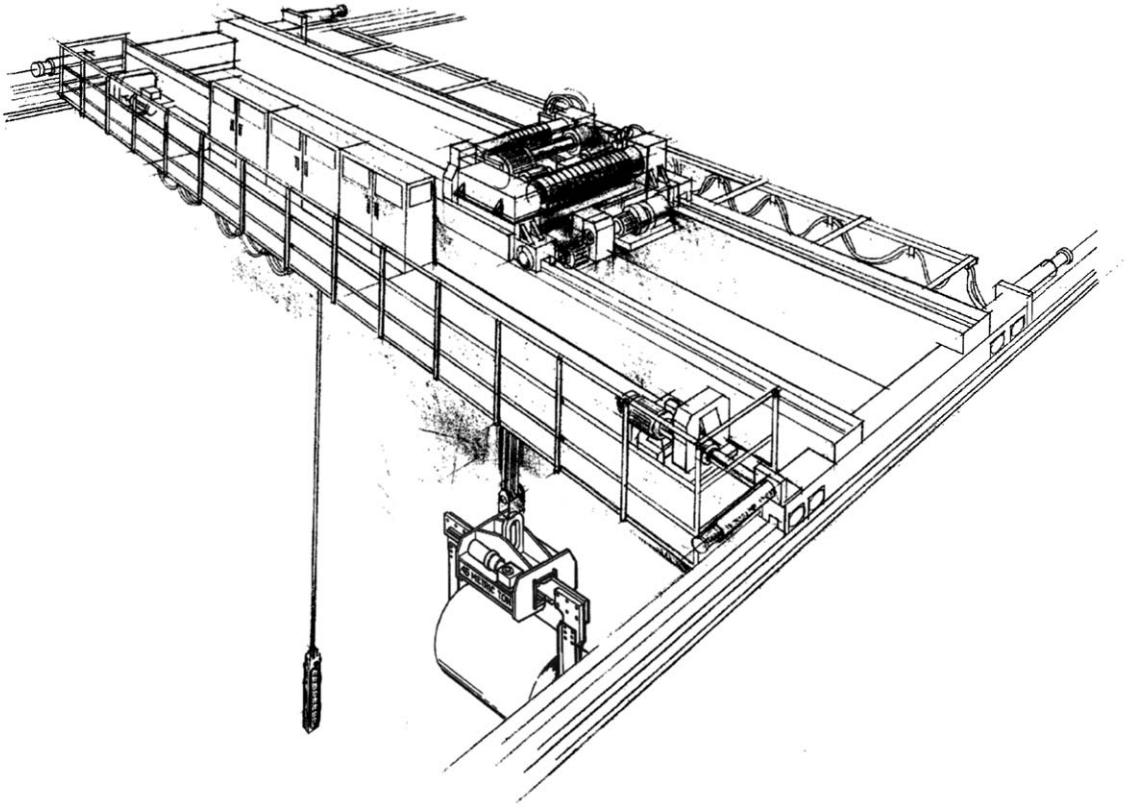

IMPULSE•VG+

Series 3

Flux Vector Crane Controls

Instruction Manual

MAGNETEK
UNCOMMON POWER

Electromotive Systems

Software # 8001.X July 2005
Part Number: 140-10257

Contents:

Chapter 6: Troubleshooting

Appendix A: Parameter Listing

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

Electromotive Systems 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.

chapter 1

Introduction

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WARNING

Do not touch any circuitry components while the main AC power is on. In addition, you must wait until the red “CHARGE” LED is out before performing any service on that unit. (As you look at the face of the circuitry, the “CHARGE” LED is located in the lower right corner of the board.) It may take as long as 10 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 (T1, T2, T3) to the incoming, three-phase AC source.

Before executing Auto-Tuning, ensure that the motor is disconnected from the drive train and the electric brake is released. If the electric brake cannot be released, you must ensure that the brake is disengaged for the entire tuning process.

The instructions in the next three chapters apply to most IMPULSE•VG+ Series 3 crane, hoist, and monorail applications. However, you need to carefully evaluate your specific situation and ensure that you follow NEC codes and your local wiring practices.

These chapters tell you how to install IMPULSE•VG+ Series 3 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’s important to develop a “plan of attack” for both the mounting and wiring since each task has an effect on the other one. To assist you, “IMPULSE•VG+ Series 3 Wiring Practices” is included.

NOTE: If your IMPULSE•VG+ Series 3 is part of an Electromotive Systems, pre-engineered TCONTROLS® motor control panel, disregard this chapter and turn to Chapter 4.

Introduction

Assessing the System Requirements

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

- Speed control method(s)
- Braking method(s)
- Power source voltage, number of phases, and kVA rating
- Power source location
- Wire size
- Grounding location and method

Assessing the Drive Environment

When you choose a location for IMPULSE•VG+ Series 3, perform the following steps:

1. Ensure that a 220V or 230V (-15% to +10%) three-phase power source is available for a 230V-rated drive, and that a 380V, 400V, 415V, 440V, or 460V (-15% to +10%) three-phase power source is available for a 460V-rated drive.
2. Ensure the encoder is supplied with +12VDC.
3. If the amperage 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 250 ft. unless appropriate reactors and/or filters are used.
5. If required, install reactors.

   When connecting a drive (230V/460V, Model 2085-FVG+/4045-FVG+ and smaller) to a large-capacity power supply transformer (500kVA or greater or more than 10 times the inverter kVA rating), or when switching a phase-advancing capacitor, excessive peak current can flow through the input power supply circuit. To prevent damage to the rectifier section in such cases, install a DC reactor between drive Terminals 1 and 2, or an AC reactor on the input side. Installing reactors also improves the power factor on the power supply side.
6. Ensure that the encoder wiring is less than 300 feet, unless fiber optic cables are used.
7. Ensure that the encoder wiring is isolated from the power wiring.
8. Ensure that the encoder wiring shield is grounded only at drive end.
9. Ensure that the drive circuit wiring is protected or isolated from:
   - Ambient temperatures outside the range of +14° F to +113° F (-10° C to +45° C). (Consult Electromotive Systems if you must exceed this temperature range.)
   - Rain or moisture
   - Corrosive gases or liquids
   - Direct sunlight
   - Severe mechanical vibration
10. Ensure that the drive is housed in an appropriate NEMA-rated enclosure.
11. For severe-duty applications (for example—long lifts) or with 75-Hp-or-greater motors, ensure that the drive control system is adequately cooled, even though the ambient temperature limit is not exceeded. For more information, contact Electromotive Systems.

IMPULSE•VG+ Series 3 General Specifications

230V Class

Specification	Specification Values and Information for Each 230V-Class Model												
	2007	2009	2015	2023	2031	2045	2058	2071	2085	2145	2215	2283	2346
Rated current (A)	7	9.6	15	23	31	45	58	71	85	145	215	283	346
Capacity (kVA)	2.7	3.7	5.7	8.8	12	17	22	27	32	55	82	110	130

460V Class

Specification	Specification Values and Information for Each 460V-Class Model																				
	4002	4003	4005	4008	4012	4017	4024	4031	4039	4045	4060	4075	4091	4112	4150	4180	4260	4304	4370	4477	4590
Rated current (A)	2.1	3.7	5.3	8.7	12.5	17	24	31	39	45	60	75	91	112	150	180	260	304	370	477	590
Capacity (kVA)	1.6	2.8	4.0	6.6	9.5	13	18	24	30	34	46	57	69	85	110	140	200	230	280	390	510

230V and 460V Classes

Specification	Specification Value and Information for All Models
Certification	UL, CUL
Rated input power supply volts & freq	3-phase 200/208/220/230V or 380/400/415/440/460V/480V
Allowable input voltage fluctuation	+10% or -15% of nominal
Allowable input frequency fluctuation	±5% of nominal
Control method	Fully digital, flux vector control; sine-wave, pulse-width–modulated
Maximum output voltage (VAC)	Max output voltage 3-phase, 200/208/220/230V; 380/400/415/440/460V/480V (proportional to input voltage).
Rated frequency (Hz)	Up to twice motor nameplate RPM (Ultra-Lift) 150 Hz standard (400 Hz, consult factory)
Output speed control range	1000:1
Output frequency accuracy	.01%—with digital reference command .1%—with analog reference command; 10 bits/10V
Frequency reference resolution	Digital: .01 Hz; analog: .03 Hz (at 60 Hz)
Output frequency resolution	.01 Hz
Overload capacity	150% of rated load for 1 min
Remote frequency reference sources	0–10VDC (20kΩ); 4–20mA (250Ω); ±10VDC serial (RS-485)
Accel/decel times	0.1 to 6000.0 sec—4 sets; 8 parameters are independently adjustable
Braking torque	Approximately 20% if motor and inverter are sized 1:1; 150% or more with dynamic braking (optional)
Motor overload protection	UL recognized electronic thermal overload relay; field-programmable
Overcurrent protection level (OC1)	200% of rated current
Circuit protection	Ground fault and blown-fuse protection
Overvoltage protection level	410/820VDC
Undervoltage protection level	190/380VDC
Heatsink overtemperature	Thermostat trips at 105° C
Torque limit selection	Separate functions for FORWARD, REVERSE, REGEN.; all selectable from 0–300%

Specification	Specification Value and Information for All Models
Stall prevention	Separate functions for accel, decel, at-speed, and constant horsepower region
Other protection features	Speed deviation, overspeed, mechanical brake failure, lost output phase, failed-oscillator, PG-disconnect, mechanical overload, roll-back detection, and internal braking transistor failure.
DC bus voltage indication	Charge LED is on until DC bus voltage drops below 50VDC
Location	Indoors; requires protection from moisture, corrosive gases, and liquids
Ambient operating temperature	14° to 113° F (-10° to 45° C) for open chassis
Storage temperature	-4° to 140° F (-20° to 60° C)
Humidity	95% relative; noncondensing
Vibration	1 G less than 20 Hz; 0.2 G for 20–50 Hz
Elevation	3300 Ft. (1000M) or less

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:

- Install an input reactor if the power source is greater than 500kVA.
- 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.
- 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 an amperage equal to or greater than the sum of the amperage for all the drives.

230V Class

Model Number	230V Part Number	Maximum Amps of Reactor
2007-FVG+S3	REA230-2	8
2009-FVG+S3	REA230-2	8
2015-FVG+S3	REA230-3	12
2023-FVG+S3	REA230-5	18
2031-FVG-S3	REA230-7.5	25
2045-FVG+S3	REA230-10	35
2058-FVG+S3	REA230-20	55
2071-FVG+S3	REA230-25	80
2085-FVG+S3	REA230-30	80
2145-FVG+S3	REA230-50	130
2215-FVG+S3	REA230-75	200
2283-FVG+S3	REA230-100	250
2346-FVG+S3	REA230-125	320

460V Class

Model Number	460 V Part Number	Maximum Amps of Reactor
4002-FVG+S3	REA460-1	2
4003-FVG+S3	REA460-2	4
4005-FVG+S3	REA460-5	8
4008-FVG+S3	REA460-5	8
4012-FVG+S3	REA460-7.5	12
4017-FVG+S3	REA460-10	18
4024-FVG+S3	REA460-15	25
4031-FVG+S3	REA460-20	35
4039-FVG+S3	REA460-25	35
4045-FVG+S3	REA460-30	45
4060-FVG+S3	REA460-40	55
4075-FVG+S3	REA460-50	80
4091-FVG+S3	REA460-60	80
4112-FVG+S3	REA460-75	100
4150-FVG+S3	REA460-100	130
4180-FVG+S3	REA460-150	200
4260-FVG+S3	REA460-200	250
4304-FVG+S3	REA460-250	320
4370-FVG+S3	REA460-300	400
4477-FVG+S3	REA460-400	500
4590-FVG+S3	REA460-500	600

Interface Specifications

IMPULSE•VG+ Series 3 is designed to interface with 120VAC user input and output devices through the GIF7 interface board. This eliminates the need for an additional interface relay or isolation circuitry.

The drive has eight optically isolated drive terminals which can be used to connect with the user input device. Terminals S1 and S2 are always used for the directional run commands (Forward and Reverse, Up and Down). The rest of six terminals are multi-function terminals, and are used for speed control and other characteristics. With multi-function terminals you can assign various functions and performance characteristics without having to rewire the drive.

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

G5IN4 card has four additional input terminals, which can have a total of 14 sets of input selections. The individual terminals can be enabled/disabled within a set. For program information refer to Chapter 5, Programming Advanced Features.

c h a p t e r 2

Installation

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WARNING

•When preparing to mount the IMPULSE•VG+ Series 3 drive, lift it by its base. Never lift it by the front cover.

•Mount the drive on nonflammable material.

•The IMPULSE•VG+ Series 3 drive generates heat. For the most effective cooling possible, mount it vertically. For more details, refer to the "IMPULSE•VG+ Series 3 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 113°F (45°C).

Failure to observe these Warnings may result in equipment damage.

This chapter explains the following:

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

In addition, this section will cover information on the components that interconnect with IMPULSE•VG+ Series 3.

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:
  Open Chassis: +14 to 113°F (-10 to 45°C)
- Direct sunlight (not for use outdoors)
- Rain, moisture
- High humidity
- Oil sprays, splashes
- Salt spray
- Dust or metallic particles in the air
- Corrosive gases (e.g. sulfurized gas or liquids)
- Radioactive substances
- Combustibles (e.g. thinner, solvents, etc.)
- Physical shock, vibration
- Magnetic noise (e.g. welding machines, power devices, etc.)

IMPULSE•VG+ Series 3 System Components And External Devices

Standard IMPULSE•VG+ Series 3 Drive Components

- PG-T2 Encoder Card

Optional Drive Components

- G5IN4 Control Input Card
- D0-08 Control Output Board
- D0-02 Control Output Relay Board
- AI-14B Analog Input Card

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

When an inverter is stored for six months or more without operation, reforming of the main circuit electrolytic capacitor is required.

NOTE: If the procedure is not feasible, the drive may be powered up every six months using rated line voltage.

Execute the reforming as follows:

1. Connect a single or three phase variable AC supply to the inverter input terminals L1-L3.
2. Increase the voltage linearly to the rated input voltage for a period of three minutes.
3. Apply rated input voltage for 30-60 minutes or longer.

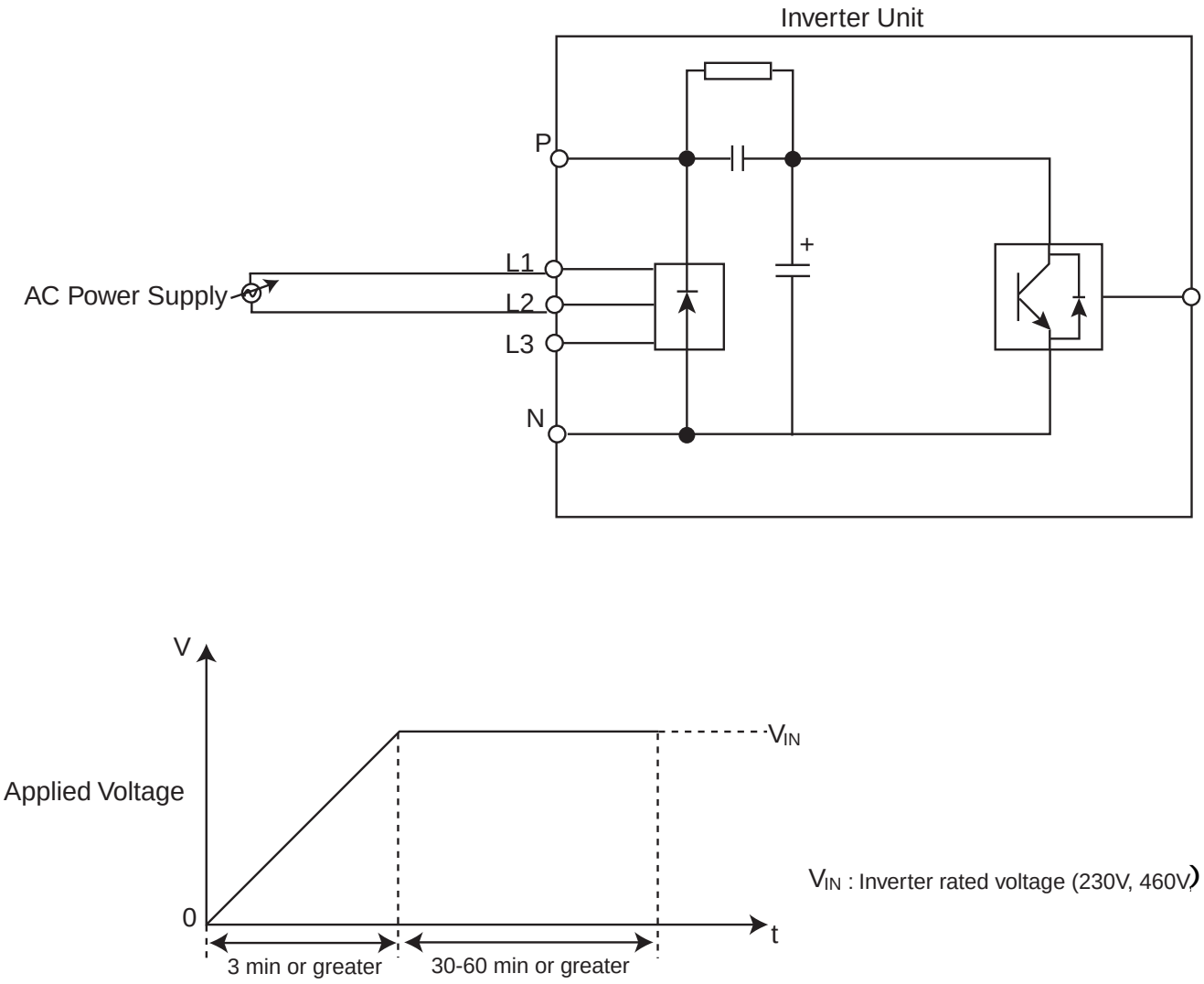

Figure 2-2: Long Time Storage

Installing the Drive

To install IMPULSE•VG+ Series 3:

1. Ensure the drive will be used in a proper environment. Refer to page 1-4.
2. Review “IMPULSE•VG+ Series 3 Terminal Diagram”.
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 position of the subpanel.
5. Ensure that the drive is positioned vertically so that the heat can dissipate properly.
6. Ensure that the air can flow freely around the heat sink as shown below in Figure 2-3.

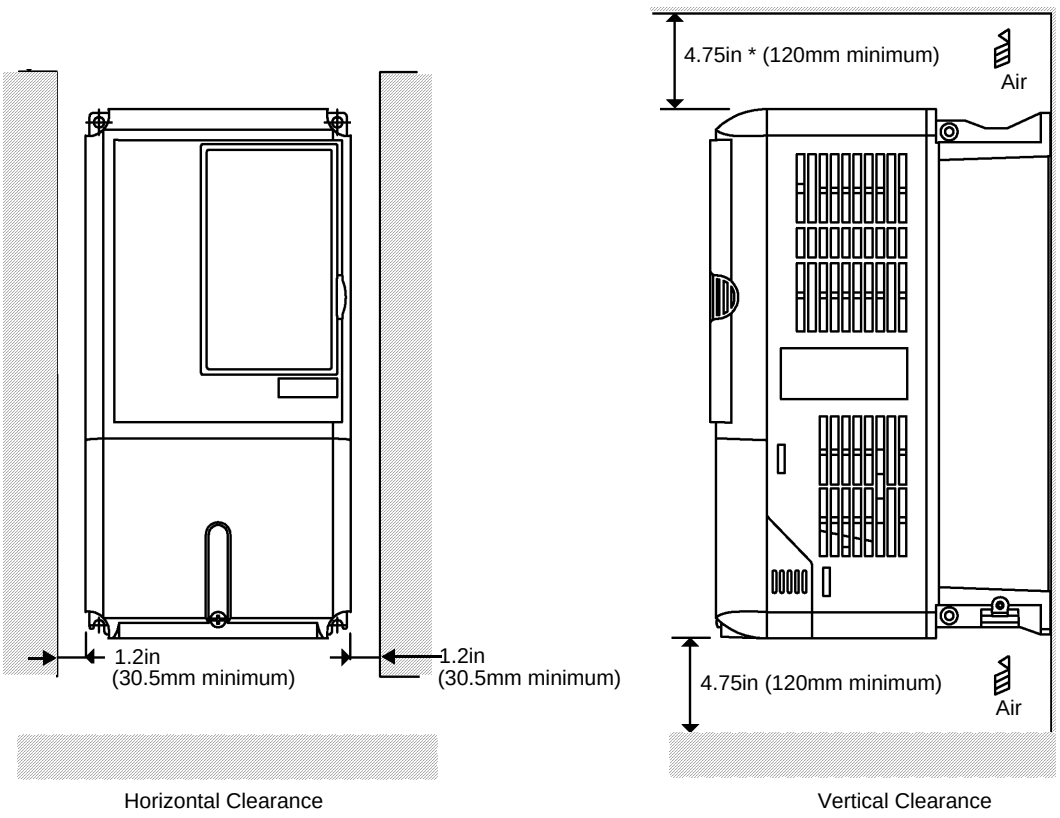

Figure 2-3

NOTE:

- *The recommended clearances at the top, bottom, and both sides of the inverter are the same for both open chassis and NEMA 1 enclosures.*
- *Allowable intake air temperature: 14°F to 104°F (-10°C to +40°C)*
- *If necessary, a heater or air conditioner must be used to maintain the temperature range listed above.*
- *For drive model 4590-FVG+S3, the top clearance is 11.8 inches.*

7. Lay out the wire runs. Size the wire according to NEC Table 610-14(a). At a minimum, use #16 AWG for control wiring and #12 AWG for power wiring. When performing this step:
   - 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.
8. Obtain the appropriate hardware for mounting.
9. Mount the subpanel or surface to which you are mounting the drive. (Contact Electromotive Systems if you need advice on mounting, especially for larger drives.)
10. Fasten the drive and components to the subpanel.
11. Remove the terminal cover.
12. Follow the wiring practices outlined in Chapter 3.

IMPULSE•VG+ Series 3 Dimensions/Heat Loss—Open Chassis

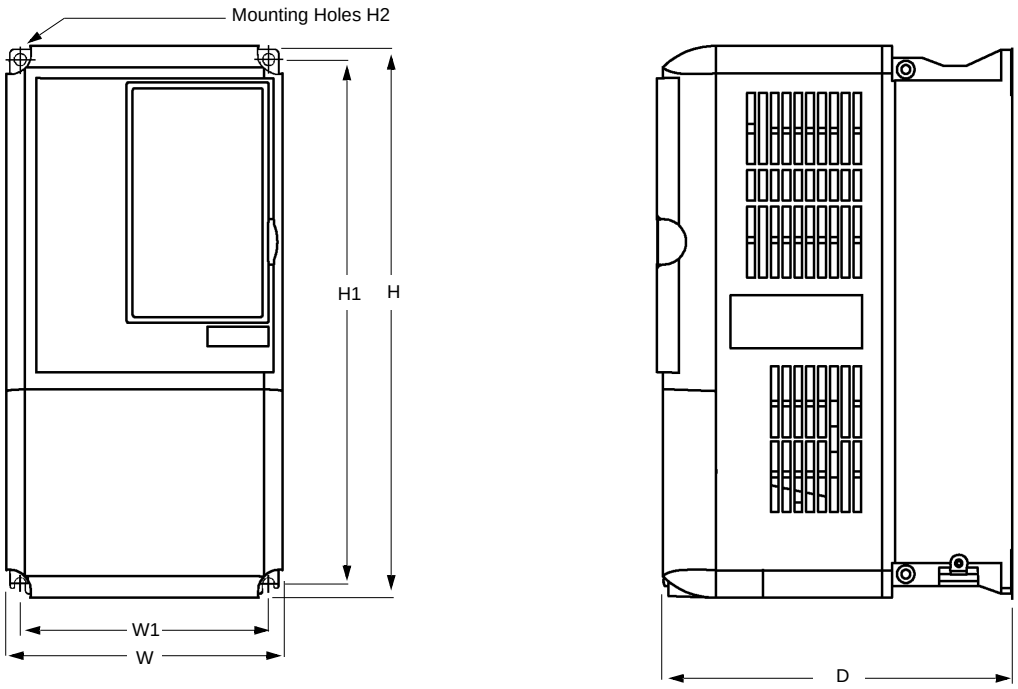

Figure 2-6: Open Chassis

NOTE: Some models are shipped with metal enclosures that can be removed and discarded.

230V Class

	Overall Dimensions in inches and (mm)			Mounting Dimensions in inches and (mm)				Heat Loss (W)
Model	**W**	**H**	**D**	**W1**	**H1**	**H2**	**Wt Lbs**	**Total**
2007-FVG+S3	5.51 (140)	11.02 (280)	6.30 (160)	4.95 (126)	10.47 (266)	0.28 (7)	6.6	98
2009-FVG+S3	5.51 (140)	11.02 (280)	6.30 (160)	4.95 (126)	10.47 (266)	0.28 (7)	6.6	127
2015-FVG+S3	5.51 (140)	11.02 (280)	7.09 (180)	4.95 (126)	10.47 (266)	0.28 (7)	8.8	134
2023-FVG+S3	5.51 (140)	11.02 (280)	7.09 (180)	4.95 (126)	10.47 (266)	0.28 (7)	8.8	184
2031-FVG+S3	7.87 (200)	11.81 (300)	7.87 (200)	7.32 (186)	11.22 (285)	0..28 (7)	13.2	332
2045-FVG+S3	7.87 (200)	12.20 (310)	7.87 (200)	7.32 (186)	11.22 (285)	0.28 (7)	15.4	525
2058-FVG+S3	9.45 (240)	13.78 (350)	8.27 (210)	8.50 (216)	13.19 (335)	0.30 (7.62)	24.2	598
2071-FVG+S3	9.45 (240)	14.96 (380)	8.27 (210)	8.50 (216)	13.19 (335)	0.30 (7.62)	24.2	680
2085-FVG+S3	10.0 (254)	21.06 (535)	10.24 (260)	7.68 (195)	15.16 (385)	0.30 (7.62)	53	835
2145-FVG+S3	14.76 (375)	23.62 (600)	11.81 (300)	9.84 (250)	22.64 (575)	0.49 (12.5)	125	1431
2215-FVG+S3	17.72 (450)	28.54 (725)	13.78 (350)	12.80 (325)	27.56 (700)	0.49 (12.5)	189	2207

	Overall Dimensions in inches and (mm)			Mounting Dimensions in inches and (mm)				Heat Loss (W)
Model	**W**	**H**	**D**	**W1**	**H1**	**H2**	**Wt Lbs**	**Total**
2283-FVG+S3	17.72 (450)	28.54 (725)	13.78 (350)	12.80 (325)	27.56 (700)	0.49 (12.5)	191	2800
2346-FVG+S3	19.69 (500)	33.46 (850)	14.17 (360)	14.57 (370)	32.28 (820)	0.59 (15)	238	3158

460V Class

	Overall Dimensions—in. & (mm)			Mounting Dimensions—in. & (mm)				Heat Loss (W)
Model	**W**	**H**	**D**	**W1**	**H1**	**H2**	**Wt Lbs**	**Total**
4002-FVG+S3	5.51 (140)	11.02 (280)	6.30 (160)	4.95 (126)	10.47 (266)	0.28 (7)	6.6	58
4003-FVG+S3	5.51 (140)	11.02 (280)	6.30 (160)	4.95 (126)	10.47 (266)	0.28 (7)	6.6	84
4005-FVG+S3	5.51 (140)	11.02 (280)	7.09 (180)	4.95 (126)	10.47 (266)	0.28 (7)	8.8	115
4008-FVG+S3	5.51 (140)	11.02 (280)	7.09 (180)	4.95 (126)	10.47 (266)	0.28 (7)	8.8	148
4012-FVG+S3	5.51 (140)	11.02 (280)	7.09 (180)	4.95 (126)	10.47 (266)	0.28 (7)	8.8	208
4017-FVG+S3	7.87 (200)	11.81 (300)	7.87 (200)	7.32 (186)	11.22 (285)	.28 (7)	13.2	307
4024-FVG+S3	7.87 (200)	11.81 (300)	7.87 (200)	7.32 (186)	11.22 (285)	.28 (7)	13.2	390
4031-FVG+S3	9.45 (240)	13.78 (350)	8.27 (210)	8.5 (215)	13.19 (335)	0.30 (7.5)	22	465
4039-FVG+S3	9.45 (240)	13.78 (350)	8.27 (210)	8.5 (215)	13.19 (335)	0.30 (7.5)	22	590
4045-FVG+S3	10.98 (275)	17.72 (450)	10.24 (260)	8.66 (220)	17.13 (435)	0.30 (7.5)	53	653
4060-FVG+S3	10.98 (275)	17.72 (450)	10.24 (260)	8.66 (220)	17.13 (435)	0.30 (7.5)	53	988
4075-FVG+S3	12.80 (325)	21.65 (550)	11.22 (285)	10.24 (260)	21.06 (535)	0.30 (7.5)	88	1133
4091-FVG+S3	12.80 (325)	21.65 (550)	11.22 (285)	10.24 (260)	21.06 (535)	0.30 (7.5)	88	1287
4112-FVG+S3	12.80 (325)	21.65 (550)	11.22 (285)	10.24 (260)	21.06 (535)	0.30 (7.5)	88	1682
4150-FVG+S3	17.72 (450)	28.54 (725)	13.78 (350)	12.80 (325)	27.56 (700)	0.49 (12.5)	194	1847
4180-FVG+S3	17.72 (450)	28.54 (725)	13.78 (350)	12.80 (325)	27.56 (700)	0.49 (12.5)	196	2287
4260-FVG+S3	19.69 (500)	33.46 (850)	14.17 (360)	14.57 (370)	32.28 (820)	0.59 (15)	265	3393
4304-FVG+S3	22.64 (575)	36.06 (916)	14.88 (373)	17.52 (445)	33.66 (855)	0.59 (15)	352	3935
4370-FVG+S3	27.95 (710)	51.38 (1305)	16.26 (413)	10.63 (270)	50.00 (1270)	0.79 (20)	572	3964
4477-FVG+S3	27.95 (710)	51.38 (1305)	16.26 (413)	10.63 (270)	50.00 (1270)	0.79 (20)	616	5509
4590-FVG+S3	36.06 (916)	58.07 (1475)	16.26 (413)	14.37 (365)	56.70 (1440)	0.79 (20)	891	8320

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chapter 3

Wiring

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IMPULSE•VG+ Series 3 Wiring Practices

WARNING

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

- **Do not** connect the main output terminals (T1, T2, and T3) to the incoming, three-phase AC source. This will damage the unit!
- Ensure that the drive-to-motor wiring distance is less than 150 ft unless appropriate reactors and/or filters are used.
- 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.
- On external user input devices, use hard contact inputs rather than solid-state inputs.
- 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 percent impedance between the power source and the drive input. To accomplish this, you can install a DC reactor between inverter terminals 1 and 2, or use an AC line reactor on the input of the drive. If you don't provide enough impedance, excessive peak currents could damage the input power supply circuit.
- If the user input device is a PLC TRIAC output, use a 5-K, 10-W resistor between the signal and L2 (X2).
- Comply with "Suggested Circuit Protection Specifications" on page 3-6.
- Use time delay fuses, which are sized at 150% of drive's continuous-rated current, for drive input 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 you use any welding or high-current machines near the crane, disconnect all line and ground wiring.
- Do not use output contactors between the drive and the motor.
- 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.
- Hard-wire the drive and motor (e.g., festoon cable). Do not use sliding collector bars.
- If you have 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 (T1, T2 and T3) for possible short circuits and ground faults.
- Increase the wire size by one size for every 250 ft. between the drive and motor; suggested for center driven cranes, trolleys and bridges. (Voltage drop is especially 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, interchange any two motor leads (T1, T2 or T3). (Changing L1, L2 or L3 will not affect the shaft rotation direction.)
- Use shielded cable for all low-level DC speed reference signals (0 to10VDC, 4 to 20 mA). Ground the shield only at the drive side.
- Please observe National Electrical Code (NEC) guidelines when wiring electrical devices.

Failure to observe these warnings may result in equipment damage.

IMPULSE•VG+ Series 3 Standard Connection Diagram

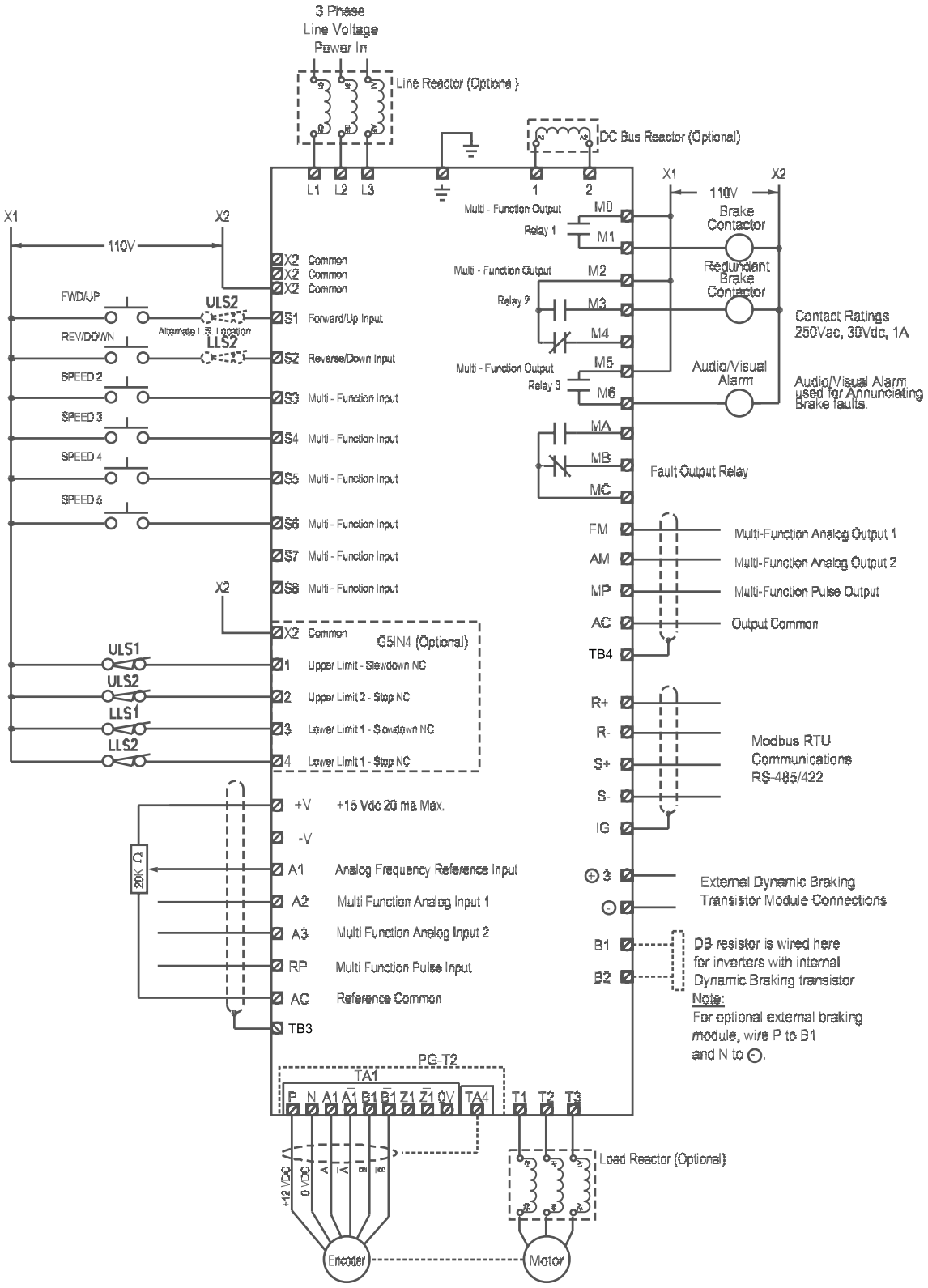


Figure 3-1: IMPULSE•VG+ Series 3 Terminal Diagram

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•VG+ Series 3. 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.

