IMPULSE® • G+ Mini

Adjustable Frequency Crane Controls

Technical Manual

MAGNETEK

VFD Firmware: 14515
Part Number: 144-25085 R8
November 2020

SERVICE INFORMATION

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PRODUCT SAFETY INFORMATION

Magnetek, Inc. (Magnetek) offers a broad range of radio remote control products, control products and variable frequency drives (VFD), and industrial braking systems for material handling applications. This manual has been prepared by Magnetek to provide information and recommendations for the installation, use, operation and service of Magnetek's material handling products and systems (Magnetek Products). Anyone who uses, operates, maintains, services, installs or owns Magnetek Products should know, understand and follow the instructions and safety recommendations in this manual for Magnetek Products.

The recommendations in this manual do not take precedence over any of the following requirements relating to cranes, hoists lifting devices or other material handling equipment which use or include Magnetek Products:

- Instructions, manuals, and safety warnings of the manufacturers of the equipment where the Magnetek Products are used,
- Plant safety rules and procedures of the employers and the owners of the facilities where the Magnetek Products are being used,
- Regulations issued by the Occupational Health and Safety Administration (OSHA),
- Applicable local, state or federal codes, ordinances, standards and requirements, or
- Safety standards and practices for the industries in which Magnetek Products are used.

This manual does not include or address the specific instructions and safety warnings of these manufacturers or any of the other requirements listed above. It is the responsibility of the owners, users and operators of the Magnetek Products to know, understand and follow all of these requirements. It is the responsibility of the employer to make its employees aware of all of the above listed requirements and to make certain that all operators are properly trained. **No one should use Magnetek Products prior to becoming familiar with and being trained in these requirements and the instructions and safety recommendations for this manual.**

Product Warranty Information

Magnetek, hereafter referred to as Company, assumes no responsibility for improper programming of a VFD by untrained personnel. A VFD should only be programmed by a trained technician who has read and understands the contents of this manual. Improper programming of a VFD can lead to unexpected, undesirable, or unsafe operation or performance of the VFD. This may result in damage to equipment or personal injury. Company shall not be liable for economic loss, property damage, or other consequential damages or physical injury sustained by the purchaser or by any third party as a result of such programming. Company neither assumes nor authorizes any other person to assume for Company any other liability in connection with the sale or use of this product.

WARRANTY INFORMATION

For information on Magnetek's product warranties by product type, please visit www.magnetekmh.com.

WARNING

Improper programming of a VFD can lead to unexpected, undesirable, or unsafe operation or performance of the VFD.

DANGER, WARNING, CAUTION and NOTE Statements

Read and understand this manual before installing, operating or servicing this product. Install the product according to this manual and local codes.

The following conventions indicate safety messages in this manual. Failure to heed these messages could cause fatal injury or damage products and related equipment and systems.

DANGERS, WARNINGS and CAUTIONS

Throughout this document DANGERS, WARNING and CAUTION statements have been deliberately placed to highlight items critical to the protection of personnel and equipment.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING

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

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTE: *A NOTE statement is used to notify people of installation, operation, programming or maintenance information that is important, but not hazard-related.*

DANGERS, WARNINGS and CAUTIONS SHOULD NEVER BE DISREGARDED.

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Table of Contents

1 Introduction

WARNING

Read and understand this manual before installing, operating, or servicing this VFD. All warnings, cautions, and instructions must be followed. All activity must be performed by qualified personnel. The VFD must be installed according to this manual and local codes.

Do not touch any circuitry components while the main AC power is on. In addition, you must wait until the red “CHARGE” LED is out before performing any service on that unit. (As you look at the face of the circuitry, the “CHARGE” LED is located inside the left side of the VFD.) It may take as long as ten minutes for the charge on the main DC bus capacitors to drop to a safe level.

Do not check signals during operation.

Do not connect the main output terminals (U/T1, V/T2, W/T3) to the incoming, three-phase AC source.

Before executing Auto-Tuning, ensure that the motor is disconnected from the drive train, and the electric brake is set (locked) closed to ensure the load does not move. If the electric brake cannot be released, you must ensure that the brake is disengaged for the entire tuning process.

Do not connect or disconnect wiring while the power is on. Do not remove covers or touch circuit boards while the power is on.

Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50VDC. To prevent electric shock, wait at least ten minutes after all indicators are OFF and measure DC bus voltage level to confirm safe level.

Do not perform a withstand voltage test on any part of the unit. This equipment uses sensitive devices and may be damaged by high voltage.

The VFD is suitable for circuits capable of delivering not more than 30,000 RMS symmetrical Amperes, 240VAC maximum (230V Class) and 480VAC maximum (460V Class). Install adequate branch circuit short circuit protection per applicable codes. Failure to do so may result in equipment damage and/or personal injury.

Do not connect unapproved LC or RC interference suppression filters, capacitors, or overvoltage protection devices to the output of the VFD. These devices may generate peak currents that exceed the VFD specifications.

This manual will provide support for the basic and advanced operating features of IMPULSE®•G+ Mini. For additional information, visit www.columbusmckinnon.com/magnetek.

1.1 Specifications

1.1.1 230V Class

Specification	Model Number									
	2001	2003	2005	2008	2011	2017	2025	2033	2047	2060
Rated Output Current (A)	1.6	3.0	5.0	8.0	11.0	17.5	25.0	33.0	47.0	60.0
Capacity (kVA)	0.6	1.1	1.9	3.0	4.2	6.7	9.5	12.6	17.9	22.9

1.1.2 460V Class

Specification	Model Number										
	4001	4002	4003	4004	4005	4007	4009	4014	4018	4024	4031
Rated Output Current (A)	1.2	1.8	3.4	4.8	5.5	7.2	9.2	14.8	18.0	24.0	31.0
Capacity (kVA)	0.9	1.4	2.6	3.7	4.2	5.5	7.0	11.3	13.7	18.3	23.6

1.1.3 Common Specifications

Specification	Specification Value and Information for All Models
Certification	UL, cUL, CSA, CE, RoHS
Crane Duty Classification	Rated for CMAA Crane Duty Class A-D (or equivalent)
Rated input power supply	3-phase 200–240V or 380–480V; 50/60 Hz
Short Circuit Rating	The VFD is suitable for circuits capable of delivering a maximum of 31,000 RMS symmetrical Amps.
Control Voltage	120 VAC (50/60 Hz) 42–48 VAC (50/60 Hz) 24 VAC (50/60 Hz) 24 VDC
Allowable input voltage fluctuation	+10% or -15% of nominal
Allowable input frequency fluctuation	±5% of nominal
Allowable control frequency fluctuation	±3 Hz of nominal
Control method	Fully digital; sine-wave, pulse-width modulated
Maximum output voltage (VAC)	Max output voltage 3-phase, 200–240V; 380–480V (proportional to input voltage).
Rated frequency (Hz)	0 to 150 Hz
Output speed control range	40:1 - V/f, 100:1 - Open Loop Vector (OLV)
Output frequency accuracy	0.01%—with digital reference command 0.5%—with analog reference command; 10 bits/10V
Frequency reference resolution	Digital: 0.01 Hz; Analog: 1/1000 of max frequency (11 bit and sign bit)
Output frequency resolution	0.01 Hz
Overload capacity	150% of rated output current of the VFD for 1 minute
Remote frequency reference sources	0–10VDC (2kΩ); 4–20mA (250Ω); serial (RS-485)
Accel/decel times	0.0 to 25.5 sec - 1 set; 0.0 to 6000.0 sec - 3 sets; 8 adjustable parameters
Braking torque	150% or more with dynamic braking

Specification	Specification Value and Information for All Models
Motor overload protection	UL recognized electronic thermal overload relay; field-programmable
Overcurrent protection level	200% of VFD rated current
Circuit protection	Ground fault and blown-fuse protection
Overvoltage protection level	Approximately 410VDC (230V Class), 820VDC (460V Class)
Undervoltage protection level	Approximately 190VDC (230V Class), 380VDC (460V Class)
Heatsink overtemperature	Thermostat trips at 184–249°F (90–121°C), dependent on VFD capacity
Torque limit selection	Limiting of Forward, Reverse, and Regen torques; selectable from 0–300%
Stall prevention	Functions for accel, decel, at-speed, and constant horsepower region
Other protection features	Lost output phase, failed-oscillator, mechanical overload, and internal braking transistor failure.
DC bus voltage indication	Charge LED is on until DC bus voltage drops below 50VDC
Location	Indoors; requires protection from moisture, corrosive gases, and liquids
Ambient operating temperature	14° to 122°F (-10° to 50°C)
Storage temperature	-4° to 140°F (-20° to 60°C)
Humidity	95% relative; non-condensing
Vibration	10 to 20 Hz: 9.8 m/s^2 20 to 55 Hz: 5.9 m/s^2
Elevation	1,000 m and up to 3,000 m with derate. Derate 1% for every 100 m higher than 1,000 m.
Orientation	Install the VFD vertically to maintain maximum cooling effects.

1.1.4 AC Reactor Specifications

Reactors, both as input (line) and output (load) devices, protect variable frequency drives (VFD), motors, and other load devices against excessive voltage and current.

The following guidelines may help determine input and output reactor requirements:

- Install an input reactor if the power source is greater than 500kVA.
- Ensure the VFD-to-motor wiring distance is less than 150 ft (45.7 m) unless appropriate reactors, filters, and/or Inverter Duty motor is used.
- Install an output reactor if a device, such as a power limit switch, is used to disconnect the motor from the VFD.
- Install one output reactor per VFD for a multiple-VFD arrangement requiring reactor protection.
- For a multiple VFD arrangement, an input reactor for each VFD is recommended for optimal protection. However, if the VFDs are within two VFD sizes of each other, a single input reactor can be used. The reactor must be rated at amperage equal to or greater than the sum of the amperage for all the VFDs.

1.1.4.1 230V Class

VFD Model Number	Reactor Part Number	Reactor Fundamental Amps
2001-G+M	REA230-1	4
2003-G+M	REA230-1	4
2005-G+M	REA230-1	4
2008-G+M	REA230-2	8
2011-G+M	REA230-3	12
2017-G+M	REA230-5	18
2025-G+M	REA230-7.5	25
2033-G+M	REA230-10	35
2047-G+M	REA230-15	45
2060-G+M	REA230-20	55

1.1.4.2 460V Class

VFD Model Number	Reactor Part Number	Reactor Fundamental Amps
4001-G+M	REA460-1	2
4002-G+M	REA460-1	2
4003-G+M	REA460-2	4
4004-G+M	REA460-3	4
4005-G+M	REA460-5	8
4007-G+M	REA460-5	8
4009-G+M	REA460-5	8
4014-G+M	REA460-7.5	12
4018-G+M	REA460-10	18
4024-G+M	REA460-15	25
4031-G+M	REA460-20	35

2 Installation

2.1 Assessing the System Requirements

WARNING

- When preparing to mount the IMPULSE®•G+ Mini VFD, lift it by its base. Never lift it by the front cover.
- Mount the VFD on nonflammable material.
- The IMPULSE®•G+ Mini VFD generates heat. For the most effective cooling possible, mount it vertically. For more details, ***see Section 2.3 on page 16***.
- When mounting units in an enclosure, install a fan or other cooling device to keep the enclosure temperature below 122°F (50°C).

Failure to observe these warnings may result in equipment damage.

It is important to know how you are going to use the VFD before you start installation and wiring. You will need to know your requirements for the following components:

- Motion (traverse or hoist)
- Motor HP, RPM, and FLA
- Speed control method (2-speed, 3-speed, etc.)
- Stopping method (Decelerate or Coast to Stop)
- Wire size
- Grounding location and method

2.1.1 Choosing a Location

Be sure the VFD is mounted in a location protected against the following conditions:

- Extreme cold and heat. Use only within the ambient temperature range:
  Open Chassis: +14 to 122°F (-10 to 50°C)
- Direct sunlight (not for use outdoors)
- Rain, moisture
- High humidity
- Oil sprays, splashes
- Salt spray
- Dust or metallic particles in the air
- Corrosive gases (e.g. sulfurized gas or liquids)
- Radioactive substances
- Combustibles (e.g. thinner, solvents, etc.)
- Physical shock, vibration
- Magnetic noise (e.g. welding machines, power devices, etc.)

2.1.2 System Components And External Devices

2.1.2.1 Optional Components

- 120 VAC Interface Board (Part Number G+M-IF-120VAC)
- 42-48 VAC Interface Board (Part Number G+M-IF-48VAC)
- 24 VAC Interface Board (Part Number G+M-IF-24VAC)
- P3S2OUT2 Board (Part Number P3S2-OUT2-KIT)
- Copy Stick (Part Number COPY-STICK)

2.1.2.2 As-Required Components

- AC reactor—line or load
- DC bus reactor
- External dynamic braking resistor(s)
- External dynamic braking unit

2.1.2.3 Required External Devices

- Motor
- User input device (pendant, joystick, PC, PLC, radio, or infrared control)
- External circuit protection devices (fuses or circuit breakers) (***See Section 3.4 on page 25***.)
- R-C surge suppressors on contactor coils

2.2 Long Time Storage

Powering up the VFD every six months is quite beneficial. Over longer periods of time without power, the electrolytic DC bus capacitors require reformation, especially if stored in an area of high temperatures. Capacitor reforming is required if VFDs are stored without power for more than two to three years. This process can be avoided by powering up the VFD bi-annually for 30 to 60 minutes.

NOTE: *Bus cap reforming alone may not restore full functionality after two to three years of storage without power.*

VFDs contain large bus capacitors that have the potential to be reformed. However, printed circuit boards also contain electrolytic capacitors that may not function after several years without power. Magnetek recommends replacing the PCBs should the VFD's functionality not be restored after bus cap reforming. Contact Magnetek Service for questions.

2.2.1 Capacitor Storage and their Reforming Process

The electrical characteristics of aluminum electrolytic capacitors are dependent on temperature; the higher the ambient temperature, the faster the deterioration of the electrical characteristics (i.e., leakage current increase, capacitance drop, etc.). If an aluminum electrolytic capacitor is exposed to high temperatures such as direct sunlight, heating elements, etc., the life of the capacitor may be adversely affected. When capacitors are stored under humid conditions for long periods of time, the humidity will cause the lead wires and terminals to oxidize, which impairs their solderability. Therefore, aluminum electrolytic capacitors should be stored at room temperature, in a dry location and out of direct sunlight.

In the event that a capacitor has been stored in a high ambient environment for more than two or three years, a voltage treatment reformation process to electrolytic capacitors may have to be performed. When stored above room temperatures for long periods of time, the anode foil may react with the electrolyte, increasing the leakage current. After storage, the application of even normal voltages to these capacitors may result in higher than normal leakage currents. In most cases the leakage current levels will decrease in a short period of time as the normal chemical reaction within the capacitor occurs. However, in extreme cases, the amount of gas generated may cause the safety vent to open.

Capacitors, when used in VFDs that are stored for long periods of time, should be subjected to a voltage treatment/ reforming process as noted below, which will reform the dielectric and return the leakage current to the initial level.

- VFD Bus Capacitor Reforming Procedure:
- Connect the VFD inputs L1 and L2 to a variac.
- Make sure the variac voltage setting is turned down so that when input power is applied to the variac, the output of the variac will be at or near 0 volts.
- Apply power to the variac, listening for abnormal sounds and watching for abnormal visual indications in the VFD. If the variac has an output current indication, make sure the current is very near zero with zero or a steady output voltage applied.
- Slowly turn the variac up, increasing the variac's output voltage to nominal rated input voltage over a time period of 2 to 3 minutes. In other words, ramp the voltage up at a rate of approximately 75 to 100 volts/minute for 230 VAC units and 150 to 200 volts/minute for 460 VAC units.
- Let the output voltage remain at rated voltage for 30 to 60 minutes while keeping close watch for abnormal signs within the VFD. While increasing the variac's output voltage, the current will momentarily increase as current is necessary to charge the capacitors.
- Once 30 to 60 minutes elapse, remove power and the process is complete.

If any abnormal indications occur during this process, it is recommended that the process be repeated. Otherwise, this completes the capacitor reforming procedure.

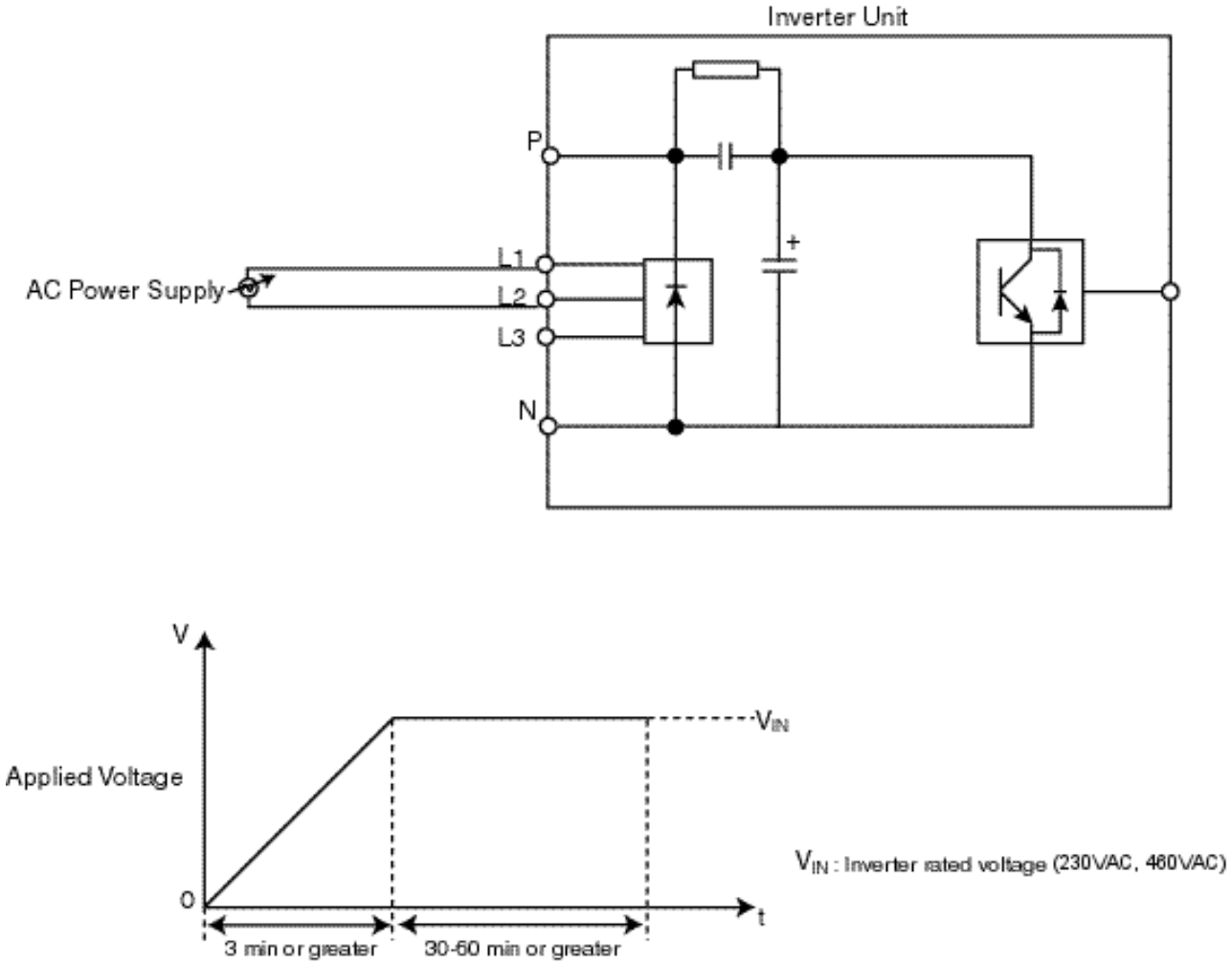


Figure 2-1: Long Time Storage

2.3 Dimensions and Heat Loss - Open Chassis

Voltage	Model	Diagram	W	H	D	W1	H1	d	Wt lb (kg)	Total Heat Loss (W)**
			Dimensions in Inches (mm)							
230V	2001-G+M	A	2.68 (68)	5.04 (128)	2.99 (76)	2.20 (56)	4.65 (118)	M4	1.3 (0.6)	14.7
	2003-G+M	A	2.68 (68)	5.04 (128)	4.25 (108)	2.20 (56)	4.65 (118)	M4	2.0 (0.9)	24.0
	2005-G+M	A	2.68 (68)	5.04 (128)	5.04 (128)	2.20 (56)	4.65 (118)	M4	2.4 (1.1)	36.7
	2008-G+M	B	4.25 (108)	5.04 (128)	5.08 (129)	3.78 (96)	4.65 (118)	M4	3.7 (1.7)	61.9
	2011-G+M	B	4.25 (108)	5.04 (128)	5.41 (137.5)	3.78 (96)	4.65 (118)	M4	3.7 (1.7)	81.3
	2017-G+M	B	5.51 (140)	5.04 (128)	5.63 (143)	5.04 (128)	4.65 (118)	M4	5.3 (2.4)	122.7
	2025-G+M	C	5.51 (140)	9.70 (246)	5.51 (140)	4.80 (122)	9.76 (248)	M5	8.4 (3.8)	248.5
	2033-G+M	C	5.51 (140)	9.70 (246)	5.51 (140)	4.80 (122)	9.76 (248)	M5	8.4 (3.8)	282.6
	2047-G+M	C	7.09 (180)	11.42 (290)	6.42 (163)	6.30 (160)	11.18 (284)	M5	12.1 (5.5)	389.7
	2060-G+M	C	8.66 (220)	13.78 (350)	7.36 (187)	7.56 (192)	13.23 (336)	M6	20.3 (9.2)	563.8
460V	4001-G+M	B	4.25 (108)	5.04 (128)	3.19 (81)	3.78 (96)	4.65 (118)	M4	2.2 (1.0)	19.1
	4002-G+M	B	4.25 (108)	5.04 (128)	3.90 (99)	3.78 (96)	4.65 (118)	M4	2.6 (1.2)	27.1
	4003-G+M	B	4.25 (108)	5.04 (128)	5.41 (137.5)	3.78 (96)	4.65 (118)	M4	3.7 (1.7)	38.3
	4004-G+M	B	4.25 (108)	5.04 (128)	6.06 (154)	3.78 (96)	4.65 (118)	M4	3.7 (1.7)	57.4
	4005-G+M	B	4.25 (108)	5.04 (128)	6.06 (154)	3.78 (96)	4.65 (118)	M4	3.7 (1.7)	67.1
	4007-G+M	B	4.25 (108)	5.04 (128)	6.06 (154)	3.78 (96)	4.65 (118)	M4	3.7 (1.7)	75.7
	4009-G+M	B	5.51 (140)	5.04 (128)	5.63 (143)	5.04 (128)	4.65 (118)	M4	5.3 (2.4)	97.1
	4014-G+M	C	5.51 (140)	9.70 (246)	5.51 (140)	4.80 (122)	9.76 (248)	M5	8.4 (3.8)	173.4
	4018-G+M	C	5.51 (140)	9.70 (246)	5.51 (140)	4.80 (122)	9.76 (248)	M5	8.4 (3.8)	219.4
	4024-G+M	C	7.09 (180)	11.42 (290)	5.63 (143)	6.30 (160)	11.18 (284)	M5	11.5 (5.2)	283.8
	4031-G+M	C	7.09 (180)	11.42 (290)	6.42 (163)	6.30 (160)	11.18 (284)	M5	12.1 (5.5)	344.3

NOTE: *Applications such as high duty cycles in conjunction with high ambient temperatures or other unique environmental conditions can impact VFD ratings. Please consult factory.*

*** Heat loss for carrier frequency of 2.0 kHz (heavy duty).*

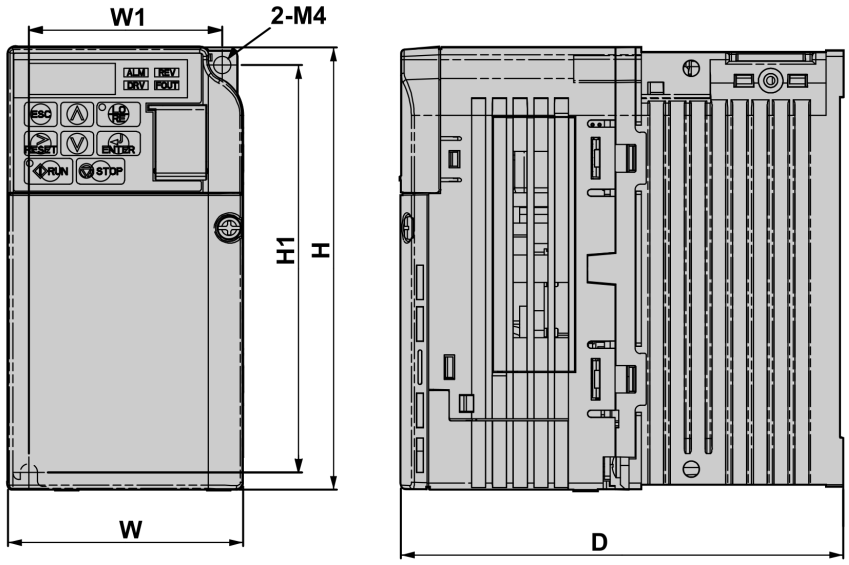


Figure 2-2: Diagram A

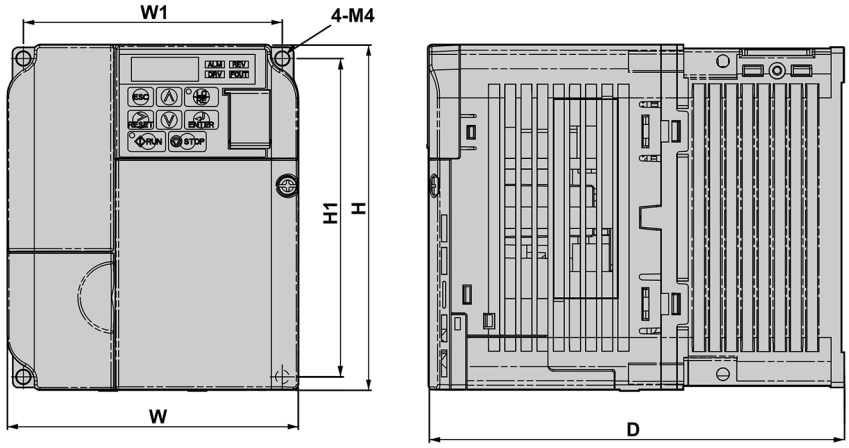


Figure 2-3: Diagram B

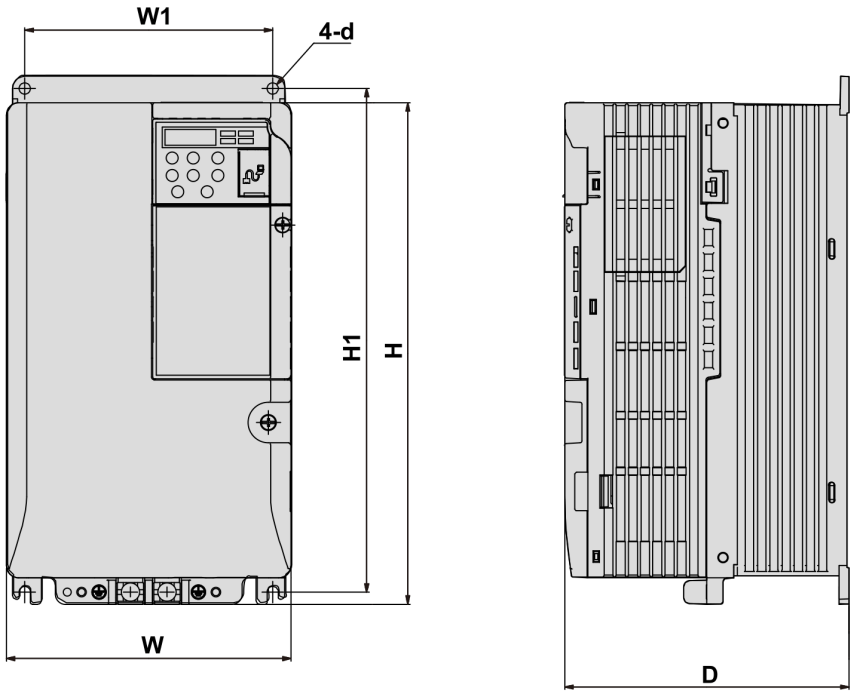


Figure 2-4: Diagram C

2.4 Installing the VFD (Recommended Clearances)

The following two figures show the recommended minimum clearances when mounting the VFD in standard or side-by-side installations. If the recommended clearances cannot be met, decreased airflow may reduce the life of the VFD.

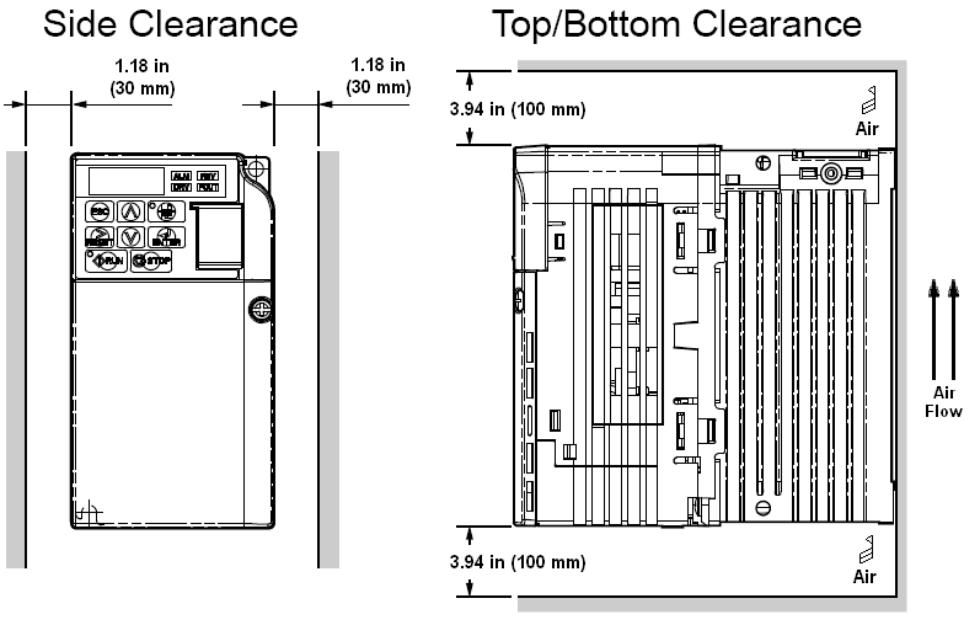


Figure 2-5: Standard Installation

2.5 Installing the VFD (Side-by-Side)

It is recommended to set parameter L08.35 = 1 when mounting VFDs in a side-by-side configuration. This provides a more conservative OL2 overload protection.

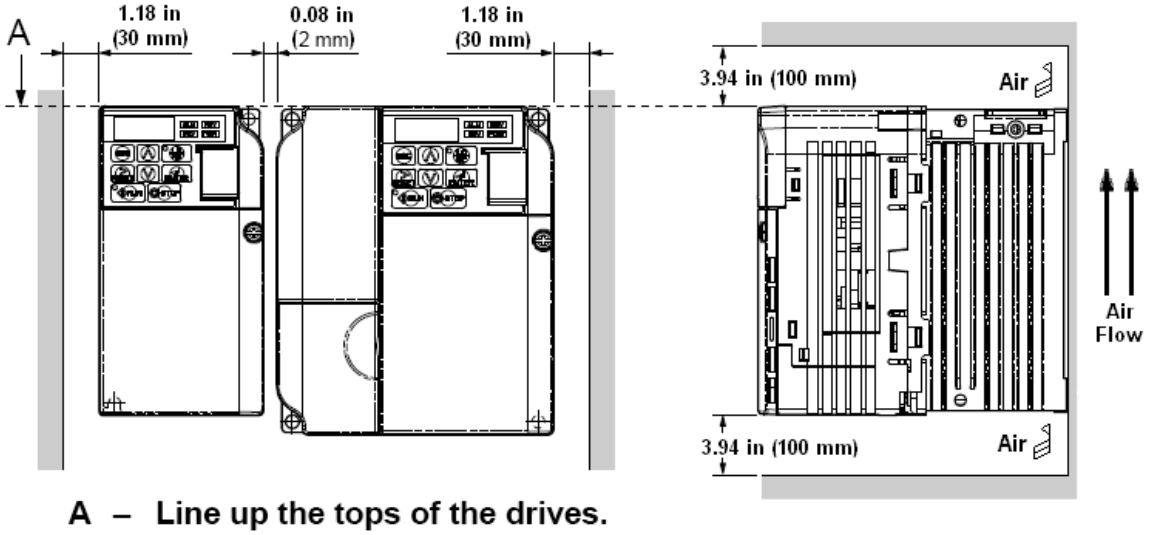


Figure 2-6: Side-by-Side Installation

2.6 Installation Orientation

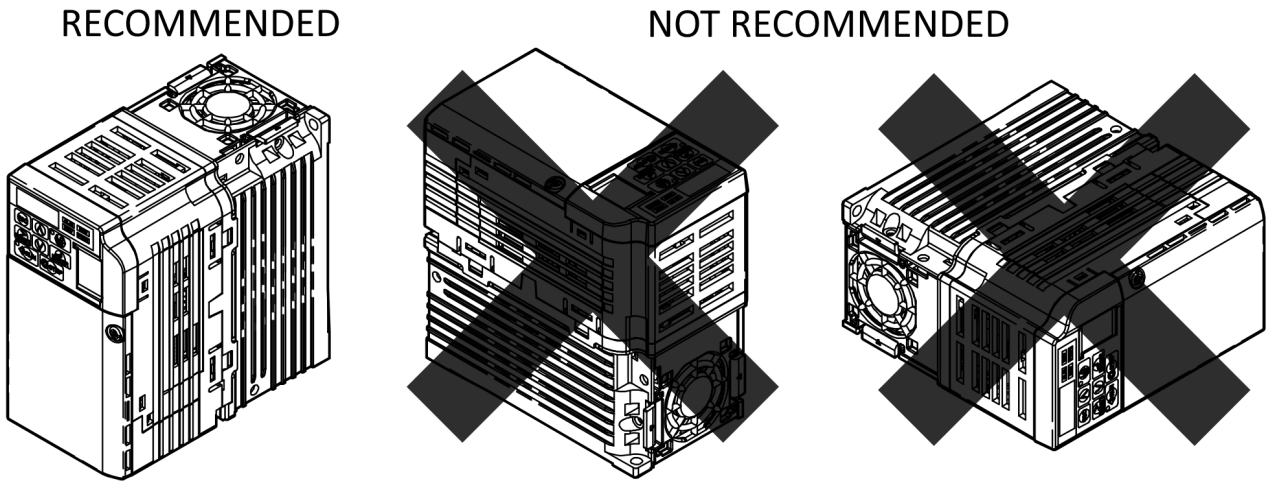


Figure 2-7: Installation Orientation

3 Wiring

3.1 Wiring Practices

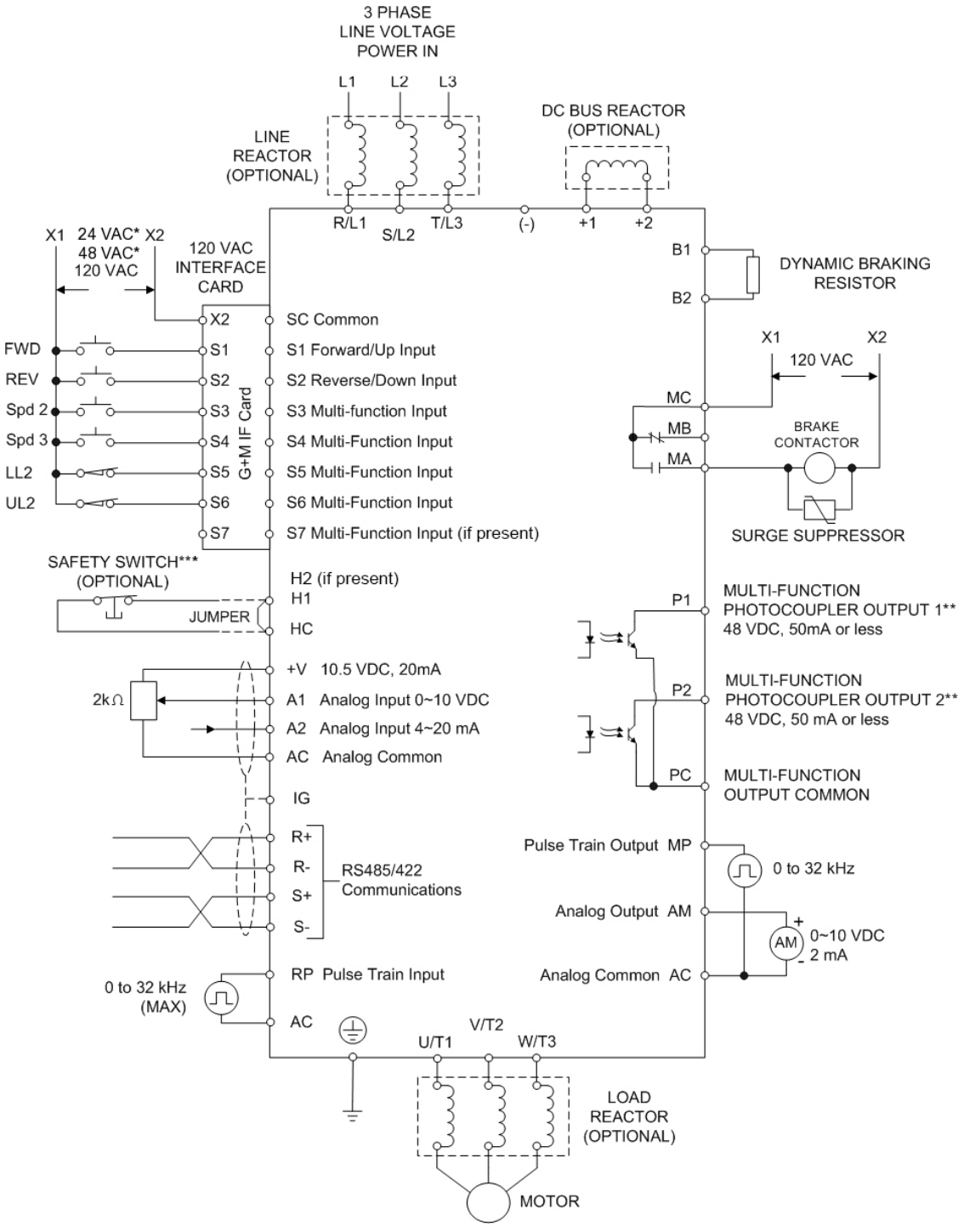
WARNING

Before you wire the VFD, review the following practices to help ensure that your system is wired properly.

- Connect the incoming three-phase AC source to terminals R/L1, S/L2, T/L3.
- Connect the Motor leads to terminals U/T1, V/T2, W/T3.
- Ensure the VFD-to-motor wiring distance is less than 150 ft unless appropriate reactors and/or filters are used.
- Install a line reactor between the output of the VFD in applications that require a disconnecting means between the VFD's output and motor. Use a "make before break" auxiliary contact with the disconnect means and the hardware base block of the VFD.
- If the power source is 500 kVA or greater, or more than 10 times the VFD kVA rating, ensure that there is at least 3 percent impedance between the power source and the VFD input. To accomplish this, you can install a DC reactor between VFD terminals +1 and +2, or use an AC line reactor on the input of the VFD. If you don't provide enough impedance, excessive peak currents could damage the input power supply circuit.
- Comply with the circuit protection and wire size recommendations in ***Section 3.4 on page 25***.
- Use appropriate R-C or MOV type surge absorbers across the coil of all contactors and relays in the system. Failure to do so could result in noise-related, nuisance fault incidents.
- Use external dynamic braking resistors for all applications.
- Do not ground the VFD with any large-current machines.
- Before you use any welding or high-current machines near the crane, disconnect all line and ground wiring.
- Do not let the wiring leads come in contact with the VFD enclosure.
- Do not connect power factor correction capacitors to the VFD input or output.
- Hard-wire the VFD and motor (e.g., festoon cable). Do not use sliding collector bars.
- Shielded cable is recommended for all analog and digital I/O.
- Before turning on the VFD, check the output circuit (U/T1, V/T2 and W/T3) for possible short circuits and ground faults.
- Increase the wire size by one size for every 250 feet (76.2 meters) between the VFD and motor; suggested for center driven cranes, trolleys, and bridges. (Voltage drop is significant at low frequencies.)
- When using more than one transformer for the VFD's power, properly phase each transformer.
- To reverse the direction of rotation, interchange any two motor leads (U/T1, V/T2 or W/T3 or change parameter B03.04.
- Please observe National Electrical Code (NEC) guidelines when wiring electrical devices.
- IMPORTANT: All wire connections must have strain relief, and must not apply downward pressure to the terminals on the VFD.
- IMPORTANT: In order to maintain the finger-safe properties of the VFD, it must be mounted inside an enclosure. Adhere to all safety warnings when handling the VFD with live voltage applied to it.

NOTE: *Failure to observe these warnings may result in equipment damage.*

3.2 Typical Connection Diagram



* Requires optional 24 VAC or 48 VAC Interface Boards
** Optional P3S2-OUT2 card provides two 240 VAC, 1.5 Amp solid-state relay outputs
*** In accordance with UL508C, EN954-1 Safety Category 3, and EN61508, SIL2

Figure 3-1: Typical Connection Diagram

3.2.1 Terminal Description

Type	Terminal		Name	Function (Signal Level)		
Main Circuit	R/L1, S/L2, T/L3		AC power supply input	AC power supply input		
	U/T1, V/T2, W/T3		VFD output	VFD output (connected to motor)		
	B1, B2		Braking resistor connection	Braking resistor connection		
	+2, +1		DC reactor connection	When connecting a DC reactor, remove the short-circuit bar between +2 and +1.		
	+1, (–)		DC power supply input	DC power supply input (+1: positive; (–): negative)		
	⏚		Ground	Ground to local grounding codes		
Control Circuit	Digital Inputs	S1	Digital input 1	Inputs are programmable	H01.01 ~ H01.07	Interface Board Options: 120 VAC, 42-48 VAC, 24 VAC, 24 VDC ±10%
		S2	Digital input 2			
		S3	Digital input 3			
		S4	Digital input 4			
		S5	Digital input 5			
		S6	Digital input 6			
		S7	Digital input 7 (if present)			
		X2*	Digital input common	Common for control signal		
	Analog Inputs	+V	Power supply output	Analog input power supply		+10.5 VDC (20 mA max)
		A1	Analog input 1	Inputs are programmable	H03.01	0 to 20 mA (250 Ω) – A1 only 4 to 20 mA (250 Ω) – A1 only 0 to +10 VDC (20 kΩ)
		A2	Analog input 2		H03.09	
		AC	Analog common	0V		
	Safe Disable Input	HC	Safe disable power supply	+24 VDC (max 10 mA)	*NOTE:* Disconnect wire jumper between HC and H1/H2 when using the safe disable input. ***See Section 3.3 on page 24.***	
		H1	Safe disable input 1	Open: Output disabled Closed: Normal Operation		
		H2	Safe disable input 2 (if present)			
	Pulse Train	RP	Pulse Input	Pulse Input frequency reference	H06.01	0 to 32kHz (3 kΩ impedance) ±5% High level voltages 3.5 to 13.2 Low level voltages 0.0 to 0.8 Duty Cycle (on/off) 30% to 70%
		MP	Pulse Output	Pulse output frequency	H06.06	0 to 32kHz ±5% (load: 1.5 kΩ)
	Digital Outputs	MA	N.O. contact output	Factory setting: brake output	H02.01	Dry contact capability: 250VAC 1A or less, 30VDC 1A or less
		MB	N.C. contact output			
		MC	Contact output common			
		P1	Photo coupler output 1	Outputs are programmable	H02.02 ~ H02.03	Photo-coupler output +48VDC, 50mA or less
		P2	Photo coupler output 2			
		PC	Photo coupler output common	0V		
	Analog Output	AM	Analog output 1	Output is programmable	H04.01	0 to +10 VDC, 2mA or less, 8-bit resolution
		AC	Analog common	0V		
Communication	Modbus	R+	Communications input (+)	Modbus communication RS-485 or RS-422.	H05.01 ~ H05.08	RS-485/422 Modbus, 115.2 kbps max.
		R-	Communications input (-)			
		S+	Communications output (+)			
		S-	Communications output (-)			
		I(G)	Signal Common	0V (shield)		

** SC when 24 VDC interface board is used.*

3.3 Safe Disable Function

The Safe Disable function (Safe Torque Off) can be utilized to perform a safe stop as defined in IEC/EN 61800-5-2:2007. It is designed to meet the requirements of ISO 13849-1 (Cat. 3, PL d) and IEC/EN 61508 (SIL2).

Removing the voltage from terminal H1 (and H2, if available) disables the VFD output, i.e. the power supply to the motor is cut by stopping the switching of the output transistors in a safe way. “Hbb” is shown on the display. Safe Disable is applicable for induction and permanent magnet motors.

3.3.1 Installation

If the Safe Disable function is utilized, the wire link between the terminals HC and H1 (and H2, if available) that is installed at shipment must be removed entirely.

Connect the VFD to an ISO 13849-1 (Cat. 3, PL d) interrupting device so that in case of a Safe Disable request, the connection between the terminals HC and H1 is opened.

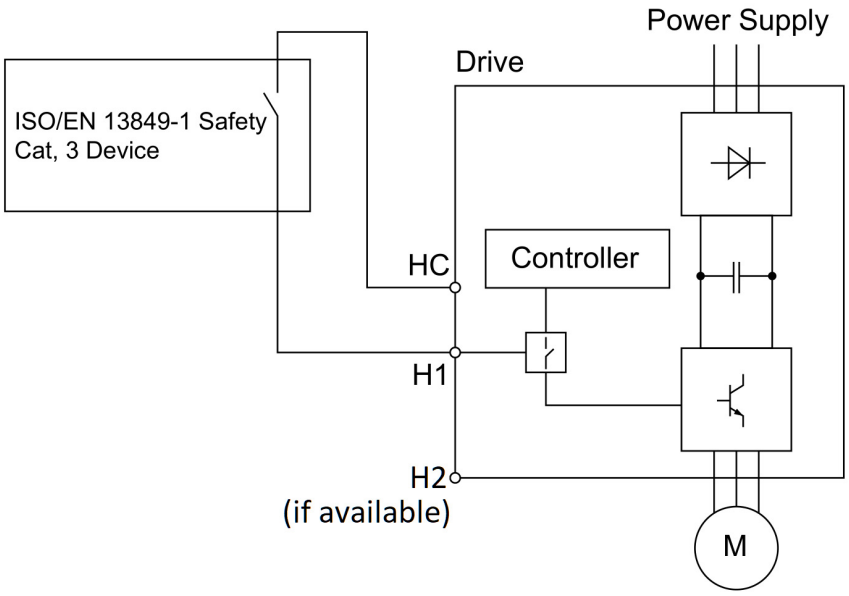


Figure 3-2: Safe Disable Wiring Example

Installation Precautions:

- To ensure the Safe Disable function appropriately fulfills the safety requirements of the application a thorough risk assessment for the safety system must be carried out.
- The VFD must be installed in an enclosure with a protection degree of at least IP54 in order to maintain ISO 13849-1 (Cat. 3, PL d) compliance.
- If the safety device and the VFD are installed in separate cabinets, install the Safe Disable wires in a manner preventing short circuits.
- The Safe Disable function does not cut the power supply to the VFD and does not provide electrical isolation. Before any installation or maintenance work is done, the power supply of the VFD must be switched off.
- The wiring distance for the Safe Disable inputs should not exceed 30 m (98 ft).
- The time from opening the Safe Disable input until the VFD output is switched off is less than 1 ms.
- When utilizing the Safe Disable function use the recommended filters manufactured by Schaffner only.

3.4 Suggested Circuit Protection and Wire Size

In order to comply with most safety standards, circuit protective devices should be used between the incoming three-phase power supply and the IMPULSE®•G+ Mini. These devices can be thermal, magnetic, or molded-case breakers (MCCB); or “slow-blow” type time-delay fuses.

NOTE: *The following are recommendations based on the rated capacity of the VFD. Per NEC guidelines, circuit protection and wiring can be selected based on the capacity of the motor.*

CAUTION

The following guidelines are suggested values. Always conform to local electrical codes and wiring practices.

