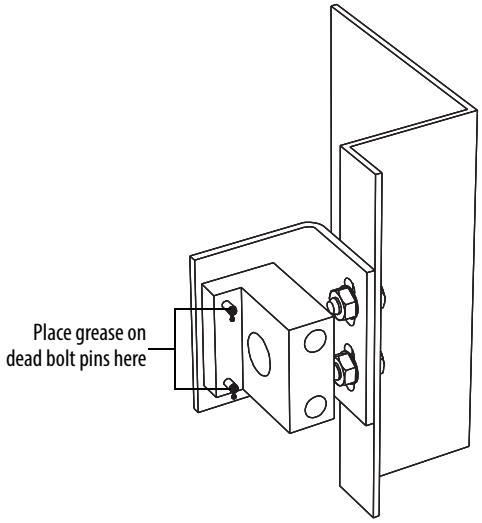
ATTENTION: Servicing energized industrial control equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of control equipment. Hazardous voltages may exist in the cabinet even with the circuit breaker in the off position. Recommended practice is to disconnect or lock out control equipment from power sources, and confirm discharge of stored energy in capacitors. If it is necessary to work in the vicinity of energized equipment, the safety-related work practices of NFTA 70E, Electrical Safety requirements for Employee Work places, must be followed.

Figure 19 - Dead Bolt Assembly Mounted to Door



1. Lock out and isolate the drive from medium voltage. Verify with a hot stick that there is no medium voltage present.
2. Determine that the key interlock is correctly aligned by securely bolting the medium voltage doors of the cabinet closed and removing from the lock. The key should turn easily; if any force is required to turn the key, the dead bolt alignment requires adjustment.
3. Open the doors of the cabinet and inspect the key assembly. Place high visibility grease on the pins of the dead-bolt counterpart. The factory recommends using yellow torque sealant, however if it is unavailable almost any grease will do (See Figure 19).

Figure 20 - Dead Bolt Counterpart Mounted to Cabinet



4. Bolt the cabinet door closed so the pins on the dead bolt counterpart make contact with the dead bolt assembly. Doing so should leave two marks of torque sealant or grease on the assembly where the pins made contact (See Figure 13).
5. Slightly loosen the adjustment bolts on the counterpart and make the necessary movements on the counterpart to verify that the pins align with the landing plates on the dead bolt assembly. As the amount of counterpart movement that is required is an estimate, it may take a couple attempts to properly align the assembly.
6. Clean the torque seal/grease from the key interlock once finished aligning the counterpart.

Once properly aligned, the key should turn freely when the cabinet door is fully bolted shut. If the key does not function when the door is tightly bolted closed, adjustments will have to be made to the depth of the counterpart. This can be done by adding shims on the landing plate where the counterpart is mounted.

Besides the mechanical interlock, PowerFlex 6000 drives also provide Guardmaster safety limit switch on each cabinet door that interlocks with input switching devices.

When any of the cabinet doors are open, the drive will turn off the IGBT output. Simultaneously, a trip signal will be sent to the circuit breaker to open the circuit.

Two pairs of passive dry contacts (open and close) are provided to the user.

Voltage Sensing Board

The Voltage Sensing Board (VSB) is connected to the medium voltage and converts medium voltage to low voltage levels, which allows the drive to monitor the output/input voltage.

Figure 21 - Voltage Sensing Board

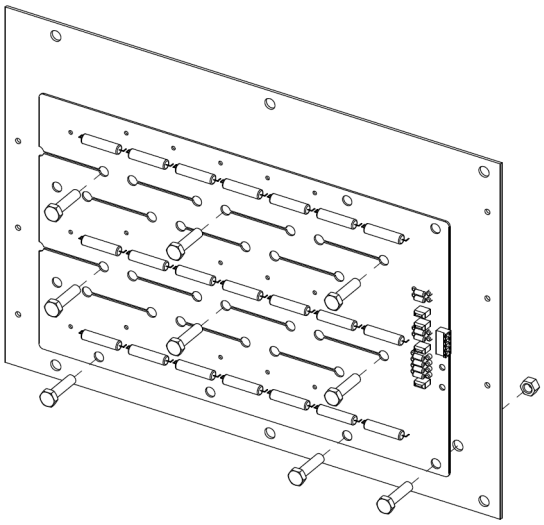
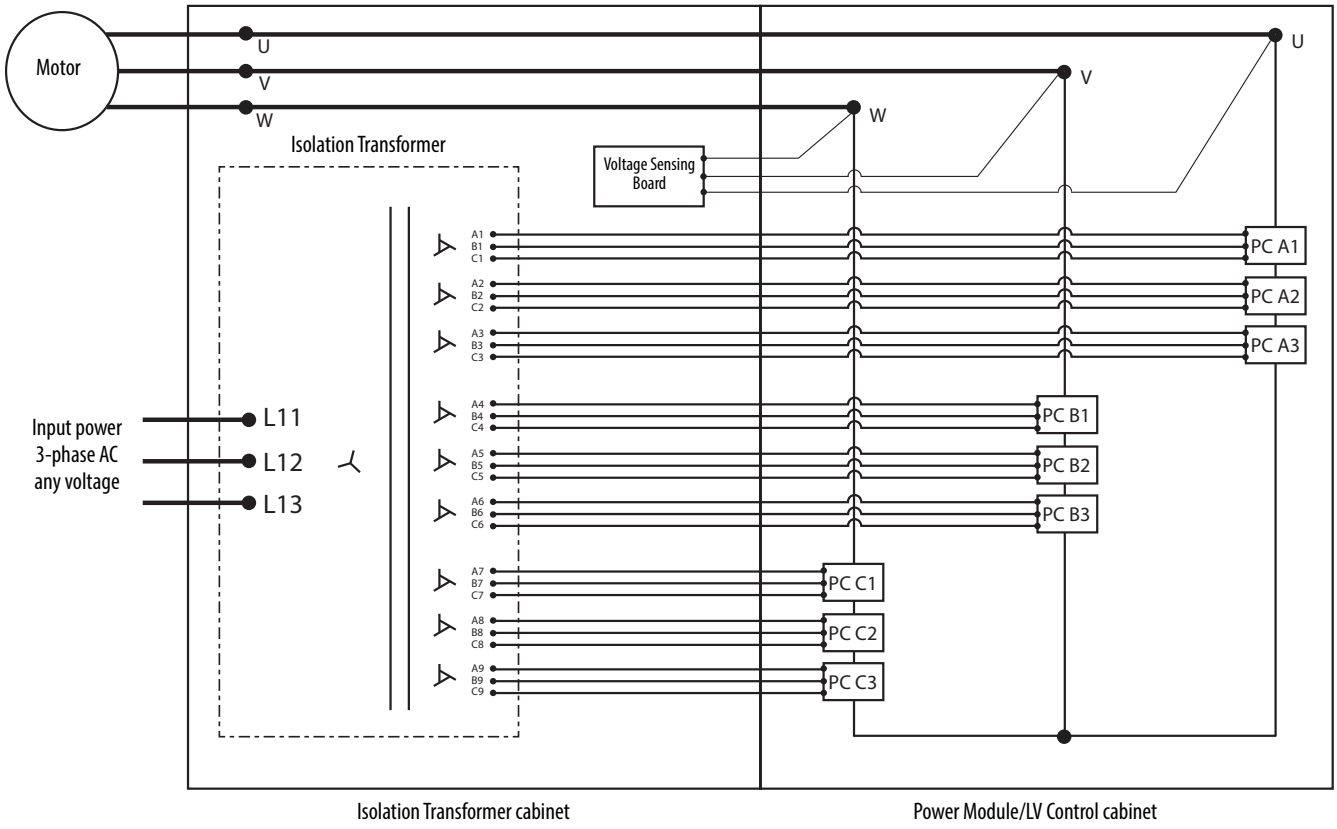


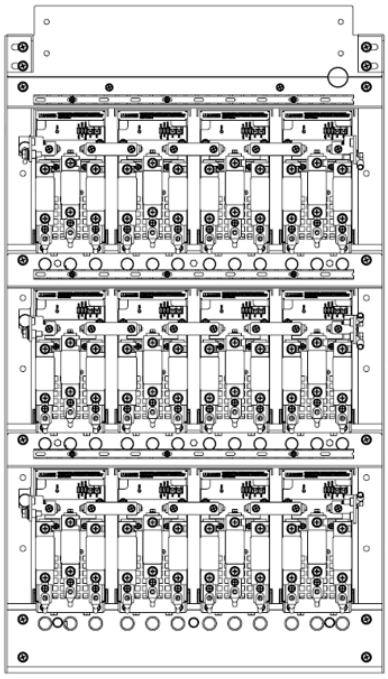
Figure 22 - Power Cabling Overview (3.3 kV)



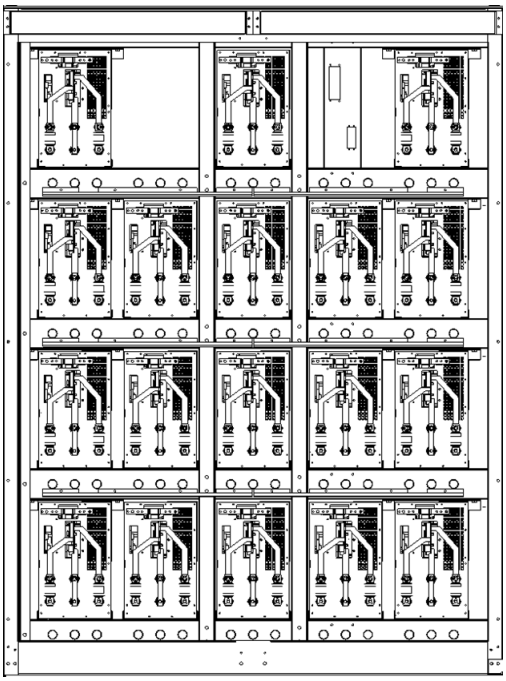
Power Module Cabinet

Figure 23 - Power Module Configuration

A-Frame



H-Frame and B-Frame



Power Modules

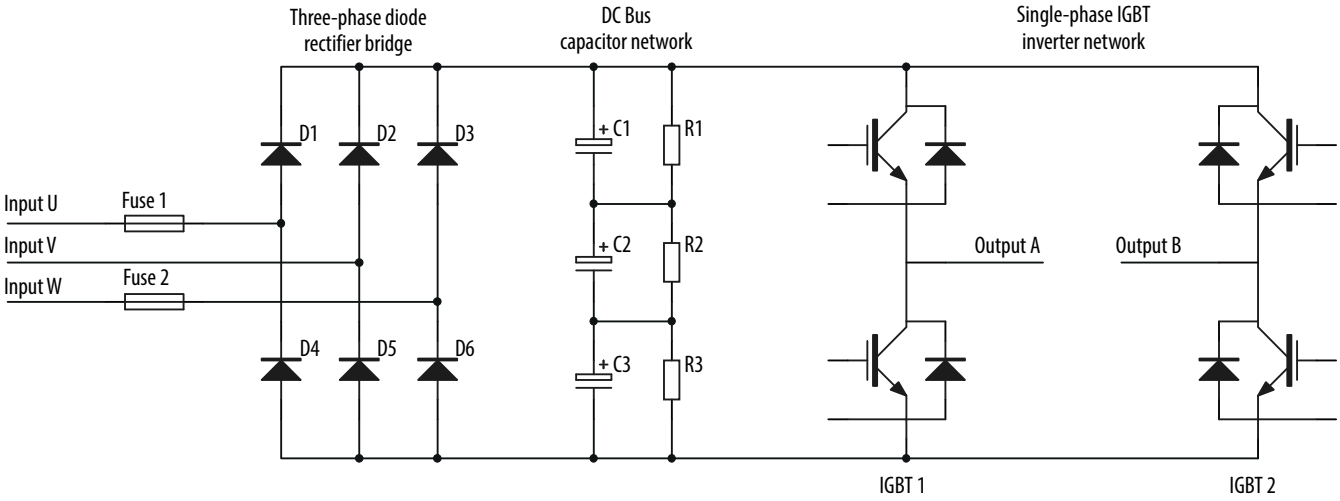
Power Modules are available in a wide variety of amperage ratings relating to the required motor current. Power Modules that are rated up to and including 350 A are fixed-mounted in the drive and ship already installed. Power Modules that are rated above 350 A are shipped separately, therefore site installation and cable connection is needed. In this case, a lifting cart is supplied for power cell replacement.

An optional built-in Power Module bypass feature is also available for all drive ratings. With the Power Module inside pass circuit, the drive can continue to run without shutting down when encountering a Power Module failure. This ensures a higher level of process reliability. Since the drive uses a solid-state bypass, the dimensions of the drive do not increase when adding the automatic bypass option.

Basic Principle of Power Module

The Power Module combines a three-phase rectifier and an "H" bridge inverter, which is powered from the secondary side windings of the Isolation Transformer. After rectifying and filtering, it outputs AC current with variable frequency and variable voltage under the control of four IGBTs using a PWM switching pattern. Several Power Modules, after being connected in series and superposed, can output three-phase AC current with adjustable frequency and voltage to control an AC motor.

Figure 24 - Low Voltage Power Module



Control signals to the Power Module and the feedback signals from the Power Module are transmitted by fiber-optic cables, which provide electrical isolation between the medium voltage and low voltage sections of the drive, and protects against electromagnetic interference.

The control signals from the main control unit, through the optical-electrical converter, are sent to the Power Module control board for further processing and to the corresponding gate drive circuits to turn the IGBTs on or off.

The status information of the Power Module is transmitted through the electrical-optical converter and sent to the main control unit. When there is a fault, the main control unit sends control signals to lockout or bypass the affected Power Module.

The Power Module cabinet consists of Power Modules, current transformers and high-voltage cable.

The Power Modules are divided evenly into three phases (U, V, and W). The units in each phase are connected end-to-end at the output terminals. Then individual phases are formed, using a star connection. Current transformers are installed into the U phase and W phase.

Different models of Power Modules are used for drives of different power ratings (Figure 26).

Figure 25 - Power Module, A-Frame

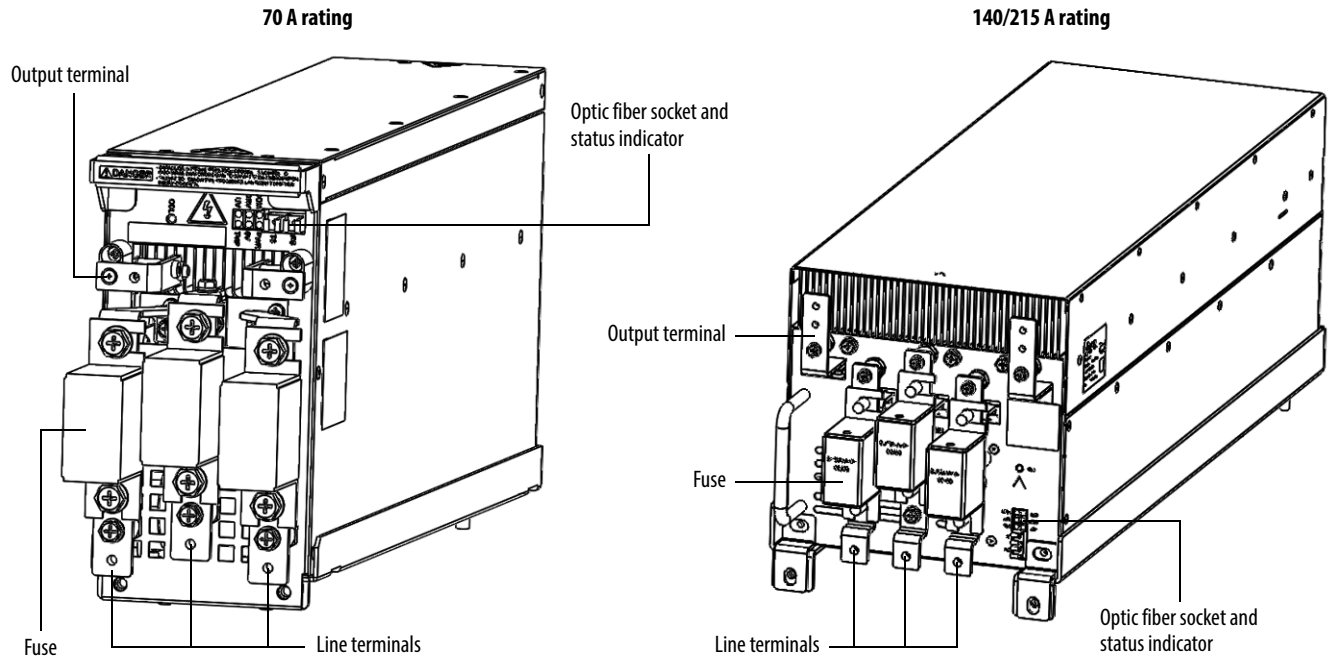


Figure 26 - Power Module, H-Frame and B-Frame

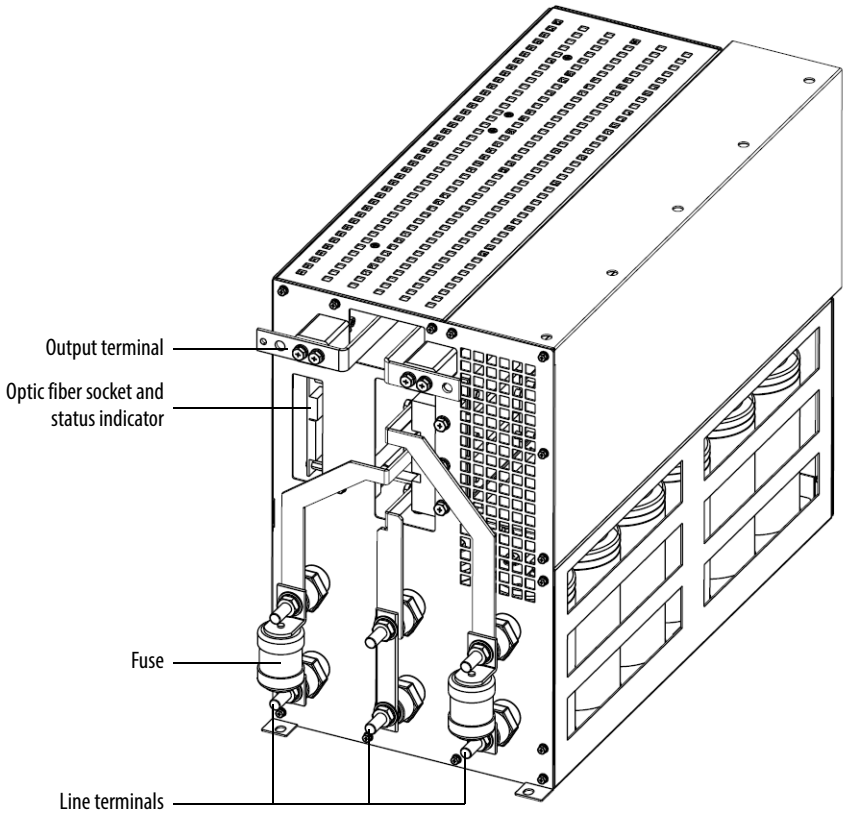


Table 2 - Power Module Ratings

Frame Rating	Bypass	Description	Current Rating (Amps)
A-Frame	Non-Module Bypass	Powercell 36 A, without Bypass	36
		Powercell 50 A, without Bypass	50
		Powercell 70 A, without Bypass	70
		Powercell 100 A, without Bypass	100
		Powercell 140 A, without Bypass	140
		Powercell 180 A, without Bypass	180
		Powercell 215 A, without Bypass	215
	Module Bypass	Powercell 36 A, with Bypass	36
		Powercell 50 A, with Bypass	50
		Powercell 70 A, with Bypass	70
		Powercell 100 A, with Bypass	100
		Powercell 140 A, with Bypass	140
		Powercell 180 A, with Bypass	180
		Powercell 215 A, with Bypass	215
H-Frame	Non-Module Bypass	Powercell 40 A, without Bypass	40
		Powercell 75 A, without Bypass	75
		Powercell 100 A, without Bypass	100
		Powercell 120 A, without Bypass	120
		Powercell 150 A, without Bypass	150
		Powercell 180 A, without Bypass	180
		Powercell 200 A, without Bypass	200
	Module Bypass	Powercell 40 A, with Bypass	40
		Powercell 75 A, with Bypass	75
		Powercell 100 A, with Bypass	100
		Powercell 120 A, with Bypass	120
		Powercell 150 A, with Bypass	150
		Powercell 180 A, with Bypass	180
		Powercell 200 A, with Bypass	200
B-Frame	Non-Module Bypass	Powercell 250 A, without Bypass	250
		Powercell 305 A, without Bypass	305
		Powercell 350 A, without Bypass	350
		Powercell 438 A, without Bypass	438
		Powercell 560 A, without Bypass	560
		Powercell 680 A, without Bypass	680
	Module Bypass	Powercell 250 A, with Bypass	250
		Powercell 305 A, with Bypass	305
		Powercell 350 A, with Bypass	350
		Powercell 438 A, with Bypass	438
		Powercell 560 A, with Bypass	560
		Powercell 680 A, with Bypass	680

Hall Effect Current Sensors (HECs)

The Hall Effect Current Sensors are current transformers capable of measuring current throughout the output frequency range of the drive. They monitor the current waveform in each of the phases going to the motor and provide feedback to the control system.

Top-mounted Cooling Fan(s)

The top-mounted cooling fans deliver reliable cooling of the Power Modules. They draw cool air in through the vents in the Power Module cabinet doors, through the Power Modules, and exhaust out the heated air through the top of the cabinet.

LV Control Cabinet

The LV Control cabinet consists of the Control Unit, the human-machine Interface (HMI), PLC, AC/DC power supplies, contactors, and relays.

The HMI is located on the front door of the LV Control cabinet, where an operator can set up, monitor, and control the drive.

IMPORTANT	When wiring a power supply to the Phoenix connectors, verify the configuration on the markings and labels. Some power supplies may use two 6-pin connectors with similar configuration but have a different voltage input.

Figure 27 - LV Control Cabinet, A-Frame

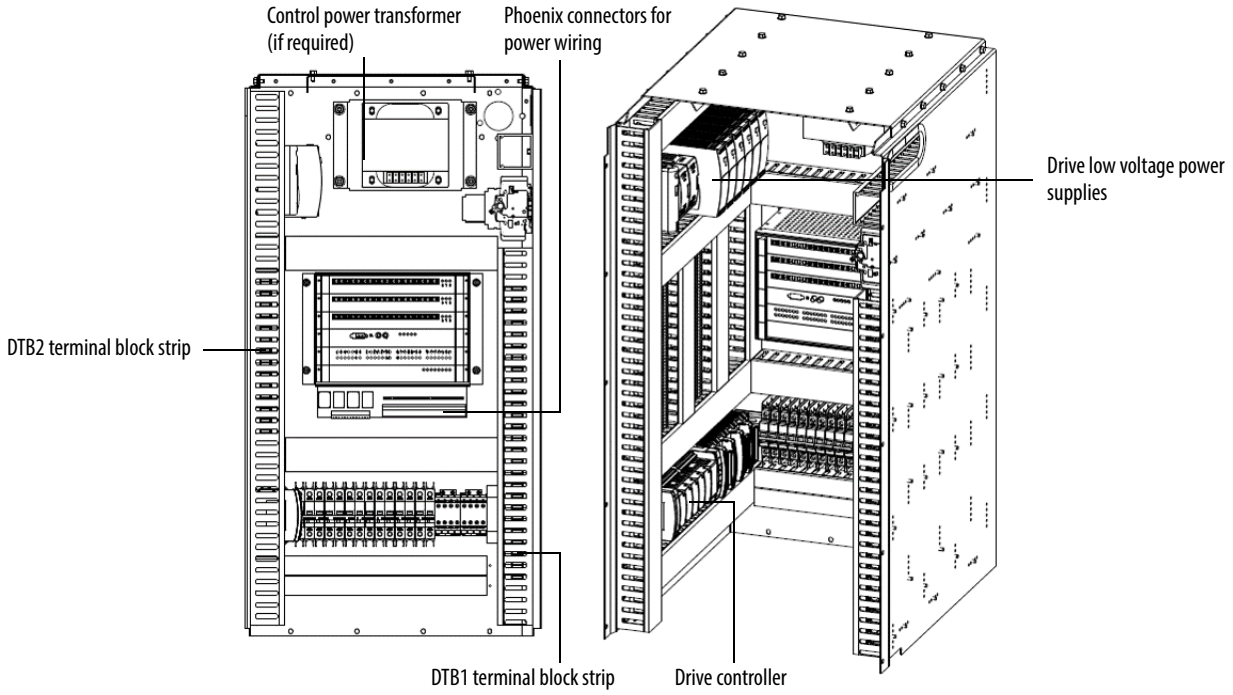
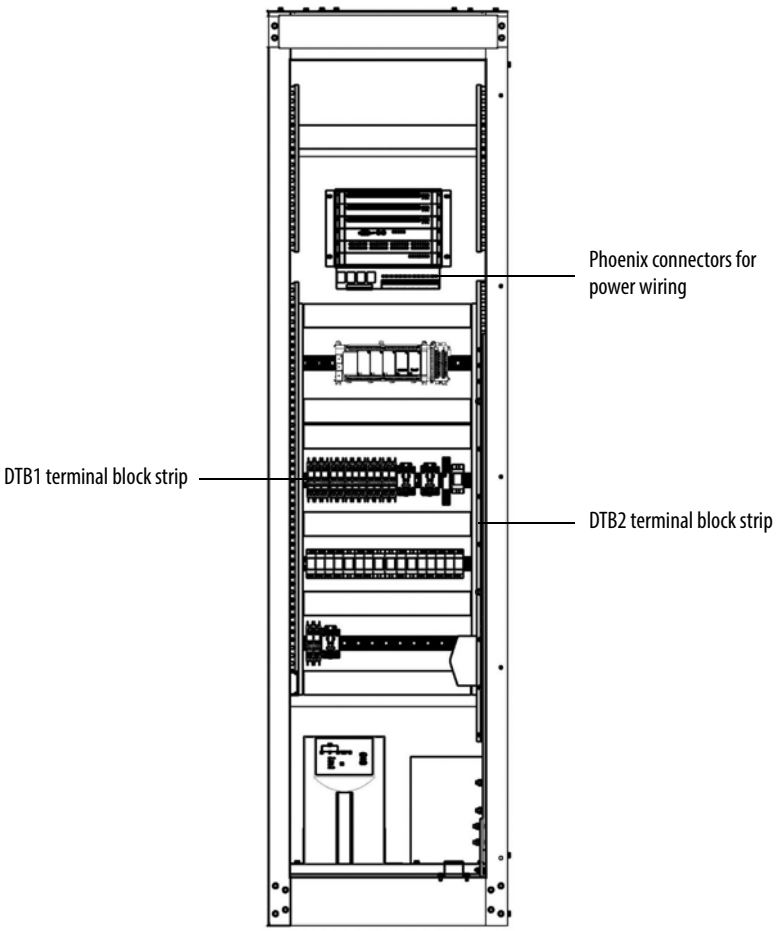


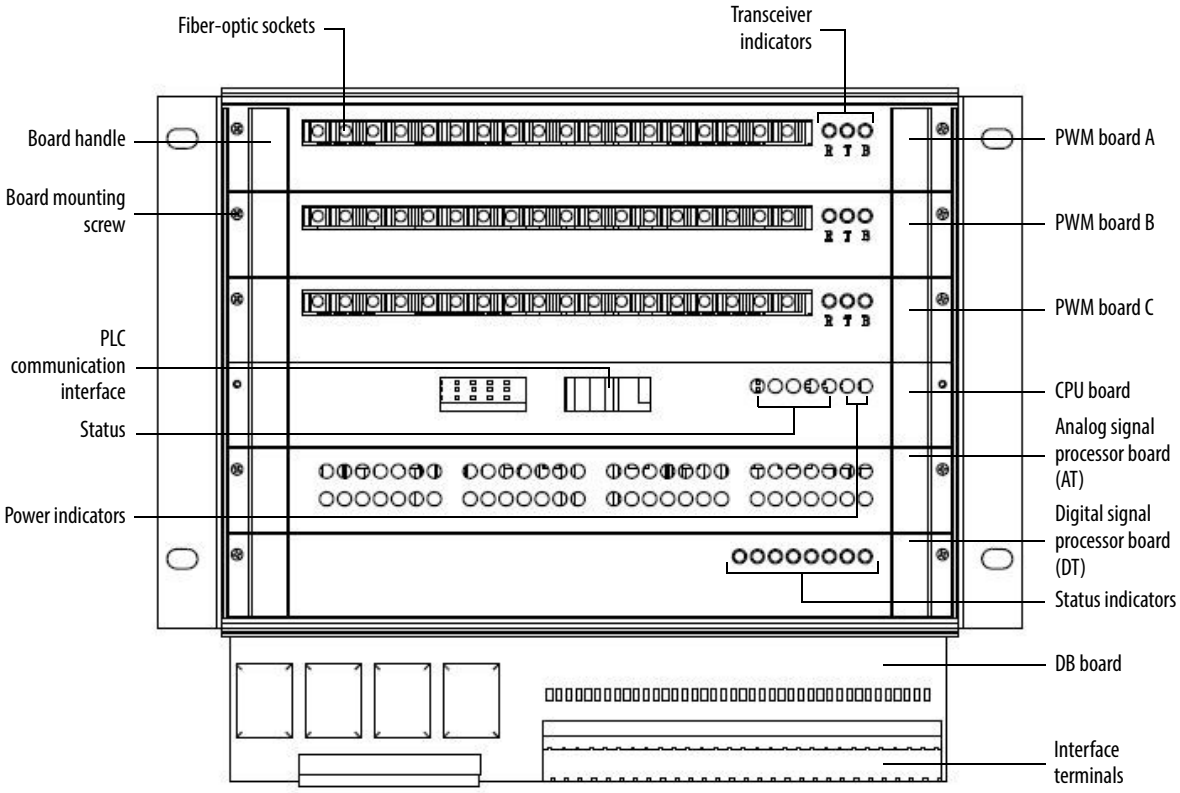
Figure 28 - LV Control Cabinet, H-Frame and B-Frame



Control Unit (all modules)

The control unit provides the core functionality of the variable frequency drive. This includes controlling the power modules to produce the required output voltage and frequency, monitoring the power modules, motor voltage, and motor current to provide alarm and trip signals based on the information.

Figure 29 - PowerFlex 6000 Interface



The CPU Board accepts external inputs through the connected communication network, hard-wired control devices, or user interactions via the HMI to determine the actions required of the drive. The CPU Board also monitors motor voltage and current as well as internal inputs from the PLC, analog and digital signal processor boards and Power Modules. It uses these inputs in its motor control and protection algorithms to determine the necessary actions to be taken and outputs to be set. In combination with the PWM Boards, the CPU board sends the necessary optical PWM control signals to the Power Modules to allow the Power Modules to output the required voltage and frequency to the motor

Figure 30 - Control Unit Layout

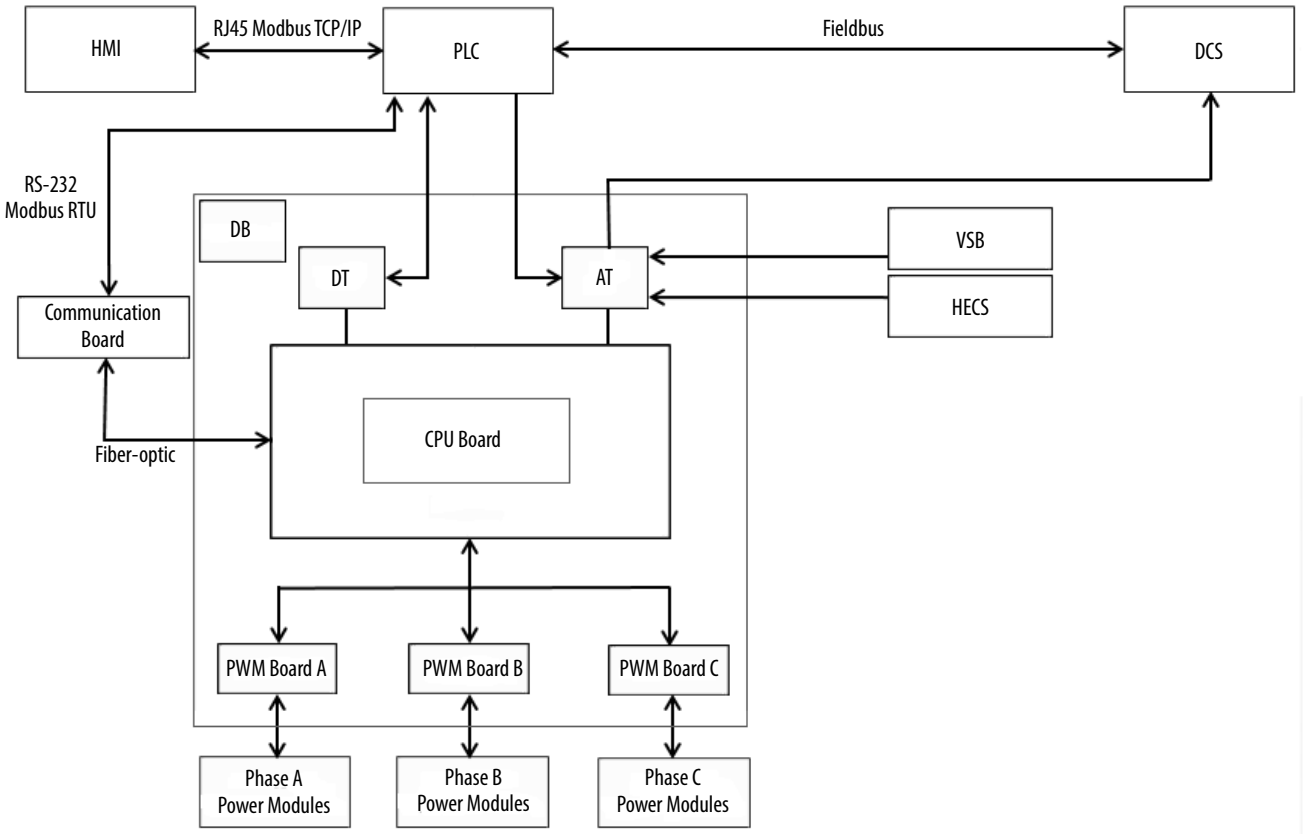


Table 3 - Control Unit Description

Board Function	
PWM Board A, B, C	Output PWM and control signals to Power Modules Collect and process fault and state information from Power Modules to CPU board Each phase PWM board can control up to nine power cells
CPU Board	Process analog input signals, switch and fault information, control DA and switch signal output, realize V/F algorithm, set, and change parameters in communication with PLC
Analog Signal Processor Board (AT)	Collect and process analog input signals to CPU Board, output analog signals processed by DT board
Digital Signal Processor Board (DT)	Collect and output digital signals, digital to analog conversion function
DB Board	Acts as a base board in the Control Unit and interfaces the digital and analog signal cables
Connector	
PLC Communication Interface	Connection between PLC and Control Unit.
Fiber-optic Socket	Connection between Power Modules and Control Unit (two per module)
Interface Terminals	Connects external inputs and outputs
Status Indicators	
Phase control board transceiver indicator light	B: board healthy indicator T: transmit data to power module indicator R: receive data from power module indicator
CPU Board Indicator Lights	
RX	Receive communication signals from PLC
TX	Transmit communication signals to PLC
FPGA	FPGA healthy indicator
DSP2	DSP2 healthy indicator
DSP1	DSP1 healthy indicator

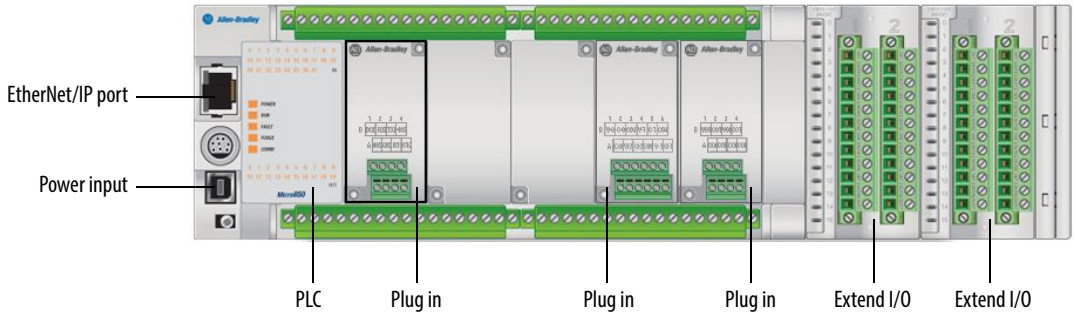
5V	5V power supply indicator
3.3V	3.3V power supply indicator
Digital Signal Processor Board Indicator Lights	
HVEN	Allow High-voltage switching on indicator
RUN	Drive Running indicator
Fault	Drive is in fault state
Trip	Drive is in trip state; any fault can result in trip
Standby	–
Standby	–
Standby	–

PLC

The PowerFlex 6000 drive uses a Micro850® controller to perform many of its internal control functions. The controller controls and monitors the cooling fans, input, and bypass switching devices, door switch status, and so on.

The controller is also responsible for interfacing with the user's automation control system via many optional communication protocols. Standard communication protocols are EtherNet/IP™, Modbus/TCP Server, and Modbus RTU. Optional communication modules are available to support other communication protocols.

