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Welcome!

IMPULSE•VG+ Series 2 represents the second generation of our high-performance flux vector crane controls. It goes far beyond the scalar (voltage and frequency control) drive designs by having *true torque-control* capabilities. The IMPULSE•VG+ Series 2, which is designed for a closed-loop system, is ideal for hoists without mechanical load brakes and for very high-performance traverse applications.

Incorporating a pulse-width-modulated (PWM), flux vector design, IMPULSE•VG+ Series 2 generates the optimum current waveform, which gives you impressive torque and speed motor control. The drive offers a 1000:1 speed range — compared to a 3:1 range for two-speed motors and a 10:1 range for wound-rotor motors.

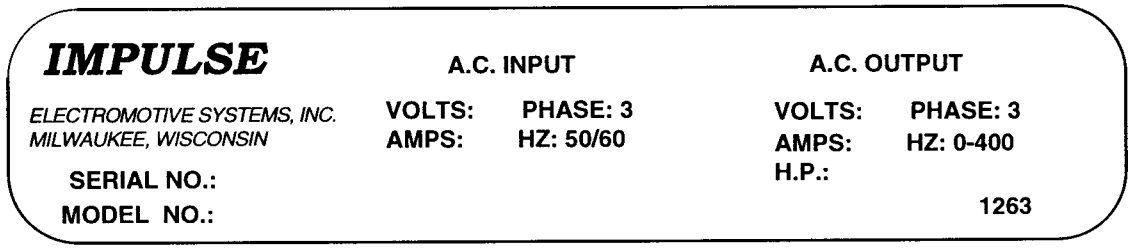
Here's a sample of IMPULSE•VG+ Series 2's special features and how they can help you improve your overhead material handling performance:

- Distinct speed control (up to five speeds) as well as infinitely variable speed control are provided; you can use pendant pushbutton stations, infrared or radio controls, or joysticks.
- An English, plain-language liquid crystal display (2 lines, 16 characters per line) makes programming, troubleshooting, and operating the drive easy.
- Built-in Serial Communication (9600-baud modbus) provides reliable digital linkage among the various crane system peripherals, including our line of PulseStar™ Remote Crane Controls.
- Micro-Positioning Control™ is used to place loads with a high degree of precision, eliminating the need to jog or plug your motors.
- A compact circuit design gives the drive a small footprint.
- Ultra-Lift™ capabilities enhance productivity by allowing the overspeeding of any load less than full load.
- Safe Operating Windows™ prevents you from programming the drive with unsafe parameters.
- Automatic Keypad Lockout™ and a snap-in, removable keypad helps you limit programming access and reduce the possibility of programming errors.
- Load Check™ prevents you from overstressing equipment by attempting to lift a load beyond the capacity of the crane or hoist.
- Weight Measurement enables you to weigh a load with an accuracy of ±5 percent of full load.
- Phase Loss Detection causes the drive to fault and commands the electric brake to set if an input or output phase loss occurs.
- Quick Stop™ ensures a rapid deceleration to stop once a drive RUN command is removed, reducing the possibility of a crane collision.
- Reverse Plug Simulation™ allows you to change the direction of travel (motor's phase sequence) very rapidly before the electric brake can be set.
- Flash ROM stores the drive system's last four fault occurrences in the drive's memory—even after power-down—for diagnostic purposes.

- Slack Cable Detection identifies slack cable conditions and adjusts outputs to immediately stop lowering.
- Load Float Start & Stop, with the crane fully at rest (without electric brakes set), allows the precise placement of critical loads without rollback or delays because of electric brake operation.
- Motor Changeover Capability allows you to use one inverter for two motors (e.g., main and auxiliary hoists) with different motor characteristics.
- A 120V Control Voltage Interface Card gives you direct access to a 120V user input device (e.g., pendant) without adding electromechanical components.
- Elapsed Time Counter (with fault history) indicates actual operation time, total power-up time, and the elapsed time between fault occurrences.

Identifying Your Drive

If you ever have to contact Electromotive Systems about your drive, first determine the model and serial numbers of your drive by looking at the nameplate shown below.



This nameplate is located on the side of the drive nearest to the keypad.

IMPULSE•VG+ Series 2 General Specifications

230V Class

Specification	Specification Values and Information for Each 230V-Class Model (####-FVG+)												
	2006	2008	2011	2017	2025	2033	2054	2068	2080	2130	2160	2224	2300
Rated current (A)	6	8	11	17.5	25	33	54	68	80	130	160	224	300
Capacity (kVA)	2.3	3.0	4.2	6.7	9.5	13	19	24	30	50	61	85	110

460V Class

Specification	Specification Values and Information for Each 460V-Class Model (####-FVG+)																			
	4001	4003	4005	4008	4011	4014	4021	4028	4034	4041	4052	4065	4080	4096	4128	4165	4224	4302	4450	4605
Rated current (A)	1.9	3.6	5.1	8.5	11.7	14.8	21	28.6	34	41	52	65	80	96	128	165	224	302	450	605
Capacity (kVA)	1.4	2.6	3.7	6.1	8.4	11	16	21	26	31	40	50	61	73	98	130	170	230	340	460

230V and 460VClasses

Specification	Specification Value and Information for All Models
Certification	UL, CSA
Rated input power supply volts & freq	3-phase 200/400, 208/415, 220/440, or 230/460VAC; 50 or 60 Hz
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)	3-phase 200/400, 208/415, 220/440, 230/460, or 480VAC; (maximum depends on input supply voltage)
Rated frequency (Hz)	Up to twice motor nameplate RPM (Ultra-Lift)
Output speed control range	1000:1
Output frequency accuracy	.01%—with digital reference command, -10° to 40° C; .1%—with analog reference command; 10 bits/10V; 25° C ±10° C
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 (optional); serial (optional)
Accel/decel times	0.1 to 25.5 sec—2 sets; 4 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	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	400/800VDC
Undervoltage protection level	190/380VDC
Heatsink overtemperature	Thermostat trips at 90° 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, and roll-back detection
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 104° F (-10° to 40° C) for NEMA 1; 14° to 122° F (-10° to 50° C) for open chassis
Storage temperature	-4° to 140° F (-20° to 60° C)
Humidity	90% relative; noncondensing
Vibration	1 G less than 20 Hz; 0.2 G for 20–50 Hz

chapter 1

Installing and Wiring IMPULSE•VG+ Series 2

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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.
- Do not connect the control board terminals, which are the 27 two-tiered terminals, directly to the 120VAC user input device.
- Before executing Built-In 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 this chapter apply to most IMPULSE•VG+ Series 2 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.

This chapter tells you how to install IMPULSE•VG+ Series 2 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 for you to know how you're going to approach both mounting and wiring before you start accomplishing either task. Both the mounting and wiring affect each other very much. To assist you, "IMPULSE•VG+ Series 2 Wiring Practices" is included.

NOTE: If your IMPULSE•VG+ Series 2 is part of an Electromotive Systems, pre-engineered TCONTROLS® motor control panel, disregard this chapter and turn to Chapter 2.

Preparing for Installation and Wiring

Control Input

IMPULSE•VG+ Series 2 is designed to interface directly with a 120VAC user input device[a], which is where the control input signal originates. This design feature eliminates the need for interface relays or isolation circuitry. The user interface device is connected to the G5IF 120V Control Interface Card, which includes Terminals 1, 2, 3, 4, 5, 6, 7, and 8. Four more terminals can be added with the optional G5IN4 120V Control Input Card.

NOTE: Terminal X2 is also on both control input cards, and should always be connected to X2 of the user input device.

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[a] User input devices include: pendant controls (pushbutton station), remote control transmitters (infrared and radio), master switches, programmable logic controls (PLC), and personal computers.

For the G5IF, Terminals 1 and 2 are always used for the directional run commands (FORWARD, REVERSE, UP, DOWN, LEFT, RIGHT). The other terminals are programmable multi-function terminals, and are used for speed control and other functions. With multi-function terminals you can assign entirely different functions and performance characteristics without having to rewire the drive.

Control Output

The following table summarizes the control output terminal functions:

Circuit Board	Terminal	Function
G5OUT	C	Connection to X1 of 120VAC power supply
G5OUT	01	Multi-function Output (See H2 Constants)
G5OUT	02	Multi-function Output (See H2 Constants)
Drive Control Board	9	Electric brake output; electric brake release signal
Drive Control Board	10	Electric brake output; electric brake release signal
Drive Control Board	18	Fault output—normally open; closed to COM at fault
Drive Control Board	19	Fault output—normally closed; open to COM at fault
Drive Control Board	20	Fault output—common

Additional Terminals

If you need more input or output terminals than are available (for additional features and/or external accessories like lights, horns, etc.), contact Electromotive Systems.

IMPULSE•VG+ Series 2 System Components and External Devices

When you install and wire the drive motor system, you are concerned with the following drive components and external devices:

Standard IMPULSE•VG+ Series 2 Drive Components

- Drive (inverter)[b],[c]
- PG-X2 Encoder Interface Card[d]
- G5IF 120V Control Interface Card
- G5OUT Control Output Card

Optional Drive Components

- G5IN4 Control Input Card
- DO-08 Control Output Board
- DO-02 Control Output Relay Board

As-Required Drive Components

- A-C reactors—line or load[e]
- DC bus reactor(s)
- External dynamic braking unit [f]
- External dynamic braking resistor(s)[g]

Required External Devices

- Motor
- User input device (pendant, joystick, PC, PLC, radio, or infrared control)
- Encoder[h]
- External circuit protection devices (fuses or circuit breakers)[i]
- Electrically released holding brake (for hoist)
- Surge suppressors on contactor coils

(b) See "IMPULSE•VG+ Series 2 General Specifications."

(c) See "IMPULSE•VG+ Series 3 Control Board Terminal Functions."

(d) See "PG-X2 Encoder Interface Card Specifications."

(e) See "R-C Surge Absorber Selection"

(f) See "External Dynamic Braking Unit (DBU)."

(g) See "External Dynamic Braking Resistor."

(h) See the "Wiring the Encoder Circuit."

(i) See "Suggested Circuit Protection Specifications—IMPULSE•VG+ Series 2"

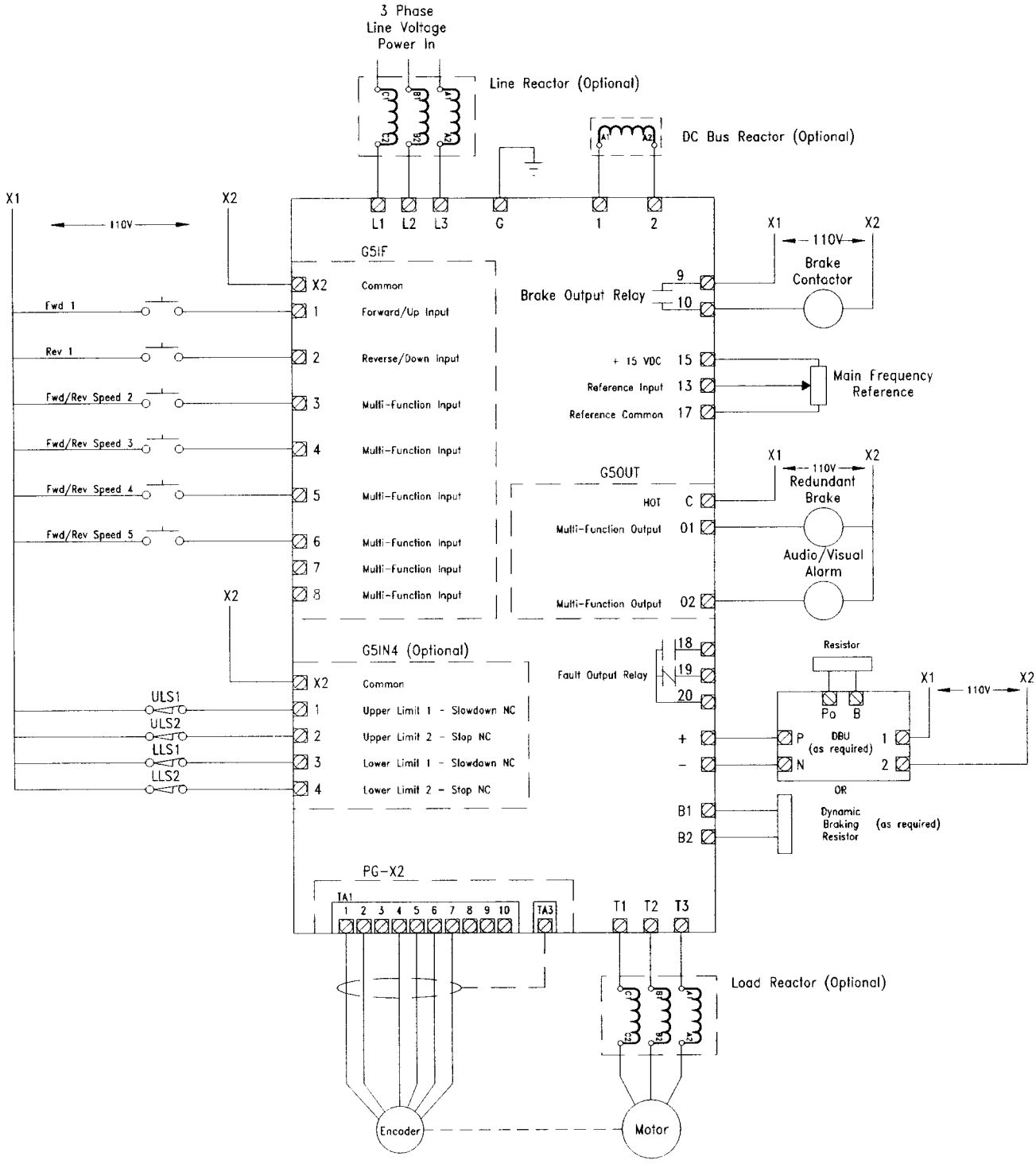


Figure 1.1: IMPULSE•VG+ Series 2 Wiring Diagram

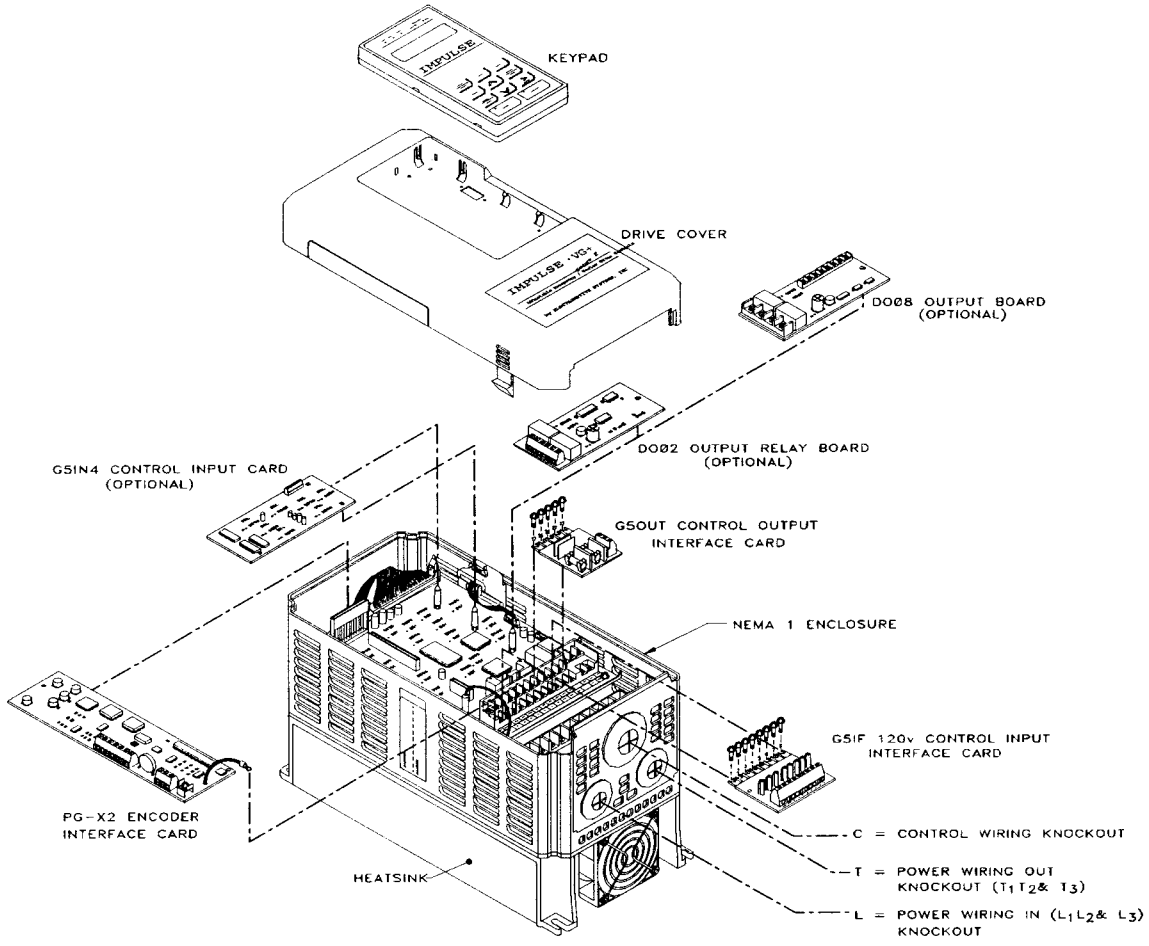


Figure 1.2: IMPULSE•VG+ Series 2 Components Diagram

System Requirements

You must also know how you're going to use the drive before you start installation and wiring. You 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

Drive Environment

When you choose a location for IMPULSE•VG+ Series 2, 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 2033-FVG+/4034-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 at only one end (drive Terminal 12).
9. Ensure that the drive circuit wiring is protected or isolated from:
   - Ambient temperatures outside the range of -14° F to +104° F (-10° C to +40° 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.