		Recommended Circuit Protection			Recommended Wire Size (AWG)(1), (4)		
Model (-G+M)	**Continuous HD Input Amps**	**Time Delay Input Fuse (A)**	**Time Delay Input Fuse Class**	**Inverse Time Molded/ Case Circuit Breaker (A)(3)**	**Power Circuit Wiring**	**Control Wiring**	**Ground Copper (2)**
230V Class							
2001	1.5	3	CC	15	18 to 14	18 to 16	14
2003	2.9	5	CC	15	18 to 14	18 to 16	14
2005	5.8	10	CC	15	18 to 14	18 to 16	14
2008	7.5	15	CC	20	14 to 10	18 to 16	12
2011	11	20	CC	30	14 to 10	18 to 16	12
2017	18.9	35	CC	50	14 to 10	18 to 16	10
2025	24	45	J	60	10 to 6	18 to 16	8
2033	37	70	J	100	10 to 6	18 to 16	8
2047	52	100	J	150	6 to 4	18 to 16	4
2060	68	125	J	175	8 to 2	18 to 16	4
460V Class							
4001	1.2	2	CC	15	14 to 10	18 to 16	14
4002	1.8	3	CC	15	14 to 10	18 to 16	14
4003	3.2	6	CC	15	14 to 10	18 to 16	14
4004	4.4	8	CC	15	14 to 10	18 to 16	14
4005	6.0	12	CC	15	14 to 10	18 to 16	12
4007	8.2	15	CC	25	14 to 10	18 to 16	12
4009	10.4	20	CC	30	14 to 10	18 to 16	12
4014	15	30	CC	40	14 to 10	18 to 16	10
4018	20	35	CC	50	10 to 6	18 to 16	10
4024	29	60	J	80	10 to 6	18 to 16	8
4031	39	70	J	100	10 to 6	18 to 16	8

1) NFPA 70 National Electric Code 2011. 430.122(a) and Table 610-14(a) 40°C, 60-minute, copper 50°C ambient

2) NFPA 70 National Electric Code 2011. Table 250.122.

3) NFPA 70 National Electric Code 2011. Table 430.52 (selected based on motor FLA).

4) NFPA 40 National Electric Code 2011. Table 315(b)(2)(a).

3.4.1 Grounding

1. Connect terminal ⏚ to the common panel ground. Use ground wiring as specified in ***Section 3.4 on page 25***, and keep the length as short as possible.
   - Ground Resistance: 230V class; 100Ω or less, 460V or greater class; 10Ω or less.
   - Never run the IMPULSE®•G+ Mini ground wires in common with welding machines, or other high-current electrical equipment.
   - When more than one VFD is used for the same system, ground each VFD directly, or daisy-chain to the ground pole. Do not loop the ground wires.

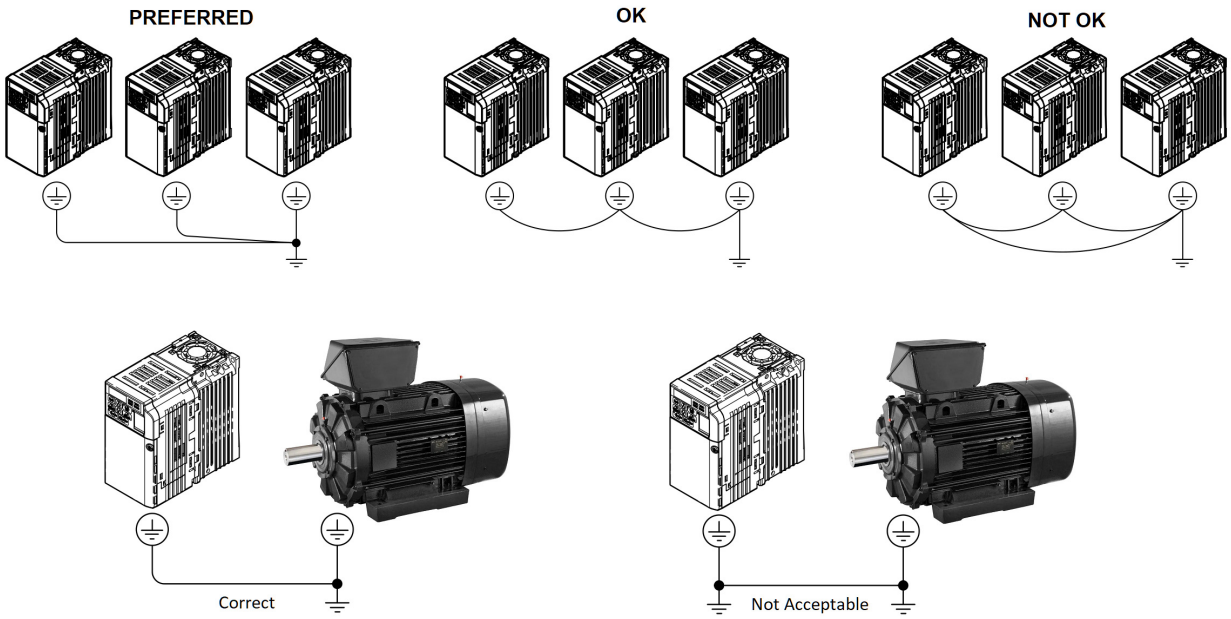


Figure 3-3: Grounding

3.4.2 Wiring the Control Circuit

3.4.2.1 AC Interface Board Terminals

The IMPULSE®•G+ Mini includes a 24VDC interface board and optionally ships with an adder AC interface board, allowing direct connection of 24, 42-48, or 120 VAC user input devices. The interface board connects to VFD terminals S1-S7 and SC. The user input device then connects to terminals S1-S7 and X2 (or SC on the 24VDC interface board) on the interface board. Terminals S1 and S2 are factory programmed for the forward (up) and reverse (down) run commands; however, they can be programmed for speed control and other functions like the remaining terminals. The figure below shows the control terminal arrangement for the IMPULSE®•G+ Mini along with the adder AC interface board.

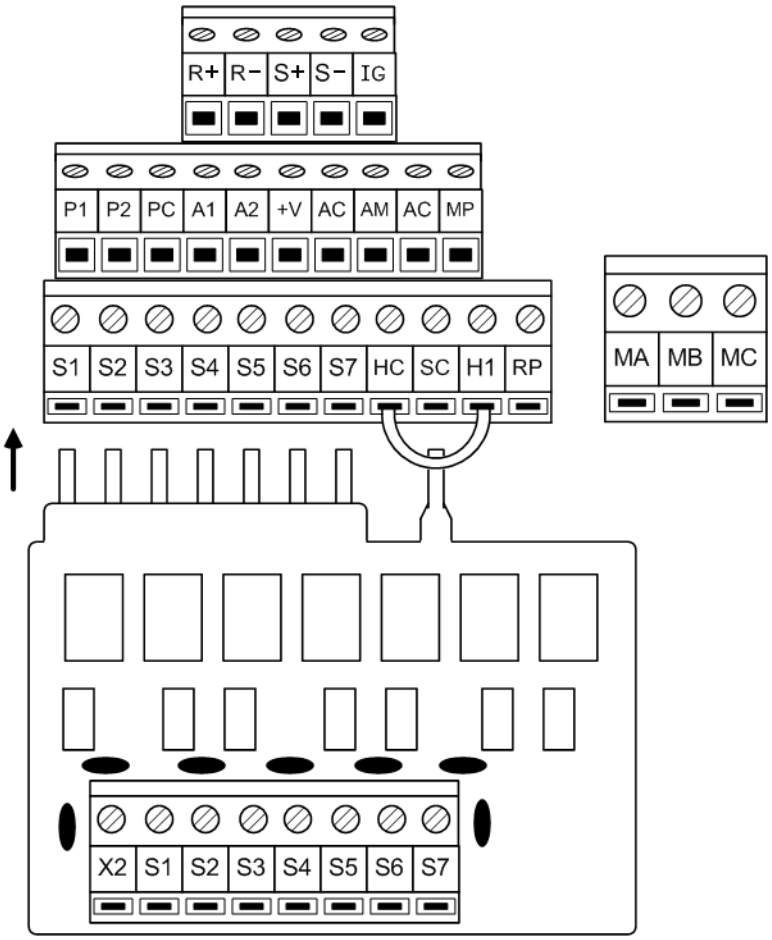


Figure 3-4: AC Interface Board

3.4.2.2 24VDC Interface Board Variation (Europe Only)

The standard 24VDC interface board includes terminals S1 - S7, but a variation is available in the European market that replaces terminal S7 with terminal H2.

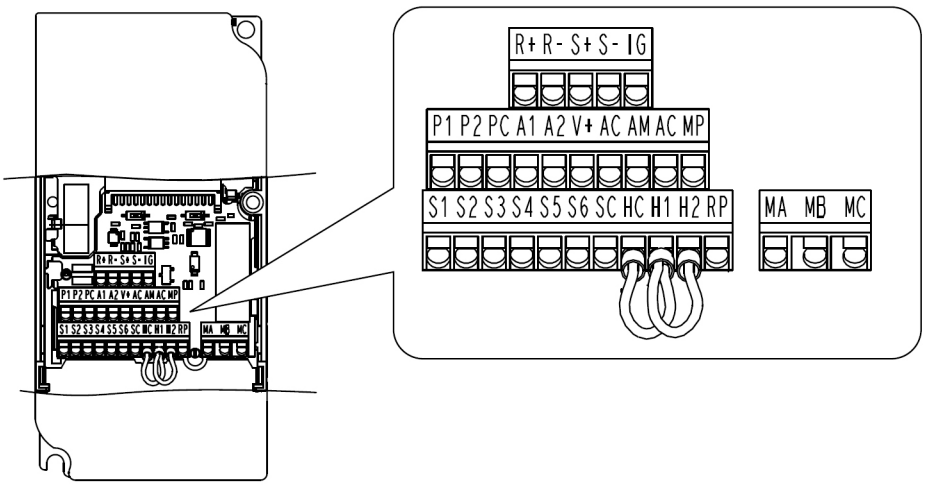


Figure 3-5: 24VDC Interface Board (Non-Standard)

3.4.2.3 Terminal and Wire Specifications

The table below lists the wiring specifications for the terminals located on the interface card.

Terminal Symbol	Terminal Screw	Tightening Torque in-lbs (N-m)	Wire Range AWG (mm^2)
S1-S7, X2, SC, RP, +V, A1, A2, AC, HC, H1, H2, P1, P2, PC, MP, AM, AC, S+, S-, R+, R-, IG	M2	0.22 to 0.25 (1.9 to 2.2)	Stranded: 24 to 18 (0.25 to 1.0) Solid: 24 to 16 (0.25 to 1.5)
MA, MB, MC	M3	0.5 to 0.6 (4.4 to 5.3)	24 to 16 (0.25 to 1.5)

3.4.2.4 Control Board DIP Switches

There are three switch settings on the controller board that are used for controller input (S1 - S7) polarity, analog input signal control method, and RS485 termination. The figure below shows the location of these switches and their function along with the default settings.

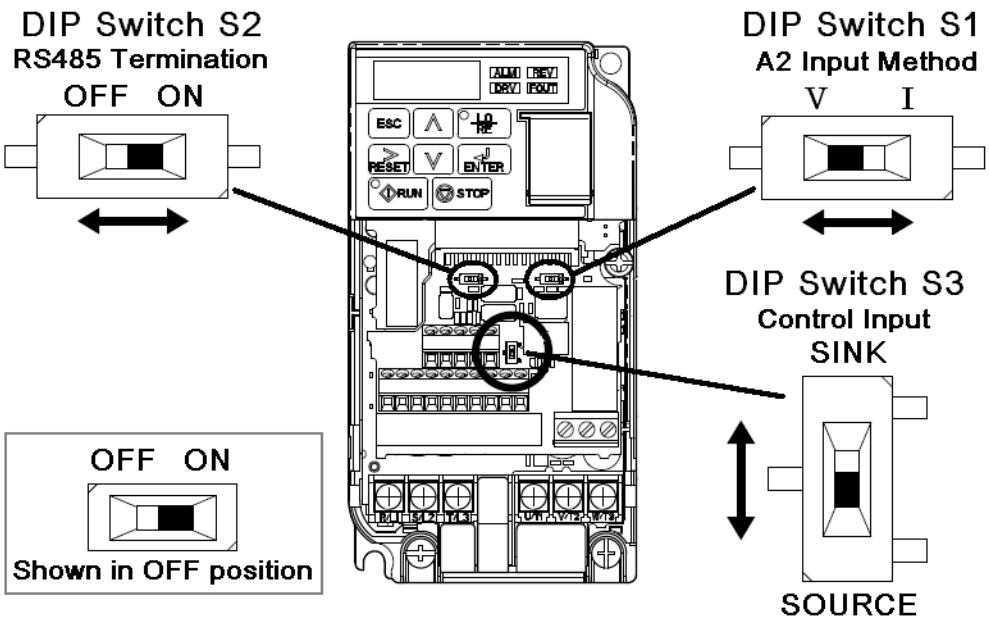


Figure 3-6: DIP Switches

Name	Function	Settings
DIP Switch S1	Input method for analog input A2	**V:** 0–10VDC input (internal resistance: 20K Ohm) **I**: 4–20 mA input (internal resistance 250 Ohm) **(Default)**
DIP Switch S2	RS485 Termination	**OFF:** No terminating resistance **(Default)** **ON:** Terminating resistance of 110 Ohm
DIP Switch S3	Controller input signal polarity (S1-S7) on the controller board	**SINK:** Must remain in this position for use with the adder AC interface boards **(Default)** **SOURCE:** Use external 24V power supply

3.4.2.5 Sinking/Sourcing Mode

Set DIP switch S3 to switch the digital input terminal logic between sinking mode and sourcing mode. The default setting is sinking mode.

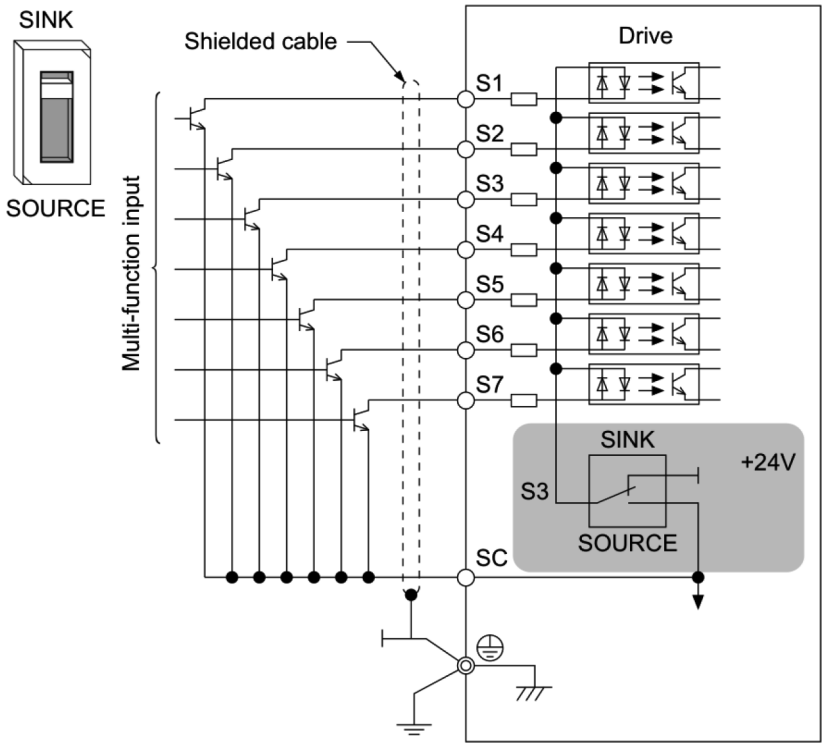


Figure 3-7: Sinking Mode - Sequence for NPN Transistor (0 V Common)

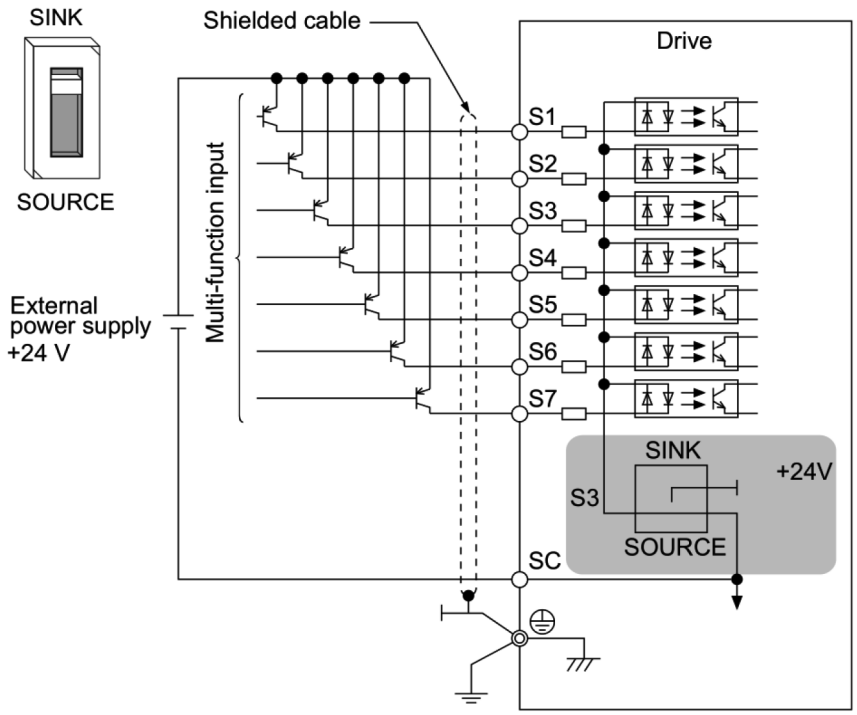


Figure 3-8: Sourcing Mode - Sequence for PNP Transistor (+24 V Common)

3.4.2.6 Optional Relay Output Board

The output board P3S2-OUT2 provides two 240 VAC, 1.5 Amp rated solid-state relay outputs. Each relay is independently programmable. Parameters H02.02 and H02.03 will configure these digital outputs.

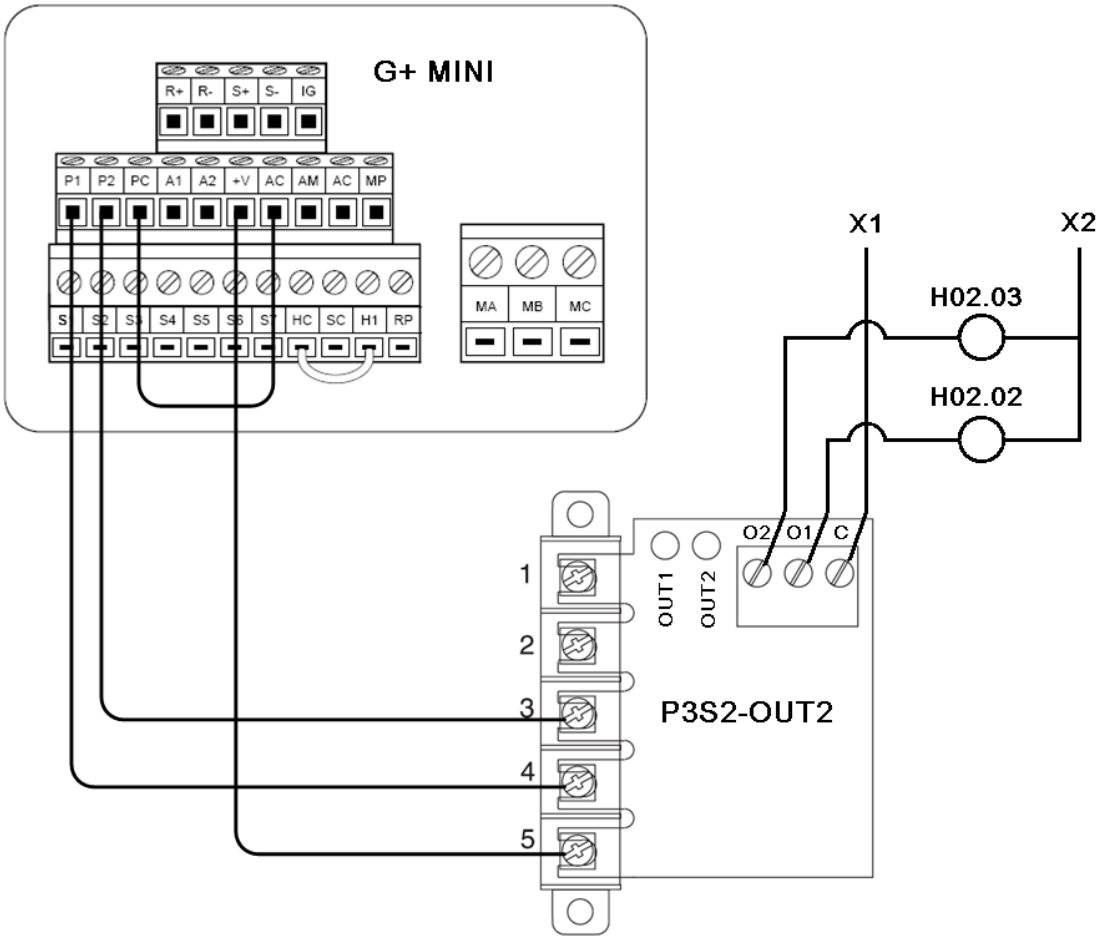


Figure 3-9: P3S2-OUT2 Relay Output Board

3.4.2.7 Power Terminal Arrangement

230V	Arrangement	460V	Arrangement
2001-G+M	1	4001-G+M	2
2003-G+M	1	4002-G+M	2
2005-G+M	1	4003-G+M	2
2008-G+M	2	4004-G+M	2
2011-G+M	2	4005-G+M	2
2017-G+M	2	4007-G+M	2
2025-G+M	3	4009-G+M	2
2033-G+M	3	4014-G+M	3
2047-G+M	4	4018-G+M	3
2060-G+M	5	4024-G+M	4
--	--	4031-G+M	4

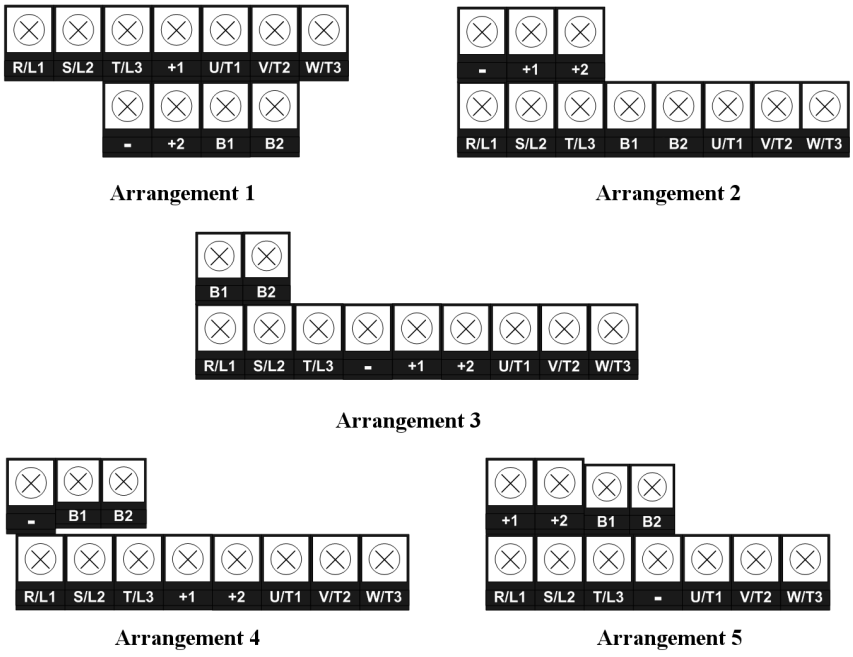


Figure 3-10: Power Terminal Arrangement

4 Getting Started

4.1 Overview

With its easy-to-use keypad and X-Press Programming™ feature, the IMPULSE®•G+ Mini makes it easy to get up and running right away. This chapter explains how to navigate through the VFD's menus along with the function and meaning of each button and indicator. The keypad makes it possible to view fault codes and change parameter settings. The keypad enables you to:

- Program the various VFD parameters.
- Monitor the functions of the VFD.
- Read fault-diagnostic indications.
- Operate the VFD using the keypad (local operation).

WARNING

Because of the potential hazards that are introduced when any VFD is operated locally, Magnetek advises the user to avoid operating it this way. If you do operate the VFD locally, be aware that the crane or hoist will move when you press the RUN button. If you have questions, contact Magnetek.

4.1.1 Checks Before Powering

After mounting and interconnections are completed, verify:

- Correct connections.
- Correct input power supply (no voltage drop or imbalance, source kVA ≤ 500, unless a line reactor is used). If unsure of the source transformer, use a line reactor.

WARNING

DO NOT power 230V-rated VFDs with 460V power.

- No short circuit conditions.
- No loose screw terminals (check especially for loose wire clippings).
- Proper load conditions.

4.1.2 Precautions

- Only start the motor if motor shaft rotation is stopped.
- Even with small loading, never use a motor whose nameplate amperage exceeds the VFD rated current.

DANGER

Extreme caution should be used if braking method is set to decelerate to stop. If deceleration time is too long, equipment could run into end stop device, causing damage to equipment or injury to personnel.

4.2 Using the Keypad

All functions of the VFD are accessed using the keypad. The operator can enter information using the keypad to configure the VFD for their application. This information will be stored in the VFD's memory.

4.2.1 Keypad Functions

The keypad has a 5-digit LED alpha-numeric display.

Indicators and keys on the keypad are described in ***Figure 4-1*** and the following tables.

NOTE: *The STOP key is always active and will immediately cause the motor to stop, following the B03.03 stopping method.*

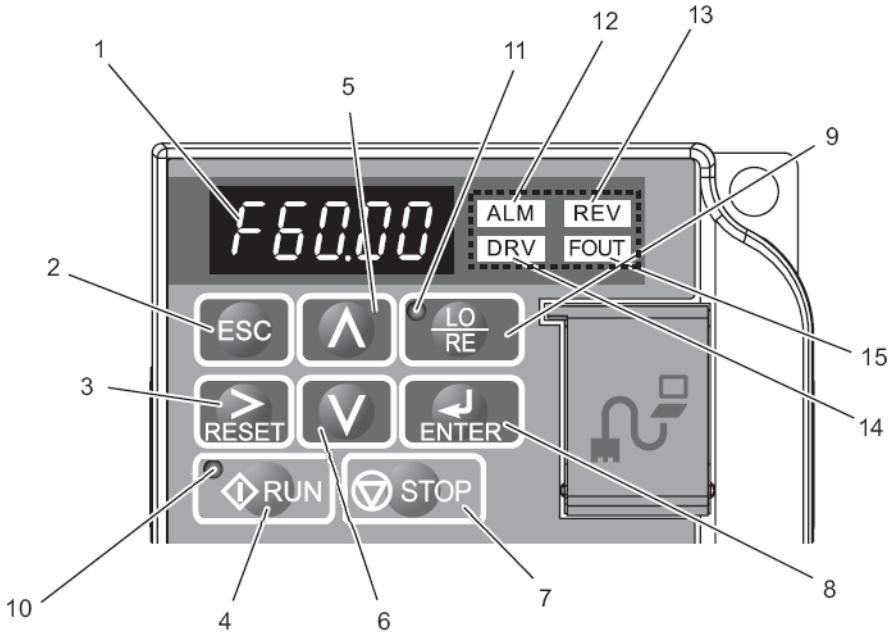


Figure 4-1: Keypad Display

4.2.2 Keypad LED and Button Functions

Some of the keypad buttons, whose functions are described below, are dual-purpose. The dual-purpose keys have one function when used in a view-only mode, and another function when used in a programming mode.

4.2.2.1 Keys and Displays on the LED Keypad

No.	Display	Name	Function
1		Data Display Area	Displays the frequency reference, parameter number, etc.
2		ESC Key	Returns to the previous menu (before ENTER Key is pressed), or cursor position.
3		RESET Key	Moves the cursor to the right. Resets the VFD to clear a fault situation.
4		RUN Key	Pressing the key initiates the RUN command when LOCAL mode operation is selected. Starts the auto-tuning process.
5		Up Arrow Key	Scrolls up to select the next parameter group or parameter settings. It also increases the value of the blinking digit of a parameter setting.
6		Down Arrow Key	Scrolls down to select the next parameter group or parameter settings. It also decreases the value of the blinking digit of a parameter setting.
7		STOP Key	Stops the VFD by initiating a base block STOP command.
8		ENTER Key	Selects modes or parameters. Displays each parameter's set value. By pressing this key again, the set value is stored.
9		LO/RE Selection Key	Pressing the key once displays support phone number 866-624-7378. Pressing the key again shows control method, motion, and reference speed. Pressing the key again will show RESET. Pressing the ENTER Key afterwards will reset the maintenance timers.

4.2.2.2 LO/RE LED and RUN LED Indications

No.	LED	Lit	Flashing	Flashing Quickly	Off
10		During run.	During deceleration to stop. When a run command is input and frequency reference is 0.	During deceleration at a fast-stop. During stop by interlock operation.	During stop.
11		When run command is selected from keypad (LOCAL).	--	--	Run command is selected from device other than keypad (REMOTE).

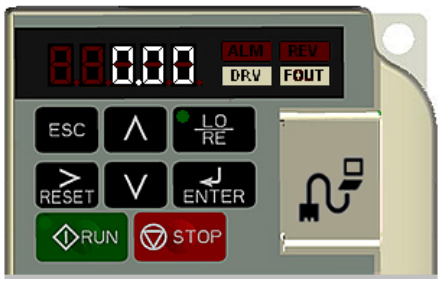
4.2.2.3 Function LEDs

No.	Display	Lit	Flashing	Off
12		When the VFD detects an alarm or error	When an alarm occurs OPE detected When a fault or error occurs during Auto-Tuning	Normal state (no fault or alarm)
13		When the REVERSE command is given	--	When the FORWARD command is given
14		VFD Ready Auto-Tuning	--	Programming Mode
15		Displays output frequency (Hz)	--	--

4.2.3 Quick Start Guide Information

Basic programming of the VFD consists of entering motor parameters, choosing a motion, and selecting a speed reference.

After applying power to the VFD, the display will show the output frequency of 0.00.



Navigation Keys:

The above figure shows the keypad on the G+ Mini. These keys are used for navigation and for changing various settings within the VFD.

Use the ∧ and ∨ keys to change the display and/or change the value of a parameter.

Use the RESET key to move the cursor to the right and to reset the VFD after a fault.

Use the ENTER key to view and save any parameter changes or the ESC key to exit without saving changes.

Setting Motion:

From the output frequency display, press the ∧ key five times until the display shows the parameter menu (PAr).

Press ENTER. The display will show A01.01.

Press RESET two times to move the blinking digit to the right.

Press ∧ until the parameter A01.03 (Motion) appears.

Press ENTER.

Use the following table to select the desired motion for your application:

A01.03 - Motion	
Data Value	**Function**
00	Traverse
01	Hoist (Default)

Use the RESET, ∨, and ∧ keys to change the value.

Press ENTER to save your changes. The display will temporarily show End, then A01.03.

Setting Speed Reference:

Press the ∧ key to navigate to A01.04 (Speed Reference), press ENTER.

Use the following table to select the speed reference for your application:

A01.04 - Speed Reference	
Data Value	**Function**
00	2-speed Multi-Step
01	3-speed Multi-Step (Default)
02	5-speed Multi-Step
03	2-step Infinitely Variable
04	3-step Infinitely Variable
05	Uni-Polar Analog (0-10 VDC or 4-20mA)

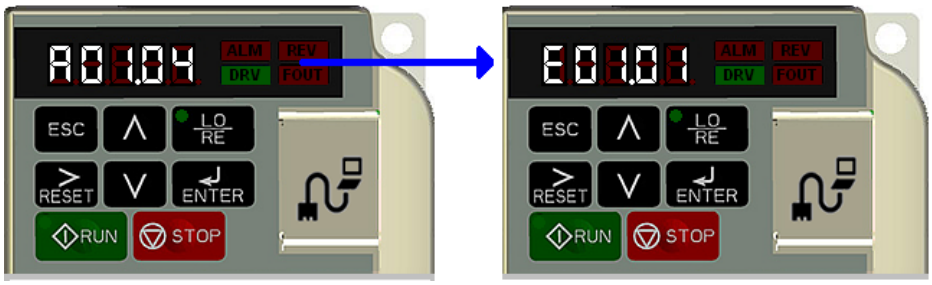
Use the RESET, ∨, and ∧ keys to change the value.

Press ENTER to save your changes. The display will temporarily show End, then A01.04.

Setting Motor Full Load Amps:

Locate the nameplate on your motor to find the Full Load Amps (FLA), and the motor RPM.

Press the RESET key once to move the cursor to the left most spot. Use the ∨ and ∧ keys to navigate to the “E” menu. The display should show E01.01.



Press the RESET key once to move the blinking digit to the right.

Press the ∨ key once to change from E01 to E02. The display now shows E02.01 (Motor FLA). Press ENTER twice.

NOTE: *If more than one motor is being controlled by the VFD, enter in the total of all the motor full load amp ratings. This step is important to provide proper motor overload protection.*

Use the RESET, ∨, and ∧ keys to enter the FLA from the motor nameplate.

Press ENTER to save your changes. The display will temporarily show End, then E02.01.

Press ESC four times to return to the frequency reference display.

Your VFD is now ready.

4.2.4 Parameters

The parameters are organized by function group and determine how the VFD functions. These parameters are programmed in the VFD's software as measurable values or options—both of which will be referred to in this manual as *settings*. While some of these parameters are associated with one setting, others are tied to a number of possible settings.

By default, the IMPULSE®•G+ Mini is configured for a common crane system. If you find it necessary to change the initial settings, it is recommended that you only allow qualified crane system technicians to program the VFD. This can be accomplished by using the Password and Access Level features. For more information on these security features, ***see Section 4.2.6 on page 42***.

4.2.5 Parameter Modes

All parameters are organized under four modes:

4.2.5.1 Operation Mode

VFD operation is enabled. VFD status LED lights.

4.2.5.2 Programming Mode

Parameter access levels, control method, motion, speed reference, and passwords are selected. Parameters are set/read. Items to be set/read vary depending on the access level setting.

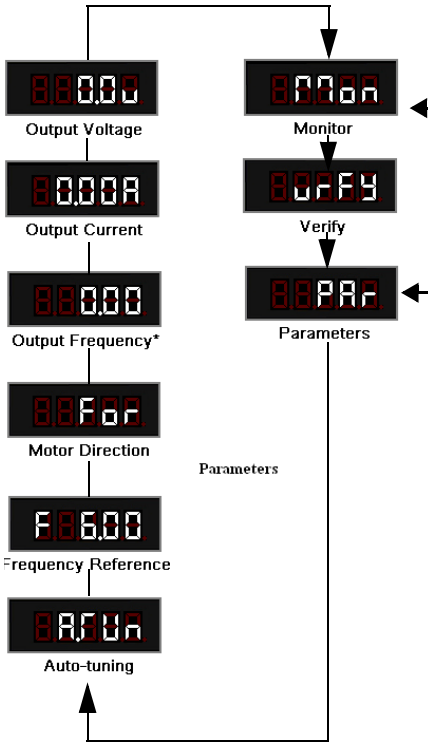
4.2.5.3 Auto-Tuning Mode

Motor parameters are automatically set by entering tuning data (motor nameplate values) when using V/f or OLV control method.

4.2.5.4 Modified Parameters Mode

Only parameters that have been changed from the factory default settings are shown here. They can be set/read.

4.2.5.5 Structure of Parameters



*View after power-up

Group		Function
Monitor	U1	Monitor
	U2	Fault Trace
	U3	Fault History
	U4	Maintenance
	U6	Motor
Initialize	A1	Initialization Parameters
	A2	User-Defined Parameters
Application	B1	Speed References
	B2	Reference Limits
	B3	Sequence/Reference Source
	B5	Acceleration/Deceleration
	B8	Jump Frequencies
Special Function	C1	Quick Stop
	C1	Reverse Plug Simulation
	C2	Micro-Speed
	C3	Travel Limits
	C3	Phantom Stop
	C3	Klixon
	C5	Load Check II
	C6	Swift-Lift
	C7	Torque Limit
	C8	Brake Answerback
	C12	Brake Delay Timers
	C12	On/Off Delay Timers
	C12	Maintenance Timer
	C13	Inching Control
Tuning	D1	DC Injection
	D2	Automatic Slip Compensation
	D3	Torque Compensation
	D8	Dwell
	D9	S-Curve Acceleration/Deceleration
	D10	Carrier Frequency
	D11	Hunting Prevention
Motor	E1	V/f Pattern
	E2	Motor Set-up
PGO	F1	Pulse Generated Control
Terminal	H1	Digital Inputs
	H2	Digital Outputs
	H3	Analog Inputs
	H4	Analog Outputs
	H5	Serial Communication
	H6	Pulse Inputs
Protection	L1	Motor Overload Protection
	L2	Voltage Detection
	L3	Stall Prevention
	L4	Reference Detection
	L6	Torque Detection
	L8	Hardware Protection
	L9	Automatic Reset
Motor Tuning	N2	Automatic Frequency Regulator Tuning
	N6	Online Motor Tuning
Keypad	O1	Monitor Selection
	O2	Keypad Key Selection
	O3	Clear History

4.2.6 Initialization Set-up

4.2.6.1 Parameter Access Level (A01.01)

This parameter controls the level of access for the parameters in the VFD. There are three access levels available - BASIC, ADVANCED and USER. When the access level is set to ADVANCED (A01.01 = 02), it will allow access to all parameters outlined in this manual. The BASIC (A01.01 = 01) access level allows access to commonly used parameters.

Changing the access level to USER (A01.01 = 00) limits access to only parameters stored in the A02.xx table (up to 32). To set up the A02.xx group, ***see Section 4.2.7.4 on page 47***.

Setting	Description
00	User Level - Allows access to only the parameters programmed to A02.01 through A02.32.
01	Basic Level - Allows access to a limited amount of commonly used parameters.
02	Advanced Level - Full access to parameters.

4.2.6.2 Control Method (A01.02)

Select the control method best suited for your application.

Setting	Description
00	V/f Control—For general purpose and multiple motor applications.
02	OLV—Open Loop Vector; for applications requiring precise speed control, quick response and higher torque at low speeds (150% torque below 1 Hz).

NOTE: *An auto-tune must be performed for all open loop vector applications.* ***See Section 4.3 on page 48****.*

4.2.6.3 Motion (A01.03)

Set this parameter to match the motion of application. ***See Table 4-1 on page 44*** and ***Table 4-2 on page 45*** (X-Press Programming) for details.

Setting	Description
00	Traverse - Decelerate to stop upon removal of RUN command.
01	Standard Hoist - Immediate stop upon removal of RUN command
04	Braketronic

4.2.6.4 Speed Reference (A01.04)

This parameter will automatically define the input terminals for the selections listed below. ***See Table 4-1 on page 44*** and ***Table 4-2 on page 45*** (X-Press Programming) for details.

Setting	Description
00	2-Speed Multi-step — Defines Terminal S3 = 2nd speed.
01	3-Speed Multi-step — Defines Terminals S3 and S4 as speeds 2 and 3 respectively.
02	5-Speed Multi-step — Defines Terminals S3-6 as speeds 2-5.
03	2-Step infinitely variable — Terminals S1 and S2 = B01.01 (Reference 1) and speed hold. Terminal S3 = Accelerate.
04	3-Step infinitely variable — Terminals S1 and S2 = B01.01 (Reference 1). Terminal S3 = Speed Hold. Terminal S4 =Accelerate.
05	Uni-polar analog — Terminals S1 and S2 = A directional input. Terminal A1 = 0-10V. For 4-20mA control, configure terminal A2.

Parameters Changed by X-Press Programming

Table 4-1: Traverse (A01.03 = 00)

A01.04	Description	B01.01	B01.02	B01.03	B01.04	B01.05	B01.17	B01.18	B02.03	B03.03	B05.01	B05.02
		Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Jog Ref	Ref Priority	Ref. Lower Limit	Stopping Method	Accel Time 1	Decel Time 1
00	2-Speed Multi-Step	6.00	60.00	0.00	0.00	0.00	6.00	00	2.0	00	5.0	5.0
01	3-Speed Multi-Step	6.00	30.00	60.00	0.00	0.00	6.00	00	2.0	00	5.0	5.0
02	5-Speed Multi-Step	6.00	15.00	30.00	45.00	60.00	6.00	00	2.0	00	5.0	5.0
03	2-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	6.00	00	2.0	00	5.0	5.0
04	3-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	6.00	00	2.0	00	5.0	5.0
05	Uni-Polar Analog	0.00	0.00	0.00	0.00	0.00	6.00	01	2.0	00	5.0	5.0

A01.04	Description	C01.01	D09.01	D09.02	D09.03	E01.03	H01.01	H01.02	H01.03	H01.04	H01.05	H01.06	H01.07	H02.01	H02.02	H02.03	H03.01	N02.05
		Quick Stop	S-Curve Accel at Start	S-Curve Accel at End	S-Curve Decel at Start	V/f Selection	Terminal S1 Select	Terminal S2 Select	Terminal S3 Select	Terminal S4 Select	Terminal S5 Select	Terminal S6 Select	Terminal S7 Select	Terminal MA/MB/MC Select	Terminal P1 Select	Terminal P2 Select	Terminal A1 Signal	OLV Stab. Level
00	2-Speed Multi-Step	00	1.50	1.50	1.50	00	80	81	00	0F	0F	0F	0F	00	0F	0F	00	00
01	3-Speed Multi-Step	00	1.50	1.50	1.50	00	80	81	00	01	0F	0F	0F	00	0F	0F	00	00
02	5-Speed Multi-Step	00	1.50	1.50	1.50	00	80	81	00	01	02	03	0F	00	0F	0F	00	00
03	2-Step Infinitely Variable	00	1.50	1.50	1.50	00	80	81	05	0F	0F	0F	0F	00	0F	0F	00	00
04	3-Step Infinitely Variable	00	1.50	1.50	1.50	00	80	81	04	05	0F	0F	0F	00	0F	0F	00	00
05	Uni-Polar Analog	00	1.50	1.50	1.50	00	80	81	0F	0F	0F	0F	0F	00	0F	0F	00	00

Parameters Changed by X-Press Programming

Table 4-2: Standard Hoist (A01.03 = 01)

A01.04	Description	B01.01	B01.02	B01.03	B01.04	B01.05	B01.17	B01.18	B02.03	B03.03	B05.01	B05.02
		Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Jog Ref	Ref Priority	Ref. Lower Limit	Stopping Method	Accel Time 1	Decel Time 1
00	2-Speed Multi-Step	6.00	60.00	0.00	0.00	0.00	6.00	00	2.0	01	5.0	3.0
01	3-Speed Multi-Step	6.00	30.00	60.00	0.00	0.00	6.00	00	2.0	01	5.0	3.0
02	5-Speed Multi-Step	6.00	15.00	30.00	45.00	60.00	6.00	00	2.0	01	5.0	3.0
03	2-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	6.00	00	2.0	01	5.0	3.0
04	3-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	6.00	00	2.0	01	5.0	3.0
05	Uni-Polar Analog	0.00	0.00	0.00	0.00	0.00	6.00	01	2.0	01	5.0	3.0

A01.04	Description	C01.01	D09.01	D09.02	D09.03	E01.03	H01.01	H01.02	H01.03	H01.04	H01.05	H01.06	H01.07	H02.01	H02.02	H02.03	H03.01	N02.05
		Quick Stop	S-Curve Accel at Start	S-Curve Accel at End	S-Curve Decel at Start	V/f Selection	Terminal S1 Select	Terminal S2 Select	Terminal S3 Select	Terminal S4 Select	Terminal S5 Select	Terminal S6 Select	Terminal S7 Select	Terminal MA/MB/MC Select	Terminal P1 Select	Terminal P2 Select	Terminal A1 Signal	OLV Stab. Level
00	2-Speed Multi-Step	00	0.50	0.50	0.50	04	80	81	00	0F	0F	0F	0F	00	0F	0F	00	00
01	3-Speed Multi-Step	00	0.50	0.50	0.50	04	80	81	00	01	0F	0F	0F	00	0F	0F	00	00
02	5-Speed Multi-Step	00	0.50	0.50	0.50	04	80	81	00	01	02	03	0F	00	0F	0F	00	00
03	2-Step Infinitely Variable	00	0.50	0.50	0.50	04	80	81	05	0F	0F	0F	0F	00	0F	0F	00	00
04	3-Step Infinitely Variable	00	0.50	0.50	0.50	04	80	81	04	05	0F	0F	0F	00	0F	0F	00	00
05	Uni-Polar Analog	00	0.50	0.50	0.50	04	80	81	0F	0F	0F	0F	0F	00	0F	0F	00	00

Parameters Changed by X-Press Programming

Table 4-3: Braketronic (A01.03 = 04)

A01.04	Description	B01.01	B01.02	B01.03	B01.04	B01.05	B01.17	B01.18	B02.03	B03.03	B05.01	B05.02
		Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Jog Ref	Ref Priority	Ref. Lower Limit	Stopping Method	Accel Time 1	Decel Time 1
00	2-Speed Multi-Step	6.00	60.00	0.00	0.00	0.00	6.00	02	2.0	00	1.0	1.0
01	3-Speed Multi-Step	6.00	30.00	60.00	0.00	0.00	6.00	02	2.0	00	1.0	1.0
02	5-Speed Multi-Step	6.00	15.00	30.00	45.00	60.00	6.00	02	2.0	00	1.0	1.0
03	2-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	6.00	02	2.0	00	1.0	1.0
04	3-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	6.00	02	2.0	00	1.0	1.0
05	Uni-Polar Analog	0.00	0.00	0.00	0.00	0.00	6.00	02	2.0	00	1.0	1.0

A01.04	Description	C01.01	D09.01	D09.02	D09.03	E01.03	H01.01	H01.02	H01.03	H01.04	H01.05	H01.06	H01.07	H02.01	H02.02	H02.03	H03.01	N02.05
		Quick Stop	S-Curve Accel at Start	S-Curve Accel at End	S-Curve Decel at Start	V/f Selection	Terminal S1 Select	Terminal S2 Select	Terminal S3 Select	Terminal S4 Select	Terminal S5 Select	Terminal S6 Select	Terminal S7 Select	Terminal MA/MB/MC Select	Terminal P1 Select	Terminal P2 Select	Terminal A1 Signal	OLV Stab. Level
00	2-Speed Multi-Step	00	0.00	0.00	0.00	00	80	81	00	0F	0F	0F	65	0F	0F	0F	00	00
01	3-Speed Multi-Step	00	0.00	0.00	0.00	00	80	81	00	01	0F	0F	65	0F	0F	0F	00	00
02	5-Speed Multi-Step	00	0.00	0.00	0.00	00	80	81	00	01	02	03	65	0F	0F	0F	00	00
03	2-Step Infinitely Variable	00	0.00	0.00	0.00	00	80	81	05	0F	0F	0F	65	0F	0F	0F	00	00
04	3-Step Infinitely Variable	00	0.00	0.00	0.00	00	80	81	04	05	0F	0F	65	0F	0F	0F	00	00
05	Uni-Polar Analog	00	0.00	0.00	0.00	00	80	81	0F	0F	0F	0F	65	0F	0F	0F	00	00

4.2.7 Initialize Parameters (A01.05)

Use this parameter to reset the VFD to user-specified initial values or clear an oPE04 fault.

Setting	Description
0000	No Initialize (factory default)
1110	User Initialize - Restores the VFD to user-specified initial values.
5550	Copies saved parameters from terminal board to the VFD's memory.

4.2.7.1 User Initialize (A01.05 = 1110)

Once the VFD is configured and the system is running, set parameter O02.03 = 01 to save all modified parameters to the User Initialized memory on the terminal board. Changing A01.05 = 1110 will recall all modified parameters back to the last time saved using O02.03.

4.2.7.2 Terminal Board to Control Board Parameter Transfer (A01.05 = 5550)

The oPE04 fault indicates the parameters in the terminal board do not match the parameters of the control board. To reset the oPE04 fault, set A01.05 = 5550. This will copy the parameters from the terminal board to the control board. Check and verify your kVA setting (O02.04) before operating the VFD.

4.2.7.3 Password Entry 1 (A01.06)

This parameter enables the user to set a password that inhibits the programming of parameters A01.01 ~ A01.08 and locks the remaining parameters in the VFD except those stored in the User Parameter group, A02.xx.

To program a password, access the programming menu, “PAr”, and navigate to parameter A01.06. Press the STOP and UP arrow keys at the same time to change the display from A01.06 to A01.07. Press ENTER and program a password number into A01.07.

When parameters A01.06 ≠ A01.07, only parameters A01.01, A01.06, and A01.08 are visible and cannot be modified. The Access Level is set to User (A01.01 = 00). Parameters programmed in A02.xx can be viewed in the “USEr” menu with read/write accessibility. When A01.06 = A01.07, then A01.01 to A01.08 can be modified, along with the remaining parameters in the VFD.