Figure 31 - PLC Overview



HMI

The PowerFlex 6000 drive uses a PanelView™ Plus 6 series graphic terminal, catalog number 2711P-T7C4D9 as the HMI.

The HMI is connected to the Micro850 controller through a communication interface (standard RJ45 EtherNet/IP connection). The HMI configures operating parameters and input operation commands, and displays the operation status, operation parameters, parameter trends, and fault messages.

UPS

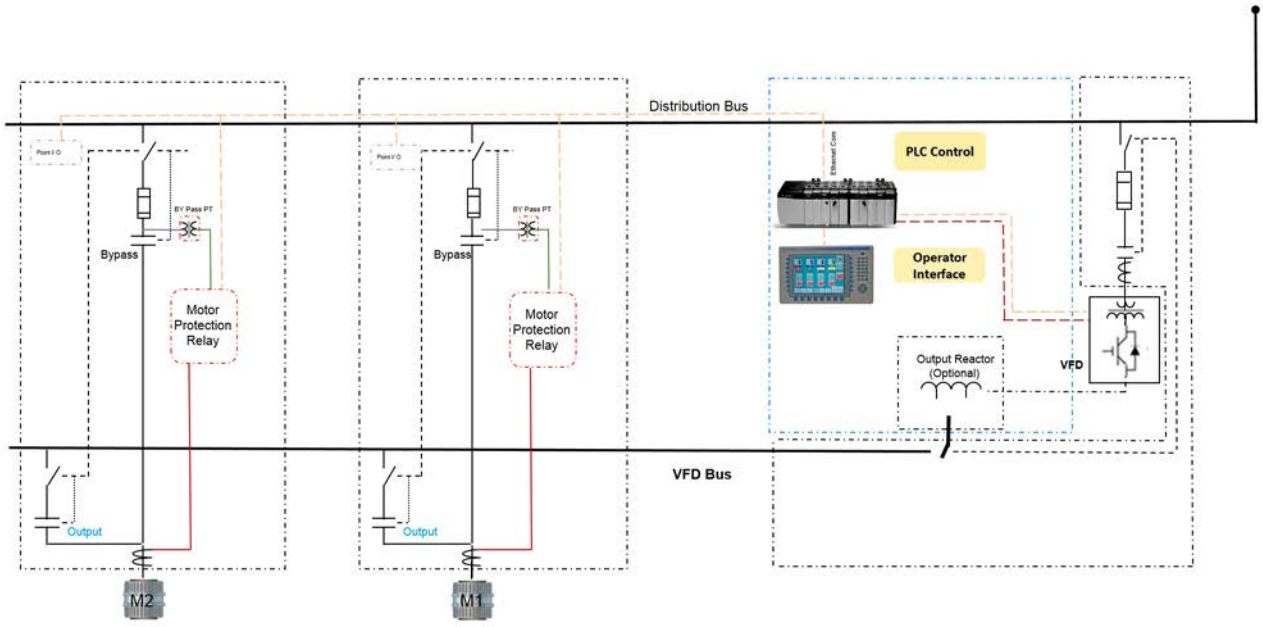
The UPS supplies power to the LV Control cabinet using internal batteries if the customer-supplied control power and isolation transformer control power is off. The UPS provides control power in the event of transient power loss to ensure the drive control can operate without interruption.

Synchronous Transfer

Synchronous transfer is an optional feature of the PowerFlex 6000 drive, which allows either a single or multi-motor application to be transferred between the drive, and a fixed frequency supply in either direction without stopping and with a very short to no interruption of power. At the moment of transfer between the VFD source and the utility source, the motor stator voltage is perfectly aligned, the outgoing VFD source and incoming utility source are in-phase; the waveforms are synchronized. Compared to a non-synchronous transfer in which power to the motor is interrupted for a significant length of time, the transient drop in motor speed is much less with synchronous transfer.

The PowerFlex 6000 drive can start up to 10 motors on one drive utilizing a 'bumpless' transfer that is available with and without an output reactor. See Figure 32 for configuration details.

Figure 32 - Typical Synchronous Transfer Configuration Using a PowerFlex 6000 Drive

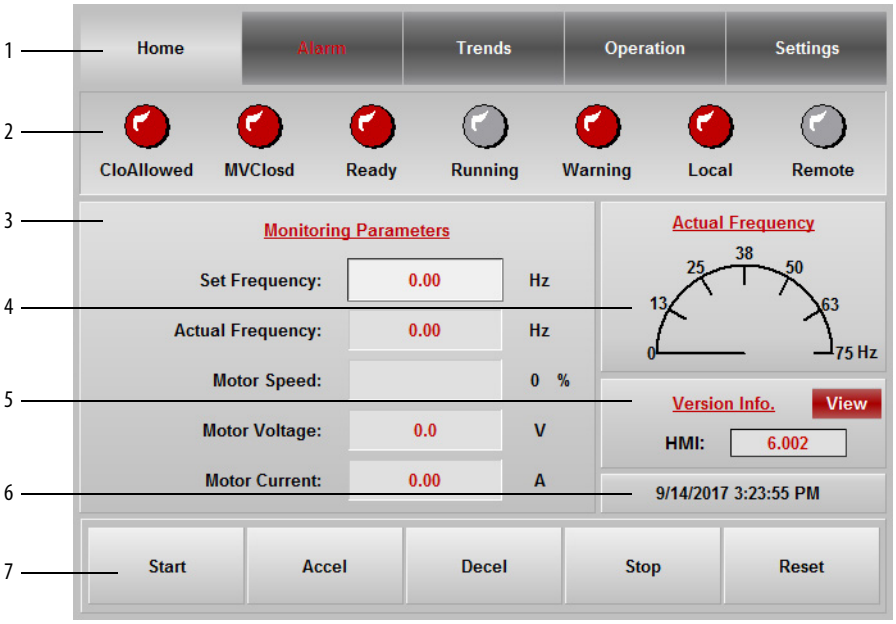


Setup and Operation

Main Interface

The Main Interface Screen contains configuration and operation controls, monitoring parameters and actual speed.

Figure 33 - Main Interface Screen



	Screen Layout
1	Top Menu Bar
2	Status Bar
3	Set and Monitor Box
4	Actual Frequency Display Box
5	Version Information Box
6	Actual Date and Time
7	Operation Bar

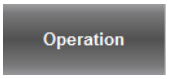
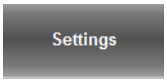
Drive Setup and Configuration Controls

There are five buttons in the Top Menu Bar. A description of the functionality is described in Table 4.

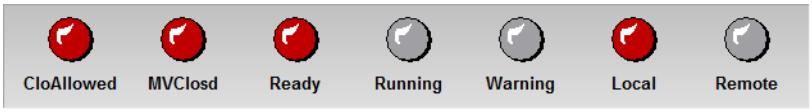
Table 4 - Setup and Configuration Controls

Home	• Return to Main Interface screen
Alarm	• Check warnings • Check faults • Reset alarm status • Show alarm history

Table 4 - Setup and Configuration Controls

	• Check voltage trend • Check current trend • Check frequency trend • Check power trend • Pause trending
	• Confirm bypass configuration • Change from local to remote control • Close/open drive contactors (auto bypass)
	• Access System Settings – Change Language • Access P Parameters

Status Indicators



There are seven status indicators on the Status Bar. Three additional status indicators will appear under certain conditions. For details, see the table below.

Table 5 - Status Indicators

CloAllowed	The drive is in a state that will allow MV to be applied
MVClosd	Indicates that the input switching device feeding MV power to the drive is closed
Ready	Drive is ready to start
Running	The drive is running
Warning/Fault	If there are only warnings in the system, the Warning indicator will turn red. Once there is a fault in the system, the Warning indicator will turn to a Fault indicator, as shown. 
Local **Remote**	When the system is under Local Control, the Local indicator will turn red.  When the system is under DCS Control, the Remote indicator will turn into a DCS indicator, as shown.  When the system is under Remote Box Control, the Remote indicator will turn into a Remote Box indicator, as shown. 

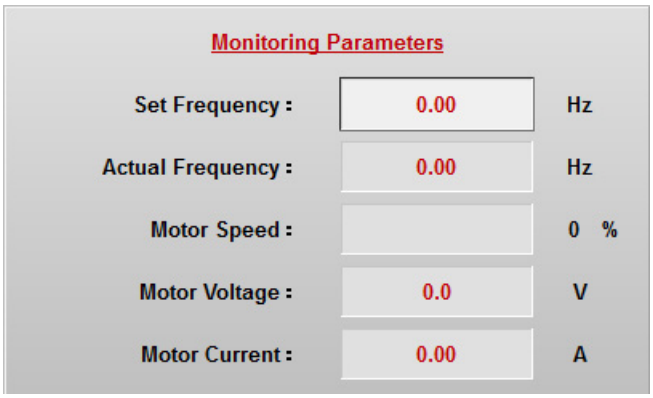
Operation Bar

Table 6 - Operation Bar Buttons

Start	Starts the drive only if no fault is found during self-test at startup; otherwise, this button is invalid
Accel	Increases the frequency by the set step
Decel	Decreases the frequency by the set step
Stop	Stop output of the drive
Reset(1)	Resets the drive (under fault conditions) once

(1) The drive must not be running to complete this operation.

Setup and Monitor Box



The set frequency field is the only one that is user-configurable. See Set Frequency (Hz) for instruction on how to set the frequency.

Table 7 - Monitoring Parameters

Set Frequency	Frequency set for the drive (Hz)
Actual Frequency	Actual frequency of the drive (Hz)
Motor Speed	Speed of the motor (%)
Motor Voltage	Voltage of the motor stator (V)
Motor Current	Current of the motor stator (A)

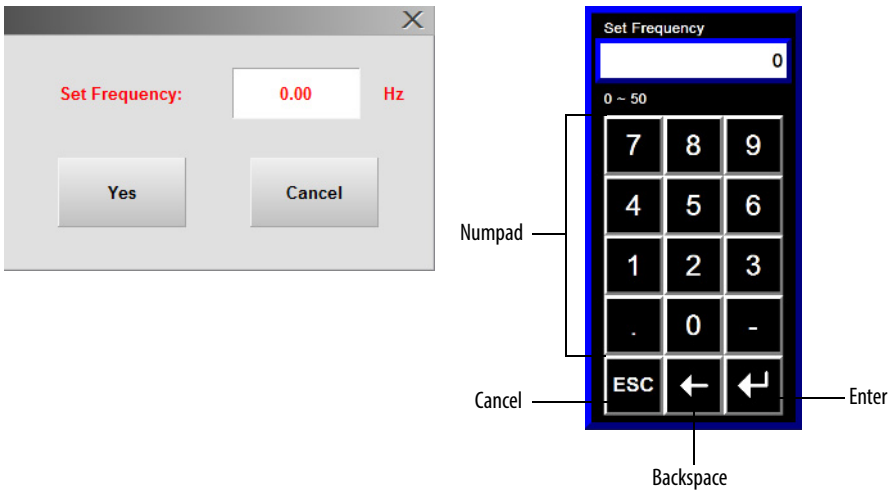
Main Interface Controls

From the Main Interface screen, you can:

Set Frequency (Hz)

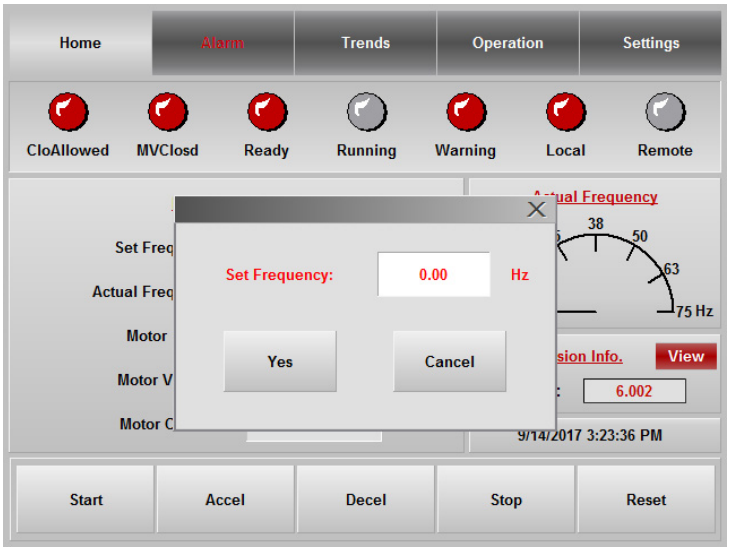
1. Press the **Set Frequency:** input field.

2. Press the Set Freq: input field.



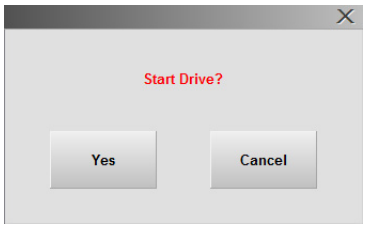
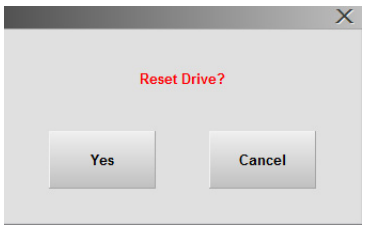
3. Enter desired frequency and press  .

4. Press Yes to accept or Cancel to cancel.



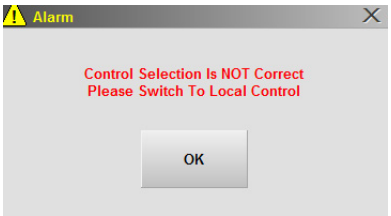
Drive Operation Controls

Press the desired Drive Operation Control button, and Yes to accept or Cancel to cancel.

Start	
Accel	
Decel	
Stop	
Reset	

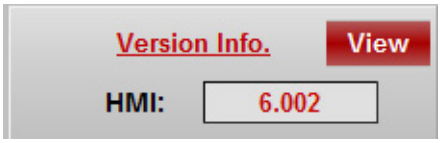
ATTENTION: Drive Operation Controls will only function if using Local Control, otherwise the following dialog appears.

The Stop command will function regardless of which control method is active.

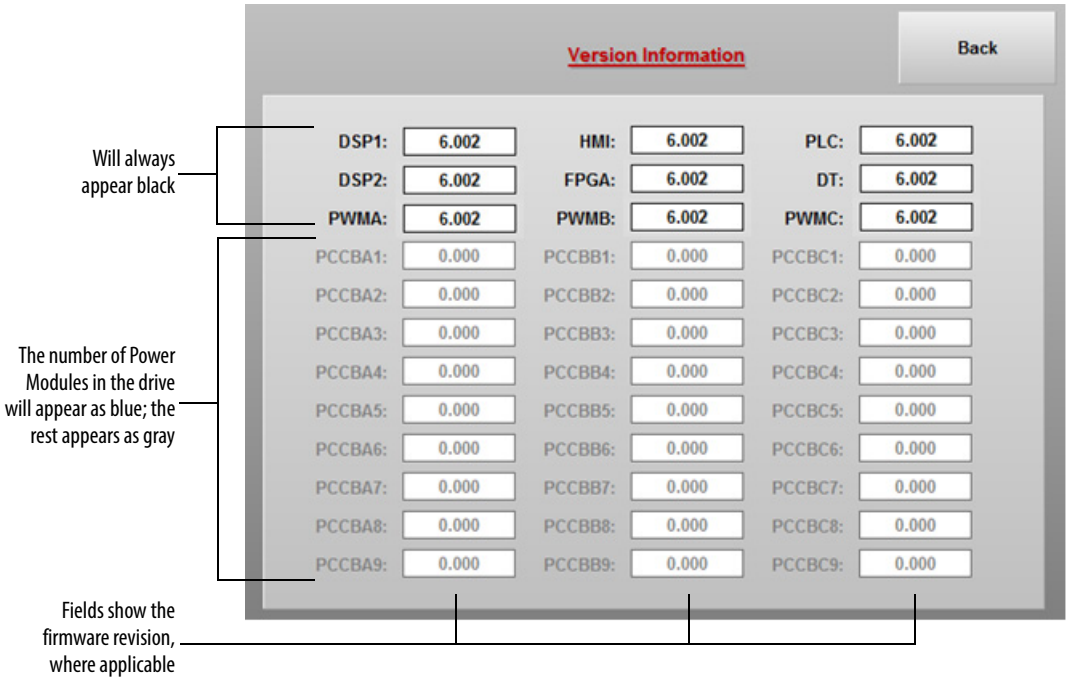


View Version Information

Press **View** under **Version Info.** to view the currently installed Firmware.



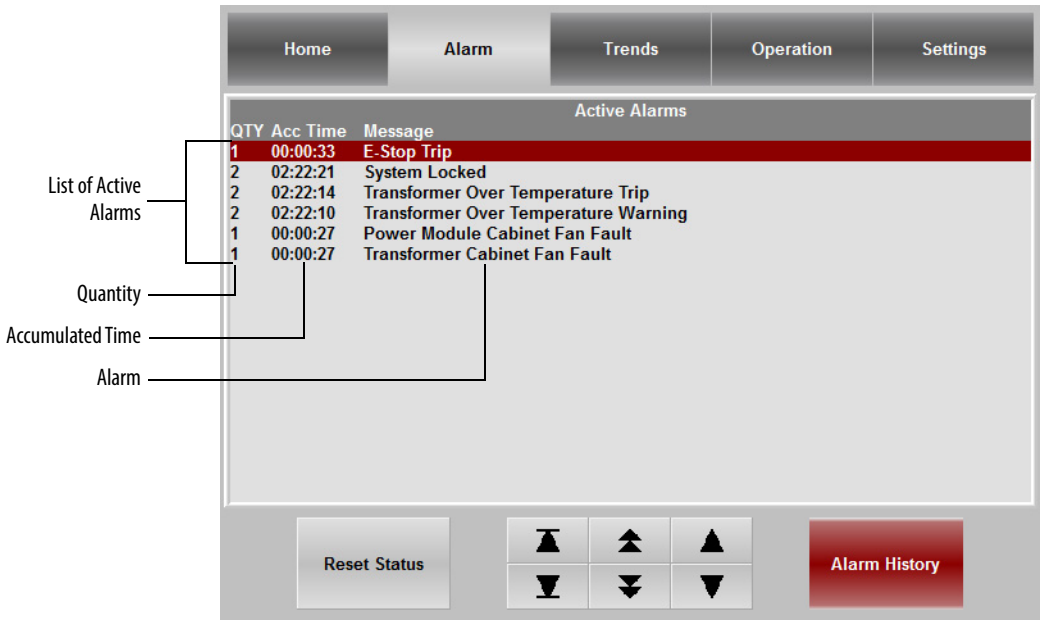
The Version Information screen shows the most current firmware that is installed for the applicable devices.



Alarm

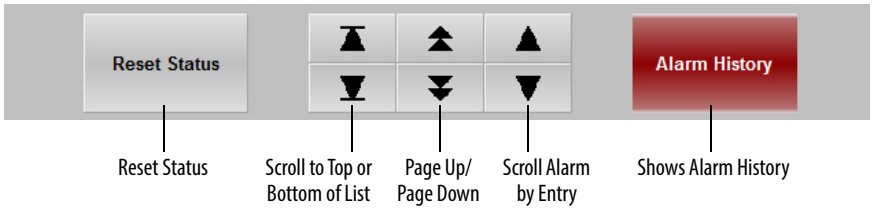
If the drive encounters and alarm or warnings, Alarm will blink, indicating an active alarm.

Press the Alarm button in the Top Menu Bar to see the active alarms.



QTY	How many times the alarm has occurred
Acc Time	Time that has elapsed since the alarm
Message	Description of the warning or fault

Active Alarms Controls

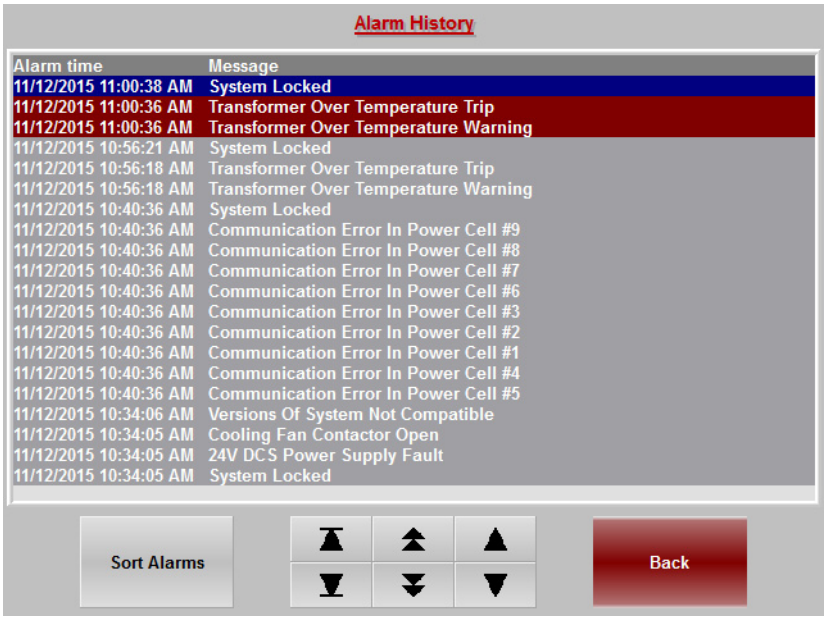


Reset Status

Reset Status will reset just the quantity and accumulated time of the alarms. This function does not reset the drive.

Alarm History

Press Alarm History to see a detailed listed of all warnings and faults on the drive. The controls to scroll through the alarms are the same.



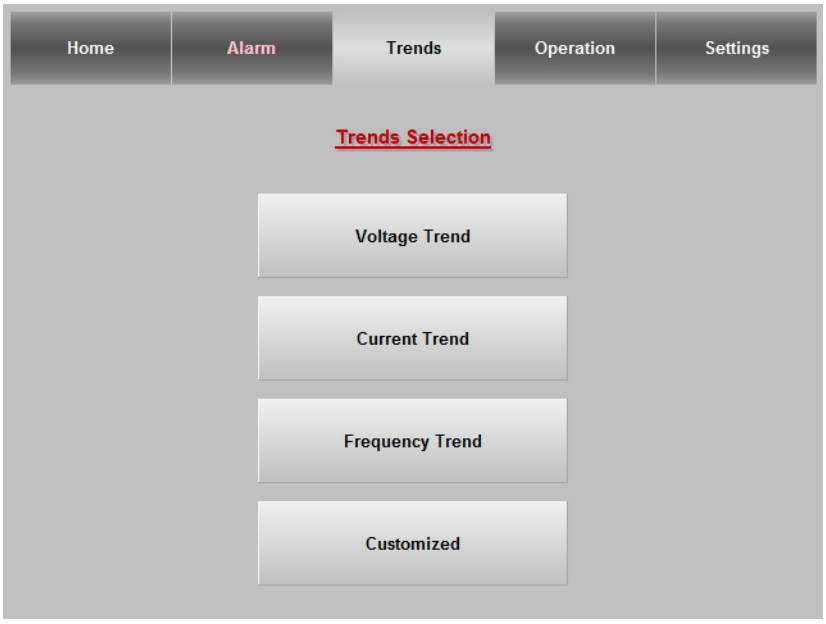
Sort Alarms

Press Sort Alarms once to sort once to sort by time. Press again to sort by message.

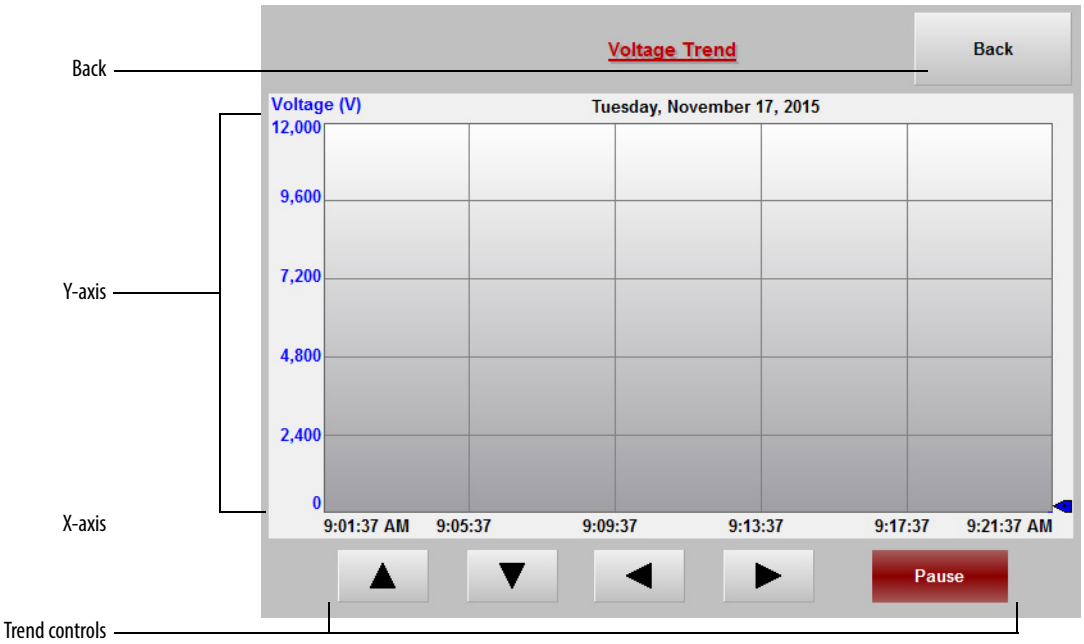
TIP Current alarms appear as red; past alarms appear as gray.

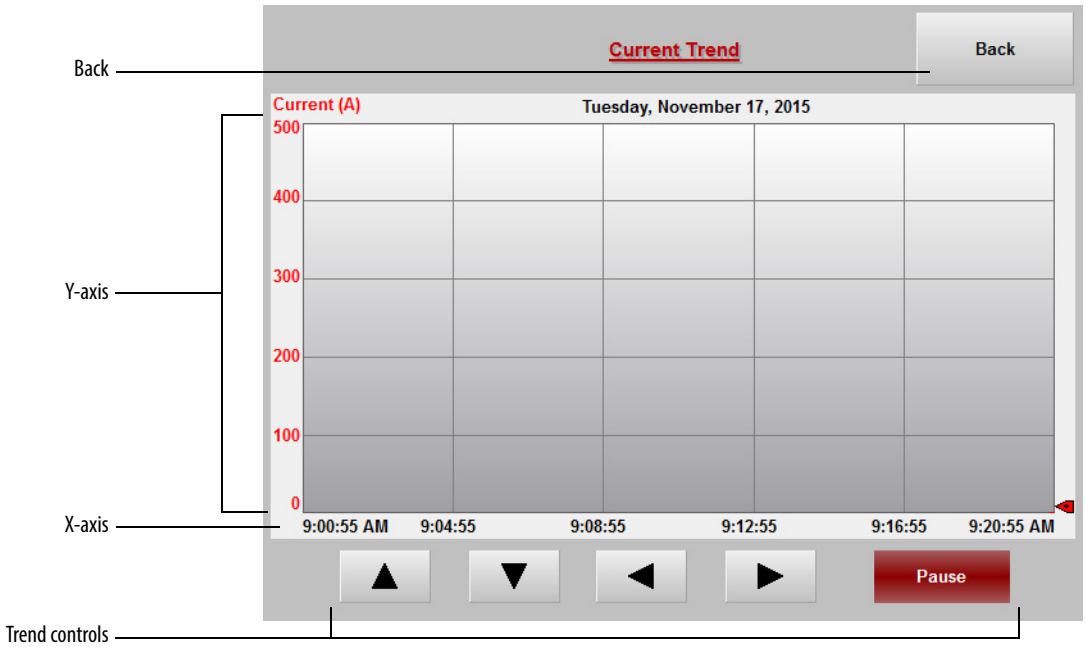
Trends

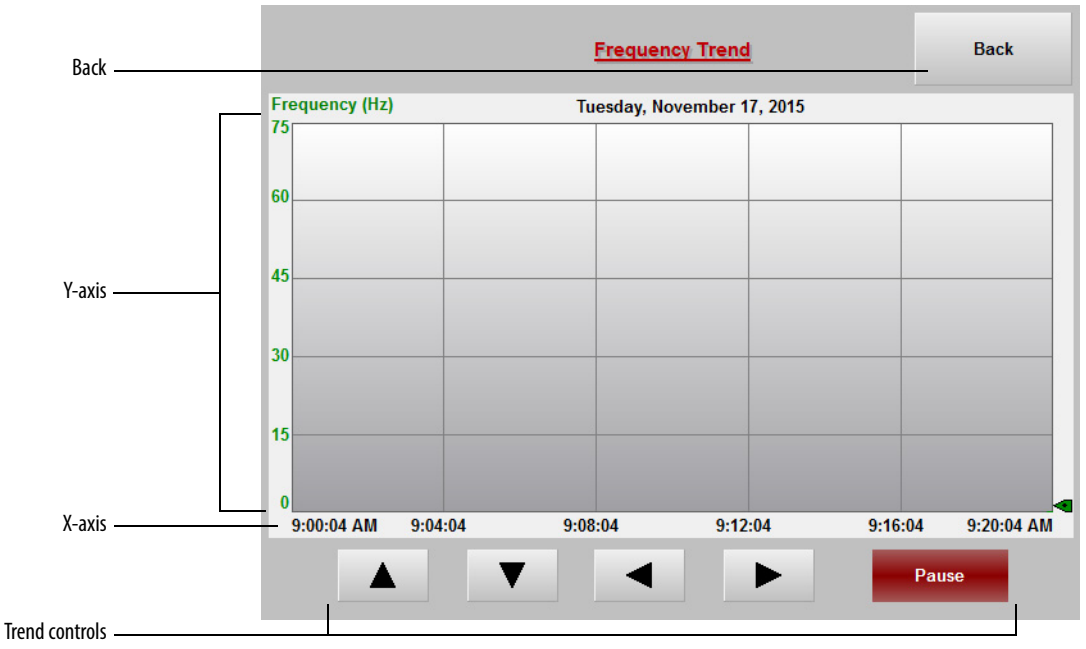
There are four different trending options, Voltage, Current, Frequency, and Customized. Press any button to view the trends.

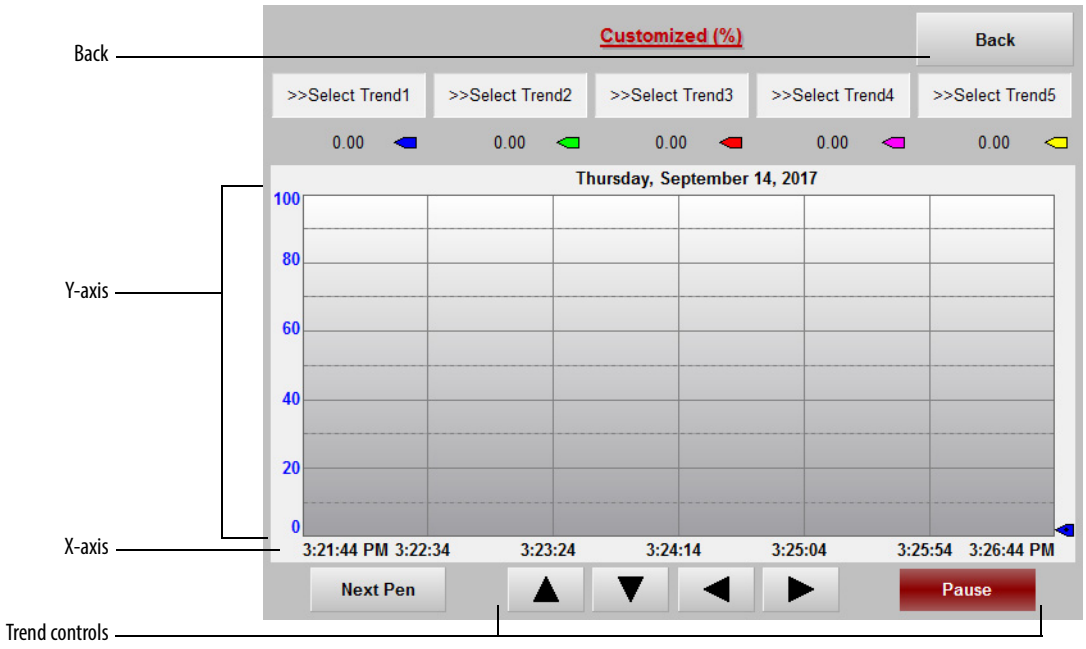


You can view Voltage, Current, and Frequency trends, or create up to five of your own customized trends. Voltage is measured in volts, Current in amps, and Frequency in Hz.

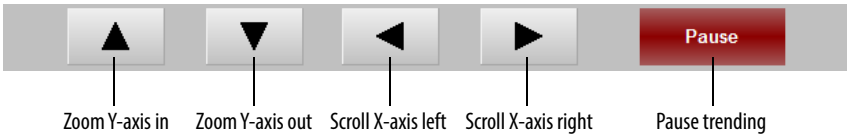



Back
Y-axis
X-axis
Trend controls
Current Trend
Back
Current (A)
Tuesday, November 17, 2015
500
400
300
200
100
0
9:00:55 AM
9:04:55
9:08:55
9:12:55
9:16:55
9:20:55 AM
Pause


Back
Y-axis
X-axis
Trend controls
Frequency Trend
Back
Frequency (Hz)
Tuesday, November 17, 2015
75
60
45
30
15
0
9:00:04 AM
9:04:04
9:08:04
9:12:04
9:16:04
9:20:04 AM
Pause

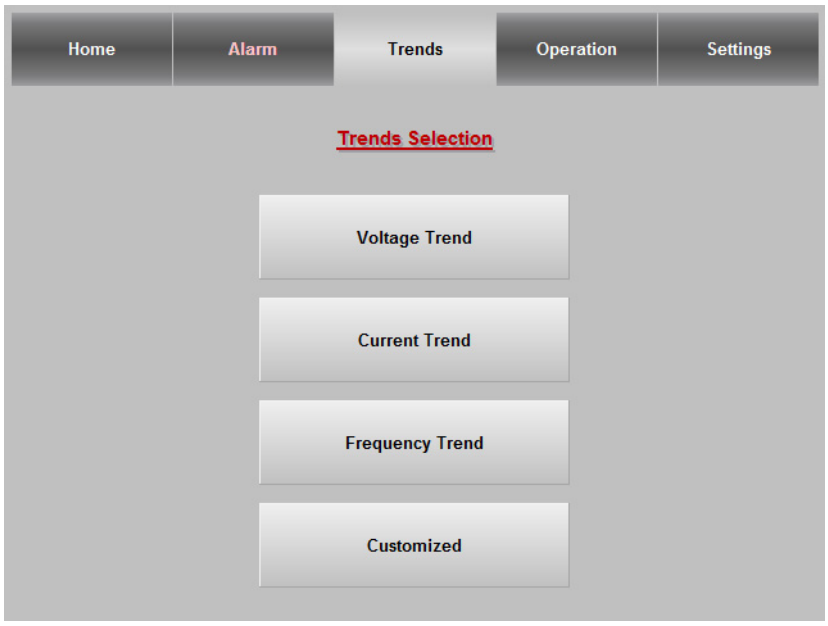


The trend controls are the same for all four screens.



View Voltage, Current, or Frequency Trends

1. From the Main Interface screen, press Trends.
2. Press Voltage Trend, Current Trend, or Frequency Trend in the **Trends Selection** screen.



3. Use the ▲ and ▼ buttons to zoom in or out.

   Press the ◀ and ▶ buttons to scroll.

   TIP The time that is shown in the X-axis captures 20 minutes. Scrolling left or right will scroll in 10 minute increments.

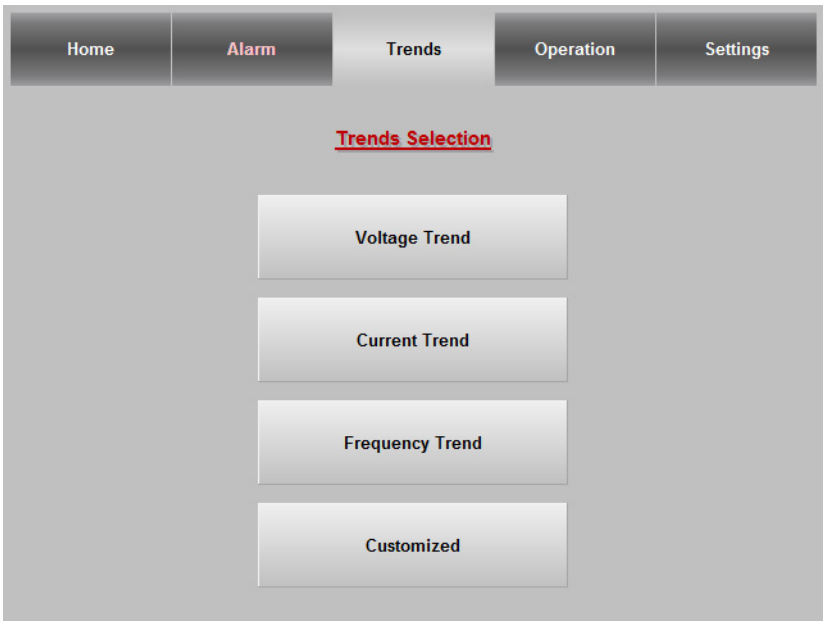
4. Press Pause to pause the trend capture.
5. Press Back to return to the **Trends Selection** screen.