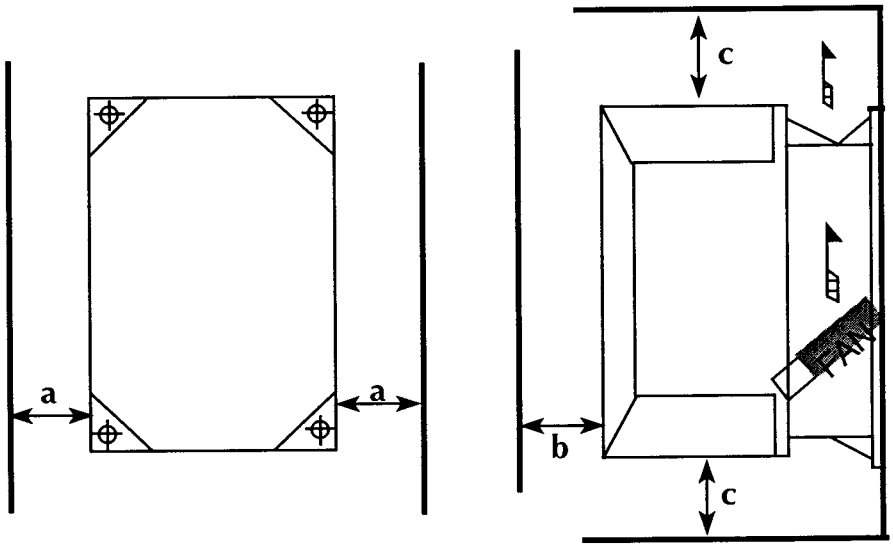
11. For severe-duty applications (for example—long lifts) or with 75-Hp-or-greater motors, ensure that the drive control system is adequately cooled, even though the ambient temperature limit is not exceeded. For more information, contact Electromotive Systems.

Installing the Drive

Before installing and wiring the drive, review "Wiring Specifications" (Page 1-35).

To install IMPULSE•VG+ Series 2

1. Orient yourself by looking at the drawings Figure 1.1: IMPULSE•VG+ Series 2 Wiring Diagram and Figure 1.2: IMPULSE•VG+ Series 2 Components Diagrams.
2. Determine the sizes and connection locations for the drive components and external devices that need to be wired. Locate the ground too. For exact dimensions, see "IMPULSE•VG+ Series 2 Dimensions/Heat Loss—Open Chassis."
3. Determine the position of the subpanel.
4. Ensure that the drive is oriented vertically so that the heat can dissipate properly.
5. Ensure that the air can flow freely around the heat sink as shown in Figure 1.3.



Minimum Clearance Requirements:
a = 1.18 in **c** = 2.00 in
b = 2.00 in

Figure 1.3

6. 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 drive control festoon wiring in different cables.
   - Separate control drive circuit and power circuit wiring on the terminal block strip.
7. Obtain the appropriate hardware for mounting.

8. Mount the subpanel or surface to which you are mounting the drive. [j]
9. Fasten the drive and components to the subpanel.
10. Remove the keypad from the front cover by pushing the depression area and lifting the keypad as shown in Figure 1.4.

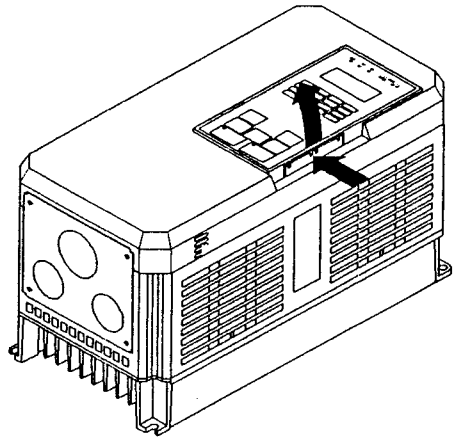


Figure 1.4

11. Remove the drive cover. For Models 2003-FVG+ through 2033-FVG+ and 4001-FVG+ through 4014-FVG+, push in the two squeeze spots located on the top rim of the enclosure and lift the cover as shown in Figure 1.5. On larger size drives, the cover is attached with screws.

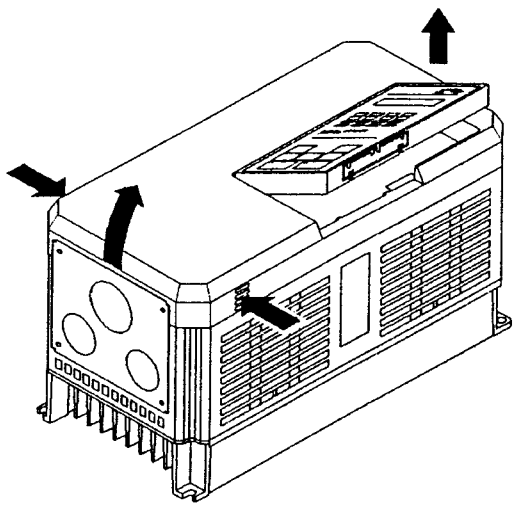


Figure 1.5

12. Remove the G5OUT Control Output Card.
13. Remove the G5IF 120V Control Interface Card.
14. Measure the power wire lengths, making them as short as possible.

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[j] Contact Electromotive Systems if you need advice on mounting, especially for the larger drives.

Wiring the Power Circuit

This section includes wiring diagrams and procedures for wiring a typical power circuit. The power circuit includes external dynamic braking units, external dynamic braking resistors, circuit protection devices, and motors.

Power Circuit Wiring Diagrams

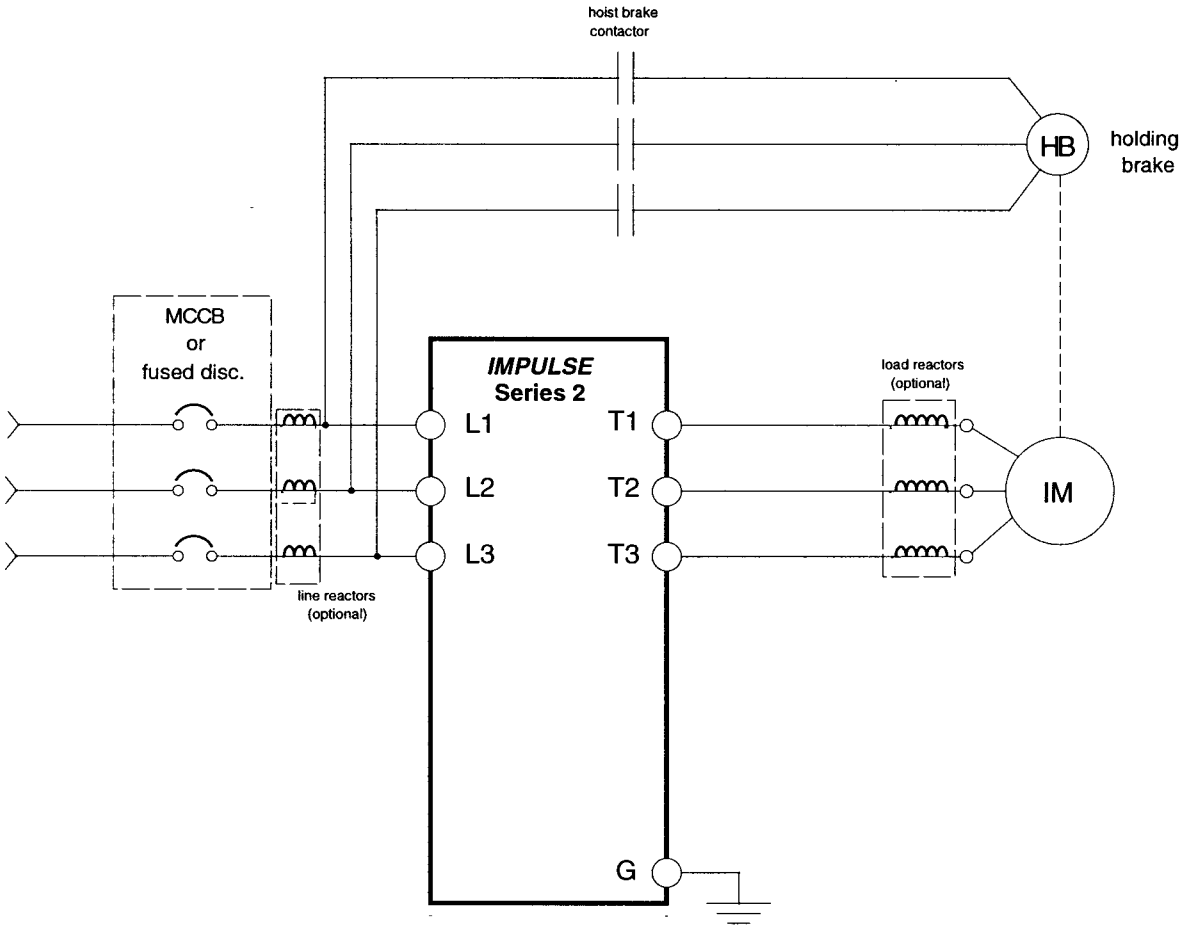

Figure 1.6

Detailed Power Circuits—By Model

The following ten drawings show detailed power wiring circuits by model.

NOTE: If a Series 2 drive is used to replace an older version IMPULSE drive, it is permissable to use the older version dynamic brake units—also known as CDBRs.