When A01.06 ≠ A01.07, then A01.06 will show “LoC”. When A01.06 = A01.07, then A01.06 will show “UnLoC”.

4.2.7.4 User Parameters (A02.01 through A02.32)

This function allows users to select up to 32 parameters for quick-access programming in the “USEr” menu when the access level is set to User (A01.01 = 00). This function is useful when used in conjunction with A01.06, which locks all parameters in the VFD except those stored in the User Parameter Group, A02.xx.

To assign a parameter as a user parameter, change the Access Level to Advanced (A01.01 = 02), go to the A02 function group and select an A02.01 ~ A02.32 parameter. Press ENTER. The display will show “----”. Use the UP or DOWN arrow keys to select a user parameter and press ENTER when done.

To clear a parameter stored in the A02.xx, change the value to “----”. Change the Access Level to User (A01.01 = 00).

4.2.7.5 Password Entry 2 (A01.08)

OEM use only.

4.3 Auto-Tuning

The IMPULSE®•G+ Mini can perform a calibration process with its automatic tuning function. The VFD prompts for minimal motor information, and then runs a quick tuning process. Ideally, perform a rotational Auto-Tune with the motor uncoupled from the load. When the motor cannot be disconnected from the load, perform a stationary or non-rotating Auto-Tune.

NOTE: *Contact Magnetek Inc. Service Department if an Auto-Tune cannot be performed.*

CAUTION

The brake output is not energized during Auto-Tune. The brake must be manually released before a rotational Auto-Tune and re-engaged when Auto-Tuning is complete.

The IMPULSE®•G+ Mini can perform both a stationary and rotational Auto-Tune. For optimal Open Loop Vector performance, a rotational Auto-Tune should be performed.

Parameter	Name	Description	Range	Default
T01.01	Tuning Mode Select 00: Standard Auto-Tuning (Rotational for OLV) 02: Stationary Auto-Tuning for Line-to-Line resistance	Selects Tuning Method	00, 02	02
T01.02	Motor Rated Power	Sets the motor size in HP/kW (Note: kW = HP x 0.746)	Model Dependent	--
T01.03	Motor Rated Voltage	Sets motor rated voltage in VAC	Model Dependent	--
T01.04	Motor Rated Current	Sets motor rated current in Amps	Model Dependent	--
T01.05	Motor Rated Frequency	Sets the rated frequency of the motor	0.00–150.00 Hz	60.00
T01.06	Number of Poles	Sets the number of motor poles	02–48	04
T01.07	Motor Rated Speed	Sets the motor rated speed in RPM	0–24000	1750

4.3.1 Using Auto-Tuning

With the keypad, use the UP or DOWN arrow keys to show the auto-tuning menu  . Press the ENTER key and scroll through the tuning parameters using the UP Arrow key and enter each of the required parameter settings. Press the RUN key to begin the Auto-Tuning process when the display shows the RUN10 or RUN12 message. During the tuning process, the display will flash the RUN10, RUN12 or RUN13 message. When complete the VFD will display END, indicating the tuning was successful. Press the ESC key twice to exit. If there is a fault during the tuning process, the VFD will display an error message. ***See Section 6.1.4 on page 141***.

NOTE: *If the STOP key is pressed during tuning or the auto-tuning is interrupted, the motor will coast to stop and the VFD display will show ER-03. The data changed during tuning will revert to its original values.*

5 Programming Features

5.1 Application

The application parameters control the acceleration and deceleration characteristics, as well as any preset frequencies the system will require for operation. Application parameters included in this section are listed below:

- B1 Speed References
- B2 Reference Limits
- B3 Sequence/Reference Source
- B5 Acceleration/Deceleration
- B8 Jump Frequencies

5.1.1 Speed References

Parameter	Name	Function	Range	Default
B01.01	Reference 1	Sets the Speed 1 frequency.	0.00–150.00 Hz	15.00*
B01.02	Reference 2	Sets the Speed 2 frequency.	0.00–150.00 Hz	30.00*
B01.03	Reference 3	Sets the Speed 3 frequency.	0.00–150.00 Hz	60.00*
B01.04	Reference 4	Sets the Speed 4 frequency.	0.00–150.00 Hz	0.00*
B01.05	Reference 5	Sets the Speed 5 frequency.	0.00–150.00 Hz	0.00*
B01.06	Reference 6	Sets the Speed 6 frequency.	0.00–150.00 Hz	0.00*
B01.07	Reference 7	Sets the Speed 7 frequency.	0.00–150.00 Hz	0.00*
B01.08	Reference 8	Sets the Speed 8 frequency.	0.00–150.00 Hz	0.00*
B01.09	Reference 9	Sets the Speed 9 frequency.	0.00–150.00 Hz	0.00*
B01.10	Reference 10	Sets the Speed 10 frequency.	0.00–150.00 Hz	0.00*
B01.11	Reference 11	Sets the Speed 11 frequency.	0.00–150.00 Hz	0.00*
B01.12	Reference 12	Sets the Speed 12 frequency.	0.00–150.00 Hz	0.00*
B01.13	Reference 13	Sets the Speed 13 frequency.	0.00–150.00 Hz	0.00*
B01.14	Reference 14	Sets the Speed 14 frequency.	0.00–150.00 Hz	0.00*
B01.15	Reference 15	Sets the Speed 15 frequency.	0.00–150.00 Hz	0.00*
B01.16	Reference 16	Sets the Speed 16 frequency.	0.00–150.00 Hz	0.00*
B01.17	Jog Reference	Sets the Jog frequency.	0.00–150.00 Hz	6.00*
B01.18	Reference Priority *00 Digital Ref Only* *01 Analog Ref Only* *02 Higher Ref Sel*	Determines whether the digital or analog frequency reference is used. ***NOTE:*** *When using Higher Ref Sel, 2-Step Infinitely Variable should NOT be used (A01.04 = 03). The two functions are not intended to work in conjunction.*		00*

* *Initial value is determined by X-Press Programming (**Table 4-1 on page 44** and **Table 4-2 on page 45**).*

Table 5-1: Multi-Step Speed Selection by Digital Input (B01.01 ~ B01.16)

Speed Reference	Forward/Reverse H01.01 = 80 H01.02 = 81	Multi-Step Speed 2 H01.03 = 00	Multi-Step Speed 3 H01.04 = 01	Multi-Step Speed 4 H01.05 = 02	Multi-Step Speed 5 H01.06 = 03	Fwd/Rev Jog-Fwd/ Rev Inch H01.07 = 15, 16, 17, 18
STOP	Off	--	--	--	--	Off
B01.01 Speed Ref 1	On	Off	Off	Off	Off	Off
B01.02 Speed Ref 2	On	On	Off	Off	Off	Off
B01.03 Speed Ref 3	On	On	On	Off	Off	Off
B01.04 Speed Ref 4	On	On	On	On	Off	Off
B01.05 Speed Ref 5	On	On	On	On	On	Off
B01.06 Speed Ref 6	On	Off	On	Off	Off	Off
B01.07 Speed Ref 7	On	Off	On	On	Off	Off
B01.08 Speed Ref 8	On	Off	Off	On	Off	Off
B01.09 Speed Ref 9	On	Off	On	On	On	Off
B01.10 Speed Ref 10	On	Off	Off	On	On	Off
B01.11 Speed Ref 11	On	Off	Off	Off	On	Off
B01.12 Speed Ref 12	On	On	Off	Off	On	Off
B01.13 Speed Ref 13	On	On	On	Off	On	Off
B01.14 Speed Ref 14	On	Off	On	Off	On	Off
B01.15 Speed Ref 15	On	On	Off	On	Off	Off
B01.16 Speed Ref 16	On	On	Off	On	On	Off

5.1.2 Reference Limits

These parameters will limit the frequency range as a percentage of maximum output frequency (E01.04).

An alternate upper limit frequency can be used during operation when a Multi-Function Digital Input (MFDI) is set to 59 (Alt F-Ref UpLimit) and the MFDI is on. Alternate Upper Limit Frequency = (B02.04) % x (E01.04).

Parameter	Name	Function	Range	Default
B02.01	Frequency Reference Upper Limit	Sets as a percentage of the maximum output frequency (E01.04), the maximum frequency at which the VFD is able to run.	0.0–110%	100.0
B02.02	Frequency Reference Lower Limit	Sets as a percentage of the maximum output frequency (E01.04), the minimum master frequency reference only.	0.0–110%	0.0
B02.03	Reference 1 Lower limit	Sets as a percentage of the maximum output frequency (E01.04), and determines the minimum frequency the VFD is able to run when an analog signal is below this level.	0.0–110%	2.0*
B02.04	Alt Upper Limit	Alternate of B02.01 set by H01.xx = 59.	0-110%	100.0

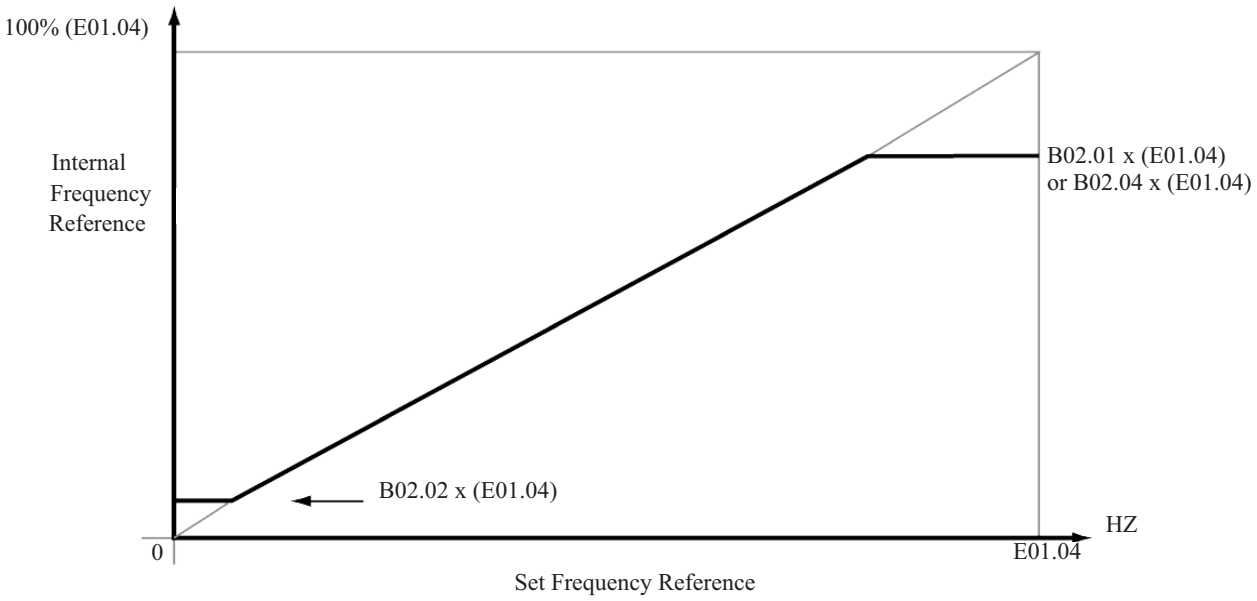


Figure 5-1: Setting Frequency Upper and Lower Limits

5.1.3 Sequence/Reference Source

B03.01 and B03.02 determine the source from where the frequency reference and RUN command are generated.

Parameter	Name	Function	Range	Default
B03.01	Reference Source	Selects frequency reference source.	00–04	01
	00 Keypad	Keypad		
	01 Terminals	Control circuit terminal		
	02 Serial Communication	Modbus Serial Communication		
	03 Option PCB	Industrial Communication		
	04 Pulse Input	Pulse Input (Terminal RP)		
B03.02	Run Source	Selects run command source.	00–03	01
	00 Keypad	Keypad		
	01 Terminals	Control circuit terminal.		
	02 Serial Communication	Modbus Serial Communication		
	03 Option PCB	Industrial Communication		

WARNING

Because of the potential hazards that are introduced when any VFD is operated locally, Magnetek advises the user to avoid operating it this way. If the user does operate the VFD locally, be aware that the crane or hoist will move when the RUN button is pressed. Contact Magnetek with any questions.

5.1.3.1 Stopping Method

B03.03 selects the stopping method suitable for the particular application.

Parameter	Name	Function	Range	Default
B03.03	Stop Method	Determines stop method.	00–02, 04	*
	00 Decel to Stop	Used to stop when motion is traverse (***Figure 5-2 on page 53*** and ***Figure 5-3 on page 53***)		
	01 Coast to Stop	Used to stop when motion is hoist (***Figure 5-4 on page 54*** and ***Figure 5-5 on page 54***)		
	02 DC Injection	(***Figure 5-6 on page 55*** and ***Figure 5-7 on page 55***)		
	04 Decel w/ Timer (traverse only)	(***Figure 5-9 on page 57***, ***Figure 5-10 on page 57***, and ***Figure 5-11 on page 58***)		

* *Initial value is determined by X-Press Programming*

5.1.3.2 Decel to Stop (B03.03 = 00)

Upon removal of the FWD or REV run command, the motor decelerates at a rate determined by the time set in deceleration time 1 (B05.02) and DC injection braking is applied after the DC injection start frequency, D01.01, has been reached. If the deceleration time is set too short or the load inertia is large, an overvoltage fault (OV) may occur during deceleration. In this case, increase the deceleration time or check if the braking resistor is functioning properly.

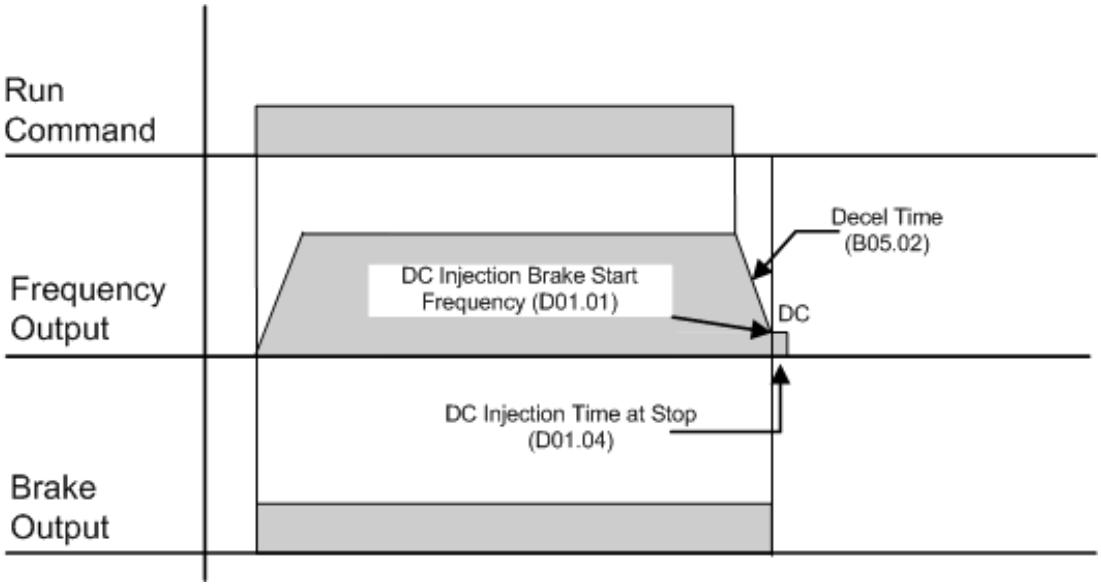


Figure 5-2: B03.03 = 00 (Decel to Stop) without DC Injection

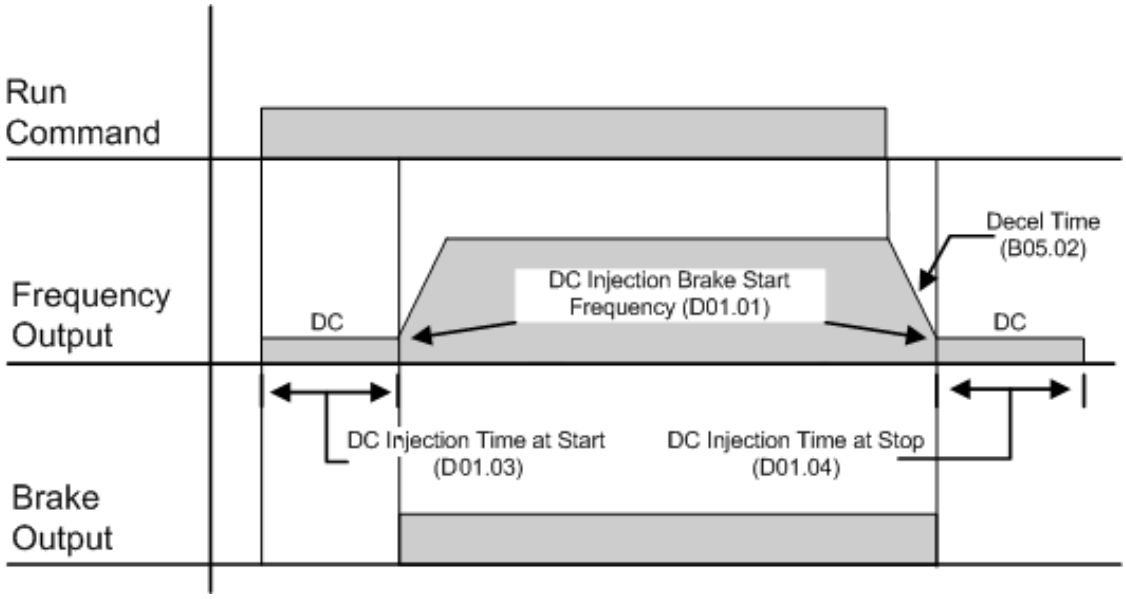


Figure 5-3: B03.03 = 00 (Decel to Stop) with DC Injection

5.1.3.3 Coast to Stop (B03.03 = 01)

Upon removal of the FWD or REV run command, the motor starts to coast and the electric brake sets.

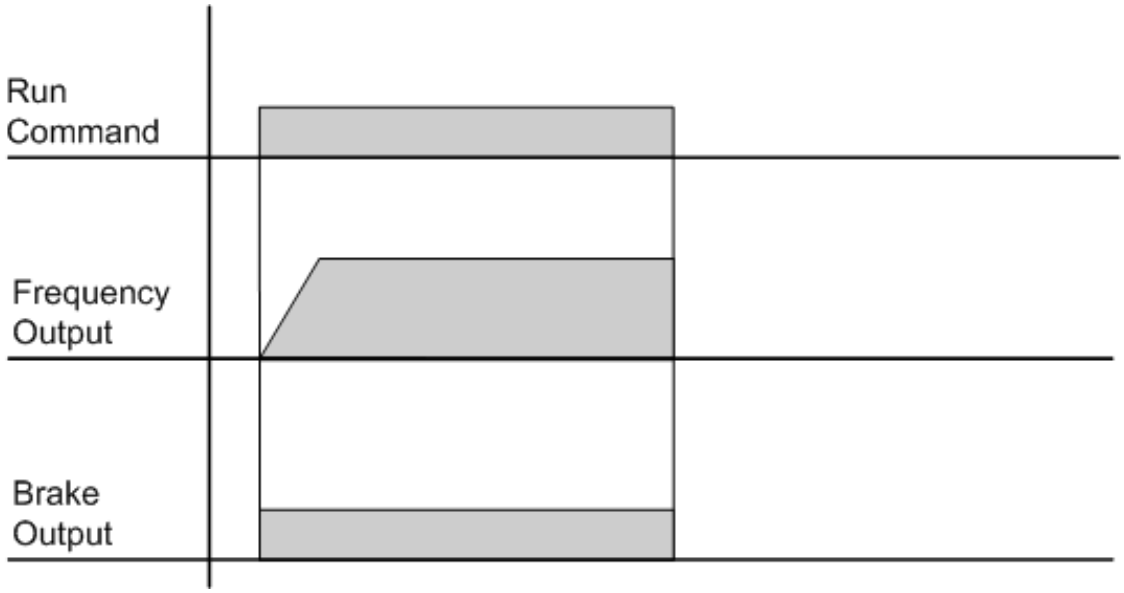


Figure 5-4: B03.03 = 01 (Coast to Stop) without DC Injection

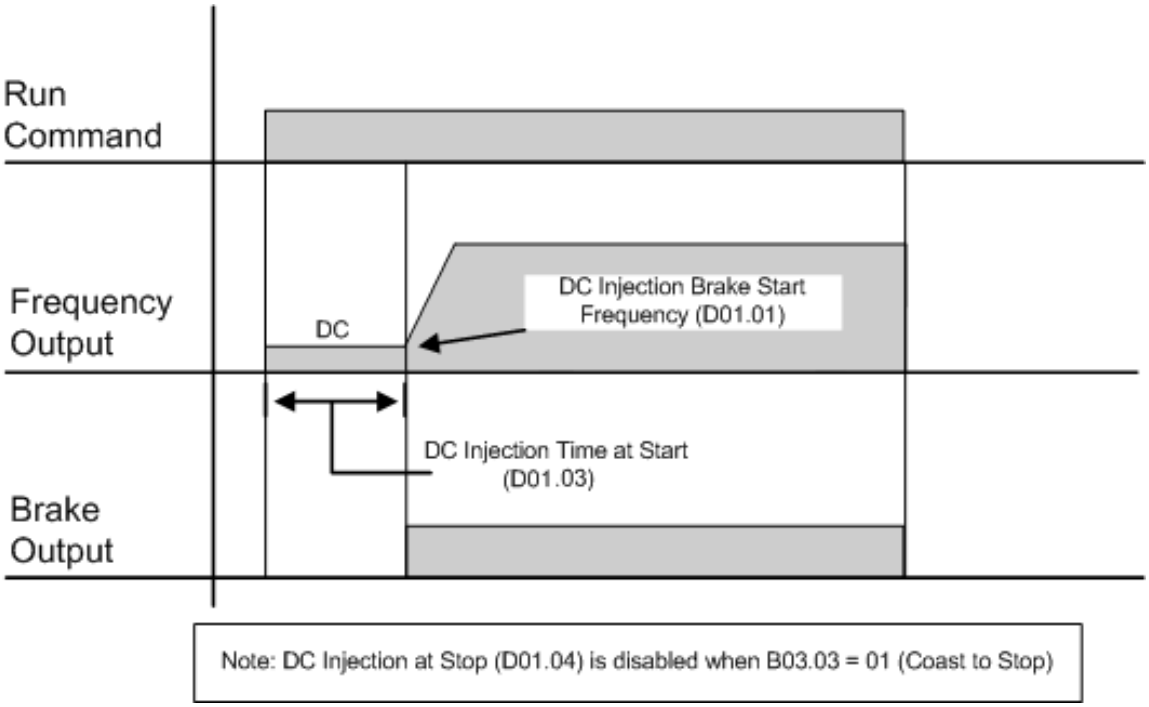


Figure 5-5: B03.03 = 01 (Coast to Stop) with DC Injection

5.1.3.4 DC Injection Braking (B03.03 = 02)

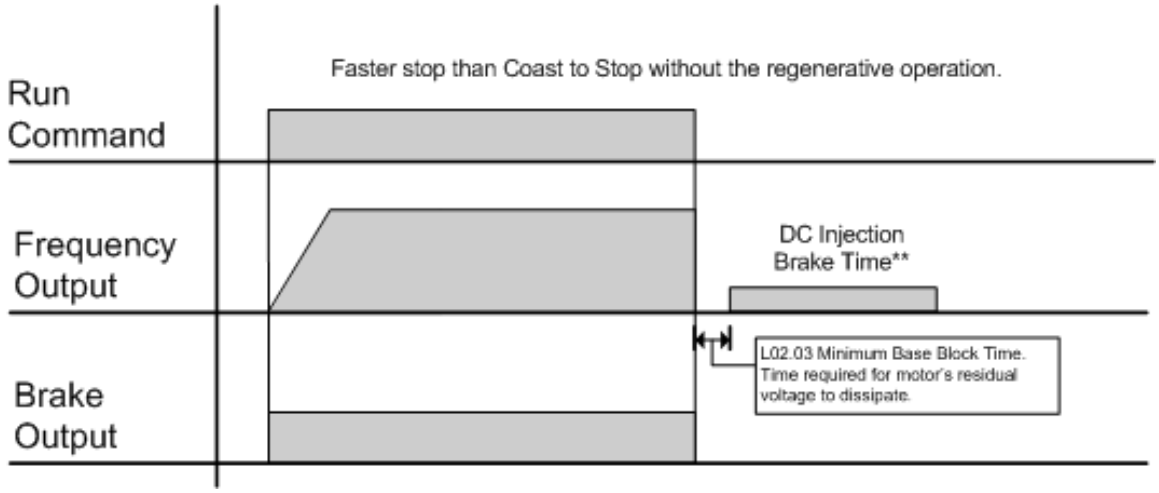


Figure 5-6: B03.03 = 02 (DC Injection at Stop) without DC Injection at Start

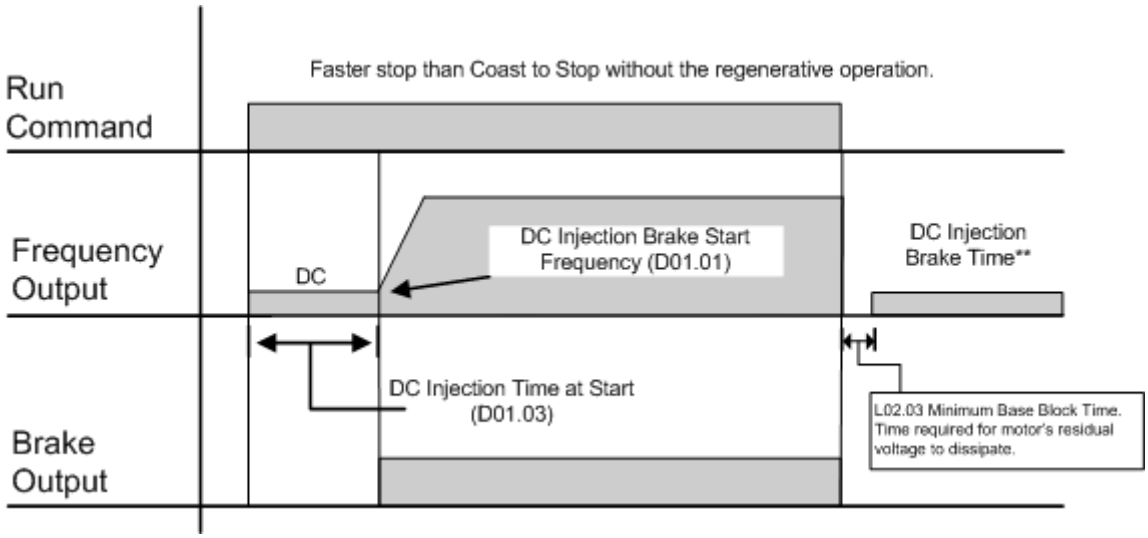


Figure 5-7: B03.03 = 02 (DC Injection at Stop) with DC Injection at Start

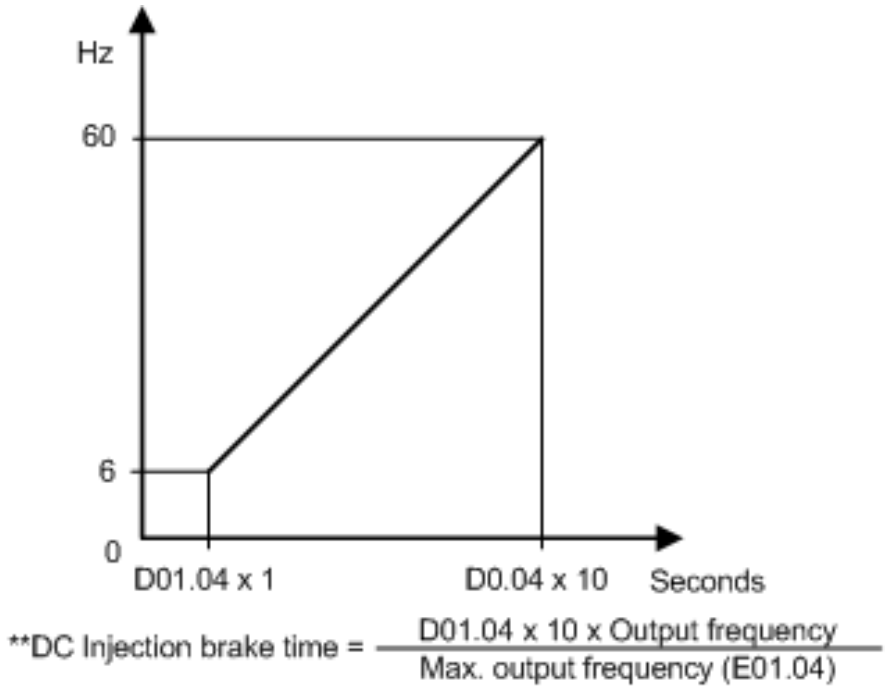


Figure 5-8: DC Injection Brake Time Calculation

5.1.3.5 Decel with Timer (B03.03 = 04)

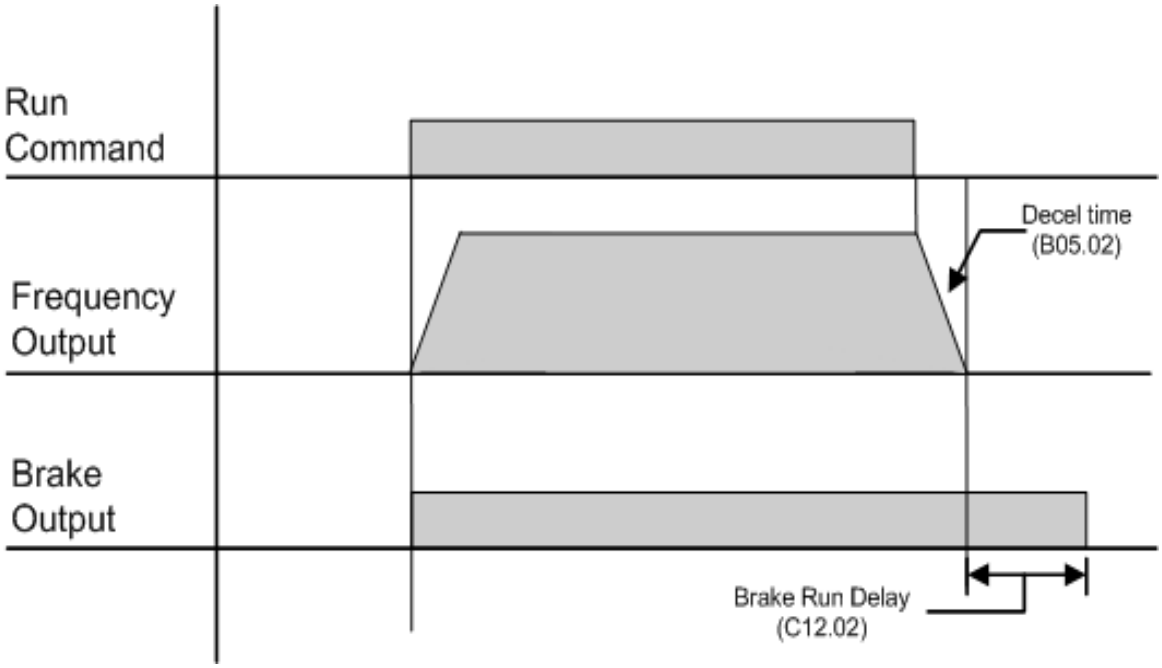


Figure 5-9: B03.03 = 04 (Decel with timer) without DC Injection

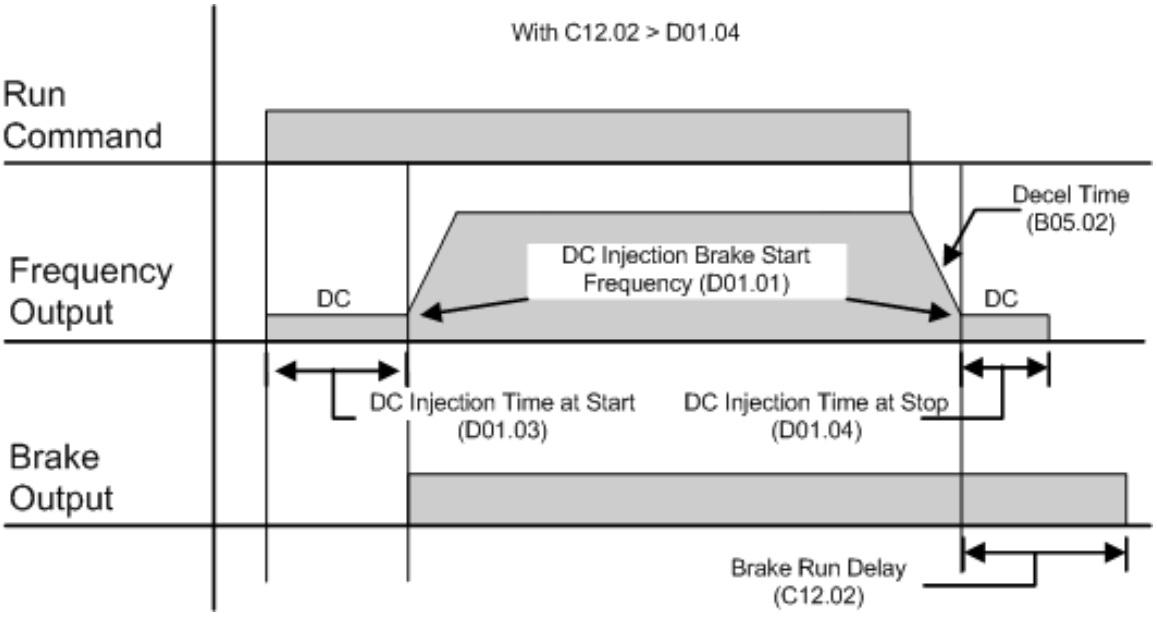


Figure 5-10: B03.03 = 04 (Decel with timer) with DC Injection, where C12.02 > D01.04

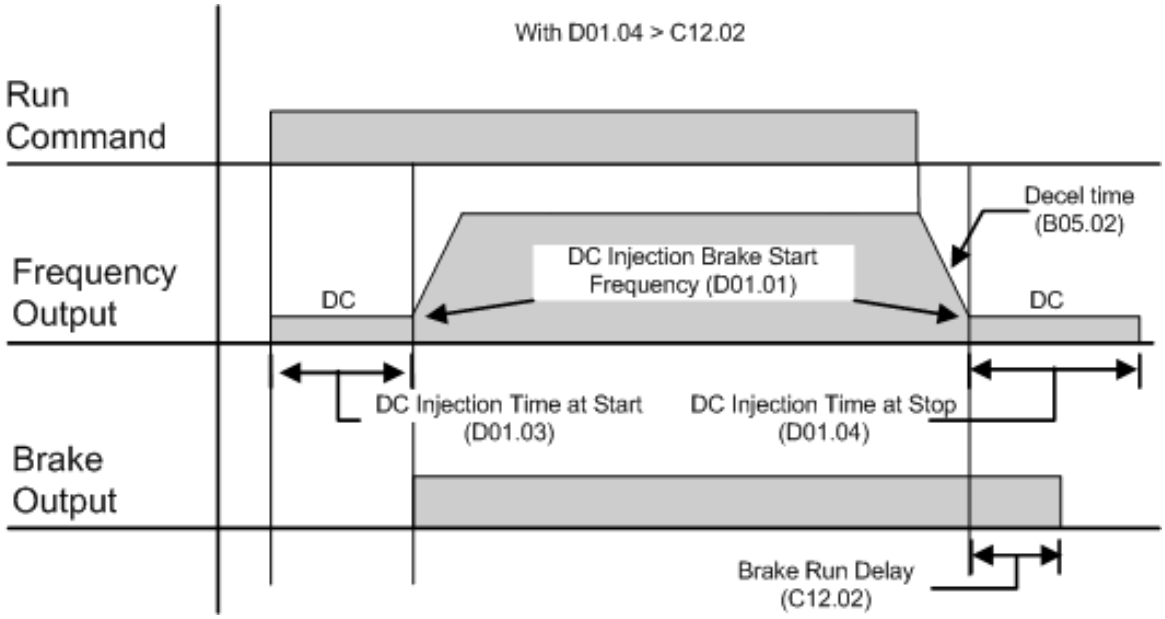


Figure 5-11: B03.03 = 04 (Decel with timer) without DC Injection, where D01.04 > C12.02

5.1.3.6 Fast Stop (H01.xx = 40 or 42)

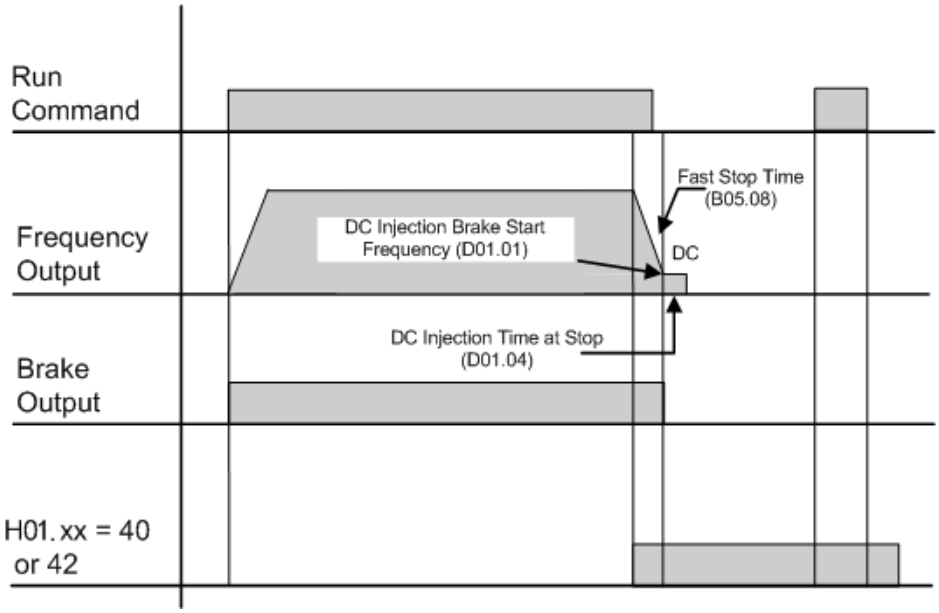


Figure 5-12: H01.XX = 40 or 42 (Fast Stop) without DC Injection

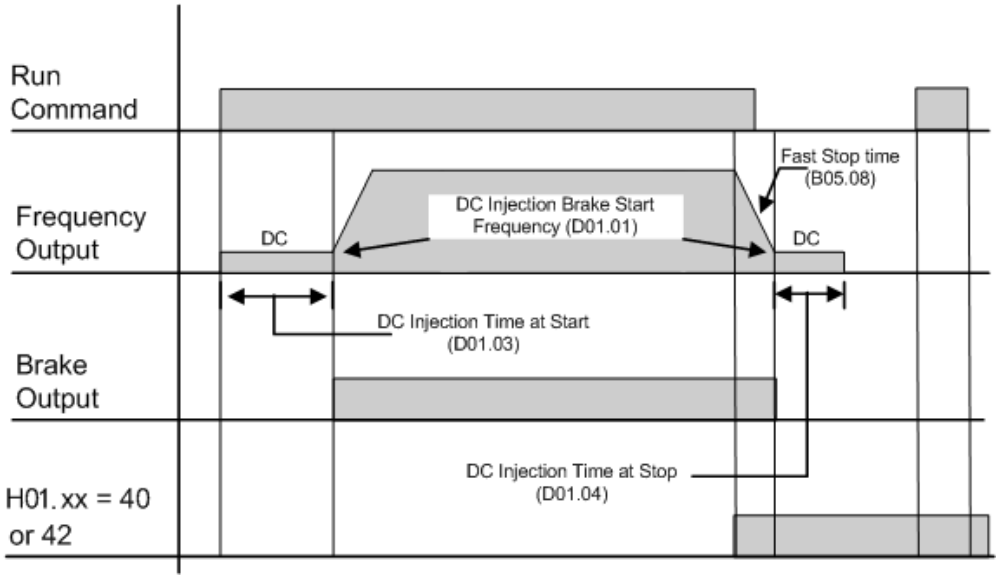


Figure 5-13: H01.XX = 40 or 42 (Fast Stop) with DC Injection

5.1.3.7 Motor Rotation Change

This parameter allows you to change the motor direction without changing the motor leads.

Parameter	Name	Function	Range	Default
B03.04	Change Rotation	Reverse motor direction	00–01	00
	00 Normal Rotation			
	01 Exchange Phases			

5.1.3.8 LOC/REM Run Select

If the run reference/speed reference are switched between serial mode and terminal mode, B03.07 determines action after the switch.

Parameter	Name	Function	Range	Default
B03.07	LOC/REM Run Sel	Determines action after switching Run/Speed reference source.	00–01	00
	00 Cycle Extrn Run	If the run command is present at the time when Run/Speed reference source is switched, it requires the run command to be removed and then reapplied from the new source to resume the normal operation.		
	01 Accept Extrn RUN	If the run command is present at the time when the Run/Speed reference source is switched, it does not require the run command from the new source to be removed. The normal operation will continue.		
B03.10	Allow Run at Power UP *00 Disabled* *01 Enabled*	Determines whether a run command, enabled on VFD power up, will run the motor. When disabled, a new run command is required before the motor will run.	00–01	00

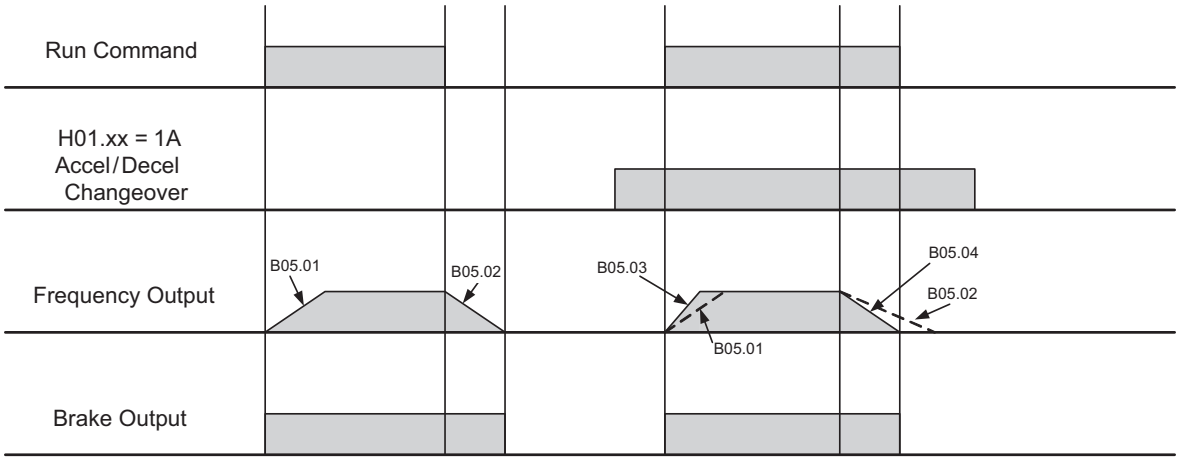
Parameter	Name	Function	Range	Default
B03.15	Reference Source 2 Selection	Selects frequency reference source when H01.xx = 1F.	00–04	01
	00 Keypad	Keypad		
	01 Terminals	Control circuit terminal		
	02 Modbus Communication	Modbus Serial Communication		
	03 Option PCB	Industrial Communication		
	04 Pulse Input	Pulse Input (Terminal RP)		
B03.16	Run Source 2 Selection	Selects run command source when H01.xx = 1F.	00–03	01
	00 Keypad	Keypad		
	01 Terminals	Control circuit terminal		
	02 Modbus Communication	Modbus Serial Communication		
	03 Option PCB	Industrial Communication		

5.1.4 Acceleration/Deceleration

Acceleration time sets the time for the output frequency to accelerate from 0Hz to maximum output frequency (E01.04). Deceleration time sets the time for the output frequency to decelerate from the maximum output frequency (E01.04) to 0Hz.

Parameter	Name	Function	Range	Default
B05.01	Accel Time 1	Sets acceleration time.	0.0–25.5 sec	5.0*
B05.02	Decel Time 1	Sets deceleration time.	0.0–25.5 sec	3.0*
B05.03	Accel Time 2	Sets alternate accel time. Enabled by H01.xx = 1A.	0.0–6000.0 sec	2.0
B05.04	Decel Time 2	Sets alternate decel time. Enabled by H01.xx = 1A.	0.0–6000.0 sec	2.0
B05.05	Accel Time N Change	Sets acceleration time at Speed Switch frequency.	0.0–25.5 sec	2.0
B05.06	Decel Time N Change	Sets deceleration time at Speed Switch frequency.	0.0–25.5 sec	2.0
B05.08	Fast Stop Time	Sets deceleration time for complete stop at external fault. ***See Section 5.6.2 on page 97***.	0.0–25.5 sec	1.0
B05.09	Accel/Decel Units	Determines acceleration/deceleration switching level	00, 01	01
	00 0.01 sec for 0.00-2.55 sec *01 0.1 sec for 0.0-25.5 sec*	***NOTE:*** *Setting will not change if any accel/decel time is > 2.55 sec.*		
B05.10	Accel/Decel Switch Frequency	Determines acceleration/deceleration switching level	0.0–150.0 Hz	120
B05.11	Switch Frequency	Determines when Acceleration Time and Deceleration Time at Speed Switch Hz is enabled	0.0–6000.0	01
	00 Lower Switch Frequency	B05.05/06 is enabled, N-out ≤ B5.10		
	01 Upper Switch Frequency	B05.06 is enabled, N-out ≥ B5.10		
B05.12	Accel Time 3	Acceleration time when H01.xx = 1B	0.0–6000.0	3.0
B05.13	Decel Time 3	Deceleration time when H01.xx = 1B	0.0–6000.0	3.0
B05.14	Accel Time 4	Acceleration time when H01.xx = 1C	0.0–6000.0	3.0
B05.15	Decel Time 4	Deceleration time when H01.xx = 1C	0.0–6000.0	3.0

* *Initial value is determined by X-Press Programming (**Table 4-1 on page 44** and **Table 4-2 on page 45**).*



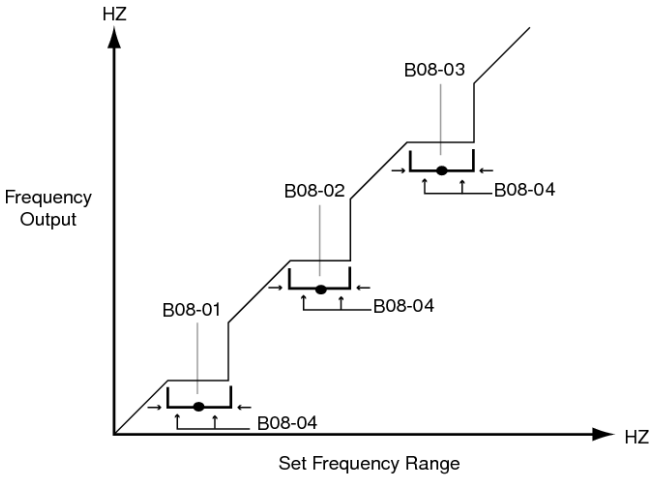
NOTE: *Assume B03.03 is set to "00" (Decel to Stop).*

Figure 5-14: Normal Accel/Decel Time and Multiple Accel/Decel Changeover

5.1.5 Jump Frequencies

This function allows the "jumping" of frequencies so that the motor can operate without resonant vibrations caused by some machine systems. This function is also used for deadband control. Setting the jump frequency to 0.0 Hz disables this function.

Parameter	Name	Function	Range	Default
B08.01	Jump Frequency 1	First of three jump frequencies.	0.0–150.0 Hz	0.0
B08.02	Jump Frequency 2	Second of three jump frequencies.	0.0–150.0 Hz	0.0
B08.03	Jump Frequency 3	Third of three jump frequencies.	0.0–150.0 Hz	0.0
B08.04	Jump Bandwidth	Jump frequency reference bandwidth.	0.0–20.0 Hz	1.0



5.2 Special Functions

The special function parameters are crane and hoist specific functions used to control how the system will operate. Listed below are the special function parameters covered in this section.