Customize a Trend

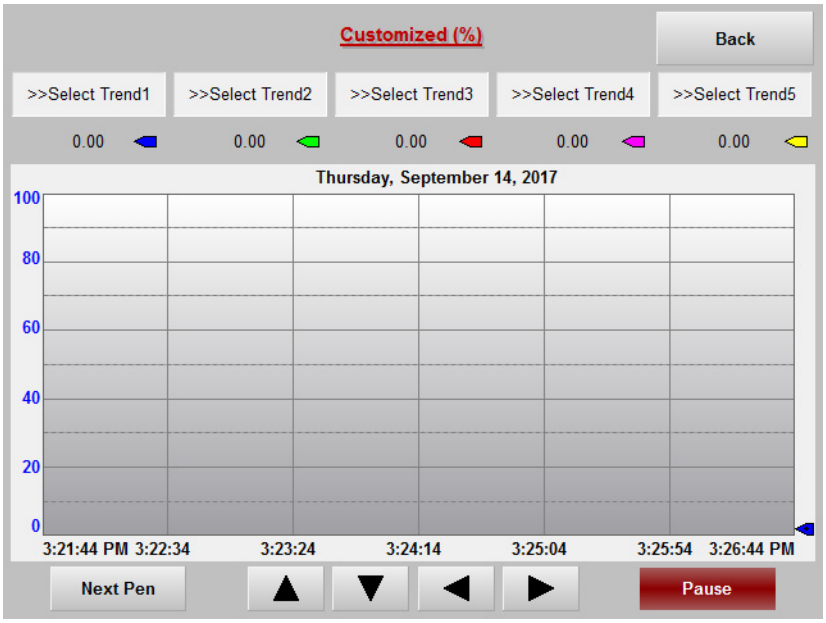
IMPORTANT You can customize up to five trends, however these trends will not be saved.

1. From the Main Interface screen, press Trends.

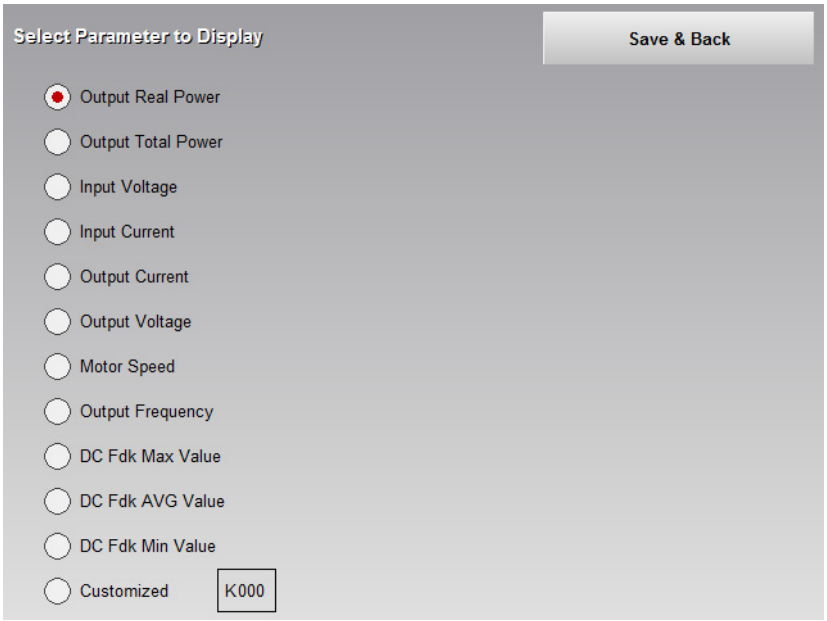
2. Press Customized in the **Trends Selection** screen.



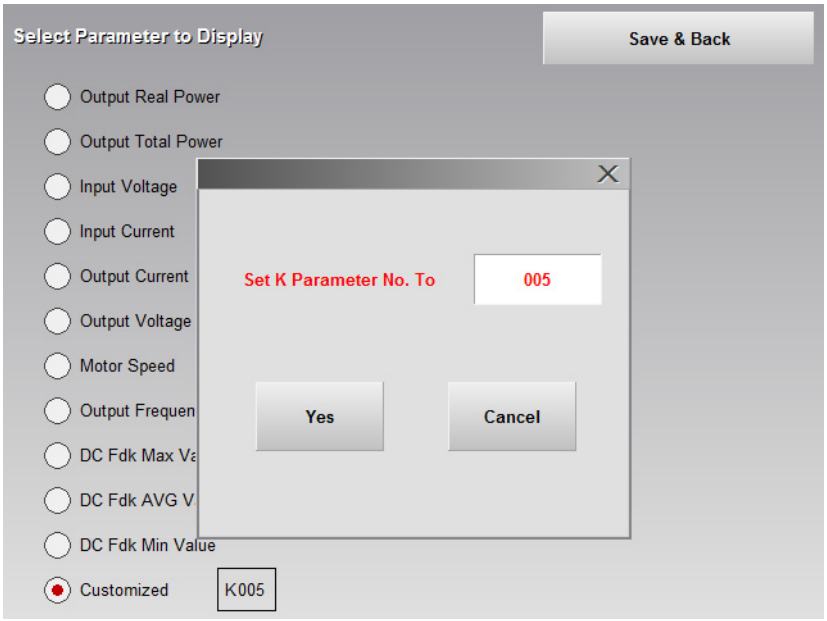
3. Press >>Select Trend1 in the **Customized (%)** screen.



4. Select the parameter that you want to display from the list.



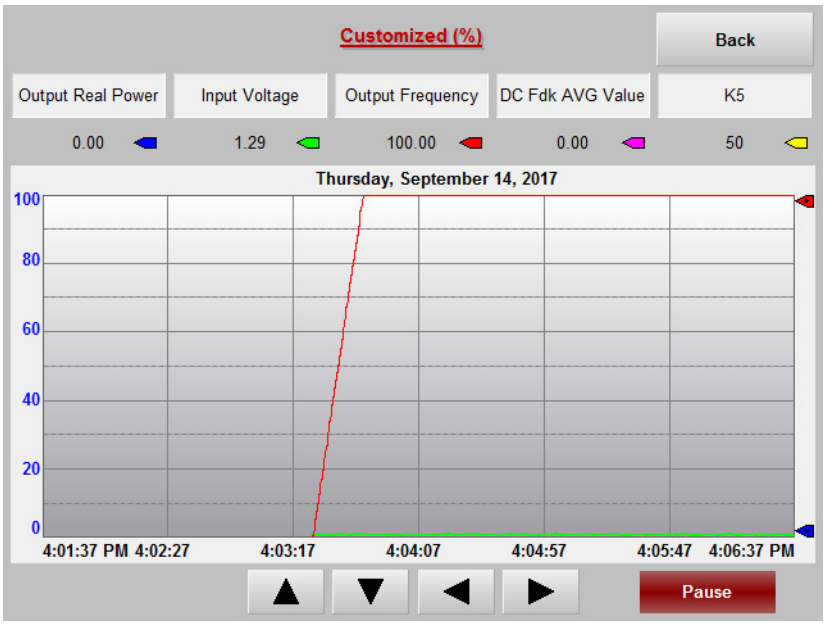
You can also select a K parameter to display.



IMPORTANT If a parameter is selected, the trend is displayed in percentage (%). If a K parameter is selected, the trend displays the actual value.

5. Press Save & Back to return to the **Customized (%)** screen.

An example of a Customized Trend is shown below.



6. Use the ▲ and ▼ buttons to zoom in or out.

   Press the ◀ and ▶ buttons to scroll.

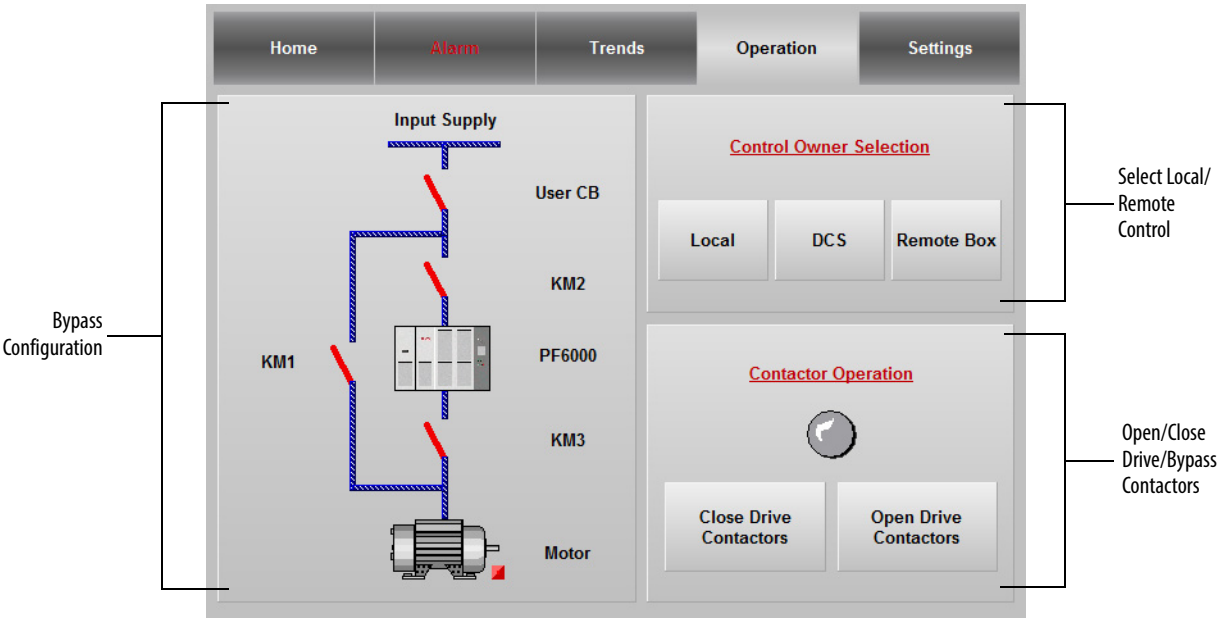
   TIP The time that is shown in the X-axis captures 20 minutes. Scrolling left or right will scroll in 10 minute increments.

7. Press **Pause** to pause the trend capture.

8. Press **Back** to return to the **Trends Selection** screen.

Operation

The Operation interface displays the bypass mode, control owner selection, and contactor operation.

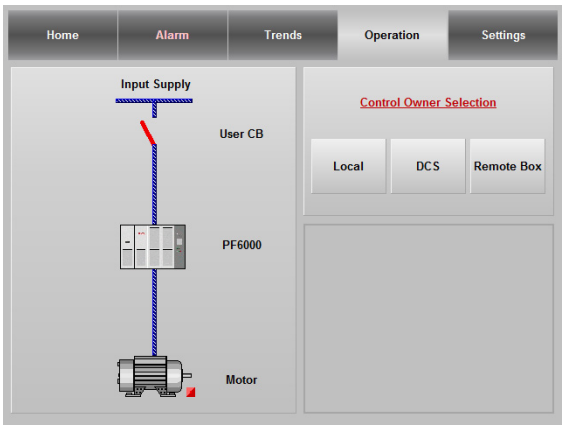


In this screen, you can:

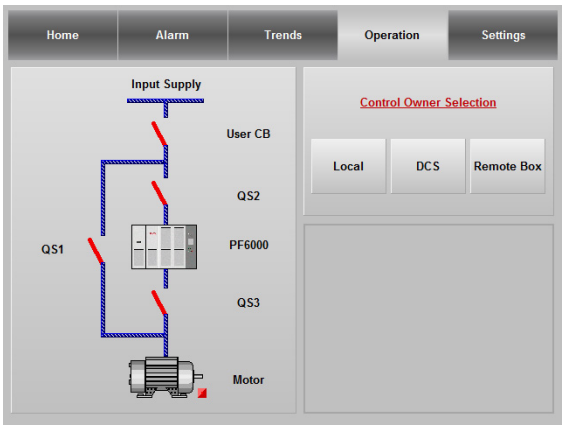
Confirm Bypass Mode

1. Press Operation from the Main Interface screen.
2. Confirm that the Bypass Configuration matches one of the three **Input Supply** graphics.

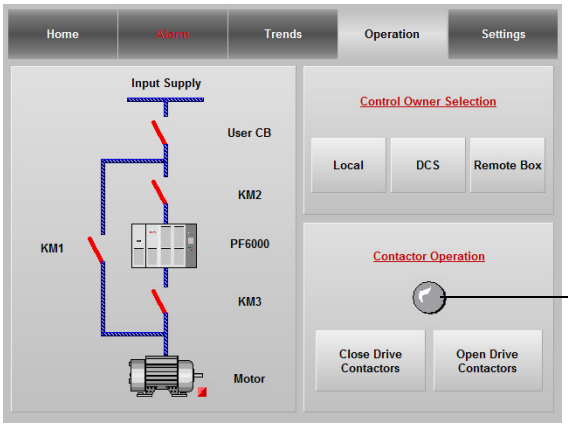
No Bypass Cabinet



Manual Bypass Cabinet



Automatic Bypass Cabinet

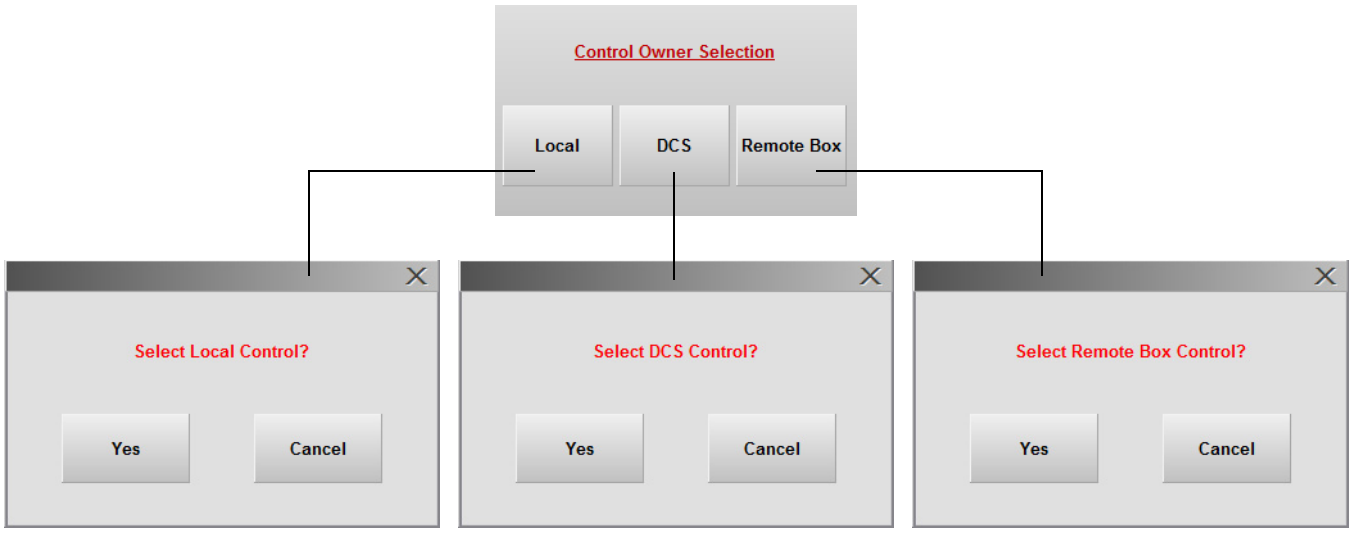


The Contactor Operation selection appears when Automatic Bypass is selected

3. To change the Bypass Mode, set parameter P484.

Choose Local/Remote Operation

1. Press Operation from the Main Interface screen.
2. Under **Control Owner Selection**, press either Local, DCS, or Remote Box.
3. Select Yes to confirm in the **Select Local Control?**, **Select DCS Control?**, or **Select Remote Box Control?** dialog box.

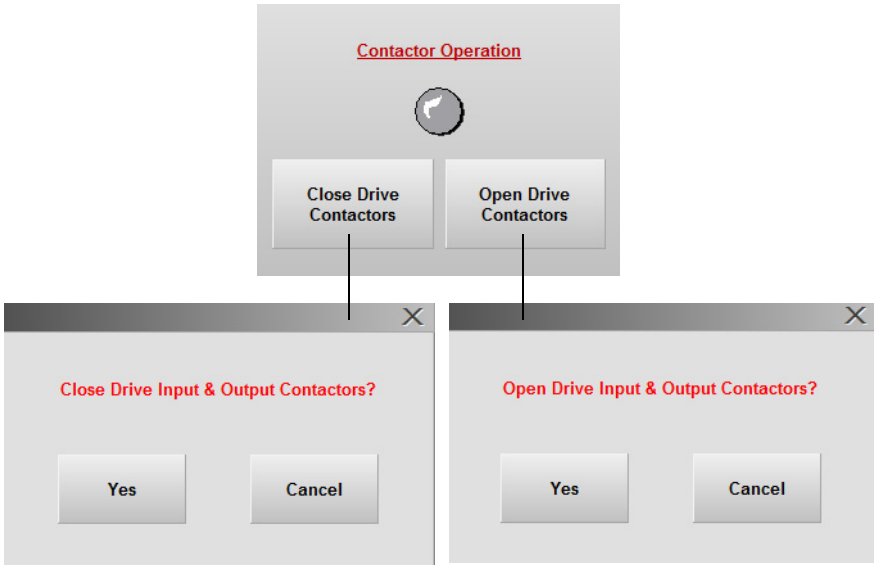


ATTENTION: Changing the Control Owner Selection while the drive is running may lead to personal injury and/or equipment damage.

Open/Close Drive Input and Output Contactors

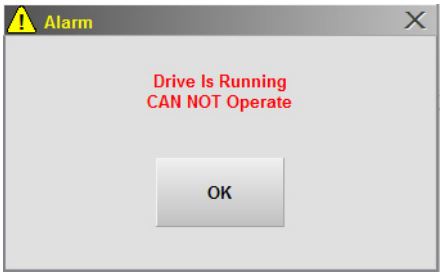
IMPORTANT Turn the 2-position on the selector switch on the front of the LV cabinet to the DCS position.

1. Under **Contactor Operation**, press either Close Drive Contactors or Open Drive Contactors.
2. Select Yes to confirm in the **Close Drive Input & Output Contactors?** or **Open Drive Input & Output Contactors?** dialog box.



ATTENTION: Operations in this graphic can only operate while on local control.

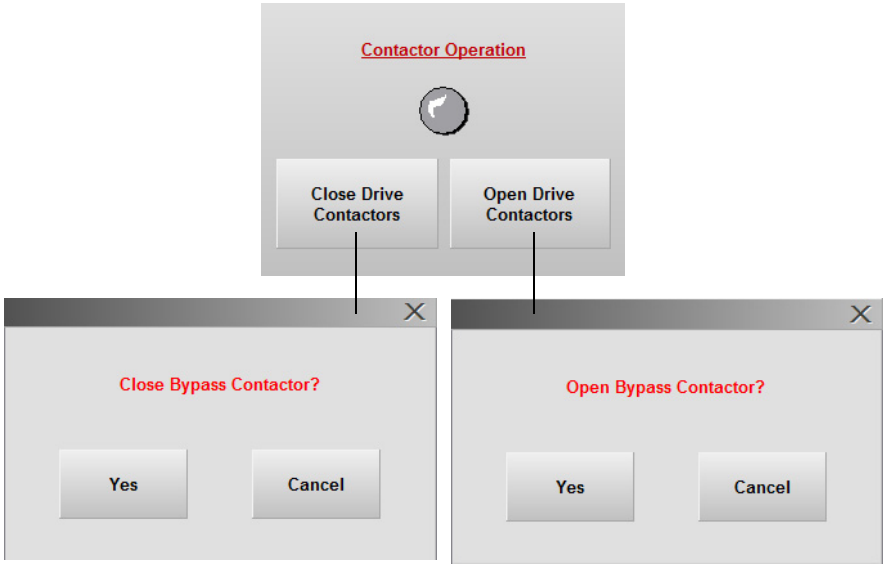
ATTENTION: This operation can only operate while drive is not running.



Open/Close Bypass Contactors

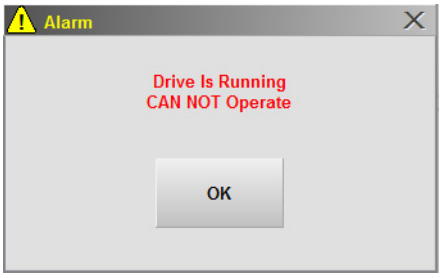
IMPORTANT Turn the 3-position on the selector switch on the front of the LV cabinet to the Bypass position.

1. Under **Contactor Operation**, press either Close Bypass Contactor or Open Bypass Contactor.
2. Select Yes to confirm in the **Close Bypass Contactors?** or **Open Bypass Contactors?** dialog box.



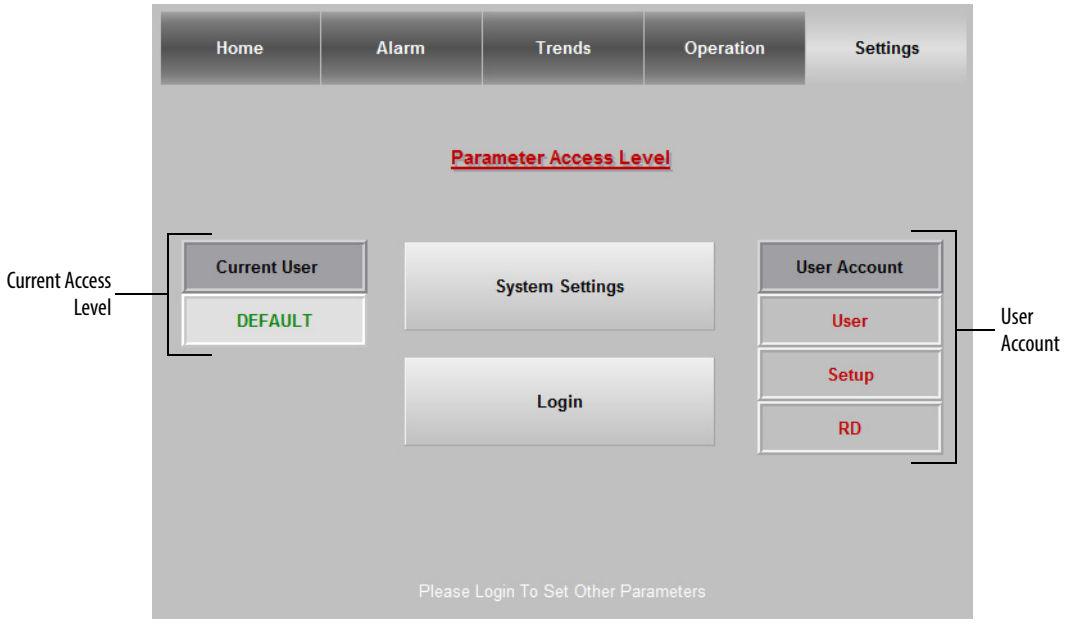
ATTENTION: Operations in this graphic can only operate while on local control.

ATTENTION: This operation can only operate while drive is not running.



Settings

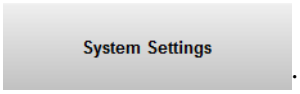
The Settings screen is where you can access and modify parameters or change the system language.

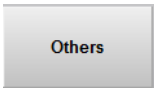


System Settings	Select Language
User Settings	View or modify User-level parameter settings
Setup Settings	View or modify Setup-level parameters settings
R&D Settings	For use by authorized Rockwell Automation personnel only.

System Settings

Change the HMI language and view the bypass status under System Settings.

1. Press 

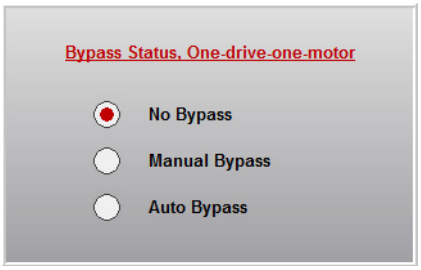
.
2. Press 

to select other language from the Languages screen.

3. Select the language that you want, then press 

to return.

4. The Bypass Status windows shows the current bypass mode setting.

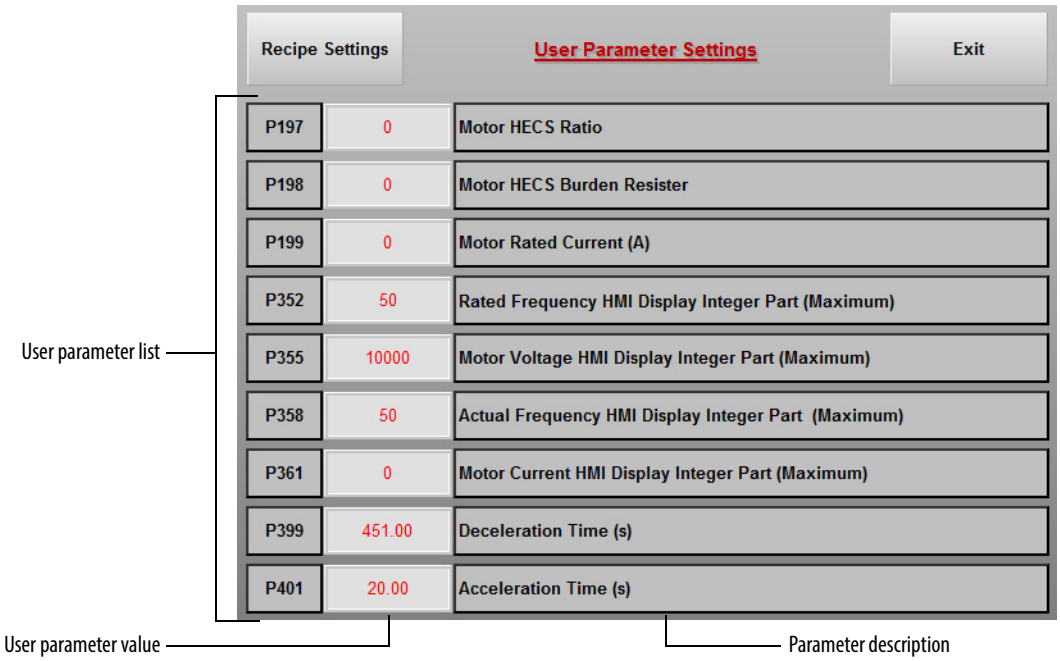


5. To change the bypass mode setting, modify parameter P484.

6. Press RETURN to accept.

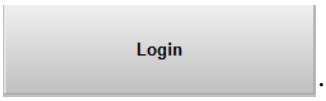
User Parameter Settings

You can access, view, or change the user parameters in the **User Parameter Settings** screen.

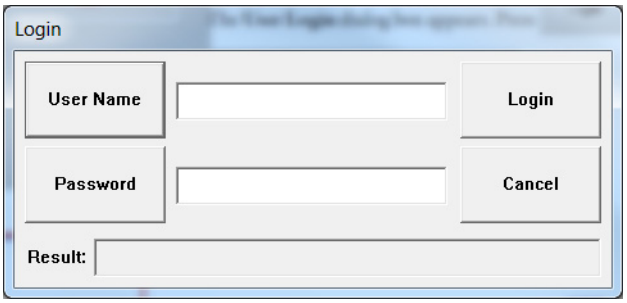


Change User Parameters

To change the user parameters, you must first log in to the User Access level by doing the following:

1. In the Settings screen, press 

.
The **Login** dialog box appears.



2. Enter the User Name and Password details.

   Press 

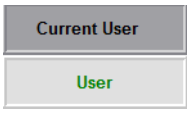
to enter the user name. Press 
when finished.

   Press 

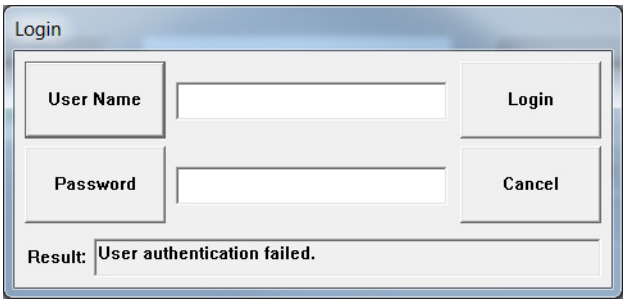
to enter the password. Press 
when finished.

3. Press 

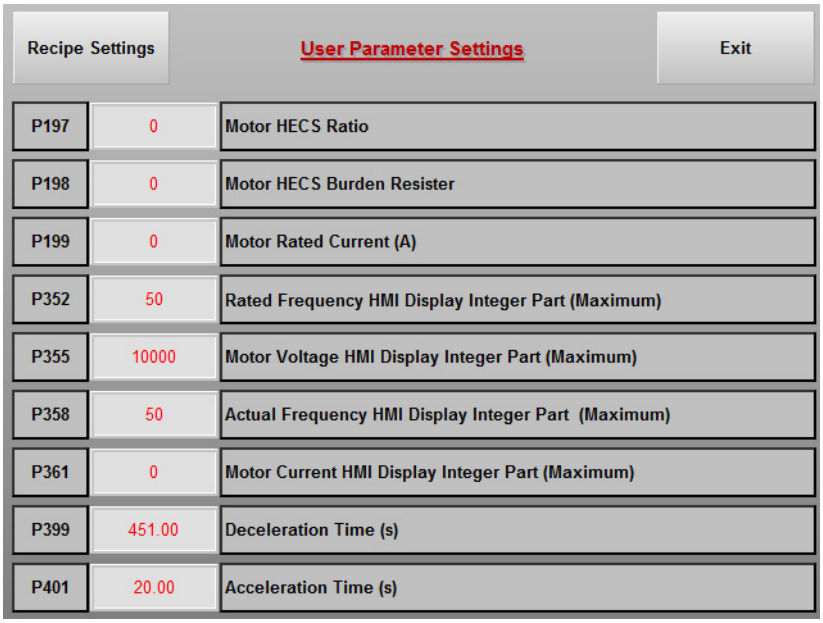
to login.
4. If the login was successful, the Current User will show as User and the **User Parameter Settings** screen is displayed automatically.



If the login failed, the Login dialog is shown again.

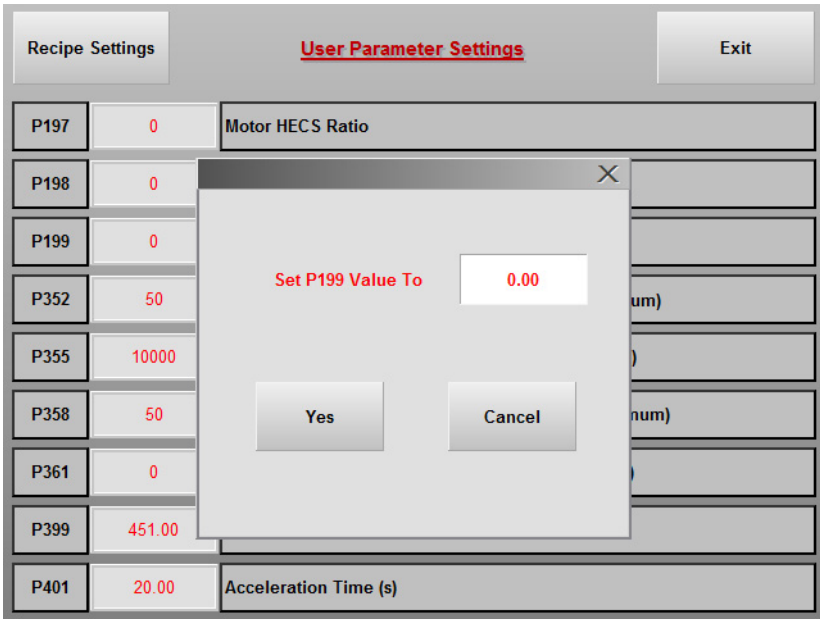


In the **User Parameters Settings** screen, the user parameters automatically refresh.

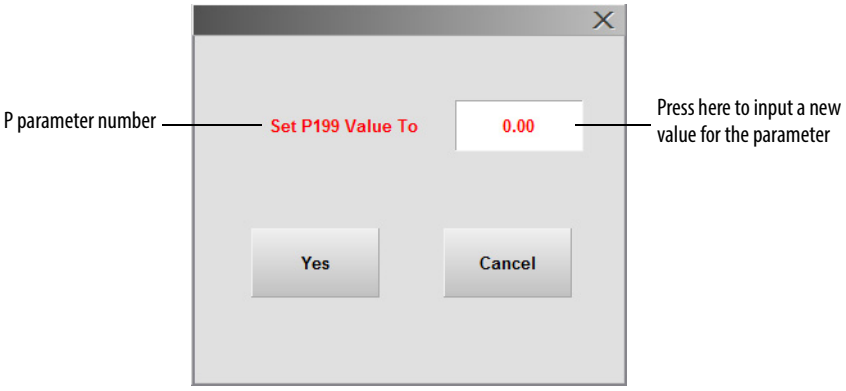


After you have logged in to the User Access level, you can change the parameter value by doing the following:

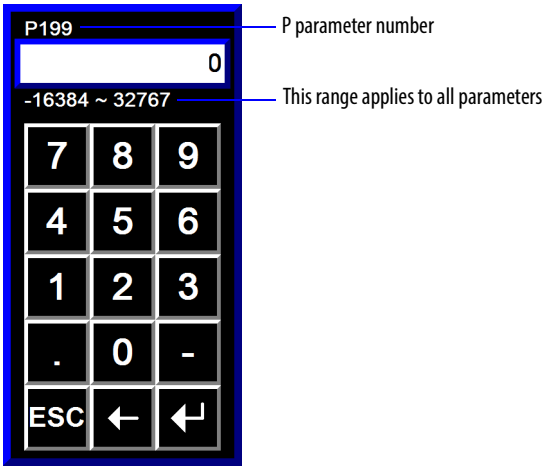
1. Press the parameter number that you want to change.
   A dialog box appears.



2. Press the parameter input field to change the parameter value.



Use the keypad to enter a new value for the parameter.



3. Press Yes to confirm the new value.

Press Exit to return to the **Parameter Access Level** screen.

TIP User parameter access will logout when you exit User Settings.

Parameters and Function Codes

For detailed descriptions on the parameters and alarms that are described in this chapter, see the PowerFlex 6000 Medium Voltage Variable Frequency Drive Firmware, Parameters, and Troubleshooting Manual, publication 6000-TD004.