				Wiring Size (AWG/KCMIL)		
Model #	**Rated Current(A) InputFuse**	**Time Delay Input Fuse Class**	**Inverse Time Molded/Case Circuit Breaker**	**Power Circuit Wiring (1)**	**Control Wiring**	**Ground Copper (2)**
230VClass						
2007-FVG+-S3	12	CC	15	12	16/14	12
2009-FVG+-S3	15	CC	20	12	16/14	12
2015-FVG+-S3	25	CC	30	12	16/14	10
2023 -FVG+S3	30	J	45	12	16/14	10
2031 -FVG+S3	45	J	60	10	16/14	10
2045 -FVG+S3	60	J	90	6	16/14	10
2058 -FVG+S3	80	J	110	6	16/14	8
2071 -FVG+S3	100	J	150	4	16/14	8
2085 -FVG+S3	125	J	175	2	16/14	6
2145 -FVG+S3	200	J	300	1/0	16/14	6
2215 -FVG+S3	300	J	450	(2) 1/0	16/14	4
2283 -FVG+S3	400	J	600	(2) 1/0	16/14	2
2346 -FVG+S3	500	J	700	(2) 3/0	16/14	2
460VClass						
4002 -FVG+S3	3.5	CC	15	12	16/14	12
4003 -FVG+S3	6	CC	15	12	16/14	12
4005 -FVG+S3	9	CC	15	12	16/14	12
4008 -FVG+S3	15	CC	20	12	16/14	12
4012 -FVG+S3	20	CC	25	12	16/14	12
4017 -FVG+S3	25	J	35	12	16/14	10
4024-FVG+S3	35	J	50	12	16/14	10
4031 -FVG+S3	45	J	60	10	16/14	10
4039 -FVG+S3	50	J	80	8	16/14	10
4045 -FVG+S3	60	J	90	6	16/14	10
4060-FVG+S3	80	J	125	4	16/14	8
4075 -FVG+S3	100	J	150	4	16/14	8
4091 -FVG+S3	125	J	175	2	16/14	6
4112 -FVG+S3	150	J	225	1/0	16/14	6

Model #	Rated Current(A) InputFuse	Time Delay Input Fuse Class	Inverse Time Molded/Case Circuit Breaker	Wiring Size (AWG/KCMIL) Power Circuit Wiring (1)	Control Wiring	Ground Copper (2)
4150 -FVG+S3	200	J	300	2/0	16/14	6
4180 -FVG+S3	250	J	350	3/0	16/14	4
4260 -FVG+S3	350	J	500	(2) 1/0	16/14	2
4304 -FVG+S3	400	J	600	(2) 2/0	16/14	2
4370 -FVG+S3	500	J	700	(2) 3/0	16/14	2
4477 -FVG+S3	700	L	900	(2) 250 KCMIL	16/14	1/0
4590 -FVG+S3	800	L	1000	(2) 300 KCMIL	16/14	1/0

References:

1. NFPA 70 National Electrical Code 2002 Table 610-14(a) 90° C, 60-minute, copper, 45° C ambient.
2. NFPA 70 National Electrical Code 2002. Table 250-122.

Power Circuit Wiring Procedures

To wire the power circuit for IMPULSE•VG+ Series 3:

1. Run the three-phase power supply wires through an appropriate enclosure hole.
2. Referring to “Suggested Circuit Protection Specifications—IMPULSE•VG+ Series 3” and the following two tables, 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 L1, L2 and L3.
4. From Terminals T1, T2 and 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.
5. For Models 4150-FVG+S3 and greater, ensure the jumper plug is inserted in the printed-circuit board (8PCB), which is underneath the control board, as follows:

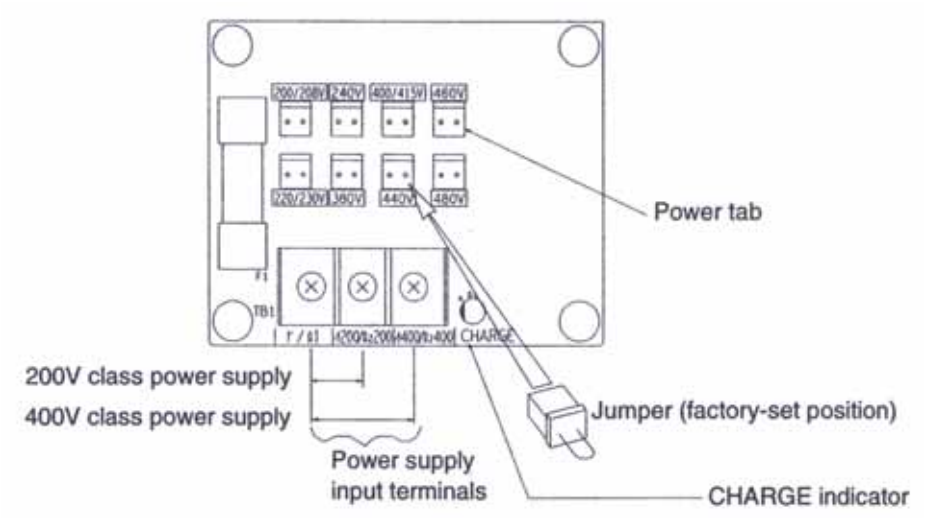


Figure 3-2: Models 4150-FVG+S3 to 4590-FVG+S3

230 V Class Terminal Functions

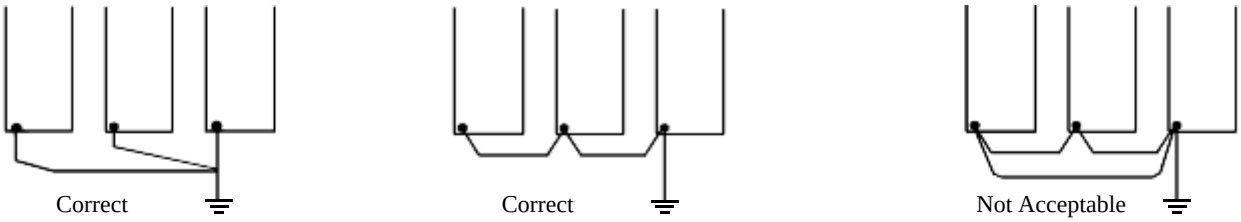
	Model	2007-FVG+ to 2071-FVG+	2085-FVG+	2145-FVG+	2180-FVG+ to 2346-FVG+
	Rated Current	7 to 71 Amps	85 Amps	145 Amps	180 to 346 Amps
Terminal	R/L1	Main circuit input power supply			
	S/L2				
	T/L3				
	U/T1	Inverter output			
	V/T2				
	W/T3				
	B1	Braking resistor	n/a		
	B2				
	⊖	DC reactor (⊕1–⊕2) DC Power supply (⊕1–⊖)	DC power supply (⊕1–⊖) Braking unit (⊕3–⊖) ⊕2 terminal not provided		
	⊕1				
	⊕2				
	⊕3				
	r (*l* 1)	n/a		Cooling fan power supply	
	s (*l* 2)				
	⏚	Ground terminal (Ground resistance: 100 Ω or less)			

460 V Class Terminal Functions

	Model	4002-FVG+ to 4039-FVG+	4045-FVG+ to 4112-FVG+	4150-FVG+ to 4304-FVG+	4477-FVG+ to 4590-FVG+
	Rated Current	2.1 to 39 Amps	45 to 112 Amps	150 to 304 Amps	477 to 590 Amps
Terminal	R/L1	Main circuit input power supply			
	S/L2				
	T/L3				
	U/T1	Inverter output			
	V/T2				
	W/T3				
	B1	Braking resistor	n/a		
	B2				
	⊖	DC reactor (⊕1–⊕2) DC power supply (⊕1– ⊖)	DC power supply (⊕1– ⊖) Braking unit (⊕3– ⊖)		
	⊕1				
	⊕2				
	⊕3	n/a			
	s (*l* 1)	n/a	n/a	n/a	
	r (*l* 2)			Cooling fan power supply (Control power supply) r–s200: 200 to 230VAC input r–s400: 380 to 460VAC input	
	s200		n/a		
	s400				
	⏚	Ground terminal (Ground resistance: 10 Ω or less			

Grounding

6. 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: 230V class; 100Ω or less, 460V or greater class; 10Ω or less.
   - Never run the IMPULSE•VG+ Series 3 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.



Grounding of three IMPLULSE VG+ Series 3 Drives

Grounding of IMPLULSE VG+ Series 3 Drive and Vector Control Motor

Figure 3-3: Grounding

Control Circuit Terminals - Continued
Control Circuit board 2PCB

DIP Switch S1 and Jumper CN15

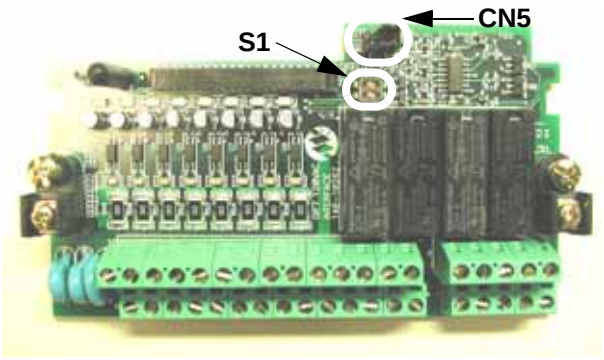


Figure 3-4: DIP Switch S1 and Jumper CN15 Location

Dip Switch S1

DIP Switch S1 is described in this section. The functions of DIP switch S1 are shown in the table below.

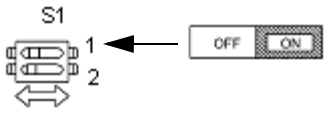
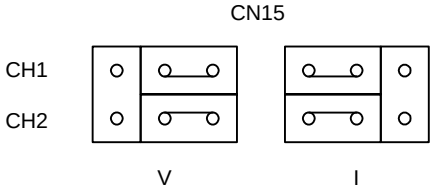


Figure 3-5: DIP Switch S1 Function

DIP Switch S1		
Name	**Function**	**Setting**
S1-1	RS-485 and RS-422 terminating resistance	OFF: No terminating resistance ON: Terminating resistance of 110 Ohm Factory Default = OFF
S1-2	Input method for analog input A2	OFF: 0 to 10Vdc or -10 to 10Vdc (internal resistance: 20K) ON: 4-20mA (internal resistance: 250 Ohm) Factory Default = OFF

Jumper CN15



Jumper CN15 is described in this section. The jumper position of CH1 and CH2 determines the signal level of the multi-function analog output FM and AM, respectively. The functions and positions of CN15 are shown in the table below.

Jumper CN15		
Name	**Multi-function Analog Output**	**Output Range**
CH1	FM	V: 0 to 10V or -10V to +10V (default)I: 4 to 20mA
CH2	AM	V: 0 to 10V or -10V to +10V (default)I: 4 to 20mA

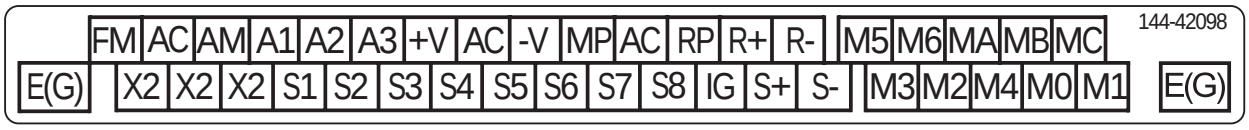
Control Circuit Terminals

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

Classification	Terminal	Signal Function	Description		Signal Level
Sequence Input Signal	S1	Forward run/stop	Forward run when closed, stop when open		120 VAC ± 10%
	S2	Reverse run/stop	Reverse run when closed, stop when open		
	S3	Speed 2	Multi-function contact inputs (H1-01 to H1-06)		
	S4	Speed 3			
	S5	Speed 4			
	S6	Speed 5			
	S7	External Fault			
	S8	M-Speed Gain 1			
	SN	Control Input Common			
Analog Input Signal	+V	+15V Power supply output	For analog command +15V power supply		+15V (Allowable current 20 mA max.)
	-V	-15V Power supply output	For analog command -15V power supply		-15V (Allowable current 20 mA max.)
	A1	Master frequency reference	-10 to +10V/-100% to 100% 0 to +10V/0 to 100%		-10 to +10V (20k Ohm), 0 to +10V/(20k Ohm)
	A2	Multi-function analog reference	4 to 20 mA/0 to 100% -10 to +10V/-100% to 100% 0 to 10 V/0 to 100%	Multi-function analog reference (H3-09)	4 to 20mA (250 Ohm) -10 to +10V (20k Ohm), 0 to +10V/(20k Ohm)
	A3	Multi-function analog input	-10 to +10V/-100% to +100% 0 to +10 V/0 to 100%	Auxiliary analog input (H3-05)	-10 to +10V (20k Ohm), 0 to +10V/(20k Ohm)
	AC	Common terminal for control circuit	0V		–
	E(G)	Connection to shield sheath of signal lead	–		–
Relay Output Signal	M0	Brake output N.O. Contact	Multi-function output (H2-01 to H2-03)		Dry contact Contact capacity: 250VAC, 1A or less 30VDC, 1A or less
	M1				
	M2	N.O./N.C. Contact			
	M3				
	M4				
	M5	Fault annunciate			
	M6				
	MA	Fault contact output (NO/NC contact)	Terminals MA & MC N/O; closed at major faults Terminals MB & MC N/C open at major fault		
	MB				
	MC				
Analog Output Signal	FM	Multi-Function Analog Output 1	0 to ± 10V	Multi-function analog monitor (H4-01 to H4-03)	0 to ±10V Max. ±5% 2mA or less
	AC	Common			
	AM	Multi-Function Analog Output 2	0 to ± 10V	Multi-function analog monitor 2 (H4-04 to H4-06)	0 to ±10V Max. ±5% 2mA or less

Classification	Terminal	Signal Function	Description		Signal Level
Pulse I/O Signal	RP	Pulse Input	Pulse input frequency reference	Function set by H6-01	0 to 32kHz (3k) ±5% High level voltages 3.5 to 13.2 Low level voltages 0.0 to 0.8 Duty Cycle (on/off) 30% to 70%
	MP	Pulse Monitor	Pulse output frequency	Function set by H6-06	0 to 32kHZ ±5% output (load: 1.5k)
RS-485/422	R+	Modbus communication input	For 2-wire RS-485, jumper R+ and S+ and jumper R- and S-		Differntial input, PHC isolation
	R-				
	S+	Modbus communication output			Differntial output, PHC isolation
	S-				
	IG	Signal Common			

Control Circuit Terminal Diagram



Wiring the Encoder Circuit

A shaft-mounted encoder is required to provide speed and shaft position feedback to IMPULSE•VG+ Series 3. Without an encoder, a flux vector control cannot operate properly.

Before you wire the encoder circuit, refer to the specification tables in this section and to "Wiring Specifications."

Encoder Circuit Wiring Procedures

Encoder Specifications

Power supply	+12VDC; if current demand is greater than 200 mA, an auxiliary power supply must provided
Output Type	Quadrature (A and B channels; Z is not necessary)
Type of output circuit	High-speed, differential line driver.
Resolution	1024 PPR
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 3 (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 Electromotive Systems 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-T2 Encoder Interface Card. Refer to Figure 3-9: "PG-T2 Encoder Card Wiring" on page 3-15.

   NOTE: Use twisted-pair, shielded cable (Electromotive R-20/6, 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 Electromotive Systems for information on available fiber optic cable systems.)

3. Ground the shielded cable to Terminal TA4 of the PG-T2 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 at TA4 and connected to the shield at the encoder.

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

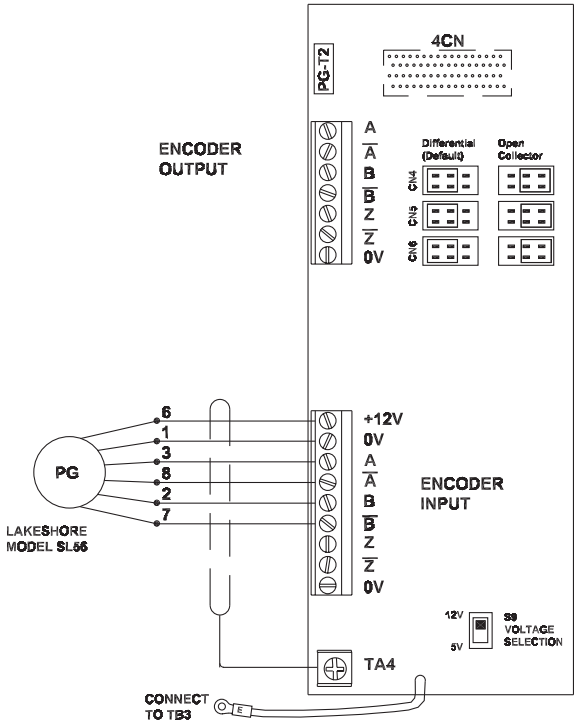


Figure 3-9: PG-T2 Encoder Card Wiring

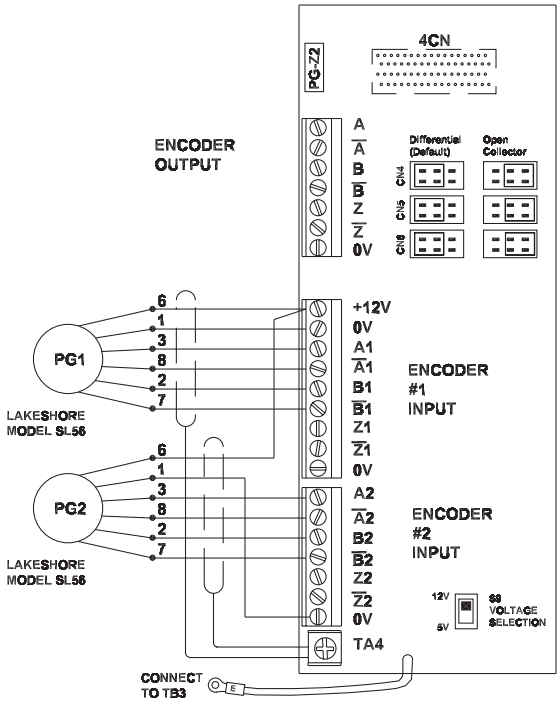


Figure 3-10: PG-Z2 Encoder Card Wiring

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

Encoder Signal	Wire Color	PG-T2 Terminal
+5 to 15VDC	Red	8
OV	Black	9
A+	Blue	10
A-	Gray	11
B+	Green	12
B-	Yellow	13
Shield	N/A	FG

PG-T2 Encoder Interface Card Specifications

Power supply to encoder:	Dual; +5VDC or +12VDC; 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

PG-Z2 Encoder Interface Card Terminal Functions

Terminal Block	Function
1	A+ pulse output
2	A- pulse output
3	B+ pulse output
4	B- pulse output
5	Z+ pulse output
6	Z- pulse output
7	OV (power supply common)
8	+12VDC power supply
9	Power supply common
10	A+ pulse input, Channel 1
11	A- pulse input, Channel 1
12	B+ pulse input, Channel 1
13	B- pulse input, Channel 1
14	Z+ pulse input, Channel 1
15	Z- pulse input, Channel 1
16	Power supply common
17	A+ pulse input, Channel 2
18	A- pulse input, Channel 2
19	B+ pulse input, Channel 2
20	B- pulse input, Channel 2
21	Z+ pulse input, Channel 2
22	Z- pulse input, Channel 2
23	Power supply common
FG	Shield terminal

c h a p t e r **4**

Programming Basic Features

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Overview

With its easy-to-use keypad and X-Press Programming, IMPULSE•VG+ Series 3 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 ≤ 500, unless a line reactor is used.)

WARNING

DO not power 230V-rated drives with 460V power.

- 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 end stop device, causing damage to equipment or injury to personnel.

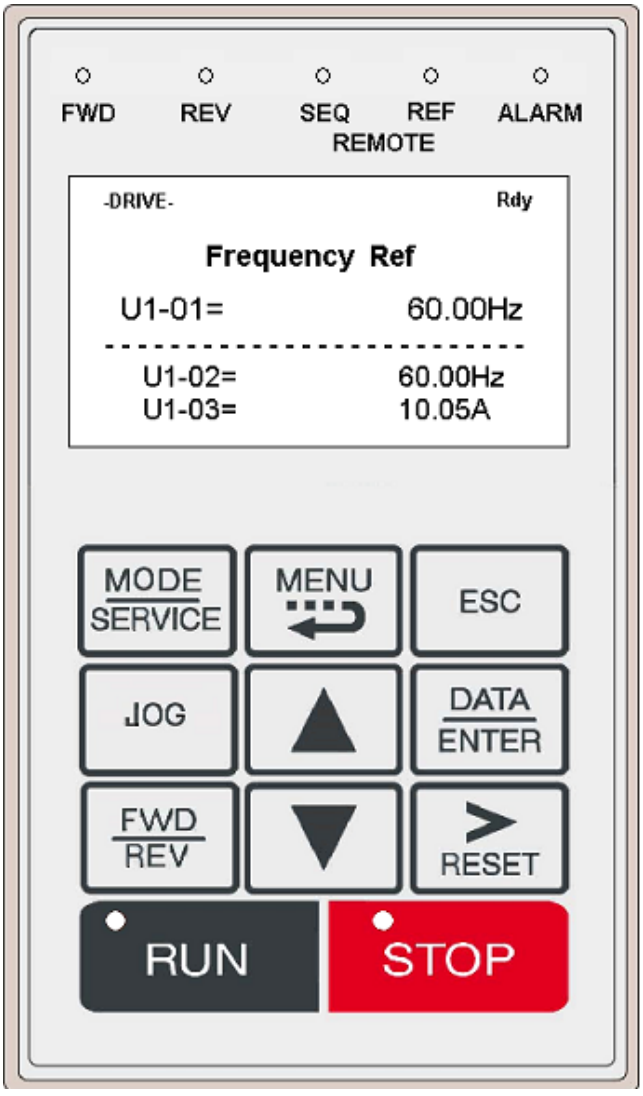
Using the Keypad

With five 16-character lines available, the keypad display makes it possible to view fault codes and change parameter settings. Parameter settings, with their parameter codes, are displayed in most cases. 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 you do operate the drive locally, be aware that the crane or hoist will move when you press the RUN button. If you have questions, contact Magnetek.



Keypad LED and Button Functions

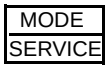
Some of the keypad buttons, whose functions are described below, are dual-purpose. The dual-purpose keys have one function when used in a view-only mode, and another function when used in a programming mode.

This LED lights when a fault has occured, flashes when an alarm has occured.

This LED lights when the FORWARD command is given.

This LED lights when the REVERSE command is given.

- The SEQ LED lights when selecting the RUN command from the control circuit terminals or communication option card.
- The REF LED lights when the **Speed Reference** is input through control circuit terminals or communication option card.



- Pressing this key toggles between the mode display and the phone number for Magnetek Service Department.
- Also toggles between REMOTE and LOCAL (operate from keypad) operation when O2-1 is set to 1.
- Pressing the key 3 times resets the maintenance timer, U1-52.

Displays the four key pad functions; operation, programming, modified constants and auto tunning.

Backs up to the previous display (before the DATA/ENTER key is depressed).

Jog run is enabled when local operation is selected.

Selects the next parameter group, parameter or parameter setting. It also increases the blinking digit of a parameter setting.

Selects the previous parameter group, parameter or parameter setting. It also decreases the blinking digit of a parameter setting.

Selects the digit—from left to right—to be changed (indicated by blinking). It also resets the operation at faults.

DATA / ENTER

Selects mode or parameter. Displays each parameter's set value. By pressing this key again, the set value is entered.

FWD / REV

Selects forward or reverse run when LOCAL operation is selected.

- Pressing this key initiates run command when LOCAL operation is selected.
- The red LED lights steadily during run.

- Pressing this key initiates Base Block stop command.
- The red LED lights steadily when drive is at stop; blinks when Run command is active but output frequency reference is zero, off when drive output is controlling motor speed.

Parameters

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

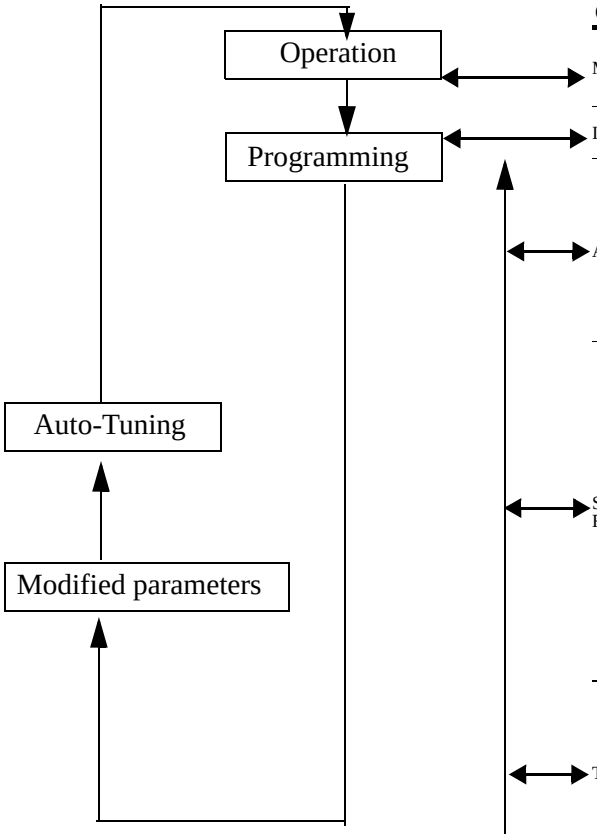
NOTE: The terms "constant" and "parameter" have the same meaning.

Before shipping the drive to you, we programmed initial settings in the drive's software so that most, if not all, of your crane system requirements are supported. However, if you do find it necessary to change the initial settings, we recommend that you only allow qualified crane system technicians to 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.

You also have the option of allowing personnel with limited crane system knowledge to program only certain parameters—**User Parameters**—that you select. To select these parameters, see "User Parameters (A2-XX)" on page 4-14.

Two other features to be aware of are **Initialize Parameters** (A1-05) and **User Defaults** (O2-03). Both these features are related and allow you to revert back to parameter settings that you save. This is especially helpful when you have made a number of programming changes, but want to get back to the settings you had before you made any changes. To program these features, see "Initialize Parameters (A1-05)" and "User Defaults (02-03)".

IMPULSE•VG+ Series 3 Structure of Parameters



Group	Function	
Monitor	U1	Monitor
	U2	Fault Trace
	U3	Fault History
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
	B6	Speed Search
	B8	Jump Frequencies
Special Function	C1	Quick Stop/Reverse Plug Simulation
	C2	Micro Speed
	C3	Travel Limits
	C4	Load Float 2
	C5	Load Check
	C6	Ultra-Lift
	C7	Torque Limit
	C8	No Load Brake Hoist
	C9	G5IN4 Setup
	C10	Weight Measurement
	C11	Slack Cable Detection
	C12	Delay Timers
	C13	Inching Timers
Tuning	D1	Braking
	D2	Automatic Slip Compensation
	D4	Automatic Speed Regulator Tuning
	D5	Torque Control
	D6	Droop Control
	D8	Dwell Function
	D9	S-Curve Acceleration/Deceleration
Motor	E1	V/f Pattern 1
	E2	Motor Set-up
	E3	Motor 2 Method
	E3	Motor 2 V/f Pattern
	E4	Motor 2 Set-up
Options	F1	Pulse Generator (PG) Option Set-up
	F2	Analog Input 14 Set-up
	F3	Digital Input Option Set-up
	F4	Analog Output Option Set-up
	F5	Digital Output 2 Set-up
	F5	Digital Output 8 Set-up
	F6	Communication Option Set-Up
Terminal	H1	Digital Inputs
	H2	Digital Outputs
	H3	Analog Inputs
	H4	Analog Outputs
	H5	Serial Communication Set-up
	H6	Pulse I/O Set-up
Protection	L1	Motor Overload
	L2	Under voltage level/Power Loss
	L4	Ref Detection
	L6	Torque Detection
	L8	Hardware Protection
	L9	Automatic Reset
Operator	O1	Monitor Selection
	O2	Keypad Key Selection
	O3	Clear History
	O4	Copy Function

Parameter Modes

All parameters are organized under four modes:

Operation Mode

Drive operation is enabled. Drive status LED lights.

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

Motor parameters are automatically set by entering tuning data (motor nameplate values) when using open loop vector control method.

Modified Constants Mode

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

Initialization Set-up

Parameter Access Level (A1-01)

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

Setting	Description
0	Operation Only
1	User Program - Accesses parameters selected by OEM (A2-01 to A2-32).
2	Advanced Level - For advanced programming in special applications.

Refer to the parameter code table in Chapter 5 for available parameters at each level.

Control Method Selection (A1-02)

Select the control method best suited for your application.

Setting	Description
3	Flux Vector

NOTE: An auto-tune must be performed for all flux vector applications. Refer to the Auto-Tuning section on page 4-15.

Select Motion (A1-03)

Set this parameter to match the motion of application. See tables 4.1 and 4.2 (X-Press Programming) for details.

Setting	Description
0	Traverse - Decelerate to stop upon removal of RUN command.
2	No-Load Brake Hoist

Speed Reference (A1-04)

This parameter will automatically define the input terminals for the selections listed below. See tables 4.1 and 4.2 (X-Press Programming) for details.

Setting	Description
0	2-SPD Multi-step — Defines Terminal 3 = 2nd speed.
1	3-SPD multi-step — Defines Terminals 3 and 4 as speeds 2 and 3 respectively.
2	5-SPD Multi-step — Defines Terminals 3-6 as speeds 2-5.
3	2-Step infinitely variable — Terminals 1 and 2 = b1-01 (Reference 1) and speed hold. Terminal 3 = Accelerate.
4	3-Step infinitely variable — Terminals 1 and 2 = b1-01 (Reference 1). Terminal 3 = Speed Hold. Terminal 4 =Accelerate.
5	Uni-polar analog — Terminals 1 and 2 = A directional input. Terminal 13 = 0-10V. Terminal 14 = 4-20mA.
6	Bi-polar analog — Terminal 13 =-10 to +10V. An input on Terminal 1 is required, but direction is determined by the reference given on Terminal 13.
7	Defines Terminals 3-8 as not used. Use this setting if using the G5IN4 option card for inputting speed references.
8	Serial option card. Sets terminals to “not used.”

