IMPULSE® Series 4 G+ & VG+

Adjustable Frequency/Vector Crane Controls
Technical Manual

MAGNETEK

VFD Firmware: 14707 & 14750
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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.*

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1 Introduction

WARNING

Do not touch any circuitry components while the main AC power is on. In addition, wait until the red “CHARGE” LED is out before performing any service on that unit. It may take as long as 5 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 a rotational Auto-Tuning, ensure that the motor is disconnected from the drive train and the electric brake is released. If the electric brake cannot be released, you must ensure that the brake is disengaged for the entire tuning process.

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 connect or disconnect wiring while the power is on. Do not remove covers or touch circuit boards while the power is on. Do not remove or insert the keypad while 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 50 VDC. To prevent electric shock, wait at least five minutes after all indicators are OFF and measure DC bus voltage 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 100,000 RMS symmetrical Amperes. 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 VFD specifications.

1.1 How to Use This Manual

This manual provides technical information on IMPULSE®•G+/VG+ Series 4 VFD (variable frequency drive) parameter settings, functions, troubleshooting, and installation details. Use this manual to expand the functionality and to take advantage of higher performance features. This manual is available for download at www.columbusmckinnon.com/magnetek.

The VFDs share a common power section and similar parameters. The parameters and performance differ because the VG+ includes a PG-X3 encoder feedback card allowing the VFD to perform Flux Vector control of the motor. The G+ VFDs operate in V/f or Open Loop Vector control methods, appropriate for traverse or standard (mechanical load brake) hoist motions. The VG+ VFDs are typically applied to hoists without mechanical load brakes, and can be applied to traverse motions where torque control or a wide speed control range is required.

Many parameter functions are common between the two VFD classes. The functions that differ by model or control method are noted in the parameter descriptions. ***Table 1-1*** below lists the available configurations by model.

Table 1-1: Configurations by Model

VFD Model	Control Method (A01-02)	Speed Control Range	Motion (A01-03)
G+	V/f (0)	40:1	Traverse (0) Standard Hoist (1)
G+	Open Loop Vector (2)	200:1	Traverse (0) Standard Hoist (1)
VG+	Flux Vector (3)	1500:1	Traverse (0) NLB Hoist (2)

The instructions in the following chapters apply to most crane, hoist, and monorail applications. However, carefully evaluate each specific situation and ensure that the National Electric Code (NEC) codes or local wiring practices are followed.

These chapters explain how to install the VFD and, to some extent, the components that it interconnects. It explains how to: assess the environment, mount, and wire the VFD. It is important to develop a plan for mounting and wiring since each task has an effect on the other one. Wiring Practices is included to provide assistance and reference.

NOTE: *If the IMPULSE•G+/VG+ Series 4 is part of a Magnetek motor control panel, reference the control drawings and this technical manual, as needed.*

1.2 General Information

1.2.1 Assessing the System Requirements

It is important to know how the VFD will be utilized before installation. Please know the requirements for the following components:

- Speed control method(s) - i.e. stepped, stepless, infinitely variable
- Braking method(s) - coast to stop, decel to stop, NLB Hoist
- Power source voltage, number of phases, and kVA rating
- Power source location
- Wire size
- Grounding location and method
- Control wiring sources - i.e., cab, pendant, radio

1.2.2 Assessing the VFD Environment

When choosing a location for IMPULSE•G+/VG+ Series 4, perform the following steps:

1. Ensure that a three-phase 200 to 240 VAC 50/60 Hz power supply is available for a 230 VAC-rated VFD, a three-phase 380 to 480 VAC 50/60 Hz power supply is available for a 460 VAC-rated VFD, and a 500 to 600 VAC 50/60 Hz power supply is available for a 575 VAC-rated VFD.
2. Ensure the encoder (if required) is compatible with +5 VDC or 12 VDC.
3. If the RMS encoder current requirement is greater than 200 mA, provide an auxiliary power supply.
4. Ensure that the VFD-to-motor wiring distance is less than 150 ft. unless appropriate reactors, filters, and/or inverter duty motor is used.
5. Ensure that the VFD is protected or isolated from:
   - Ambient temperatures outside the range of +14°F to +140°F (-10°C to +60°C).
   - Rain or moisture
   - Corrosive gases or liquids
   - Direct sunlight
   - Severe mechanical vibration
6. Ensure that the VFD is housed in an appropriate NEMA-rated enclosure.
7. For severe-duty applications (long lifts, for example), ensure that the VFD control system (including dynamic braking resistors) is adequately cooled, even though the ambient temperature limit is not exceeded. For more information, contact Magnetek.

1.3 Specifications

1.3.1 VFD Specifications

Table 1-2: VFD Capacity - Heavy Duty

230 V			460 V			575 V		
Model (-G+/VG+ S4)	Output Current (A)	Output Capacity (kVA)	Model (-G+/VG+ S4)	Output Current (A)	Output Capacity (kVA)	Model (-G+/VG+ S4)	Output Current (A)	Output Capacity (kVA)
2003	3.2	1.2	4001	1.8	1.4	5001	1.7	1.7
2005	5.0	1.9	4003	3.4	2.6	5003	3.5	3.5
2007	6.9	2.6	4004	4.8	3.7	5004	4.1	4.1
2008	8.0	3.0	4005	5.5	4.2	5006	6.3	6.3
2011	11.0	4.2	4007	7.2	5.5	5009	9.8	9.8
2014	14.0	5.3	4009	9.2	7.0	5012	12.5	12.5
2017	17.5	6.7	4014	14.8	11.3	5017	17.0	17.0
2025	25.0	9.5	4018	18.0	13.7	5022	22.0	22.0
2033	33.0	12.6	4024	24.0	18.3	5027	27.0	27.0
2047	47.0	17.9	4031	31.0	24.0	5032	32.0	32.0
2060	60.0	23.0	4039	39.0	30.0	5041	41.0	41.0
2075	75.0	29.0	4045	45.0	34.0	5052	52.0	52.0
2085	85.0	32.0	4060	60.0	48.0	5062	62.0	62.0
2115	115	44.0	4075	75.0	57.0	5077	77.0	77.0
2145	145	55.0	4091	91.0	69.0	5099	99.0	99.0
2180	180	69.0	4112	112	85.0	5130	130	129
2215	215	82.0	4150	150	114	5172	172	171
2283	283	108	4180	180	137	5200	200	199
2346	346	132	4216	216	165	-	-	-
2415	415	158	4260	260	198	-	-	-
-	-	-	4304	304	232	-	-	-
-	-	-	4370	370	282	-	-	-
-	-	-	4450	450	343	-	-	-
-	-	-	4605	605	461	-	-	-
-	-	-	4810	810	617	-	-	-
-	-	-	41090	1090	831	-	-	-

Table 1-3: VFD 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 - F (or equivalent)
Rated input power supply	230 VAC class: 3-phase 200 to 240 VAC 50/60 Hz 460 VAC class: 3-phase 380 to 480 VAC 50/60 Hz 575 VAC class: 3-phase 500 to 600 VAC 50/60 Hz
Short Circuit Rating	The drive is suitable for circuits capable of delivering a maximum of 100,000 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 and control 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, V/f, open loop vector, or closed loop flux vector control; sine-wave, pulse-width modulated
Maximum output voltage (VAC)	3-phase 200 to 240 VAC (proportional to input voltage) 3-phase 380 to 480 VAC (proportional to input voltage) 3-phase 500 to 600 VAC (proportional to input voltage)
Rated frequency (Hz)	0 to 150 Hz
Output speed control range	FLV: 1500:1; OLV: 200:1; V/f: 40:1
Output frequency accuracy	0.01%—with digital reference command 0.1%—with analog reference command; 10 bits/10 V
Frequency reference resolution	Digital: 0.01 Hz; Analog: 1/2048 of max frequency (11 bit and sign bit)
Output frequency resolution	0.001 Hz
Overload capacity	150% of VFD rated load for 1 min
Remote frequency reference sources	0–10 VDC (20kΩ); 4–20 mA (250Ω); ±10 VDC (20kΩ); 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
DC Link Choke	Models 2085 to 2415, 4045 to 41090, and 5032 to 5200 have a built-in DC link choke.
Internal Braking Transistor	Models 2003 to 2115, 4001 to 4060, and 5001 to 5041 come with an internal braking transistor (B1 and B2 terminals).
Motor overload protection	UL recognized electronic thermal overload relay; field-programmable
Overcurrent protection level (OC1)	200% of VFD rated current
Circuit protection	Ground fault and blown-fuse protection
Overvoltage protection level	230 VAC class: Stops when DC bus voltage exceeds approx. 410 VDC 460 VAC class: Stops when DC bus voltage exceeds approx. 820 VDC 575 VAC class: Stops when DC bus voltage exceeds approx. 1040 VDC
Undervoltage protection level	230 VAC class: Stops when DC bus voltage falls below approx. 190 VDC 460 VAC class: Stops when DC bus voltage falls below approx. 380 VDC 575 VAC class: Stops when DC bus voltage falls below approx. 475 VDC
Heatsink overtemperature	Thermostat trips at 105°C (221°F)

Specification	Specification Value and Information for All Models
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	**VG+:** Speed deviation, overspeed, mechanical brake failure, output phase loss, failed-oscillator, encoder disconnect, roll-back detection, micro controller watchdog, internal braking transistor failure, torque output limit, motor overcurrent, VFD overcurrent, input phase loss. **G+:** Lost output phase, micro-controller watchdog, internal braking resistor failure, motor overcurrent, VFD overcurrent, input phase loss.
DC bus voltage indication	Charge LED is on until DC bus voltage drops below 50 VDC
Location	Indoors; requires protection from moisture, corrosive gases, and liquids
Ambient operating temperature	-10° to 60°C (14° to 140°F)* -10° to 65°C (14° to 149°F)**
Storage temperature	-20°C to +70°C (-4°F to 158°F)
Humidity	95% relative; non-condensing
Vibration	10 to 20 Hz at 9.8 m/s^2 20 to 55 Hz at 5.9 m/s^2 (Models 2003 to 2180, 4001 to 4150, and 5001 to 5077) or 20 to 55 Hz at 2.0 m/s^2 (Models 2215 to 2415, 4180 to 4605, and 5099 to 5200)
Elevation	Up to 1,000 m without derate, and up to 3,000 m with derate. Derate 1% of the VFD output current for every 100 m above 1,000 m.
Atmospheric Pressure	0.7 atmosphere (10.3 psi/70.9 kPa) to 1.05 atmosphere (15.4 psi/106.4 kPa)
Orientation	Install the VFD vertically to maintain maximum cooling effects.

* *2kHz carrier frequency*

** *Maximum rated temperature of 65°C at the VFD chassis with factory approved air handling system*

1.3.2 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 are recommendations to help determine input and output reactor requirements:

- The following tables are only a guideline. The size of the reactor is based on motor HP.
- Install an input reactor if the power source is greater than 500 kVA.
- Install an output reactor if the distance between the VFD and the motor exceeds 150 feet (45.7 meters).
- Install an output reactor if a device, such as a power limit switch, is used to disconnect the motor from the VFD. Use a power limit switch early break circuit to fault 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.
- Reactors are most effective when the reactor current rating approaches the VFD current rating.

Table 1-4: 230 V Class

VFD Model Number	Reactor Part Number	Reactor Fundamental Amps	Motor HP (kW)
2003-G+/VG+S4	REA230-1	4	1 (0.75)
2005-G+/VG+S4	REA230-1	4	1 (0.75)
2007-G+/VG+S4	REA230-2	8	2 (1.5)
2008-G+/VG+S4	REA230-2	8	2 (1.5)
2011-G+/VG+S4	REA230-3	12	3 (2.2)
2014-G+/VG+S4	REA230-3	12	3 (2.2)
2017-G+/VG+S4	REA230-5	18	5 (3.7)
2025-G+/VG+S4	REA230-7.5	25	7.5 (5.6)
2033-G+/VG+S4	REA230-10	35	10 (7.5)
2047-G+/VG+S4	REA230-15	45	15 (11)
2060-G+/VG+S4	REA230-20	55	20 (15)
2075-G+/VG+S4	REA230-25	80	25 (18.5)
2085-G+/VG+S4	REA230-30	80	30 (22)
2115-G+/VG+S4	REA230-40	100	40 (30)
2145-G+/VG+S4	REA230-50	130	50 (37)
2180-G+/VG+S4	REA230-60	160	60 (45)
2215-G+/VG+S4	REA230-75	200	75 (56)
2283-G+/VG+S4	REA230-100	250	100 (75)
2346-G+/VG+S4	REA230-125	320	125 (93)
2415-G+/VG+S4	REA230-150	400	150 (112)

Table 1-5: 460 V Class

VFD Model Number	Reactor Part Number	Reactor Fundamental Amps	Motor HP (kW)
4001-G+/VG+S4	REA460-1	2	1 (0.75)
4003-G+/VG+S4	REA460-2	4	2 (1.5)
4004-G+/VG+S4	REA460-3	4	3 (2.2)
4005-G+/VG+S4	REA460-5	8	5 (3.7)
4007-G+/VG+S4	REA460-5	8	5 (3.7)
4009-G+/VG+S4	REA460-5	8	5 (3.7)
4014-G+/VG+S4	REA460-7.5	12	7.5 (5.6)
4018-G+/VG+S4	REA460-10	18	10 (7.5)
4024-G+/VG+S4	REA460-15	25	15 (11)
4031-G+/VG+S4	REA460-20	35	20 (15)
4039-G+/VG+S4	REA460-25	35	25 (18.5)
4045-G+/VG+S4	REA460-30	45	30 (22)
4060-G+/VG+S4	REA460-40	55	40 (30)
4075-G+/VG+S4	REA460-50	80	50 (37)
4091-G+/VG+S4	REA460-60	80	60 (45)
4112-G+/VG+S4	REA460-75	100	75 (56)
4150-G+/VG+S4	REA460-100	130	100 (75)
4180-G+/VG+S4	REA460-125	160	125 (93)
4216-G+/VG+S4	REA460-150	200	150 (112)
4260-G+/VG+S4	REA460-200	250	200 (150)
4304-G+/VG+S4	REA460-250	320	250 (187)
4370-G+/VG+S4	REA460-300	400	300 (224)
4450-G+/VG+S4	REA460-400	500	400 (298)
4605-G+/VG+S4	REA460-500	600	500 (373)
4810-G+/VG+S4	REA460-750	850	750 (560)
41090-G+/VG+S4	REA460-850	1000	850 (634)

Table 1-6: 575 V Class

VFD Model Number	Reactor Part Number	Reactor Fundamental Amps	Motor HP (kW)
5001-G+/VG+S4	REA575-1	2	1 (0.75)
5003-G+/VG+S4	REA575-2	4	2 (1.5)
5004-G+/VG+S4	REA575-3	4	3 (2.2)
5006-G+/VG+S4	REA575-5	8	5 (3.7)
5009-G+/VG+S4	REA575-7.5	8	7.5 (5.6)
5012-G+/VG+S4	REA575-10	12	10 (7.5)
5017-G+/VG+S4	REA575-15	18	15 (11)
5022-G+/VG+S4	REA575-20	25	20 (15)
5027-G+/VG+S4	REA575-25	25	25 (18.5)
5032-G+/VG+S4	REA575-30	35	30 (22)
5041-G+/VG+S4	REA575-40	45	40 (30)
5052-G+/VG+S4	REA575-50	55	50 (37)
5062-G+/VG+S4	REA575-60	80	60 (45)
5077-G+/VG+S4	REA575-75	80	75 (56)
5099-G+/VG+S4	REA575-100	100	100 (75)
5130-G+/VG+S4	REA575-125	130	125 (93)
5172-G+/VG+S4	REA575-150	160	150 (112)
5200-G+/VG+S4	REA575-200	200	200 (150)

1.3.3 Interface Board (S4IF) Specifications

IMPULSE•G+/VG+ Series 4 is designed to interface with user input and output devices through the S4IF interface board. This eliminates the need for an additional interface relay or isolation circuitry. The S4IF comes in 24 VDC, 24 VAC (50/60 Hz), 42 to 48 VAC (50/60 Hz), and 120 VAC (50/60 Hz) options.

The S4IF has eight optically isolated input terminals which can be used to connect the user input device to the VFD. The eight terminals are multi-function and programmable.

The S4IF has four 250 VAC, 1.0 Amp relays for output devices. It includes three programmable multi-function output terminals, and a fault output terminal.

NOTE: *The 250 VAC relays on the 120 VAC S4IF boards must be derated to 120 VAC to comply with CE.*

Table 1-7: S4IF Ratings

S4IF Model	S1-S8	
	Voltage	Frequency
S4IF-120A60	120 VAC	50/60 Hz
S4IF-120A*	120 VAC	50/60 Hz
S4IF-48A60	42–48 VAC	50/60 Hz
S4IF-24A60	24 VAC	50/60 Hz
S4IF-24D00*	24 VDC	-

** Certified for CE compliance.*

1.3.4 S4I and S4IO Option Card Specifications

IMPULSE•G+/VG+ Series 4 is compatible with AC digital input (S4I) and AC digital input/output (S4IO) option cards. The option cards expand the I/O capability of the VFD in addition to the I/O on the interface board.

The S4I has four optically isolated input terminals. The S4IO has four optically isolated input terminals and four dry contact form A relays.

Table 1-8: S4I Ratings

S4I Model	I1-I4	
	Voltage	Frequency
S4I-120A60	120 VAC	50/60 Hz
S4I-48A60	42–48 VAC	50/60 Hz
S4I-24A60	24 VAC	50/60 Hz

Table 1-9: S4IO Ratings

S4IO Model	I1-I4		O1-O6	
	Voltage	Frequency	Voltage (max)	Current (max)
S4IO-120A60	120 VAC	50/60 Hz	250 VAC (120 VAC for CE)/ 30 VDC	1.0 A
S4IO-48A60	42–48 VAC	50/60 Hz		
S4IO-24A60	24 VAC	50/60 Hz		

2 Installation

WARNING

- When preparing to mount the IMPULSE•G+/VG+ Series 4 VFD, lift it by its base. Never lift the VFD by the front cover, as doing so may cause damage or personal injury.
- Mount the VFD on nonflammable material.
- The VFD generates heat. For the most effective cooling, mount it vertically. For more details, refer to the “Dimensions (IP00/Open-Chassis)” section in this chapter.
- When mounting units in an enclosure, install a fan or other cooling device to keep the enclosure temperature below 65°C (149°F)*.

Failure to observe these warnings may result in equipment damage.

This chapter explains the following:

- Environmental requirements
- System components
- VFD dimensions
- VFD installation
- VFD derating

2.1 Environmental Requirements

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

- -10°C to +60°C (+14°F to 140°F)*:
- Excessive cold and heat. Use only within the ambient temperature range.
- Direct sunlight (The VFD must be installed inside an enclosure)
- 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 environments
- Combustibles (e.g. thinner, solvents, etc.)
- Physical shock, vibration
- Magnetic noise (e.g. welding machines, power devices, etc.)

* 2 kHz carrier frequency

2.2 System Components

2.2.1 Standard Components

- Interface Board (120 VAC, 42-48 VAC, 24 VAC, or 24 VDC)
- PG-X3 Line Driver Encoder Option Card (VG+ only)

2.2.2 Optional Components

- DI-A3 Digital DC Input Option Card
- DO-A3 Digital Output Option Card
- AI-A3 Analog Input Option Card
- AO-A3 Analog Output Option Card
- S4I Digital AC Input Option Card
- S4IO Digital AC Input/Output Option Card
- PS-A10L 24 VDC Control Power Unit for 230 V models
- PS-A10H 24 VDC Control Power Unit for 460 V and 575 V models
- PG-B3 Open Collector Encoder Option Card
- SI-EN3 EtherNet/IP Option Card
- SI-EN3D EtherNet/IP (Dual-Port) Option Card
- SI-EM3 Modbus TCP/IP Option Card
- SI-EM3D Modbus TCP/IP (Dual-Port) Option Card
- SI-EP3 PROFINET Option Card
- SI-P3 PROFIBUS-DP Option Card

2.2.3 As-Required Components

- AC reactor - line or load
- DC bus choke
- External dynamic braking unit

2.2.4 Required Control Components

- External dynamic braking resistor(s)
- Motor
- User input device (pendant, joystick, PC, PLC, radio, or infrared control)
- External circuit protection devices (fuses or circuit breakers). ***See Section 3.2 on page 31.***
- R-C surge suppressors on contactor coils

2.3 Long-Term Storage and Capacitor Reforming

Powering up the VFD every six months is recommended. Over longer periods of time without power, the VFD's 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 2 to 3 years. This process can be avoided by powering up the VFD bi-annually for 30 to 60 minutes.

NOTE: *Bus cap reforming may not restore full VFD functionality after 2 to 3 years of storage without power.*

Variable frequency drives (VFD) 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 Field Service for assistance.

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 2 or 3 years, a voltage treatment reformation process to electrolytic capacitors should 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.

2.3.1 Capacitor Reforming Procedure

1. Connect the VFD inputs L1 and L2 to a variac. It is also acceptable to use a three-phase variac or a variable DC power supply rated for the VFD's nominal DC bus voltage.
2. 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.
3. 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 near zero.
4. Slowly turn the variac up, increasing the 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, 150 to 200 volts/minute for 460 VAC units, and 225 to 300 volts/minute for 575 VAC.
5. 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.
6. Once 30 to 60 minutes elapse, remove power.

If any abnormal indications occur during this process, it is recommended that the process be repeated. If problems persist, the VFD should be replaced.

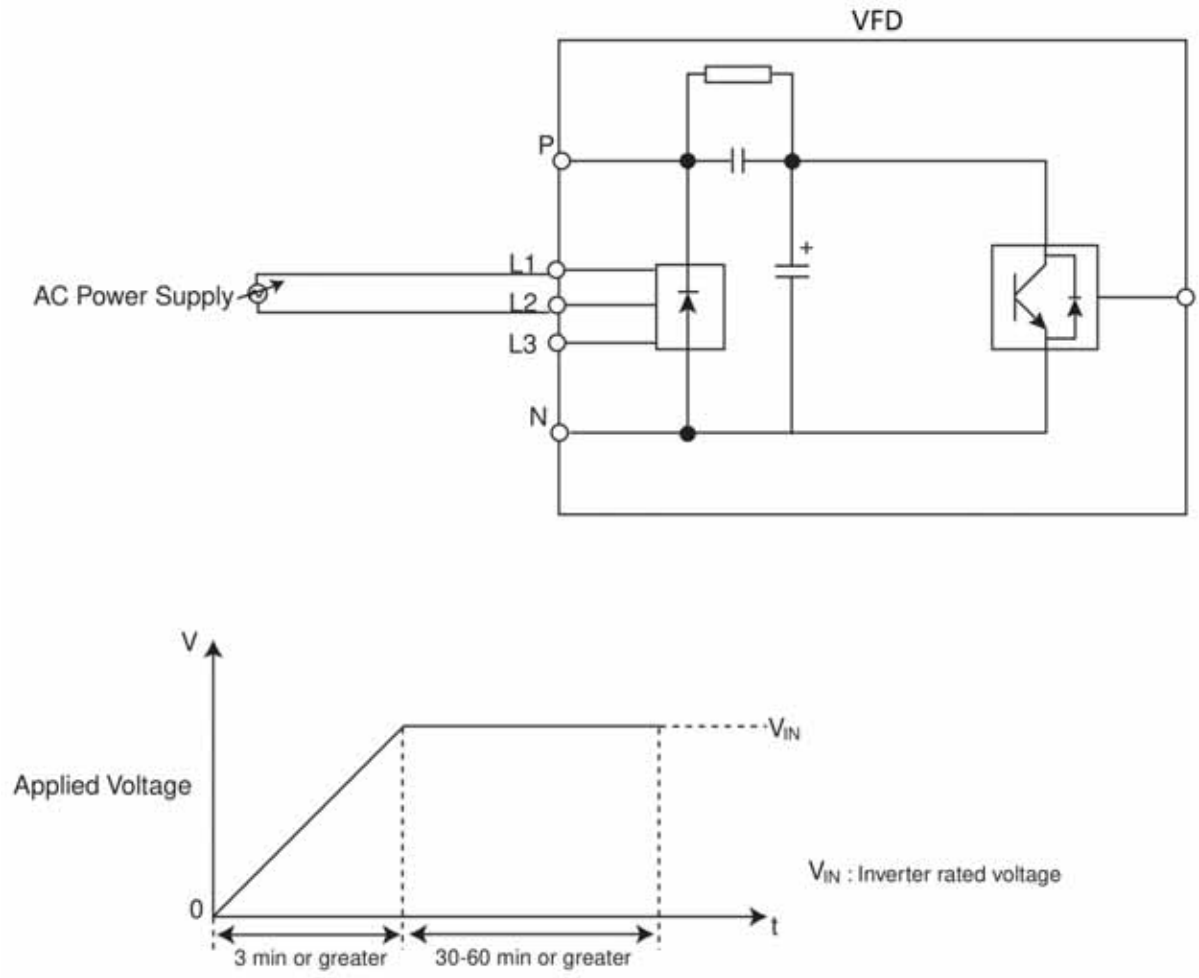


Figure 2-1: Capacitor Reform Diagrams

2.4 Installation Orientation

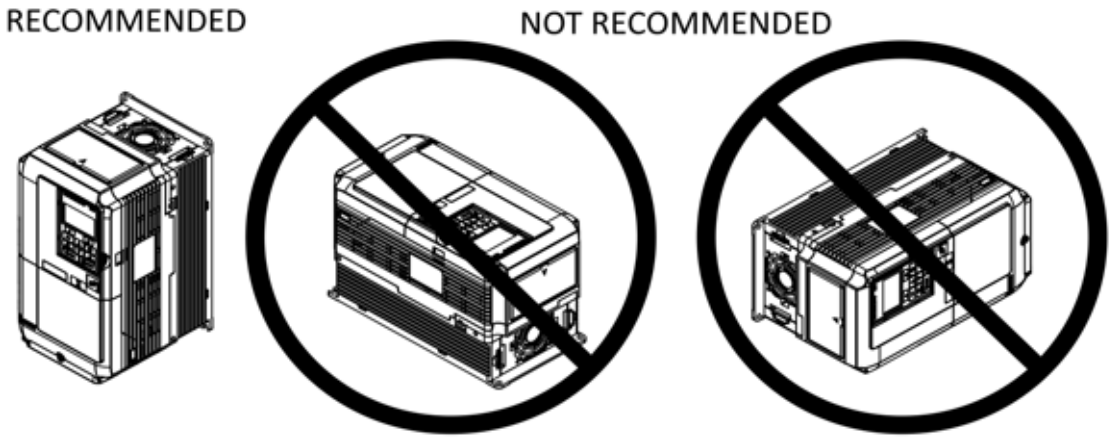


Figure 2-2: Standard Installation Orientation

2.5 Recommended Installation 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 can't be met, decreased airflow may reduce the life of the VFD.

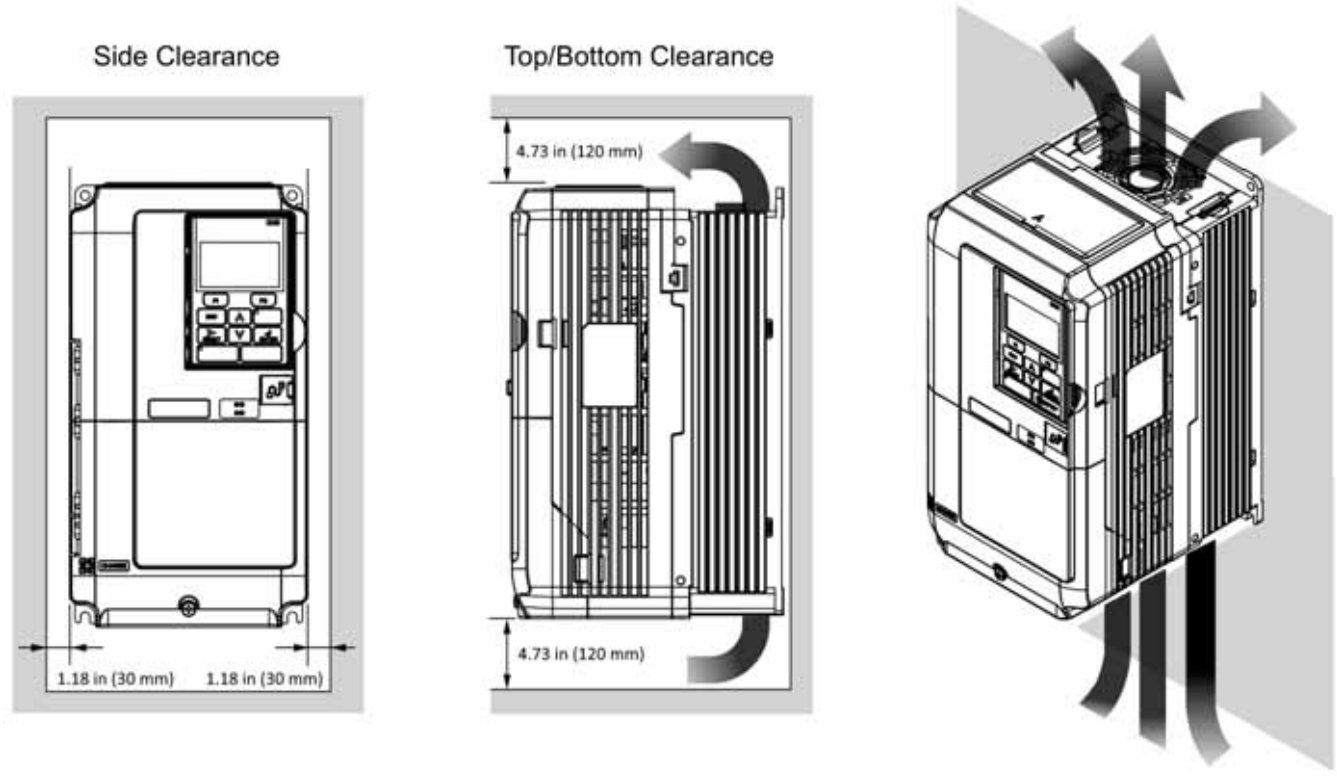


Figure 2-3: Standard Installation

2.6 Optional Side-by-Side Installation

Models 2003 to 2075, 4001 to 4039, and 5001 to 5027 can take advantage of Side-by-Side installation.

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.

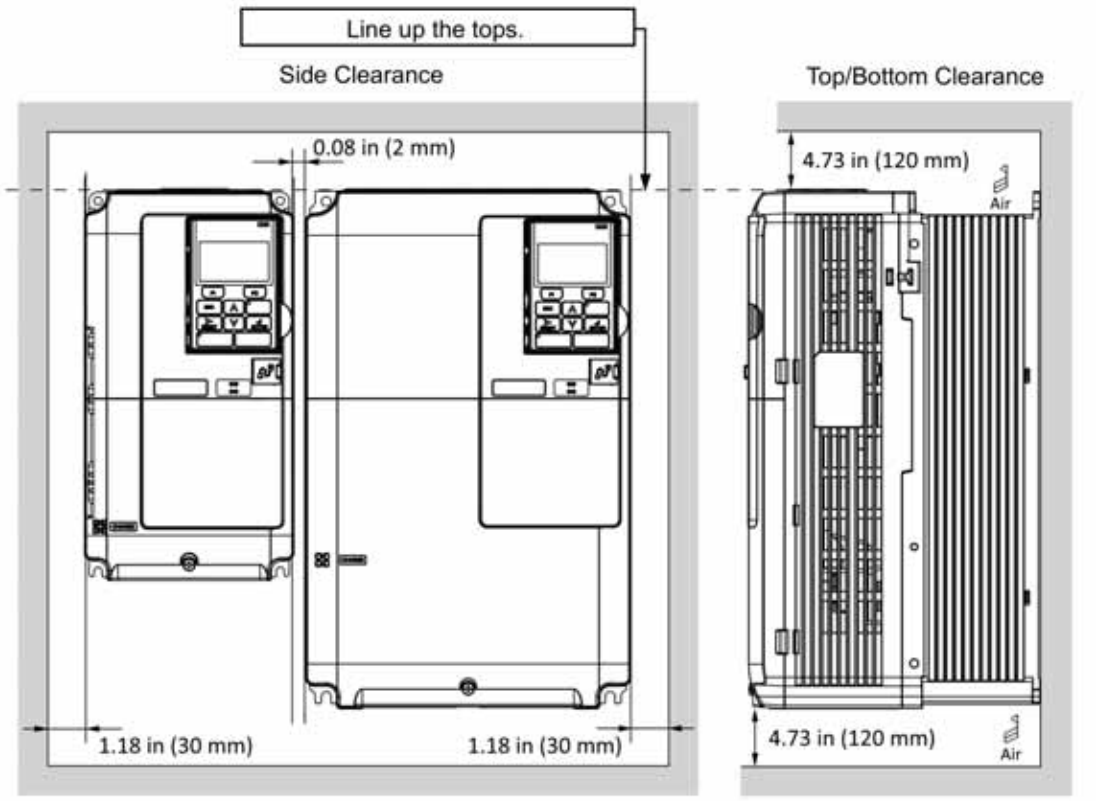


Figure 2-4: Side-by-Side Installation

2.7 VFD Derating

2.7.1 Temperature Derating

To ensure the maximum performance life, the VFD output current must be derated when it is installed in areas with high ambient temperature or if VFDs are mounted side-by-side in a cabinet. In order to ensure reliable VFD overload protection, set parameters L08-12 and L08-35 according to the installation conditions.

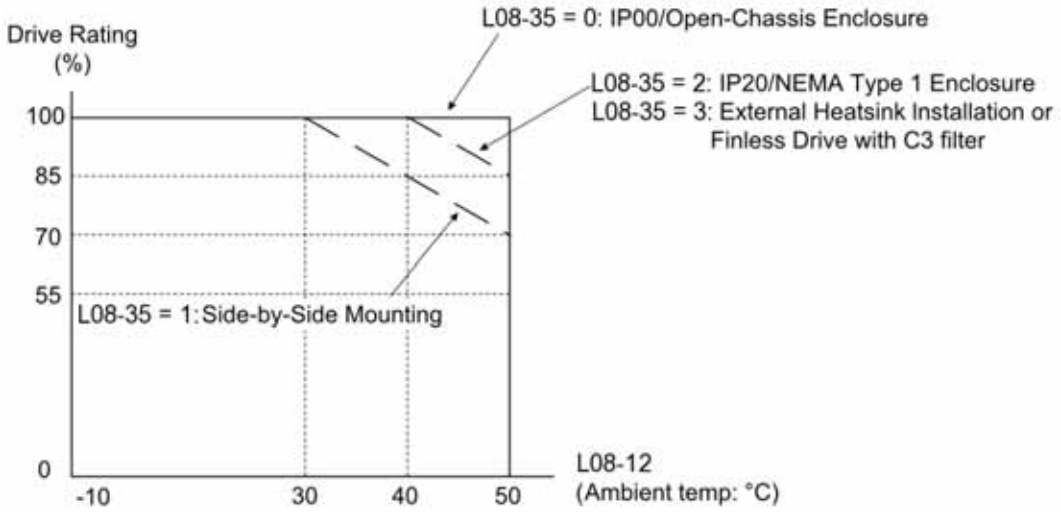


Figure 2-5: Ambient Temperature and Installation Method Derating

2.7.1.1 IP00/Open-Chassis Enclosure

An ambient temperature between -10°C to +60°C (14°F to 140°F) allows continuous and fully loaded operation without derating.

2.7.1.2 Side-by-Side Mounting

An ambient temperature between -10°C and 30°C (14°F to 86°F) allows continuous and fully loaded operation without derating. Operation between 30°C and 50°C (86°F to 122°F) requires output current derating.

2.7.2 Altitude Derating

The VFD output current must be derated when it is installed in altitudes above 1000 meters and up to a maximum of 3000 meters. Derate 1% for every 100 m above 1000 m.

2.8 Dimensions (IP00/Open-Chassis)

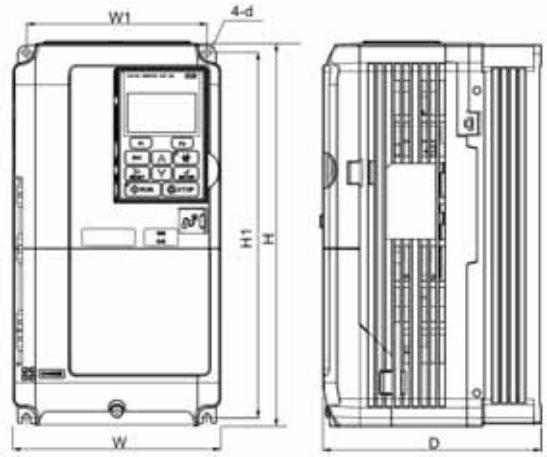


Figure 2-6

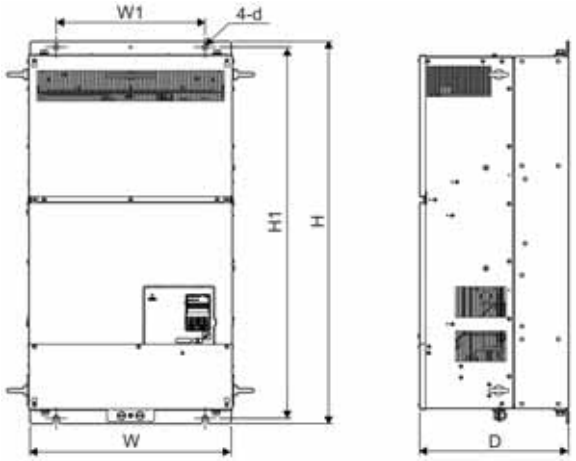


Figure 2-8

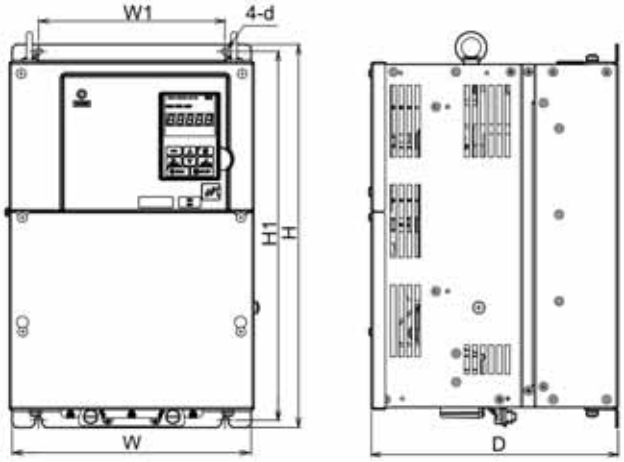


Figure 2-7

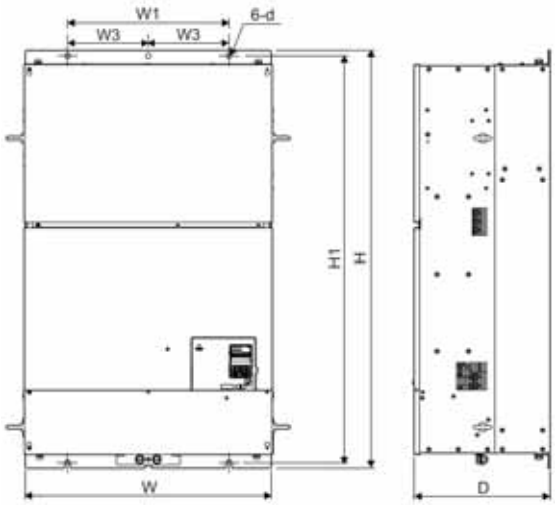


Figure 2-9

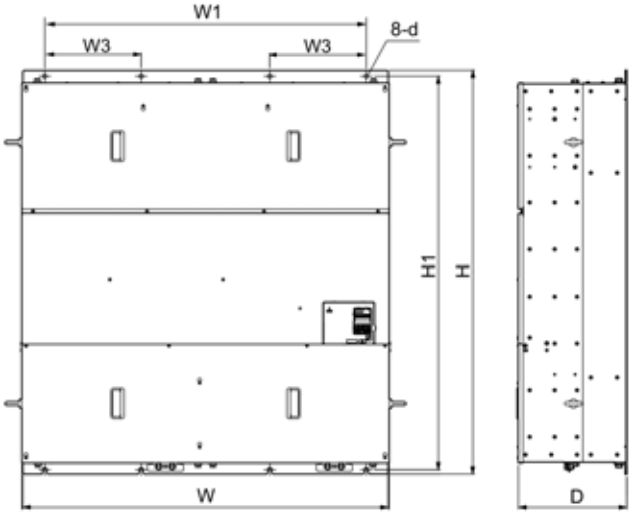


Figure 2-10

Table 2-1: IP00/Open-Chassis Dimensions – 230 V Class

Model Number (-G+/VG+ S4)	Figure	Dimensions - inches (mm)						Weight lbs (kg)	Heat Loss (W)*
		W	H	D	W1	H1	d		
2003	2-6	5.51 (140)	10.24 (260)	5.79 (147)	4.80 (122)	9.76 (248)	M5	7.3 (3.3)	59
2005		5.51 (140)	10.24 (260)	5.79 (147)	4.80 (122)	9.76 (248)	M5	7.3 (3.3)	72
2007		5.51 (140)	10.24 (260)	5.79 (147)	4.80 (122)	9.76 (248)	M5	7.5 (3.4)	84
2008		5.51 (140)	10.24 (260)	5.79 (147)	4.80 (122)	9.76 (248)	M5	7.5 (3.4)	95
2011		5.51 (140)	10.24 (260)	5.79 (147)	4.80 (122)	9.76 (248)	M5	7.5 (3.4)	122
2014		5.51 (140)	10.24 (260)	6.46 (164)	4.80 (122)	9.76 (248)	M5	8.2 (3.7)	137
2017		5.51 (140)	10.24 (260)	6.46 (164)	4.80 (122)	9.76 (248)	M5	8.2 (3.7)	168
2025		5.51 (140)	10.24 (260)	6.57 (167)	4.80 (122)	9.76 (248)	M5	9.3 (4.2)	287
2033		5.51 (140)	10.24 (260)	6.57 (167)	4.80 (122)	9.76 (248)	M5	9.3 (4.2)	319
2047		7.09 (180)	11.81 (300)	7.36 (187)	6.30 (160)	11.18 (284)	M5	13.0 (5.9)	410
2060		8.66 (220)	13.78 (350)	7.76 (197)	7.56 (192)	13.19 (335)	M6	20.1 (9.1)	558
2075		8.66 (220)	13.78 (350)	7.76 (197)	7.56 (192)	13.19 (335)	M6	22.0 (10.0)	681
2085	2-7	10.00 (254)	15.75 (400)	10.16 (258)	7.68 (195)	15.16 (385)	M6	46.2 (21.0)	721
2115		10.98 (279)	17.72 (450)	10.16 (258)	8.66 (220)	17.13 (435)	M6	55.0 (24.9)	912
2145		12.95 (329)	21.65 (550)	11.14 (283)	10.24 (260)	21.06 (535)	M6	81.4 (36.9)	1122
2180		12.95 (329)	21.65 (550)	11.14 (283)	10.24 (260)	21.06 (535)	M6	83.6 (37.9)	1354
2215		17.72 (450)	27.76 (705)	12.99 (330)	12.80 (325)	26.77 (680)	M10	167.6 (76.0)	1980
2283		17.72 (450)	27.76 (705)	12.99 (330)	12.80 (325)	26.77 (680)	M10	176.4 (80.0)	2524
2346		19.69 (500)	31.50 (800)	13.78 (350)	14.57 (370)	30.43 (773)	M12	216.1 (98.0)	3347
2415		19.69 (500)	31.50 (800)	13.78 (350)	14.57 (370)	30.43 (773)	M12	218.3 (99.0)	3626

* *Heat Loss is specified for fully-loaded, continuous operation.*

Table 2-2: IP00/Open-Chassis Dimensions – 460 V Class

Model Number (-G+/VG+ S4)	Figure	Dimensions - inches (mm)							Weight (lbs)	Heat Loss (W)*
		W	H	D	W1	W3	H1	d		
4001	2-6	5.51 (140)	10.24 (260)	5.79 (147)	4.80 (122)	-	9.76 (248)	M5	7.5 (3.4)	61
4003		5.51 (140)	10.24 (260)	5.79 (147)	4.80 (122)	-	9.76 (248)	M5	7.5 (3.4)	70
4004		5.51 (140)	10.24 (260)	5.79 (147)	4.80 (122)	-	9.76 (248)	M5	7.5 (3.4)	87
4005		5.51 (140)	10.24 (260)	6.46 (164)	4.80 (122)	-	9.76 (248)	M5	7.9 (3.6)	101
4007		5.51 (140)	10.24 (260)	6.46 (164)	4.80 (122)	-	9.76 (248)	M5	8.2 (3.7)	108
4009		5.51 (140)	10.24 (260)	6.46 (164)	4.80 (122)	-	9.76 (248)	M5	8.2 (3.7)	130
4014		5.51 (140)	10.24 (260)	6.57 (167)	4.80 (122)	-	9.76 (248)	M5	9.0 (4.1)	221
4018		5.51 (140)	10.24 (260)	6.57 (167)	4.80 (122)	-	9.76 (248)	M5	9.0 (4.1)	247
4024		7.09 (180)	11.81 (300)	6.57 (167)	6.30 (160)	-	11.18 (284)	M5	12.6 (5.7)	323
4031		7.09 (180)	11.81 (300)	7.36 (187)	6.30 (160)	-	11.18 (284)	M5	13.2 (6.0)	403
4039		8.66 (220)	13.78 (350)	7.76 (197)	7.56 (192)	-	13.19 (335)	M6	19.2 (8.7)	509
4045	2-7	10.00 (254)	15.75 (400)	10.16 (258)	7.68 (195)	-	15.16 (385)	M6	50.7 (23.0)	518
4060		10.98 (279)	17.72 (450)	10.16 (258)	8.66 (220)	-	17.13 (435)	M6	59.5 (27.0)	701
4075		12.95 (329)	20.08 (510)	10.16 (258)	10.24 (260)	-	19.49 (495)	M6	79.2 (35.9)	817
4091		12.95 (329)	20.08 (510)	10.16 (258)	10.24 (260)	-	19.49 (495)	M6	79.2 (35.9)	1022
4112		12.95 (329)	21.65 (550)	11.14 (283)	10.24 (260)	-	21.06 (535)	M6	90.2 (40.9)	1325
4150		12.95 (329)	21.65 (550)	11.14 (283)	10.24 (260)	-	21.06 (535)	M6	92.4 (41.9)	1920
4180		17.72 (450)	27.76 (705)	12.99 (330)	12.80 (325)	-	26.77 (680)	M10	174.2 (79.0)	2313
4216		19.69 (500)	31.50 (800)	13.78 (350)	14.57 (370)	-	30.43 (773)	M12	211.6 (96.0)	3075
4260		19.69 (500)	31.50 (800)	13.78 (350)	14.57 (370)	-	30.43 (773)	M12	224.9 (102.0)	3178
4304		19.69 (500)	31.50 (800)	13.78 (350)	14.57 (370)	-	30.43 (773)	M12	235.9 (107.0)	4060
4370	2-8	19.69 (500)	37.40 (950)	14.57 (370)	14.57 (370)	-	36.34 (923)	M12	275.6 (125.0)	4742
4450	2-9	26.38 (670)	44.88 (1140)	14.57 (370)	17.32 (440)	8.66 (220)	43.70 (1110)	M12	476.2 (216.0)	5358
4605		26.38 (670)	44.88 (1140)	14.57 (370)	17.32 (440)	8.66 (220)	43.70 (1110)	M12	487.2 (221.0)	5875
4810	2-10	49.21 (1250)	54.33 (1380)	14.57 (370)	43.70 (1110)	13.00 (330)	52.95 (1345)	M12	1201.5 (545.0)	9367
41090		49.21 (1250)	54.33 (1380)	14.57 (370)	43.70 (1110)	13.00 (330)	52.95 (1345)	M12	1223.6 (555.0)	10781

* *Heat Loss is specified for fully-loaded, continuous operation.*

Table 2-3: IP00/Open-Chassis Dimensions – 575 V Class

Model Number (-G+/VG+ S4)	Figure	Dimensions - inches (mm)						Weight (lbs)	Heat Loss (W)*
		W	H	D	W1	H1	d		
5001	2-6	5.51 (140)	10.24 (260)	5.79 (147)	4.80 (122)	9.76 (248)	M5	7.5 (3.4)	48.7
5003		5.51 (140)	10.24 (260)	5.79 (147)	4.80 (122)	9.76 (248)	M5	7.5 (3.4)	81.9
5004		5.51 (140)	10.24 (260)	6.46 (164)	4.80 (122)	9.76 (248)	M5	8.2 (3.7)	80.0
5006		5.51 (140)	10.24 (260)	6.46 (164)	4.80 (122)	9.76 (248)	M5	8.2 (3.7)	115.1
5009		5.51 (140)	10.24 (260)	6.57 (167)	4.80 (122)	9.76 (248)	M5	9.0 (4.1)	160.3
5012		7.09 (180)	11.81 (300)	7.36 (187)	6.30 (160)	11.18 (284)	M5	13.2 (6.0)	212.2
5017		7.09 (180)	11.81 (300)	7.36 (187)	6.30 (160)	11.18 (284)	M5	13.2 (6.0)	284.8
5022		8.66 (220)	13.78 (350)	7.76 (197)	7.56 (192)	13.19 (335)	M6	19.2 (8.7)	381.1
5027		8.66 (220)	13.78 (350)	7.76 (197)	7.56 (192)	13.19 (335)	M6	19.2 (8.7)	465.1
5032	2-7	10.98 (279)	17.72 (450)	10.16 (258)	8.66 (220)	17.13 (435)	M6	59.5 (27.0)	533.5
5041		10.98 (279)	17.72 (450)	10.16 (258)	8.66 (220)	17.13 (435)	M6	59.5 (27.0)	688.5
5052		12.95 (329)	21.65 (550)	11.14 (283)	10.24 (260)	21.06 (535)	M6	99.2 (45.0)	1606.5
5062		12.95 (329)	21.65 (550)	11.14 (283)	10.24 (260)	21.06 (535)	M6	99.2 (45.0)	1836.5
5077		12.95 (329)	21.65 (550)	11.14 (283)	10.24 (260)	21.06 (535)	M6	99.2 (45.0)	1619.0
5099		17.72 (450)	27.76 (705)	12.99 (330)	12.80 (325)	26.77 (680)	M10	174.2 (79.0)	1750
5130		17.72 (450)	27.76 (705)	12.99 (330)	12.80 (325)	26.77 (680)	M10	174.2 (79.0)	2146
5172		19.69 (500)	31.50 (800)	13.78 (350)	14.57 (370)	30.43 (773)	M12	235.9 (107.0)	2762
5200		19.69 (500)	31.50 (800)	13.78 (350)	14.57 (370)	30.43 (773)	M12	235.9 (107.0)	3422

* *Heat Loss is specified for fully-loaded, continuous operation.*

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.

- Recommended wire is to be rated for minimum 75°C, 600 VAC, vinyl sheathed.
- Ensure that the encoder wiring is less than 300 feet unless fiber optic cables are used.
- Ensure that the encoder wiring is isolated from the power wiring.
- Ensure that the encoder wiring shield is grounded only at the VFD end.
- 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.
- 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.
- Use hard contacts between the PLC output and the VFD 120/24/48 VAC interface board. If using a solid state output from a PLC (TRIAC) to a 120/24/48 VAC input card, use a 5KΩ, 5W resistor between the signal and X2.
- If the power source is 500 kVA or greater, or more than 10 times the VFD kVA rating, ensure there is at least 3% impedance between the power source and the VFD input. To accomplish this, a DC reactor can be installed between VFD terminals +1 and +2, or an AC line reactor can be used on the input of the VFD. Excessive peak currents could damage the input power supply circuit if there is not enough impedance.
- Comply with the Suggested Circuit Protection and Wire Size specifications in ***Section 3.2 on page 31***.
- Use time delay fuses, which are sized at 150% of VFD's continuous rated input current, for wiring protection.
- 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 using 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; use a sine wave filter.
- The VFD and motor must be hardwired together. Do not use sliding collector bars.
- If there is a user input device or interface board that is remote, use shielded cable between the VFD input terminals and the interface output terminals or user input device(s).
- 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 gauge 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, program B03-04 = 1 (exchange phases), or interchange any two motor leads (changing R/L1, S/L2, or T/L3 will not affect the shaft rotation direction) as well as encoder phasing (F01-02 = 1 or swap the A+ and A- wires).
- Use shielded cable for all low-level DC speed reference signals (0 to 10 VDC, 4 to 20 mA). Ground the shield only at the VFD side.
- 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.

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

CAUTION

Do NOT connect external dynamic braking units to VFD braking resistor terminal “B2”. Connect positive external dynamic braking unit terminal(s) to terminal “+3” and negative external dynamic braking unit terminal(s) to terminal “-”. When terminal “+3” is unavailable, use terminal “B1”.

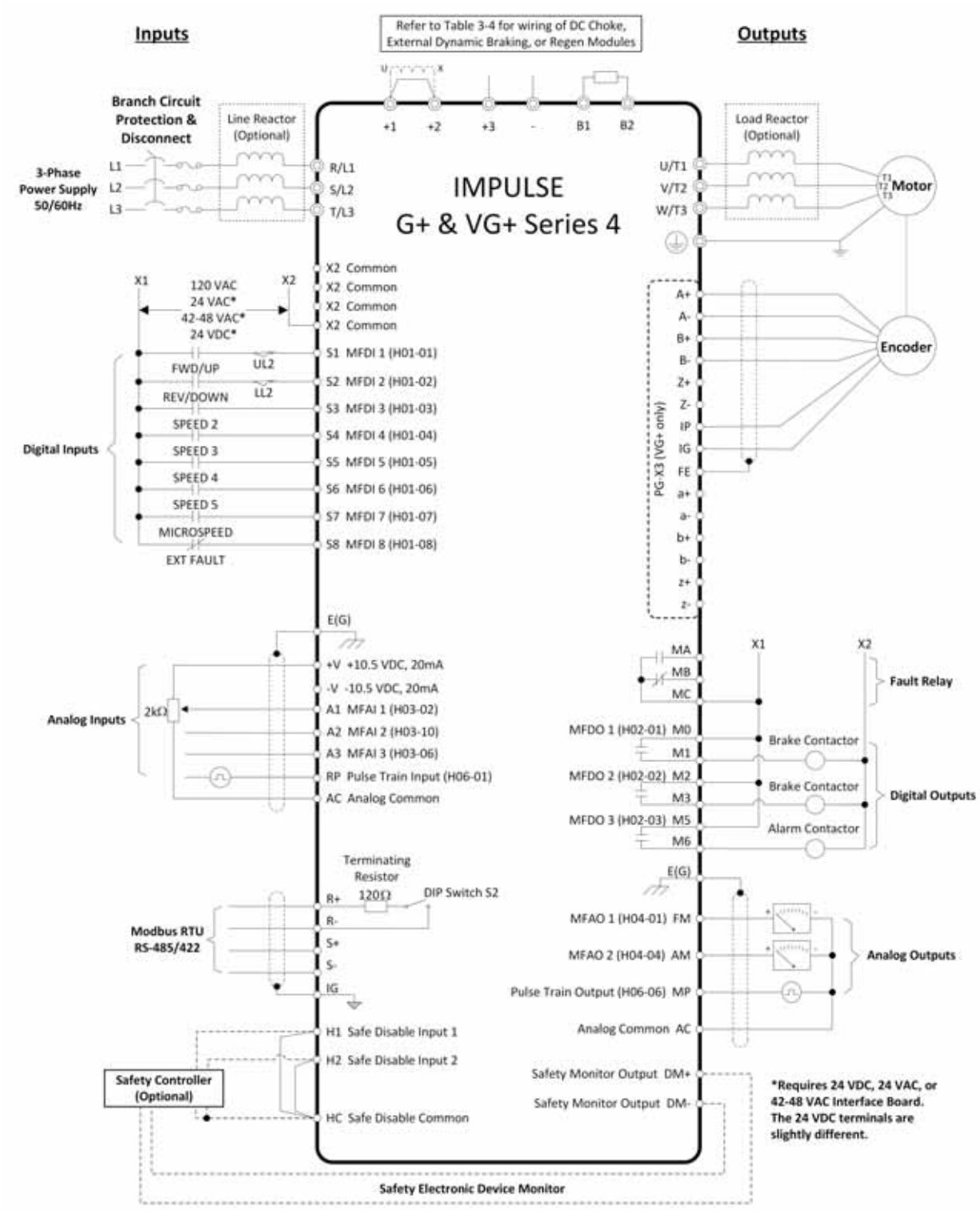


Figure 3-1: Typical Connection Diagram

3.2 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 VFD. These devices can be thermal, magnetic, or molded-case circuit 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.

Table 3-1: Wire Size and Circuit Protection for 230 V Class

Model Number (-G+/VG+ S4)	Maximum Circuit Protection				Recommended Wire Size (AWG)[1]			
	Continuous HD Input Amps	Time Delay Input Fuse (A)[3]	Time Delay Input Fuse Class	Inverse Time Molded/ Case Circuit Breaker (A)[3]	Power Circuit Wiring	Control Wiring[4]	Ground Copper[2] (Fuse)	Ground Copper[2] (Breaker)
2003	2.9	5.6	CC	15	14	18 to 16	14	14
2005	5.8	12	CC	15	14	18 to 16	14	14
2007	7.0	15	CC	20	14	18 to 16	14	12
2008	7.5	15	CC	20	14	18 to 16	14	12
2011	11.0	20	CC	30	14	18 to 16	12	10
2014	15.6	30	CC	40	14	18 to 16	10	10
2017	18.9	35	J	50	14	18 to 16	10	10
2025	28.0	50	J	70	12 to 10	18 to 16	10	8
2033	37.0	70	J	100	10 to 8	18 to 16	8	8
2047	52.0	100	J	150	8 to 6	18 to 16	8	6
2060	68.0	125	J	175	6 to 4	18 to 16	6	6
2075	80.0	150	J	200	4 to 2	18 to 16	6	6
2085	82.0	150	J	225	4 to 2	18 to 16	6	4
2115	111	200	J	300	2 to 1/0	18 to 16	6	4
2145	136	250	J	350	1/0 to 2/0	18 to 16	4	3
2180	164	300	J	450	1/0 to 4/0	18 to 16	4	2
2215	200	350	J	500	3/0 to 250	18 to 16	3	2
2283	271	500	J	700	250 to 400	18 to 16	2	1/0
2346	324	600	J	1000	(2)1/0 to (2)3/0 500	18 to 16	1	2/0
2415	394	700	J	1000	(2)4/0 to (2)250 300 to 350	18 to 16	1/0	2/0

1) NFPA 70 National Electric Code 2017. Tables 430.122(a), 310.15(b)(16), and 610.14(a), 75°C conductor, 60-minute, copper with 40°C ambient correction factor.

2) NFPA 70 National Electric Code 2017. Table 250.122.

3) NFPA 70 National Electric Code 2017. Table 430.52 (selected based on VFD input Amps).

4) One wire per terminal at 16AWG, or two wires per terminal (same type and size) at 18AWG.

Table 3-2: Wire Size and Circuit Protection for 460 V Class

Model Number (-G+/VG+ S4)	Maximum Circuit Protection				Recommended Wire Size (AWG)[1]			
	Continuous HD Input Amps	Time Delay Input Fuse (A)[3]	Time Delay Input Fuse Class	Inverse Time Molded/ Case Circuit Breaker (A)[3]	Power Circuit Wiring	Control Wiring[4]	Ground Copper[2] (Fuse)	Ground Copper[2] (Breaker)
4001	1.8	3.2	CC	15	14	18 to 16	14	14
4003	3.2	5.6	CC	15	14	18 to 16	14	14
4004	4.4	8	CC	15	14	18 to 16	14	14
4005	6.0	12	CC	15	14	18 to 16	14	14
4007	8.2	15	CC	25	14	18 to 16	14	10
4009	10.4	20	CC	30	14	18 to 16	12	10
4014	15.0	30	CC	40	14	18 to 16	10	10
4018	20	35	J	50	12	18 to 16	10	10
4024	29	60	J	80	12 to 10	18 to 16	10	8
4031	39	70	J	100	10 to 8	18 to 16	8	8
4039	44	80	J	110	8	18 to 16	8	6
4045	43	80	J	110	8 to 6	18 to 16	8	6
4060	58	110	J	150	6 to 4	18 to 16	6	6
4075	71	125	J	200	4 to 2	18 to 16	6	6
4091	86	175	J	225	4 to 2	18 to 16	6	4
4112	105	200	J	300	2 to 1/0	18 to 16	6	4
4150	142	250	J	400	1/0 to 2/0	18 to 16	4	3
4180	170	300	J	450	2/0 to 4/0	18 to 16	4	2
4216	207	400	J	600	3/0 to 250	18 to 16	3	1
4260	248	450	J	700	(2)1/0 4/0 to 300	18 to 16	2	1/0
4304	300	600	J	800	(2)2/0 250	18 to 16	1	1/0
4370	346	650	J	1000	(2)2/0 to (2)4/0	18 to 16	1/0	2/0
4450	410	750	L	1200	(2)250 to (2)300 350 to 400	18 to 16	1/0	3/0
4605	584	1100	L	1600	(2)250 to (2)500	18 to 16	3/0	4/0
4810	830	1500	L	2500	(2)350 (3)350 to (3)400	18 to 16	4/0	350
41090	1031	1900	L	3000	(2)450 to (2)500 (3)500	18 to 16	250	400

1) NFPA 70 National Electric Code 2017. Tables 430.122(a), 310.15(b)(16), and 610.14(a), 75°C conductor, 60-minute, copper with 40°C ambient correction factor.

2) NFPA 70 National Electric Code 2017. Table 250.122.

3) NFPA 70 National Electric Code 2017. Table 430.52 (selected based on VFD input Amps.

4) One wire per terminal at 16AWG, or two wires per terminal (same type and size) at 18AWG.

Table 3-3: Wire Size and Circuit Protection for 575 V Class

Model Number (-G+/VG+ S4)	Maximum Circuit Protection				Recommended Wire Size (AWG)[1]			
	Continuous HD Input Amps	Time Delay Input Fuse (A)[3]	Time Delay Input Fuse Class	Inverse Time Molded/Case Circuit Breaker (A)[3]	Power Circuit Wiring	Control Wiring[4]	Ground Copper[2] (Fuse)	Ground Copper[2] (Breaker)
5001	1.9	3.5	CC	15	14	18 to 16	14	14
5003	3.6	7	CC	15	14	18 to 16	14	14
5004	5.1	9	CC	15	14	18 to 16	14	14
5006	8.3	15	CC	25	14	18 to 16	14	10
5009	12	25	CC	30	14	18 to 16	10	10
5012	16	30	CC	40	14	18 to 16	10	10
5017	23	45	J	60	14 to 10	18 to 16	10	10
5022	31	60	J	80	14 to 8	18 to 16	10	8
5027	38	70	J	100	10 to 8	18 to 16	8	8
5032	33	60	J	90	10 to 8	18 to 16	8	8
5041	44	80	J	110	8	18 to 16	8	6
5052	54	100	J	150	6	18 to 16	8	6
5062	66	125	J	175	6 to 4	18 to 16	6	6
5077	80	150	J	200	4 to 2	18 to 16	6	6
5099	108	200	J	300	2 to 1/0	18 to 16	6	4
5130	129	250	J	350	1/0	18 to 16	4	3
5172	158	300	J	400	1/0 to 3/0	18 to 16	4	3
5200	228	400	J	600	3/0 to 300	18 to 16	3	1

1) NFPA 70 National Electric Code 2017. Tables 430.122(a), 310.15(b)(16), and 610.14(a), 75°C conductor, 60-minute, copper with 40°C ambient correction factor.

2) NFPA 70 National Electric Code 2017. Table 250.122.

3) NFPA 70 National Electric Code 2017. Table 430.52 (selected based on VFD input Amps).

4) One wire per terminal at 16AWG, or two wires per terminal (same type and size) at 18AWG.

3.3 Power Circuit Wiring

To wire the power circuit for IMPULSE•G+/VG+ Series 4:

1. Run the power supply wires through an appropriate enclosure hole.
2. Connect the power supply wires to a circuit protection system. ***See Section 3.2 on page 31.***
3. Connect the power supply wires from the circuit protection to Terminals R/L1, S/L2, and T/L3.
4. From Terminals U/T1, V/T2, and W/T3, connect the power output wires to the motor. If a load reactor is used, connect these output wires to the reactor input instead; then connect the reactor output to the motor.