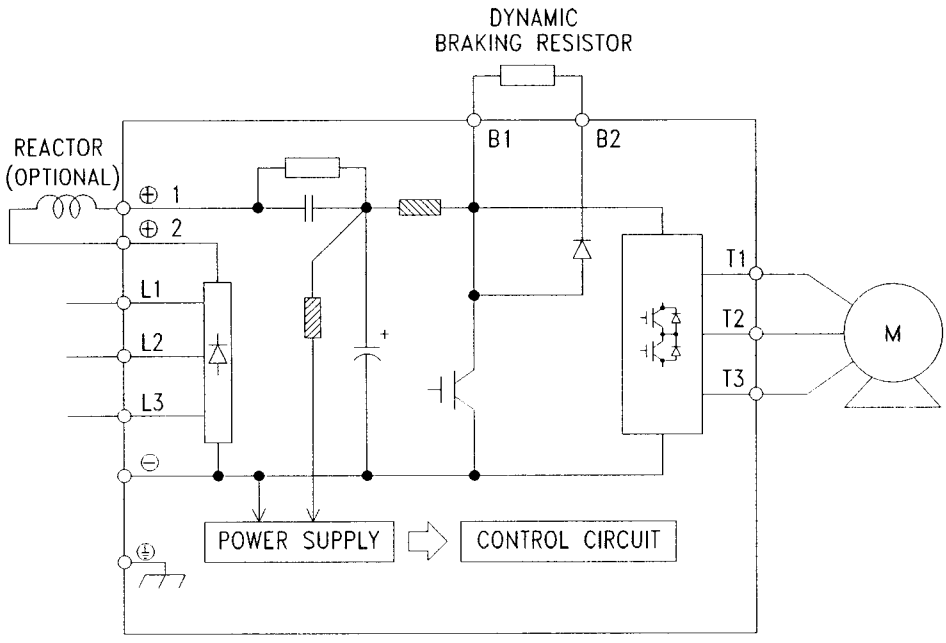

Figure 1.7: 2006-FVG+ and 2008-FVG+

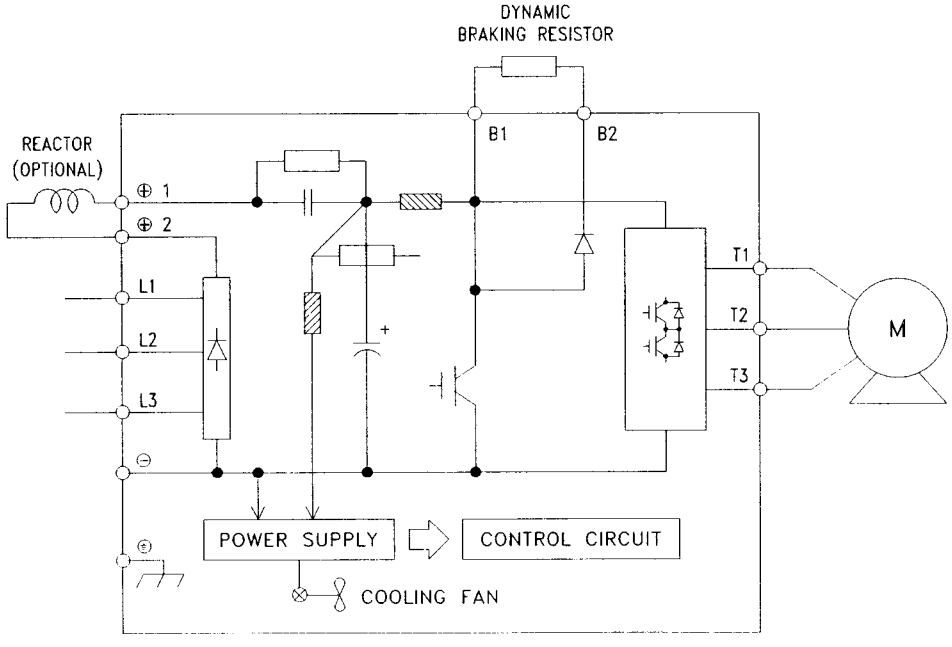

Figure 1.8: 2011-FVG+ and 2033-FVG+

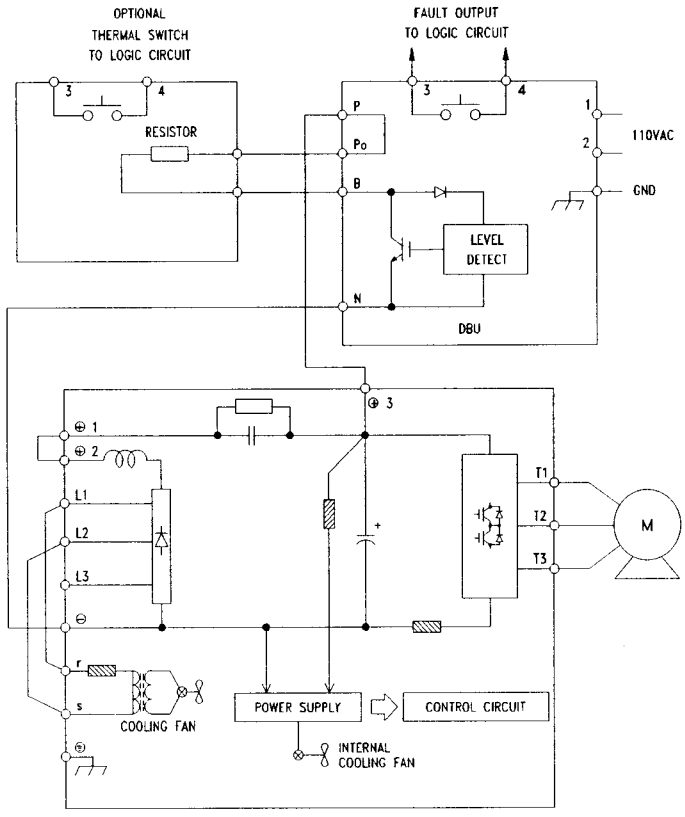

Figure 1.9: 2054-FVG+ and 2068-FVG+

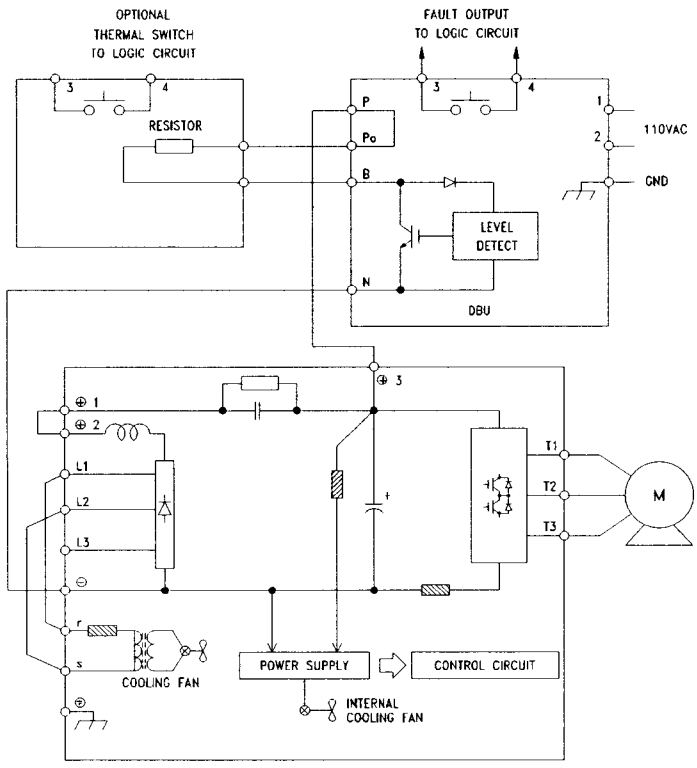

Figure 1.10: 2080-FVG+

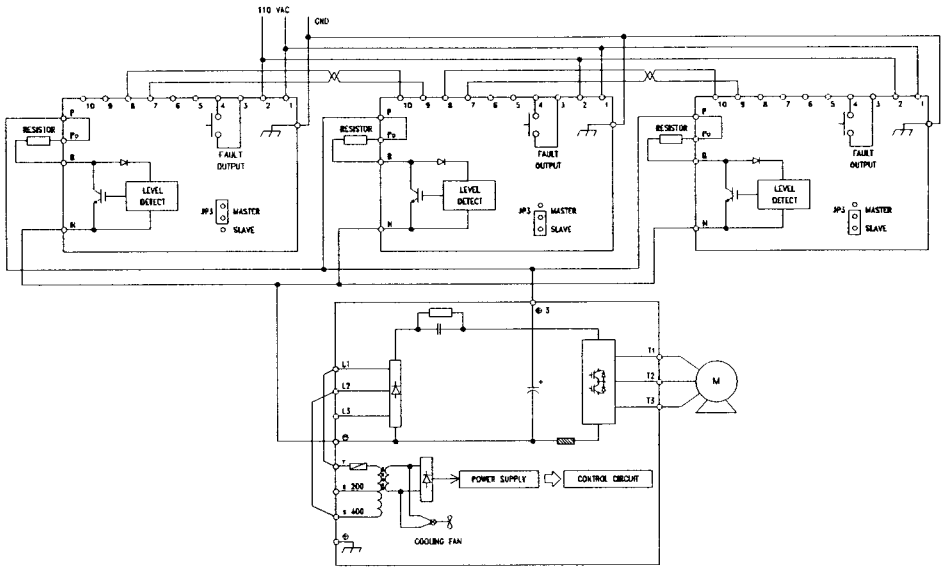

Figure 1.11: 2130-FVG+ and 2300-FVG+

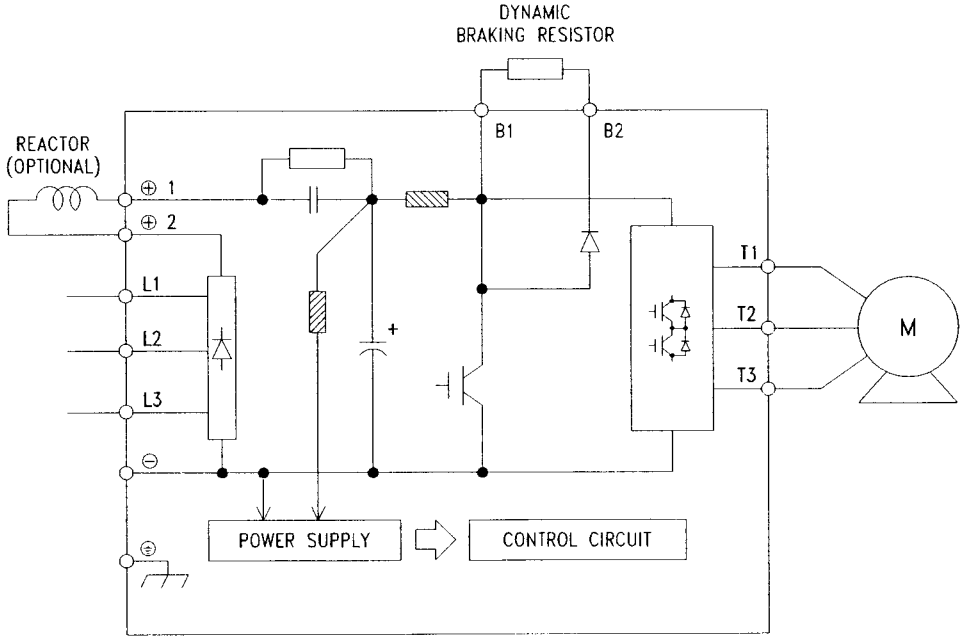

Figure 1.12: 4003-FVG+ and 4005-FVG+

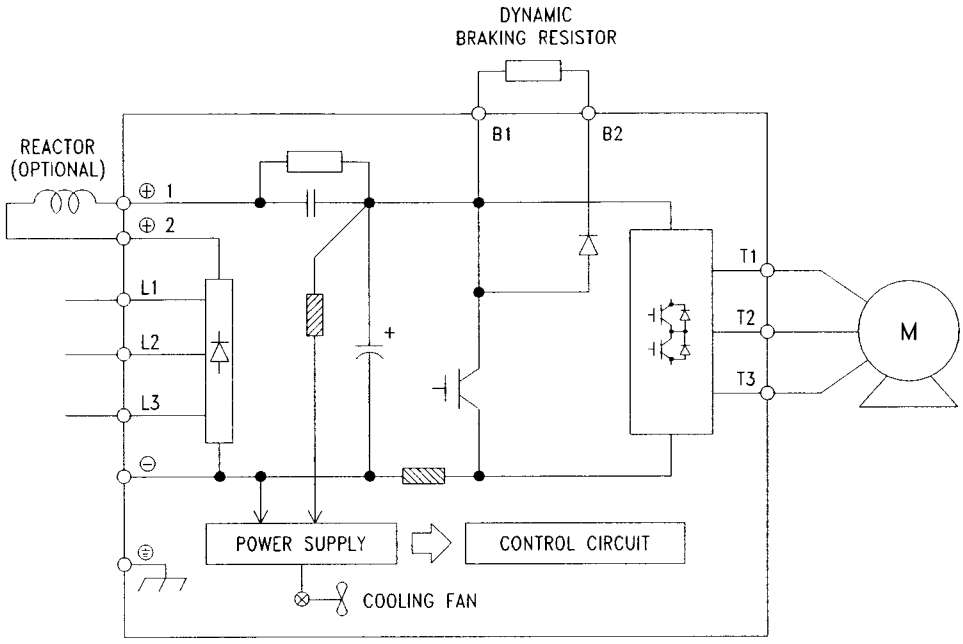

Figure 1.13: 4008-FVG+ and 4034-FVG+

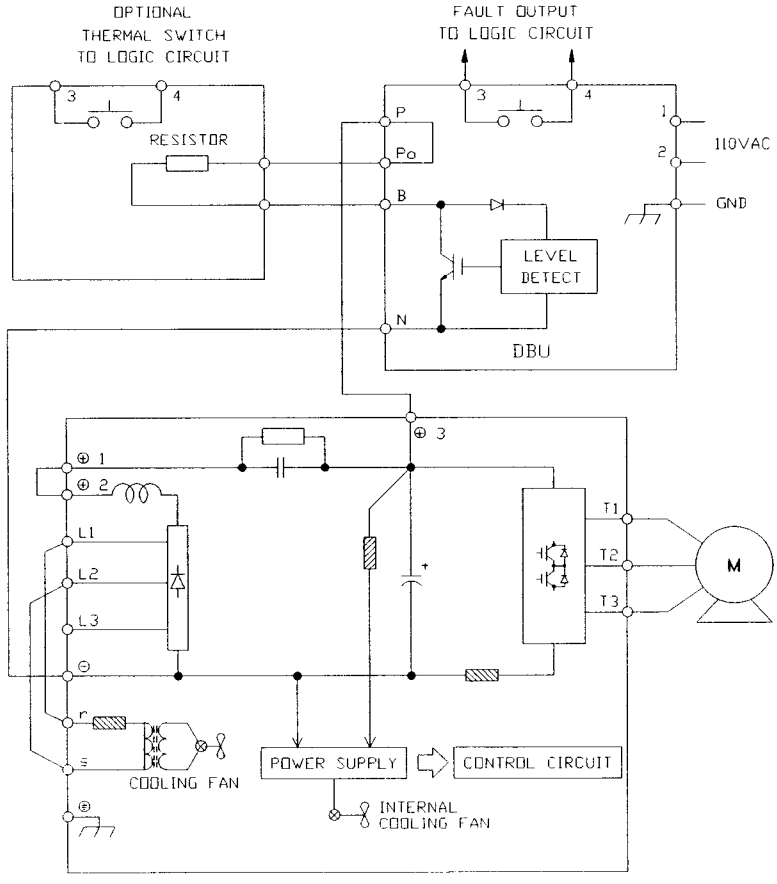

Figure 1.14: 4041-FVG+ and 4096-FVG+

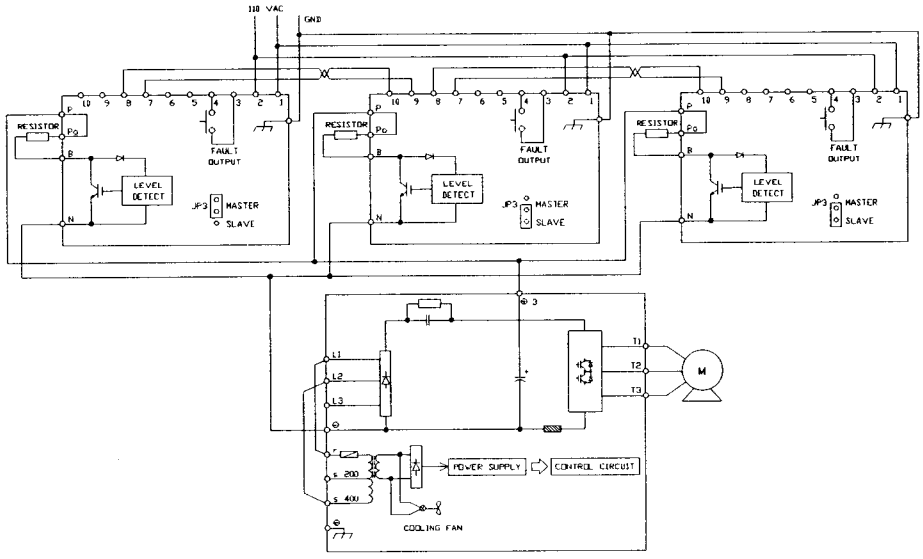

Figure 1.15: 4128-FVG+ through 4302-FVG+

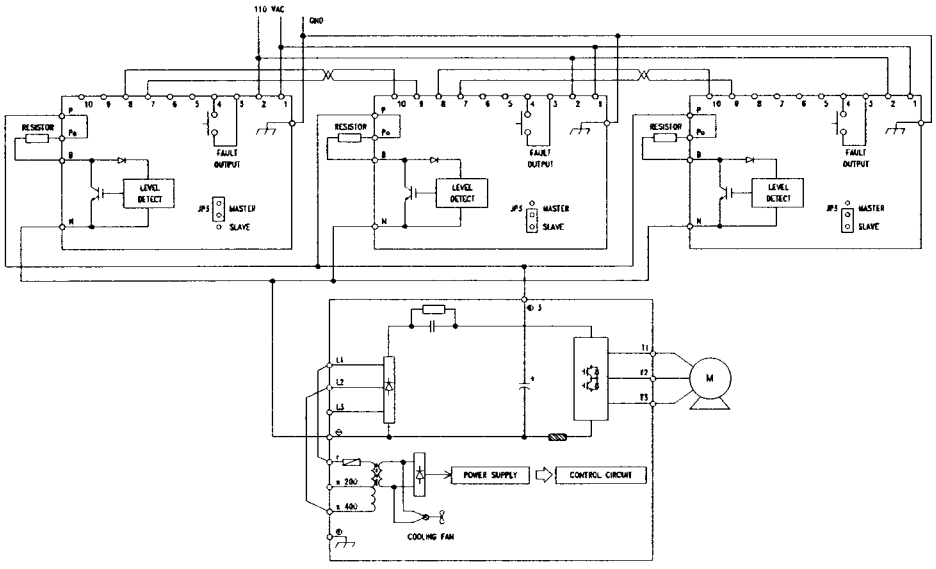

Figure 1.16: 4450-FVG+ and 4605-FVG+

Power Circuit Wiring Procedures

To wire the power circuit for IMPULSE•VG+ Series 2:

1. Run the three-phase power supply wires through an appropriate enclosure hole.
2. Referring to "Suggested Circuit Protection Specifications—IMPULSE•VG+ Series 2" and the following two tables, connect the three-phase power supply wires to a circuit protection system.

230 V Class Terminal Functions

	Model	2006-FVG+ to 2033-FVG+	2054-FVG+ to 2068-FVG+	2080-FVG+	2130-FVG+ to 2300-FVG+
	Rated Current	6 to 33 Amps	54 to 68 Amps	80 Amps	130 to 300 Amps
Terminal	L1	Main circuit input power supply			
	L2				
	L3				
	T1	Inverter output			
	T2				
	T3				
	B1	Braking resistor	n/a		
	B2				
	Ø	DC reactor (⊕1–⊕2) DC Power supply (⊕1–Ø)	DC reactor (⊕1–⊕2) DC power supply (⊕1–⊕) Braking unit (⊕3–Ø)	DC power supply (⊕1–Ø) Braking unit (⊕3–Ø) (⊕1 and ⊕2 terminals not provided)	
	⊕1				
	⊕2				
	⊕3				
	r	n/a		Cooling fan power supply	
	s				
	⊕	Ground terminal (Ground resistance: 10Ω or less)			

460 V Class Terminal Functions

	Model	4003-FVG+ to 4034-FVG+	4041-FVG+ to 4096-FVG+	4128-FVG+ to 4302-FVG+	4450-FVG+ to 4605-FVG+
	Rated Current	3.6 to 34 Amps	41 to 96 Amps	128 to 302 Amps	450 to 605 Amps
Terminal	L1	Main circuit input power supply			
	L2				
	L3				
	T1	Inverter output			
	T2				
	T3				
	B1	Braking resistor	n/a		
	B2				
	Ø	DC reactor (⊕1–⊕2) DC power supply (⊕–Ø)	DC power supply (⊕1–Ø) Braking unit (⊕3–Ø)	Braking unit (⊕3–Ø) (⊕1 and ⊕2 terminals not provided)	
	⊕1				
	⊕2				
	⊕3	n/a			
	s	n/a	Cooling fan power supply	n/a	
	r			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: 10Ω or less			

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 4041-FVG+ and greater, ensure the jumper plug is inserted in the printed-circuit board (3PCB), which is underneath the control board, as follows:

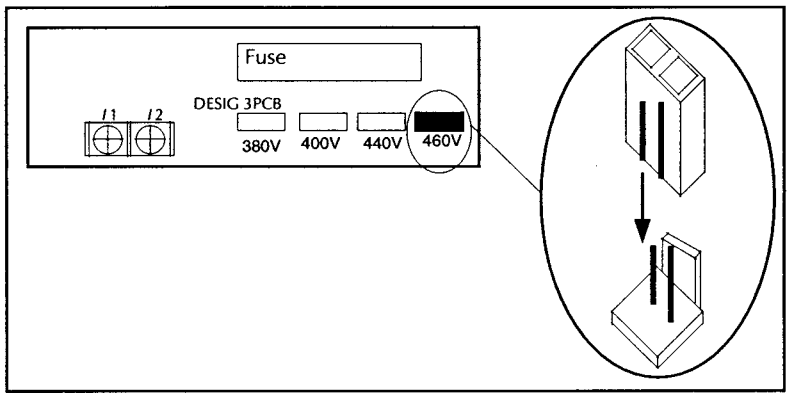

Figure 1.17: Models 4041-FVG+ through 4096-FVG+

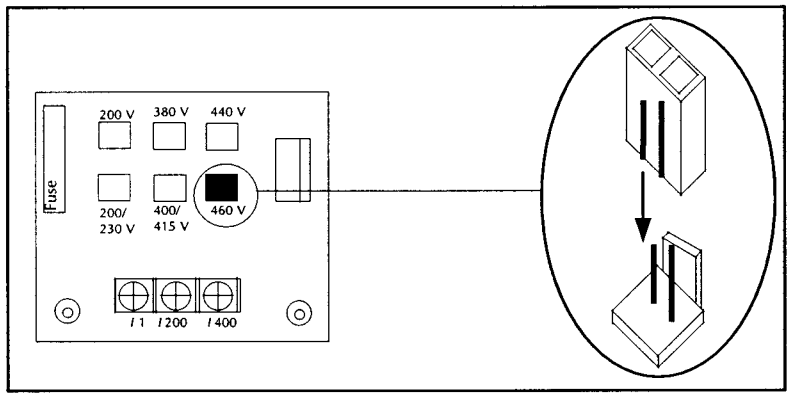

Figure 1.18: Models 4128-FVG+ through 4605-FVG+

External Dynamic Braking Unit (DBU)

For applications that require more than one External DBU, wire the DBUs in parallel as shown in Figure 1.11: 2130-FVG+ and 2300-FVG+, Figure 1.15: 4128-FVG+ through 4302-FVG+, and Figure 1.16: 4450-FVG+ and 4605-FVG+.

You can connect up to 10 of these units in a "master/slave" configuration. An application can have multiple slaves, but only one master. With this configuration, ensure that you connect all of the thermal switches (Terminals 3 and 4) in parallel and connect them to your RUN circuitry. Use twisted-pair, shielded cable (Belden 8760) for this control circuitry. For more information on the DBU, see "IMPULSE•VG+ Series 2 External Dynamic Braking Unit—Specifications & Dimensions."

NOTE: The wiring distance between the DBU and IMPULSE•VG+ Series 2 must be less than 16.4 feet (5 m). The wiring distance between the DB resistor and the DBU must be less than 32.8 feet (10 m).

6. Run the wires into the DBU through the holes in the bottom of its enclosure.

   NOTE: The maximum wire size for a single DBU is #6.

7. Make a cross cut in the rubber bushings supplied with the unit.
8. Run the wires through a hole in both the drive and the DBU. (This will provide the DBU components with an extra degree of protection from the environment.)
9. Connect DBU terminals to the drive as indicated in "Detailed Power Circuits—By Model" (Figure 1.7: 2006-FVG+ and 2008-FVG+ through Figure 1.16: 4450-FVG+ and 4605-FVG+.)
10. "Jumper" JP5, and then JP4, on the DBU logic card, as indicated in Figure 1.19: 200V and Figure 1.20: 400V, to correspond with the incoming line voltage.

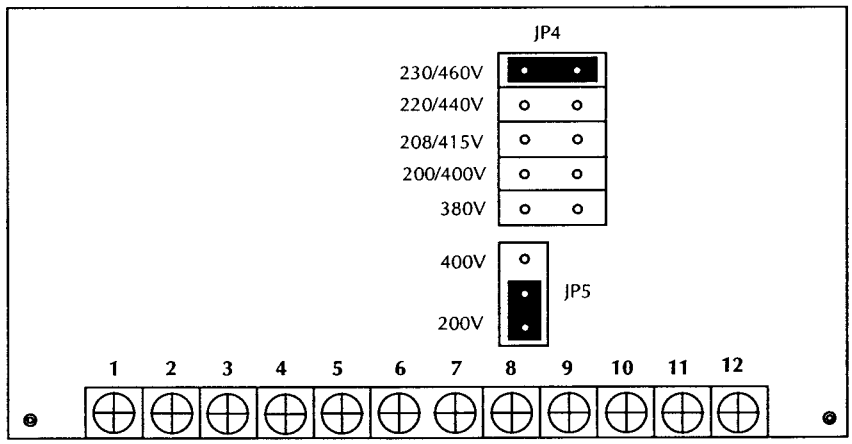

Figure 1.19: 200V

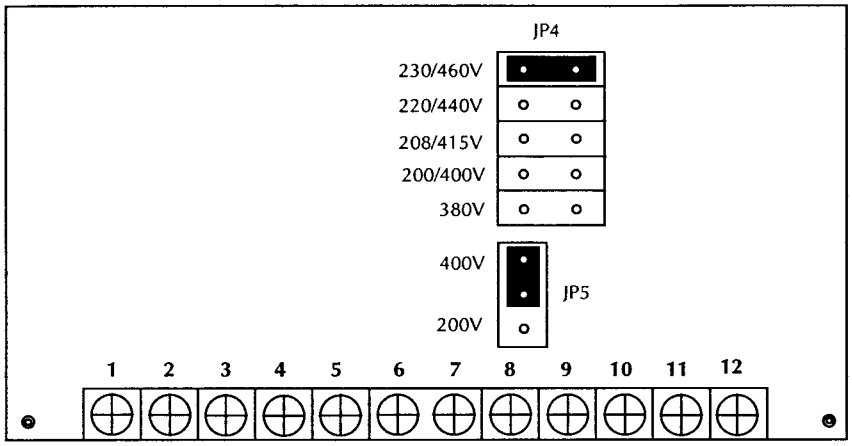

Figure 1.20: 400V

External Dynamic Braking Resistor

11. Referring to Figure 1.7: 2006-FVG+ and 2008-FVG+ through Figure 1.16: 4450-FVG+ and 4605-FVG+, connect the dynamic braking resistor(s) as follows:
    - For Models 2003-FVG+ through 2033-FVG+ through 4034-FVG+, connect the resistor(s) to terminals B1 and B2.
    - For all other models, connect the resistor(s) to terminals PO and B on the External DBU.

