

# **IMPULSE<sup>®</sup>G+ & VG+** *Series 4*

Adjustable Frequency/Vector Crane Controls

## **INSTRUCTION MANUAL**



**MAGNETEK**  
MATERIAL HANDLING

Software #14703.x April 2012  
Part Number: 144-23910 R2  
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## ***DANGER, WARNING, CAUTION, and NOTE* Statements**

*DANGER, WARNING, CAUTION, and Note* statements are used throughout this manual to emphasize important and critical information. You must read these statements to help ensure safety and to prevent product damage. The statements are defined below.



### **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 installation, operation, programming, or maintenance information that is important, but not hazard-related.

## Disclaimer of Warranty

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



### **WARNING**

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

## Service Information

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# *C h a p t e r* **1**

## **Introduction**

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## 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 drive. All warnings, cautions, and instructions must be followed. All activity must be performed by qualified personnel. The drive 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 digital operator 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 drive 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 drive. These devices may generate peak currents that exceed drive specifications.

# How to Use This Manual

This manual provides technical information on IMPULSE®•G+ and VG+ Series 4 parameter settings, drive functions, troubleshooting, and installation details. Use this manual to expand drive functionality and to take advantage of higher performance features. This manual is available for download on the Magnetek Material Handling document center website at [www.magnetekmh.com](http://www.magnetekmh.com).

The IMPULSE®•G+ and VG+ Series 4 drives share a common power section, and similar parameters. The parameters and performance differ because the VG+ drives includes a PG-X3 encoder feedback card allowing the drive to perform Flux Vector control of the motor. The G+ drives operate in V/f or Open Loop Vector control modes, appropriate for traverse or standard hoist motions. The VG+ drives are typically applied to the non-mechanical load brake hoist motion, and can be applied to traverse motions where torque control or a wide speed control range is required.

Many IMPULSE®•G+ and VG+ Series 4 parameter functions are common between the two drive classes. The functions that differ are noted with a “Model” column; this column designates which parameters are available for a given function. Functions may also be control method dependant; these differences are noted in the function and parameter details. Table 1-1 below notes which drives can operate in a particular control method.

**Table 1-1: Control Methods by Model**

Drive 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+	Closed Loop Vector (3)	1500:1	Traverse (0) NLB Hoist (2)

The instructions in the following chapters apply to most IMPULSE®•G+ & VG+ Series 4 crane, hoist, and monorail applications. However, carefully evaluate each specific situation and ensure that the National Electric Code (NEC) codes and local wiring practices are followed.

These chapters explain how to install the IMPULSE®•G+ & VG+ Series 4 and, to some extent, the components that it interconnects. It explains how to: assess the drive’s environment, mount the drive, and wire the drive circuits. It is important to develop a “plan of attack” for both the mounting and wiring since each task has an effect on the other one. IMPULSE®•G+ & VG+ Series 4 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, disregard this chapter, and turn to Chapter 4.*

# Introduction

## Assessing the System Requirements

It is important to know how the drive will be utilized before working on installation and wiring. 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, No Load Brake (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

## Assessing the Drive 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 drive, a three-phase 380 to 480 VAC 50/60 Hz power supply is available for a 460 VAC-rated drive, and a 500 to 600 VAC 50/60 Hz power supply is available for a 575 VAC-rated drive.
2. Ensure the encoder is supplied with +5 VDC or 12 VDC.
3. If the RMS encoder current requirement is greater than 200 mA, provide an auxiliary power supply to the encoder.
4. Ensure that the drive-to-motor wiring distance is less than 150 ft. unless appropriate reactors, filters, and/or inverter duty motor is used.
5. Ensure that the drive circuit wiring is protected or isolated from:
  - Ambient temperatures outside the range of +14°F to +140°F (-10°C to +60°C) at 2 kHz carrier frequency.
  - Rain or moisture
  - Corrosive gases or liquids
  - Direct sunlight
  - Severe mechanical vibration
6. Ensure that the drive is housed in an appropriate NEMA-rated enclosure.
7. For severe-duty applications (for example—long lifts) or with 75-HP-or-greater motors, ensure that the drive control system (including dynamic braking resistors) is adequately cooled, even though the ambient temperature limit is not exceeded. For more information, contact Magnetek.

# IMPULSE®•G+ & VG+ Series 4 General Specifications

**Table 1-2: Specification Values and Information - Heavy Duty**

230 V			460 V			575 V		
Model (-G+/ VG+S4)	Rated Output Current (A)	Capacity (kVA)	Model (-G+/ VG+S4)	Rated Output Current (A)	Capacity (kVA)	Model (-G+/ VG+S4)	Rated Output Current (A)	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	--	--	--



**Table 1-3: Specifications for 230 V, 460 V, and 575 V**

<b>Specification</b>	<b>Specification Value and Information for All Models</b>
Certification	UL, cUL, CSA (CE available upon request)
Crane Duty Classification	Rated for CMAA Crane Duty Class A - F only (or equivalent)
Rated input power supply volts & freq	3-phase 200 to 240 VAC 50/60 Hz for a 230 VAC-rated drive 3-phase 380 to 480 VAC 50/60 Hz for a 460 VAC-rated drive 3-phase 500 to 600 VAC 50/60 Hz for a 575 VAC-rated drive
Control Voltage	120 V (+10%/-15%)/60 Hz (±3 Hz) standard 24 VDC, 24 VAC/60 Hz, 48 VAC/60 Hz, 120 VAC/50 Hz optional
Allowable input voltage fluctuation	+10% or -15% of nominal
Allowable input frequency fluctuation	±5% of nominal
Control method	Fully digital, V/f, open loop vector, or flux vector control; sine-wave, pulse-width-modulated
Maximum output voltage (VAC)	3-phase 200 to 240 VDC (proportional to input voltage) 3-phase 380 to 480 VDC (proportional to input voltage) 3-phase 500 to 600 VDC (proportional to input voltage)
Rated frequency (Hz)	150 Hz standard (400 Hz optional, consult factory and equipment manufacturer)
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: 0.03 Hz (at 60 Hz)
Output frequency resolution	0.01 Hz
Overload capacity	150% of drive rated load for 1 min
Remote frequency reference sources	0–10 VDC (20kΩ); 4–20 mA (250Ω); ±10 VDC serial (RS-485)
Accel/decel times	0.1 to 6000.0 sec—4 sets; 8 parameters are independently adjustable
Braking torque	150% or more with dynamic braking
Motor overload protection	UL recognized electronic thermal overload relay; field-programmable
Overcurrent protection level (OC1)	200% of drive 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)
Torque limit selection	Separate functions for FORWARD, REVERSE, REGEN; all selectable from 0–300%
Stall prevention	Separate functions for accel, decel, at-speed, and constant horsepower region

\* 2kHz carrier frequency

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

Specification	Specification Value and Information for All Models
Other protection features	Speed deviation, overspeed, mechanical brake failure, lost output phase, failed-oscillator, PG-disconnect, mechanical overload, roll-back detection, micro controller watchdog, and internal braking transistor failure.
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 humidity or less and free of condensation
Vibration	10 to 20 Hz at 9.8 m/s <sup>2</sup> 20 to 55 Hz at 5.9 m/s <sup>2</sup> (Models 2003 to 2180, 4001 to 4150, and 5001 to 5077) or 20 to 55 Hz at 2.0 m/s <sup>2</sup> (Models 2215 to 2415, 4180 to 4605, and 5099 to 5200)
Elevation	1000 m or lower, up to 3000 m with derating.
Orientation	Install the drive vertically to maintain maximum cooling effects.

\* 2kHz carrier frequency

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

## AC Reactor Specifications

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

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

- The following tables are only a guideline. The motor FLA should not exceed the reactor FLA.
- Install an input reactor if the power source is greater than 500 kVA.
- Install an output reactor if the distance between the drive and the motor exceeds 150 feet.
- Install an output reactor if a device, such as a power limit switch, is used to disconnect the motor from the drive. Use a power limit switch early break circuit to fault the drive.
- Install one output reactor per drive for a multiple-drive arrangement requiring reactor protection.
- For a multiple drive arrangement, an input reactor for each drive is recommended for optimal protection. However, if the drives are within two drive 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 drives.
- Reactors are most effective when the reactor current rating approaches the drive current rating.

**Table 1-4: 230 V Class**

<b>Model Number</b>	<b>230 V Part Number</b>	<b>Maximum Amps of Reactor</b>
2003-G+/VG+S4	REA230-1	4
2005-G+/VG+S4	REA230-1	4
2007-G+/VG+S4	REA230-2	8
2008-G+/VG+S4	REA230-2	8
2011-G+/VG+S4	REA230-3	12
2014-G+/VG+S4	REA230-3	12
2017-G+/VG+S4	REA230-5	18
2025-G+/VG+S4	REA230-7.5	25
2033-G+/VG+S4	REA230-10	35
2047-G+/VG+S4	REA230-15	45
2060-G+/VG+S4	REA230-20	55
2075-G+/VG+S4	REA230-25	80
2085-G+/VG+S4	REA230-30	80
2115-G+/VG+S4	REA230-40	100
2145-G+/VG+S4	REA230-50	130
2180-G+/VG+S4	REA230-60	160
2215-G+/VG+S4	REA230-75	200
2283-G+/VG+S4	REA230-100	250
2346-G+/VG+S4	REA230-125	320
2415-G+/VG+S4	REA230-150	400

**Table 1-5: 460 V Class**

<b>Model Number</b>	<b>460 V Part Number</b>	<b>Maximum Amps of Reactor</b>
4001-G+/VG+S4	REA460-1	2
4003-G+/VG+S4	REA460-2	4
4004-G+/VG+S4	REA460-3	6
4005-G+/VG+S4	REA460-5	8
4007-G+/VG+S4	REA460-5	8
4009-G+/VG+S4	REA460-5	8
4014-G+/VG+S4	REA460-7.5	12
4018-G+/VG+S4	REA460-10	18
4024-G+/VG+S4	REA460-15	25
4031-G+/VG+S4	REA460-20	35
4039-G+/VG+S4	REA460-25	35
4045-G+/VG+S4	REA460-30	45
4060-G+/VG+S4	REA460-40	55
4075-G+/VG+S4	REA460-50	80
4091-G+/VG+S4	REA460-60	80
4112-G+/VG+S4	REA460-75	100
4150-G+/VG+S4	REA460-100	130
4180-G+/VG+S4	REA460-150	200
4216-G+/VG+S4	REA460-150	200
4260-G+/VG+S4	REA460-200	250
4304-G+/VG+S4	REA460-250	320
4370-G+/VG+S4	REA460-300	400
4450-G+/VG+S4	REA460-400	500
4605-G+/VG+S4	REA460-500	600

**Table 1-6: 575 V Class**

<b>Model Number</b>	<b>600 V Part Number</b>	<b>Maximum Amps of Reactor</b>
5001-G+/VG+S4	REA575-1	2
5003-G+/VG+S4	REA575-2	4
5004-G+/VG+S4	REA575-3	4
5006-G+/VG+S4	REA575-5	8
5009-G+/VG+S4	REA575-10	12
5012-G+/VG+S4	REA575-10	12
5017-G+/VG+S4	REA575-15	18
5022-G+/VG+S4	REA575-20 & 25	25
5027-G+/VG+S4	REA575-30	35
5032-G+/VG+S4	REA575-30	35
5041-G+/VG+S4	REA575-40	45
5052-G+/VG+S4	REA575-50	55
5062-G+/VG+S4	REA575-60	80
5077-G+/VG+S4	REA575-75	80
5099-G+/VG+S4	REA575-100	100
5130-G+/VG+S4	REA575-150	160
5172-G+/VG+S4	REA575-200	200
5200-G+/VG+S4	REA575-200	200

## S4IF Interface Specifications

IMPULSE®•G+ & VG+ Series 4 is designed to interface with 120 VAC/60 Hz 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/60 Hz, 48 VAC/60 Hz, and 120 VAC/50 Hz options.

The S4IF has eight optically isolated input terminals which can be used to connect the user input device to the drive. The eight terminals are multi-function terminals, and are used for speed control and other controls.

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

**Table 1-7: S4IF Ratings**

S4IF Model	S1-S8	
	Voltage	Frequency
S4IF-120A60	120 VAC	60 Hz
S4IF-48A60	48 VAC	60 Hz
S4IF-24A60	24 VAC	60 Hz
S4IF-24D00	24 VDC	--
S4IF-120A50	120 VAC	50 Hz

## S4I and S4IO Option Specifications

IMPULSE®•G+ & VG+ Series 4 is compatible with AC digital input (S4I) and AC digital input/output (S4IO) options. The options expand the I/O capability of the drives, without the need for interface relays or isolation circuitry.

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	60 Hz
S4I-48A60	48 VAC	60 Hz
S4I-24A60	24 VAC	60 Hz

**Table 1-9: S4IO Ratings**

S4IO Model	I1-I4		O1-O6	
	Voltage	Frequency	Voltage	Current
S4IO-120A60	120 VAC	60 Hz	120 VAC	1.0 A
S4IO-48A60	48 VAC	60 Hz	120 VAC	1.0 A
S4IO-24A60	24 VAC	60 Hz	120 VAC	1.0 A

# *C h a p t e r* 2

## **Installation**

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## WARNING

- When preparing to mount the IMPULSE®•G+ & VG+ Series 4 drive, lift it by its base. Never lift the drive by the front cover, as doing so may cause drive damage or personal injury.
- Mount the drive on nonflammable material.
- The IMPULSE®•G+ & VG+ Series 4 drive generates heat. For the most effective cooling possible, mount it vertically. For more details, refer to the “IMPULSE®•G+ & VG+ Series 4 Dimensions/Heat Loss—Open Chassis” 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:

1. Choosing a location
2. IMPULSE®•G+ & VG+ Series 4 components and external devices
3. Drive environment
4. Drive installation

In addition, this section will cover information on the components that interconnect with IMPULSE®•G+ & VG+ Series 4.

### Choosing a Location

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

- Extreme cold and heat. Use only within the ambient temperature range:  
-10°C to +60°C (+14°F to 140°F)\*
- Direct sunlight (not for use outdoors)
- Rain, moisture
- High humidity
- Oil sprays, splashes
- Salt spray
- Dust or metallic particles in the air
- Corrosive gases (e.g. sulfurized gas or liquids)
- Radioactive substances
- Combustibles (e.g. thinner, solvents, etc.)
- Physical shock, vibration
- Magnetic noise (e.g. welding machines, power devices, etc.)

\* 2 kHz carrier frequency

# IMPULSE®•G+ & VG+ Series 4 System Components And External Devices

## Standard IMPULSE®•VG+ Series 4 Drive Components

- PG-X3 Line Driver Encoder Card

## Optional Drive Components

- DI-A3 Digital DC Input Card
- DO-A3 Digital Output Card
- AI-A3 Analog Input Card
- AO-A3 Analog Output Card
- S4I-xxxA60 Control Digital AC Input Card
- S4IO-xxxA60 Control Digital AC Input/Output 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 Card
- SI-EN3 EtherNet/IP
- SI-EM3 Modbus TCP/IP
- SI-EP3/V PROFINET
- SI-P3 PROFIBUS-DP

## As-Required Drive Components

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

## Required External Devices

- Motor
- User input device (pendant, joystick, PC, PLC, radio, or infrared control)
- External circuit protection devices (fuses or circuit breakers) (See “Suggested Circuit Protection Specifications and Wire Size” in Chapter 3).
- R-C surge suppressors on contactor coils

# Long Time Storage

Powering up the drives every six months is quite beneficial. Over longer periods of time without power, the drives' electrolytic DC bus capacitors require reformation, especially if stored in an area of high temperatures. Capacitor reforming is required if drives are stored without power for more than 2 to 3 years. This process can be avoided by powering up the drive bi-annually for 30 to 60 minutes.

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

Inverter drives 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 drive's functionality not be restored after bus cap reforming. Contact Magnetek Service for questions.

## Capacitor Storage and their Reforming Process

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

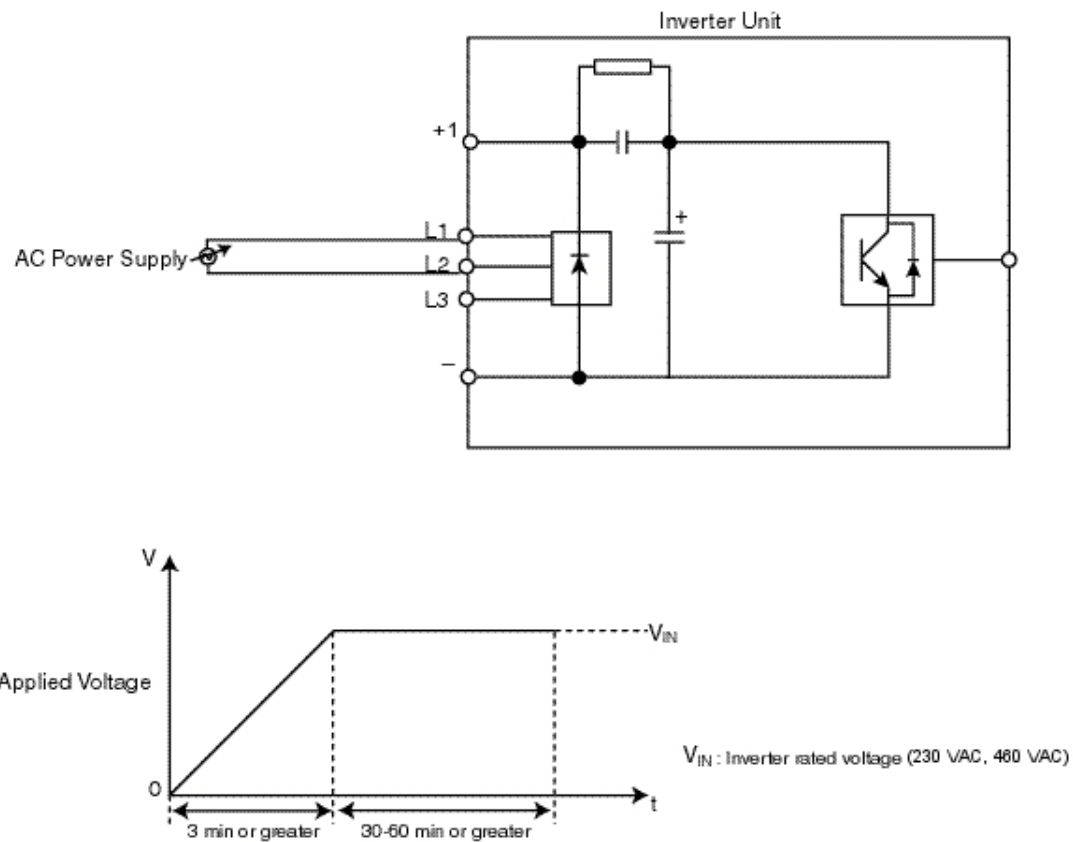
In the event that a capacitor has been stored in a high ambient environment for more than 2 or 3 years, a voltage treatment reformation process to electrolytic capacitors may have to be performed. When stored above room temperatures for long periods of time, the anode foil may react with the electrolyte, increasing the leakage current. After storage, the application of even normal voltages to these capacitors may result in higher than normal leakage currents. In most cases the leakage current levels will decrease in a short period of time as the normal chemical reaction within the capacitor occurs. However, in extreme cases, the amount of gas generated may cause the safety vent to open.

Capacitors, when used in inverter drives 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.

### Inverter Bus Capacitor Reforming Procedure:

1. Connect the inverter inputs L1, L2, and L3 to a variac.
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 drive. If the variac has an output current indication, make sure the current is very near zero with zero or a steady output voltage applied.
4. Slowly turn the variac up, increasing the variac's output voltage to nominal rated input voltage over a time period of 2 to 3 minutes. In other words, ramp the voltage up at a rate of approximately 75 to 100 volts/minute for 230 VAC units, 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 inverter. 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. Otherwise, this completes the capacitor reforming procedure.

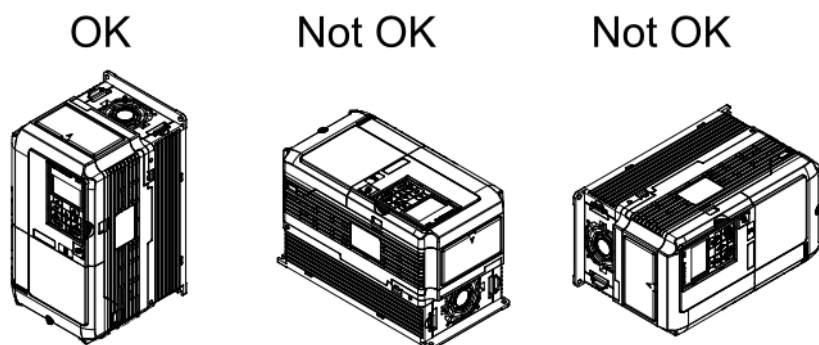


**Figure 2-1: Long Time Storage**

# Installing the Drive

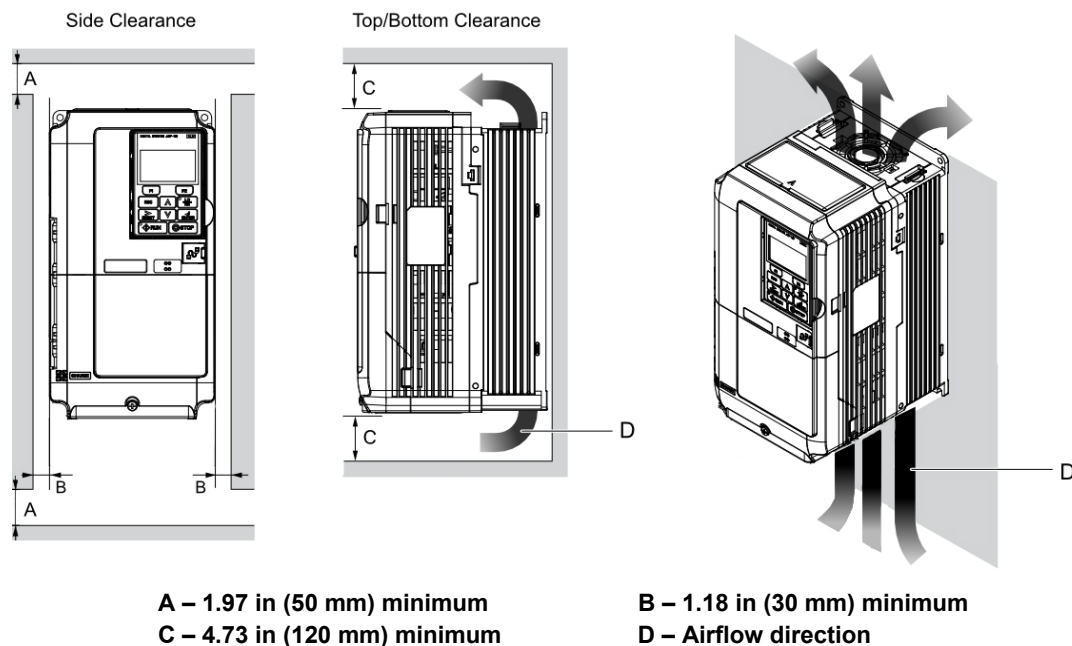
To install IMPULSE®•G+ & VG+ Series 4:

1. Ensure the drive will be used in a proper environment. Refer to page 1-5.
2. Review “IMPULSE®•G+ & VG+ Series 4 Terminal Block Configuration” on page 3-12.
3. Determine the sizes and connection locations for the drive components and external devices that need to be wired. Locate the ground.
4. Determine the proper drive orientation on the subpanel to maintain proper cooling (see Figure 2-2).



**Figure 2-2: Correct Installation Orientation**

5. Ensure that the air can flow freely around the heat sink as shown in Figure 2-3.



**Figure 2-3: Correct Installation Spacing**

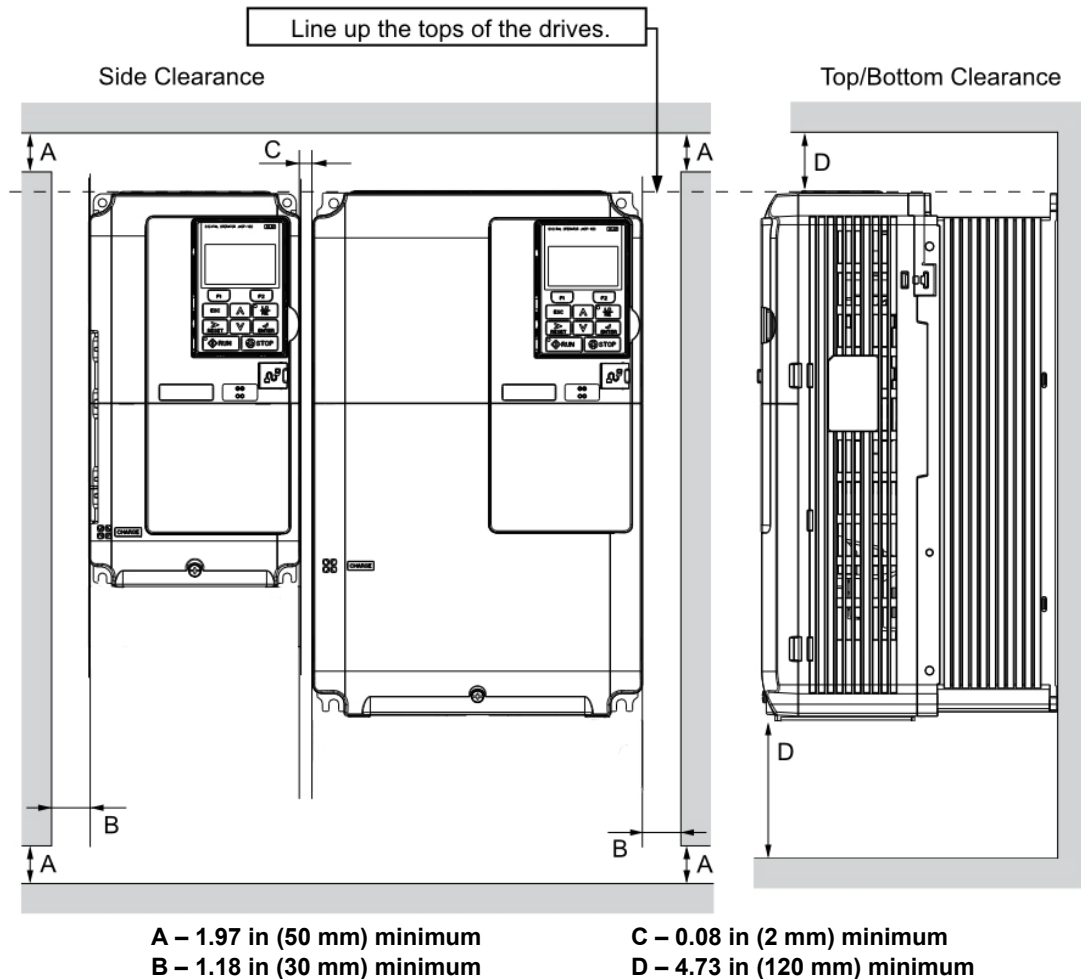
**NOTE:**

- *Allowable intake air temperature: 14° to 140°F (-10° to +60°C) at 2 kHz carrier frequency.*
  - *If necessary, a heater or air conditioner must be used to maintain the temperature range listed above.*
6. Lay out the wire runs. Size the wire according to Tables 3-1, 3-2, and 3-3, and in accordance with NEC Table 610-14(a).
    - Ensure that the drive control circuit and power circuit wires are perpendicular to each other at any point they cross.
    - Keep power and control festoon wiring in separate cables.
    - Separate control drive circuit and power circuit wiring on the terminal block strip.
  7. Obtain the appropriate hardware for mounting.
  8. Mount the subpanel or surface to which you are mounting the drive (contact Magnetek if advice is needed in regards to mounting drives, especially for larger drives).
  9. Fasten the drive and components to the subpanel.
  10. Remove the terminal cover.
  11. Follow the wiring practices outlined in Chapter 3.

## Multiple Drive Installation (Side-by-Side Installation)

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

When mounting drives with the minimum clearing of 0.08 inches (2 mm) according to Figure 2-4, set parameter L08-35 to 1 while considering derating.



**Figure 2-4: Space Between Drives (Side-by-Side Mounting)**

**NOTE:** Align the tops of the drives when installing drives of different heights in the same enclosure panel. Leave space between the tops and bottoms of stacked drives for easier cooling fan replacement.

# Drive Derating Data

## Temperature Derating

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

### **IP00/Open-Chassis Enclosure**

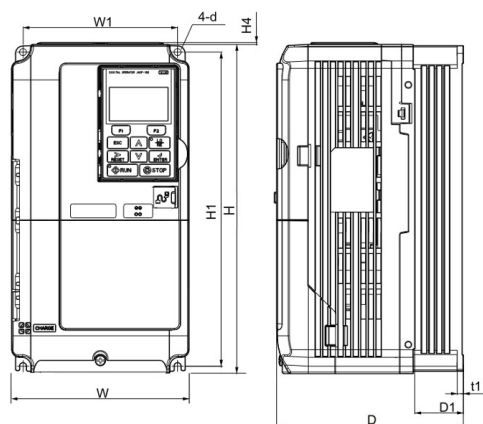
Drive operation between -10°C to +60°C (14°F to 140°F) allows CMAA Class F continuous current without derating.

### **Side-by-Side Mounting**

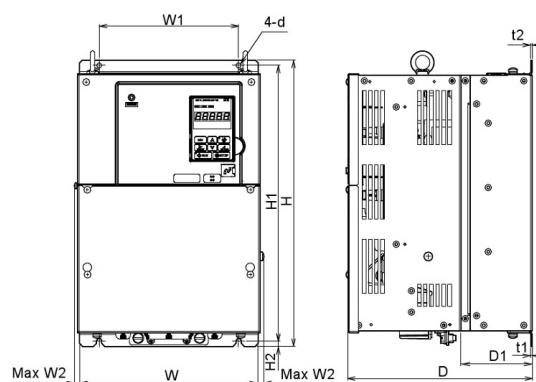
Drive operation between -10°C and 30°C (14°F to 86°F) allows CMAA Class F continuous current without derating. Operation between 30°C and 50°C (86°F to 122°F) requires output current derating.



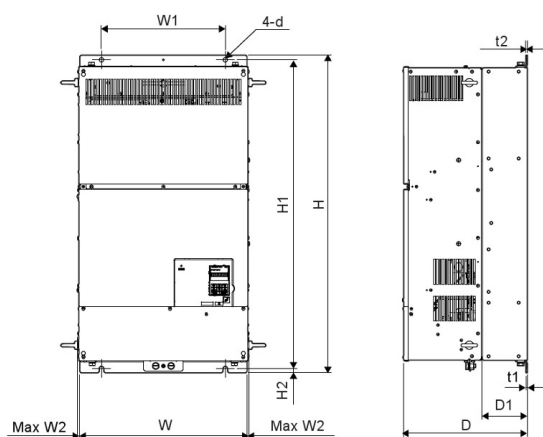
## Dimensions for IP00/Open Chassis Enclosures



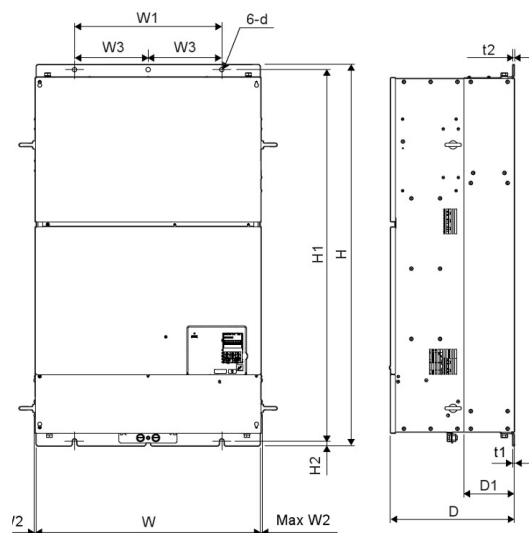
**Figure 2-5**



**Figure 2-6**



**Figure 2-7**



**Figure 2-8**

**Table 2-1: Enclosure Dimensions - 230 V Drives**

Drive Model Number (-G+/VG+S4)	Figure	Dimensions (in)												Wt. (lbs)	Total Loss (W)
		W	H	D	W1	W2	H1	H2	H4	D1	t1	t2	d		
2003	2-5	5.51	10.24	5.79	4.80	--	9.76	--	0.06	1.50	0.20	--	M5	7.3	59
2005		5.51	10.24	5.79	4.80	--	9.76	--	0.06	1.50	0.20	--	M5	7.3	72
2007		5.51	10.24	5.79	4.80	--	9.76	--	0.06	1.50	0.20	--	M5	7.5	84
2008		5.51	10.24	5.79	4.80	--	9.76	--	0.06	1.50	0.20	--	M5	7.5	95
2011		5.51	10.24	5.79	4.80	--	9.76	--	0.06	1.50	0.20	--	M5	7.5	122
2014		5.51	10.24	6.46	4.80	--	9.76	--	0.06	2.17	0.20	--	M5	8.2	137
2017		5.51	10.24	6.46	4.80	--	9.76	--	0.06	2.17	0.20	--	M5	8.2	168
2025		5.51	10.24	6.57	4.80	--	9.76	--	0.06	2.17	0.20	--	M5	9.3	287
2033		5.51	10.24	6.57	4.80	--	9.76	--	0.06	2.17	0.20	--	M5	9.3	319
2047		7.09	11.81	7.36	6.30	--	11.18	--	0.06	2.95	0.20	--	M5	13.0	410
2060		8.66	13.78	7.76	7.56	--	13.19	--	0.06	3.07	0.20	--	M6	20.1	558
2075		8.66	13.78	7.76	7.56	--	13.19	--	0.06	3.07	0.20	--	M6	22.0	681
2085	2-6	10.00	15.75	10.16	7.68	0.31	15.16	0.30	--	3.94	0.09	0.09	M6	50.7	721
2115		10.98	17.72	10.16	8.66	0.31	17.13	0.30	--	3.94	0.09	0.09	M6	61.7	912
2145		12.95	21.65	11.14	10.24	0.31	21.06	0.30	--	4.33	0.09	0.09	M6	90.4	1122
2180		12.95	21.65	11.14	10.24	0.31	21.06	0.30	--	4.33	0.09	0.09	M6	92.6	1354
2215		17.72	27.76	12.99	12.80	0.39	26.77	0.49	--	5.12	0.13	0.13	M10	167.6	1980
2283		17.72	27.76	12.99	12.80	0.39	26.77	0.49	--	5.12	0.13	0.13	M10	176.4	2524
2346		19.69	31.50	13.78	14.57	0.39	30.43	0.51	--	5.12	0.18	0.18	M12	216.1	3347
2415		19.69	31.50	13.78	14.57	0.39	30.43	0.51	--	5.12	0.18	0.18	M12	218.3	3626

**Table 2-2: Enclosure Dimensions - 460 V Drives**

Drive Model Number (-G+/VG+S4)	Figure	Dimensions (in)													Wt. (lbs)	Total Loss (W)
		W	H	D	W1	W2	W3	H1	H2	H4	D1	t1	t2	d		
4001	2-5	5.51	10.24	5.79	4.80	--	--	9.76	--	0.06	1.50	0.20	--	M5	7.5	61
4003		5.51	10.24	5.79	4.80	--	--	9.76	--	0.06	1.50	0.20	--	M5	7.5	70
4004		5.51	10.24	5.79	4.80	--	--	9.76	--	0.06	1.50	0.20	--	M5	7.5	87
4005		5.51	10.24	6.46	4.80	--	--	9.76	--	0.06	2.17	0.20	--	M5	7.9	101
4007		5.51	10.24	6.46	4.80	--	--	9.76	--	0.06	2.17	0.20	--	M5	8.2	108
4009		5.51	10.24	6.46	4.80	--	--	9.76	--	0.06	2.17	0.20	--	M5	8.2	130
4014		5.51	10.24	6.57	4.80	--	--	9.76	--	0.06	2.17	0.20	--	M5	9.0	221
4018		5.51	10.24	6.57	4.80	--	--	9.76	--	0.06	2.17	0.20	--	M5	9.0	247
4024		7.09	11.81	6.57	6.30	--	--	11.18	--	0.06	2.17	0.20	--	M5	12.6	323
4031		7.09	11.81	7.36	6.30	--	--	11.18	--	0.06	2.95	0.20	--	M5	13.2	403
4039		8.66	13.78	7.76	7.56	--	--	13.19	--	0.06	3.07	0.20	--	M6	19.2	509
4045	2-6	10.00	15.75	10.16	7.68	0.31	--	15.16	0.30	--	3.94	0.09	0.09	M6	50.7	518
4060		10.98	17.72	10.16	8.66	0.31	--	17.13	0.30	--	3.94	0.09	0.09	M6	59.5	701
4075		12.95	20.08	10.16	10.24	0.31	--	19.49	0.30	--	4.13	0.09	0.13	M6	86.0	817
4091		12.95	20.08	10.16	10.24	0.31	--	19.49	0.30	--	4.13	0.09	0.13	M6	86.0	1022
4112		12.95	21.65	11.14	10.24	0.31	--	21.06	0.30	--	4.33	0.09	0.09	M6	99.2	1325
4150		12.95	21.65	11.14	10.24	0.31	--	21.06	0.30	--	4.33	0.09	0.09	M6	101.4	1920
4180		17.72	27.76	12.99	12.80	0.39	--	26.77	0.49	--	5.12	0.13	0.13	M10	174.2	2313
4216		19.69	31.50	13.78	14.57	0.39	--	30.43	0.51	--	5.12	0.18	0.18	M12	211.6	3075
4260		19.69	31.50	13.78	14.57	0.39	--	30.43	0.51	--	5.12	0.18	0.18	M12	224.9	3178
4304		19.69	31.50	13.78	14.57	0.39	--	30.43	0.51	--	5.12	0.18	0.18	M12	235.9	4060
4370	2-7	19.69	37.40	14.57	14.57	0.31	--	36.34	0.51	--	5.31	0.18	0.18	M12	275.6	4742
4450	2-8	26.38	44.88	14.57	17.32	0.24	8.66	43.70	0.59	--	5.91	0.18	0.18	M12	476.2	5358
4605		26.38	44.88	14.57	17.32	0.24	8.66	43.70	0.59	--	5.91	0.18	0.18	M12	487.2	5875

**Table 2-3: Enclosure Dimensions - 575 V Drives**

Drive Model Number (-G+/VG+S4)	Figure	Dimensions (in)												Wt. (lbs)	Total Loss (W)
		W	H	D	W1	W2	H1	H2	H4	D1	t1	t2	d		
5001	2-5	5.51	10.24	5.79	4.80	--	9.76	--	0.06	1.50	0.20	--	M5	7.5	48.7
5003		5.51	10.24	5.79	4.80	--	9.76	--	0.06	1.50	0.20	--	M5	7.5	81.9
5004		5.51	10.24	6.46	4.80	--	9.76	--	0.06	2.17	0.20	--	M5	8.2	80.0
5006		5.51	10.24	6.46	4.80	--	9.76	--	0.06	2.17	0.20	--	M5	8.2	115.1
5009		5.51	10.24	6.57	4.80	--	9.76	--	0.06	2.17	0.20	--	M5	9.0	160.3
5012		7.09	11.81	7.36	6.30	--	11.18	--	0.06	2.95	0.20	--	M5	13.2	212.2
5017		7.09	11.81	7.36	6.30	--	11.18	--	0.06	2.95	0.20	--	M5	13.2	284.8
5022		8.66	13.78	7.76	7.56	--	13.19	--	0.06	3.07	0.20	--	M6	19.2	381.1
5027		8.66	13.78	7.76	7.56	--	13.19	--	0.06	3.07	0.20	--	M6	19.2	465.1
5032		10.98	17.72	10.16	8.66	0.31	17.13	0.30	--	3.94	0.09	0.09	M6	59.5	533.5
5041	2-6	10.98	17.72	10.16	8.66	0.31	17.13	0.30	--	3.94	0.09	0.09	M6	59.5	688.5
5052		12.95	21.65	11.14	10.24	0.31	21.06	0.30	--	4.33	0.09	0.09	M6	99.2	1606.5
5062		12.95	21.65	11.14	10.24	0.31	21.06	0.30	--	4.33	0.09	0.09	M6	99.2	1836.5
5077		12.95	21.65	11.14	10.24	0.31	21.06	0.30	--	4.33	0.09	0.09	M6	99.2	1619.0
5099		17.72	27.76	12.99	12.80	0.39	26.77	0.49	--	5.12	0.13	0.13	M10	174.2	1750
5130		17.72	27.76	12.99	12.80	0.39	26.77	0.49	--	5.12	0.13	0.13	M10	174.2	2146
5172		19.69	31.50	13.78	14.57	0.39	30.43	0.51	--	5.12	0.18	0.18	M12	235.9	2762
5200		19.69	31.50	13.78	14.57	0.39	30.43	0.51	--	5.12	0.18	0.18	M12	235.9	3422

# *C h a p t e r* 3

## **Wiring**

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# IMPULSE®•G+ & VG+ Series 4 Wiring Practices



## WARNING

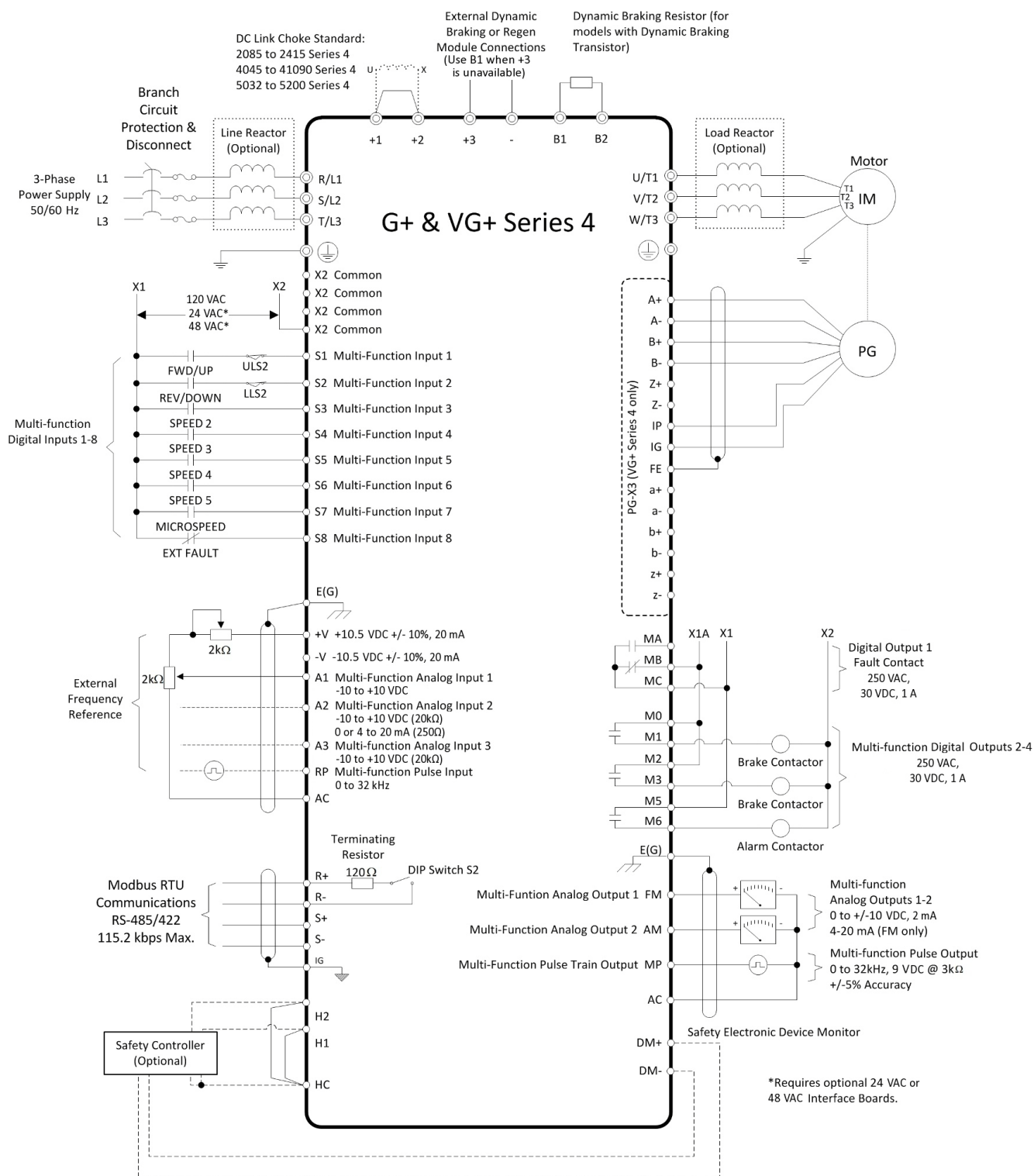
Before you wire the drive, review the following practices to help ensure that your system is wired properly.

- Ensure that the encoder wiring is less than 300 feet, unless the Wireless Pulse Data System or 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 drive 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 drive in applications that require a disconnecting means between the drive's output and motor. Use a "make before break" auxiliary contact with the disconnect means and the hardware base block of the drive.
- Use hard contacts between the PLC output and the drive 120/24/48 VAC input card. If using a solid state output from a PLC (TRIAC) to a 120/24/48 VAC input card, use a 5K $\Omega$ , 5W resistor between the signal and X2.
- If the power source is 500 kVA or greater, or more than 10 times the inverter kVA rating, ensure that there is at least 3% impedance between the power source and the drive input. To accomplish this, a DC reactor can be installed between inverter terminals 1 and 2, or an AC line reactor can be used on the input of the drive. Excessive peak currents could damage the input power supply circuit if there is not enough impedance provided.
- Comply with "Suggested Circuit Protection Specifications" on page 3-6.
- Use time delay fuses, which are sized at 150% of drive'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 drive 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 drive enclosure.
- Do not connect power factor correction capacitors to the drive input or output; use a sine wave filter.
- When possible, hard-wire the drive and motor. Do not use sliding collector bars (e.g., festoon cable).
- If there is a user input device or interface board that is remote, use shielded cable between the drive input terminals and the interface output terminals or user input device(s).
- Before turning on the drive, 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 drive 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 drive'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 = 0/1 or swapping A and  $\bar{A}$  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 drive side.
- Please observe National Electrical Code (NEC) guidelines when wiring electrical devices.

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





**Figure 3-1: IMPULSE® G+ & VG+ Series 4 Typical Connection Diagram**

# Suggested Circuit Protection Specifications and Wire Size

In order to comply with most safety standards, some circuit protective devices should be used between the incoming three-phase power supply and the IMPULSE®•G+ & VG+ Series 4. These devices can be thermal, magnetic, or molded-case breakers (MCCB); or “slow-blow” type fuses such as “CCMR” or “J.”



## CAUTION

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

**Table 3-1: Wire Sizing for 230 V Class**

Model # (-G+/VG+S4)	Continuous HD Input Amps	Time Delay Input Fuse (A)	Time Delay Input Fuse Class	Inverse Time Molded/Case Circuit Breaker (A) <sup>3</sup>	Recommended Gauge (AWG) <sup>1, 4</sup>		
					Power Circuit Wiring	Control Wiring	Ground Copper <sup>2</sup>
2003	2.9	5	CC	15	14 to 10	18 to 16	14 to 10
2005	5.8	10	CC	15	14 to 10	18 to 16	14 to 10
2007	7.0	12	CC	15	14 to 10	18 to 16	14 to 10
2008	7.5	15	CC	15	14 to 10	18 to 16	14 to 10
2011	11.0	20	CC	20	14 to 10	18 to 16	14 to 10
2014	15.6	25	CC	30	14 to 10	18 to 16	14 to 10
2017	18.9	30	CC	35	12 to 10	18 to 16	12 to 10
2025	28.0	40	J	50	10 to 6	18 to 16	10 to 8
2033	37.0	50	J	70	8 to 6	18 to 16	10 to 8
2047	52.0	60	J	90	6 to 4	18 to 16	8 to 6
2060	68.0	80	J	110	4 to 2	18 to 16	6 to 4
2075	80.0	125	J	150	4 to 2	18 to 16	6 to 4
2085	82.0	125	J	150	2 to 1/0	18 to 16	6 to 4
2115	111	175	J	200	2 to 1/0	18 to 16	4
2145	136	200	J	250	1/0 to 2/0	18 to 16	4 to 2
2180	164	250	J	300	1/0 to 2/0	18 to 16	4 to 1/0
2215	200	300	J	350	250 2-2/0	18 to 16	3 to 300
2283	271	400	J	450	350 2-3/0	18 to 16	2 to 300
2346	324	500	J	600	400 2-250	18 to 16	1 to 350
2415	394	600	J	700	400 2-250	18 to 16	1 to 350

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

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

3) NFPA 70 National Electric Code 2011. Table 430.52.

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

**Table 3-2: Wire Sizing for 460 V Class**

Model # (-G+/VG+S4)	Continuous HD Input Amps	Time Delay Input Fuse (A)	Time Delay Input Fuse Class	Inverse Time Molded/Case Circuit Breaker (A) <sup>3</sup>	Recommended Gauge (AWG) <sup>1, 4</sup>		
					Power Circuit Wiring	Control Wiring	Ground Copper <sup>2</sup>
4001	1.8	2	CC	15	14 to 10	18 to 16	14 to 12
4003	3.2	6	CC	15	14 to 10	18 to 16	14 to 12
4004	4.4	8	CC	15	14 to 10	18 to 16	14 to 10
4005	6.0	9	CC	15	14 to 10	18 to 16	14 to 10
4007	8.2	15	CC	15	14 to 10	18 to 16	14 to 10
4009	10.4	20	CC	15	14 to 10	18 to 16	14 to 10
4014	15.0	25	CC	30	12 to 6	18 to 16	14 to 10
4018	20	30	CC	40	10 to 6	18 to 16	12 to 10
4024	29	35	J	50	8 to 6	18 to 16	10 to 8
4031	39	45	J	60	8 to 6	18 to 16	10 to 6
4039	44	50	J	70	6 to 4	18 to 16	8 to 6
4045	43	60	J	80	6 to 4	18 to 16	8 to 6
4060	58	80	J	100	4 to 2	18 to 16	6
4075	71	100	J	125	4 to 2	18 to 16	6 to 4
4091	86	125	J	175	2 to 1/0	18 to 16	6 to 4
4112	105	150	J	225	1/0 to 2/0	18 to 16	4
4150	142	200	J	300	3/0 to 4/0	18 to 16	4 to 2
4180	170	250	J	350	250 2-2/0	18 to 16	4 to 300
4216	207	300	J	400	250 2-2/0	18 to 16	2 to 350
4260	248	350	J	500	350 2-3/0	18 to 16	2 to 350
4304	300	400	J	600	350 2-4/0	18 to 16	1 to 350
4370	346	500	J	700	500 2-250	18 to 16	1 to 1/0
4450	410	700	L	900	500 2-300 4-3/0	18 to 16	1/0 to 300
4605	584	800	L	1200	2-400 4-250 4-3/0	18 to 16	2/0 to 300

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

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

3) NFPA 70 National Electric Code 2011. Table 430.52.