NOTE: *If a device that can interrupt power is installed between the VFD and the motor, install a reactor on the output side of the VFD.*

Table 3-4: Power Circuit Terminals

<table>
<tr><th>Terminal</th><th colspan="3">VFD Model</th><th rowspan="4">Function</th></tr>
<tr><th>230 V Class</th><th>2003 to 2075</th><th>2085 to 2115</th><th>2145 to 2415</th></tr>
<tr><th>460 V Class</th><th>4001 to 4039</th><th>4045 to 4060</th><th>4075 to 41090</th></tr>
<tr><th>575 V Class</th><th>5001 to 5027</th><th>5032 to 5041</th><th>5052 to 5200</th></tr>
<tr><td>R/L1
S/L2
T/L3</td><td colspan="3">Main circuit power supply input
NOTE: *6-pulse operation only*</td><td>Connects line power to the VFD</td></tr>
<tr><td>U/T1
V/T2
W/T3</td><td colspan="3">VFD Output</td><td>Connects to the motor</td></tr>
<tr><td>B1
B2</td><td colspan="2">Braking Resistor</td><td>Not Available
(External braking unit required)</td><td>Connects to a braking resistor</td></tr>
<tr><td>+2</td><td rowspan="3">DC link choke (+1, +2)
(remove the bar between +1 and +2)
DC power supply input
(+1, -)
External braking unit
(B1, -)</td><td colspan="2">Not Available</td><td rowspan="3">For connecting:
• the VFD to a DC power supply
• external braking unit
• a DC link choke</td></tr>
<tr><td>+1</td><td>DC power supply input
(+1, -)
External braking unit
(B1, -)</td><td rowspan="2">DC power supply input
(+1, -)
External braking unit
(+3, -)</td></tr>
<tr><td>-</td></tr>
<tr><td>+3</td><td colspan="2">Not available. Use B1 instead.</td><td></td></tr>
<tr><td>⏚</td><td colspan="3">For 230 V class: 100Ω or less
For 460 V class: 10Ω or less
For 575 V class: 10Ω or less</td><td>Grounding terminal</td></tr>
</table>

3.3.1 Power Circuit Connection Diagrams

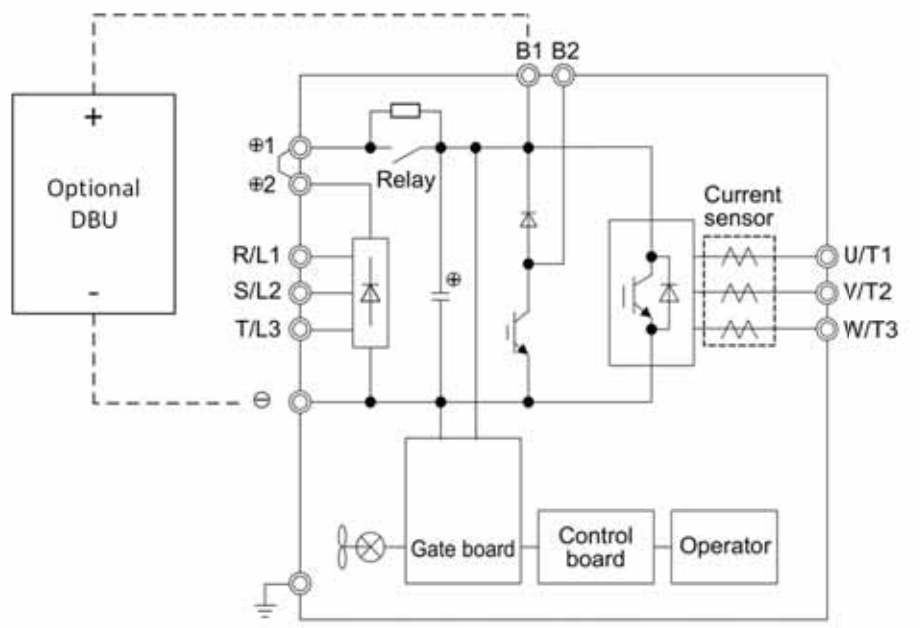


Figure 3-2: Power Circuit Connections (2003 to 2075, 4001 to 4039, 5001 to 5027)

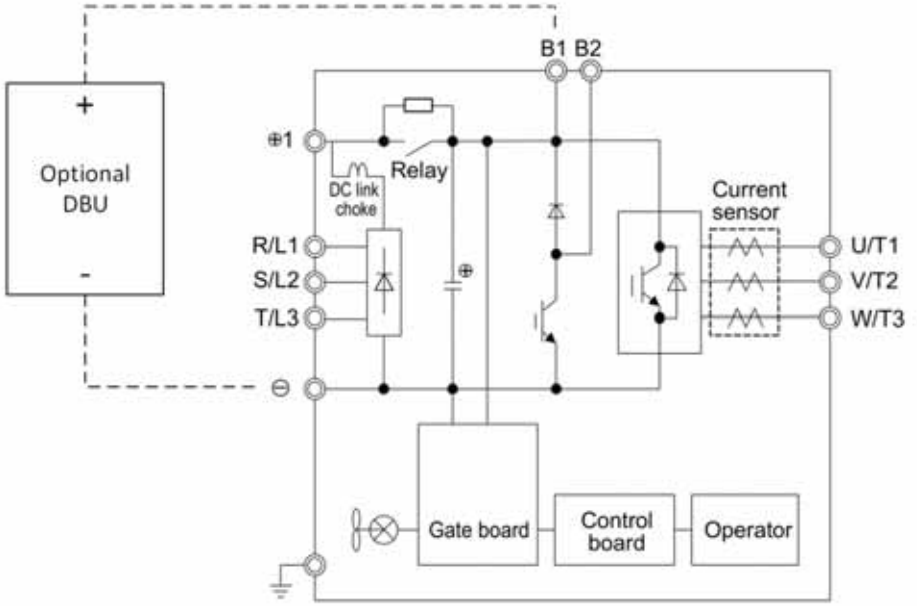


Figure 3-3: Power Circuit Connections (2085 and 2115, 4045 and 4060, 5032 and 5041)

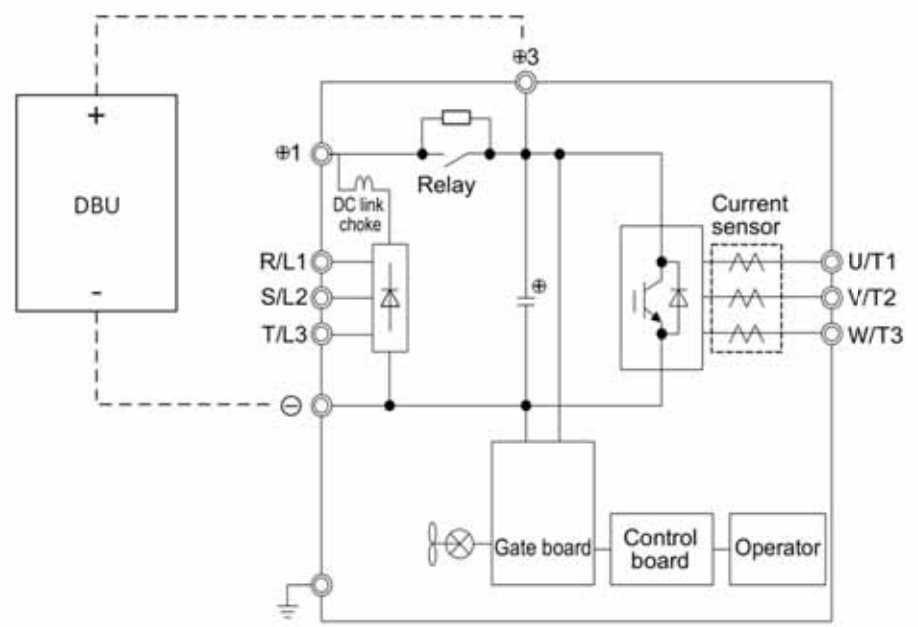


Figure 3-4: Power Circuit Connections (2145 to 2180, 4075 to 4112, 5052 to 5077)

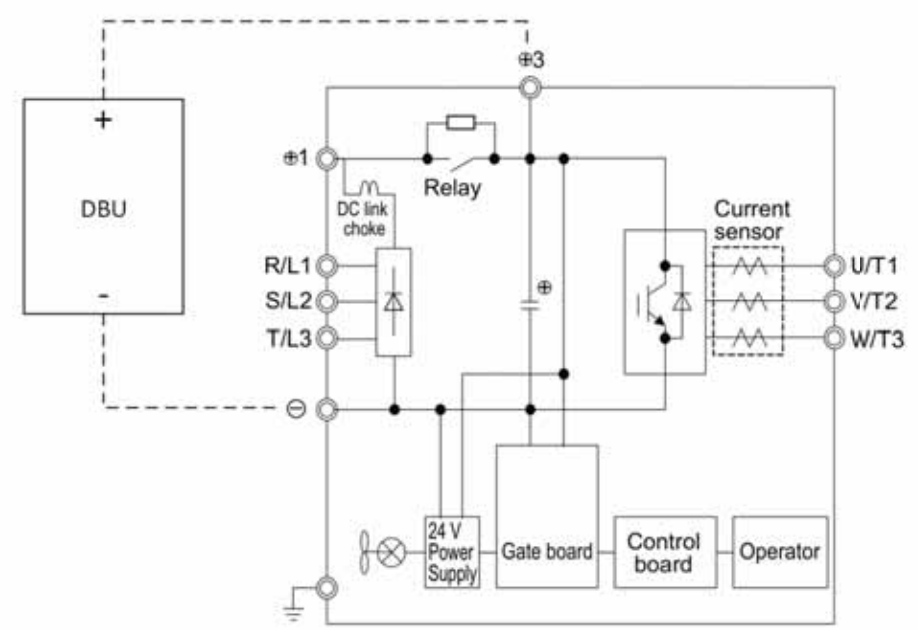


Figure 3-5: Power Circuit Connections (2215 to 2415, 4150 to 4605, 5099 to 5200)

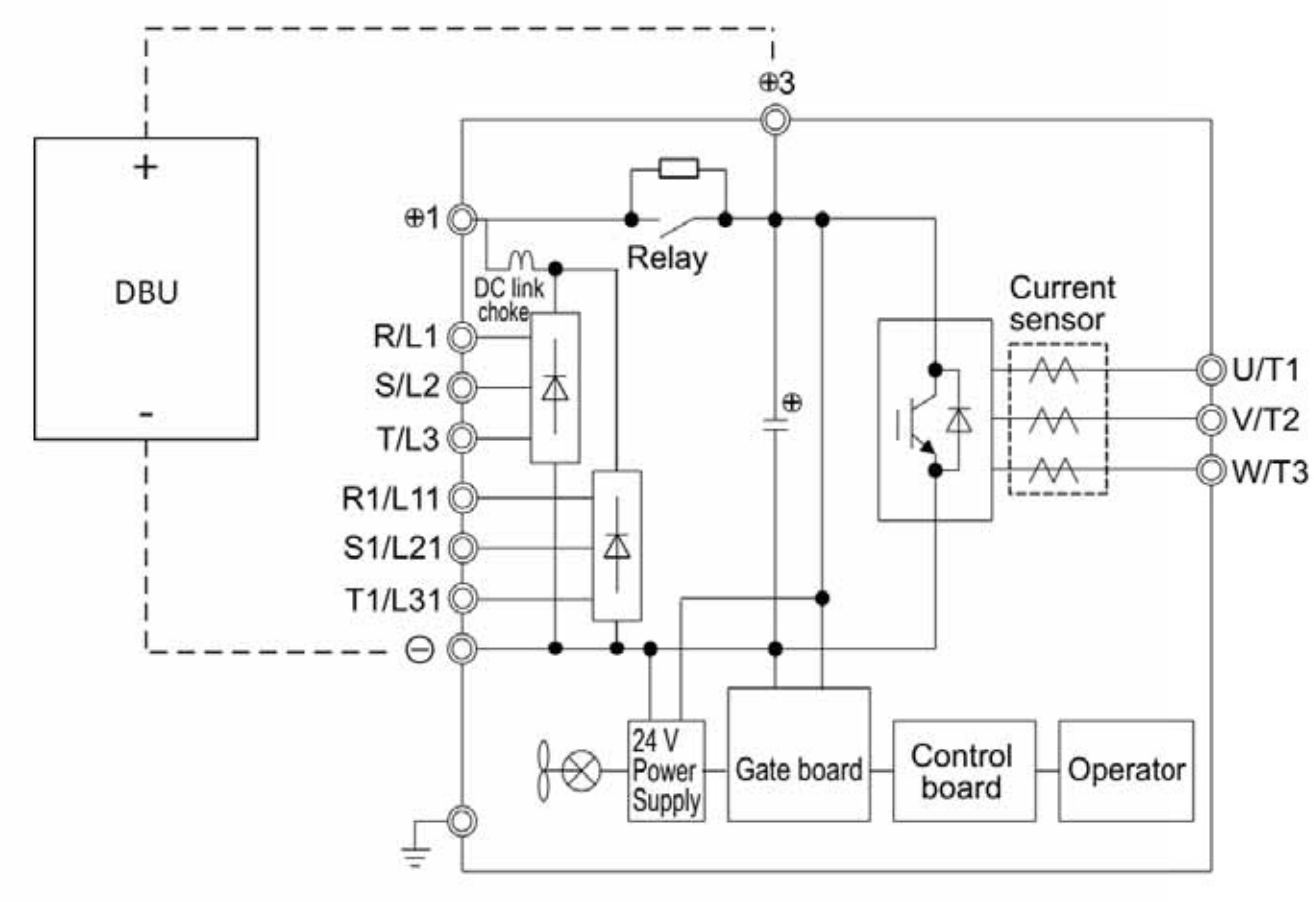


Figure 3-6: Power Circuit Connections (4810 and 41090)

3.3.2 Power Circuit Terminal Block Diagrams

Figure 3-7 and ***Figure 3-8*** show the main circuit terminal arrangements for the various VFD models.

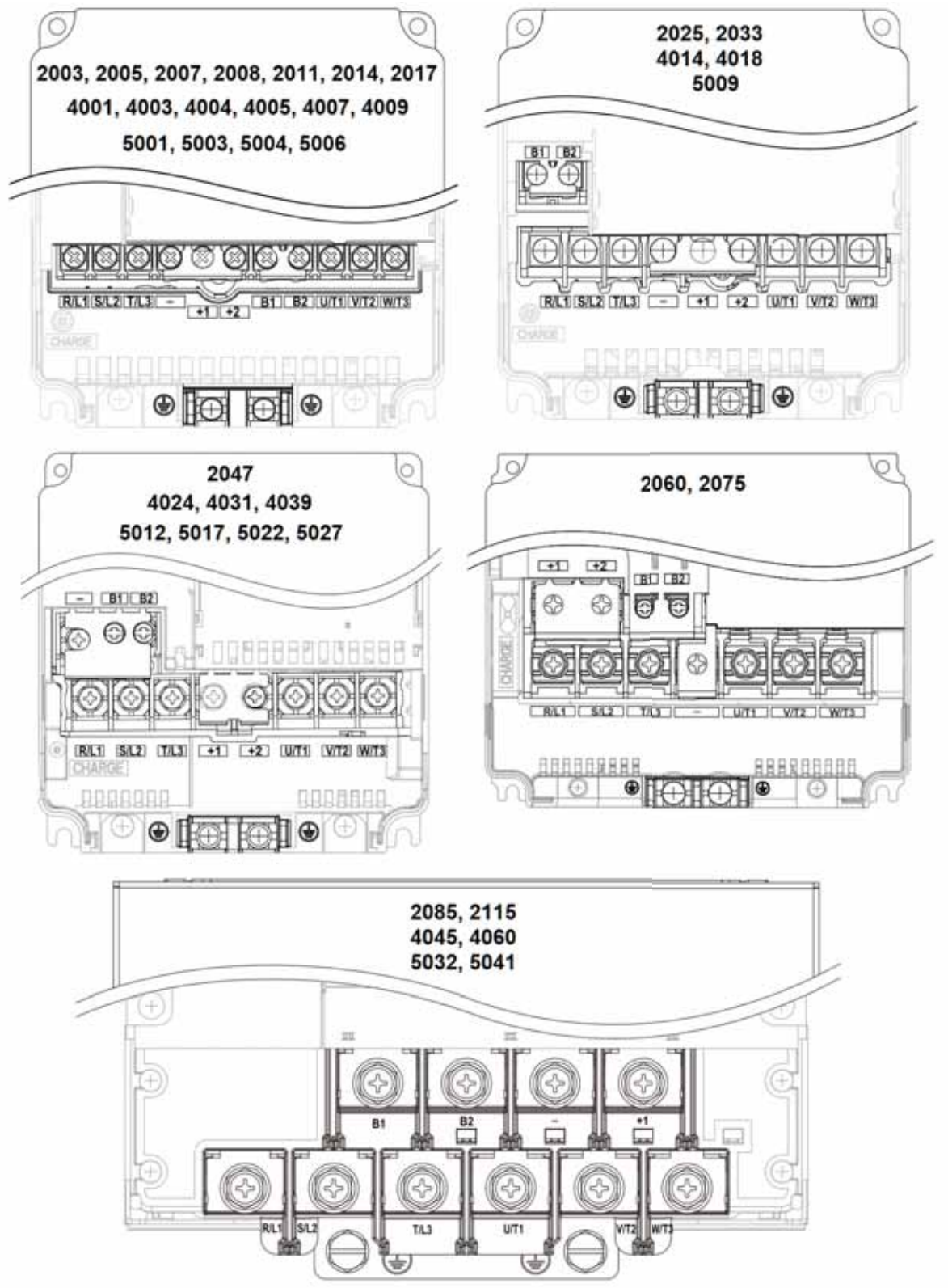
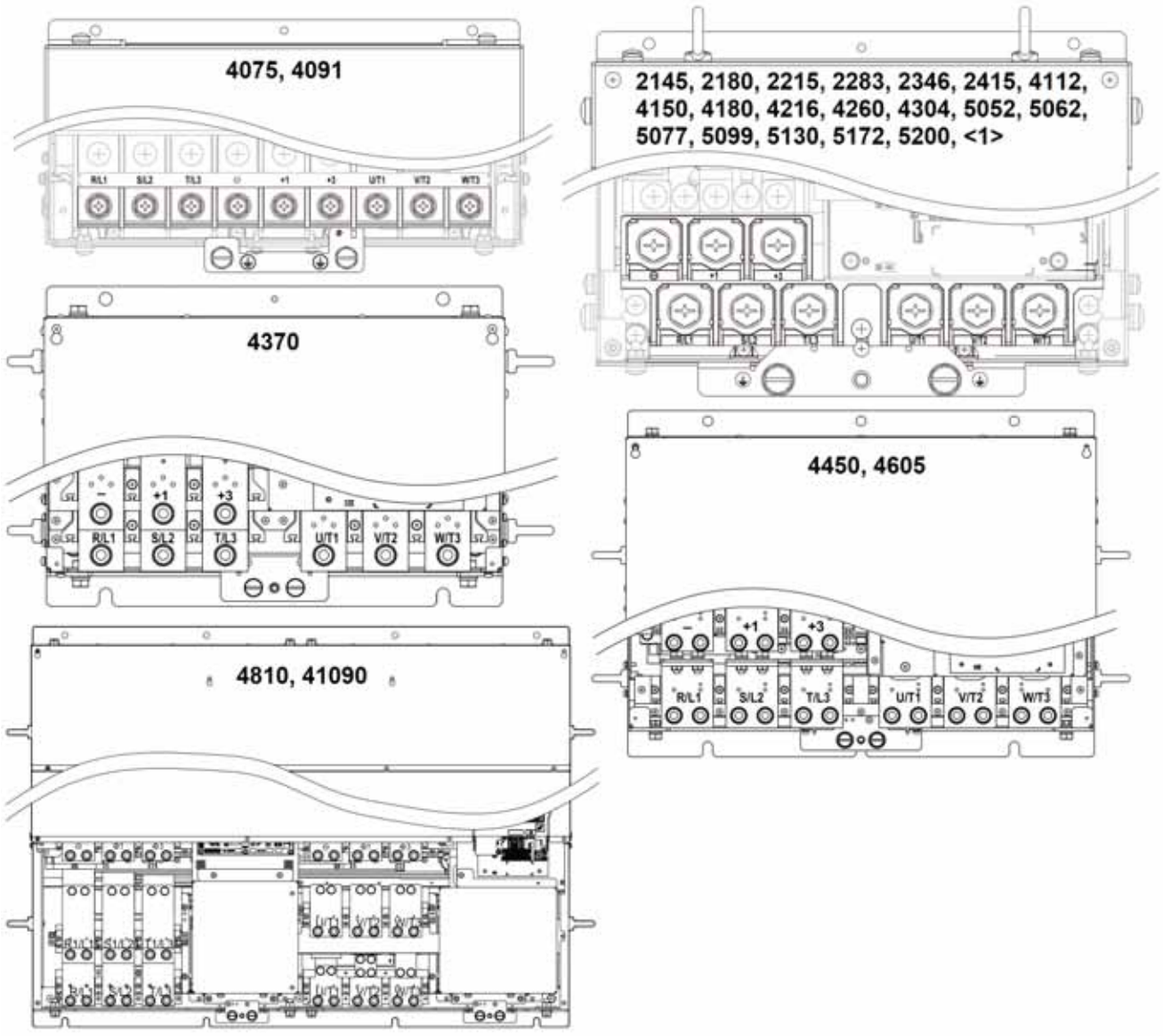


Figure 3-7: Power Circuit Terminal Blocks



<1> Terminal block design differs slightly for models 2215 to 2415, 4180 to 4304, and 5099 to 5200.

Figure 3-8: Power Circuit Terminal Blocks (continued)

3.3.3 Insulation Barrier

Insulation barriers are packaged with VFD models 4370 through 41090 to provide added protection between terminals. Magnetek recommends using the provided insulation barriers to ensure proper wiring. ***See Figure 3-9*** for instructions on placement of the insulation barriers.

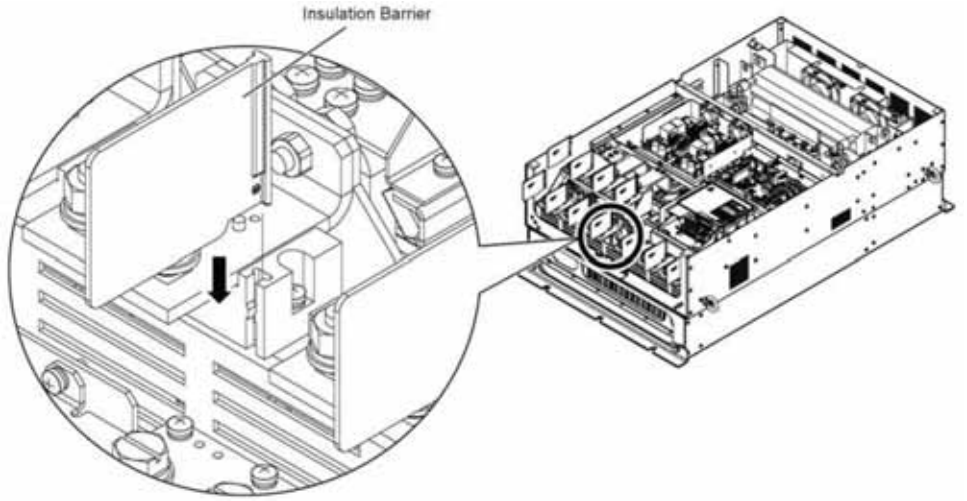


Figure 3-9: Installing Insulation Barriers

3.4 Grounding

Connect the VFD's ground terminal to a common grounding point on the control panel. Use ground wiring as specified in ***Section 3.2 on page 31***, and keep the length as short as possible.

- Ground Resistance:
  - For 230V class: 100Ω or less
  - For 460V class: 10Ω or less
  - For 575V class: 10Ω or less
- Never run the VFD 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 directly or daisy-chain to the ground pole. Do not loop the ground wires.

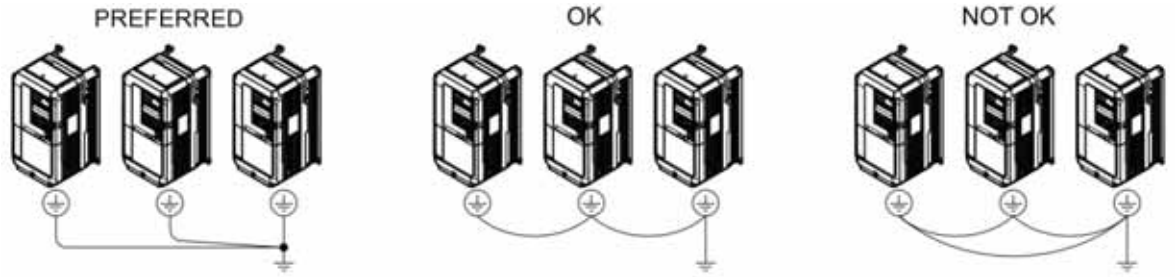


Figure 3-10: VFD Grounding

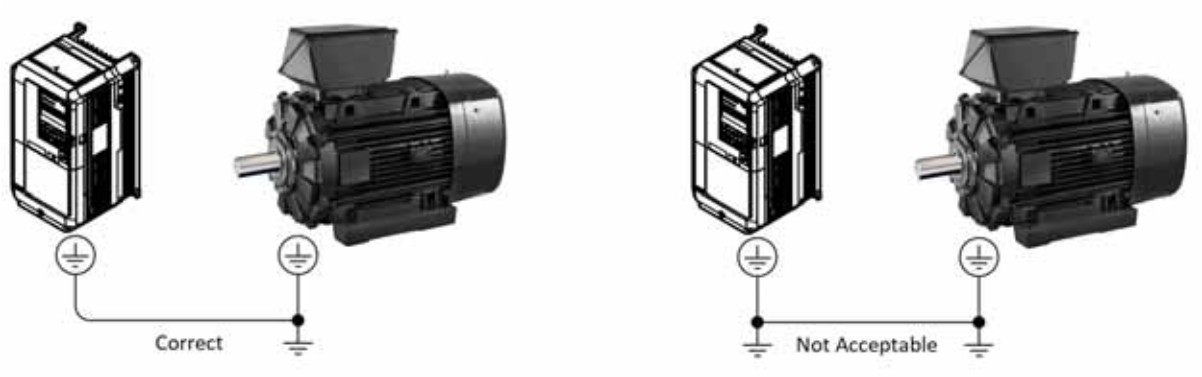


Figure 3-11: Motor Grounding

3.5 Interface Board (S4IF)

Table 3-5: Terminal and Wire Specifications

Terminal Symbol	Screw Size	Tightening Torque in.-lbs (N-m)	Wire Size AWG (mm^2)
All Terminals	M3	4.4 to 5.3 (0.5 to 0.6)	Stranded: 24 to 17 (0.25 to 1.0) Solid: 24 to 16 (0.25 to 1.5)

3.5.1 Terminal Block, DIP Switch, and Jumper Diagrams

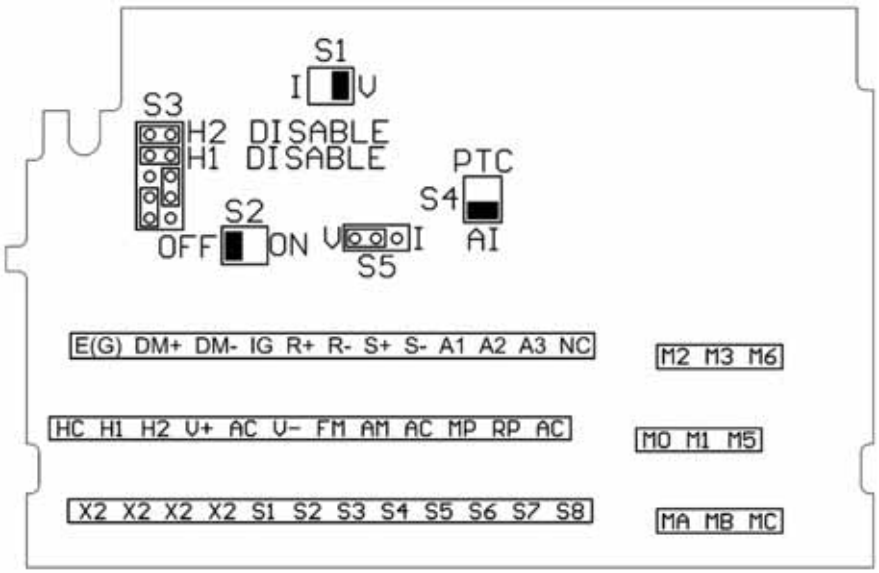


Figure 3-12: 120 VAC, 42–48 VAC, and 24 VAC Interface Board

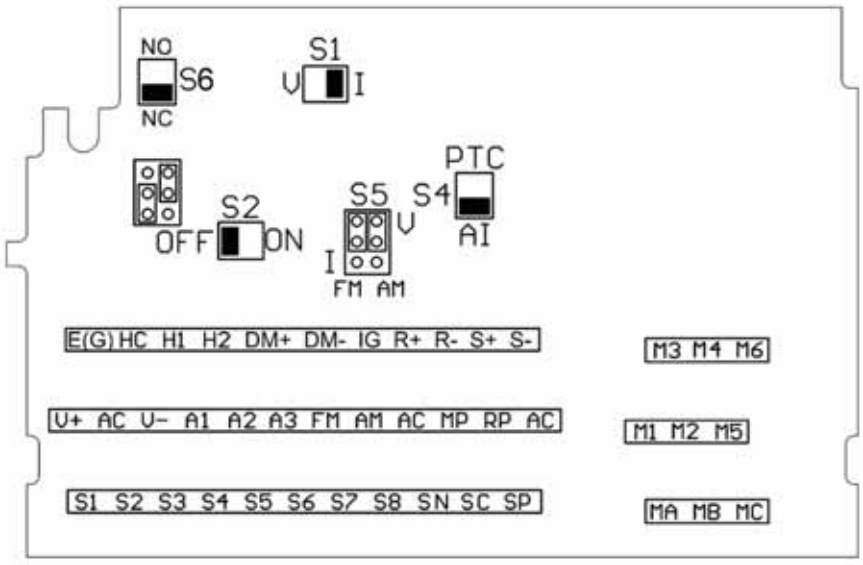


Figure 3-13: 24 VDC Interface Board

3.5.2 DIP Switch Functions

DIP Switches are described in this section, and the functions are shown in ***Table 3-6***.

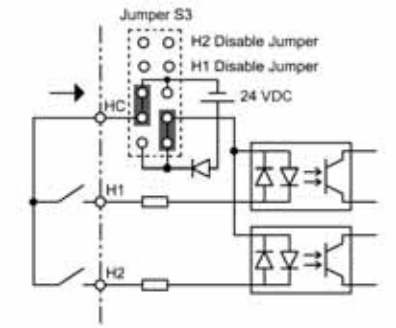
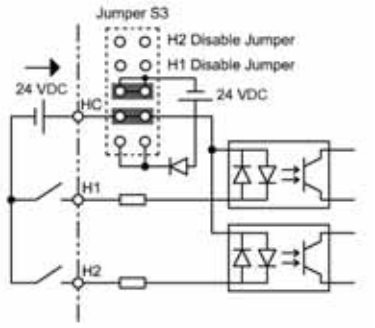
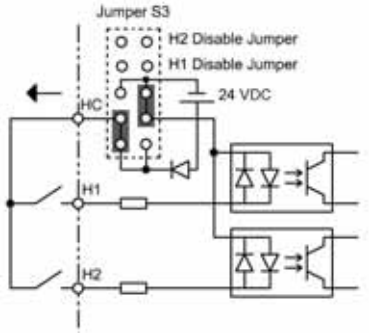
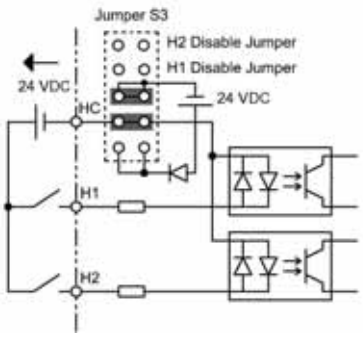
Table 3-6: DIP Switches

Name	Function	Setting
S1	Analog Input A2 Signal Level	V: 0 to 10 VDC or -10 to 10 VDC (internal impedance: 20 kΩ) **(default)** I: 4–20mA (internal impedance: 250 Ω)
S2	RS-485/RS-422 Termination Resistor	OFF: No terminating resistance **(default)** ON: Terminating resistance of 120 Ω
S3	Hardware Base Block Configuration	Selects the functionality of the Safe Disable inputs. ***See Table 3-7*** for details.
S4	Analog Input A3 Select	AI: A3 is used as Analog Input 3 **(default)** PTC: A3 is used with a Positive Temperature Coefficient (PTC) thermistor
S5	Analog Output FM Signal Level	V: 0 to 10 VDC or -10 VDC to 10 VDC **(default)** I: 4–20mA (internal impedance: 250 Ω)
S6	DM+/DM- Polarity	N.C.: Normally Closed (default) N.O.: Normally Open

3.5.3 Sinking/Sourcing Mode for Safe Disable Inputs

Jumper S3 selects between Sink mode, Source mode, or external power for the Safe Disable inputs H1 and H2. If the top two jumpers are in place, Safe Disable inputs H1 and H2 are disabled. The 24VDC interface board does not have these two jumpers and instead has a wire jumper in the H1 and H2 terminals. Remove H1 and H2 disable jumpers if external Safe Disable functionality is to be used. ***See Figure 3-12*** for locating jumper S3.

Table 3-7: Safe Disable Input Sink/Source/External Power Supply Selection

Mode	VFD Internal Power Supply	External 24 VDC Power Supply
Sinking Mode		
Sourcing Mode		
	(Default)	

3.6 Control Circuit Wiring

The table below outlines the functions of the control circuit terminals.

Terms:

- Multi-Function Digital Input (MFDI)
- Multi-Function Digital Output (MFDO)
- Multi-Function Analog Input (MFAI)
- Multi-Function Analog Output (MFAO)

Table 3-8: Control Circuit Terminals

Type	Terminal	Function	Description	Signal Level
Digital Inputs	S1	MFDI 1	Multi-function digital inputs (H01-01 to H01-08)	Photo-coupler isolation 120 VAC, 42-48 VAC, 24 VAC, or 24 VDC options; 8 mA per input
	S2	MFDI 2		
	S3	MFDI 3		
	S4	MFDI 4		
	S5	MFDI 5		
	S6	MFDI 6		
	S7	MFDI 7		
	S8	MFDI 8		
	X2	MFDI Common	Common for control signal	0 V
	SC	MFDI Common	24 VDC interface board only	0 V
	SN	MFDI Power Supply 0 V	24 VDC interface board only	0 V
	SP	MFDI Power Supply +24 VDC	24 VDC interface board only	+24 VDC, 150 mA
Analog Inputs	+V	MFAI Power Supply +10.5 VDC	Positive supply for analog inputs	+10.5 VDC, 20 mA
	-V	MFAI Power Supply -10.5 VDC	Negative supply for analog inputs	-10.5 VDC, 20 mA
	A1	MFAI 1	Multi-function analog input (H03-02)	-10 to +10 V (impedance: 20kΩ) 0 to +10 V (impedance: 20kΩ)
	A2	MFAI 2	Multi-function analog input (H03-10)	10 to +10 V (impedance: 20kΩ) 0 to +10 V (impedance: 20kΩ) 4 to 20 mA (impedance: 250Ω)
	A3	MFAI 3	Multi-function analog input (H03-06)	-10 to +10 V (impedance: 20kΩ) 0 to +10 V (impedance: 20kΩ)
	AC	Analog Common	Common for analog signal	0 V
	E(G)	Signal Common	Ground for shielded lines	-
Digital Outputs	M0	MFDO 1	Multi-function digital output (H02-01)	Form A Relay: 250 VAC*, 1 A; 30 VDC, 1 A
	M1			
	M2	MFDO 2	Multi-function digital output (H02-02)	Form A Relay: 250 VAC*, 1 A; 30 VDC, 1 A
	M3			
	M5	MFDO 3	Multi-function digital output (H02-03)	Form A Relay: 250 VAC*, 1 A; 30 VDC, 1 A
	M6			

Type	Terminal	Function	Description	Signal Level
Digital Outputs (cont.)	MA	Fault Relays Terminals MA-MC: N/O	MA-MC N/O; closed during fault	Form C Relay: 250 VAC*, 1 A; 30 VDC, 1 A
	MB			
	MC	Terminals MB-MC: N/C	MB-MC N/C; open during fault	
Analog Outputs	FM	MFAO 1	Multi-function analog output 1 (H04-01 to H04-03)	-10 to +10V, 2 mA 0 to +10V, 2 mA 4 to 20 mA
	AC	Analog Common	Analog signal common	0 V
	AM	MFAO 2	Multi-function analog output 2 (H04-04 to H04-06)	-10 to +10V, 2 mA 0 to +10V, 2 mA 4 to 20 mA (24 VDC S4IF only)
Pulse I/O Signal	RP	Pulse Input	Pulse input frequency reference (H06-01)	Input Freq.: 0 to 32 kHz Duty Cycle: 30 to 70% High level: 3.5 to 13.2 VDC Low Level: 0 to 0.8 VDC Input Impedance: 3kΩ
	MP	Pulse Output	Pulse output frequency (H06-06)	32 kHz (max)
RS-485/422	R+	Receive (+)	For 2-wire RS-485, jumper R+ to S+ and jumper R- to S-	RS-485/422 Line Driver 115.2 kbps (max)
	R-	Receive (-)		
	S+	Transmit (+)		
	S-	Transmit (-)		
	IG	Shield connection	Serial Communication Shield	0 V (not grounded)
Safe Disable	H1	Safe Disable input 1	• One or both open: Motor Output Disabled • Both closed: normal operation • Off time of at least 1ms	24 VDC, 8 mA Internal Impedance: 3.3kΩ
	H2	Safe Disable input 2		
	HC	Safe Disable common		-
	DM+	Safety monitor output	Outputs the status of the Safe Disable function. Closed when both H1 and H2 are closed.	Up to 48 VDC, 50 mA
	DM-	Safety monitor output		

** The relays must be derated to 120 VAC for CE compliance.*

3.6.1 Control Circuit Terminal Block Diagrams

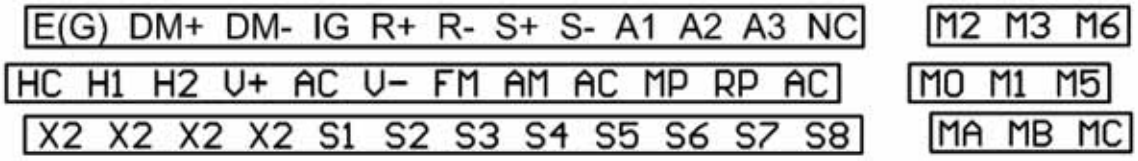


Figure 3-14: S4IF Terminal Diagram (120 VAC, 42–48 VAC, 24 VAC)

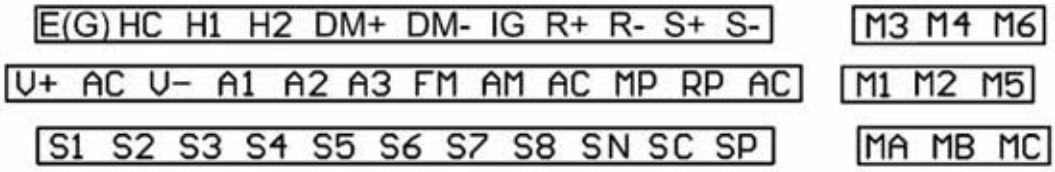
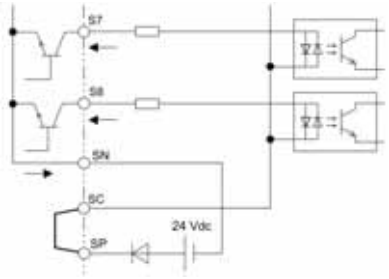
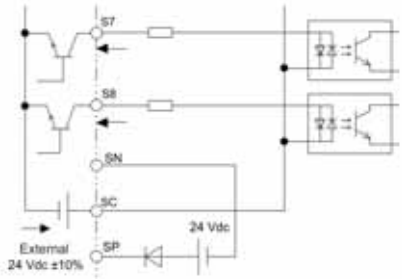
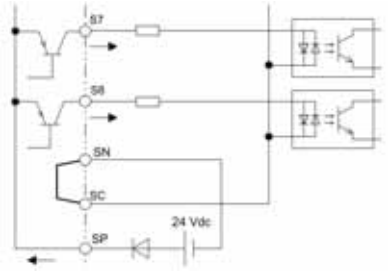
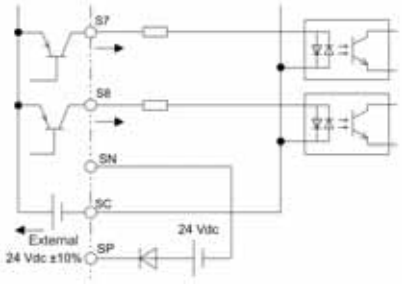


Figure 3-15: S4IF Terminal Diagram (24 VDC)

3.6.2 Sinking/Sourcing for Digital Inputs (24 VDC Only)

Use the wire jumper between terminals SC and SP or SC and SN to select Sink mode, Source mode, or to externally power the digital inputs. This function only applies to the 24 VDC interface board.

Table 3-9: Safe Disable Input Sink/Source/External Power Supply Selection

Mode	VFD Internal Power Supply	External 24 VDC Power Supply
Sinking Mode	 **(Default)**	
Sourcing Mode		

3.6.3 Safe Disable and Safe Torque Off

The Safe Disable inputs provide a stop function in compliance with “Safe Torque Off” as defined in IEC/EN 61800-5-2. Safe Disable inputs have been designed to meet the requirements of the ISO/EN 13849-1, Category 3 PLd, and IEC/EN 61508, SIL2.

Inputs/Outputs		Two Safe Disable inputs and one EDM output according to ISO/EN 13849-1 Cat. 3 PLd, IEC/EN 61508 SIL2.
Operation Time		Time from input open to VFD output stop is less than 1 ms.
Failure Probability	**Demand Rate Low**	PFD = $5.15E^{-5}$
	Demand Rate High/ Continuous	PFH = $1.2E^{-9}$
Performance Level		The Safe Disable inputs satisfy all requirements of Performance Level (PL) d according to ISO/EN 13849-1 (DC from EDM considered).

Safe Torque Off disables the VFD power section for mechanical maintenance, E-stops, or redundancy safety monitor controller intervention. The feature provides safe removal of motor torque without removal of power to the VFD. This is a standard feature on the IMPULSE•G+/VG+ Series 4. A Safe Disable Status Monitor for error detection in the safety circuit is also provided.

The Safe Disable circuit (***Figure 3-16***) consists of two independent input channels (H1 and H2) that can block the output transistors and provide a monitoring output channel (DM+ and DM-) to indicate the status of those input channels.

The input can use the internal 24VDC power supply of the VFD or an external power supply, and it will support Sink mode or Source mode. The mode selected for the digital input terminals S1 to S8 by jumper S3 will also be used for the Safe Disable inputs.

NOTE: *Terminals H1, H2, DM+, and DM- on 575V class models are designed to the functionality, but are not certified to IEC/EN 61800-5-1, ISO/EN 13849 Cat. 3, IEC/EN 61508 SIL2, Insulation coordination: class 1.*

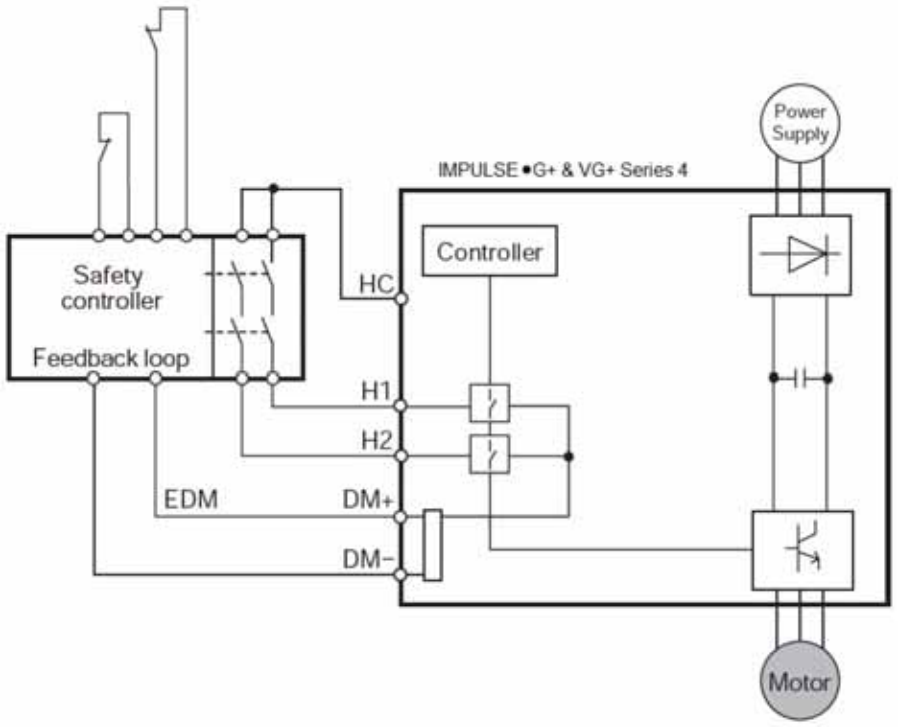


Figure 3-16: Safe Torque Off Block Diagram

3.7 Encoder Circuit

A shaft-mounted encoder is required to provide speed and shaft position feedback to the IMPULSE•VG+ Series 4. Without an encoder, flux vector control cannot operate properly.

Before you wire the encoder circuit, refer to ***Table 3-10 on page 48*** and ***Table 3-11 on page 49***.

3.7.1 Encoder Circuit Specification and Wiring Procedure

Table 3-10: Encoder and PG-X3 Option Card Specifications

Power supply	+12 VDC (+5 VDC by CN3 jumper); max. 200 mA (consult factory if inrush currents exceed 200 mA), an auxiliary power supply is required
Output Type	Differential Quadrature (A+, A-, B+, and B- channels; Z is not used)
Compatible Types	Line Driver (TTL/RS422) Push-Pull (HTL) Open Collector (PNP or NPN)
Non-Compatible Types	Resolver Absolute (sine/cosine)
Maximum Input Frequency	300 kHz
Mounting method	Encoder must be direct-coupled to motor shaft, using a zero-backlash-type coupling.

To wire the encoder circuit (assuming the VFD cover and keypad are detached):

1. Direct-couple the encoder to the motor shaft, using a zero-backlash-type coupling.

NOTE: *Do not connect the encoder to the motor with roller chain or gear drive. If unable to direct-couple the encoder, use a timing belt to drive the encoder. Also, do not connect the encoder to the low-speed shaft of a speed reducer.*

2. Connect the encoder to the PG-X3 Encoder Option Card. ***See Figure 3-17 on page 49***.

NOTE: *Use twisted-pair, shielded cable 100 Ω impedance (Magnetek R-20/6, R-22/6, Belden 9730, or equivalent. Strip the encoder wires 0.25 in. (5.5 mm). Keep the wiring length less than 300 feet (for cable lengths greater than 300 feet, use fiber optic cable).*

3. Connect the shield to Terminal FE of the PG-X3 Option Card (on only one end of the shielded cable).
4. Whenever possible, the encoder cable should be a continuous run between the motor and VFD. If it cannot be a direct run, the splice should be in its own junction box and isolated from the power wires.

3.7.2 Encoder Wiring Diagram

Encoder 1: Install in option port CN5-C

Encoder 2: Install in option port CN5-B

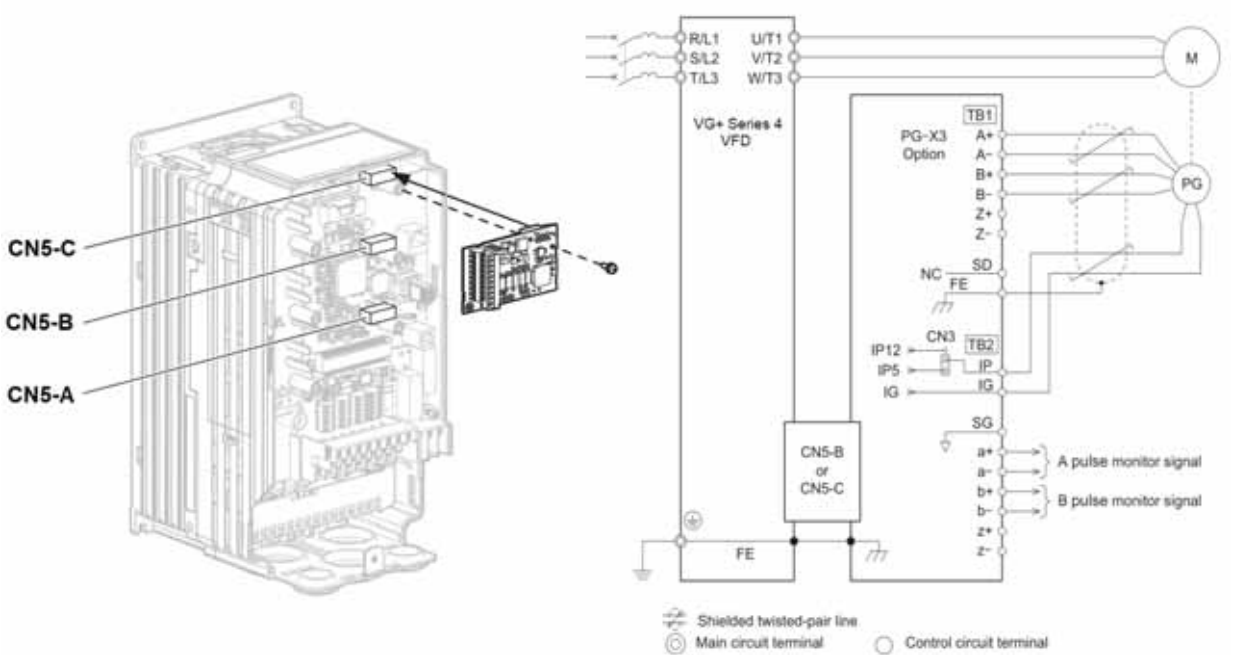


Figure 3-17: PG-X3 Encoder Card Wiring

Table 3-11: Encoder Wiring

Encoder Signal	Wire Color Example	PG-X3 Terminal
+5 or 12 VDC (select via CN3 jumper)	Red	IP
0V	Black	IG
A+	Blue	A+
A-	Gray	A-
B+	Green	B+
B-	Yellow	B-
Shield	-	FE

4 Getting Started

4.1 Overview

With its easy-to-use keypad and X-Press Programming, the IMPULSE•G+/VG+ Series 4 makes it easy to get up and running quickly. In addition to explaining the keypad and X-Press Programming, this chapter explains how to navigate the menus and configure the VFD.

4.1.1 Checks Before Powering

After VFD installation and wiring are completed, verify:

- Correct connections.
- Correct input power supply (no voltage drop or imbalance, source kVA ≤ 500, unless a line reactor is used).
- 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 for Decelerate to stop. If deceleration time is too long, equipment could run into the end stop device, causing damage to equipment or injury to personnel.

4.2 Using the Keypad

With five 16-character lines available, the keypad display makes it possible to monitor VFD operation, change parameter settings, and view fault codes. In addition, the parameter description is included on the top line of the display. The keypad enables you to:

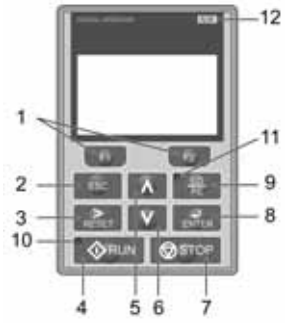
- Program the various VFD parameters.
- Monitor the functions of the VFD.
- Read alpha-numeric fault-diagnostic indications.
- Operate the VFD using the keypad (local operation).

WARNING

Because of additional potential hazards when the VFD is operated locally, we advise you to avoid operating it this way. If the VFD is operated locally, be aware that the crane or hoist will move when the RUN button is pressed. Contact Magnetek with any questions.

4.2.1 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.



1	F1 F2	The functions assigned to F1 and F2 vary depending on the current displayed menu. The name of each function appears in the lower half of the display window.
2	ESC	• Returns to the previous display • Moves the cursor one space to the left. • Pressing and holding this button will return to the home screen.
3	RESET	• Moves the cursor to the right. • Resets the VFD to clear a fault.
4	RUN	Starts the VFD when in LOCAL mode.
5	∧	Scrolls up to display the next item, selects parameter numbers, and increments setting values.
6	∨	Scrolls down to display the previous item, selects parameter numbers, and decrements setting values.
7	STOP	Stops VFD operation. *1
8	ENTER	• Enters parameter values and settings. • Selects a menu item to move between displays.
9	LO RE	• Displays the phone number for the Magnetek Service department. • Switches VFD control between the keypad (LOCAL) and an external source (REMOTE) for the Run command and frequency reference. *2 • Pressing the key three times resets the maintenance timer, U01-52.
10	RUN	Lit while the VFD is operating the motor. Flashing when the VFD has a phantom fault.
11	LO RE	Lit while the keypad is selected to run the VFD (LOCAL mode).
12	ALM	Off during normal operation (no fault or alarm). Illuminated when the VFD detects an alarm or error. Flashes when an alarm occurs, when an oPE is detected, or when an error occurs during Auto-Tuning.

**1 The STOP key has highest priority. Pressing the STOP key will always cause the VFD to stop the motor, even if a Run command is active at any external Run command source.*

**2 The LO/RE key can only switch between LOCAL and REMOTE when the VFD is stopped. To enable the LO/RE key to switch between LOCAL and REMOTE, set parameter O02-01 = 1.*

4.3 Parameters

There are a variety of parameters that determine how the VFD functions. These parameters are programmed into 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.

Before shipping the VFD, Magnetek programmed initial settings so that most, if not all, of the crane system requirements are supported. However, if it is necessary to change the initial settings, Magnetek recommends that only qualified crane system technicians program the VFD. Security can be enabled by using the **Password** and **Access Level** features. For more information on these security features, ***see Section 4.3.3 on page 55***.

The VFD can be restricted to allow access to only certain parameters, called **User Parameters**. To select these parameters, ***see Section 4.3.3.9 on page 62***.

Two additional features are **Initialize Parameters** (A01-05) and **User Defaults** (O02-03). Both of these features are related and revert back to previously saved parameter settings. This is especially helpful when a number of programming changes were made, but the previous settings may still be needed. To program these features, ***see Section 4.3.3.7 on page 61*** and ***User Defaults (O02-03) on page 177***.

4.3.1 Parameter Menus

All parameters are organized under four modes:

4.3.1.1 Monitor Menu

VFD operation is enabled, and various live monitors can be viewed.

4.3.1.2 Programming and Quick Setting Menu

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.

4.3.1.3 Auto-Tuning Menu

Automatically calculates and sets motor parameters to optimize VFD performance.

4.3.1.4 Modified Parameters Menu

Only parameters that have been changed from the default settings are shown.

4.3.2 Menu Structure

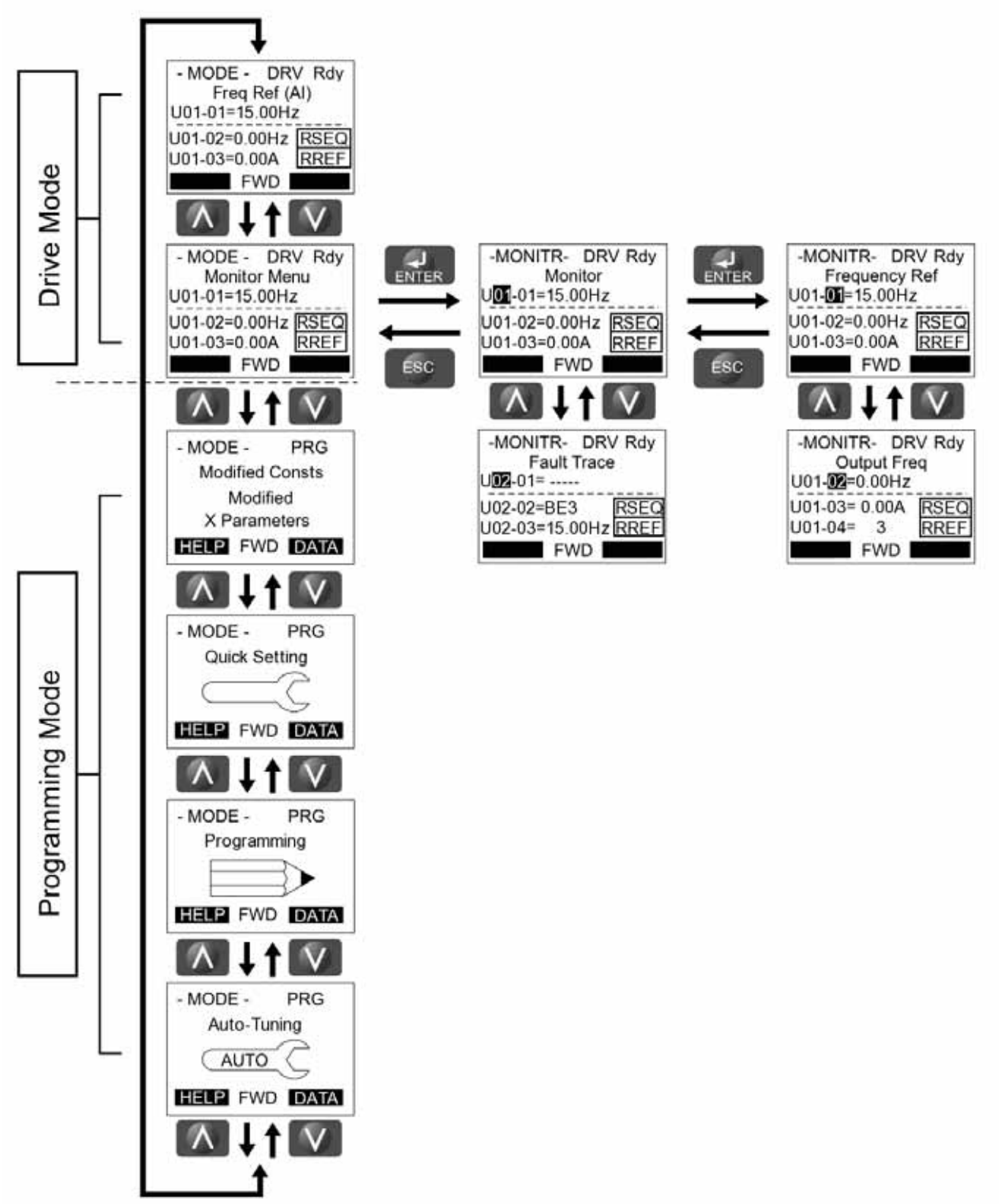
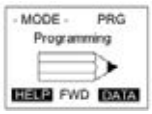


Figure 4-1: Menu Structure



Group	Function	
Monitor	U01	Status
	U02	Fault Trace
	U03	Fault History
	U04	Maintenance
	U06	Control
Initialize	A01	Initialization Parameters
	A02	User Parameters
Application	B01	Speed References
	B02	Reference Limits
	B03	Run/Reference Source
	B05	Acceleration/Deceleration
	B08	Jump Frequencies
	B09	Field Forcing
Special Function	C01	Quick Stop
	C01	Reverse Plug Simulation
	C02	Micro-Speed
	C03	End of Travel Limits
	C03	Phantom Stop
	C03	Load Share (Torque Following)
	C03	Klixon
	C03	Hook Height Measurement
	C03	Electronic Programmable Limit Switches (EPLS)
	C04	Load Float 2
	C05	Load Check II
	C06	Swift-Lift/Ultra-Lift
	C07	Torque Limit
	C07	Anti-Shock
	C08	No-Load Brake Hoist
	C08	Brake Answerback
	C08	Emergency Lift
	C09	Digital Input (DI-A3, S4I, or S4IO) Option Card Setup
	C10	Weight Measurement
	C11	Slack Cable Detection
	C11	Snap Shaft Detection
	C12	Delay Timers and Timer Functions
	C13	Inch Control
	C13	Index Control
Tuning	D01	DC Injection Braking
	D02	Motor Slip Compensation
	D03	Torque Compensation
	D04	Automatic Speed Regulator (ASR) Tuning
	D05	Torque Control
	D08	Dwell
	D09	S-Curve Acceleration/Deceleration
	D10	Carrier Frequency
	D11	Hunting Prevention
Motor	E01	V/f Pattern
	E02	Motor Setup
	E03	Test Mode Configuration
Options	F01	Encoder Feedback (PG-X3) Option Card Setup
	F02	Analog Input (AI-A3) Option Card Setup
	F04	Analog Output (AO-A3) Option Card Setup
	F05	Digital Output (DO-A3 or S4IO) Option Card Setup
	F06	Profibus-DP (SI-P3) Option Card Setup
	F07	Ethernet (SI-EN3) & Modbus (SI-EM3) Option Card Setup
Terminal	H01	Digital Inputs
	H02	Digital Outputs
	H03	Analog Inputs
	H04	Analog Outputs
	H05	Serial Communication
	H06	Pulse Train Input/Output
Protection	L01	Motor Overload
	L02	Power Loss Ride Thru
	L03	Stall Prevention
	L04	Speed Agree
	L05	Test Mode
	L06	Torque Detection
	L08	Hardware Protection
	L09	Automatic Fault Reset
	L09	Fault Latch
Keypad	O01	Monitor Selection
	O02	VFD and Keypad Selection
	O03	Maintenance History
	O04	Copy Function

4.3.3 Initial Setup

4.3.3.1 Parameter Access Level (A01-01)

This parameter allows the “masking” of parameters according to user level.

Table 4-1: Parameter Access Level Settings

Setting	Description
0	**Operation Only** Access to only parameters A01-01, A01-06, and all U monitors.
1	**User Parameters** Allows access to only the parameters programmed to A02-01 through A02-32.
2	**Advanced Level** All parameters can be viewed and edited.

4.3.3.2 Control Method (A01-02)

A VG+ VFD comes pre-configured to Flux Vector and locked into that setting. A G+ VFD comes pre-configured to V/f and may be changed to Open Loop Vector, but not Flux Vector.

Table 4-2: Control Method Settings

Setting	Description	Model
0	**Volts-per-Hertz (V/f)** Use this mode for simple speed control and for multiple motor applications with low demands to dynamic response or speed accuracy. This control method is also used when the motor parameters are unknown and Auto-Tuning cannot be performed. The speed control range is 40:1.	G+
2	**Open Loop Vector (OLV)** Use this mode for applications that require precise speed control, quick torque response, and high torque at low speed without using a speed feedback signal from the motor. The speed control range is 200:1.	G+
3	**Flux Vector (FLV)** Use this mode for applications that require precise speed control down to zero speed, quick torque response or precise torque control, and a speed feedback signal from the motor. The speed control range is up to 1500:1.	VG+

NOTE: *An auto-tune should be performed for all Flux Vector and Open Loop Vector applications.* ***See Section 4.4 on page 63****.*

4.3.3.3 X-Press Programming™

X-Press Programming™ automatically configures several commonly used parameters and features when Control Method (A01-02), Motion (A01-03), or Speed Reference (A01-04) are programmed. These parameters are also added to the Quick-Set menu for fast parameter modification. ***See Table 4-6 on page 58***, ***Table 4-7 on page 59***, and ***Table 4-8 on page 60*** for X-Press Programming™ defaults.

4.3.3.4 Motion (A01-03)

Set this parameter to match the motion of application. See X-Press Programming (***Table 4-6 on page 58***, ***Table 4-7 on page 59***, or ***Table 4-8 on page 60***) for details.

Table 4-3: Motion Settings

Setting	Notes		Model
0	Traverse		G+/VG+
1	Standard Hoist	G+ Default	G+
2	NLB Hoist	VG+ Default	VG+
4	Braketronic		G+/VG+

4.3.3.5 Speed Reference (A01-04)

This parameter will automatically define the input terminals for the selections listed below. See X-Press Programming (***Table 4-6 on page 58***, ***Table 4-7 on page 59***, or ***Table 4-8 on page 60***) for details.

Table 4-4: Speed Reference Settings

Setting	Description
0	**2-Speed Multi-Step** – Terminal S3 = 2nd speed.
1	**3-Speed Multi-Step** – Terminals S3 and S4 = speeds 2 and 3 respectively (default).
2	**5-Speed Multi-Step** – Terminals S3-S6 = speeds 2–5.
3	**2-Step Infinitely Variable** – Terminals S1 (Forward) and S2 (Reverse) use B01-01 and speed hold. Terminal S3 = Accelerate.
4	**3-Step Infinitely Variable** – Terminals S1 (Forward) and S2 (Reverse) use B01-01. Terminal S3 = Speed Hold. Terminal S4 = Accelerate.
5	**Uni-Polar Analog** – Terminals S1 and S2 = Directional input. Terminal A1 = 0-10V. Terminal A2 = 4-20mA (when using Terminal A2, set H03-02 to 1F and H03-10 to 0).
6	**Bi-Polar Analog** – Terminal S1 = Run Command. Terminal A1 = direction and frequency -10 to +10VDC.
7	**Industrial Coms** Sets all terminals to “Not Used”. Speed and Run commands come from optional communication card.
8	**RS485/RDSI Coms** Sets all terminals to “Not Used.” Speed and Run commands come from serial communications.

WARNING

When changing A01-03 or A01-04, the MFDI, MFDO, and speed reference parameters will be overwritten by X-Press Programming™ (***Table 4-6 on page 58***, ***Table 4-7 on page 59***, or ***Table 4-8 on page 60***). All parameter settings must be verified for proper operation.

Table 4-5: X-Press Programming I/O Quick Reference

A01-04 =	0	1	2	3	4	5	6
Terminal S1	FWD	FWD	FWD	FWD	FWD	FWD	FWD
Terminal S2	REV	REV	REV	REV	REV	REV	REV
Terminal S3	Step 2	Step 2	Step 2	Accel	Hold	-	-
Terminal S4	-	Step 3	Step 3	-	Accel	-	-
Terminal S5	-	-	Step 4	-	-	-	-
Terminal S6	-	-	Step 5	-	-	-	-
Terminal S7	-	-	-	-	-	-	-
Terminal S8	-	-	-	-	-	-	-
Terminal A1	-	-	-	-	-	FREF	FREF
Terminal M0/M1	Brake	Brake	Brake	Brake	Brake	Brake	Brake
Terminal M2/M3	Brake (NLB Hoist only), otherwise not used						
Terminal M5/M6	Fault Annunciate (NLB Hoist only), otherwise not used						

4.3.3.6 Parameters Changed by X-Press Programming

Table 4-6: Traverse (A01-03 = 0)

Parameter	Description	A01-04 =								
		0	1	2	3	4	5	6	7	8
		2-Speed Multi-Step	3-Speed Multi-Step	5-Speed Multi-Step	2-Step Infinitely Variable	3-Step Infinitely Variable	Uni-Polar Analog	Bi-Polar Analog	Industrial Coms	RS485/ RDSI Coms
B01-01	Speed 1	20.00	15.00	6.00	6.00	6.00	0.00	0.00	15.00	0.00
B01-02	Speed 2	60.00	30.00	15.00	0.00	0.00	0.00	0.00	30.00	0.00
B01-03	Speed 3	0.00	60.00	30.00	0.00	0.00	0.00	0.00	60.00	0.00
B01-04	Speed 4	0.00	0.00	45.00	0.00	0.00	0.00	0.00	0.00	0.00
B01-05	Speed 5	0.00	0.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00
B01-06–16	Speed 6–16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B01-17	Jog Ref	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
B01-18	Ref Priority	0	0	0	0	0	1	1	0	1
B02-03	Ref. Lower Limit	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
B03-01	Freq. Ref. Select	1	1	1	1	1	1	1	3	2
B03-02	Run Cmd Select	1	1	1	1	1	1	1	3	2
B03-03	Stopping Method	0	0	0	0	0	0	0	0	0
B05-01	Accel Time 1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
B05-02	Decel Time 1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
C01-01	Quick Stop	0	0	0	0	0	0	0	0	0
C03-07	Action @ LL2/UL2	2	2	2	2	2	2	2	2	2
C08-10	Load Float Time	0	0	0	0	0	0	0	0	0
C13-12	Index Brake Ctrl	0	0	0	0	0	0	0	0	0
D09-01	S-Curve Accel at Start	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
D09-02	S-Curve Accel at End	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
D09-03	S-Curve Decel at Start	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
E01-03	V/f Selection	0	0	0	0	0	0	0	0	0
H01-01	Terminal S1	80	80	80	80	80	80	80	80	F
H01-02	Terminal S2	81	81	81	81	81	81	81	81	F
H01-03	Terminal S3	0	0	0	5	4	F	F	F	F
H01-04	Terminal S4	F	1	1	F	5	F	F	F	F
H01-05	Terminal S5	F	F	2	F	F	F	F	F	F
H01-06	Terminal S6	F	F	3	F	F	F	F	F	F
H01-07	Terminal S7	F	F	F	F	F	F	F	F	F
H01-08	Terminal S8	F	F	F	F	F	F	F	F	F
H02-01	Terminal M0/M1	0	0	0	0	0	0	0	0	0
H02-02	Terminal M2/M3	F	F	F	F	F	F	F	F	F
H02-03	Terminal M5/M6	F	F	F	F	F	F	F	F	F
H03-01	Terminal A1 Signal Level	0	0	0	0	0	0	1	0	0
H03-02	Terminal A1	0	0	0	0	0	0	0	0	0
H03-06	Terminal A3	1F	1F	1F	1F	1F	1F	1F	1F	1F
H03-10	Terminal A2	1F	1F	1F	1F	1F	1F	1F	1F	1F

Table 4-7: Standard Hoist (A01-03 = 1)

Parameter	Description	A01-04 =								
		0	1	2	3	4	5	6	7	8
		2-Speed Multi-Step	3-Speed Multi-Step	5-Speed Multi-Step	2-Step Infinitely Variable	3-Step Infinitely Variable	Uni-Polar Analog	Bi-Polar Analog	Industrial Coms	RS485/ RDSI Coms
B01-01	Speed 1	20.00	15.00	6.00	6.00	6.00	0.00	0.00	15.00	0.00
B01-02	Speed 2	60.00	30.00	15.00	0.00	0.00	0.00	0.00	30.00	0.00
B01-03	Speed 3	0.00	60.00	30.00	0.00	0.00	0.00	0.00	60.00	0.00
B01-04	Speed 4	0.00	0.00	45.00	0.00	0.00	0.00	0.00	0.00	0.00
B01-05	Speed 5	0.00	0.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00
B01-06–16	Speed 6–16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B01-17	Jog Ref	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
B01-18	Ref Priority	0	0	0	0	0	1	1	0	1
B02-03	Ref. Lower Limit	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
B03-01	Freq. Ref. Select	1	1	1	1	1	1	1	3	2
B03-02	Run Cmd Select	1	1	1	1	1	1	1	3	2
B03-03	Stopping Method	1	1	1	1	1	1	1	1	1
B05-01	Accel Time 1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
B05-02	Decel Time 1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
C01-01	Quick Stop	0	0	0	0	0	0	0	0	0
C03-07	Action @ LL2/UL2	1	1	1	1	1	1	1	1	1
C08-10	Load Float Time	0	0	0	0	0	0	0	0	0
C13-12	Index Brake Ctrl	0	0	0	0	0	0	0	0	0
D09-01	S-Curve Accel at Start	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
D09-02	S-Curve Accel at End	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
D09-03	S-Curve Decel at Start	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
E01-03	V/f Selection	4	4	4	4	4	4	4	4	4
H01-01	Terminal S1	80	80	80	80	80	80	80	80	F
H01-02	Terminal S2	81	81	81	81	81	81	81	81	F
H01-03	Terminal S3	0	0	0	5	4	F	F	F	F
H01-04	Terminal S4	F	1	1	F	5	F	F	F	F
H01-05	Terminal S5	F	F	2	F	F	F	F	F	F
H01-06	Terminal S6	F	F	3	F	F	F	F	F	F
H01-07	Terminal S7	F	F	F	F	F	F	F	F	F
H01-08	Terminal S8	F	F	F	F	F	F	F	F	F
H02-01	Terminal M0/M1	0	0	0	0	0	0	0	0	0
H02-02	Terminal M2/M3	F	F	F	F	F	F	F	F	F
H02-03	Terminal M5/M6	F	F	F	F	F	F	F	F	F
H03-01	Terminal A1 Signal Level	0	0	0	0	0	0	1	0	0
H03-02	Terminal A1	0	0	0	0	0	0	0	0	0
H03-06	Terminal A3	1F	1F	1F	1F	1F	1F	1F	1F	1F
H03-10	Terminal A2	1F	1F	1F	1F	1F	1F	1F	1F	1F

Table 4-8: NLB Hoist (A01-03 = 2)

Parameter	Description	A01-04 =								
		0	1	2	3	4	5	6	7	8
		2-Speed Multi-Step	3-Speed Multi-Step	5-Speed Multi-Step	2-Step Infinitely Variable	3-Step Infinitely Variable	Uni-Polar Analog	Bi-Polar Analog	Industrial Coms	RS485/ RDSI Coms
B01-01	Speed 1	20.00	15.00	6.00	6.00	6.00	0.00	0.00	15.00	0.00
B01-02	Speed 2	60.00	30.00	15.00	0.00	0.00	0.00	0.00	30.00	0.00
B01-03	Speed 3	0.00	60.00	30.00	0.00	0.00	0.00	0.00	60.00	0.00
B01-04	Speed 4	0.00	0.00	45.00	0.00	0.00	0.00	0.00	0.00	0.00
B01-05	Speed 5	0.00	0.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00
B01-06–16	Speed 6–16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B01-17	Jog Ref	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
B01-18	Ref Priority	0	0	0	0	0	1	1	0	1
B02-03	Ref. Lower Limit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B03-01	Freq. Ref. Select	1	1	1	1	1	1	1	3	2
B03-02	Run Cmd Select	1	1	1	1	1	1	1	3	2
B03-03	Stopping Method	6	6	6	6	6	6	6	6	6
B05-01	Accel Time 1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
B05-02	Decel Time 1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
C01-01	Quick Stop	1	1	1	1	1	1	1	1	1
C03-07	Action @ LL2/UL2	2	2	2	2	2	2	2	2	2
C08-10	Load Float Time	10	10	10	10	10	10	10	10	10
C13-12	Index Brake Ctrl	2	2	2	2	2	2	2	2	2
D09-01	S-Curve Accel at Start	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
D09-02	S-Curve Accel at End	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
D09-03	S-Curve Decel at Start	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
E01-03	V/f Selection	F	F	F	F	F	F	F	F	F
H01-01	Terminal S1	80	80	80	80	80	80	80	80	F
H01-02	Terminal S2	81	81	81	81	81	81	81	81	F
H01-03	Terminal S3	0	0	0	5	4	F	F	F	F
H01-04	Terminal S4	F	1	1	F	5	F	F	F	F
H01-05	Terminal S5	F	F	2	F	F	F	F	F	F
H01-06	Terminal S6	F	F	3	F	F	F	F	F	F
H01-07	Terminal S7	F	F	F	F	F	F	F	F	F
H01-08	Terminal S8	F	F	F	F	F	F	F	F	F
H02-01	Terminal M0/M1	0	0	0	0	0	0	0	0	0
H02-02	Terminal M2/M3	0	0	0	0	0	0	0	0	0
H02-03	Terminal M5/M6	78	78	78	78	78	78	78	78	78
H03-01	Terminal A1 Signal Level	0	0	0	0	0	0	1	0	0
H03-02	Terminal A1	0	0	0	0	0	0	0	0	0
H03-06	Terminal A3	1F	1F	1F	1F	1F	1F	1F	1F	1F
H03-10	Terminal A2	1F	1F	1F	1F	1F	1F	1F	1F	1F

4.3.3.7 Initialize Parameters (A01-05)

Use this parameter to reset the VFD to its factory default settings or transfer parameters.