Ground

12. Connect Terminal G to the common panel ground. When two or more drives are used for the same system, they should all be directly grounded to a common ground point. Use the method marked "Good" in Figure 1.21.

Figure 1.21

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Wiring the Control Circuit

Before you wire the control circuit, review the following table and Figure 1.22: Interface Cards. The table may be helpful if you have wiring requirements that cannot be fulfilled by the G5IF 120V Control Interface Card.

IMPULSE•VG+ Series 2 Control Board Terminal Functions

Terminal	Signal Type	Signal Function	Signal Level
1	Sequence (digital) input	RAISE/FORWARD at closed position	+24VDC, 8ma [1]
2	Sequence (digital) input	LOWER/REVERSE at closed position	+24VDC, 8ma [1]
3	Sequence (digital) input	Speed 2 (Multi-Function Input 1)	+24VDC, 8ma [1]
4	Sequence (digital) input	Speed 3 (Multi-Function Input 2)	+24VDC, 8ma [1]
5	Sequence (digital) input	Speed 4 (Multi-Function Input 3)	+24VDC, 8ma [1]
6	Sequence (digital) input	Maximum Speed/Speed 5 (Multi-Function Input 4)	+24VDC, 8ma [1]
7	Sequence (digital) input	Micro-Positioning Control 1 (Multi-Function Input 5)	+24VDC, 8ma [1]
8	Sequence (digital) input	External Fault (Multi-Function Input 6)	+24VDC, 8ma [1]
9, 10	Sequence (digital) output	Brake relay; contact closed to open brake	Max 250VAC or 30VDC at no more than 5 A [2]
11	Sequence (digital) input	Sequence Common	0 V [1]
12	Analog input signal	Connection to shield of analog cable	n/a
13	Analog input signal	Master Frequency Reference [3]	-10V to +10V (20 kΩ)
14	Analog input signal	Master Frequency Reference [4]	4 mA–20mA (250Ω)
15	Analog input signal	Power supply	+15VDC; 20 ma
16	Analog input signal	Auxiliary Speed Reference (multi-function) [5]	-10V to +10V (20 kΩ)
17	Analog input signal	Common lead for control circuit	0V
18	Sequence (digital) output	N/0 Fault Relay (closes at fault)	Max 250VAC or 30VDC at no more than 8 A [2]
19	Sequence (digital) output	N/C Fault Relay (opens at fault)	Max 250VAC or 30VDC at no more than 8 A [2]
20	Sequence (digital) output	Common for fault relay	0V
21	Analog output signal	Frequency Meter (multi-function) [6]	0V to ±11V max (±5%); 2 mA or less
22	Analog output signal	Common lead (multi-function)	0V
23	Analog output signal	Current Monitor (multi-function) [7]	0V to ±11V max (±5%); 2 mA or less
25	Sequence (digital) output;	PHC Output 1; G5OUT	48V; ≤ 1A (open collector)
26	Sequence (digital) output;	PHC Output 2; G5OUT	48V; ≤ 1A (open collector)
27	Sequence (digital) output;	Open collector common lead; G5OUT	0V
33	Analog input signal	Power supply	-15VDC; 20 ma

[1] Photo-coupler isolation
[2] Dry contact
[3] ±10V/-100% to +100% speed; 0V to 10V/0% to 100% speed
[4] 4 mA to 20ma/0% to 100% speed
[5] V = H3-05
[6] 0V to ±10V/0% to 100% frequency
[7] Inverter-Rated Current = 5V

Control Circuit Wiring Procedures

To wire the drive control circuit for IMPULSE•VG+ Series 2:

1. Run the control circuit wires through hole C.

   While the G5IF 120V Control Voltage Interface and G5OUT Control Output Cards are already attached to the drive control terminals when the drive is shipped, the Figure 1.22: Interface Cards is provided in case you have to reattach these boards.

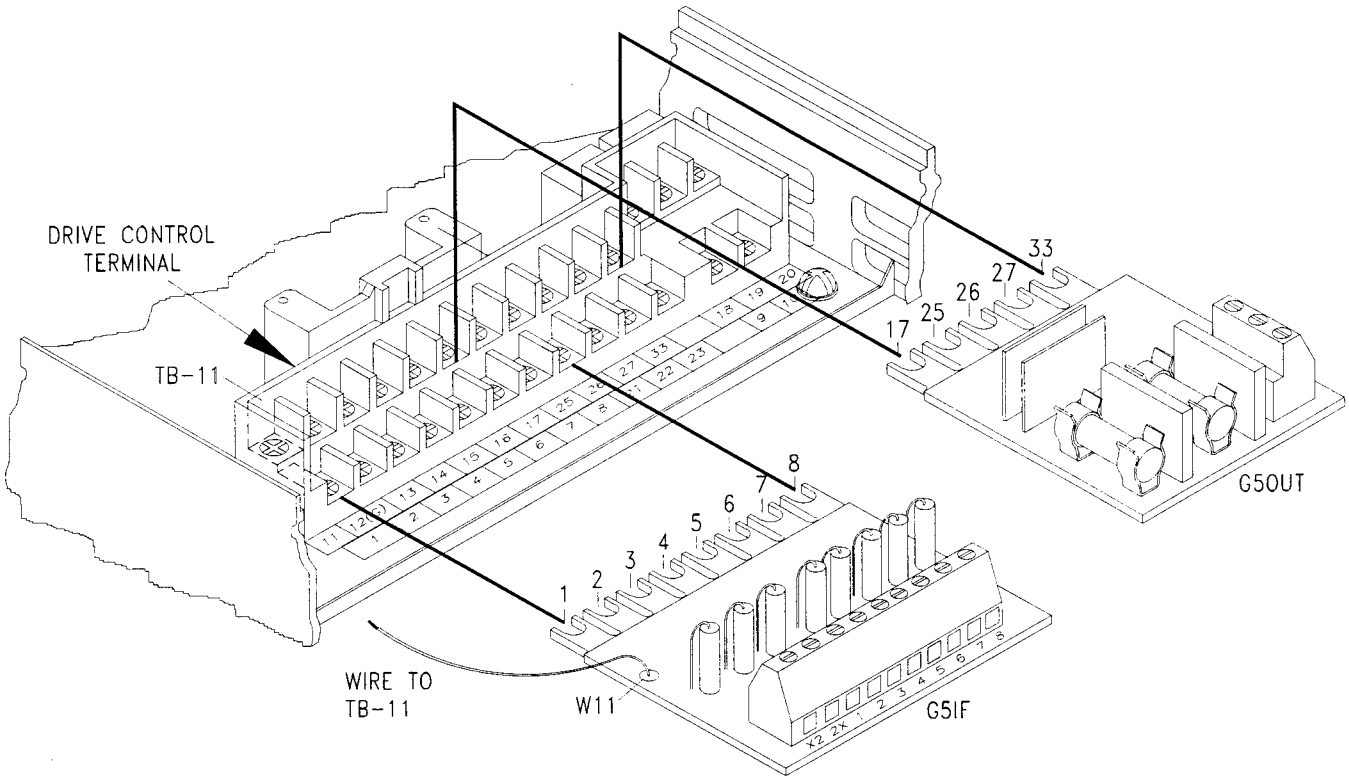

Figure 1.22: Interface Cards

2. Connect input terminals—X2, 1, 2, 3, 4, 5, 6 and 7 for G5IF and X2, 1, 2, 3 and 4 for G5IN4—to the user input device. The following drawing which shows a typical five-speed interconnection, should help you to understand how to wire any control circuit application. For more information on multi-function inputs, see **Terminal 4 Sel** (H1-01) through **Terminal 8 Sel** (H1-06) in Appendix A.

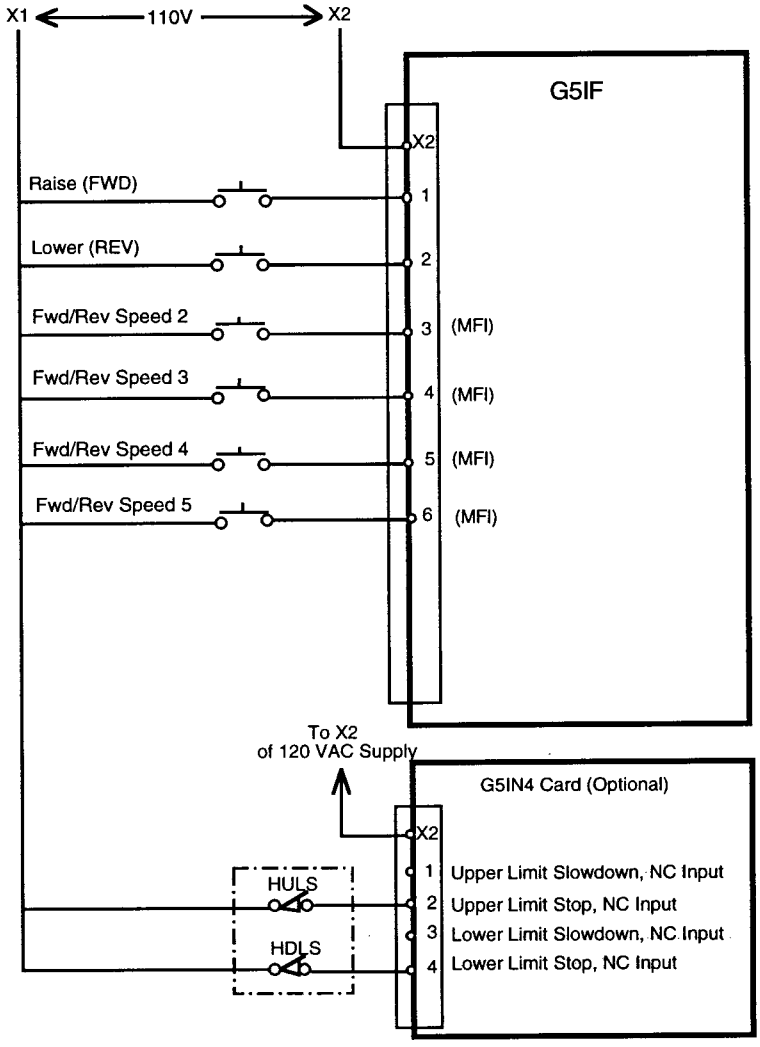

Figure 1.23: Five-Step Multi-Speed Terminal Diagram (Example)

3. Install G5OUT card to the drive as indicated in Figure 1.22: Interface Cards.
4. Connect the output terminals, as indicated in the following drawing, to the intended output device(s).

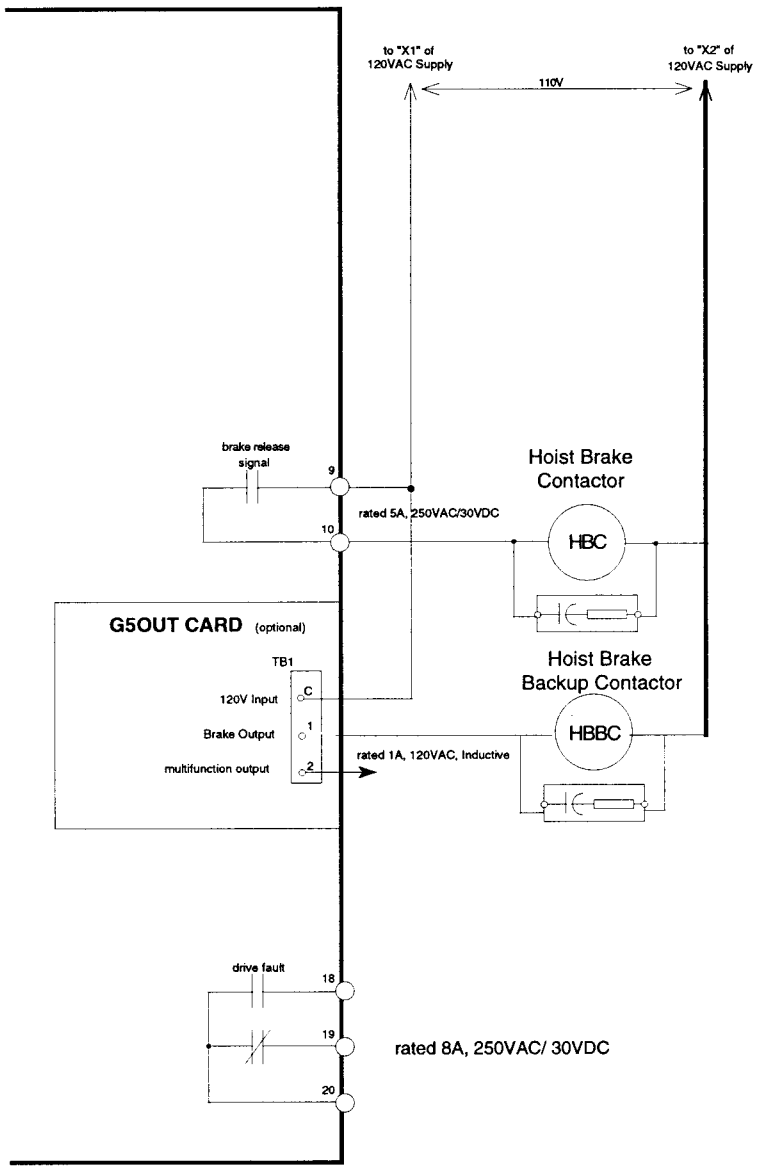

Figure 1.24: Output Terminals

5. Connect the G5IF common lead (blue wire W11) to Terminal 11 on the drive control terminal. Refer to Figure 1.22: Interface Cards.

R-C Surge Absorber Selection

6. Install R-C-type surge absorbers (not MOV-type) across the coils of any contactors installed in the drive's control panel enclosure. Refer to the following table when selecting surge absorbers.

Applied VAC	Application	Resistance	R-C Surge Absorber Part Number[1], [2]
120 VAC (1Ø)	Contactor or magnetic brake coils	100 Ω	RCS1C6[3], [4]
		150 Ω	RCS1H6
		220 Ω	RCS1A6
240VAC (1Ø)	Contactor or magnetic brake coils	100 Ω	RCS2G6
		150 Ω	RCS2H6
		220 Ω	RSC2A6
480VAC (3Ø)	Brake coils	100 Ω	RCY6G-30
		220 Ω	RCY6A-30

[1] Part numbers are those of R-K Electronics, and are available from Electromotive Systems.
[2] All surge absorbers .47 microfarads.
[3] The surge absorber most often used by Electromotive Systems.
[4] If an A-B–type contactor (IEC–type) is used, then part number used is A-B 199-FSMA1.

Electric Brake Coil and Reattachment

7. Connect 110VAC supply (X1) to Terminal 9, the electric brake contactor coil to Terminal 10, and the other side of the contactor coil to the 110V return (X2).
8. Reattach the G5IF card to the lower-level control board Terminals 1 through 8. (Refer to Figure 1.22: Interface Cards.)
9. Reattach the G5OUT card to top-level control board Terminals 17, 25, 26, 27, and 33. (Refer to Figure 1.22: Interface Cards.)

Cover and Keypad

NOTE: Before you perform the following step, wire the encoder circuit, which is explained in "Wiring the Encoder Circuit."

10. Refasten the cover, inserting the top of the cover first.

11. Referring to the following drawing, reinsert the keypad in the keypad well of the cover by aligning the keypad with the claws and locking the keypad into place.

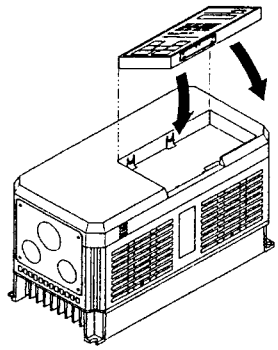

Figure 1.25

Wiring the Encoder Circuit

A shaft-mounted encoder is required to provide speed and shaft position feedback to IMPULSE•VG+ Series 2. 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 drive
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 2 (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. Referring to Figure 1.26: Generic Encoder and "PG-X2 Encoder Interface Card Terminal Functions," connect the encoder to the PG-X2 Encoder Interface Card.

   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 TA-3 of the PG-X2 Encoder Interface Card. (Ground only one end of the shielded cable.)

Encoder Wiring Diagrams and Information

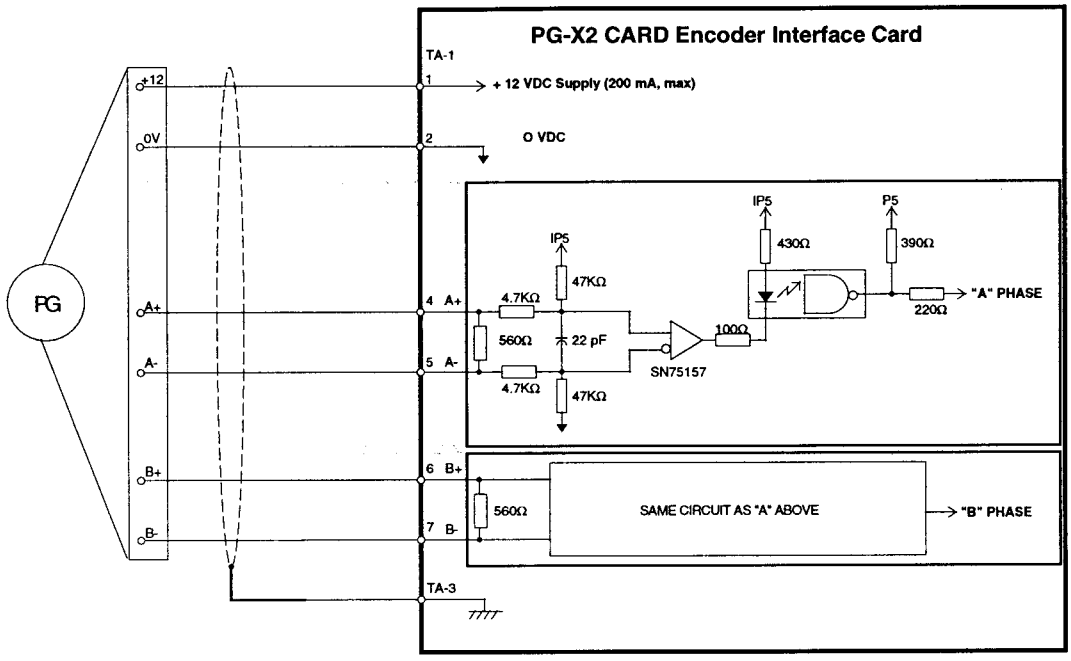

Figure 1.26: Generic Encoder

The following drawing and table shows you how to connect a LakeShore Model 8500 encoder to the PG-X2 Encoder Interface Card.