- C1 Quick Stop
- C1 Reverse Plug Simulation
- C2 Micro-Speed
- C3 End of Travel Limits
- C3 Phantom Stop
- C3 Klixon
- C5 Load Check II
- C6 Swift-Lift
- C7 Torque Limit
- C8 Brake Answerback
- C9 Serial Communication Digital Inputs
- C12 Brake Delay Timers
- C12 On/Off Delay Timers
- C12 Maintenance Timer
- C13 Inching Control

	A01.01 = 02 (Advanced)					
	Traverse (00)		Hoist (01)		Braketronic (04)	
Special Function	V/f (00)	OLV (02)	V/f (00)	OLV (02)	V/f (00)	OLV (02)
C1: Quick Stop	○	○	○	○	○	○
C1: Reverse Plug Simulation	○	○	○	○	○	○
C2: Micro-Speed	○	○	○	○	○	○
C3: End of Travel Limits	○	○	○	○	○	○
C3: Phantom Stop	○	○	○	○	○	○
C3: Klixon	○	○	○	○	○	○
C5: Load Check II	×	×	○	○	×	×
C6: Swift-Lift	×	×	○	○	×	×
C7: Torque Limit	×	○	×	○	×	○
C8: Brake Answerback	○	○	○	○	○	○
C9: Serial Communication Digital Inputs	○	○	○	○	○	○
C12: Brake Delay Timers	○	○	×	×	×	×
C12: On/Off Delay Timers	○	○	○	○	○	○
C12: Maintenance Timer	○	○	○	○	○	○
C13: Inching Control	○	○	○	○	×	×

○: Available for the Motion selected

×: Not available for the Motion selected

5.2.1 Quick Stop

The **Quick Stop** function provides an alternate deceleration time when the run command is removed.

NOTE: *The Quick Stop Deceleration time differs from the normal deceleration time and is applied only when the RUN command is removed.*

Parameter	Name	Function	Range	Default
C01.01	Quick Stop	Determines whether Quick Stop is enabled	00–01	00*
	00 Disabled			
	01 Enabled			
C01.02	Quick Stop Time	Deceleration time during Quick Stop function.	0.0–25.5 sec	1.0

** Initial value is determined by X-Press Programming (**Table 4-1 on page 44** and **Table 4-2 on page 45**).*

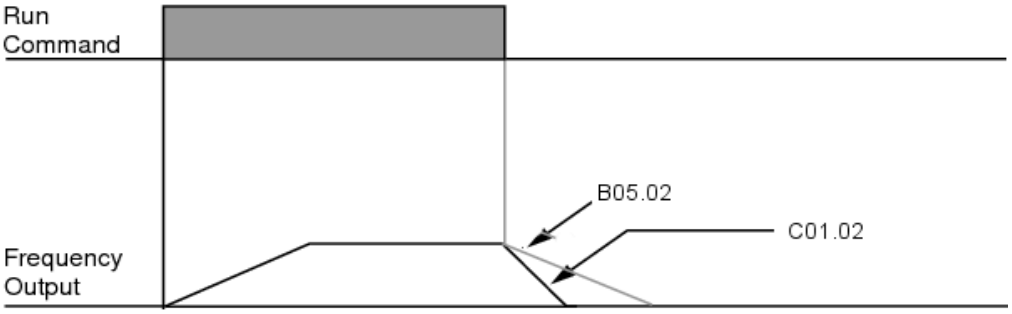


Figure 5-15: Quick Stop

5.2.2 Reverse Plug Simulation™

The **Reverse Plug Simulation** function provides an alternate deceleration time/acceleration time at a change direction command. The deceleration time and the acceleration time are set independently of the normal acceleration and deceleration times.

Parameter	Display	Function	Range	Default
C01.03	Reverse Plug	Determines whether Reverse Plug Simulation is enabled.	00–01	00
	00 Disabled			
	01 Enabled			
C01.04	Reverse Plug Decel Time	Deceleration time during Reverse Plug Simulation.	0.0–25.5 sec	2.0
C01.05	Reverse Plug Accel Time	Acceleration time during Reverse Plug Simulation	0.0–25.5 sec	2.0

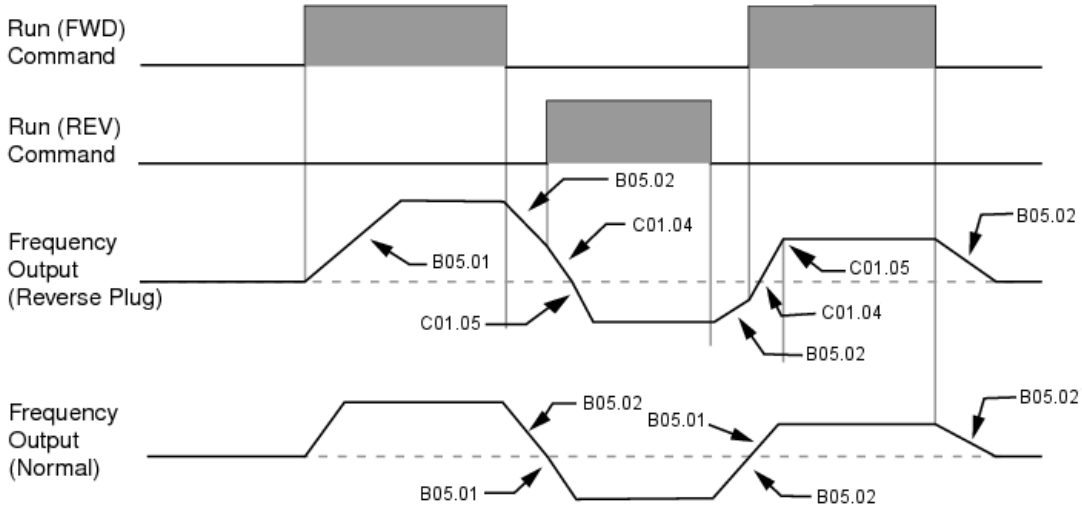


Figure 5-16: Reverse Plug Simulation

5.2.3 Micro-Speed™

Micro-Speed can provide a reduced speed range operation for precise positioning. Enabled by a digital input, it multiplies the normal speed reference by the Micro-Speed Gain. Two Micro-Speed Gains are available and can be adjusted and enabled independently.

Parameter	Name	Function	Range	Default
C02.01	Micro-Speed Gain 1	The multiplier of the Analog or Digital Speed Reference to achieve slow-speed operation. H01.xx = 0E	0.00–2.55	1.00
C02.02	Micro-Speed Gain 2	An alternate multiplier of the Analog or Digital Speed Reference to achieve slow-speed operation. H01.xx = 10	0.00–2.55	1.00

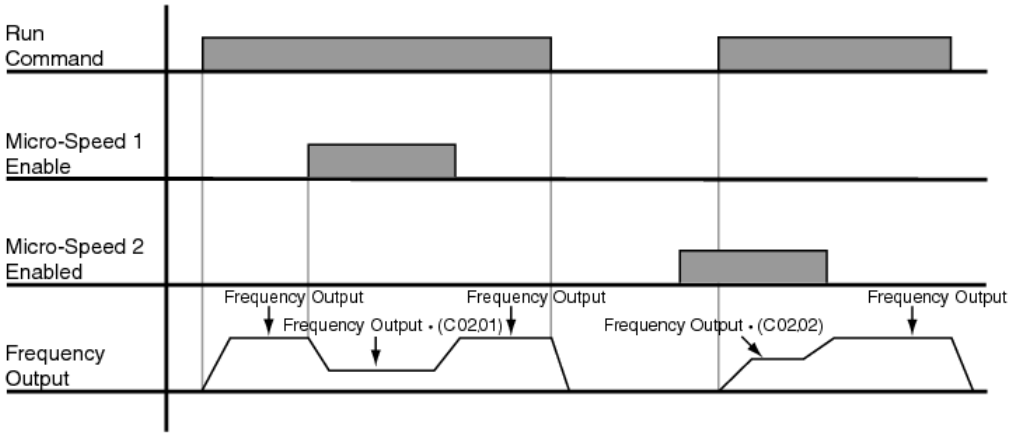


Figure 5-17: Micro-Speed

NOTE: *If both Micro-Speed 1 and Micro-Speed 2 are enabled, Micro-Speed 1 takes higher priority over Micro-Speed 2.*

5.2.4 Travel Limits

This function can automatically slow and stop a crane or hoist when it reaches the end of the travel limits. Two types of limit inputs (slow and stop) are available in both travel directions. Inputs can be programmed through H01.01–H01.07.

When the crane reaches either the Upper Limit 1 (UL1) or Lower Limit 1 (LL1), the motor will decelerate to the Upper and Lower Limit speeds C03.01 and C03.04 respectively. When the crane reaches either the Upper Limit 2 (UL2) or Lower Limit 2 (LL2), the motor will come to a stop based on the Limit Stopping Method (C03.07). If C03.07 is set to 00 or 02, then the deceleration time will use Upper Limit 2 Stop Time (C03.03) or Lower Limit 2 Stop Time (C03.06).

Parameter	Name	Function	Range	Default
C03.01	Upper Limit 1 Speed	Speed at Upper Limit input.	0.00–150.00 Hz	6.00
C03.02	Upper Limit 1 (UL1) Decel Time	Decel time to Upper Limit Speed.	0.0–25.5 sec	1.0
C03.03	Upper Limit 2 (UL2) Stop Time	Decel time to STOP when Upper Limit is input.	0.0–25.5 sec	1.0
C03.04	Lower Limit 1 Speed	Speed at Lower Limit input.	0.00–150.00 Hz	6.00
C03.05	Lower Limit 1 (LL1) Decel Time	Decel time to Lower Limit Speed	0.0–25.5 sec	1.0
C03.06	Lower Limit 2 (LL2) Stop Time	Decel time to STOP when Lower Limit is input.	0.0–25.5 sec	1.0
C03.07	Limit Action @ LL2/UL2	Determine the stop method at Upper Limit 2 and Lower Limit 2 Input.	00–02	02*
	00 Decel to Stop			
	01 Coast to Stop			
	02 Use B03.03 Method			
C03.08	Limit Action @ UL3	Weight Limit Stop Method and action when Multi-Function Input H01.01 ~ H01.07 = 12 or 62	00–05	04
	00 Decel/Alarm (no further raise allowed)			
	01 Coast/Alarm (no further raise allowed)			
	02 Use B03.03/Alarm (no further raise allowed)			
	03 Decel/Fault			
	04 Coast/Fault			
	05 Use B03.03/Fault			
	***NOTE:** For setting 00, 02, 03, 05, deceleration is by B05.08.*			

** Initial value is determined by X-Press Programming*

5.2.5 Phantom Stop

The Phantom Stop feature is designed to stop operation using the stopping method selected in C03.09 when a Phantom Fault input (H01.01–H01.07 = 5F or 63) is active. The VFD will indicate a Phantom Fault has occurred by blinking the LED on the RUN key in sequence of two short bursts. The VFD will resume normal operation when a Phantom Fault is removed.

Parameter	Name	Function	Range	Default
C03.09	Phantom Stop Selection	Stopping Method when H01.01–H01.07 = 5F or 63 (Phantom Fault)	00–02	01
	00 Decel to Stop			
	01 Coast to Stop			
	02 Use B03.03 Method			

5.2.6 Klixon Action

The Klixon digital input is intended for motors that have a Motor Thermal Overload Switch called a Klixon. The Klixon is usually embedded in the motor windings, and changes state when the motor reaches a certain temperature. When a digital input (H01.01~H01.07 = 56 or 57) is active, the VFD will use the stopping method programmed in C03.11 and display the oL8 Klixon alarm. The VFD will resume normal operation when the motor cools down and the input changes state for normal operation.

Parameter	Name	Function	Range	Default
C03.11	Klixon Action	Stopping Method when H01.01–H01.07 = 56 or 57	00–01	00
	00 Use B03.03 Method			
	01 Allow Lower Only			

5.2.7 Load Check II™

The Load Check II function is a load-limiting feature which ensures the programmed load limit of the hoist is not exceeded. It prevents the lifting (and potential stall) of a load that is overweight. When the IMPULSE®•G+ Mini detects an overload condition it prevents any further lifting. The load may then be lowered at the speed that is specified by the Load Check Lowering Speed (C05.08).

V/f Operation (A01.02 = 00)

When using Load Check II in V/f control mode (during lifting) the IMPULSE®•G+ Mini will compare the motor current readings (U01.03) to values stored during the Load Check set up process. If they exceed the values for the active Load Check Zone, the VFD will stop based on the LC Alarm Action (C05.02) and display a Load Check alarm (LC).

OLV Operation (A01.02 = 02)

When using Load Check II in Open Loop Vector control mode (during lifting) the IMPULSE®•G+ Mini will compare the motor torque readings (U01.09) to values stored during the Load Check set up process. If they exceed the values for the active Load Check Zone, the VFD will stop based on the LC Alarm Action (C05.02) and display a Load Check alarm (LC).

NOTE: Precautions should be taken when two or more hoists are used to lift a single load.

Example: *Use a normally closed relay from the load check output to break the raise (FWD Run) command to the other hoist(s). This will ensure that all hoists stop lifting if one hoist is overloaded.*

5.2.7.1 Load Check II Set Up (C05.01 = 09)

The Load Check set up procedure will quickly measure and calculate the current or torque required at each of the Load Check Zones. These values will automatically be stored in parameters C05.09 through C05.24 during the Load Check set up process.

To following are the steps required to perform the Load Check set up process.

1. Auto-tune the motor.
   - OLV operation – Rotational Auto-tune (stationary is acceptable, though not ideal).
   - V/f operation – Stationary Auto-tune.
2. With Load Check disabled, lift the rated load a foot or two off the ground.
3. Set C05.01 = 09.
4. Press and hold the Hoist (up) command for full speed operation.

NOTE: *The Load Check setup process can be temporarily paused by lowering the load (suspended), then issuing a new Hoist (up) command at full speed until the Load Check set up process is complete.*

5. When the Load Check set up process finishes its calculations, the VFD will decelerate the load to indicate that the set up calibration is complete.

NOTE: *The Load Check setup process will only complete if the motor reaches full speed (Base Frequency) for two seconds. If using an analog or Infinitely Variable speed reference, make sure that no biases or limits prevent the frequency reference from reaching the Base Frequency.*

6. Press the Lower (down) command to complete the Load Check set up process.
7. Lift the rated load numerous times to ensure there are no unwanted LC faults. If an LC alarm is detected, increase the LC Margins (C05.05 and C05.07).

Parameter	Name	Function	Range	Default
C05.01	Load Check (LC)	Used to set up and enable the Load Check function.	00, 01, 03, 09	00
	00 Disable			
	01 Enable Load Check			
	03 Enable Load Check Continuous			
	09 Load Check Set Up			
C05.02	LC Alarm Action	Sets the action at a Load Check alarm or fault (Fault reset is required via keypad or MFDI to raise the load).	00–05	04
	00 Alarm Only (Continue operation)			
	01 Decel to Stop (Allows lower only)			
	02 Coast to Stop (Allows lower only)			
	03 Fault Stop (No operation)			
	04 Use B03.03 Method (allows lower only)			
	05 B03.03 with Reset (allows lower only)			
C05.03	LC Setting Time	Sets the time to hold the output frequency allowing the output current/ torque to stabilize.	0.00–2.55 sec	0.15
C05.04	LC Testing Time	Sets the time (after the LC Setting Time) for comparing output current/torque to values for a particular LC Zone being tested.	0.00–2.55 sec	0.25
C05.05	LC Acceleration Margin	Sets the margin for Load Check detection during acceleration. A setting of 00 is the most sensitive.	00–50	5
C05.07	LC Margin	Sets the margin for Load Check detection at speed agree. A setting of 00 is the most sensitive.	00–20	5
C05.08	LC Lowering Speed	Sets the maximum lowering speed after an LC alarm.	0.1–30.0 Hz	6.0
C05.09	LC Zone 01	Current/Torque for Zone 01	000–250%	000
C05.10	LC Zone 02	Current/Torque for Zone 02	000–250%	000
C05.11	LC Zone 03	Current/Torque for Zone 03	000–250%	000
C05.12	LC Zone 04	Current/Torque for Zone 04	000–250%	000
C05.13	LC Zone 05	Current/Torque for Zone 05	000–250%	000
C05.14	LC Zone 06	Current/Torque for Zone 06	000–250%	000
C05.15	LC Zone 07	Current/Torque for Zone 07	000–250%	000
C05.16	LC Zone 08	Current/Torque for Zone 08	000–250%	000
C05.17	LC Zone 09	Current/Torque for Zone 09	000–250%	000
C05.18	LC Zone 10	Current/Torque for Zone 10	000–250%	000
C05.19	LC Zone 11	Current/Torque for Zone 11	000–250%	000
C05.20	LC Zone 12	Current/Torque for Zone 12	000–250%	000
C05.21	LC Zone 13	Current/Torque for Zone 13	000–250%	000

Parameter	Name	Function	Range	Default
C05.22	LC Zone 14	Current/Torque for Zone 14	000–250%	000
C05.23	LC Zone 15	Current/Torque for Zone 15	000–250%	000
C05.24	LC Zone 16	Current/Torque for Zone 16	000–250%	000
C05.25	LC Integral Time	Integral time used to smooth transitions	0.00–2.55 sec	0.05
C05.26	LC Delay Time	Load Check delay time for transitions	0.00–2.55 sec	0.25
C05.27	LC Rev Dir Delay	Minimum delay between Reverse to Forward transition after Reverse frequency exceeds C05.28	0.00–2.55 sec	0.00
C05.28	LC Rev Dir Freq	Minimum frequency that will trigger the C05.27 delay	0.0–60.0 Hz	30.0

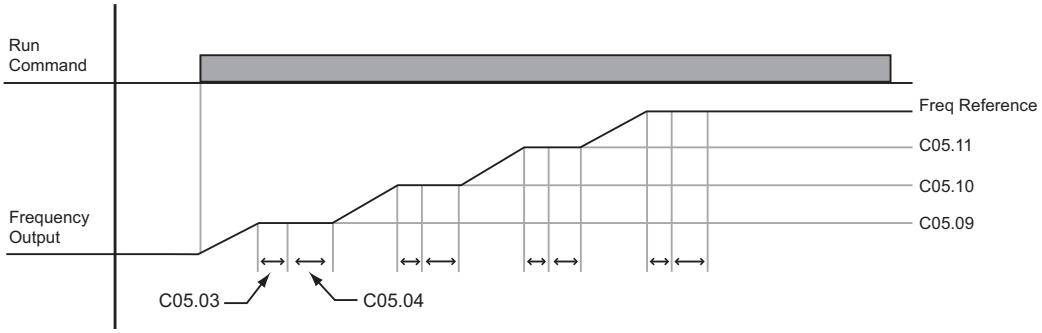


Figure 5-18: Load Check

5.2.8 Swift-Lift™

Swift-Lift provides additional productivity by allowing a hoist to quickly move into position by increasing speeds under light or no load conditions. Swift-Lift will enable the motor to over-speed by calculating the maximum safe speed and automatically accelerating to this speed. However, the maximum speed cannot exceed the lesser of the Swift-Lift Forward Speed (C06.02) or Swift-Lift Reverse Speed (C06.03) and the Max Output Frequency (E01.04).

NOTE: *Swift-Lift is disabled when in traverse applications.*
The maximum frequency (E01.04) ≥ C06.02 and C06.03.

There are two methods that may be utilized to enable Swift-Lift:

1. Automatic: Swift-Lift can be enabled to automatically occur whenever the load is less than the maximum percentage of motor current (C06.04 or C06.05) and the output frequency is greater than the Swift Lift Enabling Speed (C06.06).
2. Manual: Swift-Lift may be enabled manually through the Multi-Functional Digital Inputs by setting H01.01 ~ H01.07 = 13.

WARNING

Motors and drive machinery must be capable of operating above motor base speed. Consult the motor/gearbox/hoist manufacturer before enabling Swift-Lift function. Failure to observe this warning may result in damage to equipment and possible injury or death to personnel.

Parameter	Name	Function	Range	Default
C06.01	Swift-Lift	Determines whether Swift-Lift is enabled.	00–02	00
	00 Disabled			
	01 Enabled Automatic			
	02 Enabled by H01.xx = 13			
C06.02	Swift-Lift Forward Speed	Maximum Output Frequency during Swift-Lift—FORWARD.	0.0–150.0 Hz	60.0
C06.03	Swift-Lift Reverse Speed	Maximum Output Frequency during Swift-Lift—REVERSE.	0.0–150.0 Hz	60.0
C06.04	Swift-Lift Forward Current	Maximum output current below which Swift-Lift—FORWARD is enabled.	000–100%	50
C06.05	Swift-Lift Reverse Current	Maximum output current below which Swift-Lift REVERSE is enabled.	000–100%	30
C06.06	Swift-Lift Enabling Speed	Threshold frequency at which Swift-Lift is enabled.	0.0–150.0 Hz	59.0
C06.07	Swift-Lift Delay Time	Delay time at enabling speed prior to torque-compare function.	0.0–25.5 sec	2.0
C06.08*	Swift Lift Acceleration Gain	Speed feedback acceleration multiplier	0.1–9.9	1.0

* *Only available when A01.02 = 00 (V/f)*

5.2.8.1 Configuring the Swift-Lift Function:

Using Multi-Step 2, 3, 5 (A01.04 = 00, 01, or 02):

If the system is using **Multi-Step** as the **Speed Reference**, use the following instructions to set up Swift-Lift.

1. Set **V/f Selection (E01.03) = 0F** to allow for a custom V/f pattern.

NOTE: *Choosing a **Custom V/f pattern** will require setting of E01.01 ~ E01.13 parameters to the current V/f selection. For additional V/f selections, **see Table 5-4 on page 87** and **Table 5-5 on page 87**.*

2. Ensure that the **Maximum Frequency (E01.04)** is increased to be equal to or slightly greater than the maximum Swift-Lift Forward or Reverse speeds you want to run at.

   Maximum frequency (E01.04) ≥ C06.02 and C06.03.

3. Set C06.01 = 01 or 02 to enable the **Swift-Lift Function**.
   a. 01 = Enable Automatic
   b. 02 = Enable by H01.xx = 13.
4. Set C06.02 and C06.03 to determine **Swift-Lift** maximum FWD/REV output frequency.
5. Set C06.04 and C06.05 to determine **Swift-Lift** maximum enable output current.
6. Set the **Swift-Lift Enabling Speed (C06.06)** one or two hertz below the maximum normal running speed reference.
   a. For example: If the maximum normal running speed is at 60 Hz, set C06.06 to 58 or 59 Hz as the **Swift-Lift Enabling Speed**.

Using Infinitely Variable 2, 3 Step (A01.04 = 03 or 04):

If the system is using **2-Step** or **3-Step Infinitely Variable** as the **Speed Reference**, use the following formula to adjust **B02.01 (Reference Upper Limit)**:

B02.01 = (60 Hz x 100) / E01.04

1. Set **V/f Selection (E01.03) = 0F** to allow for setting a custom V/f pattern.

NOTE: *Choosing a **Custom V/f pattern** will require setting of E01.01 ~ E01.13 parameters to the current V/f selection. For additional V/f selections, **see Table 5-4 on page 87** and **Table 5-5 on page 87**.*

2. Ensure that the **Maximum Frequency (E01.04)** is increased from 60 Hz and will be equal to or slightly greater than the maximum Swift-Lift Forward or Reverse speeds you want to run at.
   a. Maximum frequency (E01.04) ≥ C06.02 and C06.03.
3. Set the Frequency Upper Limit (B02.01). This is done so that the *maximum normal running speed* will be 60 Hz with the new E01.04 setting.
   a. For example, if E01.04 is set to 75.0 Hz, then B02.01 = 80%
      B02.01 = (60.0 Hz x 100%) / (75.0 Hz) = 80%
4. Set C06.01 = 01 or 02 to enable the **Swift-Lift Function**:
   a. 01 = Enable Automatic.
   b. 02 = Enable by Multi-Function Digital Input (MFDI).
5. Set C06.02 and C06.03 to determine **Swift-Lift** maximum FWD/REV output frequency.
6. Set C06.04 and C06.05 to determine **Swift-Lift** maximum enable output current.
7. Set the **Swift-Lift Enabling Speed (C06.06)** one or two hertz below the *maximum normal running speed* reference (see step 3).
   a. For example: if the *maximum normal running speed* is at 60 Hz, set C06.06 to 58 or 59 Hz as the **Swift-Lift Enabling Speed**.

Using Uni-Polar Analog (A01.04 = 05):

If the system is using **Uni-Polar Analog** as the **Speed Control Method**, use the following formula to adjust **H03.03 (Gain Multiplier for Terminal A1 analog input signal)** or **H03.11 (Gain Multiplier for Terminal A2 analog input signal)**:

Gain Terminal A1: H03.03 = (60 Hz x 100) / E01.04

or

Gain Terminal A2: H03.11 = (60 Hz x 100) / E01.04

1. Set **V/f Selection (E01.03) = 0F** to allow for setting a custom V/f pattern.
2. Ensure that the **Maximum Frequency (E01.04)** is increased from 60 Hz and will be equal to or slightly greater than the maximum Swift-Lift Forward or Reverse speeds you want to run at.
   a. Maximum frequency (E01.04) ≥ C06.02 and C06.03.
3. Set the terminal gain multiplier for H03.03 or H03.11. This is done so that the *maximum normal running speed* will be 60 Hz with the new E01.04 setting. Use one of the above equations to determine the correct multiplier.
   a. For example, to set the gain for Terminal A1 if E01.04 is set to 80.0 Hz, then H03.03 = 75%
      H03.03 = (60.0 Hz x 100%) / (80.0 Hz) = 75%
4. Set C06.01 = 01 or 02 to enable the **Swift-Lift Function**:
   a. 01 = Enable Automatic.
   b. 02 = Enable by Multi-Function Digital Input (MFDI).
5. Set C06.02 and C06.03 to determine **Swift-Lift** maximum FWD/REV output frequency.
6. Set C06.04 and C06.05 to determine **Swift-Lift** maximum enable output current.
7. Set the **Swift-Lift Enabling Speed (C06.06)** one or two hertz below the *maximum normal running speed* reference (see step 3).
   a. For example: If the *maximum normal running speed* is at 60 Hz, set C06.06 to 58 or 59 Hz as the **Swift-Lift Enabling Speed**.

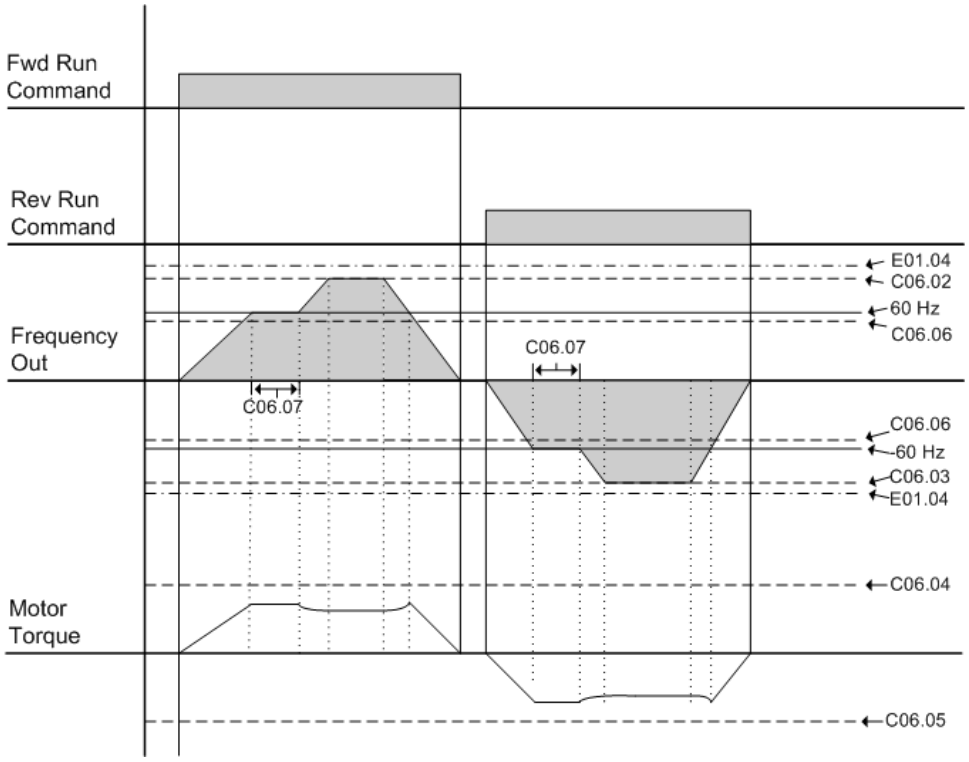


Figure 5-19: Swift Lift Timing Diagram

5.2.9 Torque Limit (Open Loop Vector Only)

IMPULSE®•G+ Mini dynamically controls the torque output of the motor at all times when the control method is set to Open Loop Vector (A01.02 = 02). The Torque Limit Function limits the amount of motor torque on all four quadrants of vector control operation:

- Forward Motoring
- Reverse Motoring
- Forward Regenerating
- Reverse Regenerating

When the torque limits are reached during operation, the programmed acceleration and deceleration times become second priority.

Parameter	Name	Function	Range	Default
C07.01	Forward Torque Limit	FORWARD torque limit	000–300%	150
C07.02	Reverse Torque Limit	REVERSE torque limit	000–300%	150
C07.03	Forward Regen Torque Limit	Regenerative torque limit at FORWARD	000–300%	180
C07.04	Reverse Regen Torque Limit	Regenerative torque limit at REVERSE	000–300%	180
C07.05	Torque Limit Gain	Enabled by H01.xx = 14	0.00–2.55	1.25
C07.06	Torque Limit Time Constant	Torque Limit Integral Time Constant	5–10000ms	00200
C07.07	Torque Limit Select	Torque Limit Select	00–01	00
	00 P Control			
	01 PI Control			

5.2.9.1 Brake Answerback

The following timers are used when a digital input (H01.01–H01.07) is set for 58, brake answerback.

Parameter	Name	Function	Range	Default
C08.04	Rollback Timer	Sets the amount of time for the brake to release and for brake feedback to be received into the Brake Answer Back Multi-Function input at start before posting BE4 alarm. It is also the time period during which the amount of roll back is checked.	0.00–2.55 sec	0.30
C08.11	Brake Set Delay	Sets the amount of time for the brake to set and for brake feedback to be removed from the Brake Answer Back Multi-Function input at stop before posting a BE5 Alarm.	0.0–25.5 sec	0.7
C08.17	BE6 Up Speed Lim	Maximum speed in Forward (Up) direction by BE6.	0.00–150.00	6.00

5.2.10 Serial Communication Digital Inputs

Provides additional programmable multi-function digital inputs via serial communication.

Parameter	Name	Function	Range	Default
C09.01	Digital Input Setup	Provides additional programmable digital inputs via serial communications	0, 5	0
	00 Disabled			
	05 Serial			
C09.03	DIO Terminal 1		00-FF	0F
C09.04	DIO Terminal 2		00-FF	0F
C09.05	DIO Terminal 3		00-FF	0F
C09.06	DIO Terminal 4		00-FF	0F
C09.07	DIO Terminal 5		00-FF	0F
C09.08	DIO Terminal 6		00-FF	0F
C09.09	DIO Terminal 7		00-FF	0F
C09.10	DIO Terminal 8		00-FF	0F
C09.11	DIO Terminal 9		00-FF	0F
C09.12	DIO Terminal 10		00-FF	0F
C09.13	DIO Terminal 11		00-FF	0F
C09.14	DIO Terminal 12		00-FF	0F
C09.15	DIO Terminal 13		00-FF	0F
C09.16	DIO Terminal 14		00-FF	0F
C09.17	DIO Terminal 15		00-FF	0F
C09.18	DIO Terminal 16		00-FF	0F

5.2.11 Brake Delay Timers

This function is used in trolley or bridge applications. It can reduce the mechanical brake wear when the operator tries to position a load. This function is available only in traverse mode when B03.03 = 04 (Decel With Timer).

Parameter	Name	Function	Range	Default
C12.01	Brake Jog Delay	Brake set delay time at Jog Control input.	0.0–100.0 sec	0.0 sec
C12.02	Brake Run Delay	Brake set delay time at RUN input.	0.0–100.0 sec	0.0 sec

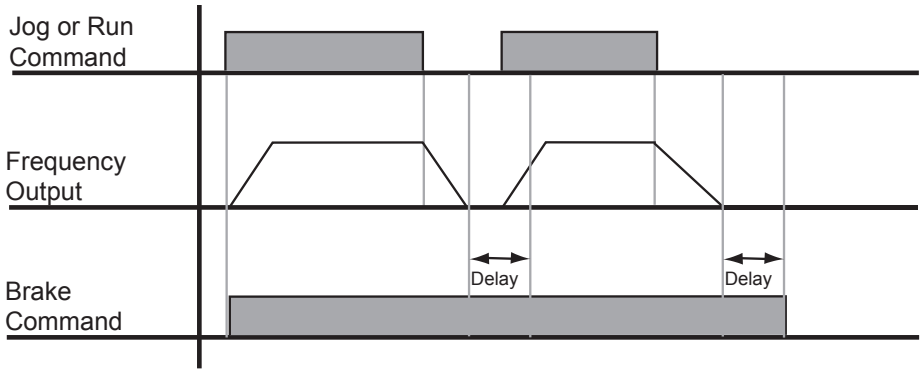


Figure 5-20: Brake Delay Timers

5.2.12 ON/OFF Delay Timer Function

- The timer function is enabled when the timer function input (H01.01~H1.07 = 043) and the timer function output (H02.01~H02.03 = 012) are set respectively.
- These serve as general purpose I/O. Chattering of sensors, switches, contactors, etc., can be prevented by setting a delay time.
- When the timer function input **ON** time is longer than the value set for **C12.03** (Timer function ON-Delay Time), the timer function output turns **ON**.
- When the timer function input **OFF** time is longer than the value set for **C12.04** (Timer function OFF-Delay Time), the timer function output turns **OFF**.

Parameter	Name	Function	Range	Default
C12.03	ON-Delay Timer	Timer output On-delay	0.0–3000.0	0.0
C12.04	OFF-Delay Timer	Timer output Off-delay	0.0–3000.0	0.0

5.2.13 Maintenance Timer

The maintenance timer feature will set an output after a pre-determined period of time (hours) to alert an operator to perform or take some action, i.e. grease the bearings.

To use this feature, program the number of hours between each maintenance cycle in C12.05. Then program a digital input for maintenance timer enable (H01.01–H01.07 = 43), and then program an MFDO (H02.xx = 37). U01.52 will display the maintenance timer accumulator. Setting C12.05 = 00 will disable this function.

When the pre-determined time has been reached (C12.05), the digital output will close, the keypad will flash “MNT,” and the VFD will slow down to the speed determined by the Maintenance Speed Gain (C12.06).

The maintenance alarm can be set in one of two methods.

Method 1: A digital input can be programmed for Maintenance Reset (H01.01–H01.07 = 05A). Closing this input will reset the maintenance accumulator (U01.52) and reset the digital output.

Method 2: Press the Local/Remote (LO/RE) button three consecutive times with no more than 2 seconds between each press until the blinking RESET message is displayed. Press ENTER to reset the maintenance timer. The RESET message will stop blinking when maintenance is reset. The digital output will turn off at this time.

Parameter	Name	Function	Range	Default
C12.05	Maintenance Timer	Maintenance Timer Trip Level	00000–32767	00000
C12.06	Maintenance Speed Gain	Speed Reference Gain	0.00–1.00	0.5

5.2.14 Inching Control

Inching Control function can be enabled by programming a digital input to H01.xx = 17, 18, or 19. The frequency reference used during inching is determined by B01.17 (Jog Reference).

CAUTION

A directional input is not needed on terminals S1 or S2 to run the motor.

Parameter	Name	Function	Range	Default
C13.01	Inch Run Time	Inching Control run time.	0.00–2.55 sec	1.00
C13.02	Repeat Delay Time	Inching Control repeat delay time.	0.00–2.55 sec	1.00
H01.01 ~ H01.07	Terminal Selection *17 Forward Inch* *18 Reverse Inch* *19 Inch Repeat*	Multi-Function Input Terminals	00–81	-

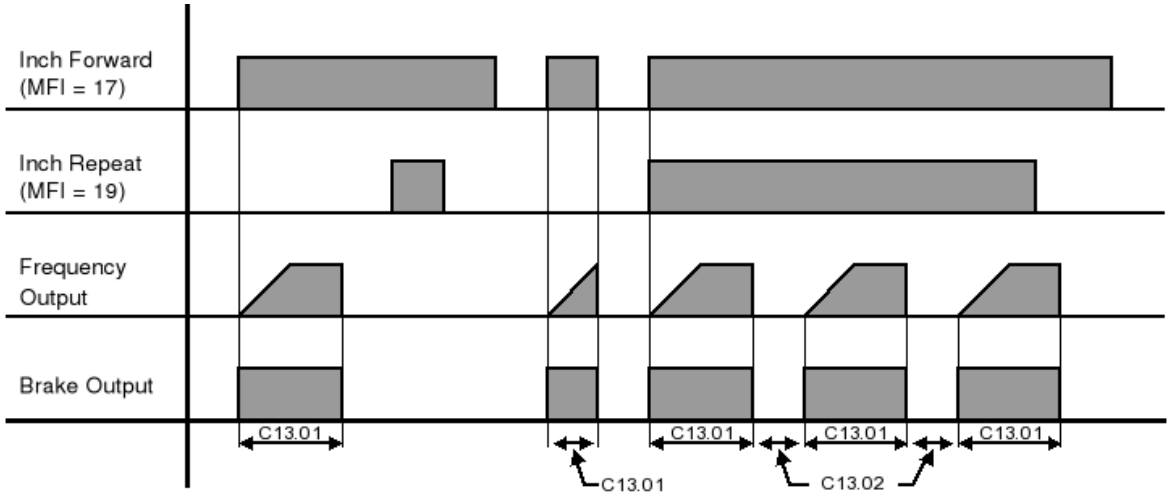


Figure 5-21: Inching Function and Inching Repeat

NOTE: *C13.01 did not expire during the second inch forward command.*

5.3 Tuning

These parameters help tune the motor for your application, which include Torque Compensation and S-Curve characteristics for smoother transition during machine acceleration and deceleration. Below are the parameters included in this section.

- D1 DC Injection
- D2 Automatic Slip Compensation
- D3 Torque Compensation
- D8 Dwell
- D9 S-Curve Acceleration/Deceleration
- D10 Carrier Frequency
- D11 Hunting Prevention

5.3.1 DC Injection

DC Injection can be used to stop a motor whose rotational direction is uncertain at start-up.

With Decel to Stop enabled (B03.03 = 00), upon removal of the run command the IMPULSE®•G+ Mini controls motor deceleration according to the Decel Time setting, until output frequency reaches the DC Injection Braking Start Frequency (D01.01 setting). Then the VFD output is turned off and DC injection current is applied to the motor. The effective DC injection time and current should be set to provide adequate stopping without excessive motor heating. The DC injection voltage is determined by the DC injection braking current and motor impedance.

Parameter	Name	Function	Range	Default
D01.01	DC Injection Start Frequency	DC Injection braking frequency start.	0.0–10.0 Hz	0.5
D01.02	DC Injection Current	% of VFD rated current.	0–75%	50
D01.03	DC Injection Time @ Start	DC Injection braking time.	0.00–10.00 sec	0.00
D01.04	DC Injection Time @ Stop	DC Injection braking time at stop.	0.00–10.00 sec	0.05

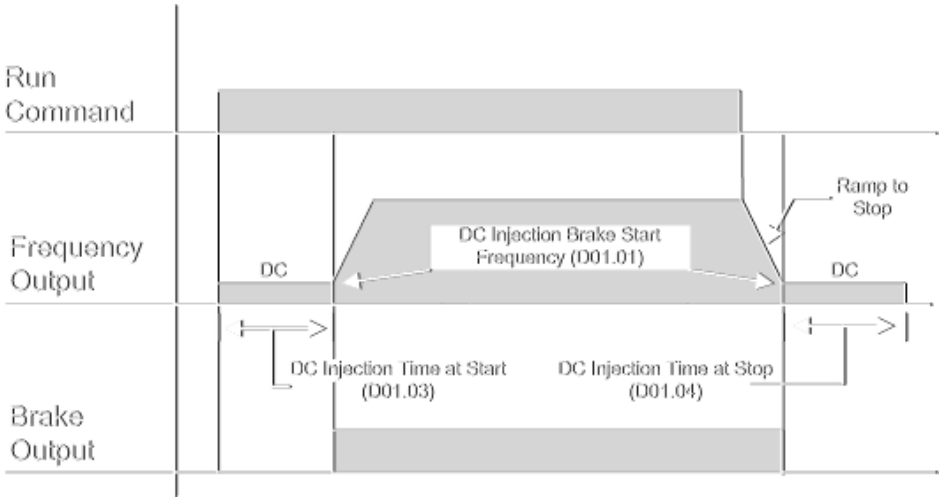


Figure 5-22: DC Braking Sequence

Parameter	Name	Function	Range	Default
D01.08	Magnetic Flux Compensation	Sets the magnetic flux compensation as a percentage of the no load current value (E02.03).	0000–1000	0000
D01.15	Mechanical Weakening Detection Speed Level	Changes the DC Injection braking reference one second after start. Disabled when set to zero.	000–100%	050

5.3.2 Automatic Slip Compensation

As the load becomes larger, the motor speed is reduced and the motor slip increases. The slip compensation function keeps the motor speed constant under varying load conditions. D02.01 sets the slip compensation gain. When the gain is “1.0”, the output frequency is increased by 1% of the E01.06 setting at rated current. A setting of “0.0” results in no slip compensation.

Parameter	Name	Function	Range	Default
D02.01	Slip Compensation Gain	Slip compensation multiplier.	0.0–2.5	1.0 (OLV) 0.0 (V/f)
D02.02	Slip Compensation Time	Slip compensation primary delay time	0–10000 ms	200 (OLV) 2000 (V/f)
D02.03	Slip Compensation Limit	Slip compensation limit	0–250%	200
D02.04	Slip Compensation Regen *00 Disabled* *01 Enabled*	Slip compensation during regeneration	00, 01	00
D02.05	Slip Compensation V/f *00 Include* *01 Exclude*	Slip Compensation at V/f setting	00, 01	00
D02.06	Magnetic Flux Characteristic *00 Include* *01 Exclude*	Magnetic Flux Characteristic Calculation	00, 01	00

5.3.3 Torque Compensation

The motor torque requirement changes according to load conditions. Full-range automatic torque boost adjusts the voltage of the V/f pattern according to the required torque. The IMPULSE®•G+ Mini automatically adjusts the voltage during constant-speed operation as well as during acceleration. ***See Figure 5-23***.

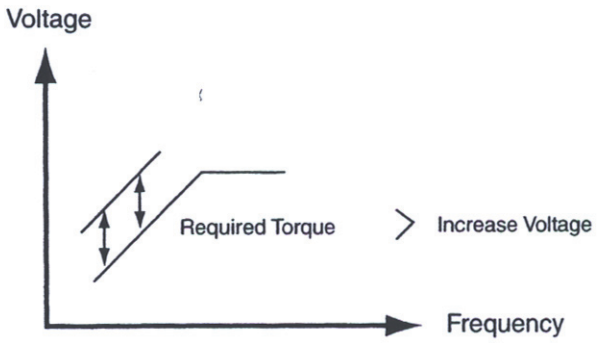


Figure 5-23: Torque Characteristics

The required torque is calculated by the VFD. This ensures trip-less operation and power savings.

Output voltage α Torque compensation gain x Required torque

When more torque is needed, increase the torque compensation gain in one-tenth (0.1) increments. Increase the setting when the wiring distance between the VFD and the motor is 100ft. or longer. If the motor generates excessive vibration or oscillates, decrease the torque compensation.

Increasing torque compensation gain increases motor torque, but an excessive increase may cause the following:

- VFD fault trips due to motor overexcitation and/or
- Motor overheat or excessive vibration

Increase the torque compensation time constant in 10ms increments when the motor's output current is unstable. Decrease this value when speed response is slow.

Parameter	Name	Function	Range	Default	Control Method
D03.01	Torque Compensation Gain	Torque compensation multiplier.	0.00–2.50	1.00	V/f or OLV
D03.02	Torque Compensation Time	Torque compensation time.	0.00–10000 ms	60 (OLV)* 200 (V/f)	V/f or OLV
D03.03	Forward Torque Compensation @ Start	FWD compensation at start.	0.0–200%	0.0	OLV
D03.04	Reverse Torque Compensation @ Start	REV compensation at start.	-200–0.0%	0.0	OLV
D03.05	Torque Compensation Delay Time	Torque compensation delay time at start (disabled if 4 ms or less)	0–200 ms	10ms	OLV
D03.06	Torque Compensation Delay Time 2	Starting Torque Start-Up Time (ms)	0–10000 ms	150	OLV

** See N02.05 for the setting D03.02 (**Table 5-16 on page 122**) OLV Stabilization Level*

NOTE: *D03.02 is read only if N02.05 is not equal to FF.*

5.3.4 Dwell

The Dwell function is used to temporarily hold the output frequency at a set reference for a set time. This function can be used when driving a motor with a heavy starting load. This pause in acceleration reduces traditionally high starting current. Enable by setting H01.01–H01.07 = 65.

NOTE: *This function is only available when using Braketronic (A01.03 = 06).*

Parameter	Name	Function	Range	Default
D08.01	Dwell Reference @ Start	Sets Dwell frequency reference at start.	0.0–150.0 Hz	0.0
D08.02	Dwell Time @ Start	Sets the time duration for the Dwell function at start.	0.0–10.0 sec	0.0
D08.03	Dwell Reference @ Stop	Sets Dwell frequency reference at stop.	0.0–150.0 Hz	0.0
D08.04	Dwell Time @ Stop	Sets the time duration for the Dwell function at stop.	0.0–10.0 sec	0.0

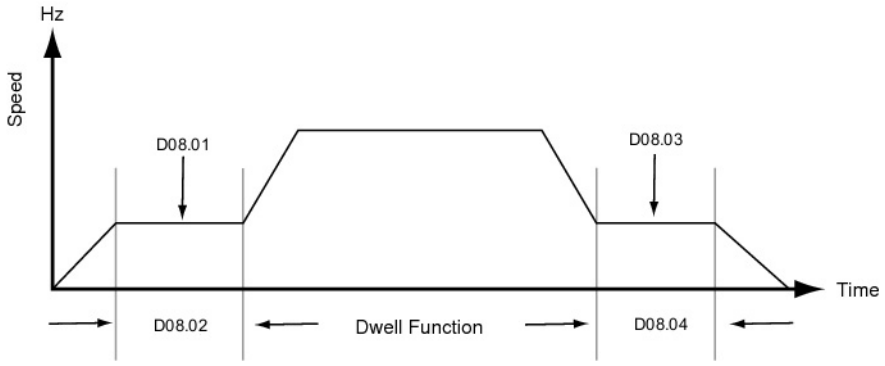


Figure 5-24: Dwell Function

5.3.5 S-Curve Acceleration/Deceleration

An S-Curve pattern is used to reduce shock and provide smooth transitions during machine acceleration and deceleration. S-Curve characteristic time is the time from the output frequency to the set accel/decel time. ***See Figure 5-25***.

Parameter	Name	Function	Range	Default
D09.01	S-Curve Accel @ Start	Sets S-Curve time at Accel start	0.00–10.0 sec	0.50*
D09.02	S-Curve Accel @ End	Sets S-Curve time at Accel end	0.00–10.0 sec	0.50*
D09.03	S-Curve Decel @ Start	Sets S-Curve time at Decel start	0.00–10.0 sec	0.50*
D09.04	S-Curve Decel @ End	Sets S-Curve time at Decel end	0.00–10.0 sec	0.20

Initial value is determined by X-Press Programming (Table 4-1 on page 44** and **Table 4-2 on page 45**).*

Figure 5-25 on page 83 shows FWD/REV run switching during deceleration to stop. The S-Curve function will add time to the acceleration and deceleration.