Parameters Changed by X-Press Programming

Table 4-1: Traverse (A1-03= 0)

A1-04	Description	B1-01	B1-02	B1-03	B1-04	B1-05	B1-06	B1-07	B1-08	B1-09	B1-10	B1-11	B1-12	B1-13	B1-14	B1-15	B1-16	B1-17	B1-18	B2-01	B2-03	B3-03	B5-01	B5-02
		Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Speed 6	Speed 7	Speed 8	Speed 9	Speed 10	Speed 11	Speed 12	Speed 13	Speed 14	Speed 15	Speed 16	Jog Ref	Ref Priority	Ref. Upper Limit	Ref. Lower Limit	Stopping Method	Accel Time 1	Decel Time 1
0	2-Speed Multi-Step	20.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	2.0	0	10.0	10.0
1	3-Speed Multi-Step	15.00	30.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	2.0	0	10.0	10.0
2	5-Speed Multi-Step	6.00	15.00	30.00	45.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	2.0	0	10.0	10.0
3	2-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	2.0	0	10.0	10.0
4	3-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	2.0	0	10.0	10.0
5	Uni-Polar Analog	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	1	100.0	2.0	0	10.0	10.0
6	Bi-Polar Analog	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	1	100.0	2.0	0	10.0	10.0
7	G5IN4 Opt. Card	15.00	30.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	2.0	0	10.0	10.0
8	Serial Opt. Card	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	1	100.0	2.0	0	10.0	10.0

A1-04	Description	C1-01	C3-07	C8-10	D9-01	D9-02	D9-03	E1-03	H1-01	H1-02	H1-03	H1-04	H1-05	H1-06	H2-01	H2-02	H2-03	H3-01	H3-05
		Quick Stop 0/1	Action@ LL2/UL2	Load Float Time	S-Curve Accel at Start	S-Curve Accel at End	S-Curve Decel at Start	V/F Selection	Terminal S3 Select	Terminal S4 Select	Terminal S5 Select	Terminal S6 Select	Terminal S7 Select	Terminal S8 Select	Terminal M1 / M2 Select	Terminal M3 / M4 Select	Terminal M5 / M6 Select	Terminal A1 Signal	TerminalA 3 Select
0	2-Speed Multi-Step	0	2	0	1.50	1.50	1.50	01	00	0F	0F	0F	0F	0F	00	0F	0F	0	1F
1	3-Speed Multi-Step	0	2	0	1.50	1.50	1.50	01	00	01	0F	0F	0F	0F	00	0F	0F	0	1F
2	5-Speed Multi-Step	0	2	0	1.50	1.50	1.50	01	00	01	02	03	0F	0F	00	0F	0F	0	1F
3	2-Step Infinitely Variable	0	2	0	1.50	1.50	1.50	01	05	0F	0F	0F	0F	0F	00	0F	0F	0	1F
4	3-Step Infinitely Variable	0	2	0	1.50	1.50	1.50	01	04	05	0F	0F	0F	0F	00	0F	0F	0	1F
5	Uni-Polar Analog	0	2	0	1.50	1.50	1.50	01	0F	0F	0F	0F	0F	0F	00	0F	0F	0	1F
6	Bi-Polar Analog	0	2	0	1.50	1.50	1.50	01	0F	0F	0F	0F	0F	0F	00	0F	0F	1	1F
7	G5IN4 Opt. Card	0	2	0	1.50	1.50	1.50	01	0F	0F	0F	0F	0F	0F	00	0F	0F	0	1F
8	Serial Opt. Card	0	2	0	1.50	1.50	1.50	01	0F	0F	0F	0F	0F	0F	00	0F	0F	0	1F

Parameters Changed by X-Press Programming

Table 4-2: No Load Brake Hoist (A1-03 = 2)

A1-04	Description	B1-01 Speed 1	B1-02 Speed 2	B1-03 Speed 3	B1-04 Speed 4	B1-05 Speed 5	B1-06 Speed 6	B1-07 Speed 7	B1-08 Speed 8	B1-09 Speed 9	B1-10 Speed 10	B1-11 Speed 11	B1-12 Speed 12	B1-13 Speed 13	B1-14 Speed 14	B1-15 Speed 15	B1-16 Speed 16	B1-17 Jog Ref	B1-18 Ref Priority	B2-01 Ref. Upper Limit	B2-03 Ref. Lower Limit	B3-03 Stopping Method	B5-01 Accel Time 1	B5-02 Decel Time 1
0	2-Speed Multi-Step	20.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	0.0	6	5.0	3.0
1	3-Speed Multi-Step	15.00	30.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	0.0	6	5.0	3.0
2	5-Speed Multi-Step	6.00	15.00	30.00	45.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	0.0	6	5.0	3.0
3	2-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	0.0	6	5.0	3.0
4	3-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	0.0	6	5.0	3.0
5	Uni-Polar Analog	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	1	100.0	0.0	6	5.0	3.0
6	Bi-Polar Analog	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	1	100.0	0.0	6	5.0	3.0
7	G5IN4 Opt. Card	15.00	30.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0	100.0	0.0	6	5.0	3.0
8	Serial Opt. Card	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	1	100.0	0.0	6	5.0	3.0

A1-04	Description	C1-01 Quick Stop 0/1	C3-07 Action @ LL2/UL2	C8-10 Load Float Time	D9-01 S-Curve Accel at Start	D9-02 S-Curve Accel at End	D9-03 S-Curve Decel at Start	E1-03 V/F Selection	H1-01 Terminal S3 Select	H1-02 Terminal S4 Select	H1-03 Terminal S5 Select	H1-04 Terminal S6 Select	H1-05 Terminal S7 Select	H1-06 Terminal S8 Select	H2-01 Terminal M1 / M2 Select	H2-02 Terminal M3 / M4 Select	H2-03 Terminal M5 / M6 Select	H3-01 Terminal A1 Signal	H3-05 Terminal A3 Select
0	2-Speed Multi-Step	1	2	10	0.50	0.50	0.50	0F	00	0F	0F	0F	0F	0F	00	00	78	0	1F
1	3-Speed Multi-Step	1	2	10	0.50	0.50	0.50	0F	00	01	0F	0F	0F	0F	00	00	78	0	1F
2	5-Speed Multi-Step	1	2	10	0.50	0.50	0.50	0F	00	01	02	03	0F	0F	00	00	78	0	1F
3	2-Step Infinitely Variable	1	2	10	0.50	0.50	0.50	0F	05	0F	0F	0F	0F	0F	00	00	78	0	1F
4	3-Step Infinitely Variable	1	2	10	0.50	0.50	0.50	0F	04	05	0F	0F	0F	0F	00	00	78	0	1F
5	Uni-Polar Analog	1	2	10	0.50	0.50	0.50	0F	0F	0F	0F	0F	0F	0F	00	00	78	0	1F
6	Bi-Polar Analog	1	2	10	0.50	0.50	0.50	0F	0F	0F	0F	0F	0F	0F	00	00	78	1	1F
7	G5IN4 Opt. Card	1	2	10	0.50	0.50	0.50	0F	0F	0F	0F	0F	0F	0F	00	00	78	0	1F
8	Serial Opt. Card	1	2	10	0.50	0.50	0.50	0F	0F	0F	0F	0F	0F	0F	00	00	78	0	1F

Initial Parameters (A1-05)

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

Setting	Description
0	No Initialization (factory default)
1110	User Initialization - resets the inverter to user-specified initial values. To set user-specified initial values, make all required changes to parameter settings, then set 02-03 to “1”. The inverter will memorize all current settings as the user-specified initial values. Up to 50 changed parameters can be stored.

Password Entry (A1-06)

This parameter will enable the user to set a password that will inhibit the programming of the *A1-01* to *A1-03* parameters. This function is useful when used in conjunction with the access level parameter *A1-01*. To set the password, press the MENU and RESET buttons at the same time and the display will change from *A1-06* to *A1-07*. Program in a password number, then when *A1-06* is not the same as *A1-07* parameter *A1-01* to *A1-03* cannot be changed. When *A1-06* is the same as *A1-07*, then *A1-01* to *A1-03* can be changed.

User Parameters (A2-01 through 32)

The user can select up to 32 parameters for quick-access programming. By setting the user access level (*A1-01*) 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 *A1-01* is programmed to “User Program,” only the parameters visible in the program menu will be assigned to an A2 parameter.

Auto-Tuning

CAUTION

The brake output is not energized during auto-tune. The brake must be manually released and unreleased when Auto-Tuning is complete.

The IMPULSE•VG+ Series 3 can adapt to all motors manufactured worldwide with its automatic tuning function. The inverter asks the user for minimal motor information, 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 Electromotive Systems service department if an auto-tune can not be performed.

Parameter Code	Display	Description	Default Setting
T1-00	Select Motor	Selects between motor 1 or 2 (Available only when H1-XX=41	1
T1-01	Tuning Mode Sel	Selects Tuning Method	0
	0 Standard Tuning		
	1 Tune - no rotate (first operation should be no load)		
	2 Term Resistance (used to obtain motor lead resistance)		
T1-02	Mtr Rated Power	Sets the motor size in HP (note: KW = Hp x .746)	KVA dependent
T1-03	Rated Voltage	Sets motor rated voltage in VAC	KVA dependent
T1-04	Rated Current	Sets motor rated current in Amps	KVA dependent
T1-05	Rated Frequency	Sets motor rated frequency in Hertz	60.0 Hz
T1-06	Number of Poles	Sets the number of motor poles	4
T1-07	Rated Speed	Sets motor rated speed in RPM	1750 RPM
T1-08	PG Pulses/Rev	Sets encoder PPR	1024 PPR

After scrolling through the tuning parameters using the Up Arrow key, depress the RUN key to begin auto-tuning. During tuning, “Tuning Proceeding” flashes on the digital operator display. When complete, “Tune Successful”, is displayed. Depress the Menu key to exit auto-tuning mode. Please refer to the “Fault Display and Corrective Actions at Auto-Tuning” section on page 6-19 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.

c h a p t e r **5**

Programming Advanced Features

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Application

- B1 Preset References
- B2 Reference Limits
- B3 Sequence/Reference Source
- B4 Trim Control Level
- B5 Acceleration/Deceleration
- B6 Phase Loss Detection
- B8 Jump Frequencies

Preset Reference

Parameter Code	Display	Function	Range	Initial Value	Access Level
B1-01*	Reference 1	Sets the frequency of Minimum Speed/Speed 1.	0.00–150.00 Hz**	15.00	Adv
B1-02*	Reference 2	Sets the Speed 2 frequency.	0.00–150.00 Hz	30.00	Adv
B1-03*	Reference 3	Sets the Speed 3 frequency.	0.00–150.00 Hz	60.00	Adv
B1-04*	Reference 4	Sets the Speed 4 frequency.	0.00–150.00 Hz	45.00	Adv
B1-05*	Reference 5	Sets the Speed 5 frequency.	0.00–150.00 Hz	60.00	Adv
B1-06*	Reference 6	Sets the Speed 6 frequency.	0.00–150.00 Hz	0.00	Adv
B1-07*	Reference 7	Sets the Speed 7 frequency.	0.00–150.00 Hz	0.00	Adv
B1-08*	Reference 8	Sets the Speed 8 frequency.	0.00–150.00 Hz	0.00	Adv
B1-09*	Reference 9	Sets the Speed 9 frequency.	0.00–150.00 Hz	0.00	Adv
B1-10*	Reference 10	Sets the Speed 10 frequency.	0.00–150.00 Hz	0.00	Adv
B1-11*	Reference 11	Sets the Speed 11 frequency.	0.00–150.00 Hz	0.00	Adv
B1-12*	Reference 12	Sets the Speed 12 frequency.	0.00–150.00 Hz	0.00	Adv
B1-13*	Reference 13	Sets the Speed 13 frequency.	0.00–150.00 Hz	0.00	Adv
B1-14*	Reference 14	Sets the Speed 14 frequency.	0.00–150.00 Hz	0.00	Adv
B1-15*	Reference 14	Sets the Speed 15 frequency.	0.00–150.00 Hz	0.00	Adv
B1-16*	Reference 16	Sets the Speed 16 frequency.	0.00–150.00 Hz	0.00	Adv
B1-17*	Jog Reference	Jog Control and Inching Control frequency reference.	0.00–150.00 Hz	6.00	Adv
B1-18*	Ref Priority *0 Digital Ref Only* *1 Analog Ref Only* *2 Higher Ref Sel*	Determines whether the digital or analog frequency reference is used. ***NOTE:*** *When using Higher Reference Select, 2-Step Infinitely Variable should NOT be used for a Speed Reference setting in parameter A1-04. The two functions are not intended to work in conjunction.*		0	Adv

** Initial value is determined by X-Press Programming (Table 4.1-4.2). **Maximum frequency above 150 HZ is available, consult Electromotive Systems.*

Table 5-1: Multi-Step Speed Processing by Multi-Function Input (B1-01 ~ B1-16)

Speed Referance	Forward/Reverse Terminal 1 or 2	Multi-Step Speed 2 H1-01 ~ 06 = 0	Multi-Step Speed 3 H1-01 ~ 06 = 1	Multi-Step Speed 4 H1-01 ~ 06 = 2	Mult-Step Speed 5 H1-01 ~ 06 = 3	Fwd/Rev Jog-Fwd/Rev Inch H1-01 ~ 06 = 15, 16, 17, 18
STOP	Off	–	–	–	–	Off
B1-01 Speed Ref 1	On	Off	Off	Off	Off	Off
B1-02 Speed Ref 2	On	On	Off	Off	Off	Off
B1-03 Speed Ref 3	On	On	On	Off	Off	Off
B1-04 Speed Ref 4	On	On	On	On	Off	Off
B1-05 Speed Ref 5	On	On	On	On	On	Off
B1-06 Speed Ref 6	On	Off	On	Off	Off	Off
B1-07 Speed Ref 7	On	Off	On	On	Off	Off
B1-08 Speed Ref 8	On	Off	Off	On	Off	Off
B1-09 Speed Ref 9	On	Off	On	On	On	Off
B1-10 Speed Ref 10	On	Off	Off	On	On	Off
B1-11 Speed Ref 11	On	Off	Off	Off	On	Off
B1-12 Speed Ref 12	On	On	Off	Off	On	Off
B1-13 Speed Ref 13	On	On	On	Off	On	Off
B1-14 Speed Ref 14	On	Off	On	Off	On	Off
B1-15 Speed Ref 15	On	On	Off	On	Off	Off
B1-16 Speed Ref 16	On	On	Off	On	On	Off

Reference Limits

These parameters will limit the frequency range as a percentage of maximum output frequency (E1-04). However, if the lower limit is below the zero speed level (D1-01), then operation will continue according to B3-05.

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.

Parameter Code	Display	Function	Range	Initial Value	Access Level
B2-01	Ref Upper Limit	Sets as a percentage of the maximum output frequency (E1-04), which determines the maximum frequency at which the drive is able to run.	0.0–110%	100.0	Adv
B2-02	Ref Lower Limit	Sets as a percentage of the maximum output frequency (E1-04), which determines the minimum master frequency reference only.	0.0–110%	0.0	Adv
B2-03	Ref 1 Lower limit	Sets as a percentage of the maximum output frequency (E1-04), which determines the minimum frequency at which the drive is able to run.	0.0–110%	*	Adv
B2-04	Alt Upper Limit	Alternate of B2-01 set by MFI=59.	0-110%	100.0	Adv

*Initial value set by X-Press programming.

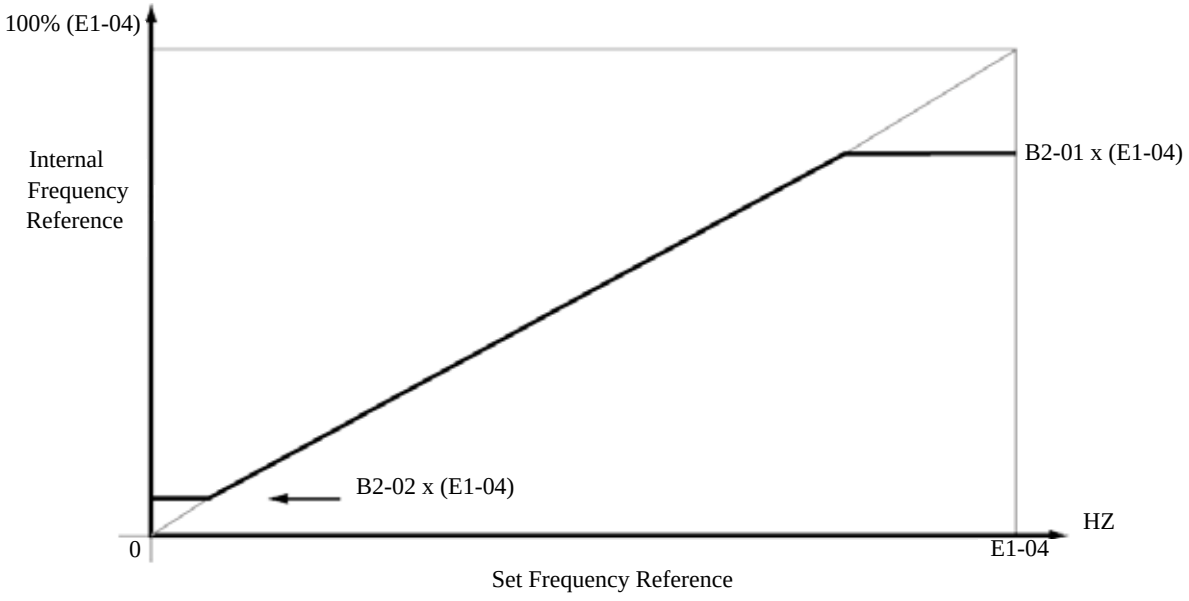


Figure 5-1: Setting Frequency Upper and Lower Limits

Sequence/Reference Source

B3-01 and B3-02 determine the source from where the frequency reference and RUN command are generated.

Parameter Code	Display	Function	Range	Initial Value	Access Level
B3-01	Reference Source	Source from where the frequency reference is generated.	0-4	1	Adv
	0 Operator	Digital operator (Keypad).			
	1 Terminals	Control circuit terminal			
	2 Communication	Serial communication (Port 6CN).			
	3 Option PCB	Optional card (Port 2CN).			
	4 Pulse Input (H6-01)	Pulse input.			
B3-02	Run Source	Source from where the RUN command is generated.	0-3	1	Adv
	0 Operator	Digital operator (Keypad).			
	1 Terminals	Control circuit terminal.			
	2 Communication	Serial communication (Port 6CN).			
	3 Option PCB	Optional card (Port 2CN).			

Stop Method

B3-03 selects the stopping method suitable for the particular application.

Parameter Code	Display	Function	Range	Initial Value	Access Level
B3-03	Stop Method	Determines stop method.		*	Adv
	0 Decel to Stop (A1-03=0)	(Fig 5-2)			
	1 Coast to Stop (A1-03=1)	(Fig 5-3)			
	4 Decel with timer (Traverse mode only)	Fig (5-4)			
	6 No Load Brake (A1-03=2) (See No-Load Brake Start/Stop)				

** Initial value is determined by X-Press Programming (Table 4.1-4.2)*

Decel to Stop (B3-03=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 (B5-02) and DC injection braking is applied after the DC injection start frequency D1-01 has been reached. If the deceleration time is set too short or the load inertia is large, an overvoltage fault (OV) may occur during deceleration. In this case, increase the deceleration time or install an optional braking transistor and/or braking resistor.

Braking torque: without braking resistor, approximately 20% of motor rated torque; with braking option, approximately 150% of motor rated torque.

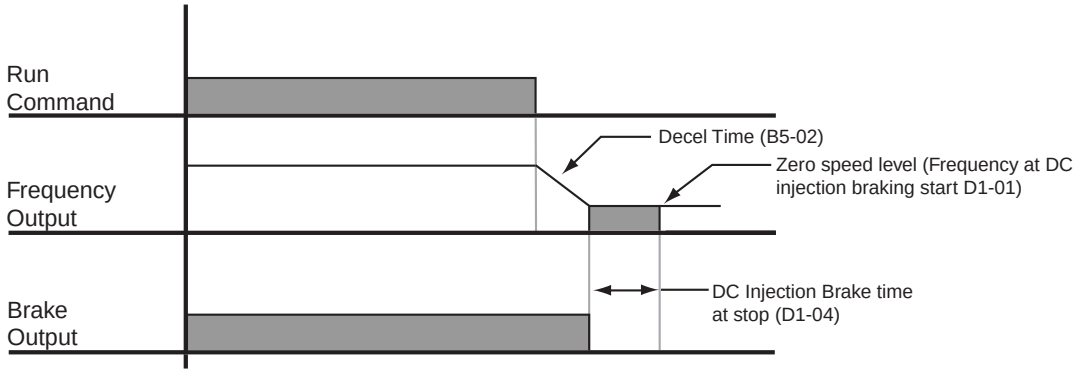


Figure 5-2: Decel to Stop

Coast to Stop (B3-03=1)

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

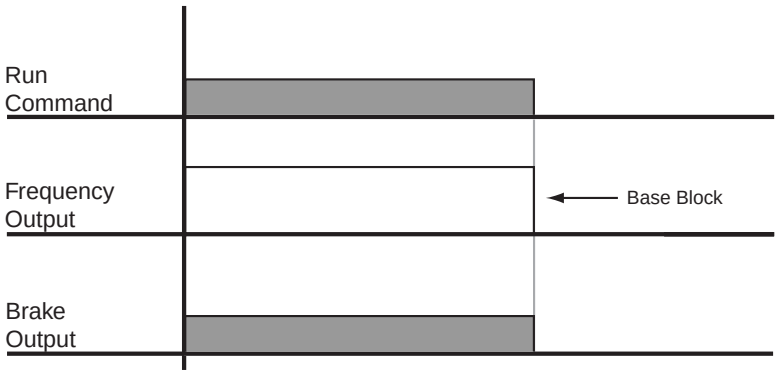


Figure 5-3: Coast to Stop

Decel w/Timer (B3-03=4)

(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.

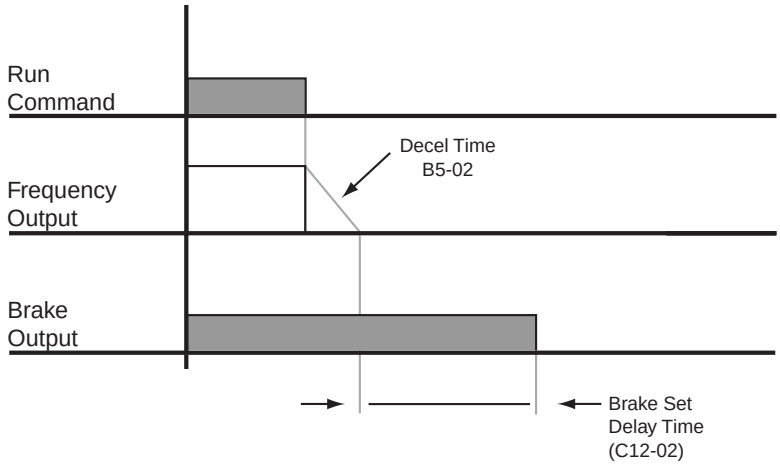


Figure 5-4: Decel w/Timer

Motor Rotation Change

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

Parameter Code	Display	Function	Range	Initial Value	Access Level
B3-04	Reverse Oper 0 Normal Rotation 1 Exchange Phases	Reverse motor direction	0-1	0	Adv

Zero-Speed Operation

This parameter sets the speed reference level at which Zero Speed mode operation will activate, in accordance with the selection programmed B3-05 (see the figures below).

Parameter Code	Display	Function	Range	Initial Value	Access Level
B3-05	Zero-Speed Oper	Operation Selection at Zero Speed.	0-3	0	Adv.
	0 RUN at Freq Ref	Operate according to the Frequency Reference			
	1 Stop	Coast when the Frequency Reference is below E1-09			
	2 RUN at Min. Freq (E1-09)	Output the Frequency set in E1-09			
	3 RUN at Zero RPM				

Input Scan Time

B3-06 selects the microprocessor scan time for reading sequence input data from the control circuit terminals. Set B3-06 to “0” when a quicker response is needed from the control circuit terminal.

Parameter Code	Display	Function	Range	Initial Value	Access Level
B3-06	Cntl Input Scans	Selects the terminal scan time	0-1	1	Adv
	0 2ms–2 scans				
	1 5ms–2 scans				

LOC/REM Run Select

If the run reference/speed reference are switched between serial mode and drive terminal mode, B3-07 determines action after the switch.

Parameter Code	Display	Function	Range	Initial Value	Access Level
B3-07	LOC/REM Run Sel	Determines action after switching Run/Speed reference source.	0-1	0	Adv
	0 Cycle Extrn 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 Accep Extrn Run	If the run command is present at the time when the Run/Speed reference source is switched, it does not require the run command from the new source to be removed. The normal operation will continue.			
B3-08	Run Command at Program		0-1	0	Adv
	0 Disabled				
	1 Enabled (B3-02=0 is Disabled)				
B3-10	Allow Run at Power UP		0-1	0	Adv
	0 Disabled				
	1 Enabled				
B4-01	MOP Ref Memory	Motor operated Pot frequency reference. Enabled when mult. function input = 38, 3D, or 3E. Will memorize previous held frequency after a re-start or power is cycled.		0	Adv
	0 Disabled				
	1 Enabled				

Trim Control Level

The trim control level is valid when the trim control increase command (setting: 45) or trim control decrease command (setting: 46) is set for a multi-function input (H1-01 to H1-06).

If the trim control increase command is ON when a frequency reference is input on the analog input, the trim control level will be added to the analog frequency reference and then that sum will be output as the output frequency. If the trim control decrease command is ON, the frequency reference will be decreased by the trim control level.

Parameter Code	Display	Function	Range	Initial Value	Access Level
B4-02	Trim Control LVL	Sets Trim Control speed level	0–100%	10	Adv

Set the trim control level as a percentage of the maximum output frequency.

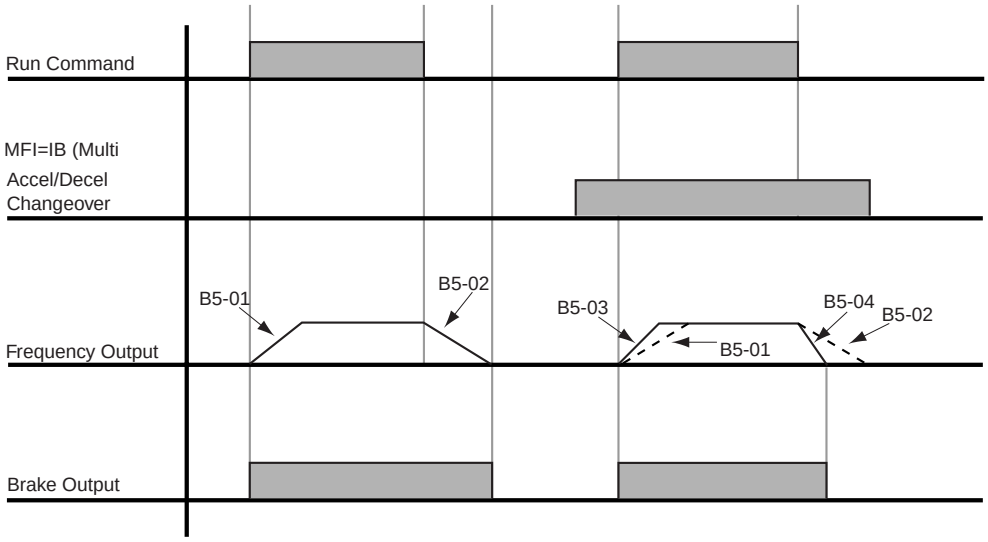
If the frequency reference minus the trim control level is less than zero, the output frequency will be zero.

Acceleration/Deceleration

Acceleration time sets the time necessary for the output frequency to accelerate from 0Hz to maximum output frequency (E1-04). Deceleration time sets the time necessary for the output frequency to decelerate from the maximum output frequency (E1-04) to 0Hz.

Parameter Code	Display	Function	Range	Initial Value	Access Level
B5-01*	Accel Time 1	Sets acceleration time.	0.0–25.5 sec	5.0	Adv
B5-02*	Decel Time 1	Sets deceleration time.	0.0–25.5 sec	3.0	Adv
B5-03	Accel Time 2	Sets alternate accel. time. Enabled by multifunction input=1A.	0.0–6000.0 sec	2.0	Adv
B5-04	Decel Time 2	Sets alternate decel. time. Enabled by multi-function input=1A.	0.0–6000.0 sec	2.0	Adv

* Initial value is determined by X-Press Programming (Table 4.1 to 4.12).



NOTE: Assume the constant B3-03 is set to "0" (Decel to Stop).

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

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.

Parameter Code	Display	Function	Range	Initial Value	Access Level
B5-05	Accel Time N Chg	Sets acceleration time at Speed Switch frequency.	0.0–25.5 sec	2.0	Adv
B5-06	Dec Time N Chg	Sets deceleration time at Speed Switch frequency.	0.0–25.5 sec	2.0	Adv
B5-08	Fault Stop Time	Sets deceleration time for complete stop at external fault. See External Response Selection page 5-89.	0.0–25.5 sec	0.5	Adv
B5-09	Acc/Dec Units	Determines acceleration and deceleration time interval and range.		1	Adv
	0 0.01sec for 0.00–2.55 sec	*Note: Setting will not change if any acc/dec time is > 255 sec.*			
	1 0.1sec for 0.0–25.5				
B5-10	Acc/Dec SW Freq	Determines acceleration/deceleration switching level	0.0–150.0Hz	60.0	Adv
B5-11	SW Freq Compare	Determines when Acceleration Time and Deceleration Time at Speed Switch Hz is enabled;		1	Adv
	0 lower SW Freq	0: B5-05/06 is enabled, N-out≤B5-10			
	1 upper SW Freq	1: B5-05/06 is enabled, N-out≥B5-10			
B5-12	*Accel Time 3*	Acceleration time when H1-01 to H1-06 = 1B	0.0-6000.0	3.0	Adv
B5-13	*Decel Time 3*	Deceleration time when H1-01 to H1-06 = 1B	0.0-6000.0	3.0	Adv
B5-14	*Accel Time 4*	Acceleraton time when H1-01 to H1-06 = 1C	0.0-6000.0	3.0	Adv
B5-15	*Decel Time 4*	Deceleraton time when H1-01 to H1-06 = 1C	0.0-6000.0	3.0	Adv

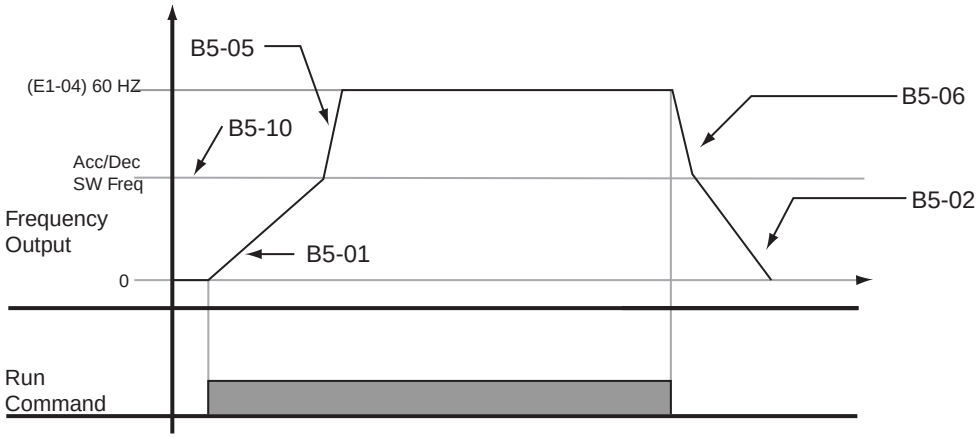


Figure 5-6: When B5-11=1 (Upper Switch Frequency)

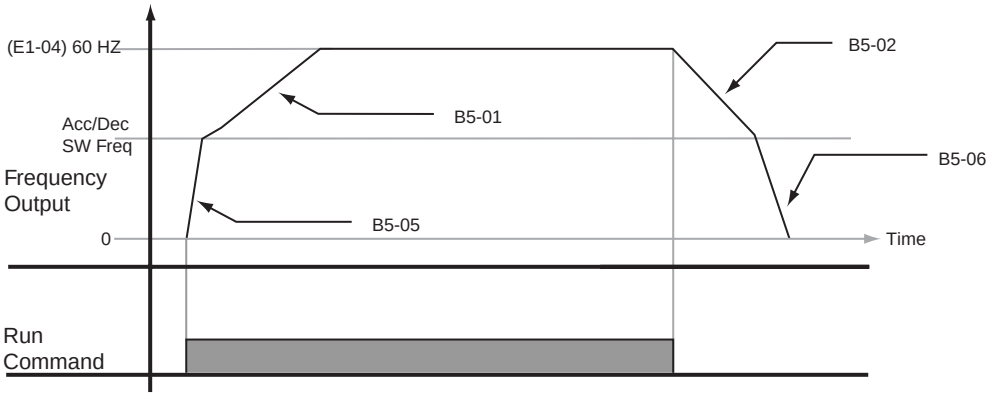


Figure 5-7: B5-11=0 (Lower Switch Frequency)

Speed Search

Parameter Code	Display	Function	Range	Initial Value	Access Level
B6-05	Search Delay	Delay timer for speed search at start	0.0-20.0 sec	0.2	Adv

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.

Parameter Code	Display	Function	Range	Initial Value	Access Level
B8-01	Jump Freq 1	First of three jump frequencies.	0.0–150.0 Hz	0.0	Adv
B8-02	Jump Freq 2	Second of three jump frequencies.	0.0–150.0 Hz	0.0	Adv
B8-03	Jump Freq 3	Third of three jump frequencies.	0.0–150.0 Hz	0.0	Adv
B8-04	Jump Bandwidth	Jump frequency reference bandwidth.	0.0–20.0 Hz	1.0	Adv

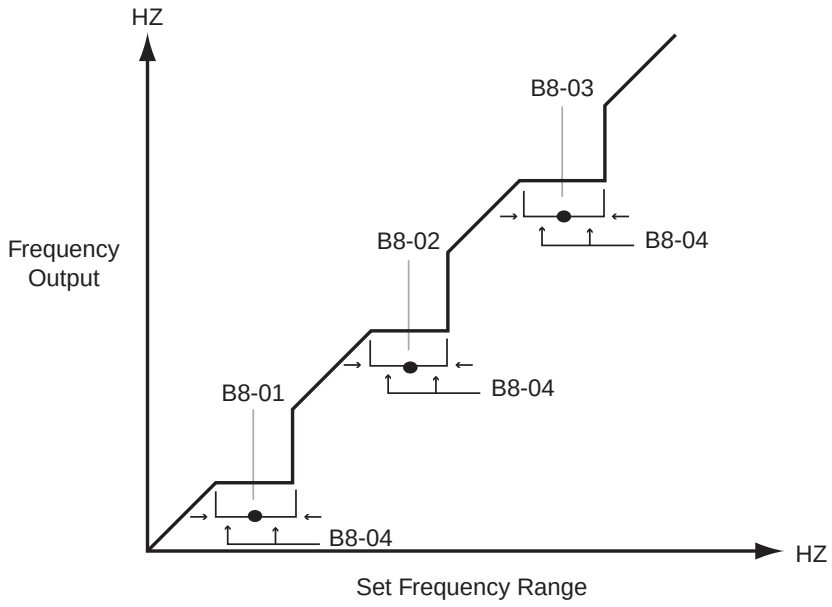


Figure 5-8: Jump Frequencies

Special Functions

- C1 Quick Stop/Reverse Plug Simulation
- C2 Micro-Positioning Control Multiplier
- C3 End of Travel Limit
- C4 Zero Servo
- C5 Load Check
- C6 Ultra-Lift
- C7 Torque Limit
- C8 No Load Brake
- C9 G5IN4 Setup
- C10 Weight Measurement
- C11 Slack Cable Detection
- C12 Delay Timers
- C13 Inching/Indexing Control

	Motion (A1-03)	
Special Function	**Traverse (A1-03=0)**	**No-Load Brake (A1-03=2)**
C1: Quick Stop/Reverse Plug Simulation	Yes	Yes
C2: Micro Positioning	Yes	Yes
C3: End of Travel Limits	Yes	Yes
C4: Zero Servo	Yes	Yes
C5: Load Check	No	Yes
C6: Ultra Lift	No	Yes
C7: Torque Limit	Yes	Yes
C8: No-Load Brake Hoist	No	Yes
C9: G5IN4 Setup	Yes	Yes
C10: Weight Measurement	No	Yes
C11: Slack Cable Detection	No	Yes
C12: Delay Timers	Yes	No
C13: Inching Control	Yes	Yes

Quick Stop™/Reverse Plug Simulation™

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

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

Parameter Code	Display	Function	Range	Initial Value	Access Level
C1-01*	Quick Stop 0/1	Determines whether Quick Stop is enabled		0	Adv
	0 Disabled				
	1 Enabled				
C1-02	Quick Stop Time	Deceleration time during Quick Stop function.	0.0–25.5 sec	1.0	Adv

* Initial value is determined by X-Press Programming (Table 4.1 to 4.2).