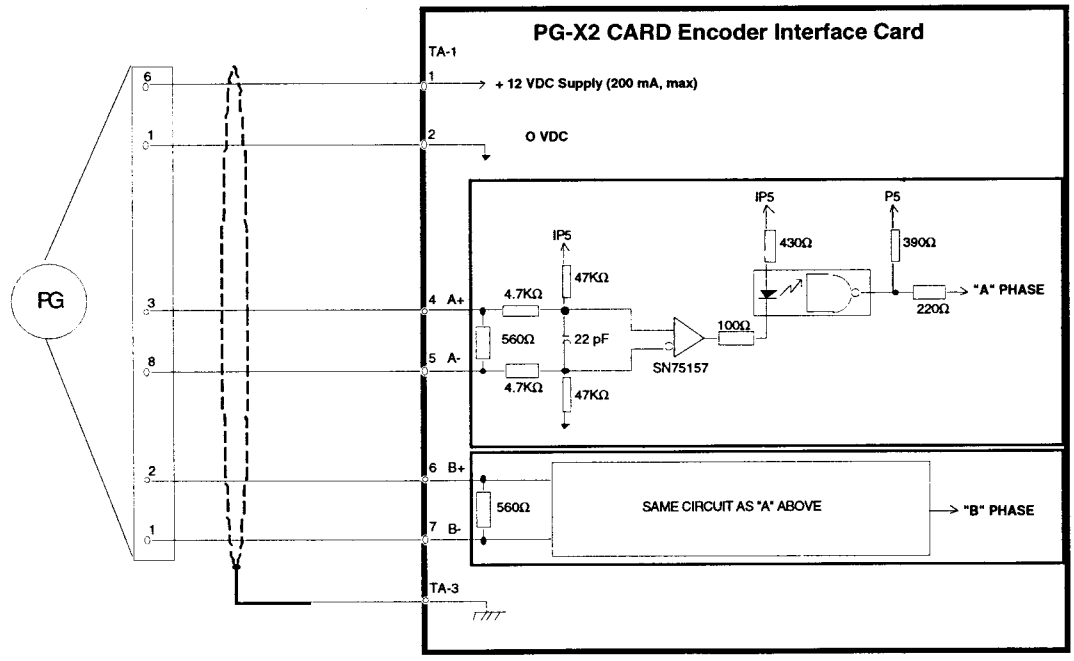

Figure 1.27: LakeShore Model 8500 Encoder

Lakeshore Model SL56 Encoder Wiring Scheme

Encoder Signal	Wire Color	PG-X2 Terminal (TA-1)
+5 to 15VDC	Red	1
OV	Black	2
A+	Blue	4
A-	Gray	5
B+	Green	6
B-	Yellow	7

PG-X2 Encoder Interface Card Specifications

Power supply to encoder:	Dual; +12VDC; 200 mA maximum
Encoder input signal:	RS-422–level, line-driver-type
Pulse monitor output signal (repeater):	RS-422–level, line-driver-type
Pulse phases accepted:	Phases A and B (both + and -)
Maximum input frequency:	300 kHz
Connector type:	Phoenix MKDS1 series

PG-X2 Encoder Interface Card Terminal Functions

Terminal Block	Pin #	Function
TA1	1	+12VDC power supply; do not use Pins 1 and 3 together
TA1	2	Power supply common
TA1	3	Alternate 5VDC power supply for encoder; do not use Pins 1 and 3 together
TA1	4	A+ pulse input
TA1	5	A- pulse input
TA1	6	B+ pulse input
TA1	7	B- pulse input
TA1	10	Ground
TA2	1	A-pulse output
TA2	2	A-pulse output
TA2	3	B-pulse output
TA2	4	B-pulse output
TA2	7	Common signal ground terminal
TA3	–	Shielded-sheath connection terminal

Wiring Specifications

This section consists of reference information that help you to install and wire the drive.

IMPULSE•VG+ Series 2 Wiring Practices

> **WARNING**
>
> Ensure that you follow the practices, as appropriate, in this section.

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

- Do not touch any circuit components while the main AC power is on. In addition, you must wait unit 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.) 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 injury.
- Exercise caution when checking signals; ensure access to crane controls is controlled.
- Do not connect the main output terminals (T1, T2, and T3) to the incoming, three-phase AC source. This will damage the unit!
- Except for Terminals 18, 19, and 20, do not connect the control board terminals directly to the 120VAC user input device. This, too, will damage the unit!
- Ensure the cover remains on the drive during operation.
- Ensure that the drive-to-motor wiring distance is less than 250 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 A-C 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-kΩ, 10-W resistor between the signal and L2 (X2).
- Comply with "Suggested Circuit Protection Specifications—IMPULSE•VG+ Series 2."
- Use R-C–type (not 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. For selection information, see "R-C Surge Absorber Selection" on page 1-29.
- 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 between the drive and motor.
- 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 25 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.

Suggested Circuit Protection Specifications—*IMPULSE•VG+* Series 2

	Rated Current(A)				Wiring Size (AWG/MCM)		
Model #	Drive	InputFuse	Input Fuse Class	Molded/Case Circuit Breaker	Power Circuit Wiring	Control Wiring	Ground
230VClass							
2006 -FVG+	6	9	CC	15	12	16/14	14/10
2008 -FVG+	8	12	CC	20	12	16/14	12/10
2011 -FVG+	11	20	CC	25	12	16/14	12/10
2015 -FVG+	17.5	25	LPJ	40	12	16/14	10
2025 -FVG+	25	35	LPJ	60	10	16/14	10/8
2033 -FVG+	33	45	LPJ	70	10	16/14	10/8
2054 -FVG+	54	70	LPJ	100	6	16/14	8
2068 -FVG+	68	90	LPJ	100	4	16/14	6
2080 -FVG+	80	100	LPJ	175	4	16/14	6
2130 -FVG+	130	175	LPJ	250	1/0	16/14	4
2160 -FVG+	160	200	LPJ	300	1/0	16/14	4
2224 -FVG+	224	300	LPJ	450	4/0	16/14	3
2300 -FVG+	300	400	LPJ	600	2/0 x 2P	16/14	1
460VClass							
4001 -FVG+	1.9	3	CC	10	12	16/14	12/10
4003 -FVG+	3.4	6	CC	10	12	16/14	12/10
4005 -FVG+	4.8	8	CC	15	12	16/14	12/10
4008 -FVG+	8.5	15	CC	20	12	16/14	12/10
4011 -FVG+	11.7	20	CC	25	12	16/14	12/10
4014 -FVG+	14.8	25	CC	30	12	16/14	8/6
4021-FVG+	21	30	LPJ	50	10	16/14	8
4028 -FVG+	28.6	40	LPJ	60	10	16/14	8
4034 -FVG+	34	45	LPJ	80	8	16/14	8
4041 -FVG+	41	60	LPJ	80	8	16/14	8
4052-FVG+	52	70	LPJ	125	6	16/14	8
4065 -FVG+	65	90	LPJ	125	6	16/14	8
4080 -FVG+	80	100	LPJ	150	4	16/14	6
4096 -FVG+	96	125	LPJ	200	2	16/14	6
4128 -FVG+	128	175	LPJ	250	1/0	16/14	4
4165 -FVG+	165	225	LPJ	350	2/0	16/14	4
4224 -FVG+	224	300	LPJ	450	4/0	16/14	3
4302 -FVG+	302	400	LPJ	600	2/0 x 2P	16/14	1
4450 -FVG+	450	600	J	900	2/0 x 2P	16/14	1/0
4605 -FVG+	605	800	KRP-C	1450	250 MCM x 2P	16/14	1/0

IMPULSE•VG+ Series 2 Dimensions/Heat Loss—Open Chassis

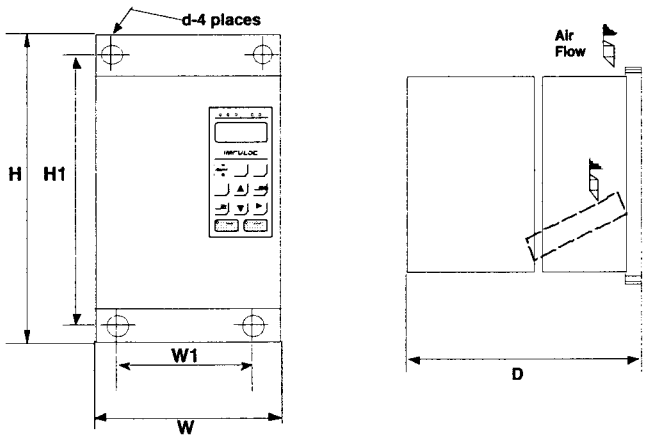

Figure 1.28: 230V Class—Open Chassis

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

	Overall Dimensions—in. & (mm)			Mounting Dimensions—in. & (mm)				Heat Loss (W)		
Model	W	H	D	W1	H1	H2	Wt lbs/ (kg)	Heat sink	Inside unit	Total
2006-FVG+	5.51 (140)	11.02 (280)	6.30 (160)	4.95 (126)	10.47 (266)	0.28 (7)	6.5 (3)	25	65	90
2008-FVG+	5.51 (140)	11.02 (280)	6.30 (160)	4.95 (126)	10.47 (266)	0.28 (7)	6.5 (3)	40	80	120
2011-FVG+	5.51 (140)	11.02 (280)	7.09 (180)	4.95 (126)	10.47 (266)	0.28 (7)	10 (4.5)	80	60	140
2015-FVG+	5.51 (140)	11.02 (280)	7.09 (180)	4.95 (126)	10.47 (266)	0.28 (7)	10 (4.5)	135	80	215
2025-FVG+	7.87 (200)	11.81 (300)	8.07 (205)	7.32 (186)	11.22 (285)	0.31 (8)	12 (5.5)	210	90	300
2033-FVG+	7.87 (200)	11.81 (300)	8.07 (205)	7.32 (186)	11.22 (285)	0.31 (8)	13 (6)	235	110	345
2054-FVG+	9.84 (250)	14.96 (380)	8.86 (225)	9.29 (236)	14.37 (365)	0.30 (7.62)	24 (10.8)	425	160	585
2068-FVG+	9.84 (250)	14.96 (380)	8.86 (225)	9.29 (236)	14.37 (365)	0.30 (7.62)	24 (10.8)	525	200	725
2080-FVG+	12.80 (325)	17.72 (450)	11.22 (285)	10.83 (275)	17.13 (435)	0.30 (7.5)	62 (28)	655	230	885
2130-FVG+	16.73 (425)	26.57 (675)	13.78 (350)	12.60 (320)	25.59 (650)	0.49 (12.5)	134 (61)	930	440	1370
2160-FVG+	16.73 (425)	26.57 (675)	13.78 (350)	12.60 (320)	25.59 (650)	0.49 (12.5)	137 (62)	1110	620	1730
2224-FVG+	18.70 (475)	31.50 (800)	13.78 (350)	14.57 (370)	30.51 (775)	0.49 (12.5)	176 (80)	1740	890	2630
2300-FVG+	22.64 (575)	36.42 (925)	15.75 (400)	17.52 (445)	35.24 (895)	0.59 (15)	298 (135)	2050	1160	3210

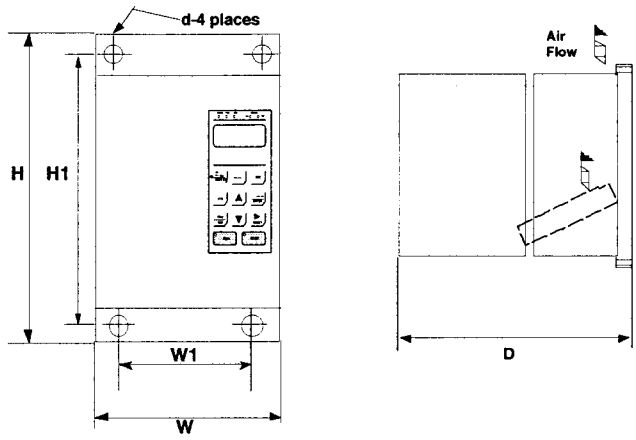

Figure 1.29: 460V Class—Open Chassis

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

	Overall Dimensions in inches and (mm)			Mounting Dimensions in inches and (mm)				Heat Loss (W)		
Model	W	H	D	W1	H1	H2	Wt Lbs/(kg)	Heat sink	Inside unit	Total
4001-FVG+	5.51 (140)	11.02 (280)	6.30 (160)	4.95 (126)	10.47 (266)	0.28 (7)	6.5 (3)	10	50	60
4003-FVG+	5.51 (140)	11.02 (280)	6.30 (160)	4.95 (126)	10.47 (266)	0.28 (7)	6.5 (3)	20	65	85
4005-FVG+	5.51 (140)	11.02 (280)	6.30 (160)	4.95 (126)	10.47 (266)	0.28 (7)	8.8 (4)	30	80	110
4008-FVG+	5.51 (140)	11.02 (280)	7.09 (180)	4.95 (126)	10.47 (266)	0.28 (7)	10 (4.5)	80	65	145
4011-FVG+	5.51 (140)	11.02 (280)	7.09 (180)	4.95 (126)	10.47 (266)	0.28 (7)	10 (4.5)	120	80	200
4014-FVG+	7.87 (200)	11.81 (300)	8.07 (205)	7.32 (186)	11.22 (285)	0.31 (8)	13 (6)	135	85	220
4021-FVG+	7.87 (200)	11.81 (300)	8.07 (205)	7.32 (186)	11.22 (285)	0.31 (8)	13 (6)	240	120	360
4028-FVG+	9.84 (250)	14.96 (380)	8.86 (225)	9.29 (236)	14.37 (365)	0.30 (7.5)	24 (11)	305	150	455
4034-FVG+	9.84 (250)	14.96 (380)	8.86 (225)	9.29 (236)	14.37 (365)	0.30 (7.5)	24 (11)	390	180	570
4041-FVG+	12.80 (325)	17.72 (450)	11.22 (285)	10.83 (275)	17.13 (435)	0.30 (7.5)	60 (27)	465	195	660
4052-FVG+	12.80 (325)	17.72 (450)	11.22 (285)	10.83 (275)	17.13 (435)	0.30 (7.5)	60 (27)	620	260	880
4065-FVG+	12.80 (325)	24.61 (625)	11.22 (285)	10.83 (275)	24.02 (610)	0.30 (7.5)	97 (44)	705	315	1020
4080-FVG+	12.80 (325)	24.61 (625)	11.22 (285)	10.83 (275)	24.02 (610)	0.30 (7.5)	97 (44)	875	370	1245
4096-FVG+	12.80 (325)	24.61 (625)	11.22 (285)	10.83 (275)	24.02 (610)	0.30 (7.5)	97 (44)	970	415	1385
4128-FVG+	17.91 (455)	32.28 (820)	13.78 (350)	13.78 (350)	31.30 (795)	0.49 (12.5)	174 (79)	1110	710	1820
4165-FVG+	17.91 (455)	32.28 (820)	13.78 (350)	13.78 (350	31.30 (795)	0.49 (12.5)	176 (80)	1430	890	2320
4224-FVG+	22.64 (575)	36.42 (925)	14.76 (375)	17.52 (445)	35.24 (895)	0.59 (15)	298 (135)	1870	1160	3030
4302-FVG+	22.64 (575)	36.42 (925)	15.75 (400)	17.52 (445)	35.24 (895)	0.59 (15)	320 (145)	2670	1520	4190
4450-FVG+	37.40 (950)	57.09 (1450)	17.13 (435)	29.53 (750)	55.12 (1400)	0.98 (25)	794 (360)	4740	2110	6850

Model	Overall Dimensions in inches and (mm) W	H	D	Mounting Dimensions in inches and (mm) W1	H1	H2	Wt Lbs/(kg)	Heat Loss (W) Heat sink	Inside unit	Total
4605-FVG+	37.80 (960)	62.99 (1600)	17.91 (455)	29.53 (750)	61.02 (25)	0.98 (25)	926 (420)	6820	2910	9730

IMPULSE•VG+ Series 2 External Dynamic Braking Unit—Specifications & Dimensions

External Dynamic Braking Unit Specifications

	Specification Information by Model (DBU-XXXX) 24045	24090	24160	24220
Required control circuit power supply	110V; 10VAC			
Braking start voltage[1]	Jumper-selectable; 330V, 344V, 364V, or 380V for 200V jumper selection; or 629V, 660V, 687V, 727V, or 760V for 400V jumper selection.			
Maximum hysteresis error	Jumper-selectable 1% or 2%			
Power charge indication	Charge lamp stays on until bus voltage drops below 70VDC			
Location	Indoors; requires protection from moisture, corrosive gases and liquids			
Ambient temperature	-4° F to 122° F (-20° C to 50° C)			
Storage temperature	-4° F to 140° F (-20° C to 60° C)			
Humidity	90% relative (noncondensing)			
Vibration	1G less than 20 Hz; up to 0.2 G at 20–50 Hz			
Protective configuration	Wall-mounted, enclosed			

[1] Voltage at which dynamic braking is activated; ±2% variance.

NOTE: If a Series 2 drive is used to replace with an older version IMPULSE drive, it is permissable to use the older version dynamic braking units—also known as CDBRs.

External Dynamic Braking Unit Dimensions

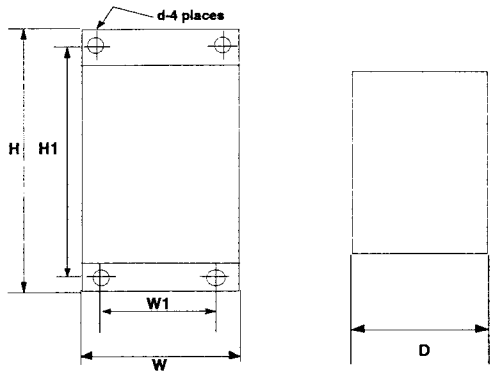

Figure 1.30 IMPULSE•VG+ External Dynamic Braking Unit

	Dimensions in inches and (mm)			Mounting Dimensions in inches and (mm)			
Model No.	**W**	**H**	**D**	**W1**	**H1**	**d**	**Wt Lb & (kg)**
DBU-24045	5.69 (144)	11.02 (280)	6.59 (167)	3.94 (100)	10.23 (260)	.236 (M6)	7.7 (3.5)
DBU-24090	9.64 (245)	14.75 (375)	7.56 (192)	8.26 (210)	13.98 (355)	.236 (M6)	27.6 (12.5)
DBU-24160	9.64 (245)	14.75 (375)	7.56 (192)	8.26 (210)	13.98 (355)	.236 (M6)	27.6 (12.5)
DBU-24220	9.64 (245)	14.75 (375)	7.56 (192)	8.26 (210)	13.98 (355)	.236 (M6)	27.6 (12.5)

chapter 2

Getting Up and Running With IMPULSE•VG+ Series 2

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Understanding the Drive

With its easy-to-use English keypad and logically organized parameters, *IMPULSE•VG+* Series 2 makes it easy to get up and running right away. This chapter explains how to navigate the parameter structure with the English display keypad. It also shows you how to view and program these parameters.