P Parameters

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P007	Number of Power Cells Per Phase	0	9	3	3	3	3	4	4	5	6	6	6	8	9		Offline		Y	Y
P008	Motor Rotation Direction Under Local Control 0 = Reverse 1 = Forward	0	1	1	1	1	1	1	1	1	1	1	1	1	1		Offline		Y	Y
P009	Motor Rotation Direction Command Selection 0 = Local 1 = DCS	0	1	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P011	Power Cell DC Bus Rated Voltage	50	1300	650	650	920	920	848	848	976	920	920	976	976	976	V	Offline		Y	Y
P012	Motor Rated Voltage	0	32767	2300	2400	3000	3300	4000	4160	6000	6300	6600	6900	10000	11000	V	Offline		Y	Y
P013	Motor Rated Power	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	kW	Offline		Y	Y
P014	Motor Rated Speed	0	5000	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	RPM	Offline		Y	Y
P015	Motor Rated Power Factor	0	100	87.99	87.99	87.99	87.99	87.99	87.99	87.99	87.99	87.99	87.99	87.99	87.99	%	Offline		Y	Y
P017	Number of Motor Pole Pairs	0	100	2	2	2	2	2	2	2	2	2	2	2	2		Offline			Y
P019	Encoder Resolution	0	4096	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024		Offline			Y
P024	Stop Method 0 = Ramp Down 1 = Coast Stop	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P025	Flux Reduction Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P030	Powercell Fault Trip Signal Mask	-32768	32767	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		Offline		Y	Y
P031	System Fault Trip Signal Mask	-32768	32767	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		Offline		Y	Y
P034	Current Stability Loop Filter Time	0	32767	63	63	63	63	63	63	63	63	63	63	63	63		On/Off			Y
P035	Current Stability Loop Frequency Range1 Output Scaling Factor	0	100	15	15	15	15	15	15	15	15	15	15	15	15		On/Off		Y	Y
P036	Current Stability Loop Output Upper Limit	0	100	10	10	10	10	10	10	10	10	10	10	10	10		On/Off			Y
P037	Current Stability Loop Output Lower Limit	-100	100	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10		On/Off			Y
P038	Current Stability Loop Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P039	Current Stability Loop Enable Frequency Range1 Upper limit	0	100	30	30	30	30	30	30	30	30	30	30	30	30		On/Off			Y
P040	Safe Start Condition 0 = Zero Frequency Command Required 1 = Frequency Command Allowed	0	1	1	1	1	1	1	1	1	1	1	1	1	1		Offline		Y	Y
P041	Power Cell Bypass Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P042	Power Cell Bypass Delay After Power Cell Bypassed	20	16000	500	500	500	500	500	500	500	500	500	500	500	500	ms	On/Off			Y
P043	Power Cell Bypass Upper Limit For Bypassed Feedback Time	30	500	100	100	100	100	100	100	100	100	100	100	100	100	ms	On/Off			Y
P044	Power Cell Bypass Fault Simulation Power Cell Count	0	3	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P045	Load Loss Control Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P046	Load Loss Enable Frequency	0	100	20	20	20	20	20	20	20	20	20	20	20	20	%	On/Off		Y	Y
P047	Load Loss Control Differential Scaling	0	2000	8	8	8	8	8	8	8	8	8	8	8	8	%	On/Off			Y
P048	Load Loss Frequency Compensation Upper Limit	0	5	5	5	5	5	5	5	5	5	5	5	5	5	%	On/Off		Y	Y
P049	Load Loss Control Scaling Factor	0	2000	0	0	0	0	0	0	0	0	0	0	0	0	%	On/Off			Y
P050	Load Loss Control Integral Time	0	100	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P051	Load Loss Control Filter Time	0	200	100	100	100	100	100	100	100	100	100	100	100	100	ms	On/Off			Y
P052	Load Loss Enable Current Threshold	0	100	10	10	10	10	10	10	10	10	10	10	10	10	%	On/Off			Y
P053	Load Loss Control Exit Delay	0	16000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	ms	On/Off			Y
P057	Power Cell Bypass Upper Limit Time For Over Temperature	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	s	On/Off			Y
P058	Power Cell Bypass Phase A Cell Number For Simulation	0	9	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P059	Power Cell Bypass Phase B Cell Number For Simulation	0	18	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P060	Power Cell Bypass Phase C Cell Number For Simulation	0	27	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P061	Power Cell Bypass Fault Simulation	-32768	32767	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P065	Power Cell Bypass Enable Frequency Range Lower limit	0.00	19.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		On/Off			Y
P066	Power Cell Bypass Restart Enable After Power Cell Bypassed 0 = Disable 1 = Enable	0	1	1	1	1	1	1	1	1	1	1	1	1	1		Offline			Y
P068	One Phase Lost Filter Time	5	1000	30	30	30	30	30	30	30	30	30	30	30	30	10 ms	On/Off		Y	Y
P069	Current Stability Loop Enable Frequency Range2 Upper Limit	0	100	80	80	80	80	80	80	80	80	80	80	80	80		On/Off			Y
P070	Current Stability Loop Frequency Range2 Output Scaling Factor	0	100	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P071	Current Stability Loop Frequency Range3 Output Scaling Factor	0	100	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P072	Current Stability Loop Enable Delay	0	163	10	10	10	10	10	10	10	10	10	10	10	10		On/Off	Y	Y	Y
P073	Input Voltage Loss Filter Time	0	1000	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P078	Power Cell Reactivation Time Upper Limit	0	200	100	100	100	100	100	100	100	100	100	100	100	100	ms	On/Off			Y
P079	VFD Minimum Overload Current	0.00	399.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	%	On/Off		Y	Y
P080	VFD Overload Current	0.00	399.99	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	%	On/Off		Y	Y
P081	VFD Overload Time	0	32767	60	60	60	60	60	60	60	60	60	60	60	60	s	On/Off		Y	Y
P082	VFD Overload Cycle Time	0	32767	600	600	600	600	600	600	600	600	600	600	600	600	s	On/Off		Y	Y
P087	Switch Frequency Setting Enable Code 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		Offline			Y
P088	Switch Frequency Setting 0 = 600 Hz 1 = 1200 Hz	0	1	0	0	0	0	0	0	0	0	0	0	0	0		Offline			Y
P089	Skip Frequency Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P090	Skip Frequency 1 Lower Limit	0	75	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P091	Skip Frequency 1 Upper Limit	0	75	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P092	Skip Frequency 2 Lower Limit	0	75	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P093	Skip Frequency 3 Upper Limit	0	75	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P094	Fan Control Mode	0	2	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P095	Fan Control Group #1 Fan Number	0	10	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P096	Fan Control Group #2 Fan Number	0	10	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P097	Fan Control Group #3 Fan Number	0	10	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P098	Fan Control Group #4 Fan Number	0	10	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P099	Fan Control Main Cooling Fan Cycle Time	0	14400	720	720	720	720	720	720	720	720	720	720	720	720	hr	On/Off		Y	Y
P100	Fan Control Redundant Fan Working Time	0	14400	1	1	1	1	1	1	1	1	1	1	1	1	hr	On/Off		Y	Y
P101	Fan Control Fan Feedback Delay	0	1000	200	200	200	200	200	200	200	200	200	200	200	200	100 ms	On/Off		Y	Y
P102	Fan Control Fan Stop Delay	0	10	0	0	0	0	0	0	0	0	0	0	0	0	m	On/Off		Y	Y
P103	Pre-charge Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P104	Pre-charge Feedback Delay	0	100	20	20	20	20	20	20	20	20	20	20	20	20	100 ms	On/Off			Y
P105	Pre-charge DC Bus Threshold	0	100	80	80	80	80	80	80	80	80	80	80	80	80	%	On/Off			Y
P106	Fan Control Transformer Cabinet Fan Quantity Upper Limit	0	16	10	10	10	10	10	10	10	10	10	10	10	10		On/Off		Y	Y
P107	VFD Overload Current Offset	0.00	399.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	%	On/Off			Y
P108	Motor Overload Current Offset	0.00	399.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	%	On/Off			Y
P110	Heating Current Threshold	0.00	399.99	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	A-Frame 105.00 H-Frame, B-Frame 110.00	%	On/Off			Y
P111	Slip Compensation Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P113	Flying Start-Initial Output Voltage	0	100	8	8	8	8	8	8	8	8	8	8	8	8	%	On/Off		Y	Y
P114	Flying Start-Current Comparison Delay For Motor Speed Search	0	5000	500	500	500	500	500	500	500	500	500	500	500	500	ms	On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P115	Flying Start-Current Threshold For Successful Motor Speed Search	0.00	100.00	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99	4.99		On/Off		Y	Y
P116	Fan Control TX Cabinet Fan Fault Trip Delay	1	60	30	30	30	30	30	30	30	30	30	30	30	30	m	On/Off		Y	Y
P117	Fan Control Filter Cabinet Fan Fault Trip Delay	1	60	30	30	30	30	30	30	30	30	30	30	30	30	m	On/Off		Y	Y
P118	Pre-charge Max Time	2	20	6	6	6	6	6	6	6	6	6	6	6	6	s	On/Off		Y	Y
P119	Pre-charge Min Repeat Interval	5	60	5	5	5	5	5	5	5	5	5	5	5	5	m	On/Off		Y	Y
P120	Pre-charge Primary Voltage Threshold	0	100	80	80	80	80	80	80	80	80	80	80	80	80	%	On/Off			Y
P121	Motor Autotune Selection 0 = Manual Configuration 1 = Nameplate Calculation 2 = Static Autotune 3 = Rotating Autotune	0	3	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P122	Motor Autotune Delay	0	32767	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	ms	On/Off			Y
P123	Motor Autotune Filter Time	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off			Y
P124	Motor Autotune Current Id Kp	0.00	128.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		On/Off			Y
P125	Motor Autotune Current Id Ki	0.0	128.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		On/Off			Y
P126	Motor Autotune Current Iq Kp	0.00	128.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		On/Off			Y
P127	Motor Autotune Current Iq Ki	0.0	128.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		On/Off			Y
P128	Motor Autotune Id Feedback Error Valid	0.00	100.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	%	On/Off			Y
P129	Motor Autotune Lr/Lm	0	32767	10526	10526	10526	10526	10526	10526	10526	10526	10526	10526	10526	10526	*0.0001	On/Off		Y	Y
P130	Motor Autotune Id Reference	0.00	100.00	29.99	29.99	29.99	29.99	29.99	29.99	29.99	29.99	29.99	29.99	29.99	29.99		On/Off			Y
P131	Motor Autotune Iq Reference	0	100	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P132	Motor Autotune Time Limit	0	32767	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	m	On/Off			Y
P133	Current Limit Loop Kp	0.0	128.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3		On/Off			Y
P134	Current Limit Loop Ki	0.0	128.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		On/Off			Y
P135	Current Limit Loop Kd	0	12800	0	0	0	0	0	0	0	0	0	0	0	0	*0.001	On/Off			Y
P136	Motor Autotune Rs/Rr	0.00	327.67	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30		On/Off			Y
P137	Motor Rated Current	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	A	On/Off		Y	Y
P138	Motor Stator Resistance Rs	0	10	0	0	0	0	0	0	0	0	0	0	0	0	Ω	On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P139	Motor Magnetizing Current Id	0	100	30	30	30	30	30	30	30	30	30	30	30	30	%	On/Off		y	Y
P140	Motor Rotor Resistance Rr	0	10	0	0	0	0	0	0	0	0	0	0	0	0	Ω	On/Off		Y	Y
P141	Motor Magnetizing Inductance Lm	0.0	3276.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	mH	On/Off		Y	Y
P142	Motor Stator Leakage Inductance Lls	0.0	3276.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	mH	On/Off		Y	Y
P143	Motor Rotor Leakage Inductance Llr	0.0	3276.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	mH	On/Off		Y	Y
P145	System Fault B Trip Signal Mask	-32768	32767	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		Offline		Y	Y
P146	Line Rated Voltage	0	32767	2300	2400	3000	3300	4000	4160	6000	6300	6600	6900	10000	11000	V	On/Off		Y	Y
P147	Line Rated Frequency	0	32767	50	50	50	50	50	50	50	50	50	50	50	50	Hz	On/Off		Y	Y
P148	Transformer Rated Power	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	kVA	On/Off		Y	Y
P149	Transformer Short Circuit Impedance	0	100	5	5	5	5	5	5	5	5	5	5	5	5	%	On/Off		Y	Y
P151	Line Voltage Uab Scaling Factor	0.00	199.99	153.00	146.70	175.90	159.90	175.80	169.00	146.50	167.40	159.80	152.80	158.10	143.70	%	On/Off		Y	Y
P152	Line Voltage Ubc Scaling Factor	0.00	199.99	153.00	146.70	175.90	159.90	175.80	169.00	146.50	167.40	159.80	152.80	158.10	143.70	%	On/Off		Y	Y
P153	Line Voltage Ung Scaling Factor	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	%	On/Off		Y	Y
P154	Line Over Voltage Fault Threshold	0.00	199.99	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	115.00	%	On/Off		Y	Y
P155	Line Over Voltage Fault Delay	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P156	Line Under Voltage Warning Threshold	0	100	80	80	80	80	80	80	80	80	80	80	80	80	%	On/Off		Y	Y
P157	Line Under Voltage Warning Delay	0	32767	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	On/Off		Y	Y
P158	Line Neutral Over Voltage Warning Threshold	0.00	199.99	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	%	On/Off		Y	Y
P159	Line Neutral Over Voltage Warning Delay	0	32767	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	On/Off		Y	Y
P160	Line Neutral Over Voltage Fault Threshold	0.00	199.99	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	%	On/Off		Y	Y
P161	Line Neutral Over Voltage Fault Delay	0	32767	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	On/Off		Y	Y
P162	Line Voltage Positive Sequence Filter Time	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P163	Line Voltage Negative Sequence Filter Time	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P164	Line Voltage Negative Sequence Fault Threshold	0.00	199.99	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	%	On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P165	Line Voltage Negative Sequence Fault Delay	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P166	Line Voltage Phaser Sequence Reverse Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P168	Line Current Filter Time	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P169	Line Short Circuit Fault Threshold	0	400	180	180	180	180	180	180	180	180	180	180	180	180	%	On/Off		Y	Y
P170	Line Short Circuit Fault Delay	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P171	Line Current Phase A Scaling Factor	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	%	On/Off			Y
P172	Line Current Phase B Scaling Factor	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	%	On/Off			Y
P173	Line Current Phase C Scaling Factor	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	%	On/Off			Y
P174	Line Current Positive Sequence Filter Time	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P175	Line Current Negative Sequence Filter Time	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P176	Line Current Negative Sequence Fault Threshold	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	%	On/Off		Y	Y
P177	Line Current Negative Sequence Fault Delay	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P178	Motor Autotune Rs Upper Limit	0	100	50	50	50	50	50	50	50	50	50	50	50	50	%	On/Off			Y
P179	Motor Autotune Maximum Iq For No Load	0.00	399.99	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	%	On/Off			Y
P180	Pre-charge Resistor Short Circuit Fault Threshold	0	10	2	2	2	2	2	2	2	2	2	2	2	2	%	On/Off			Y
P181	Pre-charge Resistor Short Circuit Fault Delay	0	10000	500	500	500	500	500	500	500	500	500	500	500	500	ms	On/Off			Y
P182	Derating Function Enable 0 = Disable 1 = Enable	0	1	1	1	1	1	1	1	1	1	1	1	1	1		On/Off			
P183	Voltage Lower Threshold For Drive Derating Per Cooling Fan Input Voltage Drop	0	100	70	70	70	70	70	70	70	70	70	70	70	70		On/Off			
P184	Voltage Upper Threshold For Drive Derating Per Cooling Fan Input Voltage Drop	0	100	75	75	75	75	75	75	75	75	75	75	75	75		On/Off			

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P185	Drive Output Current Upper Limitation Per Cooling Fan Input Voltage Drop	0	100	76	76	76	76	76	76	76	76	76	76	76	76		On/Off			
P186	Drive Start Delay	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P187	Flying Start Voltage Threshold	0	100	3	3	3	3	3	3	3	3	3	3	3	3		On/Off		Y	Y
P195	Line CT Ratio	0	0	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P196	Line CT Burden Resistor	0	0	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P197	Motor HECS Ratio	0	9999.99	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00		Offline	Y	Y	Y
P198	Motor HECS Burden Resistor	0	19.99	15	15	15	15	15	15	15	15	15	15	15	15		Offline	Y	Y	Y
P199	Motor Rated Current	0	5000	40	40	40	40	40	40	40	40	40	40	40	40	A	Offline	Y	Y	Y
P200	Ia Motor Current Memory Address	0	500	13	13	13	13	13	13	13	13	13	13	13	13		On/Off			Y
P201	Motor Ia Scaling Factor	0.00	199.99	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00		On/Off			Y
P202	Ic Motor Current Memory Address	0	500	14	14	14	14	14	14	14	14	14	14	14	14		On/Off			Y
P203	Motor Ic Scaling Factor	0.00	199.99	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00		On/Off			Y
P204	Motor Uab Voltage Address	0	500	11	11	11	11	11	11	11	11	11	11	11	11		On/Off			Y
P205	Motor Uab Voltage Scaling Factor	0.00	199.99	153.00	146.70	175.90	159.90	175.80	169.00	146.50	167.40	159.80	152.80	158.10	143.70		On/Off		Y	Y
P206	Motor Uac Voltage Scaling Factor	0.00	199.99	153.00	146.70	175.90	159.90	175.80	169.00	146.50	167.40	159.80	152.80	158.10	143.70		On/Off		Y	Y
P208	Phase Over Current Enable Frequency Range Upper limit	0	100	10	10	10	10	10	10	10	10	10	10	10	10		On/Off			Y
P209	Phase Over Current Filter Time	0	32767	5	5	5	5	5	5	5	5	5	5	5	5		On/Off			Y
P210	Phase Over Current Threshold	0.00	399.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99		On/Off		Y	Y
P211	Filter Time For Abnormal Output Voltage	0	32767	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	On/Off			Y
P212	Filter Time For Output Short-Circuit	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P213	Output Short-Circuit Fault Threshold	0.00	399.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99	179.99		On/Off		Y	Y
P214	Motor Minimum Overload Current	0.00	399.99	104.99	104.99	104.99	104.99	104.99	104.99	104.99	104.99	104.99	104.99	104.99	104.99	%	On/Off		Y	Y
P215	Motor Overload Cycle Time	0	32767	600	600	600	600	600	600	600	600	600	600	600	600	s	On/Off		Y	Y
P216	Motor Overload Trip Threshold	0.00	399.99	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	%	On/Off		Y	Y
P217	Motor Overload Time	0	32767	60	60	60	60	60	60	60	60	60	60	60	60	s	On/Off		Y	Y
P221	Filter Time For Output Over Voltage	0	32767	100	100	100	100	100	100	100	100	100	100	100	100	ms	On/Off			Y
P222	Output Over Voltage Fault Threshold	0.00	199.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P223	Output Voltage Deviation Warning Threshold	0.00	199.99	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00		On/Off		Y	Y
P224	Output Voltage Deviation Fault Threshold	0.00	199.99	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00		On/Off		Y	Y
P226	Output Voltage Abnormality Warning Cancellation Threshold	0.00	199.99	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00		On/Off			Y
P227	Ground Fault Detection Scaling Correction Factor	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		On/Off			Y
P228	Filter Time For Ground Fault	0	32767	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	On/Off			Y
P229	Ground Fault Warning Threshold	0.00	199.99	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00		On/Off			Y
P230	Ground Fault Trip Threshold	0.00	199.99	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00		On/Off			Y
P231	Filter Time For Overspeed Fault (Upper Limit)	0	32767	100	100	100	100	100	100	100	100	100	100	100	100		On/Off			Y
P232	Filter Time For Overspeed Fault (Lower Limit)	0	32767	100	100	100	100	100	100	100	100	100	100	100	100		On/Off			Y
P233	Threshold Of Over-Speed Fault At Lower Frequency Limit	0.00	199.99	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00		On/Off			Y
P234	Threshold Of Over-Speed Fault At Upper Frequency Limit	0.00	199.99	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00		On/Off			Y
P235	Frequency Deviation Warning Cancellation Threshold	0.00	199.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99		On/Off			Y
P236	Frequency Deviation Warning Threshold	0.00	199.99	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00		On/Off			Y
P237	Frequency Deviation Warning Delay	0	32767	8	8	8	8	8	8	8	8	8	8		8	ms	On/Off			Y
P238	Motor Stall Fault Threshold	0.00	199.99	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00		On/Off		Y	Y
P239	Motor Stall Fault Delay	0	32767	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	ms	On/Off			Y
P240	Transformer Over Temperature Fault Delay	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off			Y
P241	Transformer Over Temperature Warning Delay	0	32767	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off			Y
P250	Input Contactor/Circuit Breaker Close Delay	0	32767	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	ms	On/Off			Y
P251	Frequency Command-Low Frequency Region Boundary	0.0	100.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		On/Off			Y
P252	Motor In Stopping Condition Threshold	0	100	1	1	1	1	1	1	1	1	1	1	1	1		On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P253	Motor Coast Stop Time	0	10000	10	10	10	10	10	10	10	10	10	10	10	10		On/Off		Y	Y
P254	DC Bus Under Voltage Fault Threshold	0	100	63	63	63	63	63	63	63	63	63	63	63	63	%	On/Off			Y
P256	Ground Fault Warning Cancellation Threshold	0.00	199.99	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00		On/Off			Y
P257	Motor Stall Warning Cancellation Threshold	0.00	199.99	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98		On/Off			Y
P258	DC Bus Under Voltage Fault Delay	0	32767	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	On/Off			Y
P263	Power Loss Restart Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P264	Power Loss Allowable Time	0	3600	60	60	60	60	60	60	60	60	60	60	60	60	s	Offline		Y	Y
P265	Power Loss Time Max Limit	0	3600	300	300	300	300	300	300	300	300	300	300	300	300	s	Offline			Y
P266	DC Bus Voltage Deviation Fault Threshold	0	100	25	25	25	25	25	25	25	25	25	25	25	25	%	On/Off		Y	Y
P267	DC Bus Voltage Deviation Fault Filter Time	0	1000	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off		Y	Y
P268	Flux Control Signal Filter Time	0.00	13663.80	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	ms	On/Off			Y
P269	System Derating Control Signal Filter Time	9.60	13663.80	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	10000.08	ms	On/Off			Y
P270	Delayed Lockout Time of Stop Operation	0	5000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	ms	On/Off			Y
P271	Flux Delay	0	5000	500	500	500	500	500	500	500	500	500	500	500	500	ms	On/Off			Y
P272	Flux Control Compensation Gain	0	100	25	25	25	25	25	25	25	25	25	25	25	25	%	On/Off			Y
P273	Flux Control Regulation Control Enable 0 = Disable 1 = Enable	0	1	1	1	1	1	1	1	1	1	1	1	1	1		On/Off			Y
P274	DC Bus Under Voltage Warning Threshold	0	100	80	80	80	80	80	80	80	80	80	80	80	80	%	On/Off		Y	Y
P275	DC Bus Under Voltage Warning Hysteresis Band	0	100	5	5	5	5	5	5	5	5	5	5	5	5	%	On/Off		Y	Y
P276	Flux Control-Lag Band Width	0	100	3	3	3	3	3	3	3	3	3	3	1	3		On/Off			Y
P277	DC Link Voltage Sag Scaling At Rated Load	0	100	5	5	5	5	5	5	5	5	5	5	5	5	A	On/Off			Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P278	Derating Control Enable Threshold	50.00	199.99	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00		On/Off		Y	Y
P279	Derating Control Output Filter Time	9.95	1999.94	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95		On/Off			Y
P280	Low Voltage Ride Through Recovery Voltage Boost Coefficient	0	100	0	0	0	0	0	0	0	0	0	0	0	0	%	On/Off			Y
P281	Low Voltage Ride Through Min Time Interval	0	1000	10	10	10	10	10	10	10	10	10	10	10	10	s	On/Off		Y	Y
P282	Low Voltage Ride Through Min Frequency Limit	5	100	5	5	5	5	5	5	5	5	5	5	5	5		Offline		Y	Y
P283	Low Voltage Ride Through Enable 0 = Disable 1 = Enable	0	1	1	1	1	1	1	1	1	1	1	1	1	1		On/Off		Y	Y
P284	Low Voltage Ride Through Min Time Limit	10	16383	40	40	40	40	40	40	40	40	40	40	40	40	ms	Offline			Y
P285	Low Voltage Ride Through Max Time Limit	10	16383	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	Offline			Y
P286	Low Voltage Ride Through Recovery Frequency Compensation Factor	-200.00	199.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		Offline			Y
P287	Low Voltage Ride Through Recovery Time	10	16383	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	ms	Offline			Y
P288	Low Voltage Ride Through System Delay Correction Factor	-10000.00	10000.00	999.76	999.76	999.76	999.76	999.76	999.76	999.76	999.76	999.76	999.76	999.76	999.76	µs	Offline			Y
P289	Low Voltage Ride Through Motor Speed Estimation Filter Time	0.98	1000.00	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95	9.95	ms	Offline			Y
P290	Voltage Loop Enable 0 = Disable 1 = Enable	0	1	1	1	1	1	1	1	1	1	1	1	1	1		Offline			Y
P291	SVC Low Frequency Acceleration Time Enable Frequency Range Upper Limit	0	100	10	10	10	10	10	10	10	10	10	10	10	10	%	On/Off			Y
P292	SVC Low Frequency Acceleration Time	1	3276.7	5	5	5	5	5	5	5	5	5	5	5	5	s	On/Off			Y
P293	SVC Flux Voltage Boost Coefficient	0	500	300	300	300	300	300	300	300	300	300	300	300	300	%	On/Off			Y
P294	SVC Flux Voltage Boost Upper Frequency	0	100	10	10	10	10	10	10	10	10	10	10	10	10	%	On/Off			Y
P295	Iq Filter Time For Slip Estimation	0	1000	100	100	100	100	100	100	100	100	100	100	100	100		On/Off			Y
P296	Current Feedback Filter Time	0	1000	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off			Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P297	Voltage Feedback Filter Time	0	1000	10	10	10	10	10	10	10	10	10	10	10	10	ms	On/Off			Y
P298	Filter Time A For DC Bus Average Value	0	1000	100	100	100	100	100	100	100	100	100	100	100	100	ms	On/Off			Y
P299	Filter Time B For DC Bus Average Value	0	1000	5	5	5	5	5	5	5	5	5	5	5	5	ms	On/Off			Y
P300	Digital Output #0 Memory Address	0	500	99	99	99	99	99	99	99	99	99	99	99	99		On/Off			Y
P301	Digital Output #0 Logic 0 = Non-Inverting 1 = Inverting	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P302	Digital Output #0 Bit Selection	0	15	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P303	Digital Output #0 Delay	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P304	Digital Output #1 Memory Address	0	500	99	99	99	99	99	99	99	99	99	99	99	99		On/Off			Y
P305	Digital Output #1 Logic 0 = Non-Inverting 1 = Inverting	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P306	Digital Output #1 Bit Selection	0	15	1	1	1	1	1	1	1	1	1	1	1	1		On/Off			Y
P307	Digital Output #1 Delay	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P308	Digital Output #2 Memory Address	0	500	99	99	99	99	99	99	99	99	99	99	99	99		On/Off			Y
P309	Digital Output #2 Logic 0 = Non-Inverting 1 = Inverting	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P310	Digital Output #2 Bit Selection	0	15	2	2	2	2	2	2	2	2	0	2	2	2		On/Off			Y
P311	Digital Output #2 Delay	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P312	Digital Output #3 Memory Address	0	500	99	99	99	99	99	99	99	99	99	99	99	99		On/Off			Y
P313	Digital Output #3 Logic 0 = Non-Inverting 1 = Inverting	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P314	Digital Output #3 Bit Selection	0	15	3	3	3	3	3	3	3	3	3	3	3	3		On/Off			Y
P315	Digital Output #3 Delay	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P316	Digital Output #4 Memory Address	0	500	99	99	99	99	99	99	99	99	99	99	99	99		On/Off			Y
P317	Digital Output #4 Logic 0 = Non-Inverting 1 = Inverting	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P318	Digital Output #4 Bit Selection	0	15	4	4	4	4	4	4	4	4	4	4	4	4		On/Off			Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P319	Digital Output #4 Delay	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P320	Digital Output #5 Memory Address	0	500	99	99	99	99	99	99	99	99	99	99	99	99		On/Off			Y
P321	Digital Output #5 Logic 0 = Non-Inverting 1 = Inverting	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P322	Digital Output #5 Bit Selection	0	15	5	5	5	5	5	5	5	5	5	5	5	5		On/Off			Y
P323	Digital Output #5 Delay	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P324	Digital Output #6 Memory Address	0	500	99	99	99	99	99	99	99	99	99	99	99	99		On/Off			Y
P325	Digital Output #6 Logic 0 = Non-Inverting 1 = Inverting	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P326	Digital Output #6 Bit Selection	0	15	6	6	6	6	6	6	6	6	6	6	6	6		On/Off			Y
P327	Digital Output #6 Delay	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P328	Digital Output #7 Memory Address	0	500	99	99	99	99	99	99	99	99	99	99	99	99		On/Off			Y
P329	Digital Output #7 Logic 0 = Non-Inverting 1 = Inverting	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P330	Digital Output #7 Bit Selection	0	15	7	7	7	7	7	7	7	7	7	7	7	7		On/Off			Y
P331	Digital Output #7 Delay	0	32767	0	0	0	0	0	0	0	0	0	0	0	0	ms	On/Off			Y
P332	Analog Output #1 Memory Address	0	500	252	252	252	252	252	252	252	252	252	252	252	252		On/Off			Y
P333	Analog Output #1 Filter Time	0	32767	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	On/Off			Y
P334	Analog Output #1 Offset	-100	100	0	0	0	00	0	0	0	0	0	0	0	0		On/Off			Y
P335	Analog Output #1 Scaling Factor	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		On/Off		Y	Y
P336	Analog Output #2 Memory Address	0	500	206	206	206	206	206	206	206	206	206	206	206	206		On/Off			Y
P337	Analog Output #2 Filter Time	0	32767	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	On/Off			Y
P338	Analog Output #2 Offset	-100	100	0	0	0	00	0	0	0	0	0	0	0	0		On/Off			Y
P339	Analog Output #2 Scaling Factor	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		On/Off		Y	Y
P340	Analog Output #3 Memory Address	0	500	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P341	Analog Output #3 Filter Time	0	32767	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	On/Off			Y
P342	Analog Output #3 Offset	-100	100	0	0	0	00	0	0	0	0	0	0	0	0		On/Off			Y
P343	Analog Output #3 Scaling Factor	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		On/Off			Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P344	Analog Output #4 Memory Address	0	500	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P345	Analog Output #4 Filter Time	0	32767	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	ms	On/Off			Y
P346	Analog Output #4 Offset	-100	100	0	0	0	00	0	0	0	0	0	0	0	0		On/Off			Y
P347	Analog Output #4 Scaling Factor	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		On/Off			Y
P351	Rated Frequency HMI Display Filter Time	0	32767	100	100	100	100	100	100	100	100	100	100	100	100	ms	On/Off			Y
P352	Rated Frequency HMI Display Integer Part	0	75	50	50	50	50	50	50	50	50	50	50	50	50		On/Off	Y	Y	Y
P353	Rated Frequency HMI Display Decimal Part	0	1000	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P354	Motor Voltage HMI Display Filter Time	0	32767	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	ms	On/Off			Y
P355	Motor Voltage HMI Display Integer Part	0	16384	2300	2400	3000	3300	4000	4160	6000	6300	6600	6900	10000	11000		On/Off	Y	Y	Y
P356	Motor Voltage HMI Display Decimal Part	0	1000	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P357	Actual Frequency HMI Display Filter Time	0	32767	100	100	100	100	100	100	100	100	100	100	100	100	ms	On/Off			Y
P358	Actual Frequency HMI Display Integer Part	0	75	50	50	50	50	50	50	50	50	50	50	50	50		On/Off	Y	Y	Y
P359	Actual Frequency HMI Display Decimal Part	0	1000	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P360	Motor Current HMI Display Filter Time	0	32767	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	ms	On/Off			Y
P361	Motor Current HMI Display Integer Part	0	5000	0	0	0	0	0	0	0	0	0	0	0	0		On/Off	Y	Y	Y
P362	Motor Current HMI Display Decimal Part	0	1000	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P371	Rated Frequency HMI Display Address	0	500	221	221	221	221	221	221	221	221	221	221	221	221		On/Off			Y
P372	Motor Voltage HMI Display Address	0	500	119	119	119	119	119	119	119	119	119	119	119	119		On/Off			Y
P373	Actual Frequency HMI Display Address	0	500	252	252	252	252	252	252	252	252	252	252	252	252		On/Off			Y
P374	Motor Current HMI Display Address	0	500	118	118	118	118	118	118	118	118	118	118	118	118		On/Off			Y
P375	Frequency At First Point for 5 Point VF	0.00	10.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	%	Offline		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P376	Amplitude At First Point for 5 Point VF	0.00	3.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	%	Offline		Y	Y
P377	Frequency At Second Point for 5 Point VF	10	100	20	20	20	20	20	20	20	20	20	20	20	20	%	Offline	Y	Y	Y
P378	Amplitude At Second Point for 5 Point VF	0	100	10	10	10	10	10	10	10	10	10	10	10	10	%	Offline	Y	Y	Y
P379	Frequency At Third Point for 5 Point VF	10	100	40	40	40	40	40	40	40	40	40	40	40	40	%	Offline		Y	Y
P380	Amplitude At Third Point for 5 Point VF	0	100	27	27	27	27	27	27	27	27	27	27	27	27	%	Offline		Y	Y
P381	Frequency At Fourth Point for 5 Point VF	10	100	60	60	60	60	60	60	60	60	60	60	60	60	%	Offline		Y	Y
P382	Amplitude At Fourth Point for 5 Point VF	0	100	45	45	45	45	45	45	45	45	45	45	45	45	%	Offline		Y	Y
P383	Frequency At Fifth Point for 5 Point VF	10	100	80	80	80	80	80	80	80	80	80	80	80	80	%	Offline			Y
P384	Amplitude At Fifth Point for 5 Point VF	0	100	70	70	70	70	70	70	70	70	70	70	70	70	%	Offline		Y	Y
P385	Deceleration Process Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P386	Deceleration Time 1	1.0	3276.7	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	s	On/Off		Y	Y
P387	Deceleration Frequency 1	0	75	30	30	30	30	30	30	30	30	30	30	30	30		On/Off		Y	Y
P388	Deceleration Time 2	1.0	3276.7	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	s	On/Off		Y	Y
P389	Deceleration Frequency 2	0	75	20	20	20	20	20	20	20	20	20	20	20	20		On/Off		Y	Y
P390	Deceleration Time 3	1.0	3276.7	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	s	On/Off		Y	Y
P391	Deceleration Frequency 3	0	75	10	10	10	10	10	10	10	10	10	10	10	10		On/Off		Y	Y
P392	Deceleration Time 4	1.0	3276.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	s	On/Off		Y	Y
P393	Flying Start Compensation Enable 0 = Disable 1 = Enable	0	1	1	1	1	1	1	1	1	1	1	1	1	1		On/Off		Y	Y
P394	Flying Start Compensation Current Threshold	0.00	399.99	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00		On/Off		Y	Y
P395	Flying Start Compensation Frequency Reduce Speed	10	16384	50	50	50	50	50	50	50	50	50	50	50	50		On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P396	Deceleration Control Enable 0 = Disable 1 = Enable	0	1	1	1	1	1	1	1	1	1	1	1	1	1		On/Off		Y	Y
P397	DC Bus Lower Limit	0	32767	700	700	950	950	900	900	1000	950	950	1000	1000	1000	V	On/Off		Y	Y
P398	DC Bus Upper Limit	0	32767	800	800	1050	1050	1000	1000	1050	1050	1050	1050	1050	1050	V	On/Off		Y	Y
P399	Deceleration Time	1.0	3276.7	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	s	On/Off	Y	Y	Y
P401	Acceleration Time	1.0	3276.7	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	s	On/Off	Y	Y	Y
P402	Acceleration Ramp Transition Time	0.00	100.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	%	On/Off			Y
P403	Acceleration Time Unit 1000 = 0.01 s 10000 = 0.1 s	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		On/Off			Y
P405	Deceleration Ramp Transition Time	0.00	100.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	%	On/Off			Y
P406	Deceleration Time Unit 1000 = 0.01 s 10000 = 0.1 s	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		On/Off			Y
P408	Flying Start Compensation Defer Restore Voltage Speed Current Threshold	20.00	399.99	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00		On/Off			Y
P409	Amplification Coefficient Of Error Terms	0.00	199.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		On/Off			Y
P410	Flying Start Compensation Current Threshold for Fast Compensation	0.00	399.99	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00		On/Off			Y
P411	Over Speed Lower Limit Reference	0	100	100	100	100	100	100	100	100	100	100	100	100	100		On/Off			Y
P412	Over Speed Lower Limit Reference	0	100	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P413	Frequency Command Lower Limit	-100	100	0	0	0	0	0	0	0	0	0	0	0	0		On/Off			Y
P414	Frequency Command Deadband Upper Limit	0	100	10	10	10	10	10	10	10	10	10	10	10	10		Offline			Y
P415	Frequency Command Upper Limit	-100	100	100	100	100	100	100	100	100	100	100	100	100	100		On/Off			Y
P416	Flying Start Mode 0 = Disable 1 = Set Frequency 2 = Stop Frequency Plus 5 Hz 3 = Maximum Output Frequency	0	3	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P417	Flying Start Motor Speed Search Timeout	0	1000	50	50	50	50	50	50	50	50	50	50	50	50	s	On/Off		Y	Y
P418	Acceleration Time 1	1.0	3276.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	s	On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P419	Acceleration Frequency 1	0	75	10	10	10	10	10	10	10	10	10	10	10	10		On/Off		Y	Y
P420	Acceleration Time 2	1.0	3276.7	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	s	On/Off		Y	Y
P421	Acceleration Frequency 2	0	75	20	20	20	20	20	20	20	20	20	20	20	20		On/Off		Y	Y
P422	Acceleration Time 3	1.0	3276.7	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	s	On/Off		Y	Y
P423	Acceleration Frequency 3	0	75	30	30	30	30	30	30	30	30	30	30	30	30		On/Off		Y	Y
P424	Acceleration Time 4	1.0	3276.7	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	s	On/Off		Y	Y
P425	Acceleration Process Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P434	Deceleration Iq Threshold	5	100	25	25	25	25	25	25	25	25	25	25	25	25	%	On/Off			Y
P435	Deceleration Control Frequency Range	0	100	20	20	20	20	20	20	20	20	20	20	20	20		On/Off		Y	Y
P436	Current Limitation Enable 0 = Disable 1 = Enable	0	1	1	1	1	1	1	1	1	1	1	1	1	1		On/Off		Y	Y
P438	Current Limitation Enable Frequency Range Lower Limit	0	100	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P441	Current Limitation Threshold	0.00	399.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		On/Off		Y	Y
P442	Current Limitation Heating Time	0	16384	60	60	60	60	60	60	60	60	60	60	60	60	s	On/Off		Y	Y
P443	Current Limitation Cooling Time	0	16384	540	540	540	540	540	540	540	540	540	540	540	540	s	On/Off		Y	Y
P444	Current Limitation Decel Ramp Slope Change	0.00	399.99	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00	A-Frame 110.00 H-Frame, B-Frame 120.00		On/Off		Y	Y
P445	Current Limitation Cycle Load Control Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P447	Minimum Start Frequency During Time	0	13.65	0	0	0	0	0	0	0	0	00	0	0	0	s	Offline		Y	Y
P448	Minimum Start Frequency	0	10	0	0	0	0	0	0	0	0	0	0	0	0	%	Offline		Y	Y
P449	Low Speed Voltage Compensation During Flux Building Process	0	3	2	2	2	2	2	2	2	2	2	2	2	2	%	Offline		Y	Y
P451	Low Speed Voltage Compensation	0	3	1	1	1	1	1	1	1	1	1	1	1	1	%	Offline		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P452	Low Speed Voltage Compensation Frequency Threshold	0	100	20	20	20	20	20	20	20	20	20	20	20	20		On/Off		Y	Y
P453	V/F Curve 0 = Linear 1 = Parabolic Curve 2 = Predefined Curve #1 3 = Predefined Curve #2 4 = 5 Point VF 5 = SVC	0	5	5	5	5	5	5	5	5	5	5	5	5	5		Offline		Y	Y
P454	Flux Time	0	10	2	2	2	2	2	2	2	2	2	2		2	s	Offline			Y
P455	Modulation Index	0.0	110.0	84.0	87.6	77.3	85.0	83.8	87.0	87.0	81.0	85.0	83.7	91.0	89.0		On/Off		Y	Y
P456	Motor Voltage Upper Limit	0.00	110.0	84.0	87.6	77.3	85.0	83.8	87.0	87.0	81.0	85.0	83.7	91.0	89.0		On/Off		Y	Y
P457	Flying Start Voltage Recovery Time (Low Speed Region)	0.00	163.84	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	s	On/Off		Y	Y
P458	Coefficient A	0	100	40	40	40	40	40	40	40	40	40	40	40	40		Offline			Y
P459	Flying Start Voltage Recovery Time (High Speed Region)	0.00	163.84	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	s	On/Off		Y	Y
P460	Rated Output Frequency	0	75	50	50	50	50	50	50	50	50	50	50	50	50		Offline		Y	Y
P461	Restart Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P462	Fault Reset Timeout	0.04	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	s	On/Off			Y
P463	Flying Start Low/High Speed Regions Boundary	0	100	16	16	16	16	16	16	16	16	16	16	16	16	%	On/Off		Y	Y
P465	Power Cell Fault Auto Reset Delay	0	10	4	4	4	4	4	4	4	4	4	4	4	4	s	On/Off			Y
P466	Maximum Output Frequency	0	75	50	50	50	50	50	50	50	50	50	50	50	50		Offline		Y	Y
P467	Over Speed Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P470	Version Compatibility Enable 0 = Disable 1 = Enable	0	1	1	1	1	1	1	1	1	1	1	1	1	1		Offline			Y
P471	Fault-To-Bypass 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P472	Fault-To-Bypass Delay	0	5	3	3	3	3	3	3	3	3	3	3	3	3		On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P473	Fault-To-Bypass Delay When Starting The Motor	0	60	60	60	60	60	60	60	60	60	60	60	60	60	s	On/Off		Y	Y
P474	Fault-To-Bypass Minimum Frequency	0	75	5	5	5	5	5	5	5	5	5	5	5	5	Hz	Offline		Y	Y
P475	Owner #1 Selection	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P476	Owner #2 Selection	2	23	8	8	8	8	8	8	8	8	8	8	8	8		On/Off		Y	Y
P477	Owner #3 Selection	18	23	23	23	23	23	23	23	23	23	23	23	23	23		On/Off		Y	Y
P478	Local/Remote Owner Selection 0 = HMI 1 = Selector Switch 2 = First Use HMI, then Use Customer Selector Switch 3 = First Use Selector Switch in Control Cabinet, then Use Customer Selector Switch	0	3	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P479	Power Display Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y
P480	4-Step Variable Speed – Speed1	0	75	10	10	10	10	10	10	10	10	10	10	10	10		On/Off		Y	Y
P481	4-Step Variable Speed – Speed2	0	75	20	20	20	20	20	20	20	20	20	20	20	20		On/Off		Y	Y
P482	4-Step Variable Speed – Speed3	0	75	30	30	30	30	30	30	30	30	30	30	30	30		On/Off		Y	Y
P483	4-Step Variable Speed – Speed4	0	75	40	40	40	40	40	40	40	40	40	40	40	40		On/Off		Y	Y
P484	Bypass Mode Selection 0 = No Bypass 1 = Manual Bypass, one-drive-one-motor 2 = Auto Bypass, one-drive-one-motor 3 = Manual Bypass, one-drive-two-motor 4 = Auto Bypass, one-drive-two-motor	0	4	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P485	When Disconnected Between DCS and PLC 0 = Stop 1 = Keep Current Frequency 2 = Keep P480 – Speed 1 3 = Keep P481 – Speed 2 4 = Keep P482 – Speed 3 5 = Keep P483 – Speed 4	0	5	1	1	1	1	1	1	1	1	1	1	1	1		On/Off		Y	Y

No.	Name	Min.	Max.	Default Values												Units	Modify Root	Access		
				2300V	2400V	3000V	3300V	4000V	4160V	6000V	6300V	6600V	6900V	10000V	11000V			U	S	R
P486	PID Control Enable 0 = Disable 1 = Enable	0	1	0	0	0	0	0	0	0	0	0	0	0	0		Offline		Y	Y
P487	PID Control Proportional Gain	0.000	32.767	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001		On/Off		Y	Y
P488	PID Control Integral Time	0.000	32.767	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001		On/Off		Y	Y
P489	PID Control Differential Gain	0.000	32.767	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001		On/Off		Y	Y
P490	PID Control Differential Time	0.000	32.767	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		On/Off		Y	Y
P491	PID Control Feedback Lower Limit	0.000	32.767	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		Offline		Y	Y
P492	PID Control Feedback Upper Limit	0.000	32.767	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		Offline		Y	Y
P494	User Analog Set-point Switch	0	3	0	0	0	0	0	0	0	0	0	0	0	0		On/Off		Y	Y

ATTENTION: If you enter a value that is greater than the allowed range for the parameter, the input field will turn red.