Total acceleration time from minimum frequency to maximum frequency:

$$Total\ Acceration\ Time\ (s) = B05.01 + \left(\frac{\left(D09.01 + D09.02 \right)}{2} \right)$$

Total deceleration time from maximum frequency to minimum frequency:

$$Total\ Deceleration\ Time\ (s) = B05.02 + \left(\frac{\left(D09.03 + D09.04 \right)}{2} \right)$$

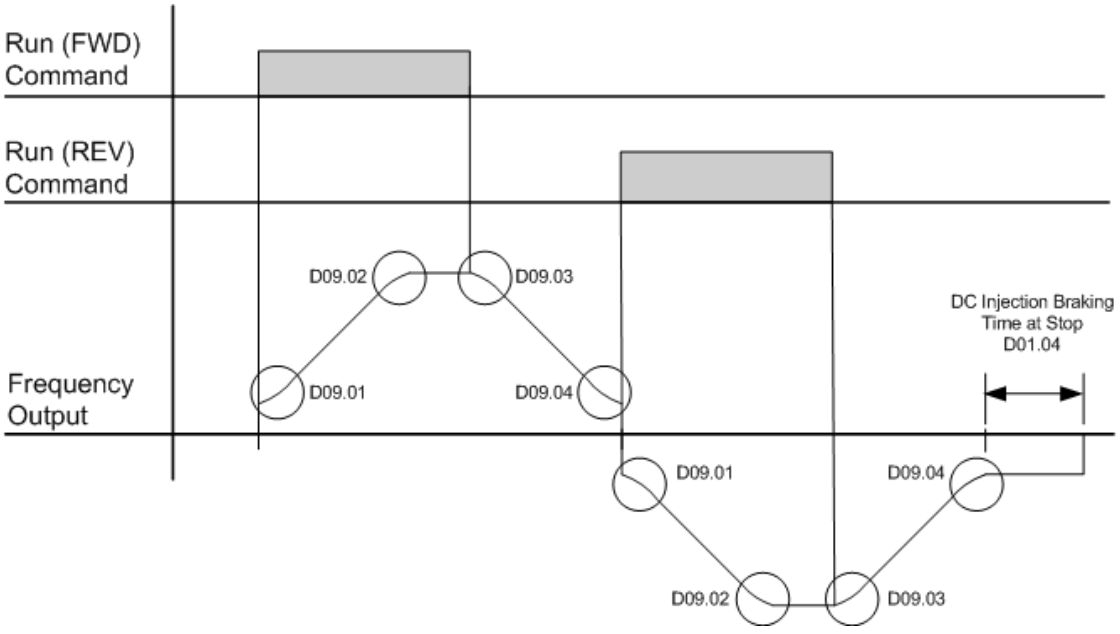


Figure 5-25: S-Curve Characteristics–FWD/REV Operation

5.3.6 Carrier Frequency

Parameter	Name	Function	Range	Default
D10.01	Normal/Heavy Duty	Selects the duty, which affects the overload rating	00, 01	00
	00 Heavy Duty			
	01 Normal Duty			
D10.02	Carrier Frequency Selection	Carrier Frequency Selection	01–0F	01
	01 2 kHz			
	02 5.0 kHz			
	03 8.0 kHz			
	04 10.0 kHz			
	05 12.5 kHz			
	06 15.0 kHz			
	07 Swing PWM1			
	08 Swing PWM2			
	09 Swing PWM3			
	0A Swing PWM4			
	0F Custom (determined by the settings of D10.03~D10.06)			
D10.03	Carrier Frequency Max	Carrier Frequency Upper Limit	1.0–15.0 kHz	2.0
D10.04	Carrier Frequency Min	Carrier Frequency Lower Limit	1.0–15.0 kHz	2.0
D10.05	Carrier Frequency Gain	Carrier Frequency Gain	00–99	00
D10.19	2/3 Phase Modulation	Sets the 2/3 phase switchover frequency	0.0-60.0 Hz	30.0

5.3.7 Hunting Prevention

Occasionally, in an application, resonance between the internal control system and the mechanical system causes current instability. This is called hunting, and may cause a crane to vibrate at a lower speed (up to 30 Hz) and light load. The hunting prevention function monitors the motor flux and attempts to “smooth out” any peaks in the output current wave form.

Increase D11.02 when hunting is present while driving a light load. Decrease D11.02 when the motor vibrates or stalls while driving a heavy load. The D11 parameters are only available in V/f control (A01.02 = 00).

Parameter	Name	Function	Range	Default
D11.01	Hunt Prevention Selection	Enable/Disable Hunt Prevention function	00, 01	01
	00 Disable			
	01 Enable			
D11.02	Hunt Prevention Gain	Hunting Prevention Gain	0.00–2.50	1.00
D11.03	Hunt Prevention Time Constant	Hunting Prevention Time Constant	000–500ms	10
D11.05	Hunt Prevention Gain in Reverse	Reverse Hunting Prevention Gain	0.00–2.50	0.00

5.4 Motor Parameters

Motor data such as full load amps and V/f patterns are selected with the following parameters. These parameters include the ability to select and set up custom V/f patterns for the type of motor used.

- E1 V/f Pattern
- E2 Motor Set-up

5.4.1 Voltage/Frequency Pattern

Parameter	Name	Function	Range	Default
E01.01	Input Voltage	Sets input voltage	155–255/ 310–510	230 460

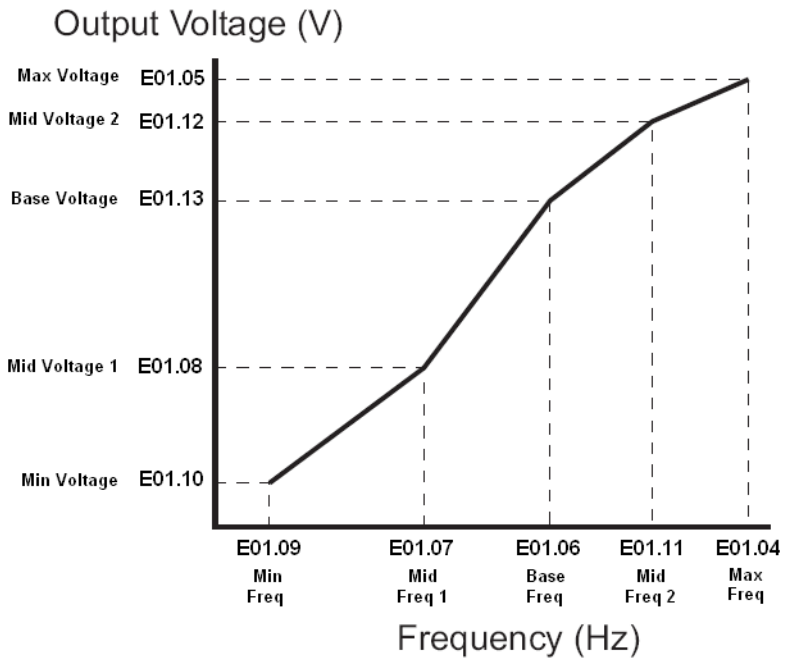


Figure 5-26: E01.01 Input Voltage

- Factory setting is 230 (230V units) or 460 (460V units).
- Setting E01.11 ~ E01.13 = 0 means it's not used.

An OPE10 error will occur if the following conditions are not met:

$$E01.05 \geq E01.12 \geq E01.13 \geq E01.08 \geq E01.10$$

$$E01.04 \geq E01.11 \geq E01.06 \geq E01.07 \geq E01.09$$

The setting E01.01 adjusts the overvoltage level, braking transistor turn on level, and the stall prevention level during deceleration.

Table 5-2: DC Bus Regulation

VFD Voltage	E01.01 Setting	Overvoltage Trip		Braking Transistor	
		Trip	Reset	On	Off
230	150-255	400V	380V	380V	375V
460	≥400	800V	760V	760V	750V
460	<400	720V	680V	660V	650V

Table 5-3: V/f Parameters

Parameter	Name	Function	Range	Default
E01.03	V/f Pattern	V/f Pattern Selection	00–0F, FF	04*
	0 60Hz, Level 0			
	1 60Hz, Level 1			
	2 60Hz, Level 2			
	3 60Hz, Level 3			
	4 60Hz, Level 4			
	5 60Hz, Level 5			
	6 60Hz, Level 6			
	7 60Hz, Level 7			
	8 60Hz, Level 8			
	9 50Hz, Level 0			
	A 50Hz, Level 2			
	B 50Hz, Level 4			
	C 50Hz, Level 6			
	D 75Hz, Level 4			
	E 90Hz, Level 4			
	F Custom			
	FF Custom w/o Limit			
E01.04***	Max Frequency	Maximum Frequency	20.0–150.0 Hz	**
E01.05	Max Voltage	Maximum Voltage	0.0–510.0 V	**
E01.06	Base Frequency	Motor Base Frequency	0.0–150.0 Hz	**
E01.07	Mid Frequency A	Midpoint Output Frequency A	0.0–150.0 Hz	**
E01.08	Mid Voltage A	Midpoint Frequency Voltage A	0.0–510.0 V	**
E01.09	Min Frequency	Minimum Frequency	0.0–150.0 Hz	**
E01.10	Min Voltage	Minimum Voltage	0.0–510.0 V	**
E01.11	Mid Frequency B	Midpoint Output Frequency B	0.0–150.0 Hz	0.0
E01.12	Mid Voltage B	Midpoint Output Voltage B	0.0–510.0 V	0.0
E01.13	Base Voltage	Motor Base Voltage	0.0–510.0 V	0.0

** Initial value determined by X-Press Programming*

*** Initial value determined by voltage class and setting of E01.03.* ***See Table 5-4 on page 87*** *and* ***Table 5-5 on page 87****.*

**** To change E01.04 "Max Frequency," E01.03 must first be set to "0F", or pick a V/f pattern from* ***Table 5-4 on page 87*** *or* ***Table 5-5 on page 87****.*

Table 5-4: Voltage/Frequency Pattern Options for 230 V Class

	E01.04	E01.05	E01.06	E01.07	E01.08	E01.09	E01.10	E01.11	E01.12	E01.13
	Max Freq	Max Volt	Base Freq	Mid Freq A	Mid Volt A	Min Freq	Min Volt	Mid Freq B	Mid Volt B	Base Volt
E01.03	**Hz**	**VAC**	**Hz**	**Hz**	**VAC**	**Hz**	**VAC**	**Hz**	**VAC**	**VAC**
0*	60.0	230.0	60.0	3.0	15.0	1.3	8.1	0.0	0.0	0.0
1	60.0	230.0	60.0	3.0	16.1	1.3	9.2	0.0	0.0	0.0
2	60.0	230.0	60.0	3.0	17.3	1.3	10.4	0.0	0.0	0.0
3	60.0	230.0	60.0	3.0	18.4	1.3	11.5	0.0	0.0	0.0
4*1	60.0	230.0	60.0	3.0	19.6	1.3	12.7	0.0	0.0	0.0
5	60.0	230.0	60.0	3.0	20.7	1.3	13.8	0.0	0.0	0.0
6	60.0	230.0	60.0	3.0	21.9	1.3	15.0	0.0	0.0	0.0
7	60.0	230.0	60.0	3.0	23.0	1.3	16.1	0.0	0.0	0.0
8	60.0	230.0	60.0	3.0	24.2	1.3	17.3	0.0	0.0	0.0
9*2	50.0	200.0	50.0	25	13.0	1.1	7.0	0.0	0.0	0.0
A	50.0	200.0	50.0	25	15.0	1.1	9.0	0.0	0.0	0.0
B*3	50.0	200.0	50.0	25	17.0	1.1	11.0	0.0	0.0	0.0
C	50.0	200.0	50.0	25	19.0	1.1	13.0	0.0	0.0	0.0
D	75.0	200.0	50.0	25	17.0	1.1	11.0	0.0	0.0	0.0
E	90.0	230.0	60.0	30	19.6	1.3	12.7	0.0	0.0	0.0
US (V/f) F & FF	60.0	230.0	60.0	3.0	19.6	1.3	12.7	0.0	0.0	0.0
Euro (V/f) F & FF	50.0	200.0	50.0	2.5	17.0	1.3	11.0	0.0	0.0	0.0
US (OLV) F & FF	60.0	230.0	60.0	3.0	13.8	0.5	2.9	0.0	0.0	0.0
Euro (OLV) F & FF	50.0	200.0	50.0	2.5	12.0	0.5	2.5	0.0	0.0	0.0

** Default for O02.09 = 1 (America) and not Std Hoist*
**1 Default for O02.09 = 1 (America) and Std Hoist*
**2 Default for O02.09 = 2 (Europe) and not Std Hoist*
**3 Default for O02.09 = 2 (Europe) and Std Hoist*

Table 5-5: Voltage/Frequency Pattern Options for 460 V Class

	E01.04	E01.05	E01.06	E01.07	E01.08	E01.09	E01.10	E01.11	E01.12	E01.13
	Max Freq	Max Volt	Base Freq	Mid Freq A	Mid Volt A	Min Freq	Min Volt	Mid Freq B	Mid Volt B	Base Volt
E01.03	**Hz**	**VAC**	**Hz**	**Hz**	**VAC**	**Hz**	**VAC**	**Hz**	**VAC**	**VAC**
0*	60.0	460.0	60.0	3.0	29.9	1.3	16.2	0.0	0.0	0.0
1	60.0	460.0	60.0	3.0	32.2	1.3	18.4	0.0	0.0	0.0
2	60.0	460.0	60.0	3.0	34.6	1.3	20.8	0.0	0.0	0.0
3	60.0	460.0	60.0	3.0	36.8	1.3	23.0	0.0	0.0	0.0
4*1	60.0	460.0	60.0	3.0	39.2	1.3	25.4	0.0	0.0	0.0
5	60.0	460.0	60.0	3.0	41.4	1.3	27.6	0.0	0.0	0.0

** Default for O02.09 = 1 (America) and not Std Hoist*
**1 Default for O02.09 = 1 (America) and Std Hoist*
**2 Default for O02.09 = 2 (Europe) and not Std Hoist*
**3 Default for O02.09 = 2 (Europe) and Std Hoist*

	E01.04	E01.05	E01.06	E01.07	E01.08	E01.09	E01.10	E01.11	E01.12	E01.13
	Max Freq	Max Volt	Base Freq	Mid Freq A	Mid Volt A	Min Freq	Min Volt	Mid Freq B	Mid Volt B	Base Volt
E01.03	**Hz**	**VAC**	**Hz**	**Hz**	**VAC**	**Hz**	**VAC**	**Hz**	**VAC**	**VAC**
06	60.0	460.0	60.0	3.0	43.8	1.3	30.0	0.0	0.0	0.0
07	60.0	460.0	60.0	3.0	46.0	1.3	32.2	0.0	0.0	0.0
08	60.0	460.0	60.0	3.0	48.4	1.3	34.6	0.0	0.0	0.0
09*2	50.0	400.0	50.0	2.5	26.1	1.1	14.1	0.0	0.0	0.0
0A	50.0	400.0	50.0	2.5	30.1	1.1	18.1	0.0	0.0	0.0
0B*3	50.0	400.0	50.0	2.5	34.1	1.1	22.1	0.0	0.0	0.0
0C	50.0	400.0	50.0	2.5	38.1	1.1	26.1	0.0	0.0	0.0
0D	75.0	400.0	50.0	2.5	34.1	1.1	22.1	0.0	0.0	0.0
0E	90.0	460.0	60.0	3.0	39.2	1.3	25.4	0.0	0.0	0.0
US (V/f) F & FF	60.0	460.0	60.0	3.0	39.1	1.3	25.3	0.0	0.0	0.0
Euro (V/f) F & FF	50.0	200.0	50.0	2.5	34.0	1.3	22.0	0.0	0.0	0.0
US (OLV) F & FF	60.0	460.0	60.0	3.0	27.6	0.5	5.8	0.0	0.0	0.0
Euro (OLV) F & FF	50.0	400.0	50.0	2.5	24.0	0.5	5.0	0.0	0.0	0.0

** Default for O02.09 = 1 (America) and not Std Hoist*
**1 Default for O02.09 = 1 (America) and Std Hoist*
**2 Default for O02.09 = 2 (Europe) and not Std Hoist*
**3 Default for O02.09 = 2 (Europe) and Std Hoist*

5.4.2 Motor Set-up

E2 parameters define motor specifications. Normally, the default settings for E2 parameters are determined by KVA selection (O02.04). In open loop vector control the E2 parameters will be set automatically during auto-tuning. If the control method is V/f (A01.02 = 00), the motor rated current should be entered into E02.01.

If auto-tuning cannot be performed, some E2 parameters can be calculated using the motor's nameplate information.

Motor rated slip frequency (E02.02) can be calculated by using the following equation:

$$f_s = f - \frac{(N * P)}{120}$$

Where… f_s: slip frequency (Hz)
f: rated frequency (Hz)
N: rated motor speed (rpm)
P: number of motor poles

Motor terminal resistance E02.05 can be calculated by using the following equation:

$$r_t = r_p * \frac{273 + \left[\frac{(25°C + T_i)}{2}\right]}{273 + T_i}$$

Where… r_t: motor terminal resistance
r_p: Phase-to-Phase resistance at insulation class temperature
T_i: insulation class temperature (°C)

Parameter	Name	Function	Range	Default
E02.01	Motor Rated FLA	Motor-rated current full load amps	0.01–70.0 A	*
E02.02	Motor Rated Slip	Motor-rated slip frequency	0.00–20.00 Hz	**
E02.03	No-Load Current	Motor no-load current	0.0–70.0 A	**
E02.04	Number of Poles	Number of poles in motor	02–48	04
E02.05	Terminal Resistance	Motor terminal resistance	0.000–65.000 Ω	**
E02.06	Leakage Inductance	Motor Leakage Inductance	0.0–40.0%	**
E02.07	Saturation Comp 1	Core-Saturation Compensation Coefficient 1	0.00–0.50	**
E02.08	Saturation Comp 2	Core-Saturation Compensation Coefficient 2	0.00–0.75	**
E02.09	Motor Mechanical Loss	Mechanical Torque Loss as a % of motor torque	0.0–10.0%	0.0
E02.10	Motor Iron Loss of Torque Compensation	Motor iron loss	0–65535 W	**
E02.11	Motor Rated Power	Motor rated power output	0.0–20.0 HP/kW	**
E02.12	Saturation Comp 3	Core-Saturation Compensation Coefficient 3	1.30–5.00%	**

** Initial value is determined by O02.04 (kVA Selection)*

*** This value is automatically set during auto tuning*

5.5 Option Parameters

- F1 Pulse Generated (PG) Control
- F6 Profibus-DP Communication Option Card Setup
- F7 Ethernet Option Card Setup (Ethernet IP & Modbus TCP/IP)

5.5.1 Pulse Generated (PG) Control

The following parameters are used to set and control the action for the Pulse Generated (PG) input and output, including overspeed detection. These parameters become visible when the pulse generator function (H06.01) is set to 03 and the control method is set to OLV (A01.02 = 02).

Parameter	Name	Function	Range	Default
F01.02	Pulse Feedback Loss *00 Decel to Stop (by B05.02)* *01 Coast to Stop* *02 Fast Stop (by B05.08)* *03 Alarm Only*	Stopping Method for PG Disconnect	00–03	01
F01.03	Operation at Overspeed *00 Decel to Stop (by B05.02)* *01 Coast to Stop* *02 Fast Stop (by B05.08)* *03 Alarm Only*	Stopping Method for PG Overspeed	00–03	01
F01.04	Operation at Deviation *00 @ speed agree - Decel (by B05.02)* *01 @ speed agree - Coast to Stop* *02 @ speed agree - Fast Stop (by B05.08)* *03 @ speed agree - Alarm only* *04 @ Run - Decel to Stop (by B05.02)* *05 @ Run - Coast to Stop* *06 @ Run - Fast Stop (by B05.08)* *07 Alarm only (Dev-1 and Dev-2 Alarm)*	Stopping Method for PG Deviation	00–07	05
F01.08	Overspeed Detection Level	PG Overspeed Detection Level	0–120%	105
F01.09	Overspeed Detection Time	PG Overspeed Detection Time	0.0–2.0sec	0.0
F01.10	Excessive Speed Detection Level	Excessive Speed Deviation Level	0–50%	10
F01.11	Excessive Speed Detection Time	Excessive Speed Deviation Detection Time	0.0–10.0sec	0.3
F01.14	PGO Detection Time	PGO Detection Time	0.0–10.0sec	0.5

5.5.2 Profibus-DP Communication Option Card Setup

Settings for the Profibus-DP communication option card SI-P3.

Parameter	Name	Function	Range	Default
F06.01	Comm Bus Fault (BUS)	Stopping method when a BUS fault occurs	00-04	01
	00 Decel to Stop			
	01 Coast to Stop			
	02 Fast-Stop			
	03 Use B03.03 Method			
	04 Alarm Only			
	05 Decel to Stop (Auto Reset)			
	06 Coast to Stop (Auto Reset)			
	07 Fast-Stop (Auto Reset)			
	08 Use B03.03 Method (Auto Reset)			
F06.02	Comm External Fault (EF0)	External Fault (EF0) detection method via Profibus-DP	00-01	00
	00 Always Detected			
	01 Only During Run			
F06.03	EF0 Fault Action	Stopping method when an EF0 fault occurs	00-04	01
	00 Decel to Stop			
	01 Coast to Stop			
	02 Fast-Stop			
	03 Use B03.03 Method			
	04 Alarm Only			
F06.08	Comm Parameter Initalization	Determines whether communication-related parameters (F06.xx and F07.xx) are reset when the VFD is initialized with A01.05.	00-01	00
	00 Initalize Comm Parameters			
	01 Don't Initialize Comm Parameters			
F06.14	BUS Fault Auto Reset	Determines whether a BUS fault will be automatically reset.	00-01	00
	00 Disabled			
	01 Enabled			
F06.30	Profibus Node Address	Sets the node address for Profibus-DP communications.	0-125	00
F06.31	Profibus Clear Select	Determines the operation when a “Clear Mode” command is received on the Profibus-DP option card.	00-01	00
	00 Reset to Zero			
	01 Hold Previous Value			

Parameter	Name	Function	Range	Default
F06.32	Profibus Map Select	Sets the data format used for Profibus-DP communications.	00-05	00
	00 PPO Type			
	01 Conventional			
	02 PPO (Bit 0)			
	03 PPO (Enter)			
	04 Conventional (Bit 0)			
	05 PPO (Bit 0, Enter)			

5.5.3 Ethernet Option Card Setup (Ethernet IP & Modbus TCP/IP)

Settings for communication option cards SI-EN3 (Ethernet/IP) and SI-EM3 (Modbus TCP/IP).

Parameter	Name	Function	Range	Default
F07.01	IP Address 1	IP Address 1	0-255	192
F07.02	IP Address 2	IP Address 2	0-255	168
F07.03	IP Address 3	IP Address 3	0-255	1
F07.04	IP Address 4	IP Address 4	0-255	20
F07.05	Subnet Mask 1	Subnet Mask 1	0-255	255
F07.06	Subnet Mask 2	Subnet Mask 2	0-255	255
F07.07	Subnet Mask 3	Subnet Mask 3	0-255	255
F07.08	Subnet Mask 4	Subnet Mask 4	0-255	0
F07.09	Gateway Address 1	Gateway Address 1	0-255	192
F07.10	Gateway Address 2	Gateway Address 2	0-255	168
F07.11	Gateway Address 3	Gateway Address 3	0-255	1
F07.12	Gateway Address 4	Gateway Address 4	0-255	1
F07.13	IP Address Mode	Sets how the IP Address is set at start up.	00-02	02
	00 User Defined			
	01 BOOTP			
	02 DHCP			
F07.14	Duplex Select	Sets the duplex mode.	00-08	01
	00 Half/Half			
	01 Auto/Auto			
	02 Full/Full			
	03 Half/Auto			
	04 Half/Full			
	05 Auto/Half			
	06 Auto/Full			
	07 Full/Half			
	08 Full/Auto			

Parameter	Name	Function	Range	Default
F07.15	Baud Rate *10 10 Mbps* *100 100 Mbps* *101 10/100 Mbps* *102 100/10 Mbps*	Sets the communication speed.	10,100-102	10
F07.16	Comm Loss Timeout	Sets the time-out value for communication loss detection.	0.0-30.0	0.0
F07.17	Ethernet Speed Scale	Sets the scaling factor for the Ethernet/IP speed setting/monitor.	-15-15	0.0
F07.18	Ethernet Current Scale	Sets the scaling factor for the Ethernet/IP output current setting/monitor.	-15-15	0.0
F07.19	Ethernet Torque Scale	Sets the scaling factor for the Ethernet/IP torque setting/monitor.	-15-15	0.0
F07.20	Ethernet Power Scale	Sets the scaling factor for the Ethernet/IP power setting/monitor.	-15-15	0.0
F07.21	Ethernet Voltage Scale	Sets the scaling factor for the Ethernet/IP voltage setting/monitor.	-15-15	0.0
F07.22	Ethernet Time Scale	Sets the scaling factor for the Ethernet/IP time setting/ monitor.	-15-15	0.0
F07.23 to F07.32	DOA116 (1 to 10)	Dynamic parameters that contain the Modbus addresses used for programmable registers in the output assembly 116. Data residing in bites 20 to 39 of assembly 116 will be written to the respective Modbus registers identified by the addresses contained in these parameters. No data is written to the Modbus registers if the parameter setting is 0.	00-FF	00
F07.33 to F07.42	DOA166 (1 to 10)	Dynamic parameters that contain the Modbus addresses used for programmable registers in the input assembly 166. Data residing in bites 20 to 39 of assembly 166 will be written to the respective Modbus registers identified by the addresses contained in these parameters. No data is written to the Modbus registers if the parameter setting is 0.	00-FF	00

5.6 Terminal Parameters

There are digital and analog inputs and outputs that can be programmed for customized operation and sequencing. These include input and output terminal selection along with serial communication. Listed below are the parameters that are customizable for your system.

- H1 Digital Inputs
- H2 Digital Outputs
- H3 Analog Inputs
- H4 Analog Outputs
- H5 Serial Communication
- H6 Pulse Inputs

5.6.1 Digital Inputs

The IMPULSE®•G+ Mini has seven multi-function digital inputs for the set-up of numerous functions (terminals S1 to S7). An OPE03 error will occur if the same function is programmed in more than one terminal at the same time.

Parameter	Name	Function	Page	Range	Default
H01.01	Terminal S1 Select	Setting for S1.	-	00–81	80*
H01.02	Terminal S2 Select	Setting for S2.	-	00–81	81*
H01.03	Terminal S3 Select	Setting for S3.	-	00–81	00*
H01.04	Terminal S4 Select	Setting for S4.	-	00–81	01*
H01.05	Terminal S5 Select	Setting for S5.	-	00–81	0F*
H01.06	Terminal S6 Select	Setting for S6.	-	00–81	0F*
H01.07	Terminal S7 Select	Setting for S7.	-	00–81	0F*
	00 Multi-Step Ref 2	*Multi-Step Speed 2.*	***43***		
	01 Multi-Step Ref 3	*Multi-Step Speed 3.*	***43***		
	02 Multi-Step Ref 4	*Multi-Step Speed 4.*	***43***		
	03 Multi-Step Ref 5	*Multi-Step Speed 5.*	***43***		
	04 Speed Hold 2	*Hold function (2nd step of Three-Step Infinitely Variable).*	***43***		
	05 Accel Command	*Acceleration function (2nd step of Two-Step Infinitely Variable or 3rd step of Three-Step Infinitely Variable).*	***43***		
	06 Upper Limit 1 N.O.	*Upper Limit - SLOW DOWN; Normally Open. UL1 - blinking*	***67***		
	07 Upper Limit 2 N.O.	*Upper Limit - STOP; Normally Open. UL2 - blinking*	***67***		
	08 Lower Limit 1 N.O.	*Lower Limit - SLOW DOWN; Normally Open. LL1 - blinking*	***67***		
	09 Lower Limit 2 N.O.	*Lower Limit - STOP; Normally Open. LL2 - blinking*	***67***		
	0A Upper Limit 1 N.C.	*Upper Limit - SLOW DOWN; Normally Closed. UL1 - blinking*	***67***		
	0B Upper Limit 2 N.C.	*Upper Limit - STOP; Normally Closed. UL2 - blinking*	***67***		

** Parameter defaults changed by X-Press Programming*

Parameter	Name	Function	Page	Range	Default
0C	Lower Limit 1 N.C.	Lower Limit - SLOW DOWN; Normally Closed. LL1 - blinking	**67**		
0D	Lower Limit 2 N.C.	Lower Limit - STOP; Normally Closed. LL2 - blinking	**67**		
0E	M-Speed Gain 1	Micro-Speed positioning control multiplier 1. Gain is set by parameter C02.01 (has priority over MS2)	**66**		
0F	Not used	No function - terminal is disabled	-		
10	M-Speed Gain 2	Micro-Speed positioning control multiplier 2. Gain is set by parameter C02.02.	**66**		
12	Weight Limit N.C.	Weighted Upper Limit (UL3); Stopping Method determined by C03.08.	**67**		
13	Swift-Lift	Swift-Lift Enable (C06.01 = 2). Not available for Traverse Motion	**72**		
14	Alt T-Lim Gain	Alternate Torque Limit Gain - C07.05. Use when load testing a hoist	**75**		
15	Forward Jog	Uses B01.17 reference	**49**		
16	Reverse Jog	Uses B01.17 reference	**49**		
17	Forward Inch	Inch Forward	**78**		
18	Reverse Inch	Inch Reverse	**78**		
19	Inch Repeat	Inch Repeat	**78**		
1A	Acc/Dec 2	Acceleration and Deceleration Time Changeover 2 using B05.03 and B05.04	**61**		
1B	Acc/Dec 3	Acceleration and Deceleration Time Changeover 3 using B05.12 and B05.13	**61**		
1C	Acc/Dec 4	Acceleration and Deceleration Time Changeover 4 using B05.14 and B05.15	**61**		
1D	Digital Chngover	Analog/Digital Reference Changeover B01.18 = 1 Open = Analog Closed = Digital	**49**		
1F	Opt/Inv Switch	Option Reference Selection (Frequency and Run Reference from Option card. Input On = Option Card). Set B03.01, B03.02 = Terminals	**52**		
20 thru 2F	External Fault	External Fault selection	**97**		
30	Program Lockout	Program Lockout Closed: Parameters enabled to write Open: Parameters disabled to write other than freq. reference (U01.01)	-		
31	Local/Remote Sw	Closed = Local	-		
32	Ext BB N.O.	N.O.: Baseblock by ON. Immediate stop at STOP command; normally open	-		
33	Ext BB N.C.	N.C.: Baseblock by OFF. Immediate stop at STOP command; normally closed	-		
39	External OH2	VFD overheat prediction (OH2 is shown by ON). Alarm only.	-		

** Parameter defaults changed by X-Press Programming*

Parameter	Name	Function	Page	Range	Default
3A	*Trm A1/A2 Enable*	*Multi-function analog input A1/A2 Enable/Disable. When programmed, analog input A1/A2 is enabled by ON.*	-		
3F	*Fault Reset*	*Reset by ON*	-		
40	*Fast Stop N.O.*	*Input On = Decel to stop via fast stop time B05.08*	***61***		
42	*Fast Stop N.C.*	*Input Off = Decel to stop via fast stop time B05.08*	***61***		
43	*Timer Enable*	*Function settings by C12.03, C12.04. It is set with timer function output [Multi-Function Output]*	***77***		
47	*Analog Hold*	*Analog frequency reference Sample/Hold*	-		
4C	*DCInj Braking*	*ON: DC injection braking command, once SFS reaches Zero Speed*	-		
53	*Comm Test*	*Communication test mode - loopback test of modbus RS-422/485*	-		
55	*Drive Enable*	*When programmed, must be ON in order for Inverter Ready - Generates "Drive not Ready". "DNE" is displayed.*	-		
56	*Klixon N.O.*	*When Closed, Reset run command, use stopping method B03.03, display oL8 - Klixon Alarm on Keypad*	***68***		
57	*Klixon N.C.*	*When Open, Reset run command, use stopping method B03.03, display oL8- Klixon Alarm on Keypad*	***68***		
58	*Brake Answer back*	*Generates BE0, BE4, BE5, alarm or fault conditions (C08.04, C08.11)*	***75***		
59	*Alternate Upper Frequency*	*Alternate Reference Upper Limit Frequency*	***51***		
5A	*Maintenance Reset*	*Reset Maintenance Timer (C12.05 - C12.06, U01.52)*	***77***		
5B	*BE6 Up Speed Limit*	*Limit Fref to C08.17 (BE6 Up Speed Limit)*	***75***		
5F	*Phantom Fault N.C.*	*Stops motion based C03.09 but does not change Keypad display. Stop L.E.D. on JVOP blinks*	***68***		
62	*Weight Limit N.O.*	*Weighted Upper Limit (UL3). Stopping Method determined by C03.08*	***67***		
63	*Phantom Fault N.O.*	*Stops motion based C03.09 but does not change Keypad display. STOP L.E.D. on JVOP blinks*	***68***		
65	*Dwell Enable*	*Enables/Disables Dwell function.*	***82***		
69	*LC Disable*	*Input On = Load Check disabled.*	-		
70	*Torque Detection*	*Overtorque/Undertorque detection is enabled and disabled by MFDI. When the input is closed, Overtorque/Undertorque detection is enabled*	-		
80	*Forward Run*	*Forward Run Command*	-		
81	*Reverse Run*	*Reverse Run Command*	-		

** Parameter defaults changed by X-Press Programming*

5.6.2 External Fault Response Selection

It is sometimes desirable to have at least one external fault input to the VFD. To properly program a multi-function input (H01.01 to H01.07) for this purpose an external fault response must be selected. The table below shows the possible selections for an external fault response.

Table 5-6: External Fault Response Selection

External Fault Selection								MFDI Setting
Input Level Selection		Detection Method		External Fault Action				
N.O.[1]	N.C.[1]	Always	During Run	Ramp to Stop	Coast to Stop	Fast-stop[2]	Alarm Only	
√		√		√				20
√		√			√			24
√		√				√		28
√		√					√	2C
√			√	√				22
√			√		√			26
√			√			√		2A
√			√				√	2E
	√	√		√				21
	√	√			√			25
	√	√				√		29
	√	√					√	2D
	√		√	√				23
	√		√		√			27
	√		√			√		2B
	√		√				√	2F

(1) N.O. = normally open contact; N.C. = normally closed contact

(2) Uses B05.08 timer

5.6.3 Digital Outputs

The IMPULSE®•G+ Mini has three multi-function digital outputs (one relay, two open collector) for indicating various conditions. The following table lists the function selections for the multi-function digital outputs.

Parameter	Name	Function	Page	Range	Default
H02.01	Output Contactor (MC-MB-MA) select	Digital Output 1 Function	-	000–1FF	000
H02.02	Output Terminal P1 Select	Digital Output 2 Function	-	000–1FF	000
H02.03	Output Terminal P2 Select	Digital Output 3 Function	-	000–1FF	00F
	00 Brake Release	*Closed when the VFD provides a voltage or frequency is output*	-		
	01 Zero Speed	*Closed when the output frequency is below D01.01*	-		
	02 Fref/Fout Agree 1	*Closed when Frequency Reference and Frequency Output agree*	-		
	03 Fref/Set Agree 1	*Closed when the Output Frequency = L04.01*	***112***		
	04 Freq Detect 1	*Closed when the output frequency is < L04.01.*	***112***		
	05 Freq Detect 2	*Closed when the output frequency is > L04.01.*	***112***		
	06 Inverter Ready	*Closed when not in a fault state*	-		
	07 DC Bus Undervolt	*Closed when DC Bus voltage drops below UV trip point*	-		
	08 BaseBlk N.O.	*Closed when the VFD is not outputing voltage*	-		
	09 Frequency Reference Source	*Closed when the frequency reference is input from the keypad (O02.01)*	***125***		
	0A Local Operation	*Closed when the RUN command is input from the keypad.*	-		
	0B Trq Det 1 N.O.	*Closed when torque > L06.02*	***114***		
	0D DB Overheat	*Closed when VFD displays “RH” or “RR” fault*	-		
	0E Fault	*Closed during a major fault.*	-		
	0F Not Used	*No function*	-		
	10 Minor Fault	*Closed during minor fault or alarm*	-		
	11 Reset Cmd Active	*Closed when a reset command is present*	-		
	12 Timer Output	*Timer function output*	***77***		
	13 Fref/Fout Agree 2	*Closed when output frequency = frequency reference*	***112***		
	14 Fref/Set Agree 2	*Closed when output frequency = L04.03*	***112***		
	15 Freq Detect 3	*Closed when output frequency ≤ L04.03*	***112***		
	16 Freq Detect 4.	*Closed when output frequency ≥ L04.03*	***112***		
	17 Trq Det 1 N.C.	*Open when torque > L06.02 for longer than L06.03 time*	***114***		
	18 Trq Det 2 N.O.	*Closed when torque > L06.05*	***114***		
	19 Trq Det 2 N.C.	*Open when torque > L06.05*	***114***		
	1A Forward Direction	*Closed when running FWD/UP*	-		
	1B Reverse Direction	*Closed when running REV/DOWN*	-		

Parameter	Name	Function	Page	Range	Default
	1C Swift Lift Active	*Closed when Swift Lift is active*	***72***		
	1D BaseBlk N.C.	*Open during baseblock 2*	-		
	20 Auto-Rst Attempt	*Closed when auto reset is enabled*	***119***		
	21 Overload OL1	*Closed when an OL1 Overload fault code occurs*	***106***		
	22 Overheat Prealarm	*Closed when "OH" is displayed on keypad*	***117***		
	23 Torque Limit	*Closed when current Torque Limit is reached*	***75***		
	26 Run Cmd is input	*Closed when either a Fwd or Rev Run Command is active*	-		
	27 Load Check Det	*Closed when Load Check detected*	***69***		
	29 Upper Limit	*Closed when Upper Limit-SLOW DOWN or Upper Limit STOP is input*	***67***		
	2A During Run1	*Closed when the VFD is Outputting Voltage*	-		
	2B During Fast Stop	*Closed During Fast Stop*	***59***		
	2F Load Weakening	*Closed during Load Weakening*	***114***		
	30 Lower Limit	*Closed when Lower Limit-SLOW DOWN or Lower Limit STOP is input*	***67***		
	31 Upper/Lower Limit	*Closed when Upper Limit-SLOW DOWN or Upper Limit STOP or Lower Limit-SLOW DOWN or Lower Limit STOP is input*	***67***		
	37 Maintenance	*Closed when the timer reaches C12.05*	***77***		
	39 Drive Enable	*Closed when drive enable is active*	-		
	3A Overheat Pre Alarm Time Limit	*Closed when OH Pre Alarm Time Limit is reached*	***117***		
	3D During Speed Search	*Closed during Speed Search*	-		
	3F Klixon	*Closed when MFDI 56 or 57 is on - motor is overheating*	***68***		
	40~FF Fault Annunciate	*Closed on specific faults*	-		
	101 Inverse Zero Speed	*Open when the output frequency is below D01.01*	***79***		
	102 Inverse Frequency Agree 1	*Open when Frequency Reference and Frequency Output agree*	-		
	103 Inverse Frequency Set 1	*Open when Output Frequency Reference equals L04.01*	***112***		
	104 Inverse Freq Detect 1	*Open when output frequency is < L04.01.*	***112***		
	105 Inverse Freq Detect 2	*Open when output frequency is > L04.01.*	***112***		
	106 Inverse Inverter Ready	*Open when VFD is not in a fault state*	-		
	107 Inverse DC Bus Undervolt	*Open when DC Bus voltage drops below UV trip point*	-		
	108 Inverse Baseblock N.O.	*Open when VFD is not outputting voltage*	-		
	109 Inverse Frequency Reference Source	*Open when the frequency reference is input from the keypad (O02.01)*	***125***		

Parameter	Name	Function	Page	Range	Default
	10A Inverse Local Operation	*Open when the RUN command is input from the keypad*	-		
	10B Inverse Trq Det 1 N.O.	*Open when torque > L06.02*	***114***		
	10D Inverse DB Overheat	*Open when VFD displays "RH" or "RR" fault*	-		
	10E Inverse Fault	*Open during a major fault*	-		
	110 Inverse Minor Fault	*Open during minor fault or alarm*	-		
	111 Inverse Reset Command Active	*Open when a reset command is present on the terminals*	-		
	112 Inverse Timer Output	*See Timer function output*	***76***		
	113 Inverse Freq Agree 2	*Open when output frequency = frequency reference*	***112***		
	114 Inverse Frq Set 2	*Open when output frequency = L04.03*	***112***		
	115 Inverse Frequency Detect 3	*Open when output frequency ≤ L04.03*	***112***		
	116 Inverse Frequency Detect 4	*Open when output frequency ≥ L04.03*	***112***		
	117 Inverse Torque Detect 1 N.C.	*Closed when torque > L06.02 for longer than L06.03 time*	***114***		
	118 Inverse Torque Detect 2 N.O.	*Open when torque > L06.05*	***114***		
	119 Inverse Torque Detect 2 N.C.	*Closed when torque > L06.05*	***114***		
	11A Inverse Forward Direction	*Open when running FWD/UP*	-		
	11B Inverse Reverse Direction	*Open when running REV/DOWN*	-		
	11C Inverse Swift-Lift Active	*Open when Swift Lift is active*	***72***		
	11D Inverse Baseblock N.C.	*Closed during baseblock 2*	-		
	120 Inverse Auto-Reset	*Open when auto-reset is enabled*	***119***		
	121 Inverse Overload OL1	*Open when an OL1 Overload fault code occurs*	***106***		
	122 Inverse Overheat Pre-alarm	*Open when "OH" is displayed on keypad*	***117***		
	123 Inverse Torque Limit	*Open when current Torque Limit is reached*	***75***		
	126 Inverse Run Command is input	*Open when either a Fwd or Rev Run Command is active*	-		
	127 Inverse Load Check Detect	*Open when Load Check detected*	***69***		
	129 Inverse Upper Limit	*Open when Upper Limit-SLOW DOWN or Upper Limit STOP is input*	***67***		
	12A Inverse During Run 1	*Open when VFD is Outputting Voltage*	-		

Parameter	Name	Function	Page	Range	Default
	12B Inverse During Fast Stop	*Open During Fast Stop*	***59***		
	12F Inverse Load Weakening	*Open during Load Weakening*	-		
	130 Inverse Lower Limit	*Open when Lower Limit-SLOW DOWN or Lower Limit STOP is input*	***67***		
	131 Inverse Upper/Lower Limit	*Open when Upper Limit-SLOW DOWN or Upper Limit STOP or Lower Limit-SLOW DOWN or Lower Limit STOP is input*	***67***		
	137 Inverse Maintenance	*Open when the timer reaches C12.05*	***77***		
	139 Inverse Drive Enable	*Open when drive enable is active*	-		
	13A Inverse Overheat Pre-Alarm Time Limit	*Open when OH Pre Alarm Time Limit is reached*	***117***		
	13D Inverse During Speed Search	*Open during Speed Search*	-		
	13F Inverse Klixon	*Open when MFDI 56 or 57 is on - motor is overheating*	***68***		
	140~1FF Inverse Fault Annunciate	*Open on specific faults*	-		

5.6.4 Analog Inputs

The IMPULSE®•G+ Mini has two analog inputs for the external input of numerous references and limits.

Parameter	Name	Function	Range	Default
H03.01	Terminal A1 Signal Select	Voltage for Terminal A1 analog input signal	00	00
	00 0 to 10VDC			
H03.02	Terminal A1 Select	Assigns one of the following functions for the analog input Terminal A1.	00–1F	00
	00 Frequency Bias			
	01 Frequency Gain			
	02 Aux Speed Reference 1			
	03 Aux Speed Reference 2			
	04 Output Voltage Bias			
	07 OT/UT Detection Level	*Overtorque Detection Level*		
	0E Motor Temperature	*PTC thermistor input used in conjunction with L01.03, L01.04 and L01.05*		
	0F Not used	*Not Used*		
	10 Forward Torque Limit			
	11 Reverse Torque Limit			
	12 Regen Torque Limit			
	15 FWD/REV Torque Limit			
	1F Not Used	*Not used*		
H03.03	Terminal A1 Gain	Gain multiplier for Terminal A1 analog input signal	-999.9 – 999.9%	100.0
H03.04	Terminal A1 Bias	Bias multiplier for Terminal A1 analog input signal	-999.9 – 999.9%	000.0
H03.09	Terminal A2 Signal Select	Selects the signal level for Terminal A2	00–03	02
	00 0 to 10VDC (DIP S1 must be in the “V” position)			
	02 4 to 20mA (DIP S1 must be in the “I” position)			
	03 0 to 20mA (DIP S1 must be in the “I” position)			
H03.10	Terminal A2 Select	Assigns one of the following functions for the analog input Terminal A2.	00–1F	00
	00 Frequency Bias			
	01 Frequency Gain			
	02 Aux Speed Reference 1			
	03 Aux Speed Reference 2			
	04 Output Voltage Bias			
	07 OT/UT Detection Level	*Overtorque Detection Level*		
	0E Motor Temperature	*PTC thermistor input used in conjunction with L01.03, L01.04 and L01.05*		
	0F Not used			
	10 Forward Torque Limit			
	11 Reverse Torque Limit			

Parameter	Name	Function	Range	Default
	12 Regen Torque Limit			
	15 FWD/REV Torque Limit			
	1F Not Used			
H03.11	Terminal A2 Gain	Gain multiplier for terminal A2 analog input signal	-999.9–999.9%	100.0
H03.12	Terminal A2 Bias	Bias multiplier for terminal A2 analog input signal	-999.9–999.9%	000.0
H03.13	Analog Input Filter Time Constant	Analog input filter average time; analog delay time constant between Terminals A1 and A2	0.00-2.00sec	0.03

5.6.5 Analog Output

The IMPULSE®•G+Mini has one analog output for the external monitoring of VFD conditions.

Parameter	Name	Function	Range	Default
H04.01	Terminal AM Select	Assigns one of the following functions for analog output Terminal AM.	0–154	102
	0 Not Used			
	101 Frequency Reference			
	102 Output Frequency			
	103 Output Current			
	105 Motor Speed (OLV only)			
	106 Output Voltage			
	107 DC Bus Voltage			
	108 Output Power			
	109 Torque Reference (OLV only)			
	115 Term A1 Level			
	116 Term A2 Level			
	120 SFS Output			
	154 Input Pulse Monitor			
H04.02	Terminal AM Gain	Gain multiplier for Terminal AM analog output signal	-999.9–999.9%	100.0
H04.03	Terminal AM Bias	Bias multiplier for Terminal AM analog output signal	-999.9–999.9%	000.0

5.6.6 Serial Communication

The IMPULSE®•G+ Mini uses terminals R^+/R^-, S^+/S^- to communicate MODBUS RTU (RS-485/422) protocol.

Parameter	Name	Function	Range	Default
H05.01	Serial Comm Address	Serial communication address (hexadecimal)	00–20	1F
H05.02	Serial Baud Rate	Sets the baud rate (bits per second)	00–08	03
	00 1200 bps			
	01 2400 bps			
	02 4800 bps			
	03 9600 bps			
	04 19200 bps			
	05 38400 bps			
	06 57600 bps			
	07 76800 bps			
	08 115200 bps			
H05.03	Communication - Parity	Determines the parity	00–02	00
	00 No parity			
	01 Even parity			
	02 Odd parity			
H05.04	Communication - Error Stopping Method	Determines stopping method after a serial fault occurrence	00–03	04
	00 Decel to Stop			
	01 Coast to Stop			
	02 Fast Stop			
	03 Alarm Only			
H05.05	Communication - Error Detection Select	Enable/Disable serial fault detection	00, 01	01
	00 Disabled			
	01 Enabled			
H05.06	Transmit Wait Time	Send waiting time	05–65 ms	05
H05.07	RTS Control Sel	RTS Control enable/disable	00, 01	01
	00 Disabled (RTS is always on)			
	01 Enabled (RTS is ON only when sending)			
H05.09	Communication - Error Detection Time	Communication Error Detection Time	0.0–10.0	2.0
H05.10	Output Voltage Reference	Changes output voltage reference unit when reading register 0x25	00, 01	00
	00 0.1V/unit			
	01 1V/unit			

Parameter	Name	Function	Range	Default
H05.11	Communication Enter Function Select	Select whether or not an Enter Command is required to save parameter data to VFD	00, 01	00
	00 Enter Command must be used			
	01 Enter Command not required			
H05.12	Run Command Method Selection	Select Run Command Method	00, 01	00
	00 Bit 0 = Start/Stop Forward Direction *Bit 1 = Start/Stop Reverse Direction*			
	01 Bit 0 = Start/Stop *Bit 1 = Forward/Reverse Direction*			

NOTE: *After changing any H05.XX parameter, power to the VFD must be cycled for the changes to take effect.*

NOTE: *After initial communication, if the VFD does not detect communication for H05.09 time, a communication fault will occur (CE Modbus ERR).*

5.6.7 Pulse Inputs

Parameter	Name	Function	Range	Default
H06.01	Pulse Input Selection	Sets the function of the Pulse Input Terminal (RP)	00, 03	00
		00 Frequency Reference		
		03 Encoder Feedback		
H06.02	Pulse Input Scaling	Sets the number of pulses equal to the maximum output frequency	1,000 – 32,000 Hz	1440
H06.03	Pulse Input Gain	Sets the gain of the output frequency when the input frequency is at 100%	0.0 – 1,000.0%	100.0
H06.04	Pulse Input Bias	Sets the output frequency level when the input frequency is ONE	-100.0 – 100.0%	0.0
H06.05	Pulse Input Filter Time	Sets the input filter time delay constant in seconds	0.00–2.00 sec	0.10
H06.06	Pulse Monitor Selection	Selects which monitor output to use for the Pulse Train Monitor Output Terminal (MP). Ex: 102 means U01.02 (Output Frequency)	000 – 120	102
	000 Not Used			
	101 Frequency Ref			
	102 Output Freq			
	105 Motor Speed			
	120 SFS Output			
H06.07	Pulse Monitor Scaling	Sets the output frequency of the terminal (MP) at 100%. To monitor output frequency simultaneously, set H06.06 = 102 and H06.07 = 0	0 – 32,000 Hz	1440

5.7 Protection Parameters

The IMPULSE®•G+ Mini has the ability to protect itself and the motor by allowing various means to detect and take corrective action when a condition occurs. These include motor overload detection, torque detection, and the ability to perform a self-diagnostic check, and then resume operation after a fault is cleared.