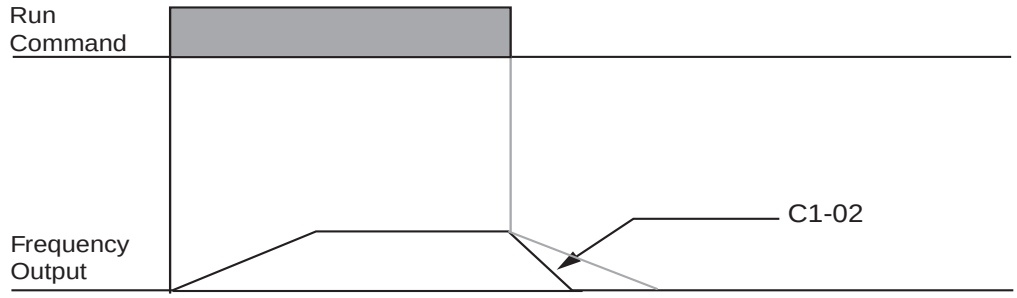


Figure 5-9: Quick Stop

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.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C1-03	Reverse Plug 0/1	Determines whether Reverse Plug Simulation is enabled.		0	Adv
	0 Disabled				
	1 Enabled				
C1-04	Rev-Plg Dec Time	Deceleration time during Reverse Plug Simulation.	0.0–25.5 sec	2.0	Adv
C1-05	Rev-Plg Acc Time	Acceleration time during Reverse Plug Simulation	0.0–25.5 sec	2.0	Adv

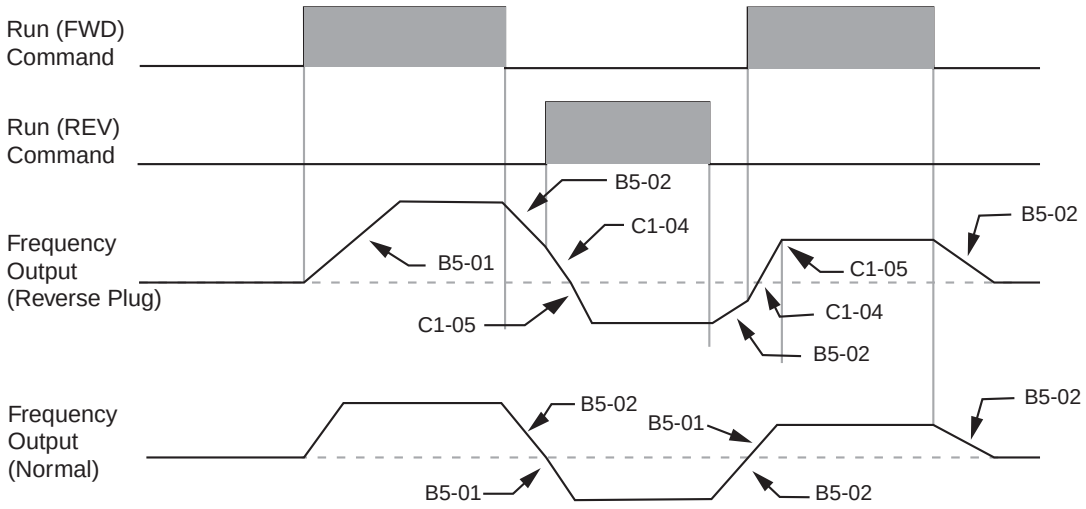


Figure 5-10: Reverse Plug Simulation

Micro-Positioning Control™

Micro-Positioning Control function can provide 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 (C2-01) and Gain 2 (C2-02). They can be adjusted and enabled independently.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C2-01	MicroSpd Gain 1	The muliplier of the Analog or Digital Speed Reference to achieve slow-speed operation. Multi function Input = E	0.00–2.55	1.00	Adv
C2-02	MicroSpd Gain 2	An alternate multiplier of the Analog or Digital Speed Reference to achieve slow-speed operation. Multi function Input = 10	0.00–2.55	1.00	Adv

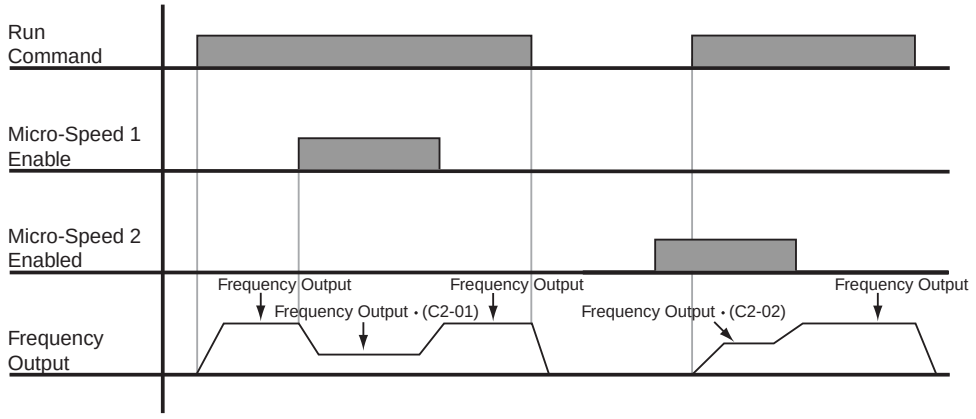


Figure 5-11: Micro-Positioning Control

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

Travel Limits

This function can automatically slow and stop a crane or hoist when it reaches the MS travel limits. Two types of limit inputs (slowdown and stop) are available in both travel directions. Inputs can be programmed through either GI F7 and G5IN4 cards.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C3-01	Up Limit 1 Speed	Speed at Upper Limit input.	0–400 Hz	6.00	Adv
C3-02	UL 1 Decel Time	Decel time to Upper Limit Speed.	0.0–25.5 sec	1.0	Adv
C3-03	UL 2 Stop Time	Decel time to STOP when Upper Limit is Input.	0.0–25.5 sec	1.0	Adv
C3-04	Low Limit 1 Speed	Speed at Lower Limit input.	0–400 Hz	6.00	Adv
C3-05	LL 1 Decel Time	Decel time to Lower Limit Speed	0.0–25.5 sec	1.0	Adv
C3-06	LL 2 Stop Time	Decel time to STOP when Lower Limit is input.	0.0–25.5 sec	1.0	Adv
C3-07*	Lmt Stop Method	Determine the stop method at Upper Limit 2 and Lower Limit 2 Input.	0-2	2*	Adv
	0 Decel to Stop				
	1 Coast to Stop				
	2 Use B3-03 Method				
C3-08	UL3 Stop Method	Weight Limit Stop Method and action when Multi Function Input = 12 or 62	0-5	4	Adv
	0 Decel/Alarm (no further raise allowed)				
	1 Coast/Alarm (no further raise allowed)				
	2 Use B3-03 /Alarm (no further raise allowed)				
	3 Decel/Fault				
	4 Coast/Fault				
	5 Use B3-03/Fault				
	Note: For setting 0, 2, 3, 5, deceleration is by B5-08.				
C3-09	Phantom Stop Method	Stopping Method when Multi Function Input = 5F and 63	0-2	1	Adv
	0 Decel to Stop				
	1 Coast to Stop				
	2 Use B3-03 Method				

* Initial value is determined by X-Press Programming

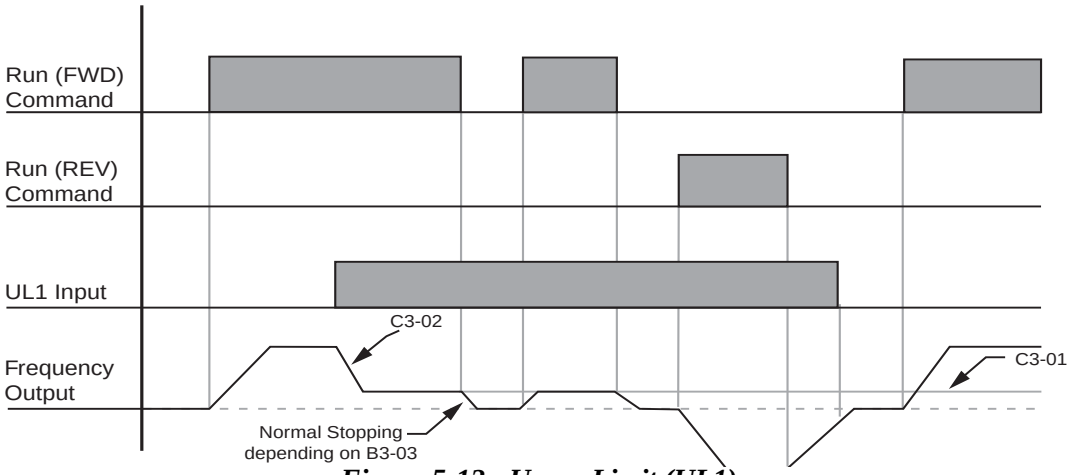


Figure 5-12: Upper Limit (UL1)

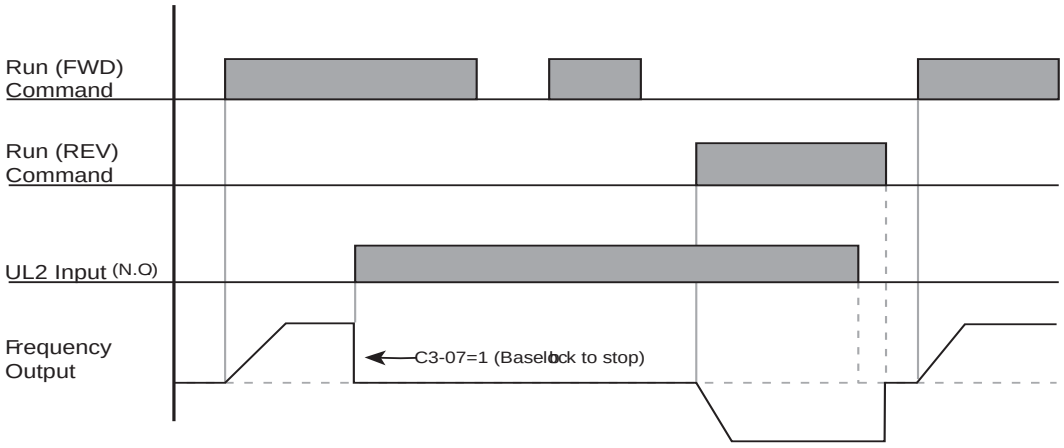


Figure 5-13: Upper Limit 2 (UL2)

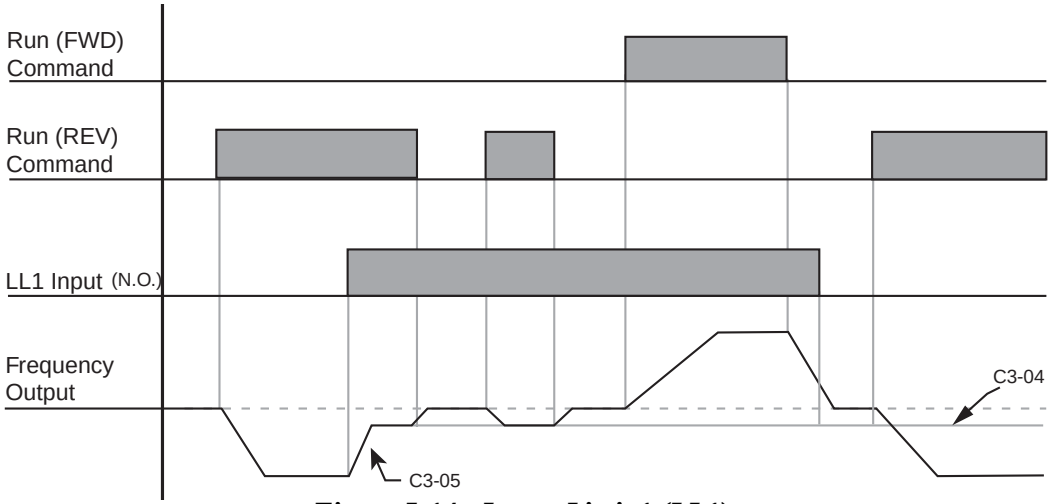


Figure 5-14: Lower Limit 1 (LL1)

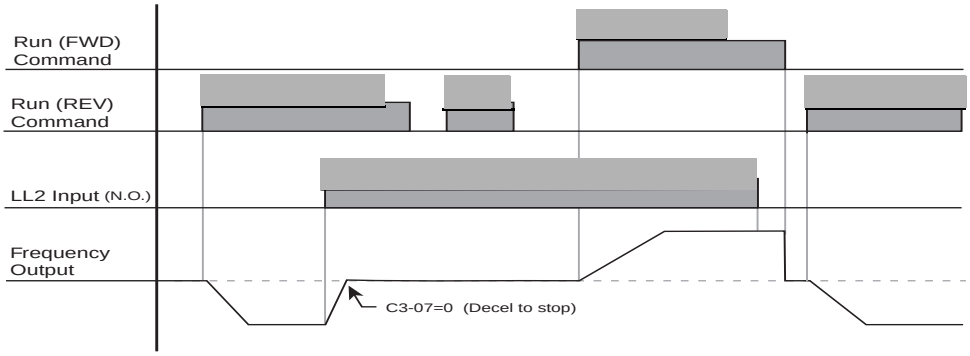


Figure 5-15: Lower Limit 2 (LL2)

Load Sharing/Torque Following—2 or more mechanically coupled motors

The VG+ Series 3 Software allows one or more Impulse VG+ Series 3 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 ± 10V analog signal into the Slave inverter, which correlates directly to the direction and quantity of torque the slave inverter should apply to it's 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 or 3 generation.

When using Multi-function input H1-0x = "66"—Load Share 0/1 (Torque Following mode), setting C3-10 = **Enabled** will allow the inverter to accept the Limit Switch inputs where H1-0x = 6 ~ D. When C3-10 = **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 H1-0x = "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 generally 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.

Notes:

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 (12, 62) — Upper Limit 3 is always active regardless of the setting of parameter C3-10.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C3-10	Load Share Lim	Load Share enable/disable	0-1	0	Adv

Minimum Programming Requirement for "Load Sharing" Operation

1. The **Master** and **Slave** drives must be programmed for the Flux Vector control method, A1-02 = 3.
2. The **Slave** drive requires a Multi-function Digital Input programmed for 66 — 'Load Share 0/1'
3. The **Slave** drive requires a ±10V Multi-function Analog Input programmed for 13 — 'Torque Reference'.
4. The **Master** drive requires a Multi-function Digital Output programmed for 2A — 'During Run 1'.
5. The **Master** drive requires a ±10V Multi-function Analog Output programmed for 9 — 'Torque Reference'.
6. The digital operator must not be in LOCAL mode.

Load Float Time 2

When Load Float (C8-10) is enabled, it maintains the motor shaft at a stationary position. Load Float Time 2 is enabled by a MFI (Multi-Function Input) that is programmed as the digital input data 35 (H1-01~06=35). If load float is being used, this time (C4-01) will be added to the standard load float time (C8-10).

Parameter Code	Display	Function	Range	Initial Value	Access Level
C4-01	Load Float Time 2	Maximum duration of Zero Servo action at multi-function input. Data = 35	0–255 sec	10	Adv
C4-02	Load Float Gain	Zero Servo multiplier.	0–100	*	Adv
C4-03	Load Float Count	Zero Servo completion width. Enables Multi Function output = 25	0–16383	10	Adv

** 10/20 depending on drive size*

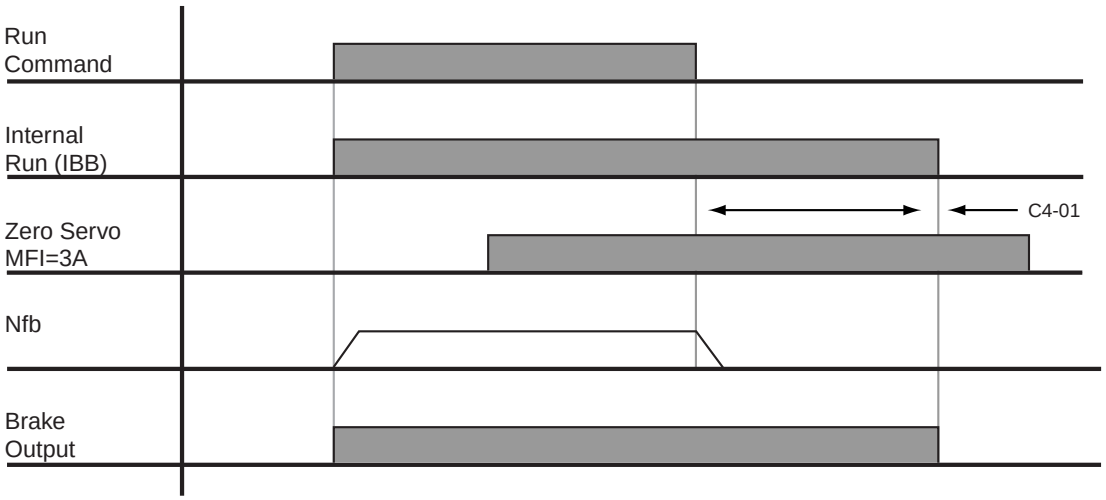


Figure 5-16: Load Float

Load Check

Load Check function is a load-limiting feature that ensures the programmed load limit of the hoist is not exceeded. It prevents the lifting (and potential loss) of a load that is overweight. When IMPULSE•VG+ Series 3 detects an overload condition, it prevents any further raising. However, the load can be lowered at the speed that is specified by constant C5-14 (Load Check Fault speeds).

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

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

Parameter Code	Display	Function	Range	Initial Value	Access Level
C5-01	Load Check 0/1	Determines whether Load Check is enabled.		0	Adv
	0 Disabled				
	1 Enabled				
C5-02	LC Alarm Action	Action at Load Check alarm or fault.		4	Adv
	0 Alarm Only				
	1 Decel to Stop				
	2 Coast to Stop				
	3 Fault Stop				
	4 Use B3-03 Method (allows Lower only)				
C5-03	Min Torque Ref	Minimum current/torque reference during acceleration that triggers Load Check.	0–100%	60	Adv
C5-04	Look Speed 1	First Load Check frequency reference.	0–150 Hz	6	Adv
C5-05	I/T Ref for LS 1	Current/Trq Reference when Fout or Fnfb - Look Speed 1	1-300%	160	Adv
C5-07	Look Speed 2	Second Load Check frequency reference.	0–150 Hz	20	Adv
C5-08	I/T Ref for LS 2	Current/Trq Reference when Fout or Fnfb - Look Speed 2	1-300%	160	Adv
C5-09	Look Speed 3	Third Load Check frequency reference.	0–150 Hz	40	Adv
C5-10	I/T Ref for LS 3	Current/Trq Reference when Fout or Fnfb - Look Speed 3	1-300%	160	Adv
C5-11	I/T Ref for > LS 3	Load Check Current when Output Frequency > Look Speed 3.	1-300%	160	Adv
C5-12	LC Holding Time	Time for holding Output Frequency to stabilize Output Current.	0.00–2.55 sec	1.00	Adv
C5-13	LC Testing Time	Time (after the LC Setting Time) for comparing Output Current with Reference Current	0.00–2.55 sec	0.25	Adv
C5-14	LC Fault Speed	Maximum lowering speed after Load Check fault	0–30 Hz	6.0	Adv

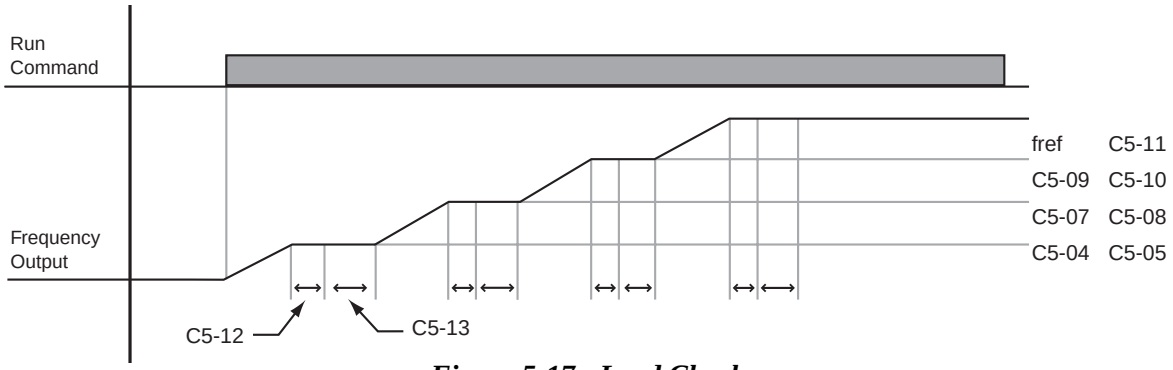


Figure 5-17: Load Check

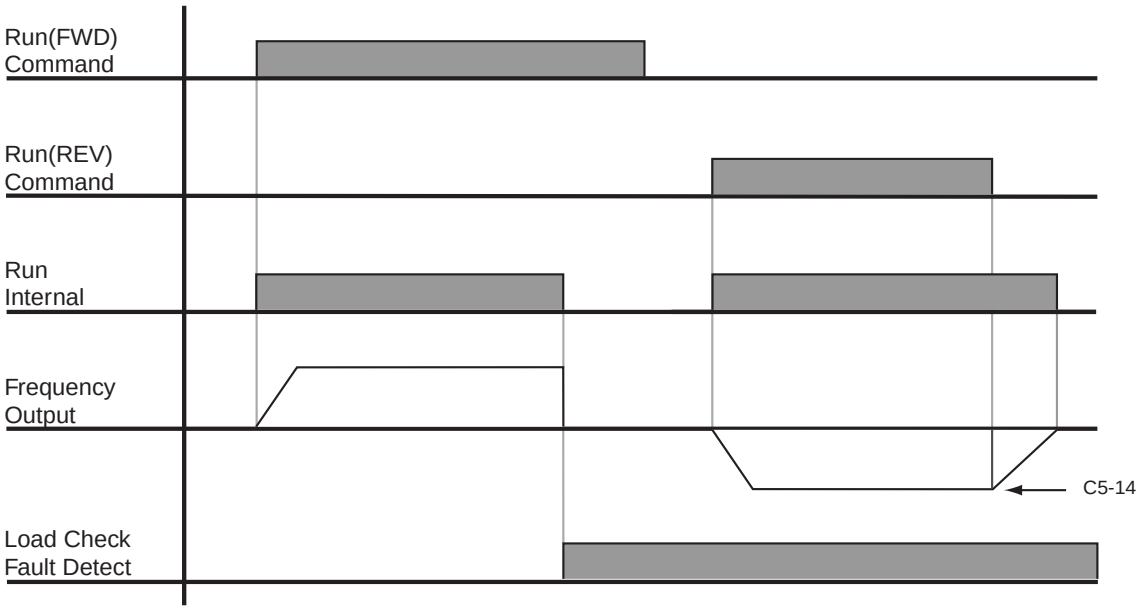


Figure 5-18: Example of Operation C5-02=2

Ultra-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 percent 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 Ultra-Lift Maximum Output Frequency-RAISE (C6-02), Ultra-Lift Maximum Output Frequency-LOWER (C6-03), and Maximum Frequency (E1-04).

NOTE: Note: Ultra-Lift is disabled when in traverse applications. Maximum Frequency (E1-04) must be ≥ C6-02 and C6-03.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C6-01	Ultra Lift 0/1	Determines whether Ultra Lift is enabled.		0	Adv
	0 Disabled				
	1 Enabled Automatic				
	2 Enabled by MFI = 13				
C6-02	Ultra Lift ForSpd	Maximum Output Frequency during Ultra Lift—FORWARD.	0–150 Hz	60	Adv
C6-03	Ultra Lift RevSpd	Maximum Output Frequency during Ultra Lift—REVERSE.	0–150 Hz	60	Adv
C6-04	UL Fwd torque	Maximum output torque below which Ultra Lift—FORWARD is enabled.	0–100%	50	Adv
C6-05	UL Rev Torque	Maximum output torque below which Ultra Lift REVERSE is enabled.	0–100%	30	Adv
C6-06	UL Enabling Spd	Threshold frequency at which Ultra Lift is enabled.	0–150 Hz	59.0	Adv
C6-07	UL Delay Time	Delay time at enabling speed prior to torque-compare function.	0.0–25.5 sec	2.0	Adv
C6-08	SFS Acc Gain	Speed feedback acceleration multiplier.	0.1–9.9	1.0	Adv
C6-09	Normal OS Level	Overspeed level when not in Ultra Lift mode	40-150 Hz	60	Adv

Enable Ultra-Lift Function:

2,3,5-Speed Multi-Step (A1-04=0, 1, or 2):

1. Set C6-01=1 or 2 to enable the **Ultra-Lift Function**, 1= Enable Automatic, 2= Enable by Multi-Function Input (MFI).
2. Set C6-02 and C6-03 to determine **Ultra-Lift** maximum FWD/REV output frequency.
3. Set C6-04 and C6-05 to determine **Ultra-Lift** maximum enable output current.
4. Set the **Ultra-Lift Enabling Speed (C6-06)** one or two hertz below the maximum normal running speed reference.

   For example: If the maximum normal running speed is at 60 Hz, set C6-06 to 59 Hz or 58 Hz as the **Ultra-Lift Enabling Speed**.

5. Ensure that the **Maximum Frequency (E1-04)** is increased from 60 Hz.

2, 3 Step Infinitely Variable (A1-04=3 or 4)

6. 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 ***B2-01 (Reference Upper Limit)***.

   B2-01=60 Hz x 100 / E1-04

Uni-Polar/Bi-Polar Analog (A1-04=5 or 6)

7. 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 ***H3-02 (Gain Multiplier for Terminal A1 analog input signal). H3-10 (Gain Multiplier for Terminal A2 analog input signal).***

   H3-02=60 Hz x 100 / E1-04 or H3-10=60 Hz x 100/E1-04

WARNING

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

Torque Limit

IMPULSE•VG+ Series 3 dynamically controls the torque output of the motor at all times. The Torque Limit Function limits the amount of motor torque on all four quardrants of vector control operation:

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

Parameter Code	Display	Function	Range	Initial Value	Access Level
C7-01	Torq Limit Fwd	FORWARD torque limit	0–300%	150	Adv
C7-02	Torq Limit Rev	REVERSE torque limit	0–300%	150	Adv
C7-03	Torq Lmt Fwd Rgn	Regenerative torque limit at FORWARD	0–300%	180	Adv
C7-04	Torq Limit Rev Rgn	Regenerative torque limit at REVERSE	0–300%	180	Adv
C7-05	Torq Limit Gain	Used when H1-01~H1-06 = 14 and MFI is on	0–2.55	1.25	Adv

No-Load Brake Start/Stop

The No-Load Brake Hoist mode provides a special start/stop sequence designed specifically for No-Load Brake Hoists. This mode is enabled automatically when the Motion is set to NLB Hoist (A1-03=2). This will also automatically set the Stopping Method to No-Load Brake (B3-03 = 6).

The NLB Sequence is comprised of a series of Timers and Counters that monitor certain feedback devices. The sequence is divided into two parts, NLB Start and NLB Stop.

The NLB Start Sequence begins by building up torque in the motor to a predefined level within the C8-01 (Torque Compensation Time) timer. This level is determined by several factors which are defined below. During the C8-01 time, the drive is monitoring current to motor. The internal current feedback equation must be satisfied within the time set in C8-02 (IFB OK Time). If it is not, a BE2 (No-Current) alarm will be displayed on the keypad and the drive will stop outputting voltage to the motor. The brake will remain closed.

Factor 1: On the first run command after power up, or after any major fault which causes the NLB Stop sequence to be skipped, the NLB Start sequence by default looks at the value programmed in C8-16, the Initial Brake Release torque.

Factor 2: Once the system has completed a successful NLB Start and NLB Stop, a new value is used. This value is one that has been memorized and stored into memory during the NLB Stop Sequence. It is equivalent to the amount of torque required for the motor to hold the load that is on the hook in Load Float with the brake released. Some benefits of memorized 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 memorized value is less than the programmed value in C8-03 (Minimum Brake Release torque), then C8-03 is used as the next brake release value. If the feature must be disabled, C8-03 will override C8-16 if it is a greater value than C8-16.

Once the brake has been commanded to release, the output remains in Load Float for the amount of time programmed into C8-04. During C8-04, the drive waits for the brake to completely open and watches encoder feedback. If the amount of feedback is less than the setting in C8-05 (Roll Back Count), then the drive proceeds to the BE3 check. If it is not, a BE1 alarm 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 C8-07 (BE3 Detect Count) within the time set in C8-06 (BE3/Alternate Torque Time). If it is not, then BE3 is displayed. By the time the drive has completed the BE3 check, there should be a significant amount of motor shaft movement and the NLB start sequence is complete.

The NLB 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 C8-10 (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 NLB 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 Zero Servo is maintained for the time set in C8-11 (Brake Delay Time) 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 and compares it to C8-13 (BE6 Max count). The encoder feedback must not exceed the number of counts in C8-13 within the C8-12 (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 zero servo 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 C8-17 (BE6 Up speed) and the NLB stop sequence will begin again once the run command had been removed.

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 indicating 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. The use of an indicating light wired to relay output terminals MC-MB, a N/C contact, 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 it's ratings do not exceed the 1 Amp, 120 VAC, Inductive.

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 alarms: BE1, BE2, BE3, 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 (C8-10) 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 C8-17 (C8-17 is 6Hz by default.) This is an additional indication that the brake has failed 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.

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WARNING

DO NOT turn off power to the drive during a BE6 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.

To enable BE6 detection, C8-12 must be greater than 0.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C8-01	Torque Comp Time	Time for torque to build to 300% at start.	0.00–2.55 sec	*1.0/1.5	Adv
C8-02	IFB OK Timer	Sets the amount of time to look for the current feedback to be OK before posting a BE2 fault. Setting this parameter to 0 (Zero) will disable torque proving at start & eliminate BE2 detection (Not recommended).	0.00–2.55 sec	*1.0/1.5	Adv
C8-03	Min Brk Rel Torq	Minimum brake release torque.	0–300%	10	Adv
C8-04	Roll Back 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	Adv
C8-05	Roll Back Count	Detection counts for excessive roll back.	0–16536 pulses	800	Adv
C8-06	BE3/Alt Torq Tim	Time period during which C8-07 is measured. Also see C8-08.	0.00–2.55 sec	0.30	Adv
C8-07	BE3 Detect Count	Detection count for Encoder/ Seized-Brake Fault (BE3). It is the minimum encoder pulse count, during the time period of C8-06, below which the BE3 alarm is triggered.	0–16536 pulses	25	Adv

**Depends on drive size.*

Parameter Code	Display	Function	Range	Initial Value	Access Level
C8-08	Alt Rev Torq Lim	For a LOWER command in the NLB Hoist Motion Mode only—Torque limit for time of C8-06 to prevent driving through a brake that has failed closed with a load on the hook.	0–100%	25	Adv
C8-09	Zero Speed Level	Determines speed feedback at which Load Float activates.	0–10 Hz	1	Adv
C8-10	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.	0-255 sec	10	Adv
C8-11	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	Adv
C8-12	BE6 Detect Timer	Time period during which the electric brake is set and tested for sustaining the load. NOTE: To disable BE6 detection, set C8-12 to 0.0.	0.0–25.5 sec	5.0	Adv
C8-13	BE6 Max Count	Total pulse counts must be less than C8-13, during C8-12, otherwise BE6 alarm.	0–16536 pulses	250	Adv
C8-15	Load Float Ext. T	Load Float extension time enabled by MFI=5D.	0–255sec	10	Adv
C8-16	Init Brk Rel Trq	Brake release torque at power up and after UL2, LL2, EF faults or MFI's which cause the output to base block.	0-300%	100	Adv
C8-17	BE6 Up Speed	Maximum up speed after BE6 is detected.	0.00–150.00 Hz	6.00	Adv
C8-19	Brake Test Torq	Motor will push against brake in FWD direction at C8-20 speed when input by MFI=61	0-300%	125	Adv
C8-20	Brake Test Speed	Speed to push against brake while testing	0-10 Hz	6	Adv
C8-21	Height Measure	Number of motor revolutions from UL2 to lowest hook position	0-65535	250	Adv

Optional Digital Input Set-up (G5IN4 Digital Multi-Function Inputs)

Parameter Code	Display	Function	Range	Initial Value	Access Level
C9-01	G5IN4 0/1	Determines whether the G5IN4 Digital Multi-Function Inputs are enabled.		0	Adv
	0 Disabled				
	1 Enabled				
C9-02	G5IN4 Setup	Determines the four settings for G5IN4 Digital Multi-Function Inputs.	0000–FFFF	0	Adv

The optional G5IN4 board accepts four additional multi-function inputs. The G5IN4 board has four terminals, each of which can be programmed to one of the fourteen sets of inputs. Each input in the set can be enabled or disabled.

1. Set C9-01 to 1.
2. Determine the parameter C9-02 setting by specifying the first digit (from left) and the fourth digit (from left) using tables 5-3 and 5-4. The second and third digit should always be “0”.
3. Set parameter C9-02.