Notes:

Preventative Maintenance and Component Replacement

Safety

ATTENTION: Servicing energized Medium Voltage Motor Control Equipment can be hazardous. Severe injury or death can result from electrical shock, bump, or unintended actuation of controlled equipment. Recommended practice is to disconnect and lockout control equipment from power sources, and release stored energy, if present.For countries following NEMA standards, refer to National Fire Protection Association Standard No. NFPA70E, Part II and (as applicable) OSHA rules for Control of Hazardous Energy Sources (Lockout/Tagout) and OSHA Electrical Safety Related Work Practices safety related work practices, including procedural requirements for lockout/tagout, and appropriate work practices, personnel qualifications and training requirements, where it is not feasible to de-energize and lockout or tagout electric circuits and equipment before working on or near exposed circuit parts.For countries following IEC standards, refer to local codes and regulations.

ATTENTION: Use suitable personal protective equipment (PPE) per local codes or regulations. Failure to do so may result in severe burns, injury, or death.

ATTENTION: Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

ATTENTION: These tasks require persons skilled in this type of detailed work. Read and understand this manual thoroughly before commencing. Contact Rockwell Automation with any questions or for clarification.

ATTENTION: Only qualified personnel with the correct PPE (Personal Protective Equipment) should service the equipment. Be sure to follow the safety procedures and local regulations to disconnect the high voltage. After waiting for 15 minutes, open the cabinet door and verify the absence of medium voltage on the input, output, and power cell terminals with a high-voltage detector that is properly rated for the line and motor voltages. All LED lights on the power cells must be off and the drive be grounded with portable grounding cables on the input and output before servicing. Failure to follow the safety procedures can result in severe injury or death.

Introduction

The drive can experience reduced service life if operated outside of its design parameters. Verify that the operating environment is within specifications. Daily inspection and regular maintenance will maximize the service life of the equipment.

Daily Inspection

Check the following items during normal operation of the drive:

- abnormal noise or vibration in the drive or motor
- abnormal temperature in the drive or motor
- ambient temperature in the control room above nominal
- accumulation of dust or particulate on control room floor or surfaces
- abnormal load current above nominal

Clean the Air Filters

PowerFlex 6000 medium voltage drives require a continuous, smooth airflow to cool the power components, and the main heating device to ensure the stable and reliable operation of the equipment. Obstruction of the air filters is the main cause of poor cooling airflow.

The PowerFlex 6000 drive uses a number of cooling fans that are installed at the top of the cabinet to ensure that sufficient airflow is used to cool the power components and other heating equipment. When the equipment is running for some time, the air filters accumulate dust and obstructs the airflow. Failure to clean the air filters regularly may result in insufficient cooling airflow, which may cause some parts of the drive to send an overtemperature alarm or even trip(1):

- Transformer overtemperature alarm / trip
- Power unit overtemperature trip

Immediately after receiving the overtemperature warning, you should plan to replace or clean the air filters. At this point there should be a few days or weeks before the air filters fail, but this depends on the amount of dust in the environment.

Regular Maintenance Intervals

The annual maintenance requirements are summarized on page 145 as a guideline. Detailed procedures referred to in the Preventative Maintenance Schedule are described beginning on page 95.

(1) Obstruction of the air filters is not the only cause of over temperature alarm and trip.

Medium Voltage Motor control equipment should be inspected periodically. Inspection intervals should be based on environmental and operating conditions and adjusted as indicated by experience. An initial comprehensive inspection, within 3 to 4 months after installation, is suggested. See the following standards for general guidelines for setting-up a periodic maintenance program.For countries following NEMA standards, refer to National Electrical Manufacturers Association (NEMA) Standard No. ICS 1.1 (Safety Guidelines for the Application, Installation, and Maintenance of Solid-Sate Control) for MV Drives and ICS 1.3 (Preventive Maintenance of Industrial Control and Systems Equipment) for MV Controllers. For countries following IEC standards, refer to IEC 61800-5-1 Sec. 6.5 for MV Drives and IEC 60470 Sec. 10, IEC 62271-1 Sec. 10.4 for MV Controllers.

The maintenance work for the PowerFlex 6000 drive should normally be performed on a yearly cycle. This work is carried out by Rockwell Automation medium voltage drive customers. The customer may extend the maintenance interval appropriately according to the installation conditions and operating conditions of the drive. Determine the maintenance cycle and component/items according to the customer site application. The purpose of performing annual maintenance is to locate potential failures and take preventive measures before a real failure occurs. Therefore it is recommended to spend about 16 hours to perform annual maintenance to verify that the drive is functioning reliably. This can greatly reduce the risk of unplanned downtime.

Before starting preventive maintenance, you should record some important information, including:

1. Report of the previous preventive maintenance (if any).
2. Get motor parameters and applications.
3. Check the current settings of the drive.
4. Check the fault/warning queue.
5. Save parameters to a recipe file(1) or parameter record.
6. Record the board part number, serial number, and edition.(2)

If inspection reveals that dust, dirt, moisture, or other contamination has reached the control equipment, the cause must be eliminated. This could indicate unsealed enclosure openings (conduit or other) or incorrect operating procedures. Replace any damaged or embrittled seals, and repair or replace any other damaged or malfunctioning parts. Replace dirty, wet, or contaminated control devices unless they can be cleaned effectively by vacuuming or wiping.

IMPORTANT Compressed air is not recommended for cleaning because it may displace dirt, dust, or debris into other parts or equipment, or damage delicate parts.

(1) For devices with recipe function options.

(2) Records are required only if spare parts replacement is replaced after preventive maintenance activities.

Physical Checks (No Medium Voltage or Control Power)

Power Connection Inspection

- Inspect PowerFlex 6000 drive, input/output/bypass sections, and all associated drive components for loose power cable connections and ground cable connections: torque them based on the required torque specifications.
- Inspect the bus bars and check for any signs of overheating / discoloration and tighten the bus connections to the required torque specifications.
- Clean all cables and bus bars that exhibit dust build-up.
- The torques of incoming / outgoing cable screws of the power unit shall be check if they are in the specified range.
- Use torque sealer on all connections. Conduct integrity checks on the signal ground and safety grounds.

Physical Inspection

- Check for any visual/physical evidence of damage or degradation of components in the low voltage compartments.
  - This includes Relays, Contactors, Timers, Terminal connectors, Circuit breakers, Ribbon cables, Control Wires, UPS, AC/DC Power Supplies, and so on. Causes could be corrosion, excessive temperature, or contamination.
- Check for any visual/physical evidence of damage or degradation of components in the medium voltage compartments (cables, contactors, circuit breakers, isolation disconnecting blades, power units, and so on).
  - This includes main cooling fan, power devices, heatsinks, circuit boards, insulators, cables, capacitors, current transformers, potential transformers, fuses, wiring, and so on; Causes could be corrosion, excessive temperature, or contamination.
- Clean all contaminated components using a vacuum cleaner (DO NOT use a blower), and wipe clean components where appropriate.
- Conduct the physical inspection and verification for the proper operation of the contactor/isolator interlocks, and door interlocks.
- Conduct the physical inspection and verification for the proper operation of the key interlocks.
- Conduct the cleaning of the fans and verify that the ventilation passages are not blocked and the impellers are freely rotating without any obstruction.
- Conduct the Insulation Resistance (IR) test on the transformer, motor, and associated cabling.
- Check all bolts for fastening and adjust them as necessary.
- Check all labels for readability. If any labels are unreadable, damaged, or missing, contact Rockwell Automation for replacements.

Medium Voltage Testing

Medium voltage insulation resistance (IR) or dielectric withstanding voltage tests should not be used to check solid-state control equipment. When performing IR tests on electrical equipment, such as transformers or motors, solid-state devices must be bypassed before performing the test. Even though no damage may be readily apparent after an IR test, the solid-state devices are degraded and repeated application of high voltage can lead to failure.

Maintenance after a Fault Condition

Opening of the short circuit protective device (such as fuses or circuit breakers) in a properly coordinated motor branch circuit is an indication of a fault condition in excess of operating overload. Such conditions can cause damage to medium voltage motor control equipment. Before restoring power, the fault condition must be corrected and any necessary repairs or replacements must be made to restore the medium voltage motor control equipment to good working order. See NEMA Standards Publication No. ICS-2, Part ICS2-302 for procedures. Use only replacement parts and devices that are recommended by Rockwell Automation to maintain the integrity of the equipment. Verify that the parts are properly matched to the model, series, and revision level of the equipment. After maintenance or repair of the equipment, always test the control system for proper functioning under controlled conditions (that avoid hazards in the event of a control malfunction). For additional information, see NEMA ICS 1.3, PREVENTIVE MAINTENANCE OF INDUSTRIAL CONTROL AND SYSTEMS EQUIPMENT, published by the National Electrical Manufacturers Association, and NFPA70B, ELECTRICAL EQUIPMENT MAINTENANCE, published by the National Fire Protection Association.

Isolation Transformer Cabinet

ATTENTION: Wait at least 15 minutes for the stored energy to fully discharge before performing maintenance on the Isolation Transformer cabinet. Failure to do so may result in severe burns, injury, or death.

Replace/Clean Door-mounted Air Filters

Periodically remove and clean, or remove and replace, the air filters according to the Preventative Maintenance table on page 146. The frequency with which you renew the filters depends on the cleanliness of the available cooling air.

There are two types of design for the air filters. The air filters are located on the Power Module cabinet and the Isolation Transformer cabinet. The quantity of air filters on the cabinet door are different, depending on the drive ratings. However, the method to remove or clean the air filters is the same. The screens may be replaced while the drive is operating, but the procedure is easier to perform while the drive is shut down.

If the drive is running, you must replace the filter as soon as possible to prevent foreign material from entering into the drive.

Recommended Cleaning Method of Filters:

- Vacuum Cleaner – A vacuum cleaner on the inlet side of the filter will remove accumulated dust and dirt.
- Blow with Compressed Air – point compressed air nozzle in opposite direction of operating airflow (Blow from exhaust side toward intake side)
- Cold Water Rinse – Under normal conditions the foam media used in the filters, require no oily adhesives. Collected dirt is washed away quickly and easily using just a standard hose nozzle with plain water.

ATTENTION: The filter must be completely dry before reinstalling.

- Immersion in Warm Soapy Water – Where stubborn air-borne dirt is present, the filter may be dipped in a solution of warm water and mild detergent. Rinse in clear clean water, let stand until completely dry and free of moisture.

Use only Rockwell Automation-supplied or -approved replacement filters. Replace the filters in the reverse order of its removal. Check that there are no openings to allow foreign matter to enter the drive.

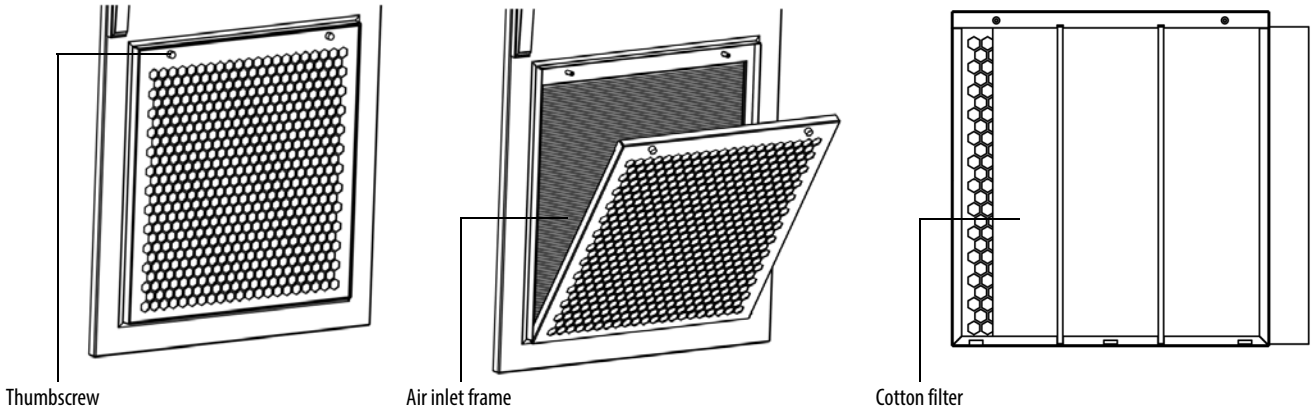
Replace Filter for A-Frame Drives

1. Unlatch the thumbscrews and remove the air filter frame.
2. Remove and clean the cotton filter, or replace with a new cotton filter.

IMPORTANT When removing the filter, prevent accumulated dirt on the inlet side of the filter from being sucked into the drive. It may be difficult to remove the filter material without tearing due to the suction at the air inlet.

3. Close the air filter frame and tighten thumbscrews.

Figure 34 - Replace the Filter, A-Frame



Replace Filter for H-Frame and B-Frame Drives

1. Unlatch and open the cabinet filter door more than 90°.

Figure 35 - Replace the Filter, H-Frame

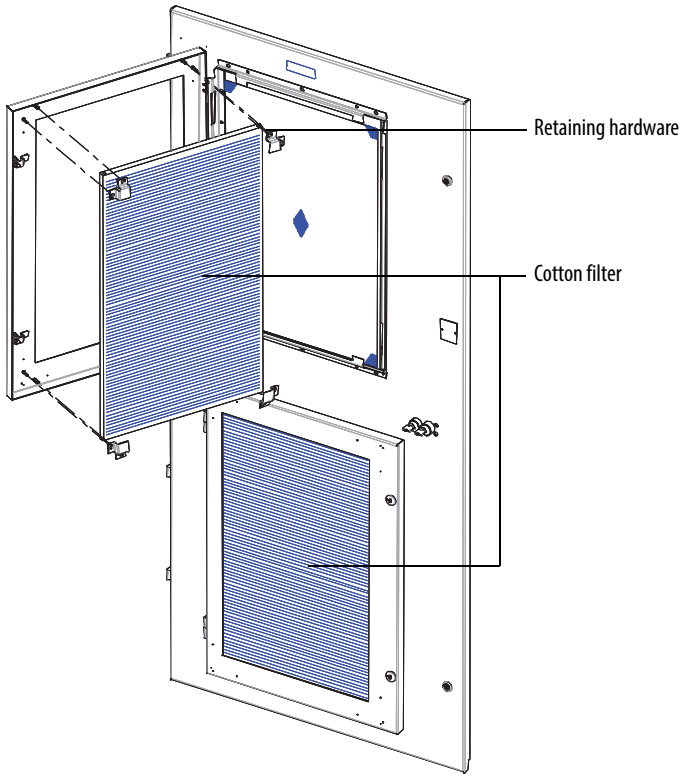
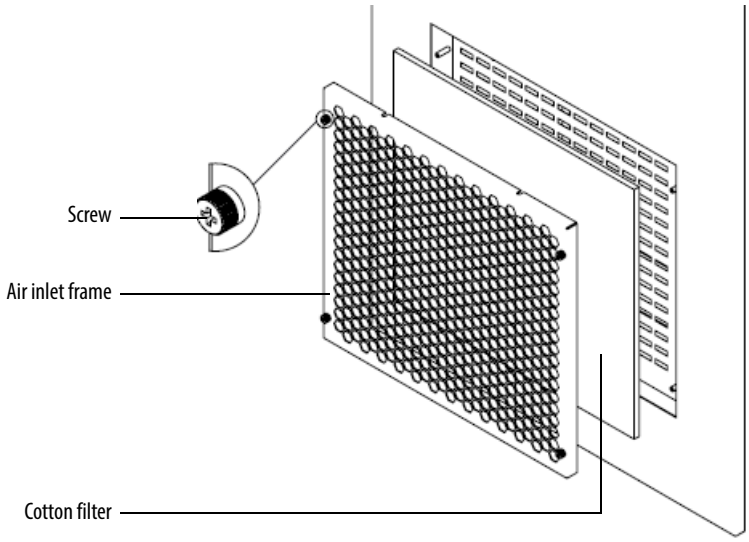


Figure 36 - Replace the Filter, B-Frame



2. Remove the screens by pulling up out of the door.

IMPORTANT When removing the filter, prevent accumulated dirt on the inlet side of the filter from being sucked into the drive. It may be difficult to remove the filter material without tearing due to the suction at the air inlet.

3. Reinstall the cleaned or new air filter using reverse order of removal. Verify that the door is fully closed and locked.

Inspect Top Mounted Cooling Fans

Inspect fans that are used for forced air cooling. Replace any that have bent, chipped, or missing blades, or if the shaft does not turn freely.

The fans are supplied with 380/460V AC power, which is fed by the low voltage taps of the Isolation Transformer. The control voltage is 220V. The voltage of the fan can be measured through a small door on the Isolation Transformer.

ATTENTION: Exercise caution when measuring the voltage of the fans.

Apply power momentarily to check operation. If unit does not operate, check and replace wiring, fuse, or fan motor as appropriate. Clean or change air filters as recommended in the Users Manual. Verify that the aviation plug has a proper hand-tight connection. Verify that the ventilation passages are not blocked and the impellers can rotate freely without any obstruction.

Replace Top Mounted Cooling Fans

There are two types of top fan housings. The top fan housing consists of a motor and impeller assembly. To replace the fan, it is necessary to remove the fan housing lid.

ATTENTION: Fan replacement requires working at a significant height from the floor. Complete this procedure on a safe, stable platform.

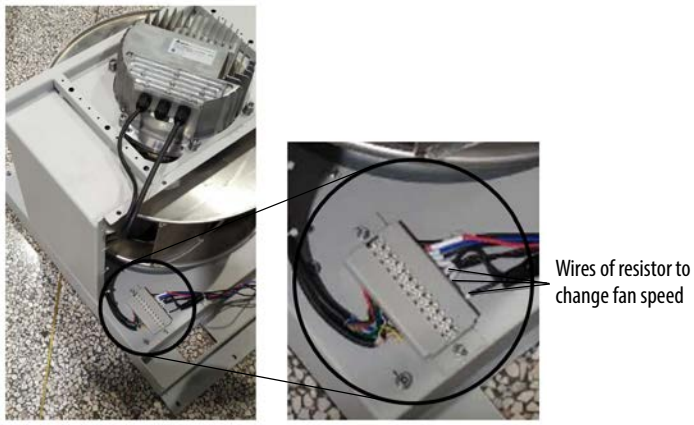
ATTENTION: Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

ATTENTION: Medium Voltage must be turned off when replacing the main cooling fans.

Replace Fan for A-Frame Fan Housing

To replace an E400 fan, you need to change the wiring so that the fan runs at a different speed than what it does for the B-Frame drive.

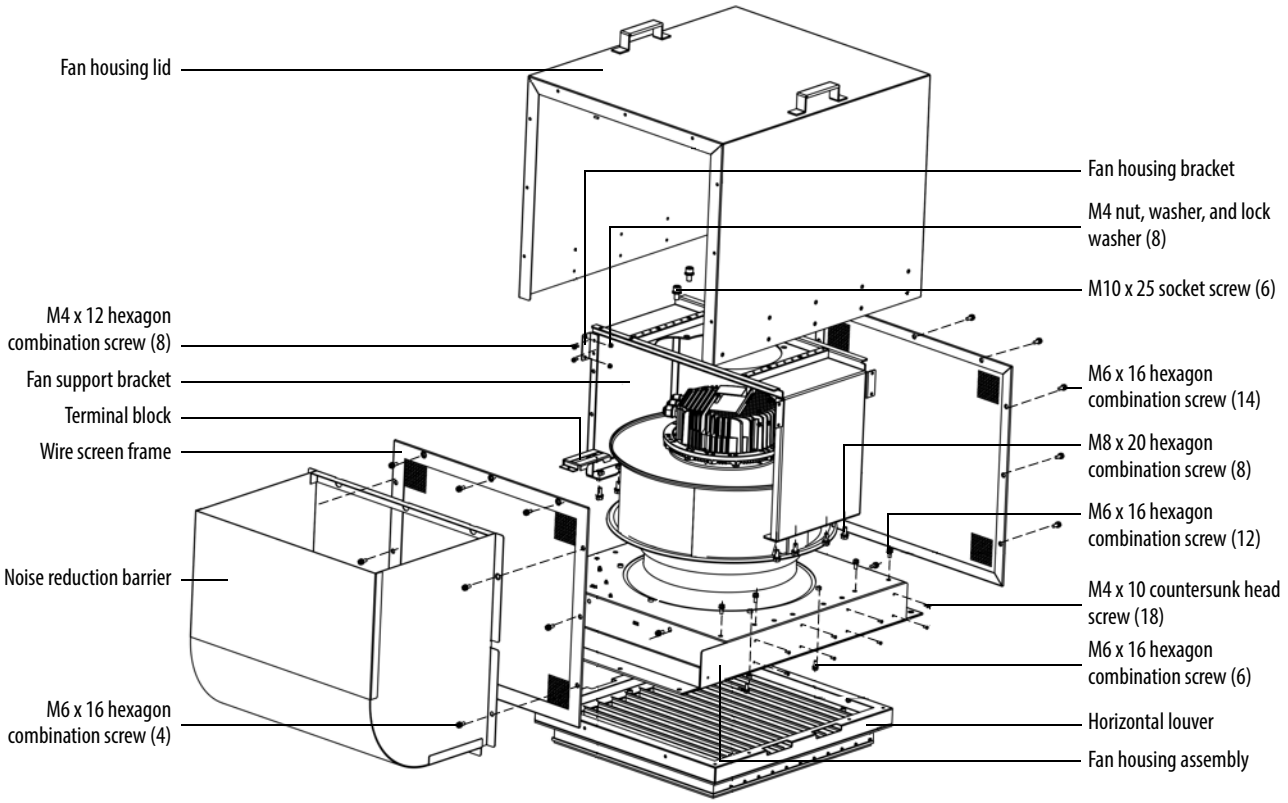
1. Remove the three terminals in the front that are secured on the terminal block in the fan housing, as shown.



2. Install the new wires of the resistor in reverse order of removal.
3. After you have changed the wiring, see Replace Fan for B-Frame Fan Housing on page 102 for instructions on how to replace the fan.

To replace an EC500 fan, follow these instructions:

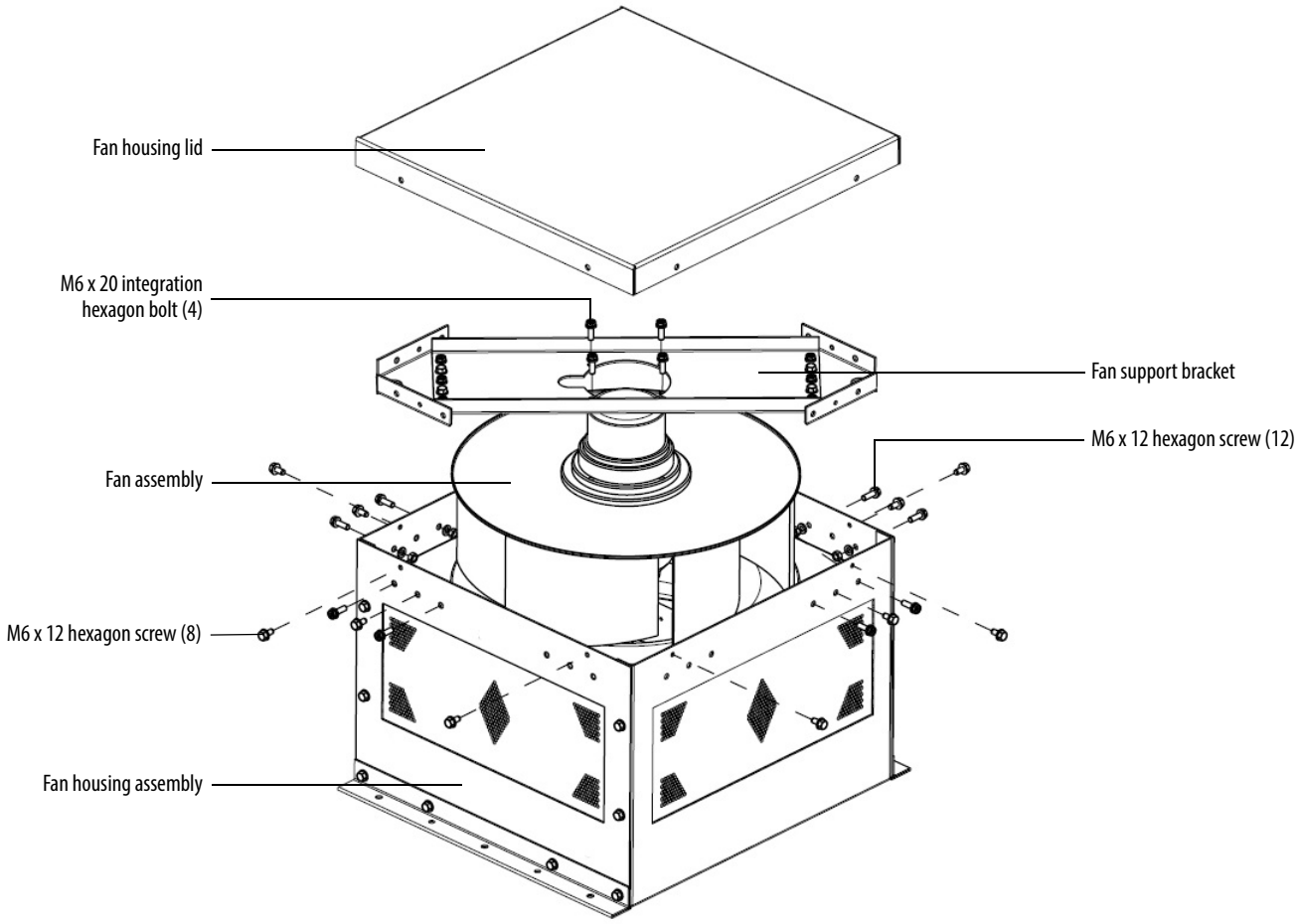
1. Remove the four M6 x 16 hexagon combination screws that secure the noise reduction barrier, and remove the barrier.



2. Remove and retain the fourteen M6 x 16 hexagon combination screws around the wire screen frame, and remove the frame.
3. Remove and retain the eight M4 x 12 hexagon combination screws, M4 nut washer, and lock washer that secure the L-shape fan housing bracket and fan housing lid, and remove the bracket.
4. Remove and retain the eighteen M4 x 10 countersunk head screws that secure the fan housing lid, and remove the lid.
5. Remove and retain the twelve M6 x 16 hexagon combination screws that secure the horizontal louver, and remove the louver.
6. Disconnect the fan cables from the terminal block.
7. Turn the fan assembly housing upside down, and remove and retain the eight M8 x 20 hexagon combination screws that secure the fan support bracket, and remove the bracket.
8. Turn back the assembly, and remove and retain the six M10 x 25 and M6 x 16 hexagon combination screws that secure the fan, and remove the fan.
9. Install the fan in the reverse order of removal. Rotate the impeller by hand to verify that there is no contact with the fan housing assembly.

Replace Fan for H-Frame Fan Housing

1. Remove and retain four tapping screws around the fan housing lid, and remove the lid.
2. Remove and retain eight M6 x 12 hexagon screws from the fan housing assembly, which connect to the fan support bracket.

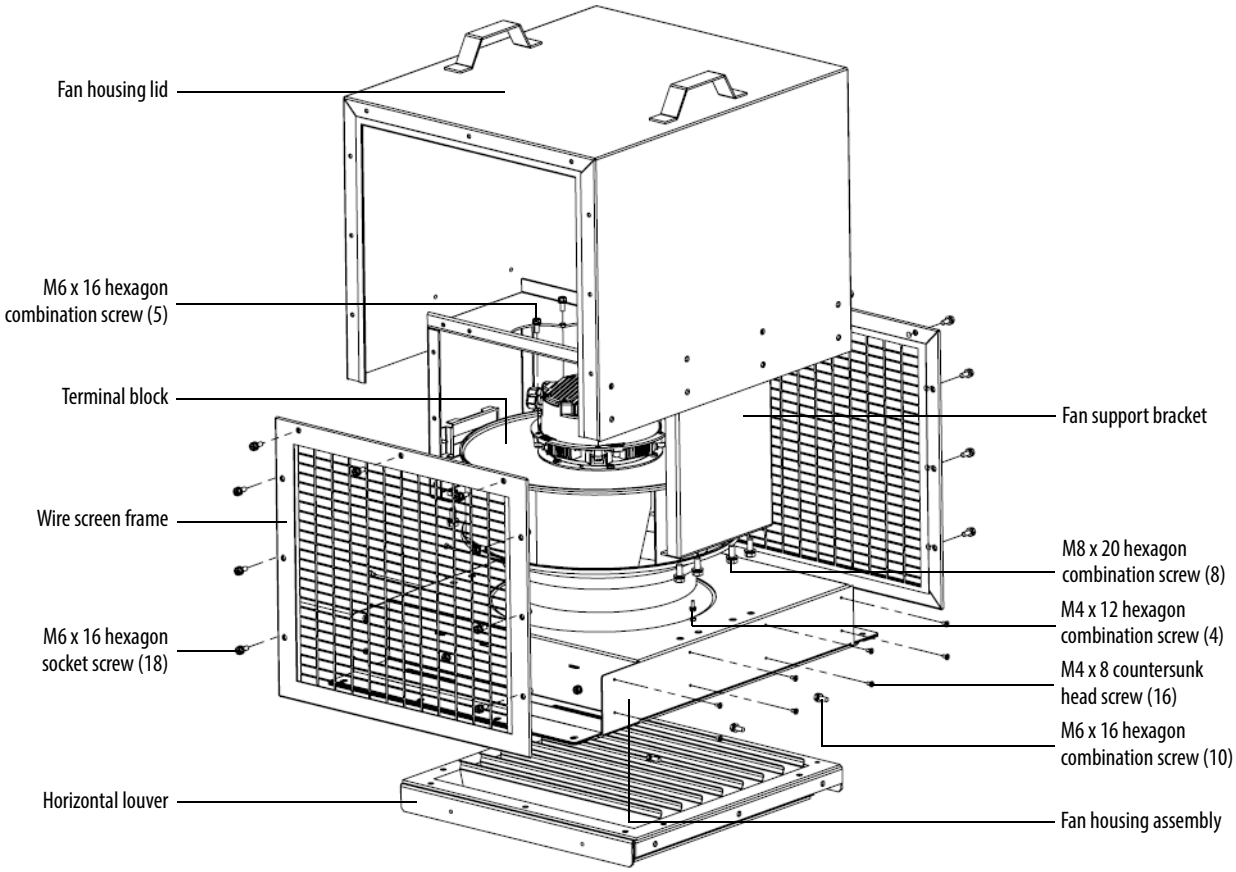


3. Remove and retain four M6 x 12 hexagon screws from the top of the fan support bracket, and remove the bracket from the fan assembly.
4. Remove the wiring cover and disconnect the wiring.
5. Install the fan in the reverse order of its removal. Rotate the impeller by hand to verify that there is no contact with the fan housing assembly.

ATTENTION: The fan must be handled with extreme care. Failure to do so can alter the fan balance and will negatively impact performance and life span.

Replace Fan for B-Frame Fan Housing

1. Remove and retain 18 M6 x 16 hexagon socket screws around the wire screen frame, and remove the frame.
2. Remove and retain 16 M4 x 8 countersunk head screws that secure the fan housing lid, and remove the lid.



3. Remove and retain 10 M6 x 16 hexagon combination screws that secure the horizontal louver, and remove the louver.
4. Disconnect the fan from the terminal block.
5. Remove and retain eight M8 x 20 hexagon combination screws that secure the fan support bracket, and remove the bracket.
6. Remove and retain five M6 x 16 and four M4 x 12 hexagon combination screws that secure the fan, and remove the fan.
7. Install the fan in the reverse order of its removal. Rotate the impeller by hand to verify that that there is no contact with the fan housing assembly.

ATTENTION: The fan must be handled with extreme care. Failure to do so can alter the fan balance and will negatively impact performance and life span.

Fan Balance

Fan impellers are statically and dynamically balanced within acceptable tolerances at the factory. Damage in shipping or from incorrect handling or installation may upset the balance. An improperly balanced impeller can lead to excessive vibration causing undue wear on the entire unit.