- L1 Motor Overload
- L2 Power Loss Ride Thru
- L3 Stall Prevention
- L4 Reference Detection
- L6 Torque Detection
- L8 Hardware Protection
- L9 Automatic Reset

5.7.1 Motor Overload

The IMPULSE®•G+ Mini protects against motor overload with a UL-recognized, built-in electronic thermal overload function, so an external thermal overload relay is not required for single motor operation.

The electronic thermal overload function estimates motor temperature, based on VFD output current, frequency and time to protect the motor from overheating. This time is based on a “hot start” for the motor. ***See Figure 5-27***. When the thermal overload fault is activated, an “OL1” trip occurs, shutting OFF the VFD output and preventing excessive overheating in the motor. As long as the VFD is powered up, it continues to calculate the motor temperature.

When operating several motors with one VFD, use the internal thermal protection from the motor in accordance with NEC 430.126 (c) or install an external thermal overload relay on each motor and disable the motor overload protection, L01.01 = “00”.

Parameter	Name	Function	Range	Default
L01.01	Motor Overload Fault Select	Enable/disable motor overload detection.	00–03	03
	00 Disabled	Disables the motor thermal overload protection		
	01 Standard Fan Cooled	Selects a motor with limited cooling capability below rated (base) speed when running at 100% load. The OL1 function derates the motor any time it is running below base speed.		
	02 Standard Blower Cooled	Selects a motor capable of cooling itself over a 10:1 speed range when running at 100% load. The OL1 function derates the motor when it is running at 1/10th of its rated (base) speed or less.		
	03 Vector Motor	Selects a motor capable of cooling itself at any speed when running at 100% load. Includes zero speed. The OL1 function does not derate the motor at any speed.		
L01.02	Motor Overload Time Const	Time for OL1 fault when motor current is ≥ 150% of the motor rated current. Hot start. ***See Figure 5-27***.	0.1–5.0 min	1.0

Parameter	Name	Function	Range	Default
L01.03	Motor Overheat Alarm Selection	Operation when the motor temperature analog input exceeds the OH3 alarm level. (1.17V) (H03.02 or 10 = 0E)	00–04	03
	00 Decel to Stop			
	01 Coast to Stop			
	02 Fast Stop by B05.08			
	03 Alarm Only (OH3 Flashes)			
	04 Stop by B03.03 Method			
L01.04	Motor Overheat Fault Selection	Operation when the motor temperature analog input exceeds the OH4 fault level. (2.34V) (H03.02 or 10 = 0E)	00–03	03
	00 Decel to Stop			
	01 Coast to Stop			
	02 Fast Stop by B05.08			
	03 Stop by B03.03 method			
L01.05	Motor Temp Filter	Motor temperature analog input filter time constant	0.00–10.00sec	0.20
L01.13	Overload Operation Selection	Determines whether or not to hold the Electrothermal value when power is interrupted	00–01	01
	00 Disable			
	01 Enable			

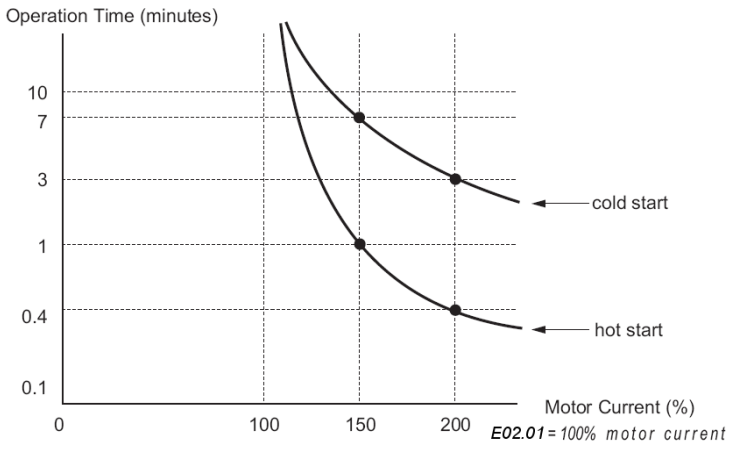


Figure 5-27: Motor Protection Operation Time

5.7.2 Power Loss Ride Thru

Parameter	Name	Function	Range	Default
L02.01	Power-Loss Selection	Enables/disables the Power Loss Ride Thru function	00–02	00
	00 Disable	Disabled		
	01 Enable	VFD will restart if power returns within L02.02		
	02 CPU Power Active	VFD will restart if power returns before CPU shutdown		
L02.02	Power-Loss Ride Thru Time	Time in which power has to return before a UV fault occurs	0.0–25.5 sec	Varies
L02.03	Power-Loss BaseBlock Time	Output turn on delay after power resumes	0.1–5.0 sec	Varies
L02.04	Power-Loss V/F Ramp Time	Voltage recovery time after speed search is complete	0.0–5.0 sec	Varies
L02.05	PUV Detection Level	Under voltage fault detection level	150–210 VDC 300–420 VDC	190/380
L02.07	Power-Loss Ride Thru Accel	Acceleration time after a Power Loss Ride Thru	0.0–25.5	0.0

5.7.3 Stall Prevention

CAUTION

This function automatically adjusts the output frequency, acceleration and/or deceleration rates in order to continue operation without tripping or “stalling” the motor.

Parameter	Name	Function	Range	Default
L03.01	Stall Prevention Accel Select	Stall prevention during acceleration.	00–02	01
	00 Disable	***See Table 5-7 on page 109***		
	01 General Purpose	***See Table 5-7 on page 109***		
	02 Intelligent	***See Table 5-7 on page 109***		

Table 5-7: Stall Prevention Accel Selection

Setting	Description
00 Disable	Stall prevention/current limit during acceleration is disabled. The VFD increases the output frequency at the set acceleration rate. If the acceleration rate is too fast for the load condition, the VFD may trip on overcurrent (OC) or overload (OL).
01 General Purpose	Stall prevention/current limit during acceleration is enabled (factory default). The acceleration rate is automatically extended according to motor current to prevent stalling during acceleration. The acceleration time may be longer than the set value (B05.01).
02 Intelligent	Stall prevention/current limit during acceleration is enabled with an intelligent acceleration mode. By monitoring motor current, the acceleration is the shortest amount of time, regardless of the set acceleration time.

Parameter	Name	Function	Range	Default
L03.02	Stall Prevention Accel Level	Stall prevention level during acceleration.	0–150%	150

The stall prevention/current limit level during acceleration is set as a percentage of VFD rated current. Setting L03.01 = 00 disables current limit during acceleration. During acceleration, if the output current exceeds this current limit level (L03.02), acceleration stops and frequency is maintained. When the output current decreases below this current level (L03.02), acceleration restarts. ***See Figure 5-28***.

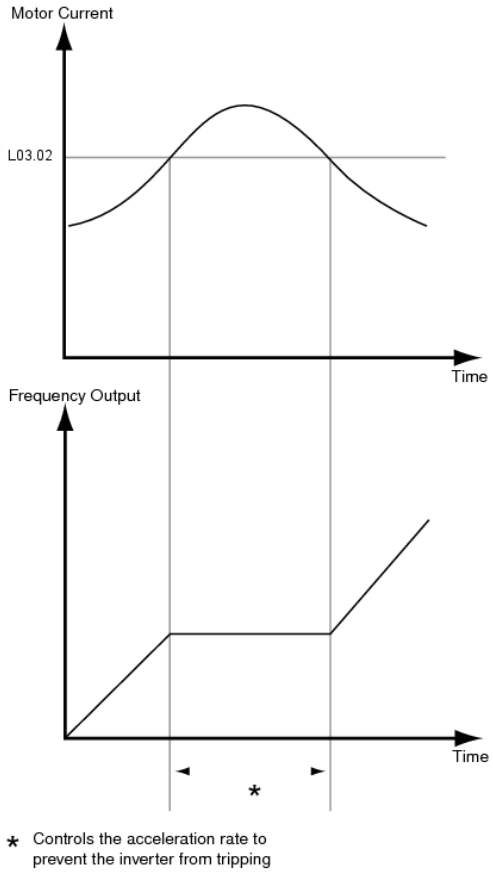


Figure 5-28: Stall Prevention/Current Limit During Acceleration

Parameter	Name	Function	Range	Default
L03.03	Stall Prevention Constant HP Limit	Stall prevention limit	0–100%	50

When a motor is run above rated speed (E01.06), the output characteristics change from constant torque to constant HP (see Figure 5-29). During acceleration above rated speed, the stall prevention current limit level is automatically reduced for smoother acceleration. The parameters (L03.02 and L03.03) limit the stall prevention current limit level in this region. The current limit during acceleration is changed according to the following equation:

$$\text{Current Limit Level During Accel in Constant Output Area} = \text{Current Limit Level During Acceleration (L03.02)} \times \frac{\text{Max Voltage Output Frequency (E01.06)}}{\text{Output Frequency}}$$

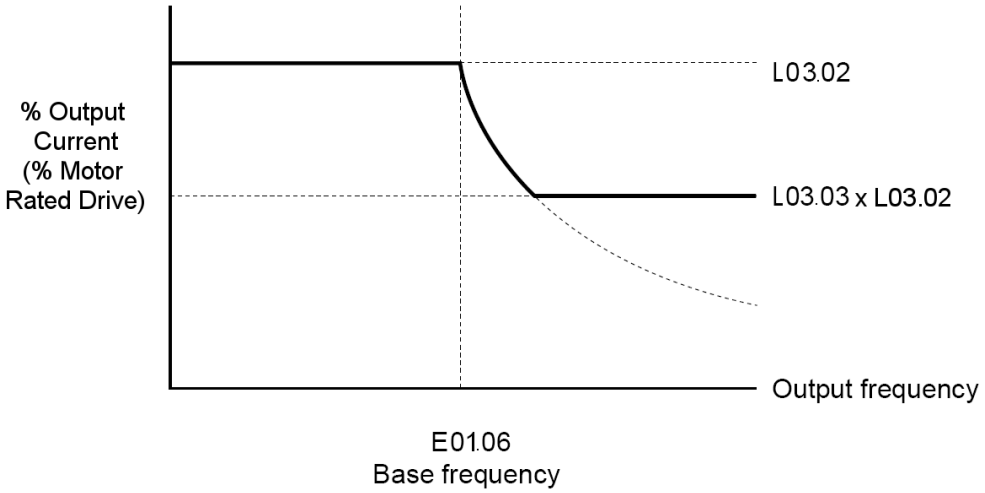


Figure 5-29: Stall Prevention Constant HP Limit

CAUTION

This function automatically adjusts the output frequency, acceleration and/or deceleration rates in order to continue operation without tripping or “stalling” the motor.

Parameter	Name	Function	Range	Default
L03.05	Stall Prevention Run Select	Enable/Disable stall prevention during running	00–02	01
	00 Disable	***See Table 5-8 on page 111***		
	01 Decel Time 1	***See Table 5-8 on page 111***		
	02 Decel Time 2	***See Table 5-8 on page 111***		

Sets a function to prevent stalling during an overload condition while running at constant speed.

Table 5-8: Stall Prevention Run Selection

Setting	Description
00 Disable	Stall prevention/current limit during running is disabled.
01 Decel Time 1	Stall prevention/current limit during running is enabled (factory default). When the VFD output current exceeds the current limit level (L03.06) for more than 100ms during speed agree, the output frequency is decreased according to deceleration time 1 (B05.02). This can help prevent stalling. When the load condition is stabilized, the VFD accelerates to the previous frequency.
02 Decel Time 2	Stall prevention/current limit running is enabled as in setting “01”, however the output frequency is decreased according to deceleration time 2 (B05.04).

Parameter	Name	Function	Range	Default
L03.06	Stall Prevention Run Level	Stall prevention level during run.	30–150%	150

The stall prevention/current limit level during running is set as a percentage of VFD rated current. A setting of L03.05 = 00 disables current limit during running. During speed agree, if the output current exceeds this current limit level (*L03.06*) during running, deceleration starts. When the output current decreases below this current limit level (*L03.06*), acceleration starts, up to the set frequency. ***See Figure 5-30***.

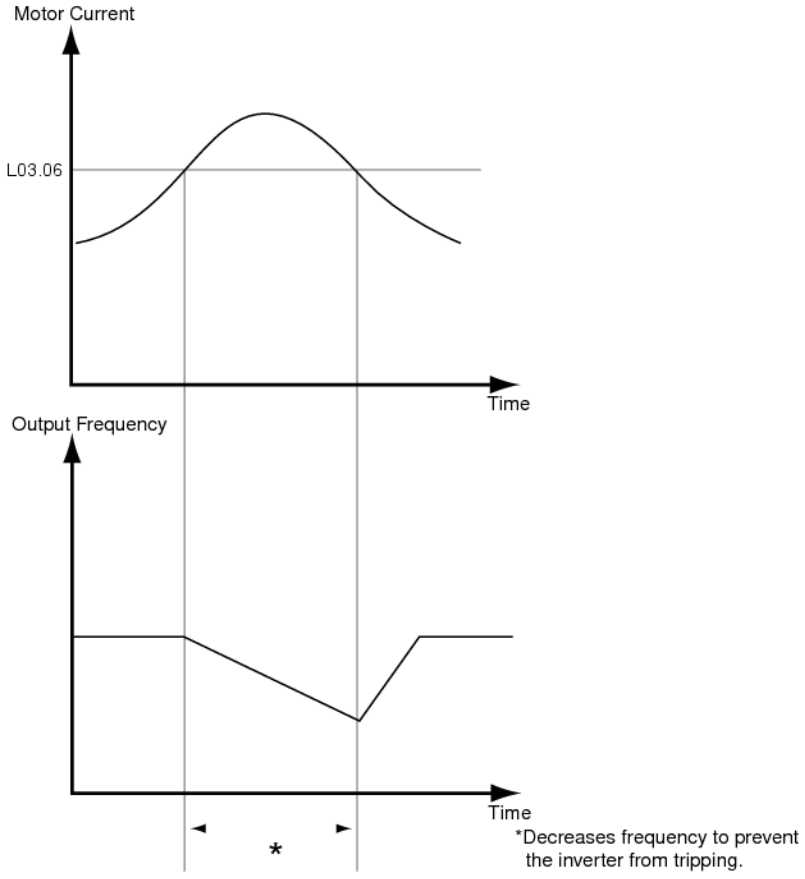


Figure 5-30: Stall Prevention/Current Limit During Running

Parameter	Name	Function	Range	Default
L03.17	Overvoltage Suppression and Stall Prevention	Sets the desired value for the DC bus voltage during overvoltage suppression and Stall Prevention during deceleration.	150–400 VDC	370
L03.23	Automatic Reduction Selection for Stall Prevention during Run	Automatic Reduction Selection for Stall Prevention during Run *00 Sets the Stall Prevention level throughout the entire frequency range to the value in parameter L03.06* *01 Automatically lowers the Stall Prevention level in the constant output range. The lower limit value is 40% of L03.06*	00, 01	00
L03.24	Motor Acceleration Time for Inertia Calculations	Sets the time needed to accelerate the uncoupled motor at rated torque from stop to the maximum frequency. Setting the VFD capacity to parameter O02.04 or changing E02.11 will automatically set this parameter for a 4-pole motor.	0.001–10.000 sec	Depends on O02.04
L03.25	Load Inertia Ratio	Sets the ratio between the connected machinery and the motor	0.0–1000.0	1.0

5.7.4 Reference Detection

Speed Agree 1

- When enabled using MFDO “H02.xx = 2", the contact closes when the output frequency (U01.02) is equal to the frequency reference (U01.01) plus or minus the speed agree detection width (L04.02).
  - *U01.02 = (U01.01 ± L04.02)*
- When enabled using MFDO “H02.xx = 3”, the contact closes when the output frequency (U01.02) is equal to the speed agree detection level (L04.01) plus or minus the speed agree detection width (L04.02).
  - *U01.02 = (L04.01 ± L04.02)*

Speed Agree 2

- When enabled using MFDO “H02.xx = 13”, the contact closes when the output frequency (U01.02) is equal to the frequency reference (U01.01) plus or minus the speed agree detection width (L04.04).
  - *U01.02 = (U01.01 ± L04.04)*
- When enabled using MFDO “H02.xx = 14”, the contact closes when output frequency (U01.02) is equal to the speed agree detection level (L04.03) plus or minus the speed agree detection width (L04.04).
  - *U01.02 = (L04.03 ± L04.04)*

Frequency Detect

When Frequency Detect is enabled using MFDO “H02.xx = 4":

- Contact closes at start.
- Contact opens when accelerating: U01.02 ≥ (L04.01 + L04.02).
- Contact closes again when decelerating: U01.02 < L04.01.

When Frequency Detect is enabled using MFDO “H02.xx = 5":

- Contact opens at start.
- Contact closes when accelerating: U01.02 ≥ L04.01.
- Contact opens again when decelerating: U01.02 < (L04.01 - L04.02).

NOTE: *If L04.01 or L04.03 is set below 5 Hz, the DC Injection Start Frequency (D01.01) and Speed Agree Widths (L04.02/L04.04) may need to be adjusted lower in order for the VFD to recognize runs properly.*

Parameter	Name	Function	Range	Default
L04.01	Speed Agree Level	Sets the detection level for the desired speed agree 1 and frequency detection functions. The detection level is effective during both FWD and REV operation.	0.0–150.0 Hz	0.0
L04.02	Speed Agree Width	Sets the detection width for speed agree 1 and frequency detection functions.	0.0–20.0 Hz	2.0
L04.03	Speed Agree Level ±	Sets the detection level for the desired speed agree 2 function. The detection level is effective during either FWD or REV operation, depending on the set detection level (positive value for FWD operation, negative value for REV operation).	-150.0–150.0 Hz	0.0
L04.04	Speed Agree Width ±	Sets the detection width for the speed agree 2 function.	0.0–20.0 Hz	2.0
L04.07	Speed Agree Detection *00 No detection during baseblock* *01 Detection always enabled*	Sets the detection level during baseblock	00, 01	00

5.7.5 Torque Detection

The overtorque detection circuit activates when the motor load causes the motor current to exceed the overtorque detection level (L06.02). When an overtorque condition is detected, alarm signals will be shown on the keypad as well, and can be sent to a multi-function digital output. To output an overtorque detection signal, select torque detection 1 at either of the multi-function digital outputs (H02.xx = “00B,” “017,” “10B,” or “117”).

Parameter	Name	Function	Range	Default
L06.01	Torque Detect 1 Select	Activates overtorque/undertorque detection and selects whether detection generates an alarm or a fault	00–08	00
	00 Disable			
	01 Overtorque At Speed Agree (Alarm)			
	02 Overtorque At Run (Alarm)			
	03 Overtorque At Speed Agree (Fault)			
	04 Overtorque At Run (Fault)			
	05 UT At Speed Agree (Alarm)			
	06 UT At Run (Alarm)			
	07 UT At Speed Agree (Fault)			
	08 UT At Run (Fault)			

Table 5-9: Torque Detection 1 Selection Definition

Setting	Description
00	Torque detection is disabled (*default*).
01	Overtorque detection is enabled whenever at the speed agree level (when VFD is not accelerating or decelerating). Continue running after detection (OT1 alarm).
02	Overtorque detection is enabled always. Continue running after detection (OT1 alarm).
03	Overtorque detection is enabled whenever at the speed agree level. Coast to a stop after detection (OT1 fault).
04	Overtorque detection is enabled always. Coast to a stop after detection (OT1 fault).
05	Undertorque detection is enabled whenever at the speed agree level (when VFD is not accelerating or decelerating). Continue running after detection (UT1 alarm).
06	Undertorque detection is enabled always. Continuing running after detection (UT1 alarm).
07	Undertorque detection is enabled whenever at the speed agree level. Coast to a stop after detection (UT1 fault).
08	Undertorque detection is enabled always. Coast to stop after detection (UT1 fault)

NOTE:

- *To detect overtorque/undertorque during acceleration or deceleration, set to “02” or “04” / “06” or “08”.*
- *To continue operation after overtorque/undertorque detection, set to “01” or “02” / “05” or “06”. During detection, the keypad displays an “OT1/UT1” alarm (blinking).*
- *To stop after an OT1 or UT1 fault, set to “03” or “04” / “07” or “08”. During detection, the keypad displays an “OT1/UT1” fault.*

Parameter	Name	Function	Range	Default
L06.02	Torque Detection 1 Level	Sets the overtorque detection as a percentage of VFD rated current, during V/f control, and motor rated torque during vector control.	0–300%	150
L06.03	Torque Detection 1 Time	The overtorque detection delay time inserts a delay, between the time motor current (or torque) exceeds the overtorque level (L06.02) and when the overtorque detection function is enabled. The keypad then displays “OT1”.	0.0–10.0 sec	0.1
L06.04	Torque Detection 2 Select	Activates overtorque/undertorque detection, and selects whether detection generates an alarm or a fault.	00–08	00
	00 Disable			
	01 Overtorque At Speed Agree (Alarm)			
	02 Overtorque At Run (Alarm)			
	03 Overtorque At Speed Agree (Fault)			
	04 Overtorque At Run (Fault)			
	05 UT At Speed Agree (Alarm)			
	06 UT At Run (Alarm)			
	07 UT At Speed Agree (Fault)			
	08 UT At Run (Fault)			

Table 5-10: Torque Detection 1 Selection Definition

Setting	Description
00	Torque detection is disabled (*default*).
01	Overtorque detection is enabled whenever at the speed agree level (when VFD is not accelerating or decelerating). Continue running after detection (OT1 alarm).
02	Overtorque detection is enabled always. Continue running after detection (OT1 alarm).
03	Overtorque detection is enabled whenever at the speed agree level. Coast to a stop after detection (OT1 fault).
04	Overtorque detection is enabled always. Coast to a stop after detection (OT1 fault).
05	Undertorque detection is enabled whenever at the speed agree level (when VFD is not accelerating or decelerating). Continue running after detection (UT1 alarm).
06	Undertorque detection is enabled always. Continuing running after detection (UT1 alarm).
07	Undertorque detection is enabled whenever at the speed agree level. Coast to a stop after detection (UT1 fault).
08	Undertorque detection is enabled always. Coast to stop after detection (UT1 fault)

Overtorque detection 2 functions the same as overtorque/undertorque detection 1 (*L06.01*), except that “OT2/UT2” is displayed on the keypad instead.

Parameter	Name	Function	Range	Default
L06.05	Torque Detection 2 Level	Torque Detection 2 Level	0–300%	150
L06.06	Torque Detection 2 Time	Torque Detection 2 Time	0.0–10.0 sec	0.1
L06.08	Mechanical Weakening Detection Selection *00 Disabled* *01 Speed (signed) > L06.09; Continue Running (Alarm)* *02 Speed (unsigned) > L06.09; Continue Running (Alarm)* *03 Speed (signed) > L06.09; Stop (Protection)* *04 Speed (unsigned) > L06.09; Stop (Protection)* *05 Speed (signed) < L06.09; Continue Running (Alarm)* *06 Speed (unsigned) < L06.09; Continue Running (Alarm)* *07 Speed (signed) < L06.09; Stop (Protection)* *08 Speed (unsigned) < L06.09; Stop (Protection)*	Determines the action to take during and after detection	00–08	00
L06.09	Mechanical Weakening Detection Speed Level	Sets the speed for Load Weakening Detection	-110.0–110.0%	110.0
L06.10	Mechanical Weakening Detection Time	Sets the time required for Mechanical Weakening to be detected before triggering parameter L06.08.	0.0–10.0 sec	0.1
L06.11	Mechanical Weakening Detection Start Time	Mechanical Weakening Detection is triggered when the cumulative operation time exceeds U04.01.	0–65535 hr	0

5.7.6 Hardware Protection

The IMPULSE®•G+ Mini comes equipped with a number of built-in functions designed to protect itself and its components from damage.

Parameter	Name	Function	Range	Default
L08.02	OH Pre-Alarm Level	Sets the heatsink temperature level for protection against overheat (OH). ***NOTE:*** *The VFD measures heatsink temperature by a negative temperature coefficient thermistor.*	50–130°C	95°
L08.03	OH Pre-Alarm Selection	Selects the stopping method when heatsink overheat is detected.	00–05	05
	00 Decel to Stop	(Decel to stop using B05.02)		
	01 Coast to Stop	(Immediate stop)		
	02 Fast-Stop	(Decel to stop using B05.08)		
	03 Use B03.03 Method	Uses programmed B03.03 Method		
	04 Alarm Only	(Operation continues and “OH Heatsink Overtemp” is displayed on keypad)		
	05 Derated Operation	Operation continues, but derates the frequency based on L08.19		
L08.05	Input Phase Loss Selection	Input phase loss detection	00, 01	01
	00 Disabled			
	01 Enabled			
L08.06	Input Phase Detection Level	Input phase loss detection level ***NOTE:*** *Increasing L08.06 level from default may cause DB Bus Capacitor Failure.*	0.0–50.0%	5.0
L08.07	Output Phase Loss Selection	Output phase loss detection	00–02	01
	00 Disabled			
	01 1PH Loss Det			
	02 2/3PH Loss Det			
L08.08	Output Phase Loss Detection Level	Output Phase Loss Detection Level	0.0–20.0%	5.0
L08.09	Ground Fault Detect	Enables/disables ground fault detection	00, 01	01*
	00 Disabled			
	01 Enabled			
L08.10	Fan Operation Selection	Cooling fan operation select	00, 01	00
	00 Fan On-Run Mode	Fan will operate (L08.11) seconds after Run Command is removed		
	01 Fan Always On			
L08.11	Fan Off-Delay Time	Fan delay time	0–300 sec	60
L08.12	Ambient Temp	Adjusts Overload (OL2) Protection for high ambients	-10–50°C	40°

** Value depends on VFD model*

Parameter	Name	Function	Range	Default
L08.15	OL2 Sel @ Low Spd	Enables/disables OL when output frequency ≤ 6 Hz	00, 01	01
	00 Disabled	***NOTE:** Setting depends on D10.02*		
	01 Enabled			
L08.18	Soft CLA Sel	Enables/disables the software current limit function. Limits output frequency when current exceeds 110% of rated.	00–01	01
	00 Disabled			
	01 Enabled			
L08.19	Overheat Pre-Alarm Frequency Reduction Rate	Specifies the frequency reference reduction gain at overheat pre-alarm when L08.03 = 4.	0.1–0.9%	0.8
L08.35	Mounting Selection	Mounting selection	00–03	00
	00 Open Chassis			
	01 Side-by-Side			
	02 NEMA 1			
	03 Finless			
L08.41	High Current Alarm Selection	High current alarm selection	00–01	00
	00 Disable			
	01 Enable			

** Value depends on VFD model*

5.7.7 Automatic Fault Reset

When a fault occurs during operation, the IMPULSE®•G+ Mini can be programmed to automatically reset the fault and restart operation.

Parameter	Name	Function	Range	Default
L09.01	Auto Reset Select *00 Disabled* *01 Enabled*	Activates the fault auto-reset function.	00, 01	01
L09.02	Auto Reset Attempts	Sets the number of reset attempts. Reset attempt counter is returned to zero if no faults occur within a ten minute period.	00–10	03
L09.03	Auto Reset Time	Sets the reset starting time	0.5–180.0 sec	0.5
L09.04*	Auto Reset Flt Sel 1	Reset Fault Select 1.	0000–FFFF	0001
L09.05*	Auto Reset Flt Sel 2	Reset Fault Select 2.	0000–FFFF	E000
L09.06	Output Contact (MC-MB-MA) Select *00 No Fault Relay* *01 Fault Relay active*	Fault contact operation during reset attempts	00, 01	01

** To program L09.04 and L09.05, refer to the example on the following page and follow steps 1 through 4:*

1. Assign a "1" to each fault code that you wish to enable the auto reset.

2. Assign a "0" to each fault code that you wish to disable the auto reset.

3. Convert all digits (1 to 4) from binary to hex.

4. Program L09.04 and L09.05 by entering the hex number obtained from step 3.

Example:

Enable auto-reset for UV1, BE1, BE2, COF, UV2, and CE faults.

Table 5-11: Auto Reset Table (default)

	Digit 4				Digit 3				Digit 2				Digit 1			
HEX	0				0				0				1			
Binary	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
L09.04	EF0	-	-	-	LF	PF	UT1	--	OH1	SC	OV	GF	OC	UV3	UV2	UV1
HEX	E				0				0				0			
Binary	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
L09.05	BE1	BE2	COF	FBL	OL1	OL2	OT1	OT2	CE	CALL	-	EF7	EF6	EF5	EF4	EF3

Table 5-12: Auto Reset Table with UV2 and CE Fault (modified)

	Digit 4				Digit 3				Digit 2				Digit 1			
HEX	0				0				0				3			
Binary	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
L09.04	E F 0	- - -	- - -	- - -	L F	P F	U T 1	- - -	O H 1	S C	O V	G F	O C	U V 3	U V 2	U V 1
HEX	E				0				8				0			
Binary	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0
L09.05	B E 1	B E 2	C O F	F B L	O L 1	O L 2	O T 1	O T 2	C E	C A L L	- - -	E F 7	E F 6	E F 5	E F 4	E F 3

1. Place a “1” above UV1, UV2, BE1, BE2, COF, and CE faults.
2. Convert binary to hexadecimal using ***Table 5-13*** for each digit.
3. Set L09.04 = 0003 to enable UV2 and UV1 from ***Table 5-12***.
4. Set L09.05 = E080 to enable BE1, BE2, CoF, and CE from ***Table 5-12***.

Table 5-14: UV2 Example

L09.04	Binary	HEX
Digit 4	0000	0
Digit 3	0000	0
Digit 2	0000	0
Digit 1	0011	3

Table 5-15: CE Example

L09.05	Binary	HEX
Digit 4	1110	E
Digit 3	0000	0
Digit 2	1000	8
Digit 1	0000	0

Table 5-13: Binary to Hexadecimal Conversion

Binary Number	Hexadecimal Number
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

5.8 Motor Tuning

- N2 Automatic Frequency Regulator Tuning (OLV Only)
- N6 Online Tuning

5.8.1 Automatic Frequency Regulator Tuning (OLV Only)

The Automatic Frequency Regulator (AFR) is used to achieve stability when a load is suddenly applied or removed by calculating changes in the torque current feedback, and adjusting the output frequency accordingly.

If the system is hunting, increase the OLV Stabilization Level (N02.05) by one until the load stabilizes. Both D03.02 and N02.02 will be incremented or decremented accordingly. ***See Table 5-16 on page 122***.

Parameter	Name	Function	Range	Default
N02.01	Automatic Frequency Regulator (AFR) Tuning	Automatic Frequency Regulator (AFR) Tuning	0.00–10.00	1.00
N02.02	AFR Detection Time	AFR Detection Time	0–2000ms	150
N02.03	AFR Time Constant	AFR Time Constant	0–2000ms	750
N02.05	OLV Stabilization Level	Sets the stabilization for OLV control	00–11, FF	08

Table 5-16: OLV Stabilization Table

Control Method (A01.02)	OLV Stabilization Level (N02.05)	Torq. Comp Time (D03.02)	AFR Time (N02.02)	Independent setting of D03.02 & N02.02
2 (OLV)	00 (default)	20	50	No
	01	25	63	No
	02	30	75	No
	03	35	88	No
	04	40	100	No
	05	45	113	No
	06	50	125	No
	07	55	138	No
	08	60	150	No
	09	65	163	No
	0A	70	175	No
	0B	75	188	No
	0C	80	200	No
	0D	85	213	No
	0E	90	225	No
	0F	95	238	No
	10	100	250	No
	11	105	263	No
	FF	Note 1	Note 1	Yes

NOTE 1: *If N02.05 = FF, the values that were in D03.02 & N02.02 will be retained.*

When N02.05 = FF, use the following equation to determine the new N02.02 value:

$$N02.02_{(new)} = \left(\frac{D03.02_{(new)}}{D03.02_{(default)}} \right) x N02.02_{(default)}$$

NOTE: *If the motor is hunting, increase the value of N02.05 per the table to stabilize the load.*

CAUTION

Increasing the value of N02.05 too high may result in the motor not developing enough torque to lift the load.

5.8.2 Online Tuning

Parameter	Name	Function	Range	Default
N06.01	Line-to-Line Motor Tuning Selection	Line-to-Line Motor Tuning	00–01	01
	00 Disabled			
	01 Enabled			

5.9 Keypad Parameters and Monitors

The keypad parameters give the ability to show a variety of information such as frequency reference, motor current, input and output terminal status, along with fault trace information. Information displayed can be customized to meet your crane and hoist application. Below is a list of parameters covered in this section.

- O1 Monitor Selection
- O2 Keypad Key Selection
- O3 Clear History
- U1 Monitor
- U2 Fault Trace
- U3 Fault History
- U4 Maintenance
- U6 Motor Control Monitor

5.9.1 Monitor Selection

The home level of the keypad allows the viewing of four monitor variables. They are Fref, Fout, Iout, and User-Selected monitor. This user-selected monitor can be selected from the following table.

Parameter	Name	Function	Range	Default
O01.01	User Monitor Selection	Assigns one of the following monitor parameters to be displayed upon power-up. For example, set O01.01 = 403 to display U04.03.	104–621	106
	104 Control Method			
	105 Motor Speed - OLV ONLY			
	106 Output Voltage			
	107 DC Bus Voltage			
	108 Output Power			
	109 Torque Reference - OLV ONLY			
	110 Input Terminal Status			
	111 Output Terminal Status			
	112 Operation Status			
	113 Elapsed Time			
	114 FLASH ID			
	115 Terminal A1 level			
	116 Terminal A2 level			
	120 Output Frequency After Soft Start			
	128 CPU ID			
	134 OPE Detected			
	139 Modbus Comm Error Code			
	152 Maintenance Timer			
	154 Input Pulse Monitor			
	401 Cumulative Operation Time			

Parameter	Name	Function	Range	Default
	403 Cooling Fan Operation Time			
	404 Cooling Fan Maintenance			
	405 Capacitor Maintenance			
	406 Soft Charge Bypass Relay Maintenance			
	407 IGBT Maintenance			
	408 Heatsink Temperature			
	410 kWh; Lower 4 Digits			
	411 kWh; Upper 5 Digits			
	412 CPU Resources Used			
	413 Peak Hold Current			
	414 Peak Hold Output Frequency			
	416 Motor Overload (oL1) Detection Level			
	417 VFD Overload (oL2) Detection Level			
	418 Frequency Reference Source Selection			
	419 Frequency Reference Modbus			
	420 Output Frequency Reference (decimal)			
	421 Run Command Selection Results			
	422 Modbus Communication Reference			
	423 Not Used			
	601 Motor Secondary Current (Iq)			
	602 Motor Excitation Current (Id) - OLV ONLY			
	605 Output Voltage Reference (Vq) - OLV ONLY			
	606 Output Voltage Reference (Vd) - OLV ONLY			
	607 ACR (q) Output - OLV ONLY			
	608 ACR (d) Output - OLV ONLY			
	620 Frequency Reference Bias (Up/Down 2)			
	621 Offset Frequency			
O01.02	Power-On Monitor	Selects the monitor to be displayed on the keypad immediately after the power supply is turned on.	01–05	03
	01 Frequency Reference (U01.01)			
	02 Forward/Reverse			
	03 Output Frequency (U01.02)			
	04 Output Current (U01.03)			
	05 User Monitor (O01.01)			

Parameter	Name	Function	Range	Default
O01.03	Display Scaling	Units for parameters and monitor related to frequency reference and output frequency can be scaled as shown below	00–03	00
	00 0.01 Hz			
	01 0.01%			
	02 r/min			
	03 User-set			
O01.10	User-set Display Maximum Units	Sets maximum when operating at maximum output frequency	00000–60000	06000
O01.11	User-set Display Decimal	Sets user display decimal point	00–03	02
	00 No Decimal Point			
	01 01			
	02 0.01			
	03 0.001			

5.9.2 Keypad Key Selection

Parameter	Name	Function	Range	Default
O02.01	Local/Remote Key	Sets Local/Remote Key Operation	00–01	00
	00 Disable			
	01 Enable			
O02.02	Stop Key Operation	Sets Stop key Operation	00–02	00
	00 Coast to Stop			
	01 Decel to Stop			
	02 Use B03.03 Stopping Method			
O02.03	User Defaults	Sets/Clears User Defaults	00–02	00
	00 No Change			
	01 Set Defaults			
	02 Clear All			
O02.04	kVA Selection	Determines the model number of the VFD, which is based on the kVA rating. The following are Magnetek model numbers. *Initial value determined by VFD model.	61-9D	*
	61 2A0002	2001-G+M		
	62 2A0004	2003-G+M		
	63 2A0006	2005-G+M		
	65 2A0010	2008-G+M		
	66 2A0012	2011-G+M		
	68 2A0020	2017-G+M		
	6A 2A0030	2025-G+M		
	6B 2A0040	2033-G+M		

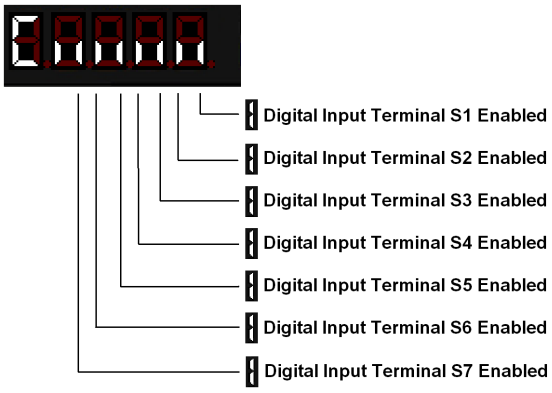
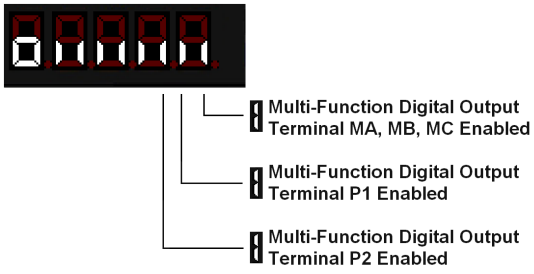
Parameter	Name	Function	Range	Default
	6D 2A0056	2047-G+M		
	6E 2A0069	2060-G+M		
	91 4A0001	4001-G+M		
	92 4A0002	4002-G+M		
	93 4A0004	4003-G+M		
	94 4A0005	4004-G+M		
	95 4A0007	4005-G+M		
	96 4A0009	4007-G+M		
	97 4A0011	4009-G+M		
	99 4A0018	4014-G+M		
	9A 4A0023	4018-G+M		
	9C 4A0031	4024-G+M		
	9D 4A0038	4031-G+M		
O02.05	Keypad M.O.P.	Selects whether the ENTER key is used when the frequency reference is set by the keypad. The keypad can simulate a motor operated potentiometer (M.O.P.) by setting this parameter.	00, 01	00
	00 Disabled	ENTER Key Required	Note: This feature cannot be used in conjunction with infinitely variable speed control.	
	01 Enabled	ENTER Key Not Required		
O02.07	Motor Direction at Power-Up	Sets direction of motor at power-up.	00, 01	00
	00 Forward			
	01 Reverse			
O02.09	Initialization Selection	Sets the VFD region. This presets the voltage and frequencies along with the motor power units that are common to the region.	01~02	01
	01 American Spec			
	02 European Spec			
O02.10	Motor Power Units	Sets the units for motor power	00~01	00
	00 HP			
	01 kW			

5.9.3 Clear History

Parameter	Name	Function	Range	Default
O03.01	Elapsed Time Setting	Accumulated operation time displayed in monitor U04.01.	0000–9999hr	0000
O03.02	Elapsed Time Selection *00 Power On Time* *01 Running Time*	Selects how the Elapsed Time is accumulated	00, 01	01
O03.03	Fan ON Time Set	Sets the value of the Fan Operation Time monitor (U04.03) in units of 10 hours. A setting of 30 = 300 hours	0000–9999 x 10hr	0000
O03.05	Capacitor Maintenance Setting	DC Bus Capacitors maintenance time displayed in U04.05 as a percentage of the total expected performance life.	000–150%	000
O03.07	Pre-Charge Relay Maintenance Setting	Pre-Charge Relay maintenance time displayed in U04.06 as a percentage of the total expected performance life.	000–150%	000
O03.09	IGBT Maintenance Setting	IGBT maintenance time displayed in U04.07 as a percentage of the total expected performance life.	000–150%	000
O03.11	Fault Trace Clear *00 Not Cleared* *01 Clear U2/U3*	Clears Fault History	00, 01	00
O03.12	kWh Monitor Initial Value Selection *00 No Reset* *01 Reset*	Sets kWh Monitor Initial Value	00, 01	00
O03.14	Clear Count History *00 Not Clear* *01 Reset Runs* *02 Clear OL/LC Count* *03 Clear Both Counts*	Clears count history	00–03	00

5.9.4 Monitors

Table 5-17: Monitor

Monitor	Name	Function	Units
U01.01	Frequency Reference	Frequency Reference	Hz
U01.02	Output Frequency	VFD Output Frequency	Hz
U01.03	Output Current	VFD Output Current	A
U01.04	Control Method	Displays the value of A01.02	-
U01.05	Motor Speed	Motor Speed (OLV only)	Hz
U01.06	Output Voltage	VFD Output Voltage (Reference)	VAC
U01.07	DC Bus Voltage	DC Bus Voltage (Measured)	VDC
U01.08	Output Power	VFD Output Power (Calculated)	HP/kW
U01.09	Motor Torque	Motor Torque (OLV only)	%
U01.10	Input Terminal Status	Input Terminal Status 	-
U01.11	Output Terminal Status	Output Terminal Status 	-

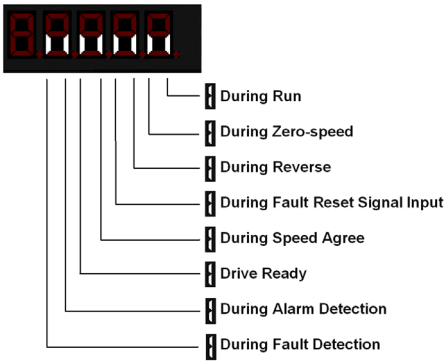
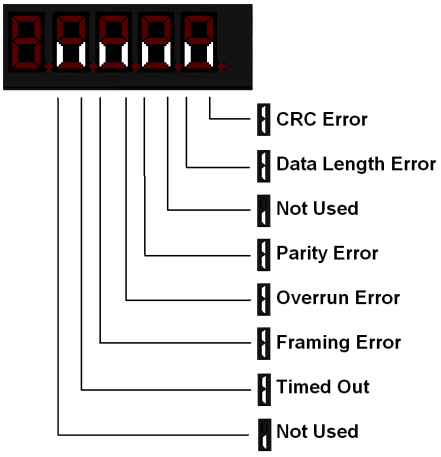
Monitor	Name	Function	Units
U01.12	VFD Control Status	Operation Status	-
			
U01.13	Elapsed Time	Cumulative VFD operation time. Defined by O03.02.	hr
U01.14	Flash ID	Firmware version	-
U01.15	Terminal A1 Level	Terminal A1 input level	V
U01.16	Terminal A2 Level	Terminal A2 input level	V/mA
U01.20	Output Frequency after Soft Start	Primary freq. after the SFS	Hz
U01.28	Software CPU	ROM ID	-
U01.34	OPE Detection Parameter	Parameter OPE detected	-
U01.39	Modbus Communication Error	Displays content of Modbus error	-
			
U01.52	Maintenance Timer	Hours since last timer reset.	hr
U01.54	Pulse Monitor	Displays the pulse train input RP frequency	Hz
U01.64	LC Zone	Displays the LC Zone the VFD is currently running in. If an LC Fault occurs, the value displayed will be which LC Zone the LC Fault occurred.	-
U01.65	LC Margin	Displays how close the current/torque levels are to the target value for each of the LC Zones. Values less than zero will cause an LC Detection and/or LC Fault to occur. If the LC Fault occurs, the value displayed will be the amount the level was below the LC Zone setting.	%

Table 5-18: Fault Trace

Monitor	Name	Function	Units
U02.01	Current Fault	Most recent fault detected before being reset	-
U02.02	Last Fault	Most recent fault after being reset (same as U03.01)	-
U02.03	Frequency Reference @ Fault	Freq ref when fault was detected	Hz
U02.04	Output Frequency @ Fault	Output freq when fault was detected	Hz
U02.05	Output Current @ Fault	Output current when fault was detected	A
U02.06	Motor Speed @ Fault (OLV Only)	Motor speed when fault was detected	Hz
U02.07	Output Voltage @ Fault	Output voltage when fault was detected	VAC
U02.08	DC Bus Voltage @ Fault	DC Bus voltage when fault was detected	VDC
U02.09	Output Power @ Fault	Output power when fault was detected	HP/kW
U02.11	Input Terminal Status @ Fault	Input terminal status when fault was detected	-
U02.12	Output Terminal Status @ Fault	Output terminal status when fault was detected	-
U02.13	Operation Status @ Fault	VFD status before fault was detected	-
U02.14	Elapsed Time @ Fault	Elapsed time when fault was detected	hr
U02.15	Speed Reference During Soft Start @ Fault	Speed reference during soft start at previous fault	%
U02.16	Motor q-Axis Current During Fault	Displays the q-axis current for the motor at the previous fault (U02.02).	%
U02.17	Motor d-Axis Current During Fault	Displays the d-axis current for the motor at the previous fault (U02.02).	%

Table 5-19: Fault History

Monitor	Name	Function	Units
U03.01	Last Fault	Displays most recent fault detected	-
U03.02	Fault Message 2	Displays second most recent fault	-
U03.03	Fault Message 3	Displays third most recent fault	-
U03.04	Fault Message 4	Displays fourth most recent fault	-
U03.05	Fault Message 5	Displays fifth most recent fault	-
U03.06	Fault Message 6	Displays sixth most recent fault	-
U03.07	Fault Message 7	Displays seventh most recent fault	-
U03.08	Fault Message 8	Displays eighth most recent fault	-
U03.09	Fault Message 9	Displays ninth most recent fault	-
U03.10	Fault Message 10	Displays tenth most recent fault	-
U03.11	Elapsed Time 1	Elapsed time of most recent fault	-
U03.12	Elapsed Time 2	Elapsed time of second most recent fault	-
U03.13	Elapsed Time 3	Elapsed time of third most recent fault	-
U03.14	Elapsed Time 4	Elapsed time of fourth most recent fault	-
U03.15	Elapsed Time 5	Elapsed time of fifth most recent fault	-
U03.16	Elapsed Time 6	Elapsed time of sixth most recent fault	-
U03.17	Elapsed Time 7	Elapsed time of seventh most recent fault	-
U03.18	Elapsed Time 8	Elapsed time of eighth most recent fault	-
U03.19	Elapsed Time 9	Elapsed time of ninth most recent fault	-
U03.20	Elapsed Time 10	Elapsed time of tenth most recent fault	-
U03.21	Accumulated Operations	Displays the number of FWD and REV commands	-
U03.22	U03.21 Rollovers	Increments when U03.21 reaches 9999. U03.21 is set to zero.	-
U03.23	Overload/Load Check Count	Displays the number of OL1, OL2 and LC faults	-

Table 5-20: Maintenance

Monitor	Name	Function	Units
U04.01	Elapsed Time	Cumulative VFD operation time. Defined by O03.02	hr
U04.03	Cooling Fan Operation Time	Cumulative operating time of cooling fan.	hr
U04.04	Cooling Fan Maintenance	Displays main cooling fan usage time in as a percentage of its expected performance life. (See O03.03)	%
U04.05	Capacitor Maintenance	Displays main circuit capacitor usage time in as a percentage of their expected performance life. (See O03.05)	%
U04.06	Pre-Charge Relay Maintenance	Displays the pre-charge relay maintenance time as a percentage of its estimated performance life. (See O03.07)	%
U04.07	IGBT Maintenance	Displays IGBT usage time as a percentage of the estimated performance life. (See O03.09)	%
U04.08	Heatsink Temperature	Displays the heatsink temperature.	°C
U04.09	LED Check	Lights all segments of the LED to verify that the display is working properly.	-
U04.10	kWh; Lower 4 Digits	Monitors the VFD output power. The value is shown as a 9 digit number displayed across two monitor parameters, U04.10 and U04.11.	kWh
U04.11	kWh; Upper 5 Digits	-	MWh
U04.12	CPU Resources Used	Displays the amount of space being used in the CPU.	-
U04.13	Peak Hold Current	Displays the highest current value that occurred during run.	-
U04.14	Peak Hold Output Frequency	Displays the output frequency when the current value shown in U04.13 occurred.	-
U04.16	Motor Overload (oL1) Detection Level	Shows the value of the motor overload detection accumulator. 100% is equal to the OL1 detection level. Accumulator is reset when VFD power is cycled.	-
U04.17	Motor Overload (oL2) Detection Level	100% = OL2 detection level.	-
U04.18	Frequency Reference Source Selection	Displays the source for the frequency reference as XY-nn.	-
U04.19	Frequency Reference Modbus	Displays the frequency reference provided by Modbus (decimal).	-
U04.20	Output Frequency Reference (decimal)	Displays the frequency reference input by an option card (decimal).	-
U04.21	Run Command Selection Results	Displays the source for the Run command as XY-nn.	-
U04.22	Modbus Communication Reference	Displays the VFD control data set by Modbus communications register no. 0001H as a four-digit hexadecimal number.	-
U04.23	Option Card Reference	Displays VFD control data set by an option card as a four-digit hexadecimal number.	-

Table 5-21: Motor Control Monitor

Monitor	Name	Function	Units
U06.01	Motor Secondary Current (Iq)	Displays the value of the motor secondary current (Iq). Motor rated secondary current is 100%.	%
U06.02	Motor Excitation Current (Id)	Displays the value calculated for the motor excitation current (Id). Motor rated secondary current is 100%.	%
U06.03	ASR Input	Displays the input value when using ASR control.	%
U06.04	ASR Output	Displays the output value when using ASR control.	%
U06.05	Output Voltage Reference (Vq)	Output voltage reference (Vq) for the q-axis.	V
U06.06	Output Voltage Reference (Vd)	Output voltage reference (Vd) for the d-axis.	V
U06.07	ACR (q) Output	Displays the output value for current control relative to motor secondary current (q-axis).	%
U06.08	ACR (d) Output	Displays the output value for current control relative to motor secondary current (d-axis).	%
U06.20	Frequency Reference Bias (Up/Down2)	Displays the bias value used to adjust the frequency reference.	%
U06.36	GAIA Communication Error	Count of communication errors by the GAIA. This monitor is cleared at power-down.	-
U06.37	LUNA Communication Error	Count of communication errors by the GAIA. This monitor is cleared at power-down.	-
U06.38	Option Card Error	Count of communication errors between VFD and option card. This monitor is cleared at power-down.	-

6 Troubleshooting

6.1 Maintenance, Faults, and Alarms

In this troubleshooting section, “check” means investigating whether an item is functioning and in an acceptable physical condition, and then taking corrective action (adjusting, fixing, replacing, etc.) as necessary. In the Corrective Action column, you may not have to perform all of the steps to correct the problem.