English Keypad

With two 16-character lines available, the English keypad display makes it possible for you to often understand what's going on without the use of a constants or fault codes table. 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. There are no potentiometers or selector switches. The English 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 very aware that the crane or hoist will move when you press the RUN button. If you have questions, contact Electromotive Systems.

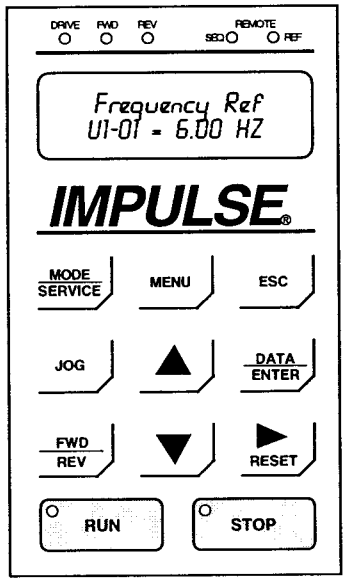


Figure 2.1

Keypad LED and Button Functions

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

This LED is on only when the drive is in the **Operation** mode, which includes when the drive is first powered up.

This LED is on when the FORWARD command is in effect.

This LED is on when the REVERSE command is in effect.

- The SEQ LED is on when the RUN or STOP command originates from the G5IF board. It is out when the RUN or STOP command originates from the keypad.
- The REF LED is on when **Speed Reference** is input through the main terminal strip.

- Pressing once, a three-digit value, "02X" appears. The unknown digit, "X," identifies the **Speed Reference** (A1-04) setting.
- Pressing twice, the telephone number of the Electromotive Systems Service Department appears.

Returns to the Main Menu—Operation display. (The Operation mode is not selected, however, until DATA/ENTER is pressed.)

Backs up to the previous display (parameter description or parameter description group).

Only functional when the drive is so programmed, it initiates the RUN command locally (from the keypad). The directional command, FORWARD/UP or REVERSE/DOWN, is determined by 

. It functions like 

, but at an alternate frequency.

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

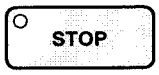
Selects the previous mode, parameter group, parameter function, parameter or parameter setting. It also decreases the blinking digit of a parameter setting.

Selects the digit—from left to right—to be changed (indicated by blinking). It also resets the fault log.

When in a view-only status, the DATA function displays the parameter setting. When in a programming status, the ENTER function sets and stores the parameter setting.

Selects the directional command that is in effect—FORWARD or REVERSE—when the drive is programmed to initiate the RUN command locally (from the keypad).

Only functional when the drive is so programmed, it initiates the RUN command locally (from the keypad). The directional command, FORWARD/UP or REVERSE/DOWN, is determined by . The button includes an LED, which is on when the button is being used.



Stops drive operation. The button includes an LED, which blinks during the deceleration of the crane or hoist, and stays on parameter while the crane or hoist is at rest.

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.

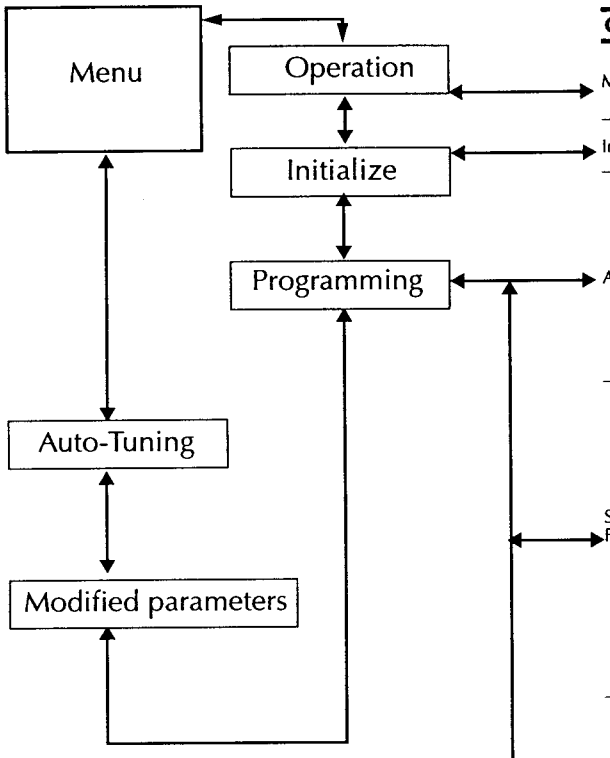
NOTE: The term "constant" and "parameter" have the same meaning.

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 Barrier** and **Access Level** features. For more information on these security features, see "Initialize Mode—Password Barrier and Access Level."

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

Two other features of which you should be aware are **Initialize Parameters** (A1-05) and **User Defaults** (O2-03). Both these features are related; when both programmed properly, they 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 (O2-03)."

IMPULSE•VG+ Series 2 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	Motor-Operated Potentiometer Seq
	B5	Acceleration/Deceleration
	B6	Phase Loss Detection
	B7	SVR Function
	B8	Jump Frequencies
Special Function	C1	Quick Stop/Reverse Plug Simulation
	C2	Micro-Positioning Control Multiplier
	C3	End of Travel Limit
	C4	Load Float
	C5	Load Check
	C6	Ultra-Lift
	C7	Torque Limit
	C8	Hoist or Traverse W/out Mech Load Brake
	C9	Optional Digital Input Set-up
	C10	Weight Measurement
	C11	Slack Cable Detection
	C14	Swing Control
Tuning	D1	DC Injection
	D2	Automatic Slip Compensation
	D4	Automatic Speed Regulator Tuning
	D5	Torque Control
	D6	Droop Control
	D8	Dwell Function
	D9	S-Curve Acceleration/Deceleration
	D10	Carrier Frequency
	D12	Factory Tuning
Motor	E1	V/f Pattern 1
	E2	Motor Set-up
	E3	Motor 2 Method
	E4	Motor 2 V/f Pattern
	E5	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
	F6	Digital Output 8 Set-up
	F7	PG Output 36 Set-up
Terminal	H1	Digital Inputs
	H2	Digital Outputs
	H3	Analog Inputs
	H4	Analog Outputs
	H5	Serial Communication Set-up
Protection	L1	Motor Overload
	L3	Stall Prevention
	L4	Ref Detection
	L6	Torque Detection
	L8	Hardware Protection
	L9	Automatic Rest
Operator	O1	Motor Selection
	O2	Keypad Key Selection
	O3	Clear History

An entire parameter list, along with descriptive information, can be found in Appendix A. It is quite easy to look up parameters as you are programming the drive because parameter codes appear on both the drive display and in Appendix A.

Function Modes

The parameters are organized under five modes: **Operation**, **Initialize**, **Programming**, **Modified Constants**, and **Auto-Tuning**. To run the crane, program the drive so it is in **Operation Mode**. The majority of the programming is accomplished when the drive is in the **Initialize** or **Programming Modes**. The **Modified Constants** mode is used for viewing and resetting changed parameters, which are found in the **Initialize** and **Programming** modes. The **Auto-tuning Mode** allows the drive to be programmed for a particular motor's specification, therefore the best performance can be achieved.

Programming the Drive

When you start programming *IMPULSE•VG+* Series 2, you will soon see that programming one parameter is similar to programming any other parameter. Remember to refer to Appendix A and "IMPULSE•VG+ Series 2 Structure of Parameters" as you program the drive. In addition, before you program the drive, ensure that you have read "Understanding the Drive."

NOTE: A digit that is double-underlined represents blinking text on the display.

To get up and running, there are three types of programming that you will have to perform:

- **Initialize Mode** parameters, which include the **Password Barrier** and **Access Level** features.
- **Programming Mode** parameters (The majority of the parameters are found in this mode.)
- **Built-In Auto-Tuning** parameters.

Initialize Mode—Password Barrier and Access Level

There are two "barriers" that determine what parameters you can view and change. Both **Password Barrier** and **Access Level**, which are found in the **Initialize** mode, determine the extent of programming you can accomplish. In order to change a parameter, you must be in a certain access level (or any access level less restrictive than that access level). However, to change **Access Level**, you must first be able to "unlock" **Password Barrier.**

Password Barrier remains unlocked when the **Enter Password 1** (A1-06) setting is equal to the **Select Password 1** setting (A1-07) setting. As long as **Password Barrier** is unlocked, you can change **Access Level** (A1-01), which in turn allows you to change all parameters except for **Factory Level** parameters.

NOTE: To change parameters that require Factory Level access, contact Electromotive Systems.

In addition to the **Factory Level**, there are three other access levels: **Operation Only, User Program,** and **Advanced Level**. The **Factory Access Level** is the most restricted level, followed by **Advanced Level, User Program,** and **Operation Only.** To find out the access level that needs to be set in order to program a parameter, see Appendix A.. Each parameter is assigned a minimum access level.

If **Password Barrier** is "locked" (A1-06 ≠ A1-07), you cannot change **Access Level**. You can, however, change any parameters that appear for the **Access Level** that is currently set. For example, if **Password Barrier** is locked, but the **Access Level** is **Advanced,** you are still able to program all of the parameters except for the **Factory Level** parameters.

Select Password 1 (A1-07)

To lock **Password Barrier,** you must enter a password. When the drive is shipped, the password is set to 0000, which means that **Password Barrier** is unlocked (A1-06 = A1-07). Locking **Password Barrier** requires that you change the password to a value other than 0000. You accomplish this by programming **Select Password 1** (A1-07).

NOTE: If you use **Password Barrier,** *remember your password. If you forget it, contact Electromotive Systems; you will have to return the drive so that* **Password Barrier** *can be unlocked.*

To program **Select Password 1** and set your own password:

1. Power up the drive. `Frequency Ref / U1-01=XX.XXHZ` appears. (*1.20Hz* is the initial setting.)

2. Press MENU. `** Main Menu ** / Operation` appears.

3. Press ▲. `** Main Menu ** / Initialize` appears.

4. Press DATA ENTER. `Select Language / English` appears.

5. Press ▲ until `Enter Password 1 / A1-06=Unlock` appears.

6. Press RESET, and while continuing to press RESET, press MENU.

   `Select Pass. 1 / A1-07=0000` appears.

   NOTE: Pressing RESET and then MENU will not get you to A1-07 unless A1-06=A1-07.

7. Press DATA ENTER. `Select Pass. 1 / 0000` appears.

8. Press ▲, ▼, or RESET until the desired 4-digit password appears.

9. Press DATA ENTER. `Entry Accepted` appears for one second, followed by

   `Select Pass. 1 / A1-07=XXXX`.

10. Press ESC. `Enter Password 1 / A1-06=Lock` appears.

11. Press DATA ENTER . Enter Password 1 A1-06=0000 appears.

12. Press ▲ , ▼ , or ► RESET until a number that is not equal to the **Select Password 1** setting (A1-07) appears.

13. Press DATA ENTER . You have now changed the password and locked **Password Barrier.**

NOTE: If you do not perform steps 10 through 13 the password barrier will remain unlocked.

Also, "Entry Accepted" does not necessarily mean that you have unlocked the password barrier. It merely means that a setting has been entered.

Enter Password 1 (A1-06)

To enter the password to unlock **Password Barrier**, perform the preceding steps 1 through 6, and then, press DATA ENTER . Enter password 1 here and press the DATA ENTER key again . Remember—**Password Barrier** remains unlocked (even when power is removed) until you lock it again (steps 10 through 13).

Access Level (A1-01)

To change **Access Level** (assuming you have unlocked **Password Barrier**):

1. Press MENU . ** Main Menu ** Operation appears.

2. Press ▲ until ** Main Menu ** Initialize appears.

3. Press DATA ENTER . Select Language English appears.

4. Press ▲ . Access Level XXXXXXXXXX appears. One of the following three **Access Levels** appears below "Access Level":

   - **Operation Only**
   - **User Program**
   - **Advanced Level**

5. Press DATA ENTER . A1-01= 1 *** XXXXXXXXXX appears. (Once again, one of the three **Access Levels** appears on the second line.)

6. Press ▲ until the desired **Access Level** appears.

7. Press DATA ENTER . Entry Accepted appears for one second, followed by Access Level XXXXXXXXXX . You have now changed the **Access Level**.

Other Initialize Mode Parameters

Once you have addressed the **Access Level** and **Password Barrier**, you can program the other **Initialize Mode** parameters.

Motion Method (A1-03)—X-Press Programming

Unless you specify otherwise when you order the drive, **Motion Method** will be set to **NLB Hoist** (Hoist Without Mechanical Load Brake). It may also be specified to be set to **Traverse** at the time of order.

Speed Control Method (A1-04) ("Speed Ref")—X-Press Programming

There are seven **Speed Control Method** options: **Two-, Three-, and Five-Speed Multi-Step; Two- and Three-Step Infinitely Variable**; **Uni-polar Analog**; and **Bi-polar Analog**. When you select a Speed Control Method multi-step option, your speed references (B1-01 through B1-05) are X-Press Programmed as shown below.

Const#	Abbreviation	5-Speed M-Step	2-Step Infinitely Variable	3-Step Infinitely Variable	Uni-Polar Analog	Bi-Polar Analog	2-Speed M-Step	3-Speed M-Step
A1-04	Speed Ref	0	1	2	3	4	5	6
B1-01	Speed 1	6.00	6.00	6.00	6.00	6.00	20.00	15.00
B1-02	Speed 2	15.00	15.00	15.00	15.00	15.00	60.00	30.00
B1-03	Speed 3	30.00	30.00	30.00	30.00	30.00	30.00	60.00
B1-04	Speed 4	45.00	45.00	45.00	45.00	45.00	45.00	45.00
B1-05	Speed 5	60.00	60.00	60.00	60.00	60.00	60.00	60.00
B1-06	Speed 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B1-07	Speed 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B1-08	Speed 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B1-09	JOG Speed	6.00	6.00	6.00	6.00	6.00	6.00	6.00
B1-10	Ref Priority	0	0	0	1	1	0	0
H1-01	Terminal 3 Sel	00	05	04	07	07	00	00
H1-02	Terminal 4 Sel	01	07	05	09	09	07	01
H1-03	Terminal 5 Sel	02	09	07	13	13	09	07
H1-04	Terminal 6 Sel	03	13	09	16	16	13	09
H1-05	Terminal 7 Sel	24	24	24	24	24	24	24
H1-06	Terminal 8 Sel	0E	0E	0E	0E	0E	0E	0E

To select your **Speed Control Method** (assuming you unlocked **Password Barrier**):

1. Press MENU. `** Main Menu **` `Operation` appears.
2. Press ▲. `** Main Menu **` `Initialize` appears.
3. Press DATA ENTER. `Select Language` `English` appears.
4. Press ▲ until `Speed Ref ***` `XXXXXX` appears. In the second line, either of the following options will appear:
   - 5-SPD Multi-Step
   - 2-Step Infinitely Variable

- 3-Step Infinitely Variable
- Unipolar Analog
- Bipolar Analog
- 2-SPD Multi-Step
- 3-SPD Multi-Step

5. Press DATA ENTER. A1-04= 0 *** 5-SPD Multi-Step, A1-04= 1 *** 2-Step Inf Var, A1-04= 2 *** 3-Step Inf Var, A1-04= 3 *** Uni-Polar Analog, A1-04= 4 *** Bi-Polar Analog, A1-04= 5 *** 2-SPD Multi-Step, or A1-04= 6 *** 3-SPD Multi-Step appears.

6. Press ▲ until the desired **Speed Control Method** appears.

7. Press DATA ENTER. Entry Accepted appears for one second, followed by a display of the speed control method selected. You have now changed **Speed Control Method**.

Modifying Speed in—2-, 3-, or 5-Speed Multi-Step

To select speed values other than default values for **Multi-Step** control, perform the followings:

1. Select the desired speed, **Speed Control Method**, as described in the preceding "Speed Control Method (A1-04) ("Speed Ref")—X-Press Programming."
2. Program the **Preset References** (B1-01 through B1-08) to the desired speed values. These references are the speeds (Hz) assigned to each step, which are represented by the **Terminal Selection** parameters, H1-02 through H1-06.

Initialize Parameters (A1-05) and User Defaults (O2-03)

Initialize Parameters and **User Defaults** allow you to accomplish two very useful tasks:

- Establish your own parameter defaults. (02-03)
- Revert back to your own parameters defaults after making some programming changes. (A1-03)

User Defaults (O2-03)

To establish your own parameter defaults, perform the following steps (assuming you are already in **Programming Mode**):

1. Press DATA ENTER. Group b / Application appears.
2. Press ▲ until Group o / Operator appears.
3. Press DATA ENTER. Function o1 / Monitor Select appears.
4. Press ▲ until Function o2 / Key Select appears.
5. Press DATA ENTER. Mode Service / XXXXXXXXXXX appears.
6. Press ▲ until User Defaults / No Change appears.
7. Press DATA ENTER. o2-03= 0 *** / No Change appears.
8. Press ▲. o2-03= 1 / Set Defaults appears.

NOTE: Once you perform the next step, you erase any defaults that you had previously saved. Make sure that the parameter settings that you currently have are satisfactory before you perform the next step.

9. Press DATA ENTER . Entry Accepted appears for one second, followed by User Defaults / No Change . You have now programmed **User Defaults**, by which you defined your own parameter defaults.

   NOTE: Even though the display indicates "No Change" at this point, the parameter values that you currently have programmed are indeed saved as your new defaults.

Initialize Parameters (A1-05)

Initialize Parameters enables you to revert back to the defaults that you defined when you programmed **User Defaults (O2-03)**.

To revert back to your user-defined defaults, perform the following steps (assuming you are already in **Initialize Mode**):

1. Press DATA ENTER . Select Language / English appears.

2. Press ▲ until Init Parameters / No Initialize appears.

3. Press DATA ENTER . A1-05= 0 *** / No Initialize appears.

4. Press ▲ . A1-05= 1110 / User Initialize appears.

   NOTE: Once you perform the next step, you will erase your current parameter settings and revert to your user-defined defaults, which may differ from the current settings.