If vibration is excessive, shut down the fan and determine the cause. Common causes of excessive vibration include:

- Drive support structure not sufficiently rigid or level
- Loose mounting bolts
- Loose impeller or bushing

Inspect Isolation Transformer

1. Verify that the fan is rotating in the proper direction.
2. Verify the incoming and outgoing power cable connections are torqued to specifications.

   See Torque Requirements on page 149.
3. Check the cabinet interior and Isolation Transformer windings and remove any foreign material. Vacuum dust or debris from the Isolation Transformer cabinet.
4. Check for any physical evidence of damage or degradation of components.

Inspect Voltage Sensing Board

The input VSB cable connections and output VSB wire connectors must be firmly fastened and show no signs of damage or accumulation of dirt, dust, or debris.

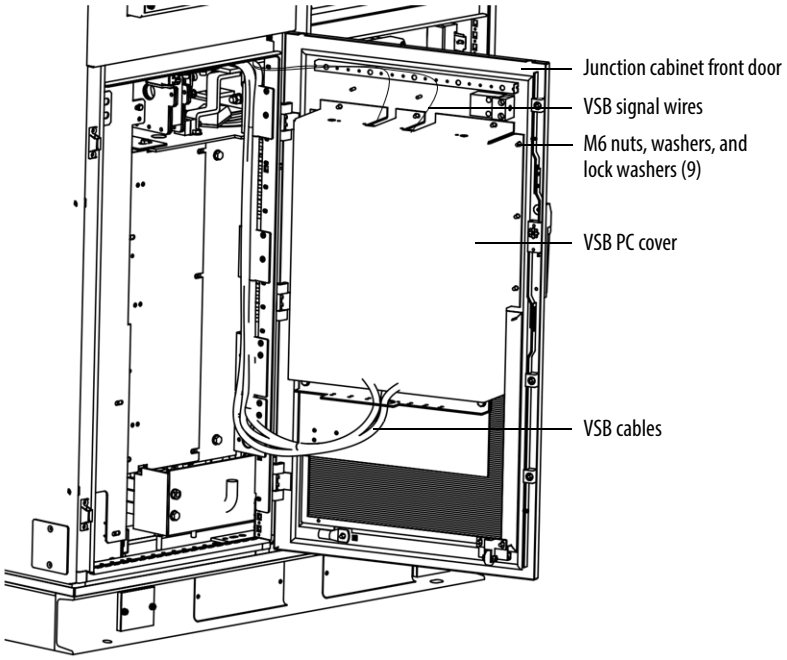
Replace Voltage Sensing Board

ATTENTION: To prevent electrical shock, disconnect the main power before working on the Voltage Sensing Board. Verify that all circuits are voltage-free, using a hot stick or appropriate high voltage-measuring device. Failure to do so may result in injury or death.

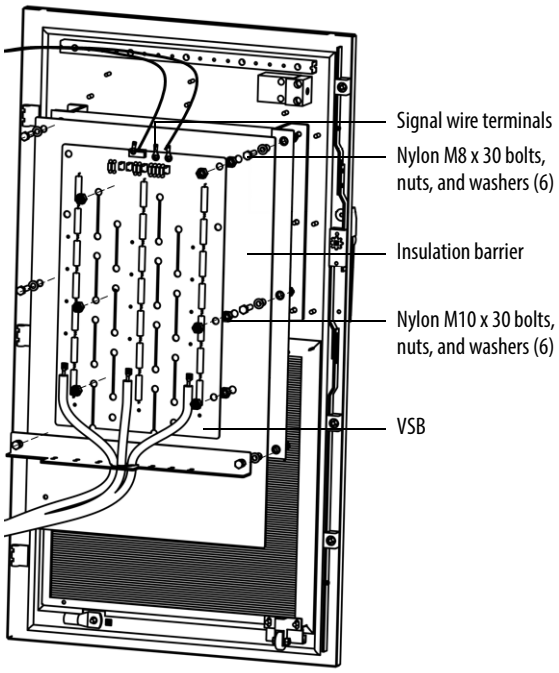
For A-Frame Drives

1. Open the front door of the Junction cabinet.

2. Remove and retain the nine M6 nuts, D6 washers, and D6 lock washers that secure the VSB PC cover, and remove the cover.



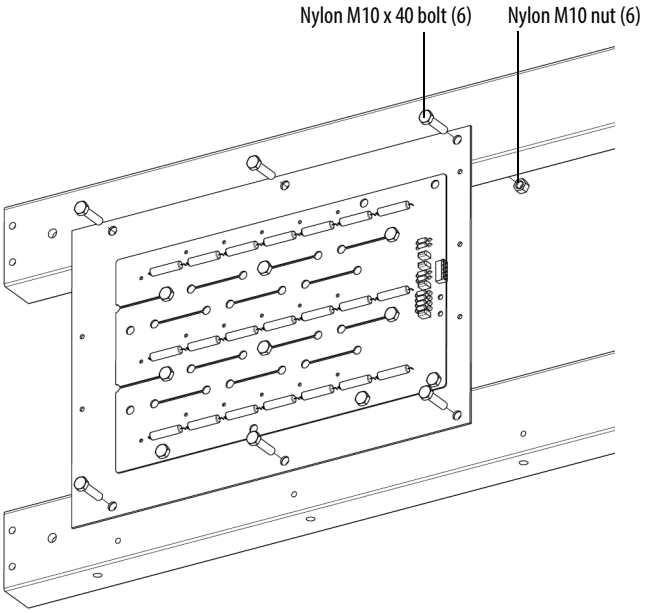
3. Remove the three signal terminal wires and VSB cables.
4. Remove and retain the six nylon M8 x 30 bolts, nuts, and washers that secure the insulation barrier, and remove the barrier.
5. Remove and retain the six nylon M10 x 30 bolts, nuts, and washers that secure the VSB, and remove the VSB.
6. Install the new VSB in the reverse order of removal.



For H-Frame and B-Frame Drives

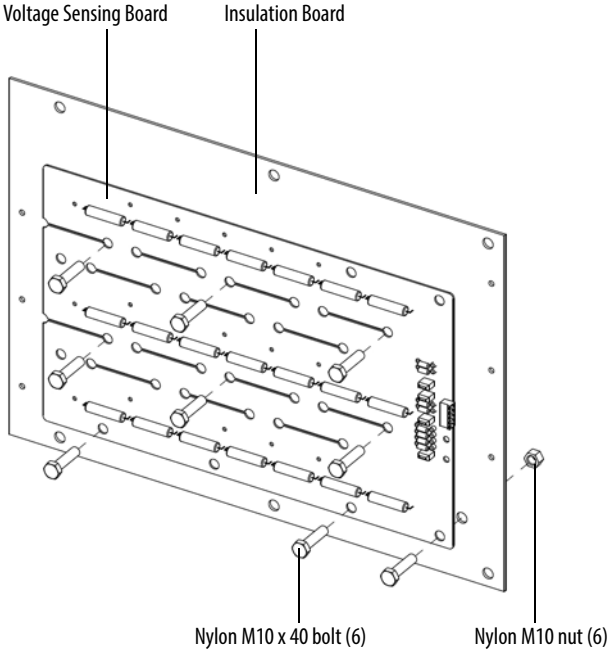
1. Remove the Voltage Sensing Board input and output cables.
2. Remove the eight nylon nuts to remove the Insulation Board from the cabinet side sheet.

Figure 37 - Remove the Insulation Board



3. Remove the nylon nuts that connect the Voltage Sensing Board to the Insulation Board.

Figure 38 - Remove the Voltage Sensing Board from the Insulation Board



4. Install the new Voltage Sensing Board to the Insulation Board in reverse order of removal.
5. Reinstall the Insulation Board to the cabinet side sheet in reverse order of removal.
6. Reconnect the input and output cables according to the Electrical Drawings.

Inspect Door Position Limit Switch

Check for obvious signs of damage, dust, or foreign material. Remove any dirt or foreign material. Wipe components with an anti-static cloth, where applicable. Check that the aviation plug has a hand-tight connection.

Replace Door Position Limit Switch

ATTENTION: Verify that the input circuit breaker feeding the drive is open. Lock out and tagout the input circuit breaker before performing any work on the drive or bypass units.

1. Open the drive cabinet door.
2. Disconnect the aviation plug from the back of the Limit Switch.
3. For A-Frame drives – remove two M4 x 30 bolts from the mounting bracket.
   For H-Frame and B-Frame drives – remove two M4 x 35 bolts and hardware from the mounting bracket.
4. Install the new Limit Switch in reverse order of removal.

Figure 39 - Replace Door Position Limit Switch, A-Frame

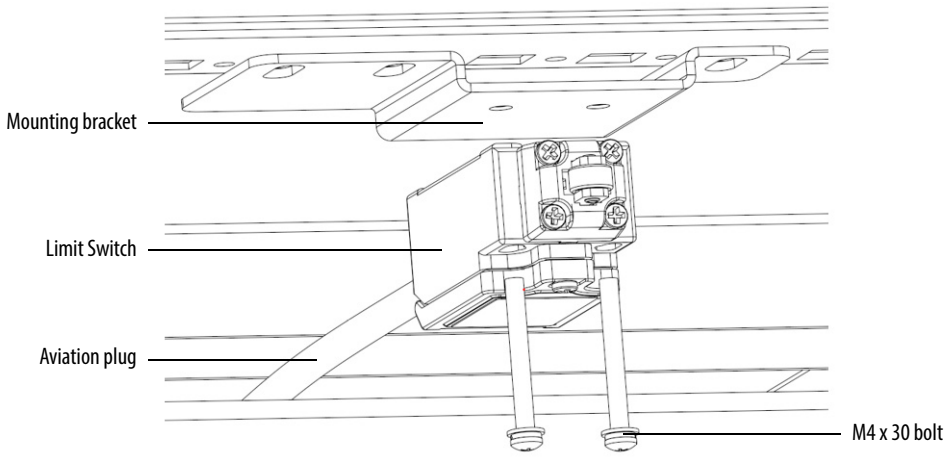
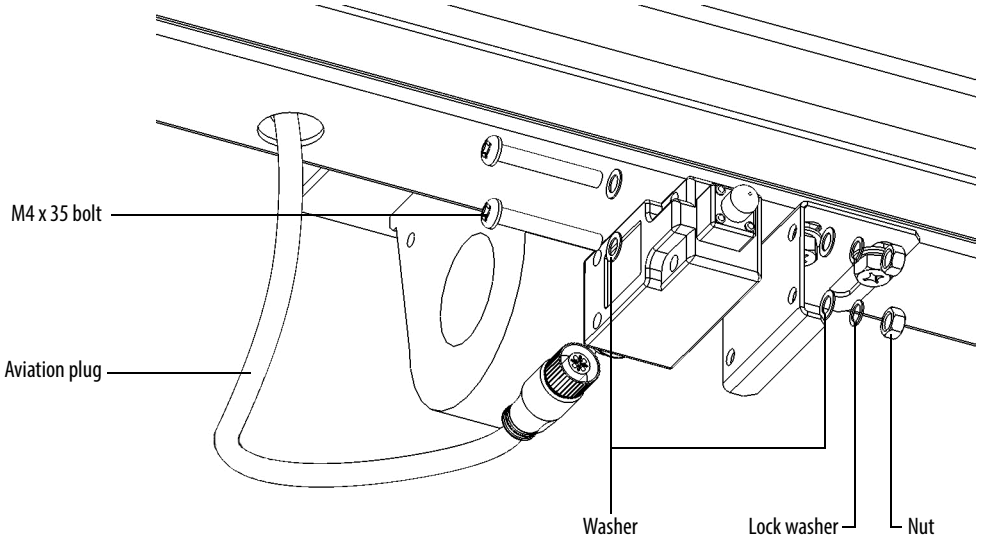


Figure 40 - Replace Door Position Limit Switch, H-Frame and B-Frame



Power Module Cabinet

Inspect, Clean, or Replace Door Mounted Air Filters

See Replace/Clean Door-mounted Air Filters on page 96.

Inspect or Replace Top Mounted Cooling Fans

See Inspect Top Mounted Cooling Fans on page 98.

Inspect Power Modules

1. Inspect the power connections for loose connections or any evidence of discoloration of connections from heating.
2. Remove dust or debris from all ventilation openings on the Power Module
3. Inspect the electrolytic capacitors, which are located in the ventilation openings of the Power Module.
   a. Inspect for signs of discoloration, odor, or leakage.
   b. Replace Power Modules if the capacitors have discoloration, odor, or leakage.

Replace Power Module

Table 8 - Power Module Specifications

Frame	Output Rating (Amps)	Dimensions (HxWxD), approx.	Weight, approx.
A-Frame	36…70 A	210 x 110 x 569 mm (8.3 x 4.3 x 22.4 in.)	13 kg (28.6 lb)
	71…140 A	210 x 190 x 624.5 mm (8.3 x 7.5 x 24.6 in)	25 kg (55 lb)
	141…215 A	210 x 215 x 674 mm (8.3 x 8.5 x 26.5 in)	35 kg (77 lb)
H-Frame	≤150 A	420 x 180 x 615 mm (16.5 x 7.1 x 24.2 in.)	20 kg (44.1 lb)
	151…200 A	420 x 260 x 615 mm (16.5 x 10.2 x 24.2 in.)	25 kg (55.1 lb)
B-Frame	201…305 A	552.5 x 244.5 x 663 mm (21.8 x 9.6 x 26.1 in.)	70 kg (154 lb)
	351…680 A	471 x 354 x 746 mm (18.5 x 13.9 x 29.4 in.)	95 kg (209 lb)

ATTENTION: At least two people are required to handle the Power Modules.

ATTENTION: The high-voltage power source must be switched off before replacing a Power Module. Wait for 20 minutes before opening the cabinet doors. Verify that all circuits are voltage-free, using a hot stick or appropriate high voltage-measuring device. Failure to do so may result in injury or death.

1. Remove the mounting bolts (M6 x 20) from both sides of the Power Module.
2. Disconnect the three-phase input power cables.

Figure 41 - Power Module Component Location, A-Frame

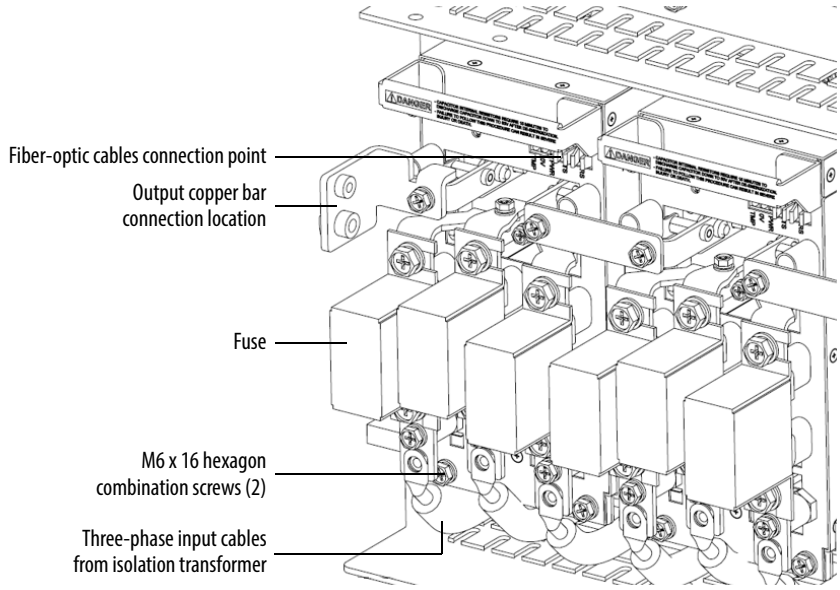
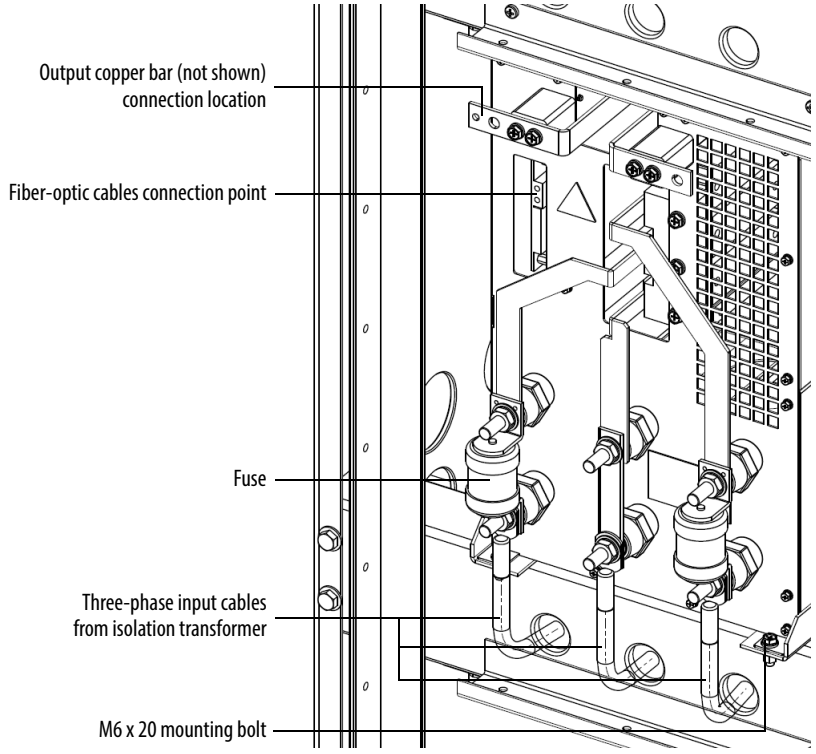


Figure 42 - Power Module Component Location, H-Frame and B-Frame



3. Remove the output copper bars that connect adjacent Power Modules (Figure 44).

   If the Power Module is at the end of a row, remove the VSB and motor cable instead of an output copper bus.

4. Disconnect the fiber-optic cables.

ATTENTION: When removing the fiber-optic cables, be careful to prevent the cables from straining or crimping as the resulting loss in light transmission will impact performance.

ATTENTION: Minimum bend radius that is permitted for the fiber-optic cables is 50 mm (2.0 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable.

Figure 43 - Close up of Fiber-optic Location and Power Cables, A-Frame

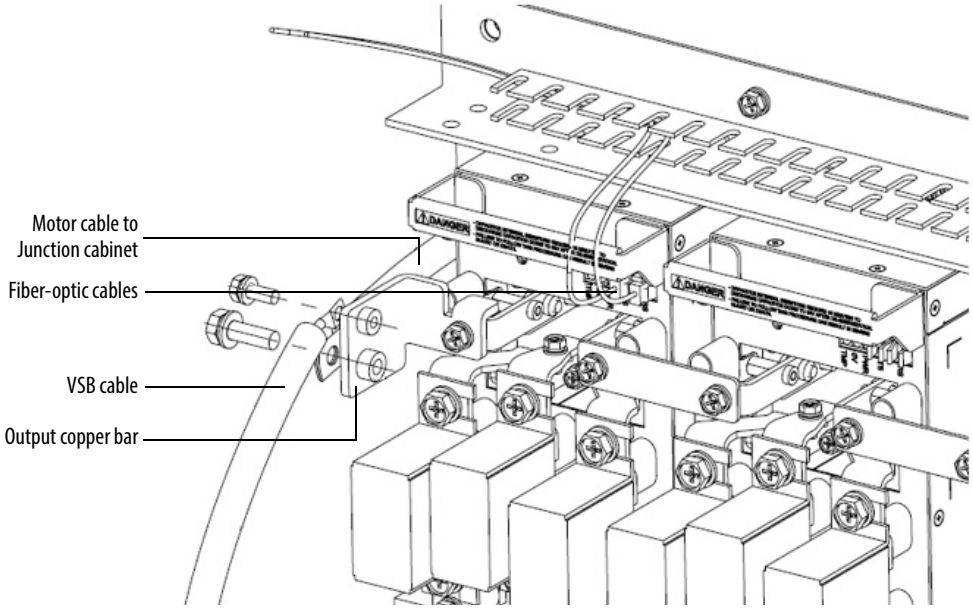
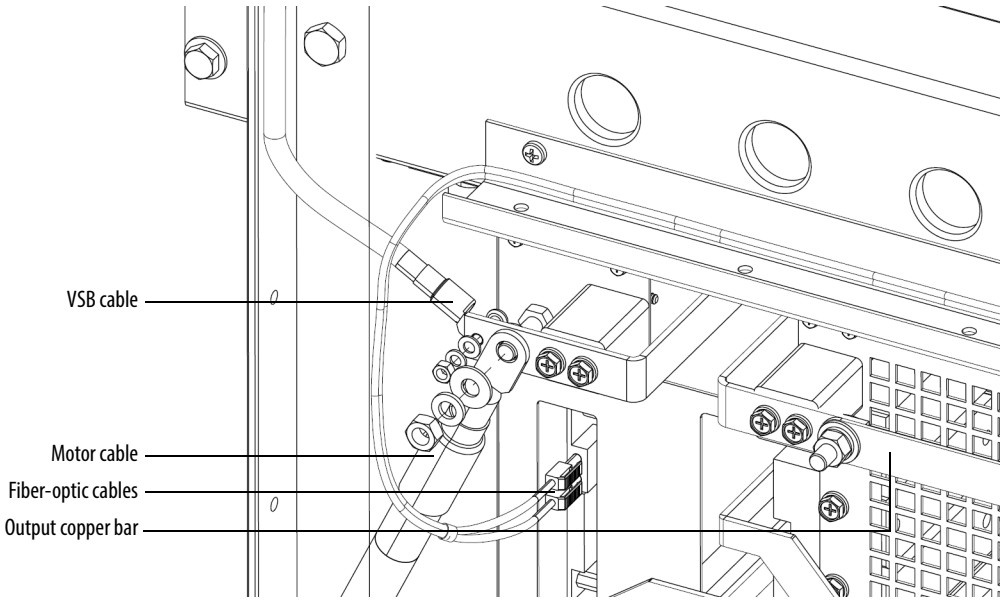


Figure 44 - Close up of Fiber-optic Location and Power Cables, H-Frame and B-Frame



5. Carefully withdraw the Power Module.

6. Install the new Power Module in reverse order of removal.

ATTENTION: Do not use the front-mounted positioning handles for lifting the Power Modules. They are designed to position or withdraw the Power Module when on the tray assembly.

ATTENTION: The Power Module finger assemblies must be fully seated on the cabinet stab assemblies.

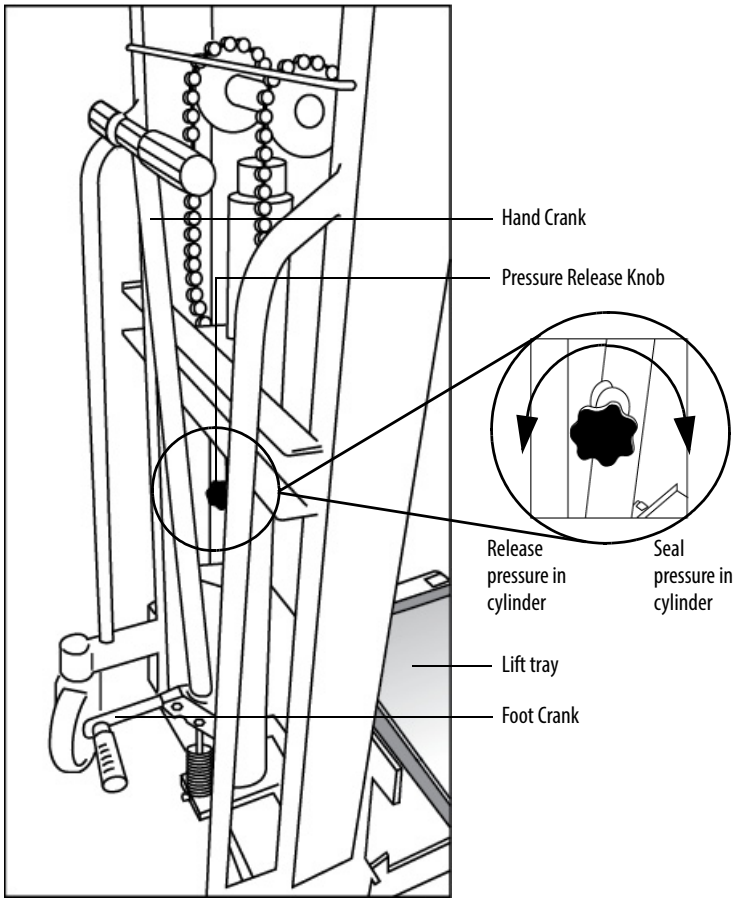
Using the Lift Cart

Power Modules that are rated above 350 A are shipped separately, therefore site installation and cable connection is needed. In this case, a lift cart is supplied for power cell replacement.

ATTENTION: Only authorized personnel should operate the lift cart. Keep hands and feet away from the lifting mechanism. Do not stand under the lift tray when in use. Store the lift cart with the tray fully lowered.

The lift cart's hydraulic cylinder can be operated by either a hand or foot crank. The lifting capacity is 400 kg (882 lb).

Figure 45 - Lift Cart Procedure



1. Check the lift tray before use to verify that the tray can be raised and lowered smoothly.
2. Rotate the Pressure Release Knob counterclockwise to verify that the tray is in the lowest position.
3. Move the Power Module on the tray and lift the module to the appropriate height using the Foot Crank and complete the installation.

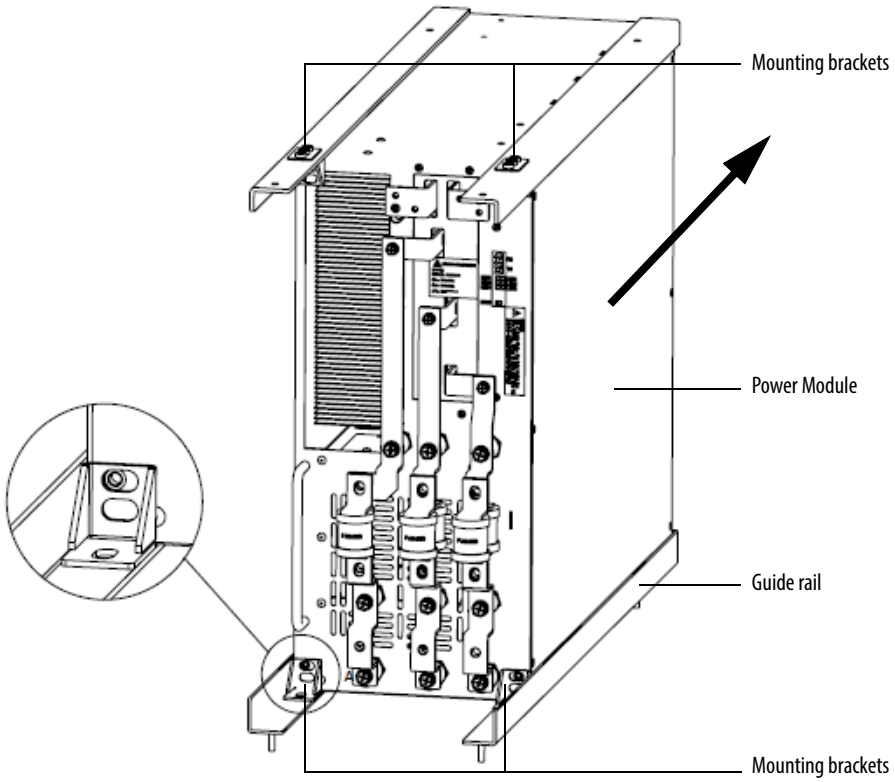
   TIP The Foot Crank raises the lift tray faster than the Hand Crank. Use this to raise the Power Module to just below the tray assembly in the drive. Use the Hand Crank for final precise positioning.

4. Rotate the Pressure Release Knob counterclockwise to lower the tray to its original position.
5. Repeat steps 1...4 to complete the installation for all the Power Modules.

Install Power Module for H-Frame and B-Frame Drives

IMPORTANT The Power Module should be handled carefully. After removing the packaging, inspect the Power Module to confirm that there is no damage and moisture.

1. You can use the lift cart to move and position the Power Module to the appropriate location in the cabinet.
2. Push the Power Module slowly along the guide rails until it cannot be pushed in further.
3. After installing the Power Module in place, use the mounting brackets and the M6 × 16 large flat pad galvanized nickel screws to fix the four corners, as shown below.



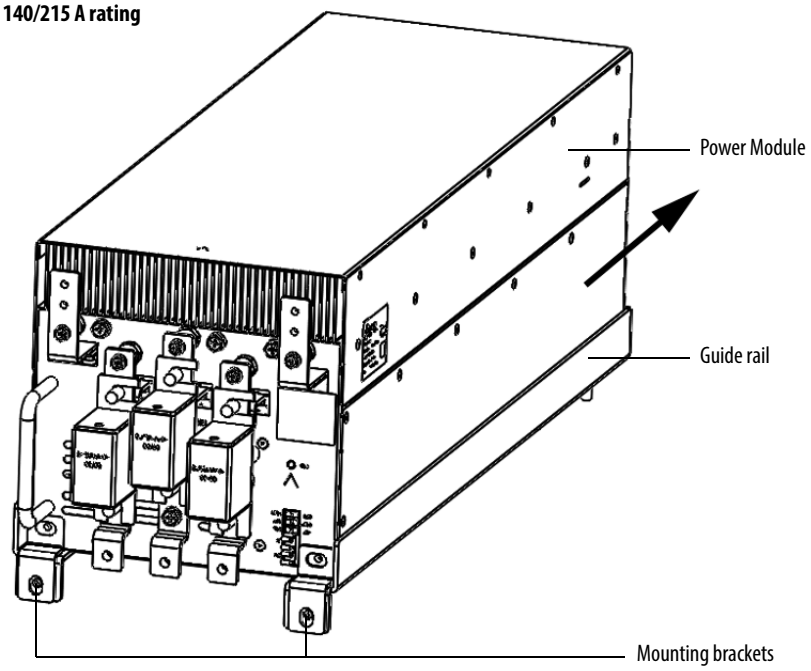
Install Power Module for A-Frame Drives

IMPORTANT The Power Module should be handled carefully. After removing the packaging, inspect the Power Module to confirm that there is no damage and moisture.

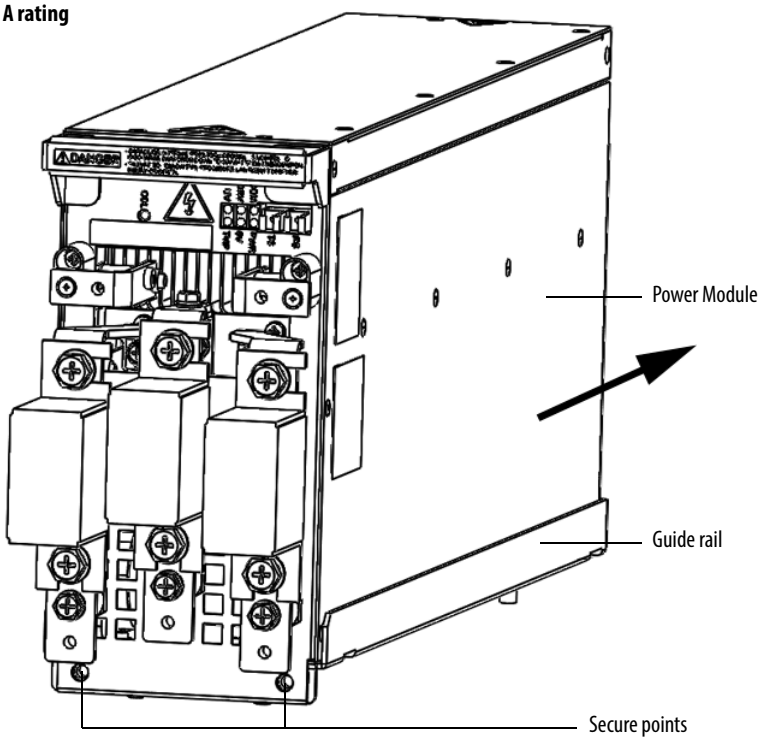
1. Disconnect the three-phase input power cables.
2. Remove the M6 x 16 mounting bolts from both sides of the Power Module.
3. Remove the output copper bars that connect adjacent Power Modules.
4. If the Power Module is at the end of a row, remove the VSB and Motor cable instead of an output copper bar.

5. Disconnect the fiber-optic cables.
6. Carefully withdraw the Power Module.
7. Install the new Power Module in reverse order of removal.

140/215 A rating



70 A rating

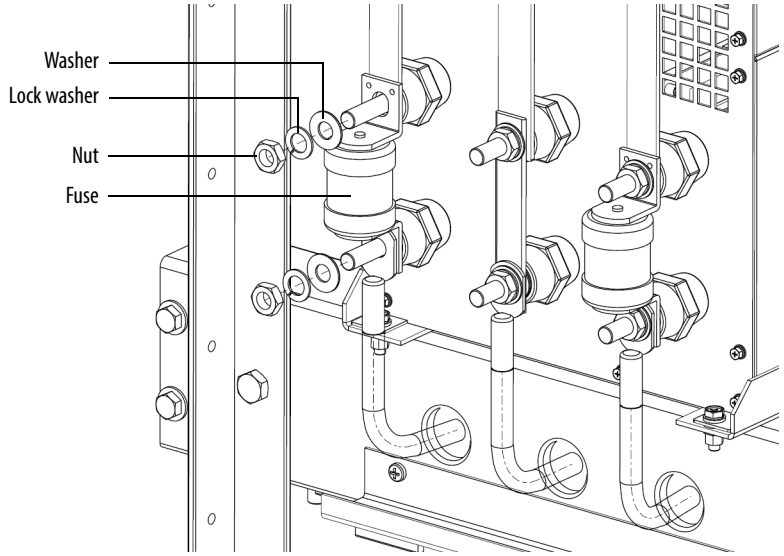


Replace Power Module Fuses

ATTENTION: Verify that the input circuit breaker feeding the drive is open. Lock out and tagout the input circuit breaker before performing any work on the drive or bypass units.

1. Remove the nut, lock washer, and washer from the top and bottom of the fuse.
2. Remove the cables from the top and bottom of the fuse, and remove another washer.
3. Install the new fuse, and replace cables and hardware in reverse order of removal.
4. Torque all hardware to specifications (see Torque Requirements on page 149).

Figure 46 - Exploded View of Power Module Fuse



Inspect or Replace HECS

ATTENTION: To prevent electrical shock, disconnect the main power before working on the drive. Verify that all circuits are voltage-free, using a hot stick or appropriate high voltage-measuring device. Failure to do so may result in injury or death.

PowerFlex 6000 drives have three current sensors. For H-Frame drives they are located inside the Power Module cabinet. For A-Frame and B-Frame drives they are located inside the Transformer cabinet. Verify that the current sensor wire connector is properly seated. Check for obvious signs of damage.

1. Unplug the Current Sensor Connector from the HECS.

Figure 47 - HECS for A-Frame

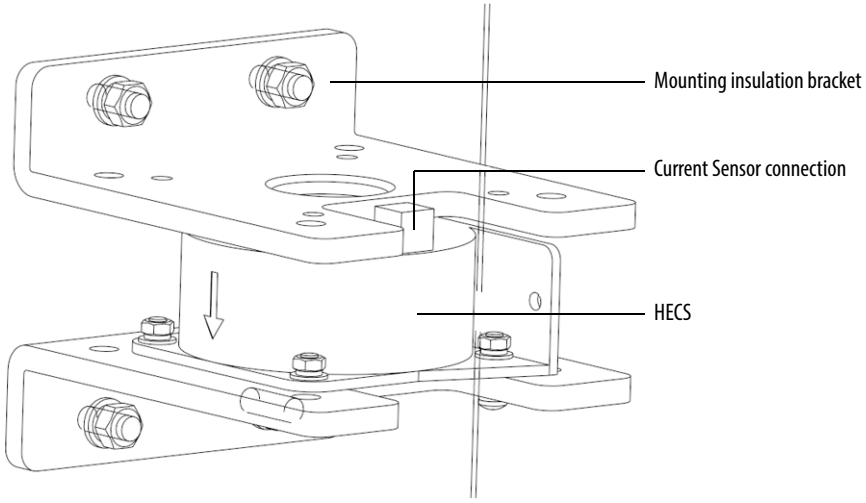


Figure 48 - HECS for H-Frame

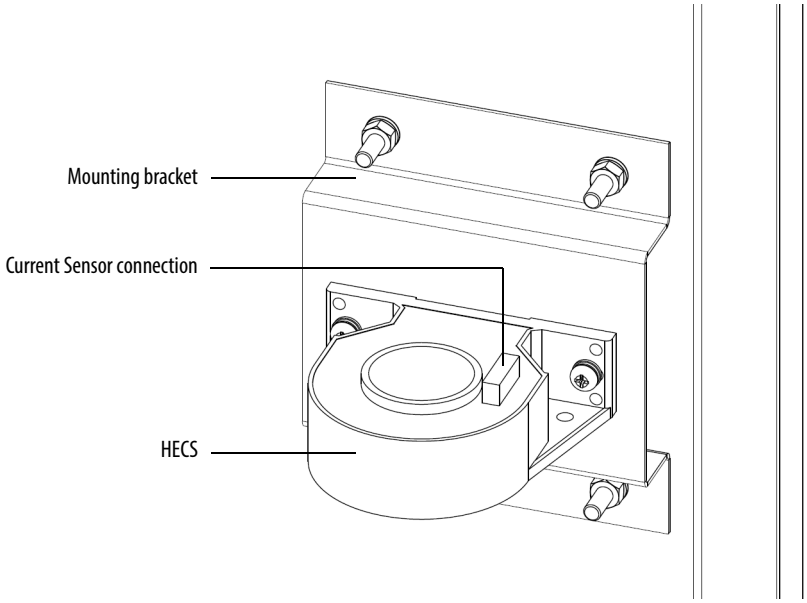
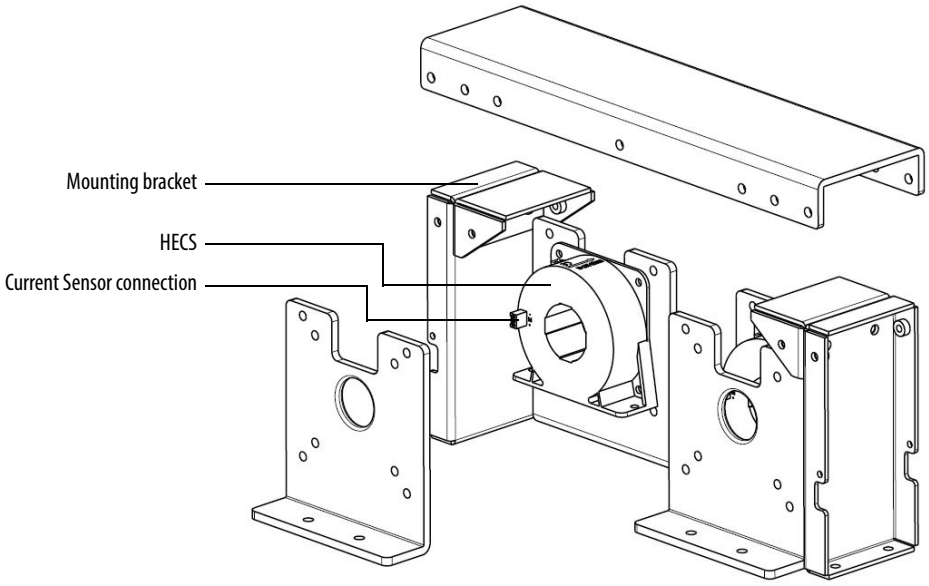


Figure 49 - HECS for B-Frame



2. Disconnect one end of the power cable that goes through the HECS from the Power Module.
3. Remove the Mounting Bracket with the HECS still attached.
4. Remove and retain hardware connecting the HECS to the Mounting Bracket.