6.1.1 Maintenance and Inspection

This section describes basic maintenance and inspection procedures for the IMPULSE®•G+ Mini.

Component	Check	Corrective Action
External terminals, connectors, mounting screws, etc.	Loose screws or connectors	Securely tighten.
Heatsink	Build-up of dust and dirt	Blow with dry, compressed air (57-86 psi).
Printed Circuit Board (PCB)	Accumulation of conductive dust or oil	Blow with dry, compressed air (57-86 psi). If dust and oil cannot be removed, replace the board.
Cooling Fan	Abnormal noise and vibration	Clean or replace the fan.
Power Components	Accumulation of dust or dirt	Blow with dry, compressed air (57-86 psi).

Alarm and Fault classes are described as follows:

- Major Fault: Brake is set, ALM indicator LED remains lit, fault is displayed on keypad and brake contact output (terminals MC, MB, & MA) is deactivated. In order to continue operation the reset key must be pressed, a multi-function digital input set for fault reset or power must be cycled.
- Fault (minor): Brake is set, ALM/indicator LED flashes, fault code flashes in the keypad brake contact output (terminals MC, MB, & MA) is deactivated. The reset key does not need to be pressed. The VFD will attempt to run again at the next run command.
- Alarm (Warning): Brake does not set, operation continues, ALM/indicator LED flashes, alarm code flashes, brake contact output (terminals MC, MB, & MA) stay activated.

6.1.2 Motor Faults and Corrective Actions

Symptom	Corrective Action
Analog frequency reference is not stable (drifting).	1. Stabilize the analog source. 2. Increase B02.02. 3. Increase B05.01, B05.02.
No motor rotation.	1. Verify that power is on (Charge LED). 2. Verify that the keypad display is not showing a fault. 3. Verify that the run command is input to the VFD (U01.10). 4. Check if motor stalled due to excessive current (U01.03).
Motor rotation is in the wrong direction.	1. Verify FWD/REV or UP/DN is wired correctly at the interface board. 2. Switch any two leads on U/T1, V/T2, or W/T3 going to the motor. 3. Check parameter B03.04.

Symptom	Corrective Action
Motor rotates, but at minimum speed only.	1. Check wiring of speed inputs and verify inputs (U01.10). 2. Verify speed reference setting (A01.04). 3. Verify reference and run source settings are correct (B03.01, B03.02). 4. Verify reference priority setting (B01.18). 5. Check if motor stalled due to excessive current (U01.03).
Motor RPM too high or too low.	1. Compare motor nameplate specifications with E2 parameters. 2. Check maximum frequency setting (E01.04). 3. Check minimum frequency setting (E01.09).

6.1.3 VFD Faults, Alarms and Indicators

Fault	Fault or Indicator Name/Description	Corrective Action
bb (flashing) Base Block	**External Base Block Indicator.** The flashing base block signal is the result of a multi-function input in the terminal strip. The base block indicates that the VFD's IGBTs have been disabled. The motor will begin coasting when the base block input is received. If a RUN command is still present when the BB signal is removed, the output voltage will be restored to the previous operating level and operation will continue at the previously commanded frequency.	1. Check H01.01 through H01.07 for proper programming. 2. Check terminal status. (U01.10)
BE0 (flashing) Brake Ans Lost	**Brake Answer-Back signal lost during run.** While running, the multi-function input brake answer back is lost.	1. Check brake answer back circuit. 2. Check terminal status. (U01.10)
BE4 (flashing) Brake Answer 1	**Brake Answer-Back, Brake not Released.** At Start, Brake Answer-back is not input within predetermined time (C08.04) after electric brake release command is output–Electric brake not released.	1. Check brake answer back circuit. 2. Increase the value of C08.04. 3. Check terminal status (U01.10).
BE5 (flashing) Brake Answer 2	**Brake Answer-Back At Stop.** At Stop, Brake Answer-back signal is not removed within predetermined time (C08.11) after electric brake release command is removed–Electric brake not closed.	1. Check brake answer back circuit. 2. Increase the value of C08.11 time.
CALL (flashing)	**Serial Communication Transmission Error.** Control data is not received correctly after power supply is turned ON for 2 sec.	1. Check serial device connections. 2. Ensure VFD is properly programmed for serial communication.
CE Modbus Com Err	**Modbus Communication Error.** Serial communications data corrupted.	1. Check serial connections (R+, R-, S+, & S-). 2. Check H05.01 through H05.03 for proper programming.
CF Control Fault	**Control Fault.** A torque limit was reached for 3 seconds or longer while in Open Loop Vector.	1. Perform auto tune. 2. Check motor parameters.
CoF	**Current Offset Fault.** The VFD automatically adjusts the current offset, the calculated value exceeded the allowable setting range.	1. Press reset. 2. Check brake. 3. Check brake contact.

Fault	Fault or Indicator Name/Description	Corrective Action
CPF02	**A/D Conversion Error.** An A/D conversion error occurred.	1. Cycle power to the VFD. 2. Ensure that the control board terminals and wiring are shielded from electrical noise. 3. Check resistance of potentiometer. 4. Replace the VFD.
CPF03	**PWM Data Error.** There is a problem with the PWM data.	1. Cycle power to the VFD. 2. Replace the control board.
CPF06	**EEPROM Data Error.** There is an error in the data saved to EEPROM.	1. Cycle power to the VFD. 2. If the problem continues, replace the VFD.
CPF07	**Terminal Board Communications Error.** A communication error occurred at the terminal board.	1. Cycle power to the VFD. 2. Check connections on the control board.
CPF08	**EEPROM Serial Communications Fault.** EEPROM communications are not functioning properly.	1. Cycle power to the VFD. 2. If the problem continues, replace the VFD.
CPF11	**RAM Fault.**	1. Cycle power to the VFD. 2. Replace the VFD.
CPF12	**FLASH Memory Fault.** Problem with the ROM (FLASH memory).	1. Cycle power to the VFD. 2. Replace the VFD.
CPF13	**Watchdog Circuit Exception.** Control circuit damage.	1. Cycle power to the VFD. 2. Replace the VFD.
CPF14	**Control Circuit Fault.** CPU Error (CPU operates incorrectly due to noise, etc.)	1. Cycle power to the VFD. 2. Replace the VFD.
CPF16	**Clock Fault.** Standard clock error.	1. Cycle power to the VFD. 2. Replace the VFD.
CPF17	**Timing Fault.** A timing error occurred during an internal process.	1. Cycle power to the VFD. 2. Replace the VFD.
CPF18 and CPF19	**Control Circuit Fault.** CPU error (CPU operates incorrectly due to noise, etc).	1. Cycle power to the VFD. 2. Ensure that the control board terminals and wiring are shielded from electrical noise. 3. Replace the VFD.
CPF20 and CPF21	**RAM fault, FLASH memory error, watchdog circuit exception.**	1. Cycle power to the VFD. 2. Replace the VFD.
CPF22	**A/D Conversion Fault.** A/D conversion error.	1. Cycle power to the VFD. 2. Ensure that the control board terminals and wiring are shielded from electrical noise. 3. Check resistance of potentiometer.
CPF23	**PWM Feedback Fault.** PWM feedback error.	1. Cycle power to the VFD. 2. Replace the VFD.
CPF24	**VFD Capacity Signal Fault.** Entered a capacity that does not exist (checked when the VFD is powered up).	1. Cycle power to the VFD. 2. Replace the VFD.
CRST	**Cannot reset.** External fault occurred and reset button was pressed before motor was completely stopped. Fault reset was being executed when a RUN command is executed during a fault.	1. Wait for motor to come to complete stop. 2. Reset fault before issuing a RUN command.

Fault	Fault or Indicator Name/Description	Corrective Action
dnE Drive not ready	User is trying to give a run command while a FWD or REV is present at Power Up.	1. Check input terminals. 2. Check H01.01 to H01.07 programming.
EF *(flashing)* External Fault	Both FORWARD/UP and REVERSE/DOWN commands are input at same time for 500 msec or longer.	1. Check control input wiring. 2. Check the sequence of operation.
EF0 Option Card External Fault	External fault input from communication option card.	1. Check communication option card connection and signals. 2. Check external device for any fault(s)
EF1 External Fault 1	External fault occurs on Terminal S1.	1. Check H01.01 for proper programming. 2. Check the conditions for input terminal S1 (U01.10).
EF2 External Fault 2	External fault occurs on Terminal S2.	1. Check H01.02 for proper programming. 2. Check the conditions for input terminal S2 (U01.10).
EF3 External Fault 3	External fault occurs on Terminal S3.	1. Check H01.03 for proper programming. 2. Check the condition for input terminal S3 (U01.10).
EF4 External Fault 4	External fault occurs on Terminal S4.	1. Check H01.04 for proper programming. 2. Check the condition for input terminal S4 (U01.10).
EF5 External Fault 5	External fault occurs on Terminal S5.	1. Check H01.05 for proper programming. 2. Check the condition for input terminal S5 (U01.10).
EF6 External Fault 6	External fault occurs on Terminal S6.	1. Check H01.06 for proper programming. 2. Check the condition for input terminal S6 (U01.10).
EF7 External Fault 7	External fault occurs on Terminal S7.	1. Check H01.07 for proper programming. 2. Check the condition for input terminal S7 (U01.10).
GF Ground Fault	**Ground Fault.** Current shorted to ground exceeded 50% of rated current on output side of the VFD. Setting L08.09 to 1 enable ground fault detection in models 2025 and 4014 or larger.	1. Disconnect motor from VFD and check it for shorts using a megger. 2. Ensure that R/C Surge Suppressors are used across all brake contactor coils to prevent disturbance by electrical transients.
Hbb Hardware BB	**Hardware Base Block.** The Safe Disable Input channel is open.	1. Check if external safety circuit tripped and disabled the VFD. 2. If the Safe Disable function is not utilized, check if the terminals HC and H1 are linked.
LC Load Check Err	**Load Check Alarm.** This fault is displayed when the load detected is greater than the measured load during the Load Check set up process for a particular LC Zone.	1. Reduce Load. 2. Decrease the LC Sensitivity (higher value). 3. Increase the settings for the particular LC Zone where the fault occurred by 1.
LC dn LC Done	**Load Check Done Alarm.** This alarm is displayed after the LC set up process is done. The alarm will clear when the Down command is pressed and completes the LC set up process	-

Fault	Fault or Indicator Name/Description	Corrective Action
LF Output Phase Loss	An open phase occurred at the VFD output.	1. Check for broken wires in output cable. 2. Check for open winding in the motor. 3. Check for loose terminals.
LL1 *(flashing)* Lower Limit 1 Err	**Lower Limit 1—SLOW DOWN Indicator.** Lower Limit 1—SLOW DOWN is input (switch status is changed).	1. May not require corrective action. 2. Check the position of the Limit Switch. 3. Check the condition of the Limit Switch. 4. Check the conditions of/for input terminal H01.XX (U01.10).
LL2 *(flashing)* Lower Limit 2 Err	**Lower Limit 2—STOP Indicator.** Lower Limit 2—STOP is input (switch status is changed).	1. May not require corrective action. 2. Check the position of the Limit Switch. 3. Check the condition of the Limit Switch. 4. Check the conditions of/for input terminal H01.XX (U01.10).
MNT Maintenance Reqd	**Maintenance Required Alert.** Running time has exceeded C12.05	1. Reset timer by MFDI H01.xx = 5A or depress Mode/Service key three times and enter within 2 seconds.
oC Over Current	**Over Current Fault.** Output current exceeds 200% of VFD rated output current.	1. Check for a phase-to-phase short in the motor or wiring using a megger. 2. Extend the acceleration/deceleration time. 3. Check torque limit setting.
oH (flashing) Heatsnk Over temp	**Overheat Pre-Alarm.** Heatsink is overheating. The temperature of the VFD's heatsink exceeded the setting in L08.02.	1. The VFD cooling fan has stopped. 2. Reduce the ambient temperature.
oH1 Heatsink MaxTemp	**Overheat Fault.** There are two situations that result in an overheat fault. The first occurs when the measured heat sink exceeds 105°C. The second is a result of a fault in the internal 24VDC cooling fan.	1. Ensure that the heat sink cooling fans are functioning. 2. Ensure that the heat sink is free from dirt and debris. 3. Ensure that the VFD's ambient temperature is within specification. 4. Replace the 24VDC fan. 5. Replace the heat sink thermistor(s).
oH2 (flashing) Overheat 2	**Overheat Alarm.** Signal is input by external terminal. H01.XX=39	
oH3 Motor Overheat 1	**Motor Overheating 1.** Thermistor analog input detected motor overheating. See L01.03	1. Check the motor rated current value, E02.01. 2. Increase cycle time or reduce the load.
oH4 Motor Overheat 2	**Motor Overheating 2.** Thermistor analog input detected motor overheating. See L01.04	
oL1 Motor Overloaded	**Motor Overload Fault.** VFD output exceeded the motor overload level.	1. Ensure VFD is programmed with proper motor full load Amps (E02.01). 2. Reduce the load.
oL2 VFD Overloaded	**VFD Overload Fault.** VFD output exceeded the VFD overload level.	1. Reduce the load. 2. Extend the acceleration time.
oL8 Klixon	**Klixon Circuit Alarm.** Input by MFDI H01.xx = 56 or 57	1. Check motor for overtemp. 2. Check Klixon circuit.
oPE01 kVA Selection	**kVA Setting Fault.** VFD kVA setting range is incorrect.	1. Check O02.04 for proper kVA.
oPE02	**Parameter Range Setting Error.** Parameter settings are set outside the parameter range.	1. Press enter to view parameter. 2. Change parameter to appropriate setting.

Fault	Fault or Indicator Name/Description	Corrective Action
oPE03 Terminal	**Multi-Function Input Setting Fault.** Set values other than “F” and “FF” are duplicated.	1. Check the settings for H01.01 to H01.07, verify that the same input is not used twice.
oPE04 Terminal	**Parameters do not match.** The VFD, control board, or terminal board has been replaced, and the parameter settings between the controller board or terminal board do not match.	1. Press ENTER to view the parameter. 2. Change parameter(s) to appropriate settings. 3. Set A01.05 = 5550.
oPE07 Analog Selection	**Multi-Function Analog Input Setting Fault.** Set values other than 00 and 0F are duplicated.	1. Check setting for H03.02 and H03.10. Verify that the same value is not used twice.
oPE08 Terminal	**Selection Parameter error.** A parameter has been changed that is not available in the present control method.	1. Undo the last parameter change (if known). 2. Scroll through modified parameters for obvious setting errors. 3. Perform a user initialize (A01.05=1110). **CAUTION: All settings will be restored to the factory defaults.**
oPE10 V/f Ptrn Setting	**V/f Parameter Setting Error.**	1. Check Parameters E01.04 to E01.11.
oPE23 Load Check	**Load Check setting error.**	1. Check C05.04 < C05.07 < C05.09.
OT1 Overtorque Det 1	**Overtorque Detection Level 1 Fault.** Current is higher than set value (L06.02) for more than set time (L06.03).	1. Check for proper programming of L06.02 and L06.03.
OT2 Overtorque Det 2	**Overtorque Detection Level 2 Fault.** Defined by L06.05. Alarm default defined by L06.04.	1. Check for proper programming for L06.05 and L06.06.
oV DC Bus Overvolt	**Overvoltage Fault.** The DC bus voltage exceeded the overvoltage level. Detection level: 230V class—approx. 410V 460V class—approx. 820V	1. Extend the deceleration time. 2. Check for proper DBU operation. 3. Check the resistor. 4. Check the line voltage. 5. If on a load brake hoist, check the gear box.
oV (flashing) DC Bus Overvolt	**Overvoltage Fault.** Overvoltage occurs during stop. Main circuit DC voltage rises above the detection level while the VFD output is off. Detection level: 410V or more for 230V, 820V or more for 460V.	1. Check the line voltage.
PF Input Pha Loss	**Input Phase Loss Fault.** VFD input power supply has open phase.	1. Check the line voltage. 2. Remove power. 3. Re-tighten the input terminal screws. 4. Check line fuses.
rr DynBrk Transistr	**Braking Transistor Fault.** Internal Braking transistor failed.	1. Verify that the external braking resistor is connected to the proper terminals. 2. Confirm that the proper resistor is installed. 3. Check for a short circuit across the braking resistor.
UL1 Upper Limit 1 Err	**Upper Limit 1—SLOW DOWN Indicator.** Upper Limit 1—SLOW DOWN switch status is changed.	1. May not require corrective action. 2. Check the position of the Limit Switch. 3. Check the condition of the Limit Switch. 4. Check the conditions of/for terminal H01.XX (U01.10).

Fault	Fault or Indicator Name/Description	Corrective Action
UL2 Upper Limit 2 Err	**Upper Limit 2—STOP Indicator.** Upper Limit 2—STOP switch status is changed.	1. May not require corrective action. 2. Check the position of the Limit Switch. 3. Check the condition of the Limit Switch. 4. Check the conditions of/for terminal H01.XX (U01.10)
UL3 Upper Limit 3 Err	**Upper Limit 3—Weighted Stop.** Upper Limit weighted limit switch tripped.	1. May not require corrective action. 2. Check the position of the Limit Switch. 3. Check the condition of the Limit Switch. 4. Check the conditions of/for terminal H01.XX (U01.10)
UT1 Undertorque Det 1	**Undertorque Detection 1.** The current is less than L06.02 for more than L06.03	1. Check settings. 2. Check motor coupling.
UT2 Undertorque Det 2	**Undertorque Detection 2.** The current is less than L06.05 for more than L06.06	1. Check settings. 2. Check motor coupling.
Uv (Flashing) DC Bus Undervolt	**Undervoltage Fault.** Undervoltage status occurs for more than 2 sec during STOP. Input voltage drops below 190V DC or less for 230V AC class, 380V DC or less for 460V AC class.	1. Check the power source wiring. 2. Replace any bad branch fuses. 3. Check collector system.
Uv1 DC Bus Undervolt	**Undervoltage 1 Fault.** Undervoltage status occurs for more than 2 sec during RUN command. Input voltage drops below 190V DC or less for 230V AC class, 380V DC or less for 460V AC class.	1. Check power supply wiring. 2. Correct the line voltage. 3. Check collector system.
Uv2 CTL PS Undervolt	**Undervoltage 2 Fault.** The VFD detected a loss of the 24V logic power supply voltage.	1. Check power supply wiring. 2. Correct the line voltage. 3. Check collector system.
Uv3 MC Answerback	**MC Fault.** The pre-charge contactor opened during operation.	1. Check power supply wiring. 2. Correct the line voltage. 3. Check collector system. 4. Wait 30-45 seconds before restarting VFD after auto shut down.

6.1.4 Fault Display and Corrective Actions at Auto-Tuning

The following are fault displays and corrective actions at auto-tuning. If any of the following faults are found, the keypad displays that fault's contents; the motor coasts to stop if it is under operation. Fault contact output or minor fault contact output does not operate.

Fault Display	Fault or Indicator Name/Description	Corrective Action
Er-01 Motor Data	**Motor Data Fault**. Motor data was entered incorrectly for auto-tuning. Relationship between motor HP and motor rated current fault. Input motor rated current and motor no-load current fault don't match.	• Check the T1 parameters. • Check VFD and motor capacity • Check motor rated current and no-load current.
Er-02 Minor Fault	**Alarm**. The minor fault is detected during auto-tuning.	• Check the T1 parameters. • Check wirings • Disconnect motor from load.
Er-03 STOP Key	**STOP Key Input**. The stop key is pressed during auto-tuning.	
Er-04 Resistance	**Line to Line Resistance Fault**. Auto-tuning is not completed within the expected time. The auto-tuning is outside the parameter setting.	• Check the T1 parameters. • Check motor wiring. • Disconnect motor from load.
Er-05 No-Load Current	**No-load Current Fault.** Auto-tuning is not completed within the expected time. The auto-tuning is outside the parameter setting.	
Er-08 Rated Slip	**Rated Slip Fault.** Auto-tuning is not completed within the expected time. The auto-tuning is outside the parameter setting.	
Er-09 Accelerate	**Acceleration Fault (rotating auto-tuning only)**. The motor did not accelerate at the expected time.	• Increase B05.01 (acceleration time). • If C07.01 and C07.02 (torque limit value) are decreased, increase values. • Disconnect motor from load.
Er-11 Motor Speed	**Motor Speed Fault (rotating auto-tuning only).** The motor speed was over 100% at auto-tuning (vector control without PG only).	• Increase B05.01 (acceleration time). • Disconnect motor from load.
Er-12 Current Detection	**Current Detection Fault.** Current exceeded the motor rated current.	• Release brake. • Check for open motor lead.
End 1 V/f Oversetting	**Excess V/f setting * (rotating auto-tuning only).** The torque reference exceeded 20% and no load current exceeded 80%.	• Check the T1 parameters. • Disconnect the motor from the load.
End 2 Saturation	**Motor Iron Core Saturation Coefficient Fault (rotating auto-tuning only).** Since the motor iron core saturation coefficient could not be auto-tuned within the set time, tentative value is set in the iron core saturation coefficient	• Check the T1 parameters. • Check motor wiring. • Disconnect the motor from the load
End 3 Rated FLA Alm	**Rated Current Set Alarm**. Motor current during tuning was greater than the set value.	• Check E02.01. • Check T01.04.

NOTE: ** Excessive V/f set value, motor iron core saturation coefficient fault, and rated current set alarm are all displayed after the auto tuning is completed.*

6.2 Power Section Check

WARNING

Do NOT touch any circuit components while AC main power is on or immediately after the main AC power is disconnected. You must wait until the red “CHARGE” lamp is extinguished. It may take as long as 10 minutes for the charge on the main DC bus capacitors to drop to a safe level. Failure to adhere to this warning could result in serious injury.

6.2.1 Power Off Checks

To perform a power section check, remove the VFD’s main and control wiring from the terminal strips. Obtain reading as specified in the table on the next page, and ensure that the reading falls within the normal reading range.

Test equipment - Analog Ohmmeter set R x 1 scale or digital multimeter set to the diode check.

Device	VOM (on Rx1 Scale)		Normal Reading (Analog Meter)	Normal Reading (Digital Meter)
	Positive Lead	Negative Lead		
Input Rectifier Bridge *1	L1	+	7–100Ω	Approximately 0.5 V
	L2	+		
	L3	+		
	-	L1		
	-	L2		
	-	L3		
	L1	-	Infinite Ω	OL Displayed
	L2	-		
	L3	-		
	+	L1		
	+	L2		
	+	L3		
Bus Capacitors	+	-	Observe gradually increasing resistance	Observe gradually increasing voltage to OL
Pre-charge Resistor	-	Across the Resistors	100 Ω or less	–
Output Transistors *2 *3	T1	+	7-100 Ω	Approximately 0.5V
	T2	+		
	T3	+		
	-	T1		
	-	T2		
	-	T3		
	T1	-	Infinite Ω	OL Displayed
	T2	-		
	T3	-		
	+	T1		
	+	T2		
	+	T3		
Braking Diode	B2	B1	10 Ω	0.5 V
	B1	B2	Infinite Ω	OL Displayed
	B2	-	Infinite Ω	OL Displayed
	-	B2	Infinite Ω	0.5 V

**1. “+” could be any one of two (+) terminals which are labeled as +1 and +2.*

**2. If the bus fuse is blown you must install a jumper across the fuse terminals to get accurate resistance measurements.*

**3. If the pre-charge resistor is open, you will read infinite Ω between + and any output terminal unless you install a temporary jumper across the resistor.*

6.2.2 Braking Circuit

Test Equipment - Analog Ohmmeter set to R x 1 scale or digital multimeter set to the diode check.

Step No.	Ohmmeter Positive Lead	Ohmmeter Negative Lead	Expected Reading (Analog Meter)	Expected Reading (Digital Meter)
1	Connect to B2	Connect to B1	10 Ohms	0.5 Volts
2	Connect to B1	Connect to B2	Infinite Ohms	OL displayed
3	Connect to B2	–	Infinite Ohms	OL displayed
4	–	Connect to B2	Infinite Ohms	OL displayed

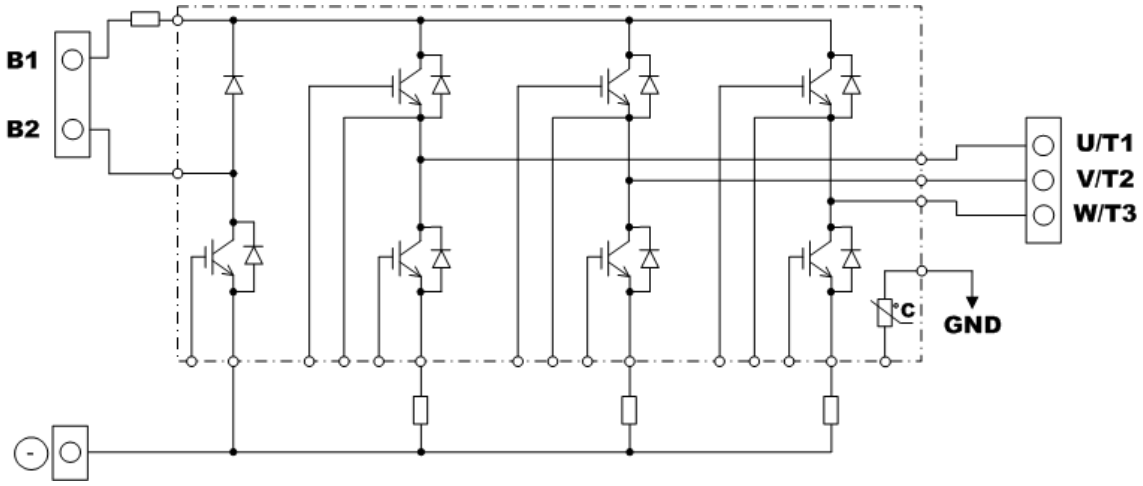


Figure 6-1: Braking Circuit

Appendix A: Parameter Listing

Parameter	Parameter Name	Default	Range	Units	Page
A01.01	Access Level 00: User 01: Basic 02: Advanced	0001	0000~0001	-	***42***
A01.02	Control Method 00: V/f 02: OLV	00	00, 02	-	***42***
A01.03	Motion 00: Traverse 01: Hoist 04: Braketronic	01	00, 01, 04	-	***44***
A01.04	Speed Reference 00: 2-Speed Multi-Step 01: 3-Speed Multi-Step 02: 5-Speed Multi-Step 03: 2-Step Infinitely Variable 04: 3-Step Infinitely Variable 05: Analog - Uni-Polar	01	00–05	-	***43***
A01.05	Initialize 0000: No Initialize 1110: User Initialize 5550: Moves modified parameters from terminal board to control board	0000	0000–5550	-	***47***
A01.06	Password 1	0000	0000–9999	-	***47***
A01.08	Password 2	0000	0000–9999	-	***47***
B01.01	Frequency Reference 1	15.00*	0.00–150.00	Hz	***49***
B01.02	Frequency Reference 2	30.00*	0.00–150.00	Hz	***49***
B01.03	Frequency Reference 3	60.00*	0.00–150.00	Hz	***49***
B01.04	Frequency Reference 4	0.00*	0.00–150.00	Hz	***49***
B01.05	Frequency Reference 5	0.00*	0.00–150.00	Hz	***49***
B01.06	Frequency Reference 6	0.00*	0.00–150.00	Hz	***49***
B01.07	Frequency Reference 7	0.00*	0.00–150.00	Hz	***49***
B01.08	Frequency Reference 8	0.00*	0.00–150.00	Hz	***49***
B01.09	Frequency Reference 9	0.00*	0.00–150.00	Hz	***49***
B01.10	Frequency Reference 10	0.00*	0.00–150.00	Hz	***49***
B01.11	Frequency Reference 11	0.00*	0.00–150.00	Hz	***49***
B01.12	Frequency Reference 12	0.00*	0.00~150.00	Hz	***49***
B01.13	Frequency Reference 13	0.00*	0.00–150.00	Hz	***49***
B01.14	Frequency Reference 14	0.00*	0.00–150.00	Hz	***49***

Parameter	Parameter Name	Default	Range	Units	Page
B01.15	Frequency Reference 15	0.00*	0.00–150.00	Hz	***49***
B01.16	Frequency Reference 16	0.00*	0.00–150.00	Hz	***49***
B01.17	Jog Reference	6.00*	0.00–150.00	Hz	***49***
B01.18	Reference Priority	00*	00–02	-	***49***
	00: Digital Reference Only				***49***
	01: Analog Reference Only				***49***
	02: Higher Reference Select				***49***
B02.01	Frequency Reference Upper Limit	100.0	0.0–110.0	%	***51***
B02.02	Frequency Reference Lower Limit	0.0	0.0–110.0	%	***51***
B02.03	Reference 1 Lower Limit	2.0*	0.0–110.0	%	***51***
B02.04	Alt Upper Limit	100.0	0.0–110.0	%	***51***
B03.01	Reference Source	01	00–04	-	***52***
	00: Keypad				
	01: Terminals				
	02: Modbus Communication				
	03: Option PCB				
	04: Pulse Input				
B03.02	Run Source	01	00–03	-	***52***
	00: Keypad				
	01: Terminals				
	02: Modbus Communication				
	03: Option PCB				
B03.03	Stop Method	01*	00–02, 04	-	***52***
	00: Decel to Stop				
	01: Coast to Stop				
	02: DC Injection Braking				
	04: Decel with Timer				
B03.04	Change Motor Rotation	00	00–01	-	***59***
	00: Normal Rotation				
	01: Exchange Phases				
B03.07	Local/Remote	00	00–01	-	***60***
	00: Cycle External Run				
	01: Accept External Run				
B03.10	Allow Run at Power UP	00	00–01	-	***60***
	00: Disabled				
	01: Enabled				

Parameter	Parameter Name	Default	Range	Units	Page
B03.15	Reference Selection	01	00–04	-	***60***
	00: Keypad				
	01: Terminals				
	02: Modbus Communication				
	03: Option PCB				
	04: Pulse Input				
B03.16	Reference Source	01	00–03	-	***60***
	00: Keypad				
	01: Terminals				
	02: Modbus Communication				
	03: Option PCB				
B05.01	Accel Time 1	5.0*	0.0–25.5	sec	***61***
B05.02	Decel Time 1	3.0*	0.0–25.5	sec	***61***
B05.03	Accel Time 2	2.0	0.0–6000.0	sec	***61***
B05.04	Decel Time 2	2.0	0.0–6000.0	sec	***61***
B05.05	Accel Time N Change	2.0	0.0–25.5	sec	***61***
B05.06	Decel Time N Change	2.0	0.0–25.5	sec	***61***
B05.08	Fast Stop Time	1.0	0.0–25.5	sec	***61***
B05.09	Accel/Decel Units	01	00–01	-	***61***
	00: Unit of 0.01 Seconds				
	01: Unit of 0.1 Seconds				
B05.10	Accel/Decel Switch Frequency	120.0	0.0–150.0	Hz	***61***
B05.11	Switch Frequency Compare	01	00–01	-	***61***
	00: Lower Switch Frequency				
	01: Upper Switch Frequency				
B05.12	Accel Time 3	3.0	0.0–6000.0	sec	***61***
B05.13	Decel Time 3	3.0	0.0–6000.0	sec	***61***
B05.14	Accel Time 4	3.0	0.0–6000.0	sec	***61***
B05.15	Decel Time 4	3.0	0.0–6000.0	sec	***61***
B08.01	Jump Frequency 1	0.0	0.0–150.0	Hz	***62***
B08.02	Jump Frequency 2	0.0	0.0–150.0	Hz	***62***
B08.03	Jump Frequency 3	0.0	0.0–150.0	Hz	***62***
B08.04	Jump Frequency Width	1.0	0.0–20.0	Hz	***62***
C01.01	Quick Stop	00*	00, 01	-	***64***
	00: Disabled				
	01: Enabled				
C01.02	Quick Stop Time	1.0	0.0–25.5	sec	***64***
C01.03	Reverse Plug	00	00, 01	-	***65***
	00: Disabled				
	01: Enabled				

Parameter	Parameter Name	Default	Range	Units	Page
C01.04	Reverse Plug Decel Time	2.0	0.0–25.5	sec	***65***
C01.05	Reverse Plug Accel Time	2.0	0.0–25.5	sec	***65***
C02.01	MicroSpd Gain 1	1.00	0.00–2.55	-	***66***
C02.02	MicroSpd Gain 2	1.00	0.00–2.55	-	***66***
C03.01	Upper Limit 1 (UL1) Speed	6.00	0.00–150.00	Hz	***67***
C03.02	Upper Limit 1 (UL1) Decel Time	1.0	0.0–25.5	sec	***67***
C03.03	Upper Limit 2 (UL2) Decel Time	1.0	0.0–25.5	sec	***67***
C03.04	Lower Limit 1 (LL1) Speed	6.00	0.00–150.00	Hz	***67***
C03.05	Lower Limit 1 (LL1) Decel Time	1.0	0.0–25.5	sec	***67***
C03.06	Lower Limit 2 (LL2) Decel Time	1.0	0.0–25.5	sec	***67***
C03.07	Limit Action @ LL2/UL2 00: Decel to Stop 01: Coast to Stop 02: Use B03.03 Stopping Method	02*	00–02	-	***67***
C03.08	Limit Action @ UL3 00: Decel to Stop/Alarm 01: Coast to Stop/Alarm 02: Use B03.03 Stopping Method/ Alarm 03: Decel/Fault 04: Coast/Fault 05: Use B03.03 Stopping Method/Fault	04	00–05	-	***67***
C03.09	Phantom Stop Selection 00: Decel to Stop 01: Coast to Stop 02: Use B03.03 Stopping Method	01	00–02	-	***68***
C03.11	Klixon Action 00: Decel to Stop 01: Lower Only	00	00–01	-	***68***
C05.01	Load Check 00: Disable 01: Enable Load Check 03: Enable Load Check Continuous 09: Load Check Set Up	00	00, 01, 03, 09	-	***70***
C05.02	LC Alarm Action 00: Alarm Only 01: Decel to Stop 02: Coast to Stop 03: Fast Stop 04: Use B03.03 Stopping Method	04	00–04	-	***70***
C05.03	LC Setting Time	0.15	0.00–2.55	sec	***70***

Parameter	Parameter Name	Default	Range	Units	Page
C05.04	LC Testing Time	0.25	0.00–2.55	sec	***70***
C05.05	LC Acceleration Margin	05	00–50	-	***70***
C05.07	LC Margin	05	00–20	-	***70***
C05.08	LC Lowering Speed	6.0	0.1–30.0	Hz	***70***
C05.09	LC Zone 01	000	000–160	%	***70***
C05.10	LC Zone 02	000	000–160	%	***70***
C05.11	LC Zone 03	000	000–160	%	***70***
C05.12	LC Zone 04	000	000–160	%	***70***
C05.13	LC Zone 05	000	000–160	%	***70***
C05.14	LC Zone 06	000	000–160	%	***70***
C05.15	LC Zone 07	000	000–160	%	***70***
C05.16	LC Zone 08	000	000–160	%	***70***
C05.17	LC Zone 09	000	000–160	%	***70***
C05.18	LC Zone 10	000	000–160	%	***70***
C05.19	LC Zone 11	000	000–160	%	***70***
C05.20	LC Zone 12	000	000–160	%	***70***
C05.21	LC Zone 13	000	000–160	%	***70***
C05.22	LC Zone 14	000	000–160	%	***70***
C05.23	LC Zone 15	000	000–160	%	***70***
C05.24	LC Zone 16	000	000–160	%	***70***
C05.25	LC Integral Time	0.05	0.00–2.55	sec	***70***
C05.26	LC Delay Time	0.25	0.00–2.55	sec	***70***
C05.27	LC Rev Dir Delay	0.0	0.0–25.5	sec	***71***
C05.28	LC Rev Dir Freq	30.0	0.0–60.0	Hz	***71***
C06.01	Swift-Lift 00: Disabled 01: Enabled Automatic 02: Enabled by MFDI 13	00	00–02	-	***72***
C06.02	Swift-Lift Forward Speed	60.00	0.00–150.00	Hz	***72***
C06.03	Swift-Lift Reverse Speed	60.00	0.00–150.00	Hz	***72***
C06.04	Swift-Lift Forward Torque/Current	50	0–100	%	***72***
C06.05	Swift-Lift Reverse Torque/Current	30	0–100	%	***72***
C06.06	Swift-Lift Enabling Speed	59.00	0.00–150.00	Hz	***72***
C06.07	Swift-Lift Delay Time	2.0	0.0–25.5	sec	***72***
C06.08	Swift-Lift Acceleration Gain	1.0	0.1–9.9	-	***72***
C07.01	Forward Torque Limit	150	000–300	%	***75***
C07.02	Reverse Torque Limit	150	000–300	%	***75***
C07.03	Forward Regen Torque Limit	180	000–300	%	***75***
C07.04	Reverse Regen Torque Limit	180	000–300	%	***75***
C07.05	Torque Limit Gain	1.25	0.00–2.55	-	***75***

Parameter	Parameter Name	Default	Range	Units	Page
C07.06	Torque Limit Time Constant	00200	5–10000	ms	***75***
C07.07	Torque Limit Select 00: P Control 01: P1 Control	00	00–01	-	***75***
C08.04	Rollback Timer	0.30	0.00–2.55	sec	***75***
C08.11	Brake Set Delay	0.7	0.0–25.5	sec	***75***
C08.17	BE6 Up Speed Limit	6.00	0.00–150.00	Hz	***75***
C09.01	Digital Input Setup	0	0, 5	-	***76***
C09.03	DIO Terminal 1	0F	00–FF	-	***76***
C09.04	DIO Terminal 2	0F	00–FF	-	***76***
C09.05	DIO Terminal 3	0F	00–FF	-	***76***
C09.06	DIO Terminal 4	0F	00–FF	-	***76***
C09.07	DIO Terminal 5	0F	00–FF	-	***76***
C09.08	DIO Terminal 6	0F	00–FF	-	***76***
C09.09	DIO Terminal 7	0F	00–FF	-	***76***
C09.10	DIO Terminal 8	0F	00–FF	-	***76***
C09.11	DIO Terminal 9	0F	00–FF	-	***76***
C09.12	DIO Terminal 10	0F	00–FF	-	***76***
C09.13	DIO Terminal 11	0F	00–FF	-	***76***
C09.14	DIO Terminal 12	0F	00–FF	-	***76***
C09.15	DIO Terminal 13	0F	00–FF	-	***76***
C09.16	DIO Terminal 14	0F	00–FF	-	***76***
C09.17	DIO Terminal 15	0F	00–FF	-	***76***
C09.18	DIO Terminal 16	0F	00–FF	-	***76***
C12.01	Brake Jog Delay	0.0	0.0–100.0	sec	***76***
C12.02	Brake Run Delay	0.0	0.0–100.0	sec	***76***
C12.03	Delay-on timer	0.0	0.0–3000.0	sec	***77***
C12.04	Delay-off timer	0.0	0.0–3000.0	sec	***77***
C12.05	Maintenance Timer	00000	0000–32767	hr	***77***
C12.06	Maintenance Speed Gain	0.5	0.0–1.0	-	***77***
C13.01	Inch Run Time	1.00	0.00–2.55	sec	***78***
C13.02	Repeat Delay Time	1.00	0.00–2.55	sec	***78***
D01.01	DC Injection Start Frequency	0.5	0.0–10.0	Hz	***79***
D01.02	DC Injection Current	50	0–75	%	***79***
D01.03	DC Injection Time @ Start	0.00	0.00–10.00	sec	***79***
D01.04	DC Injection Time @ Stop	0.05	0.00–10.00	sec	***79***
D01.08	Magnetic Flux Compensation	0000	0000–1000	%	***80***
D01.15	DC Injection Braking Current 2	050	000–100	%	***80***
D02.01	Slip Compensation Gain	0.0****	0.0–2.5	-	***80***
D02.02	Slip Compensation Time	200***	0–10000	ms	***80***

Parameter	Parameter Name	Default	Range	Units	Page
D02.03	Slip Compensation Limit	200	0–250	%	***80***
D02.04	Slip Compensation Regen	00	00–01	-	***80***
	00: Disabled				
	01: Enabled				
D02.05	Slip Compensation V/f	00	00–01	-	***80***
	00: Disable				
	01: Enable				
D02.06	Magnetic Flux Characteristic	00	00–01	-	***80***
	00: Slip Include				
	01: Slip Exclude				
D03.01	Torque Compensation Gain	1.00	0.00–2.50	-	***81***
D03.02	Torque Compensation Time	200****	0–60000	ms	***81***
D03.03	Forward Torque Compensation @ Start	0.0	0.0–200.0	%	***81***
D03.04	Reverse Torque Compensation @ Start	0.0	-200.0–0.0	%	***81***
D03.05	Torque Compensation Delay Time	10	0–200	ms	***81***
D03.06	Torque Compensation Delay Time 2	150	0–10000	ms	***81***
D08.01	Dwell Reference @ Start	0.0	0.0–150.0	Hz	***82***
D08.02	Dwell Time @ Start	0.0	0.0–10.0	sec	***82***
D08.03	Dwell Reference @ Stop	0.0	0.0–150.0	Hz	***82***
D08.04	Dwell Time @ Stop	0.0	0.0–10.0	sec	***82***
D09.01	S-Curve Accel @ Start	0.50*	0.00–10.00	sec	***83***
D09.02	S-Curve Accel @ End	0.50*	0.00–10.00	sec	***83***
D09.03	S-Curve Decel @ Start	0.50*	0.00–10.00	sec	***83***
D09.04	S-Curve Decel @ Stop	0.20	0.00–10.00	sec	***83***
D10.01	Duty Selection	00	00–01	-	***84***
	00: Heavy Duty				
	01: Normal Duty				
D10.02	Carrier Frequency Selection	01	01–0F	-	***84***
	01: 2.0 kHz				
	02: 5.0 kHz				
	03: 8.0 kHz				
	04: 10.0 kHz				
	05: 12.5 kHz				
	06: 15.0 kHz				
	07: Swing PWM1				
	08: Swing PWM2				
	09: Swing PWM3				
	0A: Swing PWM4				
	0F: Custom (determined by the settings of D10.03~D10.06)				
D10.03	Carrier Frequency Upper Limit	2.0	1.0–15.0	kHz	***84***

Parameter	Parameter Name	Default	Range	Units	Page
D10.04	Carrier Frequency Lower Limit	2.0	1.0–15.0	kHz	***84***
D10.05	Carrier Frequency Gain	00	00–99	-	***84***
D11.01	Hunting Prevention Selection 00: Disabled 01: Enabled	01	00–01	-	***84***
D11.02	Hunting Prevention Gain	1.00	0.00–2.50	-	***84***
D11.03	Hunting Prevention Time Constant	10	0–500	ms	***84***
D11.05	Hunting Prevention Gain in Reverse	0.00	0.0–2.50	-	***84***
E01.01	Input Voltage	***	155–255 310–510	V	***85***
E01.03	V/f Pattern	04*	00–FF	-	***86***
E01.04	Max Frequency	**	0.00–150.00	Hz	***86***
E01.05	Max Voltage	**	0.0–255.0 0.0–510.0	V	***86***
E01.06	Base Frequency	**	0.00–150.00	Hz	***86***
E01.07	Mid Frequency A	**	0.00–150.00	Hz	***86***
E01.08	Mid Voltage A	**	0.0–255.0 0.0–510.0	V	***86***
E01.09	Min Frequency	**	0.00~150.00	Hz	***86***
E01.10	Min Voltage	**	0.0–255.0 0.0–510.0	V	***86***
E01.11	Mid Frequency B	**	0.00–150.00	Hz	***86***
E01.12	Mid Voltage B	**	0.0–255.0 0.0–510.0	V	***86***
E01.13	Base Voltage	**	0.0–255.0 0.0–510.0	V	***86***
E02.01	Motor Rated FLA	-	0.0–70.0	A	***89***
E02.02	Motor Rated Slip	-	0.00–20.00	Hz	***89***
E02.03	No-Load Current	-	0.0–70.0	A	***89***
E02.04	Number of Poles	04	02–48	-	***89***
E02.05	Terminal Resistance	-	0.000–65.000	W	***89***
E02.06	Leakage Inductance	-	0.0–40.0	%	***89***
E02.07	Saturation Comp 1	-	0.00–0.50	-	***89***
E02.08	Saturation Comp 2	-	0.00–0.75	-	***89***
E02.09	Motor Mechanical Loss	0.0	0.0–10.0	%	***89***
E02.10	Motor Iron Loss of Torque Compensation	-	0–65535	W	***89***
E02.11	Motor Rated Power	-	0.0–20.0	HP	***89***
E02.12	Saturation Comp 2	-	1.30–5.00	%	***89***

Parameter	Parameter Name	Default	Range	Units	Page
F01.02	Pulse Feedback Loss	01	00–03	-	***90***
	00: Decel to Stop (by B05.02)				
	01: Coast to Stop				
	02: Fast Stop (by B05.08)				
	03: Alarm Only				
F01.03	Operation at Overspeed	01	00–03	-	***90***
	00: Decel to Stop (by B05.02)				
	01: Coast to Stop				
	02: Fast Stop (by B05.08)				
	03: Alarm only				
F01.04	Operation at Deviation:	05	00–07	-	***90***
	00: @ speed agree - Decel (by B05.02)				
	01: @ speed agree - Coast to Stop				
	02: @ speed agree - Fast Stop (by B05.08)				
	03: @ speed agree - alarm only				
	04: @ run - Decel to Stop (by B05.02)				
	05: @ run - Coast to Stop				
	06: @ run - Fast Stop (by B05.08)				
	07: @ run - Alarm Only (Dev-1 and Dev-2 Alarm)				
F01.08	Overspeed Detection Level	105	00–120	%	***90***
F01.09	Overspeed Detection Time	0.0	0.0–2.0	sec	***90***
F01.10	Excessive Speed Detection Level	10	00–50	%	***90***
F01.11	Excessive Speed Detection Time	0.3	0.0–10.0	sec	***90***
F01.14	PGO Detection Time	0.5	0.0–10.0	sec	***90***
F06.01	Comm Bus Fault (BUS)	01	00–04	-	***91***
	00: Decel to Stop				
	01: Coast to Stop				
	02: Fast-Stop				
	03: Use B03.03 Method				
	04: Alarm Only				
	05: Decel to Stop (Auto Reset)				
	06: Coast to Stop (Auto Reset)				
	07: Fast-Stop (Auto Reset)				
	08: Use B03.03 Method (Auto Reset)				
F06.02	Comm External Fault (EF0)	00	00–01	-	***91***
	00: Always Detected				
	01: Only During Run				

Parameter	Parameter Name	Default	Range	Units	Page
F06.03	EF0 Fault Action	01	00–04	-	***91***
	00: Decel to Stop				
	01: Coast to Stop				
	02: Fast-Stop				
	03: Use B03.03 Method				
	04: Alarm Only				
F06.08	Comm Parameter Initialization	00	00–01	-	***91***
	00: Initialize Comm Parameters				
	01: Don't Initialize Comm Parameters				
F06.14	BUS Fault Auto Reset	00	00–01	-	***91***
	00: Disabled				
	01: Enabled				
F06.30	Profibus Node Address	00	0–125	-	***91***
F06.31	Profibus Clear Select	00	00–01	-	***91***
	00: Reset to Zero				
	01: Hold Previous Value				
F06.32	Profibus Map Select	00	00–05	-	***92***
	00: PPO Type				
	01: Conventional				
	02: PPO (Bit 0)				
	03: PPO (Enter)				
	04: Conventional (Bit 0)				
	05: PPO (Bit 0, Enter)				
F07.01	IP Address 1	192	0–255	-	***92***
F07.02	IP Address 2	168	0–255	-	***92***
F07.03	IP Address 3	1	0–255	-	***92***
F07.04	IP Address 4	20	0–255	-	***92***
F07.05	Subnet Mask 1	255	0–255	-	***92***
F07.06	Subnet Mask 2	255	0–255	-	***92***
F07.07	Subnet Mask 3	255	0–255	-	***92***
F07.08	Subnet Mask 4	0	0–255	-	***92***
F07.09	Gateway Address 1	192	0–255	-	***92***
F07.10	Gateway Address 2	168	0–255	-	***92***
F07.11	Gateway Address 3	1	0–255	-	***92***
F07.12	Gateway Address 4	1	0–255	-	***92***
F07.13	IP Address Mode	02	00–02	-	***92***
	00: User Defined				
	01: BOOTP				
	02: DHCP				

Parameter	Parameter Name	Default	Range	Units	Page
F07.14	Duplex Select 00: Half/Half 01: Auto/Auto 02: Full/Full 03: Half/Auto 04: Half/Full 05: Auto/Half 06: Auto/Full 07: Full/Half 08: Full/Auto	01	00–08	-	***92***
F07.15	Baud Rate 10: 10 Mbps 100: 100 Mbps 101: 10/100 Mbps 102: 100/10 Mbps	10	10,100–102	-	***93***
F07.16	Comm Loss Timeout	0.0	0.0–30.0	-	***93***
F07.17	Ethernet Speed Scale	00	-15–15	-	***93***
F07.18	Ethernet Current Scale	00	-15–15	-	***93***
F07.19	Ethernet Torque Scale	00	-15–15	-	***93***
F07.20	Ethernet Power Scale	00	-15–15	-	***93***
F07.21	Ethernet Voltage Scale	00	-15–15	-	***93***
F07.22	Ethernet Time Scale	00	-15–15	-	***93***
F07.23 to F07.32	DOA116 (1 to 10)	00	00–FF	-	***93***
F07.33 to F07.42	DOA166 (1 to 10)	00	00–FF	-	***93***

Parameter	Parameter Name	Default	Range	Units	Page
H01.01	Input Terminal S1 Select	80*	00–81	-	***94***
	00: Multi-Step Reference 2				
	01: Multi-Step Reference 3				
	02: Multi-Step Reference 4				
	03: Multi-Step Reference 5				
	04: Speed Hold 2				
	05: Accel Command				
	06: Upper Limit 1 N.O.				
	07: Upper Limit 2 N.O.				
	08: Lower Limit 1 N.O.				
	09: Lower Limit 2 N.O.				
	0A: Upper Limit 1 N.C.				
	0B: Upper Limit 2 N.C.				
	0C: Lower Limit 1 N.C.				
	0D: Lower Limit 2 N.C.				
	0E: M-Speed Gain 1				
	0F: Not Used				
	10: M-Speed Gain 2				
	12: Weight Limit N.C.				
	13: Swift-Lift				
	14: Alternate Torque Limit Gain				
	15: Forward Jog				
	16: Reverse Jog				
	17: Forward Inch				
	18: Reverse Inch				
	19: Inch Repeat				
	1A: Acc/Dec 2				
	1B: Acc/Dec 3				
	1C: Acc/Dec 4				
	1D: Digital Changeover				
	1F: Option Reference Switch				
	20~2F: External Fault				
	30: Program Lockout				
	31: Local/Remote Switch				
	32: Ext BB N.O.				
	33: Ext BB N.C.				
	39: External OH2				
	3A: Terminal A1/A2 Enable				
	3F: Fault Reset				
	40: Fast Stop N.O.				