Table 4-9: Initialize Settings

Setting	Description
0	**No Initialization** (factory default)
1110	**User Default** (defaults) Resets parameters to the values saved by the user as User Settings. User Settings are stored when parameter O02-03 is set to “1: Set defaults”. ***NOTE:*** *User Initialization resets all parameters to a user-defined set of default values previously saved to the VFD. Set parameter O02-03 to 2 to clear the user-defined default values.*
5432	**Cntrl Int→Term** Moves the parameters stored in the control board and copies them to the interface board (S4IF).
5550	**Control Init (OPE04 Reset)** An oPE04 error appears on the keypad when a interface card with settings saved to its built-in memory is installed in a VFD that has edited parameters. Set A01-05 to 5550 to use the parameter settings saved to the interface board (S4IF) memory.
7770	**Swap Setup** Prepares all modified and user parameters for terminal board (S4IF) replacement. This will also clear a parameter set stored in the keypad.
8880	**Swap Exe** Finalizes interface board (S4IF) swap process once A01-05 = 7770 has been executed and the new interface board (S4IF) has been installed.

4.3.3.8 Password Entry (A01-06)

This parameter enables the user to set a password that inhibits the programming of the parameters. This function is used in conjunction with the access level parameter A01-01. To set the password, enter a password number in parameter A01-07 and press the ENTER key. If A01-06 is not the same as A01-07, A01-01 cannot be changed once A01-01 is set to 0 or 1. When A01-06 is the same as A01-07, A01-01 can be changed.

To create a password, when A01-06 is displayed, press the ∧ and STOP key simultaneously to reveal A01-07.

4.3.3.9 User Parameters (A02-01 through 32)

The user can select up to 32 parameters for quick-access programming. By setting the user access level (*A01-01*) to “User Program”, only the parameters selected in the A02 parameters can be accessed by the user. To assign a parameter as a user parameter, go to the A02 level in the initialize menu. Once the A02 parameters are set and *A01-01* is programmed to “User Program”, only the parameters visible in the program menu will be assigned to an A02 parameter.

The A02 group is pre-loaded with the settings listed in ***Table 4-10***, based on A01-03.

Table 4-10: Application Quick Set

A01-03	0	1	2
Parameter	**Traverse**	**Std Hoist**	**NLB Hoist**
-	B01-01: Speed 1	B01-01: Speed 1	B01-01: Speed 1
A02-01	B01-02: Speed 2	B01-02: Speed 2	B01-02: Speed 2
A02-02	B01-03: Speed 3	B01-03: Speed 3	B01-03: Speed 3
A02-03	B01-04: Speed 4	B01-04: Speed 4	B01-04: Speed 4
A02-04	B01-05: Speed 5	B01-05: Speed 5	B01-05: Speed 5
A02-05	B03-04: Change Rotation	B03-04: Change Rotation	B03-04: Change Rotation
A02-06	B05-01: Accel Time 1	B05-01: Accel Time 1	B05-01: Accel Time 1
A02-07	B05-02: Decel Time 1	B05-02: Decel Time 1	B05-02: Decel Time 1
A02-08	C01-03: Reverse Plug	C02-01: MicroSpd Gain 1	C01-01: Quick Stop
A02-09	C01-04: Rev-Plg Dec Time	C03-01: UL1 Speed	C01-02: Quick Stop Time
A02-10	C01-05: Rev-Plg Acc Time	C03-04: LL1 Speed	C02-01: MicroSpd Gain 1
A02-11	C02-01: MicroSpd Gain 1	C06-01: Swift-Lift	C03-01: UL1 Speed
A02-12	E01-03: V/f Selection	C06-02: SwiftLift FWDSpd	C03-04: LL1 Speed
A02-13	E02-01: Motor Rated FLA	C06-03: SwiftLift REVSpd	C06-01: Ultra-Lift
A02-14	H01-06: Terminal S6	C06-04: SL FWD Current/Torque	C06-02: UltraLift FWDSpd
A02-15	H01-07: Terminal S7	C06-05: SL REV Current/Torque	C06-03: UltraLift REVSpd
A02-16	H01-08: Terminal S8	C06-06: SL Enabling Spd	C06-04: UL FWD Torque
A02-17	H02-03: Terminal M5/M6	E01-03: V/F Selection	C06-05: UL REV Torque
A02-18	H03-02: Terminal A1	E01-04: Max Frequency	C08-03: Min Brk Rel Trq
A02-19	H04-02: Terminal FM Gain	E02-01: Motor Rated FLA	C08-10: Load Float Time
A02-20	-	H01-06: Terminal S6	C08-11: Brake Set Delay
A02-21	-	H01-07: Terminal S7	C08-14: Brake Hold Speed
A02-22	-	H01-08: Terminal S8	F01-01: PG1 Pulses/Rev
A02-23	-	H02-03: Terminal M5/M6	F01-05: PG1 #Gear Teeth2
A02-24	-	H03-02: Terminal A1	H01-06: Terminal S6
A02-25	-	H04-02: Terminal FM Gain	H01-07: Terminal S7
A02-26	-	-	H01-08: Terminal S8
A02-27	-	-	H02-03: Terminal M5/M6
A02-28	-	-	H03-02: Terminal A1
A02-29	-	-	H04-02: Terminal FM Gain
A02-30	-	-	-
A02-31	-	-	-
A02-32	-	-	-

4.4 Auto-Tuning

CAUTION

The brake output is not energized during Auto-Tune. The brake must be manually released before a rotational Auto-Tune and reengaged when Auto-Tuning is complete. Ensure no load is on the hook, and that the hook is near the floor.

The IMPULSE•G+/VG+ Series 4 can perform a calibration process with its automatic tuning function. The VFD prompts for motor information, and then runs a quick tuning process. Ideally, perform a standard Auto-Tune with the motor uncoupled from the load. When the motor cannot be decoupled, perform a static or non-rotating Auto-Tune.

NOTE: *Contact Magnetek's service department if an auto-tune cannot be performed.*

Table 4-11: Auto-Tuning Parameter Settings

Parameter	Display	Description	Default
T01-01	Tuning Mode Sel	Tuning Method	0
	0 Standard Tuning	*Rotational Auto-Tuning*	
	1 Tune-No Rotate1	*Non-Rotational Auto-Tuning 1*	
	2 Term Resistance	*Stationary Auto-Tuning for Line-to-Line Resistance*	
	4 Tune-No Rotate2	*Non-Rotational Auto-Tuning 2*	
T01-02	Rated Power	Motor rated power as specified on the motor nameplate (note: HP = kW/0.746)	Model dependent
T01-03	Rated Voltage	Motor rated voltage as specified on the motor nameplate	Model dependent
T01-04	Rated Current	Motor rated full-load current (FLA) as specified on the motor nameplate	Model dependent
T01-05	Rated Frequency	Rated frequency of the motor as specified on the motor nameplate	60.0 Hz
T01-06	Number of Poles	Number of motor poles as specified on the motor nameplate	4
T01-07	Rated Speed	Rated motor speed, as shown on the motor nameplate. This is the rotor speed, not the synchronous speed.	1750 RPM
T01-08	PG Pulses/Rev	Number of pulses per revolution for the encoder (VG+ only)	1024 PPR
T01-09*	No-Load Current	No-load current for the motor. Enter the no-load current as indicated on the motor test report or motor nameplate (G+ only).	-
T01-10*	Motor Rated Slip	Motor rated slip. Enter the motor slip as indicated on the motor test report or motor nameplate (G+ only).	-

** If the value is not known, leave at default.*

4.4.1 Standard Auto-Tune (T01-01 = 0)

This is a rotational Auto-Tuning method for Open Loop Vector and Flux Vector only, which allows for Auto-Tuning a motor that is unloaded and ideally decoupled from the gearbox. The brake must also be disengaged.

The instructions below will provide a step-by-step procedure to complete this Auto-Tune function:

1. In preparation for the Auto-Tune, the crane should be with minimal attachments. This Auto-Tuning method requires free rotation of the motor, so decoupling the motor from the load or gearbox is ideal.
2. Ensure the brake is disengaged.
3. Using the keypad, browse to the “Auto-Tuning” menu.
4. Choose “Standard Tuning” (T01-01 = 0) for the Tuning Mode.
5. Enter the nameplate motor characteristics (T01-02 – T01-08) until the “Tuning Ready?” screen is reached.
6. Press the green “RUN” key to start the Auto-Tune. It will take up to a few minutes to complete. During this time, the current will ramp up and down and a high pitched frequency may be audible coming from the motor; this is normal. The motor will then begin a rotational cycle, which will complete in one minute or less.
7. When the Auto-Tune has completed, the keypad display will display an “End Tune Successful” message. Press the “ESC” key twice to exit.

NOTE: *If the STOP key is depressed during tuning, auto-tuning is interrupted and the motor coasts to a stop. The data changed during tuning returns to its original values.*

4.4.2 Non-Rotational 1 Auto-Tune (T01-01 = 1)

This is a non-rotational Auto-Tuning method for Open Loop Vector and Flux Vector only, which allows for Auto-Tuning without decoupling the motor.

This method will require a short movement of the crane subsequent to the non-rotational Auto-Tune process which allows the VFD to calibrate the Motor Rated Slip and No-Load Current.

The instructions below will provide a step-by-step procedure to complete this Auto-Tune function:

1. In preparation for the Auto-Tune, the crane should be unloaded with minimal hook attachments. For Traverse motion, ensure freedom of travel for Step #6.
2. Using the keypad, browse to the “Auto-Tuning” menu.
3. Choose “Tune-No Rotate1” (T01-01 = 1) for the Tuning Mode.
4. Enter the nameplate motor characteristics (T01-02 – T01-09) until the “Tuning Ready?” screen is reached.
5. Press the green “RUN” key to start the Auto-Tune. It will take up to a few minutes to complete. During this time, the current will ramp up and down and a high pitched frequency may be audible coming from the motor; this is normal. When the Auto-Tune has completed, the keypad display will display an “End Tune Successful” message. Press the “ESC” key twice to exit.
6. Run the motor to at least 30% of the Rated Frequency (T01-05). For example, if the Rated Frequency is 60 Hz, the motor must run to at least 18 Hz. In a hoisting motion, the motor must be run in the Up/Raising direction.
7. When the short run and adjustments have been completed, the motor will stop, and the keypad will display “TMDN Tune Complete”. The Auto-Tune is now complete and the VFD is ready for normal operation.

4.4.3 Terminal Resistance Auto-Tune (T01-01 = 2)

This is a non-rotational Auto-Tuning method, which allows for Auto-Tuning without decoupling the motor.

This method is recommended for motors configured with the V/f control method when the motor horsepower and motor rated current are known.

The instructions below will provide a step-by-step procedure to complete this Auto-Tune function:

1. In preparation for the Auto-Tune, the crane should be unloaded with minimal hook attachments.
2. Using the keypad, browse to the “Auto-Tuning” menu.
3. Choose “Term Resistance” (T01-01 = 2) for the Tuning Mode.
4. Enter the nameplate motor characteristics for Motor Horsepower and Motor Rated Current (T01-02 and T01-04) until the “Tuning Ready?” screen is reached.
5. Press the green “RUN” key to start the Auto-Tune. It will take up to a few minutes to complete. During this time, the current will ramp up and down and a high pitched frequency may be audible coming from the motor; this is normal. When the Auto-Tune has completed, the keypad display will display an “End Tune Successful” message. Press the “ESC” key twice to exit.

4.4.4 Non-Rotational 2 Auto-Tune (T01-01 = 4)

This is a non-rotational Auto-Tuning method for Open Loop Vector and Flux Vector only, which allows for Auto-Tuning without decoupling the motor.

This method is recommended when the motor cannot be decoupled, and the Motor Rated Slip is known. If the Motor Rated Slip is not known, then the Non-Rotational 1 (T01-01 = 1) is recommended.

The instructions below will provide a step-by-step procedure to complete this Auto-Tune function:

1. In preparation for the Auto-Tune, the crane should be unloaded with minimal hook attachments.
2. Using the keypad, browse to the “Auto-Tuning” menu.
3. Choose “Tune-No Rotate2” (T01-01 = 4) for the Tuning Mode.
4. Enter the nameplate motor characteristics (T01-02 ~ T01-10) until the “Tuning Ready?” screen is reached.
5. Press the green “RUN” key to start the Auto-Tune. It will take up to a few minutes to complete. During this time, the current will ramp up and down and a high pitched frequency may be audible coming from the motor; this is normal. When the Auto-Tune has completed, the keypad display will display an “End Tune Successful” message. Press the “ESC” key twice to exit.

5 Programming Advanced Features

5.1 Speed Parameters

The speed parameters control the speed frequencies, acceleration and deceleration characteristics, and reference sources. Speed parameters included in this section are listed below:

- B01 Speed References
- B02 Reference Limits
- B03 Run/Reference Source
- B05 Acceleration/Deceleration
- B08 Jump Frequencies
- B09 Field Forcing

5.1.1 Speed References

Table 5-1: Speed Reference Parameter Settings

Parameter	Display	Function	Range	Default
B01-01	Reference 1	Speed 1 frequency	0.00–E01-04 Hz	15.00*
B01-02	Reference 2	Speed 2 frequency	0.00–E01-04 Hz	30.00*
B01-03	Reference 3	Speed 3 frequency	0.00–E01-04 Hz	60.00*
B01-04	Reference 4	Speed 4 frequency	0.00–E01-04 Hz	0.00*
B01-05	Reference 5	Speed 5 frequency	0.00–E01-04 Hz	0.00*
B01-06	Reference 6	Speed 6 frequency	0.00–E01-04 Hz	0.00*
B01-07	Reference 7	Speed 7 frequency	0.00–E01-04 Hz	0.00*
B01-08	Reference 8	Speed 8 frequency	0.00–E01-04 Hz	0.00*
B01-09	Reference 9	Speed 9 frequency	0.00–E01-04 Hz	0.00*
B01-10	Reference 10	Speed 10 frequency	0.00–E01-04 Hz	0.00*
B01-11	Reference 11	Speed 11 frequency	0.00–E01-04 Hz	0.00*
B01-12	Reference 12	Speed 12 frequency	0.00–E01-04 Hz	0.00*
B01-13	Reference 13	Speed 13 frequency	0.00–E01-04 Hz	0.00*
B01-14	Reference 14	Speed 14 frequency	0.00–E01-04 Hz	0.00*
B01-15	Reference 15	Speed 15 frequency	0.00–E01-04 Hz	0.00*
B01-16	Reference 16	Speed 16 frequency	0.00–E01-04 Hz	0.00*
B01-17	Jog Reference	Jog Control and Inching Control frequency	0.00–E01-04 Hz	6.00*
B01-18	Ref Priority *0 Digital Ref Only* *1 Analog Ref Only* *2 Higher RefSelect*	Determines whether the digital or analog frequency reference is used. ***NOTE:*** *When using Higher Reference Select, Infinitely Variable should NOT be used (A01-04 = 3). The two functions are not intended to work in conjunction.*	0–2	0*

* *Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

Table 5-2: Multi-Step Speed Processing by Multi-Function Digital Input (B01-01–B01-16)

Speed Reference	Forward/ Reverse Terminal S1 or S2	Multi-Step Speed 2 H01-01–08 = 0	Multi-Step Speed 3 H01-01–08 = 1	Multi-Step Speed 4 H01-01–08 = 2	Multi-Step Speed 5 H01-01–08 = 3	Fwd/Rev Jog Fwd/Rev Inch H01-01–08 = 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 limit the frequency range as a percentage of maximum output frequency (E01-04). If the lower limit is below the DC Inj Start Freq (D01-01), then operation will continue according to B03-05.

An alternate upper limit frequency can be used during operation when a Multi-Function Digital Input (MFDI) is set to 59 (Alt F-Ref Up Lmt) and the MFDI is on.

Table 5-3: Reference Limits Parameter Settings

Parameter	Display	Function	Range	Default
B02-01	Ref Upper Limit	Percentage of the maximum output frequency (E01-04), which determines the maximum frequency at which the VFD is able to run.	0.0–110.0%	100.0*
B02-02	Ref Lower Limit	Frequency reference lower limit as a percentage of maximum output frequency (E01-04).	0.0–110.0%	0.0
B02-03	Ref1 Lower Limit	Frequency reference lower limit, from analog inputs, as a percentage of maximum output frequency (E01-04).	0.0–110.0%	2.0*
B02-04	Alt Upper Limit	Alternate of B02-01 set by MFDI=59.	0.0–110.0%	0.0

** Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

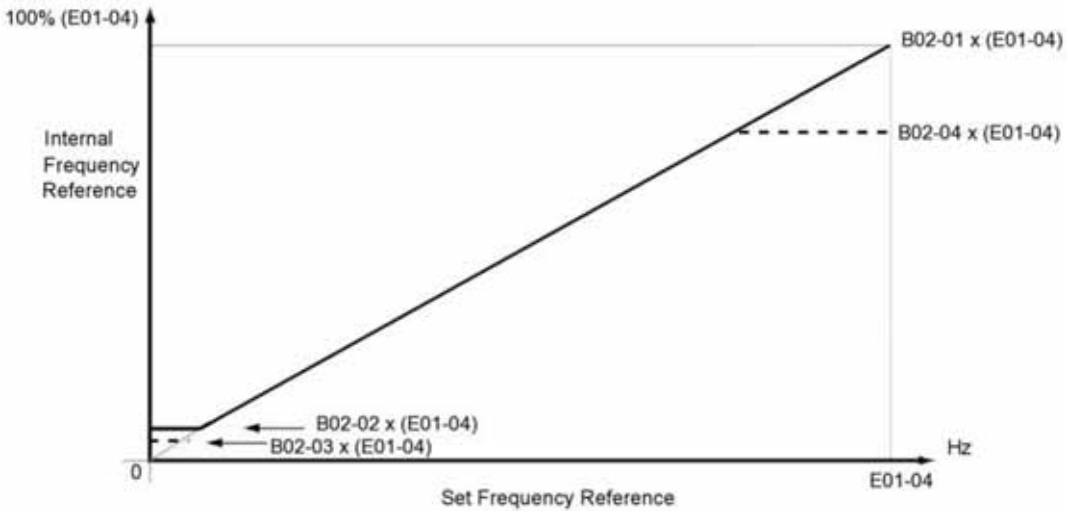


Figure 5-1: Frequency Upper and Lower Limits

5.1.3 Run/Reference Source

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

Table 5-4: Run/Reference Source Parameter Settings

Parameter	Display	Function	Range	Default
B03-01	Ref Source 1	Source from where the frequency reference is generated.	0-4	1*
	0 Operator	Keypad		
	1 Terminals	Terminals or Analog Input • S4IF Interface Board • S4I Digital Input Option Card • S4IO Digital Input/Output Option Card • DI-A3 Digital Input Option Card		
	2 Serial Com	Serial communication • RS485/422 Serial Communications (R+, R-, S+, S-)		
	3 Option PCB	Communication Option card (Port CN5-A) • EtherNet/IP • Modbus TCP/IP • PROFINET • PROFIBUS-DP		
	4 Pulse Input	Pulse input via Terminal RP (H06-01)		
B03-02	Run Source 1	Source from where the RUN command is generated.	0-3	1*
	0 Operator	Keypad		
	1 Terminals	Terminals • S4IF Interface Board		
	2 Serial Com	Serial communication • RS485/422 Serial Communications (R+, R-, S+, S-)		
	3 Option PCB	Communication Option card (Port CN5-A) • EtherNet/IP • Modbus TCP/IP • PROFINET • PROFIBUS-DP		

** Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

5.1.4 Stop Method

Selects the stopping method suitable for the application.

Table 5-5: Stop Method Parameter Settings

Parameter	Display	Function	Range	Default
B03-03	Stopping Method	Determines stop method.	0, 1, 4, 6	G+: 0* VG+: 6*
	0 Decel to Stop	(***Figure 5-2***)		
	1 Coast to Stop	(***Figure 5-3***)		
	4 Decel with timer (Traverse only)	(***Figure 5-4***)		
	6 No Load Brake	See No-Load Brake Parameter Group C08 (VG+ only).		

** Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

5.1.4.1 Decel to Stop (B03-03 = 0)

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 too large, an overvoltage fault (OV) or deviation (DEV) may occur during deceleration. In this case, increase the deceleration time or verify the braking resistor is sized correctly.

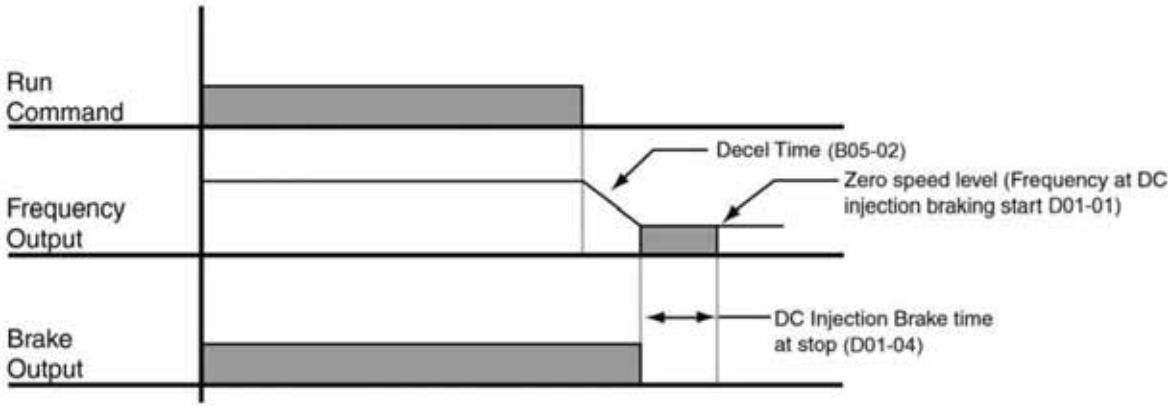


Figure 5-2: Decel to Stop

5.1.4.2 Coast to Stop (B03-03 = 1)

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

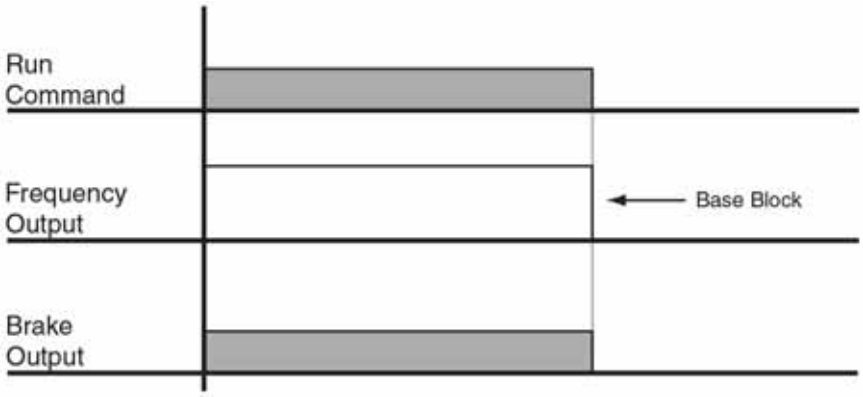


Figure 5-3: Coast to Stop

5.1.4.3 Decel w/Timer (B03-03 = 4)

NOTE: *This option is only available in traverse motion.*

Upon run command removal, the motor decelerates to stop. The brake delays for a time interval (C12-02) before it is set. This option reduces brake wear for applications that involve frequent stopping and starting.

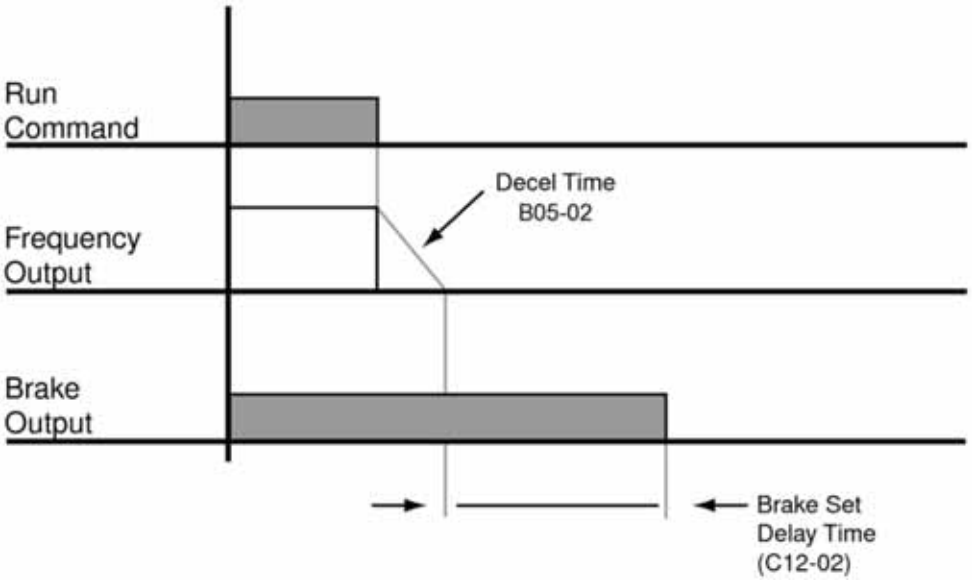


Figure 5-4: Decel w/Timer

5.1.5 Motor Rotation Change

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

Table 5-6: Motor Rotation Parameter Settings

Parameter	Display	Function	Range	Default
B03-04	Change Rotation	Reverse motor direction	0, 1	0
	0 Standard			
	1 SwitchPhaseOrder	Switch phase order (reverses the motor direction)		

NOTE: *To reverse the direction of rotation, program B03-04 = 1, or interchange any two motor leads (changing R/L1, S/L2, or T/L3 will not affect the shaft rotation direction) as well as encoder phasing (F01-02 = 1 or swap A+ and A- wires).*

5.1.6 Zero-Speed Operation

This parameter sets the VFD behavior when the frequency reference is below the Zero Speed level (VG+ only).

Table 5-7: Zero-Speed Operation Parameter Settings

Parameter	Display	Function	Range	Default
B03-05	Zero-Speed Oper	Operation Selection at Zero Speed	0–3	0
	0 RUN at Freq Ref	Operate according to the Frequency Reference		
	1 STOP	Coast when the Frequency Reference is below E01-09		
	2 RUN at Min Freq	Output the Frequency set in E01-09		
	3 RUN at Zero RPM	Operate at zero speed		

5.1.7 Input Scan Time

Selects the microprocessor scan time for reading the status of the input control terminals. Set B03-06 = 0 when a quicker response is needed from the control circuit terminal.

Table 5-8: Input Scan Time Parameter Settings

Parameter	Display	Function	Range	Default
B03-06	Cntl Input Scans	Selects the terminal scan time	0, 1	1
	0 1 Scan	1 ms		
	1 2 Scans	2 ms (better for noise immunity)		

5.1.8 Run Select

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

Table 5-9: Run Select Parameter Settings

Parameter	Display	Function	Range	Default
B03-07	LO/RE RUN Sel	Determines action after switching Run/Speed reference source.	0, 1	0
	0 Cycle Extrn RUN	The run command must be cycled in order for the new source to be activated.		
	1 Accept Extrn RUN	A new run command is not required for the new source to be activated. Operation will continue.		
B03-08	RUN CMD at PRG	Determines whether the VFD is allowed to run while inside the Programming menu.	0–2	0
	0 Run Disabled@PRG	Run command not accepted while in Programming menu.		
	1 Run Enabled@PRG	Run command is accepted while in Programming menu.		
	2 PRG Only @ Stop	Prohibit entering Programming menu while running.		
B03-10	AllowRun@PowerUp	Determines how the VFD reacts if a run command is active when the VFD powers up.	0, 1	0
	0 Cycle Ext Run	A new Run command must be issued after power up.		
	1 Accept Ext Run	Motor will start immediately after power up if a Run command is already enabled.		
B03-15	Ref Source 2	Determines what the VFD will use for Frequency Reference. Enabled by H01-0x = 1F.	0–4	0
	0 Operator	Keypad		
	1 Terminals	Terminals or Analog Input • S4IF Interface Board • S4I Digital Input Option Card • S4IO Digital Input/Output Option Card • DI-A3 Digital Input Option Card		
	2 Serial Com	Serial communication • RS485/422 Serial Communications (R+, R-, S+, S-)		
	3 Option PCB	Communication Option card (Port CN5-A) • EtherNet/IP • Modbus TCP/IP • PROFINET • PROFIBUS-DP		
	4 Pulse Input	Pulse input via Terminal RP (H06-01)		

Parameter	Display	Function	Range	Default
B03-16	Run Source 2	Determines what the VFD will use for Run Reference. Enabled by H01-0x = 1F.	0–3	0
	0 Operator	Keypad		
	1 Terminals	Terminals • S4IF Interface Board		
	2 Serial Com	Serial communication • RS485/422 Serial Communications (R+, R-, S+, S-)		
	3 Option PCB	Communication Option card (Port CN5-A) • EtherNet/IP • Modbus TCP/IP • PROFINET • PROFIBUS-DP		
B03-21	PG Start Sel	Allows the VFD to start when the Frequency Reference is between D01-01 and E01-09.	0, 1	0
	0 RejectRunCmd			
	1 AcceptRunCmd			

5.1.9 Acceleration/Deceleration

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

Table 5-10: Acceleration/Deceleration Parameter Settings

Parameter	Display	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	Acceleration time 2 enabled when H01-xx = 1A.	0.0–25.5 sec**	10.0
B05-04	Decel Time 2	Deceleration time 2 enabled when H01-xx = 1A.	0.0–25.5 sec**	10.0

** Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

*** Range is extended to 0.0–6000.00 when B05-16 = 1.*

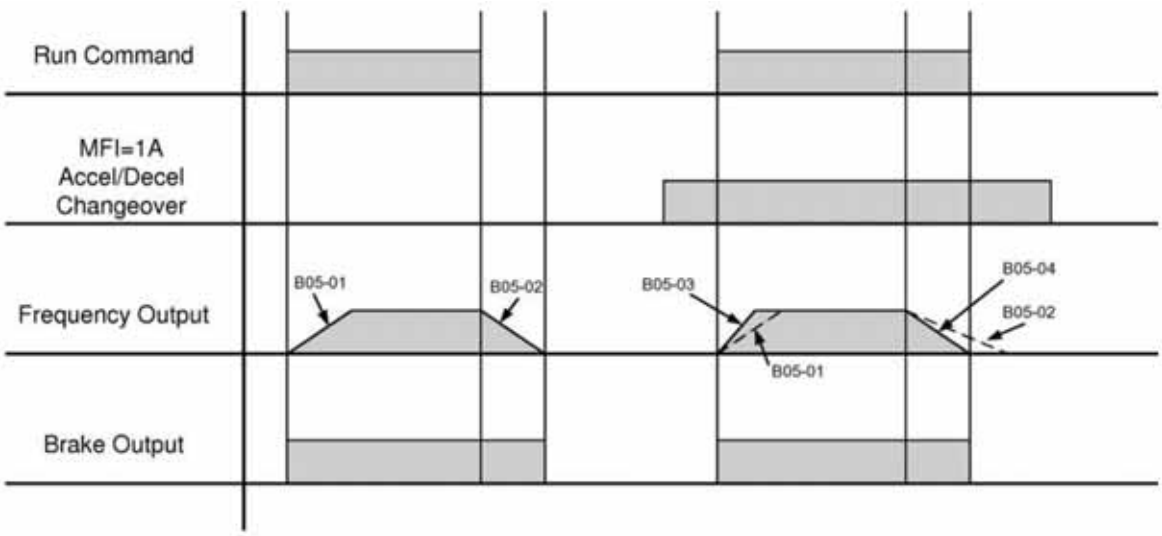


Figure 5-5: Normal Accel/Decel Time and Multiple Accel/Decel Changeover

NOTE: *Assume B03-03 is set to "0" (Decel to Stop).*

5.1.10 Accel/Decel Time Switching Frequency

Accel/Decel times can be changed automatically without using digital inputs. Alternatively, digital inputs can be used to enable additional accel and decel times. This has priority over automatic change of Accel/Decel.

Table 5-11: Accel/Decel Time Switching Frequency Parameter Settings

Parameter	Display	Function	Range	Default
B05-05	Acc Time N Chg	Acceleration time at Acc/Dec Switch Frequency (B05-10)	0.0–25.5 sec	2.0
B05-06	Dec Time N Chg	Deceleration time at Acc/Dec Switch Frequency (B05-10)	0.0–25.5 sec	2.0
B05-08	Fast Stop Time	Deceleration time for Fast Stop at external fault. ***See Section 5.6.1.1 on page 144.***	0.0–25.5 sec	0.5
B05-10	Acc/Dec SW Freq	Frequency to switch between acceleration/ deceleration time settings	0.0–E01-04	0.0
B05-11	SW Freq. Compare	Determines when Acceleration Time and Deceleration Time at Speed Switch Hz is enabled:	0, 1	1
	0 Lower SW Freq	0: B05-05/B05-06 enabled, U01-02 < B05-10		
	1 Upper SW Freq	1: B05-05/B05-06 enabled, U01-02 > B05-10		
B05-12	Accel Time 3	Acceleration time 3 enabled when H01-xx = 1B.	0.0–25.5 sec*	3.0
B05-13	Decel Time 3	Deceleration time 3 enabled when H01-xx = 1B.	0.0–25.5 sec*	3.0
B05-14	Accel Time 4	Acceleration time 4 enabled when H01-xx = 1C.	0.0–25.5 sec*	3.0
B05-15	Decel Time 4	Deceleration time 4 enabled when H01-xx = 1C.	0.0–25.5 sec*	3.0
B05-16	Acc/Dec Ext Rang	Enables extended range of Acc/Dec Params: B05-01–B05-04, B05-12–B05-15, C03-02, C03-03, C03-05 and C03-06	0, 1	0
	0 Disabled	Range = 0.0–25.5		
	1 Enabled	Range = 0.0–6000.0		

** Range is extended to 0.0–6000.00 when B05-16 = 1.*

5.1.11 Jump Frequencies

Allows the “jumping” of critical frequencies so that the motor can operate without resonant vibrations caused by some machine systems. This is also used for deadband control. A setting of 0.0 Hz disables this function.

Table 5-12: Jump Frequencies Parameter Settings

Parameter	Display	Function	Range	Default
B08-01	Jump Freq 1	First of three jump frequencies	0.0–150.0 Hz	0.0
B08-02	Jump Freq 2	Second of three jump frequencies	0.0–150.0 Hz	0.0
B08-03	Jump Freq 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

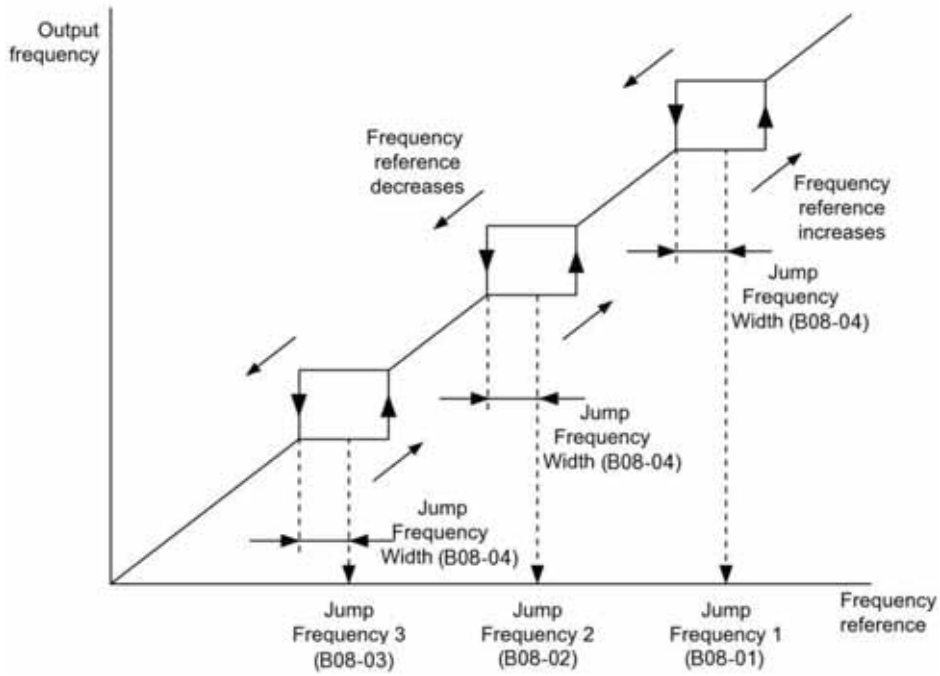


Figure 5-6: Jump Frequencies

5.1.12 Field Forcing

This function compensates the delaying influence of the motor time constant when changing the excitation current reference and improves motor responsiveness. Field Forcing has no effect during DC Injection Braking.

Table 5-13: Field Forcing Parameter Settings

Parameter	Display	Function	Range	Default
B09-03	Field Forcing Selection *0 Disabled* *1 Enabled*	Enables or disables the Field Forcing Function	0, 1	0
B09-06	Field Forcing Limit	Maximum level at which the Field Forcing function can boost the excitation current reference. The value is set as a percentage of the motor no load current. This does not normally need to be changed.	100–400%	200

5.2 Special Functions

Table 5-14: Special Function Usage

Access Level (A01-01)	Advanced (2)					
Motion (A01-02)	Traverse (0)			Standard Hoist (1)		NLB Hoist (2)
Function/Control Method (A01-03)	V/f (0)	OLV (2)	FLV (3)	V/f (0)	OLV (2)	FLV (3)
C01: Quick Stop™	○	○	○	○	○	○
C01: Reverse Plug Simulation™	○	○	○	×	×	○
C02: Micro-Speed™	○	○	○	○	○	○
C03: End of Travel Limits	○	○	○	○	○	○
C03: Phantom Stop	○	○	○	○	○	○
C03: Load Share (Torque Following)	×	×	○	×	×	○
C03: Klixon	○	○	○	○	○	○
C03: Hook Height Measurement	×	×	○	×	×	○
C03: EPLS	×	×	○	×	×	○
C04: Load Float	×	×	○	×	×	○
C05: Load Check II™	×	×	×	○	○	○
C06: Swift-Lift™/Ultra-Lift™	×	×	×	○	○	○
C07: Torque Limit	×	○	○	×	○	○
C07: Anti-Shock	×	×	×	×	×	○
C08: No-Load Brake Hoist	×	×	×	×	×	○
C08: Brake Answerback	○	○	○	○	○	○
C08: Emergency Lift	×	×	×	×	×	○
C09: Digital Input Option Setup	○	○	○	○	○	○
C10: Weight Measurement	×	×	×	○	○	○
C11: Slack Cable Detection	×	×	×	×	×	○
C11: Snap Shaft Detection	×	×	×	×	×	○
C12: Brake Delay Timers	○	○	○	×	×	×
C12: On/Off Delay Timers	○	○	○	○	○	○
C12: Maintenance Timer	○	○	○	○	○	○
C13: Inch Control	○	○	○	○	○	○
C13: Index Control	×	×	○	×	×	○

○*: Available*

×*: Not available*

5.2.1 Quick Stop™

Quick Stop provides an automatic Alternate Deceleration at Stop.

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

Table 5-15: Quick Stop Parameter Settings

Parameter	Display	Function	Range	Default
C01-01	Quick Stop	Determines whether Quick Stop is enabled	0, 1	0*
	0 Disabled			
	1 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 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

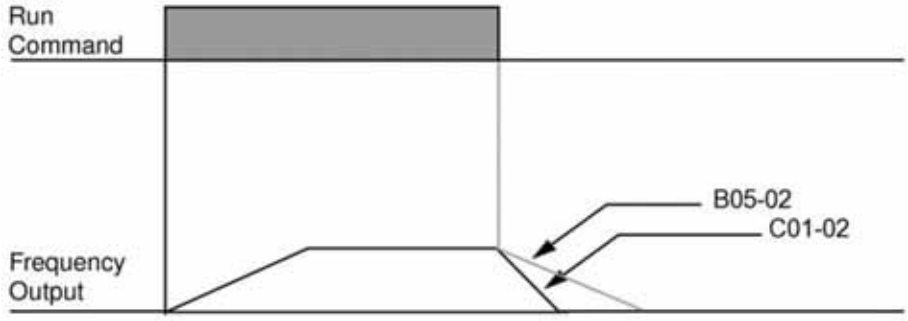


Figure 5-7: Quick Stop

5.2.2 Reverse Plug Simulation™

Reverse Plug Simulation provides an automatic 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.

NOTE: *Reverse Plug Simulation is not available in Standard Hoist mode (A01-03 = 1).*

Table 5-16: Reverse Plug Simulation Parameter Settings

Parameter	Display	Function	Range	Default
C01-03	Reverse Plug *0 Disabled* *1 Enabled*	Determines whether Reverse Plug Simulation is enabled.	0, 1	0
C01-04	Rev-Plg Dec Time	Deceleration time during Reverse Plug Simulation.	0.0–25.5 sec	2.0
C01-05	Rev-Plg Acc Time	Acceleration time during Reverse Plug Simulation.	0.0–25.5 sec	0.0

NOTE: *A setting of 0.0 in C01-05 will cause B05-01 to be used during acceleration.*

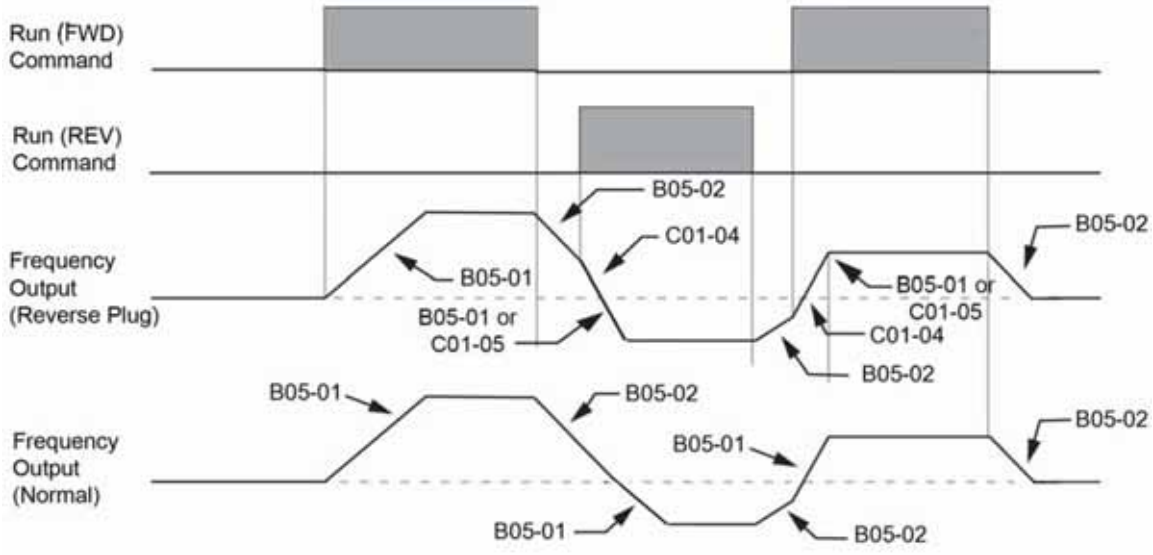


Figure 5-8: Reverse Plug Simulation

5.2.3 Micro-Speed™

Micro-Speed provides a reduced speed range operation for precise positioning. Enabled by a Multi-Function Input, it multiplies the normal speed reference by the Micro-Speed Gain. Two Micro-Speed Gains are available: Gain 1 (C02-01) and Gain 2 (C02-02). They can be adjusted and enabled independently.

Table 5-17: Micro-Speed Parameter Settings

Parameter	Display	Function	Range	Default
C02-01	MicroSpd Gain 1	The multiplier of the Analog or Digital Speed Reference to achieve slow-speed operation. H01-xx = E	Hoist: 0.01–1.00 Traverse: 0.01–2.55	1.00
C02-02	MicroSpd Gain 2	An alternate multiplier of the Analog or Digital Speed Reference to achieve slow-speed operation. H01-xx = 10	Hoist: 0.01–1.00 Traverse: 0.01–2.55	1.00

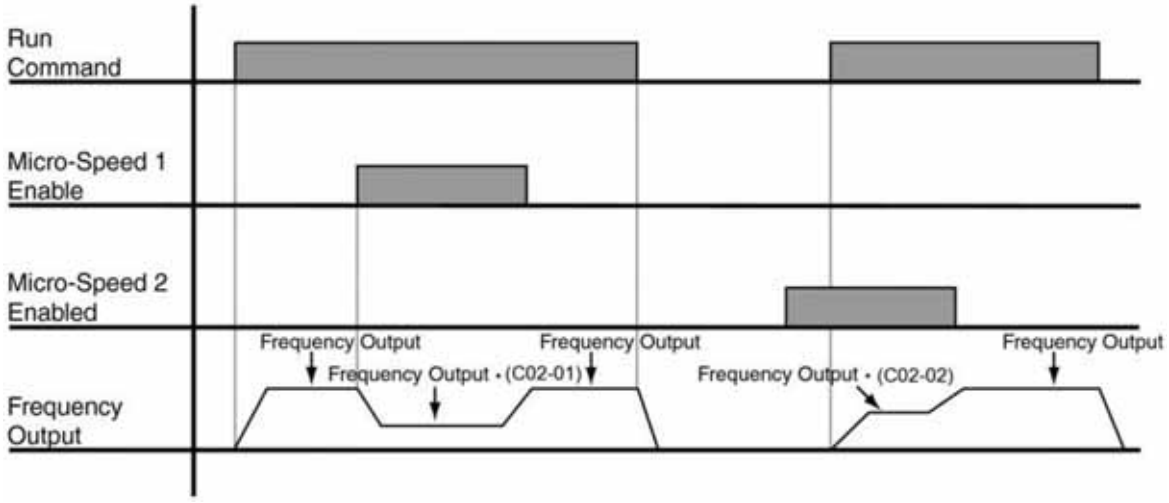


Figure 5-9: Micro-Speed Control

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

5.2.4 End of Travel Limits

This function can automatically slow and stop a crane or hoist when it reaches the end of travel limits. Two types of limit inputs (slowdown and stop) are available in both travel directions. Travel limit inputs can be programmed through the H01 and C09 digital input parameters.

Table 5-18: End of Travel Limits Parameter Settings

Parameter	Display	Function	Range	Default
C03-01	UL1 Speed	Speed when UL1 is detected	0.00–E01-04 Hz	6.00
C03-02	UL1 Decel Time	Decel time when UL1 is detected	0.0–25.5 sec**	1.0
C03-03	UL2 Stop Time	Decel time to STOP when UL2 is detected	0.0–25.5 sec**	1.0
C03-04	LL1 Speed	Speed when LL1 is detected	0.00–E01-04 Hz	6.00
C03-05	LL1 Decel Time	Decel time when LL1 is detected	0.0–25.5 sec**	1.0
C03-06	LL2 Stop Time	Decel time to STOP when LL2 is detected	0.0–25.5 sec**	1.0
C03-07	Lmt Stop Method	Stopping method when UL2 or LL2 is detected	0-2	2*
	0 Decel to Stop			
	1 Coast to Stop			
	2 Use B3-03 Method			
C03-08	UL3 Stop Method	Weight Limit Stop Method for H01-xx = 12 or 62. Alarm only when VFD is not running.	0-5	4
	0 Decel / Alarm	Decel to Stop with Alarm (raise not allowed)		
	1 Coast / Alarm	Coast to Stop with Alarm (raise not allowed)		
	2 Use B3-03/Alarm	B03-03 to Stop with Alarm (raise not allowed)		
	3 Decel / Fault	Decel to Stop with Fault		
	4 Coast / Fault	Coast to Stop with Fault		
	5 Use B3-03/Fault	B03-03 to Stop with Fault		
C03-09	UL3 Decel Time	Decel time when UL3 is detected.	0.0–25.5 sec	1.0

** Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

*** Range is extended to 0.0–6000.00 when B05-16 = 1.*

5.2.5 Phantom Stop

Phantom Stop allows quick identification of a faulted VFD while stopping other VFDs with Phantom Stop enabled. This feature is designed to stop the VFD operation using the stopping method selected in C03-10 when a Phantom Fault input (H01-xx = 5F or 63) is active. The VFD will indicate a Phantom Fault by blinking the keypad RUN key LED, in sequence of two short bursts. The VFD will resume normal operation when a Phantom Fault is removed.

Table 5-19: Phantom Stop Parameter Settings

Parameter	Display	Function	Range	Default
C03-10	Phantom Stop Met	Stopping Method when H01-xx = 5F or 63	0–2	1
	0 Decel to Stop	Declaration by B05-08		
	1 Coast to Stop			
	2 Use B3-03 Method	Declaration by B05-08		

5.2.6 Load Share (Torque Following)

Load Share allows one or more mechanically coupled motors to be connected in a Master/Follower fashion where the Follower VFD will follow the torque reference of the Master VFD. It can be configured in two ways, either as a dedicated Follower or as a Master/Follower that can be switched with a digital input. When in Load Share, the follower motor is a torque helper to the master motor. The Master outputs the commanded torque from a ± 10 VDC analog signal into the Follower, which correlates directly to the direction and quantity of torque the Follower should apply to its own motor. This can be particularly useful when two or more motors are driving a common load (i.e. single drum, gear box, etc.) and need to share the load. This will allow one VFD/motor to handle the speed reference and speed regulation while the others simply help. This overcomes inherent problems with having more than one VFD/motor trying to regulate speed on a common load. The Load Sharing function can be used for Hoist or Traverse motions.

Table 5-20: Load Share Parameter Settings

Parameter	Display	Function	Range	Default
C03-11	Load Share Limit *0 Disabled* *1 Enabled*	Determines whether the Follower will accept Limit Switch inputs (H01-xx = 06–0D). This only has effect when the Load Share digital input (H01-xx = 66) is on. In most cases, this is left as Disabled and the Master VFD will handle the limit switch logic.	0, 1	0

1. The master VFD can be an IMPULSE•VG+ Series 1, 2, 3, or 4.
2. The Limit Switch stopping method is not selectable in Load Sharing mode. If a Stop Limit is input, the output is turned off and the brake output will set immediately.
3. Weight Limit Input (H01-xx = 12 or 62) — Upper Limit 3 is always active regardless of the C13-11 setting.

5.2.6.1 Load Share Setup Example

At least one wire interconnection is required between the Master and Follower VFDs, in addition to the parameter settings below. Connect a wire between an analog output on the Master to an analog input on the Follower. If using the Optional step below, connect a wire between a digital output on the Follower and a digital input on the Master.

1. **Master** and **Follower** VFDs must be set to Flux Vector, A01-02 = 3.
2. **Master** VFD ±10 VDC analog output H04-01 or H04-04 = 109 — “Torque Reference”.
3. **Master** VFD analog output gain H04-02 or H04-05 = 50%.
4. **Master** VFD digital output H02-0x = 2A — “During RUN 2”.
5. **Follower** VFD digital input H01-xx = 66 — “Load Share”.
6. **Follower** VFD ±10 VDC analog input H03-06 or H03-10 = 13 — “Torque Reference”.
7. **Follower** VFD analog input gain H03-07 or H03-11 = 200%.
8. OPTIONAL: The **Master** VFD can be set to H01-xx = 68 — “LodShr Ready Run”, and then the **Follower** VFD set to H02-0x = 0 — “Brake Release.”

5.2.7 Klixon

The Klixon digital input is intended for motors that have a Thermal Overload Switch. Klixon is usually embedded in the motor windings and changes state when the motor reaches a certain temperature. When a digital input (H01-0x = 56 or 57) is active, the VFD will use the stopping method set in C03-12 and display the KLX Klixon alarm. The VFD will resume operation when the motor cools down and a new RUN command is applied.

Table 5-21: Klixon Parameter Settings

Parameter	Display	Function	Range	Default
C03-12	Klixon Action	When H01-xx = 56 (N.O.) or 57 (N.C.)	0, 1	0
	0 Use B3-03 Method			
	1 Allow Lower Only	Only available in a hoist motion		

5.2.8 Hook Height Measurement

Hook Height Measurement is an IMPULSE•VG+ Series 4 feature that provides a monitor parameter (U01-50) and analog output proportional to the hook's current position between a home position and a limit position. Hook height programming is used in conjunction with the Electronic Programmable Limit Switch parameters. ***See Figure 5-10 on page 85*** for Hook Height configuration. The physical limit switch must be normally open (N.O.) to prevent homing during a power-down or power loss.

NOTE: *The F1 and F2 keys can be used for homing the hook height. This can be useful for zeroing out the hook height without the need of a digital input. See parameters H01-09 and H01-10.*

Table 5-22: Hook Height Parameter Settings

Parameter	Display	Function	Range	Default
C03-13	Height Measure	Number of motor revolutions from the top of travel (FWD direction) to the bottom of travel (REV direction).	0–65535 Rev	250
C03-14	Hook Height Home	MFDI to be used for setting the Hook Height Home position. Corresponding MFDI must be programmed or OPE23 will be shown.	0–4	2
	0 Home = UL2 N.O.	Motor Revolutions is set to 0 when UL2 N.O. is closed (H01-xx = 07).		
	1 Home = LL2 N.O.	Motor Revolutions is set to C03-13 when LL2 N.O. is closed (H01-xx = 09).		
	2 Home MFDI Upper	Motor Revolutions is set to 0 when Hook Height Home is closed (H01-xx = 67).		
	3 Home MFDI Lower	Motor Revolutions is set to C03-13 when Hook Height Home is closed (H01-xx = 67).		
	4 Home = UL3 N.O.	Motor Revolutions is set to 0 when UL3 N.O. is closed (H01-xx = 62).		
C03-15	Hook Height Out	Output voltage for the analog Hook Height monitor.	0, 1	0
	0 0 Revs = 0%	U01-50 = 0%, MFAO = 0V		
	1 0 Revs = 100%	U01-50 = 100%, MFAO = 10V		

NOTE: *Motor revolutions (U01-51) will not go negative. If 0 motor revolutions has been reached and the hoist continues in the Up (FWD) direction, the motor revolutions will remain at 0.*

Table 5-23: Monitor Values at Hook Height Home Position

		C03-15 = 0	C03-15 = 1
C03-14	**U01-51**	**U01-50**	**U01-50**
0	0	0%	100%
1	C03-13	100%	0%
2	0	0%	100%
3	C03-13	100%	0%
4	0	0%	100%

5.2.9 Electronic Programmable Limit Switches (EPLS)

Using the motor revolutions (U01-51) from the Hook Height Measurement function, it is possible to program UL1, UL2, LL1, and LL2 positions without the use of rotary limit switches. Hook Height Measurement must be correctly set up before using EPLS.

Table 5-24: Electronic Programmable Limit Switches Parameter Settings

Parameter	Display	Range	Default
C03-16	UL2 Revolutions	0–65535 Rev	0
C03-17	UL1 Revolutions	0–65535 Rev	0
C03-18	LL1 Revolutions	0–65535 Rev	0
C03-19	LL2 Revolutions	0–65535 Rev	0

NOTE: *A setting of 0 disables that specific limit.*

Table 5-25: Limit Switch Outputs

H02-0x or F05-0x =	Function
2B - Upper Limit 1	Output ON when keypad displays UL1
2C - Upper Limit 2	Output ON when keypad displays UL2
2D - Lower Limit 1	Output ON when keypad displays LL1
2E - Lower Limit 2	Output ON when keypad displays LL2
30 - Lower Limit	Output ON when keypad displays LL1 or LL2
31 - Up/Low Limit	Output ON when keypad displays UL1, UL2, LL1, or LL2

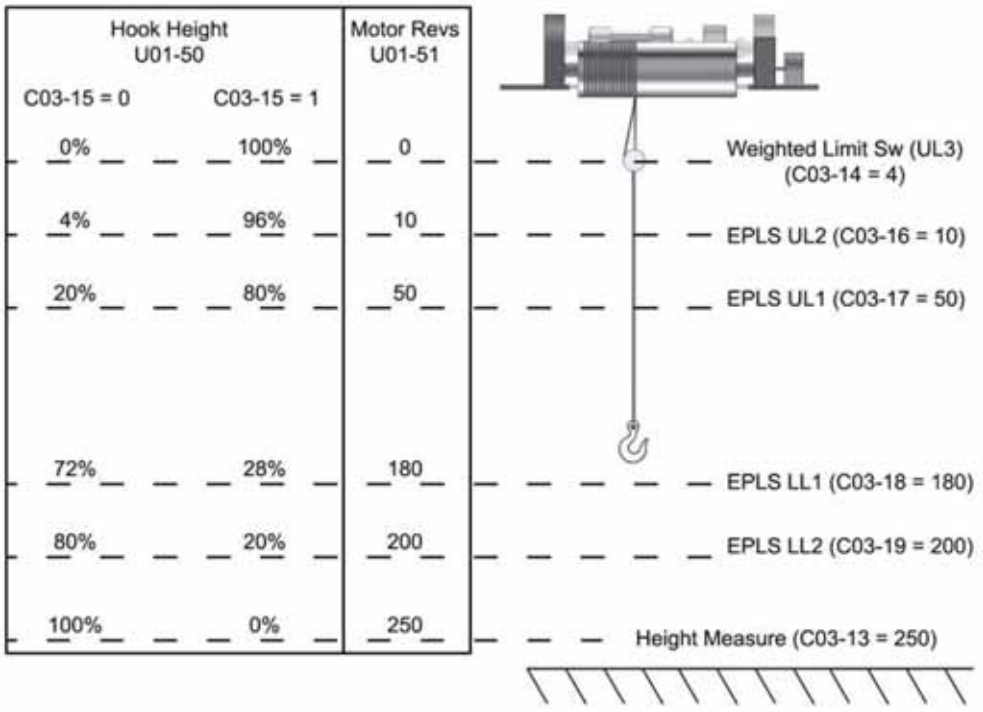


Figure 5-10: EPLS Parameter Layout

5.2.10 Upper/Lower Limit Bypass

The Limit Bypass allows for the following without the use of jumpers or re-programming parameters:

1. Ease of testing the Weighted Upper Limit Switch (UL3) or re-homing the Hook Height.
2. To allow changing of the wire ropes, i.e. spooling all the rope off of the hoist drum.

NOTE: *A momentary key-switch is recommended to operate this function and should only be accessible to maintenance personnel, not the crane operator. A functional description and usage procedure should be included in an administrative control program to avoid confusion and potentially have the End of Travel Limit switches left in a bypassed state during normal operation of the crane.*

Table 5-26: Limit Bypass MFDI

Functions Bypassed	C09-0x or H01-0x =	
	73	74
Upper Limit 1 N.O. (MFDI = 06)		×
Upper Limit 2 N.O. (MFDI = 07)	×	×
Lower Limit 1 N.O. (MFDI = 08)		×
Lower Limit 2 N.O. (MFDI = 09)	×	×
Upper Limit 1 N.C. (MFDI = 0A)		×
Upper Limit 2 N.C. (MFDI = 0B)	×	×
Lower Limit 1 N.C. (MFDI = 0C)		×
Lower Limit 2 N.C. (MFDI = 0D)	×	×
UL2 detected by EPLS (C03-16)	×	×
UL1 detected by EPLS (C03-17)		×
LL1 detected by EPLS (C03-18)		×
LL2 detected by EPLS (C03-19)	×	×

× = *Limit Bypass*

Figure 5-11: Upper Limit 1 (UL1)

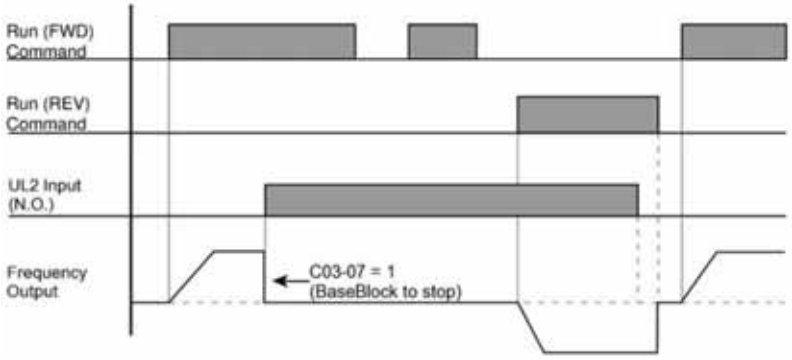


Figure 5-12: Upper Limit 2 (UL2)

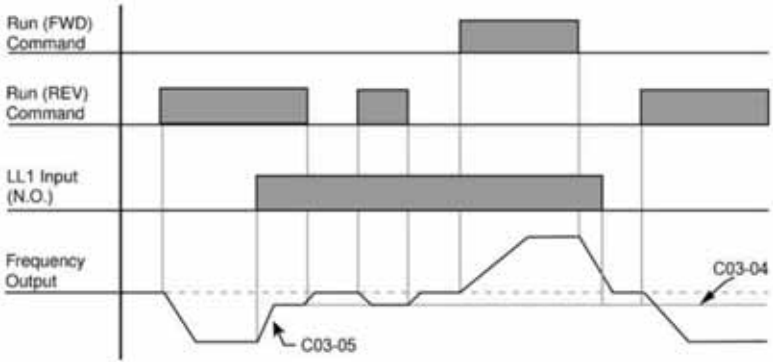


Figure 5-13: Lower Limit 1 (LL1)

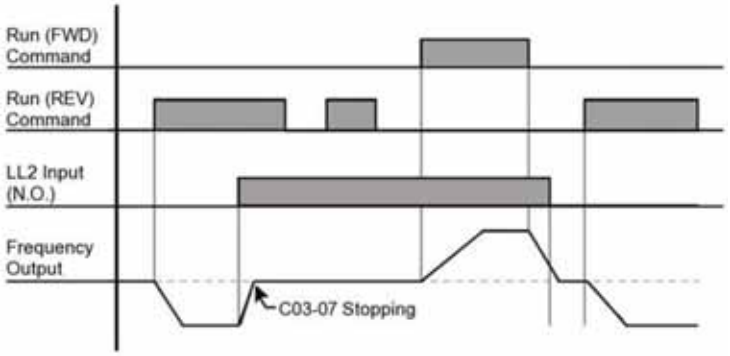


Figure 5-14: Lower Limit 2 (LL2)

5.2.11 Load Float 2

When Load Float (C08-10) is enabled, it maintains the motor shaft at a stationary position with brake open. The Load Float 2 (MFDI=35) function triggers the VFD to go into Load Float for the time set in C04-01. During this time, the VFD will open the brake and hold the motor at a zero position. A FWD or REV run command takes priority over this function.

Table 5-27: Load Float 2 Parameter Settings

Parameter	Display	Function	Range	Default
C04-01	Load Float Time2	Maximum duration of Load Float 2 time when MFDI = 35	0–65535 sec	10
C04-02	Load Float Gain	Gain for the control loop to hold the load from moving during load float	0–100	10*

** Dependent on kVA (≤ 30 HP: 10; > 30 HP: 20)*

5.2.12 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 an overload condition is detected, further lifting is restricted. The load may then be lowered at the speed that is specified by the Load Check Alarm Speed (C05-08).

DANGER

Load Check II is designed to limit loads less than or equal to the crane's rated capacity. Consult the factory and crane manufacturer before calibrating Load Check II with a load heavier than the crane capacity.

5.2.12.1 V/f Operation (A01-02 = 0)

When using Load Check II in V/f, motor current (U01-03) is compared to values stored during the Load Check set up process. If they exceed the values for the active Load Check Zone, the motor will stop based on the LC Alarm Action (C05-02) and display a Load Check alarm (LC).

NOTE: *If an application requires Load Check to be bypassed, program an MFDI to 69 (N.O.) or 6A (N.C.).*

NOTE: *It is highly recommended to use OLV or FLV control methods for Load Check II.*

5.2.12.2 OLV and FLV Operation (A01-02 = 2 and 3)

When using Load Check II in Open Loop Vector or Flux Vector, motor torque (U01-09) is compared to values stored during the Load Check set up process. If they exceed the values for the active Load Check Zone, the motor will stop based on the LC Alarm Action (C05-02) and displays a Load Check alarm (LC).

NOTE: *If an application requires Load Check to be bypassed, program an MFDI to 69 (N.O.) or 6A (N.C.).*

NOTE: *The Load Check II function will alter the acceleration time, depending on loading. It must be disabled when using two or more hoists to lift a single load.*

5.2.12.3 Load Check II Set Up (C05-01 = 9)

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

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

1. Verify that when the Master Switch is at full deflection (the highest speed point if stepped, or 10V if Analog), the Frequency Reference shown in U01-01 is equal to Motor Base Frequency shown in E01-06 (typically 60Hz). For example, with a 3-Step speed reference, if B01-03 is set at 60Hz, then the frequency reference should be 60Hz when the Master Switch is pushed to full deflection. If the frequency reference doesn't reach Motor Base Frequency, set the following (depending on Speed Ref):
   - Multi-Step: B01-0x is 60Hz
   - Infinitely Variable: B02-01 = 100%
   - Analog: H03-03 = 100% and B02-01 = 100%
2. The motor should be properly Auto-tuned.
   - FLV and OLV operation – Rotational Auto-tune.
   - V/f operation – Stationary Auto-tune.
3. Ensure B02-03 and E01-09 are at the desired values. If you change these, re-run Load Check II setup.
4. Motor should be at normal operating temperature for the application (operate at or near rated capacity for at least 10 minutes) before performing the Load Check set up process.
5. Suspend the rated load just off of the ground (this allows for accurate measurements during calibration).
6. Set C05-01 = 9.
7. Press and hold the Hoist (Up) command on the pendant or radio for full speed operation (60 Hz).

NOTE: *The Load Check set up process can be temporarily paused by lowering the load back to the ground, keeping the load suspended, then pressing and holding the Hoist (Up) command button at full speed until the Load Check set up process is complete.*

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

NOTE: *If an application requires Load Check to be bypassed, program an MFDI to 69 (N.O.) or 6A (N.C.).*

NOTE: *Upon completion of the Load Check setup process, the VFD will automatically set C05-01 = 1.*

NOTE: *If an error occurs during the Load Check set up, the load being lifted may have caused the current or torque to exceed 250%. Increase Holding Time and Testing Time, or decrease the load weight.*

5.2.12.4 Clearing a Load Check Alarm (LC)

A Load Check alarm/fault can be reset by pressing the RESET key on the keypad.

Table 5-28: Load Check II Parameter Settings

Parameter	Display	Function	Range	Default
C05-01	Load Check	Determines whether Load Check is enabled.	0, 1, 3, 9	0
	0 Disabled	Disables Load Check II Function		
	1 Hold & Measure	Checks per Holding and Testing Time		
	3 Immediate	Immediately faults when I/T level is exceeded		
	9 LC Set Up	Set up Load Check II		
C05-02	LC Alarm Action	Action at Load Check alarm or fault	0–5	4
	0 Alarm Only	L.C. blinking, can continue raising		
	1 Decel to Stop	Allows lower only		
	2 Coast to Stop	Allows lower only		
	3 Fault Stop	Fault contacts change state - requires reset		
	4 Use B3-03 Method	Allows Lower only		
	5 B03-03 with Reset	Stopping method is B3-03. Allows Lower Only. Alarm will be reset when load is lowered.		
C05-03	Holding Time	Time to hold the output frequency allowing the output current/torque to stabilize.	0.00–2.55 sec	0.15
C05-04	Testing Time	Time (after the Holding Time) for comparing output current/torque to values for a particular LC Zone being tested.	0.00–2.55 sec	0.25
C05-05	I/T Margin Acc	Margin for Load Check detection during acceleration. A setting of 0 is the most sensitive.	0–50%	5
C05-07	I/T Margin	Margin for Load Check detection at speed agree. A setting of 0 is the most sensitive.	0–20%	5
C05-08	Alarm Speed	Maximum lowering speed after an LC alarm.	0.1–30.0 Hz	6.0
C05-09	I/T Level 01	Current/Torque for Zone 01	0–250%	0
C05-10	I/T Level 02	Current/Torque for Zone 02	0–250%	0
C05-11	I/T Level 03	Current/Torque for Zone 03	0–250%	0
C05-12	I/T Level 04	Current/Torque for Zone 04	0–250%	0
C05-13	I/T Level 05	Current/Torque for Zone 05	0–250%	0
C05-14	I/T Level 06	Current/Torque for Zone 06	0–250%	0
C05-15	I/T Level 07	Current/Torque for Zone 07	0–250%	0
C05-16	I/T Level 08	Current/Torque for Zone 08	0–250%	0
C05-17	I/T Level 09	Current/Torque for Zone 09	0–250%	0
C05-18	I/T Level 10	Current/Torque for Zone 10	0–250%	0
C05-19	I/T Level 11	Current/Torque for Zone 11	0–250%	0
C05-20	I/T Level 12	Current/Torque for Zone 12	0–250%	0
C05-21	I/T Level 13	Current/Torque for Zone 13	0–250%	0
C05-22	I/T Level 14	Current/Torque for Zone 14	0–250%	0
C05-23	I/T Level 15	Current/Torque for Zone 15	0–250%	0
C05-24	I/T Level 16	Current/Torque for Zone 16	0–250%	0
C05-25	LC Integral Time	Integral time used to smooth transitions	0.00–2.55 sec	0.05

Parameter	Display	Function	Range	Default
C05-26	LC Delay Time	Load Check delay time for transitions	0.00–2.55 sec	0.25
C05-27	Min I->Fwd Tim	Minimum delay when switching from REV to FWD in LC. Used when the VFD cannot stop the load fast enough. Disabled when set to 0.	0.0–25.5 sec	0.0
C05-28	Dly Trig Freq	Minimum frequency that will trigger C05-27	0.0–60.0 Hz	30.0

5.2.13 Swift-Lift™ & Ultra-Lift™

Swift-Lift/Ultra-Lift provides additional productivity by allowing a hoist to run above base speed when the load is less than 100% of the rated capacity. Ultra-Lift determines the torque required for the load, calculates the maximum safe speed, and automatically accelerates to this speed. The maximum speed cannot exceed the lesser value of the Maximum Forward Speed (C06-02), Maximum Reverse Speed (C06-03), and Maximum Frequency (E01-04).