IMPORTANT Note the orientation of the HECS on the bracket. The new HECS must be installed facing the same direction.

Figure 50 - Exploded view of the HECS and Mounting Bracket for A-Frame

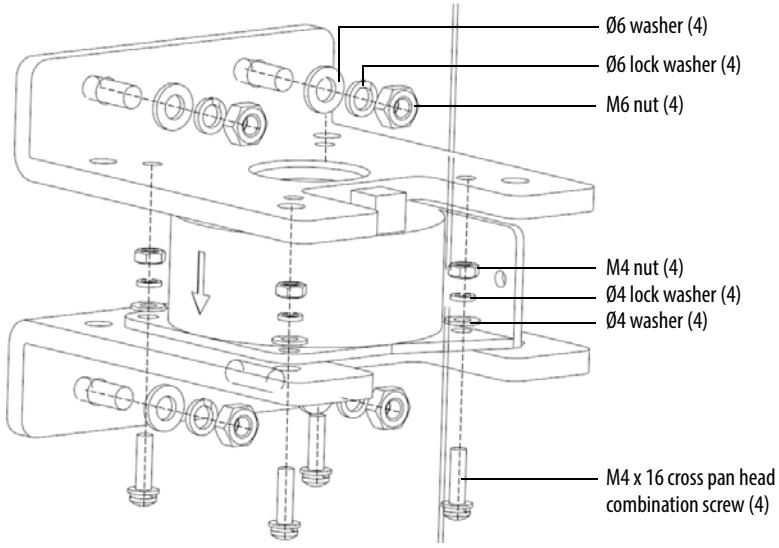


Figure 51 - Exploded view of the HECS and Mounting Bracket for H-Frame

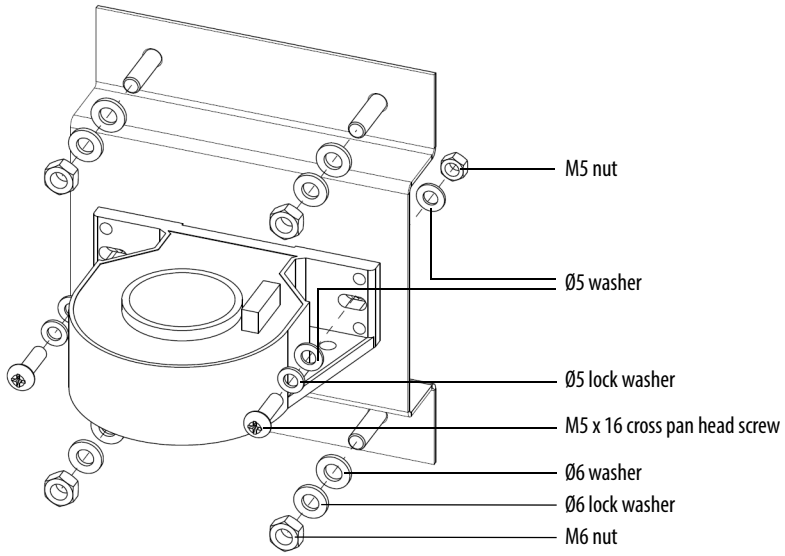
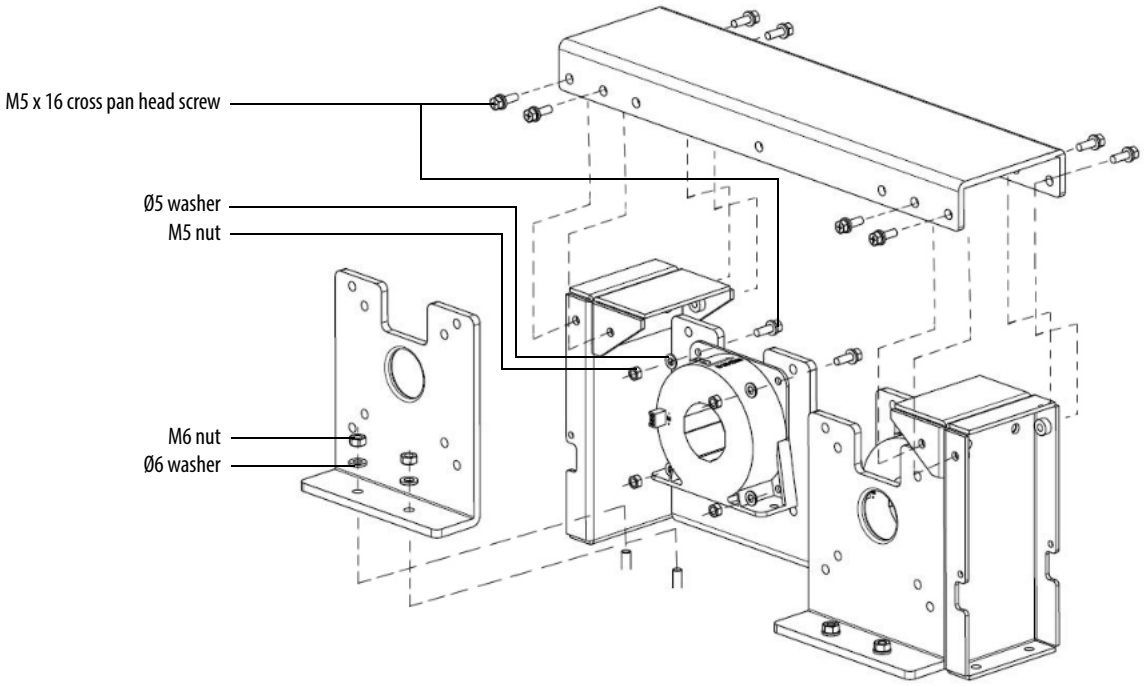


Figure 52 - Exploded view of the HECS and Mounting Bracket for B-Frame



5. Install the HECS on the Mounting Bracket using the existing hardware.

ATTENTION: Verify that the current sampling direction is correct. This is indicated by an arrow symbol on the top of the HECS.

6. Install the Mounting Bracket to the cabinet using existing hardware.
7. Reroute the power cable through the HECS and reattach to the Power Module.

Inspect or Replace Door Position Limit Switch

See Replace Door Position Limit Switch on page 106.

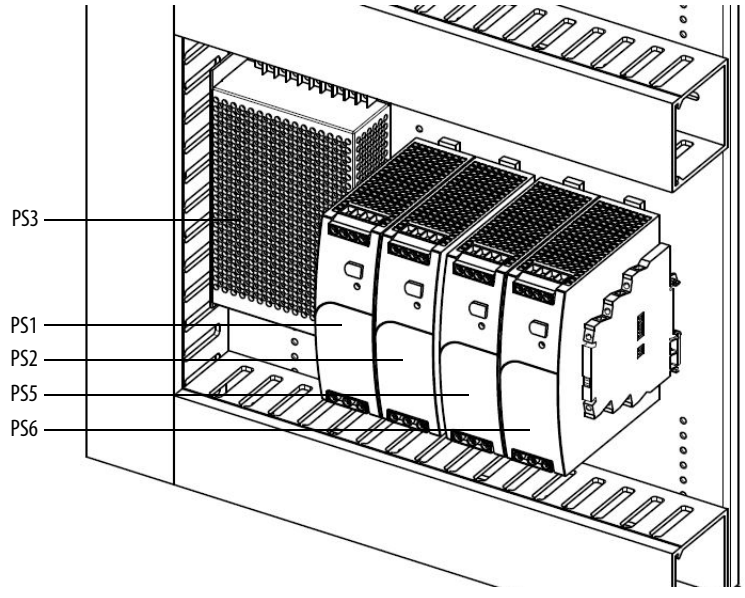
LV Control Cabinet

Inspect AC/DC Power Supplies

Verify that the input and output terminal connections are tight.

Use a voltmeter to check the output voltage. A green LED indicates normal operation.

Figure 53 - AC/DC Power Supplies



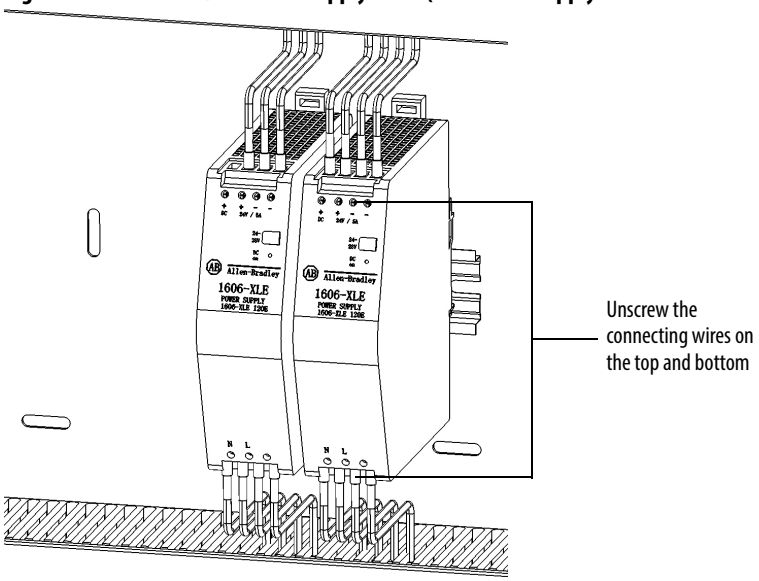
Replace AC/DC Power Supplies

ATTENTION: Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

PS1, PS2, PS5, or PS6 Power Supplies

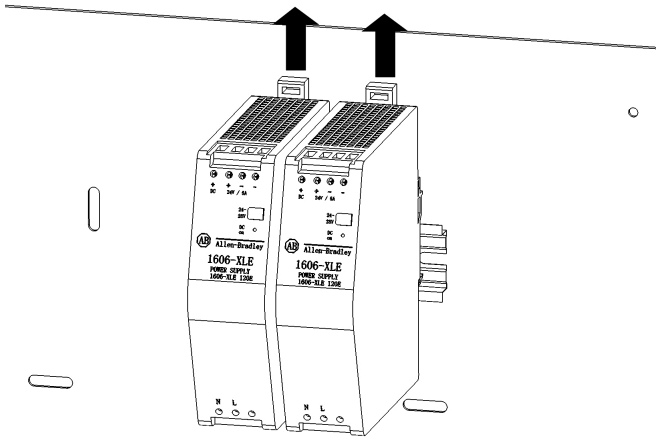
1. Open the LV Control cabinet door.
2. Loosen the top and bottom terminal screws and remove the wires on the PS1, PS2, PS5, or PS6 power supplies.

Figure 54 - Remove AC/DC Power Supply wires (PS3 Power Supply not shown for clarity)



3. Release the spring-loaded latches at the bottom of the power supply and lift the control relay off the DIN rail.

Figure 55 - Release the latches on the Power Supplies (PS3 Power Supply not shown for clarity)

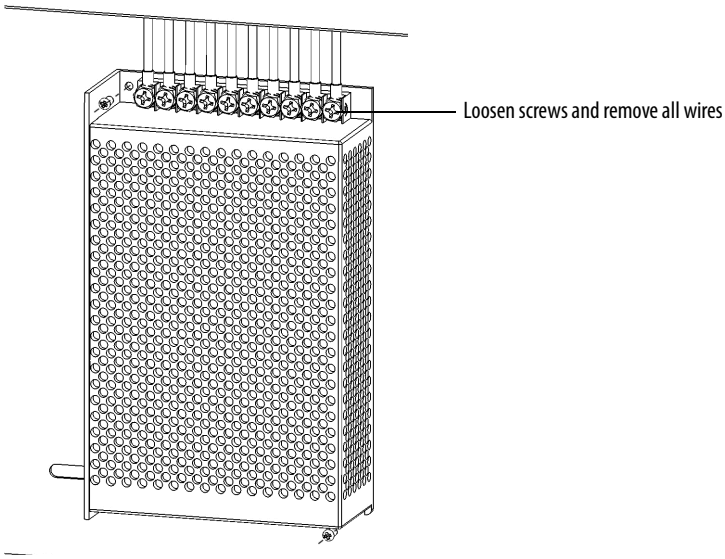


4. Install the new power supply in reverse order of removal.

PS3 Power Supply

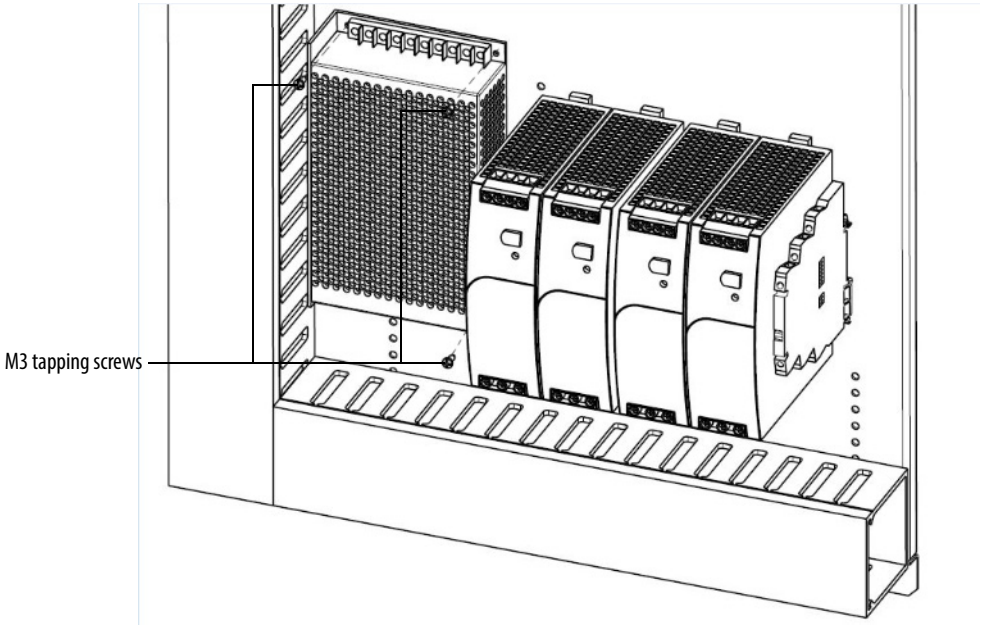
1. Loosen, but do not remove, the screws on the top of the PS3 Power Supply.
2. Remove the wires.

Figure 56 - Remove PS3 Power Supply wires (PS1 and PS2 Power Supply not shown for clarity)



3. Remove three M3 tapping screws to remove the unit.

Figure 57 - Remove AC/DC Power Supply



4. Install the new power supply in reverse order of removal.

Inspect UPS

1. Check that there are no obstructions or dirt/debris in the exhaust heat fan.
2. Verify that there are no visible signs of damage.

IMPORTANT If the drive has not been turned on for more than 3 months, the UPS batteries must be charged for at least 10 hours. Apply either MV to the drive or customer-supplied control power.

Check UPS Output Voltage

1. Open the LV Control cabinet door.
2. Turn off the back-up control power circuit breaker (CB5) and the customer-supplied power supply circuit breaker (CB1).

Figure 58 - Circuit Breaker Location in LV Control Cabinet (for A-Frame)

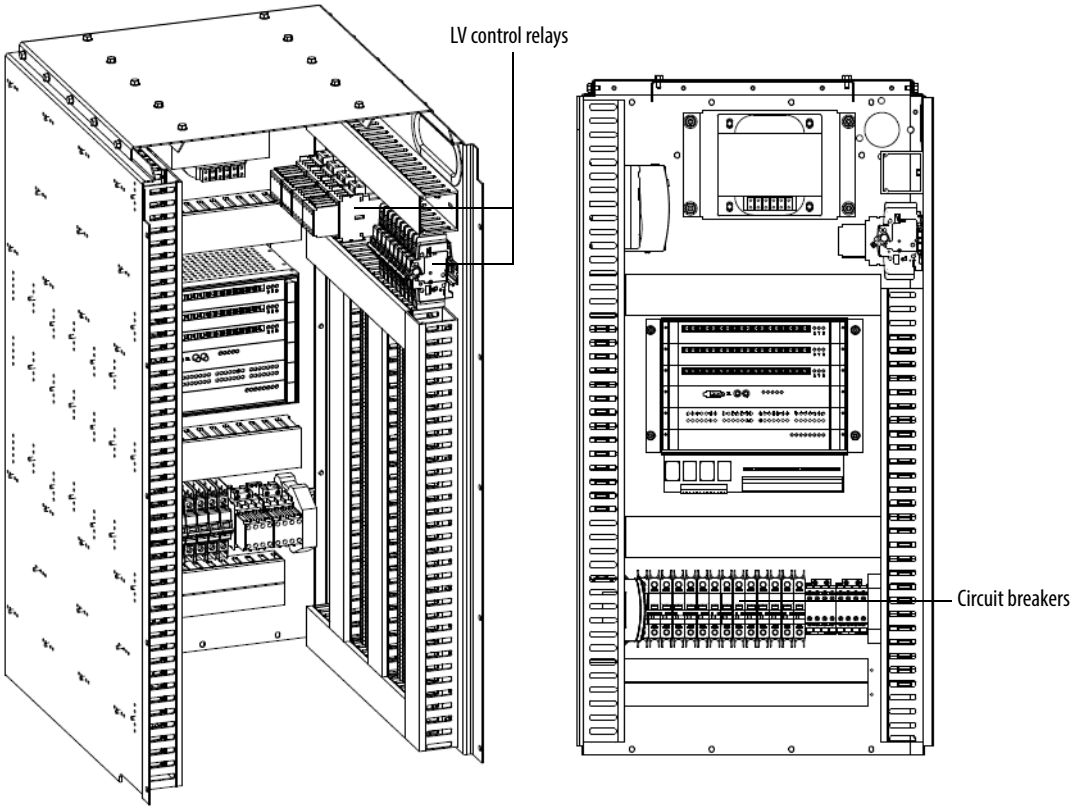
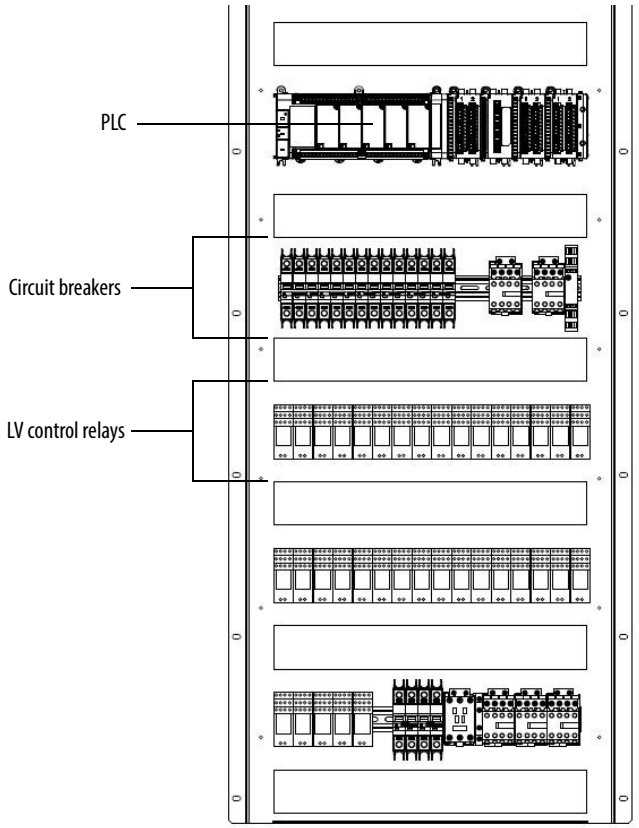


Figure 59 - Circuit Breaker Location in LV Control Cabinet (for H-Frame and B-Frame)



3. Press ON on the front of the UPS.
4. Using a voltmeter, check the output voltage of the UPS by checking the input voltage on the line side of the CB2 circuit breaker (equivalent electrical point).

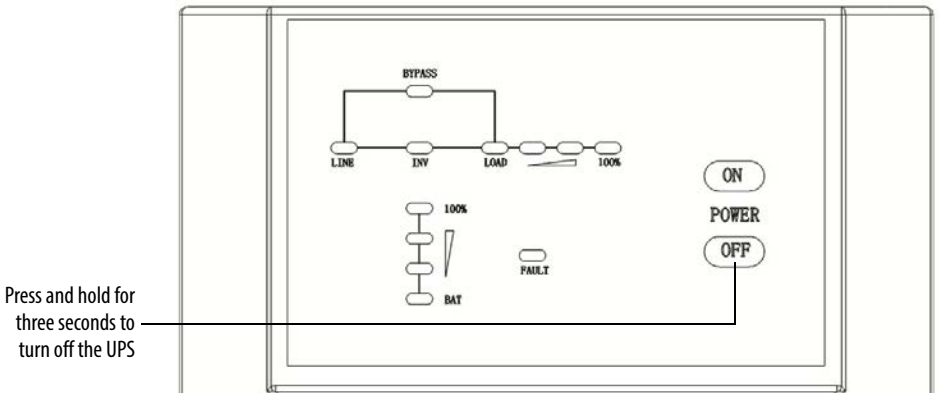
   The input voltage must be 110/120/220/240V AC optional.

Replace UPS

ATTENTION: Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

1. Turn off the CB2, CB3, and CB6 circuit breakers in the LV Control cabinet (Figure 59).
2. Press and hold OFF on the front of the UPS.

Figure 60 - Front Display of UPS



3. Turn off the CB1 and CB5 circuit breakers in the LV Control cabinet.
4. Unplug the UPS input and output power cables and disconnect the ground wire.
5. For A-Frame drives – remove and retain four M6 screws and one UPS mounting bolt from the mounting base (Figure 61).
   For H-Frame and B-Frame drives – remove and retain four screws from the mounting bracket (Figure 62).

Figure 61 - Replace UPS for A-Frame Drives

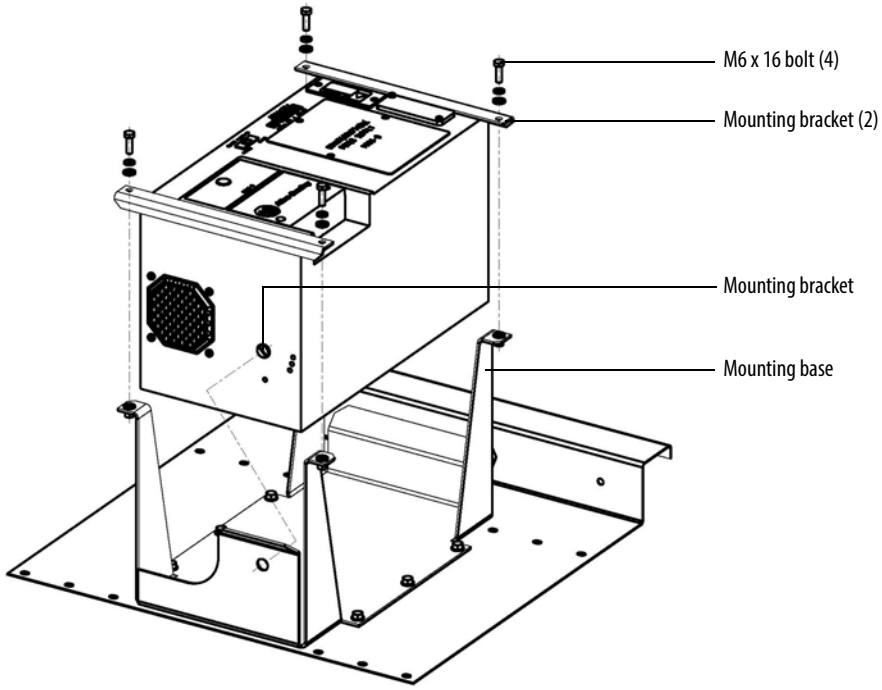
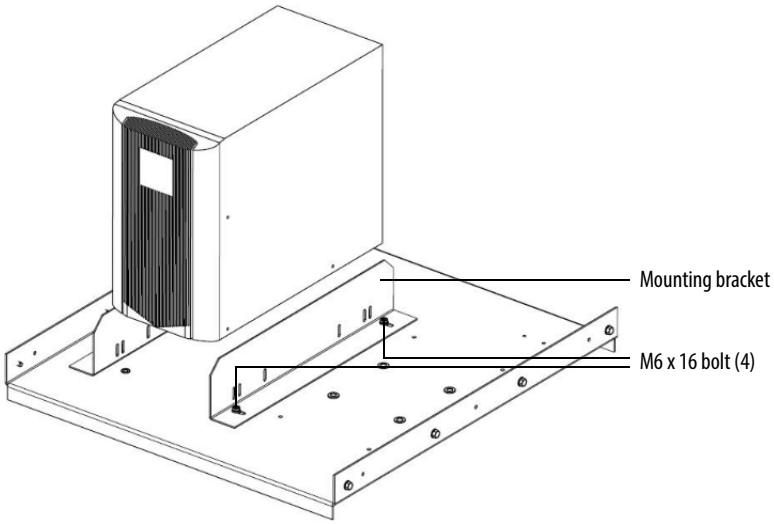


Figure 62 - Replace UPS for H-Frame and B-Frame Drives



6. Install the replacement UPS, and reconnect input and output cables.
7. Turn the CB1 circuit break and press the ON button on the UPS.

   Wait for 2...3 seconds.
8. Using a voltmeter, check the input voltage on the line side of the CB2 circuit breaker.

   The input voltage must be 220V AC.
9. Turn on CB2, CB3, CB5, and CB6 circuit breakers to complete the procedure.

ATTENTION: During removal and installation of the UPS, do not omit the UPS ground wire.

Inspect PLC

1. Verify that all input and output terminal connections are secure.
2. Verify all LEDs are working and indicate normal status.

See publication 2080-UM002 for further information for the PLC, or publication 2080-WD002 for further information regarding the Isolated Serial Port Plug-in Modules.

Inspect/Replace Control Unit or Control Boards

ATTENTION: Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

- Verify that the terminal connections on the bottom of the Control Unit are secure and are free of dirt, dust, or foreign material. Clean with an anti-static cloth.
- Verify that the fiber-optic cables are properly connected to the A/B/C PWM boards. Verify an appropriate bend radius (if applicable).
- Check all boards for damage and properly working LEDs.

Replace a Control Unit

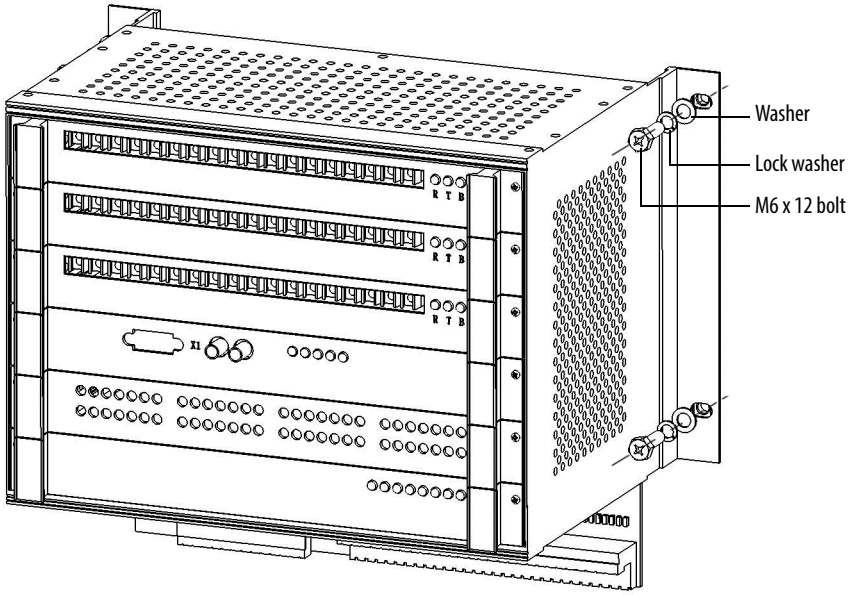
IMPORTANT The Control Unit does not have to be removed to replace Control Boards.

1. Turn off all the control power, turn off the UPS, and confirm that the LV Control cabinet is unenergized before operation.
2. Disconnect all of the bottom terminals.
3. Disconnect the fiber-optic wires from A/B/C Phase board.

ATTENTION: When removing the fiber-optic cables, be careful to prevent the cables from straining or crimping as a resulting loss in light transmission will impact performance.

4. Disconnect the PLC communication cable from the CPU board.
5. Remove four M6 x 12 bolts, and remove the Control Unit.

Figure 63 - Remove Retaining Screws of Control Unit



6. Install the new Control Unit in reverse order of removal. See the Electrical Drawings for exact placement of all wires and connections.

Replace a Control Board

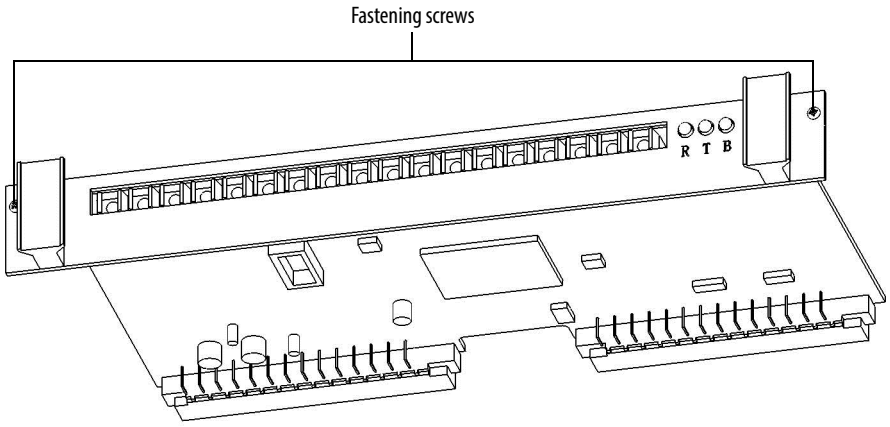
ATTENTION: Some circuit boards can be destroyed by static charges. Use of damaged circuit boards may also damage related components. Use a grounding wriststrap when handling sensitive circuit boards.

1. Turn off all the control power, turn off the UPS, and confirm that the LV Control cabinet is unenergized before operation.

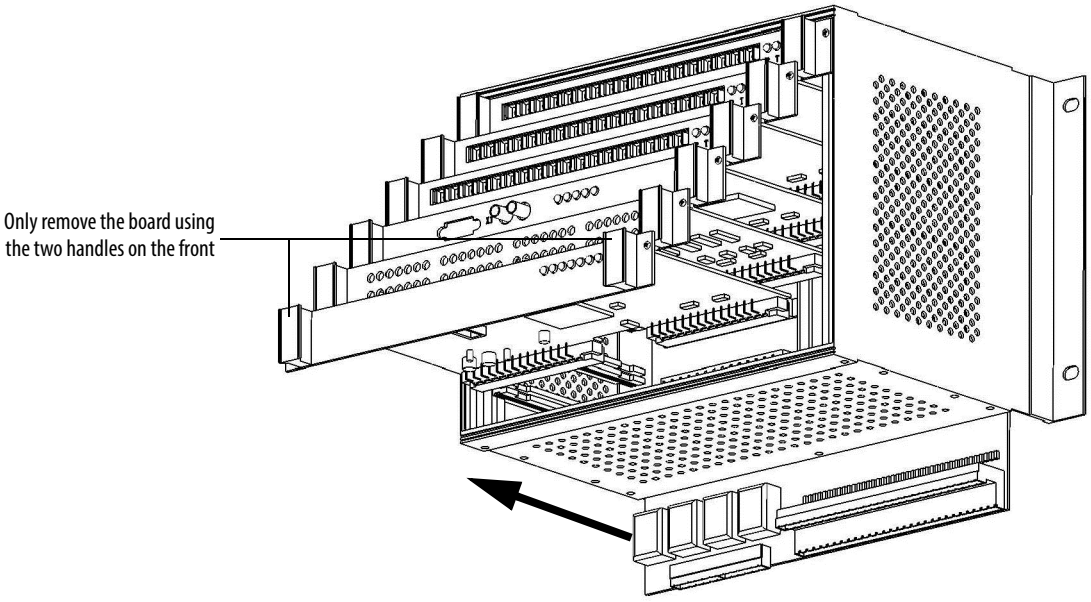
   If applicable, remove the fiber-optic wires.

ATTENTION: When removing the fiber-optic cables, be careful to prevent the cables from straining or crimping as a resulting loss in light transmission will impact performance.

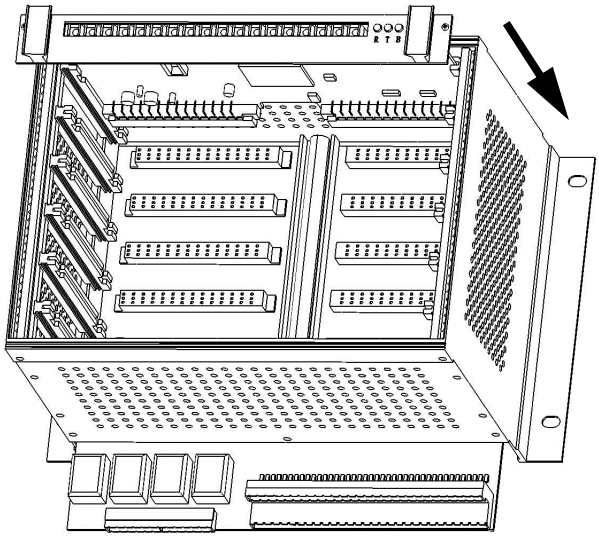
2. Remove the fastening screws on both sides of the board.



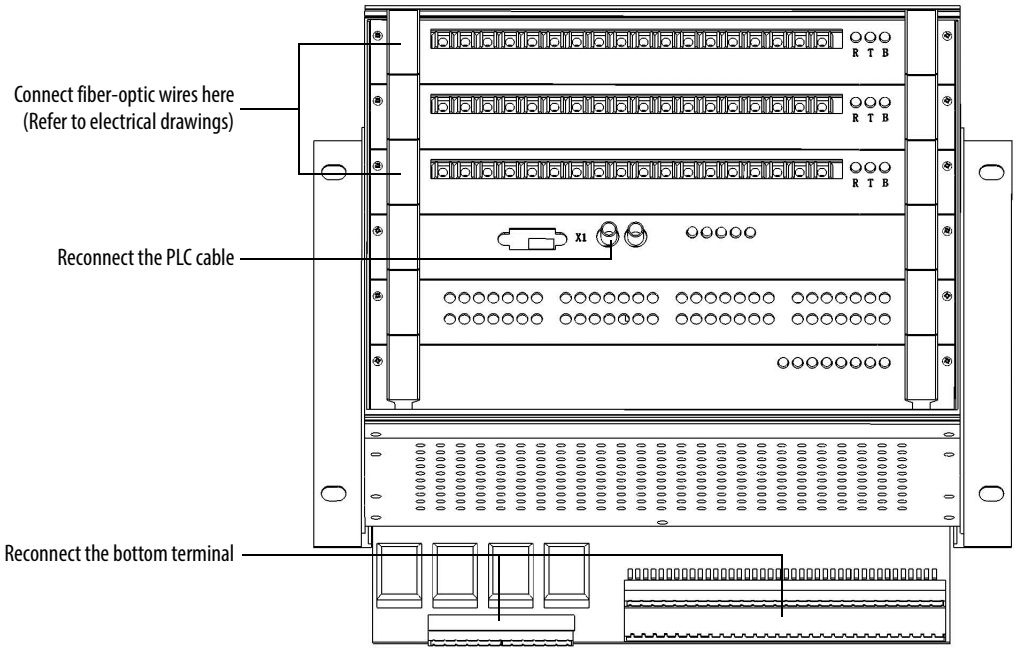
3. Use both hands and carefully remove the board by using the handles on either side on the front of the board.