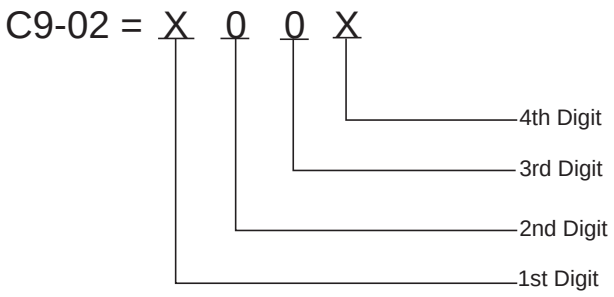


Table 5-2:
1 = 120V is present on terminal
0 = No voltage is present on terminal

MONITOR	TERMINAL			
U1-25	1	2	3	4
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1
A	0	1	0	1
B	1	1	0	1
C	0	0	1	1
D	1	0	1	1
E	0	1	1	1
F	1	1	1	1

Table 5-3: G5IN4 Digital Multi-Function Input Sets (0 through F)

First Digit (From Left) You Enter	Multi-Function Input Assigned to Each Terminal			
	Terminal 1	**Terminal 2**	**Terminal 3**	**Terminal 4**
0	*No function*	*No function*	*No function*	*No function*
1	*Upper Limit–SLOW DOWN; Normally Closed*	*Upper Limit–STOP; Normally Closed*	*Lower Limit–SLOW DOWN; Normally Closed*	*Lower Limit–STOP; Normally Closed*
2	*Upper Limit–SLOW DOWN; Normally Open*	*Upper Limit–STOP; Normally Open*	*Lower Limit–SLOW DOWN; Normally Open*	*Lower Limit–STOP; Normally Open*
3*	*Multi-Step Speed 2*	*Multi-Step Speed 3*	*Multi-Step Speed 4*	*Multi-Step Speed 5*
4*	*Hold function (2nd step of Three-Step Infinitely Variable).*	*Acceleration function (2nd step of Two-Step Infinitely Variable or 3rd step of Three-Step Infinitely Variable).*	*Micro-Positioning Control Multiplier 1*	*Upper Limit–STOP; Normally Closed*
5	*Upper Limit–STOP Normally Closed*	*Upper Limit–SLOW DOWN; Normally Closed*	*Lower Limit–STOP; Normally Closed*	*Lower Limit–SLOW DOWN; Normally Closed*
6	*Upper Limit–STOP; Normally Open*	*Upper Limit–SLOW DOWN; Normally Open*	*Lower Limit–STOP; Normally Open*	*Lower Limit–SLOW DOWN; Normally Open*
7*	*Multi-Step Speed 5*	*Multi-Step Speed 4*	*Multi-Step Speed 3*	*Multi-Step Speed 2*
8*	*Upper Limit–STOP; Normally Closed*	*Micro-Positioning Control Multiplier 1*	*Acceleration function (2nd step or Two-Step Infinitely Variable or 3rd step of Three-Step Infinitely Variable).*	*Hold function (2nd step of Three-Step Infinitely Variable).*
9	*Upper Limit–STOP; Normally Closed*	*Lower Limit–STOP; Normally Closed*	*Micro-Positioning Control Multiplier 1*	*External base block N/O*
A	*Upper Limit–STOP; Normally Closed*	*Lower Limit–STOP; Normally Closed*	*Micro-Positioning Control Multiplier 1*	*Weight Measurement Control*
B	*Ultra-Lift Enable*	*Brake answerback*	*Micro-Positioning Control Multiplier 1*	*Micro-Positioning Control Multiplier 2*
C	*External Base Block N/O*	*Phantom Fault N/O*	*Klixon N/O*	*BE6 Up Speed Limit*
D	*External Base Block N/O*	*Brake Answerback*	*Micro-Positioning Control Multiplier 1*	*Micro-Positioning Control Multiplier 2*
E	*Alternate Upper Limit Frequency Reference*	*Option/Inverter Run and Speed Reference Changeover*	*Micro-Positioning Control Multiplier 1*	*Brake Answerback*
F	*External Base Block N/C*	*Phantom Fault N/C*	*Klixon N/C*	*BE6 Up Speed Limit*

* If using the G5IN4 to input speed references, A1-04 should be set for Data 7 (G5IN4 Opt Card). This will help to avoid and OPE03 fault caused by having more than one terminal programmed with the same data.

Table 5-4:Enabling/Disabling Decision Table for C9-02

Input for Terminal 1	Input for Terminal 2	Input for Terminal 3	Input for Terminal 4	Fourth Digit (From Left) You Enter
E	D	D	D	**1**
D	***E***	D	D	**2**
E	***E***	D	D	**3**
D	D	***E***	D	**4**
E	D	***E***	D	**5**
D	***E***	***E***	D	**6**
E	***E***	***E***	D	**7**
D	D	D	***E***	**8**
E	D	D	***E***	**9**
D	***E***	D	***E***	**A**
E	***E***	D	***E***	**B**
D	D	***E***	***E***	**C**
E	D	***E***	***E***	**D**
D	***E***	***E***	***E***	**E**
E	***E***	***E***	***E***	**F**

Key Enable = ***E***
Disable = D

Weight Measurement

The IMPULSE•VG+ Series 3 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 or 3 (Automatic) or it can be configured to take a reading at any speed with a Multi-function input when C10-01 = 2 or 3 (Manual). The calculated weight can be displayed on the keypad of the hoist drive or by an external display device connected to an analog output 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 C5-04 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 load weight. 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% or better accuracy of the rated capacity.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C10-01	Load Weight 0/1	Determines whether Load Weight is enabled.	0~4	0	Adv
	0 Disabled				
	1 Enabled at C5-04 (Automatic for the duration of C5-12 + C5-13)				
	2 Enabled at MFI=5C				
	3 Both Auto & MFI=5C				
	4 Analog Input (Load Cell) MFAI=16				
C10-02	Torque Pri Delay	Torque Output Calculation primary delay time.	0–1000 msec	200	Adv
C10-03	LW Display Hold		0, 1	0	Adv
	0 Hold Display	Until next run command is on			
	1 Hold Disp 3 sec				
C10-04* **	LW Conversion	Multiplier of torque output calculation for display. Data is n0000, so multiplier is 10000; “n” is decimal point.	00000–39999	0	Adv
C10-05	Full Load Torque	Percentage of Torque Output that is defined as Full-Load Torque Output.	0.0–200.0%	100.0	Adv
C10-06	No Load Torque	Percentage of Torque Output that is defined as No-Load Torque Output.	0.0–200.0%	20.0	Adv
C10-07**	Unit Displayed	Determines “weight” measurement units in which the parameter settings will be expressed. The unit abbreviations appear on line 2 of the display	0~4	0	Adv
	0 Tons				
	1 Pounds				
	2 Kilograms				
	3 Metric Tons				
	4 Percent Load				
C10-08	Weight Limit Output	Turn on Level for MFO=33 Weight Measurement enabled by Multi-Function Input = 5C.	0.0-200.0%	125%	Adv

*For an example, please refer to Table 5.14 on page 5-88.

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

System Tare and Calibration

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. For example: If C10-01 = 1, then the hoist will automatically pause at the speed programmed in parameter C5-04 (6 Hz is the factory setting) 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 C5-04 or, if using an analog speed reference, then program B2-02 (minimum speed) so that it is equal to C5-04.
3. Record the torque reading being displayed by the monitor parameter U1-09 (Torque Reference). Repeat this step several times and record the average “No Load Torque” in parameter C10-06 (No Load Torque).
4. Attach all of the under hook attachments that are required during **normal** lifting (Chains, Slings, spreader beam, etc.). 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 speed that the weight will be calculated at. See Step 2 for an example.
6. Record the torque reading being displayed by the monitor parameter U1-09 (Torque Reference). Repeat this step several times and record the average “Full Load Torque” in parameter C10-05 (Full Load Torque).
7. The monitor parameter U1-29 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 an External Display Device

NOTE: This procedure assumes that the System Tare and Calibration procedure has been completed. The setup of parameter C10-03 and C10-07 should be returned to the factory default settings for this procedure or may be skipped entirely if the displayed weight does not need to be read on the keypad of the hoist drive. C10-03 and C10-07 = 0. The external display device should be configured to accept a 0 - 10VDC input where 0 V = no load and 10V - Full load or 125% load. (This may be site specific.)

1. Program the desired analog output terminal (FM or AM) for 'Load Weight'

   Example: H4-01 = 29 (Terminal FM) or H4-04 = 29 (Terminal AM).

2. 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 weight of the lifting device used for each lift should be manually subtracted from weight that is calculated by the drive.

3. Lift **no-load** and monitor the 'Weight Measurement' on U1-29 on the keypad. The keypad digital display should read 0; however, if it does not, lower C10-06 until the keypad digital display reads zero. Re-test as necessary to get as close to 0 as possible.

4. After lifting **no-load** again, read the weight displayed on the display device. If the displayed weight is greater than 0, begin to add a ***negative bias*** to terminal FM by adjusting H4-03 down from 0.00. It will be in -xx.x format. To switch from a positive bias to a negative bias, move the cursor to the far left digit and press the up arrow key, which will display the - sign. As the ***negative bias*** is increased, the weight displayed on the digital display device will decrease. Continue to add ***negative bias*** until the weight deployed on the digital display device reads as closed to 0 as possible without going negative.

5. Pick up a known load of approximately 50% or greater and read the weight displayed on the display device. If the indicated weight does not match the actual weight, adjust H4-02 or H4-05 (Terminal FM or AM Gain) to obtain the required reading. H4-02 and H4-05 are gain multiplier parameters for the respective analog output and will raise or lower the 0-10V dc signal to the display device.

6. Re-test with no load. If the weight displayed on the display device does not equal zero, re-adjust the negative bias at H4-03.

7. This procedure may be repeated as many times as necessary until the correct combination of gain and bias is found to make the system within tolerance at the high and low end of maximum capacity of the hoist.

Slack Cable Detection

IMPULSE•VG+ Series 3 offers Slack Cable Detection in the hoist application. 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:

- *To 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 (U1-09). Repeat above operation several times to ensure an accurate reading.*
- *Then Set C11-03 = [(U1-09)-2].*
- *Enable Slack Cable Detection by setting the C11-01 to 1.*
- *Select output action when Slack Cable is detected by defining C11-02.*

Parameter Code	Display	Function	Range	Initial Value	Access Level
C11-01	Slack Cable 0/1	(For Hoist Application) Determines whether Slack Cable Detection is enabled.	0~1	0	Adv
	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 (MFO=28).	0~5	2	Adv
	0 No Action	Alarm Only			
	1 No Act/C3-04	Next LOWER command is at Lower Limit 1 speed (C3-04).			
	2 Decel/C3-04	Decelerate to Lower Limit 1 Speed C3-04. Continued LOWER commands allowed, but at C3-04.			
	3 Decel/No Opr	Decelerate to Lower Limit 1 Speed C3-04. Continued LOWER commands are *not* allowed.			
	4 Dec Stop/C3-04	Decel (by C3-05) to Lower Limit 1 Speed C3-04. Continued LOWER commands allowed, but at C3-04.			
	5 Dec Stop/No Opr	Decel (by C3-06) to stop. Continued LOWER commands are *not* allowed.			

Parameter Code	Display	Function	Range	Initial Value	Access Level
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	Adv
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).	0–150Hz	2	Adv
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. Prevents false outputs.	0.00–2.55sec.	0.50	Adv
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).	0–150Hz	60	Adv
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. Prevents false outputs.	0.00–2.55sec.	0.10	Adv

Snap Shaft Detection

The snap shaft condition is detected when the speed of two shafts changes per setting of C11-10, delta speed, after a delay time C11-11, action of C11-09 will be taken.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C11-08	Snap Shaft 0//1 *0 Disabled* *1 Enabled*	Determines whether snap shaft detection is enabled.	0-1	0	Adv
C11-09	Action at Snap *0 Brake/fault out* *1 Alarm Only*	Action at snap shaft detection (drive train discontinuity)	0-1	0	Adv
C11-10	SS Delta speed	Snap shaft speed difference	0-150 Hz	1.0 Hz	Adv
C11-11	SS Delay Time	Snap shaft delay time (gear backlash time)	0-2000 m.sec.	250	Adv
C11-12	SS Gear Ratio Num	Snap shaft gear ratio numerator	1-10000	10000	Adv
C11-13	SS Gear Ratio Den	Snap shaft gear ratio denominator	1-10000	10000	Adv

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 B3-03 must be set to 4 (Ramp With Timer).

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

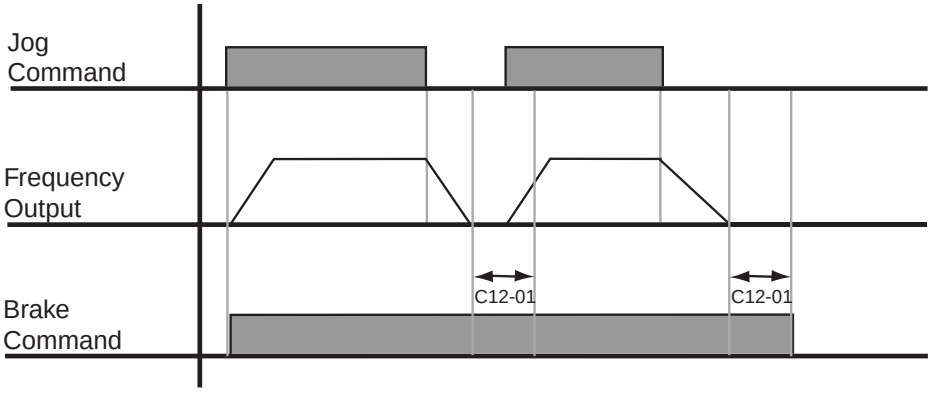


Figure 5-22: Brake Delay Timers

NOTE: The Jog control input is a multi-function input. It is enabled by programming data 15 or 16 in H1-01~06.

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.
- These inputs 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**.

Parameter Code	Display	Setting Range	Factory Default Setting	Access Level
C12-03	Delay-on timer	0.0~3000.0	0.0	Adv.
C12-04	Delay-off timer	0.0~3000.0	0.0	Adv.

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 (Data 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 (H1-01 ~ 06 = 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 C12-0 = 0, the function is disabled.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C12-05	Maintenance Tmr	Maintenance Timer Trip Level	0-32767	0	Adv
C12-06	Maintenance Gain	Speed Reference Gain	0.00-1.00	0.5	Adv

Inching Control

Inching Control Function can be enabled by programming data 17, 18, and 19 respectively to the Multi-Function input terminals (H1-01~06).The frequency reference used during inching is determined by B1-17 (Jog Reference).

CAUTION

A directional input is not needed on terminals 1 or 2.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C13-01	Inch Run Time	Inching Control run time.	0.00–2.55 sec	1.00	Adv
C13-02	Repeat Delay T	Inching Control repeat delay time.	0.00–2.55 sec	1.00	Adv
H1-01~06	Terminal Selection				Adv
	17 Forward Inch				
	18 Reverse Inch				
	19 Inch Repeat				

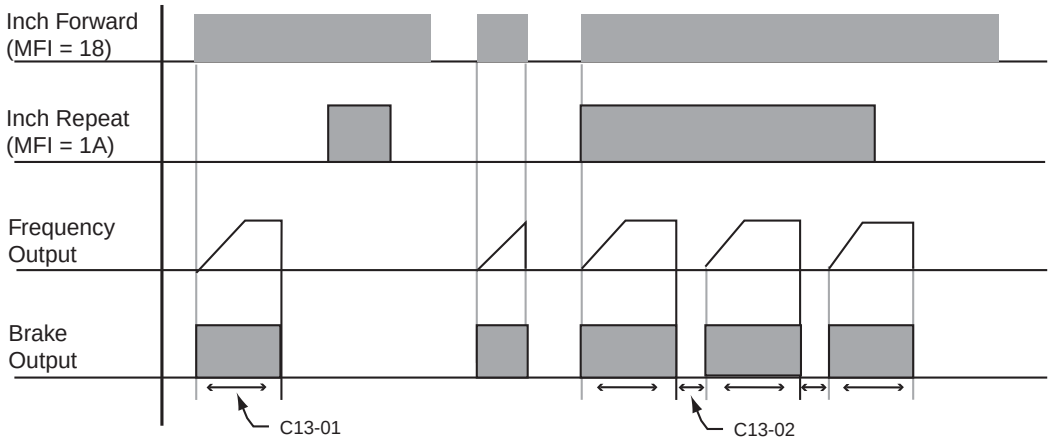


Figure 5-23: Inching Function and Inching Repeat

Index Function

This function will rotate the motor a programmed amount of encoder pulses (C13-04 and C13-05) at a programmed frequency (C13-03). If desired, it can also repeat the move by simply entering a repeat delay time (C13-06).The function works in both NLB Hoist and Traverse motions when the drive is in Flux Vector or V/F with PG mode and for any speed reference method.

When the motion is Traverse, the function can be enabled at anytime. If the crane is in motion when enabled, the Index function will not be triggered until motor speed is less than or equal to D1-01. Enable the function via Multi-function Input (Index Enable = 60) and the brake will release and hold position in Zero Servo mode until a directional command is input (Forward or Reverse) and indexing will begin. When the move is complete, the Multi-Function Output (Index Complete = 34) will be logic 1, and will remain high until another directional run input is received, the repeat delay has

expired and the movement is repeating, or the Multi-function Input is removed. The drive will remain in Zero Servo mode when the move is complete as long as the Multi-function Input is enabled.

When the motion is NLB Hoist, the function can also be enabled at anytime. If the crane is in motion when enabled, the Index function will not be triggered until motor speed is less than or equal to D1-01. If the drive is in the ready state, but not outputting current to the motor, enabling the Multi-function Input will do nothing until the directional run input is received. At this time, the NLB Start sequence will be initiated and act as any other NLB Hoist and Indexing will begin once C8-04 time has expired. Sequencing is now identical to a Traverse motion. The NLB Stopping sequence will be initiated once the Index enable Multi-function Index is removed.

Parameter Code	Display	Function	Range	Initial Value	Access Level
C13-03	Index Run Ref	Index frequency Ref. MFI=60).	0.01–60.00 Hz	0.10	Adv
C13-04	Index Revs	Index motor revolutions (F1-01 PPR = 1 Rev.)	0-65535 Rev	0**	Adv
C13-05	Index Count	Index fractional motor revolution (Setting in encoder pulses)	0-65535	100**	Adv
C-13-06	Index Rpt Delay	Index repeat delay time	0.00-60.00 Sec	0.00	Adv
C13-07	Index Complete	Index Complete Width	0-32767	10	Adv
C13-08	Index Zsv Gain	Index Zero Servo Gain	0-100	10	Adv
C13-09	Index ASR P Gain	Index ASR P Gain	0.00-300.00	30	Adv
C13-10	Index ASR I Time	Index ASR Integral Time	0.0000-10.000 Sec	0.02	Adv
C13-11	Index Gain	Index Accel/Decel Rate Gain	0.0-20.0	5.0	Adv

** If both C13-04 and C14-5 = 0, the Index function is disabled.

Tuning

- D1 DC Injection
- D2 Automatic Slip Compensation
- D4 ASR Tuning
- D5 Torque Control
- D6 Droop Control
- D8 Dwell Function
- D9 S-Curve Acceleration/Deceleration
- D10 Carrier Frequency
- D12 Factory Tuning

DC Injection

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

With decel to stop enabled (B3-03=0), upon removal of the run command the IMPULSE•VG+ Series 3 drive controls motor deceleration according to the Decel Time setting, until output frequency reaches the DC Injection Braking Start Frequency (D1-01 setting). Then the IMPULSE•VG+ Series 3 drive output is turned off and DC injection current is applied to the motor. The effective DC injection time and current should be set to provide adequate stopping without excessive motor heating. The DC injection voltage is determined by the DC injection braking current and motor impedance.

Parameter Code	Display	Function	Range	Initial Value	Access Level
D1-01	DCInj Start Freq	DC Injection braking frequency start.	0.0–10 Hz	0.5	Adv
D1-03	DCInj Time@Start	DC Injection braking time.	0.00–10.00 sec	0.00	Adv
D1-04	DCInj Time@Stop	DC Injection braking time at stop.	0.00–10.00 sec	0.05	Adv

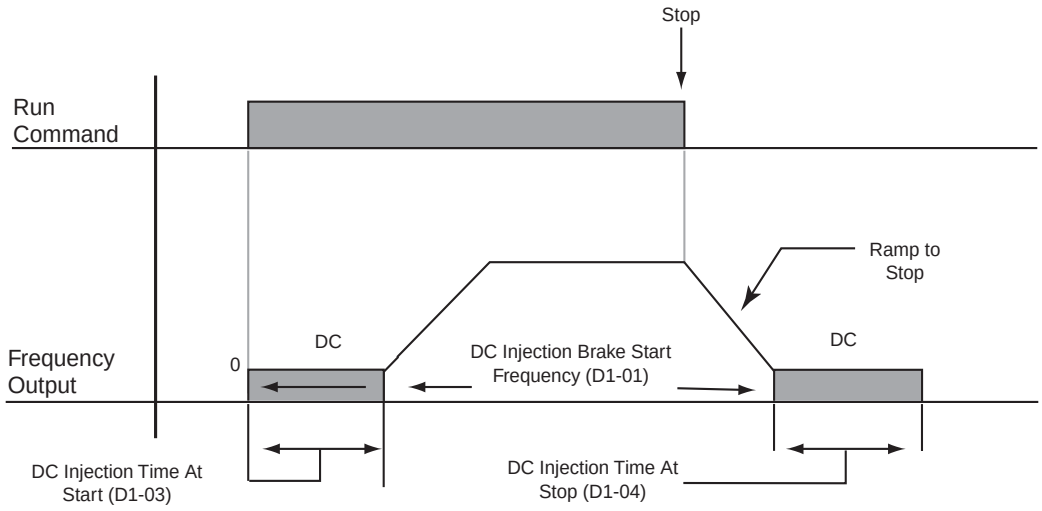


Figure 5-24: DC Braking Sequence

Automatic Slip Compensation

As the load becomes larger, the motor speed is reduced and the motor slip increases. The slip compensation function keeps the motor speed constant under varying load conditions. D2-01 sets the slip compensation gain. When the gain is “1.0”, the output frequency is increased by 1% of the E1-06 setting at rated current. A setting of “0.0” results in no slip compensation.

Parameter Code	Display	Function	Range	Initial Value	Access Level
D2-01	Slip Comp Gain	Slip compensation multiplier.	0.0–2.5	1.0	Adv
D2-05	Output V Lim Sel	V/F Slip Compensation	0-1	0	Adv
0 Disable					
1 Enable					

Automatic Speed Regulator (ASR) Tuning

Parameter Code	Display	Function	Range	Initial Value	Access Level
D4-01	ASR P Gain 1	ASR Proportional Gain 1.	1.00–300.00	30.00	Adv
D4-02	ASR I Time 1	ASR Integral Time 1.	0.000–10.000 sec.	0.500	Adv

Parameters D4-01 and D4-02 provide adjustments to enable the optimum performance during load disturbances. The proportional gain (D4-01) adjusts the amount of instantaneous droop as a function of loss, and provides dampening from load disturbances such as speed reference change, or a change in load. The integral time (D4-02) adjusts the response time of the IMPULSE•VG+ Series 3 to the load disturbances.

NOTE: Speed control response is increased by increasing the proportional gain setting and decreasing the integral time. However, instability or hunting may occur between the IMPULSE•VG+ Series 3 and the load if D4-01 (ASR Proportional Gain) is set too high, or D4-02 (ASR Integral Time) is set too low.

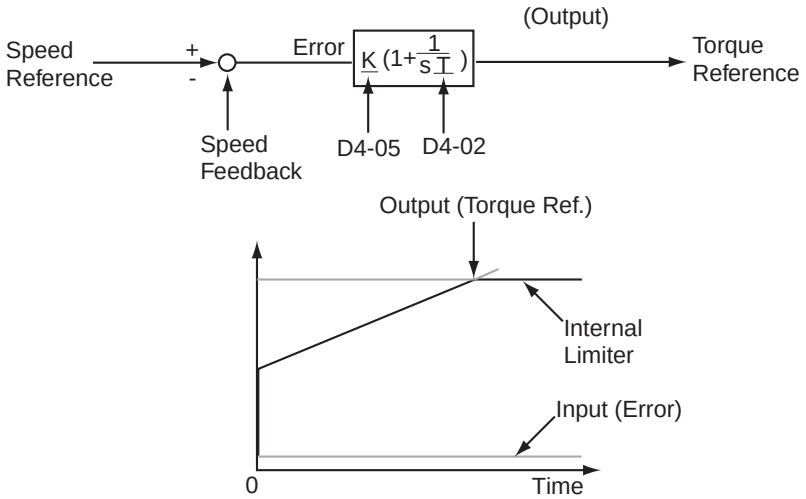


Figure 5-25: Automatic Speed Regulator (ASR) Tuning

Parameter Code	Display	Function	Range	Initial Value	Access Level
D4-03	ASR P Gain 2	ASR Proportional Gain 2.	1.00–300.00	30.00	Adv
D4-04	ASR I Time 2	ASR Integral Time 2.	0.000–10.000 sec	0.100	Adv
D4-06	ASR Delay Time	ASR Output Primary Delay Time.	0.000–0.500 sec	0.004	Adv
	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.				
D4-07	ASR Gain SW Freq	ASR Gain Switching Frequency.	0.0–150.0 Hz	0.0	Adv
D4-08	ASR I Limit	ASR Integral Limit.	0–400%	400	Adv

Parameter D4-03 is used as an additional proportional gain adjustment, and parameter D4-04 determines the response time for Proportional Gain 2 (D4-03).

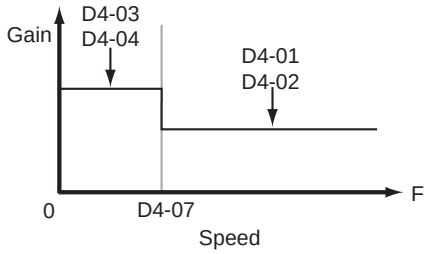


Figure 5-26: Proportional Gain

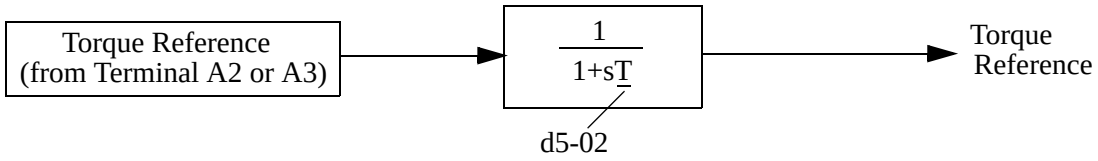
NOTE: When D4-07= "0," proportional gain 1 (D4-01) and integral time 1 (D4-02) are selected.

Torque Control

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

Parameter Code	Display	Function	Range	Initial Value	Access Level
D5-01	Torque Control	Determines whether Speed or Torque Control is selected.	0~1	0	Adv
	0 Speed Control	Speed Control enabled with torque limit			
	1 Torque Control	Torque control enabled with speed limit.			
	Speed/torque control selection can also be made by using a multi-function input select (H1-XX=34 speed- torque control changeover).				
D5-02	Torque Ref Filter	Primary delay time for Torque Reference Input.	0–1000msec	0	Adv

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



Parameter Code	Display	Function	Range	Initial Value	Access Level
D5-03	Speed Limit Sel	Speed Limit Selection (See figure below)	1-2	2	Adv
	1 Analog Input				
	2 Program Setting				
D5-04	Speed Lmt Value	Speed Limit Value (% of E1-04)	-120–120%	100	Adv
D5-05	Speed Lmt Bias	Speed Limit Bias (% of E1-04)	0–120%	0	Adv
D5-06	Ref Hold Time	Speed/Torque Switching Timer	0–1000 ms	0	Adv

Speed/Torque Control Switching

Speed control or torque control can be selected “on the fly” by using the multi-function input speed/ torque control selection command (H1-XX = “34”).

Terminal Number	Parameter Number	Setting	Description
S8	H1-06	34	Speed/torque control selection
A1	B3-01	1	Frequency reference selection (terminals A1, A2 or A3)
	D5-03	1	Speed limit selection (terminals A1, A2 or A3)
A3/A2	H3-05/H3-09	13	Torque reference/torque limit

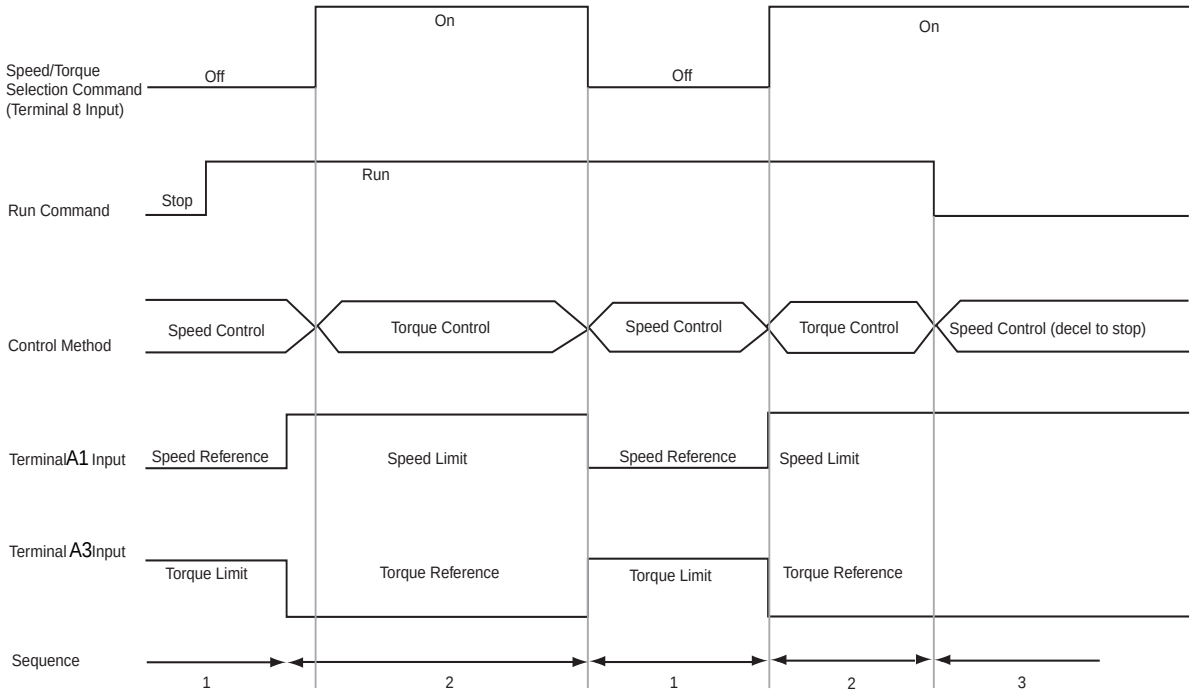


Figure 5-28: Speed/Torque Control Selection Timing Diagram

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 (B3-01) setting. To use terminal A1, A2, or A3 as the master frequency reference, set B3-01 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 (C7-01 to C7-04) 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 A3 torque limit, or the values set in the torque limit parameters (C7-01 to C7-04) 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 (D5-03) is set to "1", and is the speed limit value (D5-04) when D5-03 = "2", regardless of the frequency reference selection (B3-01) 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 (C7-01 to C7-04).

NOTE: The control mode actually changes after the speed/torque control selection command changes and the reference delay timer (D5-06) elapses. The speed reference/speed limit and the torque limit/torque reference are stored in the inverter until the time set to D5-06 elapses.

Droop Control

The Drooping function reduces the motor speed based on the load torque of the motor. The actual amount of motor speed reduction is based on the ratio of the amount of motor torque and maximum output frequency (E1-04).

The Droop Delay Time D6-02 sets the response time for the drooping function. Decreasing the Droop Delay Time will cause the response to become quicker, however, instability may occur.

Parameter Code	Display	Function	Range	Initial Value	Access Level
D6-01	Droop Quantity	Sets the motor speed reduction when torque output equals 100%	0.0 - 100.0%	0.0	Adv
D6-02	Droop Delay Time	Sets the response time for the drooping function	0.03 - 2.0 sec	0.05	Adv

Dwell Function

The Dwell Function is used to temporarily hold the output frequency at a set reference for a set time. This function can be used when driving a motor with a heavy starting load. This pause in acceleration reduces traditionally high starting current. Enable by setting H1-01 ~ 06 to 65.

NOTE: This function should not be used for hoists.

Parameter Code	Display	Function	Range	Initial Value	Access Level
D8-01	Dwell Ref @ Start	Sets Dwell frequency reference at start.	0.0–150.0 Hz	0.0	Adv
D8-02	Dwell Time @ Start	Sets the time duration for the Dwell function at start.	0.0–10.0 sec	0.0	Adv
D8-03	Dwell Ref @ Stop	Sets dwell frequency Reference at stop.	0.0–150.0 Hz	0.0	Adv
D8-04	Dwell Time @ Stop	Sets the time duration for the Dwell function at stop.	0.0–10.0 sec	0.0	Adv

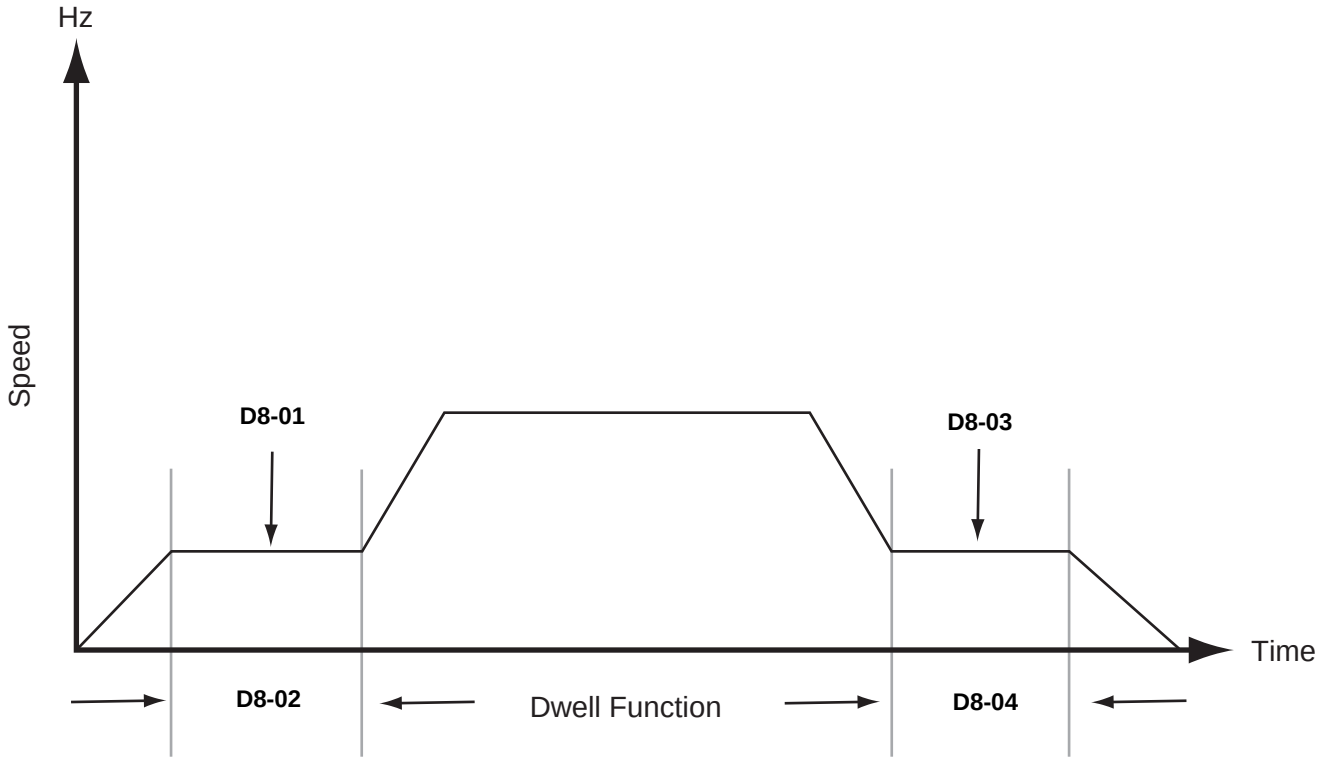


Figure 5-29: Dwell Function

S-Curve Acceleration/Deceleration

A 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.