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

**Table 3-3: Wire Sizing for 575 V Class**

Model # (-G+/VG+S4)	Continuous HD Input Amps	Time Delay Input Fuse (A)	Time Delay Input Fuse Class	Inverse Time Molded/Case Circuit Breaker (A) <sup>3</sup>	Recommended Gauge (AWG) <sup>1, 4</sup>		
					Power Circuit Wiring	Control Wiring	Ground Copper <sup>2</sup>
5001	1.9	3	CC	15	14 to 10	18 to 16	14 to 10
5003	3.6	5	CC	15	14 to 10	18 to 16	14 to 10
5004	5.1	7	CC	15	14 to 10	18 to 16	14 to 10
5006	8.3	10	CC	15	14 to 10	18 to 16	12 to 10
5009	12	15	CC	20	14 to 10	18 to 16	12 to 8
5012	16	20	CC	25	10 to 8	18 to 16	12 to 8
5017	23	25	CC	35	10 to 8	18 to 16	10 to 6
5022	31	35	J	45	10 to 6	18 to 16	10 to 6
5027	38	45	J	50	10 to 6	18 to 16	10 to 6
5032	33	50	J	60	10 to 6	18 to 16	6
5041	44	60	J	80	8 to 4	18 to 16	6
5052	54	70	J	100	6 to 4	18 to 16	4
5062	66	90	J	125	4	18 to 16	4
5077	80	100	J	150	4	18 to 16	4
5099	108	125	J	200	2	18 to 16	4 to 300
5130	129	175	J	250	1/0	18 to 16	4 to 300
5172	158	225	J	350	2/0	18 to 16	1 to 350
5200	228	300	J	450	3/0	18 to 16	1 to 350

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

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

3) NFPA 70 National Electric Code 2011. Table 430.52.

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


## Power Circuit Wiring Procedures

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

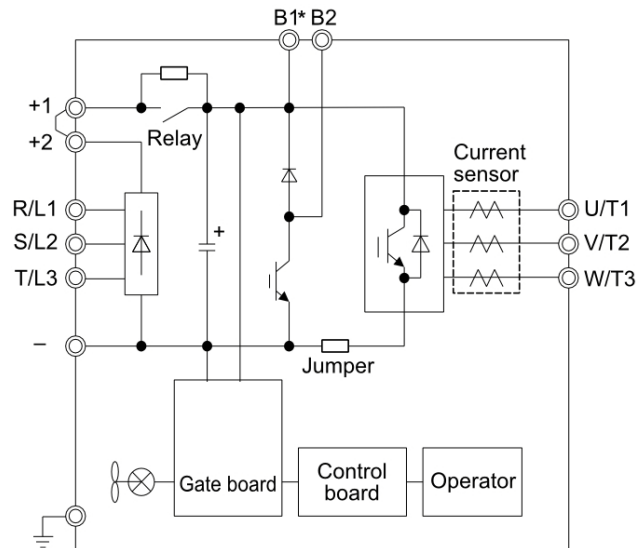
1. Run the three-phase power supply wires through an appropriate enclosure hole.
2. Refer to “Suggested Circuit Protection Specifications and Wire Size” on page 3-6, connect the three-phase power supply wires to a circuit protection system.
3. Connect the three-phase power supply wires from the circuit protection 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 drive and the motor, install a reactor on the output side of the drive.

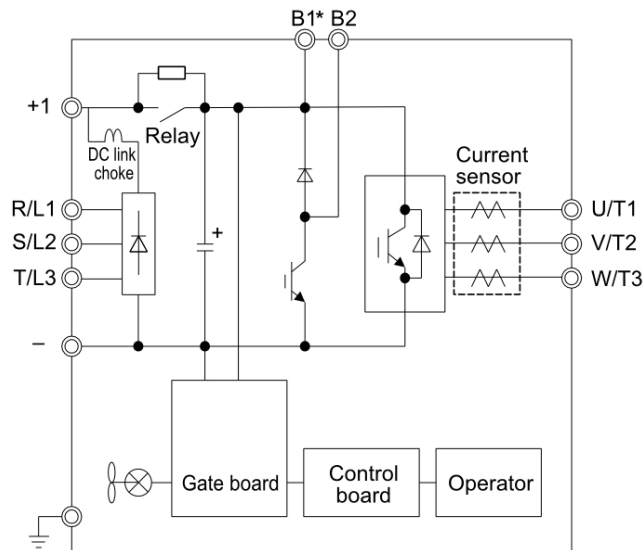
**Table 3-4: Main Circuit Terminal Wiring**

Terminal	Drive Model			Function
230 V Class	2003 to 2075	2085 to 2115	2145 to 2415	
460 V Class	4001 to 4039	4045 to 4060	4075 to 4605	
575 V Class	5001 to 5027	5032 to 5041	5052 to 5200	
R/L1	Main circuit power supply input <i>NOTE: 6-pulse operation only</i>			Connects line power to the drive
S/L2				
T/L3				
U/T1	Drive Output			Connects to the motor
V/T2				
W/T3				
B1	Braking Resistor		Not Available	Available for connecting a braking resistor or a braking resistor unit option
B2				
+2	DC link choke connection (+1, +2) (remove the bar between +1 and +2) DC power supply input (+1, -)	Not Available		For connecting: <ul style="list-style-type: none"><li>the drive to a DC power supply (terminals +1 and - are not UE/CE or UL approved)</li><li>dynamic braking options</li><li>a DC link choke</li></ul>
+1		DC power supply input (+1, -)	DC power supply input (+1, -) Braking unit connections (+3, -)	
--				
+3	Not available Same as B1 on models: 2003 to 2115 4001 to 4060 5001 to 5041			
	For 230 V class: 100Ω or less For 460 V class: 10Ω or less For 575 V class: 10Ω or less			Grounding terminal

## Main Circuit Connection Diagram

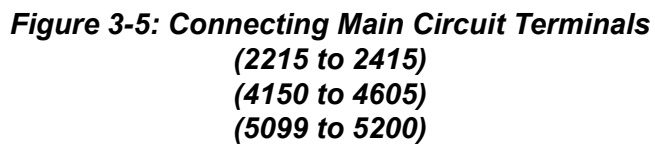
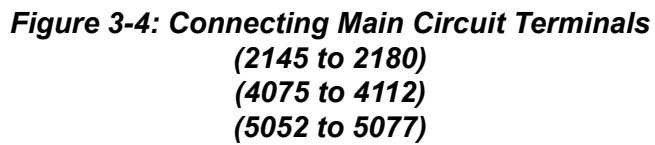


**Figure 3-2: Connecting Main Circuit Terminals**  
**(2003 to 2075)**  
**(4001 to 4039)**  
**(5001 to 5027)**



**Figure 3-3: Connecting Main Circuit Terminals**  
**(2085 and 2115)**  
**(4045 and 4060)**  
**(5032 and 5041)**

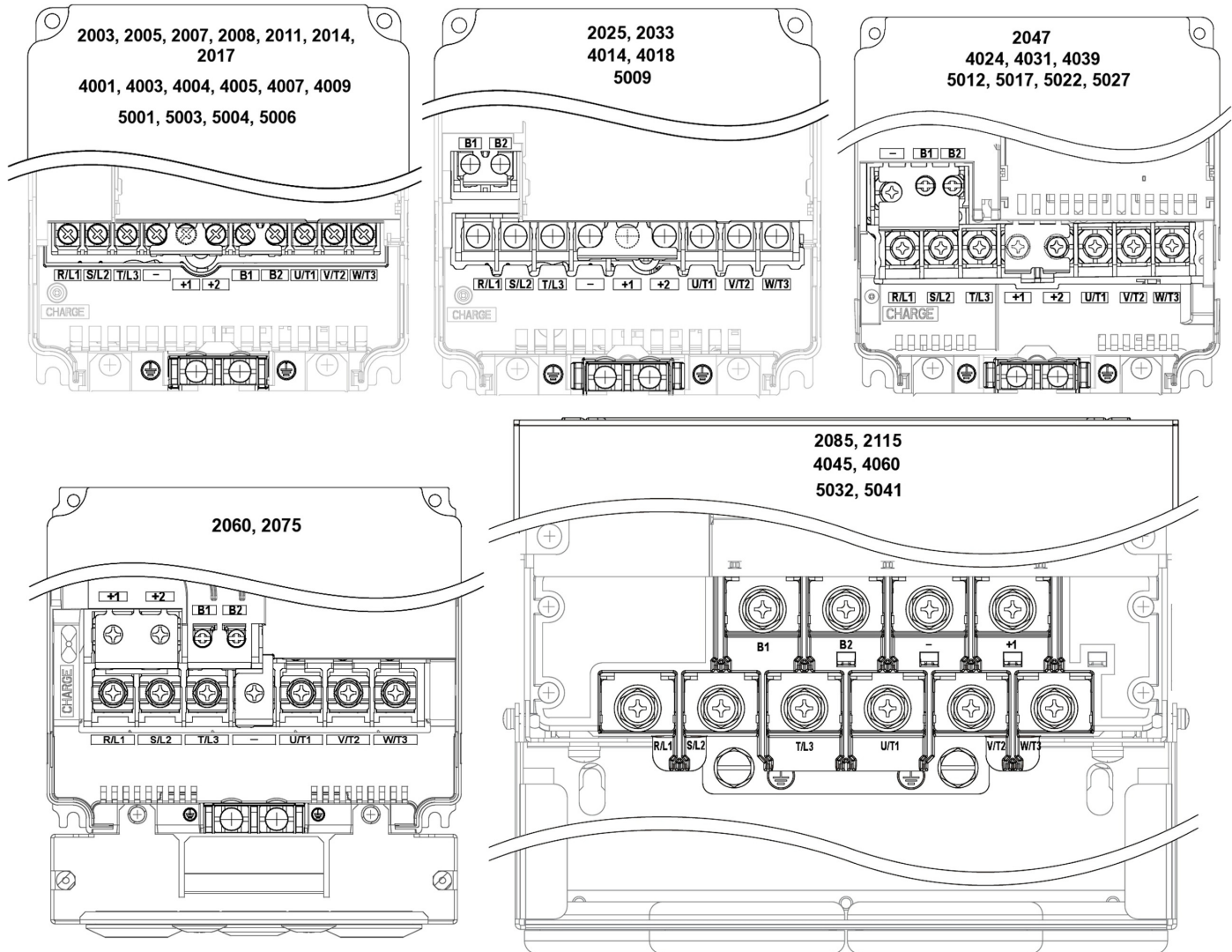
\* Connect optional DBU to terminals B1 and -



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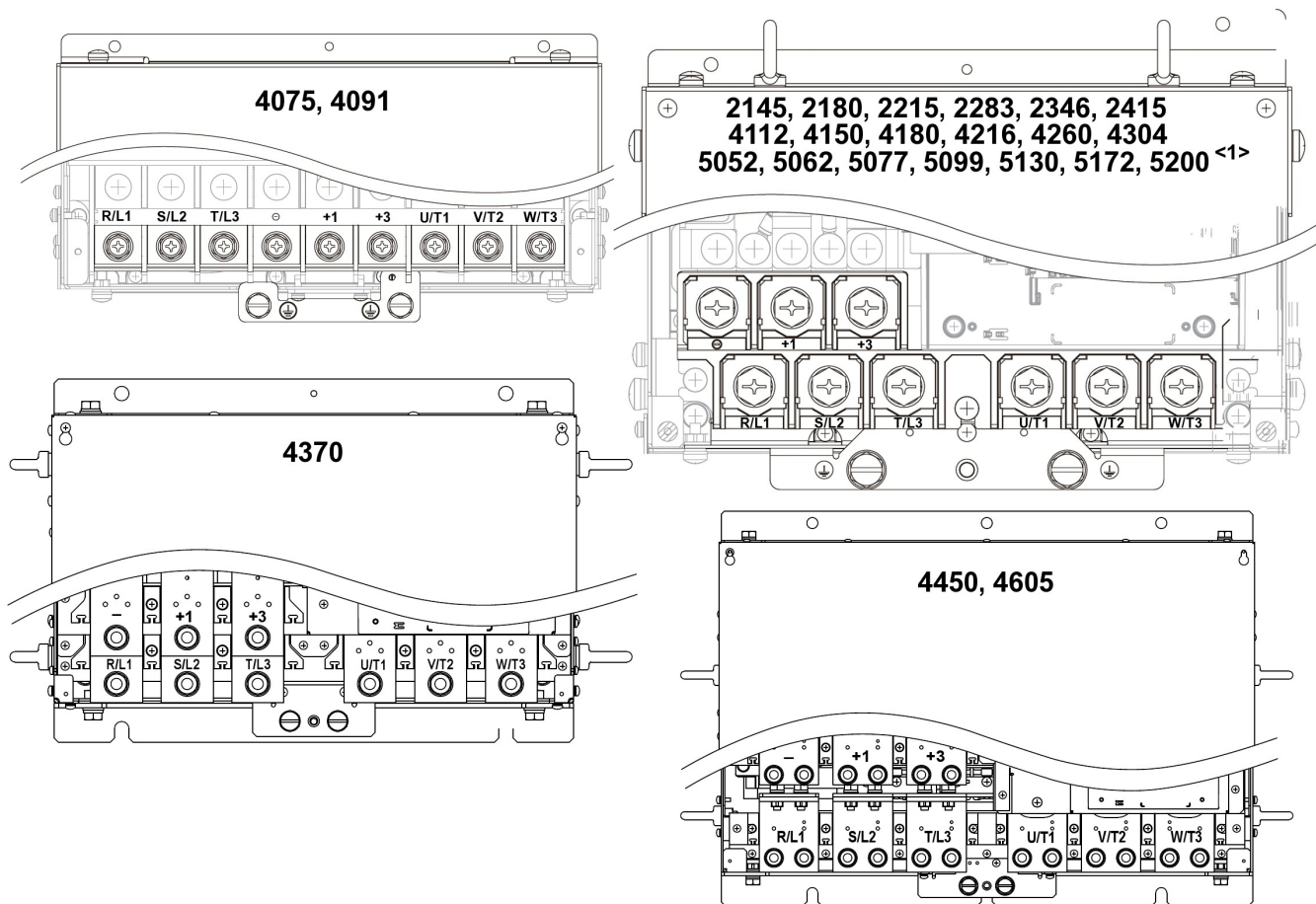
## Terminal Block Configuration

Figure 3-6 and Figure 3-7 show the different main circuit terminal arrangements for the drive capacities.



**Figure 3-6: Main Circuit Terminal Block Configuration**



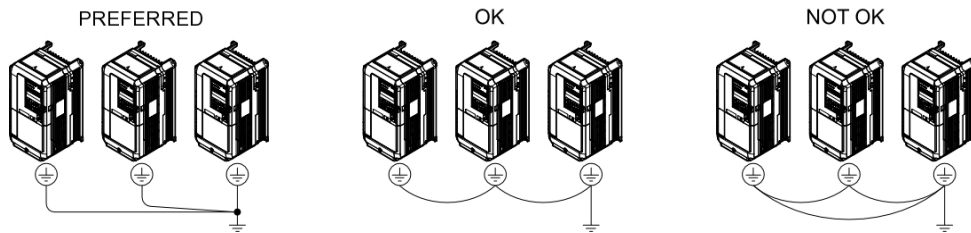


<1> Terminal block design differs slightly for models 2215 to 2415, 4180 to 4304, and 5099 to 5200.

**Figure 3-7: Main Circuit Terminal Block Configuration (continued)**

## Grounding

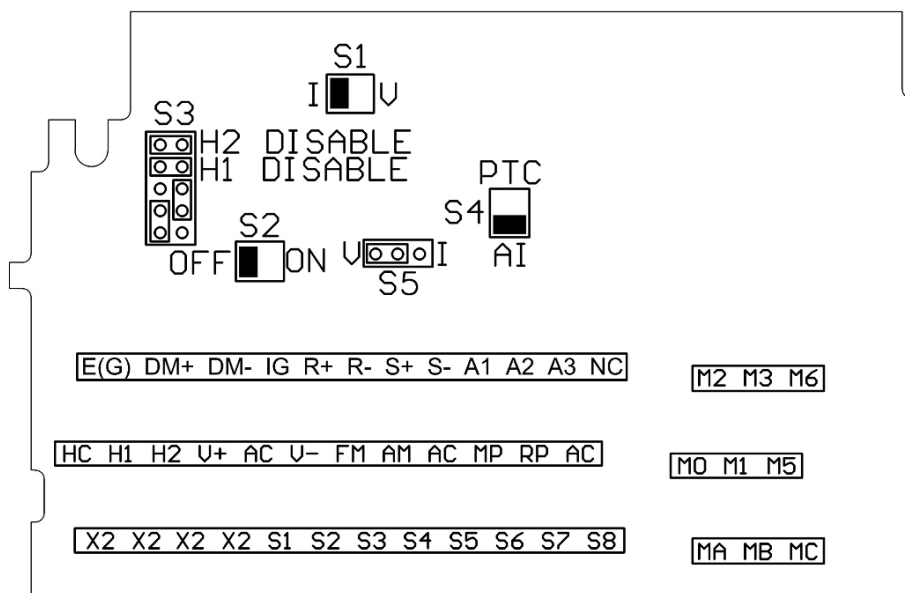
5. Connect terminal G to the common panel ground. Use ground wiring as specified in “Suggested Circuit Protection and Wire Size” on page 3-6, and keep the length as short as possible.
  - Ground Resistance:  $10\Omega$  or less.
  - Never run the IMPULSE®•G+ & VG+ Series 4 drive ground wires in common with welding machines, or other high-current electrical equipment.
  - When more than one drive is used for the same system, ground each directly or daisy-chain to the ground pole. Do not loop the ground wires.



**Figure 3-8: Grounding**

## Interface Circuit Board

### S4IF DIP Switches and Jumper (120 VAC, 48 VAC, and 24 VAC)



**Figure 3-9: S4IF DIP Switches and Jumper Location**

**Table 3-5: Terminal and Wire Specifications**

Terminal Symbol	Terminal Screw	Clamping Torque Lb-in (N-m)	Wire Range AWG (mm <sup>2</sup> )
TB	M3	4.2 to 5.3 (0.5 to 0.6)	26 to 16 (Stranded: 0.14 to 1.5) (Solid: 0.14 to 1.5)

## Dip Switches

DIP Switches are described in this section. The functions of the DIP switches are shown in the table below.

**Table 3-6: DIP Switches**

Name	Function	Setting
S1	Input method for analog input A2	V: 0 to 10 VDC or -10 to 10 VDC (internal resistance: 20 $\Omega$ ) <b>(default)</b> I: 4-20mA (internal resistance: 250 $\Omega$ )
S2	RS-485 and RS-422 terminating resistance	OFF: No terminating resistance <b>(default)</b> ON: Terminating resistance of 110 $\Omega$
S3	Hardware Base Block Configuration	See page 3-16 for setting details
S4	Analog 3/PTC input select	OFF: A3 is used as Analog Input 3 <b>(default)</b> ON: A3 is used with a Positive Temperature Coefficient (PTC) thermistor
S5	Output method for analog output FM	V: 0 to 10 VDC or -10 VDC to 10 VDC <b>(default)</b> I: 4 to 20 mA

# Sinking/Sourcing Mode Selection for Safe Disable Inputs

Use jumper S3 on the Interface Board to select between Sink mode, Source mode, or external power for the Safe Disable inputs H1 and H2 (as shown in Table 3-7). Jumper S3 is also used to disable the Safe Disable inputs H1 and H2, with the jumpers in place the Safe Disable inputs are disabled. Remove H1 and H2 disable jumpers if external Safe Disable functionality is to be used. Refer to Figure 3-9 for locating jumper S3.

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

Mode	Drive Internal Power Supply	External 24 VDC Power Supply
Sinking Mode		
Sourcing Mode		

(Default)

## Control Circuit Terminals

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

### Terms:

- Mutli-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**

Classification	Terminal	Signal Function	Description	Signal Level
Sequence Input Signal	S1	MFDI 1 (Run Forward)	Multi-function contact inputs (H01-01 to H01-08) *Programmable input	Photo-coupler isolation 120 VAC
	S2	MFDI 2 (Run Reverse)		
	S3	MFDI 3 (Speed 2)		
	S4	MFDI 4 (Speed 3)		
	S5	MFDI 5 (Speed 4)		
	S6	MFDI 6 (Speed 5)		
	S7	MFDI 7 (External Fault)		
	S8	MFDI 8 (Microspeed Gain 1)		
	X2	MFDI Common	Common for control signal	0 V
Analog Input Signal	+V	Power supply for analog inputs	Positive supply for analog inputs	+10.5 VDC, 20 mA
	-V	Power supply for analog inputs	Negative supply for analog inputs	-10.5 VDC, 20 mA
	A1	MFAI 1 (Master Frequency Reference)	-10 to +10 VDC/-100% to 100% 0 to +10 VDC/0 to 100%	-10 to +10 V (20kΩ) 0 to +10 V (20kΩ)
	A2	MFAI 2 (Not Used)	Multi-function analog reference (H03-09)	-10 to +10 V (20kΩ) 0 to +10 V (20kΩ) 4 to 20 mA (250Ω)
	A3	MFAI 3 (Master Frequency Reference)	Auxiliary analog input (H03-05)	-10 to +10 V (20kΩ) 0 to +10 V (20kΩ)
	AC	Analog Common	Common for analog signal	0 V
	E(G)	Ground for shielded lines and option cards	Earth ground	—

Classification	Terminal	Signal Function	Description	Signal Level
Relay Output Signal	M0	MFDO (Brake Release)	(H02-01) Programmable Output	Form A Relay: 250 VAC, 1 A 30 VDC, 1 A
	M1			
	M2	MFDO (X-Press Programming)	(H02-02) Programmable Output	Form A Relay: 250 VAC, 1 A 30 VDC, 1 A
	M3			
	M5	MFDO (X-Press Programming)	(H02-03) Programmable Output	Form A Relay: 250 VAC, 1 A 30 VDC, 1 A
	M6			
	MA	Fault annunciate Terminals MA-MC: N/O Terminals MB-MC: N/C	Terminals MA & MC N/O; closed at major faults Terminals MB & MC N/C open at major fault	Form C Relay: 250 VAC, 1 A 30 VDC, 1 A
	MB			
	MC			
Analog Output Signal	FM	MFAO 1 (Output frequency)	Multi-function analog monitor (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	0V
	AM	MFAO 2 (Output current)	Multi-function analog monitor 2 (H04-04 to H04-06)	-10 to +10V, 2 mA 0 to +10V, 2 mA
Pulse I/O Signal	RP	Multi-Function Pulse Train 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 train output (Output frequency)	Pulse output frequency (H06-06)	32 kHz (max)
RS-485/422	R+	Receive (+)	For 2-wire RS-485, jumper R+ and S+ and jumper R- and S-	RS-485/422 Line Driver 115.2 kbps (max)
	R-	Receive (-)		
	S+	Transmit (+)		
	S-	Transmit (-)		
	IG	Shield connection	Serial Communication Shield	0V
Safe Disable	H1	Safe Disable input 1	<ul style="list-style-type: none"> <li>One or both open: Motor Output Disabled</li> <li>Both closed: normal operation</li> <li>Off time of at least 1ms</li> </ul>	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 Safe Disable channels are closed.	48 VDC, 8 mA
	DM-	Safety monitor output common		—

### S4IF Control Circuit Terminal Diagram (120 VAC, 48 VAC, 24 VAC)

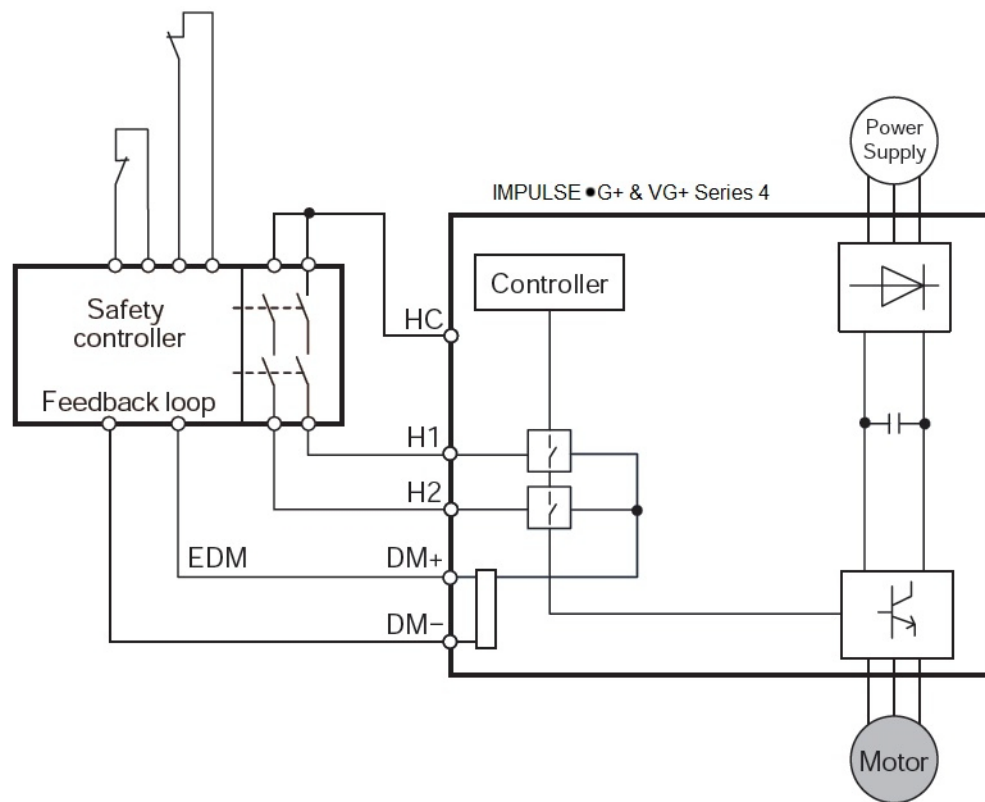
E(G) DM+ DM- IG R+ R- S+ S- A1 A2 A3 NC	M2 M3 M6
HC H1 H2 V+ AC V- FM AM AC MP RP AC	M0 M1 M5
X2 X2 X2 X2 S1 S2 S3 S4 S5 S6 S7 S8	MA MB MC

**Figure 3-10: S4IF Control Circuit Terminal Diagram**

## Safe Torque Off

Safe Torque Off disables the drive power section for mechanical maintenance, E-STOPS, or redundant safety monitoring controller intervention. Safe Torque Off provides safe removal of motor torque without removal of power to the drive. The IMPULSE®•G+ & VG+ Series 4 provides this functionality as standard in a safety category 3 architecture, and is designed to meet SIL CL2 according to ISO/EN 13849-1 and IEC/EN 62021 respectively, meeting the requirements for IEC/EN 61508. TUV certified drives can be purchased optionally; consult Magnetek Material Handling for details.

The Safe Torque Off feature (Figure 3-11) includes safe disable inputs (H1 and H2) and safe monitor outputs (DM+ and DM-).



**Figure 3-11: Safe Torque Off Block Diagram**

# Wiring the Encoder Circuit

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

Before you wire the encoder circuit, refer to the specification tables 3-10 and 3-11 and “Suggested Circuit Protection and Wire Size” on page 3-6.

## Encoder Circuit Wiring Procedures

**Table 3-9: Encoder Specifications**

Power supply	+12 VDC (+5 VDC by CN3 jumper); if current demand is greater than 200 mA (consult factory if inrush currents exceed 200 mA), an auxiliary power supply must be equipped - contact Magnetek to purchase
Output Type	Quadrature (A and B channels; Z is not required)
Type of output circuit	High-speed, differential line drive (open collector interface is optional).
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 for IMPULSE®•VG+ Series 4 (assuming the cover and keypad are detached):

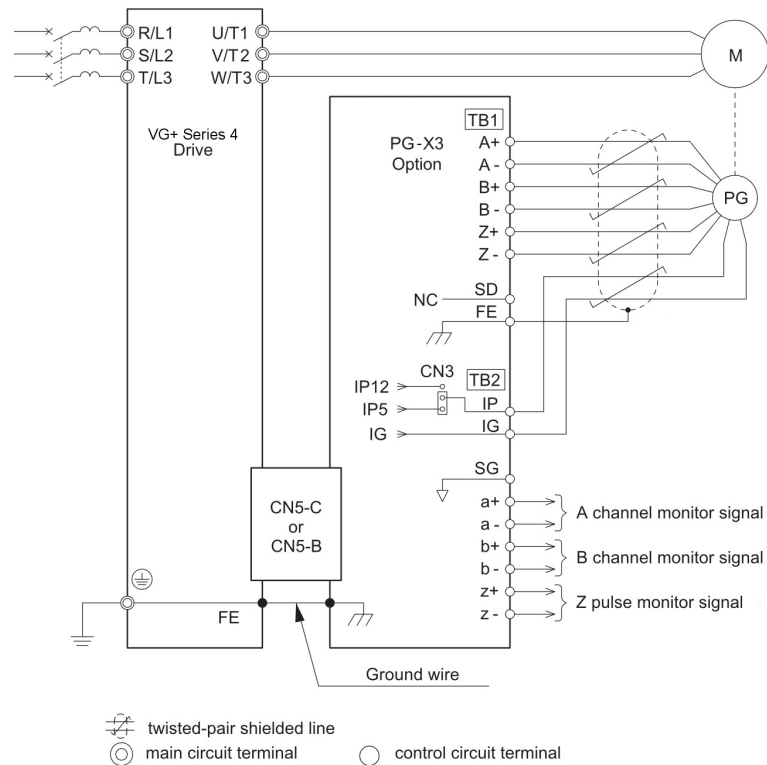
1. Direct-couple the encoder to the motor shaft, using a zero-backlash-type coupling.  
*NOTE: Do not connect the encoder to the motor with roller chain or gear drive. If unable to direct-couple the encoder, use a timing belt to drive the encoder. (Contact Magnetek for encoder kits.) Also, do not connect the encoder to the low-speed shaft of a speed reducer.*
2. Connect the encoder to the PG-X3 Encoder Interface Card. Refer to Figure 3-12: “PG-X3 Encoder Card Wiring” on page 3-21.  
*NOTE: Use twisted-pair, shielded cable W100W impedance (Magnetek R-20/6, R-22/6, Belden 9730, or Brand Rex T-11651). Strip the encoder wires .25 in. (5.5 mm). Keep the wiring length less than 300 feet (for cable lengths greater than 300 feet, contact Magnetek for information on available fiber optic cable and wireless encoder systems).*
3. Ground the shielded cable to Terminal FE of the PG-X3 Encoder Interface Card (ground only one end of the shielded cable).  
*NOTE: For LakeShore encoders, the shield connection is not considered “Ground.” The shield should be grounded.*
4. Whenever possible, the encoder cable should be wired in a continuous run between the motor and drive. If it cannot be a direct run, the splice should be in its own junction box and isolated from the power wires.



## Encoder Wiring Diagrams and Information

Encoder 1: Install in option port CN5-C

Encoder 2: Install in option port CN5-B.



**Figure 3-12: PG-X3 Encoder Card Wiring**

**Table 3-10: Encoder Wiring**

(Lakeshore Model: SL56 and SL85; Avtron Models: M56 and M85)

Encoder Signal	Wire Color	PG-X3 Terminal
+5 to 15 VDC	Red	IP
0V	Black	IG
A+	Blue	A+
A-	Gray	A-
B+	Green	B+
B-	Yellow	B-
Shield	--	FE

**Table 3-11: PG-X3 Line Driver Encoder Interface Card Specifications**

Power supply to encoder:	Dual; +5 VDC or +12 VDC; 200 mA maximum
Encoder input signal:	RS-422-level, line-driver-type
Pulse monitor output signal (repeater):	RS-422-level, line-driver-type or open collector
Pulse phases accepted:	Phases A and B (both + and -)
Maximum input frequency:	300 kHz

**NOTE:** See PG-B3 Open Collector Encoder Card manual for wiring and terminal descriptions.

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# *C h a p t e r* **4**

## **Getting Started**

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# 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 right away. In addition to explaining the keypad and X-Press Programming, this chapter explains how to view the scroll settings, get into the programming mode, and program speeds.

## Checks Before Powering

After mounting and interconnections are completed, verify:

- Correct connections.
- Correct input power supply (no voltage drop or imbalance, source kVA  $\leq$  500, unless a line reactor is used).
- No short circuit conditions.
- No loose screw terminals (check especially for loose wire clippings).
- Proper load conditions.

## Precautions

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

## Using the Keypad

With five 16-character lines available, the keypad display makes it possible to monitor drive 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 drive parameters.
- Monitor the functions of the drive.
- Read alpha-numeric fault-diagnostic indications.
- Operate the drive using the keypad (local operation).

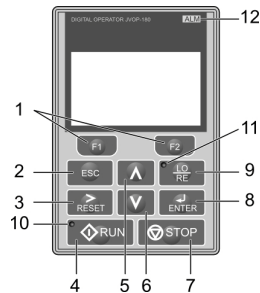


### **WARNING**

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

## 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		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		<ul style="list-style-type: none"> <li>Returns to the previous display</li> <li>Moves the cursor one space to the left.</li> <li>Pressing and holding this button will return to the Frequency Reference Display.</li> </ul>
3		<ul style="list-style-type: none"> <li>Moves the cursor to the right.</li> <li>Resets the drive to clear a fault situation.</li> </ul>
4		Starts the drive 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		Stops drive operation. *1
8		<ul style="list-style-type: none"> <li>Enters parameter values and settings.</li> <li>Selects a menu item to move between displays.</li> </ul>
9		<ul style="list-style-type: none"> <li>Displays the phone number for the Magnetek Service department.</li> <li>Switches drive control between the operator (LOCAL) and an external source (REMOTE) for the Run command and frequency reference. *2</li> <li>Pressing the key three times resets the maintenance timer, U01-52.</li> </ul>
10		Lit while the drive is operating the motor. Flashing when the drive has a phantom fault.
11		Lit while the operator is selected to run the drive (LOCAL mode).
12		Off during normal operation (no fault or alarm). Illuminated when the drive detects an alarm or error. Flashes when an alarm occurs, when an oPE is detected, or when a fault or error occurs during Auto-Tuning.

\*1 The STOP key has highest priority. Pressing the STOP key will always cause the drive 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 drive is stopped. To enable the LO/RE key to switch between LOCAL and REMOTE, set parameter O02-01 to 1.

## Parameters

There are hundreds of parameters that determine how the drive functions. These parameters are programmed into the drive'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.

*NOTE: The terms "constant" and "parameter" have the same meaning.*

Before shipping the drive, Magnetek programmed initial settings in the drive's software 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 drive. This can be accomplished by using the **Password** and **Access Level** features. For more information on these security features, see "Initialization Set-Up" on page 4-9.

The drive can be programmed to allow personnel with limited crane system knowledge to program only certain parameters, called **User Parameters**. To select these parameters, see "User Parameters (A02-01 through 32)" on page 4-15.

Two other features to be aware of 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 "Initialize Parameters (A01-05)" on page 4-14 and "User Defaults (O02-03)" on page 5-120.



## Parameter Modes

All parameters are organized under four modes:

### Operation Mode

Drive operation is enabled. Drive status LED is lit.

### Programming Mode

Parameter access levels, control method, motion, speed control mode, and passwords are selected.

Parameters are set/read. Items to be set/read vary depending on the access level setting.

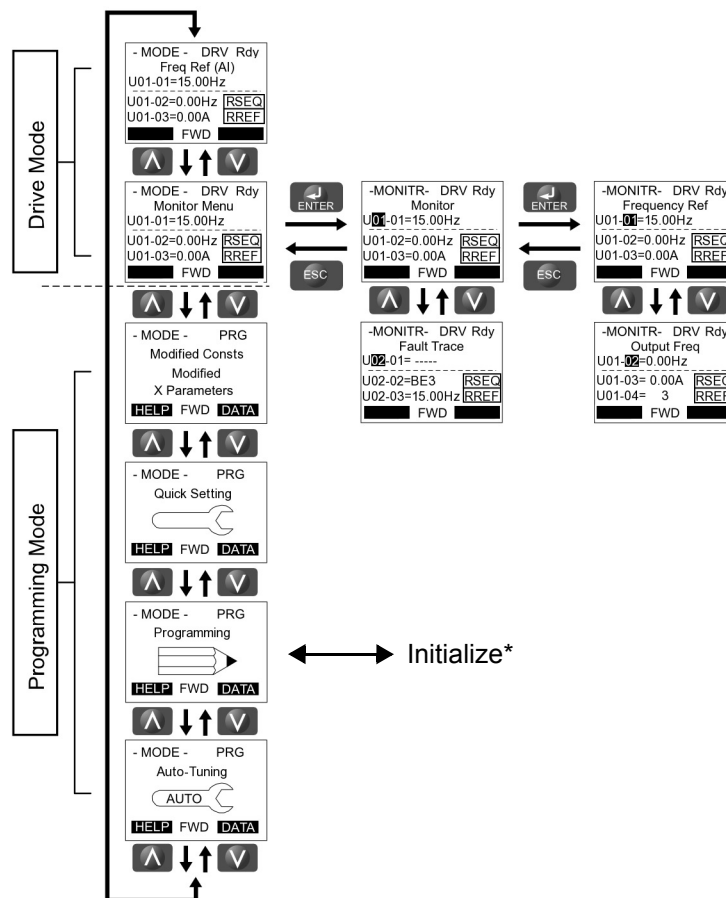
### Auto-Tuning Mode

Automatically calculates and sets motor parameters to optimize drive performance.

### Modified Constants Mode

Only parameters that have been changed from the factory settings are set/read.

## IMPULSE®•G+ & VG+ Series 4 Menu Structure



\*Refer to parameter list on page 4-8.

**Figure 4-1: IMPULSE®•G+ & VG+ Menu Structure**

Group		Function
Monitor	U1	Monitor
	U2	Fault Trace
	U3	Fault History
	U4	Maintenance
	U6	Control Monitor
Initialize	A1	Initialization Parameters
	A2	User-Defined Parameters
Application	B1	Preset References
	B2	Reference Limits
	B3	Sequence/Reference Source
	B4	Trim Control Level
	B5	Acceleration/Deceleration
	B8	Jump Frequencies
	C1	Quick Stop
	C1	Reverse Plug Simulation
	C2	Micro-Speed
	C3	End of Travel Limits
Special Function	C3	Phantom Stop
	C3	Klixon
	C3	Electronic Programmable Limit Switches (ELPS)
	C3	Hook Height Measurement
	C4	Load Float 2
	C5	Load Check II
	C6	Swift-Lift/Ultra-Lift
	C7	Torque Limit
	C8	No-Load Brake Hoist
	C8	Brake Answerback
	C9	Digital Input Option Set-Up
	C10	Weight Measurement
	C11	Slack Cable Detection
Tuning	C11	Snap Shaft Detection
	C12	Delay Timers and Timer Functions
	C12	Inching Control
	C13	Indexing Control
	D1	DC Injection Braking
	D2	Motor Slip Compensation
	D3	Torque Compensation
	D4	Automatic Speed Regulator Tuning
	D5	Torque Control
	D8	Dwell Function
	D9	S-Curve Acceleration/Deceleration
Motor	D10	Carrier Frequency
	D11	Hunting Prevention
Options	E1	V/F Pattern 1
	E2	Motor Set-up
	F1	Encoder (PG-X3) Option Set-up
	F2	Analog Input (AI-A3) Option Set-up
	F4	Analog Output (AO-A3) Option Set-up
Terminal	F5	Digital Output (DO-A3 or S4IO) Option Set-up
	F6	Communication Option Card Set-Up
	F7	Ethernet Option Card Set-Up
Protection	H1	Digital Inputs
	H2	Digital Outputs
	H3	Analog Inputs
	H4	Analog Outputs
	H5	Serial Communication Set-up
	H6	Pulse Train Input/Output Set-up
Operator	L1	Motor Overload
	L2	Power Loss Ride Thru
	L3	Stall Prevention
	L4	Reference Detection
	L5	Test Mode
	L6	Torque Detection
	L8	Hardware Protection
	L9	Automatic Fault Reset
	O1	Operator Display
	O2	Operator Key
	O3	Maintenance
	O4	Copy Function

## Initialization Set-up

### Parameter Access Level (A01-01)

This parameter allows the “masking” of parameters according to user level. See the following table:

**Table 4-1: Parameter Access Level Settings**

Setting	Description
0	<b>Operation Only</b> Access to only parameters A01-01, A01-06, and all U monitor parameters.
1	<b>User Parameters</b> Accesses parameters selected by OEM or installer (A02-01 to A02-32). These User Parameters can be accessed using the Setup Mode of the digital operator.
2	<b>Advanced Level</b> For advanced programming in special applications. All parameters can be viewed and edited.

### Control Method Selection (A01-02)

Select the control method best suited for your application.

**Table 4-2: Control Method Selection Settings**

Setting	Description	Model
0	<b>V/F Control for Induction Motors</b> Use this mode for simple speed control and for multiple motor applications with low demands to dynamic response or speed accuracy. This control mode is also used when the motor parameters are unknown and Auto-Tuning cannot be performed. The speed control range is 40:1.	G+
2	<b>Open Loop Vector Control</b> Use this mode for general, variable-speed applications that require precise speed control, quick torque response, and high torque at low speed without using a speed feedback signal from the motor (a speed control range of 200:1).	G+
3	<b>Flux Vector Control</b> Use this mode for general, variable-speed 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. Refer to the Auto-Tuning section on page 4-16.

## 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. Reference tables 4-5, 4-6, and 4-7 for X-Press™ Programming defaults.

### Motion (A01-03)

Set this parameter to match the motion of application. See tables 4-5, 4-6, and 4-7 (X-Press Programming) for details.

**Table 4-3: Select Motion Settings**

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

### Speed Reference (A01-04)

This parameter will automatically define the input terminals for the selections listed below. See tables 4-5, 4-6, and 4-7 (X-Press Programming) for details.

**Table 4-4: Speed Reference Settings**

Setting	Description
0	<b>2-SPD Multi-step</b> — Defines Terminal 3 = 2nd speed.
1	<b>3-SPD Multi-step</b> — Defines Terminals 3 and 4 as speeds 2 and 3 respectively (default).
2	<b>5-SPD Multi-step</b> — Defines Terminals 3-6 as speeds 2–5.
3	<b>2-Step infinitely variable</b> — Terminals S1 and S2 use B01-01 and speed hold. Terminal S3 = Accelerate.
4	<b>3-Step infinitely variable</b> — Terminals S1 and S2 use B01-01. Terminal S3 = Speed Hold. Terminal S4 = Accelerate.
5	<b>Uni-polar analog</b> — Terminals A1 and A2 = A directional input. Terminal A1 = 0-10V. Terminal A2 = 4-20mA.
6	<b>Bi-polar analog</b> — Terminals A1 and A2 = Run Command. Terminals A1 and A2 = direction and frequency -10 to +10VDC.
7	<b>S4IO Digital Opt Card</b> (Other than MFDI H01-01–08)
8	<b>Serial option card</b> . Sets all terminals to “not used.” Reference B03-01 and B03-02.



### WARNING

When changing A01-03 or A01-04, MFDI, MFDO, and speed reference parameters will be overwritten by X-Press Programming™ (tables 4-5, 4-6, and 4-7). All parameter settings must be verified for proper operation.

## Parameters Changed by X-Press Programming

**Table 4-5: Traverse (A01-03= 0) for G+ and VG+S4 Models**

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	Digital Input Option Card	Serial Option Card
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	60.00	60.00	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	1
B03-02	Run Cmd Select	1	1	1	1	1	1	1	3	1
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 @ LL1/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	00	00	00	00	00	00	00	00	00
H01-01	Terminal S1 Select	80	80	80	80	80	80	80	80	80
H01-02	Terminal S2 Select	81	81	81	81	81	81	81	81	81
H01-03	Terminal S3 Select	00	00	00	05	04	0F	0F	0F	0F
H01-04	Terminal S4 Select	0F	01	01	0F	05	0F	0F	0F	0F
H01-05	Terminal S5 Select	0F	0F	02	0F	0F	0F	0F	0F	0F
H01-06	Terminal S6 Select	0F	0F	03	0F	0F	0F	0F	0F	0F
H01-07	Terminal S7 Select	0F	0F	0F	0F	0F	0F	0F	0F	0F
H01-08	Terminal S8 Select	0F	0F	0F	0F	0F	0F	0F	0F	0F
H02-01	Terminal M0/M1 Select	000	000	E00	000	000	000	000	000	000
H02-02	Terminal M2/M3 Select	00F	00F	00F	00F	00F	00F	00F	00F	00F
H02-03	Terminal M5/M6 Select	00F	00F	00F	00F	00F	00F	00F	00F	00F
H03-01	Terminal A1 Signal Level	0	0	0	0	0	0	1	0	0
H03-02	Terminal A1 Function Select	0	0	0	0	0	0	0	0	0
H03-06	Terminal A3 Function Select	1F	1F	1F	1F	1F	1F	1F	1F	1F

**Table 4-6: Hoist - Standard MLB (A01-03 = 1) for G+S4 Models**

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	Digital Input Option Card	Serial Option Card
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	60.00	60.00	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	1
B03-02	Run Cmd Select	1	1	1	1	1	1	1	3	1
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 @ LL1/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	04	04	04	04	04	04	04	04	04
H01-01	Terminal S1 Select	80	80	80	80	80	80	80	80	80
H01-02	Terminal S2 Select	81	81	81	81	81	81	81	81	81
H01-03	Terminal S3 Select	00	00	00	05	04	0F	0F	0F	0F
H01-04	Terminal S4 Select	0F	01	01	0F	05	0F	0F	0F	0F
H01-05	Terminal S5 Select	0F	0F	02	0F	0F	0F	0F	0F	0F
H01-06	Terminal S6 Select	0F	0F	03	0F	0F	0F	0F	0F	0F
H01-07	Terminal S7 Select	0F	0F	0F	0F	0F	0F	0F	0F	0F
H01-08	Terminal S8 Select	0F	0F	0F	0F	0F	0F	0F	0F	0F
H02-01	Terminal M0/M1 Select	000	000	000	000	000	000	000	000	000
H02-02	Terminal M2/M3 Select	00F	00F	00F	00F	00F	00F	00F	00F	00F
H02-03	Terminal M5/M6 Select	00F	00F	00F	00F	00F	00F	00F	00F	00F
H03-01	Terminal A1 Signal Level	0	0	0	0	0	0	1	0	0
H03-02	Terminal A1 Function Select	0	0	0	0	0	0	0	0	0
H03-06	Terminal A3 Function Select	1F	1F	1F	1F	1F	1F	1F	1F	1F

**Table 4-7: Hoist NLB (A01-03 = 2) for VG+S4 Models**

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	Digital Input Option Card	Serial Option Card
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	60.00	60.00	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	1
B03-02	Run Cmd Select	1	1	1	1	1	1	1	3	1
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 @ LL1/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	0F	0F	0F	0F	0F	0F	0F	0F	0F
H01-01	Terminal S1 Select	80	80	80	80	80	80	80	80	80
H01-02	Terminal S2 Select	81	81	81	81	81	81	81	81	81
H01-03	Terminal S3 Select	00	00	00	05	04	0F	0F	0F	0F
H01-04	Terminal S4 Select	0F	01	01	0F	05	0F	0F	0F	0F
H01-05	Terminal S5 Select	0F	0F	02	0F	0F	0F	0F	0F	0F
H01-06	Terminal S6 Select	0F	0F	03	0F	0F	0F	0F	0F	0F
H01-07	Terminal S7 Select	0F	0F	0F	0F	0F	0F	0F	0F	0F
H01-08	Terminal S8 Select	0F	0F	0F	0F	0F	0F	0F	0F	0F
H02-01	Terminal M0/M1 Select	000	000	000	000	000	000	000	000	000
H02-02	Terminal M2/M3 Select	000	000	000	000	000	000	000	000	000
H02-03	Terminal M5/M6 Select	078	078	078	078	078	078	078	078	078
H03-01	Terminal A1 Signal Level	0	0	0	0	0	0	1	0	0
H03-02	Terminal A1 Function Select	0	0	0	0	0	0	0	0	0
H03-06	Terminal A3 Function Select	1F	1F	1F	1F	1F	1F	1F	1F	1F

## Initialize Parameters (A01-05)


Use this parameter to reset the inverter to its factory default settings.



**Table 4-8: Initialize Parameter Settings**

Setting	Description
0	<b>No Initialization</b> (factory default)
1110	<b>User Default</b> (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". <i>NOTE: User Initialization resets all parameters to a user-defined set of default values previously saved to the drive. Set parameter O02-03 to 2 to clear the user-defined default values.</i>
5550	<b>Control Init (OPE04 Reset)</b> An oPE04 error appears on the digital operator when a interface card with settings saved to its built-in memory is installed in a drive that has edited parameters. Set A01-05 to 5550 to use the parameter settings saved to the terminal block memory.
7770	<b>Swap Setup</b> Prepares all modified and user parameters for IF card removal.
8880	<b>Swap Exe</b> Prepares new IF card with previously modified and user parameters after A1-05 = 7770 has been executed.

*NOTE: Performing a 7770 initialization will clear a parameter set stored in the digital operator.*

## Password Entry (A01-06)

This parameter enables the user to set a password that inhibits the programming of the parameters. This function is useful when 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  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  key simultaneously to set A01-07.



## 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 function A2 can be accessed by the user. To assign a parameter as a user parameter, go to the A2 level in the initialize menu. Once the A2 parameters are set and A01-01 is programmed to “User Program”, only the parameters visible in the program menu will be assigned to an A2 parameter.

The A2 group is pre-loaded with the following settings, based on A01-03.

**Table 4-9: Application Quick Set**

A01-03	0	1	2
<b>Favorite</b>	<b>Traverse</b>	<b>Std Hoist</b>	<b>NLB Hoist</b>
--	B01-01	B01-01	B01-01
A02-01	B01-02	B01-02	B01-02
A02-02	B01-03	B01-03	B01-03
A02-03	B01-04	B01-04	B01-04
A02-04	B01-05	B01-05	B01-05
A02-05	B03-04	B03-04	B03-04
A02-06	B05-01	B05-01	B05-01
A02-07	B05-02	B05-02	B05-02
A02-08	C01-03	C02-01	C01-01
A02-09	C01-04	C03-01	C01-02
A02-10	C01-05	C03-04	C02-01
A02-11	C02-01	C06-01	C03-01
A02-12	E01-03	C06-02	C03-04
A02-13	E02-01	C06-03	C06-01
A02-14	H01-06	C06-04	C06-02
A02-15	H01-07	C06-05	C06-03
A02-16	H01-08	C06-06	C06-04
A02-17	H02-03	E01-03	C06-05
A02-18	H03-02	E01-04	C08-03
A02-19	H04-02	E02-01	C08-10
A02-20	--	H01-06	C08-11
A02-21	--	H01-07	C08-14
A02-22	--	H01-08	F01-01
A02-23	--	H02-03	F01-05
A02-24	--	H03-02	H01-06
A02-25	--	H04-02	H01-07
A02-26	--	--	H01-08
A02-27	--	--	H02-03
A02-28	--	--	H03-02
A02-29	--	--	H04-02
A02-30	--	--	--
A02-31	--	--	--
A02-32	--	--	--

# Auto-Tuning



## CAUTION

The brake output is not energized during Auto-Tune. The brake must be manually released before tuning and set 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 adapt to nearly all motors manufactured worldwide with its automatic tuning function. The inverter asks the user for minimal motor information, and then guides the user through a quick simple tuning process. Ideally, perform a standard Auto-Tune with the motor uncoupled from the load. When the motor cannot be disconnected from the load, perform a static or non-rotating Auto-Tune.