5. Press DATA ENTER . Entry Accepted appears for one second, followed by Init Parameters / No Initialize . You have now programmed **Initialize Parameters** so that the drive parameters revert back to your user-defined defaults.

   NOTE: Even though the display indicates "No Initialize" at this point, your drive parameter settings have indeed reverted to the user-defined defaults that you established when you programmed **User Defaults (O2-03)**.

User-Defined Parameters (A2-XX)

With **User-Defined Parameters** (A2), you can allow an operator who is limited to **User Program** access to program only selected **Programming Mode** parameters (the "B," "C," "D," "E," "F," "H," "L," and "O" parameters). You can select up to 30 **User-Defined** parameters.

We recommend that you limit your operators' access to the following parameters so that you can avoid nuisance faults and unintended parameter changes:

- Minimum Speed/Speed 1 (B1-01)
- Speed 2 (B1-02)
- Speed 3 (B1-03)
- Speed 4 (B1-04)
- Speed 5 (B1-05)
- Micro-Speed Gain 1 (C2-01)

To select a **User-Defined Parameter**:

1. Ensure you are in **Advanced Level** access.

2. Press MENU. `** Main Menu **` `Operation` appears.

3. Press ▲ until `** Main Menu **` `Initialize` appears.

4. Press DATA ENTER. `Select Language` `English` appears.

5. Press ▼. `Function A2` `User Constants` appears.

6. Press DATA ENTER. `User Param 1` `A2-01= -----` appears.

7. Press DATA ENTER again. `User Param 1` `-----` `=` appears.

8. Press ▲, ▼, or ▶ RESET until the desired parameter constant number appears (for example—A1-01, C3-5, etc.)

9. Press DATA ENTER . You have now selected a **User-Defined Parameter.**

10. To select another one, press ▲ and perform steps 6 through 9 again.

    ("User Param 2," "User Param 3," etc., appears as you continue to select **User-Defined Parameters.**)

Modified Constants Mode

In the **Modified Constants Mode**, any parameter—except for the **Monitor** and **Initialize** parameters—that has been changed from the factory initial setting will appear. To use this mode, you must be in the **Advanced Access Level.**

To view or change any parameters that have been changed:

1. Press MENU . `** Main Menu **` `Operation` appears.

2. Press ▲ until `** Main Menu **` `Modified Consts` appears.

3. Press DATA ENTER . If any parameters change, they appear—one after another.

4. To view the next changed parameter, press ▲ .

5. To modify a changed parameter, press DATA ENTER , followed by pressing ▲ , ▼ ,

   or RESET to obtain the desired setting.

6. Press DATA ENTER to enter the change.

Programming Mode

Most of your programming will be performed in the **Programming Mode.** The following steps explain how to program the parameters in this mode.

To change a parameter setting for a parameter that is in the Programming Mode:

1. From Appendix A, identify the parameter code and **Access Level** associated with the parameter that you are programming.
2. Power up the drive.

3. Unlock the Password Barrier by performing the steps in "Initialize Mode—Password Barrier and Access Level."
4. Select the appropriate **Access Level** by performing the steps in "Access Level (A1-01)."
5. Refer to Appendix A and identify the parameter function and group that are associated with the parameter code.
6. From Appendix A, determine whether the parameter group is in the **Operation**, **Initialize**, or **Programming** mode.
7. Press MENU. ** Main Menu ** Operation appears.
8. Press ▲ until the desired parameter mode appears (** Main Menu ** Initialize or ** Main Menu ** Programming).
9. Press DATA ENTER. Group b Application appears.
10. Press ▲ until the desired **Parameter Group** appears, and then press DATA ENTER.

    Press ▲, ▼, RESET, or DATA ENTER to get to the desired parameter and to change the parameter setting.

Ultra-Lift (C6-01)

Ultra-Lift provides additional productivity by allowing a crane or hoist to be moved into position quickly. 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 **Ultra-Lift Maximum Ouput Frequency-RAISE** (C6-02), **Ultra-Lift Maximum Output Frequency-LOWER**(C6-03), and **Maximum Frequency** (E1-04).

Enable Ultra-Lift Function:

2,3,5-Speed Multi-Step (A1-04=0, 5, or 6):

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 FOR/REV output frequency.
3. Set C6-04 and C5-05 to determine **Ultra-Lift** maximum enable output current.
4. Set the **Ultra-Lift Enabling Speed C6-06** is set 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 Infinite Variable (A1-04=1 or 2)

6. If the system is using **2-Step** or **3-Step Infinite Variable** as the **Speed Control Method**, additions to the steps form 1 to 5, the following formula is used to adjust the constant ***B2-1 (Reference Upper Limit).***

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

Bi-Polar/Uni-Polar Analog (A1-04=3 or 4)

7. If the system is using **Bi-Polar Analog** or **Uni-Polar Analog** as the **Speed Control Method**, additions to the steps from 1 to 5, the following formula is used to adjust the constant ***H3-2 (Gain Multiplier for Terminal 13 analog input signal).***

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

G5IN4 Digital Multi-Function Inputs (C9-01 and C9-02)

If you have the optional G5IN4 board installed, you are able to assign additional multi-function inputs to the drive. The G5IN4 board has four terminals, each of which can be programmed to one of the following 14 sets of inputs. In addition, you can determine whether each input within the set is enabled.

G5IN4 Digital Multi-Function Input Sets (1 through E)

Multi-Function Input Assigned to Each Terminal				First Digit (From Left) You Enter
Terminal 1	**Terminal 2**	**Terminal 3**	**Terminal 4**	
Upper Limit—SLOW DOWN; Normally Closed	*Upper Limit STOP; Normally Closed*	*Lower Limit SLOW; Normally Closed*	*Lower Limit STOP; Normally Closed*	**1**
Upper Limit—SLOW DOWN; Normally Open	*Upper Limit STOP; Normally Open*	*Lower Limit SLOW; Normally Open*	*Lower Limit STOP; Normally Open*	**2**
Upper Limit STOP; Normally Closed	*Lower Limit STOP; Normally Closed*	*Micro-Positioning Control Multiplier 1*	*Micro-Positioning Control Multiplier 2*	**3**
Upper Limit STOP; Normally Open	*Lower Limit STOP; Normally Open*	*Micro-Positioning Control Multiplier 1*	*Micro-Positioning Control Multiplier 2*	**4**
Upper Limit STOP; Normally Closed	*Lower Limit STOP; Normally Closed*	*Micro-Positioning Control Multiplier 1*	*Ultra-Lift Enable*	**5**
Upper Limit STOP; Normally Open	*Lower Limit STOP; Normally Open*	*Micro-Positioning Control Multiplier 1*	*Ultra-Lift Enable*	**6**
Upper Limit STOP; Normally Closed	*Lower Limit STOP; Normally Closed*	*Micro-Positioning Control Multiplier 1*	*Torque Limit Acceleration/ Deceleration*	**7**
Upper Limit STOP; Normally Closed	*Lower Limit STOP; Normally Closed*	*Micro-Positioning Control Multiplier 1*	*Torque Limit Acceleration/ Deceleration*	**8**
Upper Limit STOP; Normally Closed	*Lower Limit STOP; Normally Closed*	*Micro-Positioning Control Multiplier 1*	*Zero Servo Command*	**9**
Upper Limit STOP; Normally Closed	*Lower Limit STOP; Normally Closed*	*Micro-Positioning Control Multiplier 1*	*Weight Measurement Command*	**A**
Ultra-Lift Enable	*Torque Limit Acceleration/ Deceleration*	*Micro-Positioning Control Multiplier 1*	*Micro-Positioning Control Multiplier 2*	**B**
Alternate Torque Limit	*Acceleration/ Deceleration Changeover*	*Micro-Positioning Control Multiplier 1*	*Upper Limit SLOW; Normally Closed*	**C**
Zero Servo Command	*Torque Limit Acceleration/ Deceleration*	*Micro-Positioning Control Multiplier 1*	*Micro-Positioning Control Multiplier 2*	**D**
Alternate Speed Reference Upper Limit	*Serial/Inverter Command Changeover*	*Micro-Positioning Control Multiplier 1*	*Alternate Torque Limit*	**E**

To program these multi-function inputs, you have to program **G5IN4 Digital Multi-Function Input—Enabling (Disabling)** (C9-01) and **G5IN4 Digital Multi-Function Input Set Selection** (C9-02) as follows (assuming you are already in **Programming** mode).

1. Press DATA ENTER . Group b Application appears.

2. Press ▲ until | Group C
Operator | appears.

3. Press DATA ENTER . | Function C1
0-Stp/Plg Rev | appears.

4. Press ▲ until | Function C9
ESI DI-08 Setup | appears.

5. Press DATA ENTER . | DI Input
Disabled | appears.

6. Press DATA ENTER . | C9-01= 0 ***
Disabled | appears.

7. Press ▲ . | C9-01= 1
Enabled |

8. Press DATA ENTER . | Entry Accepted | appears for one second, followed by

| DI Input
Enabled | .

9. Press ▲ . | ESI DI-08
C9-02 = XXXX | , where each "X" is a hexadecimal number, as indicated in the preceding table.

10. Press DATA ENTER . | ESI DI-08
XXXX |

11. Looking at the preceding table, select a set of parameter inputs and note the corresponding "First Digit (From Left) You Enter."

12. For the first blinking character, enter the "First Digit (From Left) You Enter"

13. Press RESET , ▲ , or ▼ until the second and third digits from the left are both "0" (zero).

14. Press RESET so you are at the fourth digit from the left. You are now ready to determine which of the four inputs in the set you want enabled.

15. For each terminal, determine whether the input is enabled or disabled, and use the following table to select the corresponding number or letter that you will enter for the "Fourth Digit (From Left) You Enter."

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 E = Enable
D = Disable

16. Press ▲ or ▼ until the correct "Fourth Digit You Enter on Display" appears.

Press DATA ENTER . You have now programmed **G5IN4 Digital Multi-Function Input—Enabling (Disabling)** (C9-01) and **G5IN4 Digital Multi-Function Input Set Selection** (C9-02).

Digital Outputs—Fault Annunciate (H2-01, H2-02, and H2-03)

Digital Outputs—Fault Annunciate enables you to assign a set of six fault outputs to Terminals 25 and/or Terminal 26. In addition, you can select whether each fault output is enabled.

NOTE: Terminal 9 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 ▲ until `Group H / Terminal` appears.

2. Press DATA ENTER. `Function H1 / Digital Inputs` appears.

3. Press ▲. `Function H2 / Digital Outputs` appears.

4. Determine the output terminal to which you want **Fault Annunciate** assigned—Terminal 9, 25, or 26.

5. Press DATA ENTER. `Terminal 9 Sel / XXXXXXXXXX` appears. If you want Terminals 25 or 26, press ▲ until it appears. Let's assume you are using Terminal 9.

6. Press DATA ENTER. `H2-01= X*** / XXXXXXXXXX` appears.

7. Press ▲ or ▼ until `H2-01= 40 / Fault Annunciate` appears.

8. Press DATA ENTER. `Fault Data Input / 00` appears.

9. 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.

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	1	1	BE7	BE5	BE4	BE0	OL2	OL1
Set 2	1	0	OS	DEV	LL1	LL2	UL1	UL2
Set 3	0	1	BE6	BE5	BE4	BE3	BE2	BE1

10. Determine whether you want each fault output enabled. If you want 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 (row).

    For example, if you selected Set 2 and you chose to enable only LL1 and UL1, you would have "1 0 0 0" and "1 0 1 0" as your two 4-digit binary numbers.

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

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."

12. Press ▲ or ▼ until the appropriate hexadecimal number appears for *XX* on [Fault Data Input XX].

Continuing the example, you would enter "8A."

You have now programmed **Digital Outputs—Fault Annunciate (H2-01, H2-02, or H2-03).**

External Fault Response Selection (H1-01 through 06=24)

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. Table 2.1 below shows the possible selections for an external fault response. Use Figure 2.2 as a guide to program a multi-function input to the desired setting.

Table 2.1

External Fault Selection								Setting Result
Input Level Selection		Dectection 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

NOTES:

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

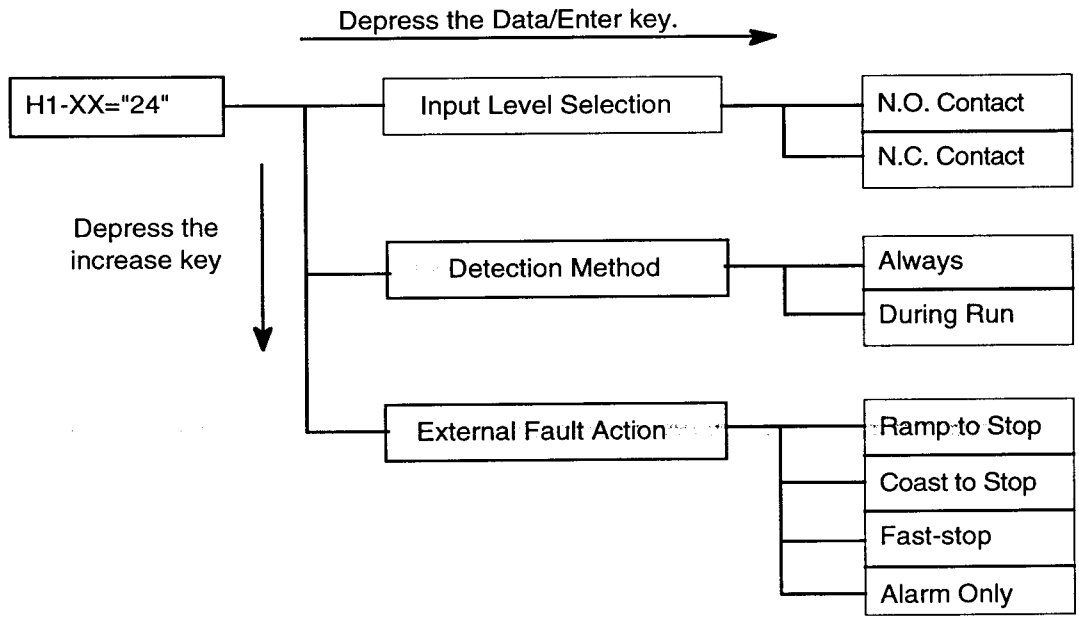


Figure 2.2

Auto-Tuning Mode

WARNING

Before executing Built-In 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.

To ensure that your overhead crane or hoist system runs optimally, *and* when using the **Flux Vector Control Method**, you must auto-tune the drive. By using *IMPULSE•VG+* Series 2's **Built-In Auto-Tuning**, you can quickly program any motor's characteristics into the drive.

When you are ready to auto-tune your drive, first obtain the following motor nameplate characteristics:

- Motor-rated voltage (**Rated Voltage**)
- Motor-rated current (**Rated Current**)
- Motor-rated frequency (**Rated Frequency**)
- Motor-rated speed (**Rated Speed**)
- Motor-selection (**Select Motor 1/2**)
- Number of poles (**Number of Poles**)
- Encoder speed (**PG Pulses/Rev**)

NOTE: The "motor selection" characteristic, which appears as "Select Motor 1/2" on the

keypad, can only be set to "1."

To auto-tune your drive with the motor's nameplate characteristics (assuming you have unlocked **Password Barrier**):

1. Press MENU. ** Main Menu ** Operation appears.

2. Press ▲ until ** Main Menu ** Auto-Tuning appears.

3. Press DATA ENTER. Rated Voltage 230.0 VAC appears. (*230.0VAC* is the initial setting.)

4. Press ▲, ▼, or RESET until the desired **Motor-Rated Voltage** appears.

5. Press DATA ENTER. Entry Accepted appears for one second, followed by Rated Voltage XXX.X VAC.

6. Press ▲. Rated Current XX.XX A appears. (*XX.XX A* is the initial setting.)

7. Press DATA ENTER. Rated Current XX.XX A appears.

8. Press ▲, ▼, or RESET until the desired **Motor-Rated Current** appears.

9. Press DATA ENTER. Entry Accepted appears for one second, followed by Rated Current XX.XX A.

10. Press ▲. Rated Frequency 60.0 Hz appears. (*60.0 Hz* is the initial setting.)

11. Press DATA ENTER . Rated Frequency 60.0 Hz appears.

12. Press ▲, ▼, or RESET until the desired **Motor-Rated Frequency** appears.

13. Press DATA ENTER . Entry Accepted appears for one second, followed by Rated Frequency XX.X Hz .

14. Press ▲ . Rated Speed XXXX rpm appears. (1750 rpm is the initial setting.)

15. Press DATA ENTER . Rated Speed XXXX rpm appears.

16. Press ▲, ▼, or RESET until the desired **Motor-Rated Speed** appears.

17. Press DATA ENTER . Entry Accepted appears for one second, followed by Rated Speed XXXX rpm .

18. Press ▲ . Number of Poles 4 appears. (4 poles is the initial setting.)

19. Press DATA ENTER . Number of Poles 4 appears.

20. Press ▲, ▼, or RESET until the desired **Number of Poles** appears.

21. Press DATA ENTER . Entry Accepted appears for one second, followed by Number of Poles X .

22. Press ▲. Select Motor 1/2 1 appears. (*1* motor is the initial setting.)

23. Press DATA ENTER. Select Motor 1/2 01 appears.

24. Press DATA ENTER. Entry Accepted appears for one second, followed by Select Motor 1/2 1.

25. Press ▲. Tuning Ready? Press RUN key appears.

26. Press RUN. Tune Proceeding 0Hz 0.01 A appears. **Built-In Auto-Tuning** takes about two minutes to complete. When the process is complete, Tune Successful appears.

27. Press MENU. ** Main Menu ** Operation appears. You have now auto-tuned the drive.

chapter 3

Servicing IMPULSE•VG+ Series 2

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Service

This chapter includes information pertaining to on-call service, drive identification, troubleshooting, and warranty. Before you install, troubleshoot, or service the drive, we highly recommend that you read this entire chapter. Doing this will help assure quick service response, minimize your on-site repair costs, and reduce crane downtime.

Your *IMPULSE•VG+* Series 2 drive includes a two-year warranty from date of shipment. The warranty is described in detail later in this chapter.

On-Call Service

If you ever require our assistance, contact us at (800) 288-8178; our fax number is (800) 298-3508. Technical support is available 24 hours a day, seven days a week, and 365 days a year. If necessary, we can arrange to have a service technician visit your site to evaluate the situation (normally at your expense).