Parameter Code	Display	Function	Range	Initial Value	Access Level
D9-01*	S-Crv Acc @ Start	Sets S-Curve time at Accel start	0.00–2.50 sec	–	Adv
D9-02*	S-Crv Acc @ End	Sets S-Curve time at Accel end	0.00-2.50 sec	–	Adv
D9-03*	S-Crv Dec @ Start	Sets S-Curve time Decel start	0.00–2.50 sec	–	Adv
D9-04	S-Crv Dec @ End	Sets S-Curve time at Decel end	0.00–2.50 sec	0.20	Adv

*Initial value is determined by X-Press Programming (Table 4.1 to 4.2).

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) = B5-01 + (D9-01 + D9-02)/2.

CAUTION

CAUTION Accel/Decel times will be extended.

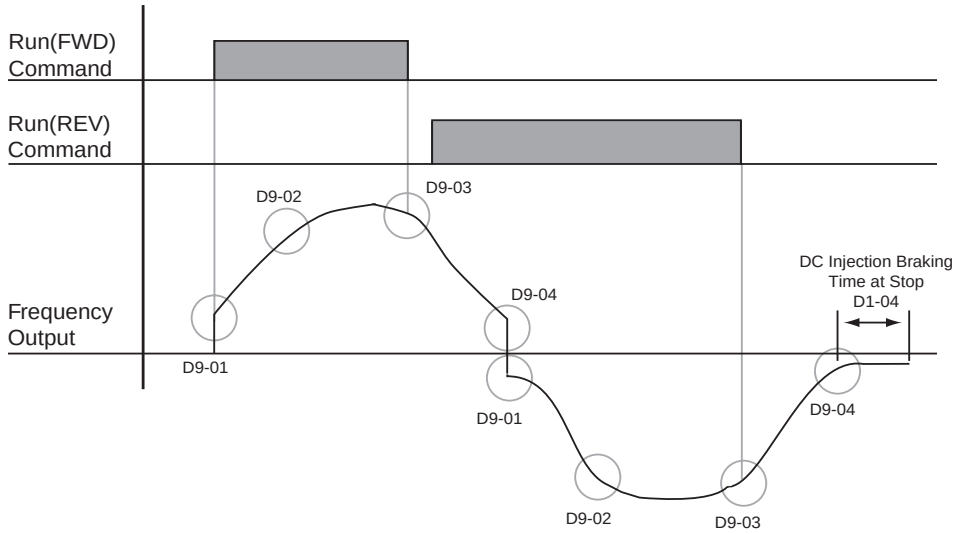


Figure 5-30: S-Curve Characteristics–FWD/REV Operation

Motor Parameters

- E1 V/f Pattern 1
- E2 Motor Set-up
- E3 Motor 2 Method
- E4 Motor 2 V/f Pattern
- E5 Motor 2 Set-up

Voltage/Frequency Pattern

Parameter Code	Display	Function	Range	Initial[(1)] Value	Access Level
E1-01	Input Voltage	Sets input voltage	155-255/ 310-510	230/460	Adv

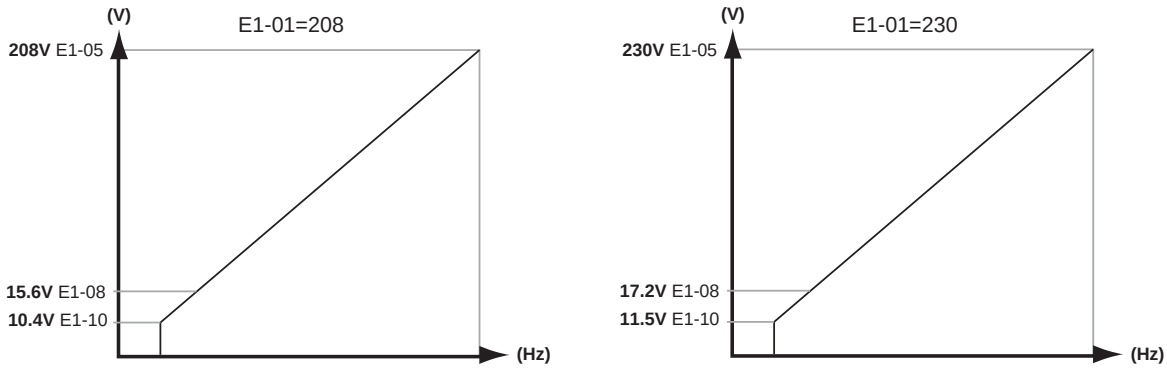


Figure 5-31: E1-01 Input Voltage

- *When using flux vector control mode, the V/f pattern voltage values will be adjusted by the Auto-Tuning function.*
- *Factory setting is 230 (230V units) or 460 (460V units).*

The setting E1-01 adjusts the overvoltage level, braking transistor turn on level and the stall prevention level during deceleration.

Table 5-5:

Inverter Voltage	E1-01 Setting	Overvoltage Trip		Braking Transistor		Stall Level
		Trip	Reset	On	Off	
230	150-255	400V	380V	380V	375V	380V
460	≥400	800V	760V	760V	750V	760V
460	<400	720V	680V	660V	650V	670V

Parameter E1-01 performs the above mentioned function in all three control modes.

V/F Parameters

Parameter Code	Display	Function	Range	Initial[1] Value	Access Level
E1-04	Max Frequency	Maximum Frequency	40.0–150.0 Hz	60.0	Adv
E1-05[2]	Max Voltage	Maximum Voltage	0.0–510.0 V	460	Adv
E1-06	Base Frequency	Motor Base Frequency	0.0–150.0 Hz	60	Adv
E1-09	Min Frequency	Minimum Frequency	0.0–150.0 Hz	0.0	Adv
E1-11	Mid Frequency B	Midpoint Output Frequency B	0.0–150.0 Hz	0.0	Adv
E1-12	Mid Voltage B	Midpoint Output Voltage B	0.0–510.0 V	0.0	Adv
E1-13[2]	Base Voltage	Motor Base Voltage	0.0–510.0 V	0.0	Adv

* Initial value determined by X-Press Programming (Table 4.1 to 4.2).

[1] The initial value displayed here is for 460V class drives.

[2] For 230V class units, the value is half that of 400V class units.

Motor Set-up

E2 constants define motor parameters. Normally, the default settings for E2 constants are determined by KVA selection (O2-04). In flux vector control the E2 constants will be set automatically during auto-tuning. If the control method is V/F (A1-02=0), the motor rated current should be entered into E2-01.

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

Motor rated slip frequency (E2-02) can be calculated by using the following equation:

$$fs = f - \frac{(N \bullet P)}{120}$$

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

Motor terminal resistance E2-05 can be calculated by using the following equation:

$$\mathbf{rt} = \mathbf{r}_p \bullet \frac{273 + (25^{\circ}C + Ti)/2}{273 + Ti}$$

Where... **rt**: motor terminal resistance
rp: Phase-to-Phase resistance at insulation class temperature
Ti: insulation class temperature (˚C)

Parameter Code	Display	Function	Range	Initial Value	Access Level
E2-01	Motor Rated FLA	Motor-rated current	0.01–1500.0 A	*	Adv
E2-02	Motor Rated Slip	Motor-rated slip frequency	0.00-20.00 Hz	*	Adv
E2-03	No-Load Current	Motor no-load current	0.0–1500.0 A	*	Adv
E2-04	Number of Poles	Number of poles in motor	2-48	4	Adv
E2-05	Term Resistance	Motor terminal resistance	0.000–65.000 Ω	*	Adv
E2-06	Leak Inductance	Leakage Inductance	0.0–30.0%	*	Adv
E2-07	Saturation Comp 1	Core-Saturation Compensation Coefficient 1	0.00–0.50	*	Adv
E2-08	Saturation Comp 2	Core-Saturation Compensation Coefficient 2	0.00–0.75	*	Adv
E2-11	Motor Rated Power	Rated output	0.0-650 Kw	*	Adv

* Initial value is determined by O2-04 (kVA Selection)
This value is automatically set during auto tuning

Motor 2 Method

The Motor 2 method function allows one drive to control two separate motors which are coupled to separate motions. The output of the drive is switched from one motor to the other and a multi-function input (H1-XX=41 Motor 2 Select) informs the drive of which motor is being used. Special functions are disabled and become read only while in Motor 2. Those functions that are disabled include: Load Check (C5), Swift/Ultra Lift (C6), Weight Measurement (C10), Slack Cable (C11), Snap Shaft (C12), and Inching (C13). If encoder feedback is used with Motor 2 then use a PG-Z2 option card.

WARNING

Do not switch between motors when the drive's output is on as it will damage the unit!

Use multi-function output, 1E, as motor 2 switch over control.

Parameter Code	Display	Function	Range	Initial Value	Access Level
E3-01	Control Method	Motor 2 control method	0–3	0	Adv
	0 V/f control				
	1 V/f w/PG Fdbk				
	2 Open loop vector				
	3 Flux Vector				
E3-02	Stopping Method	Motor 2 Stopping Method	0,1,6	1	Adv
	0 Decel to Stop				
	1 Coast to Stop				
	6 No load brake (E3-01 must = 3)				

Motor 2 Voltage/Frequency Pattern

Parameter Code	Display	Function	Range	Initial Value	Access Level
E3-03	Max Frequency	Maximum frequency for Motor 2	40.0–150.0 Hz	60.0	Adv
E3-04	Max voltage	Maximum voltage for Motor 2	0.0–255.0 V	230.0	Adv
E3-05	Base Frequency	Base frequency for Motor 2	50.0–150.0 Hz	60.0	Adv
E3-06	Mid Frequency	Midpoint output frequency for Motor 2	0.0–150.0 Hz	3.0	Factory
E3-07	Mid Voltage	Midpoint output voltage for Motor 2	0.0–255.0 V	17.2	Factory
E3-08	Min Frequency	Minimum output frequency for Motor 2	0.0–150.0 Hz	1.5	Factory
E3-09	Min Voltage	Minimum output voltage for Motor 2	0.0–255.0 V	10.3	Factory

Motor 2 Set-up

Parameter Code	Display	Function	Range	Initial Value	Access Level
E4-01	Motor Rated FLA	Motor-rated current for Motor 2	0.0–150.0 A	*	Adv
E4-02	Motor Rated Slip	Motor-rated slip frequency for Motor 2	0.00–20.0 Hz	*	Adv
E4-03	No Load Current	Motor no-load current for Motor 2	0.0–150.0 A	*	Adv
E4-04	Number of Poles	Number of poles in motor	2-48	*	Adv
E4-05	Terminal Resistance	Motor 2 Terminal Resistance	0.000–65.000Ω	*	Adv
E4-06	Leakage Inductance	Leakage Inductance for Motor 2	0.0-40%	*	Adv
E4-07	Motor Rated Power	Motor 2 Rated KW	0.40-650KW	*	Adv

** Values automatically set at Auto Tuning*

Option Parameters

- *F1 Pulse Generator Option Set-up*
- *F2 Analog Input 14 Set-up*
- *F3 Digital Input Option Set-up*
- *F4 Analog Output Option Set-up*
- *F5 Digital Output 2 Set-up*
- *F6 Communication Card Set-up*

Encoder (PG) Option Set-up

Parameter Code	Display	Function	Range	Initial Value	Access Level
F1-01	Pulses/Rev	Sets encoder Pulses/Rev for Channel 1	0–60000 pulses/rev	1024	Adv
F1-02	PG Fdbk Loss Sel	Selects stopping method or alarm output when PG line break is detected (both channels).	0-3	1	Adv
	0 Decel to Stop	Decels to stop			
	1 Coast to Stop	Immediate stop			
	*2 Fast-Stop**	Decel by B5-08			
	3 Alarm Only	Displayed on keypad only			
F1-03	PG Overspeed Sel	Selects stopping method or alarm output when motor overspeed is detected (both channels).	0-3	1	Adv
	0 Decel to Stop	Decels to stop			
	1 Coast to Stop	Immediate stop			
	*2 Fast-Stop**	Decel by B5-08			
	3 Alarm Only	Displayed on keypad only			
F1-04	PG Deviation Sel	Selects stopping method when PG deviation is detected.	0-7	5	Adv
	0 Ramp to Stop	Decels to stop by B5-02			
at speed agree	*1 Coast to Stop*	Immediate stop			
	*2 Fast-Stop**	Decel by B5-08			
	3 Alarm Only	Displayed on keypad only			
	4 Ramp to Stop	Decels to stop by B5-02			
	5 Coast to Stop	Immediate stop			
at run	*6 Fast-Stop**	Decel by B5-08			
	7 Alarm Only	Displayed on keypad only			
F1-05	PG Rotation Sel	Selects PG rotation	0-1	0	Adv
	0 Fwd = C.C.W.				
	1 Fwd = C.W.				
F1-06	PG Output Ratio	PG division rate (pulse output)	1-132	1	Adv

NOTE: *Fast-stop is selected, the stopping time is set by B5-08 (Fast stop time)

Parameter Code	Display	Function	Range	Initial Value	Access Level
F1-08	PG Overspd Level	Motor overspeed detection level.	0–120%	105	Adv
F1-09	PG Overspd Time	Motor overspeed detection time.	0–2.0 sec	0.0	Adv
F1-10	PG Deviate Level	Excessive speed deviation level.	0–50%	10	Adv
F1-11	PG Deviate Time	Excessive speed deviation time.	0–10.0 sec	0.3	Adv
F1-12	PG# Gear Teeth 1	PG Reduction Ratio	0-1000	0	Adv
F1-13	PG# Gear Teeth 2	PG Reducion Ratio Ratio = 60 x F1-13 / F1-12 Note: A Gear ratio of 1 will be used if either perameter = 0	0-1000	0	Adv
F1-15	PGO Detect Time	Open encoder circuit	0.00-10.00	0.50	Adv
F1-16	PG Ch 2 PPR	Indicates how many pulses the drive can expect per revolution of the motor.	1-60000 PPR	1024	Adv
F1-17	PG Ch 2 Rotation	O-FWD = CCW 1 - FWD = CW	0-1	0	Adv
F1-18	PGO-2-S Det Time	Channel 2 open encoder circuit	0-10.0 Sec	0.5 Sec	Adv
F1-19	PG-Z2 Output Set	PG-Z2 Output	0-3	2	Adv
	0 Select by MFI=41 *1 Channel 1* *2 Channel 2* *3 Select by MFI=64*				
F1-20	PGO-1-H 0/1	CH1 Hardware PGO enable/disable	0-1	1	Adv
	0 Disabled *1 Enabled*				
F1-21	PGO-2-H 0/1	CH2 Hardware PGO enable/disable	0-1	0	Adv
	0 Disabled *1 Enabled*				
F1-22	PG-Z2 Input Sel	Option Card PG-Z2 channel select	0-1	0	Adv
	0 Ch1 = motor 1, Ch 2 = motor 2 *1 Ch 2 = motor 2, Ch 2 = motor 1*				

** Factory setting changes based on Control Method (A1-02)*

AI-14 Set-up

Sets CH1 to CH3 input functions when AI-14B option is connected (2CN).

When the 3CH individual input is used, parameter B3-01 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 (H1-XX= “1F”), is disabled when using the AI-14B option.

Parameter Code	Display	Function	Range	Initial Value	Access Level
F2-01	AI-14 Input Sel	Determines whether the 3-channel input selection is individual or additional.		0	Adv
	0 3ch Individual				
	1 3ch Additional				

Sets CH1 to CH3 input functions when AI-14B option is connected

Setting	Function	CH1 (TC1 to TC4	CH2 (TC2 to TC4)	CH3 (TC3 to TC4)
0	3-channel individual input (factory default)	Substitute for terminals A1 & Ac	Substitute for terminals A2 & AC	Substitute for terminals A3 & AC
1	3-channel additonal input	Sum of CH1 to CH3 input values is used as the frequency reference value		

Digital Input Option Set-up

Selects the setting of the frequency reference input from the DI-08 and DI-16H option cards.

NOTE: B3-01 must be set to 3-option PCB when using these cards.

Parameter Code	Display	Function	Range	Initial Value	Access Level
F3-01	DI Option Setup	Selects the setting mode of the reference input from the DI-08 and DI-16H options	0–7	0	Adv
	0 BCD 1%	BCD 1% unit			
	1 BCD 0.1%	BCD 0.1% unit			
	2 BCD 0.01%	BCD 0.01% unit			
	3 BCD 1Hz	BCD 1Hz unit			
	4 BCD 0.1Hz	BCD 0.1Hz unit			
	5 BCD 0.01Hz	BCD 0.01Hz unit			
	6 BCD (5DG) 0.01Hz	Binary			
		DI–08:	255/100%		
		DI–16H, 12 bit selection:	4096/100%		
		DI–16H, 16 bit selection:	3000/100%		
	7 Binary	Set value is displayed in decimal notation			

Analog Output Option Set-up

Selects the analog output monitors for channel 1 and 2 if AO-08 and AO-12 optional card is connected to 3CN.

Parameter Code	Display	Function	Range	Initial Value	Access Level
F4-01	AO Ch1 Select	Analog output option Channel 1 selection	1–50	2	Adv
	1 Frequency Ref				
	2 Output Freq				
	3 Output Current				
	5 Motor Speed				
	6 Output Voltage				
	7 DC Bus Voltage				
	8 Output kWatts				
	9 Torque Reference				
	15 Term A1 Level				
	16 Term A2 Level				
	17 Term A3 Level				
	18 Mot SEC Current				
	19 Mot EXC Current				
	20 SFS Output				
	21 ASR Input				
	22 ASR Output				
	23 PG-Z2 CH2 Feedback				
	24 PID Feedback				
	26 Voltage Ref (Vq)				
	27 Voltage Ref (Vd)				
	29 Load Weight				
	30 SS Delta Speed				
	31 Not used				
	32 ACR (q) Output				
	33 ACR (d) Output				
	36 PID Input				
	37 PID Output				
	38 PID Setpoint				
	41 Heat Sink Temp (10V=100°C)				
	44 ASR Out w/o Filter				
	50 Hook height (10V=100%)				
F4-02	AO Ch1 Gain	Analog output Channel 1 multiplier	0.00-1000%	100%	Adv
F4-03	AO Ch2 Select	Analog output option Channel 2 selection (Same as F4-01)	1–50	3	Adv
F4-04	AO Ch2 Gain	Analog output Channel 2 multiplier	0.00-1000%	50%	Adv
F4-05	CH1 A0 Bias	Channel 1 bias	-110%-110%	0.0	Adv
F4-06	CH2 A0 Bias	Channel 2 bias	-110%-110%	0.0	Adv
F4-07	AO Opt Level CH1	Channel 1 output signal	0-1	0	Adv

Parameter Code	Display	Function	Range	Initial Value	Access Level
	0 0-10V DC				
	1 ¯10-10V DC				
F4-08	AO Opt Level CH2	Channel 2 output signal	0-1	0	Adv
	0 0-10V DC				
	1 ¯10-10V DC				

Digital Output Set-up with Option Card DO-02 or DO-08

Selects the multi-function output settings for channels 1 and 2 of the DO-02 option card.

Parameter Code	Display	Function	Range	Initial Value	Access Level
F5-01	DO Ch1 Select	Determines the digital output of Channel 1 (See H2-01)	0–FF	F	Adv
F5-02	DO Ch2 Select	Determines the digital output of Channel 2 (See H2-01)	0–FF	F	Adv
F5-03	DO Ch3 Select	Determines the digital output of Channel 3 (See H2-01)	0-FF	F	Adv
F5-04	DO Ch4 Select	Determines the digital output of Channel 4 (See H2-01)	0-FF	F	Adv
F5-05	DO Ch5 Select	Determines the digital output of Channel 5 (See H2-01)	0-FF	F	Adv
F5-06	DO Ch6 Select	Determines the digital output of Channel 6 (See H2-01)	0-FF	F	Adv
F5-07	DO Ch7 Select	Determines the digital output of Channel 7 (See H2-01)	0-FF	F	Adv
F5-08	DO Ch8 Select	Determines the digital output of Channel 8 (See H2-01)	0-FF	F	Adv
F5-09	DO-08 Selection	DO-08 option card output mode selection	0-3	0	Adv
	0 8 Ch Individual				
	1 Binary Output				
	2 Output per F5-01 ~ 08				
	3 Serial Communication output				

Selects the multi-function output selections for the DO-08 option.

Setting	Terminal No.	Description
0 8-Channel individual (factory fixed)	TD5/TD11	Overcurrent (SC, OC, GF)
	TD6/TD11	Overvoltage (OV)
	TD7/TD11	Inverter overload (OL2)
	TD8/TD11	Fuse blown (FU)
	TD9/TD11	Not used
	TD10/TD11	Inverter overheat (OH)
	TD1/TD2	During zero-speed detection
	TD3/TD4	During speed agree
1 binary output	TD5/TD11	Binary output*
	TD6/TD11	
	TD7/TD11	
	TD8/TD11	
	TD9/TD11	During zero-speed detection
	TD10/TD11	During speed agree
	TD1/TD2	During run
	TD3/TD4	Minor fault
2 8-channel programmable	TD5/TD11	F5-01
	TD6/TD11	F5-02
	TD7/TD11	F5-03
	TD8/TD11	F5-04
	TD9/TD11	F5-05
	TD10/TD11	F5-06
	TD1/TD2	F5-07
	TD3/TD4	F5-08

* When F5-09 is set to binary output (setting = “1”), use the table on the following page to read the DO-08 output.

TD8/TD11 (bit 3)	TD7/TD11 (bit 2)	TD6/TD11 (bit 1)	TD5/TD11 (bit 0)	Description
0	0	0	0	No Fault
0	0	0	1	Overcurrent (SC, OC, GF)
0	0	1	0	Overvoltage (OV)
0	0	1	1	Inverter overload (OL2)
0	1	0	0	Inverter overheat (OH)
0	1	0	1	Overspeed (OS)
0	1	1	0	Fuse blown (FU)
0	1	1	1	Not used
1	0	0	0	External fault (EF3~EF8)
1	0	0	1	Controller fault
1	0	1	0	Motor overload (OL1)
1	0	1	1	Not used
1	1	0	0	Power loss (UV1, UV2, UV3)
1	1	0	1	Excessive speed deviation (DEV)
1	1	1	0	PG disconnection (PGO)
1	1	1	1	Not used

Communication Option Cards

Settings for DP-RAM option cards.

Parameter Code	Display	Function	Range	Initial Value	Access Level
F6-01	Com Bus Flt Sel	Stopping method at communication error.	0-4	1	Adv
	0 Decel to Stop				
	1 Coast to Stop				
	2 Fast Stop				
	3 Use B3-03 Method				
	4 Alarm only				
F6-02	EFO Detection	Option External Fault	0-1	0	Adv
	0 Always Detected				
	1 Only During Run				
F6-03	EFO Fault Action	Option External Fault	0-4	1	Adv
	0 Decel to Stop				
	1 Coast to Stop				
	2 Fast Stop				
	3 Use B3-03				
	4 Alarm Only				
F6-05	Current Unit Sel	Current Unit	0-1	0	Adv
	0 A Display				
	1 100%/8192				
F6-06	Torq Ref/Lmt Sel	Torque Reference Limit Selection	0-1	0	Adv
	0 Disabled				
	1 Enabled				

Terminal Parameters

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

Digital Inputs

The IMPULSE•VG+ Series 3 has six 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 S3 to S8) and indicates the control modes during which each function can be enabled. An OPEO3 error will occur if a function is programmed in more than one terminal at the same time.

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Parameter Code	Display	Function	Ref Page Number	Range	Initial Value	Acess Level
H1-01*	Terminal S3 Sel *(parameter)*	Selects the multi-function inputs.		0-64	0	Adv
H1-02*	Terminal S4 Sel *(parameter)*	Same as H1-01		0–64	1	Adv
H1-03*	Terminal S5 Sel (*parameter)*	Same as H1-01		0–64	F	Adv
H1-04*	Terminal S6 Sel *(parameter)*	Same as H1-01		0–64	F	Adv
H1-05*	Terminal S7 Sel *(parameter*	Same as H1-01		0–64	F	Adv
H1-06*	Terminal S8 Sel *(parameter)*	Same as H1-01		0–64	F	Adv
	0 Multi-Step Ref 2	*Multi-Step Speed 2.*	*5-3*			
	1 Multi-Step Ref 3	*Multi-Step Speed 3.*	*5-3*			
	2 Multi-Step Ref 4	*Multi-Step Speed 4.*	*5-3*			
	3 Multi-Step Ref 5	*Multi-Step Speed 5.*	*5-3*			
	4 Speed Hold 2	*Hold function (2nd step of Three-Step Infinitely Variable).*	*4-10*			
	5 Accel Command	*Acceleration function (2nd step of Two-Step Infinitely Variable or 3rd step of Three-Step Infinitely Variable).*	*4-10*			
	6 Upper Lmt 1 N/O	*Upper Limit–SLOW DOWN; Normally Open*	5-20			
	7 Upper Lmt 2 N/O	*Upper Limit–STOP; Normally Open*	5-20			
	8 Lower Lmt 1 N/O	*Lower Limit–SLOW DOWN; Normally Open*	5-20			
	9 Lower Lmt 2 N/O	*Lower Limit–STOP; Normally Open*	5-20			
	A Upper Lmt 1 N/C	*Upper Limit–SLOW DOWN; Normally Closed*	5-20			
	B Upper Lmt 2 N/C	*Upper Limit–STOP; Normally Closed*	5-20			

Parameter Code	Display	Function	Ref Page Number
	C Lower Lmt 1 N/C	*Lower Limit–SLOW DOWN; Normally Closed*	5-20
	D Lower Limit 2 N/C	*Lower Limit–STOP; Normally Closed*	5-20
	E M-Speed Gain 1	*Micro-Positioning Control Multiplier 1*	5-19
	F Not used	*No function*	n/a
	10 M-Speed Gain 2	*Micro-Positioning Control Multliplier 2*	5-19
	11 Load Float 1	*Load Float Hold; when input during run, Load Float will remain on.*	n/a
	12 Weight Lmt N.C.	*Upper Limit - Stop by C3-08, normally closed*	n/a
	13 Ultra/Swift Lift	*Ultra-Lift enable*	5-26
	14 Alt T-Lim Gain	*Alternate Torque Limit Multiplier*	5-28
	15 Forward Jog	*Jog Control FORWARD command*	5-3
	16 Reverse Jog	*Jog Control REVERSE command*	5-3
	17 Forward Inch	*Inch Control*	5-42
	18 Reverse Inch	*Inch Control*	5-42
	19 Inch Repeat	*Inch Control*	5-42
	1A Acc/Dec 2	*Acceleration and Deceleration Changeover 2 Time*	5-12
	1B Acc/Dec 3	*Acceleration and Deceleration Changeover 3 Time*	5-13
	1C Acc/Dec 4	*Acceleration and Deceleration Changeover 4 Time*	5-13
	1D Digital Chngover	*Analog/Digital Reference Changeover B1-18=1* *Open=Analog* *Closed=Digital Reference from B1-01 Only*	5-13
	1F Opt/Inv Switch	*Frequency Reference from Option Card = Closed*	n/a
	20 thru 2F External Fault	*See "External Fault response selection"*	5-72
	30 Program Lockout	*Program Lockout*	n/a1
	31 Local/Remote Sw	*Closed = Local*	n/a
	32 Ext BB N.O.	*Immediate Stop at STOP Command; Normally Open*	n/a
	33 Ext BB N.C.	*Immediate Stop at STOP Command; Normally Closed*	n/a
	34 Spd/Trq Chngover	*Speed- and Torque-Control Changeover*	n/a
	35 Load Float 2	*Initiates Zero Servo Sequence* *Timed by C4-01 Timer*	5-23
	36 Polarity Rev	*Reverse Polarity in Torque Control*	n/a
	37 ASR Gain Switch	*Automatic Speed Regulator Multiplier Changeover*	n/a
	38 Speed Hold 1	*Frequency out is held*	n/a

Parameter Code	Display	Function	Ref Page Number
	39 External OH2	*External Overheat Alarm*	
	3A Trm A2/A3 Enable	*Analog Inputs A2 and A3 are Enabled*	
	3D Fref UP Cmd	*Used with B4-01*	
	3E Fref Down Cmd	*Used with B4-01*	
	3F Fault Reset	*Fault Reset; Normally Open*	
	40 Fast Stop N.O.	*Decel to Stop by B5-08*	n/a
	41 Motor 2 Switch	*Motor 2 enabled*	5-55
	42 Fast Stop N.C.	*Decel to Stop by B5-08*	5-5
	43 Timer Enable	*Closed: enable ON-Delay/OFF delay timer*	5-40
	45 + Speed Cmd	*Trim Control Increase*	
	46 — Speed Cmd	*Trim Control Decrease*	
	47 Analog Hold	*Analog Frequency Reference Hold*	
	4C DCInj Activate	*DC Injection Brake*	
	50 Ext Spd Search 3	*Micro-Speed Gain 1 and Load Float extent.*	
	53 Comm Test	*Comm Loopback Test*	
	55 Drive Enable	*On = Inverter Ready*	
	56 Klixon N.O.	*Klixon Input; Normally Open*	
	57 Klixon N.C.	*Klixon Input; Normally Closed*	
	58 Brake Answer back	*Brake Answer Back*	
	59 Alt F-Ref Up Lmt	*Alternate Fre Ref Up Limit*	
	5A Maintenance Reset	*Reset Maintenance Timer*	5-41
	5B BE6 Up Speed Lmt	*Limit Fref to C8-17*	
	5C Weight Measure	*Measure by C10-01*	5-35
	5D Load Float Ext	*AMS C8-15 Time to C8-10*	
	5E M-Spd Gni + LF-E	*Micro Speed Gain and Load Float Extend*	
	5F Phantom Fault N.C.	*Stop by C3-09*	
	60 Index Enable	*Enables index*	5-43
	61 Brake Test	*See C8-19*	5-31
	62 Weight Limit N.O.	*Upper Limit Stop; Normally Open*	
	63 Phantom Fault N.O.	*Stop by C3-09*	
	64 PG Ch1 Output	*Switches PG output to Ch 1*	
	65 Dwell Enable	*Enables Dwell function*	5-50
	66 Load Share	*Enables Load Share function*	5-22

** Initial value is determined by X-Press Programming (Table 4.1 to 4.2).*

Digital Outputs

The IMPULSE•VG+ Series 3 has three multi-function control outputs for indicating various conditions. 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.