NOTE: *Ultra-Lift is disabled for traverse motions. Maximum Frequency (E01-04) must be ≥ C06-02 and C06-03.*

WARNING

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

5.2.13.1 Swift-Lift

Swift-Lift can be enabled in Standard Hoist mode (A01-03 = 1). In the V/f control method, the Swift-Lift function uses motor current to determine the maximum safe speed. When the OLV control method is selected, the Swift-Lift function uses motor torque for its safe speed calculations. Swift-Lift will not be enabled if the current or torque levels exceed C06-04 or C06-05 settings. Both C06-04 and C06-05 are a percentage of E02-01.

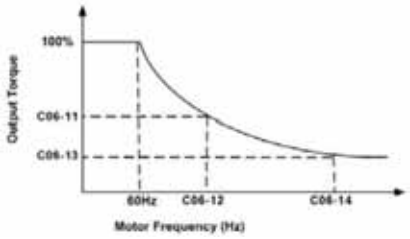
5.2.13.2 Ultra-Lift

Ultra-Lift can be enabled in NLB Hoist mode (A01-03 = 2). The Ultra-Lift function measures motor torque at base speed and then accelerates to the maximum safe speed. Ultra-Lift will not be enabled if the torque levels exceed C06-04 or C06-05 settings.

5.2.13.3 Adaptive Ultra-Lift

Adaptive Ultra-Lift can be enabled in NLB Hoist mode (A01-03 = 2). The Adaptive Ultra-Lift function continuously monitors motor torque when running above base speed to increase or decrease motor speed based on varying load conditions.

Table 5-29: Swift-Lift/Ultra-Lift Parameter Settings

Parameter	Display	Function	Range	Default
C06-01	Swift-Lift (V/f and OLV) Ultra-Lift (FLV) *0 Disabled* *1 Enabled Auto* *2 Enabled by MFDI* *3 Enabled Adaptive* *4 Adaptive by MFDI*	Determines if Swift/Ultra-Lift is enabled. Flux Vector NLB only Flux Vector NLB only	0–4	0
C06-02	SwiftLift FWDSpd UltraLift FWDSpd	Maximum Swift/Ultra-Lift Forward Speed	0.1–150.0 Hz	60.0
C06-03	SwiftLift REVSpd UltraLift REVSpd	Maximum Swift/Ultra-Lift Reverse Speed	0.1–150.0 Hz	60.0
C06-04	SL FWD Current (V/f) SL FWD Torque (OLV) UL FWD Torque (FLV)	Output Current/Torque < C06-04 to enable Swift/Ultra-Lift Forward. Not used with Adaptive UL.	0–100%	50
C06-05	SL REV Current (V/f) SL REV Torque (OLV) UL REV Torque (FLV)	Output Current/Torque < C06-05 to enable Swift/Ultra-Lift Reverse. Not used with Adaptive UL.	0–100%	30
C06-06	SL Enabling Spd UL Enabling Spd	Frequency at which to trigger Swift/Ultra-Lift.	0.1–150.0 Hz	59.0
C06-07	SL Delay Time UL Delay Time	Delay time at Enabling speed to check Output Current/Torque	0.0–25.5 sec	2.0
C06-08	SFS Acc Gain	Acceleration multiplier for V/f Modes. Greater than 1 increases accel time; less than 1 decreases accel time.	0.1–9.9	1.0
C06-10	Mtr Trq Quickset *0 Custom* *1 Very Low Torque* *2 Low Torque* *3 Standard* *4 High Torque* *5 Very High Torque*	Available motor torque over base speed.  	0–5	3
C06-11	Motor Torque 1	Available torque at Speed 1 (above base speed)	1–100%	45
C06-12	Motor Speed 1	Speed 1 point	100–300%	150
C06-13	Motor Torque 2	Available torque at Speed 2 (above base speed)	1–100%	25
C06-14	Motor Speed 2	Speed 2 point	100–300%	200
C06-15	AUL FWD Offset	Adaptive UL torque measurement offset in the up direction to allow for deceleration.	0–100%	10
C06-16	AUL REV Offset	Adaptive UL torque measurement offset in the down direction to allow for deceleration	0–100%	20

NOTE: *C06-11 through C06-16 are hidden unless C06-10 = 0 “Custom”.*

5.2.13.4 Swift-Lift & Ultra-Lift Setup

For 2, 3, 5-Speed Multi-Step (A01-04 = 0, 1, or 2):

1. Set C06-01= 1–4 to enable the **Swift-Lift & Ultra-Lift Function**, 1 = Enable Automatic, 2 = Enable by Multi-Function Digital Input (MFDI), 3 = Enable Adaptive (Ultra-Lift Only), 4 = Adaptive by MFDI (Ultra-Lift Only).
2. Set C06-02 and C06-03 to the desired **Swift-Lift & Ultra-Lift** maximum FWD/REV output frequency.
3. Set C06-04 and C06-05 to the current/torque that the motor must be under in order to enable Swift/Ultra-Lift.
4. Set C06-06 (Enabling Speed) to one or two hertz below the maximum normal running speed reference.
   For example: If the maximum normal running speed is at 60 Hz, set C06-06 = 58 or 59 Hz.
5. Ensure that the **Maximum Frequency (E01-04)** is increased above 60 Hz.

For 2, 3 Step Infinitely Variable (A01-04 = 3 or 4)

1. If the system is using **2-Step** or **3-Step Infinitely Variable** as the **Control Method**, use the following formula ***B02-01 (Reference Upper Limit)***.

$$B02\text{-}01 = \frac{60\ Hz \times 100}{E01\text{-}04}$$

For Uni-Polar/Bi-Polar Analog (A01-04 = 5 or 6)

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

$$H03\text{-}03 = \frac{60\ Hz \times 100}{E01\text{-}04} \quad \text{or } H03\text{-}11 = \frac{60\ Hz \times 100}{E01\text{-}04}$$

5.2.14 Torque Limit

IMPULSE•G+/VG+ Series 4 VFDs dynamically control the torque output of the motor while running. The Torque Limit function limits the amount of torque the motor is capable of producing in Open and Closed Loop Vector control.

- *Forward Motoring (I)*
- *Forward Regenerating (II)*
- *Reverse Motoring (III)*
- *Reverse Regenerating (IV)*

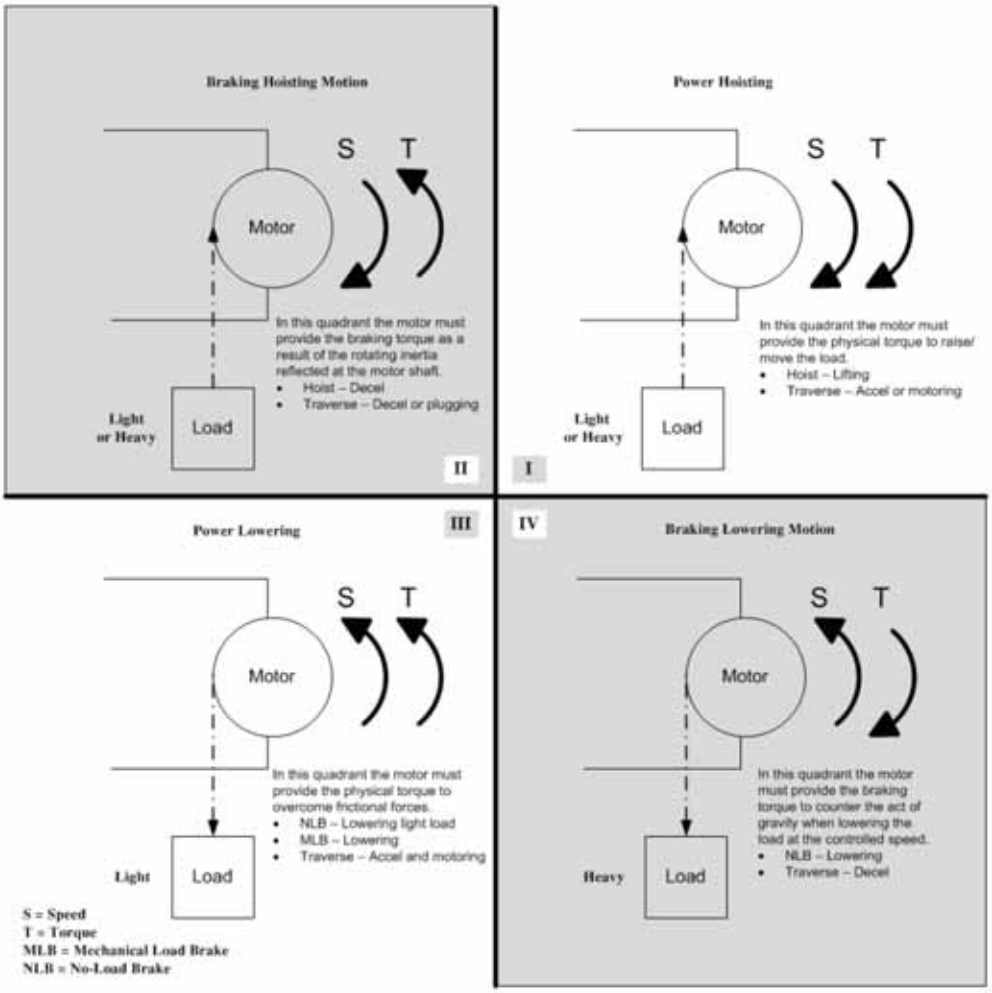


Table 5-30: Torque Limit Parameter Settings

Parameter	Display	Function	Range	Default
C07-01	Trq Limit FWD	FORWARD torque limit	0–300%	150
C07-02	Trq Limit REV	REVERSE torque limit	0–300%	150
C07-03	Trq Lmt FWD Rgn	Regenerative torque limit at FORWARD	0–300%	180
C07-04	Trq Lmt REV Rgn	Regenerative torque limit at REVERSE	0–300%	180
C07-05	T-Lim FWD Gain	Torque Limit gain in FWD direction when MFDI = 14 is ON. Gain is applied to C07-01. If T-Lim by Analog Input is used, gain is applied to post-scaled/biased input.	0.00–2.55	1.25
C07-06	T-Lim REV Gain	Torque Limit gain in REV direction when MFDI = 14 is ON. Gain is applied to C07-02. If T-Lim by Analog Input is used, gain is applied to post-scaled/biased input.	0.00–2.55	1.25
C07-07	T-Lim RGN Gain	Torque Limit gain in RGN mode when MFDI = 14 is ON. Gain is applied to C07-03 and C07-04. If T-Lim by Analog Input is used, gain is applied to post-scaled/biased input.	0.00–2.55	1.25
C07-08	Trq Lim I Time	Integral time constant for the torque limit. (OLV only)	5–10000 ms	200
C07-09	Torque Limit Sel	Torque Limit Method during Accel/Decel (OLV only)	0, 1	0
	0 P-ctrl @ Acc/Dec	The torque limit uses proportional control during accel and decel, and switches to I control at constant speed. Use this setting when getting to the desired speed has priority over the torque limit.		
	1 I-ctrl @ Acc/Dec	The torque limit will always use integral control. Use this when a highly accurate torque limit is required during speed changes. This setting may increase the acceleration time, or prevent the motor from reaching the frequency reference if the torque limit is reached first.		
C07-10	Trav Trq Limiter *0 Disabled* *1 Enabled*	ASR I time is forced to 0 when the output frequency is greater than the C07-11 speed window. When using this feature, it is suggested that the Overspeed Detect Level (F01-24) be increased to 110% to avoid overspeed faults.	0, 1	0
C07-11	Limiter Freq	Frequency window (+/-) size for Traverse Torque Limiter (C07-10) when at speed.	0.5–10.0	2.0

The Traverse Torque Limiter function (C07-10 and C07-11) is used in multi-VFD, closed-loop traverse applications to reduce skewing due to speed differences in the motors on each side of a bridge. This prevents one side of a bridge being at full forward torque, while the other side is at full regen torque, which can lead to skewing, DEV faults, or the motors simply not sharing the load sufficiently. When accelerating past the Limiter Freq (C07-11), this feature is enabled, and the ASR I time is reduced to zero to limit torque imbalance. Once the motor has reached its target speed, the regen torque limit is also reduced to zero. It will remain in this state until the speed reference is changed. When the speed reference is raised or lowered, regen torque limit is re-enabled to accel or decel the bridge as required.

5.2.15 Anti-Shock

Anti-Shock is a hoist feature on the IMPULSE•VG+ Series 4 VFD. The torque output of the hoist is continuously monitored, and when it increases above a threshold (C07-15 and C07-16), the hoist automatically decelerates and waits for the torque to stabilize before smoothly re-accelerating (C07-17 and C07-18). Anti-Shock is designed to reduce crane structure fatigue.

Initial Setup and Adjustment

1. Choose an option to enable/disable Anti-Shock:
   a. C07-12 = 0 (Disabled) ensures Anti-Shock does not function.
   b. C07-12 = 1 (Enabled) allows Anti-Shock to run always.
   c. C07-12 = 2 (Enbl, Not In MSpd) will block Anti-Shock when Micro-Speed is enabled.
   d. H01-xx = 4B (Anti-Shock OFF), when enabled, will block Anti-Shock. This allows Anti-Shock to be enabled or disabled by a digital input.
2. Run the hoist, unloaded, in the UP direction. Note the value of U01-09 and enter that value into C07-23.

To make Anti-Shock less sensitive to light loads and more sensitive to heavy loads:

1. Increasing C07-15 (Torque Delta) to a higher percentage increases the torque spike magnitude that is required to trigger Anti-Shock.
2. Increasing C07-16 (Detection Time) to a higher time widens the window that a torque spike is looked for.

To make Anti-Shock more sensitive to light loads:

1. Decreasing C07-15 (Torque Delta) to a lower percentage lowers the torque increase magnitude that is required to trigger Anti-Shock.
2. Increasing C07-16 (Detection Time) to a higher time widens the window that a torque spike is looked for.

Troubleshooting

Anti-Shock is triggered when the load is already in the air:

Cause: This is caused by a torque increase due to acceleration, which falls within the parameter settings for triggering Anti-Shock.

Corrective Action:

1. Increasing C07-14 (Re-Accel Delay) to a higher time delay.
2. Increasing C07-15 (Torque Delta) and decreasing C07-16 (Detection Time) will require a higher torque spike to occur in a shorter amount of time.

When Anti-Shock is triggered, the VFD faults with an OV (Overvoltage) or OC (Overcurrent):

Cause: By default, Anti-Shock is configured to decelerate very quickly when a torque spike is detected. The deceleration rate may cause a rapid increase in voltage or current, which may fault the VFD.

Corrective Action:

Increasing C07-18 (Smoothing Decel) will increase the time it takes for the motor to decelerate directly after the torque spike is detected. Resulting spikes in voltage and/or current will be reduced.

Table 5-31: Anti-Shock Parameter Settings

Parameter	Display	Function	Range	Default
C07-12	Anti-Shock	Enables or disables the Anti-Shock function.	0–2	0
	0 Disabled	Anti-Shock is disabled.		
	1 Enabled	Anti-Shock is enabled always.		
	2 Enbl, Not In MSpd	Disables Anti-Shock if Micro-Speed is enabled.		
C07-13	Enabling Freq	Anti-Shock is disabled until the output frequency is above this setting.	0.0–60.0 Hz	6.0
C07-14	Re-Accel Delay	If the operator decelerates the hoist then re-accelerates, Anti-Shock Detection is disabled for this period of time.	0.00–2.55 sec	0.20
C07-15	Torque Delta	Torque increase required to initiate the Anti-Shock sequence.	0–180%	10
C07-16	Detection Time	Time window to detect torque delta (C07-15).	0.01–0.50 sec	0.30
C07-17	Smoothing Freq	When the torque increase is detected, the motor will decelerate to this frequency.	0.0–15.0 Hz	3.0
C07-18	Smoothing Decel	Deceleration time once an Anti-Shock event has been detected. Increase this value in 0.1 sec increments if DEV faults are occurring.	0.00–1.00 sec	0.30
C07-20	Smoothing Time	Time window to smooth out the torque.	0.00–2.55 sec	1.00
C07-22	AlarmDisplayTime	When Anti-Shock is triggered, an alarm will display on the keypad screen for the selected duration of time.	0–30 sec	4
C07-23	No Load Torque	Any torque values below this level are ignored. Best described as the torque level while hoisting with an empty hook (no load).	0–100%	20
C07-24	Activation Torque	In order for Anti-Shock to be triggered, the torque increase is required to peak above this percentage.	0–180%	75
C07-25	Detection Method	Anti-Shock detection method.	0–2	1
	0 Always Detect	Anti-Shock can be continuously detected.		
	1 Once Per Lift	After Anti-Shock is detected once during a lift, it is disabled until the hoist is lowered.		
	2 Fault on Detect	Fault when Anti-Shock is detected.		

5.2.16 No-Load Brake Hoist

The No-Load Brake Hoist mode is a VG+ feature that provides a start and stop sequence designed specifically for hoists without a mechanical load brake. This mode is enabled automatically when the Motion is set to NLB Hoist (A01-03 = 2). This will also automatically set the Stopping Method to No-Load Brake (B03-03 = 6).

Start

The start sequence begins by building up torque in the motor to a predefined level within the C08-01 (Torque Compensation Time) timer. This level is determined by several factors which are defined below. During the C08-02 time, the VFD is monitoring current to motor. The current feedback equation must be satisfied within the time set in C08-02 (IFB OK Time). If it is not, a BE2 (No-Current) fault will be displayed on the keypad and the VFD will stop outputting voltage to the motor. The brake will remain closed.

Once the brake has been commanded to release, the VFD output remains in Load Float for the amount of time programmed into C08-04. During C08-04, the VFD waits for the brake to completely open and watches encoder feedback. If the amount of feedback is less than the setting in C08-05 (Roll Back Count), then the VFD proceeds to the BE3 check. If it is not, a BE1 fault is displayed on the keypad and the sequence stops. For the BE3 check, if the brake opened mechanically, then the encoder feedback must be greater than or equal to the value programmed in C08-07 (BE3 Detect Count) within the time set in C08-06 (BE3/Alt Torq Tim). If it is not, then a BE3 fault is displayed. By the time the VFD has completed the BE3 check, there should be a significant amount of motor shaft movement and the start sequence is complete.

Stop

The stop sequence begins when the run command has been removed and the output frequency has decelerated to zero. Once at zero speed, the motor maintains a Load Float position for the duration of C08-10 (Load Float Time). During the Load Float time, run commands in either direction are accepted and will begin accelerating immediately in the commanded direction, thereby skipping the start sequence entirely. The Load Float Timer is reset after each new run command. Once the Load Float Timer expires, the brake output command is removed (thereby closing the brake) and Load Float is maintained for the time set in C08-11 (Brake Set Delay) to allow the brake to fully close. Once the Brake Delay Time has expired, the BE6 check is executed. The BE6 check monitors encoder feedback while the load is being transferred from the motor to the brake and compares it to C08-13 (BE6 Max Count). The encoder feedback must not exceed the number of counts in C08-13 within the C08-12 (BE6 Detect Timer) time. If it does (meaning the load slipped through the brake), a BE6 alarm is displayed on the keypad and the VFD will reset its Load Float position and maintain its new position. Run commands will still be accepted with the exception of a reduced speed in the up direction set by C08-18 (BE6 Up Speed Limit) and the NLB stop sequence will begin again once the run command had been removed.

Torque Proving

Factor 1: On the first run command after power up, or after any fault which causes the stop sequence to be skipped, the start sequence by default uses the value programmed in C08-16, the Initial Brake Release torque.

Factor 2: Once the system has completed a successful start and stop, a new Brake Release Torque value is used. This value is one that has been memorized and stored into memory during the stop sequence. It is equivalent to the amount of torque required for the motor to hold the load on the hook in Load Float with the brake released. Some benefits of stored Load Float torque for the next brake release are:

- Faster response to run commands when VFD is in Base Block Status.
- Upon brake release, shaft rotation begins in the direction of the run command.

If the stored value is less than the programmed value in C08-03 (Minimum Brake Release torque), C08-03 is used as the next brake release value. If the feature must be disabled, C08-03 will override C08-16 if it is a greater value.

Dual Brake Feature

The Dual Brake feature is designed for hoist systems with redundant holding brakes. One brake is controlled by an MFDO programmed to 00, and the second brake is controlled by an MFDO programmed to 0A. After a Load Float, during the BE6 (Brake Test) time, one brake is left Open, while the VFD tests that the Closed brake is capable of holding the load. After the BE6 time expires, the second brake is closed.

This feature is only intended as a method to test each brake individually. A mechanical delay system may be required to prevent both brakes from closing simultaneously if power is lost.

NOTE: *All brake faults are annunciated by both the keypad and via a programmed digital output. Since the keypad is not visible by the operator, an external warning device must be used to ensure proper safety of personnel and equipment. Annunciating a brake fault can be accomplished by using one, or both, of the following methods: 1) An indicator or strobe light that is continuously "ON", indicating proper operation. If the light should turn "OFF", this indicates that the light bulb has either burned out, or there is a VFD or brake problem. Either scenario requires immediate corrective action. 2) The use of an indicating light wired to relay output terminals MC-MA, N.O. contact, or an audible warning device that will sound during a brake fault condition. A 120 VAC audible warning device can be wired directly to terminals MC-MA, provided that its ratings do not exceed the 1 Amp, 120 VAC, Inductive Spec.*

If a brake fault is annunciated during a "Start" sequence, it is recommended that the crane be moved to a safe location with the load on the hook. The hoist should only be operated if absolutely necessary. In this type of alarm sequence, either the brake is seized or the VFD cannot develop enough torque in the motor in the time allotted. To troubleshoot the hoist, it will be necessary to monitor the keypad on the VFD and operate the hoist at the same time. Two people are recommended for this procedure. With one person operating the hoist and the other person monitoring the keypad, run the hoist. The keypad should display one of the following faults: BE1, BE2, BE3, or BE4. For corrective action, ***see Section 6.1 on page 190****.*

If a brake fault is annunciated after the hoist has come to a complete stop, and Load Float (C08-10) has timed out, it would indicate that the VFD has checked the brake and determined that the brake has insufficient torque available to hold the load. DO NOT TURN OFF POWER. This condition indicates that the brake has failed and the VFD / motor combination is suspending the load. If, during this condition, the hoist is operated in the "Raise" direction, it will only be allowed to run at a speed equal to or less than the "BE6 Up Speed" setting in parameter C08-18 (C08-18 is 6 Hz by default.) This is an additional indication that the brake has failed to open, or the load is slipping through the brake. It is recommended that the crane be moved to a safe location and the load lowered to the ground. Corrective action should be taken to repair the brake. The keypad will be displaying one of two alarms during this condition: BE5 or BE6. ***See Section 6.1 on page 190.***

WARNING

DO NOT turn off power to the VFD during a BE5, BE6, or BE8 alarm. This may result in loss of control of the load if the brake has failed in the open position or is unable to hold the load.

Table 5-32: No-Load Brake Parameter Settings

Parameter	Display	Function	Range	Default
C08-01	Torque Comp Time	Time for the Torque Comp value to reach 300%.	0.00–2.55 sec	1.00
C08-02	IFB OK Time	Time to look for current feedback before posting a BE2 alarm. Setting this to 0.00 will disable torque proving and BE2 detection (consult factory before disabling torque proving).	0.00–2.55 sec	1.00
C08-03	Min Brk Rel Trq	Minimum brake release torque.	0–300%	10
C08-04	Rollback Timer	Time for the brake to release and for brake feedback to be received into the Brake Answerback MFDI at start before posting BE1 or BE4 alarm. It is also the time when the amount of rollback is checked.	0.00–2.55 sec	0.30
C08-05	Rollback Count	Detection counts for excessive rollback. 4 pulses = 1 ppr of F01-01	0–15000 pulses	800
C08-06	BE3/Alt Torq Tim	Time period when C08-07 is measured. See C08-08.	0.00–2.55 sec	0.30
C08-07	BE3 Detect Count	Detection count for Encoder/Seized-Brake Alarm (BE3). It is the minimum encoder pulse count, during C08-06, below which triggers a BE3 alarm. 4 pulses = 1 ppr of F01-01	0–15000 pulses	10
C08-08	Alt Rev Trq Lim	For a LOWER command in the NLB Hoist mode only (A01-03 = 2). Torque limit for time of C08-06 to prevent driving through a brake that has failed closed with a load on the hook.	0–300%	25
C08-09	Zero Speed Level	Speed feedback at which Load Float activates.	0.0–10.0 Hz	1.0
C08-10	Load Float Time	Time period during which the motor is held at the zero-position and the electric brake remains open. This time begins when the motor speed is below the Zero Speed Level (C08-09).	0-65535 sec	10*
C08-11	Brake Set Delay	Time for the brake to set and for brake feedback to be removed from the Brake Answerback Multi-Function input at stop before posting a BE5 Alarm.	0.0–25.5 sec	0.7
C08-12	BE6 Detect Time	Time period during which the electric brake is set and tested for sustaining the load. ***NOTE:*** *To disable BE6 detection, set C08-12 to 0.0.*	0.0–25.5 sec	5.0
C08-13	BE6 Max Count	Total pulse counts must be less than C08-13, during C08-12, otherwise BE6 alarm. 4 pulses = 1 ppr of F01-01	0–15000 pulses	250
C08-14	Brake Hold Speed	Frequency the VFD outputs to push against the brake for brake proving at start and the frequency the VFD outputs until Brake Set Delay time expires or the Brake Answerback MFDI is removed.	0.0–25.5%	0.0
C08-15	Load Float Ext T	Load Float extension time enabled by MFDI=5D.	0–65535 sec	10
C08-16	Init FWD Brk Trq	Initial Forward Brake Release Torque. The percent of forward/up motor torque that must be reached within C08-02 time to release the brake at the start of a forward/up run. (BE2 detection).	10–300%	100
C08-17	Init REV Brk Trq	Initial Reverse Brake Release Torque. The percent of reverse/down motor torque that must be reached within C08-02 time to release the brake at the start of a reverse/down run. (BE2 detection).	10-300%	20
C08-18	BE6 Up Speed Lim	Maximum up speed limit during a BE6 or BE8 alarm.	0.00–150.00 Hz	6.00

Parameter	Display	Function	Range	Default
C08-19	Brk Slip Reset *0 Disabled* *1 Enabled*	Determines if BE6 alarm is automatically reset. If enabled, VFD will always perform BE6 test after Load Float to determine if brake is operational and the fault can be cleared. If disabled the VFD will remain in BE6 alarm state until power is cycled.	0, 1	0
C08-20	BE6 Check Torque	Torque output during a BE6 check.	0.5–20.0%	1.0
C08-21	Add Mag I Time	Additional delay time at start to allow the motor to develop additional magnetizing current.	0.0–3.0 sec	0.0
C08-22	Brk Slip Detect *0 Disabled* *1 Enabled*	Continuous monitoring for a slipping brake. (BE8 Detection)	0, 1	0
C08-23	Brk Slip Det Spd	Adjusts the sensitivity of BE8 Slip Detection.	0–10 Hz	1.0
C08-24	Brake Test Torq	Motor runs in Forward direction at C08-25 speed when MFDI = 61 is active. Brake output relay is not energized, PGO and DEV detection are disabled. Monitor Brake Test Torque at U01-86.	0–6553.5 Flb	(see ** below)
C08-25	Brake Test Speed	Speed to push at the brake during a Brake Test.	0–10 Hz	6
C08-27	Zero Spd Brk *0 Use Brake* *2 Coast to Stop* *3 Fast SFS Hold*	Determines if the brake will set when passing through zero speed.	0, 2, 3	0
C08-28	Trq Check Time	Time during which the torque must be above C08-03 or C08-16 before releasing the brake. Increasing this time allows the load to stabilize and minimize erroneous BE2 faults. Disabled if set to 0.00.	0.00–2.55 sec	0.05
C08-29	Min REV Time	Maximum amount of time, after the brake has been released, the VFD will remain running at in the down direction.	0.0–25.5 sec	1.2
C08-30	Pos Trq Time	Time that the internal torque signal must be positive before the VFD will be allowed to transition from reverse to forward. Only in effect within the C08-29 time, after brake release.	0.0–25.5 sec	0.4
C08-31	Pos Trq Speed	Speed, in the reverse/down direction, that the VFD will output while waiting for the torque reference to go positive.	0.0–10.0 Hz	6.0
C08-32	Min Brk Set Time	Minimum time that the brake needs to be set, during BE5 detection, before a new run is allowed.	0.0-25.5 sec	0.1
C08-33	Dual Brake Test *0 Disabled* *1 Enabled*	Enabling this alternates the brake outputs after every run. MFDOs must be set to 00 and 0A or OPE28 will be displayed	0, 1	0
C08-34	DIR Flt Trq Lvl	Regen torque level required to trigger a DIR fault. This is used to detect an NLB hoist set up backwards (FWD is down). Disabled if set to 0.	0–100%	20

** Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

** $1.25x \frac{E02\text{-}11x5252}{\text{Motor RPM}}$

5.2.17 Emergency Lift

Emergency Lift (E-Lift) is a VG+ feature that allows operation of the VFD in the event of an encoder related fault (PGO-1-S/PGO-1-H) that resulted from a defective encoder, encoder cable, or PG-X3 option card. E-Lift can be enabled with a Multi-Function Digital Input (H01-xx = 44) under the condition that all run commands have been removed and the VFD is not outputting voltage.

When E-Lift is active, the VFD will switch to the control method set in E03-01. In hoist applications, it is highly recommended to leave E03-01 set to OLV, which will ensure proper control of the load. Furthermore, all functions that depend on encoder feedback will be disabled. The Test Mode Configuration parameters (E03-xx group) are active during E-Lift operation instead of the E01-xx parameters. By default, the E-Lift function may only remain operational for 10 minutes (user-adjustable by C08-37), after which a fault will be generated.

DANGER

E-Lift is designed to allow for temporary hoisting operations of motors normally equipped with an encoder in Flux Vector control. Always follow instructions given in the E-Lift setup guide, and use extreme caution when operating a hoist in E-Lift mode. Stop the hoist if any undesired motion occurs and contact Magnetek for additional assistance.

DANGER

Do NOT set E03-01 = 0 (V/f Control) when using E-Lift in hoist applications. E-Lift is designed to operate using the Open Loop Vector (OLV) control method. The use of the V/f control method may cause undesired motion of the load and is only intended for troubleshooting Flux Vector control method related problems.

5.2.17.1 Emergency Lift Setup

1. **Auto-Tune the motor:**

   Complete an Auto-Tune for the motor described in ***Section 4.4 on page 63***.

2. **Configure the E03 Parameter Group - Test Mode Configuration:**

   When E-Lift is active, the Test Mode parameters are used for voltage and frequency limits instead of the E01 group. The E03 group should be configured as described in ***Table 5-62 on page 131***.

3. **Configure the E-Lift Parameters:**

   The parameters listed in ***Table 5-33*** are used to configure the E-Lift function.

Table 5-33: Emergency Lift Parameter Settings

Parameter	Display	Function	Range	Default
C08-35	Emergency Lift	Determines if the E-Lift function is enabled.	0, 2	0
	0 Disabled			
	2 Enabled by MFDI			
C08-36	ELift Max Speed	Maximum frequency when E-Lift is active.	0–150 Hz	30
C08-37	ELift Max Time	Maximum time that E-Lift can be active.	0–6000 sec	600

4. **Conduct a Preliminary E-Lift Test:**

   After all parameters have been configured in steps 2 and 3, the E-Lift function must be tested to ensure it can raise and lower a load properly. Conduct the following steps to verify the E-Lift function:

   a. Attach a test load to the hoist (rated capacity is recommended).

   b. Raise the load approximately one foot above the floor.

   c. Turn on the MFDI associated with E-Lift enable (H01-xx = 44).

   d. The keypad display title should flash and alternate between “Emergency Lift” and the present menu title, which confirms that the E-Lift function is active.

   e. Perform a series of raise and lower commands and observe the test load.

DANGER

If any undesired motions occur while E-Lift is active, immediately remove any RUN commands, turn off the E-Lift MFDI, and contact Magnetek.

   f. If steps 4.a through 4.e were successful, turn off the E-Lift MFDI and return the hoist to normal operations.

5.2.18 Digital Input (DI-A3, S4I, or S4IO) Option Card Setup

Selects the digital input controls for the DI-A3, S4I, or S4IO option cards. Additionally, these inputs can be used virtually via serial communications (C09-01 = 5) over Modbus RTU on the R+,R-,S+,S- interface board terminals or from the communication option cards.

Table 5-34: Digital Input Setup Parameter Settings

Parameter	Display	Function	Range	Default
C09-01	Digital In Sel	Provides additional programmable MFDI	0–2, 5	0
	0 Disabled	No additional MFDI are being used.		
	1 Enabled S4IO	S4IO or S4I card is installed		
	2 Enabled DI-A3	DI-A3 card is installed		
	5 Serial	Serial communication using C09-02–C09-17		

Parameter	Display	Terminal Designation			Range	Default
		DI-A3	S4I	S4IO		
C09-02*	DIO Terminal 1	0	I1	I1	00–FF	0F
C09-03*	DIO Terminal 2	1	I2	I2	00–FF	0F
C09-04*	DIO Terminal 3	2	I3	I3	00–FF	0F
C09-05*	DIO Terminal 4	3	I4	I4	00–FF	0F
C09-06*	DIO Terminal 5	4	-	-	00–FF	0F
C09-07*	DIO Terminal 6	5	-	-	00–FF	0F
C09-08*	DIO Terminal 7	6	-	-	00–FF	0F
C09-09*	DIO Terminal 8	7	-	-	00–FF	0F
C09-10*	DIO Terminal 9	8	-	-	00–FF	0F
C09-11*	DIO Terminal 10	9	-	-	00–FF	0F
C09-12*	DIO Terminal 11	A	-	-	00–FF	0F
C09-13*	DIO Terminal 12	B	-	-	00–FF	0F
C09-14*	DIO Terminal 13	C	-	-	00–FF	0F
C09-15*	DIO Terminal 14	D	-	-	00–FF	0F
C09-16*	DIO Terminal 15	E	-	-	00–FF	0F
C09-17*	DIO Terminal 16	F	-	-	00–FF	0F

* ***See Table 5-72 on page 142*** *for MFDI selections. The following functions will not operate: 20~20F, 31, 34, 35, 47, 80, or 81.*

5.2.19 Weight Measurement

Weight Measurement is used in hosting applications and can calculate a load weight based on motor torque at a constant speed. The VFD must pause the acceleration, wait for the torque to stabilize, and then perform the weight calculation based on the system tare values. The function takes a reading once per lift when C10-02 = 0 (Automatic), or it can be configured to take a reading at any speed with an MFDI when C10-02 = 1 (Manual). The calculated weight can be displayed on the keypad.

NOTE: *Weight Calculations will be more consistent when a weight measurement is calculated at the same speed every time. Example: C10-02 = 2, weight measurement is always calculated at C10-05 speed. It is important to note that after the load has been rigged, it should be suspended. When the next raise command is given, the hoist is now ready to calculate the weight of the load. The function only works in the Raising motion (Fwd). If extreme accuracy is required, a load cell should be used. The Weight Measurement function has an accuracy within 5% with VG+ VFDs and 10% with G+ VFDs of the hoist's rated capacity.*

Table 5-35: Weight Measurement Parameter Settings

Parameter	Display	Function	Range	Default
C10-01	Load Weight	Selects method for Load Weight measurements.	0–2	0
	0 Disabled			
	1 Auto - I/T	Enabled. Measures weight via current/torque.		
	2 Auto-Analog	Enabled Analog (Load Cell)		
C10-02	LW Start	Load Weight Measurement Trigger	0-2	0
	0 At C10-05	Weight is measured once when at the C10-05 speed.		
	1 By MFDI=5C	Weight is measured when the MFDI = 5C input is turned on.		
	2 Always @ C10-05	Weight is continuously measured when at the C10-05 speed.		
C10-03	LW Display Hold	Hold the displayed weight until next run command	0, 1	0
	0 Hold Display			
	1 Hold Disp 3 Sec			
C10-04*	LW Conversion	Multiplier of torque output calculation for display. Data is n0000, so multiplier is 10000; "n" is decimal point. Example: 24000 = 40.00	0–39999	0
C10-05	Test Freq	Frequency at which the Weight Measurement will occur.	0–E01-04 Hz	6
C10-06	Unit Displayed	Units of measurement being displayed on the keypad.	0–4	4
	0 Tons			
	1 Pounds			
	2 Kilograms			
	3 Metric Tons			
	4 Percent Load			
C10-07	Holding Time	Time for holding output frequency to measure weight.	0.0–2.55 sec	0.50
C10-09	Full Load Torque	Percentage of Torque output that is considered full load (VG+ only).	0.0–200.0%	100.0
C10-10	No Load Torque	Percentage of Torque output that is considered no load (VG+ only).	0.0–200.0%	20.0

5.2.19.1 System Tare and Calibration for Weight Measurement

1. Attach all of the under-hook attachments that are required during normal lifting (chains, slings, spreader beam, etc.). Remove the load from the bottom block. If there is a spreader beam or other lifting device that is attached to the bottom block, it may be left in place. If the lifting device changes, it should be removed for this procedure and the known weight of the lifting device used for each lift should be manually subtracted from weight that is calculated by the hoist VFD.
2. Run the unloaded hoist in the raise direction at the speed that the weight will be calculated at. The hoist will automatically pause at the speed programmed in parameter C10-05 (6 Hz is the default) while calculating the weight on the hook. This is the speed the hoist should be run at. An easy method would be to set the first speed point equal to C10-05 or, if using an analog speed reference, then program B02-02 (minimum speed) so that it is equal to C10-05.
3. Record the torque reading being displayed by the monitor parameter U01-09 (Torque Reference). Repeat this step several times and record the average “No Load Torque” in parameter C10-10 (No Load Torque).
4. Rig the FULL load that the hoist and weight measurement system will be expected to calculate. If the rigging used for the full load is different than that used in steps 2 and 3, it will need to be added to the known weight being lifted to obtain an accurate total weight at a later time.
5. Run the loaded hoist in the raise direction at the same speed as step 2.
6. Record the torque reading being displayed by the monitor parameter U01-09 (Torque Reference). Repeat this step several times and record the average “Full Load Torque” in parameter C10-09 (Full Load Torque).
7. The monitor parameter U01-29 should now be displaying a value when lifting a full load. This value is a raw number that could later be converted into a meaningful weight to be displayed on the keypad. For this procedure, it is not imperative that the number is converted to tons or pounds. Most importantly, it should read a value of zero or very close to zero when lifting no load and should be relatively consistent when lifting the same weight repeatedly.

5.2.19.2 Setting Up U01-29 to Display Actual Weight

1. Enter the weight of the FULL load into C10-04, not including chains, slings or spreader beams. Enter this number into the right-most four digits of C10-04.
2. Set the desired number of decimal places in the left most digit; see the examples below:

Full load = 40.0 tons → C10-04 = 10400, C10-06 = 0 (Displays as 40.0 in U01-29)

Full load = 30,000 lbs → C10-04 = 23000, C10-06 = 1 (Displays as 30.00 in U01-29)

5.2.19.3 Weight Measurement Design Considerations

1. The VFD’s weight measurement monitor, U01-29, will display a fixed value after the measurement occurs. That value will continue to be displayed until the next weight measurement is taken at the next run.
2. When displaying the VFD’s weight measurement feedback on an auxiliary display, such as a radio or PLC interface, the most accurate feedback can be obtained from the VFD with the use of the VFD’s RS-485 Memobus interface, similar to the architecture implemented with Magnetek’s RDSI systems. An analog interface can also be implemented, but it is important to understand the analog input and output resolution’s effect on feedback accuracy before implementation.

5.2.20 Slack Cable Detection

Slack Cable Detection is a VG+ hoist function that monitors motor torque, while running at a steady speed, and detects when the torque suddenly dips below a set level (C11-03). When a Slack Cable condition occurs, the output action is defined by C11-02.

Slack Cable Detection is not executed, unless both of the following conditions are true:

- *The output frequency is at a steady speed between C11-04 and C11-06.*
- *The Slack Cable Detection delay time is between C11-05 and C11-07.*

Setup Procedure:

- *Lower the hoist without load at a constant speed that the hoist would normally run at during operation. Record the torque reference (U01-09). Repeat this several times to ensure an accurate reading.*
- *Set C11-03 = [(U01-09)-2].*
- *Enable Slack Cable Detection by setting C11-01 = 1 or 2.*
- *Select output action when Slack Cable is detected by defining C11-02.*

Table 5-36: Slack Cable Detection Parameter Settings

Parameter	Display	Function	Range	Default
C11-01	Slack Cable	Determines whether Slack Cable Detection is enabled.	0–2	0
	0 Disabled			
	1 Enabled			
	2 Enabled by MFDI			
C11-02	Action at SLC	Action and allowable motion when Slack Cable is detected. RAISE command is permitted (MFDO = 28).	0–5	2
	0 No Action	Alarm Only		
	1 No Act/C3-04	Next LOWER command is at LL1 speed C03-04.		
	2 Decel/C3-04	Decel (by C03-05) to LL1 Speed C03-04. LOWER limited to C03-04.		
	3 Decel/No Opr	Decel (by C03-05) to LL1 Speed C03-04. LOWER not allowed.		
	4 Dec Stop/C3-04	Decel (by C03-06) to stop. LOWER limited to C03-04.		
	5 Dec Stop/No Opr	Decel (by C03-06) to stop. LOWER not allowed.		
C11-03	SLC Detect Torq	Percentage of Output Torque below which Slack Cable Detection is activated-as long as the motor speed is between C11-04 and C11-06, and the delay time is between C11-05 and C11-07.	-50–100%	30
C11-04	SLC Detect Spd 1	Frequency Output that is required for Slack Cable Detection to be activated. It corresponds to Slack Cable Detection Delay Time 1 (C11-05).	0–E01-04 Hz	2
C11-05	SLC Delay Time 1	Delay time before Slack Cable Detection can be activated. Corresponds to Slack Cable Detect Speed 1 (C11-04). Prevents false outputs.	0.00–2.55 sec	0.50
C11-06	SLC Detect Spd 2	Frequency Output below which Slack Cable Detection can be activated. It corresponds to Slack Cable Detection Delay Time 2 (C11-07).	0–E01-04 Hz	60
C11-07	SLC Delay Time 2	Delay time before Slack Cable Detection can be activated. It corresponds to Slack Cable Detection Speed 2 (C11-06). Prevents false outputs.	0.00–2.55 sec	0.10

5.2.21 Snap Shaft Detection

Snap Shaft Detection is designed to detect a broken or loose coupling by monitoring for a speed deviation between rotating shafts on a drive train. Ideally, mount one encoder on the motor, which drives the gearbox and one encoder on the last rotating part of the drive train, usually near the drum if used for a hoist motion. It is required that a second brake be mounted on the drum shaft. The encoders are wired into two separate PG-X3 encoder option cards, with channel 1 (CN5-C) being the high speed shaft input and channel 2 (CN5-B) being the low speed shaft input. The VFD will use channel 1 as the flux vector feedback. The software monitors and compares the speed of both encoders. A gear ratio is entered into parameters C11-12 and C11-13. In an example, if the gearbox ratio is 46.34 : 1, then you would program C11-12 to 4634 and C11-13 to 100. If the difference in speed is greater than the value in C11-10 for a period longer than the setting of C11-11, a “Snap Shaft” is displayed on the keypad display and the VFD will perform the action at snap (C11-09).

Parameter U01-30 should be monitored during operation to obtain the exact speed difference in Hz between the two shafts. The low speed shaft speed is normalized internally by multiplying the speed of the gear ratio. The value of C11-12 should be adjusted at start up such that U01-30 approaches 0.0.

Table 5-37: Snap Shaft Parameter Settings

Parameter	Display	Function	Range	Default
C11-08	Snap Shaft *0 Disabled* *1 Enabled*	Determines if snap shaft detection is enabled.	0, 1	0
C11-09	Action at Snap *0 Brake/Fault Out* *1 Alarm Only*	Action taken at detection. A setting of 0 will set the brake and display a fault. With a setting of 1, the VFD will continue to run.	0, 1	0
C11-10	Delta Speed	Difference in speeds of the two shafts normalized by the gear ratio.	0.0–E01-04 Hz	1.0
C11-11	Delay Time	Gear backlash time in milliseconds	0–2000 ms	250
C11-12	Gear Ratio Num	Gear ratio numerator	1–65535	10000
C11-13	Gear Ratio Den	Gear ratio denominator	1–65535	10000

5.2.22 Brake Delay Timers

The Brake Delay Timers are used in trolley and bridge applications to reduce the mechanical brake wear when the operator positions a load. This function is available only in traverse mode and B03-03 must be set to 4 (Decel With Timer).

Table 5-38: Brake Delay Timers Parameter Settings

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

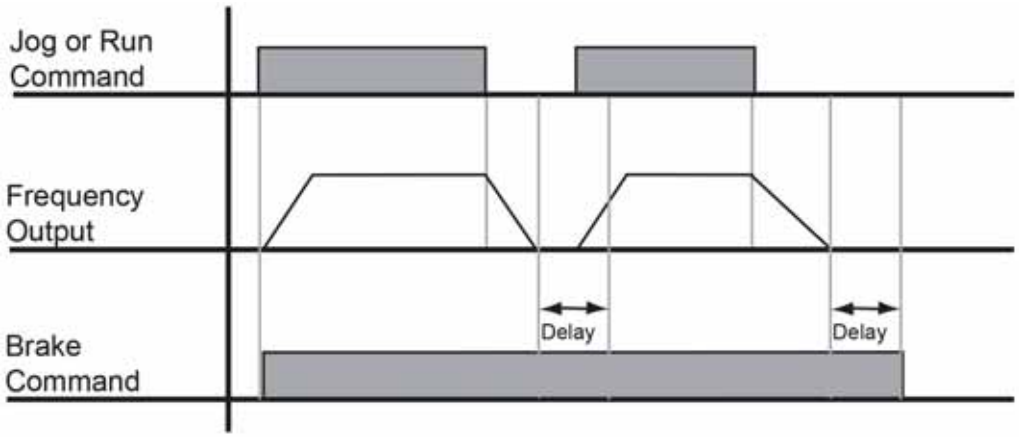


Figure 5-15: Brake Delay Timers

NOTE: *The Jog control digital input is enabled by setting H01-xx = 15 or 16.*

5.2.23 Timer Function

- The timer function is enabled when the timer function MFDI (H01-0x = 43) and the timer function MFDO (H02-0x = 12) are both set.
- The input and output 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 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 OFF-Delay Time), the timer function output turns **OFF**.

Table 5-39: Timer Function Parameter Settings

Parameter	Display	Function	Range	Default
C12-03	Delay-ON timer	Timer function On-Delay time.	0.0–3000.0 sec	0.0
C12-04	Delay-OFF timer	Timer function Off-Delay time.	0.0–3000.0 sec	0.0

5.2.24 Maintenance Timer

The Maintenance Timer function is based on the VFD run time and will alert an operator, for example, when the bearings need to be greased. It consists of a digital output (H02-0x = 37) that becomes active when the total running time has exceeded the amount of time (in hours) programmed in parameter C12-05 and the frequency reference will be multiplied by a gain (C12-06) to slow the motion down until the bearings have been greased. An alarm will be posted on the Keypad stating “Maintenance Required”. Once the bearings have been greased, the output and alarm message can be reset two ways. One method is through a digital input programmed for Maintenance Reset (H01-xx = 5A) and the second method is by pressing the Mode/Service (Local/Remote) button three consecutive times with no more than 2 seconds between presses. Press enter to reset the timer. A message will then appear on the keypad stating that the timer has been reset. The digital output will turn off at this time. When C12-05 = 0, the function is disabled.

Table 5-40: Maintenance Timer Parameter Settings

Parameter	Display	Function	Range	Default
C12-05	Maintenance Tmr	Maintenance Timer Alarm Level	0–32767 Hr	0
C12-06	Maintenance Gain	Speed Reference Gain	0.00–1.00	0.50

5.2.25 Load Share

See Section 5.2.6 on page 83 for more information on Load Share.

Table 5-41: Load Share Parameter Settings

Parameter	Display	Function	Range	Default
C12-07	LdShare Flt Time	The amount of time to wait for Follower VFD to give a Ready Signal, when in Load Share, before triggering a fault.	0.0–25.5 sec	1.5

5.2.26 Inch Control

The Inch Control function can be enabled by programming 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 to enable motion of the motor.

Table 5-42: Inch Control Parameter Settings

Parameter	Display	Function	Range	Default
C13-01	Inch Run Time	Inching Control run time	0.00–2.55 sec	1.00
C13-02	Repeat Delay Tim	Inching Control repeat delay time	0.00–2.55 sec	1.00

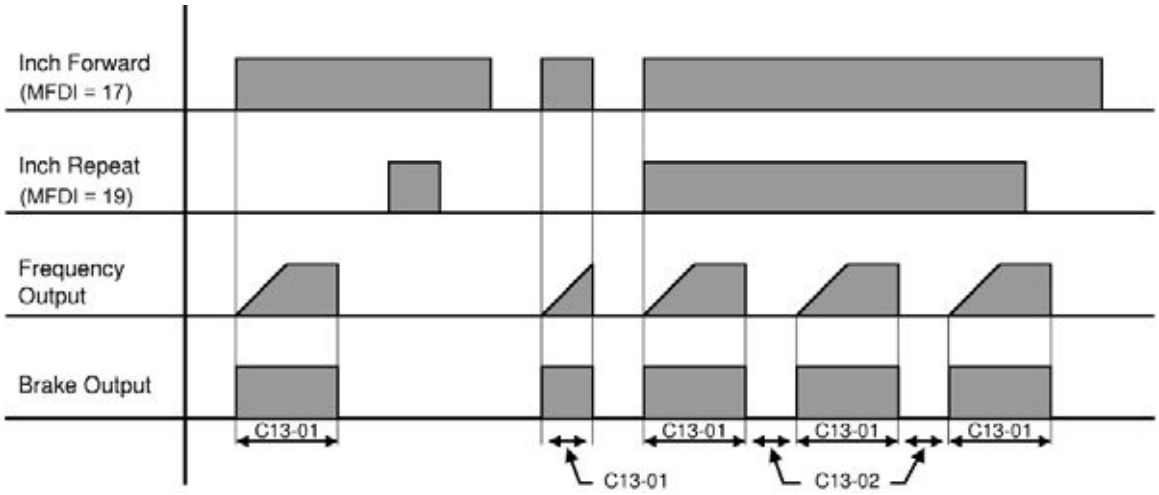


Figure 5-16: Inch Run and Inch Repeat

5.2.27 Index Control

Index Control is an IMPULSE•VG+ Series 4 feature that allows for precise movement of the motor each time a run command is applied and the Index function is enabled by a digital input (H01-xx = 60).

The total distance (Pulses) the motor will index is determined by the following equation:

$$\textbf{Total distance}\ (\text{Pulses}) = [\textbf{F01-01}(^{\text{Pulse}}/_{\text{Rev}}) * \textbf{C13-04}(\text{Revs})] + \textbf{C13-05}(\text{Pulses})$$

When Index is turned ON, it can be programmed to repeat as long as the Run command is enabled and by setting the Index Repeat Delay (C13-06) greater than 0.00 seconds. The Index will repeat after the Index Repeat Delay (C13-06) time has expired. Once the motor completes the Index, the brake will either set or remain in Load Float depending on the braking sequence described below.

When an Index is complete, a digital output (H02-xx = 34) will turn ON until one of the following is true:

- another directional run input is received,
- the repeat delay time has expired and the movement is repeating, or
- the Index Function is disabled.

When Applied in Traverse (A01-03 = 0)

When Index is turned ON, Index Brake Control (C13-12) controls the action of the brake. The following describes the brake control for each setting:

Open on Index Command (C13-12 = 0)

When Index is turned ON, the brake will release and hold the position in Load Float until a run command is applied. The brake will set and resume normal operation when the Index input is turned OFF.

Open on Each Run (C13-12 = 1)

When Index is turned ON, the brake will release after each run command is applied, then Index the motor. The brake will set after the Index or Index Repeat is complete, or the run command is removed.

Latch Open on Run (C13-12 = 2)

When Index is turned ON, the brake will release when a run command is applied, and the VFD will Index the motor and will hold position in Load Float after Index is complete. It will remain in Load Float until the next run command or the Index input is turned OFF. The brake will set and resume normal operation when the Index input is turned OFF.

NOTE: *For best performance, enable Index after brake release. Not recommended for double A4 applications.*

When Applied in NLB Hoist (A01-03 = 2)

When Index Brake Control C13-12 = 2, the action of the brake is controlled by the No-Load Brake sequence. The Index function can be enabled at any time during operation.

At Stop

If Index is turned ON while the crane is stopped, the brake will release when a run command is applied. The VFD will Index the motor and will hold position in Load Float after Index is complete. It will remain in Load Float until the next run command or the Index input is turned OFF. When Index is turned OFF, the brake will set according to the No-Load Brake stop sequence.

During Run

If the motor is in motion when Index is turned ON, the VFD will decelerate to zero and hold the position in Load Float. After a Run command is applied, the VFD will Index the load and hold the position in Load Float after the Index is complete. The brake is set according to the No-Load Brake stop sequence when Index is turned OFF.

NOTE: *For best performance, enable Index after brake release. Not recommended for double A4 applications.*

Table 5-43: Index Control Parameter Settings

Parameter	Display	Function	Range	Default
C13-03	Index Run Ref	Index frequency reference (MFDI = 60)	0.01–60.00 Hz	0.10
C13-04	Index Revs	Index motor revolutions (F01-01 PPR = 1 Rev.)	0–65535 rev	0
C13-05	Index Count	Index fractional motor revolution. 4 pulses = 1 ppr of F01-01	0–65535 pulses	100
C13-06	Index Rpt Delay	Index Repeat Delay Time (Setting of 0.00 disables Index Repeat).	0.00–60.00 sec	0.00
C13-07	Index Complete	Index Complete Width (Quadrupled) for MFDO = 34. Upper Limit range is dependent on the following conditions: 32767 or (C13-04 *4 * encoder PPR + C13-05 -1), whichever is smaller. 1 pulse = 1 ppr of F01-01	0–32767	10
C13-08	Index Zsv Gain	Index Zero Servo Gain.	0–100	10
C13-09	Index ASR P Gain	Index ASR P Gain.	0.00–300.00	30.00
C13-10	Index ASR I Time	Index ASR Integral Time.	0.000–10.000 sec	0.200
C13-11	Acc/Dec Gain	Index Accel/Decel Rate Gain.	0.0–5.0	1.0
C13-12	Index Brake Ctrl	Configures brake behavior when indexing (traverse only).	Traverse: 0–2 NLB: 0, 2	NLB: 2 else: 0
	0 Open on Index	Brake will open on Index Cmd and remain open until Index Cmd is OFF. VFD is in Load Float between runs.		
	1 Open on each Run	Brake will open on Run cmd and close when run is finished, or after Load Float in NLB.		
	2 Ltch Open on Run	Brake will open on Run cmd and remain open with VFD in Load Float until Index is turned off.		

5.3 Tuning

- D01 DC Injection Braking
- D02 Motor Slip Compensation
- D03 Torque Compensation
- D04 Automatic Speed Regulator (ASR) Tuning
- D05 Torque Control
- D08 Dwell
- D09 S-Curve Acceleration/Deceleration
- D10 Carrier Frequency
- D11 Hunting Prevention

5.3.1 DC Injection Braking

With decel to stop enabled (B03-03 = 0), upon removal of the run command, the motor will decelerate according to the Decel Time (B05-02), until output frequency reaches the DC Injection Braking Start Frequency (D01-01). Then the frequency 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.

Table 5-44: DC Injection Braking Parameter Settings

Parameter	Display	Function	Range	Default
D01-01	DCInj Start Freq	DC Injection Braking Frequency Start	0.0–10.0 Hz	0.5
D01-02*	DCInj Current	DC Injection Braking current as a percentage of the VFD rated current.	0–100%	50
D01-03	DCInj Time@Start	DC Injection Braking Time	0.00–10.00 sec	0.00
D01-04	DCInj Time@Stop	DC Injection Braking Time at Stop	0.00–10.00 sec	0.05

** Not available in the Flux Vector control method (A01-02 = 3).*

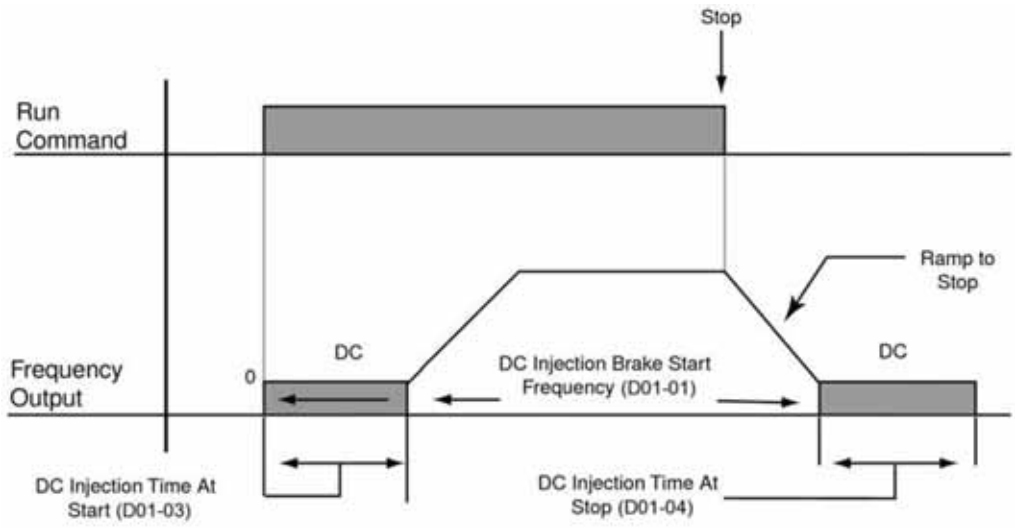


Figure 5-17: DC Injection Braking Sequence

5.3.2 Motor 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.

Table 5-45: Motor Slip Compensation Parameter Settings

Parameter	Display	Function	Range	Default
D02-01	Slip Comp Gain	Slip compensation multiplier.	0.0–2.5	V/f: 0.0 OLV: 1.0 FLV: 1.0
D02-02	Slip Comp Time	Adjusts the slip compensation function delay time (G+ only).	0–10000 ms	V/f: 2000 OLV: 200
D02-03	Slip Comp Limit	Upper limit for the slip compensation as a percentage of motor rated slip E02-02 (G+ only).	0–250%	200
D02-04	Slip Comp Regen *0 Disabled* *1 Enabled >6 Hz* *2 Enabled >2 Hz*	Disabled slip compensation during regeneration (G+ only).	0–2	0
D02-05	Output V Lim Sel *0 Disabled* *1 Enabled*	Automatically reduces motor flux when the output voltage saturates.	0, 1	0
D02-13*	Output V Lim Sta	Output Voltage Limit Operation Start Level	70.0–90.0%	85.0
D02-14*	Output V Lim Max	Maximum Output Voltage Limit Level	85.0–100.0%	90.0
D02-15*	Output V Lim Lev	Output Voltage Limit Level	30.0–100.0%	90.0

** Available only for 4810 and 41090 VG+ models.*

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 VFD automatically adjusts the voltage during constant-speed operation as well as during acceleration.

The required torque is calculated by the VFD. This ensures smooth 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 100 feet (30.5 meters) 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 faults due to motor overexcitation, and/or
- Motor overheat or excessive vibration.

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

Table 5-46: Torque Compensation Parameter Settings

Parameter	Display	Function	Range	Default
D03-01	Torq Comp Gain	Gain for the automatic torque (voltage) boost function and helps to produce better starting torque.	0.00–2.50	1.0*
D03-02	Torq Comp Time	Torque compensation delay time.	0–60000 ms	V/f: 200 OLV: 20
D03-03	F TorqCmp@Start	Torque compensation at forward start as a percentage of motor torque.	0.0–200.0%	0.0**
D03-04	R TorqCmp@Start	Torque compensation at reverse start as a percentage of motor torque.	-200.0–0.0%	0.0**
D03-05	TorqCmp Delay T	Time constant for torque compensation at forward start and reverse start (D03-03 and D03-04).	0–200 ms	10**
D03-06	Start Torq Time	Torque compensation delay time 2.	0–10000 ms	150**

** Default setting is determined by parameter A01-02, Control Method Setting.*

*** Only available in Open Loop Vector control method (A01-02 = 2).*

5.3.4 Automatic Speed Regulator (ASR) Tuning

The ASR controls the motor speed in the Flux Vector control method and adjusts the output torque reference to minimize the difference between frequency reference and actual motor speed.

The figure below illustrates ASR functionality:

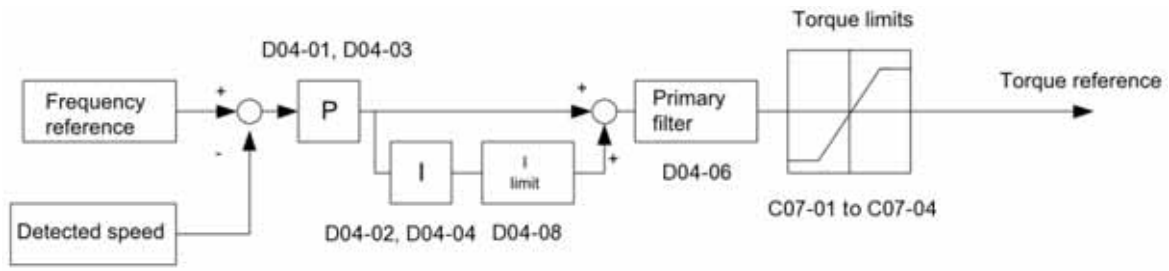


Figure 5-18: Speed Control Block Diagram for Flux Vector

Perform Auto-Tuning and set up all motor data correctly prior to adjusting ASR parameters.

Generally when tuning the ASR, optimize the ASR gain before adjusting the integral time settings. Always make adjustments with the load connected to the motor.

5.3.4.1 Adjusting the ASR Parameters in FLV

The VFD is preset to use ASR settings D04-01/D04-02 over the entire speed range in Flux Vector. If required by the application, a second set of ASR parameters (D04-03/D04-04) can be automatically activated depending on the motor speed or by using a digital input.

Perform the following steps for adjusting ASR parameters:

1. Run the motor at zero speed and increase the ASR gain (D04-01) as much as possible without oscillation.
2. Run the motor at zero speed and decrease the ASR integral time (D04-02) as much as possible without oscillation.
3. Run at the normal operating speed. Check for over/undershoot when changing speed and for any oscillation.
4. If problems occur in step 3, increase the integral time and reduce the gain.

Alternatively, use different ASR settings for high and low speed. Set the values from step 1 and 2 to parameters D04-03 and D04-04, then set an ASR switching frequency in parameter D04-07. Run the motor at a speed higher than D04-07 and repeat step 3 while adjusting D04-01 and D04-02.

5.3.4.2 Solving Problems During ASR Setup

Use ***Table 5-47*** when making adjustments to ASR.

Table 5-47: ASR Setup Problems and Corrective Actions

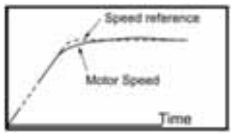
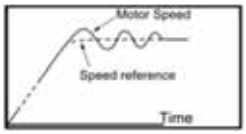
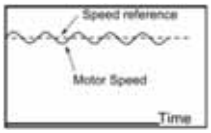
Problem		Possible Solutions
Slow response to speed changes or speed deviation lasts for too long		• Increase the ASR gain. • Decrease the integral time.
Overshoot or undershoot at the end of acceleration or deceleration		• Decrease the ASR gain. • Increase the integral time.
Vibration and oscillation occur at constant speed		• Decrease the ASR gain. • Increase the integral time. • Increase the ASR delay time (D04-06).
Oscillation at low speed and response is too slow at high speed (or vice versa)	-	• FLV: Use D04-01, D04-02, D04-03, and D04-04 to define optimal ASR settings for high and low speed. Use D04-07 to define a switching frequency.

Table 5-48: ASR Tuning Parameter Settings

Parameter	Display	Function	Range	Default
D04-01	ASR P Gain 1	Proportional gain of the speed control loop (ASR).	0.00–300.00	20.00
D04-02	ASR I Time 1	Integral time of the speed control loop (ASR).	0.000–10.000 sec	0.500
D04-03	ASR P Gain 2	Proportional gain 2 of the speed control loop (ASR).	0.00–300.00	20.00
D04-04	ASR I Time 2	Integral time 2 of the speed control loop (ASR).	0.000–10.000 sec	0.500
D04-06	ASR Delay Time	ASR Output Primary Delay Time.	0.000–0.500 sec	0.004
D04-07	ASR Gain SW Freq	ASR Gain Switching Frequency.	0.0–150.0 Hz	0.0
D04-08	ASR I Limit	ASR Integral Limit.	0–400%	400
D04-36	NLB Strt ASR I	Integral Time at NLB start	0.000–30.000	0.100
D04-37	NLB Strt ASR Dly	ASR Gain Delay at NLB start	0.00–2.55	0.50

These parameter settings will function differently depending on the control method.

NOTE: *Mechanical backlash in an application can cause secondary current (I_2) reference variations in the motor's rotor. This condition can prevent the desired adjustment of ASR parameters. The output delay time constant is used to increase the stability of the system allowing a wider setting range of ASR parameters.*

5.3.4.3 Flux Vector (FLV)

Parameters D04-03 and D04-04 define the ASR proportional gain an integral time at zero speed. The settings in D04-01 and D04-02 are used at speeds above the setting in D04-07. D04-07 is set by default to 0.0 so D04-01 and D04-02 are used by default over the entire speed range. However, changing D04-07 creates two levels of ASR control settings, as shown in ***Figure 5-19*** below.

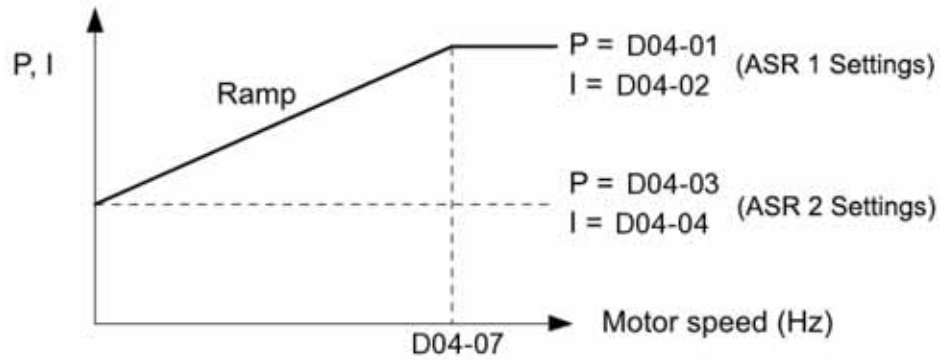


Figure 5-19: Low-speed and High-speed Gain Settings

The switching frequency (D04-07) can also be controlled with a digital input programmed to “ASR gain switch” (H01-xx = 37). When the digital input is OFF, the VFD uses the ASR gain level set by the pattern in ***Figure 5-19***. When the digital input is ON, D04-03 is used. The integral time set to D04-02 is used to change linearly between these settings, as shown in ***Figure 5-20***. The ASR gain enabled by a digital input overrides the switching frequency set to D04-07.

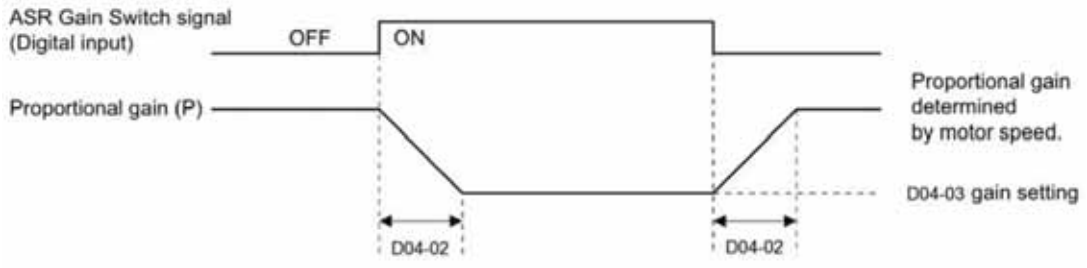


Figure 5-20: ASR Proportional Gain Switch

5.3.5 Torque Control

Please consult factory for application assistance regarding torque control. Typically, torque control should not be applied on a hoist.

This function is used to avoid excessive changes in torque, which may be caused by abnormal resonance when the torque reference changes rapidly.