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

**Table 4-10: Auto-Tuning Parameter Settings**

Parameter Code	Display	Description	Default Setting	G+		VG+
				V/f	OLV	FLV
T01-01	Tuning Mode Sel	Selects Tuning Method <i>0 Standard Tuning (Rotational Auto-Tuning )</i> <i>1 Tune-No Rotate (Stationary Auto-Tuning 1)</i> <i>2 Term Resistance (Stationary Auto-Tuning for Line-to-Line Resistance)</i>	0	x	x	x
T01-02	Rated Horsepower	Sets the motor rated HP as specified on the motor nameplate (note: KW = HP x .746)	Model dependent	x	x	x
T01-03	Rated Voltage	Sets the motor rated voltage as specified on the motor nameplate	Model dependent	x	x	x
T01-04	Rated Current	Set the motor rated full-load current (FLA) as specified on the motor nameplate	Model dependent	x	x	x
T01-05	Rated Frequency	Set the rated frequency of the motor as specified on the motor nameplate	60.0 Hz	x	x	x
T01-06	Number of Poles	Sets the number of motor poles as specified on the motor nameplate	4	x	x	x
T01-07	Rated Speed	Sets the rated speed of the motor as specified on the motor nameplate	1750 RPM	x	x	x
T01-08	PG Pulses/Rev	Set the number of pulses per revolution for the PG being used (pulse generator or encoder)	1024 PPR	--	--	x

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

Parameter Code	Display	Description	Default Setting	G+		VG+
				V/f	OLV	FLV
T01-09*	No-Load Current	Sets the no-load current for the motor. After setting the motor capacity to T01-02 and the motor rated current to T01-04, this parameter will automatically display the no-load current for a standard 4 pole motor. Enter the no-load current as indicated on the motor test report or motor nameplate.	--	--	--	x
T01-10*	Motor Rated Slip	Sets the motor rated slip. After setting the motor capacity to T01-02, this parameter will automatically display the motor slip for a 4 pole motor. Enter the motor slip as indicated on the motor test report or motor nameplate.	--	--	--	x

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

After scrolling through the tuning parameters using the Up Arrow key, depress the RUN key to begin auto-tuning. During tuning, "Tune Proceeding" flashes on the digital operator display. When complete, "Tune Successful", is displayed. Depress the Esc key to exit auto-tuning mode. Please refer to "Fault Display and Corrective Actions at Auto-Tuning" (Table 6-4) section if "Tune Successful" is not displayed.

**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.*

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# *C h a p t e r* 5

## **Programming Advanced Features**

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# Introduction

This chapter features parameters that are available only when the Series 4 drive is in Advanced mode.

## Application

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

## Preset Reference

**Table 5-1: Preset Reference Parameter Settings**

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

\* Initial value is determined by X-Press Programming (Table 4-5, 4-6, or 4-7)

\*\* Consult Magnetek for frequencies above 150 Hz.

**Table 5-2: Multi-Step Speed Processing by Multi-Function 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



## Reference Limits

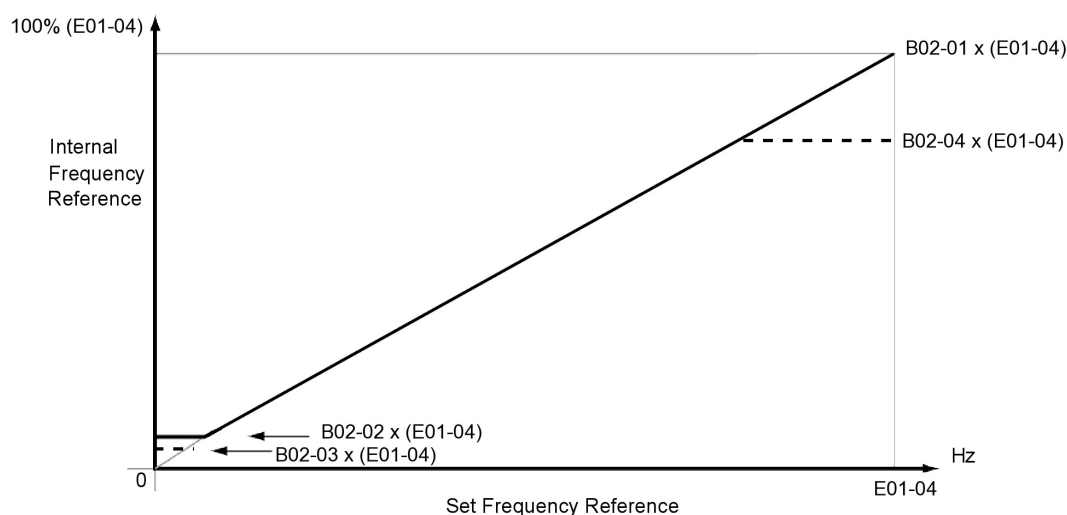
These parameters limit the frequency range as a percentage of maximum output frequency (E01-04). However, if the lower limit is below the DC Inj Start Freq (D01-01), then operation will continue according to B03-05.

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

**Table 5-3: Reference Limit Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
B02-01	Ref Upper Limit	Sets as a percentage of the maximum output frequency (E01-04), which determines the maximum frequency at which the drive is able to run.	0.0–110.0%	100.0*
B02-02	Ref Lower Limit	Sets as a percentage of the maximum output frequency (E01-04), which determines the minimum master frequency reference only.	0.0–110.0%	0.0
B02-03	Ref 1 Lower limit	Sets as a percentage of the maximum output frequency (E01-04), which determines the minimum frequency at which the drive is able to run.	0.0–110.0%	2.0*
B02-04	Alt Upper Limit	Alternate of B02-01 set by MFI=59.	0.0–110.0%	0.0

\* Initial value is determined by X-Press Programming (Table 4-5, 4-6, or 4-7)



**Figure 5-1: Setting Frequency Upper and Lower Limits**

## Sequence/Reference Source

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

**Table 5-4: Sequence/Reference Source Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
B03-01	Ref Source 1	Source from where the frequency reference is generated.	0-4	1*
	0 <i>Operator</i>	Digital Operator		
	1 <i>Terminals</i>	Terminals or Analog Input <ul style="list-style-type: none"> <li>S4-IF Interface Card</li> <li>S4-I AC Digital Input Option</li> <li>S4-IO Digital Input/Output Option</li> <li>DI-A3 Digital Input Option (not used for B03-02)</li> </ul>		
	2 <i>Serial Com</i>	Serial communication <ul style="list-style-type: none"> <li>RS485/422 Serial Communications (R+, R-, S+, S-)</li> </ul>		
	3 <i>Option PCB</i>	Industrial Communication Option card (Port CN5-A) <ul style="list-style-type: none"> <li>EtherNet/IP</li> <li>Modbus TCP/IP</li> <li>PROFINET</li> <li>PROFIBUS-DP</li> </ul>		
	4 <i>Pulse Input</i>	Pulse input (H06-01)		
B03-02	Run Source 1	Source from where the RUN command is generated.	0-3	1*
	0 <i>Operator</i>	Digital Operator		
	1 <i>Terminals</i>	Terminals <ul style="list-style-type: none"> <li>S4-IF Interface Card</li> <li>S4-I AC Digital Input Option</li> <li>S4-IO Digital Input/Output Option</li> <li>DI-A3 Digital Input Option (not used for B03-02)</li> </ul>		
	2 <i>Serial Com</i>	Serial communication <ul style="list-style-type: none"> <li>RS485/422 Serial Communications (R+, R-, S+, S-)</li> </ul>		
	3 <i>Option PCB</i>	Industrial Communication Option card (Port CN5-A) <ul style="list-style-type: none"> <li>EtherNet/IP</li> <li>Modbus TCP/IP</li> <li>PROFINET</li> <li>PROFIBUS-DP</li> </ul>		

\* Initial value is determined by X-Press Programming (Table 4-5, 4-6, or 4-7)

## Stop Method

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

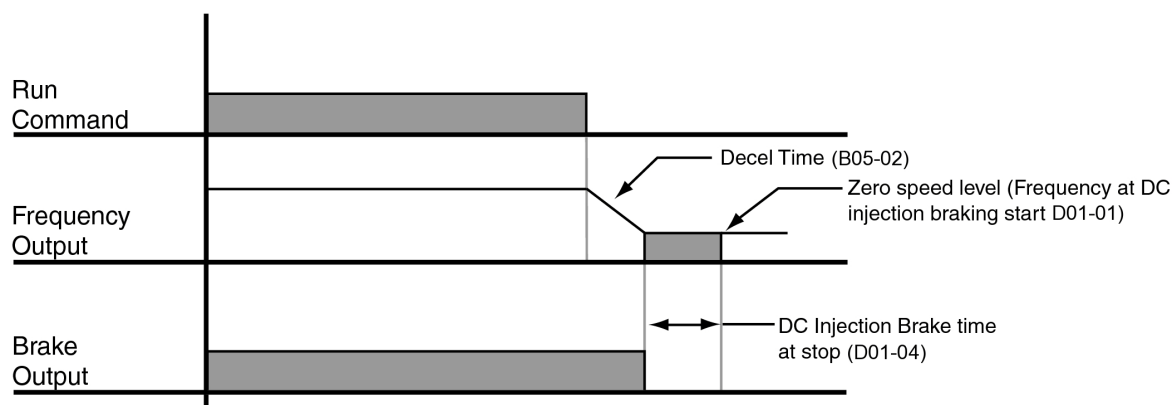
**Table 5-5: Stop Method Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
B03-03	Stopping Method	Determines stop method.	0, 1, 4, 6	G+: 0* VG+: 6*	
	0 Decel to Stop	(Fig 5-2)			G+/VG+
	1 Coast to Stop	(Fig 5-3)			G+/VG+
	4 Decel with timer (Traverse mode only)	(Fig 5-4)			G+/VG+
	6 No Load Brake (See No-Load Brake)				VG+

\* Initial value is determined by X-Press Programming (Table 4-5, 4-6, or 4-7)

### Decel to Stop (B03-03=0)

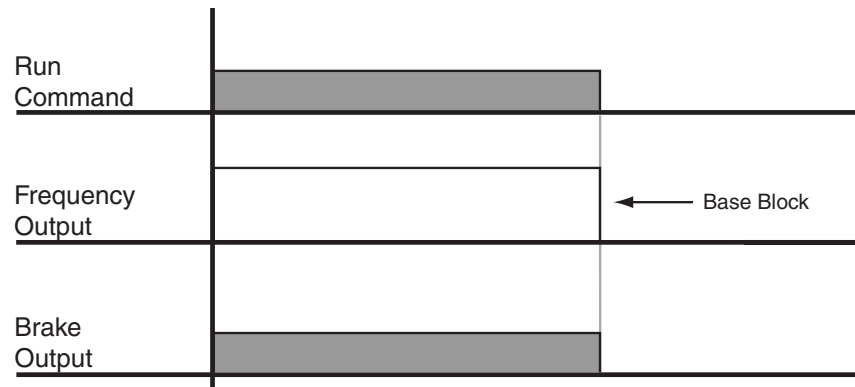
Upon removal of the FWD or REV run command, the motor decelerates at a rate determined by the time set in deceleration time 1 (B05-02) and DC injection braking is applied after the DC injection start frequency D01-01 has been reached. If the deceleration time is set too short or the load inertia is too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



**Figure 5-2: Decel to Stop**

### 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.

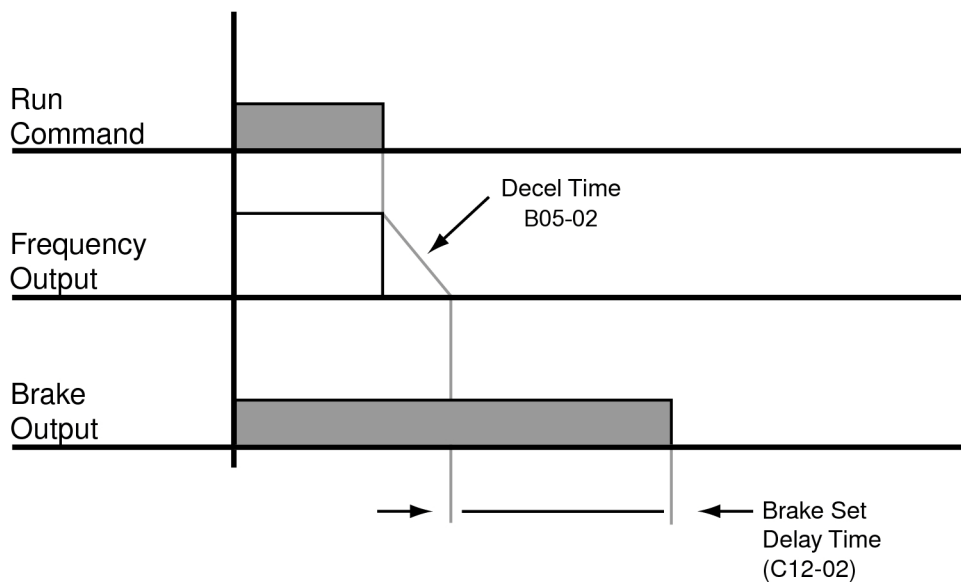


**Figure 5-3: Coast to Stop**

### 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**

## 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 Code	Display	Function	Range	Initial Value
B03-04	Change Rotation	Reverse motor direction	0, 1	0
	0 <i>Standard</i>			
	1 <i>SwitchPhaseOrder</i>	Switch phase order (reverses the direction of the motor)		

**NOTE:** 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 = 0/1 or swapping A and  $\bar{A}$  wires).

## Zero-Speed Operation

This parameter sets the speed reference level at which Zero Speed mode operation will activate.

**Table 5-7: Zero-Speed Operation Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
B03-05	Zero-Speed Oper	Operation Selection at Zero Speed.	0–3	0	
	0 <i>RUN at Freq Ref</i>	Operate according to the Frequency Reference			VG+
	1 <i>STOP</i>	Coast when the Frequency Reference is below E01-09			VG+
	2 <i>RUN at Min. Freq (E01-09)</i>	Output the Frequency set in E01-09			VG+
	3 <i>RUN at Zero RPM</i>	Operate at zero speed			VG+

## Input Scan Time

B03-06 selects the microprocessor scan time for reading sequence input data from the control circuit terminals. Set B03-06 to "0" when a quicker response is needed from the control circuit terminal.

**Table 5-8: Input Scan Time Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
B03-06	Cntl Input Scans	Selects the terminal scan time	0, 1	1
	0 1 scan (1 ms)			
	1 2 scans (2 ms)			

## LOC/REM Run Select

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

**Table 5-9: LOC/REM Run Select Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
B03-07	LOC/REM Run Sel	Determines action after switching Run/Speed reference source.	0, 1	0
	0 Cycle Extn Run	If the run command is present at the time when the Run/Speed reference source is switched, it requires the run command to be removed and then reapply the run command from the new source to resume the normal operation.		
	1 Accept Extn Run	If the run command is present at the time when the Run/Speed reference source is switched, it does not require the run command from the new source to be removed. The normal operation will continue.		
B03-08	RUN CMD at PRG	Allows the Run Method to be changed via the Local/Remote key while the drive/motor are running.	0, 1	0
	0 Disabled			
	1 Enabled (B03-02=0 is Disabled)			
B03-10	Allow Run at Power Up	Determines how the drive will start if an external run command is active when the drive is powered up.	0, 1	0
	0 Cycle Ext Run	Disregarded. A new Run command must be issued after power up.		
	1 Accept Ext Run	Allowed. Motor will start immediately after power up if a Run command is already enabled.		

Parameter Code	Display	Function	Range	Initial Value
B03-15	Ref Source 2	Selected Ref source is enabled when an input terminal set for "External reference" (H01-xx = 1F) closes.	0–4	0
	0 <i>Operator</i>	MFDI IF Card Terminals		
	1 <i>Terminals</i>	MFAI IF Card Terminals		
	2 <i>Serial Com</i>	Serial communication (Port CN5-A).		
	3 <i>Option PCB</i>	Option card (Port CN5-A, CN5-B, or CN5-C).		
	4 <i>Pulse Input (Terminal RP)</i>	Pulse Input.		
B03-16	Run Source 2	Selected Run source is enabled when an input terminal set for "External reference" (H01-xx = 1F) closes.	0–3	0
	0 <i>Operator</i>	MFDI IF Card Terminals		
	1 <i>Terminals</i>	MFAI IF Card Terminals		
	2 <i>Serial Com</i>	Serial communication (Port CN5-A).		
	3 <i>Option PCB</i>	Option card (Port CN5-A, CN5-B, or CN5-C).		

## Acceleration/Deceleration

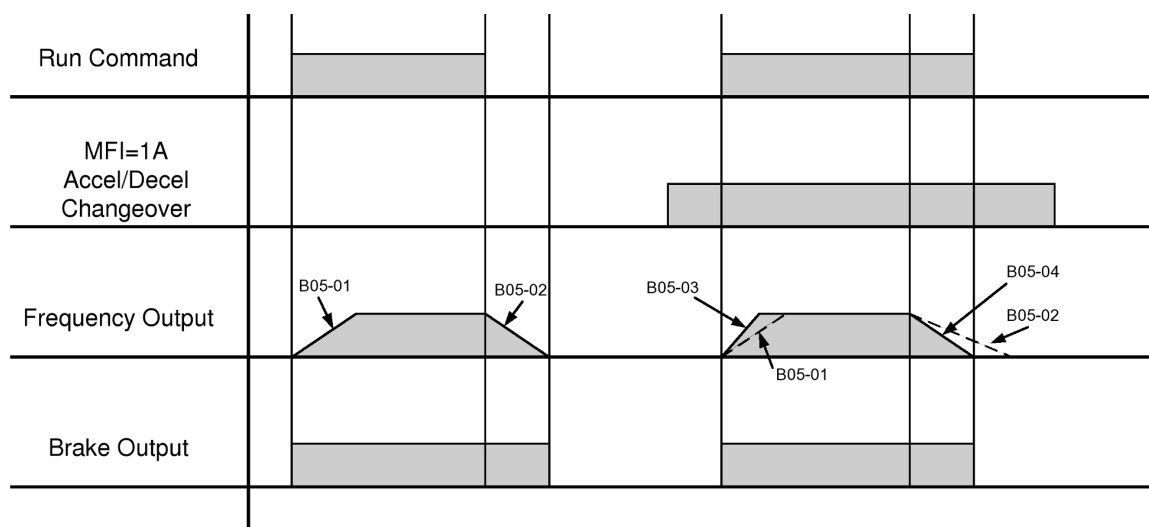
Acceleration time sets the time necessary for the output frequency to accelerate from 0 Hz to maximum output frequency (E01-04). Deceleration time sets the time necessary for the output frequency to decelerate from the maximum output frequency (E01-04) to 0 Hz.

**Table 5-10: Acceleration/Deceleration Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
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 (Tables 4-5, 4-6, and 4-7).

\*\* 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 the constant B03-03 is set to "0" (Decel to Stop).



## Accel/Decel Time Switching Frequency

Accel/Decel times can be changed automatically without using multi-function inputs. When multi-function contact inputs are set for Accel/Decel selection, this command has priority over automatic change of Accel/Decel.

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

Parameter Code	Display	Function	Range	Initial Value
B05-05	Acc Time N Chg	Sets Acceleration time at Acc/Dec Switch Frequency (B05-10)	0.0–25.5 sec	2.0
B05-06	Dec Time N Chg	Sets Deceleration time at Acc/Dec Switch Frequency (B05-10)	0.0–25.5 sec	2.0
B05-08	Fast Stop Time	Sets deceleration time for complete stop at external fault. See “External Fault Response Selection” on page 5-92.	0.0–25.5 sec	0.5
B05-10	Acc/Dec SW Freq	Determines acceleration/ deceleration time settings	0.0–150.0 Hz	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: B5-01–B5-04, B5-12–B5-15, C3-02, C3-03, C3-05 and C3-06	0, 1	0
	0 Disabled	Range = 0.0–25.5		
	1 Enabled	Range = 0.0–6000.0		

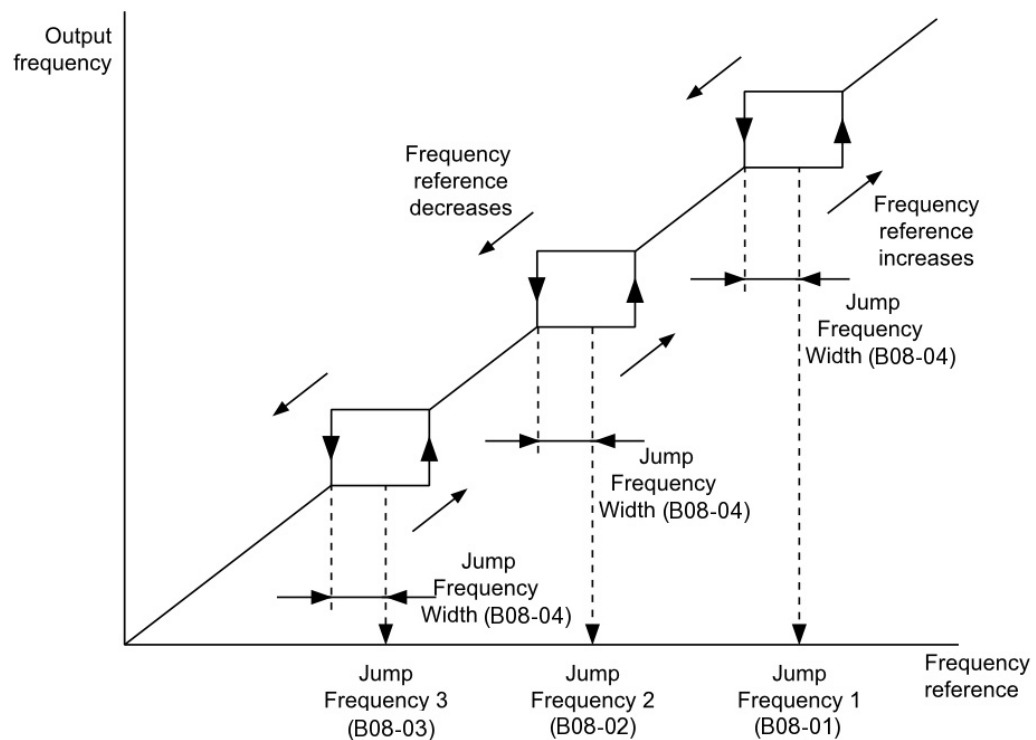
\* Range is extended to 0.0–6000.00 when B05-16 = 1.

## Jump Frequencies

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

**Table 5-12: Jump Frequencies Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
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**

# Special Functions

Table 5-13: 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)
C1: Quick Stop	○	○	○	○	○	○
C1: Reverse Plug Simulation	○	○	○	×	×	×
C2: Micro-Speed	○	○	○	○	○	○
C3: End of Travel Limits	○	○	○	○	○	○
C3: Phantom Stop	○	○	○	○	○	○
C3: Klixon	○	○	○	○	○	○
C3: EPLS	×	×	○	×	×	○
C3: Hook Height Measurement	×	×	○	×	×	○
C4: Load Float	×	×	○	×	×	○
C5: Load Check II	×	×	×	○	○	○
C6: Swift-Lift™/Ultra-Lift™	×	×	×	○	○	○
C7: Torque Limit	×	○	○	×	○	○
C8: No-Load Brake Hoist	○	○	○	○	○	○
C8: Brake Answerback	○	○	○	○	○	○
C9: Digital Input Option Set-up	○	○	○	○	○	○
C10: Weight Measurement	×	×	×	○	○	○
C11: Slack Cable Detection	×	×	×	○	○	○
C11: Snap Shaft Detection	×	×	×	×	×	○
C12: Brake Delay Timers	○	○	○	×	×	×
C12: On/Off Delay Timers	○	○	○	○	○	○
C12: Maintenance Timer	○	○	○	○	○	○
C13: Inching Control	○	○	○	○	○	○
C13: Index Control	×	×	○	×	×	○

○: Available for the Motion selected

×: Not available for the Motion selected

## Quick Stop™

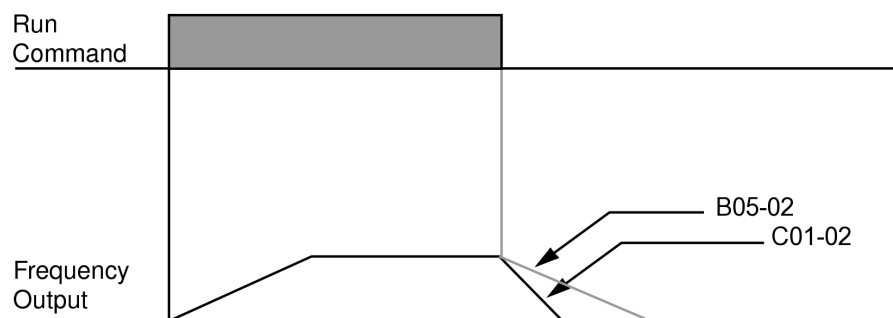
The **Quick Stop Function** provides an automatic Alternate Deceleration at Stop.

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

**Table 5-14: Quick Stop Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
C01-01*	Quick Stop  0 Disabled 1 Enabled	Determines whether Quick Stop is enabled	0, 1	0
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 (Tables 4-5, 4-6, and 4-7).



**Figure 5-7: Quick Stop**

## Reverse Plug Simulation™

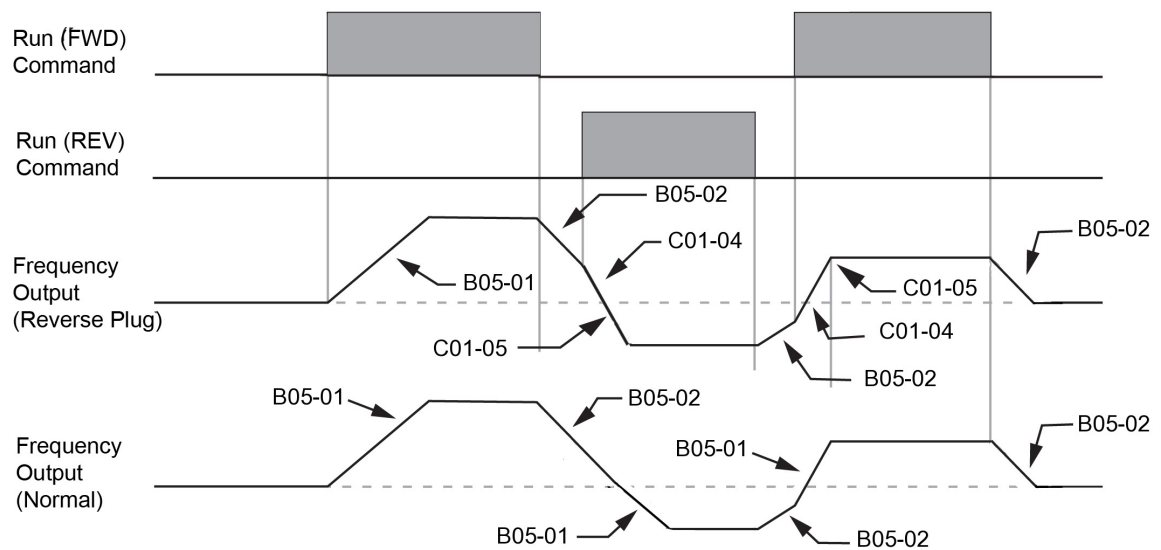
The **Reverse Plug Simulation** provides an automatic alternate deceleration time/acceleration time at a change direction command. The deceleration time and the acceleration time are set independently of the normal acceleration and deceleration times.

**NOTE:** Reverse Plug Simulation is not available in NLB or MLB Hoist; it is traverse only.

**Table 5-15: Reverse Plug Simulation**

Parameter Code	Display	Function	Range	Initial Value
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 disables Reverse Plug time.



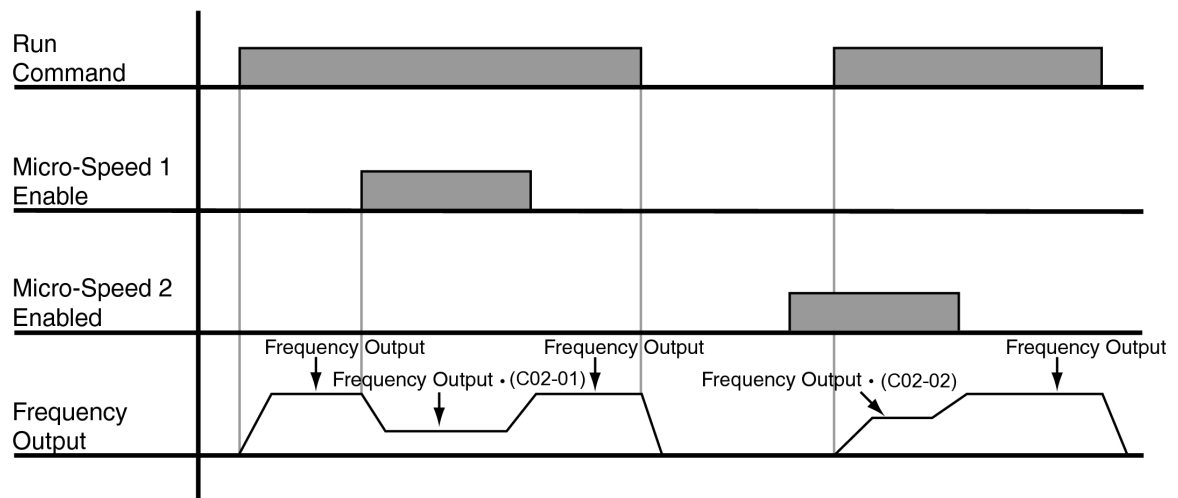
**Figure 5-8: Reverse Plug Simulation**

## 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 5-16: Micro-Speed Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
C02-01	MicroSpd Gain 1	The multiplier of the Analog or Digital Speed Reference to achieve slow-speed operation. Multi Function Input = E	0.01–1.00	1.00
C02-02	MicroSpd Gain 2	An alternate multiplier of the Analog or Digital Speed Reference to achieve slow-speed operation. Multi Function Input = 10	0.01–1.00	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 over Micro-Speed 2.

## 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. Inputs can be programmed through the S4IF card.

**Table 5-17: End of Travel Limits Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
C03-01	Up Limit 1 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	Low Limit 1 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 Decel Time	Decel time to STOP when LL2 is detected	0.0–25.5 sec**	1.0
C03-07	Lmt Stop Method	Determines the stopping method when UL2 or LL2 is detected	0-2	2*
	0 Decel to Stop			
	1 Coast to Stop			
	2 Use B03-03 Method			
C03-08	UL3 Stop Method	Weight Limit Stop Method and action when H01-xx = 12 or 62	0-5	4
	0 Decel/Alarm	Decel to Stop with Alarm (no further raise allowed)		
	1 Coast/Alarm	Coast to Stop with Alarm (no further raise allowed)		
	2 Use B03-03/Alarm	Use B03-03 to Stop with Alarm (no further raise allowed)		
	3 Decel/Fault	Decel to Stop with Fault		
	4 Coast/Fault	Coast to Stop with Fault		
	5 Use B03-03/Fault	Use B03-03 to Stop with Fault		
	Note: For setting 0, 2, 3, 5, deceleration is by B05-08.			
C03-09	UL3 Dec Time	Sets the deceleration time when H01-xx = 12 or 62	0.0–25.5 sec	1.0

\* Initial value is determined by X-Press Programming (Table 4-5, 4-6, or 4-7).

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

## Phantom Stop

The Phantom Stop allows quick identification of the faulted drive while stopping the other drives with Phantom Stop enabled. The Phantom Stop feature is designed to stop the drive operation using the stopping method selected in C03-10 when a Phantom Fault input (H01-01–H01-08 = 5F or 63) is active. The drive will indicate a Phantom Fault has occurred by blinking the LED on the RUN key in sequence of two short bursts. The drive will resume normal operation when a Phantom Fault is removed.

**Table 5-18: Phantom Stop Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
C03-10	Phantom Stop Met	Stopping Method when Multi-Function Input = 5F and 63	0–2	1
	0 Decel to Stop			
	1 Coast to Stop			
	2 Use B03-03 Method			

*NOTE: For settings of 0 or 2 deceleration is by B05-08.*

## Load Sharing/Torque Following - 2 or more mechanically coupled motors

The Load Share Limit function allows the drive to follow the limit switch frequency references and stopping methods when enabled.

**Table 5-19: Load Share Limit Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
C03-11	Load Share Limit	See below for detailed description	0, 1	0	VG+
	0 Disabled				
	1 Enabled				

The VG+ Series 4 Software allows one or more IMPULSE®•VG+ Series 4 driven motors to be connected in a Master/Slave fashion such that slave inverter will follow the torque reference of the master inverter. It can be configured in two ways, either as a dedicated Slave or as a Master/Slave that can be switched on or off by multi-function input. When it is in Load Share Mode (Slave), it is essentially nothing more than a torque helper to the master motor. The Master Inverter outputs the commanded amount of torque from a  $\pm 10$  VDC analog signal into the Slave inverter, which correlates directly to the direction and quantity of torque the slave inverter 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 it is important that they share the load. This will allow one inverter/motor to handle the speed reference and speed regulation while the others simply “help” the master. This overcomes inherent problems with having more than one inverter/motor trying to regulate speed on a common load. The Load Sharing function can be used when the master is configured for Hoist or Traverse motions (i.e. for a hoist motion, two or more motors coupled to a single gearbox.) For a traverse motion, a circular crane, multiple motors driving a single end truck, cable reel, etc.

*NOTE: The master drive can be of an IMPULSE®•VG+ Series 1, 2, 3, or 4 generation.*

When using Multi-function input H01-0x = “66”—Load Share (Torque Following mode), setting C03-11 = **Enabled** will allow the inverter to accept the Limit Switch inputs where H01-0x = 6–D. When C03-11 = **Disabled** (Factory Default), the Slave inverter will ignore any change in state of the Limit switch inputs. The setting of this parameter is only in effect when the Multi-function input H01-0x = “66” Load Share 0/1 is **ON**. It is important to understand that when in a Load Sharing mode, the



Slave inverter is only supplying torque to “help” the Master inverter. The master inverter typically handles the logic of limit switches or other special functions. If this is not the case, each inverter may try to move or decelerate at a different speed placing extra strain on the drive train and potentially resulting in a speed deviation fault.

**NOTE:**

1. 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.
2. Weight Limit Input (H01-xx = 12 or 62) — Upper Limit 3 is always active regardless of the setting of parameter C03-11.

### **Minimum Programming Requirement for “Load Sharing” Operation**

1. The **Master** and **Slave** drives must be programmed for the Flux Vector control method, A01-02 = 3.
2. The **Slave** drive requires H01-xx = 66 — ‘Load Share’
3. The **Slave** drive requires a  $\pm 10$  VDC with H02-02, H02-06, or H02-10 = 13 — ‘Torque Reference’.
4. The output gain should be = 50%.
5. The **Master** drive requires H02-0x = 2A — ‘During Run 1’.
6. The **Master** drive requires a  $\pm 10$  VDC with H03-02, H03-06, or H03-10 = 109 — ‘Torque Reference’.
7. The input gain should be = 200%.
8. The digital operator must not be in LOCAL mode.

## **Klixon**

The Klixon Multi-Function input is intended for motors that have a Motor Thermal Overload Switch called a Klixon. Klixon is usually embedded in the motor windings and changes state when the motor reaches a certain temperature. When a multi-function input (H01-01–H01-08 = 56 or 57) is active, the drive will use the stopping method programmed in C03-12 and display the KLX Klixon alarm. The drive will resume normal operation when the motor cools down and a new RUN command is applied.

**Table 5-20: Klixon Action Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
C03-12	Klixon Action	When MFDI = 56 (N.O.) or 57 (N.C.)	0, 1	0
	0 Use B03-03 method			
	1 Allow Lower only			

## Hook Height Measurement

Hook Height Measurement 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. Reference Figure 5-10 for Hook Height configuration.

**Table 5-21: Hook Height Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
C03-13	Height Measure	Number of motor revolutions from the Hook Height out position (C08-15). Displayed at U01-50 and U01-51. U01-50 and U01-51 are stored to EEPROM.	0–65535	250	VG+
C03-14	Hook Height Home	Selects the position of the hook when at Home	0–4	2	VG+
	0 Home = UL2	Upper home position is set to zero when UL2 is closed (H01-xx = 07 or 0B)			
	1 Home = LL2	Lower home position is set to zero when UL2 is closed (H01-xx = 09 or 0D)			
	2 Home MFDI Upper	Upper home position is set to zero when (UL1) H01-xx = 67 is closed			
	3 Home MFDI Lower	Lower home position is set when H01-xx = 67 is closed			
	4 Home = UL3	Upper home position is set to zero when UL3 is closed (H01-xx = 12 or 62)			
C03-15	Hook Height Out	Selects the output voltage and Monitor when the hook is at Home	0, 1	0	VG+
	0 At Home = 0%	0% - U01-50 = 0%, MFAO = 0V			
	1 At Home = 100%	100% - U01-50 = 0%, MFAO = 0V			

## Electronic Programmable Limit Switches (EPLS)

Using a stored height measurement (U01-50, U01-51), it is possible to program UL1, UL2, LL1, and LL2 functions for redundancy or use without rotary limit switches. When C03-16, C03-17, C03-18, or C03-19 has a value other than 0, the Electronic Programmable Limit Switch function will be enabled, and will use the logic in the table below. Height Measurement must be correctly set up before using EPLS.

**Table 5-22: Electronic Programmable Limit Switches Parameter Settings**

Parameter Code	Display	Range	Initial Value	Model
C03-16	UL2 Revolutions	0–65535 Rev	0	VG+
C03-17	UL1 Revolutions	0–65535 Rev	0	VG+
C03-18	LL1 Revolutions	0–65535 Rev	0	VG+
C03-19	LL2 Revolutions	0–65535 Rev	0	VG+

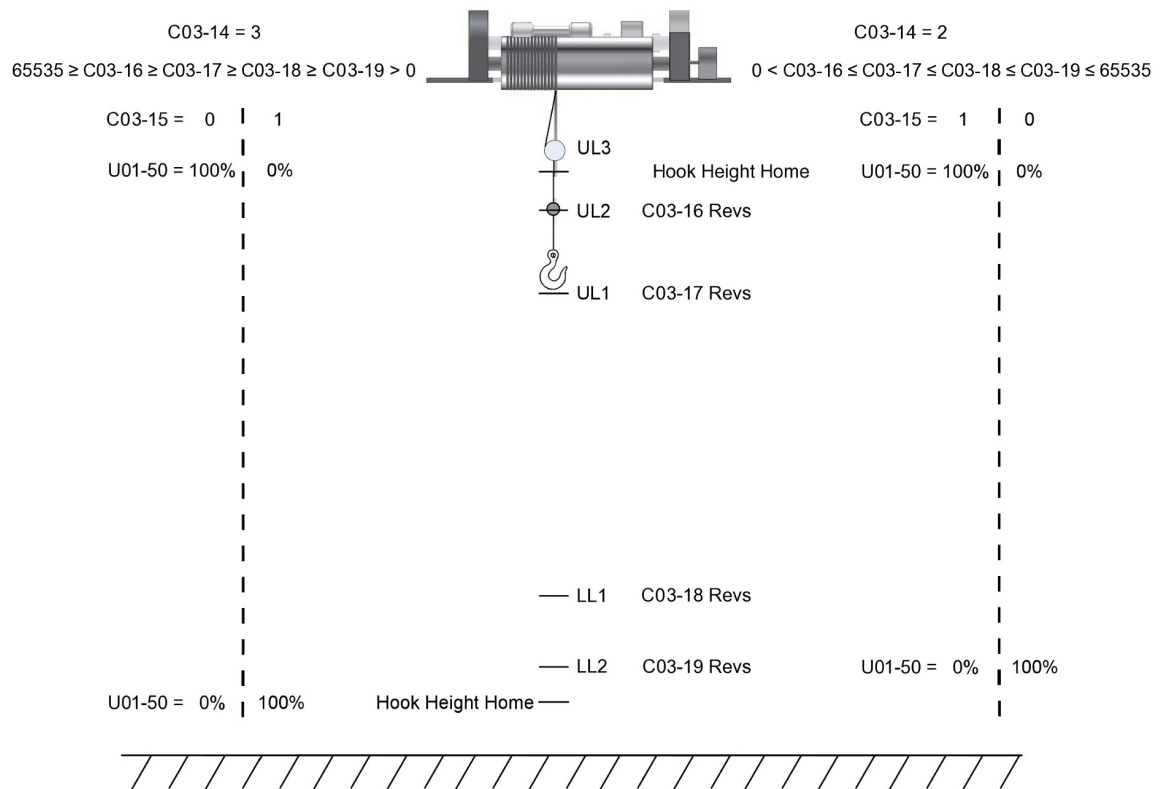
**NOTE:** An OPE26 fault will occur when C03-14 = 0 or 1 and C03-16 or C03-19 are not equal to 0.

**Table 5-23: Limit Switch Outputs**

H02-0x or F05-0x =	Function
02B - Upper Limit 1	Output ON when keypad displays UL1
02C - Upper Limit 2	Output ON when keypad displays UL2
02D - Lower Limit 1	Output ON when keypad displays LL1
02E - Lower Limit 2	Output ON when keypad displays LL2

**NOTE:** MFDO 02B–02E works with MFDI 06–0B or EPLS.

**NOTE:** When using EPLS and Hook Height Measurement, Hook Height must be homed by using UL1 or LL1; it cannot be homed by using UL2 or LL2.



**Figure 5-10: EPLS Parameter Layout**

**Example: Limit Switch Revolution Settings (C03-13 = 250 Rev)**

C03-14 Home Option	C03-15 Home = 0% or 100%	C03-16 UL2	C03-17 UL1	C03-18 LL1	C03-19 LL2
2	0	20 Rev (U01-51 ≤ C03-16)	55 Rev (U01-51 ≤ C03-17)	220 Rev (U01-51 ≤ C03-18)	240 Rev (U01-51 ≤ C03-19)
	1	240 Rev (U01-51 ≥ C03-16)	220 Rev (U01-51 ≥ C03-17)	55 Rev (U01-51 ≥ C03-18)	20 Rev (U01-51 ≥ C03-19)
3	0	20 Rev (U01-51 ≤ C03-16)	20 Rev (U01-51 ≤ C03-16)	20 Rev (U01-51 ≤ C03-16)	20 Rev (U01-51 ≤ C03-16)
	1	20 Rev (U01-51 ≤ C03-16)	20 Rev (U01-51 ≤ C03-16)	20 Rev (U01-51 ≤ C03-16)	20 Rev (U01-51 ≤ C03-16)

\* Please consult the factory for additional information on Height Measurement and Electronic Programmable Limit Switches

## Lower Limit/Upper Limit Bypass MFDI

The intent of the "Limit Bypass" MFDI is two-fold. It allows for the following without the use of jumpers or re-programming of the drive parameters:

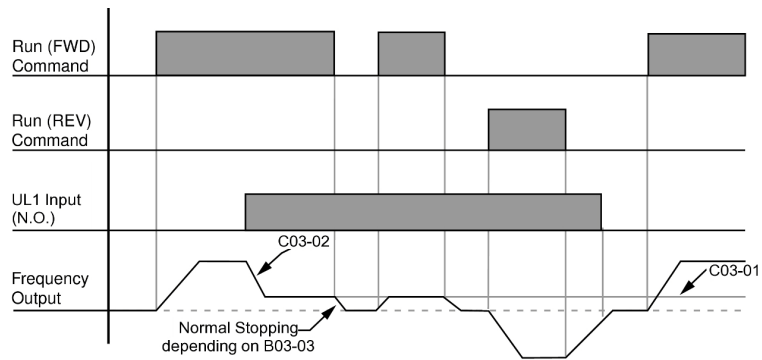
1. Ease of testing of the Weighted Upper Limit Switch (UL3) or possibly re-homing Height Measurement function
2. To allow changing of the wire ropes, i.e. spooling all the rope off of the hoist drum

**NOTE:** *The momentary key-switch to operate this function 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.*

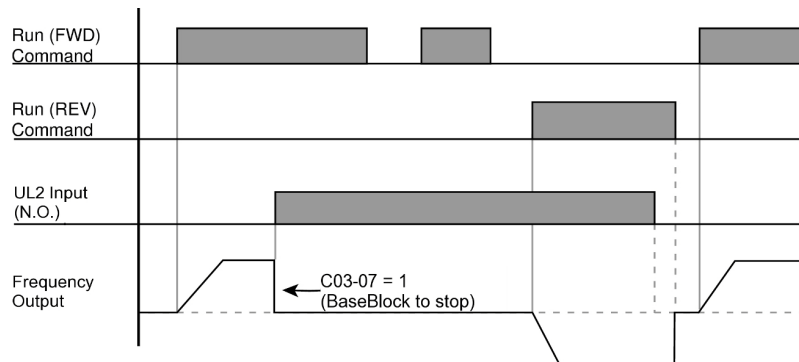
**Table 5-24: Limit Bypass MFDI**

Functions Bypassed	C09-0x or H01-0x settings will bypass the functions in the leftmost column when the input is activated	
	73	74
Upper Limit 1 N.O. (MFDI = 06)		x
Upper Limit 2 N.O. (MFDI = 07)	x	x
Lower Limit 1 N.O. (MFDI = 08)		x
Lower Limit 2 N.O. (MFDI = 09)	x	x
Upper Limit 1 N.C. (MFDI = 0A)		x
Upper Limit 2 N.C. (MFDI = 0B)	x	x
Lower Limit 1 N.C. (MFDI = 0C)		x
Lower Limit 2 N.C. (MFDI = 0D)	x	x
UL2 detected by EPLS (C03-16)	x	x
UL1 detected by EPLS (C03-17)		x
LL1 detected by EPLS (C03-18)		x
LL2 detected by EPLS (C03-19)	x	x

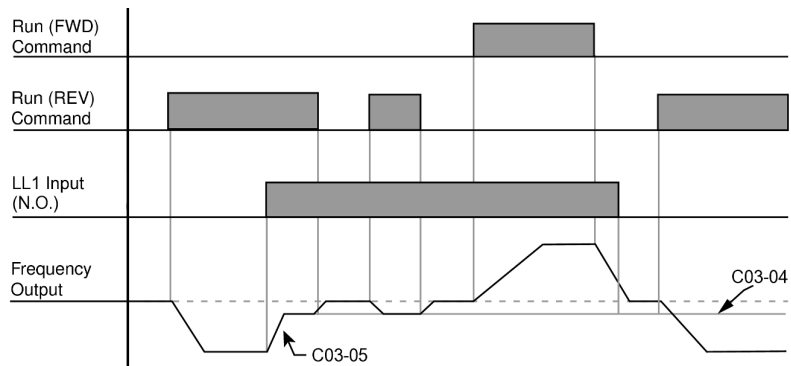
x = Limit Bypass



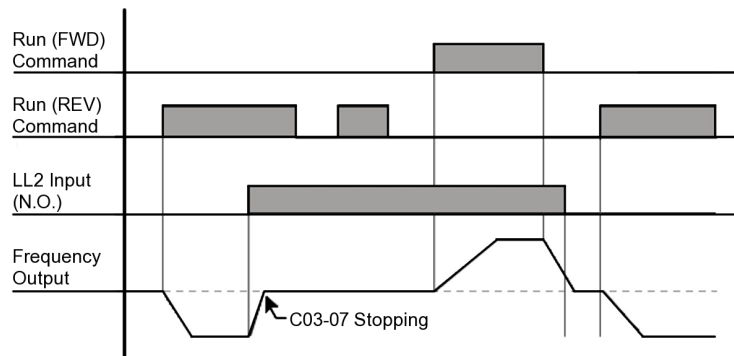
**Figure 5-11: Upper Limit (UL1)**



**Figure 5-12: Upper Limit 2 (UL2)**



**Figure 5-13: Lower Limit 1 (LL1)**



**Figure 5-14: Lower Limit 2 (LL2)**

## Load Float 2

Load Float 2 can be enabled by an MFDI at Stop to release the brakes without moving up or down for fine positioning. The Load Float function performs all torque proving and brake check functions, and allows motion when the run command is applied.

When Load Float (C08-10) is enabled, it maintains the motor shaft at a stationary position with brake open. Load Float Time 2 is enabled by a MFDI (Multi-Function Digital Input) that is programmed as the digital input setting 35 (H01-xx = 35). If load float is being used, this time (C04-01) will be added to the standard load float time (C08-10).

**Table 5-25: Load Float Time 2 Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
C04-01	Load Float Time2	Maximum duration of Load Float 2 time when MFDI = 35	0–65535 sec	10
C04-02	Load Float Gain	Load Float Gain.	0–100	10*

\* Dependent on kVA ( $\leq 30$  HP: 10;  $> 30$  HP: 20)

## 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 IMPULSE®•G+ & VG+ Series 4 detects an overload condition it prevents any further lifting. The load may then be lowered at the speed that is specified by the Load Check Alarm Speed (C05-08).

### V/f Operation (A01-02 = 00)

When using Load Check II in V/f control mode (during lifting) the IMPULSE®•G+ Series 4 will compare the motor current readings (U01-03) to values stored during the Load Check set up process. If they exceed the values for the active Load Check Zone, the IMPULSE®•G+ Series 4 will stop the motor based on the LC Alarm Action (C05-02) and display a Load Check alarm (LC).

**NOTE:** To clean an LC alarm, set H01-0x = 69. This is valid for both V/f Operation and OLV and FLV Operation.

### OLV and FLV Operation (A01-02 = 02 and 03)

When using Load Check II in Open Loop Vector or Flux Vector control mode (during lifting) the IMPULSE®•G+ & VG+ Series 4 will compare the motor torque readings (U01-09) to values stored during the Load Check set up process. If they exceed the values for the active Load Check Zone, the IMPULSE®•G+ & VG+ Series 4 will stop the motor based on the LC Alarm Action (C05-02) and displays a Load Check alarm (LC).