4. Install the new boards in the reverse order of removal.



5. See the Electrical Drawings for reconnecting the fiber-optic wires.



Inspect the HMI

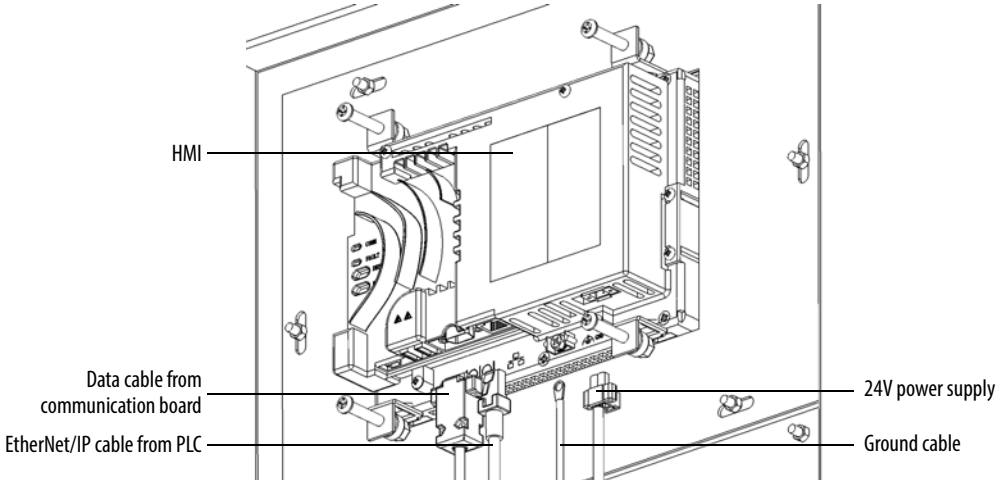
1. Verify the input and output cables and communication cables are hand-tight.
2. Power up the HMI.
3. Verify that the HMI display is operating normally.

Replace the HMI

ATTENTION: Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

The touch screen is located on the LV Control cabinet door.

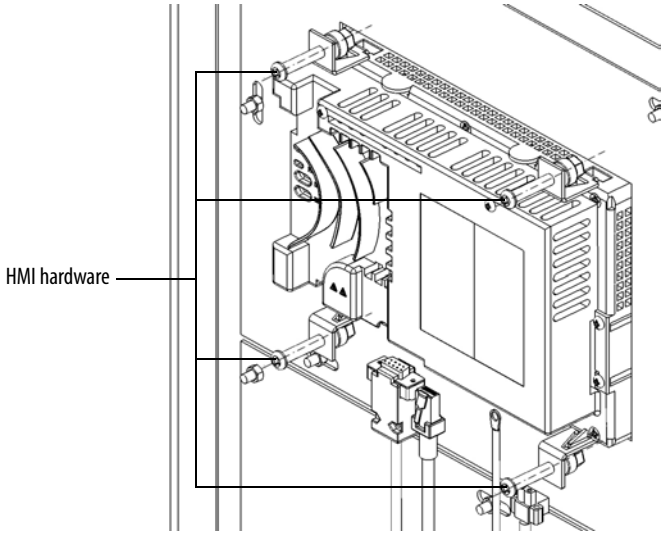
1. Disconnect the data cable from communication board, the EtherNet/IP cable from PLC, the ground cable, and the 24V power supply cable.



2. Remove and retain four screws from HMI.

IMPORTANT Support the HMI from the outside of the door to prevent it from falling through the front of the door.

3. Install the new HMI from the inside of the LV Control cabinet door.



4. Reconnect all cables in reverse order of removal.

TIP The following HMI components can be replaced:

- Logic Module
- Display Module
- Bezel
- Backlight
- Battery

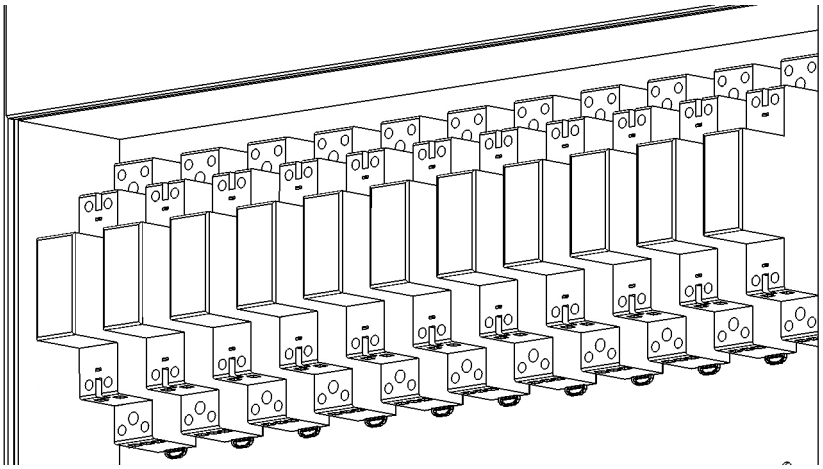
See publication 2711P-UM006_-EN-P for further information.

Replace LV Control Relays

ATTENTION: Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

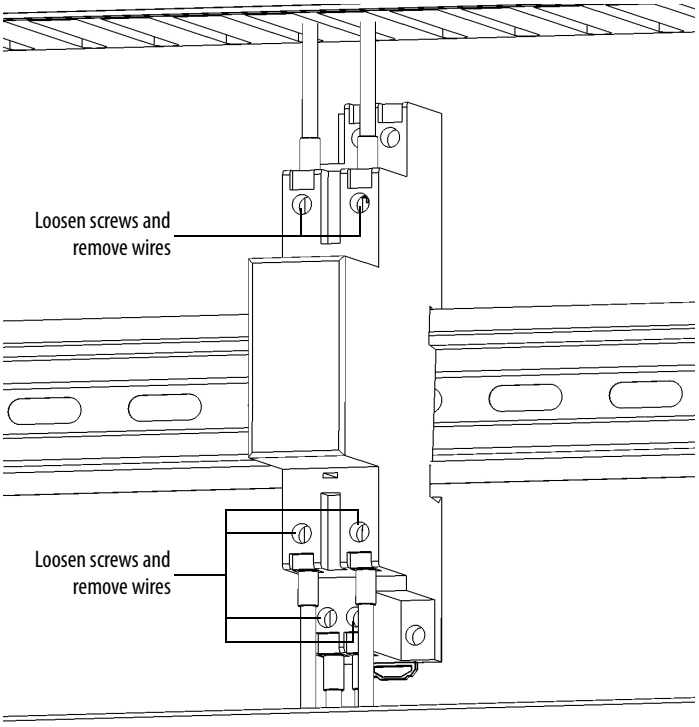
1. Open the LV Control cabinet door.

Figure 64 - LV Control Relay Location



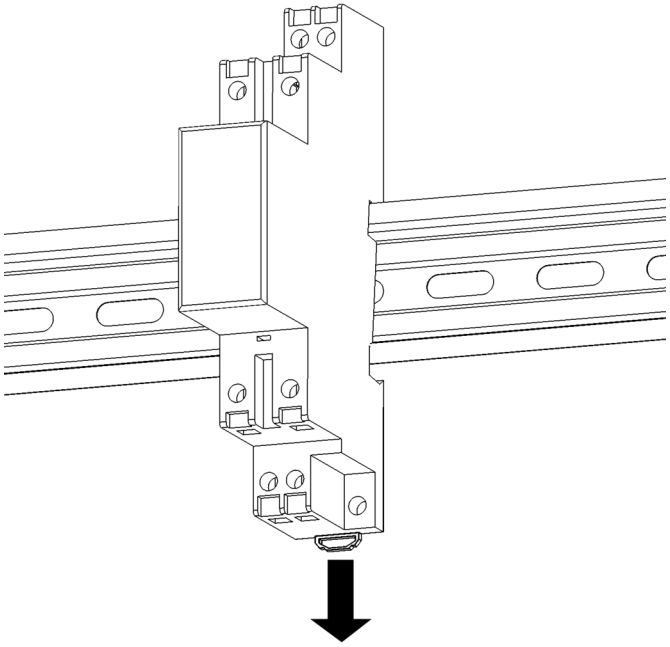
2. Loosen the top and bottom screws and remove the wires on the control relay.

Figure 65 - Loosen screws on the LV Control Relay



3. Release the spring-loaded latches at the bottom of the control relay and lift the control relay off the DIN rail.

Figure 66 - Release the spring-loaded latch on the LV Control Relay



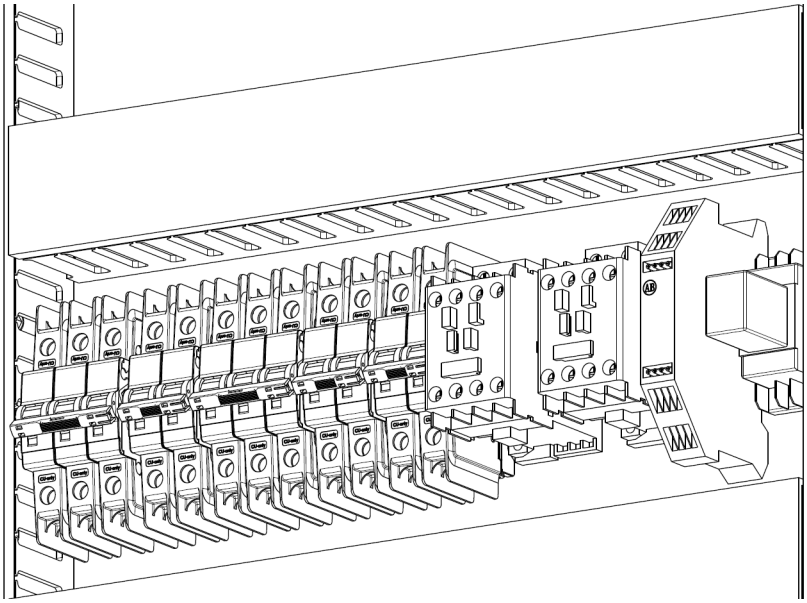
4. Install the new control relay in reverse order of removal.

Replace LV Control Circuit Breakers

ATTENTION: Always perform Power Lockout procedure before servicing equipment. Verify with a hot stick or appropriate voltage measuring device that all circuits are voltage free. Failure to do so may result in severe burns, injury, or death.

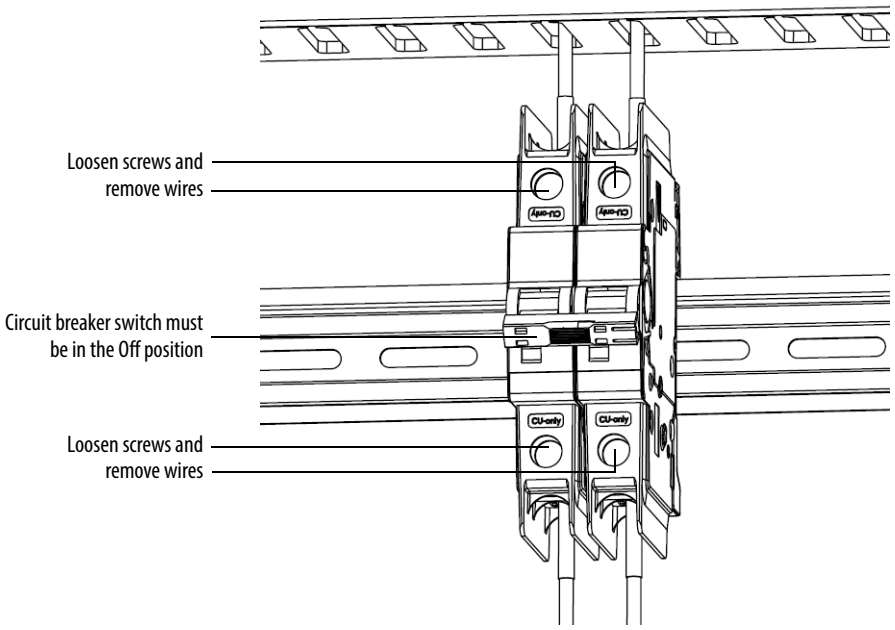
1. Open the LV Control cabinet door.
2. Switch the circuit breaker to the off position.

Figure 67 - Circuit Breaker Location in LV Control Cabinet



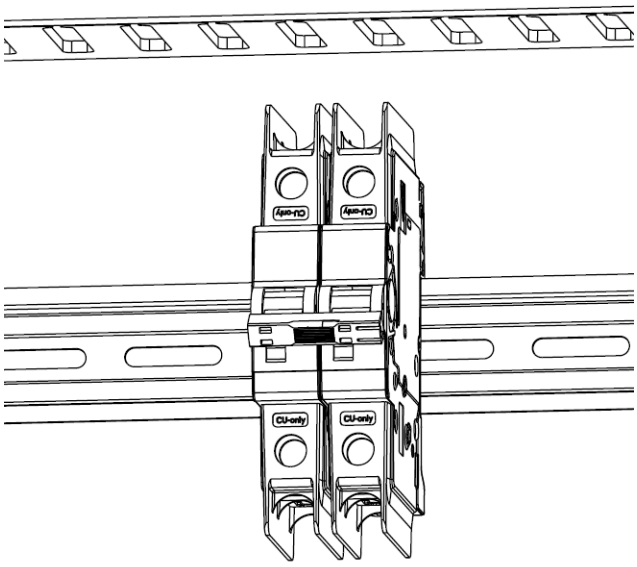
3. Loosen the top and bottom screws and remove the wires on the circuit breaker.

Figure 68 - Screw location on Circuit Breaker



4. Release the spring-loaded latches at the bottom of the circuit breaker and lift the circuit breaker off the DIN rail.

Figure 69 - Release spring-loaded latch on LV Circuit Breakers



5. Install the new circuit breaker in reverse order of removal.

Inspect Coils

If a coil exhibits evidence of overheating (cracked, melted, or burned insulation), it must be replaced. In that event, check for and correct overvoltage or undervoltage conditions, which can cause coil failure. Be sure to clean any residue of melted coil insulation from other parts of the device or replace such parts.

Inspect Contacts

Check contacts for excessive wear and dirt accumulations. Vacuum or wipe contacts with a soft cloth if necessary to remove dirt. Contacts are not harmed by discoloration and slight pitting. Do not file contacts. Do not use contact spray cleaners as residue on magnet pole faces or in operating mechanisms can cause sticking and can interfere with electrical continuity. Replace contacts only after the contact face material is badly worn. Replace contacts in complete sets to avoid misalignment and uneven contact pressure.

Inspect Pilot Lights

Replace any burned out lamps or damaged lenses. Do not use solvents or cleaning agents on the lenses.

Do not use test equipment for solid-state controls that is not factory recommended. Doing so can result in damage to the control or test equipment, or unintended actuation of the controlled equipment.

Solid-state devices require little more than a periodic visual inspection. Replace discolored, charred, or burned components. Necessary replacements should be made only at the PC board or plug-in component level. Verify that the printed circuit boards are seated in the edge board connectors. Board locking tabs should also be in place. Protect solid-state devices from contamination, and maintain appropriate cooling provisions. Do not use solvents on printed circuit boards.

Inspect Locking and Interlocking Devices

Check these devices to verify proper working condition. Make any necessary replacements only with Allen-Bradley renewal parts or kits. Adjust or repair only in accordance with Allen-Bradley instructions found in the product User Manuals.

Connections

Inspect LV Component Terminal and Plug-in Connections

All LV control connections must be secure. Check for dirt, debris, or foreign material, and clean with anti-static cloth if necessary.

Check relays, contactors, timers, terminal connectors, circuit breakers, ribbon cables, control wires, and so on. Check for corrosion, excessive temperature, or contamination. Clean all components using a vacuum cleaner.

Inspect Medium Voltage Cable Connections

Verify that all MV power cable connections and grounding cables are torqued to specification. Apply torque sealer where necessary. Check for corrosion, excessive temperature, or contamination.

Inspect Power Cable and Control Wire Terminals

Loose connections in power circuits can cause overheating that can lead to equipment malfunction or failure. Loose connections in control circuits can cause control malfunctions. Loose bonding or grounding connections can increase hazards of electrical shock and contribute to electromagnetic interference (EMI). Check the tightness of all terminals and bus bar connections and tighten securely any loose connections. Replace any parts or wiring that is damaged by overheating, and any broken wires or bonding straps. See the User Manual for torque values required for power cable and bus hardware connections.

Inspect Transformer Secondary Windings

Check the Incoming Line Power Cable connections (L1, L2, and L3), the Outgoing Motor Power Cable connections (U, V, W), and the Isolation Transformer Power Cable Connections are torqued to specifications. See Figure 16.

Inspect the bus bars and cable connections. Check for any signs of overheating / discoloration and tighten the bus connections to the required torque specifications. Clean all cables and bus bars that exhibit dust build-up. Check for corrosion, excessive temperature, or contamination.

Inspect Power Module Input and Output Power Connections

Verify that all Power Module input line cables and output bus connections are properly torqued. Verify that the output cables, VSB Cables, and star connection cables are properly torqued. Apply torque sealer if necessary. Check for corrosion, excessive temperature, or contamination.

General

Review Firmware and Hardware

Verify the firmware revision on the HMI. Contact Rockwell Automation to determine whether there are any enhancements or changes that are made to the Drive Hardware and Control that would be valuable to the application.

Verify that the HMI is operational. Check the status indicators on the Control Unit in the LV Control cabinet register as normal.

ATTENTION: Verify that there is no power to the drive and wear an anti-static wristband.

Remove any dirt or foreign material. Wipe components with an anti-static cloth, where applicable.

Inspect/Review Spare Parts

Inspect and review the spare parts that are shipped with the drive (see the packing list if applicable). Check for signs of damage, dirt, or foreign material.

ATTENTION: Some circuit boards can be destroyed by static charges. Use of damaged circuit boards may also damage related components. Use a grounding wriststrap when handling sensitive circuit boards.

ATTENTION: Due to the characteristics of DC capacitors, rejuvenation is necessary on power module DC capacitors if the power module has not been energized in the last one year. Therefore the spare power modules need to be energized annually.

Professional Maintenance Service

Rockwell Automation also offers professional maintenance service that is provided by the Rockwell Automation field support engineer, contact your local Rockwell Automation sales person for more information.

Miscellaneous Preventive Maintenance Work

- Communicate with the customer regarding problems found during the preventive maintenance process.
- Raise the problems found during the maintenance process.
- Provide relevant solutions and record them in the final report.
- Provide advice on operation and maintenance of the drive to the customer's maintenance personnel.
- Provide information about requirements for safe operation of the drive and safety instructions.
- Provide information about operating conditions (environment, temperature, and so on) required for stable operation of the drive.
- Obtain spare parts information from the customer to determine whether they have sufficient stock. Recommended the customer to purchase additional spare parts if required.

For more information, contact PF6000TechnicalSupport@ra.rockwell.com.

Table 9 - Estimated Time Required for Maintenance Work

Activity	Time Required
Daily maintenance	0.5 hours for each air filter
Annual maintenance	
Initial collection of information	0.5 hours
Visual inspection and cleaning	6.0 hours
• Electrical connection • Ground • Control cabinet • Transformer cabinet • Power cabinet • Inside the Power Module(1) • Fan • Door and mechanical parts • Insulation	
Low voltage check	2.0 hours
• Control system • Cooling fan • Parameters	
Final inspection before commissioning	2.0 hours
• Final inspection • Medium voltage test(1) • Run to maximum load	Depending on the situation
Miscellaneous work	2.0 hours
• Survey(1) • Informal training • Spare parts analysis	
Final report	4.0 hours

(1) These inspection items and time are only estimated. Depends on the situation when conducting preventive maintenance and the operation of the drive.

Tools/Materials/Documentation Requirements

The tools that are listed below for maintaining the PowerFlex 6000 drives are listed below. Only a subset of the tools is required for specific drive preventive maintenance work, but if all of the above work is to be done, all of the following tools are required.

Tools required:

- 5 kV DC Shake Table
- Digital multimeter
- Torque wrench
- Portable computer and related software, data connectivity
- Tool set (screwdriver, metric open-end wrench, metric socket wrench, and so on.)
- Fast wrench
- 10 kV electroscope (up to and including 10 kV) and ground protection line (greater than 25 square feet)
- Safety gloves that can withstand at least 17 kV
- Vacuum cleaner with anti-static hose (provided by customers)
- Anti-static cleaning cloth
- Power Module lift cart (required for pull-out Power Modules)

Materials required:

- Torque seal (yellow), part number RU6048, or equivalent
- Electrical joint compound, ALCOA EJC number 2, or equivalent
- Shell number 7 aviation grease, part number 40025-198-01, or equivalent

Documents required:

- PowerFlex 6000 Medium Voltage Variable Frequency Drive User Manual, publication 6000-UM002.
- PowerFlex 6000 Medium Voltage Variable Frequency Drive Firmware, Parameters, and Troubleshooting Manual, publication 6000-TD004.
- PowerFlex 6000 Medium Voltage Variable Frequency Drive Installation Manual, publication 6000-IN006.
- Electrical and mechanical drawings of specific drive.
- List of spare parts for specific drive.

Final Report

A complete, detailed report on all steps in the Preventive Maintenance procedures should be recorded to identify changes.

A detailed description of all adjustments and measurements that were taken during the process must be recorded (interlock adjustments, loose connections, voltage readings, insulation resistance (IR) test results, parameters, and so on).

Prepare Final Report

The Rockwell Automation Service Engineer will provide a maintenance report to the customer based on the outcome of the maintenance work. All steps in the preventive maintenance process will be recorded in detail in the report and will identify changes that are made.

The final report includes:

- A complete copy of the Preventive Maintenance Checklist.
- Problems that are found during the investigation process and rectification recommendations.
- Adjustments and measurements during maintenance (including mechanical adjustment, connection status, voltage reading, vibration test results, parameters, and so on).

This information will be sent to the PowerFlex 6000 Technical Support and Product Support for the latest on-site information for future maintenance and technical support.

Notes:

Technical Specifications

Table 10 - Specifications

Attribute	Value
Power Rating Range @ 2.3/2.4 kV motor voltage	112…2390 kW (183…3205 HP)
Power Rating Range @ 3.0 kV motor voltage	110…2990 kW (214…4010 HP)
Power Rating Range @ 3.3 kV motor voltage	110…3280 kW (235…4398 HP)
Power Rating Range @ 4.0/4.16 kV motor voltage	144…4140 kW (294…5552 HP)
Power Rating Range @ 6.0 kV motor voltage	200…5970 kW (268…8006 HP)
Power Rating Range @ 6.6 kV motor voltage	286…6570 kW (384…8810 HP)
Power Rating Range @ 6.9 kV motor voltage	286…6870 kW (384…9213 HP)
Power Rating Range @ 10.0 kV motor voltage	200…9950 kW (268…13343 HP)
Power Rating Range @ 11.0 kV motor voltage	200…10950 kW (268…14684 HP)
Motor Type	Induction (asynchronous) motors
Input Voltage Rating	2.4 kV, 3.0 kV, 3.3 kV, 4.16 kV, 6.0 kV, 6.3 kV, 6.6 kV, 6.9 kV, 7.2 kV, 10.0 kV, 11.0 kV For other input voltage ratings, contact your local sales representative or factory.
Input Voltage Tolerance	±10% of Nominal
Input Voltage Sag, minimum	-30% of Nominal
Input Frequency	50/60 Hz, ±5%
Input Impedance Device	Multiphase Isolation Transformer
Input Current THD (1st...49th)	Complies with IEEE519-1992 standard
Output Voltage	0…2300/2400V, 0…3000/3300V, 0…4000/4160V, 0…6000/6300V/6600V, 0…6900V, 0…10000V 0…11000V
Rectifier Configurations	18 pulse (2.3/2.4/3.0/3.3 kV), 24 pulse (4.0/4.16 kV), 30 pulse (6.0 kV), 48 pulse (10 kV), 54 pulse (11 kV)
Inverter Configuration	Pulse Width Modulated (PWM) power modules
Power Module Rating	36 A, 40 A, 50 A, 70 A, 75 A, 100 A, 120 A, 140 A, 150 A, 180 A, 200 A, 215 A, 250 A, 305 A, 350 A, 438 A, 560 A, 680 A
Power Semiconductors	Diodes (rectifier), IGBTs (inverter)
Medium Voltage Isolation	Fiber-optic
Control Method	Sensorless Vector Control and Volts per Hertz

Attribute	Value
Output Frequency Range	1…75 Hz
Acceleration/Deceleration time	0…3276 seconds configurable
Ride Through, minimum	5 cycles
Flying Start Capability	Yes
Service Duty Rating	Normal duty – 110% overload for 1 min every 10 min Heavy duty – 150% overload for 1 min every 10 min
Input Power Factor	>.95
VFD Efficiency(1)	96.0…96.5%, depends on drive rating and transformer type
VFD Noise Level	80…85 dB(A), depends on drive rating
Operator Interface	7 in. WinCE Color touch screen
Languages	English, Chinese, Spanish, Portuguese, Russian, German, French, Italian, Polish, Korean, Japanese, Turkish, Czech
Control Power	120V 60 Hz, 240V 60 Hz, 110V 60 Hz, or 220V 50 Hz (3 kVA)
External Input Contact Ratings	24V DC
External Output Contact Ratings	240V AC/5 A
Analog Inputs	Four non-isolated, 4…20 mA
Analog Outputs	Four isolated: 4…20 mA or 0…5V DC (optional)
Communications Protocols (Optional)	Modbus RTU RS-485, Modbus TCP RJ45, Modbus PLUS RS-465, PROFIBUS RS-485, EtherNet/IP RJ45
Enclosure	Standard – NEMA Type 1 / IP31 Optional – IP42
Structure Finish	Epoxy Powder - Paint Exterior Sandtex Light Grey (RAL 7038) - Black (RAL 8022) Internal - Control Sub Plates - High Gloss White (RAL 9003)
Corrosion Protection	Unpainted Parts (Zinc-Plated / Bronze Chromate)
Ambient Temperature (Operating)	0…40 °C (standard), 0…50 °C (optional with derating)
Ambient Temperature (Storage)	-25…+55 °C (-13…+131 °F)
Relative Humidity, max	95% noncondensing
Power Loss Auto Restart	Yes
Power Module Bypass	Optional for up to 680 A
Altitude	0…1000 m (0…3280 ft) (standard) 1001…5000 m (3284…16404 ft) (contact factory)
Short-circuit Rating	31.5 kA rms symm for 0.1 seconds
BIL Ratings	30…95 kV, depends on drive size and surge arresters
Motor Cable Distance, maximum	600 m (1968 ft) Available up to 2000 m (6561 ft) with filter
Seismic Enclosure Rating	IBC 2018 for worst case excluding class F, ASCE-7-16

(1) Depends on Transformer.

Catalog Number Explanation

PowerFlex 6000 Medium Voltage Variable Frequency Drives

Position

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
6000G	— **A**	**A**	**180**	**M**	**J**	**6**	**AJ**	— **J**	**HE**	**E**	— **...etc.**

1

Bulletin Number

Code	Description
6000G	PowerFlex 6000

2

Drive Frame Size

Code	Description
A	A-Frame (Air-cooled)
H	H-Frame (Air-cooled)
B	B-Frame (Air-cooled)

3

Service Duty

Code	Description
A	Normal Duty, 0…1000 m Altitude. Maximum 40 ˚C Ambient, 110% overload for 1 minute every 10 minutes
C	Heavy Duty, 0…1000 m Altitude. Maximum 40 ˚C Ambient, 150% overload for 1 minute every 10 minutes

4

Drive Current Rating

Code	Description	Code	Description
15	15 Amp	680	680 Amp

5

Enclosure Type

Code	Description
M	Type 1/IP31 (with door gaskets)
K	Type 1/IP42 (with door gaskets)

6

Nominal System Voltage(1)

Code	Description	Code	Description
A	2,400V	L	7,200V
B	3,000V	P	8,320V
C	3,300V	R	10,000V
E	4,160V	S	11,000V
G	4,800V	T	11,500V
D	5,500V	M	12,000V
F	6,000V	U	12,470V
H	6,300V	V	13,200V
J	6,600V	W	13,800V
K	6,900V	–	–

(1) Other Nominal System Voltage Configurations can be supplied up to 13.8 kV (contact factory).

7

Line Frequency

Code	Description
5	50 Hz
6	60 Hz

8

Control Voltage

Code	Description	Code	Description
AG	110V	AL	220V
–	–	AN	230V
AJ	120V	AP	240V

PowerFlex 6000 Medium Voltage Variable Frequency Drives (continued)

Position

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
6000G	— **A**	**A**	**180**	**M**	**J**	**6**	**AJ**	— **J**	**HE**	**E**	—**...etc.**

9

Normal Load (Motor) Voltage[1] [2]			
Code	**Description**	**Code**	**Description**
A	2300V/2400V	F	6000V
B	3000V	H	6300V
C	3300V	J	6600V
E	4000V/4160V	K	6900V
D	5500V	R	10000V
–	–	S	11000V

(1) 6900V is the maximum Motor Voltage supported in the UL rated version.

(2) Standard Nominal Line/Motor Voltage Configurations supported for UL rated version are:
- 2400V: 2300V/2400V
- 3000V: 3000V
- 3300V: 3300V
- 4160V: 4000V/4160V
- 6000V: 6000V
- 6600V: 6300V or 6600V
- 7200V: 6900V

Other Nominal Line/Motor Voltage Configurations can be supplied (contact factory).

10

Transformer Efficiency	
Code	**Description**
HE	High Efficiency – Copper
SA	Standard Efficiency – Aluminum
SE	Standard Efficiency – Copper

11

Drive Certificate	
Code	**Description**
E	IEC
U	UL

12

Options
See PowerFlex 6000 Medium Voltage Drives Options List.

Preventative Maintenance Schedule

PowerFlex 6000 Maintenance Schedule

This Annual Preventative Maintenance Program includes a visual inspection of all drive components visible from the front of the unit, power supply voltage level checks, general cleaning and maintenance, checking of all accessible power connections for tightness, and other tasks.

I – Inspection

This indicates that the component should be inspected for signs of excessive accumulation of dust/dirt/etc. or external damage.

M – Maintenance

This indicates a maintenance task that is outside the normal preventative maintenance tasks.

R – Replacement

This indicates that the component has reached its mean operational life, and should be replaced to decrease the chance of component failure. It is very likely that components will exceed the design life in the drive, and that is dependent on many factors such as usage, heating, etc.

C – Cleaning

This indicates the cleaning of a part that can be reused, and refers specifically to the door-mounted air filters.

Rv – Review

This refers to a discussion with Rockwell Automation to determine whether any of the enhancements/changes made to the Drive Hardware and Control would be valuable to the application.

RFB/R – Refurbishment/Replacement

The parts can be refurbished at lower cost OR the parts can be replaced with new ones.

ATTENTION: Customers can replace components for the PowerFlex 6000 drives. However repairs must only be performed by qualified Rockwell Automation personnel.

Table 11 - Preventative Maintenance Schedule (0…10 yrs.)

			Interval Period (in years from commissioning date)										
Component Location	Component Category	Component/Item	0	1	2	3	4	5	6	7	8	9	10
Isolation Transformer Cabinet	Air-cooling system	Door -mounted Air Filters	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R
		Top-mounted Cooling Fans		I	I	I	I	RFB/R	I	I	I	I	RFB/R
	Integral Magnetics	Isolation Transformer		I	I	I	I	I	I	I	I	I	I
	LV Control	Isolation Transformer Temperature Monitor		I	I	I	I	I	I	I	I	I	I
		Voltage Sensing Board		I	I	I	I	I	I	I	I	I	I
Power Module Cabinet	Air-cooling system	Door -mounted Air Filters	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R
		Top-mounted Cooling Fans		I	I	I	I	RFB/R	I	I	I	I	RFB/R
	Power Module	Electrolytic Capacitors(1)		I	I	I	I	I	I	I	I	I	I
	Misc.	HECS		I	I	I	I	I	I	I	I	I	I
LV Control Cabinet	Misc.	AC/DC Power Supplies		I	I	I	I	I	I	I	I	I	I
	UPS	UPS(2)		I	I	I	I	I	I	I	I	I	I
	LV Control	PLC		I	I	I	I	I	I	I	I	I	I
		Control Unit		I	I	I	I	I	I	I	I	I	I
		HMI		I	I	I	I	I	I	I	I	I	I
		LV Control Relays		I	I	I	I	I	I	I	I	I	I
		LV Control Circuit Breakers		I	I	I	I	I	I	I	I	I	I
All	Connections	LV Component Terminal & Plug-in Connections		I	I	I	I	I	I	I	I	I	I
		Medium Voltage Cable Connections		I	I	I	I	I	I	I	I	I	I
		Transformer Secondary Winding Connections		I	I	I	I	I	I	I	I	I	I
		Power Module Input and Output Power Connections		I	I	I	I	I	I	I	I	I	I
General	Enhancements	Firmware		—	—	Rv	—	—	Rv	—	—	Rv	Rv
		Hardware		—	—	Rv	—	—	Rv	—	—	Rv	—
	Operational Conditions	Parameters / Variables		I	I	Rv	I	I	Rv	I	I	Rv	I
	Spare Parts	Inventory Needs		I	I	Rv	I	I	Rv	I	I	Rv	I

(1) Based on full load/full speed operation at 8700 hours per year at 30 °C (86 °F) ambient temperature. For higher ambient temperatures the replacement should be done sooner, contact factory for details.

(2) Fully discharge and recharge the UPS batteries every 6 months, to extend battery life.

ATTENTION: Customers can replace components for the PowerFlex 6000 drives. However repairs must only be performed by qualified Rockwell Automation personnel.

Table 12 - Preventative Maintenance Schedule (11...20 yrs.)

			Interval Period (in years from commissioning date)									
Component Location	Component Category	Component/Item	11	12	13	14	15	16	17	18	19	20
Isolation Transformer Cabinet	Air-cooling system	Door-mounted Air Filters	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R
		Top-mounted Cooling Fans	I	I	I	I	RFB/R	I	I	I	I	I
	Integral Magnetics	Isolation Transformer	I	I	I	I	I	I	I	I	I	I
	LV Control	Isolation Transformer Temperature Monitor	I	I	I	I	I	I	I	I	I	I
		Voltage Sensing Board	I	I	I	I	I	I	I	I	I	I
Power Module Cabinet	Air-cooling system	Door-mounted Air Filters	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R	C / R
		Top-mounted Cooling Fans	I	I	I	I	RFB/R	I	I	I	I	I
	Power Module	Electrolytic Capacitors	I	I	R	I	I	I	I	I	I	I
	Misc.	HECS	I	I	I	I	I	I	I	I	I	I
LV Control Cabinet	Misc.	AC/DC Power Supplies	I	I	I	I	I	I	I	I	I	I
	UPS	UPS(1)	I	I	I	I	I	I	I	I	I	I
	LV Control	PLC	I	I	I	I	I	I	I	I	I	I
		Control Unit	I	I	I	I	I	I	I	I	I	I
		HMI	I	I	I	I	I	I	I	I	I	I
		LV Control Relays	I	I	I	I	I	I	I	I	I	I
		LV Control Circuit Breakers	I	I	I	I	I	I	I	I	I	I
All	Connections	LV Component Terminal & Plug-in Connections	I	I	I	I	I	I	I	I	I	I
		Medium Voltage Cable Connections	I	I	I	I	I	I	I	I	I	I
		Transformer Secondary Winding Connections	I	I	I	I	I	I	I	I	I	I
		Power Module Input and Output Power Connections	I	I	I	I	I	I	I	I	I	I
General	Enhancements	Firmware	—	Rv	—	—	Rv	—	—	Rv	—	—
		Hardware	—	Rv	—	—	Rv	—	—	Rv	—	—
	Operational Conditions	Parameters / Variables	I	Rv	I	I	Rv	I	I	Rv	I	I
	Spare Parts	Inventory Needs	I	Rv	I	I	Rv	I	I	Rv	I	I

(1) Fully discharge and recharge the UPS batteries every 6 months, to extend battery life.

Notes:

Torque Requirements

Torque Requirements

Proper tightening torque must be used for installation and wiring.

Table 13 - Torque Requirements

Thread Size	Torque	
	Class 8.8	
	N•m	lb•ft
M4	3.0	2.2
M5	5.9	4.4
M6	10.5	7.7
M8	26.0	19.2
M10	51.0	37.6
M12	89.0	65.7
M14	141.0	104.1
M16	215.0	158.7
M20	420.0	310.0

Notes:

G

H

I

J

L

M

N

O

P

R

S

T

U

V

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at https://rockwellautomation.custhelp.com/ for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to help ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication RA-DU002, available at http://www.rockwellautomation.com/literature/.

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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