Table 5-49: Torque Control Parameter Settings

Parameter	Display	Function	Range	Default
D05-01	Torq Control Sel	Selects between Speed or Torque Control.	0, 1	0
	0 Speed Control	Speed Control enabled with torque limit.		
	*1 Torque Control**	Torque control enabled with speed limit.		
D05-02	Torque Ref Filter	Primary delay time for Torque Reference Input.	0–1000 ms	0
D05-03	Speed Limit Sel	Speed Limit Selection (***Figure 5-21 on page 120***)	1, 2	2
	1 Fref Limit	Limit set by the frequency reference in B01-01.		
	2 Speed Limit Sel	Limit set by D05-04.		
D05-04	Speed Lmt Value	Speed Limit Value (% of E01-04)	-120–120%	105
D05-05	Speed Lmt Bias	Speed Limit Bias (% of E01-04)	0–120%	10
D05-06	Ref Hold Time	Speed/Torque Switching Timer	0–1000 ms	0
D05-08	Drctn SpdLmt Sel	Determines if the speed limit bias is applied.	0, 1	1
	0 Disabled			
	1 Enabled			

** Cannot set D05-01 = 1 for NLB Hoist; use Load Share MFDI (H01-xx = 66) instead.*

5.3.5.1 Speed/Torque Control Switching

Speed control or torque control is used in traverse applications and can be selected “on the fly” with the VG+ VFD by using the digital input speed/torque control selection (H01-xx = 34).

Table 5-50: Speed/Torque Control Switch Parameters

Terminal	Parameter	Setting	Description
S1 - S8	H01-01–H01-08	34	Speed/torque control selection
A1	B03-01	1	Frequency reference selection (terminals A1, A2, or A3)
	D05-03	1	Speed limit selection (terminals A1, A2, or A3)
A3/A2	H03-06/H03-10	13	Torque reference/torque limit

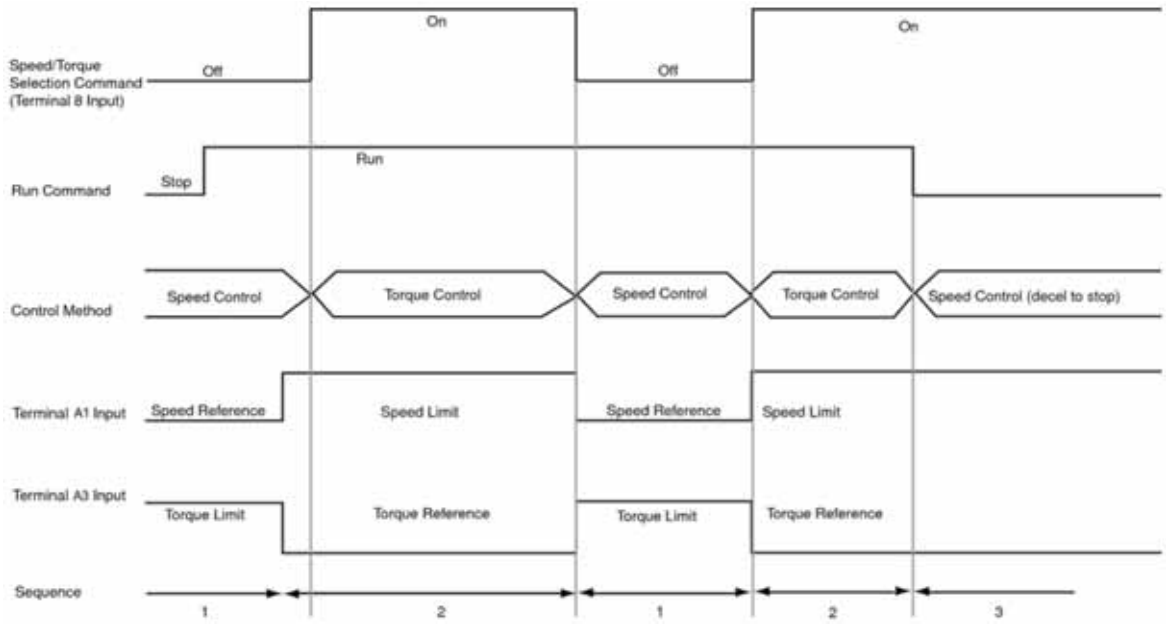


Figure 5-21: Speed/Torque Control Selection Timing Diagram

1. When the speed/torque control selection is OFF, speed control is activated.
   - Speed reference during speed control depends on the frequency reference selection (B03-01) setting. To use terminal A1, A2, or A3 as the master frequency reference, set B03-01 = 1.
   - Torque limit during speed control is the smaller of the absolute value of terminal A2 or A3 torque limit, or the values set in the torque limit parameters (C07-01 to C07-04) is used as the torque limit.
   - When a stop command is given during speed control, speed control is maintained as the motor decelerates to stop and the smaller of the absolute value of the terminal A2 or A3 torque limit, or the values set in the torque limit parameters (C07-01 to C07-04) is used as the torque limit.
2. When the speed/torque control selection is ON, torque control is activated.
   - Speed limit during torque control is the master frequency reference at terminal A1, A2, or A3 when speed limit selection (D05-03 = 1), and is the speed limit value (D05-04) when D05-03 = 2, regardless of the frequency reference selection (B03-01) setting.
   - During torque control, the terminal A2 or A3 analog input value becomes the torque reference.
3. By giving a stop command during torque control, operation changes to speed control automatically, and the motor decelerates to stop. The torque limit during deceleration to stop becomes the values set in the torque limit parameters (C07-01 to C07-04).

5.3.6 Dwell

The Dwell function is used to temporarily hold the output frequency at a set reference for a set time. Enable by setting H01-xx = 65.

Table 5-51: Dwell Function Parameter Settings

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

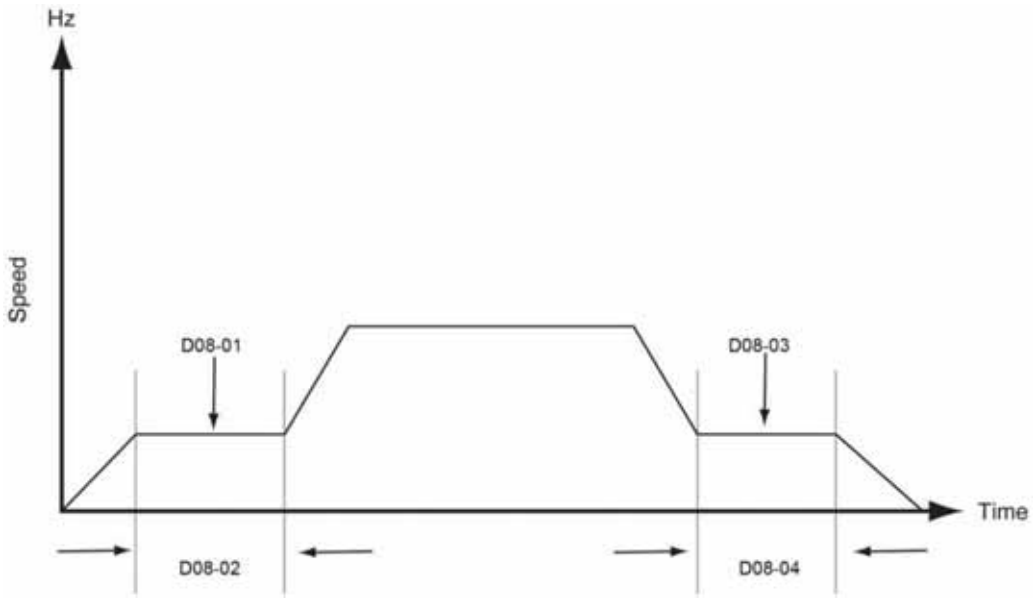


Figure 5-22: Dwell Function

5.3.7 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.

Table 5-52: S-Curve Acceleration/Deceleration Parameter Settings

Parameter	Display	Function	Range	Default
D09-01	SCrv Acc @ Start	S-Curve at the beginning of the Accel time.	0.00–10.00 sec	0.50*
D09-02	SCrv Acc @ End	S-Curve at the end of the Accel time.	0.00–10.00 sec	0.50*
D09-03	SCrv Dec @ Start	S-Curve at the beginning of the Decel time.	0.00–10.00 sec	0.50*
D09-04	SCrv Dec @ End	S-Curve at the end of the Decel time.	0.00–10.00 sec	0.20

** Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

Time to accelerate from the minimum frequency to the maximum frequency (total acceleration) is:

$$\text{Total Acceleration} = \text{B05-01} + \frac{\text{D09-01} + \text{D09-02}}{2}$$

Time to decelerate from the maximum frequency to the minimum frequency (total deceleration) is:

$$\text{Total Deceleration} = \text{B05-02} + \frac{\text{D09-03} + \text{D09-04}}{2}$$

CAUTION

Acceleration and deceleration times will be extended.

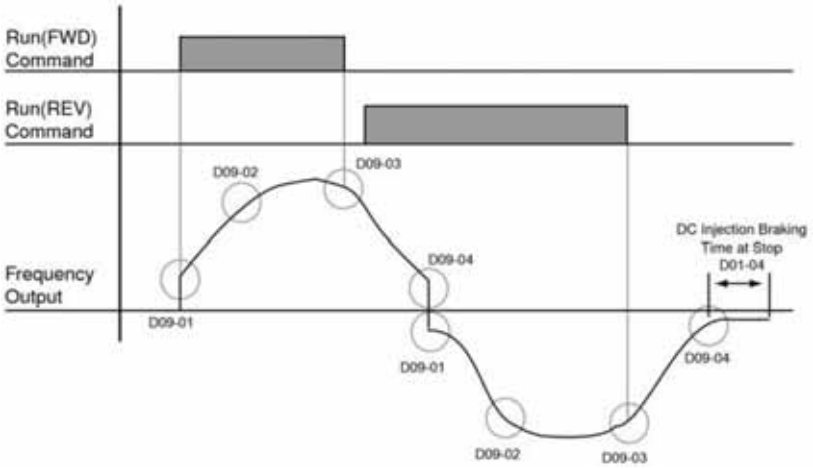


Figure 5-23: S-Curve Characteristic-FWD/REV Operation

5.3.8 Carrier Frequency

The Carrier Frequency group allows modification of the VFD's output carrier frequency and overload level.

CAUTION

Consult Magnetek for VFD derating before modifying the D10 group parameters. Failure to do so may result in equipment damage.

Table 5-53: Carrier Frequency Parameter Settings

Parameter	Display	Function	Range	Default
D10-01	Heavy/NormalDuty	Duty rating, which determines the output and overload rating	0, 1	0
	0 Heavy Duty	150% of rated output for 1 minute		
	1 Normal Duty	120% of rated output for 1 minute		
D10-02	CarrierFreq Sel	Carrier Frequency Selection	1–9, A, F	1
	1 Fc=2.0kHz			
	2 Fc=5.0kHz			
	3 Fc=8.0kHz			
	4 Fc=10.0kHz			
	5 Fc=12.5kHz			
	6 Fc=15.0kHz			
	*7 Swing PWM1**			
	*8 Swing PWM2**			
	*9 Swing PWM3**			
	*A Swing PWM4**			
	F User Defined	Determined by D10-03 through D10-05		
D10-03	CarrierFreq Max	Carrier frequency upper limit.	1.0–15.0 kHz	2.0
D10-04	CarrierFreq Min	Carrier frequency lower limit (V/f only).	1.0–15.0 kHz	2.0
D10-05	CarrierFreq Gain	Carrier Frequency Gain (V/f only).	0–99	0

* *Not available in Flux Vector (A01-02 = 3)*

5.3.9 Hunting Prevention

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

Increase the value of D11-02 when hunting is present while driving a light load. Decrease the value of D11-02 when the motor vibrates or stalls while driving a heavy load.

Table 5-54: Hunting Prevention Parameter Settings

Parameter	Display	Function	Range	Default
D11-01	Hunt Prev Select *0 Disabled* *1 Enabled*	Hunt Prevention (V/f only)	0, 1	1
D11-02	Hunt Prev Gain	Hunting Prevention Gain (V/f only)	0.00–2.50	1.00
D11-03	Hunt Prev Time	Hunting Prevention Time Constant (V/f only)	0–500ms	10
D11-05	Rev Hunt Prev Gn	Reverse Hunting Prevention Gain (V/f only)	0.00–2.50	0.00

5.4 Motor Parameters

- E01 V/f Pattern
- E02 Motor Setup
- E03 Test Mode Configuration

5.4.1 Voltage/Frequency (V/f) Pattern

WARNING

VFD input voltage (not motor voltage) must be set in E01-01 for the protective features of the VFD to function properly. Failure to do so may result in equipment damage and/or death or personal injury.

Table 5-55: V/f Pattern Parameter Settings

Parameter	Display	Function	Range	Default
E01-01	Input Voltage	VFD input voltage used as the max and base voltage by preset V/f patterns (E01-03 = 0 to E). It also adjusts the levels of protective features (e.g., Overvoltage, braking transistor turn-on, stall prevention, etc).	230V: 155–255 VAC	230
			460V: 310–510 VAC	460
			575V: 446–733 VAC	575

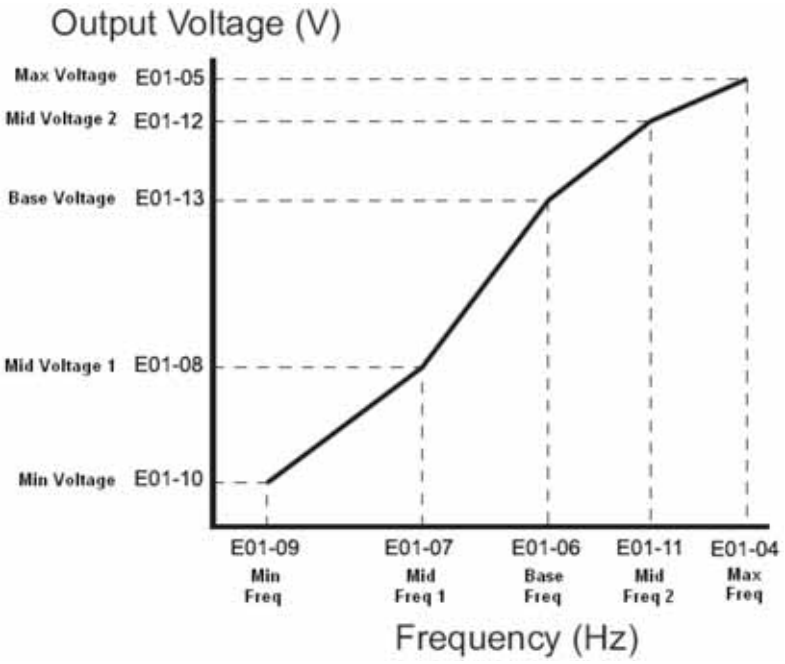


Figure 5-24: Output Voltage

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

E01-05 ≥ E01-12 ≥ E01-13 ≥ E01-08 ≥ E01-10

E01-04 ≥ E01-11 ≥ E01-06 ≥ E01-07 ≥ E01-09

NOTE: *In Flux Vector, E01-03 is hidden, and the V/f pattern values will be adjusted by the Auto-Tuning function.*

Table 5-56: DC Bus Regulation

VFD Voltage	Overvoltage Level		Braking Transistor	Stall Level
	Fault	Reset	Turn-On	
230	410 VDC	400 VDC	394 VDC	380 VDC
460	820 VDC	800 VDC	788 VDC	760 VDC
575	1178 VDC	990 VDC	1132 VDC	960 VDC

Parameter E01-01 performs the above mentioned function in all three control methods.

Table 5-57: V/f Pattern Parameter Settings - continued

Parameter	Display	Function	Range	Default
E01-03	V/f Selection	V/f Pattern Selection	V/f: 0–9, A–F, FF	*
	0 60 Hz, Level 0	(Default for A01-03 = 0 (Traverse), A01-03 = 4 (Braketronic))	OLV: F, FF	
	1 60 Hz, Level 1			
	2 60 Hz, Level 2			
	3 60 Hz, Level 3			
	4 60 Hz, Level 4	(Default for A01-03 = 1 (Std Hoist))		
	5 60 Hz, Level 5			
	6 60 Hz, Level 6			
	7 60 Hz, Level 7			
	8 60 Hz, Level 8			
	9 50 Hz, Level 0			
	A 50 Hz, Level 2			
	B 50 Hz, Level 4			
	C 50 Hz, Level 6			
	D 75 Hz, Level 4			
	E 90 Hz, Level 4			
	F Custom V/f	Default for A01-03 = 2 (NLB Hoist), E01-04 through E01-13 define the V/f pattern.		
	FF Custom w/o limit	Custom with no lower limits on E01-xx.		
E01-04	Max Frequency	Maximum Output Frequency	20.0–150.0 Hz	60.0
E01-05	Max Voltage	Maximum Output Voltage	230 V: 0.0–255.0 460 V: 0.0–510.0 575 V: 0.0–733.1	Determined by O02-04
E01-06	Base Frequency	Motor Base Frequency	0.0–150.0 Hz	60.0
E01-07	Mid Frequency A	Midpoint Output Frequency A	0.0–150.0 Hz	Determined by E01-03
E01-08	Mid Voltage A	Midpoint Output Voltage A	230 V: 0.0–255.0 460 V: 0.0–510.0 575 V: 0.0–733.1	Determined by E01-03
E01-09	Min Frequency	Minimum Output Frequency	0.0–150.0 Hz	Determined by E01-03

Parameter	Display	Function	Range	Default
E01-10	Min Voltage	Minimum Output Voltage	230 V: 0.0–255.0 460 V: 0.0–510.0 575 V: 0.0–733.1	Determined by E01-03
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	230 V: 0.0–255.0 460 V: 0.0–510.0 575 V: 0.0–733.1	0.0
E01-13	Base Voltage	Motor Base Voltage	230 V: 0.0–255.0 460 V: 0.0–510.0 575 V: 0.0–733.1	0.0

** Initial value determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

***NOTE:** Disable E01-11, E01-12, or E01-13 with a setting of 0.0.*

Table 5-58: Voltage/Frequency (V/f) Pattern Options (230 V)

	E01-04	E01-05	E01-06	E01-07	E01-08	E01-09	E01-10	E01-11	E01-12	E01-13
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	75.00	200.0	50.0	25	17.0	1.1	11.0	0.0	0.0	0.0
E	90.00	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	50.00	200.0	50.0	2.5	12.0	0.5	2.5	0.0	0.0	0.0

** Default for O02-09 = 1 (US) and not Std Hoist*

**1 Default for O02-09 = 1 (US) and Std Hoist*

**2 Default for O02-09 = 2 (Euro) and not Std Hoist*

**3 Default for O02-09 = 2 (Euro) and Std Hoist*

Table 5-59: Voltage/Frequency (V/f) Pattern Options (460 V)

	E01-04	E01-05	E01-06	E01-07	E01-08	E01-09	E01-10	E01-11	E01-12	E01-13
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	39.1	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
6	60.0	460.0	60.0	3.0	43.8	1.3	30.0	0.0	0.0	0.0
7	60.0	460.0	60.0	3.0	46.0	1.3	32.2	0.0	0.0	0.0
8	60.0	460.0	60.0	3.0	48.4	1.3	34.6	0.0	0.0	0.0
9*[2]	50.0	400.0	50.0	2.5	26.1	1.1	14.1	0.0	0.0	0.0
A	50.0	400.0	50.0	2.5	30.1	1.1	18.1	0.0	0.0	0.0
B*[3]	50.0	400.0	50.0	2.5	34.1	1.1	22.1	0.0	0.0	0.0
C	50.0	400.0	50.0	2.5	38.1	1.1	26.1	0.0	0.0	0.0
D	75.00	400.0	50.0	2.5	34.1	1.1	22.1	0.0	0.0	0.0
E	90.00	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	400.0	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	50.00	400.0	50.0	2.5	24.0	0.5	5.0	0.0	0.0	0.0

** Default for O02-09 = 1 (US) and not Std Hoist*

**1 Default for O02-09 = 1 (US) and Std Hoist*

**2 Default for O02-09 = 2 (Euro) and not Std Hoist*

**3 Default for O02-09 = 2 (Euro) and Std Hoist*

Table 5-60: Voltage/Frequency (V/f) Pattern Options (575 V)

	E01-04	E01-05	E01-06	E01-07	E01-08	E01-09	E01-10	E01-11	E01-12	E01-13
E01-03	**Hz**	**VAC**	**Hz**	**Hz**	**VAC**	**Hz**	**VAC**	**Hz**	**VAC**	**VAC**
0*	60.0	575.0	60.0	3.0	37.5	1.3	20.3	0.0	0.0	0.0
1	60.0	575.0	60.0	3.0	40.3	1.3	23.0	0.0	0.0	0.0
2	60.0	575.0	60.0	3.0	43.3	1.3	26.0	0.0	0.0	0.0
3	60.0	575.0	60.0	3.0	46.0	1.3	28.8	0.0	0.0	0.0
4*[1]	60.0	575.0	60.0	3.0	49.0	1.3	31.8	0.0	0.0	0.0
5	60.0	575.0	60.0	3.0	51.8	1.3	34.5	0.0	0.0	0.0
6	60.0	575.0	60.0	3.0	54.8	1.3	37.5	0.0	0.0	0.0
7	60.0	575.0	60.0	3.0	57.5	1.3	40.3	0.0	0.0	0.0
8	60.0	575.0	60.0	3.0	60.5	1.3	43.3	0.0	0.0	0.0
9*[2]	50.0	500.0	50.0	2.5	32.6	1.1	17.7	0.0	0.0	0.0
A	50.0	500.0	50.0	2.5	37.7	1.1	22.6	0.0	0.0	0.0
B*[3]	50.0	500.0	50.0	2.5	42.6	1.1	27.7	0.0	0.0	0.0
C	50.0	500.0	50.0	2.5	47.7	1.1	32.6	0.0	0.0	0.0
D	75.00	500.0	50.0	2.5	42.6	1.1	27.7	0.0	0.0	0.0
E	90.00	575.0	60.0	3.0	49.0	1.3	31.8	0.0	0.0	0.0
US (V/f) F & FF	60.0	575.0	60.0	3.0	49.0	1.3	31.8	0.0	0.0	0.0
Euro (V/f) F & FF	50.0	500.0	50.0	2.5	42.5	1.3	27.5	0.0	0.0	0.0
US (OLV) F & FF	60.0	575.0	60.0	3.0	34.5	0.5	7.3	0.0	0.0	0.0
Euro (OLV) F & FF	50.00	500.0	50.0	2.5	30.0	0.5	6.3	0.0	0.0	0.0

** Default for O02-09 = 1 (US) and not Std Hoist*

**1 Default for O02-09 = 1 (US) and Std Hoist*

**2 Default for O02-09 = 2 (Euro) and not Std Hoist*

**3 Default for O02-09 = 2 (Euro) and Std Hoist*

5.4.2 Motor Setup

The Motor Setup parameters define the motor characteristics. Normally, the default settings for E02 parameters are determined by kVA selection (O02-04). In flux vector and open loop vector, the E02 parameters will be set automatically during auto-tuning. At minimum, the motor rated current should be entered into E02-01.

If rotational auto-tuning cannot be performed, E02-02 and E02-05 can be calculated using the motor's nameplate information or by performing non-rotational auto-tuning.

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)

Table 5-61: Motor Setup Parameter Settings

Parameter	Display	Function	Range	Default
E02-01	Motor Rated FLA	Motor-rated current	*	*
E02-02**	Motor Rated Slip	Motor-rated slip frequency	0.00–20.00 Hz	*
E02-03**	No-Load Current	Motor no-load current	0–[(E02-01)-1]	*
E02-04	Number of Poles	Number of poles in motor	2–48	4
E02-05**	Term Resistance	Motor terminal resistance	0.000–65.000 Ω	*
E02-06**	Leak Inductance	Leakage Inductance	0.0–40.0%	*
E02-07**	Saturation Comp 1	Core-Saturation Compensation Coefficient 1	0.00–0.50	0.50
E02-08**	Saturation Comp 2	Core-Saturation Compensation Coefficient 2	E02-07–0.75	0.75
E02-09**	Mechanical Loss	Motor mechanical loss as a percentage of motor rated power (HP) for the motor.	0.0–10.0%	0.0
E02-10**	Motor Iron Loss	Motor iron loss in Watts for the motor.	0–65535 W	*
E02-11	Rated Power	Rated output	0.0–650.0 HP/kW	*

* *Initial value is determined by O02-04 (kVA Selection) and D10-01.*

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

5.4.3 Test Mode Configuration

Test Mode is a troubleshooting aid that is intended for troubleshooting Flux Vector control method problems. This feature cannot be left on indefinitely, as it will generate a fault after being on for a total accumulated time of ten minutes. At this time, the fault must be reset or the power must be cycled.

To enable Test Mode, refer to parameter L05-01.

Table 5-62: Test Mode Configuration Parameter Settings

Parameter	Display	Function	Range	Default
E03-01	Control Method *0 V/f Control* *2 Open Loop Vector*	Control Method	0, 2	2
E03-02	Stopping Method *0 Decel to Stop* *1 Coast to Stop*	Deceleration Method	0, 1	1
E03-03	Max Frequency	Maximum Frequency	20.0–150.0 Hz	60.0
E03-04	Max Voltage	Maximum Voltage	230 V: 0.0–255.0 460 V: 0.0–510.0 575 V: 0.0–733.1	Determined by O02-04
E03-05	Base Frequency	Motor Base Frequency	0.0–150.0 Hz	60.0
E03-06	Mid Frequency A	Motor Middle output frequency	0.0–150.0 Hz	Determined by E01-03
E03-07	Mid Voltage A	Motor Middle output frequency voltage	230 V: 0.0–255.0 460 V: 0.0–510.0 575 V: 0.0–733.1	Determined by E01-03
E03-08	Min Frequency	Minimum Frequency	0.0–150.0 Hz	Determined by E01-03
E03-09	Min Voltage	Motor Minimum output frequency voltage	230 V: 0.0–255.0 460 V: 0.0–510.0 575 V: 0.0–733.1	Determined by E01-03
E03-10	Mid Frequency B	Midpoint Output Frequency B	0.0–150.0 Hz	0.0
E03-11	Mid Voltage B	Midpoint Output Voltage B	230 V: 0.0–255.0 460 V: 0.0–510.0 575 V: 0.0–733.1	0.0
E03-12	Base Voltage	Motor Base Voltage	230 V: 0.0–255.0 460 V: 0.0–510.0 575 V: 0.0–733.1	0.0

5.5 Option Card Parameters

- F01 Encoder Feedback (PG-X3) Option Card Setup
- F02 Analog Input (AI-A3) Option Card Setup
- F04 Analog Output (AO-A3) Option Card Setup
- F05 Digital Output (DO-A3 or S4IO) Option Card Setup
- F06 Profibus-DP (SI-P3) Option Card Setup
- F07 Ethernet/IP (SI-EN3) and Modbus TCP/IP (SI-EM3) Option Card Setup

NOTE: *See the C09 parameter group for DI-A3, and additional S4I/S4IO setup.*

5.5.1 Encoder Feedback (PG-X3) Option Card Setup

Table 5-63: PG-X3 Parameter Settings (VG+ Only)

Parameter	Display	Function	Range	Default
F01-01	PG1 Pulses/Rev	PPR for the encoder connected to the PG-X3 card seated in port CN5-C.	0–60000 ppr	1024
F01-02	PG1 Rotation Sel *0 Fwd = C.C.W.* *1 Fwd = C.W.*	Changing this parameter has the same effect as swapping A+ and A- encoder wires.	0, 1	0
F01-03	PG1 Output Ratio	Division ratio for the pulse monitor. $f_{Pulse\ Input} = f_{Pulse\ Output} * \frac{(1+n)}{m}$ Example: For a ratio of 1/32 between the PG card pulse input and output, set F01-03 = 032 (where n = 0 and m = 32).	1–132	1
F01-04	PG1 #Gear Teeth1	Gear ratio between the motor shaft and the encoder. A gear ratio of 1 will be used if F01-04 or F01-05 = 0.	0–1000	0
F01-05	PG1 #Gear Teeth2	Gear ratio between the motor shaft and the encoder. A gear ratio of 1 will be used if F01-04 or F01-05 = 0.	0–1000	0
F01-06	PGO-1-H	Delay time for PGO-1-H detection. A setting of 0 disables PGO-1-H detection.	0–100 ms	15
F01-11	PG2 Pulses/Rev	PPR for the encoder connected to the PG-X3 card seated in port CN5-B.	0–60000 ppr	1024
F01-12	PG2 Rotation Sel *0 Fwd = C.C.W.* *1 Fwd = C.W*	Changing this parameter has the same effect as swapping A+ and A- encoder wires.	0, 1	0
F01-13	PG2 #Gear Teeth1	Gear ratio between the motor shaft and the encoder. A gear ratio of 1 will be used if F01-13 or F01-14 = 0.	0–1000	0
F01-14	PG2 #Gear Teeth2	Gear ratio between the motor shaft and the encoder. A gear ratio of 1 will be used if F01-13 or F01-14 = 0.	0–1000	0
F01-15	PG2 Output Ratio	Division ratio for the pulse monitor.	1–132	1
F01-16	PGO-2-H	Delay time for PGO-2-H detection. A setting of 0 disables PGO-2-H detection.	0–100 ms	15

Parameter	Display	Function	Range	Default
F01-21	PG Fdbk Loss Sel	PGO-1-S or PGO-2-S fault stopping method.	Traverse: 0–3	1
	0 Decel to Stop	Decelerate to stop using the decel time in B05-02.	NLB: 1	
	1 Coast to Stop			
	2 Fast Stop	Decelerate to stop using the decel time in B05-08.		
	3 Alarm Only			
F01-22	PGO-1-S Det Time	PGO-1-S disconnection detection time. A setting of zero disables PGO-1-S detection.	0.0–10.0 sec	2.0
F01-23	PG Overspeed Sel	Overspeed (OS) fault stopping method.	Traverse: 0–3	1
	0 Decel to Stop	Decelerate to stop using the decel time in B05-02.	NLB: 1	
	1 Coast to Stop			
	2 Fast Stop	Decelerate to stop using the decel time in B05-08.		
	3 Alarm Only			
F01-24	PG Overspd Level	Overspeed detection level as a percentage of the maximum output frequency.	0–120%	105
F01-25	PG Overspd Time	Time for an overspeed event to trigger a fault (oS).	0.0–2.0 sec	0.0
F01-26	PG Deviation Sel	Stopping method at excessive speed deviation.	Traverse: 0–7	5
	0 @Spd Agree-Decel	Stops by deceleration time 1 - B05-02.	NLB: 5	
	1 @Spd Agree-Coast	Coast to stop.		
	2 @SpdAgree-F-Stop	Decelerates by fast-stop B05-08.		
	3 @Spd Agree-Alm	DEV displayed, operation continues.		
	4 @Run-Decel	Stops by deceleration time 1 - B05-02.		
	5 @Run-Coast	Coast to stop.		
	6 @Run-Fast Stop	Decelerates by fast-stop B05-08.		
	7 @Run-Alarm Only	DEV displayed, operation continues		
F01-27	PG Deviate Level	Speed deviation detection level as a percentage of the maximum output frequency.	0–50%	10
F01-28	PG Deviate Time	Time for a speed deviation event to trigger a DEV fault.	0.0–10.0 sec	0.3

5.5.2 Analog Input (AI-A3) Option Card Setup

Sets CH1 to CH3 input functions when AI-A3 option card is connected.

NOTE: *This option card does not provide additional analog inputs. Using this option card is not recommended.*

When the 3CH individual input is used, parameter B03-01 is automatically set to “1” (frequency reference from control circuit terminal). The reference selection, which is selected by a multi-function digital input (H01-xx= 1F), is disabled when using the AI-A3 option card.

Table 5-64: AI-A3 Parameter Settings

Parameter	Display	Function	Range	Default
F02-01	AI Function Sel		0, 1	0
	0 3ch Individual	0: Option card input terminals V1, V2, and V3 replace VFD input terminals A1, A2, and A3.		
	1 3ch Addition	1: Input signals to terminals V1, V2, and V3 are added together to create the frequency reference.		
F02-02	AI Input Gain	Gain for the input signal.	-999.9–999.9%	100.0
F02-03	AI Input Bias	Bias for the input signal.	-999.9–999.9%	0.0

5.5.3 Analog Output (AO-A3) Option Card Setup

Selects the analog output monitors for channel 1 and 2 if the AO-A3 optional card is connected.

Table 5-65: AO-A3 Parameter Settings

Parameter	Display	Function	Range	Default
F04-01	AO Ch1 Select	Analog output option Channel 1 selection	1–630	102
F04-02	AO Ch1 Gain	Analog output Channel 1 multiplier	-999.9–999.9%	100
F04-03	AO Ch2 Select	Analog output option Channel 2 selection	1–630	103
F04-04	AO Ch2 Gain	Analog output Channel 2 multiplier	-999.9–999.9%	50
F04-05	AO Ch1 Bias	Channel 1 bias	-999.9–999.9%	0.0
F04-06	AO Ch2 Bias	Channel 2 bias	-999.9–999.9%	0.0
F04-07	AO Opt Level Ch1	Channel 1 output signal	0, 1	0
	0 0 to 10 V			
	1 -10 to 10 V			
F04-08	AO Opt Level Ch2	Channel 2 output signal	0, 1	0
	0 0 to 10 V			
	1 -10 to 10 V			

Table 5-66: Parameter Settings for F04-01 and F04-03

Display	Display
0 Not Used	*165 PG Output Freq*
101 Frequency Ref	*184 NLB State**
102 Output Freq	*185 NLB Rel Trq**
103 Output Current	*408 Heatsink Temp*
*105 Motor Speed**	*416 Motor OL1 Level*
106 Output Voltage	*417 Drive OL2 Level*
107 DC Bus Voltage	*601 Mot SEC Current*
108 Output HP	*602 Mot EXC Current**
*109 Torque Reference**	*603 ASR Input**
115 Term A1 Level	*604 ASR Output**
116 Term A2 Level	*605 Voltage Ref (Vq)**
117 Term A3 Level	*606 Voltage Ref (Vd)**
120 SFS Output	*607 ACR(q) Output**
121 AI Opt Ch1 Level	*608 ACR(d) Output**
122 AI Opt Ch2 Level	*611 Iq Reference**
123 AI Opt Ch3 Level	*612 Id Reference**
129 Load Weight	*618 PG1 CounterValue*
130 SS Delta Speed	*619 PG2 CounterValue*
*150 Hook Height**	*622 Zero Servo Pulse**
154 Input Pulse Mon	*626 FF Cont Output**
163 PG CH1 Freq	*627 FF Estimate SPD**
164 PG CH2 Freq	-

* *Not available in the V/f control method (A01-02 = 0)*

5.5.4 Digital Output (DO-A3 or S4IO) Option Card Setup

Selects the multi-function digital output settings for the DO-A3 and S4IO option cards.

Table 5-67: DO-A3/S4IO Parameter Settings

Parameter	Display	Terminal Designation		Range	Default
		DO-A3	S4IO		
F05-01*	DO Ch1 Select	P1-PC	O1-O2	0–1FF	F
F05-02*	DO Ch2 Select	P2-PC	O3-O2	0–1FF	F
F05-03*	DO Ch3 Select	P3-PC	O4-O5	0–1FF	F
F05-04*	DO Ch4 Select	P4-PC	O6-O5	0–1FF	F
F05-05*	DO Ch5 Select	P5-PC	-	0–1FF	F
F05-06*	DO Ch6 Select	P6-PC	-	0–1FF	F
F05-07*	DO Ch7 Select	M1-M2	-	0–1FF	F
F05-08*	DO Ch8 Select	M3-M4	-	0–1FF	F
F05-09	DO Function Sel	DO-A3 output mode selection.		0–2	2
	0 8ch Individual	Outputs are each assigned separate functions.			
	1 Binary Output	Binary code output.			
	2 8ch Selected	Output functions are selected by parameters F05-01 to F05-08.			

* ***See Table 5-77 on page 147*** *for MFDO selections.*

Table 5-68: DO-A3 Output Mode Selection

F05-09	Output Type	Terminal	Output Contents			
0	8-Channel Individual (Fixed Data)	P1-PC	Overcurrent (oC), Ground Fault (GF), Short Circuit (SC)			
		P2-PC	OverVoltage (OV)			
		P3-PC	Drive Overload (OL2, OH, OH1)			
		P4-PC	Not Used			
		P5-PC	OverSpeed (OS-1, OS-2)			
		P6-PC	Motor Overload (OL1)			
		M1-M2	Brake Release			
		M3-M4	Limit Switch (UL1, UL2, UL3, LL1, or LL2)			
1	Binary Coded	P1-PC (Bit 0)	**Bit 3, 2, 1, 0**	**Output**	**Bit 3, 2, 1, 0**	**Output**
			0000	No Fault	1000	EF (ALL)
			0001	SC, OC, GF	1001	CPF (ALL)
		P2-PC (Bit 1)	0010	OV	1010	oL1
			0011	OL2	1011	BE7
			0100	OH, OH1	1100	UV (ALL)
		P3-PC (Bit 2)	0101	OS-1, OS-2	1101	DEV-1, DEV-2
			0110	Not Used	1110	PGO
		P4-PC (Bit 3)				
			0111	LF	1111	Not Used
		P5-PC	Alarm			
		P6-PC	Inverter Ready			
		M1-M2	Brake Release			
		M3-M4	Limit Switch (UL1, UL2, UL3, LL1, or LL2)			
2	8-Channel Selectable	P1-PC	F05-01 (See Table 5-75 for output selections)			
		P2-PC	F05-02 (See Table 5-75 for output selections)			
		P3-PC	F05-03 (See Table 5-75 for output selections)			
		P4-PC	F05-04 (See Table 5-75 for output selections)			
		P5-PC	F05-05 (See Table 5-75 for output selections)			
		P6-PC	F05-06 (See Table 5-75 for output selections)			
		M1-M2	F05-07 (See Table 5-75 for output selections)			
		M3-M4	F05-08 (See Table 5-75 for output selections)			

5.5.5 Profibus-DP (SI-P3) Option Card Setup

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

Table 5-69: SI-P3 Parameter Settings

Parameter	Display	Function	Range	Default
F06-01	Comm Bus Flt Sel	Stopping method at communication error	0–4	1
	0 Decel to Stop			
	1 Coast to Stop			
	2 Fast-Stop			
	3 Use B3-03 Method			
	4 Alarm Only			
F06-02	EF0 Detection	Option External Fault	0, 1	0
	0 Always Detected			
	1 Only During Run			
F06-03	EF0 Fault Action	Option External Fault	0–4	1
	0 Decel to Stop			
	1 Coast to Stop			
	2 Fast-Stop			
	3 Use B3-03 Method			
	4 Alarm Only			
F06-04	BUS Err Det Time	Maximum time the VFD should wait for a communication error to occur (bUS).	0.0–5.0 sec	2.0
F06-06	Torq Ref/Lmt Sel	Torque Reference Limit Selection (FLV only)	0, 1	0
	0 Disabled			
	1 Enabled			
F06-07	Fref PrioritySel	Selects how multi-step speed inputs are treated when the NetRef command is set.	0, 1	0
	0 Net/Com REF	Multi-step reference disabled		
	1 MultiStep Speed	Multi-step reference enabled		
F06-08	Com Prm Init Sel	Determines whether communication-related parameters (F06-xx and F07-xx) are reset when the VFD is initialized using A01-05.	0, 1	0
	0 Init Com Prms	Communication-related parameters (F06-xx and F07-xx) are not reset when the VFD is initialized using A01-05.		
	1 No Init Com Prms	Reset all communication-related parameters (F06-xx and F07-xx) when the VFD is initialized using A01-05.		
F06-30	PB Node Address	Node address	0–125	0
F06-31	PB Clear Select	Determines the operation when a “Clear Mode” command is received.	0, 1	0
	0 Reset to Zero	Resets VFD operation with a Clear mode command.		
	1 Hold Prev Value	Maintains the previous operation state when Clear mode command is given.		

Parameter	Display	Function	Range	Default
F06-32	PB Map Select	Data format used for Profibus-DP comms	0–5	0
	0 PPO Type			
	1 Conventional			
	2 PPO (bit0)			
	3 PPO (Enter)			
	4 Conv (Enter)			
	5 PPO (bit0,Enter)			
F06-35	CO Node Address	Node address for CANopen option card	0–126	0
F06-36	CO Baud Rate	Baud rate for the CANopen option card	0–8	6
	0 Auto Detect			
	1 10 kbps			
	2 20 kbps			
	3 50 kbps			
	4 125 kbps			
	5 250 kbps			
	6 500 kbps			
	7 800 kbps			
	8 1 Mbps			
F06-50	DN MAC Address	MacID address of the DeviceNet option card	0–64	64
F06-51	DN Baud Rate	Baud rate for the DeviceNet option card	0–4	4
	0 125 kbps			
	1 250 kbps			
	2 500 kbps			
	3 Set from Network			
	4 Automatic			
F06-52	DN PCA Selection	Data format received from DeviceNet master	0–255	21
F06-53	DN PPA Selection	Data format sent from DeviceNet master	0–255	71
F06-54	DN Idle Flt Det	Selects whether the VFD triggers an EF0 fault when no data is received from the DeviceNet master (such as when the master is idling)	0, 1	0
	0 Enabled			
	1 Disabled	No fault detection		
F06-55	DN BAUD RATE MEM	Baud rate of the DeviceNet network. (Read Only)	0–2	0
	0 125 kbps			
	1 250 kbps			
	2 500 kbps			
F06-56	DN Speed Scale	Scaling factor for DeviceNet speed monitor	-15–15	0
F06-57	DN Current Scale	Scaling factor for DeviceNet output current monitor	-15–15	0
F06-58	DN Torque Scale	Scaling factor for DeviceNet torque monitor	-15–15	0
F06-59	DN Power Scale	Scaling factor for DeviceNet power monitor	-15–15	0
F06-60	DN Voltage Scale	Scaling factor for DeviceNet voltage monitor	-15–15	0
F06-61	DN Time Scale	Scaling factor for DeviceNet time monitor	-15–15	0

Parameter	Display	Function	Range	Default
F06-62	DN Heart Beat	Heartbeat interval for DeviceNet comms A setting of 0 disables the heartbeat.	0–10	0
F06-63	DN MAC ID MEM	DeviceNet MacID (Read Only).	0–63	0

5.5.6 Ethernet/IP (SI-EN3), PROFINET (SI-EP3), and Modbus TCP/IP (SI-EM3) Option Card Setup

Settings for Ethernet/IP (SI-EN3), PROFINET (SI-EP3), and Modbus TCP/IP (SI-EM3) option cards.

Table 5-70: SI-EN3/SI-EP3/SI-EM3 Parameter Settings

Parameter	Display	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 IP Add 1	Gateway Address 1	0–255	192
F07-10	Gateway IP Add 2	Gateway Address 2	0–255	168
F07-11	Gateway IP Add 3	Gateway Address 3	0–255	1
F07-12	Gateway IP Add 4	Gateway Address 4	0–255	1
F07-13	IP Add Mode Sel *0 User Defined* *1 BOOTP* *2 DHCP*	How the IP Address is set at start up	0–2	2
F07-14	Duplex Select *0 Half Duplex* *1 Auto Negotiate* *2 Full Duplex*	How the communication between host/client will be determined	0–2	1
F07-15	Baud Rate *10 10 Mbps* *100 100 Mbps*	Communication speed	10, 100	10
F07-16	CommLoss Tout	Time-out value for comm loss detection	0.0-30.0 sec	0
F07-17	EN Speed Scale	Scaling factor for EtherNet/IP speed monitor	-15–15	0
F07-18	EN Current Scale	Scaling factor for EtherNet/IP output current monitor	-15–15	0
F07-19	EN Torque Scale	Scaling factor for EtherNet/IP torque monitor	-15–15	0
F07-20	EN Power Scale	Scaling factor for EtherNet/IP power monitor	-15–15	0
F07-21	EN Voltage Scale	Scaling factor for EtherNet/IP voltage monitor	-15–15	0
F07-22	EN Time Scale	Scaling factor for EtherNet/IP time monitor	-15–15	0

Parameter	Display	Function	Range	Default
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.	Modbus Address 0x- - - -	0
F07-33 to F07-42*	DIA166 (1 to 10)	Dynamic parameters that contain the Modbus addresses used for programmable registers in the input assembly 166. Data residing in the Modbus registers will be written to the respective assembly 166 bytes 20 to 39. The Modbus registers are identified by the addresses contained in these parameters. No data is written to the programmable registers if the parameter setting is 0.	Modbus Address 0x- - - -	0

** The SI-EP3 PROFINET option card is limited to F07-23 to F07-27 (DOA115 1 to 6) and F07-33 to F07-37 (DIA166 1 to 5).*

5.6 Control I/O Parameters

- H01 Digital Inputs
- H02 Digital Outputs
- H03 Analog Inputs
- H04 Analog Outputs
- H05 Serial Communication
- H06 Pulse Input/Output

5.6.1 Digital Inputs

The VFD has eight multi-function digital inputs for numerous functions. The following table lists the function selections for Terminals S1 to S8. An OPE03 error will occur if a function is programmed to more than one terminal at the same time.

Table 5-71: Digital Inputs Parameter Settings

Parameter	Display	Function	Range	Default
H01-01	Term S1 Select	***See Table 5-72 on page 142***.	0–81	80 (FWD)
H01-02	Term S2 Select	***See Table 5-72 on page 142***.	0–81	81 (REV)
H01-03	Term S3 Select	***See Table 5-72 on page 142***.	0–81	*
H01-04	Term S4 Select	***See Table 5-72 on page 142***.	0–81	*
H01-05	Term S5 Select	***See Table 5-72 on page 142***.	0–81	*
H01-06	Term S6 Select	***See Table 5-72 on page 142***.	0–81	*
H01-07	Term S7 Select	***See Table 5-72 on page 142***.	0–81	*
H01-08	Term S8 Select	***See Table 5-72 on page 142***.	0–81	*
H01-14	Alt Ref Override *0 Disabled* *1 Enabled*	Alternate Frequency Reference Override. When enabled, and an input of H01-xx = 1F is ON, will switch between Frequency Reference Source 2 (B03-15) and the terminals (B01-xx).	0, 1	0

** Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

Table 5-72: Multi-Function Digital Inputs (MFDI) selectable for H01-0x and C09-0x

Display	Function
0 Multi-Step Ref 2	Multi-Step Reference 2
1 Multi-Step Ref 3	Multi-Step Reference 3
2 Multi-Step Ref 4	Multi-Step Reference 4
3 Multi-Step Ref 5	Multi-Step Reference 5
4 Speed Hold 2	Speed Hold 2 (2nd Step of Three-Step Infinitely Variable)
5 Accel Command	Accel Command (2nd Step of Two-Step Inf. Var. or 3rd Step of Three-Step Inf. Var.)
6 Upper Lmt 1 N.O.	Upper Limit - Slow Down; Normally Open. UL1 - blinking
7 Upper Lmt 2 N.O.	Upper Limit - Stop; Normally Open. UL2 - blinking
8 Lower Lmt 1 N.O.	Lower Limit - Slow Down; Normally Open. LL1 - blinking
9 Lower Lmt 2 N.O.	Lower Limit - Stop; Normally Open. LL2 - blinking
A Upper Lmt 1 N.C.	Upper Limit - Slow Down; Normally Closed. UL1 - blinking
B Upper Lmt 2 N.C.	Upper Limit - Stop; Normally Closed. UL2 - blinking
C Lower Lmt 1 N.C.	Lower Limit - Slow Down; Normally Closed. LL1 - blinking
D Lower Lmt 2 N.C.	Lower Limit - Stop; Normally Closed. LL2 - blinking
E M-Speed Gain 1	Micro-Speed multiplier 1. Gain is set by parameter C02-01. (Priority over Micro-Speed 2)
F Not Used	No function - Terminal is disabled.
10 M-Speed Gain 2	Micro-Speed multiplier 2. Gain is set by parameter C02-02.
11 Load Float 1	Load Float Hold - During run, Load Float will remain On and Fref is held at 0 Hz.
12 Weight Lmt N.C.	Weighted Upper Limit - UL3. Uses C03-08 stopping method and requires manual reset.
13 Swift/Ultra-Lift Enable	Ultra/Swift Lift Enable (C06-01 = 2 or 4). Not Available for Traverse Motion.
14 Alt T-Lim Gain	Alternate Torque Limit Gain - C07-05 to C07-07. Use when Load Testing a Hoist.
15 Forward Jog	Forward Jog (Uses B01-17 Reference)
16 Reverse Jog	Reverse Jog (Uses B01-17 Reference)
17 Forward Inch	Forward Inch
18 Reverse Inch	Reverse Inch
19 Inch Repeat	Inch Repeat
1A Acc/Dec 2	Acceleration/Deceleration Time Changeover 2 using B05-03 and B05-04
1B Acc/Dec 3	Acceleration/Deceleration Time Changeover 3 using B05-12 and B05-13
1C Acc/Dec 4	Acceleration/Deceleration Time Changeover 4 using B05-14 and B05-15
1D Digital Chngover	Analog/Digital Reference Changeover; When B01-18 = 1 On: Digital
1F Run/Ref Src 1/2	Run/Ref Source 2 Switch - On: B03-15/B03-16; Off: B03-01/B03-02 (ignores S1/S2 inputs)
20 through 2F	External Fault Selection (***See Table 5-73 on page 144***)
30 Program Lockout	When input is OFF, parameter changes disabled except freq. reference (U01-01).
31 Local/Remote Sel	Local/Remote Changeover. On: Local
32 Ext BaseBlk N.O.	External Baseblock - Normally open (On: Backblock)
33 Ext BaseBlk N.C.	External Baseblock - Normally closed (Off: Backblock)
34 Spd/Trq Chngover	Speed/Torque Control Changeover (On: Torque Control)
35 Load Float 2	Zero Speed initiated. Manual Load Float Timed by C04-01.
36 Polarity Rev	Polarity Reversing command for External Torque Control. On: Reverse Polarity
37 ASR Gain Switch	On: Switches to ASR Gain 2 parameters - Forces D04-07.
38 Acc/Dec RampHold	Speed Hold 1 - Accel/decel is stopped by ON, and frequency is held.
39 OH2 Alarm Signal	External OH2 - VFD overheat protection (OH2 is shown by ON.) (Alarm Only)

Display	Function
3A MFAI Enable	On: Terminals specified in H03-14 are enabled. Off: Disregards the input signal to the analog terminals. The terminals not set in H03-14 will always be enabled.
3F Fault Reset	On: Resets VFD faults
41 SnapShaft Disabl	On: Snap Shaft detection is disabled.
43 Timer Function	Function settings by C12-03, C12-04. Set by timer function output H02-01–H02-03 = 12.
44 Emergency Lift	Allow hoist to operate during an encoder failure.
47 Ref Sample Hold	Analog frequency reference Sample / Hold.
48 Flt Latch Reset	When a function is latched, toggle this input ON and then OFF to clear the fault.
4B Anti-Shock OFF	Anti-Shock OFF
4C DCInj Activate	On: DC injection braking command, once SFS reaches Zero Speed
53 Comm Test Mode	Communication test mode - Loopback test of Modbus RS-422/485 interface.
55 Drive Enable	When Programmed, must be ON in order for Inverter Ready - Generates “Can’t Run - Drive Not Ready” Alarm. “RDY” is displayed on keypad display when VFD is ready.
56 Klixon N.O.	On: Reset run command, use stopping method C03-12, display KLX - Klixon Alarm
57 Klixon N.C.	Off: Reset run command, use stopping method C03-12, display KLX - Klixon Alarm
58 Brake Answerback	BE0, BE4, BE5, BE7 alarm conditions (C08-04, C08-11). Normally open.
59 Alt F-Ref Up Lmt	Use Alternate Upper Limit Frequency Reference B02-04
5A MaintenanceReset	Resets Maintenance Timer (C12-05–06, U01-52)
5B BE6/8 Up Spd Lmt	Limits Fref to setting in C08-18 (BE6 Up Speed Lmt)
5C Weight Measure	Weight Measurement by C10-01.
5D Load Float Ext	Extends C08-10 Time by adding C08-15 time.
5E M-Spd Gn1 & LF-E	Micro-Speed Gain 1 and Load Float Extension Time. (MFDI “E” and “5D” ON)
5F Phantom Flt N.C.	Phantom Fault N.C. - Stops motion via C03-10. RUN LED on keypad blinks.
60 Index Enable	Enables indexing function (Hidden when B03-03 = 1 Coast to Stop)
61 Brake Test	Motor pushes against brake up to torque setting C08-24 at frequency C08-25. Disables PG Faults during this condition.
62 Weight Lmt N.O.	Weighted Upper Limit - UL3 - Stopping Method determined by C03-08.
63 Phantom Flt N.O.	Phantom Fault N.O. - Stops motion via C03-10. RUN LED on keypad blinks.
64 Slack Cable Enable	When input is ON, Slack Cable Detection is enabled.
65 Dwell Enable	Enables / Disables Dwell Function. Off: Disabled.
66 Load Share	Load Share - Enables / Disabled Load Sharing.
67 Hook Height Home	Used w/ C03-14 - Height Measurement function.
68 LodShr Slave Rdy	Load Share follower ready signal. Loss of this signal on the master VFD while running will result in a SNR fault.
69 LC Bypass N.O.	On: Disables Load Check and clears any LC Faults.
6A LC Bypass N.C.	Off: Disables Load Check and clears any LC Faults.
6B Brake 2 AnsrBack	Brake Answerback signal for Brake 2 Output (0A). VFD will verify brake is open before running the motor. BE0-2, BE4-2, BE5-2, or BE7-2 occurs if feedback is incorrect.
70 Torque Detection	Closed: Overtorque / Undertorque detection is enabled.
73 LL2/UL2 Bypass	Bypass Upper/Lower Limit 2 (UL2 and LL2)
74 LL/UL Bypass	Bypass Upper/Lower Limit 1 and 2 (UL1, UL2, LL1, and LL2)
80 Run FWD	Forward/Up Run Command
81 Run REV	Reverse/Down Run Command

5.6.1.1 Digital Inputs—External Fault

It is sometimes desirable to have at least one external fault input to the VFD. The table below shows the possible selections for external faults that can be assigned to a digital input (H01-xx or C09-xx).

Table 5-73: External Fault Selection

Input Type		Detection Method		External Fault Action				MFDI Setting
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

5.6.2 F1 and F2 Keys Function Selection

The F1 and F2 keys on the keypad have the ability of being programmed with specific functions to imitate digital inputs. The table below displays the various settings that are valid for these buttons.

- To operate a function assigned to the F1 or F2 key, the respective button must be held down. Releasing the button will stop the function.
- To quickly view the functions assigned to both buttons, press the LO/RE key three times.

Table 5-74: F1 and F2 Function Selection Parameter Settings

Parameter	Display	Function	Range	Default
H01-09	F1 Key Selection	Function selection for F1 key	0F–74	0F
H01-10	F2 Key Selection	Function selection for F2 key	0F–74	0F

Table 5-75: F1 and F2 Key Functions Selectable for H01-09 and H01-10

Display	Function	Instruction	Alert/Confirm Message
0F Not Used	No function - terminal is disabled	-	-
48 Flt Latch Reset	When a fault is latched, toggle this input ON and then OFF to clear the fault.	Press F1 or F2 once to start Fault Latch Reset. A confirm message will appear, and the same key press is required once more to reset the fault.	*Confirm?* *Flt Latch Reset*
53 Comm Test Mode	Communication Test Mode - loopback test of Modbus RS-422/ 485 interface	Hold down the F1 or F2 key for 2-3 seconds to initiate the Comm Test.	*Running:* *Comm Test Mode*
5A MaintenanceReset	Resets Maintenance Timer (C12-05, C12-06, U01-52)	Press F1 or F2 once to start Maintenance Timer Reset. A confirm message will appear, and the same key press is required once more to reset the Maintenance Timer.	*Confirm?* *MaintenanceReset*
61 Brake Test	Motor pushes against brake up to torque setting C08-24 at frequency C08-25. PG faults disabled during the test.	Hold down the F1 or F2 key to initiate the Brake Test.	*Running:* *Brake Test*
67 Hook Height Home	Used with C03-14 - Height Measurement function.	Press F1 or F2 once to start Hook Height Home. A confirm message will appear, and the same key press is required once more to home the Hook Height.	*Confirm?* *Hook Height Home*
69 LC Bypass N.O.	Disables Load Check and clears any LC faults.	Hold down the F1 or F2 key to initiate the LC Bypass.	*Running:* *LC Bypass N.O.*
73 LL2/UL2 Bypass	Bypass LL1/LL2 limits	Hold down the F1/F2 key to initiate LL2/UL2 Bypass.	*Running:* *LL2/UL2 Bypass*
74 LL/UL Bypass	Bypass LL/UL 1 and 2 limits	Hold down the F1/F2 key to initiate LL/UL Bypass.	*Running:* *LL/UL Bypass*

5.6.3 Digital Outputs

The VFD has three built-in multi-function digital outputs for indicating various conditions. Digital output capabilities can be increased with the installation of an S4IO or DO-A3 option card.

Table 5-76: Digital Outputs Parameter Settings

Parameter	Display	Function	Range	Default
H02-01	Term M0-M1 Sel	Digital Output 1 Function (***See Table 5-77 on page 147***.)	0–1FF	*
H02-02	Term M2-M3 Sel	Digital Output 2 Function (***See Table 5-77 on page 147***.)	0–1FF	*
H02-03	Term M5-M6 Sel	Digital Output 3 Function (***See Table 5-77 on page 147***.)	0–1FF	*
H02-06	Wh Disp Units *0 0.1 kWh units* *1 1 kWh units* *2 10 kWh units* *3 100 kWh units* *4 1000 kWh units*	Watt Hour Output Unit Selection	0–4	0

** Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

Table 5-77: Multi-Function Digital Outputs (MFDO) selectable for H02-0x and F05-0x

Display	Function
*0 Brake Release**	ON: VFD is commanding the brake to be Open
	OFF: VFD is commanding the brake to be Closed
*1 Zero Speed**	ON: Motor Speed < D01-01 or E01-09
2 Fref/Fout Agree1	ON: Output frequency (U01-02) is within frequency reference (U01-01) ± L04-02
	OFF: Output frequency (U01-02) is not within frequency reference (U01-01) ± L04-02
3 Fref/Set Agree 1	ON: Output frequency (U01-02) is within L04-01 ± L04-02
	OFF: Output frequency (U01-02) is not within L04-01 ± L04-02
4 Freq Detect 1	***See Frequency Detect on page 163***.
5 Freq Detect 2	***See Frequency Detect on page 163***.
*6 Inverter Ready**	ON: VFD is in a run-ready state
	OFF: VFD is not in a run-ready state
*7 DC Bus Undervolt**	ON: DC Bus voltage falls below the L02-05 level
	OFF: DC Bus voltage is above L02-05
8 BaseBlock	ON: During BaseBlock - No Voltage output
	OFF: VFD is not in a BaseBlock state - Voltage Output
9 Operator Ref	ON: Frequency reference is from the keypad
	OFF: Frequency reference is not from the keypad (i.e. external terminals)
A Brake 2	ON: VFD is commanding the secondary brake to be Open
	OFF: VFD is commanding the secondary brake to be Closed
B Trq Det 1 N.O.	ON: Output current/torque exceeds L06-02 for longer than the time set in L06-03.
	OFF: Output current/torque does not exceed L06-02 for longer than the time set in L06-03.
C Anti-Shock ON	ON: Anti-Shock is enabled and a torque spike is detected.
	OFF: Normal operation
D DB Overheat	ON: VFD displays an “RH” or “RR” fault
	OFF: Normal operation
E Fault	ON: VFD is in a fault condition (excluding CPF00 and CPF01)
	OFF: Normal operation
*F Not Used**	No Function
10 Minor Fault	ON: VFD is in a minor fault (alarm) condition
	OFF: VFD is not in a minor fault (alarm) condition
11 Reset Cmd Active	ON: Reset command is present
	OFF: Normal operation
12 Timer Output	ON: H01-xx = 43 is active for longer than C12-03 time
	OFF: H01-xx = 43 is not active
13 Fref/Fout Agree2	ON: Output frequency (U01-02) is within the frequency reference (U01-01) ± L04-04
	OFF: Output frequency (U01-02) is not within the frequency reference (U01-01) ± L04-04
14 Fref/Set Agree 2	ON: Output frequency (U01-02) is within L04-03 ± L04-04
	OFF: Output frequency (U01-02) is not within L04-03 ± L04-04
18 Trq Det 2 N.O.	ON: Output current/torque exceeds L06-05 for longer than time L06-06
	OFF: Output current/torque does not exceed L06-05 for longer than time L06-06

Display	Function
1A Forward Dir	ON: During Forward/Up operation OFF: Running in Reverse/Down direction or baseblock
1B Reverse Dir	ON: During Reverse/Down operation OFF: Running in Forward/Up direction or baseblock
1C Swift/Ultra-Lift Mode	ON: VFD is operating in Swift-Lift/Ultra-Lift OFF: VFD is not operating in Swift-Lift/Ultra-Lift
1D Brk Trans Fault	ON: VFD detects a brake transistor failure OFF: Normal operation
1E LC Operating	ON: VFD is testing the current load before posting an LC Fault OFF: Normal operation
1F Regenerating	ON: VFD is in a regenerative mode OFF: Normal operation
20 Auto-Rst Attempt	ON: Auto-reset is enabled OFF: Normal operation
21 Overload (OL1)	ON: VFD exceeds 90% of the motor overload detection level (oL1) OFF: Normal operation
22 OH Pre-Alarm	ON: VFD heatsink temperature ≥ L08-02 OFF: Normal operation
23 Torque Limit	ON: Torque (U01-09) is ≥ C07-01–C07-04. OFF: Normal operation
24 Speed Limit	ON: 1. Frequency reference has reached the upper limit set in B02-01. 2. Frequency reference has fallen below B02-02 or B02-03. 3. B03-05 = 1, 2, or 3, and the frequency reference is < E01-09. OFF: Normal operation
25 During Load Flt	ON: VFD is in Load Float OFF: VFD is not in Load Float
26 Run Cmd is Input	ON: Forward or Reverse command is active on H01-xx OFF: Forward or Reverse command is not active on H01-xx
27 Load Check Det	ON: VFD has detected a Load Check fault OFF: Normal operation
28 Slack Cable Det	ON: VFD has detected a Slack Cable OFF: Normal operation
29 Upper Limit	ON: UL1, UL2, or UL3 is detected OFF: Normal operation
2A During RUN 2	ON: Run command is active or the VFD is outputting voltage. OFF: Run command is off and the VFD is not outputting voltage.
2B Upper Limit 1	ON: UL1 is detected OFF: Normal operation
2C Upper Limit 2	ON: UL2 is detected OFF: Normal operation

Display	Function
2D Lower Limit 1	ON: LL1 is detected
	OFF: Normal operation
2E Lower Limit 2	ON: LL2 is detected
	OFF: Normal operation
30 Lower Limit	ON: LL1 or LL2 is detected
	OFF: Normal operation
31 Up/Low Limit	ON: UL1, UL2, UL3, LL1, or LL2 is detected
	OFF: Normal operation
32 Snap Shaft	ON: VFD has detected a Snap Shaft
	OFF: Normal operation
34 Index Complete	ON: Index move is complete
	OFF: Normal operation or Index move is not complete
35 Ready for F-Ref	ON: C08-04 timer has expired or Brake Answerback is detected H01-xx = 58
	OFF: Normal operation or VFD detected a BE1, BE2, BE4 alarm or is stopped.
36 Fan Alrm Det	ON: VFD detects that the internal cooling fan has failed
	OFF: Normal operation
37 Maintenance	ON: Maintenance Timer U01-52 ≥ C12-05
	OFF: Normal operation or the Maintenance Timer U01-52 < C12-05
38 Spd Lim @ T Cont	ON: Speed Limit has been reached while using Torque Control
	OFF: Speed Limit has not been reached when using Torque Control
39 Drive Enable	ON: VFD is Enabled
	OFF: VFD Enable (H01-xx = 55) is not active
3B Watt-hour Pulse	ON: Watt-hour time is reached (based on H02-06), the contact will close for 200 ms
	OFF: Normal operation
3D Fault or Alarm	ON: Fault or Alarm condition is detected
	OFF: Normal operation
3E Overspeed	ON: Overspeed condition is detected
	OFF: Normal operation
3F Klixon	ON: Klixon alarm is detected (H01-xx = 56 or 57 is active)
	OFF: Normal operation
40 through FF	ON: Specific fault condition detected (***see Section 5.6.3.1 on page 150***)
Flt Annunciate	OFF: Normal operation
*102 through 1FF***	Settings 2 through FF with inverse output.

** This output does not have an inverse output*

*** Contact will open when power is disconnected*

5.6.3.1 Digital Outputs—Alarm/Fault Annunciate (H02-01–03 = 40)

Fault Annunciate enables you to assign a set of six fault/alarm outputs to Relay Outputs M0-M1, M2-M3, and M5-M6. M0-M1 is typically assigned to a brake output, but it can be used for fault annunciate. This function will also trigger the MA-MB-MC fault relay.

You may find it convenient to print the Fault Annunciate Worksheet in this section. By being able to write in the worksheet's boxes, you will find it easier to program the feature.

Programming **Fault Annunciate** requires that you determine two 4-digit binary numbers and then convert these to two 1-digit hexadecimal values. You enter the hexadecimal values when you program the VFD.

To program **Fault Annunciate** (from the **Programming Menu**):

1. Navigate to H02-01 (M0-M1), H02-02 (M2-M3), or H02-03 (M5-M6) and press ENTER until the value blinks.
2. Press the ∧ or ∨ button until H02-xx = 40 appears.
3. Press the ENTER button. H02-xx = 40 / Flt Annunciate appears.
4. From the worksheet in ***Table 5-79 on page 151***, select one of three fault output sets (each row is a set).
5. Determine which faults/alarms will trigger the fault output. To enable a fault/alarm, enter 1 in the box; otherwise, enter 0. Do this for each column in the set.
6. Using the Binary to Hexadecimal Conversion chart (***Table 5-80 on page 151***), determine the 1-digit hexadecimal value for each 4-digit binary number.
7. Press the ∧ or ∨ and RESET buttons until the hexadecimal number appears and press Enter.

Example:

Select a Set containing the alarm/fault(s) you want to trigger an output. You can only select from one set. If you want a relay output based on only LL1 and UL1, you would choose Set 2.

1. *Place a "1" below LL1 and UL1 for Set 2.*
2. *Use table 5-80 to convert the left binary value "1 0 0 0" to Hex 8.*
3. *Use table 5-80 to convert the right binary value "1 0 1 0" to Hex A.*
4. *Enter 8A into H02-xx.*

Table 5-78: Fault Annunciate Example

	First digit				Second digit			
	1	0	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0
Set 2	1	0	OT1	OT2	LL1	LL2	UL1	UL2
Binary Number	1	0	0	0	**1**	0	**1**	0

First digit = 8
Second digit = A, so **H02-xx = 8A**

Table 5-79: Fault Annunciate Worksheet

	First digit				Second digit			
	0	1	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0
Set 1	0	1	BE8	BE6	BE5	BE3	BE2	BE1
Binary Number	0	1						

	First digit				Second digit			
	1	0	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0
Set 2	1	0	OT1	OT2	LL1	LL2	UL1	UL2
Binary Number	1	0						

	First digit				Second digit			
	1	1	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0
Set 3	1	1	SLC	BE4	BE3	BE2	BE1	BE0
Binary Number	1	1						

Table 5-80: Binary to Hexadecimal Conversion

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

5.6.4 Analog Inputs

The VFD has three built-in analog inputs for the external input of references and limits.