**NOTE:** To clean an LC alarm, set H01-0x = 69. This is valid for both V/f Operation and OLV and FLV Operation.

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

*Example: Use a load check MFDO H02-0x = 01E to break the raise (FWD Run) command to the other hoist(s). This will insure that all hoists stop lifting if one hoist is being overloaded. Ensure that C05-02 = 3 to prevent uneven lowering or design lowering logic accordingly.*

### Load Check II Set Up (C05-01 = 09)

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. The motor should be properly Auto-tuned.
  - FLV and OLV operation – Rotational Auto-tune.
  - V/f operation – Stationary Auto-tune.
2. 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.
3. Suspend the rated load just off of the ground. (This allows for accurate measurements during calibration)
4. Set C05-01 equal to 9.
5. Press and hold the Hoist (Up) command button 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.*

6. When the Load Check set up process finishes its calculations, the drive will decelerate the load to indicate the set up calibration is complete.
7. Press the Lower (Down) command to complete the Load Check set up process and lower the load to the ground.

**NOTE:** *Upon completion of the Load Check set-up process, the drive will automatically set C05-01 to 1.*

**Table 5-26: Load Check II Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
C05-01	Load Check	Determines whether Load Check is enabled.	0–9	0
		<i>NOTE: If Micro-Speed Ref is less than Look Speed 1, Load check can not detect overload.</i>		
	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	0–4	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 B03-03 Method (allows Lower only) (alarm)			
C05-03	Holding Time	Sets the time to hold the output frequency allowing the output current/torque to stabilize.	0.00–2.55 sec	0.15
C05-04	Testing Time	Sets the 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 Sensitivity Acc	Sets the margin for Load Check detection during acceleration. A setting of 00 is the most sensitive.	0–50%	5
C05-07	I/T Sensitivity	Sets the margin for Load Check detection at speed agree. A setting of 00 is the most sensitive.	0–20%	5
C05-08	Alarm Speed	Sets the maximum lowering speed after an LC alarm.	1.0–30.0 Hz	6.0
C05-09	I/T Level 01	Current/Torque values detected during LC set up for Zone 01	0–160%	0
C05-10	I/T Level 02	Current/Torque values detected during LC set up for Zone 02	0–160%	0
C05-11	I/T Level 03	Current/Torque values detected during LC set up for Zone 03	0–160%	0
C05-12	I/T Level 04	Current/Torque values detected during LC set up for Zone 04	0–160%	0
C05-13	I/T Level 05	Current/Torque values detected during LC set up for Zone 05	0–160%	0

<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Range</b>	<b>Initial Value</b>
C05-14	I/T Level 06	Current/Torque values detected during LC set up for Zone 06	0–160%	0
C05-15	I/T Level 07	Current/Torque values detected during LC set up for Zone 07	0–160%	0
C05-16	I/T Level 08	Current/Torque values detected during LC set up for Zone 08	0–160%	0
C05-17	I/T Level 09	Current/Torque values detected during LC set up for Zone 09	0–160%	0
C05-18	I/T Level 10	Current/Torque values detected during LC set up for Zone 10	0–160%	0
C05-19	I/T Level 11	Current/Torque values detected during LC set up for Zone 11	0–160%	0
C05-20	I/T Level 12	Current/Torque values detected during LC set up for Zone 12	0–160%	0
C05-21	I/T Level 13	Current/Torque values detected during LC set up for Zone 13	0–160%	0
C05-22	I/T Level 14	Current/Torque values detected during LC set up for Zone 14	0–160%	0
C05-23	I/T Level 15	Current/Torque values detected during LC set up for Zone 15	0–160%	0
C05-24	I/T Level 16	Current/Torque values detected during LC set up for Zone 16	0–160%	0
C05-25	LC Integral Time	Integral time used to smooth transitions	0.00–2.55 sec	0.05
C05-26	LC Delay Time	Load Check delay time for transitions	0.00–2.55 sec	0.25
C05-27	Min Rvs->Fwd Tim	Minimum delay when switching from REV to FWD in LC. Used when the load brake cannot stop the load fast enough. Setting of 0.0 disables delay triggering timer	0.0–25.5 sec	0.0
C05-28	Dly Trig Freq	Minimum frequency that will trigger C05-27 timer	0.0–60.0 Hz	30.0

## Swift-Lift™ & Ultra-Lift™

Swift-Lift/Ultra-Lift provides additional productivity by allowing a crane or hoist to quickly move into position. The feature enables the motor to over 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. However, 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).

### Swift-Lift

Swift-Lift can be enabled in the Standard Hoist motion of the G+ Series 4. 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 in place of motor current 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.

### Ultra-Lift

Ultra-Lift can be enabled in the Non-mechanical Load Brake (NLB) Hoist motion of the VG+ Series 4 (FLV only). 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.

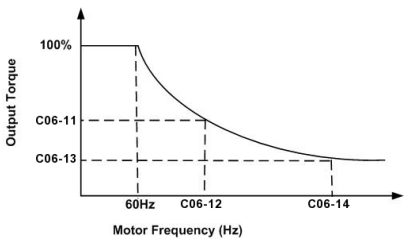
### Adaptive Ultra-Lift

Adaptive Ultra-Lift can only be enabled in the (NLB) Hoist motion of the VG+ Series 4. 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.

**NOTE:** *Ultra-Lift is disabled when in traverse applications. Maximum Frequency (E01-04) must be  $\geq$  C06-02 and C06-03.*

**Table 5-27: Swift-Lift/Ultra-Lift Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
C06-01	Swift-Lift (V/F and OLV) Ultra-Lift (FLV) <i>0 Disabled</i> <i>1 Enabled Auto</i> <i>2 Enabled by MFDI</i> <i>3 Enabled Adaptive (Ultra-Lift Only)</i> <i>4 Adaptive by MFDI (Ultra-Lift Only)</i>	Determines whether Swift-Lift/ Ultra-Lift is enabled.	0–4	0	G+/VG+
C06-02	SwiftLift FWDSPd (V/f and OLV) UltraLift FWD Spd (FLV)	Maximum Swift-Lift Forward Speed	0.1–150.0 Hz	60.0	G+/VG+
C06-03	SwiftLift REVSPd (V/f and OLV) UltraLift REVSPd (FLV)	Maximum Swift-Lift Reverse Speed	0.1–150.0 Hz	60.0	G+/VG+

Parameter Code	Display	Function	Range	Initial Value	Model
C06-04	SL FWD Motor Current (V/F) SL FWD Torque (OLV) UL FWD Torque (FLV)	Output Current/Torque < C06-04 to enable Swift-Lift Forward. Not used with Adaptive UL.	0–100%	50	G+/VG+
C06-05	SL REV Motor Current (V/F) SL REV Torque (OLV) UL REV Torque (FLV)	Output Current/Torque < C06-05 to enable Swift-Lift Reverse. Not used with Adaptive UL.	0–100%	30	G+/VG+
C06-06	SL Enabling Speed (V/f and OLV) UL Enabling Speed (FLV)	Fout > C06-06 to Enable Swift-Lift. (Threshold Speed)	0.1–150.0 Hz	59.0	G+/VG+
C06-07	SL Delay Time (V/f and OLV) UL Delay Time (FLV)	Delay time at Enabling speed to check Output Torque	0.0–25.5 sec	2.0	G+/VG+
C06-08	SFS Acc Gain	Swift-Lift acceleration multiplier for V/F Modes. Settings greater than 1 increase the acceleration time proportionately; settings less than 1 decrease the acceleration time proportionately	0.1–9.9	1.0	G+
C06-10	Mtr Trq Quickset  0 Custom 1 Very Low Torque 2 Low Torque 3 Standard 4 High Torque 5 Very High Torque	Set available motor torque over base speed.	0–5	3	VG+
					
C06-11	Mtr Trq 1	Sets the available torque at Speed 1 (above base speed)	1–100%	45	VG+
C06-12	Mtr Spd 1	Sets the Speed 1 point	0.0–150.0 Hz	90.0	VG+
C06-13	Mtr Trq 2	Sets the available torque at Speed 2 (above base speed)	1–100%	25	VG+
C06-14	Mtr Spd 2	Sets the Speed 2 point	0.0–150.0 Hz	120.0	VG+
C06-15	AUL FWD Offset	Adaptive UL torque measurement offset in the up direction to allow for deceleration.	0–100%	10	VG+
C06-16	AUL REV Offset	Adaptive UL torque measurement offset in the down direction to allow for deceleration	0–100%	20	VG+

**NOTE:** C06-11 through C06-16 are hidden unless C06-10 is set to “Custom”. Otherwise, C06-11 through C06-14 are automatically modified by C06-10.

## Configuring the Swift-Lift & Ultra-Lift Function:

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

1. Set C06-01=1 or 2 to enable the **Swift-Lift & Ultra-Lift Function**, 1 = Enable Automatic, 2 = Enable by Multi-Function Input (MFI).
2. Set C06-02 and C06-03 to determine **Swift-Lift & Ultra-Lift** maximum FWD/REV output frequency.
3. Set C06-04 and C06-05 to determine **Swift-Lift & Ultra-Lift** maximum enable output current.
4. Set the **Swift-Lift & Ultra-Lift Enabling Speed (C06-06)** 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 to 59 Hz or 58 Hz as the **Swift-Lift & Ultra-Lift Enabling Speed**.

5. Ensure that the **Maximum Frequency (E01-04)** is increased from 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 **Speed Control Method**, the following formula is used to adjust the constant **B02-01 (Reference Upper Limit)**.

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

### **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 **Speed Control Method**, the following formula is used to adjust the constant **H03-03 (Gain Multiplier for Terminal A1 analog input signal)**.  
**H03-10 (Gain Multiplier for Terminal A2 analog input signal)**.

$$H03-03 = \frac{60 \text{ Hz} \times 100}{E01-04} \quad \text{or} \quad H03-10 = \frac{60 \text{ Hz} \times 100}{E01-04}$$



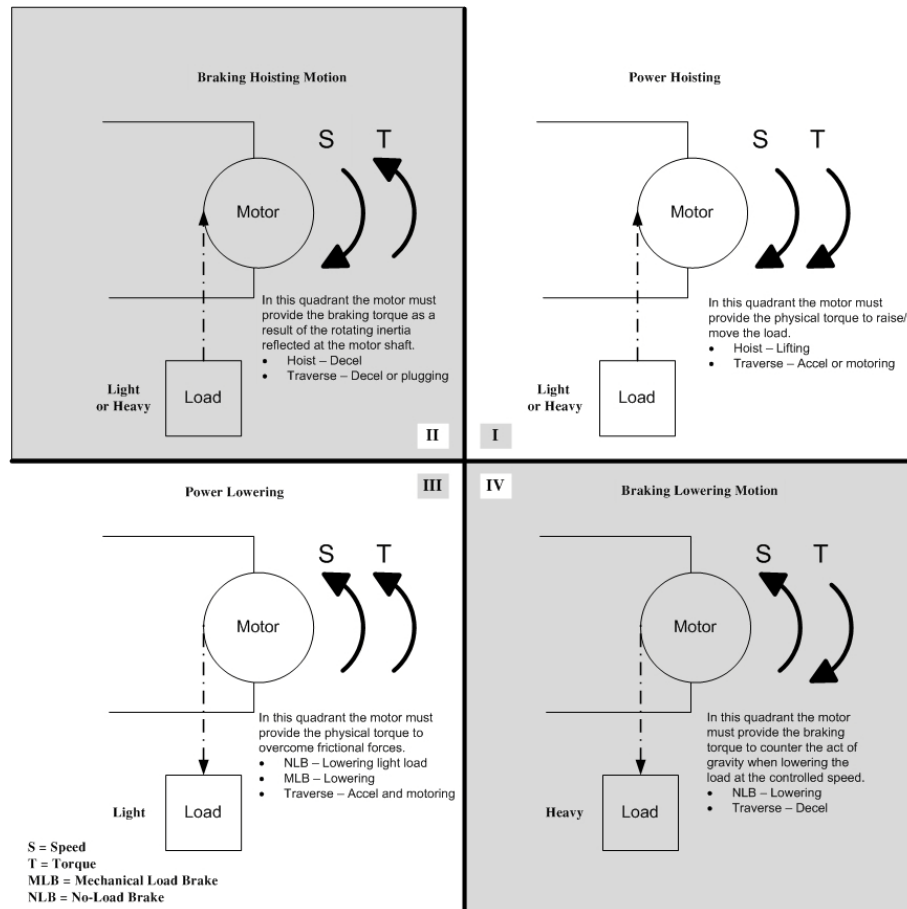
## WARNING

*Motors and drive machinery must be capable of operating above motor 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*

## Travel Torque Limit

IMPULSE®G+ & VG+ Series 4 dynamically controls the torque output of the motor at all times. The Torque Limit Function limits the amount of motor torque on all four quadrants of vector control operation:

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



This function is used in multi-drive, closed-loop traverse applications to reduce drive fighting due to speed discrepancies between the two sides of a bridge. This resolves the situation where one side of a bridge will be at full forward torque, while the other side is a full regen torque. When moving below the Limiter Freq, this feature is disabled and the drive behaves as normal. When accelerating past the Limiter Freq, the ASR I time is reduced to zero to limit torque imbalance. Once the motor has accelerated to within the Limiter Freq (i.e. 60 Hz) the regen torque limit also goes to zero. The drive will remain in this state until the speed reference is changed. When the speed reference is raised or lowered, regen torque is re-enabled to accel or decel the bridge as required.

Note that a heavy swinging load may pull the bridge faster than the PG Overspeed level. It is therefore highly suggested that a PG Overspeed Sel (F01-23) be set to Alarm Only.

**Table 5-28: Torque Limit Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	G+ OLV	VG+ FLV
C07-01	Trq Limit FWD	FORWARD torque limit	0–300%	150	x	x
C07-02	Trq Limit REV	REVERSE torque limit	0–300%	150	x	x
C07-03	Trq Lmt FWD Rgn	Regenerative torque limit at FORWARD	0–300%	180	x	x
C07-04	Trq Lmt REV Rgn	Regenerative torque limit at REVERSE	0–300%	180	x	x
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	x	x
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	x	x
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	x	x
C07-08	Trq Lim I Time	Sets the integral time constant for the torque limit. (OLV only)	5–10000 ms	200	x	--
C07-09	Torque Limit Sel	Torque Limit Control Method Selection during Accel/Decel	0, 1	0	x	--
	0 <i>P-ctrl @ Acc/Dec</i>	Changes to integral control at constant speed. Use this setting when acceleration to the desired speed should take precedence over the torque limit.				
	1 <i>I-ctrl @ Acc/Dec</i>	Integral control. Set L7-07 to 1 if the torque limit should take precedence. (OVL only)				
C07-10	Trav Trq Limiter	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	x	x
	0 <i>Disabled</i>					
	1 <i>Enabled</i>					
C07-11	Limiter Freq	Sets the frequency window (+/-) size for Traverse Torque Limiter (C07-10) when at speed.	0.5–10.0	2.0	x	x

*x = Available in the specified drive/control method*

## No-Load Brake Hoist (VG+)

The No-Load Brake Hoist mode provides a start and stop sequence designed specifically for No-Load Brake Hoists. 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 drive 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 drive will stop outputting voltage to the motor. The brake will remain closed.

Once the brake has been commanded to release, the drive output remains in Load Float for the amount of time programmed into C08-04. During C08-04, the drive 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 drive 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 drive 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 drive 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 major 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 drive 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.

**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 drive 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 drive 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 drive 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, refer to “Troubleshooting the Drive” in Chapter 6 of this manual.

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 drive 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 drive / 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. Refer to “Troubleshooting the Drive” in Chapter 6 of this manual.



## WARNING

*DO NOT turn off power to the drive during a 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 5-29: No Load Brake Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
C08-01	Torque Comp Time	Amount of time for the Torque Comp value to reach 300%.	0.00–2.55	1.00	VG+

\* Initial value is determined by X-Press Programming (Table 4-5, 4-6, or 4-7).

Parameter Code	Display	Function	Range	Initial Value	Model
C08-02	IFB OK Timer	Sets the amount of time to look for the current feedback to be OK before posting a BE2 alarm. Setting this parameter to 0.00 will disable torque proving at start & eliminate BE2 detection (consult factory before disabling torque proving).	0.00–2.55 sec	1.00	VG+
C08-03	Min Brk Rel Trq	Minimum brake release torque.	0–300%	10	VG+
C08-04	Rollback Timer	Sets the amount of time for the brake to release and for brake feedback to be received into the Brake Answer Back Multi-Function input at start before posting BE4 alarm. It is also the time period during which the amount of roll back is checked.	0.00–2.55 sec	0.30	G+/VG+
C08-05	Roll Back Count	Detection counts for excessive rollback. 4 pulses = 1 ppr of F01-01	0–15000 pulses	800	VG+
C08-06	BE3/Alt Torq Tim	Time period which C08-07 is measured. Also see C08-08.	0.00–2.55 sec	0.30	VG+
C08-07	BE3 Detect Count	Detection count for Encoder/ Seized-Brake Alarm (BE3). It is the minimum encoder pulse count, during the time period of C08-06, below which the BE3 alarm is triggered. 4 pulses = 1 ppr of F01-01	0–15000 pulses	10	VG+
C08-08	Alt Rev Trq Lim	For a LOWER command in the NLB Hoist Motion Mode only—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	VG+
C08-09	Zero Speed Level	Determines speed feedback at which Load Float activates.	0.0–10.0 Hz	1.0	VG+
C08-10	Load Float Time	After stop command time period during which the load is held at the zero-position and the electric brake is not set.	0-65535 sec	10*	VG+
C08-11	Brake Set Delay	Sets the amount of time for the brake to set and for brake feedback to be removed from the Brake Answer Back Multi-Function input at stop before posting a BE5 Alarm.	0.0–25.5 sec	0.7	G+/VG+
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	VG+
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	VG+
C08-14	Brake Hold Speed	The frequency the drive outputs to push against the brake for brake proving at start as well as the frequency the drive continues to output until Brake Set Delay Timer expires or the Brake Answerback MFI is removed 5% of F max (factory setting).	0.0–25.5%	0.0 (FLV)	VG+

\* Initial value is determined by X-Press Programming (Table 4-5, 4-6, or 4-7).

Parameter Code	Display	Function	Range	Initial Value	Model
C08-15	Load Float Ext T	Load Float extension time enabled by MFI=5D.	0–65535 sec	10	VG+
C08-16	Init FWD Brk Trq	Initial Brake Release Torque. The percentage of forward/up motor torque that must be reached within C08-02 time in order for the brake to release at the start of the run command. (BE2 detection)	10–300%	100	VG+
C08-18	BE6 Up Speed Lim	Maximum up speed limit after BE6 or BE8 is detected.	0.00–150.00 Hz	6.00	G+/VG+
C08-19	LdFlt Alm Reset	Determines if BE6 fault is automatically reset. If enabled, drive will always perform BE6 test after Load Float time to determine if brake is operational and the fault can be cleared. If disabled the drive will remain in BE6 fault state until drive power is cycled.	0, 1	1	VG+
	0 Disabled 1 Enabled				
C08-22	Brk Slip Detect	Enables continuous monitoring of the brake for NLB Hoists. (BE8 Detection)	0, 1	0	VG+
	0 Disabled 1 Enabled				
C08-23	Brk Slip Det Spd	Adjusts the sensitivity of Brake Slip Detection. BE8	0–10 Hz	1.0	VG+
C08-24	Brake Test Torq	When input by MFDI data 61, Motor runs in Forward direction at C08-25 speed. Brake output Multi-function output is not energized, PGO and DEV are disabled. Monitor Brake Test Torque at U01-86.	0–6553.5 Flb	1.25* <u>E02-11*5252</u> Motor RPM (see * below)	VG+
C08-25	Brake Test Speed	Speed the drive will push against brake during testing.	0–10 Hz	6	VG+

\* Initial value is determined by X-Press Programming (Table 4-5, 4-6, or 4-7).



## WARNING

During a BE5, BE6, or BE8 fault, power should not be removed from the control. The load should be lowered to the ground and the crane moved to a safe location for service.

## Digital Input Option Set-up (DI-A3 and S4IO)

Selects the digital input controls for either the DI-A3, S4I, or S4IO option when installed.

**Table 5-30: Digital Input Set-up Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
C09-01	Digital In Sel	Provides additional programmable MFDI	0–2	0
	0 <i>Disabled</i>	No additional MFDI are being used.		
	1 <i>Enabled S4IO</i>	S4IO or S4I card is installed		
	2 <i>Enabled DI-A3</i>	DI-A3 card is installed		

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

\* See Table 5-65 for MFDI selections

## Weight Measurement

The IMPULSE®•G+ & VG+ Series 4 includes a Weight Calculation function that can be used in hoisting applications. The weight measurement calculation is based on motor torque at a constant speed. The drive 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 one time per lift (Raise Run command) when C10-01 = 1 (Automatic), or it can be configured to take a reading at any speed with a Multi-Function Input when C10-02 = 1 (Manual). The calculated weight can be displayed on the keypad of the hoist drive.

**NOTE:** *Weight Calculations will be more consistent when a weight measurement is calculated at the same speed every time. Example: C10-01 = 1, 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 and the brakes should be set on the hoist. 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 Run). If extreme accuracy is required, a load cell should be used. The Weight Measurement function of the hoist drive should be within 5% with VG+ drives and 10% with G+ drives or better accuracy of the rated capacity.*

**Table 5-31: Weight Measurement Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
C10-01	Load Weight  0 Disabled 1 Auto - I/T 2 Auto Analog	Selects method for Load Weight measurements. Measurement is reset at Brake Closed.  Enabled (FLV Only) Enabled Analog	0–2	0	G+/VG+
C10-02	LW Start 0 At C10-05 1 By MFDI=5C	LW Measurement Start	0, 1	0	G+/VG+
C10-03	LW Display Hold 0 Hold Display 1 Hold Disp 3 sec	Hold until next run command	0, 1	0	G+/VG+
C10-04*	LW Conversion	Multiplier of torque output calculation for display. Data is n0000, so multiplier is 10000; “n” is decimal point. <i>Example: 24000 = 40.00</i>	0–39999	0	G+/VG+
C10-05	Test Freq	Frequency at which the Weight Measurement will occur.	0–E01-04 Hz	6	G+/VG+
C10-06*	Unit Displayed 0 Tons 1 Pounds 2 Kilograms 3 Metric Tons 4 Percent Load	Selects the units of measurement being displayed.	0–4	4	G+/VG+
C10-07	Holding Time	Time for holding output frequency to measure weight.	0.0–2.55 sec	1.00	G+/VG+
C10-09	Full Load Torque	Percentage of Torque output that is considered full load.	0.0–200.0%	100.0	VG+
C10-10	No Load Torque	Percentage of Torque output that is considered no load.	0.0–200.0%	20.0	VG+

\* Used for keypad display; consult factory for assistance.

## 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 **constantly** 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 drive.
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.

## 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. For example, if the FULL load is 40 tons, enter 24000 into C10-04. This will be displayed in U01-29 as the weight with two decimal places, or 40.00 tons. If the FULL load is 1000 pounds, enter 01000 into C10-04. This will be displayed in U01-29 as the weight with no decimal places, or 1000 lb.

## Slack Cable Detection

IMPULSE®•VG+ Series 4 offers Slack Cable Detection for hoist applications. The Slack Cable condition is detected when the torque output is drastically reduced and has dipped below a set-point (C11-03) level. When Slack Cable condition occurs, the output action is defined by the C11-02 which has 6 selections.

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

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

Setup Procedure:

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

**Table 5-32: Slack Cable Detection**

Parameter Code	Display	Function	Range	Initial Value	Model
C11-01	Slack Cable	(For Hoist Application) Determines whether Slack Cable Detection is enabled.	0, 1	0	VG+
	0 Disabled				
	1 Enabled				
C11-02	Action at SLC	Multi-function output that occurs at Slack Cable Detection. For all Selections, RAISE command is permitted (MFDO = 028).	0–5	2	VG+
	0 No Action	Alarm Only			
	1 No Act/C03-04	Next LOWER command is at Lower Limit 1 speed (C03-04).			
	2 Decel/C03-04	Decelerate to Lower Limit 1 Speed C03-04 by C03-05. Continued LOWER commands allowed, but at C03-04 as max speed.			
	3 Decel/No Opr	Decelerate to Lower Limit 1 Speed C03-04 by C03-05. Continued LOWER commands are <i>not</i> allowed.			
	4 Dec Stop/C03-04	Decel (by C03-05) to Lower Limit 1 Speed C03-04. Continued LOWER commands allowed, but only at C03-04 speed.			
C11-03	SLC Detect Torq	Percentage of Output Torque below which the enabled Slack Cable Detection is activated—as long as the Frequency output is between C11-04 and C11-06, and the delay time is between C11-05 and C11-07.	0–100%	30	VG+

Parameter Code	Display	Function	Range	Initial Value	Model
C11-04	SLC Detect Spd 1	The Frequency Output that is required for the enabled Slack Cable Detection to be activated. It corresponds to Slack Cable Detection Delay Time 1 (C11-05).	0–E01-04 Hz	2	VG+
C11-05	SLC Delay Time 1	The delay time before the enabled Slack Cable Detection can be activated. It corresponds to Slack Cable Detection Speed 1 (C11-04). Prevents false outputs.	0.00–2.55 sec.	0.50	VG+
C11-06	SLC Detect Spd 2	The Frequency Output below which the enabled Slack Cable Detection can be activated. It corresponds to Slack Cable Detection Delay Time 2 (C11-07).	0–E01-04 Hz	60	VG+
C11-07	SLC Delay Time 2	The delay time before the enabled 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	VG+



## Snap Shaft Detection

This feature 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 input cards, with channel 1 (CN5-C) being the high speed shaft input and channel 2 (CN5-B) being the low speed shaft input. The drive 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 drive will perform the action at snap (C11-09).

### Set Up

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 5-33: Snap Shaft Parameter Settings**

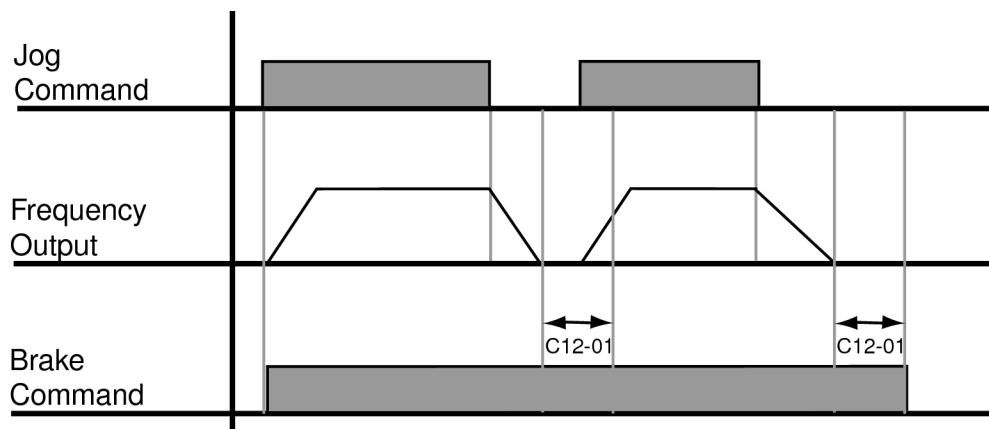
Parameter Code	Display	Function	Range	Initial Value	Model
C11-08	Snap Shaft 0 <i>Disabled</i> 1 <i>Enabled</i>	Determines whether snap shaft detection is enabled.	0, 1	0	VG+
C11-09	Action at Snap 0 <i>Brake/Fault Out</i> 1 <i>Alarm Only</i>	Action taken at detection. A setting of 0 will set the brake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

## Brake Delay Timers

This function is used in trolley or bridge applications. It can reduce the mechanical brake wear when the operator tries to position a load. This function is available only in traverse mode and the constant B03-03 must be set to 4 (Decel With Timer).

**Table 5-34: Delay Timers Parameter Settings**

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



**Figure 5-15: Brake Delay Timers**

**NOTE:** The Jog control input is a multi-function input. It is enabled by programming H01-01–08 = 15 or 16.

## Timer Function

- The timer function is enabled when the timer function input (setting: 43) and the timer function output (setting: 12) are set for the multi-function input and multi-function output respectively.
- 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 function ON-Delay Time), the timer function output turns **ON**.
- When the timer function input **OFF** time is longer than the value set for **C12-04** (Timer function OFF-Delay Time), the timer function output turns **OFF**.

**Table 5-35: Timer Function Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
C12-03*	Delay-ON timer	Timer function output On-delay time (dead zone) for timer function input is set at a unit of seconds.	0.0–3000.0 sec	0.0
C12-04*	Delay-OFF timer	Timer function output Off-delay time (dead zone) for timer function input is set at a unit of seconds.	0.0–3000.0 sec	0.0

\* This function is enabled when timer function is set to MFDI/MFDO; H01-xx=43, H02-xx=12.

## Maintenance Timer

The “Maintenance Timer” is a maintenance feature that will alert an operator, for example, when the bearings need to be greased. It consists of a Multi-Function Output (H02-0x-08 = 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 programmable gain (C12-06) to slow the motion down until the bearings have been greased. An alarm will also be posted on the Keypad stating “Maintenance Required”. Once the bearings have been greased, the output and alarm message can be reset by two different methods. One method is through a Multi-Function Input programmed for Maintenance Reset (H01-01-08 = 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 timer. A message will then appear on the keypad stating that the timer has been reset. The Multi-Function Output will turn off at this time. When C12-01 = 0, the function is disabled.

**Table 5-36: Maintenance Timer Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
C12-05	Maintenance Tmr	Maintenance Timer Trip Level	0–32767 Hr	0
C12-06	Maintenance Gain	Speed Reference Gain	0.00–1.00	0.50

## Inching Control

Inching Control Function can be enabled by programming H01-01–08 = 17, 18, and 19, respectively. The frequency reference used during inching is determined by B01-17 (Jog Reference).

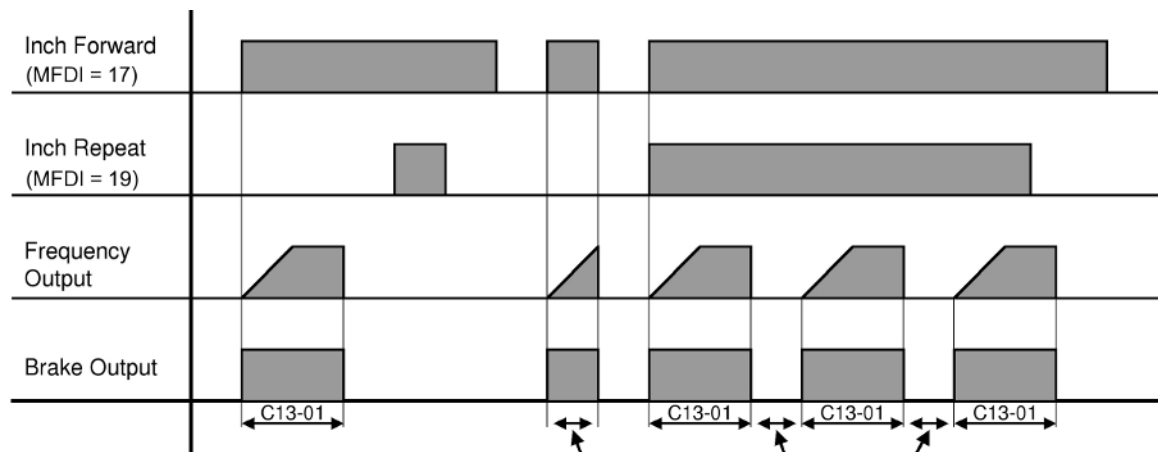


### CAUTION

A directional input is not needed to enable motor torque.

**Table 5-37: Inching Control Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
C13-01	Inch Run Time	Inching Control run time.	0.00–2.55 sec	1.00	G+/VG+
C13-02	Repeat Delay Tim	Inching Control repeat delay time.	0.00–2.55 sec	1.00	G+/VG+



**Figure 5-16: Inching Function and Inching Repeat**

## Index Function

Indexing allows for precise movement of the motor each time a run command is applied by the operator and the Index function is enabled by a Multi-Function Input (H01-xx = 60). This function can only be used with Traverse (A01-03 = 0) and No Load Brake (A01-03 = 2) motions in Flux Vector and any Speed Reference setting for A01-04.

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

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

When the Index function is turned ON, the function can also be programmed to repeat an Index 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 again 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 move is complete, a Multi-Function Output (Index Complete H02-xx = 34) can be programmed to turn ON, and will remain 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 the Index Function is turned ON in Traverse applications, the Index Brake Control (C13-12) can control the action of the brake. The following describes the brake control for each setting:

#### ***Open on Index Command (C13-12 = 0)***

When the Index Function 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 normal operation will resume when the Indexing function is disabled.

#### ***Open on Each Run (C13-12 = 1)***

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

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

### **When Applied in No-Load Brake (NLB) Hoist (A01-03 = 2)**

When the motion is No-Load Brake Hoist and the 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 and the action of the brake is described below in C13-12.

#### ***At Stop***

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

#### ***During Run***

If the motor is in motion when the Index function is turned ON, the drive will decelerate to zero and hold the position in Load Float. After a Run command is applied, the drive 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 the Index function is turned OFF.

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

**NOTE:** When either the Index Enable or Run Command is removed, the stop sequence will be initiated.

**Table 5-38: Index Function Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
C13-03	Index Run Ref	Index frequency Ref. (MFI = 60)	0.01–60.00 Hz	0.10	VG+
C13-04	Index Revs	Index motor revolutions (F01-01 PPR = 1 Rev.)	0–65535 Rev	0**	VG+
C13-05	Index Count	Index fractional motor revolution. 4 pulses = 1 ppr of F01-01	0–65535 Pulses	100**	VG+
C13-06	Index Rpt Delay	Index Repeat Delay Time (Setting of 0.00 disables Index Repeat).	0.00–60.00 sec	0.00	VG+
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 * PG constant PPR + C13-05 -1), which ever is smaller.  1 pulse = 1 ppr of F01-01	0–32767	10	VG+
C13-08	Index Zsv Gain	Index Zero Servo Gain.	0–100	10	VG+
C13-09	Index ASR P Gain	Index ASR P Gain.	0.00–300.00	30.00	VG+
C13-10	Index ASR I Time	Index ASR Integral Time.	0.000–10.000 sec	0.200	VG+
C13-11	Acc/Dec Gain	Index Accel/Decel Rate Gain.	0.0–5.0	1.0	VG+

\*\* If both C13-04 and C13-05 = 0, the Index function is disabled.

Parameter Code	Display	Function	Range	Initial Value	Model
C13-12	Index Brake Ctrl	Configures brake behavior when indexing (traverse only).	TRAV: 0–2 NLB: 0, 2	NLB: 2 else: 0	VG+
	<i>0: Open on Index Command</i>	Brake will open on Index cmd and remain open until Index Cmd is OFF. Drive is in Load Float between runs.			
	<i>1: Open on Each Run</i>	Brake will open on Run cmd and close when run is finished, or after Load Float in NLB.			
	<i>2: Ltch Open on Run</i>	Brake will open on Run cmd and remain open with drive in Load Float until Index is turned off.			

**\*\* If both C13-04 and C13-05 = 0, the Index function is disabled.**

# Tuning

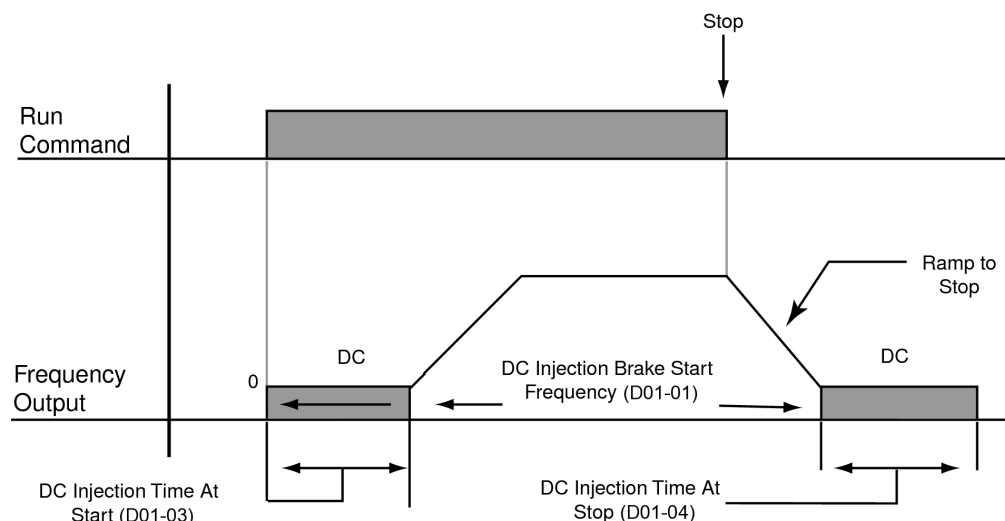
- D1 DC Injection Braking
- D2 Motor Slip Compensation
- D3 Torque Compensation
- D4 Automatic Speed Regulator (ASR) Tuning
- D5 Torque Control
- D8 Dwell Function
- D9 S-Curve Acceleration/Deceleration
- D10 Carrier Frequency
- D11 Hunting Prevention

## DC Injection

With decel to stop enabled (B03-03=0), upon removal of the run command, the IMPULSE®•G+ & VG+ Series 4 drive controls motor deceleration according to the Decel Time setting (B05-02), until output frequency reaches the DC Injection Braking Start Frequency (D01-01 setting). Then the IMPULSE®•G+ & VG+ Series 4 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 5-39: DC Injection Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
D01-01	DCInj Start Freq	DC Injection Braking Frequency Start	0.0–10.0 Hz	0.5
D01-02	DCInj Current	Sets the DC Injection Braking current as a percentage of the drive 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



**Figure 5-17: DC Braking Sequence**



## 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 5-40: Motor Slip Compensation Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
D02-01	Slip Comp Gain	Slip compensation multiplier.	0.0–2.5	V/f: 0.0 OLV: 1.0 FLV: 1.0	G+/VG+
D02-02	Slip Comp Time	Adjusts the slip compensation function delay time,	0–10000 ms	V/f: 2000 OLV: 200	G+
D02-03	Slip Comp Limit	Sets an upper limit for the slip compensation function as a percentage of motor rated slip (E02-02).	0–250%	200	G+/VG+
D02-04	Slip Comp Regen  0 Disabled 1 Enabled >6 Hz 2 Enabled >D02-07	Disabled slip compensation during regeneration.	0–2	0	G+/VG+
D02-05	Output V Lim Sel 0 Disabled 1 Enabled	Automatically reduces motor flux when the output voltage saturates.	0, 1	0	G+/VG+

## Torque Compensation

The motor torque requirement changes according to load conditions. Full-range automatic torque boost adjusts the voltage of the V/f pattern according to the required torque. The IMPULSE®•G+ & VG+ Series 4 automatically adjusts the voltage during constant-speed operation as well as during acceleration.

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

Output voltage  $\propto$  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 inverter and the motor is 100ft. or longer. If the motor generates excessive vibration or oscillates, decrease the torque compensation.

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

- Inverter fault trips 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.

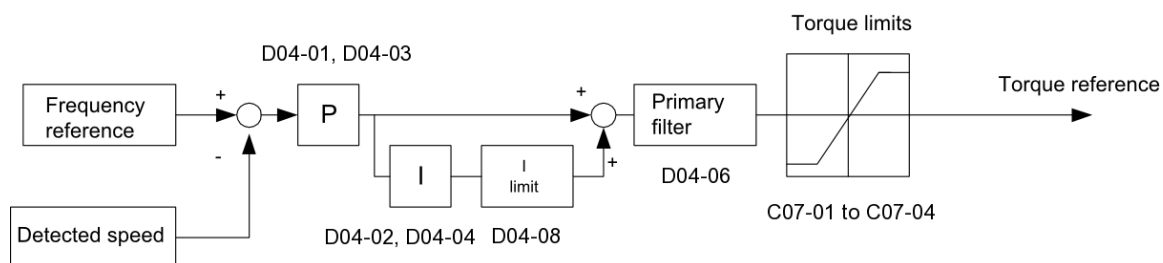
Parameter Code	Display	Function	Range	Initial Value	Model
D03-01	Torq Comp Gain	Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque.	0.00–2.50	1.0*	G+
D03-02	Torq Comp Time	Sets the torque compensation filter time.	0–60000 ms	V/f: 200 OLV: 20	G+
D03-03	F TorqCmp@start	Sets torque compensation at forward start as a percentage of motor torque.	0.0–200.0%	0.0	G+
D03-04	R TorqCmp@start	Sets torque compensation at reverse start as a percentage of motor torque.	-200.0–0.0%	0.0	G+
D03-05	TorqCmp Delay T	Sets the time constant for torque compensation at forward start and reverse start (C04-03 and C04-04).	0–200 ms	10	G+
D03-06	Start Torq Time	Sets the torque compensation time	0–10000 ms	150	G+

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

## Automatic Speed Regulator (ASR) Tuning

The ASR controls the motor speed in V/F with PG and FLV control modes and adjusts the output frequency (V/F w/PG) or torque reference (FLV) 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 FLV**

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.

### Adjusting the ASR Parameters in FLV

The drive is preset to use ASR settings D04-01/02 over the entire speed range in FLV. If required by the application, a second set of ASR parameters (D04-03/04) can be automatically activated depending on the motor speed or by using a digital input. Refer to as described in D04-01/D04-02 and D04-03/D04-04 on page 5-57.

Perform the following steps for adjusting ASR parameters:

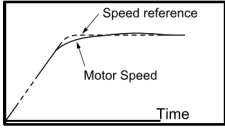
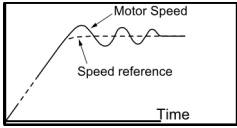
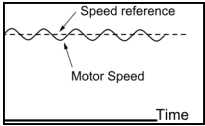
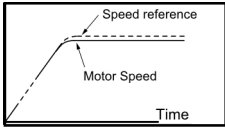
1. Run the motor at zero speed and increase the ASR gain (D04-01) as much as possible without oscillation.
2. Run the motor at zero speed and decrease the ASR integral time (D04-02) as much as possible without oscillation.
3. Run at the normal operating speed. Check for over/undershoot when changing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

### **Solving Problems During ASR Setup**

Use Table 5-40 when making adjustments to ASR.

**Table 5-41: ASR Setup Problems and Corrective Actions**

Problem		Possible Solutions
Slow response to speed changes or speed deviation lasts for too long		<ul style="list-style-type: none"> <li>• Increase the ASR gain.</li> <li>• Decrease the integral time.</li> </ul>
Overshoot or undershoot at the end of acceleration or deceleration		<ul style="list-style-type: none"> <li>• Decrease the ASR gain.</li> <li>• Increase the integral time.</li> </ul>
Vibration and oscillation occur at constant speed		<ul style="list-style-type: none"> <li>• Decrease the ASR gain.</li> <li>• Increase the integral time.</li> <li>• Increase the ASR delay time (D04-06).</li> </ul>
The motor slip is not fully compensated when running in V/F Control with PG		<ul style="list-style-type: none"> <li>• Check the pulse number set to F01-01 and the gear ratio in F01-04 and F01-05.</li> <li>• Make sure the pulse signal from the encoder is set up properly</li> <li>• Check monitor U6-04 and determine if the ASR is working at its output limit (setting of D04-05). If the ASR is at the output limit, increase D04-05.</li> </ul>
Integral operation is enabled in V/F Control with PG (D04-09 = 1) and over/undershoot occurs when changing speed	--	<ul style="list-style-type: none"> <li>• Decrease the ASR gain.</li> <li>• Increase the integral time.</li> <li>• Reduce the ASR output limit set in D04-05.</li> </ul>
Oscillation at low speed and response is too slow at high speed (or vice versa)	--	<ul style="list-style-type: none"> <li>• 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.</li> </ul>

**Table 5-42: ASR Tuning Parameter Settings**

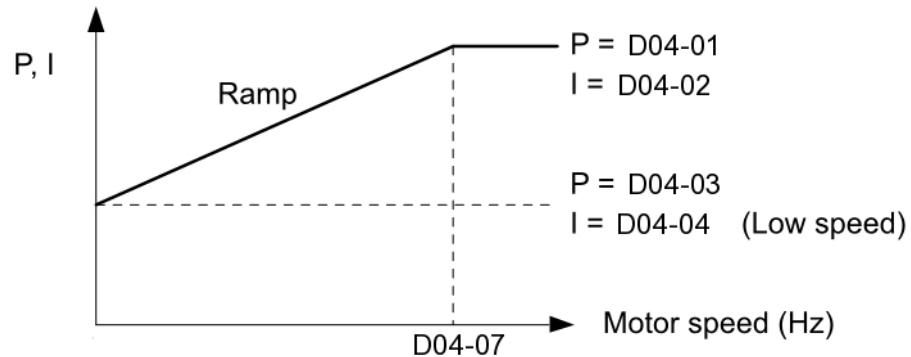
Parameter Code	Display	Function	Range	Initial Value
D04-01	ASR P Gain 1	Sets the proportional gain of the speed control loop (ASR).	0.00–300.00	G+: 0.00 VG+: 20.00
D04-02	ASR I Time 1	Sets the integral time of the speed control loop (ASR).	0.000–10.000 sec	0.100
D04-03	ASR P Gain 2	Sets the speed control gain 2 of the speed control loop (ASR).	0.00–300.00	G+: 0.00 VG+: 20.00
D04-04	ASR I Time 2	Sets the integral time 2 of the speed control loop (ASR).	0.000–10.000 sec	G+: 0.000 VG+: 0.500
D04-06	ASR Delay Time	ASR Output Primary Delay Time.	0.000–0.500 sec	G+: 0.000 VG+: 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	Proportional Gain at start	0.00–300.00	0.10
D04-37	NLB Strt ASR DIy	Proportional Gain at start	0.00–2.55	0.50

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

**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.*

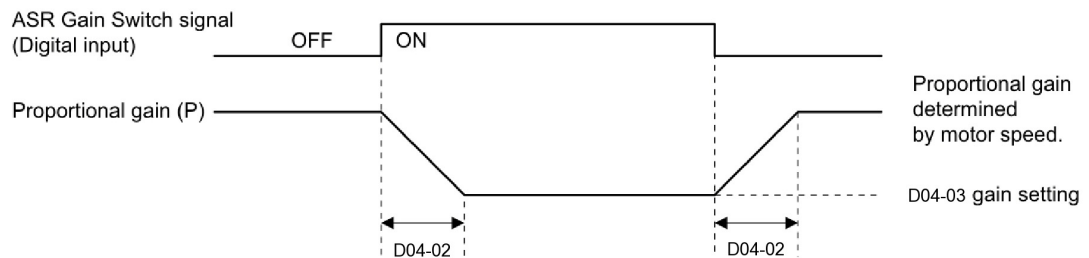
## Flux Vector (FLV)

Parameters D04-03 and D04-04 define the ASR gain and 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 to 0.0 as the default so that D04-01 and D04-02 are used over the entire speed range.



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

The gain set in D04-07 can also be activated with a digital input programmed to “ASR gain switch” (H01-xx = 37). When the terminal is open, the drive uses the ASR gain level set by the pattern in the figure above. When the terminal closes, D04-03 is used. The integral time set to D04-02 is used to change linearly between these settings. The ASR gain switch command from a multi-function input terminal overrides the switching frequency set to D04-07.



**Figure 5-20: ASR Proportional Gain Switch**

## 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 5-43: Torque Control Parameter Settings**

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

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

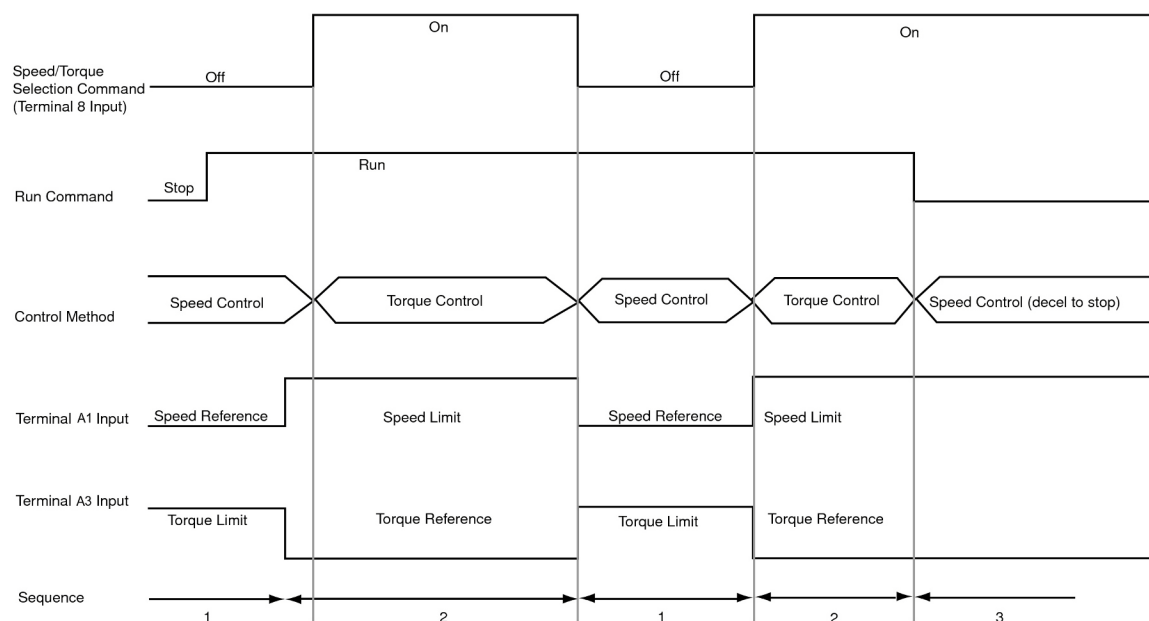
**NOTE:** Speed/torque control selection can also be made by using a multi-function input select (H01-xx = 34 speed-torque control changeover).

## Speed/Torque Control Switching

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

**Table 5-44: Speed/Torque Control Switch Parameters**

Terminal Number	Parameter Number	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 contact 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 to "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) is set to "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).

**NOTE:** *The control mode actually changes after the speed/torque control selection command changes and the reference delay timer (D05-06) elapses. The speed reference/speed limit and the torque limit/torque reference are stored in the inverter until the time set to D05-06 elapses.*

## S-Curve Acceleration/Deceleration

An S-Curve pattern is used to reduce shock and provide smooth transitions during machine acceleration and deceleration. S-Curve characteristic time is the time from the output frequency to the set accel/decel time. See S-Curve Characteristic timing diagrams below and on the following page.

**Table 5-45: S-Curve Acceleration/Deceleration Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
D09-01	S-Crv Acc @ Start	Sets the S-Curve at the beginning of the Accel time.	0.00–10.00 sec	0.20*
D09-02	S-Crv Acc @ End	Sets the S-Curve at the end of the Accel time.	0.00–10.00 sec	0.20*
D09-03	S-Crv Dec @ Start	Sets the S-Curve at the beginning of the Decel time.	0.00–10.00 sec	0.20*
D09-04	S-Crv Dec @ End	Sets the 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 4-5, 4-6, or 4-7).