Parameter	Parameter Name	Default	Range	Units	Page
	42: Fast Stop N.C.				
	43: Timer Enable				
	47: Analog Hold				
	4C: DC Injection Braking				
	53: Communication Test				
	55: Drive Enable				
	56: Klixon N.O.				
	57: Klixon N.C.				
	58: Brake Answerback				
	59: Alternate Upper Frequency Limit				
	5A: Maintenance Reset				
	5B: BE6 Up Speed Limit				
	5F: Phantom Stop N.C.				
	62: Weight Limit N.O.				
	63: Phantom Stop N.O.				
	65: Dwell Enable				
	69: LC Disable				
	70: Torque Detection Enable				
	80: Forward Run				
	81: Reverse Run				
H01.02	Terminal S2 Select	81*	00–81	-	***94***
H01.03	Terminal S3 Select	00*	00–81	-	***94***
H01.04	Terminal S4 Select	01*	00–81	-	***94***
H01.05	Terminal S5 Select	0F*	00–81	-	***94***
H01.06	Terminal S6 Select	0F*	00–81	-	***94***
H01.07	Terminal S7 Select	0F*	00–81	-	***94***

Parameter	Parameter Name	Default	Range	Units	Page
H02.01	Output Contact (MC-MB-MA) Select	000*	000–1FF	-	***98***
	000: Brake Release				
	001: Zero Speed				
	002: Fref. Fout Agree 1				
	003: Fref/Set Agree 1				
	004: Frequency Detect 1				
	005: Frequency Detect 2				
	006: Inverter Ready				
	007: DC Bus Undervolt				
	008: Base Block N.O.				
	009: Keypad Reference				
	00A: Local Operation				
	00B: Torque Detect 1 N.O.				
	00D: DB Overheat				
	00E: Fault				
	00F: Not used				
	010: Minor Fault				
	011: Reset Command Active				
	012: Timer Output				
	013: Freq/Fout Agree 2				
	014: Freq/Set Agree 2				
	015: Frequency Detect 3				
	016: Frequency Detect 4				
	017: Torque Detect 1 N.C.				
	018: Torque Detect 2 N.O.				
	019: Torque Detect 2 N.C.				
	01A: Forward Direction				
	01B: Reverse Direction				
	01C: Swift-Lift Active				
	01D: Base Block N.C.				
	020: Auto-Reset				
	021: Overload OL1				
	022: Overhead Pre-Alarm				
	023: Torque Limit				
	026: Run Command is Input				
	027: Load Check Detect				
	029: Upper Limit				
	02A: During Run 1				
	02B: During Fast Stop				
	02F: Load Weakening				

Parameter	Parameter Name	Default	Range	Units	Page
	030: Lower Limit				
	031: Upper/Lower Limit				
	035: Load Check Fault Detection				
	037: Maintenance				
	039: Drive Enable				
	03A: Overheat Pre-Alarm Time Limit				
	03D: During Speed Search				
	03F: Klixon				
	040~0FF: Fault Annunciate				
	101: (Inverse) Zero Speed				
	102: (Inverse) Fref/Fout Agree 1				
	103: (Inverse) Fref/Set Agree 1				
	104: (Inverse) Frequency Detect 1				
	105: (Inverse) Frequency Detect 2				
	106: (Inverse) Inverter Ready				
	107: (Inverse) DC Bus Undervolt				
	108: (Inverse) Base Block N.O.				
	109: (Inverse) Keypad Reference				
	10A: (Inverse) Local Operation				
	10B: (Inverse) Torque Detect 1 N.O.				
	10D: (Inverse) DB Overheat				
	10E: (Inverse) Fault				
	110: (Inverse) Minor Fault				
	111: (Inverse) Reset Command Active				
	112: (Inverse) Timer Output				
	113: (Inverse) Freq Agree 2				
	114: (Inverse) Freq Set 2				
	115: (Inverse) Frequency Detect 3				
	117: (Inverse) Torque Detect 1 N.C.				
	118: (Inverse) Torque Detect 2 N.O.				
	119: (Inverse) Torque Detect 2 N.C.				
	11A: (Inverse) Forward Direction				
	11B: (Inverse) Reverse Direction				
	11C: (Inverse) Swift-Lift Active				
	11D: (Inverse) Base Block N.C.				
	120: (Inverse) Auto-Reset				
	121: (Inverse) Overload OL1				
	122: (Inverse) Overheat Pre-Alarm				
	123: (Inverse) Torque Limit				
	126: (Inverse) Run Command is input				

Parameter	Parameter Name	Default	Range	Units	Page
	127: (Inverse) Load Check Detect				
	129: (Inverse) Upper Limit				
	12A: (Inverse) During Run 1				
	12B: (Inverse) During Fast Stop				
	12F: (Inverse) Load Weakening				
	130: (Inverse) Lower Limit				
	131: (Inverse) Upper/Lower Limit				
	135: (Inverse) Load Check Fault Detection				
	137: (Inverse) Maintenance				
	139: (Inverse) Drive Enable				
	13A: (Inverse) Overheat Pre-Alarm Time Limit				
	13D: (Inverse) During Speed Search				
	13F: (Inverse) Klixon				
	140~1FF: (Inverse) Fault Annunciate				
H02.02	Output Terminal P1 Select (See H02.01 for selections)	00F*	000–1FF	-	***98***
H02.03	Output Terminal P2 Select (See H02.01 for selections)	00F*	000–1FF	-	***98***
H03.01	Terminal A1 Signal Select	00*	00	-	***102***
	00: 0 to 10 VDC				
H03.02	Terminal A1 Select	00	00–1F	-	***102***
	00: Frequency Bias				
	01: Frequency Gain				
	02: Aux Speed Reference 1				
	03: Aux Speed Reference 2				
	04: Output Voltage Bias				
	07: OT/UT Detection Level				
	0F: Not Used				
	10: Forward Torque Limit				
	11: Reverse Torque Limit				
	12: Regen Torque Limit				
	15: FWD/REV Torque Limit				
	1F: Not Used				
H03.03	Terminal A1 Gain	100.0	-999.9–999.9	%	***102***
H03.04	Terminal A1 Bias	0.0	-999.9–999.9	%	***102***
H03.09	Terminal A2 Signal Select	02	00, 02, 03	-	***102***
	00: 0 to 10 VDC				
	02: 4 to 20 mA				
	03: 0 to 20 mA				

Parameter	Parameter Name	Default	Range	Units	Page
H03.10	Terminal A2 Select	00	00–1F	-	***102***
	00: Frequency Bias				
	01: Frequency Gain				
	02: Aux Speed Reference 1				
	03: Aux Speed Reference 2				
	04: Output Voltage Bias				
	07: OT/UT Detection Level				
	0F: Not Used				
	10: Forward Torque Limit				
	11: Reverse Torque Limit				
	12: Regen Torque Limit				
	15: FWD/REV Torque Limit				
	1F: Not Used				
H03.11	Terminal A2 Gain	100.0	-999.9–999.9	%	***103***
H03.12	Terminal A2 Bias	0.00	-999.9–999.9	%	***103***
H03.13	Analog Input Filter Time Constant	0.03	0.00–2.00	sec	***103***
H04.01	Terminal AM Select	102	101–162	--	***103***
	101: Frequency Reference				
	102: Output Frequency				
	103: Output Current				
	105: Motor Speed (OLV Only)				
	106: Output Voltage				
	107: DC Bus Voltage				
	108: Output Power				
	109: Torque Reference (OLV Only)				
	115: Terminal A1 Level				
	116: Terminal A2 Level				
	120: SFS Output				
	154: Input Pulse Monitor				
	162: Not Used				
H04.02	Terminal AM Gain	100.0	-999.9–999.9	%	***103***
H04.03	Terminal AM Bias	0.0	-999.9–999.9	%	***103***
H05.01	Serial Comm Address	1F	00–20	-	***104***

Parameter	Parameter Name	Default	Range	Units	Page
H05.02	Series Baud Rate 00: 1200 bps 01: 2400 bps 02: 4800 bps 03: 9600 bps 04: 19200 bps 05: 38400 bps 06: 57600 bps 07: 76800 bps 08: 115200 bps	03	00–08	-	***104***
H05.03	Communications - Parity 00: No Parity 01: Even Parity 02: Odd Parity	00	00–02	-	***104***
H05.04	Communication - Error Stopping Method 00: Decel to Stop 01: Coast to Stop 02: Fast-Stop 03: Alarm Only 04: Use B03.03	04	00–04	-	***104***
H05.05	Communication - Error Detection Select 00: Disable 01: Enable	01	00–01	-	***104***
H05.06	Transmit Wait Time	05	05–65	ms	***104***
H05.07	RTS Control Select 00: Disable 01: Enable	01	00–01	-	***104***
H05.09	Communication - Error Detection Time	2.0	0.0–10.0	sec	***104***
H05.10	Output Voltage Reference 00: 0.1V 01: 1V	00	00–01	-	***104***
H05.11	Communication Enter Function Select 00: Enter Command must be used 01: Enter Command Not Required	00	00–01	-	***105***
H05.12	Run Command Method Selection 00: Bit 0 = Start/Stop Forward Direction Bit 1 = Start/Stop Reverse Direction 01: Bit 0 = Start/Stop Bit 1 = Forward/Reverse Direction	00	00–01	-	***105***

Parameter	Parameter Name	Default	Range	Units	Page
H06.01	Pulse Input Selection 00: Frequency Reference 03: Encoder Feedback	00	00, 03	-	***105***
H06.02	Pulse Input Scaling	1440	1000–32,000	Hz	***105***
H06.03	Pulse Input Gain	100.0	0.0–1000.0	%	***105***
H06.04	Pulse Input Bias	0.0	-100.0–100.0	%	***105***
H06.05	Pulse Input Filter Time	0.10	0.00–2.00	sec	***105***
H06.06	Pulse Monitor Selection	102	000, 031, 101, 102, 105, 120, 501, 502	-	***105***
H06.07	Pulse Monitor Scaling	1400	0–32,000	Hz	***105***
L01.01	Motor Overload Fault Select 00: Disabled 01: Standard Fan Cooled 02: Standard Blower Cooled 03: Vector Motor	03	00–03	-	***106***
L01.02	Motor Overload Time Constant	1.0	0.1–5.0	min	***106***
L01.03	Motor Overheat Alarm Selection 00: Decel to Stop (Alarm) 01: Coast to Stop (Alarm) 02: Fast-Stop by B05.08 (Alarm) 03: Alarm Only (OH3 Flashes) 04: Stop by B03.03 Stopping Method (Alarm)	03	00–04	-	***107***
L01.04	Motor Overheat Fault Selection 00: Decel to Stop 01: Coast to Stop 02: Fast-Stop by B05.08 (Alarm) 03: Stop by B03.03 Stopping Method (Alarm)	03	00–03	-	***107***
L01.05	Motor Temp Filter	0.20	0.00–10.00	sec	***107***
L01.13	Overhead Operation Selection 00: Disable 01: Enable	01	00–01	-	***107***
L02.01	Power-loss Selection 00: Disable 01: Enabled 02: CPU Power Active	00	00–02	-	***108***
L02.02	Power-loss Ride Thru Time	0.1 (Varies)	0.0–25.5	sec	***108***
L02.03	Power-loss Base Block Time	01. (Varies)	0.1–5.0	sec	***108***
L02.04	Power-loss V/f Ramp Time	0.3 (Varies)	0.0–5.0	sec	***108***
L02.05	PUV Detection Level	190/380	150–210 300–420	V	***108***

Parameter	Parameter Name	Default	Range	Units	Page
L02.07	Power-loss Ride Thru Accel	0.0	0.0–25.5	sec	***108***
L03.01	Stall Prevention Accel Select 00: Disabled 01: General Purpose 02: Intelligent	01	00–02	-	***108***
L03.02	Stall Prevention Accel Level	150	0–150	%	***109***
L03.03	Stall Prevention Constant HP Limit	50	0–100	%	***110***
L03.05	Stall Prevention Run Select 00: Disabled 01: Decel Time 1 02: Decel Time 2	01	00–02	-	***110***
L03.06	Stall Prevention Run Level	150	30–150	%	***111***
L03.17	DC Bus Voltage for Intelligent Control	370	150–400	V	***112***
L03.20	Main Circuit Voltage Gain	A01.02	0.00–5.00	-	-
L03.21	Deceleration Calculation Gain	A01.02	0.00–200.00	-	-
L03.23	Automatic Stall Prevention Selection During Run 00: Sets the level to L03.04 throughout the entire frequency range 01: Automatically lowers Stall Prevention level during run in the constant power range. The lower limit will be 40% of L03.06.	00	00–01	-	***112***
L03.24	Motor Acceleration Time Inertial Calculations	O02.04	0.001–10.000	-	***112***
L03.25	Load Inertia Ratio	1.0	0.0–1000.0	-	***112***
L04.01	Speed Agree Level	0.0	0.0–150.0	Hz	***113***
L04.02	Speed Agree Width	2.0	0.0–20.0	Hz	***113***
L04.03	Speed Agree Level ±	0.0	-150.0–150.0	Hz	***113***
L04.04	Speed Agree Width ±	2.0	0.0–20.0	Hz	***113***
L04.07	Speed Agree Detection 00: No detection during baseblock 01: Detection always enabled	00	00, 01	-	***113***

Parameter	Parameter Name	Default	Range	Units	Page
L06.01	Torque Detection 1 Level Select	00	00–08	-	***114***
	00: Disabled				
	01: Overtorque @ Speed Agree (Alarm)				
	02: Overtorque @ Run (Alarm)				
	03: Overtorque @ Speed Agree (Fault)				
	04: Overtorque @ Run (Fault)				
	05: Undertorque @ Speed Agree (Alarm)				
	06: Undertorque @ Run (Alarm)				
	07: Undertorque @ Speed Agree (Fault)				
	08: Undertorque @ Run (Fault)				
L06.02	Torque Detection 1 Level	150	0–300	%	***115***
L06.03	Torque Detection 1 Time	0.1	0.0–10.0	sec	***115***
L06.04	Torque Detection 2 Level Select	00	00–08	-	***115***
	00: Disabled				
	01: Overtorque @ Speed Agree (Alarm)				
	02: Overtorque @ Run (Alarm)				
	03: Overtorque @ Speed Agree (Fault)				
	04: Overtorque @ Run (Fault)				
	05: Undertorque @ Speed Agree (Alarm)				
	06: Undertorque @ Run (Alarm)				
	07: Undertorque @ Speed Agree (Fault)				
	08: Undertorque @ Run (Fault)				
L06.05	Torque Detection 2 Level	150	000–300	%	***116***
L06.06	Torque Detection 2 Time	0.1	0.0–10.0	sec	***116***

Parameter	Parameter Name	Default	Range	Units	Page
L06.08	Mechanical Weakening Detection Selection 00: Disabled 01: Speed (signed) > L06.09; Continue Running (Alarm) 02: Speed (unsigned) > L06.09; Continue Running (Alarm) 03: Speed (signed) > L06.09; Stop (Protection) 04: Speed (unsigned) > L06.09; Stop (Protection) 05: Speed (signed) < L06.09; Continue Running (Alarm) 06: Speed (unsigned) < L06.09; Continue Running (Alarm) 07: Speed (signed) < L06.09; Stop (Protection) 08: Speed (unsigned) < L06.09; Stop (Protection)	00	00–08	-	***116***
L06.09	Mechanical Weakening Detection Level	110.0	-110.0–110.0	%	***116***
L06.10	Mechanical Weakening Detection Time	0.1	0.0–10.0	sec	***116***
L06.11	Mechanical Weakening Start Time	0	0–65535	hrs	***116***
L08.02	Overheat Pre-Alarm Level	95	50–130	°C	***117***
L08.03	Overheat Pre-Alarm Selection 00: Decel to Stop 01: Coast to Stop 02: Fast Stop 03: Use B03.03 Stopping Method 04: Alarm Only 05: Derated Operation (L08.19)	05	00–05	-	***117***
L08.05	Input Phase Loss Selection 00: Disabled 01: Enabled	01	00–01	-	***117***
L08.06	Input Phase Loss Detection Level (Increasing L08.06 from default value may cause DC BUS capacitor failure)	5.0	0.0–5.0	%	***117***
L08.07	Output Phase Loss Selection 00: Disabled 01: Enabled	01	00, 01	-	***117***
L08.08	Output Phase Loss Detection Level	5.0	0.0–20.0	%	***117***

Parameter	Parameter Name	Default	Range	Units	Page
L08.09	Ground Fault 00: Disable 01: Enable	01***	00, 01	-	***117***
L08.10	Fan Operation Selection 00: Fan On - Run with Time (L08.11) 01: Fan Always On	00	00, 01	-	***117***
L08.11	Fan Off-Delay Time	60	0–300	sec	***117***
L08.12	Ambient Temp	40	-10–50	°C	***117***
L08.15	OL2 Sel @ Low Speed 00: Disabled 01: Enabled	01	00, 01	-	***118***
L08.18	Soft CLA Sel 00: Disabled 01: Enabled	01	00, 01	-	***118***
L08.19	Overheat Pre-Alarm Frequency Reduction Rate	0.8	0.1, 0.9	%	***118***
L08.35	Mounting Selection 00: Disabled (standard installation) 01: Side-By-Side 02: NEMA 1 Standard 03: Finless	00	00–03	-	***118***
L08.41	High Current Alarm Selection 00: Disable 01: Enable	00	00, 01	-	***118***
L09.01	Auto Reset Select 00: Disable 01: Enable	01	00, 01	-	***119***
L09.02	Auto Reset Attempts	03	00–10	-	***119***
L09.03	Auto Reset Time	0.5	0.5–180.0	sec	***119***
L09.04	Auto Reset Fault Select 1	0001	0000–FFFF	-	***119***
L09.05	Auto Reset Fault Select 2	E000	0000–FFFF	-	***119***
L09.06	Output Contact (MC-MB-MA) Select 00: Disabled (No Fault Relay) 01: Enabled (Fault Relay Active)	01	00, 01	-	***119***
N02.01	AFR Tuning	1.00	0.00–10.00	-	***121***
N02.02	AFR Detection Time	50	0–2000	ms	***121***
N02.03	AFR Time Constant	750	0–2000	ms	***121***
N02.04	AFR Limit	5.0	0.0–60.0	Hz	-
N02.05	OLV Stabilization Level	00	00–11, FF	-	***121***

Parameter	Parameter Name	Default	Range	Units	Page
N06.01	Line-to-Line Motor Tuning	01	00–01	-	***122***
	00: Disabled				
	01: Enabled				
O01.01	User Monitor Selection	106	104–621	-	***123***
	104: Control Method				
	105: Motor Speed - OLV ONLY				
	106: Output Voltage				
	107: DC Bus Voltage				
	108: Output Power				
	109: Torque Reference - OLV ONLY				
	110: Input Terminal Status				
	111: Output Terminal Status				
	112: Operation Status				
	113: Elapsed Time				
	114: FLASH ID				
	115: Terminal A1 Level				
	116: Terminal A2 Level				
	120: Output Frequency After Soft Start				
	128: CPU ID				
	134: OPE Detected				
	139: Modbus Comm Error Code				
	152: Maintenance Timer				
	154: Input Pulse Monitor				
	401: Cumulative Operation Time				
	403: Cooling Fan Operation Time				
	404: Cooling Fan Maintenance				
	405: Capacitor Maintenance				
	406: Pre-Charge Relay Maintenance				
	407: IGBT Maintenance				
	408: Heatsink Temperature				
	410: kWh; Lower 4 Digits				
	411: kWh; Upper 5 Digits				
	412: CPU Resources Used				
	413: Peak Hold Current				
	414: Peak Hold Output Frequency				
	416: Motor Overload (oL1) Detection Level				
	417: VFD Overload (oL2) Detection Level				

Parameter	Parameter Name	Default	Range	Units	Page
	418: Frequency Reference Source Selection				
	419: Frequency Reference Modbus				
	420: Output Frequency Reference (decimal)				
	421: Run Command Selection Results				
	422: Modbus Communication Reference				
	601: Motor Secondary Current (Iq)				
	602: Motor Excitation current (Id) - OLV ONLY				
	605: Output Voltage Reference (Vq) - OLV ONLY				
	606: Output Voltage Reference (Vd) - OLV ONLY				
	607: ACR (q) Output - OLV ONLY				
	608: ACR (d) Output - OLV ONLY				
	620: Frequency Reference Bias (Up/ Down2)				
	621: Offset Frequency				
O01.02	Power-On Monitor	03	01–05	-	***124***
	01: Frequency Reference (U01.01)				
	02: Forward/Reverse				
	03: Output Frequency (U01.02)				
	04: Output current (U01.03)				
	05: User Monitor (O01.01)				
O01.03	Display Sealing	00	00–03	-	***125***
	00: 0.01 Hz				
	01: 0.01%				
	02: r/min				
	03: User-set				
O01.10	User-set Display Maximum Units	06000	00000–60000	-	***125***
O01.11	User-set Display Decimal	02	00–03	-	***125***
	00: No Decimal Point				
	01: 0.1				
	02: 0.01				
	03: 0.001				
O02.01	Local/Remote Key	00	00, 01	-	***125***
	00: Disable				
	01: Enable				

Parameter	Parameter Name	Default	Range	Units	Page
O02.02	Stop Key Operation	00	00–02	-	***125***
	00: Coast to Stop				
	01: Decel to Stop				
	02: Use B03.03 Stopping Method				
O02.03	User Defaults	00	00~02	-	***125***
	00: No Change				
	01: Set Defaults				
	02: Clear All				
O02.04	kVA Selection	-	61–9D	-	***125***
	61: 2001-G+M				
	62: 2003-G+M				
	63: 2005-G+M				
	65: 2008-G+M				
	66: 2011-G+M				
	68: 2017-G+M				
	6A: 2025-G+M				
	6B: 2033-G+M				
	6D: 2047-G+M				
	6E: 2060-G+M				
	91: 4001-G+M				
	92: 4002-G+M				
	93: 4003-G+M				
	94: 4004-G+M				
	95: 4005-G+M				
	96: 4007-G+M				
	97: 4009-G+M				
	99: 4014-G+M				
	9A: 4018-G+M				
	9C: 4024-G+M				
	9D: 4031-G+M				
O02.05	Keypad M.O.P	00	00, 01	-	***126***
	00: Disabled				
	01: Enabled				
O02.07	Motor Direction at power-up	00	00, 01	-	***126***
	00: Forward				
	01: Reverse				
O02.09	Initialization Selection	01	01~02	-	***126***
	01: American Spec				
	02: European Spec				

Parameter	Parameter Name	Default	Range	Units	Page
O02.10	Motor Power Units 00: HP 01: kW	00	00~01		***126***
O03.01	Elapsed Time Setting	0000	0000–9999	hr	***127***
O03.02	Elapsed Time Selection 00: Power On Time 01: Running Time	01	00, 01	-	***127***
O03.03	Fan On Time	0000	0000–9999	hr	***127***
O03.05	Capacitor Maintenance Time	000	000–150	%	***127***
O03.07	Pre-Charge Relay Maintenance Setting	000	000–150	%	***127***
O03.09	IGBT Maintenance Setting	000	000–150	%	***127***
O03.11	Fault Trace Clear 00: Not Cleared 01: Clear U2/U3	00	00, 01	-	***127***
O03.12	kWh Monitor Initial Value Selection 00: Save 01: Reset	00	00, 01	-	***127***
O03.14	Clear Count History 00: Not Clear 01: Clear AC Count 02: Clear OL/LC Count 03: Clear Both Counts	00	00–03	-	***127***
T01.01	Tuning Mode Select 00: Rotating Auto-Tune (OLV) 02: Stationary Auto-Tune	02	00, 02, 03	-	***48***
T01.02	Motor Rated Power	-	-	HP/kW	***48***
T01.04	Motor Rated Current	-	-	A	***48***
T01.05	Motor Rated Frequency	60.00	0.00–150.00	Hz	-
T01.06	Motor Poles	04	02–48	-	***48***
T01.07	Motor Rated Speed	1750	0–24000	RPM	***48***
U01.01	Frequency Reference	-	-	Hz	***128***
U01.02	Output Frequency	-	-	Hz	***128***
U01.03	Output Current	-	-	A	***128***
U01.04	Control Method	-	-	-	***128***
U01.05	Motor Speed (OLV Only)	-	-	Hz	***128***
U01.06	Output Voltage	-	-	VAC	***128***
U01.07	DC Bus Voltage	-	-	VDC	***128***
U01.08	Output Power	-	-	HP/kW	***128***
U01.09	Motor Torque (OLV Only)	-	-	%	***128***
U01.10	Input Terminal Status	-	-	-	***128***

Parameter	Parameter Name	Default	Range	Units	Page
U01.11	Output Terminal Status	-	-	-	***128***
U01.12	VFD Control Status	-	-	-	***129***
U01.13	Elapsed Time	-	-	hr	***129***
U01.14	Firmware Version	-	-	-	***129***
U01.15	Terminal A1 Level	-	-	%	***129***
U01.16	Terminal A2 Level	-	-	%	***129***
U01.20	Output Frequency after Soft Start	-	-	Hz	***129***
U01.28	Software CPU	-	-	-	***129***
U01.34	OPE Detection Parameter	-	-	-	***129***
U01.39	Modbus Communication Error	-	-	-	***129***
U01.52	Maintenance Timer	-	-	hr	***129***
U01.54	Pulse Monitor	-	-	Hz	***129***
U01.64	LC Zone	-	-	-	***129***
U01.65	LC Margin	-	-	%	***129***
U02.01	Current Fault	-	-	-	***130***
U02.02	Last Fault	-	-	-	***130***
U02.03	Frequency Reference @ Fault	-	-	Hz	***130***
U02.04	Output Frequency @ Fault	-	-	Hz	***130***
U02.05	Output Current @ Fault	-	-	A	***130***
U02.06	Motor Speed @ Fault (OLV Only)	-	-	Hz	***130***
U02.07	Output Voltage @ Fault	-	-	VAC	***130***
U02.08	DC Bus Voltage @ Fault	-	-	VDC	***130***
U02.09	Output Power @ Fault	-	-	HP/kW	***130***
U02.10	Torque Reference @ Fault (OLV Only)	-	-	%	***130***
U02.11	Input Terminal Status @ Fault	-	-	-	***130***
U02.12	Output Terminal Status @ Fault	-	-	-	***130***
U02.13	Operation Status @ Fault	-	-	-	***130***
U02.14	Elapsed Operation Time @ Fault	-	-	hr	***130***
U02.15	Speed Reference During Soft Start	-	-	-	***130***
U02.16	Motor q-Axis Current During Fault	-	-	-	***130***
U02.17	Motor d-Axis Current During Fault	-	-	-	***130***
U03.01	Last Fault	-	-	-	***131***
U03.02	Fault Message 2	-	-	-	***131***
U03.03	Fault Message 3	-	-	-	***131***
U03.04	Fault Message 4	-	-	-	***131***
U03.05	Fault Message 5	-	-	-	***131***
U03.06	Fault Message 6	-	-	-	***131***
U03.07	Fault Message 7	-	-	-	***131***
U03.08	Fault Message 8	-	-	-	***131***
U03.09	Fault Message 9	-	-	-	***131***

Parameter	Parameter Name	Default	Range	Units	Page
U03.10	Fault Message 10	-	-	-	***131***
U03.11	Elapsed Time 1	-	-	hr	***131***
U03.12	Elapsed Time 2	-	-	hr	***131***
U03.13	Elapsed Time 3	-	-	hr	***131***
U03.14	Elapsed Time 4	-	-	hr	***131***
U03.15	Elapsed Time 5	-	-	hr	***131***
U03.16	Elapsed Time 6	-	-	hr	***131***
U03.17	Elapsed Time 7	-	-	hr	***131***
U03.18	Elapsed Time 8	-	-	hr	***131***
U03.19	Elapsed Time 9	-	-	hr	***131***
U03.20	Elapsed Time 10	-	-	hr	***131***
U03.21	Accumulated Operations	-	-	-	***131***
U03.22	U03.21 Rollovers	-	-	-	***131***
U03.23	Overload/Load Check Count	-	-	-	***131***
U04.01	Cumulative Operation Time	-	-	hr	***132***
U04.03	Cooling Fan Operation Time	-	-	hr	***132***
U04.04	Cooling Fan Maintenance	-	-	%	***132***
U04.05	Capacitor Maintenance	-	-	%	***132***
U04.06	Pre-Charge Relay Maintenance	-	-	%	***132***
U04.07	IGBT Maintenance	-	-	%	***132***
U04.08	Heatsink Temperature	-	-	°C	***132***
U04.10	kWh; Lower 4 Digits	-	-	kWh	***132***
U04.11	kWh; Upper 5 Digits	-	-	kWh	***132***
U04.12	CPU Resources Used	-	-	-	***132***
U04.13	Peak Hold Current	-	-	A	***132***
U04.14	Peak Hold Output Frequency	-	-	Hz	***132***
U04.16	Motor Overload (oL1) Detection Level	-	-	-	***132***
U04.17	VFD Overload (oL2) Detection Level	-	-	-	***132***
U04.18	Frequency Reference Source Selection	-	-	-	***132***
U04.19	Frequency Reference Modbus	-	-	-	***132***
U04.20	Output Frequency Reference (Decimal)	-	-	-	***132***
U04.21	Run Command Selection Results	-	-	-	***132***
U04.22	Modbus Communication Reference	-	-	-	***132***
U04.23	Option Card Reference	-	-	-	***132***
U06.01	Motor Secondary Current (Iq)	-	-	%	***133***
U06.02	Motor Excitation Current (Id)	-	-	%	***133***
U06.03	ASR Input	-	-	%	***133***
U06.04	ASR Output	-	-	%	***133***
U06.05	Output Voltage Reference (Vq)	-	-	V	***133***
U06.06	Output Voltage Reference (Vd)	-	-	V	***133***

Parameter	Parameter Name	Default	Range	Units	Page
U06.07	ACR (q) Output	-	-	%	***133***
U06.08	ACR (d) Output	-	-	%	***133***
U06.20	Frequency Reference Bias (Up/Down2)	-	-	%	***133***
U06.36	GAIA Communication Error	-	-	-	***133***
U06.37	LUNA Communication Error	-	-	-	***133***
U06.38	Option Card Error	-	-	-	***133***

** Parameters defaults changed by X-Press Programming*

*** Parameters changed by E01.03*

**** Value depends on VFD model*

***** Default value depends on control method*

Appendix B: Standards Compliance

Electromagnetic Compatibility (EMC) Guidelines Compliance

Figure B-1: CE Mark

The CE mark indicates compliance with European safety and environmental regulations. It is required for engaging in business and commerce in Europe.

European standards include the Machinery Directive for machine manufacturers, the Low Voltage Directive for electronics manufacturers, and the EMC guidelines for controlling noise.

This VFD displays the CE mark based on the EMC guidelines and the Low Voltage Directive.

- Low Voltage Directive: 2014/35/EU

Devices used in combination with this VFD must also be CE certified and display the CE mark. When using VFDs displaying the CE mark in combination with other devices, it is ultimately the responsibility of the user to ensure compliance with CE standards. After setting up the device, verify that conditions meet European standards.

EMC Guidelines Compliance

This VFD is tested according to European standards IEC/EN 61800-3:2004/A1:2012 and it complies with the EMC directive 2014/30/EU.

Since the device is intended exclusively for commercial applications, it is not subject to the requirements of the EN 61000-3-2 standard for the emission of harmonic current emissions.

In a residential environment, this device may cause high-frequency interference, which requires interference suppression. If the device is used in this environment, make sure that an EMC expert carries out the installation and commissioning.

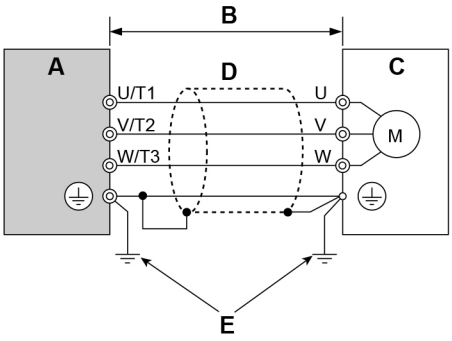
EMC Filter Installation

The following conditions must be met to ensure continued compliance with guidelines. ***See EMC Filters on page 177*** for EMC filter selection.

Installation Method

Verify the following installation conditions to ensure that other devices and machinery used in combination with this VFD also comply with EMC guidelines.

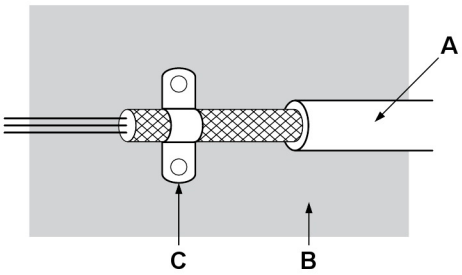
1. Install an EMC noise filter to the input side specified by Magnetek for compliance with European standards.
2. Place the VFD and EMC noise filter in the same enclosure.
3. Use braided shield cable for the VFD and motor wiring, or run the wiring through a metal conduit.
4. Keep wiring as short as possible. Ground the shield on both the VFD side and the motor side.



A – Drive
B – 20 m max cable length between drive and motor
C – Motor
D – Metal conduit
E – Ground wire should be as short as possible.

Figure B-2: Installation Method

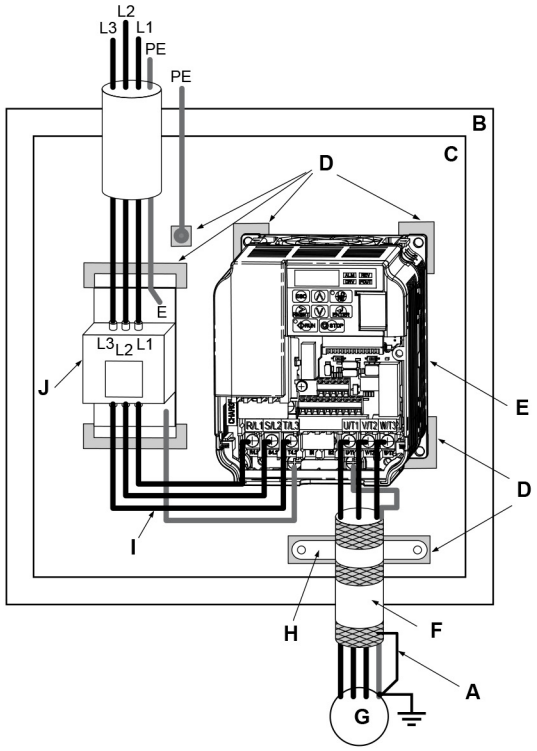
5. Ground the largest possible surface area of the shield to the metal conduit when using braided shield cable. Magnetek recommends using a cable clamp.



A – Braided shield cable
B – Metal panel
C – Cable clamp (conductive)

Figure B-3: Ground Area

Three-Phase 230/460 V Class



A – Ground the cable shield
B – Enclosure panel
C – Metal plate
D – Grounding surface (remove any paint or sealant)
E – Drive
F – Motor cable (braided shield cable, max. 20 m)
G – Motor
H – Cable clamp
I – Wiring distance as short as possible
J – EMC noise filter

Figure B-4: EMC Filter and VFD Installation for CE Compliance (Three-Phase 230/460 V Class)

EMC Filters

Install the VFD with the EMC filters listed in ***Table B-1*** and ***Table B-2*** to comply with the EN61800-3, Category C1 requirements.

Table B-1: IEC/EN61800-3 Category C1 Filters - Three-Phase 230 V Class

VFD Model (❑❑❑❑-G+M)	Filter Data (Manufacturer: Schaffner)						
	Type	Rated Current (A)	Weight lb (kg)	Dimensions W x L x H (in) [W x L x H (mm)]	Mounting Dimensions Y x X (in) [Y x X (mm)]	VFD Mounting Screw A	Filter Mounting Screw
2001	FS23637-8-07	7.3	0.88 (0.4)	2.8 x 6.7 x 1.6 (71 x 169 x 40)	2.0 x 6.1 (51 x 156)	M4	M5
2003	FS23637-8-07	7.3	0.88 (0.4)	2.8 x 6.7 x 1.6 (71 x 169 x 40)	2.0 x 6.1 (51 x 156)	M4	M5
2005	FS23637-8-07	7.3	0.88 (0.4)	2.8 x 6.7 x 1.6 (71 x 169 x 40)	2.0 x 6.1 (51 x 156)	M4	M5
2008	FS23637-14-07	14	1.28 (0.6)	4.4 x 6.7 x 1.8 (111 x 169 x 45)	3.6 x 6.1 (91 x 156)	M4	M5
2011	FS23637-14-07	14	1.28 (0.6)	4.4 x 6.7 x 1.8 (111 x 169 x 45)	3.6 x 6.1 (91 x 156)	M4	M5
2017	FS23637-24-07	24	1.98 (0.9)	5.7 x 6.9 x 2.0 (144 x 174 x 50)	4.7 x 6.3 (120 x 161)	M4	M5
2025*	FS23637-52-07	52	4.41 (2.0)	5.4 x 12.0 x 2.2 (137 x 304 x 56)	3.9 x 11.4 (100 x 289)	M5	M5
2033*	FS23637-52-07	52	4.41 (2.0)	5.4 x 12.0 x 2.2 (137 x 304 x 56)	3.9 x 11.4 (100 x 289)	M5	M5
2047*	FS23637-68-07	68	5.73 (2.6)	6.9 x 13.4 x 2.6 (175 x 340 x 65)	5.1 x 12.8 (130 x 325)	M5	M6
2060*	FS23637-80-07	80	6.83 (3.1)	8.3 x 15.5 x 2.6 (212 x 393 x 65)	6.6 x 14.9 (167 x 378)	M6	M8

* *EMC filters for models 2025 through 2060 are in compliance with IEC/EN 61800-3, Category 2. All other models comply with Category 1.*

Table B-2: IEC/EN 61800-3 Category C1 Filters - Three-Phase 460 V Class

VFD Model (❑❑❑❑-G+M)	Filter Data (Manufacturer: Schaffner)						
	Type	Rated Current (A)	Weight lb (kg)	Dimensions W x L x H (in) [W x L x H (mm)]	Mounting Dimensions Y x X (in) [Y x X (mm)]	VFD Mounting Screw A	Filter Mounting Screw
4001	FS23639-5-07	5	1.10 (0.5)	4.4 x 6.7 x 1.8 (111 x 169 x 45)	3.6 x 6.1 (91 x 156)	M4	M5
4002	FS23639-5-07	5	1.10 (0.5)	4.4 x 6.7 x 1.8 (111 x 169 x 45)	3.6 x 6.1 (91 x 156)	M4	M5
4003	FS23639-5-07	5	1.10 (0.5)	4.4 x 6.7 x 1.8 (111 x 169 x 45)	3.6 x 6.1 (91 x 156)	M4	M5
4004	FS23639-10-07	10	1.54 (0.7)	4.4 x 6.7 x 1.8 (111 x 169 x 45)	3.6 x 6.1 (91 x 156)	M4	M5
4005	FS23639-10-07	10	1.54 (0.7)	4.4 x 6.7 x 1.8 (111 x 169 x 45)	3.6 x 6.1 (91 x 156)	M4	M5
4007	FS23639-10-07	10	1.54 (0.7)	4.4 x 6.7 x 1.8 (111 x 169 x 45)	3.6 x 6.1 (91 x 156)	M4	M5
4009	FS23639-15-07	15	1.98 (0.9)	5.7 x 6.9 x 2.0 (144 x 174 x 50)	4.7 x 6.3 (120 x 161)	M4	M5
4014	FS23639-30-07	30	4.0 (1.8)	5.4 x 12.0 x 2.2 (137 x 304 x 56)	3.9 x 11.4 (100 x 289)	M5	M5
4018	FS23639-30-07	30	4.0 (1.8)	5.4 x 12.0 x 2.2 (137 x 304 x 56)	3.9 x 11.4 (100 x 289)	M5	M5
4024	FS23639-50-07	50	6.0 (2.7)	6.9 x 13.4 x 2.6 (175 x 340 x 65)	5.1 x 12.8 (130 x 325)	M5	M6
4031	FS23639-50-07	50	6.0 (2.7)	6.9 x 13.4 x 2.6 (175 x 340 x 65)	5.1 x 12.8 (130 x 325)	M5	M6

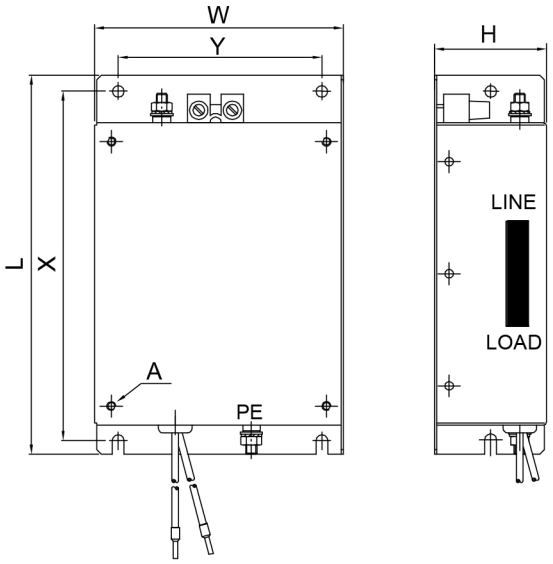


Figure B-5: EMC Filter Dimensions

DC Link Chokes for EN 61000-3-2 Compliance

Table B-3: DC Link Chokes for Harmonic Reduction

VFD Model (❑❑❑❑-G+M)	DC Link Chokes Rating
2003	5.4 A, 8 mH
2005	
4002	3.2 A, 28 mH
4003	

NOTE: *DC link chokes are not required for other models to comply with EMC.*

EU Declaration of Conformity Certificate

For the following equipment:

Product	:	IMPULSE®•G+ & VG+ Series 4 Variable Frequency Drives IMPULSE®•G+ Mini Variable Frequency Drives
Manufacturer's Name	:	Magnetek, Inc.
Manufacturer's Address	:	N49W13650 Campbell Drive Menomonee Falls, WI 53051

The undersigned hereby declares on behalf of Magnetek, that the above-referenced product, to which this declaration relates, is in conformity with the provisions of the following directives:

- Low Voltage Directive (2014/35/EU)
- Electromagnetic Compatibility Directive (2014/30/EU)
- Machine Directive (2006/42/EC)

The standards relevant for the evaluation of the product referenced above conformity to the directive requirements are as follows:

EN ISO 13849-1:2008/AC:2009 (Cat. 3, PL d)
EN 61800-3:2004/A1:2012
EN 61800-5-1:2007
EN 61800-5-2:2007 (SIL2)
EN 61000-6-2:2005

The Technical Construction File is maintained at:

Columbus McKinnon Corporation
13830 Ballantyne Corporate Place
Suite 300
Charlotte, NC 28277 USA

The European contact for technical documentation is:

Ian Knight
STAHL CraneSystems, Ltd.
Unit 2 Forge Mills Park
Station Road
Coleshill
Warwickshire B46 1JH
United Kingdom

Per Annex II.B of the Machinery Directive (2006/42/EC):

The machinery, product, assembly or sub-assembly covered by this Declaration of Conformity must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the applicable Directive(s). This statement is only necessary where the product is to be incorporated into a machine or system (e.g. a safety component).

Signature of Authorized Person:

Ben Stoller
Global Product Manager - Controls
Columbus McKinnon Corporation
Date of Issuance:

IMPULSE®•G+ Mini
Adjustable Frequency Crane Controls Technical Manual
November 2020