Table 5-81: Analog Inputs Parameter Settings

Parameter	Display	Function	Range	Default
H03-01	Term A1 Signal *0 0 to 10 V* *1 -10 to 10 V*	Terminal A1 analog input signal	0, 1	*
H03-02	Terminal A1 Sel	Function of terminal A1 (***see Table 5-82 on page 153*** and ***Table 5-83 on page 154***)	0–31	0
H03-03	Terminal A1 Gain	Gain multiplier for Terminal A1 analog input	-999.9–999.9%	100.0
H03-04	Terminal A1 Bias	Bias multiplier for Terminal A1 analog input	-999.9–999.9%	0.0
H03-05	Term A3 Signal *0 0 to 10 V* *1 -10 to 10 V*	Terminal A3 analog input signal	0, 1	0
H03-06	Terminal A3 Sel	Function of terminal A3 (***see Table 5-82 on page 153*** and ***Table 5-83 on page 154***)	0–31	1F
H03-07	Terminal A3 Gain	Gain multiplier for Terminal A3 analog input	-999.9–999.9%	100.0
H03-08	Terminal A3 Bias	Bias multiplier for Terminal A3 analog input	-999.9–999.9%	0.0
H03-09	Term A2 Signal *0 0 to 10 V* *1 -10 to 10 V* *2 4 to 20 mA* *3 0 to 20 mA* ***NOTE:*** *Use DIP switch S1 to set input terminal A2 for a current or a voltage input signal.*	Terminal A2 analog input signal	0–3	2
H03-10	Terminal A2 Sel	Function of terminal A2 (***see Table 5-82 on page 153*** and ***Table 5-83 on page 154***)	0–31	1F
H03-11	Terminal A2 Gain	Gain multiplier for terminal A2 analog input	-999.9–999.9%	100.0
H03-12	Terminal A2 Bias	Bias multiplier for terminal A2 analog input	-999.9–999.9%	0.0
H03-13	Filter Avg Time	Analog input filter average time	0.00–2.00 sec	0.03
H03-14	A1/A2/A3 Sel *1 A1 Available* *2 A2 Available* *3 A1/A2 Available* *4 A3 Available* *5 A1/A3 Available* *6 A2/A3 Available* *7 All Available*	Determines which analog input terminals will be enabled when a digital input programmed for "MFAI Enable" (H01-xx = 3A) is activated.	1–7	7
H03-16	TerminalA1Offset	Adds an offset to terminal A1	-500–500	0
H03-17	TerminalA2Offset	Adds an offset to terminal A2	-500–500	0
H03-18	TerminalA3Offset	Adds an offset to terminal A3	-500–500	0

* *Initial value is determined by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** or **Table 4-8 on page 60**).*

Table 5-82: Selections for H03-02, H03-06, and H03-10 (Flux Vector)

Display	Function
0 Analog Freq Ref1	Analog Frequency reference 1 10V = E01-04 (Maximum output frequency)
1 Frequency Gain	Analog frequency reference will be multiplied with the analog frequency reference gain.
2 Analog Freq Ref2	Analog Frequency reference 2 10V = E01-04 (Maximum output frequency)
3 Analog Freq Ref3	Analog Frequency reference 3 10V = E01-04 (Maximum output frequency)
5 Acc/Dec T Reduct	10V = 100% acceleration and deceleration time
7 OT / UT Det Lvl	Overtorque/undertorque level as a percentage of motor rated torque.
9 Ref Lower Limit	Max. output frequency 10V = E01-04 (Maximum output frequency)
D Freq Ref Bias 2	The input value of an analog input set to this function will be added to the frequency reference. This function can be used with any frequency reference source.
E MotorTemperature	PTC thermistor input. Set DIP switch S4 to “PTC.”
10 FWD Torque Limit	Torque limit when motoring in the forward direction.
11 REV Torque Limit	Torque limit when motoring in the reverse direction.
12 Regen Torque Limit	Torque limit during regen.
13 Torque Reference	Torque reference when in Torque Control mode; Torque limit when in Speed Control mode.
14 Torque Comp	Torque compensation when using torque control.
15 Torque Limit	Torque limit when motoring.
16 Load Cell	Used for Weight Measurement
1F Not Used	-

Table 5-83: Selections for H03-02, H03-06, and H03-10 (V/f)

Display	Function
0 Analog Freq Ref1	100% = Max output frequency (E01-04) Same value can be set using H03-02 and H03-10. 10V = E01-04 (Maximum output frequency)
1 Frequency Gain	Analog frequency bias will be multiplied with the analog frequency reference gain.
2 Analog Freq Ref2	Max. output frequency 10V = E01-04 (Maximum output frequency)
3 Analog Freq Ref3	Max. output frequency 10V = E01-04 (Maximum output frequency)
4 Voltage Bias	Output Voltage Bias. This bias boosts the output voltage of the V/f curve as a percentage of the maximum output voltage (E01-05). Only available in V/f mode. 10V = E01-05 (Motor rated Voltage)
5 Acc/Dec T Reduct	10V = 100% acceleration and deceleration time
6 DC Inj Braking	DC Injection Braking Current 10V = 100% VFD rated current 4 to 20 mA = 0 to 100% VFD rated current
7 OT / UT Det Lvl	Overtorque/undertorque level as a percentage of VFD rated current.
8 Stall Prev Level	Analog stall prevention level
9 Ref Lower Limit	Max. output frequency 10V = E01-04 (Maximum output frequency)
D Freq Ref Bias 2	The input value of an analog input set to this function will be added to the frequency reference. This function can be used with any frequency reference source.
E MotorTemperature	PTC thermistor input. Set DIP switch S4 to “PTC.”
16 Load Cell	Used for Weight Measurement
1F Not Used	-

5.6.5 Analog Outputs

The VFD has two built-in analog outputs for condition monitoring. Analog output capabilities can be increased with the installation of an AO-A3 option.

Table 5-84: Analog Outputs Parameter Settings

Parameter	Display	Function	Range	Default
H04-01	Terminal FM Sel	Function selection for analog output Terminal FM. Reference the U monitor group for output function descriptions.	000–630	102
	0 Not Used			
	101 Frequency Ref			
	102 Output Freq			
	103 Output Current			
	105 Motor Speed			
	106 Output Voltage			
	107 DC Bus Voltage			
	108 Output HP			
	109 Torque Reference			
	115 Term A1 Level			
	116 Term A2 Level			
	117 Term A3 Level			
	120 SFS Output			
	121 AI Opt Ch1 Level			
	122 AI Opt Ch2 Level			
	123 AI Opt Ch3 Level			
	129 Load Weight			
	130 SS Delta Speed			
	150 Hook Height			
	154 Input Pulse Mon			
	163 PG CH1 Freq			
	164 PG CH2 Freq			
	165 PG Output Freq			
	408 Heatsink Temp			
	416 Motor OL1 Level			
	417 Drive OL2 Level			
	601 Mot SEC Current			
	602 Mot EXC Current			
	603 ASR Input			
	604 ASR Output			
	605 Voltage Ref (Vq)			

Parameter	Display	Function	Range	Default
H04-01	*606 Voltage Ref (Vd)*		000–630	102
	607 ACR(q) Output			
	608 ACR(d) Output			
	611 Iq Reference			
	612 Id Reference			
	618 PG1 CounterValue			
	619 PG2 CounterValue			
	622 Zero Servo Pulse			
	625 ASR Out w/o Fil			
	626 FF Cont Output			
	627 FF Estimate SPD			
H04-02	Terminal FM Gain	Gain multiplier for Terminal FM	-999.9–999.9%	100.0
H04-03	Terminal FM Bias	Bias multiplier for Terminal FM	-999.9–999.9%	0.0
H04-04	Terminal AM Sel	Function selection for analog output Terminal AM	000–630	103
H04-05	Terminal AM Gain	Gain multiplier for Terminal AM	-999.9–999.9%	50.0
H04-06	Terminal AM Bias	Bias multiplier for Terminal AM	-999.9–999.9%	0.0
H04-07	FM Level Select	Voltage output level of Terminal FM	0–2	0
	0 0 to 10 V			
	1 -10 to 10 V			
	2 4 to 20 mA			
H04-08	AM Level Select	Voltage output level of Terminal AM	0–2	0
	0 0 to 10 V			
	1 -10 to 10 V			
	2 4 to 20 mA	Only available on 24 VDC interface board		

5.6.6 Serial Communication

The VFD uses terminals R+/R-, S+/S- to communicate the MODBUS RTU (RS-485/422) protocol. Cycle power after changing any of these parameters.

Table 5-85: Serial Communication Parameter Settings

Parameter	Display	Function	Range	Default
H05-01	Serial Comm Adr	Serial communication address	00–FF	1F
H05-02	Serial Baud Rate	Baud rate	0–8	3
	0 1200 bps			
	1 2400 bps			
	2 4800 bps			
	3 9600 bps			
	4 19.2 kbps			
	5 38.4 kbps			
	6 57.6 kbps			
	7 76.8 kbps			
	8 115.2 kbps			
H05-03	Serial Com Sel	Parity type	0–2	0
	0 No Parity			
	1 Even Parity			
	2 Odd Parity			
H05-04	Serial Fault Set	Serial fault stopping method	0–3	0
	0 Decel to Stop			
	1 Coast to Stop			
	2 Fast Stop			
	3 Alarm Only			
H05-05	Serial Flt Dtct	Serial Fault Detection	0, 1	1
	0 Disabled			
	1 Enabled			
H05-06	Transmit WaitTIM	Send waiting time	5–65 ms	5
H05-07	RTS Control Sel	RTS Control	0, 1	1
	0 Disabled	RTS is always on		
	1 Enabled	RTS is ON only when sending		
H05-09	CE Detect Time	Time required to detect a communications error. Adjustment may be needed when networking several VFDs.	0.0–10.0 sec	2.0
H05-10	CommReg 25h Unit	Units for the output voltage monitor value in Modbus Register 0025H.	0, 1	0
	0 0.1V			
	1 1V			
H05-11	Enter CommandSel	Enter command function via serial.	0, 1	1
	0 Enter Required	VFD requires an Enter command before accepting any parameter changes.		
	1 No EnterRequired	Parameter changes are activated immediately without the Enter command.		

Parameter	Display	Function	Range	Default
H05-12	Run CommandSel	Sequence for a serial run command source	0, 1	0
	0 FWD Run &REV Run	Bit 0 will start and stop the VFD in the FWD direction. Bit 1 will start and stop the VFD in the REV direction.		
	1 Run & FWD/REV	Bit 0 will start and stop the VFD. Bit 1 changes the direction.		
H05-17	Busy Enter Sel	Allows VFD to substitute a RAM enter with a ROM enter when under heavy CPU load.	0, 1	0
	0 No ROM Enter			
	1 RAM Enter			
H05-18	MtrSpd Monitor T	Motor Speed Monitor Filter Time. Adds a filter to Motor Speed monitor (U01-05).	0–100 ms	0

NOTE: *After initial communication, if the VFD is not communicated with for 2 seconds, a communication fault will occur (CE alarm/fault).*

5.6.7 Pulse Train Input/Output

Pulse Input and Output provides speed control capabilities via the RP and MP terminals.

Table 5-86: Pulse Input/Output Parameter Settings

Parameter	Display	Function	Range	Default
H06-01	Pulse Input Sel	Terminal RP pulse input	0, 5–7	0
	0 Frequency Ref	Set B03-01 = 4 (pulse input) to enable RP.		
	5 Simple PG	OLV Control with Simple PG feedback (NLB Hoist only).		
	6 PG Feedback	PG-X3 pulse feedback into the RP terminal coming from a Follower VFD.		
	7 RP Feedback	Pulse feedback into the RP terminal coming from a Follower VFD.		
H06-02	Pulse In Scale	Number of pulses equal to the maximum output frequency	1000–32000 Hz	1440
H06-03	Pulse Input Gain	Output level when input is 100%	0.0–1000.0%	100.0
H06-04	Pulse Input Bias	Output level when input is zero Hz.	-100.0–100.0%	0.0
H06-05	Pulse In Filter	Input filter time constant	0.00–2.00 sec	0.10
H06-06	Pulse Output Sel	Terminal MP pulse output	0–120	102
	000 Not Used			
	101 Frequency Ref			
	102 Output Freq			
	105 Motor Speed			
	120 SFS Output			
H06-07	Pulse Out Scale	Frequency output at 100%	0–32000 Hz	1440
H06-08	Pulse Min Freq	Minimum frequency for the pulse train input to be detected. Enabled when H06-01 = 0.	0.1–1000.0 Hz	0.5
H06-09	Pulse Dev Detect	When the Pulse Input terminal RP (H06-01) is programmed for PG Feedback (6) or RP Feedback (7), the pulse input from terminal RP is compared to the pulse output of terminal MP. If the difference is greater than the percentage programmed into H06-09, the VFD will fault and display “PULSDEV” on the keypad display.	0.0–25.5%	5.0

5.7 Protection Parameters

- L01 Motor Overload
- L02 Power Loss Ride Thru
- L03 Stall Prevention
- L04 Speed Agree
- L05 Test Mode
- L06 Torque Detection
- L08 Hardware Protection
- L09 Automatic Fault Reset
- L09 Fault Latch

5.7.1 Motor Overload

The IMPULSE•G+/VG+ Series 4 VFD has an electronic overload protection function (OL1) for protecting the motor from overheating. The VFD bases the protection on time, output current, and output frequency. The electronic thermal overload function is UL-recognized, so an external thermal overload relay is not required for single motor operation.

This parameter selects the motor overload curve used according to the type of motor applied.

L01-01 = 1 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.

L01-01 = 2 selects a motor capable of cooling itself at any speed when running at 100% load. The OL1 function derates the motor when it is running at 1/10 of its rated speed or less.

L01-01 = 3 selects a motor capable of cooling itself at any speed when running at 100% load. This includes zero speed. The OL1 function does not derate the motor at any speed.

If the VFD is connected to a single motor, the motor overload protection should be enabled

Do not disable OL1 unless another means of preventing motor thermal overload is provided. When the electronic thermal overload function is activated, an OL1 fault occurs, shutting OFF the VFD's output, thus preventing additional overheating of the motor. The motor temperature is continuously calculated as long as the VFD is powered up.

When operating several motors with one VFD, install a thermal relay on each motor and disable the motor overload protection (L01-01 = 0).

Table 5-87: Motor Overload Parameter Settings

Parameter	Display	Function	Range	Default
L01-01	Mtr OL Charact	Sets the type of motor overload protection.	0–3	3
	0 OL1 Disabled			
	1 VT Motor	General purpose motor (standard fan cooled)		
	2 CT Motor	Speed range of 1:10		
	3 Vector Motor	Speed range of 1:100		
L01-02	MOL Time Const	Time for OL1 fault when motor current is ≥ 150% of the motor rated current.	0.1–5.0 min	1.0

Parameter	Display	Function	Range	Default
L01-03	Mtr OH Alarm Sel	Operation when the motor temperature analog input (H03-02, H03-06, or H03-10 = E) exceeds the OH3 alarm level. (1.17V)	0–3	3
	0 Decel to Stop			
	1 Coast to Stop			
	2 Fast Stop (Alarm)	Decel by B05-08		
	3 Alarm Only	OH3 Flashes		
L01-04	Mtr OH Fault Sel	Operation when the motor temperature analog input (H03-02, H03-06, or H03-10 = E) exceeds the OH4 fault level. (2.34V)	0–2	1
	0 Decel to Stop			
	1 Coast to Stop			
	2 Fast Stop	Decel by B05-08		
L01-05	Mtr Temp Filter	Motor temperature analog input filter time constant (H03-02, H03-06, or H03-10 = E)	0.00–10.00 sec	0.20
L01-13	Mtr OL Mem Sel	Determines whether or not to hold the current value of the electrothermal motor protection (L01-01) when the power supply is interrupted.	0, 1	1
	0 Disabled			
	1 Enabled			

5.7.2 Power Loss Ride Thru

Table 5-88: Power Loss Ride Thru Parameter Settings

Parameter	Display	Function	Range	Default
L02-01	PwrL Selection	Enables/disables the Power Loss Ride thru function	0–2	0
	0 Disabled	UV1 fault when power is lost for more than 15 milliseconds.		
	1 Enable w/ Timer	Recover within the time set in L02-02. Uv1 will be detected if power loss is longer than L02-02.		
	2 Enable if CPU on	Recover as long as CPU has power. Uv1 is not detected.		
L02-02	PwrL Ridethru t	Power Loss Ride thru time	0.0–25.5 sec	**
L02-03	PwrL Baseblock t	Output turn on delay after power resumes	0.1–5.0 sec	**
L02-04	PwrL V/F Ramp t	Voltage recovery time after speed search is complete	0.0–5.0 sec	**
L02-05	PUV Det Level	Under voltage fault detection level	230V: 150–210 VDC 460V: 300–420 VDC 575V: 431–604 VDC	Determined by E01-01

*** Initial value is dependent on VFD size, which is determined by O02-04 (kVA Selection).*

5.7.3 Stall Prevention

Table 5-89: Stall Prevention Parameter Settings

Parameter	Display	Function	Range	Default
L03-01	StallP Accel Sel	Stall Prevention will function during acceleration. (G+ only)	0–2	1
	0 Disabled			
	1 General Purpose	Acceleration is paused as long as the current is above the L03-02 setting.		
	2 Intelligent	Accelerate in the shortest possible time without exceeding the L03-02 level.		
L03-02	StallP Accel Lvl	Output current level at which the Stall Prevention during acceleration is activated. (G+ only)	0–150%	*
L03-03	StallPAcc LowLim	Stall Prevention lower limit during acceleration when operating in the constant power range. Set as a percentage of VFD rated current. (G+ only)	0–100%	50
L03-05	StallP Run Sel	Control for the stall prevention during run. (G+ only)	0–2	1
	0 Disabled	Runs at a set frequency. A heavy load may stall.		
	1 Decel Time 1	Use Decel Time 1 (B05-02)		
	2 Decel Time 2	Use Decel Time 2 (B05-04)		
L03-06	StallP Run Level	Current level to trigger Stall Prevention during run. Depending on L03-23, the level is automatically reduced in the constant power range (speed beyond base speed). (G+ only) Enabled when L03-05 is set to 1 or 2.	30–150%	*
L03-11	OV Inhibit Sel *0 Disabled* *1 Enabled*	Enables or disables the OV suppression function, which allows the VFD to change the output frequency as the load changes to prevent an OV fault.	0, 1	0
L03-17	DC Bus Reg Level	DC bus voltage during overvoltage suppression and Stall Prevention during deceleration	230 V: 150–400 VDC 460 V: 300–800 VDC 575 V: 431–1150 VDC	230 V: 375 V 460 V: 750 V 575 V: 930 V
L03-20	DC Bus P Gain	Proportional gain for Stall Prevention and overvoltage suppression	0.00–5.00	A01-02
L03-21	Acc/Dec P Gain	Proportional gain used to calculate the deceleration rate during OV suppression function and Stall Prevention during deceleration	0.10–10.00 sec	A01-02
L03-23	CHP Stall P Sel	Reduces the Stall Prevention during run level in the constant power range. (G+ only)	0, 1	0
	0 Lvl set in L3-06	Sets the Stall Prevention level that is used throughout the entire frequency range.		
	1 Autom. Reduction	Automatic Stall Prevention level reduction in the constant output range. Lower limit is 40% of L03-06.		
L03-24	Mtr Accel Time	Time needed to accelerate the uncoupled motor at rated torque from stop to the maximum frequency.	0.001–10.000 sec	O02-04

* *Default and Range changed by D10-01.*

5.7.4 Speed Agree

The IMPULSE•G+/VG+ Series 4 has three functions for detecting output frequency:

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.*

Table 5-90: Speed Agree Parameter Settings

Parameter	Display	Function	Range	Default
L04-01	Spd Agree Level	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	Spd Agree Width	Detection width for speed agree 1 and frequency detection functions.	0.0–20.0 Hz	2.0
L04-03	Spd Agree Lvl+-	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	Spd Agree Wdth+-	Detection width for the speed agree 2 function.	0.0–20.0 Hz	2.0

Table 5-91: Reference Detection Parameter Settings

Parameter	Display	Function	Range	Default
L04-05	Ref Loss Sel	The VFD can detect a loss of an analog frequency reference from input A1, A2, or A3. Frequency reference loss is detected when the frequency reference drops below 10% of the reference or below 5% of the maximum output frequency within 400 ms.	0, 1	0
	0 Stop	VFD stops when frequency reference is lost.		
	1 Run@L4-06PrevRef	VFD runs at a reduced speed when the frequency reference is lost.		
L04-06	Fref at Floss	Percentage of the frequency reference that the VFD should run with when the frequency reference is lost.	0.0–100.0%	80
L04-07	Freq Detect Sel	Determines when frequency detection is active using parameters L04-01 to L04-04.	0, 1	0
	0 No Detection @BB	No detection during baseblock.		
	1 Always Detected	Detection always enabled.		

5.7.5 Test Mode

DANGER

Test Mode is designed to allow for temporary hoisting operations of motors normally equipped with an encoder in Flux Vector control. Always follow the instructions listed below, and use extreme caution when operating a hoist in Test Mode. Stop the hoist if any undesired motion occurs and contact Magnetek for additional assistance.

Test Mode is a troubleshooting aid intended for troubleshooting Flux Vector problems. The feature cannot be left on indefinitely and will generate a fault after being on for 10 minutes. At this time, the fault must be reset or power must be cycled.

When enabled, the Control Method in A01-02 is temporarily overridden to the setting of E03-01. All other functions for the new control method are not restricted. Certain programming may need to be done to clear any OPE conditions that occur as a result of the new Control Method. It is up to the user to determine if a special function may cause an unsafe condition during testing. Since this feature is typically used for No-Load Brake type hoists, many of the inherent safety checks will become disabled. It may be desirable to disable functions such as Ultra-Lift, but leave Limit Switch functions enabled. The user will determine what functions are being used. If unsure, it is best to disable the function (either by programming or MFDI in OFF state).

Table 5-92: Test Mode Parameter Settings

Parameter	Display	Function	Range	Default
L05-01	Test Mode *0 Disabled* *1 Enabled*	Test Mode Enable. Starts a 10 minute timer after which the VFD will not function until Test Mode is disabled. If power is cycled, Test Mode will become disabled. When test mode is enabled, Test Mode settings will be used for operation. Refer to the E03 group.	0, 1	0

5.7.6 Torque Detection

The torque detection function will trigger an alarm or fault when the motor load is above or below a set threshold. When an undertorque/overtorque condition is detected, a signal can be sent to a multi-function output (H02-0x = “B” or “18”).

Table 5-93: Torque Detection Parameter Settings

Parameter	Display	Function	Range	Default
L06-01	Torque Det 1 Sel *0 Disabled* *1 OT@SpdAgree-Alm* *2 OT At RUN - Alm* *3 OT@SpdAgree-Flt* *4 OT At RUN - Flt* *5 UT@SpdAgree-Alm* *6 UT At RUN - Alm* *7 UT@SpdAgree-Flt* *8 UT At RUN - Flt*	Activates overtorque/undertorque detection and selects whether detection generates an alarm or a fault	0-8	0

Table 5-94: Torque Detection Setting Descriptions

Settings	Description
0	Torque detection is disabled *(factory default)*.
1	Overtorque detection is enabled whenever at speed agree (when VFD is not accelerating or decelerating). Continue running after detection (OT1 alarm).
2	Overtorque detection is enabled always. Continue running after detection (OT1 alarm).
3	Overtorque detection is enabled whenever at speed agree. Coast to a stop after detection (OT1 fault).
4	Overtorque detection is enabled always. Coast to a stop after detection (OT1 fault).
5	Undertorque detection is enabled whenever at speed agree (when VFD is not accelerating or decelerating). Continue running after detection (UT1 alarm).
6	Undertorque detection is enabled always. Continuing running after detection (UT1 alarm).
7	Undertorque detection is enabled whenever at speed agree. Coast to a stop after detection (UT1 fault).
8	Undertorque detection is enabled always. Coast to stop after detection (UT1 fault)

NOTE:

- *To detect overtorque/undertorque during acceleration or deceleration, set to “2” or “4” / “6” or “8”.*
- *To continue operation after overtorque/undertorque detection, set to “1” or “2” / “5” or “6” During detection, the keypad displays an “OT1/UT1” alarm (blinking).*
- *To stop the VFD after an overtorque/undertorque detection fault, set to “3” or “4” / “7” or “8”. During detection, the keypad displays an “OT1/UT1” fault.*

Table 5-95: Torque Detection Parameter Settings - continued

Parameter	Display	Function	Range	Default
L06-02	Torq Det 1 Lvl	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	Torq Det 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. Keypad displays “OT1”.	0.0–10.0 sec	0.1
L06-04	Torq Det 2 Sel *0 Disabled* *1 OT@SpdAgree-Alm* *2 OT At RUN - Alm* *3 OT@SpdAgree-Flt* *4 OT At RUN - Flt* *5 UT@SpdAgree-Alm* *6 UT At RUN - Alm* *7 UT@SpdAgree-Flt* *8 UT At RUN - Flt*	Activates overtorque/undertorque detection, and selects whether detection generates an alarm or a fault.	0-8	0

Table 5-96: Torque Detection 2 Setting Descriptions

Settings	Description
0	Overtorque/undertorque detection is disabled *(factory default)*.
1	Overtorque detection is enabled whenever at speed agree (when VFD is not accelerating or decelerating). Continue running after detection (OT2 alarm).
2	Overtorque detection is enabled always. Continue running after detection (OT2 alarm).
3	Overtorque detection is enabled whenever at speed agree. Coast to a stop after detection (OT2 fault).
4	Overtorque detection is enabled always. Coast to a stop after detection (OT2 fault).
5	Undertorque detection is enabled whenever at speed agree (when VFD is not accelerating or decelerating). Continue running after detection (UT2 alarm).
6	Undertorque detection is enabled always. Continuing running after detection (UT2 alarm).
7	Undertorque detection is enabled whenever at speed agree. Coast to a stop after detection (UT2 fault).
8	Undertorque detection is enabled always. Coast to stop after detection (UT2 fault).

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

Table 5-97: Torque Detection Parameter Settings - continued

Parameter	Display	Function	Range	Default
L06-05	Torq Det 2 Lvl	Torque Detection 2 Level	0–300%	150
L06-06	Torq Det 2 Time	Torque Detection 2 Time	0.0–10.0 sec	0.1
L06-08	Mech Fatigue Sel *0 Disabled* *1 Alm Spd>L06-09* *2 Alm [Spd]>L06-09* *3 Flt Spd>L06-09* *4 Flt [Spd]>L06-09* *5 Alm Spd<L06-09* *6 Alm [Spd]<L06-09* *7 Flt Spd<L06-09* *8 Flt [Spd]<L06-09*	This function can detect an overtorque or undertorque in a certain speed range as a result of machine fatigue. It is triggered by a specified operation time and uses the oL1 detection settings (L06-01 and L06-03).	0-8	0

Table 5-98: Mechanical Fatigue Setting Descriptions

Settings	Description
0	Mechanical Weakening Detection disabled (factory default).
1	Continue running (alarm only). Detected when the speed (signed) is greater than L06-09.
2	Continue running (alarm only). Detected when the speed (not signed) is greater than L06-09.
3	Interrupt VFD output (fault). Detected when the speed (signed) is greater than L06-09.
4	Interrupt VFD output (fault). Detected when the speed (not signed) is greater than L06-09.
5	Continue running (alarm only). Detected when the speed (signed) is less than L06-09.
6	Continue running (alarm only). Detected when the speed (not signed) is less than L06-09.
7	Interrupt VFD output (fault). Detected when the speed (signed) is less than L06-09.
8	Interrupt VFD output (fault). Detected when the speed (not signed) is less than L06-09.

Table 5-99: Mechanical Fatigue Parameter Settings

Parameter	Display	Function	Range	Default
L06-09	MechFat Det Spd	Speed that triggers Mechanical Weakening Detection. When L06-08 is set for an unsigned value, the absolute value is used if the setting is negative.	-110.0–110.0%	110.0
L06-10	MechFat Det Time	Time mechanical weakening has to be detected before an alarm or fault is triggered.	0.0–10.0 sec	0.1
L06-11	MechFat Det Hour	Operation time (U01-04) required before Mechanical Weakening Detection is active.	0–65535	0

5.7.7 Hardware Protection

The IMPULSE•G+/VG+ Series 4 has several built-in functions designed to protect the VFD and its components from damage.

Table 5-100: Hardware Protection Parameter Settings

Parameter	Display	Function	Range	Default
L08-02	OH Pre-Alarm Lvl	Heatsink temperature level for protection against overheat (OH). ***NOTE:*** *The VFD measures heatsink temperature by a negative temperature coefficient thermistor.*	50–150°C	*
L08-03	OH Pre-Alarm Sel	Stopping method when heatsink overheat is detected	0–5	3
	0 Decel to Stop	Decel to stop using B05-02		
	1 Coast to Stop	Immediate stop		
	2 Fast Stop	Decel to stop using B05-08		
	3 Use B3-03 Method	Uses programmed B03-03 Method		
	4 Alarm Only	Operation continues and “OH Heatsink Overtemp” is displayed on keypad		
	5 Run@L8-19 Rate	Continue operation at reduced speed L08-19.		
L08-05	Ph Loss In Sel	Input phase loss detection	0, 1	1
	0 Disabled			
	1 Enabled			
L08-07	Ph Loss Out Sel	Output phase loss detection	0–2	1
	0 Disabled			
	1 1PH Loss Det			
	2 2/3PH Loss Det			
L08-08	Ph Loss Out Lvl	Output current level above which is considered an output phase.	0.0–20.0%	5.0
L08-09	Ground Fault Sel	Ground fault detection	0, 1	1
	0 Disabled			
	1 Enabled			
L08-10	Fan On/Off Sel	Cooling fan operation	0, 1	0
	0 Dur Run (OffDly)			
	1 Always On			
L08-11	Fan Delay Time	When L08-10 = 0, fan will operate L08-11 seconds after Run Command is removed	0–300 sec	60
L08-12	Ambient Temp	Adjusts Overload (OL2) Protection for high ambients	-10–50°C	40
L08-13	UV3 Detect	Soft Charge Bypass Circuit Fault	0, 1	1
	0 Disabled			
	1 Enabled			
L08-15	OL2 Sel @ L-Spd	OL2 detection when output frequency ≤ 6 Hz	0, 1	0**
	0 Disabled			
	1 Enabled			

Parameter	Display	Function	Range	Default
L08-18	Soft CLA Sel	Software current limit	0, 1	0
	0 Disabled			
	1 Enabled			
L08-19	Fc Red dur OHAlm	Frequency reference reduction gain at overheat pre-alarm when L08-03 = 4.	0.1–0.9 Hz	0.8
L08-32	MC,FAN Fault Sel	MC, FAN configure the operation of power if it detects a warning alarm	0–4	1
	0 Decel to Stop			
	1 Coast to Stop			
	2 Fast Stop			
	3 Use B3-03 Method			
	4 Alarm Only			
L08-35	Installation Sel	VFD Installation Method	0–3	2*
	0 IP20/OpenChassis			
	1 Side-by-Side			
	2 IP20/Nema Type 1			
	3 Finless/Fin Ext			
L08-38	Fc Reduct dur OL	Temporarily reduces the carrier frequency when the VFD exceeds a certain level. This temporarily increases the overload capability (OL2 detection) allowing the VFD to run through transient load peaks without faulting.	0–2	2
	0 Disabled			
	1 Active below 6Hz	Enabled below 6 Hz Carrier Frequency is reduced when: < 6Hz and current > 100% of VFD Rated Current, returns to normal carrier frequency when output current falls below 88% of VFD rated current or frequency > 7Hz		
	2 Active @ any Spd	Enabled for the entire speed range < 6Hz when current > 100% of VFD Rated Current 7Hz when current > 112% of VFD Rated Current		
L08-40	FC Reduct Time	Time that the VFD continues running with reduced carrier frequency after the carrier reduction condition is gone. Setting L08-40 to 0.00 disables the carrier frequency reduction time.	0.00–2.00 sec	A01-02
L08-41	High Cur Alm Sel	Triggers a high current alarm (HCA) when the output current rises exceeds 150% of the VFD rated current.	0, 1	0
	0 Disabled			
	1 Enabled			
L08-55	DB Tr protection	Internal Braking Transistor Protection	0, 1	0*
	0 Disabled	Disable when not using the internal braking transistor.		
	1 Enabled	Enable when connecting a braking resistor to built-in braking transistor.		

** Initial value is dependent on VFD size, which is determined by O02-04 (kVA selection)*

*** Initial value is dependent on carrier. 2kHz = 0, else 1*

5.7.8 Automatic Fault Reset

When a fault occurs during operation, it can be automatically reset.

Table 5-101: Automatic Fault Reset Parameter Settings

Parameter	Display	Function	Range	Default
L09-01	Reset Select *0 Disabled* *1 Enabled*	Activates the fault auto-reset function.	0, 1	1
L09-02	Reset Attempts	Number of reset attempts. Reset attempt counter is returned to zero if no faults occur within a ten minute period.	0–10	3
L09-03	Reset Time	Reset starting time.	0.5–600.0 sec	0.5
L09-04*	Reset Flt Sel 1	Reset Fault Select 1.	0–FFFF	4001
L09-05*	Reset Flt Sel 2	Reset Fault Select 2.	0–FFFF	E000
L09-06	Flt Contact Sel *0 Flt Outp Disabld* *1 Flt Outp Enabled*	Fault contact operation during reset attempts	0, 1	0

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

1. Assign 1 to each fault code to enable the auto reset.
2. Assign 0 to each fault code to disable the auto reset.
3. Convert all Digits (1 to 4) from binary to hex.
4. Program L09-04 or L09-05 by entering the hex number obtained from step 3.

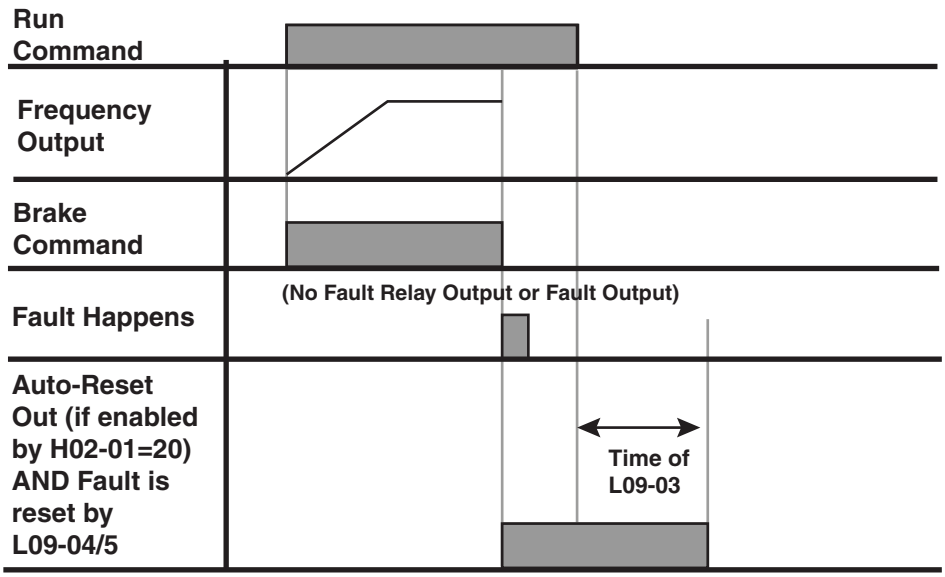


Figure 5-25: Automatic Fault Reset

Example:

Enable auto-reset for UV1 and CE faults.

Table 5-102: Auto-Reset Programming

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

Table 5-103: Auto-Reset Programming Example

L09-04	Binary	HEX	L09-05	Binary	HEX
Digit 4	0000	0	Digit 4	0000	0
Digit 3	0000	0	Digit 3	0000	0
Digit 2	0000	0	Digit 2	1000	8
Digit 1	0001	1	Digit 1	0000	0

Table 5-104: Binary to Hexadecimal Conversion

Binary Number	Hexadecimal Value
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

5.7.9 Fault Latch

The Fault Latch function allows specific faults to become “latched” after the automatic fault reset attempts (L09-02) has maxed out. The Reset key on the keypad will be blocked from clearing the fault, and the fault can only be cleared by the methods explained below. In the case of a power loss, the fault will remain latched when power is restored.

A latched fault can be cleared in three ways:

1. The recommended method is to program an MFDI (H01-xx) to 48 (Flt Latch Reset). The digital input must be toggled (ON and then OFF) in order for the fault to clear. Since this feature is intended for safety, a key switch is recommended. This will prevent a recurring fault from being continuously cleared and ignored.
2. Clear the fault using the Monitor tool within IMPULSE®•Link.
3. The F1 or F2 keypad key can be programmed to H01-09 or H01-10 = 48 (Flt Latch Reset). When a fault is latched, pressing the F1 or F2 key twice will reset the fault.

NOTE: *An MFDI and F1/F2 keys are allowed to be programmed after a fault is latched.*

Table 5-105: Fault Latch Parameter Settings

Parameter	Display	Function	Range	Default
L09-07*	Flt Latch Sel 1	Fault Latch Select 1	0000–FFFF	0000
L09-08*	Flt Latch Sel 2	Fault Latch Select 2	0000–FFFF	0000

** To program parameters L09-07 and L09-08, refer to the Auto Fault Reset example. The same programming method applies here.*

Table 5-106: Fault Latch Programming

	Digit 4				Digit 3				Digit 2				Digit 1			
HEX	0				0				0				0			
Binary	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L09-07	-	-	-	P	P	U	D	S	B	B	B	B	B	B	B	B
	-	-	-	G	G	L	E	N	E	E	E	E	E	E	E	E
	-	-	-	O	O	3	V	A	8	7	6	5	4	3	2	1
				1	2			P								
				H	H											
HEX	0				0				0				0			
Binary	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L09-08	B	B	B	B	E	E	E	E	O	O	U	L	O	O	O	O
	E	E	E	E	F	F	F	F	S	V	V	C	L	L	T	T
	7	6	5	4	5	6	7	8			1		1	2	1	2
	2	2	2	2												

5.8 Keypad and VFD Configuration

- O01 Monitor Selection
- O02 VFD and Keypad Selection
- O03 Maintenance History
- O04 Copy Function

5.8.1 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.

Table 5-107: Monitor Selection Parameter Settings

Parameter	Display	Function	Range	Default
O01-01	User Monitor Sel	Selects the last monitor that is shown when scrolling through the Monitor menu. Enter the last three digits of the monitor parameter number to be displayed: U0X-xx. Default: 106 (Monitor: Output Voltage Reference U01-06)	104–626	106
	104 Control Method			
	105 Motor Speed			
	106 Output Voltage			
	107 DC Bus Voltage			
	108 Output HP			
	109 Torque Reference			
	110 Input Term Sts			
	111 Output Term Sts			
	112 Int Ctl Sts 1			
	114 CPU 1 SW Number			
	115 Term A1 Level			
	116 Term A2 Level			
	117 Term A3 Level			
	120 SFS Output			
	121 AI Opt Ch1 Level			
	122 AI Opt Ch2 Level			
	123 AI Opt Ch3 Level			
	125 DI Opt Status			
	128 CPU 2 SW Number			
	134 OPE Error Code			
	139 Transmit Error			
	144 ASR Out w/o Fil			

Parameter	Display	Function	Range	Default
O01-01	*150 Hook Height*			
	151 Motor Revolution			
	152 MaintenanceTimer			
	153 Index Count			
	154 Term RP Inp Freq			
	160 PG CH1 Count			
	161 PG CH2 Count			
	321 RUN Cmd Counter			
	401 Drv Elapsed Time			
	403 Fan Elapsed Time			
	404 Fan Life Mon			
	405 Cap Life Mon			
	406 ChgCirc Life Mon			
	407 IGBT Life Mon			
	408 Heatsink Temp			
	410 kWh Lower 4 dig			
	411 kWh Upper 5 dig			
	412 CPU Occup Rate			
	413 Current PeakHold			
	414 Freq@ I PeakHold			
	416 Motor OL1 Level			
	417 Drive OL2 Level			
	418 Reference Source			
	419 MEMOBUS Freq Ref			
	420 Option Freq Ref			
	421 Run Cmd Source			
	422 MEMOBUS Ref Reg			
	423 Option Ref Reg			
	601 Mot SEC Current			
	602 Mot EXC Current			
	603 ASR Input			
	604 ASR Output			
	605 Voltage Ref (Vq)			
	606 Voltage Ref (Vd)			
	607 ACR(q) Output			
	608 ACR(d) Output			
	611 Iq Reference			
	612 Id Reference			
	618 PG1 CounterValue			
	619 PG2 CounterValue			
	622 Zero Servo Pulse			
	626 FF Cont Output			

Parameter	Display	Function	Range	Default
O01-02	Power-On Monitor	Monitor to be displayed on the keypad immediately after power up.	1–5	3
	1 Frequency Ref	Frequency reference (U01-01)		
	2 FWD/REV	Forward/Reverse		
	3 Output Freq	Output frequency (U01-02)		
	4 Output Current	Output current (U01-03)		
	5 User Monitor	User-selected monitor (set by O01-01)		
O01-03	Display Scaling	Units to display for the frequency reference and output frequency.	0–3	0
	0 0.01 Hz			
	1 0.01 %	(100% = E01-04)		
	2 RPM	Calculated using the number of motor poles set in E02-04		
	3 User Units	User-selected units (set by O01-10 and O01-11)		
O01-04	Display Units	Units for E01-04, E01-06, and E01-09	0, 1	A01-02
	0 Hertz			
	1 RPM			
O01-05	LCD Contrast	Adjusts brightness of the keypad display	0–5	3
O01-10	UserDisp Scaling	Display value that is equal to the maximum output frequency. Default setting is dependent on parameter O01-03. When O01-03 = 0; O01-10=6000; O01-11 = 2 When O01-03 = 1; O01-10=10000; O01-11 = 2 When O01-03 = 2; O01-10=1800 (4 pole motor); O01-11 = 0 When O01-03 = 3; O01-10=10000; O01-11 = 2	1–60000	6000
O01-11	UserDisp Dec Sel	Position of the decimal point.	0–3	2
	0 No Dec (XXXXX)			
	1 1 Dec (XXXX.X)			
	2 2 Dec (XXX.XX)			
	3 3 Dec (XX.XXX)			

5.8.2 VFD and Keypad Selection

Table 5-108: VFD and Keypad Parameter Settings

Parameter	Display	Function	Range	Default
O02-01	LO/RE Key	Pressing the LO/RE Key once displays: “Call Magnetek at 1-866-624-7378”.	0, 1	0
	0 Mode/Service	Control Method (A01-02)		
		Pressing the LO/RE Key a second time:		
		Motion (A01-03)		
		Speed Reference (A01-04)		
		Pressing the LO/RE Key a third time:		
		F1 and F2 Keys (H01-09 and H01-10)		
	1 Local/Remote	Pressing the LO/RE key switches operation command between the keypad and the settings of B03-01 and B03-02.		
O02-02	Oper STOP Key	Action when STOP key is pressed.	0–2	0
	0 Coast to Stop	(Immediate stop)		
	1 Decel to Stop			
	2 Use B3-03 Method			
O02-03	User Default Sel	Store or clear a copy of the parameter settings.	0–2	0
	0 No Change			
	1 Set Defaults	Memorizes up to 150 modified parameters. User defaults can be restored by setting A01-05 = 1110.		
	2 Clear All	Clear user defaults.		
O02-04	Inverter Model #	VFD model.	00–FF	*
		*Default determined by VFD capacity. Use VFD nameplate.		
	62 2_0004	2003-G+/VG+S4		
	63 2_0006	2005-G+/VG+S4		
	64 2_0008	2007-G+/VG+S4		
	65 2_0010	2008-G+/VG+S4		
	66 2_0012	2011-G+/VG+S4		
	67 2_0018	2014-G+/VG+S4		
	68 2_0021	2017-G+/VG+S4		
	6A 2_0030	2025-G+/VG+S4		
	6B 2_0040	2033-G+/VG+S4		
	6D 2_0056	2047-G+/VG+S4		
	6E 2_0069	2060-G+/VG+S4		
	6F 2_0081	2075-G+/VG+S4		
	70 2_0110	2085-G+/VG+S4		
	72 2_0138	2115-G+/VG+S4		
	73 2_0169	2145-G+/VG+S4		
	74 2_0211	2180-G+/VG+S4		

Parameter	Display	Function	Range	Default
O02-04	*75 2_0250*	2215-G+/VG+S4	00–FF	*
	76 2_0312	2283-G+/VG+S4		
	77 2_0360	2346-G+/VG+S4		
	78 2_0415	2415-G+/VG+S4		
	92 4_0002	4001-G+/VG+S4		
	93 4_0004	4003-G+/VG+S4		
	94 4_0005	4004-G+/VG+S4		
	95 4_0007	4005-G+/VG+S4		
	96 4_0009	4007-G+/VG+S4		
	97 4_0011	4009-G+/VG+S4		
	99 4_0018	4014-G+/VG+S4		
	9A 4_0023	4018-G+/VG+S4		
	9C 4_0031	4024-G+/VG+S4		
	9D 4_0038	4031-G+/VG+S4		
	9E 4_0044	4039-G+/VG+S4		
	9F 4_0058	4045-G+/VG+S4		
	A1 4_0072	4060-G+/VG+S4		
	A2 4_0088	4075-G+/VG+S4		
	A3 4_0103	4091-G+/VG+S4		
	A4 4_0139	4112-G+/VG+S4		
	A5 4_0165	4150-G+/VG+S4		
	A6 4_0208	4180-G+/VG+S4		
	A7 4_0250	4216-G+/VG+S4		
	A8 4_0296	4260-G+/VG+S4		
	A9 4_0362	4304-G+/VG+S4		
	AA 4_0414	4370-G+/VG+S4		
	AC 4_0515	4450-G+/VG+S4		
	AE 4_0675	4605-G+/VG+S4		
	B0 4_0930	4810-G+/VG+S4		
	B2 4_1090	41090-G+/VG+S4		
	C3 5_0003	5001-G+/VG+S4		
	C4 5_0004	5003-G+/VG+S4		
	C5 5_0006	5004-G+/VG+S4		
	C7 5_0009	5006-G+/VG+S4		
	C9 5_0011	5009-G+/VG+S4		
	CA 5_0017	5012-G+/VG+S4		
	CC 5_0022	5017-G+/VG+S4		
	CD 5_0027	5022-G+/VG+S4		
	CE 5_0032	5027-G+/VG+S4		
	CF 5_0041	5032-G+/VG+S4		
	D1 5_0052	5041-G+/VG+S4		
	D2 5_0062	5052-G+/VG+S4		

Parameter	Display	Function	Range	Default
O02-04	*D3 5_0077*	5062-G+/VG+S4	00–FF	*
	D4 5_0099	5077-G+/VG+S4		
	D5 5_0125	5099-G+/VG+S4		
	D6 5_0145	5130-G+/VG+S4		
	D7 5_0192	5172-G+/VG+S4		
	D9 5_0242	5200-G+/VG+S4		
O02-05	Operator M.O.P.	ENTER key is used when the frequency reference is set by the keypad. The keypad can simulate a motor operated potentiometer (M.O.P.).	0, 1	0
	0 Disabled	ENTER Key Required		
	1 Enabled	ENTER Key Not Required		
		NOTE: *This feature cannot be used with infinitely variable speed control.*		
O02-06	Oper Detection	Whether a disconnected keypad is detected. The keypad is only detected when the VFD is being commanded locally.	0, 1	1
	0 Disabled			
	1 Enabled			
O02-07	FWD/REVSel@PwrUp	Motor direction at power up when operation is assigned to the keypad.	0, 1	0
	0 Forward			
	1 Reverse			
O02-09	Init Model Sel	VFD region. This presets the voltage and frequencies along with the motor power units that are common to the region.	1, 2	1
	1 American Spec			
	2 European Spec			
O02-10	Motor Power Unit	Units for motor power.	0, 1	0
	0 HP			
	1 kW			
O02-11	Test Mode Sel	One-time slip measurement after a non-rotational auto-tune. Changing this parameter is normally not required.	0, 1	1
	0 Disabled			
	1 Enabled			
O02-15	Legacy RDSI	Legacy support for Hetronic RDSI.	0, 1	0
	0 Disabled			
	1 Enabled			
O02-19	ParameterSet Sel	EEPROM writes during a UV fault.	0, 1	0
	0 Disabled			
	1 Enabled			

5.8.3 Maintenance History

Table 5-109: Maintenance History Parameter Settings

Parameter	Display	Function	Range	Default
O03-01	Elapsed Time Set	Cumulative operation time of the VFD in units of 10 hours. Cumulative time can be viewed using monitor Cumulative Operation Time (U04-01). A setting of 30 = 300 hours	0–9999 x 10 hr	0
O03-02	Elapsed Time Run	How the cumulative timer will keep track of the total operation time.	0, 1	1
	0 Power-On Time	Logs power-on time		
	1 Running Time	Logs operation time when the VFD output is active.		
O03-03	Fan ON Time Set	Fan Operation Time monitor (U04-03) in units of 10 hours. A setting of 30 = 300 hours	0–9999 x 10 hr	0
O03-05	BusCap Maint Set	Maintenance Monitor for the capacitors. See U04-05 to check when the capacitors may need to be replaced.	0–150%	0
O03-09	IGBT Maint Set	Maintenance Monitor for the IGBTs. See U04-07 for IGBT replacement times.	0–150%	0
O03-11	Fault Data Init	Fault Trace (U02-xx) and Fault History (U03-xx) reset.	0, 1	0
	0 No Reset	Not cleared		
	1 Reset	Resets the U02.xx and U03.xx fault history		
O03-12	kWh Monitor Init	Reset the monitor data (U04-10 and U04-11).	0, 1	0
	0 No Reset	Not cleared.		
	1 Reset	Resets the U04-10 and U04-11 power meter.		
O03-14	Count Hist Clear	Determines which counter will be cleared. After counters are cleared, initial value (O03-14) is set to 0.	0–3	0
	0 No Reset	Not cleared.		
	1 Reset Runs	Clears run command counters (U03-21 and U03-22).		
	2 OL/LC Count Clr	Clears OL/LC Counters (U03-23).		
	3 Both Count Clr	Clears Runs and OL/LC Counters.		

5.8.4 Copy Function

Table 5-110: Copy Function Parameter Settings

Parameter	Display	Function	Range	Default
O04-01	Copy Function Sel	Copy parameters to/from keypad	0–3	0
	0 COPY SELECT			
	1 INV → OP READ	VFD → Keypad		
	2 OP → INV WRITE	Keypad → VFD		
	3 OP ↔ INV VERIFY	Keypad ↔ VFD		
O04-02	Read Allowable	Enables/disables copy function	0, 1	1
	0 Disabled			
	1 Enabled			
O04-07	ChrgCircMaintSet	Maintenance Monitor for the soft charge bypass relay. See U04-06 to check when the bypass relay may need to be replaced.	0–150%	0

The keypad has parameter COPY capabilities via built-in non-volatile memory. The keypad can READ all of the parameters in the VFD and store them for later, and then WRITE them to a VFD with the same model number and firmware version. In order to read the parameter values and store them into the keypad, select O04-02 = 1 (Enabled). If O04-02 = 0, you will get the following error:

After setting O04-02 = 1 (Enabled), it is possible to store parameter values in the keypad by setting O04-01 = 1 (INV → OP READ). A successful READ of the parameter values will display:

If an error is displayed, press any key to cancel the error display and return to parameter O04-01. Error displays and their meanings are covered in Chapter 6.5: Copy Function. To COPY the parameter values into a VFD, set O04-01 = 2 (OP → INV WRITE). During the writing of the parameter values into the VFD, the keypad will display:

A successful COPY of the parameter values will display:

If an error is displayed, press any key to return to parameter O04-01. Error displays and their meanings are covered in ***Table 6-7 on page 215***.

It is possible to compare the parameter values stored in the keypad with the parameter values currently in the VFD by using the VERIFY function. This VERIFY function should not be confused with the "-VERIFY-" that is displayed on the keypad when viewing the "Modified Parameters" menu. To VERIFY the parameter values in the VFD as compared with those stored in the keypad, set O04-01 = 3 (OP ↔ INV VERIFY). During the comparison, the keypad will display:

A successful VERIFY of the parameter values will display:

If the parameters stored in the keypad do not match those programmed in the VFD, the keypad displays the following:

The keypad will not display which parameters did not match, only that the verification found discrepancies in some parameter values.

NOTE: *In order to properly use the COPY or VERIFY functions, the following VFD information must be identical between the VFD that the parameters were read from and the VFD that the parameters are written to:*

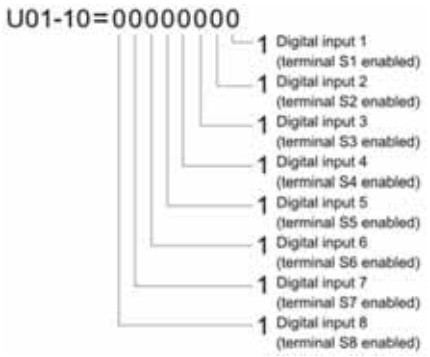
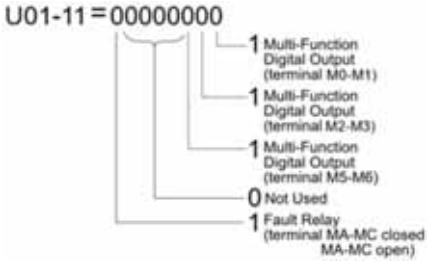
Model Number (e.g., 5001-G+ S4)
Firmware Version (e.g., 14707)
Control Method (e.g., Flux Vector)
Motion (e.g., NLB Hoist)

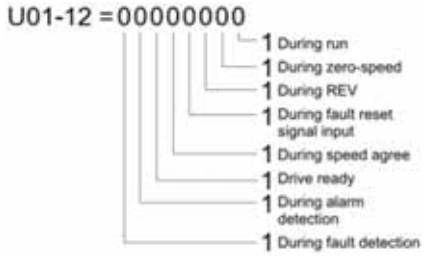
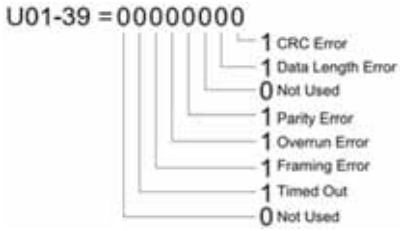
NOTE: See Section 6.5 on page 215 *for additional copy function troubleshooting.*

5.9 Monitors

- U01 Status
- U02 Fault Trace
- U03 Fault History
- U04 Maintenance
- U06 Control

Table 5-111: Status Monitors

Monitor	Display	Function	Units
U01-01	Frequency Ref	Frequency Reference	Hz
U01-02	Output Freq	Output Frequency	Hz
U01-03	Output Current	Output Current	A
U01-04	Control Method	Value of A01-02	-
U01-05	Motor Speed	Motor Speed	Hz
U01-06	Output Voltage	Output Voltage (Reference)	VAC
U01-07	DC Bus Voltage	DC Bus Voltage (Measured)	VDC
U01-08	Output Power	Output Power (Calculated)	HP/kW
U01-09	Torque Reference	Torque Reference (Internal)	%
U01-10	Input Term Sts	Input Terminal Status	-
			
U01-11	Output Term Sts	Output Terminal Status	-
			

Monitor	Display	Function	Units
U01-12	Int Ctl Sts 1	Operation Status 	-
U01-14	CPU 1 SW Number	Firmware version	-
U01-15	Term A1 Level	External Terminal A1 Input level	%
U01-16	Term A2 Level	External Terminal A2 Input level	%
U01-17	Term A3 Level	External Terminal A3 Input level	%
U01-20	SFS Output	Output frequency after the soft starter	Hz
U01-21	AI Opt Ch1 Level	Input voltage to terminal V1 on analog input card AI-A3.	%
U01-22	AI Opt Ch2 Level	Input voltage to terminal V2 on analog input card AI-A3.	%
U01-23	AI Opt Ch3 Level	Input voltage to terminal V3 on analog input card AI-A3.	%
U01-24	Opt Out	Output from the option card S4IO - 8 bits.	-
U01-25	Opt In Low	Reference value input from the option card (DI-A3, S4I, or S4IO) lower 8 bits.	-
U01-26	Opt In High	Reference value input from the option card (DI-A3, S4I, or S4IO) upper 8 bits.	-
U01-28	CPU 2 SW Number	ROM ID	-
U01-29	Load Weight	Load weight when C10-01 is enabled	C10-06
U01-30	SS Delta Speed	Snap Shaft Delta Speed between Ch1 and Ch2 after gear ratio	Hz
U01-34	OPE Error Code	Parameter number that caused the OPExx or Err (EEPROM write error) error.	-
U01-39	Transmit Error	Contents of a Modbus error 	-
U01-44	ASR Out w/o Filter	Output monitor from Speed Control loop (Primary Delay filter input value). 100% is displayed at motor rated secondary current.	%
U01-50	Hook Height	Percentage of Hook height. This will display 0% until the system is homed.	%
U01-51	Motor Revolution	Number of revolutions after Home with respect to Home.	Revs
U01-52	MaintenanceTimer	Hours since last timer reset.	Hrs
U01-53	Index Count	Number of motor revolutions the shaft has moved since the beginning of a new Index command.	Revs
U01-54	Term RP Inp Freq	Frequency of pulse train input terminal RP.	Hz

Monitor	Display	Function	Units
U01-60	PG CH1 Count	Raw PG Channel 1 pulse count 4 pulses = 1 ppr of F01-01	Pulses
U01-61	PG CH2 Count	Raw PG Channel 2 pulse count 4 pulses = 1 ppr of F01-01	Pulses
U01-63	PG CH1 Freq	Input frequency on PG Channel 1	Hz
U01-64	PG CH2 Freq	Input frequency on PG Channel 2	Hz
U01-65	PG Output Freq	Output frequency on the PG Output channel	Hz
U01-66	BE6 Pulse Count	Amount of shaft movement during the BE6 detection time 4 pulses = 1 ppr of F01-01	Pulses
U01-68	LC Zone	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 in.	-
U01-69	LC Margin	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 or an LC fault to occur. If the LC fault occurs, the value displayed is the amount the level was below the LC zone setting.	%
U01-84	NLB State	Current NLB State Machine sequence. Analog Output Level: 0.5V/State	-
U01-85	NLB Rel Trq	Torque level for next BE2 check. Is set to 100% after BE2 is passed, and set to torque output level at end of Load Float. No signal output available	%
U01-86	Brk Test Trq	Brake breakaway torque; FLV only; MFDI needs to be programmed with “Brake Test”	Flb

Table 5-112: Fault Trace Monitors

Monitor	Display	Function	Units
U02-01	Current Fault	Most current fault detected before being reset	-
U02-02	Last Fault	Most recent fault after being reset	-
U02-03	Frequency Ref	Freq ref when the fault was detected	Hz
U02-04	Output Freq	Output freq when the fault was detected	Hz
U02-05	Output Current	Output current when the fault was detected	A
U02-06	Motor Speed	Motor Speed when the fault was detected	Hz
U02-07	Output Voltage	Output voltage when the fault was detected	VAC
U02-08	DC Bus Voltage	DC Bus voltage when the fault was detected	VDC
U02-09	Output Power	Output power when the fault was detected	HP/kW
U02-10	Torque Reference	Torque reference when the fault was detected	%
U02-11	Input Term Sts	Input terminal status when the fault was detected	-
U02-12	Output Term Sts	Output terminal status when the fault was detected	-
U02-13	Inverter Status	VFD status when the fault was detected	-
U02-14	Elapsed Time	Elapsed time when the fault was detected	Hrs
U02-15	SFS Output	Speed reference for the soft starter when the fault was detected	Hz
U02-16	Motor Iq Current	Q-axis current for the motor when the fault was detected	%
U02-17	Motor Id Current	D-axis current for the motor when the fault was detected	%
U02-20	Actual Fin Temp	Temperature of the heatsink when the fault was detected	°C
U02-27*	Motor Temp (NTC)	Temperature of the motor when the fault was detected	°C
U02-28*	Fault Axis	Module where the fault occurred at a decimal number	-

* *Available only for 4810 and 41090 models.*

Table 5-113: Fault History Monitors

Monitor	Display	Function	Units
U03-01	Last Fault	First most recent fault	-
U03-02	Fault Message 2	Second most recent fault	-
U03-03	Fault Message 3	Third most recent faults	-
U03-04	Fault Message 4	Fourth most recent fault	-
U03-05	Fault Message 5	Fifth most recent fault	-
U03-06	Fault Message 6	Sixth most recent fault	-
U03-07	Fault Message 7	Seventh most recent fault	-
U03-08	Fault Message 8	Eighth most recent fault	-
U03-09	Fault Message 9	Ninth most recent fault	-
U03-10	Fault Message 10	Tenth most recent fault	-
U03-11	Elapsed Time 1	Elapsed time of the first most recent fault	Hrs
U03-12	Elapsed Time 2	Elapsed time of the second most recent fault	Hrs
U03-13	Elapsed Time 3	Elapsed time of the third most recent fault	Hrs
U03-14	Elapsed Time 4	Elapsed time of the fourth most recent fault	Hrs
U03-15	Elapsed Time 5	Elapsed time of the fifth most recent fault	Hrs
U03-16	Elapsed Time 6	Elapsed time of the sixth most recent fault	Hrs
U03-17	Elapsed Time 7	Elapsed time of the seventh most recent fault	Hrs
U03-18	Elapsed Time 8	Elapsed time of the eighth most recent fault	Hrs
U03-19	Elapsed Time 9	Elapsed time of the ninth most recent fault	Hrs
U03-20	Elapsed Time 10	Elapsed time of the tenth most recent fault	Hrs
U03-21	RUN Cmd Counter	Counts FWD or REV run commands	Count
U03-22	U3-21 Rollovers	Increments when U03-21 passes 9999. U03-21 is set to 0. Counter cleared by O03-14.	Count
U03-23	OL/LC Count	Counts OL1, OL2, LC faults. Counter cleared by O03-14.	Count

Table 5-114: Maintenance Monitors

Monitor	Display	Function	Units
U04-01	Drv Elapsed Time	Cumulative operation time of the VFD. The value for the cumulative operation time counter can be reset in parameter O03-01. Use parameter O03-02 to determine if the operation time should start as soon as the power is switched on or only while the Run command is present. The maximum number displayed is 99999, after which the value is reset to 0.	Hrs
U04-03	Fan Elapsed Time	Cumulative operation time of the cooling fan. The default value for the fan operation time is reset in parameter O03-03. After the count reaches 99999, the value will reset to 0 and start counting again.	Hrs
U04-04	Fan Life Mon	Main cooling fan usage time as a percentage of its expected performance life. Parameter O03-03 can reset this monitor.	%
U04-05	Cap Life Mon	Main circuit capacitor usage time as a percentage of their expected performance life. Parameter O03-05 can reset this monitor.	%
U04-06	ChgCirc Life Mon	Soft charge bypass relay maintenance time as a percentage of its estimated performance life. Parameter O04-07 can reset this monitor.	%
U04-07	IGBT Life Mon	IGBT usage time as a percentage of the expected performance life. Parameter O03-09 can reset this monitor.	%
U04-08	Heatsink Temp	Heatsink temperature.	°C
U04-09	LED Oper Check	Lights all LED segments to verify the display is working properly.	-
U04-10	kWh Lower 4 dig	VFD output power. The value is a 9 digit number displayed across two monitors, U04-10 and U04-11.	kWH
U04-11	kWh Upper 5 dig	-	MWH
U04-12	CPU Occup Rate	Amount of space being used in the CPU.	%
U04-13	Current PeakHold	Highest current value that occurred during run.	A
U04-14	Freq@ I PeakHold	Output frequency when the value shown in U04-13 occurred.	Hz
U04-16	Motor OL1 Level	Motor overload detection accumulator. 100% is equal to the OL1 detection level. Accumulator is reset when power is cycled.	%
U04-17	Drive OL2 Level	100% = OL2 detection level	%
U04-18	Reference Source	Source for the frequency reference as XY-nn.	-
U04-19	MEMOBUS Freq Ref	Frequency reference provided by Modbus (decimal).	%
U04-20	Option Freq Ref	Frequency reference input by an option card (decimal).	%
U04-21	Run Cmd Source	Source for the Run command as XY-nn.	-
U04-22	MEMOBUS Ref Reg	VFD control data set by Modbus communications register no. 0001H as a four-digit hexadecimal number.	-
U04-23	Option Ref Reg	VFD control data set by an option card as a four-digit hexadecimal number.	-
U04-32*	Motor Temp (NTC)	Motor temperature (NTC). U04-32 will display “20 °C” when an analog input is not set for motor thermistor input H03-xx = E.	°C
U04-37*	OH Alarm Axis	Module where the oH alarm occurred as a binary number.	BIN
U04-38*	FAN Alarm Axis	Module where the FAn alarm occurred as a binary number.	BIN
U04-39*	VOF Alarm Axis	Module where the voF alarm occurred as a binary number.	BIN

* *Available only for 4810 and 41090 models.*

Table 5-115: Control Monitors

Monitor	Display	Function	Units
U06-01	Mot SEC Current	Motor secondary current (Iq). Motor rated secondary current is 100%.	%
U06-02	Mot EXC Current	Motor excitation current (Id). Motor rated secondary current is 100%.	%
U06-03	ASR Input	Input value when using ASR control.	%
U06-04	ASR Output	Output value when using ASR control.	%
U06-05	Voltage Ref (Vq)	Output voltage reference (Vq) for the q-axis.	VAC
U06-06	Voltage Ref (Vd)	Output voltage reference (Vd) for the d-axis.	VAC
U06-07	ACR(q) Output	Output value for current control relative to motor secondary current (q-axis).	%
U06-08	ACR(d) Output	Output value for current control relative to motor secondary current (d-axis).	%
U06-18	PG1 CounterValue	Number of pulses for speed detection. Analog Output Level: 10V/65535	PPR
U06-19	PG2 CounterValue	Number of pulses for speed detection. Analog Output Level: 10V/65535	PPR
U06-22	Zero Servo Pulse	How far the rotor has moved from its last position in PG pulses (multiplied by 4).	Pulse
U06-26	FF Cont Output	Output for Feed Forward control.	%

6 Troubleshooting

6.1 Troubleshooting the VFD

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 VFD.

Table 6-1: Maintenance and Inspection

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).

Alarms and Faults are described as follows:

- Fault: Brake is set, operation indicator lights flash, fault is displayed on keypad, and fault relay MB-MC is activated. The reset key must be pressed, a digital input set for fault reset must be enabled, or power must be cycled in order to continue operation.
- Alarm: Brake does not set, operation continues, alarm is displayed on the keypad and ALM LED flashes, fault relay is not activated.

Table 6-2: Motor Related Issues

Symptom	Corrective Action
Analog frequency reference is not stable. (drifting)	1. Stabilize the analog source. 2. Increase H03-13. 3. Increase B05-01 or 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 is stalled due to excessive load.
Motor rotation is in the wrong direction.	1. Verify FWD/REV or UP/DN is correct at the interface card. 2. Match wiring to the phase order of motor leads T1, T2, T3. 3. Change motor rotation (B03-04).
Motor rotates, but at minimum speed only.	1. Check wiring of speed inputs. 2. Verify speed reference setting (A01-04). 3. Verify reference and run source settings (B03-01, -02). 4. Verify reference priority setting (B01-18). 5. Verify encoder direction (VG+).
Motor RPM too high or too low.	1. Compare motor nameplate with E02 parameters. 2. Check maximum frequency setting (E01-04). 3. Check minimum frequency setting (E01-09).