The figure below shows FWD/REV run switching during deceleration to stop. The S-curve function will add time to the acceleration and deceleration. Time to accelerate from the minimum frequency to the maximum frequency (total acceleration) is:

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

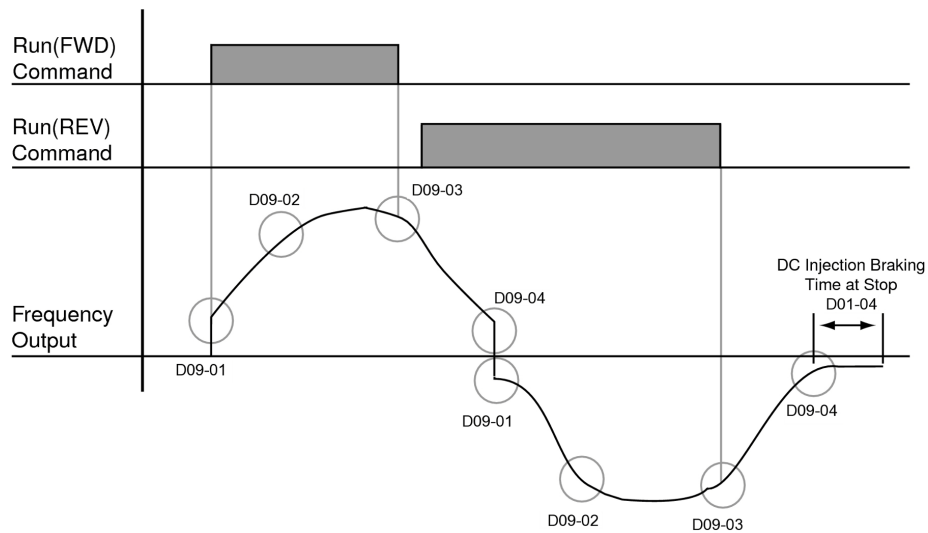
Time to decelerate from the maximum frequency to the minimum frequency (total deceleration) is:

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



**CAUTION**

CAUTION Accel/Decel times will be extended.



**Figure 5-22: S-Curve Characteristics—FWD/REV Operation**

## Carrier Frequency

The Carrier Frequency group provides the ability to modify the drive's output carrier frequency and drive overload level.



### CAUTION

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

**Table 5-46: Carrier Frequency Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
D10-01	Heavy/NormalDuty	Constant Torque/Variable Torque Selection	0, 1	0
		0 Heavy Duty		
		1 Normal Duty		

Parameter Code	Display	Function	Range	Initial Value
D10-02	CarrierFreq Sel	Carrier Frequency Selection 1 $F_c = 2.0 \text{ kHz}$ 2 $F_c = 5.0 \text{ kHz}$ 3 $F_c = 8.0 \text{ kHz}$ 4 $F_c = 10.0 \text{ kHz}$ 5 $F_c = 12.5 \text{ kHz}$ 6 $F_c = 15.0 \text{ kHz}$ 7 <i>Swing PWM1</i> 8 <i>Swing PWM2</i> 9 <i>Swing PWM3</i> A <i>Swing PWM4</i> <i>B to E No setting possible</i> F <i>User defined (determined by D10-03 through D10-05)</i>	1–9, A, F	1
D10-03	CarrierFreq Max	Determines the carrier frequency upper limit.	1.0–15.0 kHz	2.0
D10-04	CarrierFreq Min	Determines the carrier frequency lower limit (V/F Control only). In OLV, D10-03 determines the upper limit of the carrier frequency.	1.0–15.0 kHz	2.0
D10-05	CarrierFreq Gain	Carrier Frequency Gain (V/F Control only).	0–99	0

## Hunting Prevention

Occasionally, in an application, 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 set value of D11-02 when hunting is present while driving a light load. Decrease the set value of D11-02 when the motor vibrates or stalls while driving a heavy load.

**Table 5-47: Hunting Prevention Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Control Method	Model
D11-01	Hunt Prev Select	Enable/Disable Hunt Prevention function <i>0 Disabled</i> <i>1 Enabled</i>	0, 1	1	V/f	G+
D11-02	Hunt Prev Gain	Hunting Prevention Gain	0.00–2.50	1.00	V/f	G+
D11-03	Hunt Prev Time	Hunting Prevention Time Constant	000–500ms	10	V/f	G+
D11-05	Hunt Prev G Rvs	Reverse Hunting Prevention Gain	0.00–2.50	0.00	V/f	G+

# Motor Parameters

- E1 V/F Pattern 1
- E2 Motor Set-up

## Voltage/Frequency Pattern

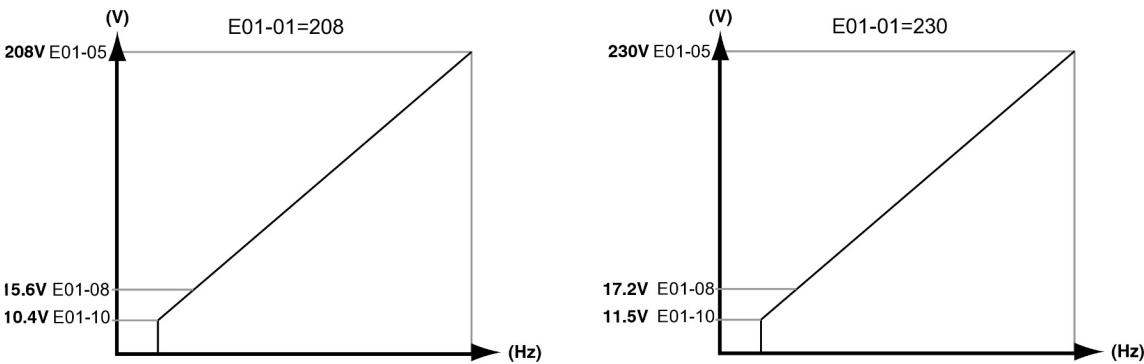


### WARNING

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

**Table 5-48: V/f Pattern Parameter**

Parameter Code	Display	Function	Range	Initial Value
E01-01	Input Voltage	Sets input voltage	230V: 155–255 VAC	230
			460V: 310–510 VAC	460
			575V: 446–733 VAC	575



**Figure 5-23: Example V/f Patterns**

**NOTE:** When using flux vector control mode, the V/F pattern voltage values will be adjusted by the Auto-Tuning function.

The setting E01-01 sets the maximum and base voltage used by preset V/F patterns (E01-03 = 0 to E), and adjusts the levels of drive protective features (e.g. Overvoltage, braking resistor turn-on, stall prevention, etc).

**Table 5-49: DC Bus Regulation**

Inverter Voltage	E01-01 Setting	Overvoltage Trip		Braking Transistor		Stall Level
		Trip	Reset	On	Off	
230	155–255	410 V	380V	380V	375V	380V
460	≥400	820 V	760V	760V	750V	760V
460	<400	740 V	680V	660V	650V	670V
575	≥500 V	1040 V	990V	990V	970V	960V
575	<500 V	990 V	940V	860V	840V	830V

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

**Table 5-50: V/F Parameters**

Parameter Code	Display	Function	Range	Initial Value
E01-03	V/F Selection	Motor V/F selection	V/F: 0–9, A–F, FF OLV: F, FF	*
	0 60 Hz, Level 0	(Default for A01-03 = 0 (Traverse), A01-03 = 4 (Braketronic))		
	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 (MLB Hoist))		
	5 60 Hz, Level 5			
	6 60 Hz, Level 6			
	7 60 Hz, Level 7			
	8 60 Hz, Level 8			
	9 72 Hz, Level 0			
	A 72 Hz, Level 1			
	B 72 Hz, Level 2			
	C 90 Hz, Level 0			
	D 90 Hz, Level 1			
	E 90 Hz, Level 2			
	F Custom V/F, E01-04 through E01-13 settings define the V/F pattern, (Default for A01-03 = 2 (NLB)). When A01-03 = 0, 1, 3, or 4 and E01-03 is changed to 0F, the values for E01-04 through E01-13 are the same as E01-03 = 4. See V/F tables for appropriate voltage			
	FF Custom with no lower limits on E01-xx.			
E01-04	Max Frequency	Maximum Frequency	40.0–150.0 Hz	60.0
E01-05	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
E01-06	Base Frequency	Motor Base Frequency (FA)	0.0–150.0 Hz	Determined by E01-03

*\* Initial value determined by X-Press Programming (Tables 4-5, 4-6, and 4-7).*

Parameter Code	Display	Function	Range	Initial Value
E01-07	Mid Frequency A	Motor Middle output frequency (FB)	0.0–150.0 Hz	Determined by E01-03
E01-08	Mid Voltage A	Motor Middle output frequency Voltage (VC)	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 Frequency (FMIN)	0.0–150.0 Hz	Determined by E01-03
E01-10	Min Voltage	Motor Minimum output frequency Voltage (VMIN)	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 (Tables 4-5, 4-6, and 4-7).



**Table 5-51: Voltage/Frequency (V/f) Pattern Options (230 V)**

<b>E01-03=</b>	<b>E01-04</b>	<b>E01-05*<sup>3</sup></b>	<b>E01-06</b>	<b>E01-07</b>	<b>E01-08</b>	<b>E01-09</b>	<b>E01-10</b>	<b>E01-11</b>	<b>E01-12</b>	<b>E01-13</b>
0*	60 Hz	230 V	60 Hz	3.0 Hz	15.0 V	1.3 Hz	8.1 V	0.0 Hz	0.0 V	230 V
1	60 Hz	230 V	60 Hz	3.0 Hz	16.1 V	1.3 Hz	9.2 V	0.0 Hz	0.0 V	230 V
2	60 Hz	230 V	60 Hz	3.0 Hz	17.3 V	1.3 Hz	10.4 V	0.0 Hz	0.0 V	230 V
3	60 Hz	230 V	60 Hz	3.0 Hz	18.4 V	1.3 Hz	11.5 V	0.0 Hz	0.0 V	230 V
4* <sup>1</sup>	60 Hz	230 V	60 Hz	3.0 Hz	19.6 V	1.3 Hz	12.7 V	0.0 Hz	0.0 V	230 V
5	60 Hz	230 V	60 Hz	3.0 Hz	20.7 V	1.3 Hz	13.8 V	0.0 Hz	0.0 V	230 V
6	60 Hz	230 V	60 Hz	3.0 Hz	21.9 V	1.3 Hz	15.0 V	0.0 Hz	0.0 V	230 V
7	60 Hz	230 V	60 Hz	3.0 Hz	23.0 V	1.3 Hz	16.1 V	0.0 Hz	0.0 V	230 V
8	60 Hz	230 V	60 Hz	3.0 Hz	24.2 V	1.3 Hz	17.3 V	0.0 Hz	0.0 V	230 V
9	72 Hz	230 V	60 Hz	3.0 Hz	16.1 V	1.3 Hz	9.2 V	0.0 Hz	0.0 V	230 V
A	72 Hz	230 V	60 Hz	3.0 Hz	17.8 V	1.3 Hz	10.9 V	0.0 Hz	0.0 V	230 V
B	72 Hz	230 V	60 Hz	3.0 Hz	19.6 V	1.3 Hz	12.7 V	0.0 Hz	0.0 V	230 V
C	90 Hz	230 V	60 Hz	3.0 Hz	16.1 V	1.3 Hz	9.2 V	0.0 Hz	0.0 V	230 V
D	90 Hz	230 V	60 Hz	3.0 Hz	17.8 V	1.3 Hz	10.9 V	0.0 Hz	0.0 V	230 V
E	90 Hz	230 V	60 Hz	3.0 Hz	19.6 V	1.3 Hz	12.7 V	0.0 Hz	0.0 V	230 V
F	60 Hz	230 V	60 Hz	3.0 Hz	19.6 V	1.3 Hz	12.7 V	0.0 Hz	0.0 V	230 V
FF	60 Hz	230 V	60 Hz	3.0 Hz	19.6 V	1.3 Hz	12.7 V	0.0 Hz	0.0 V	230 V
FF (FLV only)* <sup>2</sup>	60 Hz	230 V	60 Hz	0.0 Hz	0.0 V	0.0 Hz	0.0 V	0.0 Hz	0.0 V	230 V

\*Default for Traverse Motion/Braketronic

\*1 Default for Standard Hoist Motion

\*2 Default for No-Load Brake

\*3 Initial value is dependent on drive size, which is determined by O02-04 (kVA Selection)

**Table 5-52: Voltage/Frequency (V/f) Pattern Options (460 V)**

<b>E01-03=</b>	<b>E01-04</b>	<b>E01-05*<sup>3</sup></b>	<b>E01-06</b>	<b>E01-07</b>	<b>E01-08</b>	<b>E01-09</b>	<b>E01-10</b>	<b>E01-11</b>	<b>E01-12</b>	<b>E01-13</b>
0*	60	460 V	60 Hz	3.0 Hz	29.9 V	1.3 Hz	16.1 V	0.0 Hz	0.0 V	460 V
1	60	460 V	60 Hz	3.0 Hz	32.2 V	1.3 Hz	18.4 V	0.0 Hz	0.0 V	460 V
2	60	460 V	60 Hz	3.0 Hz	34.5 V	1.3 Hz	20.7 V	0.0 Hz	0.0 V	460 V
3	60	460 V	60 Hz	3.0 Hz	36.8 V	1.3 Hz	23.0 V	0.0 Hz	0.0 V	460 V
4* <sup>1</sup>	60	460 V	60 Hz	3.0 Hz	39.1 V	1.3 Hz	25.3 V	0.0 Hz	0.0 V	460 V
5	60	460 V	60 Hz	3.0 Hz	41.4 V	1.3 Hz	27.6 V	0.0 Hz	0.0 V	460 V
6	60	460 V	60 Hz	3.0 Hz	43.7 V	1.3 Hz	29.9 V	0.0 Hz	0.0 V	460 V
7	60	460 V	60 Hz	3.0 Hz	46.0 V	1.3 Hz	32.2 V	0.0 Hz	0.0 V	460 V
8	60	460 V	60 Hz	3.0 Hz	48.3 V	1.3 Hz	34.5 V	0.0 Hz	0.0 V	460 V
9	72	460 V	60 Hz	3.0 Hz	32.2 V	1.3 Hz	18.4 V	0.0 Hz	0.0 V	460 V
A	72	460 V	60 Hz	3.0 Hz	35.7 V	1.3 Hz	21.9 V	0.0 Hz	0.0 V	460 V
B	72	460 V	60 Hz	3.0 Hz	39.1 V	1.3 Hz	25.3 V	0.0 Hz	0.0 V	460 V
C	90	460 V	60 Hz	3.0 Hz	32.2 V	1.3 Hz	18.4 V	0.0 Hz	0.0 V	460 V
D	90	460 V	60 Hz	3.0 Hz	35.7 V	1.3 Hz	21.9 V	0.0 Hz	0.0 V	460 V
E	90	460 V	60 Hz	3.0 Hz	39.1 V	1.3 Hz	25.3 V	0.0 Hz	0.0 V	460 V
F	60	460 V	60 Hz	3.0 Hz	39.1 V	1.3 Hz	25.3 V	0.0 Hz	0.0 V	460 V
FF	60	460 V	60 Hz	3.0 Hz	39.1 V	1.3 Hz	25.3 V	0.0 Hz	0.0 V	460 V
FF (FLV only)* <sup>2</sup>	60 Hz	460 V	60 Hz	0.0 Hz	0.0 V	0.0 Hz	0.0 V	0.0 Hz	0.0 V	460 V

\*Default for Traverse Motion/Braketronic

\*1 Default for Standard Hoist Motion

\*2 Default for No-Load Brake

\*3 Initial value is dependent on drive size, which is determined by O02-04 (kVA Selection)

**Table 5-53: Voltage/Frequency (V/f) Pattern Options (575 V)**

<b>E01-03=</b>	<b>E01-04</b>	<b>E01-05*<sup>3</sup></b>	<b>E01-06</b>	<b>E01-07</b>	<b>E01-08</b>	<b>E01-09</b>	<b>E01-10</b>	<b>E01-11</b>	<b>E01-12</b>	<b>E01-13</b>
0*	60 Hz	575 V	60 Hz	3.0 Hz	37.4 V	1.3 Hz	20.1 V	0.0 Hz	0.0 V	575 V
1	60 Hz	575 V	60 Hz	3.0 Hz	40.3 V	1.3 Hz	23.0 V	0.0 Hz	0.0 V	575 V
2	60 Hz	575 V	60 Hz	3.0 Hz	43.1 V	1.3 Hz	25.9 V	0.0 Hz	0.0 V	575 V
3	60 Hz	575 V	60 Hz	3.0 Hz	46.0 V	1.3 Hz	28.8 V	0.0 Hz	0.0 V	575 V
4* <sup>1</sup>	60 Hz	575 V	60 Hz	3.0 Hz	48.9 V	1.3 Hz	31.6 V	0.0 Hz	0.0 V	575 V
5	60 Hz	575 V	60 Hz	3.0 Hz	51.8 V	1.3 Hz	34.5 V	0.0 Hz	0.0 V	575 V
6	60 Hz	575 V	60 Hz	3.0 Hz	54.6 V	1.3 Hz	37.4 V	0.0 Hz	0.0 V	575 V
7	60 Hz	575 V	60 Hz	3.0 Hz	57.5 V	1.3 Hz	40.3 V	0.0 Hz	0.0 V	575 V
8	60 Hz	575 V	60 Hz	3.0 Hz	60.4 V	1.3 Hz	43.1 V	0.0 Hz	0.0 V	575 V
9	72 Hz	575 V	60 Hz	3.0 Hz	40.3 V	1.3 Hz	23.0 V	0.0 Hz	0.0 V	575 V
A	72 Hz	575 V	60 Hz	3.0 Hz	44.6 V	1.3 Hz	27.3 V	0.0 Hz	0.0 V	575 V
B	72 Hz	575 V	60 Hz	3.0 Hz	48.9 V	1.3 Hz	31.6 V	0.0 Hz	0.0 V	575 V
C	90 Hz	575 V	60 Hz	3.0 Hz	40.3 V	1.3 Hz	23.0 V	0.0 Hz	0.0 V	575 V
D	90 Hz	575 V	60 Hz	3.0 Hz	44.6 V	1.3 Hz	27.3 V	0.0 Hz	0.0 V	575 V
E	90 Hz	575 V	60 Hz	3.0 Hz	48.9 V	1.3 Hz	31.6 V	0.0 Hz	0.0 V	575 V
F	60 Hz	575 V	60 Hz	3.0 Hz	48.9 V	1.3 Hz	31.6 V	0.0 Hz	0.0 V	575 V
FF	60 Hz	575 V	60 Hz	3.0 Hz	48.9 V	1.3 Hz	31.6 V	0.0 Hz	0.0 V	575 V
FF (FLV only)* <sup>2</sup>	60 Hz	575 V	60 Hz	0.0 Hz	0.0 V	0.0 Hz	0.0 V	0.0 Hz	0.0 V	575 V

\*Default for Traverse Motion/Braketronic

\*1 Default for Standard Hoist Motion

\*2 Default for No-Load Brake

\*3 Initial value is dependent on drive size, which is determined by O02-04 (kVA Selection)

## Motor Set-up

E2 constants define motor parameters. Normally, the default settings for E2 constants are determined by kVA selection (O02-04). In flux vector control and open loop vector, the E2 constants 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:

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

Where...  
 $r_t$ : motor terminal resistance  
 $r_p$ : Phase-to-Phase resistance at insulation class temperature  
 $T_i$ : insulation class temperature ( $^\circ C$ )

**Table 5-54: Motor Set-up Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
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 $\Omega$	*
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	Sets the motor mechanical loss as a percentage of motor rated power (HP) for the motor.	0.0–10.0%	0.0
E02-10**	Tcomp Iron Loss	Sets the motor iron loss in Watts for the motor.	0–65535 W	*
E02-11	Rated Horsepower	Rated output	0.0–650.0 HP	*

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

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

# Option Card Parameters

- F1 Encoder (PG-X3) Option Set-up
- F2 Analog Input (AI-A3) Option Set-up
- F4 Analog Output (AO-A3) Option Set-up
- F5 Digital Output (DO-A3 or S4IO) Option Set-up
- F6 Communication Option Card Set-up
- F7 Ethernet Option Card Set-up

## Encoder (PG) Option Set-up

**Table 5-55: Encoder (PG) Option Set-Up Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value	Model
F01-01	PG1 Pulses/Rev	Sets encoder Pulses/Rev for Channel 1	0–60000 ppr	1024	VG+
F01-02	PG1 Rotation Sel 0 FWD = C.C.W. - (B-phase at motor REV. run) 1 FWD = C.W. - (A-phase at motor REV. run)		0, 1	0	VG+
F01-03	PG1 Output Ratio	Sets the division ratio for the pulse monitor used of the PG option card installed to CH1 (port CN5-C).	1–132	1	VG+
$f_{\text{Pulse Input}} = f_{\text{Pulse Output}} * \frac{(1 + n)}{m}$ <p>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).</p> <p>If only using the A pulse for one-track input, the input ratio will be 1:1 regardless of F01-03 setting.</p>					
F01-04	PG1 #Gear Teeth1	Sets the gear ratio between the motor shaft and the encoder (PG). A gear ratio of 1 will be used if F01-04 or F01-05 are set to 0. A gear ratio of 1 will be used if either of these parameters is set to 0.	0–1000	0	VG+
F01-05	PG1 #Gear Teeth2	Sets the gear ratio between the motor shaft and the encoder (PG). A gear ratio of 1 will be used if F01-04 or F01-05 are set to 0. A gear ratio of 1 will be used if either of these parameters is set to 0. This function is not available in Flux Loop Vector Control.	0–1000	0	VG+
F01-06	PGO-1-H	Delay time for PGO-1-H detection. A setting of zero disables PGO-1-H detection.	0–100 ms	15	VG+

Parameter Code	Display	Function	Range	Initial Value	Model
F01-11	PG2 Pulses/Rev	Sets the number of pulses for a PG option card connected to port CN5-B.	0–60000 ppr	1024	VG+
F01-12	PG2 Rotation Sel 0 FWD = C.C.W. - (B-phase at motor REV. run) 1 FWD = C.W. - (A-phase at motor REV. run)		0, 1	0	VG+
F01-13	PG2 #Gear Teeth1	Sets the gear ratio between the motor shaft and the encoder (PG). A gear ratio of 1 will be used if F01-13 or F01-14 are set to 0.	0–1000	0	VG+
F01-14	PG2 #Gear Teeth2	Sets the gear ratio between the motor shaft and the encoder (PG). A gear ratio of 1 will be used if F01-13 or F01-14 are set to 0.	0–1000	0	VG+
F01-15	PG2 Output Ratio		1–132	1	VG+
F01-16	PGO-2-H	Delay time for PGO-2-H detection. A setting of zero disables PGO-2-H detection.	0–100 ms	15	VG+
F01-21	PG Fdbk Loss Sel 0 Decel to Stop 1 Coast to Stop 2 Fast-Stop 3 Alarm Only	Stopping method when PGO-1-H, PGO-2-H, PGO-1-S, or PGO-2-S faults are detected. Decelerate to stop using the deceleration time in B05-02. Decelerate to stop using the deceleration time in B05-08.	Traverse: 0–3 NLB: 1	1	VG+
F01-22	PGO-1-S Det Time	PGO-1-S (CH1) disconnection detection time is set at a unit of second. <b>NOTE:</b> A setting of “0.0” Disables Software PGO-1-S Detection.	0.0–10.0 sec	2.0	VG+
F01-23	PG Overspeed Sel 0 Decel to Stop 1 Coast to Stop 2 Fast-Stop 3 Alarm Only	Sets the stopping method when an overspeed (OS) fault occurs. Decelerate to stop using the deceleration time in B05-02. Decelerate to stop using the deceleration time in B05-08.	Traverse: 0–3 NLB: 1	1	VG+
F01-24	PG Overspd Level	Sets the overspeed detection level as a percentage of the maximum output frequency.	0–120%	105	VG+
F01-25	PG Overspd Time	Sets the time in seconds for an overspeed situation to trigger a fault (oS).	0.0–2.0 sec	0.0	VG+

Parameter Code	Display	Function	Range	Initial Value	Model
F01-26	PG Deviation Sel	Stopping method at excessive speed deviation.	Traverse: 0–7 NLB: 5	5	VG+
	0 @Spd Agree-Decel	Stops by deceleration time 1 - B05-02.			
	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	Sets the speed deviation detection level as a percentage of the maximum output frequency.	0–50%	10	VG+
F01-28	PG Deviate Time	Sets the time in seconds for a speed deviation situation to trigger a fault DEV.	0.0–10.0 sec	0.3	VG+

## Analog Input (AI-A3) Option Set-up

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

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

**Table 5-56: Analog Input Option Parameters**

Parameter Code	Display	Function	Range	Initial Value
F02-01	AI Function Sel	Determines whether the 3-channel input selection is individual or additional. See Table 5-56.	0, 1	0
	0 3ch Individual 1 3ch Addition			
F02-02	AI Input Gain	Sets the gain for the input signal to the analog card.	-999.9–999.9%	100.0
F02-03	AI Input Bias	Sets the bias for the input signal to the analog card.	-999.9–999.9%	0.0

**Table 5-57: Analog Input Option Configuration**

Setting	Function	CH1 (V1 to AC)	CH2 (V2 to AC)	CH3 (V3 to AC)
0	3-channel individual input (factory default)	Substitute for terminals V1 & AC	Substitute for terminals V2 & AC	Substitute for terminals V3 & AC
1	3-channel additional input	Sum of CH1 to CH3 input values is used as the frequency reference value		

## Analog Output (AO-A3) Option Set-up

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

**Table 5-58: Analog Output Option Set-Up Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
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 (Same as F04-01)	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 0 0-10V DC 1 -10-10V DC	Channel 1 output signal	0, 1	0
F04-08	AO Opt Level Ch2 0 0-10V DC 1 -10-10V DC	Channel 2 output signal	0, 1	0

**Table 5-59: Parameter Settings for F04-01 and F04-03**

Display	Display
0 Not Used	184 NLB State
31 Not Used	185 NLB Rel Trq
102 Output Freq	408 Heatsink Temp
103 Output Current	412 CPU Occup Rate
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
144 ASR Out w/o Fil	618 PG1 CounterValue
150 Hook Height	619 PG2 CounterValue
154 Term RP Inp Freq	622 Zero Servo Pulse
163 PG CH1 Freq	626 FF Cont Output
164 PG CH2 Freq	627 FF Estimate SPD
165 PG Output Freq	--



## Digital Output (DO-A3) Option Set-up

Selects the multi-function output settings for channels 1 through 8 of the DO-A3 option card.

**Table 5-60: Digital Output Set-Up Parameter Settings**

Parameter Code	Display	Terminal Designation		Range	Initial Value
		DO-A3	S4IO		
F05-01*	DO Ch1 Select	P1-PC	O1-O2	0–148	F
F05-02*	DO Ch2 Select	P2-PC	O3-O2	0–148	F
F05-03*	DO Ch3 Select	P3-PC	O4-O5	0–148	F
F05-04*	DO Ch4 Select	P4-PC	O6-O5	0–148	F
F05-05*	DO Ch5 Select	P5-PC	--	0–148	F
F05-06*	DO Ch6 Select	P6-PC	--	0–148	F
F05-07*	DO Ch7 Select	M1-M2	--	0–148	F
F05-08*	DO Ch8 Select	M3-M4	--	0–148	F
F05-09	DO-A3 Selection	Selects how the DO-A3 option card will work with the drive.		0–2	2
	0	8 Ch Individual			
	1	Binary Output			
	2	8 Ch selected			

\* See Table 5-67 for MFDO selections.

Selects the multi-function output selections for the DO-A3 option.

**Table 5-61: DO-A3 Output Mode Selection for IMPULSE®G+ and VG+ Series 4**

Parameter F05-09 setting	Output Type	Terminals	Output Contents			
0	8-Channel Individual (Fixed Data)	TD5 – TD11	OverCurrent (SC, OC, GF)			
		TD6 – TD11	OverVoltage (OV)			
		TD7 – TD11	Drive Overload (OL2, OH, OH1)			
		TD8 – TD11	Fuse Blown (PUF)			
		TD9 – TD11	OverSpeed (OS-1, OS-2)			
		TD10 – TD11	Motor Overload (OL1)			
		TD1 – TD2	Brake Release			
		TD3 – TD4	Limit Switch (UL1, UL2, UL3, LL1 or LL2)			
1	Binary Coded	TD5 – TD11 (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)
		TD6 – TD11 (Bit 1)	0010	OV	1010	oL1
			0011	OL2	1011	BE7
			0100	OH, OH1	1100	UV (ALL)
		TD7 – TD11 (Bit 2)	0101	OS-1, OS-2	1101	DEV-1, DEV-2
			0110	PUF	1110	PGO-1-S PGO-1-H PGO-2-S PGO-2-H
			0111	LF	1111	Not Used
		TD8 – TD11 (Bit 3)				
		TD9 – TD11	Minor Fault (Alarm)			
		TD10 – TD11	Inverter Ready			
		TD1 – TD2	Brake Release			
		TD3 – TD4	Limit Switch (UL1, UL2, UL3, LL1 or LL2)			
2	8-Channel Selectable	TD5 – TD11	F05-01 (See H02-01–03 for output selections)			
		TD6 – TD11	F05-02 (See H02-01–03 for output selections)			
		TD7 – TD11	F05-03 (See H02-01–03 for output selections)			
		TD8 – TD11	F05-04 (See H02-01– 03 for output selections)			
		TD9 – TD11	F05-05 (See H02-01–03 for output selections)			
		TD10 – TD11	F05-06 (See H02-01– 03 for output selections)			
		TD1 – TD2	F05-07 (See H02-01–03 for output selections)			
		TD3 – TD4	F05-08 (See H02-01–03 for output selections)			

## Communication Option Card Set-up

Settings for communication option card SI-P3.

**Table 5-62: Communication Option Card Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
F06-01	Com Bus Flt Sel	Stopping method at communication error.	0–4	1
	0 Decel to Stop			
	1 Coast to Stop			
	2 Fast-Stop			
	3 Use B03-03 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 B03-03			
	4 Alarm Only			
F06-04	Bus Err Det Time	Set the maximum time the drive 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 drive 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 drive is initialized using A01-05.		
	1 No Init Com Prms	Reset all communication-related parameters (F06-xx and F07-xx) when the drive is initialized using A01-05.		
F06-30	PB Node Address	Sets the node address if the Profibus-DP option card is installed	0–125	0

Parameter Code	Display	Function	Range	Initial Value
F06-31	PB Clear Select	Determines the operation when a "Clear Mode" command is received on the Profibus-DP option Card	0, 1	0
	0 <i>Reset to Zero</i>	Resets drive operation with a Clear mode command.		
	1 <i>Hold Prev Value</i>	Maintains the previous operation state when Clear mode command is given.		
F06-32	PB Map Select	Selects the data format used for Profibus-DP communications.	0, 1	0
	0 <i>PPO Type</i>			
	1 <i>Conventional</i>			
F06-35	CO Node Address	Sets the node address if a CANopen option card is installed.	0–126	0
F06-36	CO Baud Rate	Sets the baud rate for the CANopen option card	0–8	6
	0 <i>Auto Detect</i>			
	1 <i>10 kbps</i>			
	2 <i>20 kbps</i>			
	3 <i>50 kbps</i>			
	4 <i>125 kbps</i>			
	5 <i>250 kbps</i>			
	6 <i>500 kbps</i>			
	7 <i>800 kbps</i>			
	8 <i>1 Mbps</i>			
F06-50	DN MAC Address	Sets the MacID address of the DeviceNet option card.	0–64	64
F06-51	DN Baud Rate	Sets the baud rate for the DeviceNet option card.	0–4	4
	0 <i>125 kbps</i>			
	1 <i>250 kbps</i>			
	2 <i>500 kbps</i>			
	3 <i>Set from Network</i>			
	4 <i>Automatic</i>			
F06-52	DN PCA Selection	Sets the format of the data received from the DeviceNet master to the drive.	0–255	21
F06-53	DN PPA Selection	Sets the format of the data sent from the drive to the DeviceNet master.	0–255	71
F06-54	DN Idle Flt Det	Selects whether the drive triggers an EF0 fault when no data is received from the DeviceNet master (such as when the master is idling).	0, 1	0
	0 <i>Enabled</i>			
	1 <i>Disabled</i>	No fault detection		

Parameter Code	Display	Function	Range	Initial Value
F06-55	DN BAUD RATE MEM  0 125 kbps 1 250 kbps 2 500 kbps	Displays the baud rate of the DeviceNet network. (Read Only - Monitor)	0–2	0
F06-56	DN Speed Scale	Sets the scaling factor for the speed monitor in DeviceNet.	-15–15	0
F06-57	DN Current Scale	Sets the scaling factor for the output current monitor in DeviceNet.	-15–15	0
F06-58	DN Torque Scale	Sets the scaling factor for the torque monitor in DeviceNet.	-15–15	0
F06-59	DN Power Scale	Sets the scaling factor for the power monitor in DeviceNet.	-15–15	0
F06-60	DN Voltage Scale	Sets the scaling factor for the voltage monitor in DeviceNet.	-15–15	0
F06-61	DN Time Scale	Sets the scaling factor for the time monitor in DeviceNet.	-15–15	0
F06-62	DN Heart Beat	Sets the heartbeat interval for DeviceNet communications. A setting of 0 disables the heartbeat.	0–10	0
F06-63	DN MAC ID MEM	Displays the DeviceNet MacID assigned to the drive (Read Only - Monitor).	0–63	0

## Ethernet Option Card Set-up (Ethernet IP & Modbus TCP/IP)

Settings for communication option cards SI-EN3 and SI-EM3.

**Table 5-63: Communication Option Card Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
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

Parameter Code	Display	Function	Range	Initial Value
F07-13	IP Add Mode Sel  0 Static 1 BOOTP 2 DHCP	Sets how the option card IP Address is set at start up	0–2	2
F07-14	Duplex Select  0 Half duplex 1 Auto Negotiate 2 Full Duplex	Sets how the communication between host/client will be determined	0–2	1
F07-15	Baud Rate  10 10 Mbps 100 100 Mbps	Sets the communication speed for the option card.	10–100 mbps	10
F07-16	CommLoss Tout	Sets the time-out value for communication loss detection in tenths of a second. A value of 0 disables the connection time-out. Example: an entered value of 100 represents 10.0 seconds.	0–300 deciseconds	0

# Terminal Parameters

- H1 Digital Inputs
- H2 Digital Outputs
- H3 Analog Inputs
- H4 Analog Outputs
- H5 Serial Communication Set-up
- H6 Pulse Input/Output

## Digital Inputs

The IMPULSE®•G+ & VG+ Series 4 has eight multi-function contact inputs for the set-up of numerous functions. The following table lists the function selections for the multi-function contact inputs (terminals S1 to S8) and indicates the control modes during which each function can be enabled. An OPE03 error will occur if a function is programmed in more than one terminal at the same time.

**Table 5-64: Digital Inputs Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
H01-01	Term S1 Select	Selects the multi-function inputs. Reference Table 5-65	0–81	80 (FWD)
H01-02	Term S2 Select	Reference Table 5-65	0–81	81 (REV)
H01-03	Term S3 Select	Reference Table 5-65	0–81	*
H01-04	Term S4 Select	Reference Table 5-65	0–81	*
H01-05	Term S5 Select	Reference Table 5-65	0–81	*
H01-06	Term S6 Select	Reference Table 5-65	0–81	*
H01-07	Term S7 Select	Reference Table 5-65	0–81	*
H01-08	Term S8 Select	Reference Table 5-65	0–81	*
H01-14	Alt Ref Override	Alternate Frequency Reference Override. When enabled, and an input of H01-xx = 1F is true, 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 (Tables 4-5, 4-6, and 4-7).

**Table 5-65: Multi-Function Digital Inputs (MFDI) selectable for H01-0x and C09-0x**

Display	Function
00 Multi-Step Ref 2	Multi-Step Reference 2 (Use w/ H03-14 to Enable Analog terminal Selection)
01 Multi-Step Ref 3	Multi-Step Reference 3 (Use w/ H03-14 to Enable Analog Terminal Selection)
02 Multi-Step Ref 4	Multi-Step Reference 4
03 Multi-Step Ref 5	Multi-Step Reference 5
04 Speed Hold 2	Speed Hold 2 (2nd Step of Three-Step Infinitely Variable)
05 Accel Command	Accel Command (2nd Step of Two-Step Infinitely Variable or 3rd Step of Three-Step Infinitely Variable)

<b>Display</b>	<b>Function</b>
06 Upper Lmt 1 N.O.	Upper Limit - Slow Down; Normally Open. UL1 - blinking
07 Upper Lmt 2 N.O.	Upper Limit - Stop; Normally Open. UL2 - blinking
08 Lower Lmt 1 N.O.	Lower Limit - Slow Down; Normally Open. LL1 - blinking
09 Lower Lmt 2 N.O.	Lower Limit - Stop; Normally Open. LL2 - blinking
0A Upper Lmt 1 N.C.	Upper Limit - Slow Down; Normally Closed. UL1 - blinking
0B Upper Lmt 2 N.C.	Upper Limit - Stop; Normally Closed. UL2 - blinking
0C Lower Lmt 1 N.C.	Lower Limit - Slow Down; Normally Closed. LL1 - blinking
0D Lower Lmt 2 N.C.	Lower Limit - Stop; Normally Closed. LL2 - blinking
0E M-Speed Gain 1	Micro-Speed positioning control multiplier 1. Gain is set by parameter C02-01. (Has Priority over MS 2)
0F Not Used	No function - Terminal is disabled.
10 M-Speed Gain 2	Micro-Speed positioning control multiplier 2. Gain is set by parameter C02-02.
11 Load Float 1	Load Float Hold - When input during run, Load Float will remain On infinitely - Fref is held at 0 while MFI is ON.
12 Weight Lmt N.C.	Weighted Upper Limit - UL3. Stopping Method determined by C03-08.
13 SwiftLift Enable UltraLift Enable	Ultra/Swift Lift Enable (C06-01 = 2). Not Available for Traverse Motion.
14 Alt T-Lim Gain	Alternate Torque Limit Gain - C07-05. Use when Load Testing a Hoist. (Internal T-Lim* C07-05)
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 If Closed = Digital
1F Run/Ref Src 1/2	Run / Ref Source 2 Switch - Closed = Run / Fref Selection from B03-15 / B03-16, else B03-01/B03-02
20 through 2F	External Fault (Desired setting is possible.) Input mode: N.O. / N.C., Detection mode: Always / During run. See External Fault Selection (Table 5-71)
30 Program Lockout	Closed: Parameters enabled to write; Open: Parameters disabled to write other than freq. reference (U01-01).
31 Local/Remote Sel	Local / Remote Changeover. Closed = Local
32 Ext BaseBlk N.O.	N.O.: Baseblock by ON.
33 Ext BaseBlk N.C.	N.C.: Baseblock by OFF.
34 Spd/Trq Chngover	Speed / Torque Control Changeover (ON: Torque Control)
35 Load Float 2	Zero Servo initiated. Manual Load Float Timed by C04-01. (Stop Method must be No Load Brake)
36 Polarity Rev	Polarity Reversing command for External Torque Control. Closed = 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.



<b>Display</b>	<b>Function</b>
39 OH2 Alarm Signal	External OH2 - Inverter overheat prediction (OH2 is shown by ON.) (Alarm Only)
3A MFAI Enable	When closed, the terminals specified in H03-14 are enabled. When open, the drive disregards the input signal to the analog terminals. The terminals that are not set in H03-14 to be enabled by this feature will always be enabled.
3F Fault Reset	Reset by ON.
43 Timer Function	Function settings by C12-03, C12-04. It is set with timer function output [Multi-Function Output]
47 Ref Sample Hold	Analog frequency reference Sample / Hold.
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 in upper right hand corner of LCD when drive is ready.
56 Klixon N.O.	When Closed, Reset run command, use stopping method B03-03, display KLX - Klixon Alarm on Keypad
57 Klixon N.C.	When Open, Reset run command, use stopping method B03-03, display KLX - Klixon Alarm on Keypad
58 Brake Answerback	Generates BE0, BE4, BE5, BE7 alarm or fault conditions only when programmed to MFI. (C08-04, C08-11)
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. (Combination of MFI "E" and "5D" ON)
5F Phantom Flt N.C.	Phantom Fault N.C. - Stops motion based C03-09 but does not change Keypad display. RUN L.E.D. on JVOP Blinks.
60 Index Enable	Enables indexing function (Hidden when B03-03 = 1 Coast to Stop)
61 Brake Test	Motor pushes against brake up to programmable torque setting C08-24 at programmable 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.	Stops motion based C03-10 but does not change Keypad display. RUN L.E.D. on JVOP Blinks.
65 Dwell Enable	Enables / Disables Dwell Function. When H01-0x = 65, OFF = Disabled.
66 Load Share	Load Share - Enables / Disabled Load Sharing.
67 Hook Height Home	Used w/ C03-14 - Height Measurement function.
69 LC Bypass N.O.	Disables Load Check and clears any LC Faults.
6A LC Bypass N.C.	Disables Load Check and clears any LC Faults.
70 Torque Detect	When H01-0x = 70, Overtorque / Undertorque detection is enabled and disabled by MFDI. When the input is closed, Overtorque / Undertorque detection is enabled.
73 LL2/UL2 Bypass	Bypass Limit MFDI and EPLS
74 LL/UL Bypass	Bypass MFDI and EPLS
80 Run FWD	Forward/Up Run Command
81 Run REV	Reverse/Down Run Command

## Digital Outputs

The IMPULSE®•G+ & VG+ Series 4 has three built-in multi-function digital outputs for indicating various conditions. Drive digital output capabilities can be increased with the installation of an S4IO or DO-A3 option card. The following table lists the function selections for the multi-function contact outputs and indicates the control modes during which each function can be enabled.

**Table 5-66: Digital Outputs Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
H02-01	Term M0-M1 Sel	Digital Output 1 Function (Reference Table 5-67)	0–1FF	*
H02-02	Term M2-M3 Sel	Digital Output 2 Function (Reference Table 5-67)	0–1FF	*
H02-03	Term M5-M6 Sel	Digital Output 3 Function (Reference Table 5-67)	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 (Tables 4-5, 4-6, and 4-7).

**Table 5-67: Multi-Function Digital Outputs (MFDO) selectable for H02-0x and F05-0x**

Display	Function
0 Brake Release*	ON/CLOSED: When the drive is outputting either voltage or frequency OFF/OPEN: When the drive is <b>not</b> outputting either voltage or frequency
1 Zero Speed*	ON/CLOSED: When Motor Speed < B01-01 or E01-09
2 Fref/Fout Agree1	ON/CLOSED: When the output frequency or motor speed is within the frequency reference range $\pm L04-02$ OFF/OPEN: When the output frequency or motor speed is <b>not</b> within the frequency reference range $\pm L04-02$
3 Fref/Set Agree 1	ON/CLOSED: When output frequency and frequency are both within $L04-01 = \pm L04-02$ OFF/OPEN: When output frequency and frequency are <b>not</b> both within $L04-01 = \pm L04-02$
4 Freq Detect	ON/CLOSED: When the output frequency or motor speed is < $L04-01$ or > $L04-01 + L04-02$ OFF/OPEN: When the output frequency or motor speed is > $L04-01 + L04-02$
5 Freq Detect 2	ON/CLOSED: When the output frequency or motor speed is > $L04-01$ OFF/OPEN: When the output frequency or motor speed is < $L04-01 - L04-02$ or > $L04-01$
6 Inverter Ready*	ON/CLOSED: After the drive has performed initialization process and no faults or programming mode is detected
7 DC Bus Undervolt*	ON/CLOSED: When the DC Bus voltage falls below the trip level set in L02-05
8 BaseBlock	ON/CLOSED: During BaseBlock - No Voltage output OFF/OPEN: When drive is not in a BaseBlock state - Voltage Output

\* This output does not have an inverse output

\*\* Contact will open when power is disconnected

Display	Function
9 Operator Ref	ON/CLOSED: When frequency reference is from the operator OFF/OPEN: When frequency reference is <b>not</b> from the operator (i.e. external terminals)
B Trq Det 1 N.O.	ON/CLOSED: When the output current/torque exceeds the value set in parameter L06-02 for longer than the time set in parameter L06-03. OFF/OPEN: When the output current/torque does <b>not</b> exceed the value set in parameter L06-02 for longer than the time set in parameter L06-03.
D DB Overheat	ON/CLOSED: When the drive displays an "RH" or "RR" fault OFF/OPEN: When the drive is <b>not</b> in an "RH" or "RR" fault condition
E Fault	ON/CLOSED: When the drive is in a fault condition (excluding CPF00 and CPF01) OFF/OPEN: When the drive is <b>not</b> in a fault condition
F Not Used*	(No Function) Does not trigger any function in the drive, but does allow for status to be read via option card or MEMOBUS/Modbus communications.
10 Minor Fault	ON/CLOSED: When the drive is in a minor fault condition OFF/OPEN: When the drive is <b>not</b> in a minor fault condition
11 Reset Cmd Active	ON/CLOSED: When there is a reset command present using the terminals, serial communications, or communication option card OFF/OPEN: When a reset command is not present
12 Timer Output	ON/CLOSED: When H01-xx = 43 is active for longer than C12-03 time OFF/OPEN: When H01-xx = 43 is <b>not</b> active
13 Fref/Fout Agree2	ON/CLOSED: When the output frequency or motor speed is within the range of frequency reference $\pm L04-04$ OFF/OPEN: When the output frequency or motor speed is <b>not</b> within the range of frequency reference $\pm L04-04$
14 Fref/Set Agree 2	ON/CLOSED: When the output frequency and frequency reference are both within L04-03 $\pm L04-04$ OFF/OPEN: When the output frequency and frequency reference are <b>both</b> not within L04-03 $\pm L04-04$
18 Trq Det 2 N.O.	ON/CLOSED: When the output current/torque exceeds the value set in parameter L06-05 for longer than the time set in parameter L06-06 OFF/OPEN: When the output current/torque does <b>not</b> exceed the value set in parameter L06-05 for longer than the time set in parameter L06-06
19 During Fast Stop	ON/CLOSED: When a Fast-Stop command is detected (H01-xx = 40 or 42 is active) OFF/OPEN: When a Fast-Stop command is <b>not</b> detected (H01-xx = 40 or 42 is not active)
1A Forward Dir	ON/CLOSED: During Forward/Up operation OFF/OPEN: When running in Reverse/Down direction or baseblock
1B Reverse Dir	ON/CLOSED: During Reverse/Down operation OFF/OPEN: When running in Forward/Up direction or baseblock
1C Swift/Ultra Lift Mode	ON/CLOSED: When the drive is operating in Swift-Lift/Ultra-Lift mode OFF/OPEN: When the drive is <b>not</b> operating in Swift-Lift/Ultra-Lift mode
1D Brk Trans Fault	ON/CLOSED: When the drive detects a brake transistor failure OFF/OPEN: Normal operation
1E LC Operating	ON/CLOSED: When the drive is testing the current load before posting a LC Fault OFF/OPEN: Normal operation
1F Regenerating	ON/CLOSED: When the drive is in a regenerative mode OFF/OPEN: Normal operation
20 Auto-Rst Attempt	ON/CLOSED: When Auto-reset is enabled OFF/OPEN: Normal operation
21 Overload (OL1)	ON/CLOSED: When the drive exceeds 90% of the motor overload detection level (oL1) OFF/OPEN: Normal operation

\* This output does not have an inverse output

\*\* Contact will open when power is disconnected

Display	Function
22 OH Pre-alarm	ON/CLOSED: When the drive heatsink temperature $\geq$ L08-02 OFF/OPEN: Normal operation
23 Torque Limit	ON/CLOSED: When the torque (U01-09) is $\geq$ L7-01–L7-04. OFF/OPEN: Normal operation
24 Speed Limit	ON/CLOSED:When: 1. the frequency reference has reached the upper limit set in B02-01 (D02-01). 2. the frequency reference has fallen below B02-02 (D02-02) or B02-03 (D02-03). 3. parameter B03-05 (B01-05) = 1, 2, or 3, and the frequency reference is $<$ E01-09. OFF/OPEN: Normal operation
25 During Load Flt	ON/CLOSED: When drive is in Zero Servo mode OFF/OPEN: When drive is <b>not</b> in Zero Servo mode
26 Run Cmd is Input	ON/CLOSED: When either a Forward or Reverse command is active on H01-xx OFF/OPEN: When neither a Forward or Reverse command is active on H01-xx
27 Load Check Det	ON/CLOSED: When the drive has detected a "Load Check fault" OFF/OPEN: Normal operation
28 Slack Cable Det	ON/CLOSED: When the drive has detected a "Slack Cable" OFF/OPEN: Normal operation
29 Upper Limit	ON/CLOSED: When a UL1, UL2, or UL3 is detected OFF/OPEN: Normal operation
2A During RUN 2	ON/CLOSED: When a run command is active and the drive is outputting voltage.
2B Upper Limit 1	ON/CLOSED: When UL1 is detected OFF/OPEN: Normal operation
2C Upper Limit 2	ON/CLOSED: When UL2 is detected OFF/OPEN: Normal operation
2D Lower Limit 1	ON/CLOSED: When LL1 is detected OFF/OPEN: Normal operation
2E Lower Limit 2	ON/CLOSED: When LL2 is detected OFF/OPEN: Normal operation
30 Lower Limit*	ON/CLOSED: When LL1 or LL2 is detected OFF/OPEN: Normal operation
31 Up/Low Limit*	ON/CLOSED: UL1, UL2, UL3, LL1, or LL2 is detected OFF/OPEN: Normal operation
32 Snap Shaft	ON/CLOSED: When the drive has detected a "Snap Shaft" OFF/OPEN: Normal operation
34 Index Complete	ON/CLOSED: When the Index move is complete OFF/OPEN: Normal operation or Index move is not complete
35 Ready for F-Ref	ON/CLOSED: When C08-04 timer has expired or the Brake Answerback is detected H01-xx = 58 is true OFF/OPEN: Normal operation or drive detected a BE1, BE2, BE4 alarm or is stopped.
36 Fan Alrm Det	ON/CLOSED: When the drive detects that the internal cooling fan has failed OFF/OPEN: Normal operation
37 Maintenance	ON/CLOSED: When the Maintenance Timer (U01-52) $\geq$ C12-05 OFF/OPEN: Normal operation or the Maintenance Timer (U01-52) $<$ C12-05
38 Spd Lim @ T Cont	ON/CLOSED: When Speed Limit has been reached while using Torque Control OFF/OPEN: When the Speed Limit has <b>not</b> been reached when using Torque Control
39 Drive Enable	ON/CLOSED: When Drive Enable (H01-xx = 65) is active OFF/OPEN: When Drive Enable (H01-xx =65) is <b>not</b> active

\* This output does not have an inverse output

\*\* Contact will open when power is disconnected

<b>Display</b>	<b>Function</b>
<i>3B Watt-hour Pulse</i>	ON/CLOSED: When the Watt-hour time is reached (based on setting of H02-06), the contact will close for 200 ms OFF/OPEN: When the Watt-hour time has <b>not</b> been reached
<i>3D Fault or Alarm</i>	ON/CLOSED: When either a Fault or Alarm condition is detected OFF/OPEN: Normal operation
<i>3E Overspeed</i>	ON/CLOSED: When an overspeed condition is detected OFF/OPEN: Normal operation
<i>3F Klixon</i>	ON/CLOSED: When a Klixon alarm is detected (H01-xx = 56 or 57 is active) OFF/OPEN: Normal operation
<i>40 through FF Flt Annunciate</i>	ON/CLOSED: When specific fault condition are detected (see Fault Annunciation) OFF/OPEN: Normal operation
<i>102 through 1FF**</i>	Parameter Settings 2 through FF with inverse output.