Parameter Code	Display	Function	Reference Page Number			
H2-01	Terminal M0-M1	Digital Output 1 Function	---	0–FF	0	Adv
H2-02	Terminal M2-M3-M4	Digital Output 2 Function	---	0–FF	0	Adv
H2-03	Terminal M5 - M6	Digital Output 3 Function	---	0–FF	78	Adv
	0 Brake Release	*Closed when voltage or frequency is output*	n/a			
	1 Zero Speed	*Closed when below B2-02 or D1-01*	n/a			
	2 Fref/Fout Agree 1	*Output when Frequency Reference and Frequency Output agree*	5-79			
	3 Fref/Set Agree 1	*Output when Output Frequency Reference equals L4-01.*	5-79			
	4 Freq Detect 1	*Closed when output frequency is < L4-01.*	5-79			
	5 Freq Detect 2	*Closed when output frequency is > L4-01.*	5-79			
	6 Inverter Ready	*Closed when an inverter is not in a fault state*	n/a			
	7 DC Bus Undervolt	*Closed when DC Bus voltage drops belowUV trip point.*	n/a			
	8 BaseBlk N.O.	*Closed when the inverter is not outputting voltage.*	n/a			
	9 Operator Reference	*Closed when the frequency reference is input from the digital operator (02-01).*	5-89			
	A Local Operation	*Closed when the RUN command is input from the digital operator.*	5-89			
	B Trq Det 1 N.O.	*Output when torque > L6-02*	5-82			
	D DB Overheat	*Closed when inverter displays "RH" or "RR" fault.*	n/a			
	E Fault	*Closed during a major fault.*	6-3			
	F Not Used	*No function*				
	10 Minor Fault	*Closed during minor fault or alarm.*	6-3			
	11 Reset Cmd Active	*Closed when a reset command is present on the terminals*	n/a			
	12 Timer Output	*Timer function output*	5-40			
	13 Fref/Fout Agree 2	*Closed when output frequency = frequency reference*	5-80			
	14 Fref/Set Agree 2	*Closed when output frequency = L4-03*	5-80			

Parameter Code	Display	Function	Reference Page Number
	15 Freq Detect 3	*Closed when output frequency is ≤ L4-03*	5-80
	16 Freq Detect 4	*Closed when output frequency ≥ L4-03*	5-80
	17 Trq Det 1 N.C.	*Open when torque > L6-02*	5-82
	18 Trq Det 2 N.O.	*Closed when torque > L6-05*	5-83
	19 Trq Det 2 N.C.	*Open when torque > L6-05*	5-83
	1A Forward Dir	*Closed when running FWD/ UP*	n/a
	1B Reverse Dir	*Closed when running REV/ DOWN*	n/a
	1C Switft/Ultra mode	*Swift/Ultra Lift is active*	n/a
	1D BaseBlk N.C.	*During baseblock 2*	n/a
	1E Motor 2 Selected	*Closed when motor 2 changeover is input to terminals*	n/a
	1F Regenerating	*Regenerating*	n/a
	20 Auto-Rst Attempt	*Auto-Reset Enabled*	5-85
	21 Overload OL1	*OL1 Overload fault code*	n/a
	22 OH Prealarm	*Closed when "OH" is displayed on keypad*	n/a
	23 Torque Limit	*Current Torque Limit*	n/a
	24 Speed Limit	*Speed Limit*	n/a
	25 Load Float	*Movement SC4-03 count*	n/a
	26 Run Cmd is input	*During Run - ON:*	n/a
	27 Load Check Det	*Load Check detected*	5-24
	28 Slack Cable Det	*Slack Cable Detection output*	5-38
	29 Upper Limit	*Closed when Upper Limit– SLOW DOWN or Upper Limit STOP is input*	5-20
	2A During Run 1	*Used with Load Share*	5-22
	30 Lower Limit	*Closed when Lower Limit– SLOW DOWN or Lower Limit STOP is input*	5-20
	31 Up/Low Lmt	*Closed when Upper Limit– SLOW DOWN or Upper Limit STOP or Lower Limit– SLOW DOWN or Lower Limit STOP is input*	5-20
	32 Snap Shaft	*See C11-09*	5-39
	33 Weight Limit	*Enabled by C10-08*	
	34 Index Complete	*Index move is complete*	
	35 Torq Proving OK	*Torque Proving successful, brake is released, drive ready for F-Ref.*	
	36 During Load FLT	*Drive in Load Float*	
	37 Maintenance	*Timer reaches C12-05*	
	38 Spd Lim @ Tcont	*On when in Torque Control and output frequency is at upper limit*	
	39 Drive Enable	*Closed when drive enable is active*	

Parameter Code	Display	Function	Reference Page Number
	40 ~ FF Fault Annunciate	*Closed on specified faults.*	5-70

Digital Outputs—Alarm/Fault Annunciate (H2-01~03=40)

Digital Outputs—Fault Annunciate enables you to assign a set of six fault outputs to Relay Output M3/M4 and/or Output M5/M6. In addition, you can select whether each fault output is enabled.

NOTE: Output M1/M2 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** (assuming you are in **Programming Mode**):

1. Press the **UP** button until | *Digital Outputs*
H2-01=0
TERM M1-M2 SEL | appears.
2. Determine the output terminal to which you want **Fault Annunciate** assigned; Terminals M1-M2, M3-M4 or M5-M6.
3. Press the **>** button. "01" blinks. Press the **UP** arrow button to select Relay Outputs 2 or 3.
4. Press the **DATA/ENTER** button.
5. Press the **UP** or **DOWN** button until | *H2-XX=40*
Fault Annunciate | appears.
6. Press the **DATA/ENTER** button. | *Fault Data Input*
OF | appears.
7. From the following worksheet, 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.

For example, if you selected Set 2, you would enter "1 0" in the first two columns from the left, which would represent the first two digits of the first binary number that you would convert later.

Table 5-6:Binary-to-Hexadecimal Conversion 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
Set 2	1	0	OT1	OT2	LL1	LL2	UL1	UL2
Set 3	1	1	SLC	BE4	BE3	BE2	BE1	BE0

8. 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.

   For example, if Set 2 is selected and LL1 and UL1=1, "1 0 0 0" and "1 0 1 0 " would be the two 4-digit binary numbers.

9. Using the conversion table below, determine the 1-digit hexadecimal number for both 4-digit binary numbers.

Table 5-7:

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

Continuing with the example, "1 0 0 0" and "1 0 1 0 " converts to "8A."

10. Press the **UP** or **DOWN** and **>** button until the appropriate hexadecimal number appears for XX on *Fault Data Input XX*

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 (H1-01 to H1-06) for this purpose an external fault response must be selected. The table below shows the possible selections for an external fault response.

Table 5-8:

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

* Uses B5-08 timer

(1) N.O. = normally open contact; N.C. = normally closed contact
(2) Setting 24 is the factory default

Analog Inputs

The IMPULSE•VG+ Series 3 has three analog inputs (two multi-function and one reference) for the external input of numerous references and limits.

** Initial value is determined by X-Press Programming (Table 4-1 to 4-2).*

Parameter Code	Display	Function	Range	Initial Value	Access Level
H3-01*	Term A1 LvL SeL	Voltage for Terminal A1 analog input signal	0-1	0	Adv
	0 OVDC to 10VDC				
	1 -10VDC to +10VDC				
H3-02	Terminal A1 Gain	Gain multiplier for Terminal A1 analog input signal	0.0-1000.0%	100.0	
H3-03	Terminal A1 Bias	Bias multiplier for Terminal A1 analog input signal	-100.0–100.0%	0.0	
H3-04	Term A3 Signal	Voltage for Terminal A3 analog input signal	0-1	0	
	0 0VDC to 10VDC				
	1 -10VDC to +10VDC				
H3-05	Terminal A3 Sel	Assigns one of the following function analog input parameters to Terminal A3		1F	Adv
	0 Add to Term A1	*Auxiliary Reference*			
	1 Frequency Gain	*Frequency Gain*			
	2 Aux Speed Ref 1				
	3 Aux Speed Ref 2				
	5 Acc/Dec T Reduct	*Acceleration/Deceleration Time Reduction*			
	6 DC Brake Current				
	7 OT/UT Det Level	*Overtorque Detection Level*			
	9 Ref Lower Limit	*Speed Reference Lower Limit*			
	A Jump Frequency	*Jump Frequency*			
	E Motor Temperature	*Used in conjunction with L1-03, L1-04 and L1-05*			
	10 Fwd Torque Limit				
	11 Rev Torque Limit				
	12 Regen Torque Limit				
	13 Torque Reference				
	14 Torque Compensation				
	15 FWD/REV Torque Limit				
	16 Load Cell	*Weight input enable by C10-01=4*			
	17 Hook Height	*10V=100.0%*			
	1F Not Used	*Not Used*			
H3-06	Terminal A3 Gain	Gain multiplier for Terminal 16 analog input signal	0000.0–1000.0%	100.0	Adv
H3-07	Terminal A3 Bias	Bias multiplier for Terminal 16 analog input signal	-100.0–100.0%	0.0	Adv

Parameter Code	Display	Function	Range	Initial Value	Access Level
	Term A2 Signal	Terminal A2 Signal Level Selection	0-2	2	Adv
H3-08					
	0 *0 to +10VDC (Set S1-2 Dip Switch to Off) **				
	1 *-10 to +10VDC (Set S1-2 Dip Switch to Off) **				
	2 *4 to 20mA*	(S1-2 Dip Switch must be ON)			
H3-09	Terminal A2 Sel	Assigns one of the following function analog input parameters to Terminal A2.		0	Adv
	0 *Add to Term A1*	*Auxiliary Reference*			
	1 *Frequency Gain*	*Frequency Gain*			
	2 *Aux Speed Ref 1*				
	3 *Aux Speed Ref 2*				
	5 *Acc/Dec T Reduct*	*Acceleration/Deceleration Time Reduction*			
	7 *OT/UT Det Level*	*Overtorque Detection Level*			
	9 *Ref Lower Limit*	*Speed Reference Lower Limit*			
	A *Jump Frequency*	*Jump Frequency*			
	E *Motor Temperature*	*Used in conjunction with L1-03, L1-04 and L1-05*			
	10 *Fwd Torque Limit*				
	11 *Rev Torque Limit*				
	12 *Regen Torque Limit*				
	13 *Torque Reference*				
	14 *Torque Comp*				
	15 *FWD/REV Torque Limit*				
	16 *Load Cell*	*Weight input enable by C10-01=4*			
	17 *Hook Height*	*10V=100.0%*			
	1F *Not Used*	*Frequency Reference*			
H3-10	Terminal A2 Gain	Gain multiplier for terminal A2 analog input signal	0000.0–1000.0%	100.0	Adv
H3-11	Terminal A2 Bias	Bias multiplier for terminal A2 analog input signal	-100.0–100.0%	0.0	Adv
H3-12	Filter Avg Time	Analog input filter average time	0.00–2.00sec	0.00	Adv

* Damage may otherwise result. See page 3-11 for S1 Dip Switch Location

Analog Outputs

The IMPULSE•VG+ Series 3 has two analog outputs for the external monitoring of drive conditions.

Parameter Code	Display	Function	Range	Initial Value	Access Level
H4-01	Terminal FM Sel	Assigns one of the following function analog output parameters to Terminal FM	1-50	2	Adv
	1 Frequency Ref				
	2 Output Freq				
	3 Output Current				
	5 Motor Speed				
	6 Output Voltage				
	7 DC Bus Voltage				
	8 Output kWatts				
	9 Torque Reference				
	15 Term A1 Level				
	16 Term A2 Level				
	17 Term A3 Level				
	18 Mot SEC Current				
	19 Mot EXC Current				
	20 SFS Output				
	21 ASR Input				
	22 ASR Output				
	23 PG-Z2 Ch2				
	24 PID Feedback				
	26 Voltage Ref (Vq)				
	27 Voltage Ref (Vd)				
	29 Load Weight				
	30 SS Delta Speed				
	31 Not used				
	32 ACR (q) Output				
	33 ACR (d) Output				
	36 PID Input				
	37 PID Output				
	38 PID Setpoint				
	41 Cooling Fin Temperature				
	44 ASR OUT w/o filter				
	50 Hook Height				
H4-02	Terminal FM Gain	Gain multiplier for Terminal FM analog output signal	0.00–1000.0%	100.0	Adv
H4-03	Terminal FM Bias	Bias multiplier for Terminal FM analog output signal	-110.0–110.0%	0.0	Adv
H4-04	Terminal AM Sel	Assigns one of the above function analog output parameters to Terminal AM	(See H4-01)	3	Adv
H4-05	Terminal AM Gain	Gain multiplier for Terminal AM analog output signal	0.00–1000.0%	50.0	Adv

Parameter Code	Display	Function	Range	Initial Value	Access Level
H4-06	Terminal AM Bias	Bias multiplier for Terminal AM analog output signal	-110.0–110.0%	0.0	Adv
H4-07	AO Level Select 1 *0 0 to +10VDC* *1 -10 to +10VDC* *2 4 to 20 mA*		0-2	0	Adv
H4-08	AO Level Select 2 *0 0 to +10VDC* *1 -10 to +10VDC* *2 4 to 20 mA*		0-2	0	Adv

Serial Communication Set-up

The IMPULSE•VG+ Series 3 uses terminals R^+/R^-, S^+/S^- to communicate MODBUS RTU (RS-485/422) protocol.

Parameter Code	Display	Function	Range	Initial Value	Access Level
H5-01	Serial Com Adr	Serial communication address	0–20	1F	Adv
H5-02	Serial Baud Rate	Sets the baud rate		3	Adv
	0 1200 Baud				
	1 2400 Baud				
	2 4800 Baud				
	3 9600 Baud				
	4 19200 Baud				
H5-03	Serial Com Sel	Determines the parity	0–2	0	Adv
	0 No parity				
	1 Even parity				
	2 Odd parity				
H5-04	Serial Fault Set	Determines stopping method or fault at a serial fault occurrence		1	Adv
	0 Decel to Stop				
	1 Coast to Stop				
	2 Fast-Stop				
	3 Alarm Only				
H5-05	Serial Flt Dtct	Determines whether Serial Fault Detection is enabled		1	Adv
	0 Disabled				
	1 Enabled				
H5-06	Transmit Wait Tim	Send waiting time	5-65 ms	5	Adv
H5-07	RTS Control Sel	RTS Control enable/disable		1	Adv
	0 Disabled (RTS is always on)				
	1 Enabled (RTS is ON only when sending)				

NOTE: After changing any H5 parameter, power to the inverter must be cycled.

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

Pulse Input/Output

Parameter Code	Display	Function	Range	Initial Value	Access Level
H6-01	Pulse Input Sel *0 Frequency Reference* *1 PID Feedback* *2 PID Set Point*	Selects the function of Pulse Input Terminal RP	0–2	0	Adv
H6-02	Pulse In Scaling	Number of pulses equal to the maximum output frequency	1000-32000	1440 Hz	Adv
H6-03	Pulse Input Gain	Sets the output level when input is 100%	0.0-1000.0%	100.0	Adv
H6-04	Pulse Input Bias	Sets the output level when input is ONE	-100.0-100.0%	0.0	Adv
H6-05	Pulse In Filter	Sets the input filter time contant	0.00-2.00 sec	0.10 sec	Adv
H6-06	Pulse Moni Sel	Selects the function of pulse output terminal MP.	1, 2, 5, 20, 24, 31, 36	2	Adv
H6-07	Pulse Moni Scale	Item output by pulse monitor is selected by corresponding U1-□□ Value.	0-32000	1440 Hz	Adv

Protection Parameters

- L1 Motor Overload
- L2 Under Voltage Level
- L4 Ref Detection
- L6 Torque Detection
- L8 Hardware Protection
- L9 Automatic Reset

Motor Overload

The IMPULSE•VG+ Series 3 protects against motor overload with a UL-recognized, built-in electronic thermal overload function.

The electronic thermal overload function estimates motor temperature, based on inverter output current, frequency and time to protect the motor from overheating. When the thermal overload fault is activated, an “OL1” trip occurs, shutting OFF the inverter output and preventing excessive overheating in the motor. As long as the inverter is powered up, it continues to calculate the motor temperature.

When operating with one inverter connected to one motor, an external thermal relay is not needed. When operating several motors with one inverter, use the internal thermal protection from the motor or install an external thermal overload relay on each motor. In this case, set parameter *L1-01* to “0.”

Parameter Code	Display	Function	Range	Initial Value	Access Level
L1-01	MOL Fault Select	Enable/disable motor overload detection.	0-3	3	Adv
	0 Disabled				
	1 Std Fan Cooled				
	2 Std Blower Cooled				
	3 Vector Motor				
L1-02	MOL Time Const	Time for OL1 fault when motor current is ≥ 150% of the motor rated current.	0.1–20.0 min	8.0	Adv
L1-03	Mtr OH Alarm Sel	Operation when the motor temperature analog input exceeds teh OH3 alarm level. (1.17V) (H3-05 or 09 = E)	0-4	3	Adv
	0 Decel to Stop (Alarm)				
	1 Coast to Stop (Alarm)				
	2 Fast Stop by B5-08 (Alarm)				
	3 Alarm Only (OH3 Flashes)				
	4 Stop by B3-03 Method (Alarm)				
L1-04	Mtr OH Fault Sel	Operation when the motor temperature analog input exceeds the OH4 fault level. (2.34V) (H3-05 or 09 = E)	0-2	2	Adv
	0 Decel to Stop				
	1 Coast to Stop				
	2 Fast Stop by B5-08				
L1-05	Mtr Temp Filter	Motor temperature analog input filter time constant	0.00-10.00 sec	0.20	Adv

Power Loss Ride thru

Parameter Code	Display	Function	Range	Initial Value	Access Level
L2-01	PwrL Selection 0 Disabled 1 Enabled - drive will restart if power returns within L2-02 2 CPU Power Active - drive will restart if power returns before control supply shutdown	Enables/disables the Power Loss Ride thru function	0-2	0	Adv
L2-02	PwrL Ride thru t	Power Loss Ride thru time	0.0 - 25.5 sec	Varies	Adv
L2-03	PwrL BaseBlock t	Output turn on delay after power resumes	0.1 - 5.0 sec	Varies	Adv
L2-04	PwrL V/F Ramp t	Voltage recovery time after speed search is complete	0.0 - 5.0 sec	Varies	Adv
L2-05	PUV Det Level	Under voltage fault detection level	150 - 210 VDC	190	Adv

Reference Detection

The IMPULSE•VG+ Series 3 utilizes three different functions for detecting output frequency:

- *When frequency agree is enabled using the multi-function contact outputs (H2-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 (H2-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 (H2-XX="4", "5", "15" or "16"), the contact closes whenever the output frequency is less than or more than the speed agree detection level, depending on which detection is selected.*

Parameter Code	Display	Function	Range	Initial Value	Access Level
L4-01	Spd Agree Level	Speed Agree Level	0.0–150.0 Hz	0.0	Adv

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.

Parameter Code	Display	Function	Range	Initial Value	Access Level
L4-02	Spd Agree Width	Speed Agree Width	0.0–20.0 Hz	2.0	Adv

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

Parameter Code	Display	Function	Range	Initial Value	Access Level
L4-03	Speed Agree Lvl ±	Speed Agree Level ±	-150.0–150.0 Hz	0.0	Adv

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).

Parameter Code	Display	Function	Range	Initial Value	Access Level
L4-04	Speed Agree Width ±	Speed Agree Width ±	0.0–20.0 Hz	2.0	Adv

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

Torque Detection

The overtorque detection circuit activates when the motor load causes the motor current to exceed the overtorque detection level (L6-02). 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 (H2-XX=”B” or “17”).

Parameter Code	Display	Function	Range	Initial Value	Access Level
L6-01	Torque Det 1 Sel	Activates overtorque/ undertorque detection and selects whether detection generates an alarm or a fault		0	Adv
	0 Disable				
	1 OT At Speed Agree–Alarm				
	2 OT At Run–Alarm				
	3 OT At Speed Agree–Fault				
	4 OT At Run–Fault				
	5 UT At Speed Agree–Alarm				
	6 UT At Run–Alarm				
	7 UT At Speed Agree–Fault				
	8 UT At Run–Fault				

Table 5-9:

Setting	Description
0	Torque detection is disabled (*factory default*).
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. Contnuing running after detection (UT1 alarm).
7	Undertorque detection is enabled whenver 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.*

Parameter Code	Display	Function	Range	Initial Value	Access Level
L6-02	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	Adv
L6-03	Torq Det 1 Time	The overtorque detection delay time inserts a delay, between the time motor current (or torque) exceeds the overtorque level (L6-02) and when the overtorque detection function is enabled. The digital operator then displays “OL3”.	0.0–10.0 sec	0.1	Adv

Parameter Code	Display	Function	Range	Initial Value	Access Level
L6-04	Torq Det 2 Sel	Activates overtorque/ undertorque detection, and selects whether detection generates an alarm or a fault.		0	Adv
	0 Disable				
	1 At Speed Agree–Alarm				
	1 OT At Speed Agree–Alarm				
	2 OT At Run–Alarm				
	3 OT At Speed Agree–Fault				
	4 OT At Run–Fault				
	5 UT At Speed Agree–Alarm				
	6 UT At Run–Alarm				
	7 UT At Speed Agree–Fault				
	8 UT At Run–Fault				

Table 5-10:

Setting	Description
0	Overtorque/undertorque detection is disabled (*factory default*).
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. Contnuing running after detection (UT2 alarm).
7	Undertorque detection is enabled whenver 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 (*L6-01*), 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.

Parameter Code	Display	Function	Range	Initial Value	Access Level
L6-05	Torq Det 2 Lvl	Torque Detection 2 Level	0–300%	150	Adv
L6-06	Torq Det 2 Time	Torque Detection 2 Time	0.0–10.0 sec	0.1	Adv

Hardware Protection

The IMPULSE•VG+ Series 3 comes equipped with a number of built-in functions designed to protect the inverter and its components from damage.

Parameter Code	Display	Function	Range	Initial Value	Access Level
L8-02	OH Pre-Alarm Lvl	Sets the heatsink temperature level for protection against overheat (OH). Note: The inverter measures heatsink temperature by an negative temperature coefficient thermistor.	50–130°C	95°	Adv
L8-03	OH Pre-Alarm Sel	Selects the stopping method when heatsink overheat is detected.		4	Adv
	0 Decel to Stop	*(Decel to stop using B5-02)*			
	1 Coast to Stop	*(Immediate stop)*			
	2 Fast-Stop	*(Decel to stop using B5-08)*			
	3 Use B3-03 Method	*Uses programmed B3-03 Method*			
	4 Alarm Only	*(Operation continues and "OH Heatsink Overtemp" is displayed on keypad)*			
L8-05	PH Loss In Sel	Input phase loss detection		1	Adv
	0 Disabled				
	1 Enabled				
L8-07	PH Loss Out Sel	Output phase loss detection		2	Adv
	0 Disabled				
	1 1PH Loss Det				
	2 2/3PH Loss Det				
L8-09	Ground Fault Detect	Enables/disables ground fault detection		1	Adv
	0 Disabled				
	1 Enabled				
L8-10	Fan On/Off Sel	Cooling fan operation select		0	Adv
	0 Fan On-Run Mode				
	1 Fan Always On				
L8-11	Fan Delay Time	When L8-10 = 1, fan will operate L8-11 seconds after Run Command is removed	0-300 sec	60	Adv
L8-12	Ambient Temp	Adjusts Overload (OL2) Protection for high ambients	45-60°C	45°	Adv
L8-15	OL2 Sel @ L-Spd	Enables/disables OL when output frequency ≤ 6 Hz		0	Adv
	0 Disabled				
	1 Enabled				
L8-18	Soft CLA Sel	Enables/disables the software current limit function. Limits output frequency when current exceeds 110% of rated.		1	Adv
	0 Disabled				
	1 Enabled				

Automatic Reset

When a fault occurs during operation, the IMPULSE•VG+ Series 3 can be programmed for an auto restart operation to automatically reset the fault.

Parameter Code	Display	Function	Range	Initial Value	Level Access
L9-01	Reset Select	Activates the fault auto-reset function.	0-1	1	Adv
	0 Disabled				
	1 Enabled				
L9-02	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	Adv
L9-03	Reset Time	Sets the reset starting time	0.5–180.0 sec	0.5	Adv
L9-04*	Reset Flt Sel 1	Reset Fault Select 1.	0000–FFFF	0001	Adv
L9-05*	Reset Flt Sel 2	Reset Fault Select 2.	0000–FFFF	E000	Adv
L9-06	FLT Contact Sel	Fault contact operation during reset attempts	0-1	0	Adv
	0 No FLT Relay				
	1 FLT Relay active				

* To program constant L9-04 and L9-05, refer to the example on the following page and follow steps 1 through 4:

1. Sign 1 to each fault code that you wish to enable the auto reset.
2. Sign 0 to each fault code that you wish to disable the auto reset.
3. Convert all Digits (1 to 4) from binary to hex.
4. Program L9-04 and L9-05 by entering the hex number obtained from step 3.

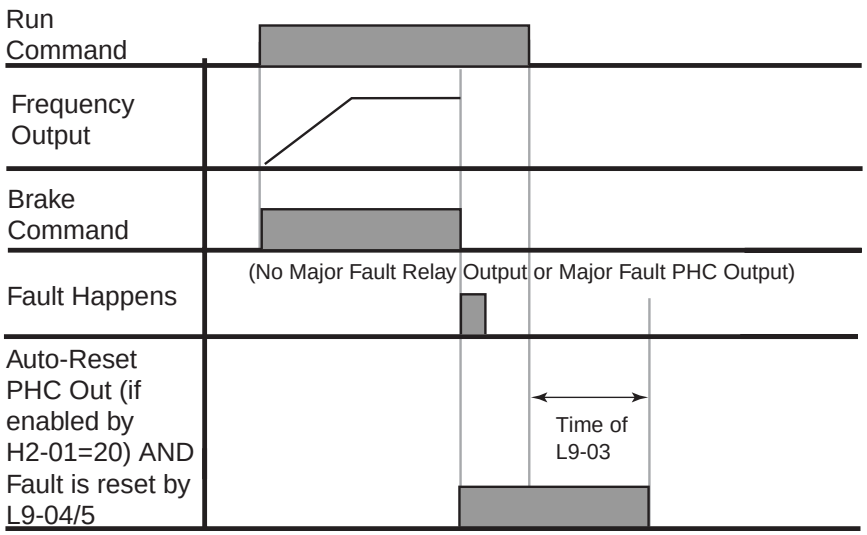


Figure 5-1: Automatic Fault Reset

Example:

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

Table 5-11:

	Digit 4				Digit 3				Digit 2				Digit 1			
HEX	2				0				0				1			
Binary	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
L9-04	EFO	---			LF	PF	UT1	UT2	OH1	SC	OV	GF	OC	UV3	UV2	UV1
HEX	0				0				8				0			
Binary	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
L9-05	BE1	BE2	BE3	FbL	OL1	OL2	Ot1	OT2	CE	CALL	EF8	EF7	EF6	EF5	EF4	EF3

Table 5-12:

L9-04	Binary	HEX
Digit 4	0010	2
Digit 3	0000	0
Digit 2	0000	0
Digit 1	0001	1

Table 5-13:

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
- 04 Copy Parameters

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 Monitor Parameters table on page 5-109 for available monitors by control method

Parameter Code	Display	Function	Range	Initial Value	Access Level
O1-01	User Monitor Sel	Assigns one of the following monitor parameter as user-selected monitor.	4-53	6	Adv
	4 Control Method				
	5 Motor Speed				
	6 Output Voltage				
	7 DC Bus Voltage				
	8 Output kWatts				
	9 Torque Reference				
	10 Input Term Sts				
	11 Output Term Sts				
	12 Int Ctl Sts 1				
	13 Elapsed Time				
	14 FLASH ID				
	15 Term A1 Level				
	16 Term A2 Level				
	17 Term A3 Level				
	18 Mot SEC Current				
	19 Mot EXC Current				
	20 SFS Output				
	21 ASR Input				
	22 ASR Output				
	23 PG-Z2 ch 2				
	24 PID Feedback				
	25 G5IN4 Reference				
	26 Voltage Ref (Vq)				
	27 Voltage Ref (Vd)				
	28 CPU ID				
	29 Load Weight				
	30 SS Delta Speed				
	32 ACR(q) Output				
	33 ACR(d) Output				
	34 OPE Detected				
	36 PID Input				

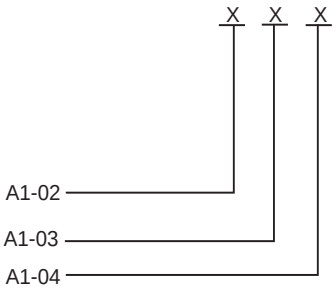
Parameter Code	Display	Function	Range	Initial Value	Access Level
	37 PID Output				
	38 PID Setpoint				
	39 Transmit Err				
	40 Fan Elapsed Time				
	41 Actual Fin Temp				
	44 ASR OUT w/o Fil				
	50 Hoook Height				
	51 Motor Revolution				
	52 Maintenance Timer				
	53 Index Count				
O1-02	Power-On Monitor	Selects the monitor to be displayed on the digital operator immediately after the power supply is turned on.		2	Adv
	1 Frequency Ref	(U1-01)			
	2 Output Freq	(U1-02)			
	3 Output Current	(U1-03)			
	4 User Monitor	(01-01)			
O1-03	Display Scaling	Units for parameters and monitor related to frequency reference and output frequency can be scaled as shown below.	0–39999	0	Adv

Table 5-14:

Setting (O1-03)	Description
00000	Unit: 0.01Hz (factory default)
00001	Unit: 0.01%
00002 to 00039	Unit: rpm (set O1-03 equal to the number of motor poles)
00040 to 39999 (user-selected units)	Digits: 5th 4th 3rd 2nd 1st 0 0 0 0 0 The first through fourth digits determine the set value at 100% output frequency. Decimal point position is set by the fifth digit as follows: 5th digit = 0: displayed as 0000 5th digit = 1: displayed as 000.0 5th digit = 2: displayed as 00.00 5th digit = 3: displayed as 0.000 Example 1 If 100% output frequency is equal to 200.0 units: Set O1-03=”12000”; 100% of this reference is displayed as 200.0 and 60% of this reference is displayed as 120.0. Example 2 If 100% output frequency is equal to 65.00: Set O1-03=”26500”; 60% of this reference is displayed as 39.00.

Parameter Code	Display	Function	Range	Initial Value	Access Level
O1-04	Display Units	Display units for motor speed		0	Adv
	0) Hertz				
	1) RPM				
O1-05	LCD Contrast	Adjusts brightness of the keypad display	0-5	3	Adv

Keypad Key Selection

Parameter Code	Display	Function	Range	Initial Value	Access Level
O2-01	Mode/Service Key	Pressing the Mode/Service Key once displays “Call ESI Service” 800-288-8178.		0	Adv
	0 Mode/Service				
		Pressing the Mode/Service Key a second time:  			
	1 Local/Remote	Local/remote key is enabled depressing the Mode/Service key switches operation command between the digital operator and the settings of B3-01 and B3-02.			
O2-02	Oper Stop Key	Selects the action when the digital stop key is pressed.		0	Adv
	0 Coast to Stop	(Immediate stop)			
	1 Decel to Stop				
	2 Use B3-03 Method				
O2-03	User Defaults			0	Adv
	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.			
O2-04	Inverter Model #	Determines the model number of the drive, which is based on the kVA rating. The following in this column are Electromotive Systems model numbers.	00-FF		Adv
	0 20P4	Not used.			
	1 20P7	Not used.			
	2 21P5	2007-FVG+S3			
	3 22P2	2009-FVG+S3			
	4 23P7	2015-FVG+S3			
	5 25P5	2023-FVG+S3			
	6 27P5	2031-FVG+S3			
	7 2011	2045-FVG+S3			
	8 2015	2058-FVG+S3			
	9 2018	2071-FVG+S3			
	A 2022	2085-FVG+S3			
	B 2030	Not Used.			

	C 2037	2145-FVG+S3			
	D 2045	Not Used			
	E 2055	2215-FVG+S3			
	F 2075	2283-FVG+S3			
	10 2090	2346-FVG+S3			
	20 40P4	4001-FVG+S3			
	21 40P7	4002-FVG+S3			
	22 41P5	4003-FVG+S3			
	23 42P2	4005-FVG+S3			
	24 43P7	Not Used			
	25 44P0	4008-FVG+S3.			
	26 45P5	4012-FVG+S3			
	27 47P5	4017-FVG+S3			
	28 4011	4024-FVG+S3			
	29 4015	4031-FVG+S3			
	2A 4018	4039-FVG+S3			
	2B 4022	4045-FVG+S3			
	2C 4030	4060-FVG+S3			
	2D 4037	4075-FVG+S3			
	2E 4045	4091-FVG+S3			
	2F 4055	4112-FVG+S3			
	30 4075	4150-FVG+S3			
	31) 4090	4180-FVG+S3			
	32 4110	Not Used.			
	33) 4132	4260-FVG+S3			
	34 4160	4304-FVG+S3			
	35 4185	4370-FVG+S3			
	36 4220	4477-FVG+S3			
	37 4300	4590-FVG+S3			
O2-05	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	Adv
	0 Disabled	ENTER Key Required	*Note: This feature cannot be used in conjunction with infinitely variable speed control.*		
	1 Enabled	ENTER Key Not Required			
O2-06	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.		1	Adv
	0 Disabled				
	1 Enabled				
O2-07	Elapsed Time Set	Viewable by U1-13	0–65535	0	Adv
O2-08	Elapsed Time Run	Defines the operation time that accumulates in the timer.		1	Adv
	0 Power-On Time				
	1 Running Time				
O2-10	Fan ON Time Set	Sets the initial fan operation timer value displayed in U1-40	0-65535	0	Adv

Clear History

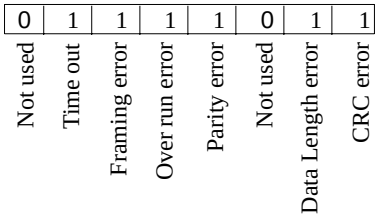
Parameter Code	Display	Function	Range	Initial Value	Access Level
O3-01	Flt Trace CLear	Clears fault history	0 to 1	0	Adv
	0 Not Clear				
	1 Clear U2/U3				
O3-02	Count Hist Clear	Clears count history.	0 to 3	0	Adv
	0 Not Clear				
	1 AC Count Clr	Clears AC operations (U3-09).			
	2 OL/LC Count Clr	Clears OL/LC (U3-10).			
	3 Both Count Clr	Clears Both (U3-09 and U3-10).			