Table 6-3: VFD Faults and Alarms

Display	Description	Corrective Action	Fault	Alarm
AS1 Anti-Shock	**Anti-Shock Indicator.** When Anti-Shock is triggered, this alarm will be displayed on the keypad for the duration of time set via C07-22.	1. No action is required.		X
BB Base Block	**External Base Block Indicator.** The base block signal is the result of a digital input. The base block indicates that the VFD's output has been disabled. The motor will begin coasting when the base block input is received while running. If a RUN command is still present when the BB signal is removed, the VFD will continue operation at the currently commanded frequency.	1. Check H01-01 through H01-08 for proper programming. 2. Check input status (U01-10).		X
BE0 Brake Ans Lost	**Brake Answerback Lost During Run Alarm.** While running, the multi-function input brake answerback (H01-0x = 58) is lost.	1. Check brake answerback circuit. 2. Check input status. (U01-10)	X	X
BE0-2 Brake2Ans Lost	**Brake 2 Answerback Lost During Run Alarm.** Brake Answerback 2 closes during operation.	1. Check brake answerback circuit. 2. Check input status. (U01-10)	X	X
BE1 Rollback Detect	**Torque Proving Fault.** The BE1 fault indicates that the VFD has released the brake, but not started to accelerate the motor when it detects excessive encoder feedback. A BE1 fault will occur if the pulses received during the BE1 detection time (C08-04) are greater then the expected number of pulses (C08-05).	1. Increase the value of C08-21. 2. ***See Section 6.2 on page 204***.	X	

Display	Description	Corrective Action	Fault	Alarm
BE2 No Current	**Torque Proving Fault.** Before the brake is released, the VFD's current/torque did not reach Initial Brake Release Torque level (C08-16) within the IFB OK timer (C08-02).	1. Ensure the motor has been Auto-tuned successfully. 2. Confirm that the holding brake is closed. 3. If a power limit switch is used, ensure the switch is closed. 4. Decrease the value of C08-02 to no less than 0.5 seconds. 5. Decrease the value of C04-02 to no less than 5. 6. Decrease the value of C08-16 to no less than 50.	X	
BE3 Brake Release NG	**Brake Release Fault.** The BE3 fault indicates that the VFD has released the brake and commanded the VFD to run, but it has not detected the expected encoder feedback. A BE3 fault will occur if the pulses received during the BE3 detection time (C08-06) are less than the expected number of pulses (C08-07).	1. ***See Section 6.2 on page 204***.	X	
BE4 Brake Answer 1	**Brake Answerback, Brake not Released Alarm.** At Start, Brake Answerback is not input within predetermined time (C08-04) after brake release command is output brake not released.	1. Check brake answerback circuit. 2. Increase the value of C08-04. 3. Check input status (U01-10).	X	X
BE4-2 Brake 2 Answer 1	**Brake 2 Answerback, Brake not Released Alarm.** Brake 2 Answerback does not release during Brake Release state.	1. Check brake answerback circuit. 2. Increase the value of C08-04. 3. Check input status (U01-10).	X	X
BE5 Brake Answer 2	**Brake Answerback At Stop Alarm.** At Stop, Brake Answerback signal is not removed within predetermined time (C08-11) after brake release command is removed—brake not closed.	1. Check brake answerback circuitries. 2. Increase the C08-11 time.	X*	X
BE5-2 Brake 2 Answer 2	**Brake 2 Answerback at Stop Alarm.** Brake 2 Answerback does not close during Brake Set time.	1. Check brake answerback circuitries. 2. Increase the C08-11 time.	X*	X
BE6 Brake Slipping	**Brake Proving Alarm.** The BE6 alarm indicates that the VFD has commanded the brake to set but detected excessive encoder feedback. This occurs if the number of pulses received during the BE6 detection time (C08-12) is greater than the expected number of pulses (C08-13).	1. Check the brake. 2. ***See Section 6.2 on page 204***.	X*	X
BE6-2 Brake 2 Slipping	**Brake 2 Slipping Alarm.** Load slipping while Brake 2 is closed.	1. Check the brake. 2. ***See Section 6.2 on page 204***.	X*	X
BE7 Brake Welded	**Brake Answerback Fault.** At Power Up, Brake Answerback is on—brake not closed.	1. Check if brake is closed. 2. Check brake answerback circuitry.	X	
BE7-2 Brake 2 Welded	**Brake 2 Answerback Fault.** Brake Answerback is on at power-up.	1. Check if brake is closed. 2. Check brake answerback circuitry.	X	

Display	Description	Corrective Action	Fault	Alarm
BE8 Brake Slipping	**Brake Slipping Alarm.** The BE8 alarm indicates that the VFD has detected excessive encoder feedback while not running. This occurs if the encoder frequency exceeds C08-23; Load Float will be enabled, and the brake will remain closed.	1. Check the brake. 2. Check C08-23 for proper programming.	X*	X
boL Tr BOLerr	**Braking Transistor Overload Fault.** The braking transistor reached its overload level.	1. The wrong braking resistor is installed. 2. Select the correct braking resistor. 3. Install an external braking module.	X	X
BUS Option Com Err	**Option Card Communication Error.** Communication to the option card was lost.	1. Check all connections.	X	X
CALL Option ComCall	**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.		X
Cant Run Drive Not Ready	User is trying to give a run command while a FWD or REV is present at Power Up.	1. Toggle the run command input. 2. Check H01-01 to H01-08 programming. 3. Change B03-10 to allow run at power up.		X
Can’t SW Motor Running	**Can’t Switch - Motor Running.** The user is trying to enable or disable the Digital Changeover MFDI (H01-XX = 1D), while the motor is still running.	1. Allow the motor to come to a stop before enabling or disabling the Digital Changeover MFDI.		X
CE Serial Com Err	**Communication Error.** Serial communications disruption. Fault or alarm defined by H05-04.	1. Check serial connections. 2. Check H05-01 through H05-05 for proper programming.	X	X
COF Current Offset	**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.	X	
CPF00 CPF01	**Control Circuit Error.** There is a self-diagnostic error in the control circuit, or the connector on the keypad is damaged.	1. Cycle power to the VFD. 2. If the problem continues, replace the control board or the entire VFD. Contact Magnetek for instructions on replacing the control board. 3. Replace the keypad if it is damaged.	X	
CPF02 Internal A/D Err	**A/D Conversion Error.** An A/D conversion error or control circuit error occurred. The control circuit is damaged.	1. Cycle power to the VFD. 2. If the problem continues, replace the control board or the entire VFD. Contact Magnetek for instructions on replacing the control board.	X	

Display	Description	Corrective Action	Fault	Alarm
CPF03 CPU Serial Err	**Control Board Connection Error.** Connection error between the control board and the VFD. Can be caused by a connection error, or the VFD failing to operate properly due to noise interference.	**Connection Error:** 1. Turn off the power and check the connection between the control board and the VFD. 2. If the problem continues, replace the control board or the entire VFD. Contact Magnetek for instructions on replacing the control board. **Noise Interference:** 1. Check the various options available to minimize the effects of noise. 2. Counteract noise in the control circuit, main circuit, and ground wiring. 3. Use only recommended cables or other shielded line. Ground the shield on the controller side or the VFD input power side. 4. Ensure that other equipment such as switches or relays do not cause noise. Use surge suppressors if required. 5. Separate all communication wiring from VFD power lines. Install an EMC noise filter to the VFD power supply input.	X	
CPF06 EEPROM Error	**EEPROM Memory Data Error.** An Error in the data saved to EEPROM. Can be caused by an error in the EEPROM control circuit, or the power supply being switched off while parameters are being saved to the VFD.	**Error in the EEPROM Circuit** 1. Turn off the power and check the connection between the control board and the VFD. 2. If the problem continues, replace the control board or the entire VFD. Contact Magnetek for instructions on replacing the control board. **Parameter Save Interruption** Reinitialize (A01-05 = 5432).	X	
CPF07 CPF08 Terminal Board Err	**Terminal Board Connection Error.** There is a fault connection between the terminal board and the control board.	1. Turn off the power and reconnect the terminal board. 2. If the problem continues, replace the control board or the entire VFD. Contact Magnetek for instructions on replacing the control board.	X	
CPF20 CPF21 CPU Err	**Control Circuit Error.** Hardware is damaged.	1. Cycle power to the VFD. 2. If the problem continues, replace the control board or the entire VFD. Contact Magnetek for instructions on replacing the control board.	X	

Display	Description	Corrective Action	Fault	Alarm
CPF22 Internal A/D Err	**Hybrid IC Failure.** Hybrid IC failure on the power board.	1. Cycle power to the VFD. 2. If the problem continues, replace the control board or the entire VFD. Contact Magnetek for instructions on replacing the control board.	X	
CPF23 CPU COM Err	**Control Board Connection Error.** Connection error between the control board and the VFD. The hardware is damaged.	1. Turn off the power and check the connection between the control board and the VFD. 2. If the problem continues, replace the control board or the entire VFD. Contact Magnetek for instructions on replacing the control board.	X	
CPF24 Signal Err	**VFD Unit Signal Fault.** The VFD capacity cannot be detected correctly (VFD capacity is checked when powered up). The hardware is damaged.	If the problem continues, replace the control board or the entire VFD. Contact Magnetek for instructions on replacing the control board.	X	
CPF25 No Terminal Board	**Terminal Board Not Connected.** Terminal board is not connected correctly.	Reconnect the terminal board to the connector on the VFD, then cycle power.	X	
CPF26– CPF34 CPF40– CPF45	**Control Circuit Error.**	1. Cycle power. 2. Ensure that the terminal board is seated properly. 3. Set A01-05 = 5550. 4. Replace control board and/or terminal board.	X	
DEV Speed Deviation	**Speed Deviation Fault.** Occurs when the deviation of the speed reference and speed feedback exceeds the regulation level, F01-27 for the time F01-28. Alarm or fault defined by F01-26.	***See Section 6.2 on page 204***.	X	X
DIR Direction Fault	**Direction Fault.** Occurs when the VFD detects that a hoist is configured so FWD direction is DOWN motion.	1. Verify FWD is shown on the keypad when moving in the UP direction. Change B03-04 if REV is shown when going UP. 2. If correct travel direction has been verified, set C08-34 = 0 to disable DIR detection.	X	
EF 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.		X
EF0 Option External Fault	External fault input from communication option card. Alarm or fault defined by F06-03.	Check communication option card connection and signals.	X	X
EF1 External Fault 1	External fault occurs on Terminal S1. Alarm or fault defined by the External Fault Selection table (***Table 5-80 on page 152***).	1. Check H01-01 for proper programming. 2. Check the conditions for input terminal S1.	X	X

Display	Description	Corrective Action	Fault	Alarm
EF2 External Fault 2	External fault occurs on Terminal S2. Alarm or fault defined by the External Fault Selection table (***Table 5-80 on page 152***).	1. Check H01-02 for proper programming. 2. Check the conditions for input terminal S2.	X	X
EF3 External Fault 3	External fault occurs on Terminal S3. Alarm or fault defined by the External Fault Selection table (***Table 5-80 on page 152***).	1. Check H01-03 for proper programming. 2. Check the conditions for input terminal S3.	X	X
EF4 External Fault 4	External fault occurs on Terminal S4. Alarm or fault defined by the External Fault Selection table (***Table 5-80 on page 152***).	1. Check H01-04 for proper programming. 2. Check the conditions for input terminal S4.	X	X
EF5 External Fault 5	External fault occurs on Terminal S5. Alarm or fault defined by the External Fault Selection table (***Table 5-80 on page 152***).	1. Check H01-05 for proper programming. 2. Check the conditions for input terminal S5.	X	X
EF6 External Fault 6	External fault occurs on Terminal S6. Alarm or fault defined by the External Fault Selection table (***Table 5-80 on page 152***).	1. Check H01-06 for proper programming. 2. Check the conditions for input terminal S6.	X	X
EF7 External Fault 7	External fault occurs on Terminal S7. Alarm or fault defined by the External Fault Selection table (***Table 5-80 on page 152***).	1. Check H01-07 for proper programming. 2. Check the conditions for input terminal S7.	X	X
EF8 External Fault 8	External fault occurs on Terminal S8. Alarm or fault defined by the External Fault Selection table (***Table 5-80 on page 152***).	1. Check H01-08 for proper programming. 2. Check the conditions for input terminal S8.	X	X
ERR EEPROM R/W Err	**EEPROM Read/Write Fault.** EEPROM internal data did not match when initializing the parameter.	1. Cycle Power. 2. User initialize (A01-05=1110). 3. Replace Control board.	X	
FAn Cooling FAN Err	**Internal Fan Fault.** Internal cooling fan has malfunctioned. Alarm or fault defined by L08-32.	1. Cycle power to the VFD. 2. Check for fan operation. 3. Verify the fan elapsed time with U04-03 and verify the fan maintenance timer with U04-04. 4. Replace fan.	X	X
GF Ground Fault	During operation, the VFD sums the currents of all three motor phases. Ideally, the sum should always equal zero. If the sum is greater than 50% of the VFD rated output current, a GF occurs.	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.	X	

Display	Description	Corrective Action	Fault	Alarm
HBB or HBBf Hardware Base Block	**Hardware Base Block.** The flashing Hardware Base Block signal is a result of either of the Safe Disable inputs being open. The motor will begin coasting when the Hardware Base Block signal is open, and the brake relay digital output will open.	1. Check signal status at the input terminals H1 and H2. 2. Check the Sink/Source Selection for the digital inputs (***see Table 3-7 on page 43***). 3. If the Safe Disable function is not utilized, verify that H1 and H2 jumpers are installed correctly (***see Table 3-7 on page 43***). 4. Replace either the control board or the entire VFD.		X
HCA High Current	**High Current Alarm.** VFD current exceeded overcurrent warning level (150% of the rated current).	1. Reduce the load. 2. Check the motor capacity.		X
KLX Klixon	**Klixon Circuit Alarm.** Input by MFDI H01-0x = 56 or 57.	1. Check Motor for Overtemp. 2. Check Klixon Circuit.		X
LC Load Check Err	**Load Check Fault.** Load is greater than specified amount. Alarm or fault defined by C05-02.	1. Reduce Load. 2. Check Load Check sequence setup (C05-xx).	X	X
LC Done Load Check 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 complete the LC set up process.	None.		X
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	X	
LF2 Output Current Imbalance	**Output Current Imbalance.** One or more of the phases in the output current are lost.	1. Check for faulty wiring or poor/loose connections on the output side of the VFD. 2. Correct the wiring. 3. Measure the line-to-line resistance for each motor phase. Ensure all values match. 4. Replace the motor.	X	
LL1 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 Limit Switches position. 3. Check the Limit Switches condition.		X
LL2 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 Limit Switches position. 3. Check the Limit Switches condition.		X

Display	Description	Corrective Action	Fault	Alarm
MNT Maintenance Reqd	**Maintenance Required Alert.** Running time has exceeded C12-05	Reset timer by H01-0x = 5A or depress Mode/Service key three times and enter within 2 seconds.		X
OC Over Current	**Over Current Detected.** 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. 4. ***See Section 6.2 on page 204***.	X	
OH Heatsnk Over temp	**Overheat Pre-Alarm.** Heatsink is overheating. The temperature of the VFD heatsink exceeded the setting in L08-02.	1. The VFD cooling fan has stopped. 2. Reduce the ambient temperature.	X	X
OH1 Heatsink MaxTemp	**Overheat Fault.** There are two situations that result in an overheat fault. The first occurs when the measured heat sink exceeded 105°C. The second is a result of a fault in the internal 24 VDC cooling fan.	1. Ensure the heat sink cooling fans are functioning. 2. Ensure the heat sink is free from dirt and debris. 3. Ensure the VFD's ambient temperature is within specification. 4. Replace the 24 VDC fan. 5. Replace the heat sink thermistor(s).	X	
OH2 Overheat 2	**Overheat Alarm.** Signal is input by external terminal. H01-0x=39			X
OH3 Motor Overheat 1	**Motor Overheating 1.** Thermistor analog input detected motor overheating. See L01-03. Alarm defined by L01-03.	1. Check the motor rated current value, E02-01. 2. Increase cycle time or reduce the load.		X
OH4 Motor Overheat 2	**Motor Overheating 2.** Thermistor analog input detected motor overheating. See L01-04.		X	
OL1 Motor Overloaded	**Motor Overload Fault.** VFD output exceeded the motor overload level. Alarm or fault defined by L06-08.	1. Check setting of motor full load Amps (E02-01). 2. Reduce the load.	X	X
OL2 VFD Overloaded	**VFD Overload Fault.** VFD output exceeded the overload level.	1. Reduce the load. 2. Extend the acceleration time.	X	X
OPR Oper Disconnect	**Keypad Disconnected.** The keypad is removed while the VFD is running, and the run command was initiated via the keypad RUN key.	1. Secure the keypad. 2. Verify O02-06 setting.	X	X
OS Over Speed	**Overspeed Fault.** The motor has exceeded the programmed detection level and time. This is typically caused by an overshoot condition due to an over-responsive ASR loop. If the VFD is programmed to flux vector "torque control" mode, and no load is present, an overspeed fault will typically occur. Alarm or fault defined by F01-23.	1. Check the Automatic Speed Regulator settings, D04 sub group. 2. Check setting of F01-24, F01-25. 3. Verify proper encoder PPR setting, F01-01.	X	X
OT1 Overtorque Det 1	**Overtorque Detection Level 1.** Defined by L06-02. Alarm or fault defined by L06-01.	Check for proper programming for L06-02 and L06-03.	X	X

Display	Description	Corrective Action	Fault	Alarm
OT2 Overtorque Det 2	**Overtorque Detection Level 2.** Defined by L06-05. Alarm or fault defined by L06-04.	Check for proper programming for L06-05 and L06-06.	X	X
OV DC Bus Overvolt	**Overvoltage Fault.** The main circuit direct current voltage exceeded the overvoltage level.	1. Extend the deceleration time. 2. Check DBU operation. 3. Check the resistor. 4. Check the line voltage.	X	
OV DC Bus Overvolt	**Overvoltage Fault.** Overvoltage occurs during stop. Main circuit DC voltage rises above the detection level while the VFD output is off.	Check the line voltage.		X
PF Input Phase Loss	**Input Phase Loss Fault.** VFD input power supply has open phase.	1. Check the line voltage and fuses. 2. Remove power. 3. Tighten input terminals.	X	
PGO-1-S PGO-1-H PG Open Ch1	**Pulse Generator Channel 1 Fault.** PGO-1-S, software detected fault. PGO-1-H, hardware detected fault. Alarm or fault defined by F01-21.	1. Check for proper direction of encoder feedback. 2. ***See Section 6.2 on page 204***.	X	X
PGO-2-S PGO-2-H PG Open Ch2	**Pulse Generator Channel 2 Fault.** PGO-2-S, software detected fault. PGO-2-H, hardware detected fault. Alarm or fault defined by F01-21.	1. Check for proper direction of encoder feedback. 2. ***See Section 6.2 on page 204***.	X	X
PULSDEV Pulse Deviation	**Pulse Deviation.** The pulse input into terminal RP compared to the pulse output from terminal MP is greater than the percentage programmed into H06-09.	1. During operation, verify that there is an incoming pulse signal on the RP terminal, viewable at U01-54. 2. Increase the deviation margin percentage in H06-09.	X	
RF Tr RFerr	**Braking Resistor Fault.** The resistance of the braking resistor is too low, or the proper braking resistor has not been installed.	Verify correct braking resistor.	X	
RH DynBrk Resistor	**Braking Resistor Overheat.** Deceleration time is too short and excessive regenerative energy is flowing back into the VFD.	Verify correct braking resistor.	X	
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.	X	
SC Short Circuit	**Short Circuit Fault.** The VFD has detected an output short circuit condition.	1. Disconnect the motor. 2. Check for a short circuit in the motor or wiring using a megger.	X	

Display	Description	Corrective Action	Fault	Alarm
SLC Slack Cable Detection	**Slack Cable Fault.** A hoist slack cable condition occurred.	1. May not require corrective action. 2. Check setting of Slack Cable Detection (C11-xx).		X
SNAP Snapped Shaft	**Snapped Shaft Fault.** A drive train discontinuity has been detected. Alarm or fault defined by C11-09.	1. Check for loose/broken coupling. 2. Check for loose encoder(s). 3. Check for broken shaft.	X	X
SNR Follower Not Ready	**Load Share follower not ready alarm.** The Load Share follower VFD ready signal has been lost.	1. Check for loose/broken wires. 2. Check digital input settings.		X
TST END Exit Test Mode	Exceeded the 10 minute time limit.	1. Ensure the test mode MFDI is OFF. 2. Reset the fault (Fault Reset MFDI, Keypad, or cycle power). 3. Ensure that test mode is not used for normal operation.		X
UBNC Unbalanced Cur	**Current Unbalance.** Current flow has become unbalanced. Exclusive to 4810 and 41090 models.	1. Check wiring. 2. Check for damaged transistors. 3. Check for short circuits or grounding problems on the connected motor.	X	
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 limit switches location and condition.		X
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 limit switches location and condition.		X
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 and condition of the limit switch. 3. Check the conditions of/for terminal H01-xx (U01-10).	X	X
UT1 Undertorque Det 1	**Undertorque Detection 1.** The current is less than L06-02 for more than L06-03. Alarm or fault defined by L06-01.	1. Check settings. 2. Check motor coupling.	X	X
UT2 Undertorque Det 2	**Undertorque Detection 2.** The current is less than L06-05 for more than L06-06. Alarm or fault defined by L06-04.	1. Check settings. 2. Check motor coupling.	X	X
UV DC Bus Undervolt	**Undervoltage Fault.** Undervoltage status occurs for more than 2 sec during STOP.	1. Check the power wiring. 2. Replace any bad branch fuses. 3. Check collector system.		X
UV1 DC Bus Undervolt	**Undervoltage 1 Fault.** Undervoltage status occurs for more than 2 sec during RUN command.	1. Check power wiring. 2. Correct the line voltage. 3. Check collector system.	X	

Display	Description	Corrective Action	Fault	Alarm
UV2 CTL PS Undervolt	**Undervoltage 2 Fault.** The VFD detected a loss of the 24V logic power supply voltage.	1. Check power wiring. 2. Correct the line voltage. 3. Check collector system.	X	
UV3 MC Answerback	**MC Fault.** The pre-charge contactor opened during operation.	1. Check power wiring. 2. Correct the line voltage. 3. Check collector system. 4. Wait 30-45 seconds before restarting VFD.	X	
UV4 GC Undervolt	**Gate Driver Board Undervoltage.** Voltage drop in the gate driver board circuit. Exclusive to 4810 and 41090 models.	1. Cycle power to the VFD and see if the fault reoccurs. 2. If the problem continues, replace the gate driver board or the entire VFD. Contact Magnetek for gate driver board replacement information.	X	X
voF Vout Det Error	**Output Voltage Detection Fault.** Problem detected with the voltage on the output side of the VFD.	Replace the VFD.	X	X

* These faults only occur when latched. ***See Table 5-105 on page 173*** for Fault Latching Options.

Table 6-4: Operation Error Table

Display	Description	Corrective Action
OPE01 kVA Selection	**kVA Setting Error.** VFD kVA setting range is incorrect.	Check O02-04 for proper kVA.
OPE02 Limit	**Setting Out of Range.** Parameter setting is out of range.	1. With the fault displayed on the keypad, press the ENTER key to reveal the “Out of Range” parameter via the U01-34 monitor. 2. Verify that E02-03 is < E02-01. 3. Verify E01-05 is within range. 4. Compare modified parameters with defaults. 5. Cycle Power.
OPE03 Terminal	**Multi-Function Input Setting Error.** Set values other than “F” are duplicated.	Check the settings for H01-01 to H01-10, verify that the same input is not used twice.
OPE04 BoardReplaceDet	**Initial Parameter Settings Error.** The control board or terminal board has been replaced and the parameter settings no longer match.	Set A01-05 to 5550 to use the parameter settings saved to the terminal block memory.
OPE05 Sequence Select	**Frequency Reference Source Selection Error.** A frequency reference is assigned to an option card that is not connected.	1. Cycle power. 2. Ensure that the option card is seated properly into the option card slot. 3. Replace option card.
OPE06 PG Opt Missing	**Missing PG Card.** A closed loop control method was selected, and the required PG feedback card is not installed.	1. Install the required encoder option card. 2. Remove power and reset the option card.
OPE07 Analog Selection	**Multi-Function Analog Input Setting Error.** H03-02, H03-06, and/or H03-10 multi-function analog input settings are set to the same value.	Check the function selections.
OPE08 Ctrl Func Error	**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.**	Check Parameters E01-04 to E01-11.
OPE11 CarrFrq/ON-Delay	**Carrier Frequency Parameter Error.**	Check Parameters D10-01 to D10-05.
OPE13 MP Func Sel Err	**Sync & Ultra-Lift.** Master: VFD is programmed for Ultra-Lift and requires an MFDI to be programmed for Sync Ultra-Lift (H01-0x or C09-0x = 7C). Follower: VFD is programmed for Ultra-Lift and requires an MFDO to be programmed for Sync Ultra-Lift (H02-0x or F05-0x = 3C).	Special programming/wiring is required to use Ultra-Lift and Hoist Synchronization. 1. Ensure that the proper wiring scheme is in place to utilize Ultra-Lift. 2. Set H01-0x = 7C or H02-0x = 3C or both according to interlock wiring requirements.
OPE16 Weight Measure	**Weight Measurement.** Full load torque is less than no load torque.	Satisfy condition C10-09 > C10-10.
OPE19 Stp-Mthd & Ctrl	**Incompatible Setting of Stopping Method and Control Method.**	Satisfy B03-03 ≥ 6 and A01-02 ≤ 1.

Display	Description	Corrective Action
OPE20 EPLS Setting	**Electronic Programmable Limit Switch Setting Error.**	1. Check if C03-14 = 0, 2 or 4: C03-19 > C03-18 > C03-17 > C03-16 2. Check if C03-14 = 1 or 3: C03-19 < C03-18 < C03-17 < C03-16
OPE21 2nd Chan Missing	**Option Card PG-X3 is missing when C11-08 is Enabled.**	Install second PG-X3 option card for Snap Shaft feature.
OPE22 Ctrl & Motion	**Incompatible Setting of Motion and Control Method.**	Satisfy A01-02 ≤ 1 and A01-03 ≥ 2.
OPE23 Hook Height Home	**Hook Height Home MFDI Setting Error.** Hook Height Home is set to UL2 N.O., LL2 N.O., or UL3 N.O., but no MFDI is programmed for the corresponding function.	1. Check C03-14 settings. 2. Check H01-xx settings.
OPE24 Slack Cable	**Slack Cable.** Incorrect setup.	Satisfy condition C11-04 < C11-06 and C11-05 < C11-07.
OPE28 Dual Brake MFDO	**Dual Brake MFDO.** MFDO programmed to 0A, but no output programmed to 00. Must have 00 and 0A programmed.	1. Check MFDO settings (H02-xx = 00 and H02-xx = 0A). 2. Set C08-33 to Disabled.

6.2 Troubleshooting Encoder and Brake Faults and Alarms

The faults and alarms in this section may involve the encoder feedback or motor brake system. During system startup, these faults and alarms are often caused by parameters that need to be adjusted. However, if the system has been running for some time, this usually indicates a problem with the physical system and adjusting the parameters should only be done after the physical system has been inspected.

6.2.1 DEV–Speed Deviation Fault

Definition

A Speed Deviation fault means that the VFD output is not able to follow the commanded speed reference. This is possible if there is not enough torque available to follow the internal speed reference. Therefore, speed deviations may occur when the VFD is at its programmed torque limit. In addition, if the VFD receives erratic, or missing, encoder pulses, speed deviations are also possible. If the initial VFD tuning and start-up of the system was successfully completed and the crane has been in operation without any faults, then the occurrence of this fault most likely indicates that something mechanical with the system has changed or VFD parameters were changed (i.e., failed encoder, load snag, crane overload, change in acceleration or deceleration times, etc.).

Corrective Action

1. Do **NOT** continue to operate the hoist.

NOTE: *Continued attempts to operate the hoist with speed deviation faults can result in loss of control of the load.*

2. As a precaution, the Load Float Time (C08-10) should be set to zero until the source of the speed deviation fault has been determined and corrected.
3. Verify if the load has snagged or if there is a load on the hook that exceeds capacity.
4. Check the alignment of the encoder pulse wheel and sensor head, or the encoder shaft coupling. If the pulse wheel is misaligned or the shaft coupling is loose, the VFD may get erratic pulse signals or no signals at all causing a Speed Deviation or PGO fault. Make repairs before attempting to operate the hoist.
5. The encoder cable should be checked for damage.
   - Each of the encoder wires should be checked for continuity, and visually checked for damage.
   - The wires should be checked for shorts between any two wires, including the shield or ground.
6. If the encoder feedback system checks out mechanically and electrically, then check for something in the mechanical system that might be resisting normal operation. One example may be the brake is not opening fully and drag is preventing the system from operating at commanded speed.
7. If the encoder feedback system checks out and no other mechanical problems can be found, then something must have changed in the control system.
   - Check if the accel or decel times have been changed (B05-01, B05-02, C01-02, C01-04, or C01-05).
   - Check if a function that provides an alternate acceleration or deceleration rate has been enabled or changed (Quick Stop, Reverse Plug Simulation, Accel/Decel Time 2).

   If one of these times is too short, causing a torque limit, then the times should be extended.
8. If none of the above steps has identified a valid problem(s), only then should the speed deviation detection levels be adjusted.

NOTE: *The reaction time necessary to stop a load is limited to the lift of the hoist and the response time of the hoist brakes. It is desirable to have as fast a fault reaction time as possible without causing nuisance faults.*

9. Increase Encoder Speed Deviation Level to no more than 30% (F01-27).
10. After the corrective action has been taken and the fault no longer occurs, set the Load Float Time (C08-10) back to its initial value.

6.2.2 PGO-X-S/PGO-X-H–Pulse Generator Signal Fault

Definition

A Pulse Generator Signal fault indicates that the VFD has detected a problem with encoder feedback. This fault will typically occur if the VFD doesn't receive any encoder feedback pulses while it is commanded to run or encoder wiring has a discontinuity.

NOTE: *The "X" in PGO-X-S and PGO-X-H depicts either a "1" if the PG-X3 is seated in connector CN5-C, or a "2" if the PG-X3 is seated in connector CN5-B.*

Corrective Action

1. Do **NOT** continue to operate the hoist in the event of a PGO-X-H fault or repeated PGO-X-S faults.

NOTE: *Continued attempts to operate the hoist with PGO faults can result in loss of control of the load.*

2. As a precaution, the Load Float Time (C08-10), should be set to zero until the source of the PGO Fault has been determined and corrected. Disable PGO hardware detection with F01-06 or F01-16.
3. Check the alignment of the encoder pulse wheel and sensor head, the encoder shaft coupling, or check for a failed encoder sensor head. If one of these conditions exists the VFD may get erratic pulse signals or no signal at all causing a Speed Deviation or PGO fault. Make repairs before attempting to operate the hoist.
4. If the encoder appears to have no mechanical problems, the encoder cable should be checked for damage.
   - Each of the encoder wires should be checked for continuity.
   - The wires should be checked for shorts between any two wires.
   - The wires should be checked for shorts to the shield or ground.
   - Visually inspect the cable for damage that may be causing intermittent problems.
5. If the encoder feedback system checks out, then check for physical obstruction to motor rotation such as the brake failing to open.
6. After corrective action has been taken and the fault no longer occurs, set the Load Float Time (C08-10) back to its initial value.

6.2.3 BE1–Rollback Fault

Definition

A BE1 fault indicates that the VFD has released the brake, but has not started to accelerate the motor when it detects more than the expected encoder feedback. A BE1 fault will occur if the pulses received during the BE1 detection time (C08-04) are greater than the expected number of pulses (C08-05). This is typically caused by the VFD/motor having insufficient torque to accelerate the load.

Correction Action

1. Check the encoder cable for damage and proper grounding. Replace it if a problem is found.
   - Each of the encoder signals should be checked for excessive noise.
   - The shielded encoder cable should be properly grounded.
   - Visually inspect the cable for damage that may be causing intermittent problems.
2. Check the alignment of the encoder pulse wheel and sensor head, or the encoder shaft coupling. If the pulse wheel is misaligned or the shaft coupling is loose the VFD may get erratic pulse signals and cause a BE1 fault. Make repairs before attempting to operate the hoist.
3. If none of the steps identified a problem(s), only then should the BE1 detection parameters be adjusted.

NOTE: *It is desirable to have as fast a fault reaction time as possible without causing nuisance faults.*

4. The Rollback Pulse Count (C08-05) setting should remain as close to 800 pulses as possible.

6.2.4 BE2–Torque Proving Fault

Definition

A BE2 fault indicates that the VFD was unable to develop sufficient torque before releasing the brake. A BE2 fault occurs when the torque (U01-09) is less than the Initial Forward Brake Release Torque (C08-16) during the current feedback timer (C08-02) at start. This typically indicates that the brake is slipping while torque is building up in the motor before releasing the brake.

NOTE: *This fault typically indicates a failed brake. Power should NOT be removed while this alarm is active and the load should be moved to a safe location and lowered before proceeding with any corrective action.*

Corrective Action

1. Check the brake for proper operation and adjustment. If the brake does not set, is improperly adjusted or is excessively worn, it may not be able to hold the load. This can cause encoder pulses to be received while torque is building up in the motor.
2. Check the encoder cable for damage and proper grounding. Replace it if a problem is found.
   - Each of the encoder signals should be checked for excessive noise.
   - The shielded encoder cable should be properly grounded.
   - Visually inspect the cable for damage that may be causing intermittent problems.
3. Check the alignment of the encoder pulse wheel and sensor head, or the encoder shaft coupling. If the pulse wheel is misaligned or the shaft coupling is loose the VFD may get erratic pulse signals and cause a BE2 fault. Make repairs before attempting to operate the hoist.
4. Perform a Brake Torque test to verify the torque matches brake specifications.
5. If none of the above steps has identified a valid problem(s), the brake may need to be replaced.

NOTE: *The Current Feedback Timer (C08-02) should be set as low as possible without causing nuisance faults.*

6.2.5 BE3–Brake Release Fault

Definition

The BE3 fault indicates that the VFD has released the brake and commanded the VFD to run, but has not detected the expected encoder feedback. A BE3 fault will occur if the pulses received during the BE3 detection time (C08-06) are less than the expected number of pulses (C08-07).

NOTE: *Depending on the condition of the crane and control system, the load may drift during the BE3 detection time until the brake is again set. If giving a run command, the BE3 fault should be detected before a PGO fault would be detected.*

Corrective Action

1. Check the brake for proper operation. If the brake does not open the VFD will not see the proper number of encoder pulses returned and will post this fault.
2. Check the alignment of the encoder pulse wheel with the sensor head, or the encoder shaft coupling. If the pulse wheel is misaligned or the shaft coupling is loose the VFD will get erratic pulse signals or no signals at all possibly causing a BE3 fault. Make repairs before attempting to operate the hoist.
3. If the encoder appears to have no mechanical problems, the encoder cable should be checked for damage and replaced if a problem is found.
   - Each of the encoder wires should be checked for continuity.
   - The wires should be checked for shorts between any two wires.
   - The wires should be checked for shorts to the shield or ground.
   - Visually inspect the cable for damage that may be causing intermittent problems.
4. If none of the above steps has identified a valid problem(s), only then should the BE3 detection parameters be adjusted.

NOTE: *It is desirable to have as fast a fault reaction time as possible without causing nuisance faults.*

5. Ensure that C08-04 is equal to the brake's mechanical delay time.
6. Increase the value of C08-06 to no more than 1 second.
7. Decrease the value of C08-07 to no less than 10 pulses.

6.2.6 BE6–Brake Proving Alarm

Definition

The BE6 alarm indicates that the VFD has commanded the brake to set but it has detected more encoder pulse feedback than expected. A BE6 alarm will occur if the number of pulses received during the BE6 detection time (C08-12) is greater than the expected number of pulses (C08-13). The VFD will initiate Load Float for the duration of the BE6 alarm.

NOTE: *This alarm typically indicates a failed brake. Power should NOT be removed while this alarm is active and the load should be moved to a safe location and lowered before proceeding with any corrective action.*

NOTE: *The BE6-Brake Proving Alarm is re-verified during every brake set, including brake sets that occur after the BE6 alarm is posted.* ***The BE6 alarm will turn off if a successful brake check occurs after an initial BE6 alarm condition is posted*** *based on the setting of C08-19.*

Corrective Action

1. Check the brake for proper operation and adjustment. If the brake does not set, is improperly adjusted or is excessively worn, it may not be able to hold the load. This will allow the encoder pulses received during the detection time to exceed the set point.
2. Check the encoder cable for damage and proper grounding. Replace it if a problem is found.
   - Each of the encoder signals should be checked for excessive noise.
   - The shielded encoder cable should be properly grounded.
   - Visually inspect the cable for damage that may be causing intermittent problems.
3. Check the alignment of the encoder pulse wheel with the sensor head, or the encoder shaft coupling. If the pulse wheel is misaligned or the shaft coupling is loose the VFD may get erratic pulse signals possibly causing a BE6 alarm. Repairs to the encoder wheel or shaft coupling should be made immediately before again attempting to operate the hoist.
4. If none of the above steps has identified a valid problem(s), only then should the BE6 detection parameters be adjusted.

NOTE: *It is desirable to have as fast an alarm reaction time as possible without causing nuisance alarms.*

5. Ensure that C08-11 is equal to the brake's mechanical delay time.
6. Increase the value of C08-13.

6.2.7 BE8–Brake Slipping Alarm

Definition

A BE8 alarm indicates that the VFD has detected that the brake is slipping after the brake is set. A BE8 alarm will occur if the load is moving greater than the Brake Slip Detection Speed (C08-23) when the brake is set. When this occurs, the VFD will go into load float while the brake is set.

NOTE: *This alarm typically indicates a failed brake. Power should NOT be removed while this alarm is active and the load should be moved to a safe location and lowered before proceeding with any corrective action.*

Corrective Action

1. Check the brake for proper operation and adjustment. If the brake does not set, is improperly adjusted or is excessively worn, it may not be able to hold the load and encoder pulses will be received.
2. Check the encoder cable for damage and proper grounding. Replace it if a problem is found.
   - Each of the encoder signals should be checked for excessive noise.
   - The shielded encoder cable should be properly grounded.
   - Visually inspect the cable for damage.
3. Check the alignment of the encoder pulse wheel and sensor head, or the encoder shaft coupling. If the pulse wheel is misaligned or the shaft coupling is loose the VFD may get erratic pulse signals and cause a BE8 alarm. Make repairs before attempting to operate the hoist.
4. If none of the above steps has identified a valid problem(s), the brake may need to be replaced.

NOTE: *It is desirable to have as fast an alarm reaction time as possible without causing nuisance alarms.*

6.2.8 OC–Over Current Fault

Definition

An over current fault is caused if the output current exceeds 200% of the VFD rated output current. This fault can be caused by short circuits in the wiring or in the motor, or caused by parameters that are not adjusted properly. Another cause of this fault could be erratic or no encoder feedback. In the last instance, the VFD is trying to command the motor to hold a position, but due to the encoder problem, is unable to find the correct position. This would cause the VFD to increase current output to the motor in an attempt to correct the position.

Corrective Action

1. Check the motor wiring and the motor itself for a short between phases.
2. Check the alignment of the encoder pulse wheel and sensor head, or the encoder shaft coupling. If the pulse wheel is misaligned or the shaft coupling is loose the VFD may get erratic pulse signals or no signals at all. Make repairs before attempting to operate the hoist.
3. If the encoder has no mechanical problems, the encoder cable should be checked for damage.
   - Each of the encoder wires should be checked for continuity.
   - The wires should be checked for shorts between any two wires.
   - The shield should be checked for proper grounding.
   - The wires should be checked for shorts to the shield or ground.
   - Visually inspect the cable for damage.
4. If none of the above steps has identified a valid problem(s), check the torque limit parameters (C07-01 to C07-04). If these parameters have been changed to allow a higher torque value, it could cause OC faults.

NOTE: *Changing these parameters may cause DEV or OL faults. Only a trained technician should make modifications. It is desirable to have a fast fault reaction time without causing nuisance faults.*

6.3 Auto-Tuning Errors

The following are errors during auto-tuning and corrective actions. If any of the following errors are detected, the keypad will display the error text and the motor will coast to stop, if running. No fault or alarm output is triggered.

Table 6-5: Error Display and Corrective Actions

Display	Description	Corrective Action
Er-01 Data Invalid	**Motor Data Fault.** Motor data input fault for auto-tuning. Relationship between motor output and motor rated current fault. Relationship between input motor rated current and set no-load current fault (at vector control method and line-to-line resistance tuning.)	• Check input data. • Check VFD and motor capacity. • Check motor rated current and no-load current.
Er-02 Minor Fault	**Alarm.** An alarm is detected during auto-tuning.	• Check input data. • Check wirings. • Check 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 input data. • Check motor wiring. • If a motor and a load are connected, disconnect the motor from machinery system.
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 Acceleration	**Acceleration Fault.** 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. • If a motor and a load are connected, separate the motor from the load.
Er-10 PG Direction	**Motor Direction Error.** The encoder signal lines are not properly connected to the VFD; the motor direction and PG direction are opposite; or the load pulled the motor in the opposite direction of the speed reference and the torque exceeded 100%.	• Check and correct wiring to the PG encoder. • Check the motor speed monitor U01-05 while manually turning the motor forward. If the sign displayed is negative, change the setting of parameter F01-02. • Uncouple the motor from the load and restart Auto-Tuning.
Er-11 Motor Speed	**Motor Speed Fault (Rotational tuning only).** The motor speed was over 100% at auto-tuning (flux vector control without PG only).	• Increase B05-01 (acceleration time). • If a motor and a load are connected, separate the motor from the load.
Er-12 I-det. Circuit	**Current Detection Fault.** Current exceeded the motor rated current.	• Release brake. • Check for open motor lead.
Er-13 Leakage L Err	**Leakage Inductance Fault.** Auto-tuning did not finish within the set time.	• Check the T1 parameters. • Check motor wiring.
End 1* High V/f Setting	**Excess V/f setting (Rotational tuning only).** The torque reference exceeded 100% and no load current exceeded 70%.	• Check the T1 parameters. • Disconnect the motor from the load.

Display	Description	Corrective Action
End 2 Iron Core Sat	**Motor Iron Core Saturation Coefficient Fault (Rotational 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 Motor FLA Err	**Rated Current Set Alarm.** Motor current during tuning was greater than the set value.	• Check E02-01.
End 4 Rated Slip Alarm	**Adjusted Slip Calculation Error.** The slip that was calculated is outside the allowable range.	• Make sure the Auto-Tuning data is correct. • Execute Rotational Auto-Tuning instead. If not possible, try Non-Rotational Auto-Tuning 2.
End 5 TermResistAlarm	**Resistance Tuning Error.** The resistance value that was calculated is outside the allowable range.	• Double check the data that was entered for the Auto-Tuning process. • Check the motor and wire connection for damage.
End 6 Leakage L Alarm	**Leakage Inductance Alarm.** The leakage inductance value that was calculated is outside the allowable range.	• Double check the data that was entered for the Auto-Tuning process.
End 7 No-Load I Alarm	**No-Load Current Alarm.** The entered no-load current value was outside the allowable range, or Auto-Tuning results were less than 5% of the motor current.	• Check and correct faulty motor wiring. • Double check the data that was entered for the Auto-Tuning process.

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

6.4 Option Card Faults

Check the following items first when an option card fault occurs on the VFD:

- Communication cable connections.
- Make sure the option card is properly installed to the VFD.
- Did a momentary power loss interrupt communications?

NOTE: *The ports are checked in alphanumeric order.*

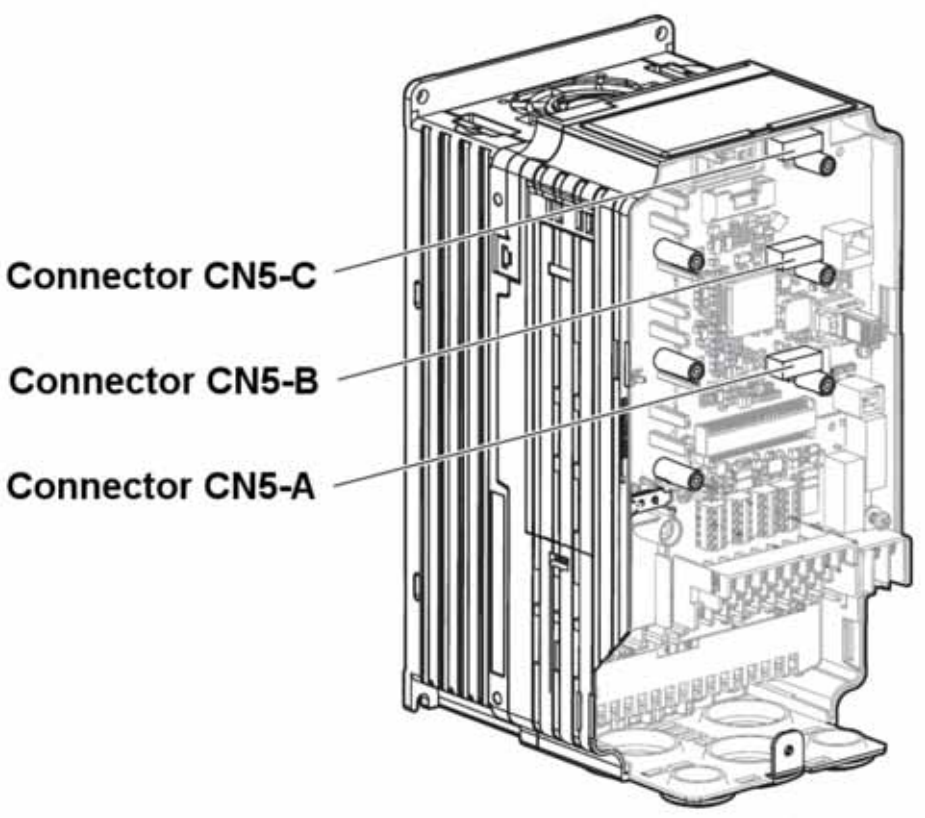


Figure 6-1: Option Card Ports

Table 6-6: Fault Codes for Option Cards

Display	Card	Description	Cause	Possible Solution
oFA00	SI- AI-A3 AO-A3 DI-A3 DO-A3 S4I S4IO	**Option Error (CN5-A).** Option Card Connection Error at Port CN5-A.	• The option card installed into port CN5-A is incompatible. • A PG- or SI- option card is connected to port CN5-A.	• Confirm that the VFD supports the option card. • PG option cards are supported in ports CN5-B and CN5-C only. Connect the PG option card to the correct port. • SI- option cards are supported in port CN5-A only. Connect the SI- option card to the correct port.
oFA01	SI- AI-A3 AO-A3 DI-A3 DO-A3 S4I S4IO	**Option Fault (CN5-A).** Option Card at Port CN5-A is not properly connected or is faulty.	• Option at port CN5-A was changed during run.	• Turn the power off and check the connectors between the VFD and the option.
oFB00	AO-A3 DO-A3 S4I S4IO	**Option Error (CN5-B).** Option Card connection error at VFD port CN5-B.	• The option card installed into port CN5-B is incompatible. • A communication option card has been installed in option port CN5-B.	• Confirm that the VFD supports the option card. • Communication option cards are only supported in port CN5-A. It is not possible to install more than one communication option.
oFB01	AO-A3 DO-A3 S4I S4IO	**Option Fault (CN5-B).** Option Card at Port CN5-B is not properly connected or is faulty.	• Option at port CN5-B was changed during run.	• Turn the power off and check the connectors between the VFD and the option.
oFB02	AO-A3 DO-A3 S4I S4IO	**Option Fault (CN5-B).** Two of the same option cards are connected simultaneously.	• Duplicate type of option card is connected to ports CN5-A, CN5-B, and CN5-C.	• AI-A3/DI-A3/SI-: These option cards may only be connected to port CN5-A. • AO-A3/DO-A3: Both of these options can't be connected at the same time.
oFC00	AO-A3 DO-A3 S4I S4IO	**Option Error (CN5-C).** Option Card Connection Error at Port CN5-C.	• The option card installed into port CN5-C is incompatible. • A communication option card has been installed in option port CN5-C.	• Confirm that the VFD supports the option card. • Communication option cards are only supported in port CN5-A. It is not possible to install more than one communication option.
oFC01	AO-A3 DO-A3 S4I S4IO	**Option Fault (CN5-C).** Option Card at Port CN5-C is not properly connected or is faulty.	• Option at VFD port CN5-C was changed during run.	• Turn off the power and check the connectors between the VFD and the option.
oFC02	AO-A3 DO-A3 S4I S4IO	**Option Fault (CN5-C).** Two of the same option cards are connected simultaneously.	• Duplicate type of option card is connected to ports CN5-A, CN5-B, and CN5-C.	• AI-A3/DI-A3/SI-: These option cards may only be connected to port CN5-A. • AO-A3/DO-A3: Both of these options can't be connected at the same time.

Display	Card	Description	Cause	Possible Solution
oFA03 to oFA17	SI- AI-A3 AO-A3 DI-A3 DO-A3 S4I S4IO	Option Card Fault at Option Port CN5-A.	• Option card or hardware is damaged.	• Cycle power to the VFD. • If the problem continues, replace the option card, control board or the entire VFD. Contact Magnetek for instructions on replacing the control board.
oFA30 to oFA43	SI-	Communication Card Fault at Option Port CN5-A.	• Option card or hardware is damaged.	• Cycle power to the VFD. • If the problem continues, replace the option card, control board, or the entire VFD. Contact Magnetek for instructions on replacing the control board.
oFB03 to oFB17	AO-A3 DO-A3 S4I S4IO	Option Card Fault at Option Port CN5-B.	• Option card or hardware is damaged.	• Cycle power to the VFD. • If the problem continues, replace the option card, control board or the entire VFD. Contact Magnetek for instructions on replacing the control board.
oFC03 to oFC17	AO-A3 DO-A3 S4I S4IO	Option Card Fault at Option Port CN5-C.	• Option card or hardware is damaged.	• Cycle power to the VFD. • If the problem continues, replace the option card, control board or the entire VFD. Contact Magnetek for instructions on replacing the control board.
oPE05	SI- AI-A3 DI-A3 S4I S4IO	Run command/frequency reference source selection error.	• Frequency reference is assigned to an option (B03-01 = 3), but an option is not connected.	• Reconnect the option to the VFD.
oPE06	PG-X3 PG-B3	Control Method Selection Error	• A control method has been selected that requires a PG option card, but one is not installed (A01-02 = 1 or 3).	• Connect a PG option card. • Correct the value set to A01-02.
oPE07	AI-A3	Multi-function Analog Input Selection Error.	• At least two analog input terminals are set to the same function. • Analog input terminal and pulse train input are set to the same function.	• Adjust H03-02, H03-06, and H03-10 settings so functions no longer conflict.

6.5 Copy Function Errors

The table below lists the messages and errors that may appear when using the Copy function.

When executing the tasks offered by the Copy function, the keypad will indicate the task being performed. When an error occurs, a code appears on the keypad to indicate the error. Note that errors related to the Copy function do not trigger the fault relay. To clear an error, simply press any key on the keypad and the error display will disappear.

NOTE:

1. *Whenever using the copy function, the VFD should be fully stopped.*
2. *The VFD will not accept a Run command while the Copy function is being executed.*
3. *Parameters can only be saved to a VFD when the model, control method, and firmware version match.*

Table 6-7: Copy Function Error Displays

Display	Description	Corrective Action
CPEr	**Control Method Mismatch.** Control method of the parameters to be loaded onto the VFD and the control method set to the VFD do not match.	• Verify the control method for the parameters to be loaded onto the VFD and the control method on the VFD to which those parameters will be written. • Set the same control method using parameter A01-02 and retry.
CPyE	**Error Writing Data.** Failed writing parameters.	Attempt to write parameters again.
CSEr	**Copy Unit Error.** Hardware fault.	Replace the keypad or the USB Copy Unit.
iFEr	**Communication Error.** • A communication error occurred between the VFD and the keypad or the USB copy unit. • A non-compatible cable is being used to connect the USB Copy Unit and the VFD.	• Check the cable connection. • Use the cable originally packaged with the USB Copy Unit.
ndAT	**Model, Voltage Class, Capacity Mismatch.** • The VFD from which the parameters were copied and the VFD to which the parameters will be written have different electrical specifications, capacities, are set to different control methods, or are different models. • The device being used to write the parameters is blank and does not have any parameters saved on it.	• Make sure model numbers and specifications are the same for both VFDs. • Make sure all connections are correct, and copy the parameter settings onto the USB Copy Unit or the keypad.
rdEr	**Error Reading Data.** Failed while attempting to read parameter settings from the VFD.	Press and hold the READ key on the USB Copy Unit for at least one second to have the unit read parameters from the VFD.
vAEr	**Voltage Class, Capacity Mismatch.** The VFD from which the parameters were copied and the VFD on which the Verify mode is being performed have different electrical specifications or are a different capacity.	Make sure electrical specifications and capacities are the same for both VFDs.
vFyE	**Parameter settings in the VFD and those saved to the copy function are not the same.** Indicates that parameter settings that have been Read and loaded onto the Copy Unit or keypad are different.	To synchronize parameters, either write the parameters saved on the USB Copy Unit or keypad onto the VFD, or Read the parameter settings on the VFD onto the USB Copy Unit.

6.6 Power Section Check

WARNING

Do NOT touch any circuit components while main power is on or immediately after main power is turned off. You must wait until the red “CHARGE” lamp is extinguished, which may take up to 10 minutes for the DC bus voltage to drop to a safe level. Failure to adhere to this warning could result in serious injury.

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 below, and ensure that the reading falls within the normal reading range.

Table 6-8: Analog Ohmmeter (R x 1 Scale) or Digital Multimeter (Diode Test)

Device	VFD Terminal		Normal Reading (Analog Meter)	Normal Reading (Digital Meter)
	Positive Lead	Negative Lead		
Input Rectifier Bridge	L1	+	7–100 Ω	0.299 ~ 0.675 VDC
	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
Output Transistors	T1	+	7–100 Ω	0.299 ~ 0.675 VDC
	T2	+		
	T3	+		
	-	T1		
	-	T2		
	-	T3		
	T1	-	Infinite Ω	OL Displayed
	T2	-		
	T3	-		
	+	T1		
	+	T2		
	+	T3		
Braking Diode	B2	B1	10 Ω	0.299 ~ 0.675 VDC
	B1	B2	Infinite Ω	OL Displayed
	B2	-	Infinite Ω	OL Displayed
	-	B2	Infinite Ω	0.299 ~ 0.675 VDC

NOTE: *“+” could be any one of three (+) terminals which are labeled as ⊕1, ⊕2, and ⊕3.*

6.7 Interface Board (S4IF) Replacement Procedure

WARNING

Do NOT touch any circuit components while AC main power is on or immediately after the main AC power is disconnected from the VFD. 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.

NOTE: *When handling circuit boards always use electrostatic discharge protection. Keep the boards in the ESD bag as long as you can. Do not lay the board on any surfaces without ESD protection. When handling, always hold the board from the edges and do not touch the components. Installation should be performed only by qualified personnel who are familiar with this type of equipment and the hazards involved.*

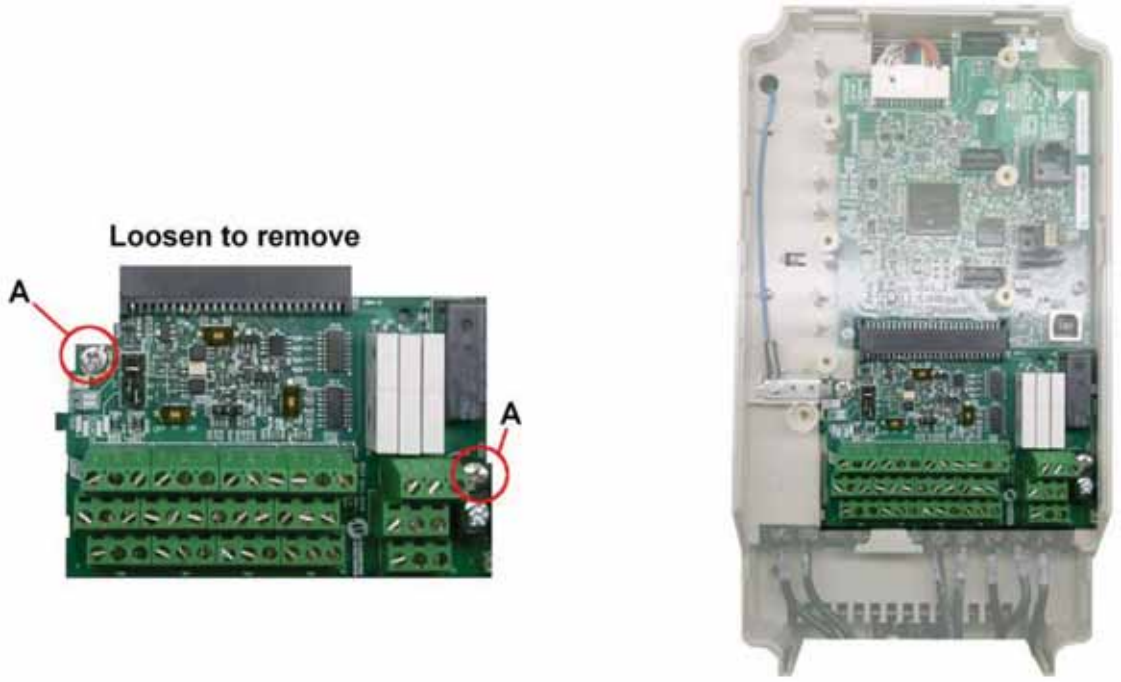


Figure 6-2: Location of Retaining Screws

Abbreviated Replacement Process

The following process can be followed when the A02 (user parameters) are not used. This abbreviated process can be followed by most users.

1. Follow the Full Replacement Process below, but skip Step 2 and 14.
2. After reconnecting power, set A01-05 = 5432. Do not set this parameter to 8880.
3. Verify that all alarms have cleared and the modified parameters have successfully transferred.

Full Replacement Process

1. Prior to installation, it is a good practice to record all modified parameters.
2. Set A01-05 = 7770 (this prepares all modified and user parameters for interface board removal).
3. Disconnect all electrical power to the VFD.
4. Remove the VFD's front cover.
5. Verify that the “CHARGE” indicator lamp inside the VFD is OFF (may take up to 10 minutes).
6. Use a voltmeter to verify the voltage at the incoming power terminals (L1, L2, and L3) has been disconnected.
7. Loosen the two retaining screws (A) pictured in ***Figure 6-2***.
8. Remove existing interface board by grasping the terminal blocks and gently pulling straight down.
9. Transfer all wire connections from the old interface board to the new one. It is also acceptable to transfer the wires prior to removing the old interface board.

NOTE: *Wires to the interface card should be stripped 0.2" ±20% for maximum system safety. Solder dipping or ferrules are also highly recommended.*

10. Insert the new interface board by sliding it onto the side guides until it mates tightly into the CN4-1 connector.
11. Tighten the screws (A) pictured in ***Figure 6-2***.
12. Reinstall and secure the VFD's front cover.
13. Reconnect power to the VFD.
14. Set A01-05 = 8880 (this moves all modified and user parameters to the new interface board).
15. Verify modified parameters match those recorded in Step 1.

Appendix A: Parameter Listing

Parameter	Parameter Name	Default	Range	Units	Reference
A01-01	Access Level	2	0–2	-	***Page 55***
A01-02	Control Method	G+: 0 VG+: 3	0, 2, 3	-	***Page 55***
A01-03	Motion	G+: 1 VG+: 2	0–2, 4	-	***Page 56***
A01-04	Speed Reference	*	0–8	-	***Page 56***
A01-05	Init Parameters	0	0–8880	-	***Page 61***
A01-06	Enter Password 1	0	-	-	***Page 61***
A02-01 to A02-32	User Parameters	-	-	-	***Page 62***
B01-01	Reference 1	15.00*	0.00–E01-04	Hz	***Page 66***
B01-02	Reference 2	30.00*	0.00–E01-04	Hz	***Page 66***
B01-03	Reference 3	60.00*	0.00–E01-04	Hz	***Page 66***
B01-04	Reference 4	0.00*	0.00–E01-04	Hz	***Page 66***
B01-05	Reference 5	0.00*	0.00–E01-04	Hz	***Page 66***
B01-06	Reference 6	0.00*	0.00–E01-04	Hz	***Page 66***
B01-07	Reference 7	0.00*	0.00–E01-04	Hz	***Page 66***
B01-08	Reference 8	0.00*	0.00–E01-04	Hz	***Page 66***
B01-09	Reference 9	0.00*	0.00–E01-04	Hz	***Page 66***
B01-10	Reference 10	0.00*	0.00–E01-04	Hz	***Page 66***
B01-11	Reference 11	0.00*	0.00–E01-04	Hz	***Page 66***
B01-12	Reference 12	0.00*	0.00–E01-04	Hz	***Page 66***
B01-13	Reference 13	0.00*	0.00–E01-04	Hz	***Page 66***
B01-14	Reference 14	0.00*	0.00–E01-04	Hz	***Page 66***
B01-15	Reference 15	0.00*	0.00–E01-04	Hz	***Page 66***
B01-16	Reference 16	0.00*	0.00–E01-04	Hz	***Page 66***
B01-17	Jog Reference	6.00	0.00–E01-04	Hz	***Page 66***
B01-18	Ref Priority	0*	0–2	-	***Page 66***
B02-01	Ref Upper Limit	100.0*	0.0–110.0	%	***Page 68***
B02-02	Ref Lower Limit	0.0	0.0–110.0	%	***Page 68***
B02-03	Ref1 Lower Limit	2.0*	0.0–110.0	%	***Page 68***
B02-04	Alt Upper Limit	0.0	0.0–110.0	%	***Page 68***
B03-01	Ref Source 1	1*	0–4	-	***Page 69***
B03-02	Run Source 1	1*	0–3	-	***Page 69***
B03-03	Stopping Method	G+: 0* VG+: 6*	0, 1, 4, 6	-	***Page 70***
B03-04	Change Rotation	0	0, 1	-	***Page 72***
B03-05	Zero-Speed Oper	0	0–3	-	***Page 72***
B03-06	Ctnl Input Scans	1	0, 1	-	***Page 72***
B03-07	LO/RE RUN Sel	0	0, 1	-	***Page 73***
B03-08	RUN CMD at PRG	0	0–2	-	***Page 73***
B03-10	AllowRun@PowerUp	0	0, 1	-	***Page 73***

Parameter	Parameter Name	Default	Range	Units	Reference
B03-15	Ref Source 2	0	0–4	-	***Page 73***
B03-16	Run Source 2	0	0–3	-	***Page 73***
B03-21	PG Start Sel	0	0, 1	-	***Page 73***
B05-01	Accel Time 1	5.0*	0.0–25.5****	sec	***Page 75***
B05-02	Decel Time 1	3.0*	0.0–25.5****	sec	***Page 75***
B05-03	Accel Time 2	10.0	0.0–25.5****	sec	***Page 75***
B05-04	Decel Time 2	10.0	0.0–25.5****	sec	***Page 75***
B05-05	Acc Time N Chg	2.0	0.0–25.5	sec	***Page 76***
B05-06	Dec Time N Chg	2.0	0.0–25.5	sec	***Page 76***
B05-08	Fast Stop Time	0.5	0.0–25.5	sec	***Page 76***
B05-10	Acc/Dec SW Freq	0.0	0.0–E01-04	Hz	***Page 76***
B05-11	SW Freq. Compare	1	0, 1	-	***Page 76***
B05-12	Accel Time 3	3.0	0.0–25.5****	sec	***Page 76***
B05-13	Decel Time 3	3.0	0.0–25.5****	sec	***Page 76***
B05-14	Accel Time 4	3.0	0.0–25.5****	sec	***Page 76***
B05-15	Decel Time 4	3.0	0.0–25.5****	sec	***Page 76***
B05-16	Acc/Dec Ext Range	0	0, 1	-	***Page 76***
B08-01	Jump Freq 1	0.0	0.0–150.0	Hz	***Page 77***
B08-02	Jump Freq 2	0.0	0.0–150.0	Hz	***Page 77***
B08-03	Jump Freq 3	0.0	0.0–150.0	Hz	***Page 77***
B08-04	Jump Bandwidth	1.0	0.0–20.0	Hz	***Page 77***
B09-03	Field Forcing Selection	0	0, 1	-	***Page 77***
B09-06	Field Forcing Limit	200	100–400	%	***Page 77***
C01-01	Quick Stop	0*	0, 1	-	***Page 79***
C01-02	Quick Stop Time	1.0	0.0–25.5	sec	***Page 79***
C01-03	Reverse Plug	0	0, 1	-	***Page 80***
C01-04	Rev-Plg Dec Time	2.0	0.0–25.5	sec	***Page 80***
C01-05	Rev-Plg Acc Time	0.0	0.0–25.5	sec	***Page 80***
C02-01	Micro-Speed Gain 1	1.00	H: 0.01–1.00 T: 0.01–2.55	-	***Page 81***
C02-02	Micro-Speed Gain 2	1.00	H: 0.01–1.00 T: 0.01–2.55	-	***Page 81***
C03-01	UL1 Speed	6.00	0.00–E01-04	Hz	***Page 82***
C03-02	UL1 Decel Time	1.0	0.0–25.5****	sec	***Page 82***
C03-03	UL2 Stop Time	1.0	0.0–25.5****	sec	***Page 82***
C03-04	LL1 Speed	6.00	0.00–E01-04	Hz	***Page 82***
C03-05	LL1 Decel Time	1.0	0.0–25.5****	sec	***Page 82***
C03-06	LL2 Stop Time	1.0	0.0–25.5****	sec	***Page 82***
C03-07	Lmt Stop Method	2*	0–2	-	***Page 82***
C03-08	UL3 Stop Method	4	0–5	-	***Page 82***
C03-09	UL3 Decel Time	1.0	0.0–25.5	sec	***Page 82***
C03-10	Phantom Stop Method	1	0–2	-	***Page 82***

Parameter	Parameter Name	Default	Range	Units	Reference
C03-11	Load Share Limit	0	0, 1	-	***Page 83***
C03-12	Klixon Action	0	0, 1	-	***Page 83***
C03-13	Height Measure	250	0–65535	Rev	***Page 84***
C03-14	Hook Height Home	2	0–4	-	***Page 84***
C03-15	Hook Height Out	0	0, 1	-	***Page 84***
C03-16	UL2 Revolutions	0	0–65535	Rev	***Page 85***
C03-17	UL1 Revolutions	0	0–65535	Rev	***Page 85***
C03-18	LL1 Revolutions	0	0–65535	Rev	***Page 85***
C03-19	LL2 Revolutions	0	0–65535	Rev	***Page 85***
C04-01	Load Float Time2	10	0–65535	sec	***Page 88***
C04-02	Load Float Gain	10**	0–100	-	***Page 88***
C05-01	Load Check	0	0, 1, 3, 9	-	***Page 90***
C05-02	LC Alarm Action	4	0–5	-	***Page 90***
C05-03	Holding Time	0.15	0.00–2.55	sec	***Page 90***
C05-04	Testing Time	0.25	0.00–2.55	sec	***Page 90***
C05-05	I/T Margin Acc	5	0–50	%	***Page 90***
C05-07	I/T Margin	5	0–20	%	***Page 90***
C05-08	Alarm Speed	6.0	0.1–30.0	Hz	***Page 90***
C05-09	I/T Level 01	0	0–250	%	***Page 90***
C05-10	I/T Level 02	0	0–250	%	***Page 90***
C05-11	I/T Level 03	0	0–250	%	***Page 90***
C05-12	I/T Level 04	0	0–250	%	***Page 90***
C05-13	I/T Level 05	0	0–250	%	***Page 90***
C05-14	I/T Level 06	0	0–250	%	***Page 90***
C05-15	I/T Level 07	0	0–250	%	***Page 90***
C05-16	I/T Level 08	0	0–250	%	***Page 90***
C05-17	I/T Level 09	0	0–250	%	***Page 90***
C05-18	I/T Level 10	0	0–250	%	***Page 90***
C05-19	I/T Level 11	0	0–250	%	***Page 90***
C05-20	I/T Level 12	0	0–250	%	***Page 90***
C05-21	I/T Level 13	0	0–250	%	***Page 90***
C05-22	I/T Level 14	0	0–250	%	***Page 90***
C05-23	I/T Level 15	0	0–250	%	***Page 90***
C05-24	I/T Level 16	0	0–250	%	***Page 90***
C05-25	LC Integral Time	0.05	0.00–2.55	sec	***Page 90***
C05-26	LC Delay Time	0.25	0.00–2.55	sec	***Page 90***
C05-27	Min I->Fwd Tim	0.0	0.0–25.5	sec	***Page 90***
C05-28	Dly Trig Freq	30.0	0.0–60.0	Hz	***Page 90***
C06-01	Swift-Lift (V/f and OLV) Ultra-Lift (FLV)	0	0–4	-	***Page 92***
C06-02	SwiftLift FWDSpd (V/f and OLV) UltraLift FWDSpd (FLV)	60.0	0.1–150.0	Hz	***Page 92***

Parameter	Parameter Name	Default	Range	Units	Reference
C06-03	SwiftLift REVSpd (V/f and OLV) UltraLift REVSpd (FLV)	60.0	0.1–150.0	Hz	***Page 92***
C06-04	SL FWD Current (V/f) SL FWD Torque (OLV) UL FWD Torque (FLV)	50	0–100	%	***Page 92***
C06-05	SL REV Current (V/f) SL REV Torque (OLV) UL REV Torque (FLV)	30	0–100	%	***Page 92***
C06-06	SL Enabling Spd (V/f and OLV) UL Enabling Spd (FLV)	59.0	0.0–150.0	Hz	***Page 92***
C06-07	SL Delay Time (V/f and OLV) UL Delay Time (FLV)	2.0	0.0–25.5	sec	***Page 92***
C06-08	SFS Acc Gain	1.0	0.1–9.9	-	***Page 92***
C06-10	Mtr Trq Quickset	3	0–5	-	***Page 92***
C06-11	Motor Torque 1	45	1–100	%	***Page 92***
C06-12	Motor Speed 1	150	100–300	%	***Page 92***
C06-13	Motor Torque 2	25	1–100	%	***Page 92***
C06-14	Motor Speed 2	200	100–300	%	***Page 92***
C06-15	AUL FWD Offset	10	0–100	%	***Page 92***
C06-16	AUL REV Offset	20	0–100	%	***Page 92***
C07-01	Torque Limit FWD	150	0–300	%	***Page 95***
C07-02	Torque Limit REV	150	0–300	%	***Page 95***
C07-03	Torque Limit FWD Regen	180	0–300	%	***Page 95***
C07-04	Torque Limit REV Regen	180	0–300	%	***Page 95***
C07-05	Torque Limit FWD Gain	1.25	0.00–2.55	-	***Page 95***
C07-06	Torque Limit REV Gain	1.25	0.00–2.55	-	***Page 95***
C07-07	Torque Limit Regen Gain	1.25	0.00–2.55	-	***Page 95***
C07-08	Torque Limit I Time	200	5–10000	ms	***Page 95***
C07-09	Torque Limit Sel	0	0, 1	-	***Page 95***
C07-10	Traverse Torque Limiter	0	0, 1	-	***Page 95***
C07-11	Limiter Freq	2.0	0.5–10.0	Hz	***Page 95***
C07-12	Anti-Shock	0	0–2	-	***Page 97***
C07-13	Enabling Freq	6.0	0.0–60.0	Hz	***Page 97***
C07-14	Re-Accel Delay	0.20	0.00–2.55	sec	***Page 97***
C07-15	Torque Delta	10	0–180	%	***Page 97***
C07-16	Detection Time	0.30	0.01–0.50	sec	***Page 97***
C07-17	Smoothing Freq	3.0	0.0–15.0	Hz	***Page 97***
C07-18	Smoothing Decel	0.30	0.00–1.00	sec	***Page 97***
C07-20	Smoothing Time	1.00	0.00–2.55	sec	***Page 97***
C07-22	AlarmDisplayTime	4	0–30	sec	***Page 97***
C07-23	No Load Torque	20	0–100	%	***Page 97***
C07-24	Required Torque	75	0–180	%	***Page 97***
C07-25	Detection Method	1	0–2	-	***Page 97***
C08-01	Torque Comp Time	1.00	0.00–2.55	sec	***Page 100***

Parameter	Parameter Name	Default	Range	Units	Reference
C08-02	IFB OK Time	1.00	0.00–2.55	sec	***Page 100***
C08-03	Min Brk Rel Trq	10	0–300	%	***Page 100***
C08-04	Rollback Timer	0.30	0.00–2.55	sec	***Page 100***
C08-05	Rollback Count	800	0–15000	pulses	***Page 100***
C08-06	BE3/Alt Torq Tim	0.30	0.00–2.55	sec	***Page 100***
C08-07	BE3 Detect Count	10	0–15000	pulses	***Page 100***
C08-08	Alt Rev Trq Lim	25	0–300	%	***Page 100***
C08-09	Zero Speed Level	1.0	0.0–10.0	Hz	***Page 100***
C08-10	Load Float Time	10*	0–65535	sec	***Page 100***
C08-11	Brake Set Delay	0.7	0.0–25.5	sec	***Page 100***
C08-12	BE6 Detect Time	5.0	0.0–25.5	sec	***Page 100***
C08-13	BE6 Max Count	250	0–15000	pulses	***Page 100***
C08-14	Brake Hold Speed	0.0	0.0–25.5	%	***Page 100***
C08-15	Load Float Ext T	10	0–65535	sec	***Page 100***
C08-16	Init FWD Brk Trq	100	10–300	%	***Page 100***
C08-17	Init REV Brk Trq	20	10–300	%	***Page 100***
C08-18	BE6 Up Speed Lim	6.00	0.00–150.00	Hz	***Page 100***
C08-19	Brk Slip Reset	0	0, 1	-	***Page 100***
C08-20	BE6 Check Torque	1.0	0.5–20.0	%	***Page 100***
C08-21	Add Mag I Time	0.0	0.0–3.0	sec	***Page 100***
C08-22	Brk Slip Detect	0	0, 1	-	***Page 100***
C08-23	Brk Slip Det Spd	1.0	0.0–10.0	Hz	***Page 100***
C08-24	Brake Test Torq	1.25* (E02-11*5252)/ F01-01	0–65535	flb	***Page 100***
C08-25	Brake Test Speed	6	0–10	Hz	***Page 100***
C08-27	Zero Speed Brake	0	0, 2, 3	-	***Page 100***
C08-28	Torque Check Time	0.05	0.00-2.55	sec	***Page 100***
C08-29	Min REV Time	1.2	0.0-25.5	sec	***Page 100***
C08-30	Positive Torque Time	0.4	0.0-25.5	sec	***Page 100***
C08-31	Positive Torque Speed	6.0	0.0-10.0	Hz	***Page 100***
C08-32	Min Brake Set Time	0.1	0.0-25.5	sec	***Page 100***
C08-33	Dual Brake Test	0	0, 1	-	***Page 101***
C08-34	DIR Flt Trq Lvl	20	0–100%	%	***Page 101***
C08-35	Emergency Lift	0	0, 2	-	***Page 102***
C08-36	E-Lift Max Speed	30	0–150	Hz	***Page 102***
C08-37	E-Lift Max Time	600	0–6000	sec	***Page 102***
C09-01	Digital In Sel	0	0–2, 5	-	***Page 104***
C09-02	DIO Terminal 1	0	0–FF	-	***Page 104***
C09-03	DIO Terminal 2	0F	0–FF	-	***Page 104***
C09-04	DIO Terminal 3	0F	0–FF	-	***Page 104***
C09-05	DIO Terminal 4	0F	0–FF	-	***Page 104***
C09-06	DIO Terminal 5	0F	0–FF	-	***Page 104***