\* This output does not have an inverse output

\*\* Contact will open when power is disconnected

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







**Digital Outputs—Fault Annunciate** enables you to assign a set of six fault outputs to Relay Output M2/M3 and/or Output M5/M6. In addition, you can select whether each fault output is enabled.

**NOTE:** *Output M0/M1 can also be used for Digital Outputs—Fault Annunciate; however, it is normally assigned to a brake output.*




Before you start to program this feature, you may find it convenient to first photocopy the “Binary-to-Hexadecimal Conversion Worksheet” in this section. By being able to write in the worksheet’s boxes, you will find it easier to program the feature.

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

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

1. Press the  and the  buttons to navigate to H02-01.
2. Determine the output terminal to which you want **Fault Annunciate** assigned; Terminals M0-M1, M2-M3 or M5-M6 and press  until the value blinks.
3. Press the  or  button until H02-xx = 040 appears.
4. Press the  button. 

H02-xx = 40 Flt Annunciate
-------------------------------

 appears.
5. From the worksheet in table 5-68, select one of three fault output sets (each row is a set). Enter the one-zero combination that corresponds to the set (row) that you selected.
6. Determine which fault outputs should be enabled. To enable a fault output, enter 1 in the box above the fault output; otherwise, enter 0. Do this for each fault output in the set.
7. Using the Binary to Hexadecimal Conversion chart (table 5-69), determine the 1-digit hexadecimal number for both 4-digit binary numbers.
8. Press the  or  and  buttons until the appropriate hexadecimal number appears and press Enter.

*Example: Select a fault annunciate set in which the fault you want to appear is shown. You must select only faults from one set. If you want to have the relay output to change based on only inputs LL1 and UL1, you would choose Set 2.*

1. *Place a “1” below LL1 and UL1 for Set 2.*
2. *Use table 5-69 to convert the left binary value “1 0 0 0” to Hex 8.*
3. *Use table 5-69 to convert the right binary value “1 0 1 0” to Hex A.*
4. *Enter this value into H02-xx.*

**Table 5-68: Fault Annunciate Example**

	First digit from the left				Second digit from the left			
	1 or 0	1 or 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 from the left = 8

Second digit from the left = A, so **H02-xx = 8A**

**Table 5-69: Fault Annunciate Worksheet**

	First digit from the left				Second digit from the left			
	1 or 0	1 or 0	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 from the left				Second digit from the left			
	1 or 0	1 or 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	1						

	First digit from the left				Second digit from the left			
	1 or 0	1 or 0	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 5-70: Binary to Hexadecimal Conversion**

Binary Number	Hexadecimal Number	Binary Number	Hexadecimal Number
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

## External Fault Response Selection

It is sometimes desirable to have at least one external fault input to the drive. To properly program a multi-function input (H01-01 to H01-08) for this purpose an external fault response must be selected. The table below shows the possible selections for an external fault response.

**Table 5-71: External Fault Selection**

Input Level Selection		Detection Method		External Fault Action				MFI Setting Result
N.O. <sup>(1)</sup>	N.C. <sup>(1)</sup>	Always	During Run	Ramp to Stop	Coast to Stop	Fast-stop <sup>(2)</sup>	Alarm Only	
√		√		√				20
√		√			√			24 <sup>(3)</sup>
√		√				√		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

(3) Factory Default



## Analog Inputs

The IMPULSE®G+ & VG+ Series 4 has three built-in analog inputs for the external input of numerous references and limits. Drive analog input capabilities can be increased with the installation of an AI-A3 option card.

**Table 5-72: Analog Inputs Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
H03-01	Term A1 Signal  0 0 to 10 V 1 -10Vto +10 V	Voltage for Terminal A1 analog input signal	0, 1	*
H03-02	Terminal A1 Sel	Sets the function of terminal A1 (see tables 5-73 and 5-74 for option selections).	0–31	*
H03-03	Terminal A1 Gain	Sets the level of the input value selected in H03-02 when 10 V is input at terminal A1.	-999.9–999.9%	100.0
H03-04	Terminal A1 Bias	Sets the level of the input value selected in H03-02 when 0 V is input at terminal A1.	-999.9–999.9%	0.0
H03-05	Term A3 Signal  0 0 to 10 V 1 -10 to +10 V	Voltage for Terminal A3 analog input signal	0, 1	0
H03-06	Terminal A3 Sel	Assigns one of the following function analog input parameters to Terminal A3 (see tables 5-73 and 5-74 for option selections).	0–31	*
H03-07	Terminal A3 Gain	Gain multiplier for Terminal A3 analog input signal	-999.9–999.9%	100.0
H03-08	Terminal A3 Bias	Bias multiplier for Terminal A3 analog input signal	-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 Signal Level Selection	0–3	2
H03-10	Terminal A2 Sel	Sets the function of terminal A2 (see tables 5-73 and 5-74 for option selections).	0–31	1F
H03-11	Terminal A2 Gain	Gain multiplier for terminal A2 analog input signal	-999.9–999.9%	100.0
H03-12	Terminal A2 Bias	Bias multiplier for terminal A2 analog input signal	-999.9–999.9%	0.0
H03-13	Filter Avg Time	Analog input filter average time	0.00–2.00sec	0.03

\* Initial value is determined by X-Press Programming (Tables 4-5, 4-6, and 4-7).

Parameter Code	Display	Function	Range	Initial Value
H03-14	A1/A2/A3 Sel	Determines which analog input terminals will be enabled when a digital input programmed for "MFAI Enable" (H01-xx = 3A) is activated.	1–7	7
	1 A1 Available			
	2 A2 Available			
	3 A1/A2 Available			
	4 A3 Available			
	5 A1/A3 Available			
	6 A2/A3 Available			
	7 All Available			
H03-15	TerminalA1Offset	Adds an offset when the analog signal to terminal A1 is 0V	-500–500	0
H03-16	TerminalA2Offset	Adds an offset when the analog signal to terminal A2 is 0V	-500–500	0
H03-17	TerminalA3Offset	Adds an offset when the analog signal to terminal A3 is 0V	-500–500	0

\* Initial value is determined by X-Press Programming (Tables 4-5, 4-6, and 4-7).

**Table 5-73: Option Selections for H03-02, H03-06, and H03-10 (Flux Vector)**

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	The value of the analog frequency reference will be multiplied with the analog frequency reference gain value.
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)
5 Acc/Dec T Reduct	10V = 100%
7 OT/UT Det Lvl	Motor rated torque (vector control); inverter rated current (V/f control)
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 Motor Temperature	
10 FWD Torque Limit	
11 REV Torque Limit	
12 Regen Torque Limit	Torque limit during regen.
13 Torque Reference	Torque reference when in Torque Control mode.
14 Torque Comp	
15 Torque Limit	FWD and REV torque limit.
16 Load Cell	Used for Weight Measurement and/or Load Check
1F Not Used	--

**Table 5-74: Option Selections for H03-02, H03-06, and H03-10 (V/f)**

Display	Function
0 <i>Analog Freq Ref1</i>	100% = Max output frequency (E01-04) Same value can be set using H03-02 and H03-10. 10V = E01-04 (Maximum output frequency)
1 <i>Frequency Gain</i>	The value of the analog frequency bias will be multiplied with the analog frequency reference gain value.
2 <i>Analog Freq Ref2</i>	Max. output frequency 10V = E01-04 (Maximum output frequency)
3 <i>Analog Freq Ref3</i>	Max. output frequency 10V = E01-04 (Maximum output frequency)
4 <i>Voltage Bias</i>	Output Voltage Bias. This bias boosts the output voltage of the V/f curve as a % of the maximum output voltage (E01-05). Only available in V/f mode. Motor rated voltage (E01-05) 10V = E01-05 (Motor rated Voltage)
5 <i>Acc/Dec T Reduct</i>	10V = 100%
6 <i>DC Inj Braking</i>	DC Injection Braking Current 10V = 100% Drive rated current 4 to 20 mA = 0 to 100% Drive rated current
7 <i>OT/UT Det Lvl</i>	Motor rated torque (vector control); inverter rated current (V/f control)
8 <i>Stall Prev Level</i>	
9 <i>Ref Lower Limit</i>	Max. output frequency 10V = E01-04 (Maximum output frequency)
D <i>Freq Ref Bias 2</i>	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 <i>MotorTemperature</i>	
13 <i>Torque Reference</i>	Torque reference when in Torque Control mode.
16 <i>Load Cell</i>	Used for Weight Measurement and/or Load Check
1F <i>Not Used</i>	--

## Analog Outputs

The IMPULSE®•G+ & VG+ Series 4 has two built-in analog outputs for the external monitoring of drive conditions. Drive analog output capabilities can be increased with the installation of an AO-A3 option.

**Table 5-75: Analog Outputs Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
H04-01	Terminal FM Sel	Assigns one of the following function analog output parameters to Terminal FM.  Reference the U monitor group for output function descriptions.	000–630	102
	0	Not Used		
	31	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	Term RP Inp Freq		
	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)		
	606	Voltage Ref (Vd)		
	607	ACR(q) Output		
	608	ACR(d) Output		

Parameter Code	Display	Function	Range	Initial Value
	611 <i>Iq Reference</i>			
	612 <i>Id Reference</i>			
	618 <i>PG1 CounterValue</i>			
	619 <i>PG2 CounterValue</i>			
	622 <i>Zero Servo Pulse</i>			
	626 <i>FF Cont Output</i>			
	627 <i>FF Estimate SPD</i>			
H04-02	Terminal FM Gain	Gain multiplier for Terminal FM analog output signal	-999.9–999.9%	100.0
H04-03	Terminal FM Bias	Bias multiplier for Terminal FM analog output signal	-999.9–999.9%	0.0
H04-04	Terminal AM Sel	Assigns one of the above function analog output parameters to Terminal AM	000–630	103
H04-05	Terminal AM Gain	Gain multiplier for Terminal AM analog output signal	-999.9–999.9%	50.0
H04-06	Terminal AM Bias	Bias multiplier for Terminal AM analog output signal	-999.9–999.9%	0.0
H04-07	FM Level Select	Sets the voltage output level of U Monitor data for Terminal FM (Some monitors may not be assigned)	0–2	0
	0 0 to 10 V			
	1 -10 to +10 V			
	2 4 to 20 mA	(Terminal FM only)		
H04-08	AM Level Select	Sets the voltage output level of U Monitor data for Terminal AM (Some monitors may not be assigned)	0, 1	0
	0 0 to 10 V			
	1 -10 to +10 V			

## Serial Communication Set-up

The IMPULSE®•G+ & VG+ Series 4 uses terminals R<sup>+</sup>/R<sup>-</sup>, S<sup>+</sup>/S<sup>-</sup> to communicate the MODBUS RTU (RS-485/422) protocol. Cycle power after changing serial format parameters.

**Table 5-76: Serial Communication Set-up Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
H05-01	Serial Com Adr	Serial communication address	00–FF	1F
H05-02	Serial Baud Rate	Sets the 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			
	<b>Cycle power for the setting to take effect.</b>			
H05-03	Serial Com Sel	Sets the parity type	0–2	0
	0 No parity			
	1 Even parity			
	2 Odd parity			
	<b>Cycle power for the setting to take effect.</b>			
H05-04	Serial Fault Set	Determines stopping method when a serial fault occurs.	0–3	0
	0 Decel to Stop			
	1 Coast to Stop			
	2 Fast-Stop			
	3 Alarm Only			
H05-05	Serial Flt Dtct	Determines whether Serial Fault Detection is enabled	0, 1	1
	0 Disabled			
	1 Enabled			
H05-06	Transmit Wait Tim	Send waiting time	5–65 ms	5
H05-07	RTS Control Sel	RTS Control enable/disable	0, 1	1
	0 Disabled (RTS is always on)			
	1 Enabled (RTS is ON only when sending)			
H05-09	CE Detect Time	Sets the time required to detect a communications error. Adjustment may be needed when networking several drives.	0.0–10.0 sec	2.0

Parameter Code	Display	Function	Range	Initial Value
H05-10	CommReg 25h Uni	Selects the units for the output voltage monitor value in Modbus Register 0025H.	0, 1	0
	0 0.1 V units			
	1 1 V units			
H05-11	Enter CommandSel		0, 1	1
	0 Enter Required	Drive requires an Enter command before accepting any changes to parameter settings.		
	1 No EnterRequired	Parameter changes are activated immediately without the Enter command.		
H05-12	Run Command Sel		0, 1	0
	0 FWD Run &REV Run			
	1 Run & FWD/REV			

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

## Pulse Train Input/Output

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

**Table 5-77: Pulse Input/Output Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
H06-01	Pulse Input Sel	Selects the function of Pulse Input Terminal RP	0, 3	0
	0 <i>Frequency Ref</i>			
	3 <i>Simple PG</i>	V/F Control with Simple PG feedback (possible only when using motor 1 in V/F Control)		
H06-02	Pulse In Scaling	Number of pulses equal to the maximum output frequency	1000–32000 Hz	1440
H06-03	Pulse Input Gain	Sets the output level when input is 100%	0.0–1000.0%	100.0
H06-04	Pulse Input Bias	Sets the output level when input is zero Hz.	-100.0–100.0%	0.0
H06-05	Pulse In Filter	Sets the input filter time constant	0.00–2.00 sec	0.10
H06-06	Pulse Moni Sel	Selects the function of pulse output terminal MP.	0–502	102
	000 <i>Not Used</i>			
	031 <i>Not Used</i>			
	101 <i>Frequency Ref</i>			
	102 <i>Output Freq</i>			
	105 <i>Motor Speed</i>			
	120 <i>Term A2 Level</i>			
	501 <i>PID Feedback</i>			
	502 <i>PID Input</i>			
H06-07	Pulse Moni Scale	Item output by pulse monitor is selected by corresponding U01-xx value.	0–32000 Hz	1440
H06-08	Pulse Min Freq	Sets the minimum frequency for the pulse train input to be detected. Enabled when H06-01 = 0.	0.0–1000.0 Hz	0.5



# Protection Parameters

- L1 Motor Overload
- L2 Power Loss Ride Thru
- L3 Stall Prevention
- L4 Reference Detection
- L5 Test Mode
- L6 Torque Detection
- L8 Hardware Protection
- L9 Automatic Fault Reset

## Motor Overload

The IMPULSE®•G+ & VG+ Series 4 drive has an electronic overload protection function (OL1) for protecting the motor from overheating. The drive 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.

Setting 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.

Setting 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.

Setting 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 drive is connected to a single motor, the motor overload protection should be enabled (L01-01 = 1, 2, 3) 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 drive's output, thus preventing additional overheating of the motor. The motor temperature is continuously calculated as long as the drive is powered up.

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

**Table 5-78: Motor Overload Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
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	Drive dedicated motor with a 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 $\geq 150\%$ of the motor rated current.	0.1–5.0 min	1.0

Parameter Code	Display	Function	Range	Initial Value
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 (Alarm)			
	1 Coast to Stop (Alarm)			
	2 Fast Stop by B05-08 (Alarm)			
	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 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			

## Power Loss Ride Thru

**Table 5-79: Power Loss Ride Thru Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
L02-01	PwrL Selection	Enables/disables the Power Loss Ride thru function	0, 1	0
	0 Disabled	Drive trips on (Uv1) fault when power is lost.		
	1 Enbl with Timer	Recover within the time set in L02-02. Uv1 will be detected if power loss is longer than L02-02.		
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 VAC 460V: 300–420 VAC 575V: 431–604 VAC	Determined by E01-01

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

## Stall Prevention

**Table 5-80: Stall Prevention Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
L03-01	StallP Accel Sel	Sets how the Stall Prevention will function during acceleration.	0–2	1
	0 <i>Disabled</i>			
	1 <i>General purpose</i>	Acceleration is paused as long as the current is above the L03-02 setting.		
	2 <i>Intelligent</i>	Accelerate in the shortest possible time without exceeding the L03-02 level.		
L03-02	StallP Accel Lvl	Sets the output current level at which the Stall Prevention during acceleration is activated.	0–150%	*
L03-03	StallPAcc LowLim	Sets Stall Prevention lower limit during acceleration when operating in the constant power range. Set as a percentage of drive rated current.	0–100%	50
L03-05	StallP Run Sel	Sets the control for the stall prevention during run.	0–2	1
	0 <i>Disabled</i>	Drive runs at a set frequency. A heavy load may cause speed loss.		
	1 <i>Decel time 1</i>	Uses the deceleration time set to C01-02 while Stall Prevention is performed.		
	2 <i>Decel time 2</i>	Uses the deceleration time set to C01-04 while Stall Prevention is performed.		
L03-06	StallP Run Level	Sets the current level to trigger Stall Prevention during run. Depending on the setting of parameter L03-23, the level is automatically reduced in the constant power range (speed beyond base speed). Enabled when L03-05 is set to 1 or 2.	30–150%	*
L03-11	OV Inhibit Sel	Enables or disables the OV suppression function, which allows the drive to change the output frequency as the load changes to prevent an OV fault.	0, 1	0
	0 <i>Disabled</i>			
	1 <i>Enabled</i>			
L03-17	DC Bus Reg Level	Sets the desired value for the DC bus voltage during overvoltage suppression and Stall Prevention during deceleration.	230 V: 150–400 VAC 460 V: 300–800 VAC 575 V: 431–1150 VAC	230 V: 375 V 460 V: 750 V 575 V: 930 V
L03-20	DC Bus P Gain	Sets the proportional gain for KEB Ride-Thru, Stall Prevention, and overvoltage suppression.	0.00–5.00	A01-02
L03-21	Acc/Dec P Gain	Sets the proportional gain used to calculate the deceleration rate during KEB Ride-Thru, OV suppression function, and Stall Prevention during deceleration.	0.10–10.00 sec	A01-02

\* Default and Range changed by D10-01.

Parameter Code	Display	Function	Range	Initial Value
L03-23	CHP Stall P Sel	This function reduces the Stall Prevention during run level in the constant power range.	0, 1	0
	0 Lvl set in L03-06	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. The lower limit value is 40% of L03-06.		
L03-24	Mtr Accel Time	Sets the time needed to accelerate the uncoupled motor at rated torque from stop to the maximum frequency.	0.001–10.000 sec	O02-04 or E5-01

\* Default and Range changed by D10-01.

## Reference Detection

The IMPULSE®•G+ & VG+ Series 4 utilizes three different functions for detecting output frequency:

- When frequency agree is enabled using the multi-function contact outputs (H02-xx = “2” or “13”), the contact closes whenever the output frequency “agrees” with the frequency reference, plus or minus the speed agree detection width.
- When desired frequency agree is enabled using the multi-function contact outputs (H02-xx = “3” or “14”), the contact closes whenever the output frequency “agrees” with the speed agree detection level, plus or minus the speed agree detection width.
- When frequency detection is enabled using the multi-function contact outputs (H02-xx = “4”, “5”, “13”, or “14”), the contact closes whenever the output frequency is less than or more than the speed agree detection level, depending on which detection is selected.

**Table 5-81: Speed Agree Parameters**

<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Range</b>	<b>Initial Value</b>
L04-01	Spd Agree Level	Speed Agree Level	0.0–150.0 Hz	0.0

Sets the detection level for the desired frequency agree 1 and frequency detection 1 and 2 functions. The set detection level is effective during both FWD and REV operation.

<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Range</b>	<b>Initial Value</b>
L04-02	Spd Agree Width	Speed Agree Width	0.0–20.0 Hz	2.0

Sets the detection width for frequency and desired frequency agree 1 and frequency detection 1 and 2 functions.

<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Range</b>	<b>Initial Value</b>
L04-03	Spd Agree Lvl $\pm$	Speed Agree Level $\pm$	-150.0–150.0 Hz	0.0

Sets the detection level for the desired frequency agree 2 and frequency detection 3 and 4 functions. The set 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).

<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Range</b>	<b>Initial Value</b>
L04-04	Spd Agree Width $\pm$	Speed Agree Width $\pm$	0.0–20.0 Hz	2.0

Sets the detection width for frequency and desired frequency agree 2 and frequency detection 3 and 4 functions.

**Table 5-82: Reference Detection Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
L04-05	Ref Loss Sel	The drive 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	Drive stops when the frequency reference is lost.		
	1 <i>Run@L04-06PrevRef</i>	Drive runs at a reduced speed when the frequency reference is lost.		
L04-06	Fref at Floss	Sets the percentage of the frequency reference that the drive 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 through L04-04.	0, 1	0
	0 <i>No Detection @BB</i>	No detection during baseblock.		
	1 <i>Always Detected</i>	Detection always enabled.		

## Test Mode

The Test Mode is a troubleshooting aid that is intended for troubleshooting Flux Vector Control Method problems in the field. The feature can not be left on indefinitely as it will generate a fault after being on for total accumulated time of 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 V/f. All other functions for the new control method are not restricted. Certain programming may need to be done to clear up any OPE conditions that may occur as a result of the change in control method during this mode. It is up to the user to determine if a special function may cause an unsafe condition during testing. Since this feature will be used mainly 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 desirable to leave Limit Switch functions enabled. The user will need to determine what functions are being used. If unsure, it is best to ensure that the function is disabled (either by programming or MFDI in OFF state) before running the drive/motor in this mode.

**Table 5-83: Test Mode Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
L05-01	Test Mode	Test Mode Enabled. Starts a 10 minute timer after which the drive will not function until Test Mode is disabled. On power up, TM Enabled is always reset to Disabled.  When test mode is enabled, Test Mode settings will be used for operation. Refer to E3 and E4 group.	0, 1	0
	0 Disabled			
	1 Enabled			

## Torque Detection

The overtorque detection circuit activates when the motor load causes the motor current to exceed the overtorque detection level (L06-02). When an overtorque condition is detected, alarm signals can be sent to a multi-function output. To output an overtorque detection signal, select torque detection 1 at either of the multi-function contact outputs (H02-0x = "B" or "18").

**Table 5-84: Torque Detection Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
L06-01	Torque Det 1 Sel	Activates overtorque/undertorque detection and selects whether detection generates an alarm or a fault	0-8	0
	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		

**Table 5-85: Torque Detection Setting Descriptions**

Setting	Description
0	Torque detection is disabled ( <i>factory default</i> ).
1	Overtorque detection is enabled whenever at the speed agree level (when inverter 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 the speed agree level. 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 the speed agree level (when inverter 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 the speed agree level. 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 digital operator displays an "OL3" alarm (blinking).
  - To stop the inverter after an overtorque/undertorque detection fault, set to "3" or "4" / "7" or "8". During detection, the digital operator displays an "OL3/UL3" fault.



**Table 5-86: Torque Detection Parameter Settings - continued**

Parameter Code	Display	Function	Range	Initial Value
L06-02	Torq Det 1 Lvl	Sets the overtorque detection as a percentage of inverter 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. The digital operator then displays “OL3”.	0.0–10.0 sec	0.1
L06-04	Torq Det 2 Sel	Activates overtorque/undertorque detection, and selects whether detection generates an alarm or a fault.	0–8	0
	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			

**Table 5-87: Torque Detection 2 Select Descriptions**

Setting	Description
0	Overtorque/undertorque detection is disabled ( <i>factory default</i> ).
1	Overtorque detection is enabled whenever at the speed agree level (when inverter 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 the speed agree level. 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 the speed agree level (when inverter 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 the speed agree level. 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 digital operator instead. This function is used when two types of detection are output to the multi-function output terminals.

**Table 5-88: Torque Detection Parameter Settings - continued**

Parameter Code	Display	Function	Range	Initial Value
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

Parameter Code	Display	Function	Range	Initial Value
L06-08	Mech Fatigue Sel	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
	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			

**Table 5-89: Mechanical Fatigue Selection Description**

Setting	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 drive output (fault). Detected when the speed (signed) is greater than L06-09.
4	Interrupt drive 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 drive output (fault). Detected when the speed (signed) is less than L06-09.
8	Interrupt drive output (fault). Detected when the speed (not signed) is less than L06-09.

**Table 5-90: Torque Detection Parameter Settings - continued**

Parameter Code	Display	Function	Range	Initial Value
L06-09	MechFat Det Spd	Sets the 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	Sets the 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	Sets the operation time (U01-04) required before Mechanical Weakening Detection is active.	0–65535	0

## Hardware Protection

The IMPULSE®-G+ & VG+ Series 4 comes equipped with a number of built-in functions designed to protect the inverter and its components from damage.

**Table 5-91: Hardware Protection Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
L08-01	DB Resistor Prot	Selects the dynamic braking resistor protection when using an optional heatsink mounted braking resistor (ERF type, 3% ED).	0, 1	0
	0 <i>Not Provided</i>	Resistor overheat protection disabled		
	1 <i>Provided</i>	Resistor overheat protection enabled		
L08-02	OH Pre-Alarm Lvl	Sets the heatsink temperature level for protection against overheat (OH). <i>NOTE: The inverter measures heatsink temperature by an negative temperature coefficient thermistor.</i>	50–150°C	*
L08-03	OH Pre-Alarm Sel	Selects the stopping method when heatsink overheat is detected.	0–5	3
	0 <i>Decel to Stop</i>	Decel to stop using B05-02		
	1 <i>Coast to Stop</i>	Immediate stop		
	2 <i>Fast-Stop</i>	Decel to stop using B05-08		
	3 <i>Use B03-03 Method</i>	Uses programmed B03-03 Method		
	4 <i>Alarm Only</i>	Operation continues and “OH Heatsink Overtemp” is displayed on keypad		
	5 <i>Run@L08-19 Rate</i>	Continue operation at reduced speed as set in L08-19.		
L08-05	PH Loss In Sel	Input phase loss detection	0, 1	1
	0 <i>Disabled</i>			
	1 <i>Enabled</i>			
L08-07	PH Loss Out Sel	Output phase loss detection	0–2	1
	0 <i>Disabled</i>			
	1 <i>1PH Loss Det</i>			
	2 <i>2/3PH Loss Det</i>			
L08-09	Ground Fault Sel	Enables/disables ground fault detection	0, 1	1
	0 <i>Disabled</i>			
	1 <i>Enabled</i>			
L08-10	Fan On/Off Sel	Cooling fan operation select	0, 1	0
	0 <i>Dur Run (OffDly)</i>			
	1 <i>Always On</i>			
L08-11	Fan Delay Time	When L08-10 = 1, 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	-10–60°C	40

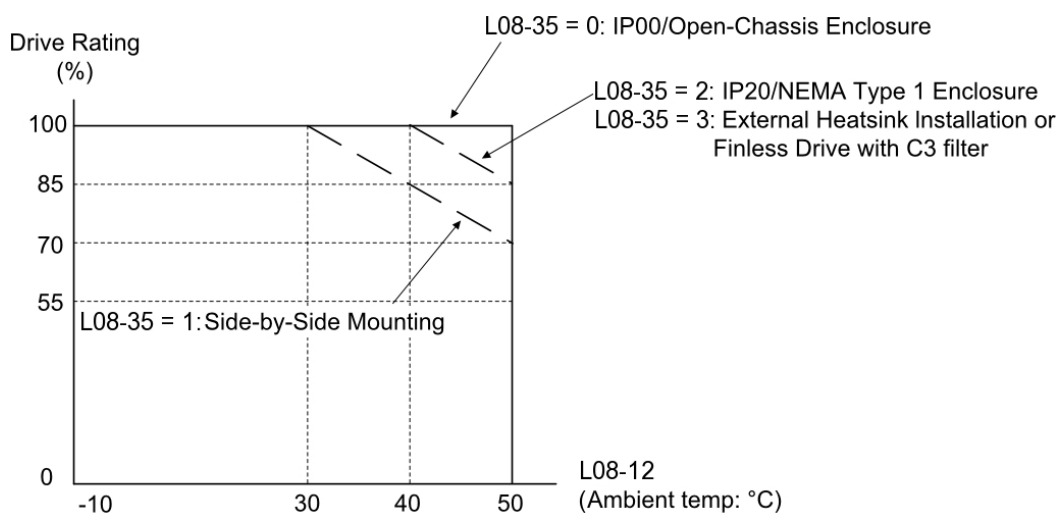
\* Initial value is dependent on drive size, which is determined by O02-04 (kVA selection)

Parameter Code	Display	Function	Range	Initial Value
L08-13	UV3 Detect  0 Disabled 1 Enabled	Enables Soft Charge Bypass Circuit Fault	0, 1	1
L08-15	OL2 Sel @ L-Spd  0 Disabled 1 Enabled	Enables/disables OL when output frequency $\leq 6$ Hz	0, 1	1
L08-18	Soft CLA Sel  0 Disabled 1 Enabled	Enables/disables the software current limit function. Limits output frequency when current exceeds 110% of rated.	0, 1	0
L08-19	Fc Red dur OHAlm	Specifies the 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  0 Decel to Stop 1 Coast to Stop 2 Fast-Stop 3 Use B03-03 method 4 Alarm only	MC, FAN configure the operation of power if it detects a warning alarm	0–4	1
L08-35	Installation Sel 0: IP20/Open Chassis 1: Side-by-Side 2: IP20/NEMA Type 1 3: Finless/Fin Ext	Drive Installation Method	0–3	*
L08-38	Fc Reduct dur OL  0 Disabled 1 Active below 6Hz  2 Active @ any Spd	Temporarily reduces the carrier frequency when the drive exceeds a certain level. This temporarily increases the overload capability (OL2 detection) allowing the drive to run through transient load peaks without tripping.  Enabled below 6 Hz Carrier Frequency is reduced when : < 6Hz when current > 100% of Drive Rated Current, returns to normal carrier frequency or when output current falls below 88% of drive rated current or frequency > 7Hz  Enabled for the entire speed range < 6Hz when current > 100% of Drive Rated Current > 7Hz when current > 112% of Drive Rated Current	0–2	*

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

Parameter Code	Display	Function	Range	Initial Value
L08-40	FC Reduct Time	Sets the time that the drive 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 drive rated current.	0, 1	0
	0 Disabled			
	1 Enabled			
L08-55	DB Tr protection	Internal Braking Transistor Protection (DB Tr protection)	0, 1	1
	0 Disable	Disable braking transistor protection when not using the internal braking transistor.		
	1 Enable	Enable when connecting a braking resistor or a braking resistor unit to the drive's built-in braking transistor.		

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



**Figure 5-24: Ambient Temperature and Installation Method Derating**

## Automatic Fault Reset

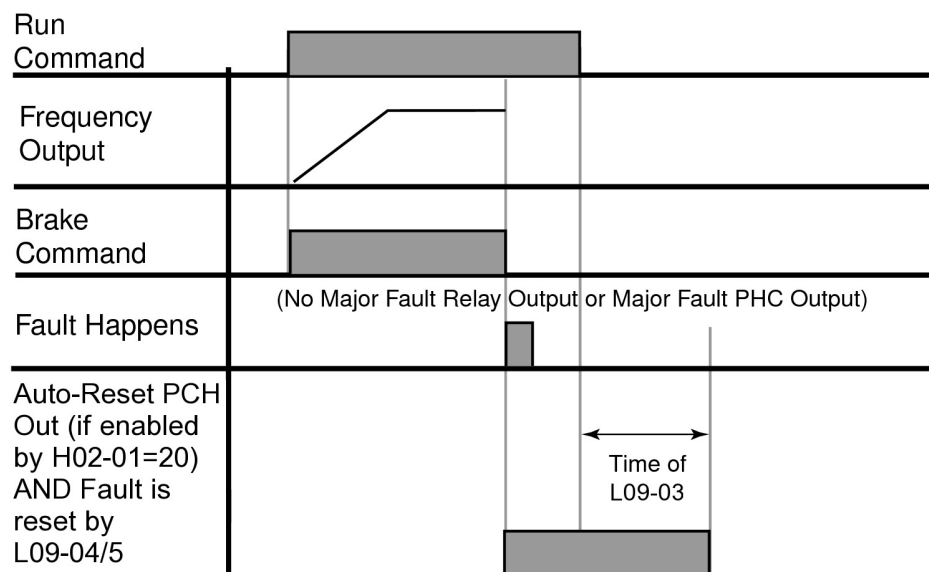
When a fault occurs during operation, the IMPULSE®•G+ & VG+ Series 4 can be programmed for an auto reset operation to automatically reset the fault.

**Table 5-92: Automatic Reset Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
L09-01	Reset Select	Activates the fault auto-reset function.	0, 1	1
	0 Disabled			
	1 Enabled			
L09-02	Reset Attempts	Sets the number of reset attempts. Reset attempt counter is returned to zero if no faults occur within a ten minute period.	0–10	3
L09-04*	Reset Flt Sel 1	Reset Fault Select 1.	0–FFFF	1
L09-05*	Reset Flt Sel 2	Reset Fault Select 2.	0–FFFF	E000
L09-06	FLT Contact Sel	Fault contact operation during reset attempts	0, 1	0
	0 Flt Outp Disabld			
	1 Flt Outp Enabled			

\* To program constant L09-04 and 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 and L09-05 by entering the hex number obtained from step 3.



**Figure 5-25: Automatic Fault Reset**

## Example:

Enable auto-reset for UV1, OS and CE faults.

**Table 5-93: 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 - - - F - - - O - - -	L P U U F F T T 1 2	O S O G H C V F 1	O U U U C V V V 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 E E E E 1 2 3 4	O O O O L L T T 1 2 1 2	C C E E E A F F L 8 7	E E E E F F F F 6 5 4 3

**Table 5-94: Auto-Reset Programming Summary**

L09-04	Binary	HEX	L09-05	Binary	Hex
Digit 4	0010	2	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 5-95: Binary to Hexadecimal Conversion**

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

# Operator Parameters

- O1 Monitor Selection
- O2 Keypad Key Selection
- O3 Clear History
- O4 Copy Function

## Monitor Selection

The top level in the operation mode 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. See the Monitor Parameters table on page 5-126 for available monitors by control method.

**Table 5-96: Monitor Selection Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
O01-01	User Monitor Sel	Selects the content of the last monitor that is shown when scrolling through Drive Mode display. Enter the last three digits of the monitor parameter number to be displayed: U0X-xx. Default: 106 (Monitor: Output Voltage Reference U01-06)	104–813	106
	104 Control Method			
	105 Motor Speed			
	106 Output Voltage			
	107 DC Bus Voltage			
	108 Output HorsePwr			
	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			
	150 Hook Height			
	151 Motor Revolution			
	152 MaintenanceTimer			
	153 Index Count			



<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Range</b>	<b>Initial Value</b>
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	Ch9Circ 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			
627	FF Estimate SPD			
636	Comm Errors - GAIA			
637	Comm Errors - LUNA			
638	Comm Errors - Opt			

Parameter Code	Display	Function	Range	Initial Value
	639 <i>CommErrors - OptB</i>			
	640 <i>CommErrors - OptC</i>			
	680 <i>OPT IP ADR1</i>			
	681 <i>OPT IP ADR2</i>			
	682 <i>OPT IP ADR3</i>			
	683 <i>OPT IP ADR4</i>			
	684 <i>OPT SUBNET MASK1</i>			
	685 <i>OPT SUBNET MASK2</i>			
	686 <i>OPT SUBNET MASK3</i>			
	687 <i>OPT SUBNET MASK4</i>			
	688 <i>OPT GATEWAY ADR1</i>			
	689 <i>OPT GATEWAY ADR2</i>			
	690 <i>OPT GATEWAY ADR3</i>			
	691 <i>OPT GATEWAY ADR4</i>			
	692 <i>OPT LINK SPEED</i>			
	693 <i>OPT DUPLEX</i>			
	694 <i>OPT SPARE1</i>			
	695 <i>OPT SPARE2</i>			
	696 <i>OPT SPARE3</i>			
	697 <i>OPT SPARE4</i>			
	698 <i>OPT FIRST FAULT</i>			
	699 <i>OPT STATUS</i>			
O01-02	Power-On Monitor	Selects the monitor to be displayed on the digital operator immediately after the power supply is turned on.	1–5	3
	1 <i>Frequency Ref</i>	Frequency reference (U01-01)		
	2 <i>FWD/REV</i>	Forward/Reverse		
	3 <i>Output Freq</i>	Output frequency (U01-02)		
	4 <i>Output Current</i>	Output current (U01-03)		
	5 <i>User Monitor</i>	User-selected monitor (set by O01-01)		
O01-03	Display Scaling	Sets the units to display the frequency reference and output frequency.	0–3	A01-02
	0 <i>0.01 Hz</i>			
	1) <i>0.01%</i>	(100% = E01-04)		
	2) <i>RPM</i>	Calculated using the number of motor poles setting in E02-04, E4-04, or E5-04		
	3) <i>User Units</i>	User-selected units (set by O01-10 and O01-11)		

Parameter Code	Display	Function	Range	Initial Value
O01-04	Display Units  0) Hertz 1) RPM	Setting units for E01-04, E01-06, and E01-09.	0, 1	A01-02
O01-05	LCD Contrast	Adjusts brightness of the keypad display	0–5	3
O01-10	UserDisp Scaling	Determines the display value that is equal to the maximum output frequency. Default setting is dependent on parameter O01-03, Digital Operator Display Selection. 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 This setting defines the displayed values when O01-03 is set to 3.	1–60000	6000
O01-11	UserDisp Dec Sel  0 No Dec (XXXXX) 1 1 Dec (XXXX.X) 2 2 Dec (XXX.XX) 3 3 Dec (XX.XXX)	Determines the position of the decimal position. When O01-03 = 0, O01-11 = 2 When O01-03 = 1, O01-11 = 2 When O01-03 = 2, O01-11 = 0 When O01-03 = 3, O01-11 = 2	0–3	2

## Keypad Key Selection

**Table 5-97: Keypad Key Selection Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
O02-01	LO/RE Key  0 Mode/Service  1 Local/Remote	Pressing the LO/RE Key once displays “Call Magnetek at 1-866-624-7378”. Pressing the LO/RE Key a second time: Control Method (A01-02) Motion (A01-03) Speed Reference (A01-04) Local/remote key is enabled depressing the LO/RE key switches operation command between the digital operator and the settings of B03-01 and B03-02.	0–1	0

Parameter Code	Display	Function	Range	Initial Value
O02-02	Oper Stop Key	Selects the action when the digital stop key is pressed.	0–2	0
	0 Coast to Stop	(Immediate stop)		
	1 Decel to Stop			
	2 Use B03-03 Method			
O02-03	User Defaults		0–2	0
	0 No Change			
	1 Set Defaults	Memorizes up to 50 modified parameters. User defaults can be restored by setting A1-05= "1110".		
	2 Clear all	Clear user defaults.		
O02-04	Inverter Model #	Enter the drive model. Setting required only if installing a new control board.	0x00–0xFF	*
		*Default determined by drive capacity. Use normal duty current ratings and drive 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		
	75 2_0250	2215-G+/VG+S4		
	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		

Parameter Code	Display	Function	Range	Initial Value
	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		
	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		
	D3 5_0077	5062-G+/VG+S4		
	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	Selects whether the ENTER key is used when the frequency reference is set by the digital operator. The digital operator can simulate a motor operated potentiometer (M.O.P.) by setting this parameter.	0, 1	0
	0 Disabled	ENTER Key Required		
	1 Enabled	ENTER Key Not Required		
		NOTE: This feature cannot be used in conjunction with infinitely variable speed control.		

Parameter Code	Display	Function	Range	Initial Value
O02-06	Oper Detection	If the digital operator is disconnected from the inverter. This parameter selects whether the inverter detects this condition. The operator is only detected when the inverter is being commanded locally.	0, 1	1
	0 Disabled 1 Enabled			
O02-07	FWD/REVSel@PwrUp	Determines the direction of the motor at power up when operation is assigned to the digital operator. This parameter requires that drive operation be assigned to the digital operator.	0, 1	0
	0 Forward 1 Reverse			
O02-19	Parameter Set Sel	Turns off writing to EEPROM during a UV fault.	0, 1	0
	0 Disabled 1 Enabled			

## Maintenance History

**Table 5-98: Clear History Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
O03-01	Elapsed Time Set	Sets the value for the cumulative operation time of the drive 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 hr	0
O03-02	Elapsed Time Run	Selects how the cumulative timer will keep track of the total operation time.	0, 1	1
	0 Power-On Time 1 Running Time	Logs power-on time Logs operation time when the drive output is active (output operation time).		
O03-03	Fan ON Time Set	Sets the value of the Fan Operation Time monitor (U04-03) in units of 10 hours. A setting of 30 = 300 hours	0–9999 hr	0
O03-05	BusCap Maint Set	Sets the value of the 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	Sets the value of the Maintenance Monitor for the IGBTs. See U04-07 for IGBT replacement times.	0–150%	0

Parameter Code	Display	Function	Range	Initial Value
O03-11	Fault Data Init	Determines if Fault Trace (U02-xx) and Fault History (U03-xx) parameters will be cleared when the drive is initialized.	0, 1	0
	0 No Reset	Not cleared		
	1 Reset	Cleared (U02-xx, U03-xx, and U04-01 set to 0, and O03-01 = 0 after U2 and U3 are initialized)		
O03-12	kWh Monitor Init	Determines if the monitor data (U04-10 and U04-11) are reset when the drive is initialized.	0, 1	0
	0 No Reset	U04-10 and U04-11 monitor data is not reset when the drive is initialized (A01-03).		
	1 Reset	U04-10 and U04-11 monitor data is reset when the drive is initialized (A01-03).		
O03-13	Run Counter Init	Determines if the Run Commands counter (U03-21) is reset when the drive is initialized.	0, 1	0
	0 No Reset	Number of Run commands counter is not reset when the drive is initialized (A01-03).		
	1 Reset	Number of Run commands counter is reset when the drive is initialized (A01-03).		
O03-14	Count Hist Clear	Determines which counter will be cleared. After counters are cleared, initial value (O03-14) is set to 0.	0, 1	0
	0 No Reset	Number of Run commands counter is not reset when the drive is initialized (A01-03).		
	1 Reset	Number of Run commands counter is reset when the drive is initialized (A01-03).		

## Copy Function

**Table 5-99: Copy Function Parameter Settings**

Parameter Code	Display	Function	Range	Initial Value
O04-01	Copy FunctionSel	Copy parameters to/from keypad	0–3	0
	0 COPY SELECT			
	1 INV → OP READ	Drive → Keypad		
	2 OP → INV WRITE	Keypad → Drive		
	3 OP ↔ INV VERIFY	Keypad ↔ Drive		
O04-02	Read Allowable	Enables/disables copy function	0, 1	1
	0 Disabled			
	1 Enabled			

Parameter Code	Display	Function	Range	Initial Value
O04-07	ChrgCircMaintSet	Sets the value of the 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 digital operator has parameter COPY capabilities via built-in non-volatile memory. The digital operator can READ all of the parameters in the Drive and store them for later, and then WRITE back to the Drive or into a Drive with the same product code and software number. In order to read the parameter values and store them into the digital operator, select O04-02 = “1: Enabled”. If you attempt to READ the data, which overwrites any previously stored data, without first setting O04-02 = “1: Enabled,” you will get the following error:

**RDER**  
READ DATA ERROR

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

**END**  
READ COMPLETE

An error may occur while saving the parameter values to the digital operator’s memory. 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: Troubleshooting of the IMPULSE®•G+ & VG+ Series 4 Users Manual. To COPY the parameter values into a Drive, set O04-01 = 2 (OP → INV WRITE). During the writing of the parameter values into the Drive, the digital operator will display:

**COPY**  
OP → INV COPYING

A successful COPY of the parameter values will display:

**END**  
COPY COMPLETE



An error may occur while writing the parameter values to the Drive. 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: Troubleshooting of the IMPULSE®•G+ & VG+ Series 4.

It is possible to compare the parameter values stored in the digital operator with the parameter values currently in the Drive by using the VERIFY function. This VERIFY function should not be confused with the “-VERIFY-” that is displayed on the digital operator when viewing the “Modified Constants” menu. To VERIFY the parameter values in the Drive as compared with those stored in the digital operator, set O04-01 = 3 (OP ↔ INV VERIFY). During the comparing of the parameter values into the drive the digital operator will display:

VRFY  
DATA VERIFYING

A successful VERIFY of the parameter values will display:

END  
VERIFY COMPLETE

If all the parameters stored in the digital operator do not match those programmed in the Drive, the digital operator displays the following:

VYE  
VERIFY ERROR

The digital operator 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 Drive information must be identical between the Drive that the parameters were read from and the Drive that the parameters are written to:*

*Model Number (e.g. 5001-G+S4)*

*Software Number (e.g. 14700 as known as FLASH ID)*

*Control Method (e.g. A01-02)*

# Monitor Parameters

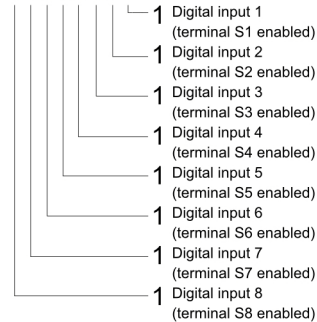
- U1 Monitor
- U2 Fault Trace
- U3 Fault History
- U4 Maintenance
- U6 Control Monitor

L9 Automatic Fault Reset

**Table 5-100: Monitor Parameters**

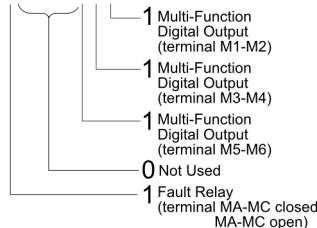
Parameter			
Code	Display	Function	Units
U01-01	Frequency Ref	Frequency Reference	Hz
U01-02	Output Freq	Inverter Output Frequency	Hz
U01-03	Output Current	Inverter Output Current	A
U01-04	Control Method	Displays the value of A01-02	--
U01-05	Motor Speed	Motor Speed	Hz
U01-06	Output Voltage	Inverter Output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

U01-10=00000000



U01-11	Output Term Sts	Output Terminal Status	--
--------	-----------------	------------------------	----

U01-11=00000000



Parameter Code	Display	Function	Units
U01-12	Int Ctl Sts 1	Operation Status	--
<p>U01-12 = 00000000</p>			
U01-14	CPU 1 SW Number	Flash ROM software ID number	--
U01-15	Term A1 Level	External Terminal Input level	%
U01-16	Term A2 Level	External Terminal Input level	%
U01-17	Term A3 Level	External Terminal Input level	%
U01-20	SFS Output	Primary freq. after the SFS	Hz
U01-21	AI Opt Ch1 Level	Displays the input voltage to terminal V1 on analog input card AI-A3.	%
U01-22	AI Opt Ch2 Level	Displays the input voltage to terminal V2 on analog input card AI-A3.	%
U01-23	AI Opt Ch3 Level	Displays the input voltage to terminal V3 on analog input card AI-A3.	%
U01-25	DI Input Status	Displays the reference value input from the DI option card (DI-A3, S4I, or S4IO) lower 8 bits.	--
U01-26	DI Output Status	Displays the reference value input from the DI option card (DI-A3, S4I, or S4IO) upper 8 bits.	--
U01-28	CPU 2 SW Number	ROM ID	--
U01-29	Load Weight	Monitors 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	Displays the parameter number that caused the OPExx or Err (EEPROM write error) error.	--
U01-39	Transmit Error	Displays the contents of a MEMOBUS/Modbus error	--
<p>U01-39 = 00000000</p>			
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 is displayed.	%
U01-51	Motor Revolution	Number of revolutions after Home	Revs
U01-52	MaintenanceTimer	Hours since last timer reset	Hrs

<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Units</b>
U01-53	Index Count	Number of motor revolutions the shaft has moved since the beginning of a new Index command in quadrature	Revs
U01-54	Term RP Inp Freq	Displays the frequency to pulse train input terminal RP.	Hz
U01-60	PG CH1 Count	Displays the raw PG Channel 1 pulse count 4 pulses = 1 ppr of F01-01	Pulses
U01-61	PG CH2 Count	Displays the raw PG Channel 2 pulse count 4 pulses = 1 ppr of F01-01	Pulses
U01-63	PG CH1 Freq	Displays the current input frequency on PG Channel 1	Hz
U01-64	PG CH2 Freq	Displays the current input frequency on PG Channel 2	Hz
U01-65	PG Output Freq	Displays the current output frequency on the PG Output channel	Hz
U01-66	BE6 Pulse Count	Displays the amount of shaft movement during the BE6 detection time 4 pulses = 1 ppr of F01-01	Pulses
U01-68	LC Zone	Displays the LC Zone the driver 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	Displays how close the current/torque levels are to the target value for each of the LC zones. Values less than zero will cause an LC detection 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.	--
U01-85	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"	Fib

**Table 5-101: Fault Trace Parameters**

<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Units</b>
U02-01	Current Fault	Display the most current fault detected before being reset.	--
U02-02	Last Fault	Displays most recent fault after being reset.	--
U02-03	Frequency Ref	Freq ref when fault was detected.	Hz
U02-04	Output Freq	Output freq when 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 fault was detected.	VAC
U02-08	DC Bus Voltage	DC Bus voltage when fault was detected.	VDC
U02-09	Output HorsePwr	Displays the output power at the fault (U02-02).	HP
U02-10	Torque Reference	Torque reference when the fault was detected.	%
U02-11	Input Term Sts	Input terminal status when fault was detected.	--
U02-12	Output Term Sts	Output terminal status when the fault was detected.	--
U02-13	Inverter Status	Inverter status before the fault was detected.	--
U02-14	Elapsed Time	Elapsed time when the fault was detected.	Hrs
U02-15	SFS Output	Displays the speed reference for the soft starter at the previous fault (U02-02).	Hz

<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Units</b>
U02-16	Motor Iq Current	Displays the q-axis current for the motor at the previous fault (U02-02).	%
U02-17	Motor Id Current	Displays the d-axis current for the motor at the previous fault (U02-02).	%
U02-20	Actual Fin Temp	Displays the temperature of the heatsink when the most recent fault occurred.	°C

**Table 5-102: Fault History Parameters**

<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Units</b>
U03-01	Last Fault	Displays the first most recent fault.	--
U03-02	Fault Message 2	Displays the second most recent fault.	--
U03-03	Fault Message 3	Displays the third most recent faults.	--
U03-04	Fault Message 4	Displays the fourth most recent fault.	--
U03-05	Fault Message 5	Displays the fifth most recent fault.	--
U03-06	Fault Message 6	Displays the sixth most recent fault.	--
U03-07	Fault Message 7	Displays the seventh most recent fault.	--
U03-08	Fault Message 8	Displays the eighth most recent fault.	--
U03-09	Fault Message 9	Displays the ninth most recent fault.	--
U03-10	Fault Message 10	Displays the 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	U03-21 Rollovers	Increments when U03-21 reaches 65535. 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 5-103: Maintenance Parameters**

<b>Parameter Code</b>	<b>Display</b>	<b>Function</b>	<b>Units</b>
U4-01	Drv Elapsed Time	Displays the cumulative operation time of the drive. 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
U4-03	Fan Elapsed Time	Displays the 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
U4-04	Fan Life Mon	Displays main cooling fan usage time in as a percentage of its expected performance life. Parameter O03-03 can be used to reset this monitor.	%
U4-05	Cap Life Mon	Displays main circuit capacitor usage time in as a percentage of their expected performance life. Parameter O03-05 can be used to reset this monitor.	%
U4-06	ChgCirc Life Mon	Displays the soft charge bypass relay maintenance time as a percentage of its estimated performance life. Parameter O03-07 can be used to reset this monitor.	%
U4-07	IGBT Life Mon	Displays IGBT usage time as a percentage of the expected performance life. Parameter O03-09 can be used to reset this monitor.	%
U04-08	Heatsink Temp	Displays the heatsink temperature.	°C
U04-09	LED Oper Check	Lights all segments of the LED to verify that the display is working properly.	--
U04-10	kWh Lower 4 dig	Monitors the drive output power. The value is shown as a 9 digit number displayed across two monitor parameters, U4-10 and U4-11.	kWH
U04-11	kWh Upper 5 dig		MWH
U04-12	CPU Occup Rate	Displays the amount of space being used in the CPU.	%
U04-13	Current PeakHold	Displays the highest current value that occurred during run.	A
U04-14	Freq@ I PeakHold	Displays the output frequency when the current value shown in U4-13 occurred.	Hz
U04-16	Motor OL1 Level	Shows the value of the motor overload detection accumulator. 100% is equal to the OL1 detection level. Accumulator is reset when drive power is cycled.	%
U04-17	Drive OL2 Level	100% = OL2 detection level	%
U04-18	Reference Source	Displays the source for the frequency reference as XY-nn.	--
U04-19	MEMOBUS Freq Ref	Displays the frequency reference provided by MEMOBUS/Modbus (decimal).	%
U04-20	Option Freq Ref	Displays the frequency reference input by an option card (decimal).	%
U04-21	Run Cmd Source	Displays the source for the Run command as XY-nn.	--
U04-22	MEMOBUS Ref Reg	Displays the drive control data set by MEMOBUS/Modbus communications register no. 0001H as a four-digit hexadecimal number.	--
U04-23	Option Ref Reg	Displays drive control data set by an option card as a four-digit hexadecimal number.	--

**Table 5-104: Control Monitor Parameters**

<b>Parameter</b>			
<b>Code</b>	<b>Display</b>	<b>Function</b>	<b>Units</b>
U06-01	Mot SEC Current	Displays the value of the motor secondary current (Iq). Motor rated secondary current is 100%.	%
U06-02	Mot EXC Current	Displays the value calculated for the motor excitation current (Id). Motor rated secondary current is 100%.	%
U06-03	ASR Input	Displays the input value when using ASR control.	%
U06-04	ASR Output	Displays the output value when using ASR control.	%
U06-05	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	Displays the output value for current control relative to motor secondary current (q-axis).	%
U06-08	ACR(d) Output	Displays the output value for current control relative to motor secondary current (d-axis).	%
U06-18	PG1 CounterValue	Monitors the number of pulses for speed detection. Analog Output Level: 10V/65535	--
U06-19	PG2 CounterValue	Monitors the number of pulses for speed detection. Analog Output Level: 10V/65535	--
U06-22	Zero Servo Pulse	Displays how far the rotor has moved from its last position in PG pulses (multiplied by 4).	--
U06-26	FF Cont Output	Output monitor for Feed Forward control.	%

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## **Troubleshooting**

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# Troubleshooting the Drive

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.