Copy Function

Parameter Code	Display	Function	Range	Initial Value	Access Level
O4-01	Copy Function Sel	Copy parameters to/from keypad	0-3	0	Adv
	0 Copy Select				
	1 Inv –>OP Read				
	2 OP –> Inv Write				
	3 OP <–> Inv Verify				
O4-02	Read Allowable	Enables/disables copy function		1	Adv
	0 Disabled				
	1 Enabled				

Monitor Parameters

Parameter Code	Display	Function	Units
Monitor			
U1-01	Frequency Ref	Frequency Reference	Hz
U1-02	Output Frequency	Inverter Output Frequency	Hz
U1-03	Output Current	Inverter Output Current	A
U1-04	Control Method	Displays the value of A1-02	n/a
U1-05	Motor Speed	Motor Speed	Hz
U1-06	Output Voltage	Inverter Output Voltage (Reference)	V
U1-07	DC Bus Voltage	DC Bus Voltage (Measured)	V
U1-08	Output kWatts	Inverter Output Power (Calculated)	kW
U1-09	Torque Reference	Torque Reference (Internal)	%
U1-10	Input Term Sts	Input Terminal Status (See figure 5-35 for a detailed description.)	n/a
U1-11	Output Term Sts	Output Terminal Status (See figure 5-35 for a detailed description.)	n/a
U1-12	Int Ctl Sts 1	Operation Status (See figure 5-35 for a detailed description.)	n/a
U1-13	Elapsed Time	Elapsed Time. See O2-07 and O2-08.	hours
U1-14	Flash ID	Flash ROM software ID number	n/a
U1-15	Terminal A1 Level	External Terminal input level	V
U1-16	Terminal A2 Level	External Terminal input level	V/mA
U1-17	Terminal A3 Level	External Terminal input level	V
U1-18	Mot SEC Current	Motor secondary current (lq).	A
U1-19	Mot EXC Current	Motor excitation current (ld).	A
U1-20	SFS Output	Primary freq. after the SFS	Hz
U1-21	ASR Input	Monitors the input to the speed regulator. 100%=FMAX	%
U1-22	ASR Output	Monitors the output from the speed regulator. The motor's secondary current corresponds to 100%.	%
U1-23	PG-Z2 ch 2	Monitors the speed feedback from option card PG-Z2, channel 2 (when used)	HZ
U1-24	PID Feedback	PID feedback signal level	%
U1-25	G5IN4 Reference	See page 5-32.	Hex
U1-26	Voltage Reference (Vq)	Motor secondary voltage reference	V
U1-27	Voltage Reference (Vd)	Motor excitation voltage reference	V
U1-28	CPU ID	CPU software ID number	n/a
U1-29	Load Weight	Monitors load weight when C10-01 is enabled	tons
U1-30	SS Delta Speed	Snap Shaft Delta Speed between Ch1 and Ch 2 after gear ratio	HZ
U1-32	ACR (q) Output		%
U1-33	ACR (d) Output		%
U1-34	OPE Detected		const #
U1-35	Zero Servo Pulse	4 times pulses of movement during zero servo	n/a
U1-36	PID Input		%
U1-37	PID Output		%
U1-38	PID Set Point		%

Parameter Code	Display	Function	Units
U1-39	Transmit Error		n/a
U1-40	Fan Elapsed Time		Hr
U1-41	Actual Fin Temp		°C
U1-44	ARSR Out w/o Fil		%
U1-49	Occupation Rate	CPU Utilization	%
U1-50	Hook Height		%
U1-51	Motor Revolution	# of Rev's after UL2	n/a
U1-52	Maintenance Timer	Hours since last timer reset	Hr
U1-53	Index Count	Numer of encoder pulses the shaft has moved since the beginning of a new Index command in quadrature.	n/a

Fault Trace

U2-01	Current Fault	Displays current fault	
U2-02	Last Fault	Displays last fault detected	
U2-03	Frequency Reference	Freq ref when fault was detected	Hz
U2-04	Output Frequency	Output freq when fault was detected	Hz
U2-05	Output Current	Output current when fault was detected	A
U2-06	Motor Speed	Motor Speed when the "Last Fault" occurred	
U2-07	Output Voltage	Output voltage when fault was detected	V
U2-08	DC Bus Voltage	DC Bus voltage when fault was detected	V
U2-09	Output kWatts	Output power when fault was detected	kW
U2-10	Torque Reference	Torque Reference when the "Last Fault" occurred	
U2-11	Input Terminal Sts	Input terminal status when fault was detected	n/a
U2-12	Output Terminal Sts	Output terminal status when fault was detected	n/a
U2-13	Inverter Status	Inverter status before fault was detected	n/a
U2-14	Elapsed Time	Elapsed time when fault was detected	hours

Fault History

U3-01	Last Fault	Most recent fault	
U3-02	Fault Message 2	2nd most recent fault	
U3-03	Fault Message 3	3rd most recent fault	
U3-04	Fault Message 4	4th most recent fault	
U3-05	Elapsed Time 1	Elapsed time of most recent fault	
U3-06	Elapsed Time 2	Elapsed time of 2nd most recent fault	
U3-07	Elapsed Time 3	Elapsed time of 3rd most recent fault	
U3-08	Elapsed Time 4	Elapsed time of 4th most recent fault	
U3-09	Fault Message 5	5th most recent fault	
U3-10	Fault Message 6	6th most recent fault	
U3-11	Fault Message 7	7th most recent fault	
U3-12	Fault Message 8	8th most recent fault	
U3-13	Fault Message 9	9th most recent fault	
U3-14	Fault Message 10	10th most recent fault	

Parameter Code	Display	Function	Units
U3-15	Elapsed Time 5	Elapsed time of 5th most recent fault	
U3-16	Elapsed Time 6	Elapsed time of 6th most recent fault	
U3-17	Elapsed Time 7	Elapsed time of 7th most recent fault	
U3-18	Elapsed Time 8	Elapsed time of 8th most recent fault	
U3-19	Elapsed Time 9	Elapsed time of 9th most recent fault	
U3-20	Elapsed Time 10	Elapsed time of 10th most recent fault	
U3-21	Accumulated Operations	Counts Fwd or Rev Run commands	
U3-22	U3-21 Rollovers	Increments when U3-21 reaches 65535, U3-21 is then set to zero	
U3-23	OL/LC Count	Counts OL1, OL2 and LC faults	

Note: Faults such as CPF00, CPF01, CPF02, CPF03, UV1 and UV2 are not stored in fault history.

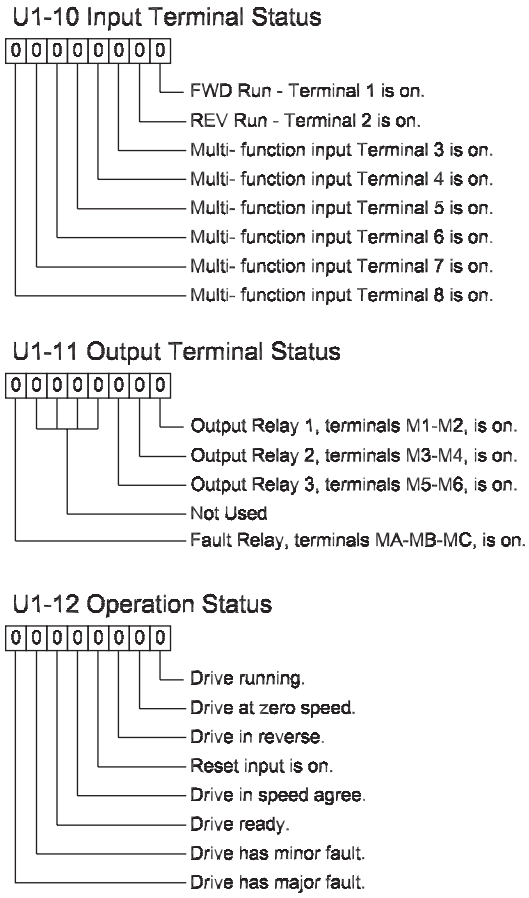


Figure 5-2: Status

c h a p t e r **6**

Troubleshooting IMPULSE•VG+ Series 3

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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•VG+Series 3.

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.

Motor Faults and Corrective Actions

Symptom	Corrective Action
Analog frequency reference is not stable. (drifting)	1. Stabilize the analog source. 2. Increase B2-02. 3. Increase B5-01, -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 (U1-10). 4. Motor 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.

Symptom	Corrective Action
Motor rotates, but at minimum speed only.	1. Check wiring of speed inputs. 2. Verify speed reference setting (A1-04). 3. Verify reference and run source settings are correct (B3-01, -02). 4. Verify reference priority setting (B1-18).
Motor RPM too high or too low.	1. Compare motor nameplate specifications with E1 parameter. 2. Check maximum frequency setting (E1-04). 3. Check minimum frequency setting (E1-09).

Drive Faults, Alarms and Indicators

Fault Code	Fault or Indicator Name/Description	Corrective Action
BB (flashing) Base Block	**External Base Block Indicator.** The flashing base block signal is the result of a multi-function input in the terminal strip. The base block indicates that the 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 H1-01 through H1-06 for proper programming. 2. Check terminal status. (U1-10)
BE0 (flashing) Brake Ans Lost	**Brake answer back signal is lost during run.** While running, the multi-function input brake answer back is lost.	1. Check brake answer back circuit. 2. Check terminal status. (U1-10)
BE1 Rollback detect	**Torque Proving Fault.** The BE1 fault indicates that the drive has released the brake, but 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 (C8-04) are greater then the expected number of pulses (C8-05).	1. Please reference troubleshooting encoder related faults on page 6-14.
BE2 No Current	**Torque Proving Fault.** Before the brake is released, the drive's current did not reach a predetermined level within a predetermined time.	1. Ensure the motor has been Auto-tuned successfully. 2. If a powerlimit switch is used, ensure that the switch is closed. 3. Decrease the values of C8-01 and C8-02 to no less then .5 seconds. *NOTE: The values of C8-01 and C8-02 should always remain equal.* 4. Decrease the value of C4-02 to no less than 5. 5. Decrease the value of C8-16 to no less than 50.
BE3 Brake Release NG	**Torque Proving Fault.** 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 (C8-06) are less than the expected number of pulses (C8-07).	1. Please reference encoder related faults on page 6-14.

Fault Code	Fault or Indicator Name/Description	Corrective Action
BE4 *(flashing)* Brake Answer 1	**Brake Answer-Back , Brake not Released.** At Start, Brake Answer-back is not input within predetermined time (C8-04) after electric brake release command is output–Electric brake not released.	1. Check brake answer back circuit. 2. Increase the value of C8-04. 3. Check terminal status (U1-10).
BE5 *(flashing)* Brake Answer 2	**Brake Answer-Back At Stop.** At Stop, Brake Answer-back signal is not removed within predetermined time (C8-11) after electric brake release command is removed–Electric brake not closed.	1. Check brake answer back circuitries 2. Increase the value of C8-11 time.
BE6 *(flashing)* Brake Stop Alarm	**Brake Proving Alarm.** 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 (C8-12) is greater than the expected number of pulses (C8-13).	1. Please reference troubleshooting encoder related faults on page 6-15.
BE7 Brake Welded	**Brake Answer-Back Major Fault.** At Power Up, Brake Answer-Back is on - Electric brake not closed.	1. Check if brake is closed. 2. Check brake answer back circuitry.
BUS Opton Com Err	**Option Card Communication Error.** Communication to the option card was lost.	1. Check all connections.
CALL (flashing) SI-F/G Com Call	**Serial Communication Transmission Error.** Control data is not received correctly after power supply is turned ON for 2 sec.	1. Check serial device connections. 2. Ensure drive is properly programmed for serial communication.
Can't Run Drive not ready	**User is giving a run command while a FWD or REV is present at Power Up.**	1. Check input terminals. 2. Check H1-01 to H1-06 programming.
CE Memobus Com Err	**Communication Error.** Serial communications disruption.	1. Check serial connections (6 CN). 2. Check H5-01 through H5-05 for proper programming.
CPF00 Com-Err (OP&INV)	**Control Circuit Fault 1— Keypad Transmission.** Because of external noise, excessive vibration or shock, or component failure (including RAM and PROM), one or both of the following occurs: • Transmission between the inverter and keypad cannot be established 5 sec after power-up. • External RAM of CPU is defective.	1. Check the keypad connection. 2. Replace keypad. 3. Replace Control board.
CPF01 Com-Err (OP&INV)	**Control Circuit Fault 2—Keypad Transmission.** 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.
CPF02 BB Circuit Err	**Base Block Circuit Fault.** 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.
CPF03 EEPROM Err	**EEPROM Fault.** Invalid data found in the EEPROM.	1. Cycle power. 2. Ensure that the control board terminals are shielded from electrical noise. 3. Replace Control board.

Fault Code	Fault or Indicator Name/Description	Corrective Action
CPF04 Internal A/D Err	**Internal A/D Converter Fault.** CPU internal analog-digital converter fault.	1. Cycle power. 2. Ensure that the control board terminals are shielded from electrical noise. 3. Replace Control board.
CPF05 External A/D Err	**External A/D Converter Fault.** CPU external analog-digital converter fault.	1. Cycle power. 2. Ensure that the control board terminals are shielded from electrical noise. 3. Replace Control board.
CPF06 Option Error	**Option Card Fault.** Optional card has disconnected or failed.	1. Power down. 2. Verify proper installation of all option cards.
CPF10 ASIC-ERR	**ASIC Version Fault 10.** .	1. Cycle power. 2. Replace the drive.
CPF20 Option A/D Error	**Control Circuit Fault 20 — AI-14.** Analog-to-digital converter fails or analog speed reference error.	1. Power down. 2. Verify proper installation of AI-14B. 3. Replace AI-14B card.
CPF21 Option CPU Down	**Control Circuit Fault 21 — CPU on Optional Card.** CPU on an installed optional card fails.	1. Power down. 2. Verify proper installation of Option card. 3. Replace card.
CPF22 Option Type Err	**Control Circuit Fault 22 — Optional Card Code.** Optional card code is not compatible with the inverter.	1. Power down. 2. Verify proper card. 3. Verify proper installation of Option card. 4. Replace card.
CPF23 Option DPRAM Err	**Control Circuit Fault 23 — DP-RAM.** DP-RAM on an installed optional card failed.	1. Power down. 2. Remove any inputs to card. 3. Verify proper installation of Option card. 4. Replace card.
Dev Speed Deviation	**Speed Deviation Fault.** Occurs when the deviation of the speed reference and speed feedback exceeds the regulation level, F1-10 for the time F1-11.	1. Please reference troubleshooting encoder related faults on page 6-12.
EF *(flashing)* External Fault	Both FORWARD/UP and REVERSE/DOWN commands are input at same time for 500 msec or longer.	1. Check control input wiring. 2. Check the sequence of operation.
EF0 Optional External Fault	External fault input from communication option card.	1. Check communication option card connection and signals.
EF3 External Fault 3	External fault occurs on Terminal S3.	1. Check constant H1-01 for proper programming. 2. Check the condition of the input terminal S3.
EF4 External Fault 4	External fault occurs on Terminal S4.	1. Check constant H1-02 for proper programming. 2. Check the condition of the input terminal S4.
EF5 External Fault 5	External fault occurs on Terminal S5 external control circuit.	1. Check constant H1-03 for proper programming. 2. Check the condition of the input terminal S5.

Fault Code	Fault or Indicator Name/Description	Corrective Action
EF6 External Fault 6	External fault occurs on Terminal S6 external control circuit	1. Check constant H1-04 for proper programming. 2. Check the condition of the input terminal S6.
EF7 External Fault 7	External fault occurs on Terminal S7 external control circuit.	1. Check constant H1-05 for proper programming. 2. Check the condition of the input terminal S7.
EF8 External Fault 8	External fault occurs on Terminal S8 external control circuit.	1. Check constant H1-06 for proper programming. 2. Check the condition of the input terminal S8.
ERR EEPROM R/W Err	**EEPROM Read/Write Fault.** EEPROM internal data did not match when initializing the parameter.	1. Cycle Power. 2. User initialize (A1-05=1110). 3. Replace Control board.
Fbl Feedback Loss	**PID Feedback Loss.** Occurs when PID Feedback loss is detected by D7-13.	1. Verify drive is programmed to receive the feedback signal.
GF 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.	1. Disconnect motor from drive and check it for shorts using a megger. 2. Ensure that R/C Surge Suppressors are used across all brake contactor coils to prevent disturbance by electrical transients.
LC Load Check Err	**Load Check Fault.** Load is greater than specified amount.	1. Reduce Load. 2. Check Load Check sequence set-up. (C5-XX).
LF Output Phase Loss	An open phase occurred at the inverter output.	1. Check for broken wires in output cable. 2. Check for open winding in the motor. 3. Check for loose terminals
LL1 *(flashing)* Lower Limit 1 Err	**Lower Limit 1—SLOW DOWN Indicator.** Lower Limit 1—SLOW DOWN is input (switch status is changed).	1. May not require corrective action. 2. Check the Limit Switches position. 3. Check the Limit Switches condition.
LL2 *(flasing)* Lower Limit 2 Err	**Lower Limit 2—STOP Indicator.** Lower Limit 2—STOP is input (switch status is changed).	1. May not require corrective action. 2. Check the Limit Switches position. 3. Check the Limit Switches condition.
MNT Maintenance Reqd	**Maintenance Required Alert.** Running time has exceeded C12-05	1. Reset timer by MFI=5A or depress Mode/ Service key three times and enter within 2 seconds.
OC Over Current	Output current exceeds 200% of inverter rated output current.	1. Check for a phase-to-phase short in the motor or wiring using a megger. 2. Extend the acceleration/deceleration time. 3. Check torque limit setting. 4. Please reference troubleshooting encoder related faults on page 6-12.
OH (flashing) Heatsnk Over temp	**Overheat Pre-Alarm.** Heatsink is overheating. The temperature of the inverters heatsink exceeded the setting in L8-02.	1. The inverter cooling fan has stopped. 2. Reduce the ambient temperature.

Fault Code	Fault or Indicator Name/Description	Corrective Action
OH1 Heatsink MaxTemp	**Overheat Fault.** There are two situations that result in an overheat fault. The first occurs when the measured heat sink exceeded 105°C. The second is a result of a fault in the internal 24VDC cooling fan.	1. Ensure that the heat sink cooling fans are functioning. 2. Ensure that the heat sink is free from dirt and debris. 3. Ensure that the inverter's ambient temperature is within specification. 4. Replace the 24VDC fan 5. Replace the heat sink thermistor(s)
OH2 (flashing) Overheat 2	**Overheat Alarm.** Signal is input by external terminal. H1-XX=39	
OH3 Motor Overheat 1	**Motor Overheating 1.** Thermister analog input detected motor overheating. See L1-03	1. Check the motor rated current value, E2-01. 2. Increase cycle time or reduce the load.
OH4 Motor Overheat 2	**Motor Overheating 2.** Thermister analog input detected motor overheating. See L1-04	
OL1 Motor Overloaded	**Motor Overload Fault.** Inverter output exceeded the motor overload level.	1. Ensure drive is programmed with proper motor full load Amps (E2-01). 2. Reduce the load.
OL2 INV Overload	**Inverter Overload Fault.** Inverter output exceeded the inverter overload level.	1. Reduce the load. 2. Extend the acceleration time.
OT1 Overtorque Det 1	**Overtorque Detection Level 1 Fault.** Defined by L6-02. Alarm defined by L6-01.	1. Check for proper programming for L6-XX constant.
OT2 Overtorque Det 2	**Overtorque Detection Level 2 Fault.** Defined by L6-05. Alarm defined by L6-04.	1. .Check for proper programming for L6-XX constant.
OPE01 kVA Selection	**kVA Setting Fault.** Inverter kVA setting range is incorrect.	1. Check 02-04 constant for proper kVA.
OPE02 Limit	**Setting Out of Range .** Parameter setting is out of range.	1. With the fault displayed on the keypad, press the DATA/ENTER key to reveal the "Out of Range" parameter via the U1-34 monitor. 2. Verify that E2-03 is < E2-01. 3. Verify E1-05 is within range. 4. Compare Modified constants with defaults. 5. Cycle Power.
OPE03 Terminal	**Multi-Function Input Setting Fault.** Set values other than "F" and "FF" are duplicated.	1. Check the settings for H1-01 to H1-06, verify that the same input is not used twice.
OPE05 Sequence Select	**Sequence Select Setting Fault.** B3-01=3 and no option is plugged in.	1. Check the function selection or plug in optional card.
OPE06 PG Opt Missing	**Missing PG Card.** A closed loop control method was selected, and the required PG feedback card is not installed.	1. Install the required option card. 2. Remove power and reset the option card. 3. Check the A1-02, control method, program setting
OPE07 Analog Selection	**Multi-Function Analog Input Setting Fault.** H3-05 and H3-09 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
OPE08 Terminal	**Selection Parameter error.** A parameter has been changed that is not available in the present control method. Example: H1-08=72 (Zero Servo Command) is set while the drive is in Flux Vector Control (A1-02=3), then the Control Method is changed to Open Loop Vector (A1-02=2).	1. Undo the last parameter change (if known) 2. Scroll through modified constants for obvious setting errors. 3. Perform a user initialize (A1-05=1110) **CAUTION: All settings will be restored to the factory defaults.**
OPE10 V/F Ptrn Setting	**V/F Parameter Setting Error.**	1. Check Parameters E1-04 to E1-11.
OPE11 Carrier Frq/On-Delay	**Carrier Frequency Parameter Error.**	1. Check Parameters D10-01 to D10-05.
OPE18 Weight Measure	**C10-05 or C10-06 Setting Error.**	1. Satisfy condition C10-05 > C10-06
OPE19 Stp-Mthd & Ctrl	**Incompatible Setting of Stopping Method and Control Method.**	1. Satisfy B3-03 $\geq$ 6 and A1-02 $\leq$ 1.
OPE21 2 Channel Missing	**Option Card PG-Z2 or PG-W2 is missing when C11-08 is Enabled.**	1. Install correct option card.
OPE22 Ctrl & Motion	**Incompatible Setting of Motion and Control Mode.**	1. Satisfy A1-02 $\leq$ 1 and A1-03 $\geq$ 2.
OPE23 Load Check	**Load Check setting error.**	1. Check C5-04 < C5-07 < C5-09.
OPE24 Slack Cable	**Slack Cable setting error.**	1. Check C11-04<C11-06 and C11-05>C5-07.
OPR Oper Disconnect	**Keypad Disconnected.** The keypad is removed while the inverter is running, and the run command was initiated via the keypad RUN key.	1. Secure the keypad. 2. Verify O2-06 setting.
OS-1, OS-2 Over Speed	**Overspeed Fault.** The motor has exceeded the programmed detection level and time. This is typically caused by an overshoot condition due to an over-responsive ASR loop. If the drive is programmed to flux vector "torque control" mode, and no load is present, an overspeed fault will typically occur.	1. Check the Automatic Speed Regulator settings, D4 sub group. 2. Check setting of F1-08, F1-09. 3. Verify proper encoder PPR setting, F1-01.
OV DC Bus Overvolt	**Overvoltage Fault.** The main circuit direct current voltage exceeded the overvoltage level. Detection level: 230V class—approx. 400V 460V class—approx. 800V	1. Extend the deceleration time. 2. Check for proper DBU operation. 3. Check the resistor. 4. Check the line voltage.
OV (flashing) DC Bus Overvolt	**Overvoltage Fault.** Overvoltage occurs during stop. Main circuit DC voltage rises above the detection level while the drive output is off. Detection level: 410V or more for 230V, 820V or more for 460V.	1. Check the line voltage.
PF Input Pha Loss	**Input Phase Loss Fault.** Inverter input power supply has open phase.	1. Check the line voltage and fuses. 2. Remove power. 3. Retighten the input terminal screws.
PGO-1 PG Open Ch1	**Pulse Generator Channel 1 Fault.** 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 6-12.

Fault Code	Fault or Indicator Name/Description	Corrective Action
PGO-2 PG Open 2 (Applies only with PG-Z2 Option Card)	**Pulse Generator Channel 2 Fault.** 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 6-12.
PUF DC Bus Fuse Open	**DC Bus Fuse Open Fault.** The DC fuse is open.	1. Check for damaged transistor. 2. Check load-side short circuit. 3. Check grounding. *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".*
RR DynBrk Transistr	**Braking Transistor Fault.** Internal Braking transistor failed.	1. Verify that the external braking resistor is connected to the proper terminals. 2. Confirm that the proper resistor is installed. 3. Check for a short circuit across the braking resistor.
SC Short Circuit	**Short Circuit Fault.** 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.
SLC Slack Cable Detection	**Slack Cable Fault.** A hoist slack cable condition occurred.	1. May not require corrective action. 2. Check proper programming of Slack Cable Detection (C11-XX).
SNAP Snapped Shaft	**Snapped Shaft Fault.** 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.
SVE Zero Servo Fault	**Zero-Servo Fault.**	1. Check Zero-Servo sequence set-up.
UL1 Upper Limit 1 Err	**Upper Limit 1—SLOW DOWN Indicator.** Upper Limit 1—SLOW DOWN switch status is changed.	1. May not require corrective action. 2. Check the limit switches location. 3. Check the limit switches condition.
UL2 Upper Limit 2 Err	**Upper Limit 2—STOP Indicator.** Upper Limit 2—STOP switch status is changed.	1. May not require corrective action. 2. Check the limit switches location. 3. Check the limit switches condition.
UT1 Undertorque Det 1	**Undertorque Detection 1.** The current is less than L6-02 for more than L6-03**.**	1. Check settings. 2. Check motor coupling.
UT2 Undertorque Det 2	**Undertorque Detection 2.** The current is less than L6-05 for more than L6-06**.**	1. Check settings. 2. Check motor coupling.
UV DC Bus Undervolt	**Undervoltage Fault.** Undervoltage status occurs for more than 2 sec during STOP. Input voltage drops below 190V DC or less for 230V AC class, 380V DC or less for 460V AC class.	1. Check the power source wiring. 2. Replace any bad branch fuses. 3. Check collector system.
UV1 DC Bus Undervolt	**Undervoltage 1 Fault.** Undervoltage status occurs for more than 2 sec during RUN command. Input voltage drops below 190V DC or less for 230V AC class, 380V DC or less for 460V AC class.	1. Check power supply wiring. 2. Correct the line voltage. 3. Check collector system.

Fault Code	Fault or Indicator Name/Description	Corrective Action
UV2 CTL PS Undervolt	**Undervoltage 2 Fault.** The inverter detected a loss of the 24V logic power supply voltage.	1. Check power supply wiring. 2. Correct the line voltage. 3. Check collector system.
UV3 MC Answerback	**MC Fault.** The pre-charge contactor opened during operation.	1. Check power supply wiring. 2. Correct the line voltage. 3. Check collector system. 4. Wait 30-45 seconds before restarting drive after auto shut down.

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 C8-10, 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 (B5-01, B5-02, or C1-02).

   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 are 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 (F1-10).

10. After the corrective action has been taken and the fault no longer occurs then the load float time, C8-10, 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.

   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 C8-10, should be set to zero until the source of the PGO Fault has been determined and corrected. Disable PGO hardware detection with F1-20 or F1-21.

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 exist 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 again attempting to operate the hoist.

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 check 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, C8-10, 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 (C8-04) are greater than the expected number of pulses (C8-05). This is typically caused by the drive/motor have 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.

   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.

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 C8-05 to no more than 800.

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 (C8-06) are less than the expected number of pulses (C8-07).

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.

   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.

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 C8-04 is equal to the brake's mechanical delay time.

6. Increase the value of C8-06 to no more than 1 second.

7. Decrease the value of C8-07 to no less than 10.

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 (C8-12) is greater than the expected number of pulses (C8-13).

NOTE: This fault typically indicates a failed brake. Power should <u>NOT</u> 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.

   3.1 Each of the encoder signals should be checked for excessive noise.

   3.2 The shielded encoder cable should be properly grounded.

   3.3 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 C8-11 is equal to the brake's mechanical delay time.

6. Increase the value of C8-13.

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 (C7-01 to C7-04) have been changed. If these parameters have been changed to allow a higher torque value, it could cause over current 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.

Fault Display	Fault or Indicator Name/Description	Corrective Action
Er-01 Fault	**Motor Data Fault**. Motor data input fault for auto-tuning. Relationship between motor output and motor rated current fault. Relationship between input motor rated current and set no-load current fault (at vecotr control mode and line-to-line resistance tuning.)	• Check input data. • Check inverter and motor capacity • Check motor rated current and no-load current.
Er-02 Minor Fault	**Alarm**. The minor fault is detected during auto-tuning.	• Check input data. • Check wirings • Check load.
Er-03 STOP Key	**STOP Key Input**. The stop key is pressed during auto-tuning.	
Er-04 Resistance	**Line to Line Resistance Fault**. Auto-tuning is not completed within the expected time. The auto-tuning is outside the parameter setting.	• Check input data. • Check motor wiring. • If a motor and a load are connected, disconnect the motor from machinery system.
Er-05 No-Load Current	**No-load Current Fault.** Auto-tuning is not completed within the expected time. The auto-tuning is outside the parameter setting.	
Er-08 Rated Slip	**Rated Slip Faul**t. Auto-tuning is not completed within the expected time. The auto-tuning is outside the parameter setting.	
Er-09 Accelerate	**Acceleration Fault**. The motor did not accelerate at the expected time.	• Increase B5-01 (acceleration time). • If C7-01 and C7-02 (torque limit value) are decreased, increase values. • If a motor and a load are connected, seperate the motor from the load.
Er-11 Motor Speed	**Motor Speed Fault (Rotation type tuning only).** The motor speed was over 100% at auto-tuning (vector control without PG only).	• Increase B5-01 (acceleration time). • If a motor and a load are connected, seperate the motor from the load.
Er-12 I.det.Circuit	**Current Detection Fault.** Current exceeded the motor rated current.	• Release brake. • Check for open motor lead.
Er-13 Leakage Inductance	**Leakage Inductance Fault**. Auto-tuning did not finish within the set time.	• Check the T1 parameters. • Check motor wiring.
End 1 V/F Oversetting	**Excess V/f setting * (Rotation type tuning only).** The torque reference exceeded 100% and no load current exceeded 70%.	• Check the T1 parameters. • Disconnect the motor from the load.
End 2 Saturation	**Motor Iron Core Saturation Coefficient Fault (Rotation type tuning only)** Since the motor iron core saturation coefficient could not be auto-tuned within the set time, tentative value is set in the iron core saturation coefficient**.**	• Check the T1 parameters. • Check motor wiring. • Disconnect the motor from the load
End 3 Rated FLA Alm	**Rated Current Set Alarm**. Motor current during tuning was greater than the set value.	• Check E2-01.

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

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 drives main and control wiring from the terminal strips. Obtain reading as specified in the table on the next page, and ensure that the reading falls within the normal reading range.

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

Device	VOM (on RX1 Scale)		Normal Reading (Analog Meter)	Normal Reading (Digital Meter)
	Positive Lead	Negative Lead		
Input Rectifier Bridge *1	L1	+	7–100Ω	Approximately 0.5 V
	L2	+		
	L3	+		
	–	L1		
	–	L2		
	–	L3		
	L1	–	Infinite Ω	OL Displayed
	L2	–		
	L3	–		
	+	L1		
	+	L2		
	+	L3		
Bus Capacitors	+	–	Observe gradually increasing resistance	Observe gradually increasing voltage to OL
Pre-charge Resistor	–	Across the Resistors	100 Ω or less	–
Output Transistors *2 *3	T1	+	7-100 Ω	Approximately 0.5V
	T2	+		
	T3	+		
	–	T1		
	–	T2		
	–	T3		
	T1	–	Infinite Ω	OL Displayed
	T2	–		
	T3	–		
	+	T1		
	+	T2		
	+	T3		
Braking Diode (2006–2033) (4001–4039)	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 Ω between + and any output terminal unless you install a temporary jumper across the resistor.

Braking Circuit

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

Step No.	Ohmmeter Positive Lead	Ohmmeter Negative Lead	Expected Reading (Analog Meter)	Expected Reading (Digital Meter)
1	Connect to B2	Connect to B1	10 Ohms	0.5 Volts
2	Connect to B1	Connect to B2	Infinite Ohms	0L displayed
3	Connect to B2	–	Infinite Ohms	0L displayed
4	–	Connect to B2	Infinite Ohms	0L displayed

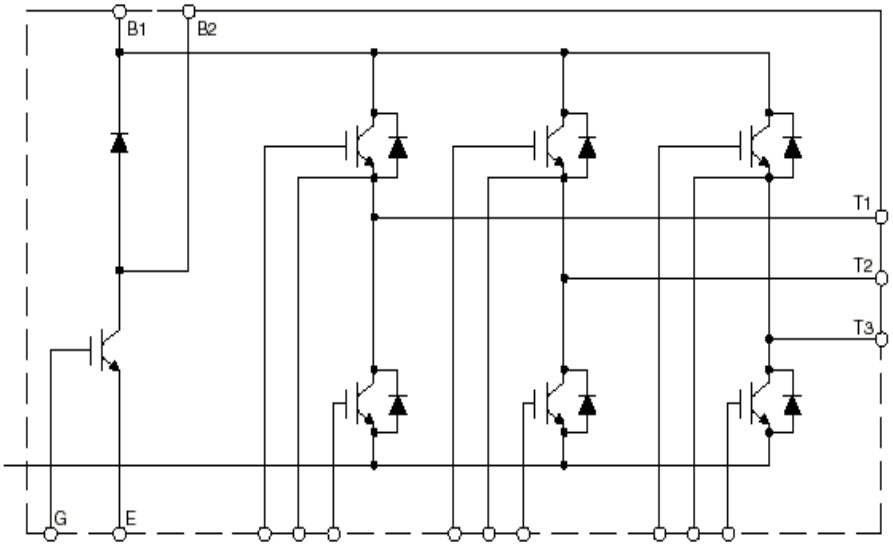

Figure 6-1

Appendix A

IMPULSE•VG+ Series 3
Parameter Listing

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IMPULSE•VG+ Series 3 Parameter Listing

No.	Parameter Name.	Factory	Ref Page#.
A1-01	Access Level	2	4-9
A1-02	Control Method	3	4-9
A1-03	Motion	0 or 2	4-10
A1-04	Speed Ref	1	4-10
A1-05	Initialize Parameters	0	4-14
A1-06	Password 1	0	4-14
A1-07	Select Password 1	0	4-14
A2-01 to A2-32	User Parameters	---	4-14
B1-01	Reference 1	15	5-3
B1-02	Reference 2	30	5-3
B1-03	Reference 3	60	5-3
B1-04	Reference 4	45	5-3
B1-05	Reference 5	60	5-3
B1-06	Reference 6	0.0	5-3
B1-07	Reference 7	0.0	5-3
B1-08	Reference 8	0.0	5-3
B1-09	Reference 9	0.0	5-3
B1-10	Reference 10	0.0	5-3
B1-11	Reference 11	0.0	5-3
B1-12	Reference 12	0.0	5-3
B1-13	Reference 13	0.0	5-3
B1-14	Reference 14	0.0	5-3
B1-15	Reference 15	0.0	5-3
B1-16	Reference 16	0.0	5-3
B1-17	Jog Reference	6.00	5-3
B1-18	Ref Priority	0	5-3
B2-01	Ref Upper Limit	100.0	5-5
B2-02	Ref Lower Limit	4.0	5-5
B2-03	Ref 1 Lower Limit	2.0	5-5
B2-04	Alt Upper Limit	100.0	5-5
B3-01	Reference Source	1	5-6
B3-02	Run Source	1	5-6
B3-03	Stopping Method	*	5-7
B3-04	Reverse Motor Direction	0	5-9
B3-05	Zero-Speed Operation	0	5-9
B3-06	Control Input Scans	1	5-10
B3-07	Local/Remote Run Select	0	5-10
B3-08	Run Command at Program	0	5-10
B3-10	Allow Run at Power Up	0	5-10
B4-01	MOP Ref Memory	0	5-10
B4-02	Trim Control Level	10	5-11
B5-01	Acceleration Time 1	5.0	5-12

No.	Parameter Name.	Factory	Ref Page#.
B5-02	Deceleration Time 1	3.0	5-12
B5-03	Acceleration Time 2	1.0	5-12
B5-04	Deceleration Time 2	1.0	5-12
B5-05	Acceleration Time N Change	1.0	5-13
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