Parameter	Parameter Name	Default	Range	Units	Reference
C09-07	DIO Terminal 6	0F	0–FF	-	***Page 104***
C09-08	DIO Terminal 7	0F	0–FF	-	***Page 104***
C09-09	DIO Terminal 8	0F	0–FF	-	***Page 104***
C09-10	DIO Terminal 9	0F	0–FF	-	***Page 104***
C09-11	DIO Terminal 10	0F	0–FF	-	***Page 104***
C09-12	DIO Terminal 11	0F	0–FF	-	***Page 104***
C09-13	DIO Terminal 12	0F	0–FF	-	***Page 104***
C09-14	DIO Terminal 13	0F	0–FF	-	***Page 104***
C09-15	DIO Terminal 14	0F	0–FF	-	***Page 104***
C09-16	DIO Terminal 15	0F	0–FF	-	***Page 104***
C09-17	DIO Terminal 16	0F	0–FF	-	***Page 104***
C10-01	Load Weight	0	0–2	-	***Page 105***
C10-02	Load Weight Start	0	0–2	-	***Page 105***
C10-03	Load Weight Display Hold	0	0, 1	-	***Page 105***
C10-04	Load Weight Conversion	0	0–39999	-	***Page 105***
C10-05	Test Frequency	6	0–E01-04	Hz	***Page 105***
C10-06	Unit Displayed	4	0–4	-	***Page 105***
C10-07	Holding Time	0.50	0.00–2.55	sec	***Page 105***
C10-09	Full Load Torque	100.0	0.0–200.0	%	***Page 105***
C10-10	No Load Torque	20.0	0.0–200.0	%	***Page 105***
C11-01	Slack Cable	0	0–2	-	***Page 107***
C11-02	Action at SLC	2	0–5	-	***Page 107***
C11-03	SLC Detect Torque	30	-50–100	%	***Page 107***
C11-04	SLC Detect Spd 1	2	0–E01-04	Hz	***Page 107***
C11-05	SLC Delay Time 1	0.50	0.00–2.55	sec	***Page 107***
C11-06	SLC Detect Spd 2	60	0–E01-04	Hz	***Page 107***
C11-07	SLC Delay Time 2	0.10	0.00–2.55	sec	***Page 107***
C11-08	Snap Shaft	0	0, 1	-	***Page 108***
C11-09	Action at Snap	0	0, 1	-	***Page 108***
C11-10	Delta Speed	1.0	0.0–E01-04	Hz	***Page 108***
C11-11	Delay Time	250	0–2000	ms	***Page 108***
C11-12	Gear Ratio Num	10000	1–65535	-	***Page 108***
C11-13	Gear Ratio Den	10000	1–65535	-	***Page 108***
C12-01	Brake Jog Delay	0.0	0.0–100.0	sec	***Page 109***
C12-02	Brake Run Delay	0.0	0.0–100.0	sec	***Page 109***
C12-03	Delay-ON Timer	0.0	0.0–3000.0	sec	***Page 109***
C12-04	Delay-OFF Timer	0.0	0.0–3000.0	sec	***Page 109***
C12-05	Maintenance Timer	0	0–32767	hr	***Page 110***
C12-06	Maintenance Gain	0.50	0.00–1.00	-	***Page 110***
C12-07	Load Share Fault Time	1.50	0.00–25.5	sec	***Page 110***
C13-01	Inch Run Time	1.00	0.00–2.55	sec	***Page 111***
C13-02	Repeat Delay Tim	1.00	0.00–2.55	sec	***Page 111***

Parameter	Parameter Name	Default	Range	Units	Reference
C13-03	Index Run Ref	0.10	0.01–60.00	Hz	***Page 113***
C13-04	Index Revs	0	0–65535	Rev	***Page 113***
C13-05	Index Count	100	0–65535	pulses	***Page 113***
C13-06	Index Repeat Delay	0.00	0.00–60.00	sec	***Page 113***
C13-07	Index Complete	10	0–32767	pulses	***Page 113***
C13-08	Index Zsv Gain	10	0–100	-	***Page 113***
C13-09	Index ASR P Gain	30.00	0.00–300.00	-	***Page 113***
C13-10	Index ASR I Time	0.200	0.000–10.000	sec	***Page 113***
C13-11	Acc/Dec Gain	1.0	0.0–5.0	-	***Page 113***
C13-12	Index Brake Ctrl	TRAV: 0–2 NLB: 0, 2	NLB: 2 else: 0	-	***Page 113***
D01-01	DCInj Start Freq	0.5	0.0–10.0	Hz	***Page 114***
D01-02	DCInj Current	50	0–100	%	***Page 114***
D01-03	DCInj Time@Start	0.00	0.00–10.00	sec	***Page 114***
D01-04	DCInj Time@Stop	0.05	0.00–10.00	sec	***Page 114***
D02-01	Slip Comp Gain	V/f: 0.0 OLV: 1.0 FLV: 1.0	0.0–2.5	-	***Page 115***
D02-02	Slip Comp Time	V/f: 2000 OLV: 200	0–10000	ms	***Page 115***
D02-03	Slip Comp Limit	200	0–250	%	***Page 115***
D02-04	Slip Comp Regen	0	0–2	-	***Page 115***
D02-05	Output V Lim Sel	0	0, 1	-	***Page 115***
D02-13	Output V Lim Sta	85.0	70.0–90.0	%	***Page 115***
D02-14	Output V Lim Max	90.0	85.0–100.0	%	***Page 115***
D02-15	Output V Lim Lev	90.0	30.0–100.0	%	***Page 115***
D03-01	Torq Comp Gain	1.0	0.00–2.50	-	***Page 116***
D03-02	Torq Comp Time	V/f: 200 OLV: 20	0–60000	ms	***Page 116***
D03-03	F TorqCmp@start	0.0	0.0–200.0	%	***Page 116***
D03-04	R TorqCmp@start	0.0	-200.0–0.0	%	***Page 116***
D03-05	TorqCmp Delay T	10	0–200	ms	***Page 116***
D03-06	Start Torq Time	150	0–10000	ms	***Page 116***
D04-01	ASR P Gain 1	20.00	0.00–300.00	-	***Page 118***
D04-02	ASR I Time 1	0.500	0.000–10.000	sec	***Page 118***
D04-03	ASR P Gain 2	20.00	0.00–300.00	-	***Page 118***
D04-04	ASR I Time 2	0.500	0.000–10.000	sec	***Page 118***
D04-06	ASR Delay Time	0.004	0.000–0.500	sec	***Page 118***
D04-07	ASR Gain SW Freq	0.0	0.0–150.0	Hz	***Page 118***
D04-08	ASR I Limit	400	0–400	%	***Page 118***
D04-36	NLB Strt ASR I	0.100	0.000–30.000	sec	***Page 118***
D04-37	NLB Strt ASR Dly	0.50	0.00–2.55	sec	***Page 118***
D05-01	Torque Control Select	0	0, 1	-	***Page 119***

Parameter	Parameter Name	Default	Range	Units	Reference
D05-02	Torque Ref Filter	0	0–1000	ms	***Page 119***
D05-03	Speed Limit Select	2	1, 2	-	***Page 119***
D05-04	Speed Limit Value	105	-120–120	%	***Page 119***
D05-05	Speed Limit Bias	10	0–120	%	***Page 119***
D05-06	Ref Hold Time	0	0–1000	ms	***Page 119***
D05-08	Direction Speed Limit	1	0, 1	-	***Page 119***
D08-01	Dwell Ref @ Start	0.0	0.0–150.0	Hz	***Page 121***
D08-02	Dwell Time @ Start	0.0	0.0–10.0	sec	***Page 121***
D08-03	Dwell Ref @ Stop	0.0	0.0–150.0	Hz	***Page 121***
D08-04	Dwell Time @ Stop	0.0	0.0–10.0	sec	***Page 121***
D09-01	SCrv Acc @ Start	0.50*	0.00–10.00	sec	***Page 122***
D09-02	SCrv Acc @ End	0.50*	0.00–10.00	sec	***Page 122***
D09-03	SCrv Dec @ Start	0.50*	0.00–10.00	sec	***Page 122***
D09-04	SCrv Dec @ End	0.20*	0.00–10.00	sec	***Page 122***
D10-01	Heavy/Normal Duty	0	0, 1	-	***Page 123***
D10-02	CarrierFreq Sel	1	1–9, A, F	-	***Page 123***
D10-03	CarrierFreq Max	2.0	1.0–15.0	kHz	***Page 123***
D10-04	CarrierFreq Min	2.0	1.0–15.0	kHz	***Page 123***
D10-05	CarrierFreq Gain	0	0–99	-	***Page 123***
D11-01	Hunt Prevention Select	1	0, 1	-	***Page 124***
D11-02	Hunt Prevention Gain	1.00	0.00–2.50	-	***Page 124***
D11-03	Hunt Prevention Time	10	0–500	ms	***Page 124***
D11-05	REV Hunting Prevention Gain	0.00	0.00–2.50	-	***Page 124***
E01-01	Input Voltage	230V: 230 460V: 460 575V: 575	230V: 155–255 460V: 310–510 575V: 446–733	VAC	***Page 125***
E01-03	V/f Selection	*	V/f: 0–9, A–F, FF OLV: F, FF	-	***Page 126***
E01-04	Max Frequency	60.0	20.0–150.0	Hz	***Page 126***
E01-05	Max Voltage	**	230V: 0.0–255.0 460V: 0.0–510.0 575V: 0.0–733.1	VAC	***Page 126***
E01-06	Base Frequency	60.0	0.0–150.0	Hz	***Page 126***
E01-07	Mid Frequency A	Determined by E01-03	0.0–150.0	Hz	***Page 126***
E01-08	Mid Voltage A	Determined by E01-03	230V: 0.0–255.0 460V: 0.0–510.0 575V: 0.0–733.1	VAC	***Page 126***
E01-09	Min Frequency	Determined by E01-03	0.0–150.0		***Page 126***
E01-10	Min Voltage	Determined by E01-03	230V: 0.0–255.0 460V: 0.0–510.0 575V: 0.0–733.1	VAC	***Page 126***
E01-11	Mid Frequency B	0.0	0.0–150.0	Hz	***Page 127***
E01-12	Mid Voltage B	0.0	230V: 0.0–255.0 460V: 0.0–510.0 575V: 0.0–733.1	VAC	***Page 127***

Parameter	Parameter Name	Default	Range	Units	Reference
E01-13	Base Voltage	0.0	230V: 0.0–255.0 460V: 0.0–510.0 575V: 0.0–733.1	VAC	***Page 127***
E02-01	Motor Rated FLA	**	**	A	***Page 130***
E02-02	Motor Rated Slip	**	0.00–20.00	Hz	***Page 130***
E02-03***	No-Load Current	**	0–[(E02-01)-1]	A	***Page 130***
E02-04	Number of Poles	4	2–48	-	***Page 130***
E02-05***	Term Resistance	**	0.000–65.000	Ω	***Page 130***
E02-06***	Leak Inductance	**	0.0–40.0	%	***Page 130***
E02-07***	Saturation Comp1	0.50	0.00–0.50	-	***Page 130***
E02-08***	Saturation Comp2	0.75	E02-07–0.75	-	***Page 130***
E02-09***	Mechanical Loss	0.0	0.0–10.0	%	***Page 130***
E02-10***	Motor Iron Loss	**	0–65535	W	***Page 130***
E02-11	Rated Horsepower	**	0.00–650.00	HP/kW	***Page 130***
E03-02	Stopping Method	1	0, 1	-	***Page 131***
E03-03	Max Frequency	60.0	20.0–150.0	Hz	***Page 131***
E03-04	Max Voltage	**	230V: 0.0–255.0 460V: 0.0–510.0 575V: 0.0–733.1	VAC	***Page 131***
E03-05	Base Frequency	60.0	0.0–150.0	Hz	***Page 131***
E03-06	Mid Frequency A	Determined by E01-03	0.0–150.0	Hz	***Page 131***
E03-07	Mid Voltage A	Determined by E01-03	230V: 0.0–255.0 460V: 0.0–510.0 575V: 0.0–733.1	VAC	***Page 131***
E03-08	Min Frequency	Determined by E01-03	0.0–150.0	Hz	***Page 131***
E03-09	Min Voltage	Determined by E01-03	230V: 0.0–255.0 460V: 0.0–510.0 575V: 0.0–733.1	VAC	***Page 131***
E03-10	Mid Frequency B	0.0	0.0–150.0	Hz	***Page 131***
E03-11	Mid Voltage B	0.0	230V: 0.0–255.0 460V: 0.0–510.0 575V: 0.0–733.1	VAC	***Page 131***
E03-12	Base Voltage	0.0	230V: 0.0–255.0 460V: 0.0–510.0 575V: 0.0–733.1	VAC	***Page 131***
F01-01	PG1 Pulses/Rev	1024	0–60000	PPR	***Page 132***
F01-02	PG1 Rotation Sel	0	0, 1	-	***Page 132***
F01-03	PG1 Output Ratio	1	1–132	-	***Page 132***
F01-04	PG1 #Gear Teeth1	0	0–1000	-	***Page 132***
F01-05	PG1 #Gear Teeth2	0	0–1000	-	***Page 132***
F01-06	PGO-1-H	15	0–100	ms	***Page 132***
F01-11	PG2 Pulses/Rev	1024	0–60000	PPR	***Page 132***
F01-12	PG2 Rotation Sel	0	0, 1	-	***Page 132***
F01-13	PG2 #Gear Teeth1	0	0–1000	-	***Page 132***
F01-14	PG2 #Gear Teeth2	0	0–1000	-	***Page 132***

Parameter	Parameter Name	Default	Range	Units	Reference
F01-15	PG2 Output Ratio	1	1–132	-	***Page 132***
F01-16	PGO-2-H	15	0–100	ms	***Page 132***
F01-21	PG Fdbk Loss Sel	1	0–3 NLB: 1	-	***Page 132***
F01-22	PGO-1-S Det Time	2.0	0.0–10.0	sec	***Page 132***
F01-23	PG Overspeed Sel	1	0–3 NLB: 1	-	***Page 132***
F01-24	PG Overspd Level	105	0–120	%	***Page 132***
F01-25	PG Overspd Time	0.0	0.0–2.0	sec	***Page 133***
F01-26	PG Deviation Sel	5	Traverse: 0–7 NLB: 5	-	***Page 133***
F01-27	PG Deviate Level	10	0–50	%	***Page 133***
F01-28	PG Deviate Time	0.3	0.0–10.0	sec	***Page 133***
F02-01	AI Function Sel	0	0, 1	-	***Page 134***
F02-02	AI Input Gain	100.0	-999.9–999.9	%	***Page 134***
F02-03	AI Input Bias	0.0	-999.9–999.9	%	***Page 134***
F04-01	AO Ch1 Select	102	1–630	-	***Page 134***
F04-02	AO Ch1 Gain	100.0	-999.9–999.9	%	***Page 134***
F04-03	AO Ch2 Select	103	1–630	-	***Page 134***
F04-04	AO Ch2 Gain	50.0	-999.9–999.9	%	***Page 134***
F04-05	AO Ch1 Bias	0.0	-999.9–999.9	%	***Page 134***
F04-06	AO Ch2 Bias	0.0	-999.9–999.9	%	***Page 134***
F04-07	AO Opt Level Ch1	0	0, 1	-	***Page 134***
F04-08	AO Opt Level Ch2	0	0, 1	-	***Page 134***
F05-01	DO Ch1 Select	F	0–1FF	-	***Page 136***
F05-02	DO Ch2 Select	F	0–1FF	-	***Page 136***
F05-03	DO Ch3 Select	F	0–1FF	-	***Page 136***
F05-04	DO Ch4 Select	F	0–1FF	-	***Page 136***
F05-05	DO Ch5 Select	F	0–1FF	-	***Page 136***
F05-06	DO Ch6 Select	F	0–1FF	-	***Page 136***
F05-07	DO Ch7 Select	F	0–1FF	-	***Page 136***
F05-08	DO Ch8 Select	F	0–1FF	-	***Page 136***
F05-09	DO Function Sel	2	0–2	-	***Page 136***
F06-01	Comm Bus Flt Sel	1	0–4	-	***Page 138***
F06-02	EF0 Detection	0	0, 1	-	***Page 138***
F06-03	EF0 Fault Action	1	0–4	-	***Page 138***
F06-04	BUS Err Det Time	2.0	0.0–5.0	sec	***Page 138***
F06-06	Torq Ref/Lmt Sel	0	0, 1	-	***Page 138***
F06-07	Fref PrioritySel	0	0, 1	-	***Page 138***
F06-08	Com Prm Init Sel	0	0, 1	-	***Page 138***
F06-30	PB Node Address	0	0–125	-	***Page 138***
F06-31	PB Clear Select	0	0, 1	-	***Page 138***
F06-32	PB Map Select	0	0–5	-	***Page 138***

Parameter	Parameter Name	Default	Range	Units	Reference
F06-35	CO Node Address	0	0–126	-	***Page 138***
F06-36	CO Baud Rate	6	0–8	-	***Page 138***
F06-50	DN MAC Address	64	0–64	-	***Page 138***
F06-51	DN Baud Rate	4	0–4	-	***Page 138***
F06-52	DN PCA Selection	21	0–255	-	***Page 138***
F06-53	DN PPA Selection	71	0–255	-	***Page 138***
F06-54	DN Idle Flt Det	0	0, 1	-	***Page 138***
F06-55	DN BAUD RATE MEM	0	0–2	-	***Page 139***
F06-56	DN Speed Scale	0	-15–15	-	***Page 139***
F06-57	DN Current Scale	0	-15–15	-	***Page 139***
F06-58	DN Torque Scale	0	-15–15	-	***Page 139***
F06-59	DN Power Scale	0	-15–15	-	***Page 139***
F06-60	DN Voltage Scale	0	-15–15	-	***Page 139***
F06-61	DN Time Scale	0	-15–15	-	***Page 139***
F06-62	DN Heart Beat	0	0–10	-	***Page 139***
F06-63	DN MAC ID MEM	0	0–63	-	***Page 139***
F07-01	IP Address 1	192	0–255	-	***Page 140***
F07-02	IP Address 2	168	0–255	-	***Page 140***
F07-03	IP Address 3	1	0–255	-	***Page 140***
F07-04	IP Address 4	20	0–255	-	***Page 140***
F07-05	Subnet Mask 1	255	0–255	-	***Page 140***
F07-06	Subnet Mask 2	255	0–255	-	***Page 140***
F07-07	Subnet Mask 3	255	0–255	-	***Page 140***
F07-08	Subnet Mask 4	0	0–255	-	***Page 140***
F07-09	Gateway IP Add 1	192	0–255	-	***Page 140***
F07-10	Gateway IP Add 2	168	0–255	-	***Page 140***
F07-11	Gateway IP Add 3	1	0–255	-	***Page 140***
F07-12	Gateway IP Add 4	1	0–255	-	***Page 140***
F07-13	IP Add Mode Sel	2	0–2	-	***Page 140***
F07-14	Duplex Select	1	0–2	-	***Page 140***
F07-15	Baud Rate	10	10, 100	-	***Page 140***
F07-16	CommLoss Tout	0.0	0.0–30.0	sec	***Page 140***
F07-17	EN Speed Scale	0	-15–15	-	***Page 140***
F07-18	EN Current Scale	0	-15–15	-	***Page 140***
F07-19	EN Torque Scale	0	-15–15	-	***Page 140***
F07-20	EN Power Scale	0	-15–15	-	***Page 140***
F07-21	EN Voltage Scale	0	-15–15	-	***Page 140***
F07-22	EN Time Scale	0	-15–15	-	***Page 140***
F07-23 to F07-32	DOA116 (1 to 10)	0	Modbus Address 0x- - - -	-	***Page 140***
F07-33 to F07-42	DIA166 (1 to 10)	0	Modbus Address 0x- - - -	-	***Page 140***

Parameter	Parameter Name	Default	Range	Units	Reference
H01-01	Terminal S1 Select	80 (FWD)	0–81	-	***Page 141***
H01-02	Terminal S2 Select	81 (REV)	0–81	-	***Page 141***
H01-03	Terminal S3 Select	*	0–81	-	***Page 141***
H01-04	Terminal S4 Select	*	0–81	-	***Page 141***
H01-05	Terminal S5 Select	*	0–81	-	***Page 141***
H01-06	Terminal S6 Select	*	0–81	-	***Page 141***
H01-07	Terminal S7 Select	*	0–81	-	***Page 141***
H01-08	Terminal S8 Select	*	0–81	-	***Page 141***
H01-09	F1 Key Selection	0F	0F–74	-	***Page 141***
H01-10	F2 Key Selection	0F	0F–74	-	***Page 141***
H01-14	Alt Ref Override	0	0, 1	-	***Page 141***
H02-01	Term M0-M1 Select	*	0–1FF	-	***Page 146***
H02-02	Term M2-M3 Select	*	0–1FF	-	***Page 146***
H02-03	Term M5-M6 Select	*	0–1FF	-	***Page 146***
H02-06	Wh Disp Units	0	0–4	-	***Page 146***
H03-01	Terminal A1 Signal	*	0, 1	-	***Page 152***
H03-02	Terminal A1 Select	*	0–31	-	***Page 152***
H03-03	Terminal A1 Gain	100.0	-999.9–999.9	%	***Page 152***
H03-04	Terminal A1 Bias	0.0	-999.9–999.9	%	***Page 152***
H03-05	Terminal A3 Signal	0	0, 1	-	***Page 152***
H03-06	Terminal A3 Select	*	0–31	-	***Page 152***
H03-07	Terminal A3 Gain	100.0	-999.9–999.9	%	***Page 152***
H03-08	Terminal A3 Bias	0.0	-999.9–999.9	%	***Page 152***
H03-09	Terminal A2 Signal	2	0–3	-	***Page 152***
H03-10	Terminal A2 Select	1F	0–31	-	***Page 152***
H03-11	Terminal A2 Gain	100.0	-999.9–999.9	%	***Page 152***
H03-12	Terminal A2 Bias	0.0	-999.9–999.9	%	***Page 152***
H03-13	Filter Avg Time	0.03	0.00–2.00	sec	***Page 152***
H03-14	A1/A2/A3 Select	7	1–7	-	***Page 152***
H03-16	TerminalA1Offset	0	-500–500	-	***Page 152***
H03-17	TerminalA2Offset	0	-500–500	-	***Page 152***
H03-18	TerminalA3Offset	0	-500–500	-	***Page 152***
H04-01	Terminal FM Select	102	000–630	-	***Page 155***
H04-02	Terminal FM Gain	100.0	-999.9–999.9	%	***Page 156***
H04-03	Terminal FM Bias	0.0	-999.9–999.9	%	***Page 156***
H04-04	Terminal AM Select	103	000–630	-	***Page 156***
H04-05	Terminal AM Gain	50.0	-999.9–999.9	%	***Page 156***
H04-06	Terminal AM Bias	0.0	-999.9–999.9	%	***Page 156***
H04-07	Terminal FM Signal	0	0–2	-	***Page 156***
H04-08	Terminal AM Signal	0	0–2	-	***Page 156***
H05-01	Serial Comm Adr	1F	00–FF	-	***Page 157***
H05-02	Serial Baud Rate	3	0–8	-	***Page 157***

Parameter	Parameter Name	Default	Range	Units	Reference
H05-03	Serial Com Sel	0	0–2	-	***Page 157***
H05-04	Serial Fault Sel	0	0–3	-	***Page 157***
H05-05	Serial Flt Dtct	1	0, 1	-	***Page 157***
H05-06	Transmit WaitTIM	5	5–65	ms	***Page 157***
H05-07	RTS Control Sel	1	0, 1	-	***Page 157***
H05-09	CE Detect Time	2.0	0.0–10.0	sec	***Page 157***
H05-10	CommReg 25h Unit	0	0, 1	-	***Page 157***
H05-11	Enter CommandSel	1	0, 1	-	***Page 157***
H05-12	Run CommandSel	0	0, 1	-	***Page 157***
H05-17	Busy Enter Sel	0	0, 1	-	***Page 157***
H05-18	MtrSpd Monitor T	0	0–100	ms	***Page 157***
H06-01	Pulse Input Sel	0	0, 5–7	-	***Page 159***
H06-02	Pulse In Scale	1440	1000–32000	Hz	***Page 159***
H06-03	Pulse Input Gain	100.0	0.0–1000.0	%	***Page 159***
H06-04	Pulse Input Bias	0.0	-100.0–100.0	%	***Page 159***
H06-05	Pulse In Filter	0.10	0.00–2.00	sec	***Page 159***
H06-06	Pulse Output Sel	102	0–120	-	***Page 159***
H06-07	Pulse Out Scale	1440	0–32000	Hz	***Page 159***
H06-08	Pulse Min Freq	0.5	0.1–1000.0	Hz	***Page 159***
H06-09	Pulse Dev Detect	5.0	0.0–25.5	%	***Page 159***
L01-01	Mtr OL Charact	3	0–3	-	***Page 160***
L01-02	MOL Time Const	1.0	0.1–5.0	min	***Page 160***
L01-03	Mtr OH Alarm Sel	3	0–3	-	***Page 161***
L01-04	Mtr OH Fault Sel	1	0–2	-	***Page 161***
L01-05	Mtr Temp Filter	0.20	0.00–10.00	sec	***Page 161***
L01-13	Mtr OL Mem Sel	1	0, 1	-	***Page 161***
L02-01	PwrL Selection	0	0–2	-	***Page 161***
L02-02	PwrL Ridethru t	**	0.0–25.5	sec	***Page 161***
L02-03	PwrL Baseblock t	**	0.1–5.0	sec	***Page 161***
L02-04	PwrL V/F Ramp t	**	0.0–5.0	sec	***Page 161***
L02-05	PUV Det Level	Determined by E01-01	230V: 150–210 460V: 300–420 575V: 431–604	VDC	***Page 161***
L03-01	StallP Accel Sel	1	0–2	-	***Page 162***
L03-02	StallP Accel Lvl	Determined by D10-01	0–150	%	***Page 162***
L03-03	StallPAcc LowLim	50	0–100	%	***Page 162***
L03-05	StallP Run Sel	1	0–2	-	***Page 162***
L03-06	StallP Run Level	Determined by D10-01	30–150	%	***Page 162***
L03-11	OV Inhibit Sel	0	0, 1	-	***Page 162***
L03-17	DC Bus Reg Level	230 V: 375 460 V: 750 575 V: 930	230 V: 150–400 460 V: 300–800 575 V: 431–1150	VDC	***Page 162***
L03-20	DC Bus P Gain	A01-02	0.00–5.00	-	***Page 162***

Parameter	Parameter Name	Default	Range	Units	Reference
L03-21	Acc/Dec P Gain	A01-02	0.10–10.00	sec	***Page 162***
L03-23	CHP Stall P Sel	0	0, 1	-	***Page 162***
L03-24	Mtr Accel Time	O02-04	0.001–10.000	sec	***Page 162***
L04-01	Spd Agree Level	0.0	0.0–150.0	Hz	***Page 164***
L04-02	Spd Agree Width	2.0	0.0–20.0	Hz	***Page 164***
L04-03	Spd Agree Lvl+-	0.0	-150.0–150.0	Hz	***Page 164***
L04-04	Spd Agree Wdth+-	2.0	0.0–20.0	Hz	***Page 164***
L04-05	Ref Loss Sel	0	0, 1	-	***Page 164***
L04-06	Fref at Floss	80.0	0.0–100.0	%	***Page 164***
L04-07	Freq Detect Sel	0	0, 1	-	***Page 164***
L05-01	Test Mode	0	0, 1	-	***Page 165***
L06-01	Torq Det 1 Sel	0	0–8	-	***Page 165***
L06-02	Torq Det 1 Lvl	150	0–300	%	***Page 166***
L06-03	Torq Det 1 Time	0.1	0.0–10.0	sec	***Page 166***
L06-04	Torq Det 2 Sel	0	0–8	-	***Page 166***
L06-05	Torq Det 2 Lvl	150	0–300	%	***Page 167***
L06-06	Torq Det 2 Time	0.1	0.0–10.0	sec	***Page 167***
L06-08	Mech Fatigue Sel	0	0–8	-	***Page 167***
L06-09	MechFat Det Spd	110.0	-110.0–110.0	%	***Page 168***
L06-10	MechFat Det Time	0.1	0.0–10.0	sec	***Page 168***
L06-11	MechFat Det Hour	0	0–65535	-	***Page 168***
L08-02	OH Pre-Alarm Lvl	**	50–150	°C	***Page 169***
L08-03	OH Pre-Alarm Sel	3	0–5	-	***Page 169***
L08-05	Input Phase Loss Protection	1	0, 1	-	***Page 169***
L08-07	Output Phase Loss	1	0–2	-	***Page 169***
L08-08	Output Phase Loss Level	5.0	0.0–20.0	%	***Page 169***
L08-09	Ground Fault Sel	1	0, 1	-	***Page 169***
L08-10	Fan On/Off Sel	0	0, 1	-	***Page 169***
L08-11	Fan Delay Time	60	0–300	sec	***Page 169***
L08-12	Ambient Temp	40	-10–50	°C	***Page 169***
L08-13	UV3 Detect	0	0, 1	-	***Page 169***
L08-15	OL2 Sel @ L-Spd	0	0, 1	-	***Page 169***
L08-18	Soft CLA Sel	0	0, 1	-	***Page 169***
L08-19	Fc Red dur OHAlm	0.8	0.1–0.9	Hz	***Page 169***
L08-32	MC,FAN Fault Sel	1	0–4	-	***Page 169***
L08-35	Installation Sel	**	0–3	-	***Page 169***
L08-38	Fc Reduct dur OL	2**	0–2	-	***Page 169***
L08-40	FC Reduct Time	A01-02	0.00–2.00	sec	***Page 169***
L08-41	High Cur Alm Sel	0	0, 1	-	***Page 170***
L08-55	DB Tr protection	1	0, 1	-	***Page 170***
L09-01	Reset Select	1	0, 1	-	***Page 171***
L09-02	Reset Attempts	3	0–10	-	***Page 171***

Parameter	Parameter Name	Default	Range	Units	Reference
L09-03	Reset Time	0.5	0.5–600.0	sec	***Page 171***
L09-04	Reset Latch Sel 1	4001	0000–FFFF	-	***Page 171***
L09-05	Reset Latch Sel 2	E000	0000–FFFF	-	***Page 171***
L09-06	Flt Contact Sel	0	0, 1	-	***Page 171***
L09-07	Flt Latch Sel 1	0000	0000–FFFF	-	***Page 173***
L09-08	Flt Latch Sel 2	0000	0000–FFFF	-	***Page 173***
O01-01	User Monitor Sel	106	104–626	-	***Page 174***
O01-02	Power-On Monitor	3	1–5	-	***Page 176***
O01-03	Display Scaling	A01-02	0–3	-	***Page 176***
O01-04	Display Units	A01-02	0, 1	-	***Page 176***
O01-05	LCD Contrast	3	0–5	-	***Page 176***
O01-10	UserDisp Scaling	6000	1–60000	-	***Page 176***
O01-11	UserDisp Dec Sel	2	0–3	-	***Page 176***
O02-01	LO/RE Key	0	0, 1	-	***Page 177***
O02-02	Oper STOP Key	0	0–2	-	***Page 177***
O02-03	User Default Sel	0	0–2	-	***Page 177***
O02-04	Inverter Model #	**	00–FF	-	***Page 177***
O02-05	Operator M.O.P.	0	0, 1	-	***Page 179***
O02-06	Oper Detection	1	0, 1	-	***Page 179***
O02-07	FWD/REVSel@PwrUp	0	0, 1	-	***Page 179***
O02-09	Init Mode Sel	1	1, 2	-	***Page 179***
O02-10	Motor Power Unit	0	0, 1	-	***Page 179***
O02-11	Test Mode Sel	1	0, 1	-	***Page 179***
O02-15	Legacy RDSI	0	0, 1	-	***Page 179***
O02-19	ParameterSet Sel	0	0, 1	-	***Page 179***
O03-01	Elapsed Time Set	0	0–9999 x10	hr	***Page 180***
O03-02	Elapsed Time Run	1	0, 1	-	***Page 180***
O03-03	Fan ON Time Set	0	0–9999 x10	hr	***Page 180***
O03-05	BusCap Maint Set	0	0–150	%	***Page 180***
O03-09	IGBT Maint Set	0	0–150	%	***Page 180***
O03-11	Fault Data Init	0	0, 1	-	***Page 180***
O03-12	kWh Monitor Init	0	0, 1	-	***Page 180***
O03-14	Count Hist Clear	0	0–3	-	***Page 180***
O04-01	Copy Function Sel	0	0–3	-	***Page 181***
O04-02	Read Allowable	1	0, 1	-	***Page 181***
O04-07	ChrgCircMaintSet	0	0–150	%	***Page 181***
T01-01	Tuning Mode Sel	0	0–4	-	***Page 63***
T01-02	Rated Power	**	-	HP/kW	***Page 63***
T01-03	Rated Voltage	**	-	VAC	***Page 63***
T01-04	Rated Current	**	-	A	***Page 63***
T01-05	Rated Frequency	60.0	-	Hz	***Page 63***
T01-06	Number of Poles	4	-	Poles	***Page 63***

Parameter	Parameter Name	Default	Range	Units	Reference
T01-07	Rated Speed	1750	-	RPM	***Page 63***
T01-08	PG Pulses/Rev	1024	-	PPR	***Page 63***
T01-09	No-Load Current	-	-	-	***Page 63***
T01-10	Motor Rated Slip	-	-	-	***Page 63***
U01-01	Frequency Ref	-	-	Hz	***Page 183***
U01-02	Output Freq	-	-	Hz	***Page 183***
U01-03	Output Current	-	-	A	***Page 183***
U01-04	Control Method	-	-	-	***Page 183***
U01-05	Motor Speed	-	-	Hz	***Page 183***
U01-06	Output Voltage	-	-	VAC	***Page 183***
U01-07	DC Bus Voltage	-	-	VDC	***Page 183***
U01-08	Output Power	-	-	HP/kW	***Page 183***
U01-09	Torque Reference	-	-	%	***Page 183***
U01-10	Input Term Sts	-	-	-	***Page 183***
U01-11	Output Term Sts	-	-	-	***Page 183***
U01-12	Int Ctl Sts 1	-	-	-	***Page 184***
U01-14	CPU 1 SW Number	-	-	-	***Page 184***
U01-15	Term A1 Level	-	-	%	***Page 184***
U01-16	Term A2 Level	-	-	%	***Page 184***
U01-17	Term A3 Level	-	-	%	***Page 184***
U01-20	SFS Output	-	-	Hz	***Page 184***
U01-21	AI Opt Ch1 Level	-	-	%	***Page 184***
U01-22	AI Opt Ch2 Level	-	-	%	***Page 184***
U01-23	AI Opt Ch3 Level	-	-	%	***Page 184***
U01-24	Opt Out	-	-	-	***Page 184***
U01-25	Opt In Low	-	-	-	***Page 184***
U01-26	Opt In High	-	-	-	***Page 184***
U01-28	CPU 2 SW Number	-	-	-	***Page 184***
U01-29	Load Weight	-	-	-	***Page 184***
U01-30	SS Delta Speed	-	-	Hz	***Page 184***
U01-34	OPE Error Code	-	-	-	***Page 184***
U01-39	Transmit Error	-	-	-	***Page 184***
U01-44	ASR Out w/o Fil	-	-	%	***Page 184***
U01-50	Hook Height	-	-	%	***Page 184***
U01-51	Motor Revolution	-	-	Revs	***Page 184***
U01-52	MaintenanceTimer	-	-	hr	***Page 184***
U01-53	Index Count	-	-	Revs	***Page 184***
U01-54	Term RP Inp Freq	-	-	Hz	***Page 184***
U01-60	PG CH1 Count	-	-	Pulse	***Page 184***
U01-61	PG CH2 Count	-	-	Pulse	***Page 184***
U01-63	PG CH1 Freq	-	-	Hz	***Page 184***
U01-64	PG CH2 Freq	-	-	Hz	***Page 184***

Parameter	Parameter Name	Default	Range	Units	Reference
U01-65	PG Output Freq	-	-	Hz	***Page 184***
U01-66	BE6 Pulse Count	-	-	Pulse	***Page 184***
U01-68	LC Zone	-	-	-	***Page 184***
U01-69	LC Margin	-	-	%	***Page 184***
U01-84	NLB State	-	-	-	***Page 184***
U01-85	NLB Rel Trq	-	-	%	***Page 184***
U01-86	Brk Test Trq	-	-	Flb	***Page 184***
U02-01	Current Fault	-	-	-	***Page 186***
U02-02	Last Fault	-	-	-	***Page 186***
U02-03	Frequency Ref	-	-	Hz	***Page 186***
U02-04	Output Freq	-	-	Hz	***Page 186***
U02-05	Output Current	-	-	A	***Page 186***
U02-06	Motor Speed	-	-	Hz	***Page 186***
U02-07	Output Voltage	-	-	VAC	***Page 186***
U02-08	DC Bus Voltage	-	-	VDC	***Page 186***
U02-09	Output Power	-	-	HP/kW	***Page 186***
U02-10	Torque Reference	-	-	%	***Page 186***
U02-11	Input Term Sts	-	-	-	***Page 186***
U02-12	Output Term Sts	-	-	-	***Page 186***
U02-13	Inverter Status	-	-	-	***Page 186***
U02-14	Elapsed Time	-	-	hr	***Page 186***
U02-15	SFS Output	-	-	Hz	***Page 186***
U02-16	Motor Iq Current	-	-	%	***Page 186***
U02-17	Motor Id Current	-	-	%	***Page 186***
U02-20	Actual Fin Temp	-	-	°C	***Page 186***
U02-27	Motor Temp (NTC)	-	-	°C	***Page 186***
U02-28	Fault Axis	-	-	-	***Page 186***
U03-01	Last Fault	-	-	-	***Page 187***
U03-02	Fault Message 2	-	-	-	***Page 187***
U03-03	Fault Message 3	-	-	-	***Page 187***
U03-04	Fault Message 4	-	-	-	***Page 187***
U03-05	Fault Message 5	-	-	-	***Page 187***
U03-06	Fault Message 6	-	-	-	***Page 187***
U03-07	Fault Message 7	-	-	-	***Page 187***
U03-08	Fault Message 8	-	-	-	***Page 187***
U03-09	Fault Message 9	-	-	-	***Page 187***
U03-10	Fault Message 10	-	-	-	***Page 187***
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U03-12	Elapsed Time 2	-	-	hr	***Page 187***
U03-13	Elapsed Time 3	-	-	hr	***Page 187***
U03-14	Elapsed Time 4	-	-	hr	***Page 187***
U03-15	Elapsed Time 5	-	-	hr	***Page 187***

Parameter	Parameter Name	Default	Range	Units	Reference
U03-16	Elapsed Time 6	-	-	hr	***Page 187***
U03-17	Elapsed Time 7	-	-	hr	***Page 187***
U03-18	Elapsed Time 8	-	-	hr	***Page 187***
U03-19	Elapsed Time 9	-	-	hr	***Page 187***
U03-20	Elapsed Time 10	-	-	hr	***Page 187***
U03-21	RUN Cmd Counter	-	-	count	***Page 187***
U03-22	U3-21 Rollovers	-	-	count	***Page 187***
U03-23	OL/LC Count	-	-	count	***Page 187***
U04-01	Drv Elapsed Time	-	-	hr	***Page 188***
U04-03	Fan Elapsed Time	-	-	hr	***Page 188***
U04-04	Fan Life Mon	-	-	%	***Page 188***
U04-05	Cap Life Mon	-	-	%	***Page 188***
U04-06	ChgCirc Life Mon	-	-	%	***Page 188***
U04-07	IGBT Life Mon	-	-	%	***Page 188***
U04-08	Heatsink Temp	-	-	°C	***Page 188***
U04-09	LED Oper Check	-	-	-	***Page 188***
U04-10	kWh Lower 4 dig	-	-	kWh	***Page 188***
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U04-12	CPU Occup Rate	-	-	%	***Page 188***
U04-13	Current PeakHold	-	-	A	***Page 188***
U04-14	Freq@ I PeakHold	-	-	Hz	***Page 188***
U04-16	Motor OL1 Level	-	-	%	***Page 188***
U04-17	Drive OL2 Level	-	-	%	***Page 188***
U04-18	Reference Source	-	-	-	***Page 188***
U04-19	MEMOBUS Freq Ref	-	-	%	***Page 188***
U04-20	Option Freq Ref	-	-	%	***Page 188***
U04-21	Run Cmd Source	-	-	-	***Page 188***
U04-22	MEMOBUS Ref Reg	-	-	-	***Page 188***
U04-23	Option Ref Reg	-	-	-	***Page 188***
U04-32	Motor Temp (NTC)	-	-	°C	***Page 188***
U04-37	OH Alarm Axis	-	-	BIN	***Page 188***
U04-38	FAN Alarm Axis	-	-	BIN	***Page 188***
U04-39	VOF Alarm Axis	-	-	BIN	***Page 188***
U06-01	Mot SEC Current	-	-	%	***Page 189***
U06-02	Mot EXC Current	-	-	%	***Page 189***
U06-03	ASR Input	-	-	%	***Page 189***
U06-04	ASR Output	-	-	%	***Page 189***
U06-05	Voltage Ref (Vq)	-	-	VAC	***Page 189***
U06-06	Voltage Ref (Vd)	-	-	VAC	***Page 189***
U06-07	ACR(q) Output	-	-	%	***Page 189***
U06-08	ACR(d) Output	-	-	%	***Page 189***
U06-18	PG1 CounterValue	-	-	PPR	***Page 189***

Parameter	Parameter Name	Default	Range	Units	Reference
U06-19	PG2 CounterValue	-	-	PPR	***Page 189***
U06-22	Zero Servo Pulse	-	-	Pulse	***Page 189***
U06-26	FF Cont Output	-	-	%	***Page 189***

** Initial value set by X-Press Programming (**Table 4-6 on page 58**, **Table 4-7 on page 59** and **Table 4-8 on page 60**).*

*** Initial value dependent on VFD size, which is determined by O02-04 (kVA Selection).*

**** Value is automatically set during auto tuning.*

***** 0.0–25.5 seconds is extended to 0.0–6000.0 seconds when B05-16 = 1.*

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.

575V class VFDs (5xxx-G+/VG+S4 models) are not compliant with European Standards.

EMC Guidelines Compliance

This VFD is tested according to European standards IEC/EN 61800-3:2004/A1:2012.

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.

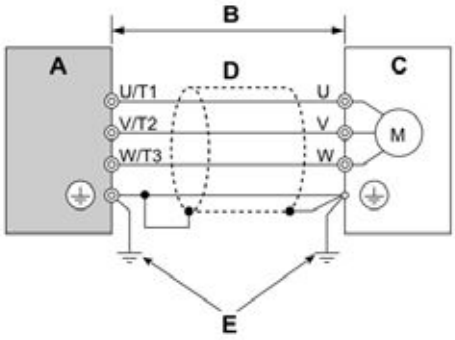
EMC Filter Installation

The following conditions must be met to ensure continued compliance with guidelines. ***See EMC Filters on page 241*** 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.



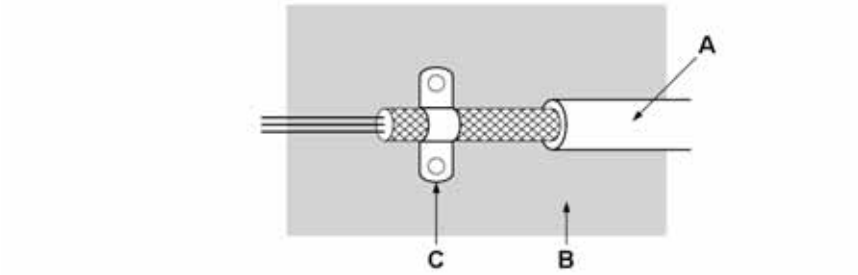
A – Drive
B – 10 m max cable length between drive and motor
C – Motor
D – Metal conduit
E – Ground wire should be as short as possible.

Figure B-2: Installation Method

5. Make sure the protective earthing conductor complies with technical standards and local safety regulations.

WARNING

Electrical Shock Hazard. Because the leakage current exceeds 3.5 mA in models 4370 to 41090-G+/VG+ S4, IEC 61800-5-1 states that either the power supply must be automatically disconnected in case of discontinuity of the protective earthing conductor, or a protective earthing conductor with a cross-section of at least 10 mm^2 (Cu) or 16 mm^2 (Al) must be used. Failure to comply may result in death or serious injury.



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

Figure B-3: Ground Area

6. Connect a DC link choke to minimize harmonic distortion. ***See DC Link Chokes for EN 61000-3-2 Compliance on page 247***.

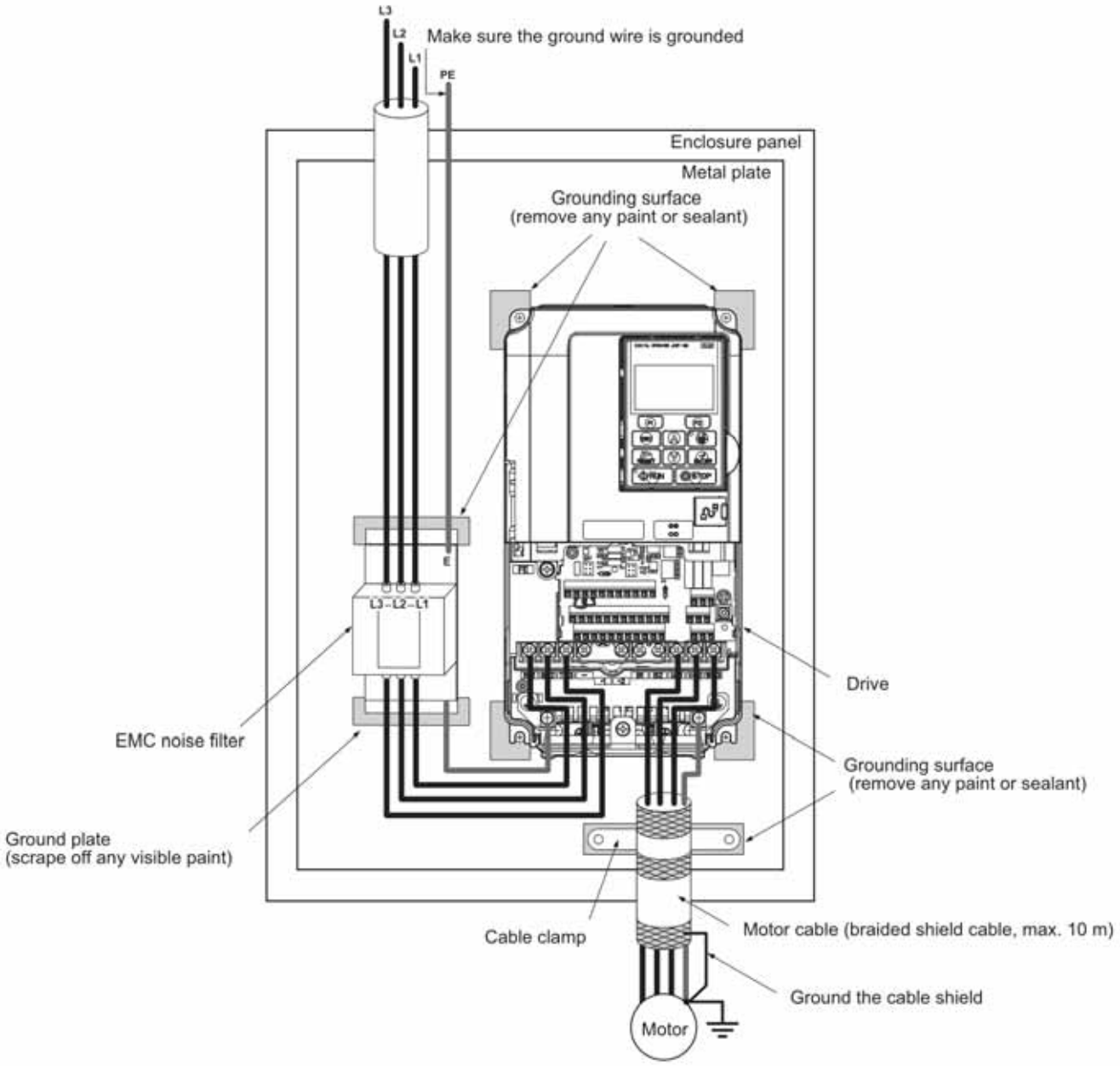


Figure B-4: EMC Filter and VFD Installation for CE Compliance

EMC Filters

Install the VFD with the EMC filters listed in ***Table B-1*** through ***Table B-4*** to comply with the EN61800-3 requirements. Schaffner filters are supplied in North America, and Block filters are supplied in Europe.

Table B-1: IEC/EN61800-3 Filters (Manufacturer: Schaffner) – 230 V Class

VFD Model	Filter Data (Manufacturer: Schaffner)					
	Schaffner Type	Rated Current (A)	Weight lb (kg)	Dimensions W x D x H (in) [W x D x H (mm)]	Mounting Dimensions Y x X (in) [Y x X (mm)]	Figure
2003	FS5972-10-07	10	2.6 (1.2)	5.6 x 1.8 x 13.0 (141 x 330 x 46)	4.5 x 12.3 (115 x 313)	***B-5***
2005						
2007						
2008	FS5972-18-07	18	2.9 (1.3)	5.6 x 1.8 x 13.0 (141 x 330 x 46)	4.5 x 12.3 (115 x 313)	
2011						
2014	FS5972-35-07	35	4.6 (2.1)	8.1 x 2.0 x 14.0 (206 x 355 x 50)	6.9 x 15.4 (175 x 336)	
2017						
2025						
2033	FS5972-60-7	60	8.8 (4.0)	9.3 x 2.6 x 16.1 (236 x 408 x 65)	8.1 x 15.4 (205 x 390)	
2047						
2060	FS5972-100-35	100	7.5 (3.4)	3.5 x 5.9 x 13.0 (90 x 330 x 150)	2.6 x 10.0 (65 x 255)	***B-6***
2075						
2085	FS5972-170-40	170	13.2 (6.0)	4.7 x 6.7 x 17.8 (120 x 451 x 170)	4.0 x 14.4 (102 x 365)	
2115						
2145	FS5972-250-37	250	25.8 (11.7)	5.1 x 9.5 x 24.0 (130 x 610 x 240)	3.5 x 19.6 (90 x 498)	
2180						
2215	FS5972-4100-99	410	23.1 (10.5)	10.2 x 4.5 x 15.2 (260 x 386 x 115)	9.3 x 4.7 (235 x 120)	***B-7***
2283						
2346	FS5972-600-99	600	24.3 (11)	10.2 x 5.3 x 15.2 (260 x 386 x 135)	9.3 x 4.7 (235 x 120)	
2415						

Table B-2: IEC/EN61800-3 Filters (Manufacturer: Schaffner) – 460 V Class

VFD Model	Filter Data (Manufacturer: Schaffner)					
	Schaffner Type	Rated Current (A)	Weight lb (kg)	Dimensions W x D x H (in) [W x D x H (mm)]	Mounting Dimensions Y x X (in) [Y x X (mm)]	Figure
4001	FS5972-10-07	10	2.7 (1.2)	5.6 x 1.8 x 13.0 (141 x 330 x 46)	4.5 x 12.3 (115 x 313)	*B-5*
4003						
4004						
4005						
4007	FS5972-18-07	18	2.9 (1.3)	5.6 x 1.8 x 13.0 (141 x 330 x 46)	4.5 x 12.3 (115 x 313)	
4009						
4014	FS5972-35-07	35	4.6 (2.1)	8.1 x 2.0 x 14.0 (206 x 355 x 50)	6.9 x 13.2 (175 x 336)	
4018						
4024						
4031	FS5972-60-07	60	8.8 (4)	9.3 x 2.6 x 16.1 (236 x 408 x 65)	8.0 x 15.4 (205 x 390)	
4039						
4045						
4060	FS5972-100-35	100	16.5 (3.4)	3.5 x 5.9 x 13.0 (90 x 330 x 150)	2.6 x 10.0 (65 x 255)	*B-6*
4075						
4091	FS5972-170-35	170	10.4 (6.0)	4.7 x 6.7 x 17.8 (120 x 451 x 170)	4.0 x 14.4 (102 x 365)	
4112						
4150						
4180	FS5972-250-37	250	25.8 (11.7)	5.1 x 9.5 x 24.0 (130 x 610 x 240)	3.5 x 19.6 (90 x 498)	
4216	FS5972-410-99	410	23.1 (10.5)	10.2 x 4.5 x 15.2 (260 x 386 x 115)	9.3 x 4.7 (235 x 120)	*B-7*
4260						
4304						
4370	FS5972-600-99	600	24.3 (11)	10.2 x 5.3 x 15.2 (260 x 386 x 135)	9.3 x 4.7 (235 x 120)	
4450						
4605	FS5972-800-99	800	69.4 (31.5)	11.8 x 6.3 x 28.2 (300 x 160 x 716)	10.8 x 8.3 (275 x 210)	
4810	FS5972-600-99*	600	24.3 (11)	10.2 x 5.3 x 15.2 (260 x 135 x 386)	9.3 x 4.7 (235 x 120)	
41090	FS5972-800-99*	800	69.4 (31.5)	11.8 x 28.2 x 6.3 (300 x 716 x 160)	10.8 x 8.3 (275 x 210)	

* *Connect two of the same EMC filters in parallel.*

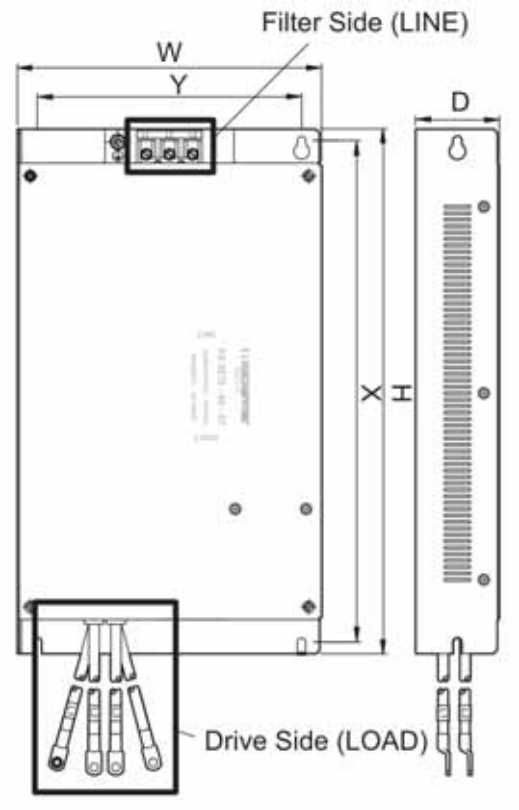


Figure B-5

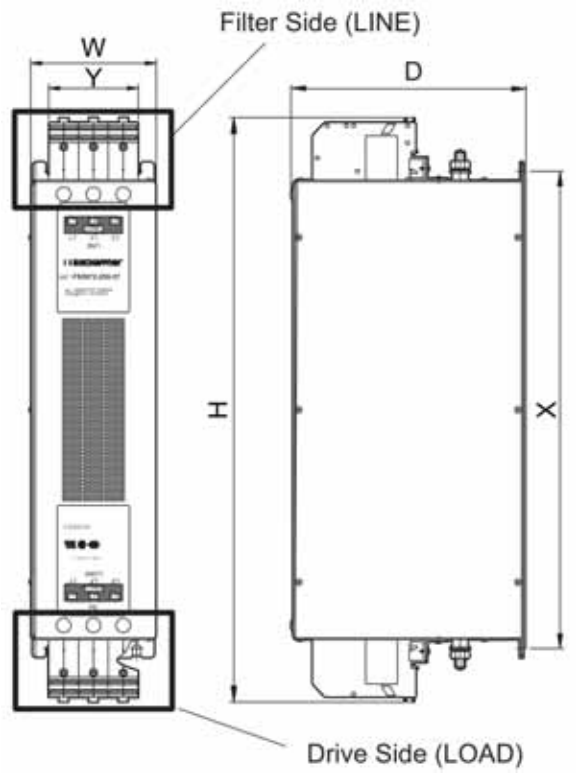


Figure B-6

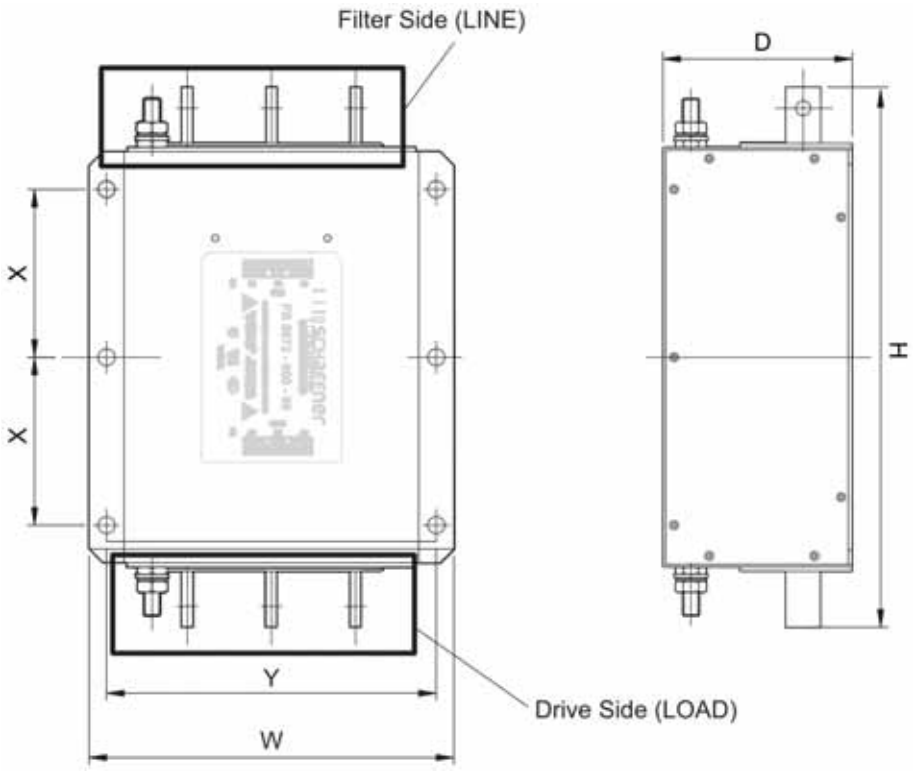


Figure B-7

Table B-3: EN 61800-3 Filters (Manufacturer: Block) – 230 V Class

VFD Model	Filter Data (Manufacturer: Block)					
	Block Type	Rated Current (A)	Weight lb (kg)	Dimensions W x D x H (in) [W x D x H (mm)]	Mounting Dimensions Y x X (in) [Y x X (mm)]	Figure
2003	FB-40008A	8	5.1 (2.3)	5.5 x 2 x 11.9 (140 x 50 x 301)	4.7 x 11.2 (120 x 285)	*B-8*
2005						
2007						
2008	FB-40014A	12	5.3 (2.4)	5.5 x 2 x 11.9 (140 x 50 x 301)	4.7 x 11.2 (120 x 285)	
2011						
2014	FB-40025A	25	6.6 (3.0)	5.5 x 2.2 x 11.9 (140 x 55 x 301)	4.7 x 11.2 (120 x 285)	
2017						
2025	FB-40060A	60	9.9 (4.5)	3.3 x 5.3 x 12.2 (85 x 135 x 310)	2.4 x 10.0 (60 x 255)	*B-9*
2033						
2047						
2060	FB-40072A	72	10.4 (4.7)	3.3 x 5.3 x 12.2 (85 x 135 x 310)	2.4 x 10.0 (60 x 255)	
2075	FB-40105A	105	11.7 (5.3)	3.7 x 5.9 x 12.8 (95 x 150 x 325)	2.6 x 10.0 (65 x 255)	
2085	FB-40170A	170	20.7 (9.4)	5.1 x 7.1 x 17.3 (130 x 181 x 440)	4.0 x 14.4 (102 x 365)	
2115						
2145						
2180	FB-40250A	250	27.3 (12.4)	6.1 x 8.7 x 20.7 (155 x 220 x 525)	4.9 x 17.1 (125 x 435)	
2215	FB-40414A	415	58.4 (26.5)	11.8 x 5.1 x 19.7 (300 x 130 x 500)	11.0 x 13.4 (280 x 340)	*B-10*
2283						
2346						
2415	FB-40675A	675	62.8 (28.5)	11.8 x 5.1 x 19.7 (300 x 130 x 500)	11.0 x 13.4 (280 x 340)	

Table B-4: EN 61800-3 Filters (Manufacturer: Block) – 460 V Class

VFD Model	Filter Data (Manufacturer: Block)					
	Block Type	Rated Current (A)	Weight lb (kg)	Dimensions W x D x H (in) [W x D x H (mm)]	Mounting Dimensions Y x X (in) [Y x X (mm)]	Figure
4001	FB-40008A	8	5.1 (2.3)	5.5 x 2 x 11.9 (140 x 50 x 301)	4.7 x 11.2 (120 x 285)	*B-8*
4003						
4004						
4005						
4007	FB-40014A	12	5.3 (2.4)	5.5 x 2 x 11.9 (140 x 50 x 301)	4.7 x 11.2 (120 x 285)	
4009						
4014	FB-40025A	25	6.6 (3.0)	5.5 x 2.2 x 11.9 (140 x 55 x 301)	4.7 x 11.2 (120 x 285)	
4018						
4024	FB-40044A	44	9.5 (4.3)	7.1 x 2.4 x 13.4 (180 x 60 x 341)	6.3 x 12.8 (160 x 325)	
4031						
4039	FB-40060A	60	9.9 (4.5)	3.3 x 5.3 x 12.2 (85 x 135 x 310)	2.4 x 10.0 (60 x 255)	*B-9*
4045						
4060	FB-40072A	72	10.4 (4.7)	3.3 x 5.3 x 12.2 (85 x 135 x 310)	2.4 x 10.0 (60 x 255)	
4075	FB-40105A	105	11.7 (5.3)	3.7 x 5.9 x 12.8 (95 x 150 x 325)	2.6 x 10.0 (65 x 255)	
4091						
4112	FB-40170A	170	20.7 (9.4)	5.1 x 7.1 x 17.3 (130 x 181 x 440)	4.0 x 14.4 (102 x 365)	
4150						
4180	FB-40250A	250	27.3 (12.4)	6.1 x 8.7 x 20.7 (155 x 220 x 525)	4.9 x 17.1 (125 x 435)	
4216						
4260	FB-40414A	415	58.4 (26.5)	11.8 x 5.1 x 19.7 (300 x 130 x 500)	11.0 x 13.4 (280 x 340)	*B-10*
4304						
4370						
4450	FB-40675A	675	62.8 (28.5)	11.8 x 5.1 x 19.7 (300 x 130 x 500)	11.0 x 13.4 (280 x 340)	
4605						
4810	FB-41200A*	1200	109.3 (49.6)	11.8 x 6.3 x 28.2 (300 x 160 x 716)	10.8 x 16.5 (275 x 420)	*B-11*
41090						

* *Connect two of the same EMC filters in parallel.*

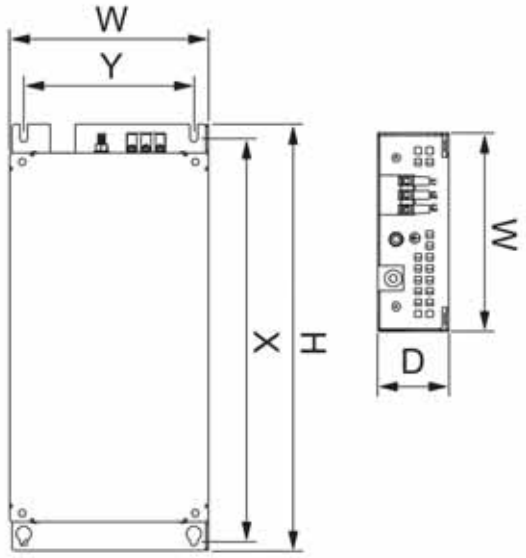


Figure B-8

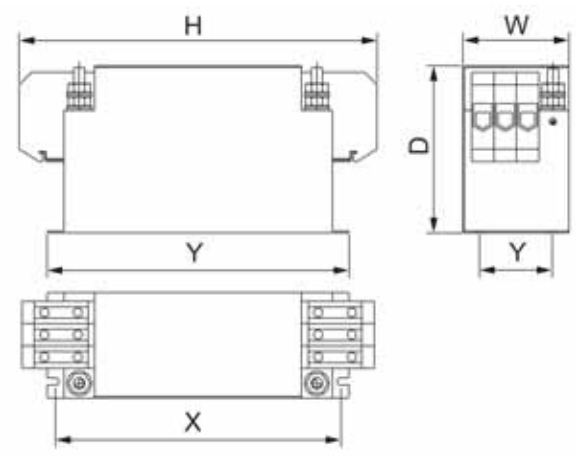


Figure B-9

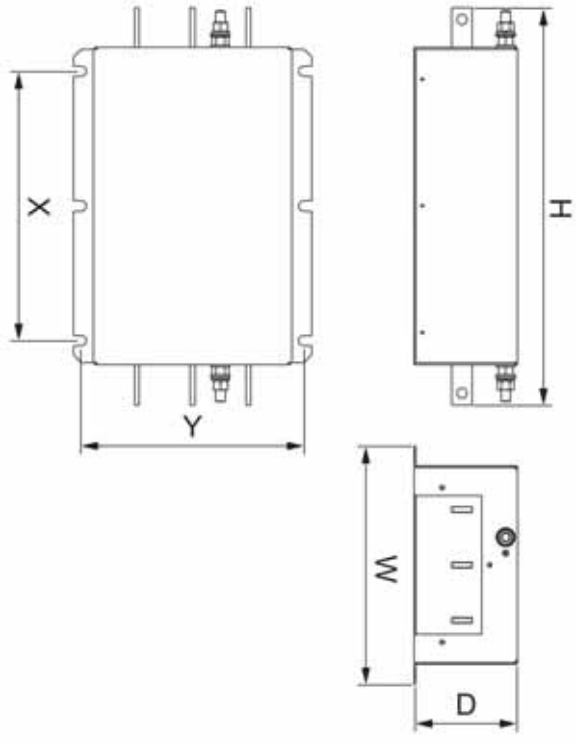


Figure B-10

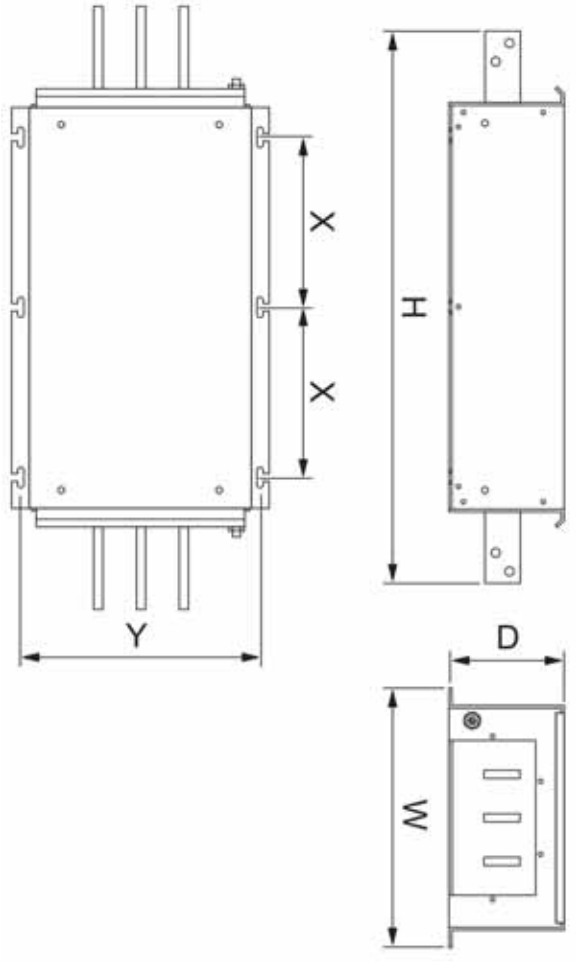


Figure B-11

DC Link Chokes for EN 61000-3-2 Compliance

Table B-5: DC Link Chokes for Harmonic Reduction

VFD Model	DC Link Chokes Rating
2003	5.4 A, 8 mH
2005	
4001	3.2 A, 28 mH
4003	

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

IMPULSE•G+/VG+ Series 4
Adjustable Frequency/Vector Crane Controls Technical Manual
November 2022

COLUMBUS McKINNON FAMILY OF BRANDS