## Maintenance and Inspection

This section describes basic maintenance and inspection procedures for the IMPULSE®•G+ & VG+ Series 4.

**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).

### Alarm and Fault classes are described as follows:

- Major Fault: Brake is set, operation indicator lights flash, fault is displayed on keypad and fault contact output (terminals MA, MB, & MC) are activated. The reset key must be pressed, a multi-function input set for fault reset or power must be cycled in order to continue operation.
- Fault (minor): Brake is set, RUN Led flashes until run command is removed, fault is displayed on keypad, fault contact output (terminals MA, MB, & MC) are not activated. The reset key does not need to be pressed. The drive will attempt to run again at the next run command.
- Alarm (Warning): Operation continues, fault is displayed on the keypad, fault contact output (terminals MA, MB and MC) are not activated.

**Table 6-2: Motor Faults and Corrective Actions**

Symptom	Corrective Action
Analog frequency reference is not stable. (drifting)	1. Stabilize the analog source. 2. Increase B02-02. 3. Increase B05-01, -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 drive (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 the motor leads T1, T2, T3. 3. Change motor rotation (B03-04). 4. Set F01-02 to 0 or 1 (VG+ only).

Symptom	Corrective Action
Motor rotates, but at minimum speed only.	<ol style="list-style-type: none"> <li>1. Check wiring of speed inputs.</li> <li>2. Verify speed reference setting (A01-04).</li> <li>3. Verify reference and run source settings are correct (B03-01, -02).</li> <li>4. Verify reference priority setting (B01-18).</li> </ol>
Motor RPM too high or too low.	<ol style="list-style-type: none"> <li>1. Compare motor nameplate specifications with E1 parameter.</li> <li>2. Check maximum frequency setting (E01-04).</li> <li>3. Check minimum frequency setting (E01-09).</li> </ol>

**Table 6-3: Drive Faults, Alarms, and Indicators**

Fault Code	Fault or Indicator Name/Description	Corrective Action
<b>BE0</b> (flashing) Brake Ans Lost	<b>Brake answer back signal is lost during run.</b> While running, the multi-function input brake answer back is lost.	<ol style="list-style-type: none"> <li>1. Check brake answer back circuit.</li> <li>2. Check terminal status. (U01-10)</li> </ol>
<b>BE1</b> Rollback detect	<b>Torque Proving Fault.</b> The BE1 fault indicates that the drive 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 than the expected number of pulses (C08-05).	<ol style="list-style-type: none"> <li>1. Please reference troubleshooting encoder related faults on page 6-13.</li> </ol>
<b>BE2</b> No Current	<b>Torque Proving Fault.</b> Before the brake is released, the drives current/torque did not reach Initial Brake Release Torque level (C08-16) within the IFB OK timer (C08-02).	<ol style="list-style-type: none"> <li>1. Ensure the motor has been Auto-tuned successfully.</li> <li>2. Confirm that the holding brake is closed.</li> <li>3. If a power limit switch is used, ensure that the switch is closed.</li> <li>4. Decrease the value of C08-02 to no less than 0.5 seconds.</li> <li>5. Decrease the value of C04-02 to no less than 5.</li> <li>6. Decrease the value of C08-16 to no less than 50.</li> </ol>
<b>BE3</b> Brake Release NG	<b>Torque Proving Fault.</b> The BE3 fault indicates that the drive has released the brake and commanded the drive 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).	<ol style="list-style-type: none"> <li>1. Please reference encoder related faults on page 6-13.</li> </ol>
<b>BE4</b> (flashing) Brake Answer 1	<b>Brake Answer-Back, Brake not Released.</b> At Start, Brake Answer-back is not input within predetermined time (C08-04) after electric brake release command is output—Electric brake not released.	<ol style="list-style-type: none"> <li>1. Check brake answer back circuit.</li> <li>2. Increase the value of C08-04.</li> <li>3. Check terminal status (U01-10).</li> </ol>
<b>BE5</b> (flashing) Brake Answer 2	<b>Brake Answer-Back At Stop.</b> At Stop, Brake Answer-back signal is not removed within predetermined time (C08-11) after electric brake release command is removed—Electric brake not closed.	<ol style="list-style-type: none"> <li>1. Check brake answer back circuitries</li> <li>2. Increase the value of C08-11 time.</li> </ol>

Fault Code	Fault or Indicator Name/Description	Corrective Action
<b>BE6</b> <i>(flashing)</i> Brake Stop Alarm	<b>Brake Proving Alarm.</b> The BE6 alarm indicates that the drive has commanded the brake to set but it has detected more than the expected encoder feedback. 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).	1. Please reference troubleshooting encoder related faults on page 6-13.
<b>BE7</b> Brake Welded	<b>Brake Answer-Back Major Fault.</b> At Power Up, Brake Answer-Back is on - Electric brake not closed.	1. Check if brake is closed. 2. Check brake answer back circuitry.
<b>BE8</b> Brake Slipping Fault	<b>Brake Slipping Fault.</b> The BE8 alarm indicates that the drive has detected more than the expected encoder feedback. A BE8 alarm will occur 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.
<b>boL</b>	<b>Braking Transistor Overload Fault.</b> 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.
<b>BUS</b> Option Com Err	<b>Option Card Communication Error.</b> Communication to the option card was lost.	1. Check all connections.
<b>CALL</b> <i>(flashing)</i> SI-F/G Com Call	<b>Serial Communication Transmission Error.</b> Control data is not received correctly after power supply is turned ON for 2 sec.	1. Check serial device connections. 2. Ensure drive is properly programmed for serial communication.
<b>Can't Run</b> Drive not ready	<b>User is trying to give a run command without first Enable Drive Enable Multi-Function input or Fwd or Rev input are present at power up.</b>	1. Turn on Drive Enable Multi-function input. 2. Check H01-01 to H01-08 programming. 3. Change B03-10 to allow run at power up.
<b>CE</b> Memobus Com Err	<b>Communication Error.</b> Serial communications disruption.	1. Check serial connections (6 CN). 2. Check H05-01 through H05-05 for proper programming.
<b>CPF00</b> Com-Err (OP&INV)	<b>Control Circuit Fault 1— Keypad Transmission.</b> Because of external noise, excessive vibration or shock, or component failure (including RAM and PROM), one or both of the following occurs: <ul style="list-style-type: none"> <li>• Transmission between the inverter and keypad cannot be established 5 sec after power-up.</li> <li>• External RAM of CPU is defective.</li> </ul>	1. Check the keypad connection. 2. Replace keypad. 3. Replace Control board.
<b>CPF01</b> Com-Err (OP&INV)	<b>Control Circuit Fault 2—Keypad Transmission.</b> After initial power-up, communication between the inverter and keypad was interrupted for more than 2 seconds.	1. Check keypad connection. 2. Cycle Power 3. Replace keypad 4. Replace Control board.
<b>CPF02</b> BB Circuit Err	<b>Base Block Circuit Fault.</b> Base block circuit fault at power-up.	1. Cycle power. 2. Ensure that the control board terminals are shielded from electrical noise. 3. Replace Control board.

<b>Fault Code</b>	<b>Fault or Indicator Name/Description</b>	<b>Corrective Action</b>
<b>CPF03</b> EEPROM Err	<b>EEPROM Fault.</b> Invalid data found in the EEPROM.	<ol style="list-style-type: none"> <li>1. Cycle power.</li> <li>2. Ensure that the control board terminals are shielded from electrical noise.</li> <li>3. Replace Control board.</li> </ol>
<b>CPF04</b> Internal A/D Err	<b>Internal A/D Converter Fault.</b> CPU internal analog-digital converter fault.	<ol style="list-style-type: none"> <li>1. Cycle power.</li> <li>2. Ensure that the control board terminals are shielded from electrical noise.</li> <li>3. Replace Control board.</li> </ol>
<b>CPF05</b> External A/D Err	<b>External A/D Converter Fault.</b> CPU external analog-digital converter fault.	<ol style="list-style-type: none"> <li>1. Cycle power.</li> <li>2. Ensure that the control board terminals are shielded from electrical noise.</li> <li>3. Replace Control board.</li> </ol>
<b>CPF06</b> Option Error	<b>Option Card Fault.</b> Optional card has disconnected or failed.	<ol style="list-style-type: none"> <li>1. Power down.</li> <li>2. Verify proper installation of all option cards.</li> </ol>
<b>CPF10</b> ASIC-ERR	<b>ASIC Version Fault 10.</b> .	<ol style="list-style-type: none"> <li>1. Cycle power.</li> <li>2. Replace the drive.</li> </ol>
<b>CPF20</b> Option A/D Error	<b>Control Circuit Fault 20 — AI-14.</b> Analog-to-digital converter fails or analog speed reference error.	<ol style="list-style-type: none"> <li>1. Power down.</li> <li>2. Verify proper installation of AI-14B.</li> <li>3. Replace AI-14B card.</li> </ol>
<b>CPF21</b> Option CPU Down	<b>Control Circuit Fault 21 — CPU on Optional Card.</b> CPU on an installed optional card fails.	<ol style="list-style-type: none"> <li>1. Power down.</li> <li>2. Verify proper installation of Option card.</li> <li>3. Replace card.</li> </ol>
<b>CPF22</b> Option Type Err	<b>Control Circuit Fault 22 — Optional Card Code.</b> Optional card code is not compatible with the inverter.	<ol style="list-style-type: none"> <li>1. Power down.</li> <li>2. Verify proper card.</li> <li>3. Verify proper installation of Option card.</li> <li>4. Replace card.</li> </ol>
<b>CPF23</b> Option DPRAM Err	<b>Control Circuit Fault 23 — DP-RAM.</b> DP-RAM on an installed optional card failed.	<ol style="list-style-type: none"> <li>1. Power down.</li> <li>2. Remove any inputs to card.</li> <li>3. Verify proper installation of Option card.</li> <li>4. Replace card.</li> </ol>
<b>CPF23– CPF34</b>	<b>Control Circuit Error.</b>	<ol style="list-style-type: none"> <li>1. Cycle power.</li> <li>2. Ensure that the terminal board is seated properly.</li> <li>3. Set A01-05 = 5550.</li> <li>4. Replace control board and/or terminal board.</li> </ol>
<b>CPF40– CPF45</b>		
<b>Dev</b> Speed Deviation	<b>Speed Deviation Fault.</b> Occurs when the deviation of the speed reference and speed feedback exceeds the regulation level, F01-27 for the time F01-28.	<ol style="list-style-type: none"> <li>1. Please reference troubleshooting encoder related faults on page 6-13.</li> </ol>
<b>EF</b> ( <i>flashing</i> ) External Fault	Both FORWARD/UP and REVERSE/DOWN commands are input at same time for 500 msec or longer.	<ol style="list-style-type: none"> <li>1. Check control input wiring.</li> <li>2. Check the sequence of operation.</li> </ol>
<b>EF0</b> Optional External Fault	External fault input from communication option card.	<ol style="list-style-type: none"> <li>1. Check communication option card connection and signals.</li> </ol>

<b>Fault Code</b>	<b>Fault or Indicator Name/Description</b>	<b>Corrective Action</b>
<b>EF1</b> External Fault 1	External fault occurs on Terminal S1.	1. Check constant H01-01 for proper programming. 2. Check the conditions for input terminal S1.
<b>EF2</b> External Fault 2	External fault occurs on Terminal S2.	1. Check constant H01-02 for proper programming. 2. Check the conditions for input terminal S2.
<b>EF3</b> External Fault 3	External fault occurs on Terminal S3.	1. Check constant H01-03 for proper programming. 2. Check the condition of the input terminal S3.
<b>EF4</b> External Fault 4	External fault occurs on Terminal S4.	1. Check constant H01-04 for proper programming. 2. Check the condition of the input terminal S4.
<b>EF5</b> External Fault 5	External fault occurs on Terminal S5.	1. Check constant H01-05 for proper programming. 2. Check the condition of the input terminal S5.
<b>EF6</b> External Fault 6	External fault occurs on Terminal S6.	1. Check constant H01-06 for proper programming. 2. Check the condition of the input terminal S6.
<b>EF7</b> External Fault 7	External fault occurs on Terminal S7.	1. Check constant H01-07 for proper programming. 2. Check the condition of the input terminal S7.
<b>EF8</b> External Fault 8	External fault occurs on Terminal S8.	1. Check constant H01-08 for proper programming. 2. Check the condition of the input terminal S8.
<b>ERR</b> EEPROM R/W Err	<b>EEPROM Read/Write Fault.</b> EEPROM internal data did not match when initializing the parameter.	1. Cycle Power. 2. User initialize (A01-05=1110). 3. Replace Control board.
<b>FAn</b>	<b>Internal Fan Fault.</b> Internal cooling fan has malfunctioned.	1. Cycle power to the drive. 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.
<b>HBB</b> (flashing) Hardware Base Block	<b>External Base Block Indicator.</b> The flashing base block signal is the result of a multi-function input in the terminal strip. The base block indicates that the drive's IGBTs have been disabled. The motor will begin coasting when the base block input is received. If a RUN command is still present when the BB signal is removed, the output voltage will be restored to the previous operating level and operation will continue at the previously commanded frequency.	1. Check constants H01-01 through H01-08 for proper programming. 2. Check terminal status. (U01-10)

<b>Fault Code</b>	<b>Fault or Indicator Name/Description</b>	<b>Corrective Action</b>
<b>GF</b> Ground Fault	During operation, the inverter sums the currents of all three motor phases. Ideally, the sum should always equal zero. If the sum is greater than 50% of the inverter rated output current, a GF occurs.	<ol style="list-style-type: none"> <li>1. Disconnect motor from drive and check it for shorts using a megger.</li> <li>2. Ensure that R/C Surge Suppressors are used across all brake contactor coils to prevent disturbance by electrical transients.</li> </ol>
<b>KLX</b> Klixon	<b>Klixon Circuit Alarm.</b> Input by MFI data 56 or 57 but not both.	<ol style="list-style-type: none"> <li>1. Check Motor for Overtemp.</li> <li>2. Check Klixon Circuit.</li> </ol>
<b>LC dn</b> Load Check Done	<b>Load Check Done Alarm.</b> 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.	<ol style="list-style-type: none"> <li>1. None.</li> </ol>
<b>LC</b> Load Check Err	<b>Load Check Fault.</b> Load is greater than specified amount.	<ol style="list-style-type: none"> <li>1. Reduce Load.</li> <li>2. Check Load Check sequence set-up. (C05-xx).</li> </ol>
<b>LF</b> Output Phase Loss	An open phase occurred at the inverter output.	<ol style="list-style-type: none"> <li>1. Check for broken wires in output cable.</li> <li>2. Check for open winding in the motor.</li> <li>3. Check for loose terminals</li> </ol>
<b>LF2</b>	<b>Output Current Imbalance.</b> One or more of the phases in the output current are lost.	<ol style="list-style-type: none"> <li>1. Check for faulty wiring or poor/loose connections on the output side of the drive.</li> <li>2. Correct the wiring.</li> <li>3. Measure the line-to-line resistance for each motor phase. Ensure all values match.</li> <li>4. Replace the motor.</li> </ol>
<b>LL1</b> <i>(flashing)</i> Lower Limit 1 Err	<b>Lower Limit 1—SLOW DOWN Indicator.</b> Lower Limit 1—SLOW DOWN is input (switch status is changed).	<ol style="list-style-type: none"> <li>1. May not require corrective action.</li> <li>2. Check the Limit Switches position.</li> <li>3. Check the Limit Switches condition.</li> </ol>
<b>LL2</b> <i>(flashing)</i> Lower Limit 2 Err	<b>Lower Limit 2—STOP Indicator.</b> Lower Limit 2—STOP is input (switch status is changed).	<ol style="list-style-type: none"> <li>1. May not require corrective action.</li> <li>2. Check the Limit Switches position.</li> <li>3. Check the Limit Switches condition.</li> </ol>
<b>MNT</b> Maintenance Req'd	<b>Maintenance Required Alert.</b> Running time has exceeded C12-05	<ol style="list-style-type: none"> <li>1. Reset timer by MFI=5A or depress Mode/Service key three times and enter within 2 seconds.</li> </ol>
<b>OC</b> Over Current	<b>Over Current Detected.</b> Output current exceeds 200% of inverter rated output current.	<ol style="list-style-type: none"> <li>1. Check for a phase-to-phase short in the motor or wiring using a megger.</li> <li>2. Extend the acceleration/deceleration time.</li> <li>3. Check torque limit setting.</li> <li>4. Please reference troubleshooting encoder related faults on page 6-13.</li> </ol>
<b>OH</b> <i>(flashing)</i> Heatsnk Over temp	<b>Overheat Pre-Alarm.</b> Heatsink is overheating. The temperature of the inverter's heatsink exceeded the setting in L08-02.	<ol style="list-style-type: none"> <li>1. The inverter cooling fan has stopped.</li> <li>2. Reduce the ambient temperature.</li> </ol>



<b>Fault Code</b>	<b>Fault or Indicator Name/Description</b>	<b>Corrective Action</b>
<b>OH1</b> Heatsink MaxTemp	<b>Overheat Fault.</b> 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 that the heat sink cooling fans are functioning. 2. Ensure that the heat sink is free from dirt and debris.
<b>OH2</b> (flashing) Overheat 2	<b>Overheat Alarm.</b> Signal is input by external terminal. H01-xx=39	3. Ensure that the inverter's ambient temperature is within specification. 4. Replace the 24 VDC fan 5. Replace the heat sink thermistor(s)
<b>OH3</b> Motor Overheat 1	<b>Motor Overheating 1.</b> Thermistor analog input detected motor overheating. See L01-03	1. Check the motor rated current value, E02-01. 2. Increase cycle time or reduce the load.
<b>OH4</b> Motor Overheat 2	<b>Motor Overheating 2.</b> Thermistor analog input detected motor overheating. See L01-04	
<b>OL1</b> Motor Overloaded	<b>Motor Overload Fault.</b> Inverter output exceeded the motor overload level.	1. Ensure drive is programmed with proper motor full load Amps (E02-01). 2. Reduce the load.
<b>OL2</b> INV Overload	<b>Inverter Overload Fault.</b> Inverter output exceeded the inverter overload level.	1. Reduce the load. 2. Extend the acceleration time.
<b>OPE01</b> kVA Selection	<b>kVA Setting Fault.</b> Inverter kVA setting range is incorrect.	1. Check 02-04 constant for proper kVA.
<b>OPE02</b> Limit	<b>Setting Out of Range.</b> Parameter setting is out of range.	1. With the fault displayed on the keypad, press the DATA/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 constants with defaults. 5. Cycle Power.
<b>OPE03</b> Terminal	<b>Multi-Function Input Setting Fault.</b> Set values other than "F" and "FF" are duplicated.	1. Check the settings for H01-01 to H01-06, verify that the same input is not used twice.
<b>OPE04</b> Reset	<b>Initial Parameter Settings Fault.</b>	1. Set A01-05 to 5550 to use the parameter settings saved to the terminal block memory.
<b>OPE05</b> Sequence Select	<b>Frequency Reference Source Selection Error.</b> 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.
<b>OPE06</b> PG Opt Missing	<b>Missing PG Card.</b> A closed loop control method was selected, and the required PG feedback card is not installed.	1. Install the required option card. 2. Remove power and reset the option card. 3. Check the A01-02, control method, program setting
<b>OPE07</b> Analog Selection	<b>Multi-Function Analog Input Setting Fault.</b> H03-06 and H03-09 multi-Function analog input settings are set to the same value.	1. Check the function selections.

Fault Code	Fault or Indicator Name/Description	Corrective Action
<b>OPE08</b> Terminal	<b>Selection Parameter error.</b> A parameter has been changed that is not available in the present control method.	<ol style="list-style-type: none"> <li>1. Undo the last parameter change (if known)</li> <li>2. Scroll through modified constants for obvious setting errors.</li> <li>3. Perform a user initialize (A01-05=1110) <b>CAUTION: All settings will be restored to the factory defaults.</b></li> </ol>
<b>OPE10</b> V/F Ptn Setting	<b>V/F Parameter Setting Error.</b>	<ol style="list-style-type: none"> <li>1. Check Parameters E01-04 to E01-11.</li> </ol>
<b>OPE11</b> Carrier Frq/On-Delay	<b>Carrier Frequency Parameter Error.</b>	<ol style="list-style-type: none"> <li>1. Check Parameters D10-01 to D10-05.</li> </ol>
<b>OPE18</b> Weight Measure	<b>C10-05 or C10-06 Setting Error.</b>	<ol style="list-style-type: none"> <li>1. Satisfy condition C10-05 &gt; C10-06</li> </ol>
<b>OPE19</b> Stp-Mthd & Ctrl	<b>Incompatible Setting of Stopping Method and Control Method.</b>	<ol style="list-style-type: none"> <li>1. Satisfy B03-03 <math>\geq</math> 6 and A01-02 <math>\leq</math> 1.</li> </ol>
<b>OPE20</b> EPLS Setting	<b>Electronic Programmable Limit Switch Setting Error.</b>	<ol style="list-style-type: none"> <li>1. Check if C03-14 = 0, 2 or 4: C03-19 &lt; C03-18 &lt; C03-17 &lt; C03-16</li> <li>1. Check if C03-14 = 1 or 3: C03-19 &gt; C03-18 &gt; C03-17 &gt; C03-16</li> </ol>
<b>OPE21</b> 2 Channel Missing	<b>Option Card PG-X3 is missing when C11-08 is Enabled.</b>	<ol style="list-style-type: none"> <li>1. Install correct option card.</li> </ol>
<b>OPE22</b> Ctrl & Motion	<b>Incompatible Setting of Motion and Control Mode.</b>	<ol style="list-style-type: none"> <li>1. Satisfy A01-02 <math>\leq</math> 1 and A01-03 <math>\geq</math> 2.</li> </ol>
<b>OPE26</b> CPU error	<b>Control Circuit Error.</b> The hardware is damaged.	<ol style="list-style-type: none"> <li>1. If the problem continues, replace the control board or the entire drive. Contact Magnetek Service for instructions on replacing the control board.</li> </ol>
<b>OPR</b> Oper Disconnect	<b>Keypad Disconnected.</b> The keypad is removed while the inverter is running, and the run command was initiated via the keypad RUN key.	<ol style="list-style-type: none"> <li>1. Secure the keypad.</li> <li>2. Verify O02-06 setting.</li> </ol>
<b>OS-1</b> <b>OS-2</b> Over Speed	<b>Overspeed Fault.</b> 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 drive is programmed to flux vector "torque control" mode, and no load is present, an overspeed fault will typically occur.	<ol style="list-style-type: none"> <li>1. Check the Automatic Speed Regulator settings, D4 sub group.</li> <li>2. Check setting of F01-24, F01-25.</li> <li>3. Verify proper encoder PPR setting, F01-01.</li> </ol>
<b>OT1</b> Overtorque Det 1	<b>Overtorque Detection Level 1 Fault.</b> Defined by L06-02. Alarm defined by L06-01.	<ol style="list-style-type: none"> <li>1. Check for proper programming for L06-xx constant.</li> </ol>
<b>OT2</b> Overtorque Det 2	<b>Overtorque Detection Level 2 Fault.</b> Defined by L06-05. Alarm defined by L06-04.	<ol style="list-style-type: none"> <li>1. Check for proper programming for L06-xx constant.</li> </ol>
<b>OV</b> DC Bus Overvolt	<b>Overvoltage Fault.</b> The main circuit direct current voltage exceeded the overvoltage level	<ol style="list-style-type: none"> <li>1. Extend the deceleration time.</li> <li>2. Check for proper DBU operation.</li> <li>3. Check the resistor.</li> <li>4. Check the line voltage.</li> </ol>

<b>Fault Code</b>	<b>Fault or Indicator Name/Description</b>	<b>Corrective Action</b>
<b>OV</b> (flashing) DC Bus Overvolt	<b>Overvoltage Fault.</b> Overvoltage occurs during stop. Main circuit DC voltage rises above the detection level while the drive output is off.	1. Check the line voltage.
<b>PF</b> Input Pha Loss	<b>Input Phase Loss Fault.</b> Inverter input power supply has open phase.	1. Check the line voltage and fuses. 2. Remove power. 3. Re-tighten the input terminal screws.
<b>PGO-1</b> PG Open Ch1	<b>Pulse Generator Channel 1 Fault.</b> PGO-1-S, software detected fault. PGO-1-H, hardware detected fault	1. Check for proper direction of encoder feedback. 2. Please reference troubleshooting encoder related faults on page 6-13.
<b>PGO-2</b> PG Open 2	<b>Pulse Generator Channel 2 Fault.</b> PGO-2-S, software detected fault. PGO-2-H, hardware detected fault	1. Check for proper direction of encoder feedback. 2. Please reference troubleshooting encoder related faults on page 6-13.
<b>PUF</b> DC Bus Fuse Open	<b>DC Bus Fuse Open Fault.</b> The DC fuse is open.	1. Check for damaged transistor. 2. Check load-side short circuit. 3. Check grounding.  <i>Do not replace an open DC bus fuse until the cause of failure has been corrected; non-warranty, damage to the drive may result. Refer to the "Power Section Check".</i>
<b>RF</b>	<b>Braking Resistor Fault.</b> the resistance of the braking resistor is too low, or the proper braking resistor has not been installed.	1. Verify correct braking resistor.
<b>RH</b>	<b>Braking Resistor Overheat.</b> Deceleration time is too short and excessive regenerative energy is flowing back into the drive.	1. Verify correct braking resistor.
<b>RR</b> DynBrk Transistr	<b>Braking Transistor Fault.</b> 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.
<b>SC</b> Short Circuit	<b>Short Circuit Fault.</b> The inverter has detected an output short circuit condition.	1. Disconnect the motor from the inverter. 2. Check for a short circuit in the motor or wiring using a megger.
<b>SLC</b> Slack Cable Detection	<b>Slack Cable Fault.</b> A hoist slack cable condition occurred.	1. May not require corrective action. 2. Check proper programming of Slack Cable Detection (C11-xx).
<b>SNAP</b> Snapped Shaft	<b>Snapped Shaft Fault.</b> A drive train discontinuity has been detected.	1. Check for loose or broken coupling. 2. Check for loose encoder(s). 3. Check for broken shaft.
<b>SVE</b> Load Float Fault	<b>Load Float Fault.</b>	1. Check to verify shaft is not rotating during load float. Ensure load is not greater than capacity. 2. Check torque limit settings (C07-xx). 3. Check encoder signal.

<b>Fault Code</b>	<b>Fault or Indicator Name/Description</b>	<b>Corrective Action</b>
<b>TEST</b> Exit Test Mode	<b>Test Mode exceeded the allowable amount of time.</b>	<ol style="list-style-type: none"> <li>1. Ensure the test mode MFDI is OFF.</li> <li>2. Reset the fault (Fault Reset MFDI, Keypad, or cycle power)</li> <li>3. Ensure that test mode is not used for normal operation.</li> </ol>
<b>UL1</b> Upper Limit 1 Err	<b>Upper Limit 1—SLOW DOWN Indicator.</b> Upper Limit 1—SLOW DOWN switch status is changed.	<ol style="list-style-type: none"> <li>1. May not require corrective action.</li> <li>2. Check the limit switches location.</li> <li>3. Check the limit switches condition.</li> </ol>
<b>UL2</b> Upper Limit 2 Err	<b>Upper Limit 2—STOP Indicator.</b> Upper Limit 2—STOP switch status is changed.	<ol style="list-style-type: none"> <li>1. May not require corrective action.</li> <li>2. Check the limit switches location.</li> <li>3. Check the limit switches condition.</li> </ol>
<b>UL3</b> Upper Limit 3 Err	<b>Upper Limit 3—Weighted Stop.</b> Upper Limit weighted limit switch tripped.	<ol style="list-style-type: none"> <li>1. May not require corrective action.</li> <li>2. Check the position of the Limit Switch.</li> <li>3. Check the condition of the Limit Switch.</li> <li>4. Check the conditions of/for terminal H01-xx (U01-10)</li> </ol>
<b>UT1</b> Undertorque Det 1	<b>Undertorque Detection 1.</b> The current is less than L06-02 for more than L06-03.	<ol style="list-style-type: none"> <li>1. Check settings.</li> <li>2. Check motor coupling.</li> </ol>
<b>UT2</b> Undertorque Det 2	<b>Undertorque Detection 2.</b> The current is less than L06-05 for more than L06-06.	<ol style="list-style-type: none"> <li>1. Check settings.</li> <li>2. Check motor coupling.</li> </ol>
<b>UV</b> DC Bus Undervolt	<b>Undervoltage Fault.</b> Undervoltage status occurs for more than 2 sec during STOP.	<ol style="list-style-type: none"> <li>1. Check the power source wiring.</li> <li>2. Replace any bad branch fuses.</li> <li>3. Check collector system.</li> </ol>
<b>UV1</b> DC Bus Undervolt	<b>Undervoltage 1 Fault.</b> Undervoltage status occurs for more than 2 sec during RUN command.	<ol style="list-style-type: none"> <li>1. Check power supply wiring.</li> <li>2. Correct the line voltage.</li> <li>3. Check collector system.</li> </ol>
<b>UV2</b> CTL PS Undervolt	<b>Undervoltage 2 Fault.</b> The inverter detected a loss of the 24V logic power supply voltage.	<ol style="list-style-type: none"> <li>1. Check power supply wiring.</li> <li>2. Correct the line voltage.</li> <li>3. Check collector system.</li> </ol>
<b>UV3</b> MC Answerback	<b>MC Fault.</b> The pre-charge contactor opened during operation.	<ol style="list-style-type: none"> <li>1. Check power supply wiring.</li> <li>2. Correct the line voltage.</li> <li>3. Check collector system.</li> <li>4. Wait 30-45 seconds before restarting drive after auto shut down.</li> </ol>
<b>voF</b>	<b>Output Voltage Detection Fault.</b> Problem detected with the voltage on the output side of the drive.	<ol style="list-style-type: none"> <li>1. Replace the drive.</li> </ol>

# Troubleshooting Encoder Related Faults

The faults in this section may involve the encoder feedback system. During system startup, these faults are often caused by parameters that need to be adjusted. However, after the system has been running for some time without a fault, this usually indicates a problem with the physical system and adjusting the parameters should only be done after the physical system has been inspected.

## Fault Code: Dev-1, Dev-2 Speed Deviation

### Definition

Speed deviation faults mean that the drive output is not following the commanded speed reference. This is possible if there is not enough torque available to follow the internal speed reference. Therefore, speed deviations will typically occur when the drive is at its programmed torque limit. In addition, if the drive receives erratic, or missing, encoder pulses, speed deviations are also possible. If the initial drive 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 drive 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 occurring can result in loss of control of the load under certain circumstances.*
2. As a precaution the load float time, parameter 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 with the sensor head, or the encoder shaft coupling (depending on the type of encoder used). If the pulse wheel is misaligned or the shaft coupling is loose the drive will get erratic pulse signals or no signals at all causing a speed deviation fault or PGO (Pulse Generator Open) fault. Repairs to the encoder wheel or shaft coupling should be made immediately before again attempting to operate the hoist.
5. If the encoder appears to have no mechanical problems, the encoder cable should be checked for damage and replaced if a problem is found.
  - 5.1 Each of the encoder wires should be checked for continuity.
  - 5.2 The wires should be checked for shorts between any two wires.
  - 5.3 The wires should be checked for shorts to the shield or ground.
  - 5.4 Visually inspect the cable for damage that may be causing intermittent problems.
6. If the encoder feedback system checks out mechanically and electrically, then the last physical check to make is for something in the mechanical system that might be resisting normal operation. One example may be the brake is not opening fully and is causing enough drag to prevent 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.
  - 7.1 Check if the acceleration or deceleration times have been changed (B05-01, B05-02, or C01-02).
  - 7.2 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 torque limited acceleration or deceleration, 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 trips.)*
9. Increase Encoder Excessive Speed Deviation Level to no more than 30 (F01-27).
10. After the corrective action has been taken and the fault no longer occurs then the load float time, C08-10, can be set back to its initial value.

## Fault Code: PGO–Pulse Generator Signal Fault

### Definition

The pulse generator signal missing fault indicates that the drive has detected a problem with encoder feedback. This fault will typically occur if the drive doesn't receive any encoder feedback pulses while it is commanded to run or encoder wiring has a discontinuity.

### 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 occurring can result in loss of control of the load under certain circumstances.*
2. As a precaution, the load float time, parameter 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 F01-08.
3. Check the alignment of the encoder pulse wheel with the sensor head, the encoder shaft coupling (depending on the type of encoder used), or check for a failed encoder sensor head. If one of these conditions exists the drive will get erratic pulse signals or no signal at all causing a speed deviation fault or PGO fault. Repairs to the encoder wheel or shaft coupling should be made immediately before attempting to operate the hoist again.
4. If the encoder appears to have no mechanical problems, the encoder cable should be checked for damage and replaced if a problem is found.
  - 4.1 Each of the encoder wires should be checked for continuity.
  - 4.2 The wires should be checked for shorts between any two wires.
  - 4.3 The wires should be checked for shorts to the shield or ground.
  - 4.4 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 brake failing to open.
6. After corrective action has been taken and the fault no longer occurs then the load float time, C08-10, can be set back to initial value.

## Fault Code: BE1–Torque Proving Fault

### Definition

The BE1 fault indicates that the drive 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 drive/motor having insufficient torque to suspend the load.

### Correction Action

1. Check the encoder cable for damage and proper grounding. Replace it if a problem is found.
  - 1.1 Each of the encoder signals should be checked for excessive noise.
  - 1.2 The shielded encoder cable should be properly grounded.
  - 1.3 Visually inspect the cable for damage that may be causing intermittent problems.
2. Check the alignment of the encoder pulse wheel with the sensor head, or the encoder shaft coupling (Depending on the type of encoder used). If the pulse wheel is misaligned or the shaft coupling is loose the drive may get erratic pulse signals possibly causing a BE1 fault. Repairs to the encoder wheel or shaft coupling should be made immediately before again attempting to operate the hoist.
3. If none of the above steps has identified a valid 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 trips.*

4. Increase C08-05 to no more than 800 pulses.

## Fault Code: BE3–Brake Release Fault

### Definition

The BE3 fault indicates that the drive has released the brake and commanded the drive 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 drive 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 (depending on the type of encoder used). If the pulse wheel is misaligned or the shaft coupling is loose the drive will get erratic pulse signals or no signals at all possibly causing a BE3 fault. Repairs to the encoder wheel or shaft coupling should be made immediately before again 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.
  - 3.1 Each of the encoder wires should be checked for continuity.
  - 3.2 The wires should be checked for shorts between any two wires.
  - 3.3 The wires should be checked for shorts to the shield or ground.

- 3.4 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 trips.*
  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.

## Fault Code: BE6–Brake Proving Alarm

### Definition

The BE6 alarm indicates that the drive has commanded the brake to set but it has detected more than the expected encoder feedback. 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).

*NOTE: This fault typically indicates a failed brake. Power should **NOT** be removed while this fault 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 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.
  - 2.1 Each of the encoder signals should be checked for excessive noise.
  - 2.2 The shielded encoder cable should be properly grounded.
  - 2.3 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 (Depending on the type of encoder used). If the pulse wheel is misaligned or the shaft coupling is loose the drive may get erratic pulse signals possibly causing a BE6 fault. 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 a fault reaction time as possible without causing nuisance trips.*
5. Ensure that C08-11 is equal to the brake's mechanical delay time.
6. Increase the value of C08-13.



## Fault Code: OC—Over Current Fault

### Definition

An over current fault is caused if the output current exceeds 200% of the inverter rated output current. This fault can be caused by short circuits in the wiring or in the motor, and it can also be caused by parameters that are not adjusted properly. One other cause of this alarm could be erratic or no encoder feedback. In the last instance, the drive 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 drive to increase current output to the motor in an attempt to correct the position until an over current fault occurs.

### 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 with the sensor head, or the encoder shaft coupling (depending on the type of encoder used). If the pulse wheel is misaligned or the shaft coupling is loose the drive will get erratic pulse signals or no signals at all possibly causing an OC fault. Repairs to the encoder wheel or shaft coupling should be made immediately before again 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.
  - 3.1 Each of the encoder wires should be check for continuity.
  - 3.2 The wires should be checked for shorts between any two wires.
  - 3.3 The shield should be check for proper grounding.
  - 3.4 The wires should be checked for shorts to the shield or ground.
  - 3.5 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), check if any of the torque limit parameters (C07-01 to C07-04) have been changed. If these parameters have been changed to allow a higher torque value, it could cause overcurrent trips.

**NOTE:** *Changing these parameters could also induce speed deviation or overload faults. Only a trained technician should modify these parameters. It is desirable to have as fast a fault reaction time as possible without causing nuisance trips.*

# Fault Display and Corrective Actions at Auto-tuning

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

**Table 6-4: Fault Display and Corrective Actions**

Fault Display	Fault or Indicator Name/Description	Corrective Action
<b>Er-01</b> Fault	<b>Motor Data Fault.</b> 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 mode and line-to-line resistance tuning.)	<ul style="list-style-type: none"> <li>• Check input data.</li> <li>• Check inverter and motor capacity</li> <li>• Check motor rated current and no-load current.</li> </ul>
<b>Er-02</b> Minor Fault	<b>Alarm.</b> The minor fault is detected during auto-tuning.	<ul style="list-style-type: none"> <li>• Check input data.</li> <li>• Check wirings</li> <li>• Check load.</li> </ul>
<b>Er-03</b> STOP Key	<b>STOP Key Input.</b> The stop key is pressed during auto-tuning.	
<b>Er-04</b> Resistance	<b>Line to Line Resistance Fault.</b> Auto-tuning is not completed within the expected time. The auto-tuning is outside the parameter setting.	<ul style="list-style-type: none"> <li>• Check input data.</li> </ul>
<b>Er-05</b> No-Load Current	<b>No-load Current Fault.</b> Auto-tuning is not completed within the expected time. The auto-tuning is outside the parameter setting.	<ul style="list-style-type: none"> <li>• Check motor wiring.</li> <li>• If a motor and a load are connected, disconnect the motor from machinery system.</li> </ul>
<b>Er-08</b> Rated Slip	<b>Rated Slip Fault.</b> Auto-tuning is not completed within the expected time. The auto-tuning is outside the parameter setting.	
<b>Er-09</b> Accelerate	<b>Acceleration Fault.</b> The motor did not accelerate at the expected time.	<ul style="list-style-type: none"> <li>• Increase B05-01 (acceleration time).</li> <li>• If C07-01 and C07-02 (torque limit value) are decreased, increase values.</li> <li>• If a motor and a load are connected, separate the motor from the load.</li> </ul>
<b>Er-11</b> Motor Speed	<b>Motor Speed Fault (Rotation type tuning only).</b> The motor speed was over 100% at auto-tuning (flux vector control without PG only).	<ul style="list-style-type: none"> <li>• Increase B05-01 (acceleration time).</li> <li>• If a motor and a load are connected, separate the motor from the load.</li> </ul>
<b>Er-12</b> I.det.Circuit	<b>Current Detection Fault.</b> Current exceeded the motor rated current.	<ul style="list-style-type: none"> <li>• Release brake.</li> <li>• Check for open motor lead.</li> </ul>
<b>Er-13</b> Leakage Inductance	<b>Leakage Inductance Fault.</b> Auto-tuning did not finish within the set time.	<ul style="list-style-type: none"> <li>• Check the T1 parameters.</li> <li>• Check motor wiring.</li> </ul>
<b>End 1*</b> V/F Oversetting	<b>Excess V/F setting (Rotation type tuning only).</b> The torque reference exceeded 100% and no load current exceeded 70%.	<ul style="list-style-type: none"> <li>• Check the T1 parameters.</li> <li>• Disconnect the motor from the load.</li> </ul>

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

Fault Display	Fault or Indicator Name/Description	Corrective Action
End 2 Saturation	<b>Motor Iron Core Saturation Coefficient Fault (Rotation type tuning only).</b> 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.	<ul style="list-style-type: none"> <li>• Check the T1 parameters.</li> <li>• Check motor wiring.</li> <li>• Disconnect the motor from the load</li> </ul>
End 3 Rated FLA Alm	<b>Rated Current Set Alarm.</b> Motor current during tuning was greater than the set value.	<ul style="list-style-type: none"> <li>• Check E02-01.</li> </ul>

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

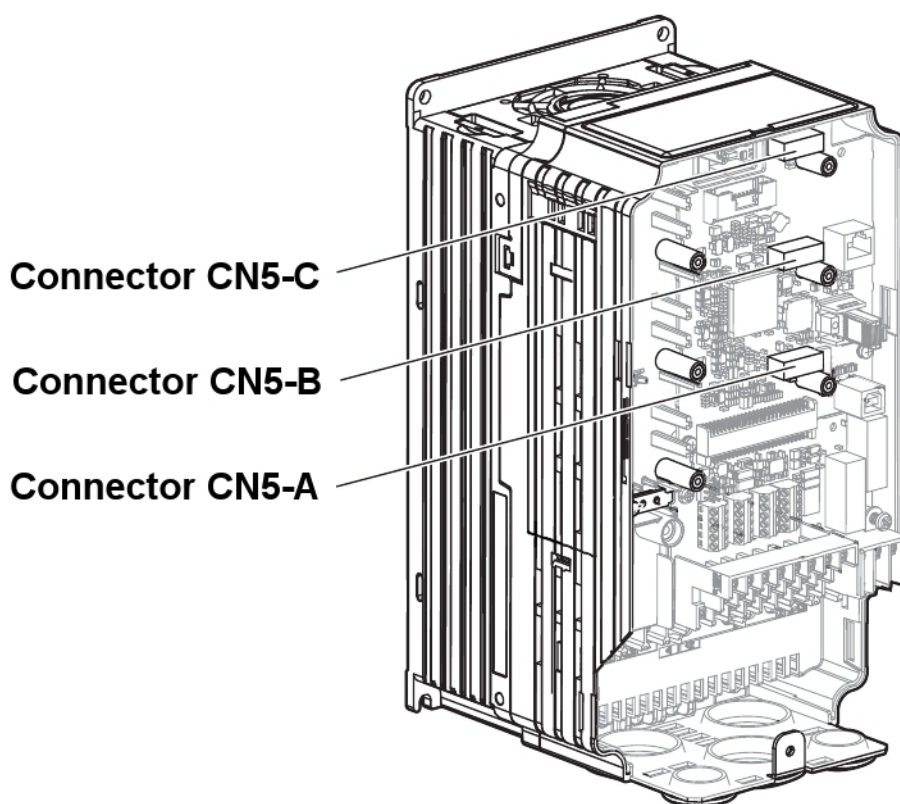
# Troubleshooting Option Card Related Faults

## Drive-Side Error Codes

Table 7 lists the various fault codes related to option cards. Check the following items first when an error code occurs on the drive:

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

**NOTE:** The ports are checked in alphanumeric order. Please see Figure 6-1 for port locations.



**Figure 6-1:Option Card Ports**

Error	Card	Fault or Indicator Name/Description	Cause	Possible Solution
oFA01	A1-A3	<b>Option Fault (CN5-A).</b> Option is not properly connected.	• Option at drive port CN5-A was changed during run.	• Turn the power off and check the connectors between the drive and the option.
	AO-A3			
	DI-A3			
	DO-A3			
	S4I			
	S4IO			

Error	Card	Fault or Indicator Name/Description	Cause	Possible Solution
oFB01	A1-A3 AO-A3 DI-A3 DO-A3 S4I S4IO	<b>Option Fault (CN5-B).</b> Option is not properly connected.	<ul style="list-style-type: none"> <li>Option at drive port CN5-B was changed during run.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the power off and check the connectors between the drive and the option.</li> </ul>
oFB02	A1-A3 AO-A3 DI-A3 DO-A3 S4I S4IO	<b>Option Fault (CN5-B).</b> Two of the same option cards are connected simultaneously.	<ul style="list-style-type: none"> <li>AI-A3: AI-A3 option connected to CN5-B port while another input option was connected to CN5-A port.</li> <li>DI-A3: DI-A3 option connected to CN5-B port while another input option was connected to CN5-A port.</li> <li>AO-A3/DO-A3: Duplicate type of option card is connected to drive ports CN5-A, CN5-B, and CN5-C.</li> </ul>	<ul style="list-style-type: none"> <li>AI-A3: Only one of the options, AI-A3, DI-A3, or SI-xx can be connected to the drive at the same time.</li> <li>DI-A3: Only one of the options, AI-A3, DI-A3, or SI-xx can be connected to the drive at the same time.</li> <li>AO-A3/DO-A3: Use only compatible options.</li> </ul>
oFC01	A1-A3 AO-A3 DI-A3 DO-A3 S4I S4IO	Option connection error at drive port CN5-C.	<ul style="list-style-type: none"> <li>Option at drive port CN5-C was changed during run.</li> </ul>	<ul style="list-style-type: none"> <li>Turn off the power and check the connectors between the drive and the option.</li> </ul>
oFC02	A1-A3 AO-A3 DI-A3 DO-A3 S4I S4IO	<b>Option Fault (CN5-C).</b> Two of the same option cards are connected simultaneously.	<ul style="list-style-type: none"> <li>AI-A3: AI-A3 option connected to CN5-B port while another input option was connected to CN5-A port.</li> <li>DI-A3: DI-A3 option connected to CN5-B port while another input option was connected to CN5-A port.</li> <li>AO-A3/DO-A3: Duplicate type of option card is connected to drive ports CN5-A, CN5-B, and CN5-C.</li> </ul>	<ul style="list-style-type: none"> <li>AI-A3: Only one of the options, AI-A3, DI-A3, or SI-xx can be connected to the drive at the same time.</li> <li>DI-A3: Only one of the options, AI-A3, DI-A3, or SI-xx can be connected to the drive at the same time.</li> <li>AO-A3/DO-A3: Use only compatible options.</li> </ul>
oPE05	A1-A3 DI-A3 S4I S4IO	Run command/frequency reference source selection error.	<ul style="list-style-type: none"> <li>Frequency reference is assigned to an option (B03-01 = 3), but an option is not connected.</li> </ul>	<ul style="list-style-type: none"> <li>Reconnect the option to the drive.</li> </ul>
oPE07	A1-A3	Multi-function Analog Input Selection Error.	<ul style="list-style-type: none"> <li>At least two analog input terminals are set to the same function.</li> <li>Analog input terminal and pulse train input are set to the same function.</li> </ul>	<ul style="list-style-type: none"> <li>Adjust H03-02, H03-06, and H03-10 settings so functions no longer conflict.</li> </ul>

# Power Section Check



## WARNING

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

## Power Off Checks

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

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

Device	VOM (on RX1 Scale)		Normal Reading (Analog Meter)	Normal Reading (Digital Meter)
	Positive Lead	Negative Lead		
Input Rectifier Bridge *1	L1	+	7–100Ω	Approximately 0.5 V
	L2	+		
	L3	+		
	–	L1		
	–	L2		
	–	L3		
	L1	–	Infinite Ω	OL Displayed
	L2	–		
	L3	–		
	+	L1		
	+	L2		
	+	L3		
Bus Capacitors	+	–	Observe gradually increasing resistance	Observe gradually increasing voltage to OL
Pre-charge Resistor	–	Across the Resistors	100 Ω or less	–
Output Transistors *2 *3	T1	+	7-100 Ω	Approximately 0.5V
	T2	+		
	T3	+		
	–	T1		
	–	T2		
	–	T3		
	T1	–	Infinite Ω	OL Displayed
	T2	–		
	T3	–		
	+	T1		
	+	T2		
	+	T3		
Braking Diode	B2	B1	10 Ω	0.5 V
	B1	B2	Infinite Ω	OL Displayed
	B2	–	Infinite Ω	OL Displayed
	–	B2	Infinite Ω	OL Displayed

1. "+" could be any one of three (+) terminals which are labeled as Ⓢ1, Ⓢ2, and Ⓢ3.

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

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

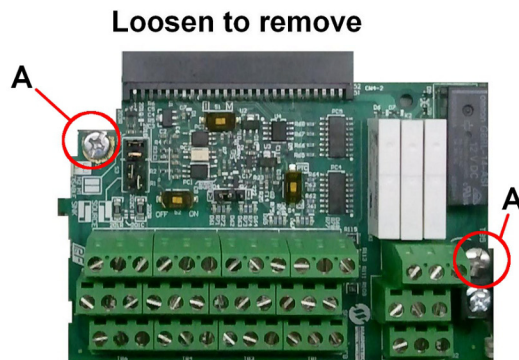
# S4IF Replacement Procedure



## WARNING

Do NOT touch any circuit components while AC main power is on or immediately after the main AC power is disconnected from the unit. 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 boards always use electro static 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**



**Figure 6-3**

1. Prior to installation, record all modified parameters.
2. Set A01-05 = 7770 (this prepares all modified and user parameters for IF card removal).
3. Disconnect all electrical power to the drive.
4. Remove the drive's front cover.
5. Verify that the "CHARGE" indicator lamp inside the drive is OFF (may take up to 5 minutes).
6. Use a voltmeter to verify the voltage at the incoming power terminals (L1, L2, and L3) has been disconnected.
7. Follow your local ESD procedures.

8. Loosen the two retaining screws (A) pictured in Figure 6-2.
  9. Remove existing interface card by grasping each corner at TB6 and TB5 and slide down until free.
  10. Return I/O board to ESD bag
  11. Complete all main circuit terminal connections as the installation of the S4IF interface card may block wiring access.
- NOTE: Wires to the S4IF interface card should be stripped 0.2"  $\pm$ 20% for maximum system safety. Solder dipping or ferrules are also highly recommended.*
12. Insert the S4IF interface card by sliding it onto the side guides until it mates tightly into the CN4-1 connector.
  13. Tighten the screws (A) pictured in Figure 6-2.
  14. Connect the command signals to the desired inputs of the S4IF interface card.
  15. Refer to Table 3-8 for additional information regarding the S1, S2, S3, and S4 settings.
  16. Reinstall and secure the drive's front cover.
  17. Reconnect power to the drive.
  18. Set A01-05 = 8880 (this moves all modified and user parameters to new IF card).
  19. Verify modified parameters with those recorded in Step 1.



# *a p p e n d i x* **A**

## **IMPULSE<sup>®</sup>•G+ & VG+ Series 4 Parameter Listing**

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## IMPULSE®•G+ & VG+ Series 4 Parameter Listing

Parameter	Parameter Name	Default	Range	Units	Reference
A01-01	Access Level	2	0–2	--	4-9
A01-02	Control Method	3	0–3	--	4-9
A01-03	Motion	G+: 1 VG+ 2	0–2	--	4-10
A01-04	Speed Ref	*	0–8	--	4-10
A01-05	Initialize Parameters	0	0–8880	--	4-14
A01-06	Password 1	0	--	--	4-14
A02-01 to A02-32	User Parameters	--	--	--	4-15
B01-01	Reference 1	15.00*	0.00–E1-04	Hz	5-3
B01-02	Reference 2	30.00*	0.00–E1-04	Hz	5-3
B01-03	Reference 3	60.00*	0.00–E1-04	Hz	5-3
B01-04	Reference 4	0.00*	0.00–E1-04	Hz	5-3
B01-05	Reference 5	0.00*	0.00–E1-04	Hz	5-3
B01-06	Reference 6	0.00*	0.00–E1-04	Hz	5-3
B01-07	Reference 7	0.00*	0.00–E1-04	Hz	5-3
B01-08	Reference 8	0.00*	0.00–E1-04	Hz	5-3
B01-09	Reference 9	0.00*	0.00–E1-04	Hz	5-3
B01-10	Reference 10	0.00*	0.00–E1-04	Hz	5-3
B01-11	Reference 11	0.00*	0.00–E1-04	Hz	5-3
B01-12	Reference 12	0.00*	0.00–E1-04	Hz	5-3
B01-13	Reference 13	0.00*	0.00–E1-04	Hz	5-3
B01-14	Reference 14	0.00*	0.00–E1-04	Hz	5-3
B01-15	Reference 15	0.00*	0.00–E1-04	Hz	5-3
B01-16	Reference 16	0.00*	0.00–E1-04	Hz	5-3
B01-17	Jog Reference	6.00	0.00–E1-04	Hz	5-3
B01-18	Ref Priority	0*	0–2	--	5-3
B02-01	Ref Upper Limit	100.0*	0.0–110.0	%	5-5
B02-02	Ref Lower Limit	0.0	0.0–110.0	%	5-5
B02-03	Ref 1 Lower Limit	2.0*	0.0–110.0	%	5-5
B02-04	Alt Upper Limit	0.0	0.0–110.0	%	5-5
B03-01	Ref Source 1	1*	0–4	--	5-6
B03-02	Run Source 1	1*	0–3	--	5-6
B03-03	Stopping Method	G+: 0* VG+: 6*	0, 1, 4, 6	--	5-7
B03-04	Change Rotation	0	0, 1	--	5-9
B03-05	Zero-Speed Oper	0	0–3	--	5-9
B03-06	Ctnl Input Scans	1	0, 1	--	5-10

\* Initial value set by X-Press Programming

\*\* Initial value dependant on drive 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.

Parameter	Parameter Name	Default	Range	Units	Reference
B03-07	LOC/REM Run Sel	0	0, 1	--	5-10
B03-08	RUN CMD at PRG	0	0, 1	--	5-10
B03-10	Allow Run at Power Up	0	0, 1	--	5-10
B03-15	Ref Source 2	0	0–4	--	5-11
B03-16	Run Source 2	0	0–3	--	5-11
B05-01	Accel Time 1	5.0*	0.0–25.5****	sec	5-12
B05-02	Decel Time 1	3.0*	0.0–25.5****	sec	5-12
B05-03	Accel Time 2	10.0	0.0–25.5****	sec	5-12
B05-04	Decel Time 2	10.0	0.0–25.5****	sec	5-12
B05-05	Accel Time N Chg	2.0	0.0–25.5	sec	5-13
B05-06	Decel Time N Chg	2.0	0.0–25.5	sec	5-13
B05-08	Fast Stop Time	0.5	0.0–25.5	sec	5-13
B05-10	Acc/Dec SW Freq	0.0	0.0–150.0	Hz	5-13
B05-11	SW Freq Compare	1	0, 1	--	5-13
B05-12	Accel Time 3	3.0	0.0–25.5****	sec	5-13
B05-13	Decel Time 3	3.0	0.0–25.5****	sec	5-13
B05-14	Accel Time 4	3.0	0.0–25.5****	sec	5-13
B05-15	Decel Time 4	3.0	0.0–25.5****	sec	5-13
B05-16	Acc/Dec Ext Rang	0	0, 1	--	5-13
B08-01	Jump Freq 1	0.0	0.0–150.0	Hz	5-14
B08-02	Jump Freq 2	0.0	0.0–150.0	Hz	5-14
B08-03	Jump Freq 3	0.0	0.0–150.0	Hz	5-14
B08-04	Jump Bandwidth	1.0	0.0–20.0	Hz	5-14
C01-01	Quick Stop	0*	0, 1	--	5-16
C01-02	Quick Stop Time	1.0	0.0–25.5	sec	5-16
C01-03	Reverse Plug	0	0, 1	--	5-17
C01-04	Rev-Plg Dec Time	2.0	0.0–25.5	sec	5-17
C01-05	Rev-Plg Acc Time	0.0	0.0–25.5	sec	5-17
C02-01	MicroSpd Gain 1	1.00	0.01–1.00	--	5-18
C02-02	MicroSpd Gain 2	1.00	0.01–1.00	--	5-18
C03-01	Up Limit 1 Speed	6.00	0–E1-03	Hz	5-19
C03-02	UL 1 Decel Time	1.0	0.0–25.5****	sec	5-19
C03-03	UL 2 Stop Time	1.0	0.0–25.5****	sec	5-19
C03-04	Low Limit 1 Speed	6.00	0–E1-04	Hz	5-19
C03-05	LL 1 Decel Time	1.0	0.0–25.5****	sec	5-19
C03-06	LL 2 Stop Time	1.0	0.0–25.5****	sec	5-19
C03-07	Lmt Stop Method	2*	0–2	--	5-19
C03-08	UL3 Stopping Method	4	0–5	--	5-19
C03-09	UL3 Dec Time	1.0	0.0–25.5	sec	5-19
C03-10	Phantom Stop Met	1	0–2	--	5-20

\* Initial value set by X-Press Programming

\*\* Initial value dependant on drive 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.

Parameter	Parameter Name	Default	Range	Units	Reference
C03-11	Load Share Limit	0	0, 1	--	5-20
C03-12	Klixon Action	0	0, 1	--	5-21
C03-13	Height Measure	250	0–65535	--	5-22
C03-14	Hook Height Home	2	0–4	--	5-22
C03-15	Hook Height Out	0	0, 1	--	5-22
C03-16	UL2 Revolutions	0	0–65535	Rev	5-23
C03-17	UL1 Revolutions	0	0–65535	Rev	5-23
C03-18	LL1 Revolutions	0	0–65535	Rev	5-23
C03-19	LL2 Revolutions	0	0–65535	Rev	5-23
C04-01	Load Float Time 2	10	0–65535	sec	5-27
C04-02	Load Float Gain	10**	0–100	--	5-27
C05-01	Load Check	0	0–9	--	5-29
C05-02	LC Alarm Action	4	0–4	--	5-29
C05-03	Holding Time	0.15	0.00–2.55	sec	5-29
C05-04	Testing Time	0.25	0.00–2.55	sec	5-29
C05-05	I/T Sensitivity Acc	5	0–50	%	5-29
C05-07	I/T Sensitivity	5	1–20	%	5-29
C05-08	Alarm Speed	6.0	1.0–30.0	Hz	5-29
C05-09	I/T Level 01	0	1–160	%	5-29
C05-10	I/T Level 02	0	1–160	%	5-29
C05-11	I/T Level 03	0	1–160	%	5-29
C05-12	I/T Level 04	0	1–160	%	5-29
C05-13	I/T Level 05	0	1–160	%	5-29
C05-14	I/T Level 06	0	1–160	%	5-30
C05-15	I/T Level 07	0	1–160	%	5-30
C05-16	I/T Level 08	0	1–160	%	5-30
C05-17	I/T Level 09	0	1–160	%	5-30
C05-18	I/T Level 10	0	1–160	%	5-30
C05-19	I/T Level 11	0	1–160	%	5-30
C05-20	I/T Level 12	0	1–160	%	5-30
C05-21	I/T Level 13	0	1–160	%	5-30
C05-22	I/T Level 14	0	1–160	%	5-30
C05-23	I/T Level 15	0	1–160	%	5-30
C05-24	I/T Level 16	0	1–160	%	5-30
C05-25	LC Integral Time	0.05	0.00–2.55	sec	5-30
C05-26	LC Delay Time	0.25	0.00–2.55	sec	5-30
C05-27	Min Rvs->Fwd Tim	0.0	0.0–25.5	sec	5-30
C05-28	Dly Trig Freq	30.0	0.0–60.0	Hz	5-30
C06-01	Swift Lift (V/F and OLV) Ultra Lift (FLV)	0	0–4	--	5-31

\* Initial value set by X-Press Programming

\*\* Initial value dependant on drive 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.

Parameter	Parameter Name	Default	Range	Units	Reference
C06-02	SwiftLift ForSpd (V/f and OLV) UltraLift FWD Spd (FLV)	60	0–150	Hz	5-31
C06-03	SwiftLift REVSpd (V/f and OLV) UltraLift REVSpd (FLV)	60	0–150	Hz	5-31
C06-04	SL FWD Motor Current (V/f) SL FWD Torque (OLV) UL FWD Torque (FLV)	50	0–100	%	5-32
C06-05	SL Rev Motor Current (V/f) SL Rev Torque (OLV) UL Rev Torque (FLV)	30	0–100	%	5-32
C06-06	SL Enabling Speed (V/f and OLV) UL Enabling Speed (FLV)	59.0	0–150	Hz	5-32
C06-07	SL Delay Time (V/f and OLV) UL Delay Time (FLV)	2.0	0.0–25.5	sec	5-32
C06-08	SFS Acc Gain	1.0	0.1–9.9	--	5-32
C06-10	Mtr Trq Quickset	3	0–5	--	5-32
C06-11	Mtr Trq 1	45	1–100	%	5-32
C06-12	Mtr Spd 1	90.0	0.0–150.0	Hz	5-32
C06-13	Mtr Trq 2	25	1–100	%	5-32
C06-14	Mtr Spd 2	120.0	1.0–150.0	Hz	5-32
C06-15	AUL FWD Offset	10	0–100	%	5-32
C06-16	AUL REV Offset	20	0–100	%	5-32
C07-01	Trq Limit FWD	150	0–300	%	5-35
C07-02	Trq Limit REV	150	0–300	%	5-35
C07-03	Trq Lmt FWD Rgn	180	0–300	%	5-35
C07-04	Trq Lmt REV Rgn	180	0–300	%	5-35
C07-05	T-Lim FWD Gain	1.25	0.00–2.55	--	5-35
C07-06	T-Lim REV Gain	1.25	0.00–2.55	--	5-35
C07-07	T-Lim RGN Gain	1.25	0.00–2.55	--	5-35
C07-08	Trq Lim I Time	200	5–10000	ms	5-35
C07-09	Torque Limit Sel	0	0, 1	--	5-35
C07-10	Trav Trq Limiter	0	0, 1	--	5-35
C07-11	Limiter Freq	2.0	0.5–10.0	Hz	5-35
C08-01	Torque Comp Time	1.00	0.00–2.55	--	5-37
C08-02	IFB OK Timer	1.00	0.00–2.55	sec	5-38
C08-03	Min Brk Rel Trq	10	0–300	%	5-38
C08-04	Rollback Timer	0.30	0.00–2.55	sec	5-38
C08-05	Roll Back Count	800	0–15000	pulses	5-38
C08-06	BE3/Alt Torq Tim	0.30	0.00–2.55	sec	5-38
C08-07	BE3 Detect Count	10	0–15000	pulses	5-38
C08-08	Alt Rev Trq Lim	25	0–300	%	5-38
C08-09	Zero Speed Level	1.0	0.0–10.0	Hz	5-38
C08-10	Load Float Time	10*	0–65535	sec	5-38

\* Initial value set by X-Press Programming

\*\* Initial value dependant on drive 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.

Parameter	Parameter Name	Default	Range	Units	Reference
C08-11	Brake Set Delay	0.7	0.0–25.5	sec	5-38
C08-12	BE6 Detect Time	5.0	0.0–25.5	sec	5-38
C08-13	BE6 Max Count	250	0–15000	pulses	5-38
C08-14	Brake Hold Speed	0.0 (FLV)	0.0–25.5 (FLV)	%	5-38
C08-15	Load Float Ext. T	10	0–65535	sec	5-39
C08-16	Init FWD Brk Trq	100	10–300	%	5-39
C08-18	BE6 Up Speed Lim	6.0	0.0–150.0	Hz	5-39
C08-19	LdFlt Alm Reset	1	0, 1	--	5-39
C08-22	Brk Slip Detect	0	0, 1	--	5-39
C08-23	Brk Slip Det Spd	1.0	0–10.0	Hz	5-39
C08-24	Brake Test Torq	1.25* (E02-11*5252)/F01-01	0–65535	flb	5-39
C08-25	Brake Test Speed	6	0–10	Hz	5-39
C09-01	Digital In Sel	0	0–2	--	5-40
C09-02	DI Terminal 1	0	0–FF	--	5-41
C09-03	DI Terminal 2	0F	0–FF	--	5-40
C09-04	DI Terminal 3	0F	0–FF	--	5-40
C09-05	DI Terminal 4	0F	0–FF	--	5-40
C09-06	DI Terminal 5	0F	0–FF	--	5-40
C09-07	DI Terminal 6	0F	0–FF	--	5-40
C09-08	DI Terminal 7	0F	0–FF	--	5-40
C09-09	DI Terminal 8	0F	0–FF	--	5-40
C09-10	DI Terminal 9	0F	0–FF	--	5-40
C09-11	DI Terminal 10	0F	0–FF	--	5-40
C09-12	DI Terminal 11	0F	0–FF	--	5-40
C09-13	DI Terminal 12	0F	0–FF	--	5-40
C09-14	DI Terminal 13	0F	0–FF	--	5-40
C09-15	DI Terminal 14	0F	0–FF	--	5-40
C09-16	DI Terminal 15	0F	0–FF	--	5-40
C09-17	DI Terminal 16	0F	0–FF	--	5-40
C10-01	Load Weight	0	0–2	--	5-41
C10-02	LW Start	0	0, 1	--	5-41
C10-03	LW Display Hold	0	0, 1	--	5-41
C10-04	LW Conversion	0	0–39999	--	5-41
C10-05	Test Freq	6	0–E01-04	Hz	5-41
C10-06	Unit Displayed	4	0–4	--	5-41
C10-07	Holding Time	1.00	0.00–2.55	sec	5-41
C10-09	Full Load Torque	100.0	0.0–200.0	%	5-41
C10-10	No Load Torque	20.0	0.0–200.0	%	5-41

\* Initial value set by X-Press Programming

\*\* Initial value dependant on drive 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.

Parameter	Parameter Name	Default	Range	Units	Reference
C11-01	Slack Cable	0	0, 1	--	5-43
C11-02	Action at SCL	2	0–5	--	5-43
C11-03	SLC Detect Torq	30	0–100	%	5-43
C11-04	SLC Detect Spd 1	2	0–E01-04	Hz	5-44
C11-05	SLC Delay Time 1	0.50	0.00–2.55	sec	5-44
C11-06	SLC Detect Spd 2	60	0–E01-04	Hz	5-44
C11-07	SLC Delay Time 2	0.10	0.00–2.55	sec	5-44
C11-08	Snap Shaft	0	0, 1	--	5-45
C11-09	Action at Snap	0	0, 1	--	5-45
C11-10	Delta Speed	1.0	0.0–E01-04	Hz	5-45
C11-11	Delay Time	250	0–2000	ms	5-45
C11-12	Gear Ratio Num	10000	1–65535	--	5-45
C11-13	Gear Ratio Den	10000	1–65535	--	5-45
C12-01	Brake Jog Delay	0.0	0.0–100.0	sec	5-46
C12-02	Brake Run Delay	0.0	0.0–100.0	sec	5-46
C12-03	Delay-ON Timer	0.0	0.0–3000.0	sec	5-46
C12-04	Delay-OFF Timer	0.0	0.0–3000.0	sec	5-46
C12-05	Maintenance Tmr	0	0–32767	hr	5-47
C12-06	Maintenance Gain	0.50	0.00–1.00	--	5-47
C13-01	Inch Run Time	1.00	0.00–2.55	sec	5-48
C13-02	Repeat Delay Tim	1.00	0.00–2.55	sec	5-48
C13-03	Index Run Ref	0.10	0.01–60.00	Hz	5-50
C13-04	index Revs	0	0–65535	Rev	5-50
C13-05	Index Count	100	0–65535	Pulses	5-50
C13-06	Index Rpt Delay	0.00	0.00–60.00	sec	5-50
C13-07	Index Complete	10	0–32767	--	5-50
C13-08	Index Zsv Gain	10	0–100	--	5-50
C13-09	Index ASR P Gain	30.00	0.00–300.00	--	5-50
C13-10	Index ASR I Time	0.200	0.000–10.000	sec	5-50
C13-11	Acc/Dec Gain	1.0	0.0–5.0	--	5-50
C13-12	Index Brake Ctrl	TRAV: 0–2 NLB: 0, 2	NLB: 2 else: 0	--	5-51
D01-01	DCInj Start Freq	0.5	0.0–10.0	Hz	5-52
D01-02	DCInj Current	50	0–100	%	5-52
D01-03	DCInj Time@Start	0.00	0.00–10.00	sec	5-52
D01-04	DCInj Time@Stop	0.05	0.00–10.00	sec	5-52
D02-01	Slip Comp Gain	V/f: 0.0 OLV: 1.0 FLV: 1.0	0.0–2.5	--	5-53

\* Initial value set by X-Press Programming

\*\* Initial value dependant on drive 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.



Parameter	Parameter Name	Default	Range	Units	Reference
D02-02	Slip Comp Time	V/f: 2000 OLV: 200	0–10000	ms	5-53
D02-03	Slip Comp Limit	200	0–250	%	5-53
D02-04	Slip Comp Regen	0	0–2	--	5-53
D02-05	Output V Lim Sel	0	0, 1	--	5-53
D03-01	Torq Comp Gain	1.0	0.00–2.50	--	5-54
D03-02	Torq Comp Time	V/f: 200 OLV: 20	0–60000	ms	5-54
D03-03	F TorqCmp@start	0.0	0.0–200.0	%	5-54
D03-04	R TorqCmp@start	0.0	-200.0–0.0	%	5-54
D03-05	TorqCmp Delay T	10	0–200	ms	5-54
D03-06	Start Torq Time	150	0–10000	ms	5-54
D04-01	ASR P Gain 1	*	0.00–300.00	--	5-57
D04-02	ASR I Time 1	*	0.000– 10.000	sec	5-57
D04-03	ASR P Gain 2	*	0.00–300.00	--	5-57
D04-04	ASR I Time 2	*	0.000– 10.000	sec	5-57
D04-06	ASR Delay Time	*	0.000–0.500	sec	5-57
D04-07	ASR Gain SW Freq	0.0	0.0–150.0	Hz	5-57
D04-08	ASR I Limit	400	0–400	%	5-57
D04-36	NLB Strt ASR I	0.10	0.00–300.00	--	5-57
D04-37	NLB Strt ASR Dly	0.50	0.00–2.55	--	5-57
D05-01	Torq Control Sel	0	0, 1	--	5-59
D05-02	Torque Ref Filter	0	0–1000	ms	5-59
D05-03	Speed Limit Sel	2	1, 2	--	5-59
D05-04	Speed Lmt Value	105	-120–120	%	5-59
D05-05	Speed Lmt Bias	10	0–120	%	5-59
D05-06	Ref Hold Time	0	0–1000	ms	5-59
D05-08	Drctn SpdLmt Sel	1	0, 1	--	5-59
D09-01	S-Crv Acc @ Start	0.20*	0.00–10.00	sec	5-62
D09-02	S-Crv Acc @ End	0.20*	0.00–10.00	sec	5-62
D09-03	S-Crv Dec @ Start	0.20*	0.00–10.00	sec	5-62
D09-04	S-Crv Dec @ End	0.00	0.00–10.00	sec	5-62
D10-01	Heavy/Normal Duty	0	0, 1	--	5-63
D10-02	CarrierFreq Sel	1	1–9, A, F	--	5-64
D10-03	CarrierFreq Max	2.0	1.0–15.0	kHz	5-64
D10-04	CarrierFreq Min	2.0	1.0–15.0	kHz	5-64
D10-05	CarrierFreq Gain	00	00–99	--	5-64
D11-01	Hunt Prev Select	1	0, 1	--	5-65
D11-02	Hunt Prev Gain	1.00	0.00–2.50	--	5-65
D11-03	Hunt Prev Time	10	000–500	ms	5-65

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

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Parameter	Parameter Name	Default	Range	Units	Reference
D11-05	Hunt Prev G Rvs	0.00	0.00–2.50	--	5-65
E01-01	Input Voltage	230V: 230 460V: 460 575V: 575	230V: 155–255 460V: 310–510 575V: 446–733	VAC	5-66
E01-03	V/f Selection	*	V/f: 0–9, A–F, FF OLV: 0F, FF	--	5-67
E01-04	Max Frequency	60.0	40.0–150.0	Hz	5-67
E01-05	Max Voltage	Determined by O02-04	0.0–733.1	VAC	5-67
E01-06	Base Frequency	Determined by E1-03	0.0–150.0	Hz	5-67
E01-07	Mid Frequency A	Determined by E1-03	0.0–150.0	Hz	5-68
E01-08	Mid Voltage A	Determined by E1-03	0.0–733.1	VAC	5-68
E01-09	Min Frequency	Determined by E1-03	0.0–150.0	Hz	5-68
E01-10	Min Voltage	Determined by E1-03	0.0–733.1	VAC	5-68
E01-11	Mid Frequency B	0.0	0.0–150.0	Hz	5-68
E01-12	Mid Voltage B	0.0	0.0–733.1	VAC	5-68
E01-13	Base Voltage	0.0	0.0–733.1	VAC	5-68
E02-01	Motor Rated FLA	**	**	--	5-71
E02-02	Motor Rated Slip	**	0.00–20.00	Hz	5-71
E02-03***	No-Load Current	**	0–[(E02-01)–1]	--	5-71
E02-04	Number of Poles	4	2–48	--	5-71
E02-05***	Terminal Resistance	**	0.000–65.000	Ω	5-71
E02-06***	Leak Inductance	**	0.0–40.0	%	5-71
E02-07***	Saturation Comp 1	0.50	0.00–0.50	--	5-71
E02-08***	Saturation Comp 2	0.75	E02-07–0.75	--	5-71
E02-09***	Mechanical Loss	0.0	0.0–10.0	%	5-71
E02-10***	Tcomp Iron Loss	**	0–65535	W	5-71
E02-11	Rated Horsepower	**	0.0–650.0	HP	5-71
F01-01	PG1 Pulses/Rev	1024	0–60000	PPR	5-72
F01-02	PG1 Rotation Sel	0	0, 1	--	5-72
F01-03	PG1 Output Ratio	1	001–132	--	5-72
F01-04	PG1 #Gear Teeth1	0	0–1000	--	5-72
F01-05	PG1 #Gear Teeth2	0	0–1000	--	5-72
F01-06	PGO-1-H	15	0–100	ms	5-72

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Parameter	Parameter Name	Default	Range	Units	Reference
F01-11	PG2 Pulses/Rev	1024	0–60000	ppr	5-73
F01-12	PG2 Rotation Sel	0	0, 1	--	5-73
F01-13	PG2 #Gear Teeth1	0	0–1000	--	5-73
F01-14	PG2 #Gear Teeth2	0	0–1000	--	5-73
F01-15	PG2 Output Ratio	1	1–132	--	5-73
F01-16	PGO-2-H	15	0–100	ms	5-73
F01-21	PG Fdbk Loss Sel	1	0–3 NLB: 1	--	5-73
F01-22	PGO-1-S Det Time	2.0	0.0–10.0	sec	5-73
F01-23	PG Overspeed Sel	1	0–3 NLB: 1	--	5-73
F01-24	PG Overspd Level	105	0–120	%	5-73
F01-25	PG Overspd Time	0.0	0.0–2.0	sec	5-73
F01-26	PG Deviation Sel	5	Traverse: 0–7 NLB: 5	--	5-74
F01-27	PG Deviate Level	10	0–50	%	5-74
F01-28	PG Deviate Time	0.3	0.0–10.0	sec	5-74
F02-01	AI Function Sel	0	0, 1	--	5-75
F02-02	AI Input Gain	100.0	-999.9– 999.9	%	5-75
F02-03	AI Input Bias	0.0	-999.9– 999.9	%	5-75
F04-01	AO Ch1 Select	102	1–630	--	5-76
F04-02	AO Ch1 Gain	100	-999.9– 999.9	%	5-76
F04-03	AO Ch2 Select	103	1–630	--	5-76
F04-04	AO Ch2 Gain	50	-999.9– 999.9	%	5-76
F04-05	AO Ch1 Bias	0.0	-999.9– 999.9	%	5-76
F04-06	AO Ch2 Bias	0.0	-999.9– 999.9	%	5-76
F04-07	AO Opt Level CH1	0	0, 1	--	5-76
F04-08	AO Opt Level CH2	0	0, 1	--	5-76
F05-01	DO Ch1 Select	F	0–148	--	5-77
F05-02	DO Ch2 Select	F	0–148	--	5-77
F05-03	DO Ch3 Select	F	0–148	--	5-77
F05-04	DO Ch4 Select	F	0–148	--	5-77
F05-05	DO Ch5 Select	F	0–148	--	5-77
F05-06	DO Ch6 Select	F	0–148	--	5-77
F05-07	DO Ch7 Select	F	0–148	--	5-77
F05-08	DO Ch8 Select	F	0–148	--	5-77

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Parameter	Parameter Name	Default	Range	Units	Reference
F05-09	DO-A3 Selection	2	0–2	--	5-77
F06-01	Com Bus Flt Sel	1	0–4	--	5-79
F06-02	EF0 Dection	0	0, 1	--	5-79
F06-03	EF0 Fault Action	1	0–4	--	5-79
F06-04	Bus Err Det Time	2.0	0.0–5.0	sec	5-79
F06-06	Torq Ref/Lmt Sel	0	0, 1	--	5-79
F06-07	Fref PrioritySel	0	0, 1	--	5-79
F06-08	Com Prm Init Sel	0	0, 1	--	5-79
F06-30	PB Node Address	0	0–125	--	5-79
F06-31	PB Clear Select	0	0, 1	--	5-80
F06-32	PB Map Select	0	0, 1	--	5-80
F06-35	CO Node Address	0	0–126	--	5-80
F06-36	CO Baud Rate	6	0–8	--	5-80
F06-50	DN MAC Address	64	0–64	--	5-80
F06-51	DN Baud Rate	4	0–4	--	5-80
F06-52	DN PCA Selection	21	0–225	--	5-80
F06-53	DN PPA Selection	71	0–225	--	5-80
F06-54	DN Idle Flt Det	0	0, 1	--	5-80
F06-55	DN BAUD RATE MEM	0	0–2	--	5-81
F06-56	DN Speed Scale	0	-15–15	--	5-81
F06-57	DN Current Scale	0	-15–15	--	5-81
F06-58	DN Torque Scale	0	-15–15	--	5-81
F06-59	DN Power Scale	0	-15–15	--	5-81
F06-60	DN Voltage Scale	0	-15–15	--	5-81
F06-61	DN Time Scale	0	-15–15	--	5-81
F06-62	DN Heart Beat	0	0–10	--	5-81
F06-63	DN MAC ID MEM	0	0–63	--	5-81
F07-01	IP Address 1	192	0–255	--	5-81
F07-02	IP Address 2	168	0–255	--	5-81
F07-03	IP Address 3	1	0–255	--	5-81
F07-04	IP Address 4	20	0–255	--	5-81
F07-05	Subnet Mask 1	255	0–255	--	5-81
F07-06	Subnet Mask 2	255	0–255	--	5-81
F07-07	Subnet Mask 3	255	0–255	--	5-81
F07-08	Subnet Mask 4	0	0–255	--	5-81
F07-09	Gateway IP Add 1	192	0–255	--	5-81
F07-10	Gateway IP Add 2	168	0–255	--	5-81
F07-11	Gateway IP Add 3	1	0–255	--	5-81
F07-12	Gateway IP Add 4	1	0–255	--	5-81
F07-13	IP Add Mode Sel	2	0–2	--	5-82
F07-14	Duplex Select	1	0–2	--	5-82

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Parameter	Parameter Name	Default	Range	Units	Reference
F07-15	Baud Rate	10	10, 100	--	5-82
F07-16	CommLoss tout	0	0–300	deci-seconds	5-82
H01-01	Terminal S1 Sel	80 (FWD)	0–81	--	5-83
H01-02	Terminal S2 Sel	81 (REV)	0–81	--	5-83
H01-03	Terminal S3 Sel	*	0–81	--	5-83
H01-04	Terminal S4 Sel	*	0–81	--	5-83
H01-05	Terminal S5 Sel	*	0–81	--	5-83
H01-06	Terminal S6 Sel	*	0–81	--	5-83
H01-07	Terminal S7 Sel	*	0–81	--	5-83
H01-08	Terminal S8 Sel	*	0–81	--	5-83
H01-14	Alt Ref Override	0	0, 1	--	5-83
H02-01	Term M0-M1 Sel	*	0–1FF	--	5-86
H02-02	Term M2-M3 Sel	*	0–1FF	--	5-86
H02-03	Term M5-M6 Sel	*	0–1FF	--	5-86
H02-06	Wh Disp Units	0	0–4	--	5-86
H03-01	Term A1 Signal	*	0, 1	--	5-93
H03-02	Term A1 Sel	*	0–31	--	5-93
H03-03	Terminal A1 Gain	100.0	-999.9–999.9	%	5-93
H03-04	Terminal A1 Bias	0.0	-999.9–999.9	%	5-93
H03-05	Term A3 Signal	0	0, 1	--	5-93
H03-06	Terminal A3 Sel	*	0–31	--	5-93
H03-07	Terminal A3 Gain	100.0	-999.9–999.9	%	5-93
H03-08	Terminal A3 Bias	0.0	-999.9–999.9	%	5-93
H03-09	Term A2 Signal	2	0–3	--	5-93
H03-10	Terminal A2 Sel	1F	0–31	--	5-93
H03-11	Terminal A2 Gain	100.0	-999.9–999.9	%	5-93
H03-12	Terminal A2 Bias	0.0	-999.9–999.9	%	5-93
H03-13	Filter Avg Time	0.03	0.00–2.00	sec	5-93
H03-14	A1/A2/A3 Sel	7	1–7	--	5-94
H03-15	TerminalA1Offset	0	-500–500	--	5-94
H03-16	TerminalA2Offset	0	-500–500	--	5-94
H03-17	TerminalA3Offset	0	-500–500	--	5-94
H04-01	Terminal FM Sel	102	000–630	--	5-96
H04-02	Terminal FM Gain	100.0	-999.9–999.9	%	5-97
H04-03	Terminal FM Bias	0.0	-999.9–999.9	%	5-97

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Parameter	Parameter Name	Default	Range	Units	Reference
H04-04	Terminal AM Sel	103	000–630	--	5-97
H04-05	Terminal AM Gain	50.0	-999.9–999.9	%	5-97
H04-06	Terminal AM Bias	0.0	-999.9–999.9	%	5-97
H04-07	FM Level Select	0	0–2	--	5-97
H04-08	AM Level Select	0	0, 1	--	5-97
H05-01	Serial Com Adr	1F	01–FF	--	5-98
H05-02	Serial Baud Rate	3	0–8	--	5-98
H05-03	Serial Com Sel	0	0–2	--	5-98
H05-04	Serial Fault Set	0	0–3	--	5-98
H05-05	Serial Flt Dtct	1	0, 1	--	5-98
H05-06	Transmit Wait Tim	5	5–65	ms	5-98
H05-07	RTS Control Sel	1	0, 1	--	5-98
H05-09	CE Detect Time	2.0	0.0–10.0	sec	5-98
H05-10	CommReg 25h Uni	0	0, 1	--	5-99
H05-11	Enter CommandSel	1	0, 1	--	5-99
H05-12	Run Command Sel	0	0, 1	--	5-99
H06-01	Pulse Input Sel	0	0, 3	--	5-100
H06-02	Pulse In Scaling	1440	1000–32000	Hz	5-100
H06-03	Pulse Input Gain	100.0	0.0–1000.0	%	5-100
H06-04	Pulse Input Bias	0.0	-100.0–100.0	%	5-100
H06-05	Pulse In Filter	0.10	0.00–2.00	sec	5-100
H06-06	Pulse Moni Sel	102	0–502	--	5-100
H06-07	Pulse Moni Scale	1440	0–32000	Hz	5-100
H06-08	Pulse Min Freq	0.5	0.0–1000.0	Hz	5-100
L01-01	Mtr OL Charact	3	0–3	--	5-101
L01-02	MOL Time Const	1.0	0.1–5.0	min	5-101
L01-03	Mtr OH Alarm Sel	3	0–3	--	5-102
L01-04	Mtr OH Fault Sel	1	0–2	--	5-102
L01-05	Mtr Temp Filter	0.20	0.00–10.00	sec	5-102
L01-13	Mtr OL Mem Sel	1	0, 1	--	5-102
L02-01	PwrL Selection	0	0–5	--	5-102
L02-02	PwrL Ridethru t	**	0.0–25.5	sec	5-102
L02-03	PwrL BaseBlock t	**	0.1–5.0	sec	5-102
L02-04	PwrL V/F Ramp t	**	0.0–5.0	sec	5-102
L02-05	PUV Det Level	Determined by E1-01	230V: 150–210 460V: 300–420 575V: 431–604	VAC	5-102

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Parameter	Parameter Name	Default	Range	Units	Reference
L03-01	StallP Accel Sel	1	0–2	--	5-103
L03-02	StallP Accel Lvl	Determined by D10-01	0–150	%	5-103
L03-03	StallPAcc LowLim	50	0–100	%	5-103
L03-05	StallP Run Sel	1	0–2	--	5-103
L03-06	StallP Run Level	Determined by D10-01	30–150	%	5-103
L03-11	OV Inhibit Sel	0	0, 1	--	5-103
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	VAC	5-103
L03-20	DC Bus P Gain	A01-02	0.00–5.00	--	5-103
L03-21	Acc/Dec P Gain	S01-02	0.10–10.00	sec	5-103
L03-23	CHP Stall P Sel	0	0, 1	--	5-104
L03-24	Mtr Accel Time	O02-04 or E5-01	0.10–10.00	sec	5-104
L04-01	Spd Agree Level	0.0	0.0–150.0	Hz	5-105
L04-02	Spd Agree Width	2.0	0.0–20.0	Hz	5-105
L04-03	Spd Agree Lvl ±	0.0	-150.0–150.0	Hz	5-105
L04-04	Spd Agree Width ±	2.0	0.0–20.0	Hz	5-105
L04-05	Ref Loss Sel	0	0, 1	--	5-106
L04-06	Fref at Floss	80.0	0.0–100.0	%	5-106
L04-07	Freq Detect Sel	0	0, 1	--	5-106
L05-01	Test Mode	0	0, 1	--	5-107
L06-01	Torque Det 1 Sel	0	0–8	--	5-108
L06-02	Torq Det 1 Lvl	150	0–300	%	5-109
L06-03	Torq Det 1 Time	0.1	0.0–10.0	sec	5-109
L06-04	Torq Det 2 Sel	0	0–8	--	5-109
L06-05	Torq Det 2 Lvl	150	0–300	%	5-109
L06-06	Torq Det 2 Time	0.1	0.0–10.0	sec	5-109
L06-08	Mech Fatigue Sel	0	0–8	--	5-110
L06-09	MechFat Det Spd	110.0	-110.0–110.0	%	5-110
L06-10	MechFat Det Time	0.1	0.0–10.0	sec	5-110
L06-11	MechFat Det Hour	0	0–65535	--	5-110
L08-01	DB Resistor Prot	0	0, 1	--	5-111
L08-02	OH Pre-Alarm Lvl	**	50–150	°C	5-111
L08-03	OH Pre-Alarm Sel	3	0–5	--	5-111
L08-05	PH Loss In Sel	1	0, 1	--	5-111
L08-07	PH Loss Out Sel	1	0–2	--	5-111

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Parameter	Parameter Name	Default	Range	Units	Reference
L08-09	Ground Fault Sel	1	0, 1	--	5-111
L08-10	Fan On/Off Sel	1	0, 1	--	5-111
L08-11	Fan Delay Time	60	0–300	sec	5-111
L08-12	Ambient Temp	40	-10–60	°C	5-111
L08-13	UV3 Detect	1	0, 1	--	5-112
L08-15	OL2 Sel @ L-Spd	1	0, 1	--	5-112
L08-18	Soft CLA Sel	0	0, 1	--	5-112
L08-19	Fc Red dur OHAIm	0.8	0.1–0.9	Hz	5-112
L08-32	MC,FAN Fault Sel	1	0–4	--	5-112
L08-35	Installation Sel	**	0–3	--	5-112
L08-38	Fc Reduct dur OL	2**	0–2	--	5-112
L08-40	FC Reduct Time	A01-02	0.00–2.00	sec	5-113
L08-41	High Cur Alm Sel	0	0, 1	--	5-113
L08-55	DB Tr protection	1	0, 1	--	5-113
L09-01	Reset Select	1	0, 1	--	5-114
L09-02	Reset Attempts	3	0–10	--	5-114
L09-04	Reset Flt Sel 1	0001	0000–FFFF	--	5-114
L09-05	Reset Flt Sel 2	E000	0000–FFFF	--	5-114
L09-06	FLT Contact Sel	0	0, 1	--	5-114
O01-01	User Monitor Sel	106	104–813	--	5-116
O01-02	Power-On Monitor	3	1–5	--	5-118
O01-03	Display Scaling	A01-02	0–3	--	5-118
O01-04	Display Units	A01-02	0, 1	--	5-119
O01-05	LCD Contrast	3	0–5	--	5-119
O01-10	UserDisp Scaling	6000	1–60000	--	5-119
O01-11	UserDisp Dec Sel	2	0–3	--	5-119
O02-01	LO/RE Key	0	0, 1	--	5-119
O02-02	Oper Stop Key	0	0–2	--	5-120
O02-03	User Defaults	0	0–2	--	5-120
O02-04	Inverter Model #	**	0x00–0xFF	--	5-120
O02-05	Operator M.O.P.	0	0, 1	--	5-121
O02-06	Oper Detection	1	0, 1	--	5-122
O02-07	FWD/REV Sel@PwrUp	0	0, 1	--	5-122
O02-19	Parameter Set Sel	0	0, 1	--	5-122
O03-01	Elapsed Time Set	0	0–9999	hr	5-122
O03-02	Elapsed Time Run	1	0, 1	--	5-122
O03-03	Fan ON Time Set	0	0–9999	hr	5-122
O03-05	BusCap Maint Set	0	0–150	%	5-122
O03-09	IGBT Maint Set	0	0–150	%	5-122
O03-11	Fault Data Init	0	0, 1	--	5-123

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Parameter	Parameter Name	Default	Range	Units	Reference
O03-12	kWh Monitor Init	0	0, 1	--	5-123
O03-13	Run Counter Init	0	0, 1	--	5-123
O03-14	Count Hist Clear	0	0, 1	--	5-123
O04-01	Copy Function Sel	0	0–3	--	5-123
O04-02	Read Allowable	1	0, 1	--	5-123
O04-07	ChrgCircMaintSet	0	0–150	%	5-124
T01-01	Tuning Mode Sel	0	0–2	--	4-16
T01-02	Rated Horsepower	**	--	Hp	4-16
T01-03	Rated Voltage	**	--	V	4-16
T01-04	Rated Current	**	--	A	4-16
T01-05	Rated Frequency	60.0	--	Hz	4-16
T01-06	Number of Poles	4	--	Poles	4-16
T01-07	Rated Speed	1750	--	RPM	4-16
T01-08	PG Pulses/Rev	1024	--	PPR	4-16
T01-09	No-Load Current	--	--	--	4-17
T01-10	Motor Rated Slip	--	--	--	4-17
U01-01	Frequency Reference	--	--	Hz	5-126
U01-02	Output Frequency	--	--	Hz	5-126
U01-03	Output Current	--	--	A	5-126
U01-04	Control Method	--	--	--	5-126
U01-05	Motor Speed	--	--	Hz	5-126
U01-06	Output Voltage	--	--	VAC	5-126
U01-07	DC Bus Voltage	--	--	VDC	5-126
U01-08	Output HP	--	--	HP	5-126
U01-09	Torque Reference	--	--	%	5-126
U01-10	Input Terminal Status	--	--	--	5-126
U01-11	Output Terminal Status	--	--	--	5-126
U01-12	Inverter Control Status 1	--	--	--	5-127
U01-14	CPU 1 SW Number	--	--	--	5-127
U01-15	Term A1 Level	--	--	%	5-127
U01-16	Term A2 Level	--	--	%	5-127
U01-17	Term A3 Level	--	--	%	5-127
U01-20	SFS Output	--	--	Hz	5-127
U01-21	AI Opt Ch1 Level	--	--	%	5-127
U01-22	AI Opt Ch2 Level	--	--	%	5-127
U01-23	AI Opt Ch3 Level	--	--	%	5-127
U01-25	DI Input Status	--	--	--	5-127
U01-26	DI Output Status	--	--	--	5-127
U01-28	CPU 2 SW Number	--	--	--	5-127
U01-29	Load Weight	--	--	--	5-127

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Parameter	Parameter Name	Default	Range	Units	Reference
U01-30	SS Delta Speed	--	--	Hz	5-127
U01-34	OPE Error Code	--	--	--	5-127
U01-39	Transmit Error	--	--	--	5-127
U01-44	ASR out w/o Filter	--	--	%	5-127
U01-50	Hook Height	--	--	%	5-127
U01-51	Motor Revolutions	--	--	Revs	5-127
U01-52	Maintenance Timer	--	--	hr	5-127
U01-53	Index Counts	--	--	Revs	5-128
U01-54	Term RP Inp Freq	--	--	Hz	5-128
U01-60	PG CH1 Count	--	--	Pulse	5-128
U01-61	PG CH2 Count	--	--	Pulse	5-128
U01-63	PG CH1 Freq	--	--	Hz	5-128
U01-64	PG CH2 Freq	--	--	Hz	5-128
U01-65	PG Output Freq	--	--	Hz	5-128
U01-66	BE6 Pulse Count	--	--	Pulse	5-128
U01-68	LC Zone	--	--	--	5-128
U01-69	LC Margin	--	--	%	5-128
U01-85	NLB Rel Trq	--	--	%	5-128
U01-86	Brk Test Trq	--	--	F1b	5-128
U02-01	Current Fault	--	--	--	5-128
U02-02	Last Fault	--	--	--	5-128
U02-03	Frequency Ref	--	--	Hz	5-128
U02-04	Output Freq	--	--	Hz	5-128
U02-05	Output Current	--	--	A	5-128
U02-06	Motor Speed	--	--	Hz	5-128
U02-07	Output Voltage	--	--	VAC	5-128
U02-08	DC Bus Voltage	--	--	VDC	5-128
U02-09	Output HorsePwr	--	--	HP	5-128
U02-10	Torque Reference	--	--	%	5-128
U02-11	Input Terminal Sts	--	--	--	5-128
U02-12	Output Terminal Sts	--	--	--	5-128
U02-13	Inverter Status	--	--	--	5-128
U02-14	Elapsed Time	--	--	hr	5-128
U02-15	SFS Output	--	--	Hz	5-128
U02-16	Motor Iq Current	--	--	%	5-129
U02-17	Motor Id Current	--	--	%	5-129
U02-20	Actual Fin Temp	--	--	°C	5-129
U03-01	Last Fault	--	--	--	5-129
U03-02	Fault Message 2	--	--	--	5-129
U03-03	Fault Message 3	--	--	--	5-129

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Parameter	Parameter Name	Default	Range	Units	Reference
U03-04	Fault Message 4	--	--	--	5-129
U03-05	Fault Message 5	--	--	--	5-129
U03-06	Fault Message 6	--	--	--	5-129
U03-07	Fault Message 7	--	--	--	5-129
U03-08	Fault Message 8	--	--	--	5-129
U03-09	Fault Message 9	--	--	--	5-129
U03-10	Fault Message 10	--	--	--	5-129
U03-11	Elapsed Time 1	--	--	hr	5-129
U03-12	Elapsed Time 2	--	--	hr	5-129
U03-13	Elapsed Time 3	--	--	hr	5-129
U03-14	Elapsed Time 4	--	--	hr	5-129
U03-15	Elapsed Time 5	--	--	hr	5-129
U03-16	Elapsed Time 6	--	--	hr	5-129
U03-17	Elapsed Time 7	--	--	hr	5-129
U03-18	Elapsed Time 8	--	--	hr	5-129
U03-19	Elapsed Time 9	--	--	hr	5-129
U03-20	Elapsed Time 10	--	--	hr	5-129
U03-21	RUN Cmd Counter	--	--	count	5-129
U03-22	U03-21 Rollovers	--	--	count	5-129
U03-23	OL/LC Count	--	--	count	5-129
U04-01	Drv Elapsed Time	--	--	hr	5-130
U04-03	Fan Elapsed Time	--	--	hr	5-130
U04-04	Fan Life Mon	--	--	%	5-130
U04-05	Cap Life Mon	--	--	%	5-130
U04-06	ChgCirc Life Mon	--	--	%	5-130
U04-07	IGBT Life Mon	--	--	%	5-130
U04-08	Heatsink Temp	--	--	°C	5-130
U04-09	LED Oper Check	--	--	--	5-130
U04-10	kWh Lower 4 dig	--	--	kWh	5-130
U04-11	kWh Upper 5 dig	--	--	MWh	5-130
U04-12	CPU Occup Rate	--	--	%	5-130
U04-13	Current PeakHold	--	--	A	5-130
U04-14	Freq@ I PeakHold	--	--	Hz	5-130
U04-16	Motor OL1 Level	--	--	%	5-130
U04-17	Drive OL2 Level	--	--	%	5-130
U04-18	Reference Source	--	--	--	5-130
U04-19	MEMOBUS Freq Ref	--	--	%	5-130
U04-20	Option Freq Ref	--	--	%	5-130
U04-21	Run Cmd Source	--	--	--	5-130
U04-22	MEMOBUS Ref Reg	--	--	--	5-130

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Parameter	Parameter Name	Default	Range	Units	Reference
U04-23	Option Ref Reg	--	--	--	5-130
U06-01	Mot SEC Current	--	--	%	5-131
U06-02	Mot EXC Current	--	--	%	5-131
U06-03	ASR Input	--	--	%	5-131
U06-04	ASR Output	--	--	%	5-131
U06-05	Voltage Ref (Vq)	--	--	VAC	5-131
U06-06	Voltage Ref (Vd)	--	--	VAC	5-131
U06-07	ACR(q) Output	--	--	%	5-131
U06-08	ACR(d) Output	--	--	%	5-131
U06-18	PG1 CounterValue	--	--	--	5-131
U06-19	PG2 CounterValue	--	--	--	5-131
U06-22	Zero Servo Pulse	--	--	--	5-131
U06-26	FF Cont Output	--	--	%	5-131

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