Identifying Your Drive

If you ever have to contact Electromotive Systems about your drive, first determine the model and serial numbers of your drive by looking at the nameplate shown below.

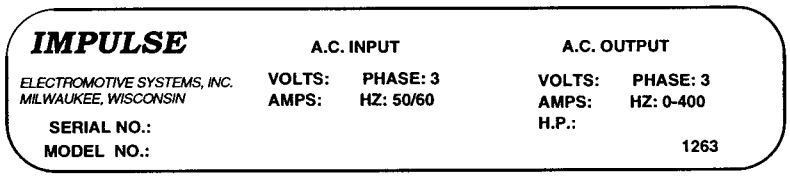

Figure 3.1

This nameplate is located on the side of the drive nearest to the keypad.

Service Policy For Small Drives, DBUs, and Other Electrical Components

This section explains Electromotive Systems' service policy for the small drives (2006-FVG+ through 2224-FVG+ and 4001-FVG+ through 4165-FVG+), dynamic braking units (DBUs), and other electrical components.

Should your *IMPULSE* product fail during the warranty period, Electromotive Systems will repair or replace your unit within 72 hours (3 working days). In most cases, we can supply a replacement unit within 24 hours (1 working day). If the problem is not covered under warranty, you are responsible for the cost of the repairs and the shipping charges.

To return a failed unit (or part):

1. Request a Return Authorization (RA) from Electromotive Systems' Service Department, as a condition for us to repair or replace the unit. Return the failed unit to Electromotive Systems **via pre-paid freight**. When you call, please have the serial number of the drive or DBU available and be prepared to provide the information requested on the Return Authorization Information Sheet found on page 3-5.

2. A purchase order or credit card is required to cover the cost of the replacement unit or repairs to a returned unit.

Electromotive Systems will inspect the failed unit and determine if the unit is covered under warranty.

- If the unit is covered under warranty, Electromotive Systems will credit the cost of the replacement unit and/or repairs and reimburse for all reasonable freight charges.

  NOTE: Freight charges incurred from sources other than common ground carriers WILL NOT be reimbursed unless pre-approved by Electromotive Systems.

- If the unit is not covered under warranty, Electromotive Systems will bill you for the cost of the replacement unit or the cost of repairs. Electromotive Systems will also bill you for a $125.00 inspection fee (this fee will be waived if repairs are made to the unit) and any freight charges incurred by Electromotive Systems.

Service Policy for Large Drives

This section explains Electromotive Systems' service policy for the large drive (2300-FVG+ and 4224-FVG+ and larger).

Because of the size and weight of large units, it may not be practical to return the entire drive to Electromotive Systems for repair. If a drive has failed, you must first contact us by telephone for assistance in diagnosis. If necessary, we may authorize the on-site replacement of specific components and the return of these failed parts for credit, replacement, or repair. These components include; but not limited to:

- Control/logic card
- Main base drive card
- Subbase drive card
- Drive unit transistor cassette
- Fan unit
- Main input diode circuit
- Capacitors
- DC Bus Fuses
- Electromotive Systems interface and special option cards.

On-site troubleshooting and the replacement of failed components is to be performed only by technicians approved by Electromotive Systems.

Follow procedures outlined above for returning components.

ELECTROMOTIVE SYSTEMS, INC.

RETURN AUTHORIZATION INFORMATION SHEET

To Expedite Processing Complete This Form

Please provide us with the information on lines with ☐ checked. If you have any questions regarding the completion of this form contact Electromotive Systems Service Deparment at 800-288-8178 ex 375

1. Return Authorization Number: RA_____ Issue Date __/__/__
2. Customer_____
3. Customer P.O. Number_____
4. Contact Name_____ Phone_____FAX_____

☐ 5. End User (name/location)_____

☐ 6. Component Model_____

☐ 7. Component Serial Number_____

ABOVE MATERIAL TO BE RETURNED VIA PRE PAID FREIGHT TO:
Electromotive Systems, Inc.
N49 W13650 Campbell Drive
Menomonee Falls, WI 53051
Please enclose a copy of this form with material to be returned and mark RA number clearly on shipping container

APPLICATION INFORMATION

☐ 8. Type of application (i.e., Mill, Log Handling, Standard Industrial): _____
_____

☐ 9. Crane Duty Cycle: CMAA A B C D E F (circle)

☐ 10. Motion: ___ Main Hoist ___ Aux Hoist ___ Bridge ___ Trolley
___ Other (please specify) _____

☐ 11. Describe conditions under which problem occurred _____
_____

☐ 12. Make/Model Dynamic Braking Resistor: _____

☐ 13. Line Voltage ___ 230 ___ 460 ___ 575 ___ Other (specify) _____

☐ 14. Motor Information: Qty___ 1 ___ 2 ___ Other (please specify) _____
_____ Motor RPM _____ Nameplate Full Load Amps

☐ 15. Reactors used___ Line ___ Load ___ None

FOR WARRANTY INFORMATION SEE BACK OF THIS FORM

Control number 1584 Original Date:04/08/97 Rev 00 Page 1 of 1

Electromotive Systems Limited Warranty

Electromotive Systems, Inc., hereafter referred to as Company, guarantees all items manufactured by it against any defects of material and/or workmanship for a period of two years from the date of shipment. Company makes NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AS TO THE MERCHANTABILITY OR FITNESS OF THE ITEMS FOR THEIR INTENDED USE OR AS TO THEIR PERFORMANCE. Any statement, description or specification in Company's literature is for the sole purpose of identification of items sold by the Company and imparts no guarantee, warranty or undertaking by company of any kind. Components and accessories not manufactured by Electromotive Systems are not included in this warranty and are warranted separately by their respective manufacturers.

Company's sole liability shall be to repair at its factory, or replace any item returned to it within two years from date of shipment, which Company finds to contain defective material or workmanship. All items to be repaired or replaced shall be shipped to Company (Note: return authorization by Company is required) within said two year period, freight prepaid, as a condition to repair or replace defective material or workmanship. Company's herein assumed responsibility does not cover defects resulting from improper installation, maintenance, or improper use. Any corrective maintenance performed by anyone other than the Company during the warranty period shall void the warranty. Company shall not be liable for damages of any kind from any cause whatsoever beyond the price of the defective Company supplied items involved. 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 the use of any Company supplied items or material.

Company neither assumes nor authorizes any other person to assume for Company any other liability in connection with the sale or use of items sold by Company.

Materials or items may not be returned for credit, without the prior written consent of the Company. Any authorized return of materials or items shall be subject to a restocking charge equal to 25% of the net invoiced amount ($100 minimum charge for all control products) after Company determines that the material or item is in resalable condition. If upon receipt of the material or items returned, the Company determines that said material or items cannot be resold without alteration or service, the Company reserves the right to reject the returned materials or items and to send the same back to said purchaser at purchaser's expense.

Any claim for errors in shipment or for material or time shortages must be received by Company within 30 days of shipment and must be accompanied by copies of the bill of lading and packing slip.

Troubleshooting the Drive

If you find that the drive-motor system is malfunctioning, troubleshoot the problem by using the information in the following table. Contact Electromotive Systems if the recommended corrective action does not adequately address any problem that you may encounter.

In the following table, *"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.

Drive Faults and Indicators

Fault Code	Fault or Indicator Name/Description	Corrective Action
BB	**External Base Block Indicator.** An external base block command is input from control circuit terminal.	Check sequence circuit.
BE0	**Brake Answer-Back Fault.** During RUN, Brake Answer-Back is lost. Input from brake contactor or brake limit switch has been disconnected for more than 500 msec.	1. Check electric brake. 2. Check auxiliary contact on brake contactor and brake switch. 3. Check brake contactor. 4. Check for open wiring between contactor or switch and drive input card (G5IN4 and/ or G5IF). 5. Replace drive input card (G5IN4 and/or G5IF).
BE1	**Torque-Proving Fault.** At START, pulse feedback, after brake release, is greater than C8-05 count. There is excessive roll-back at start.	1. Increase value of C8-03. Brake Release torque. 2. Increase the value of C8-05 counts. 3. Decrease the value of C8-04 timer. 4. Check encoder signal for noise. • Check encoder grounding. • Check encoder shielded cable. 5. Replace encoder.
BE2	**Current-Proving Fault.** At START for Torque Proving Sequence only–Current (IFB) has not reached predetermined setting within predetermined time at START.	1. Make sure motor has been auto-tuned. 2. Increase the value of C8-02 timer. 3. Increase the value of C8-01 timer. 4. Increase the value of C4-02 gain.
BE3	**Brake Release Fault.** For Brake Release-Check Sequence only–Speed feedback is less than C8-07 counts. After electric brake release command is output–Electric brake not released.	1. Check electric brake. 2. Check brake contactor. 3. Check encoder if brake is releasing. 4. Check encoder shielded cable. 5. Increase the value of C8-06 timer. 6. Decrease the value of C8-07 counts.
BE4	**Brake Answer-Back Fault.** At Start, Brake Answer-back is not input within predetermined time after electric brake release command is output–Electric brake not released.	1. Check electric brake. 2. Check brake contactor. 3. Check auxiliary contact on brake contactor. 4. Check brake limit switch. 5. Check wiring between contactor or switch and drive input card (G5IN4 and/or G5IF).

Fault Code	Fault or Indicator Name/Description	Corrective Action
bE5	**Brake Answer-Back Fault.** At Stop, Brake Answer-back signal is not removed within predetermined time after electric brake release command is removed–Electric brake not closed.	1. Check electric brake. 2. Check brake contactor. 3. Check auxiliary contact on brake contactor. 4. Check brake limit switch. 5. Check wiring between contactor and switch and drive input card (G5IN4 and/or G5IF). 6. Increase the value of C8-11 timer.
bE6	**Brake Release Fault.** At stop, Brake Proving Sequence only–Pulse feed-back after brake command removed, is greater than C8-05 count–Excessive movement through brake at stop.	1. Check for movement through brake at stop. 2. Increase the value of C8-13 counts. 3. Increase the value of C8-11 timer. 4. Check encoder signal for noise. Ensure encoder shielded cable is in good condition. 5. Replace encoder.
bE7	**Brake Answer-Back Fault**—At Power Up, Brake Answer-back is on–Electric brake not closed.	1. Check electric brake. 2. Check for failed brake contactor. 3. Check auxiliary contact on brake contactor. 4. Check brake limit switch. 5. Check wiring between contactor or switch and drive input card (G5IN4 and/or C5IF). 6. Replace drive input card (G5IN4 and/or G5IF).
CALL	**Serial Communication SI-B Transmission Fault.** Control data is not received correctly after power supply is turned ON for 2 sec.	Check transmission devices and signals.
CE	**MODBUS Communication Fault.** Control data is not received correctly when power supply is turned ON.	Check transmission devices and signals.
CF	**Control Fault.**	Replace control board.
CPF00	**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. • MPU peripheral element check fault (on-line).	1. Check the keypad connection. 2. Check the control circuit wiring. 3. Replace the control board.
CPF01	**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 is established after supplying power, but later transmission fault continues for more than 2 sec. • MPU peripheral element check fault (on-line).	Same action as for CPF00.
CPF02	**Control Circuit Fault 2—Base Block Circuit.** Inverter control board fails.	Replace the control board.
CPF03	**Control Circuit Fault 3—EEPROM.** Inverter control board fails.	Same action as for CPF02.

Fault Code	Fault or Indicator Name/Description	Corrective Action
CPF04	**Control Circuit Fault 4—CPU Internal A/D Converter.** Because of external noise, excessive vibration or shock, or component failure, one or both of the following occurs: • Nonvolatile RAM (BCC, access code) fault occurs. • Parameter initialization fault.	Same action as for CPF02.
CPF05	**Control Circuit Fault 5—CPU External A/D Converter.** Analog-to-digital converter fault in CPU because of chip failure.	Same action as for CPF02.
CPF06	**Control Circuit Fault 6—Optional Card Connection.** Optional card is disconnected.	Reinstall the optional card.
CPF10	**Control Circuit Fault 10—G5IN4.** G5IN4 Card fails.	Replace G5IN4 card.
CPF20	**Control Circuit Fault 20—AI-14.** Analog-to-digital converter fails or analog speed reference error.	Replace AI-14 board.
CPF21	**Control Circuit Fault 21—CPU on Optional Card.** CPU on an installed optional card fails.	Replace the optional card.
CPF22	**Control Circuit Fault 22—Optional Card Code.** Optional card code is not compatible with the inverter.	Check programming of Option Parameters.
CPF23	**Control Circuit Fault 23—DP-RAM.** DP-RAM on an installed optional card fails.	Replace optional card.
dEv	**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. Check the load. 2. Check encoder grounding. 3. Increase Encoder Excessive Speed Deviation Level (F1-10) to a setting less than 30%.
EF	**External Fault.** Both FORWARD/UP and REVERSE/DOWN commands are input at same time for 500 msec or longer.	Check sequence circuit.
EF3	**External Fault 3.** External fault occurs in the Terminal 3 external control circuit.	1. If the fault display is lit when the terminal is not connected, contact Electromotive Systems. 2. Check the condition of the input terminal.
EF4	**External Fault 4.** External fault occurs in the Terminal 4 external control circuit.	Same action as for EF3.
EF5	**External Fault 5.** External fault occurs in the Terminal 5 external control circuit.	Same action as for EF3.
EF6	**External Fault 6.** External fault occurs in the Terminal 6 external control circuit.	Same action as for EF3.
EF7	**External Fault 7.** External fault occurs in the Terminal 7 external control circuit.	Same action as for EF3.
EF8	**External Fault 8.** External fault occurs in the Terminal 8 external control circuit.	Same action as for EF3.
ERR	**EEPROM Read/Write Fault.** EEPROM internal data did not match when initializing the parameter.	Replace the control card.
FAn	**Fan Failure Fault.** Cooling fan fails while power is on.	1. Remove any debris from fan. 2. Check fan wiring. 3. Replace fan.

Fault Code	Fault or Indicator Name/Description	Corrective Action
GOC	**Ground Overcurrent Fault.**	1. Check motor insulation. 2. Check connection between inverter and motor.
LCI	**Load Check Fault.**	Check Load Check sequence set-up.
LF	**Output Open Phase Fault.** Inverter output has open phase.	1. Check output wiring. 2. Check the motor impedance. 3. Retighten the output terminal screws.
LL1	**Lower Limit 1—SLOW DOWN Indicator.** Lower Limit 1—SLOW DOWN is input (switch status is changed).	May not require corrective action.
LL2	**Lower Limit 2—STOP Indicator.** Lower Limit 2—STOP is input (switch status is changed).	May not require corrective action.
oC	**Overcurrent Fault.** Overcurrent, so output shuts off. Drive output current exceeds 200% of transistor-rated current.	1. Check for the following: • Drive output side short circuit. • Excess load inertia. • Insufficient accel and decel times. • Abnormal use of motor. • Motor starts during coasting. • Motor has greater capacity than drive. • Malfunctioning drive output side contactor. 2. Restart drive.
OH	**Heatsink Overheat Fault.** The transistor heatsink temperature exceeded the allowable value	1. Check the ambient temperature 2. Reduce heat from heatsink 3. Ensure proper cooling is provided to drive.
oH1	**Motor Overheat Fault.**	1. Check the motor cooling fan. 2. Check the source of motor overload.
oH2	**Fan Overheat Fault.** Cooling fan overheats and output is shut off. Temperature rise caused by drive overload operation or intake air temperature increase.	1. Reduce intake air temperature so it is less than 113° F (45° C). 2. Reduce load size.
oL1	**Motor Overload Fault.** Inverter output exceeded the motor overload level.	Reduce the load.
oL2	**Inverter Overload Fault.** Inverter output exceeded the inverter overload level.	1. Reduce the load. 2. Extend the acceleration time.
oL3	**Overtorque Detection Level 1 Fault.** Defined by L6-02. Alarm defined by L6-01.	
oL4	**Overtorque Detection Level 2 Fault.** Defined by L6-05. Alarm defined by L6-04.	
oP	**Keypad Digital Monitor Fault.** Digital monitor unit in keypad fails, or the keypad is mounted when in the program mode or during operation by the operator.	Remove power and remount keypad.
oP3	**Optional Card Fault.** Optional card is incompatible or has failed.	Replace optional card.
oPE01	**kVA Setting Fault.** Inverter kVA setting range is incorrect.	Check and reset the parameter data.
oPE02	**Parameter Setting Range Fault.** Parameter data is out of range.	Check parameters against initialized values.

Fault Code	Fault or Indicator Name/Description	Corrective Action
oPE03	**Multi-Function Input Setting Fault.** Set values other than "F" and "FF" are duplicated.	Check the function selection.
oPE05	**Sequence Select Setting Fault.** B1-01 reference source selected is "3" and no option PCB is plugged in.	Check the function selection or plug in optional card.
oPE06	**PG Setting/Missing PG Board Fault.** A1-02 is set to "1" or "3" and no PG-X2 Encoder Interface Card is plugged in.	1. Check the function selection. 2. Plug in PG-X2 Encoder Interface Card.
oPE07	**Multi-Function Analog Output Setting Fault.** H3-05 and H3-09 multi-Function analog output settings are set to the same value.	Check the function selections.
oPE10	**V/f Data Setting Fault.** V/f data is set such that the following equation is not satisfied: E1-04≥E1-06≥E1-07≥E1-09.	Check the parameter data settings.
oPE11	**Carrier Frequency Setting Fault.** Occurs when one of the following occurs: • Carrier frequency upper limit (D10-01)>5 kHz, and carrier frequency—lower limit (D10-02)≤5 kHz. • Carrier frequency proportional gain (D10-03)≥6 and (D10-01)<(D10-02).	Check the parameter data settings.
OPR	**Disconnected Keypad Fault.** Keypad is disconnected.	Check the keypad connection.
oS	**Overspeed Fault.** The motor speed exceeded the Overspeed Detection Level (F1-08).	1. Reduce excessive noise on encoder leads. 2. Reduce load.
ou	**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. Add braking circuit. 3. Correct line voltage.
ou (blinks)	**Overvoltage Fault.** Overvoltage occurs during stop. Main circuit DC voltage rises above the detection level while the drive output is off. Detection level: 410V DC or more for 230V AC and 820V DC or more for 460V AC.	Check the power supply voltage.
PF	**Input Phase Loss Fault.** Inverter input power supply has open phase. There is a large unbalance in input voltage.	1. Check the line voltage. 2. Retighten the input terminal screws.
PGo	**Pulse Generator Open Circuit Fault.** Encoder feedback is zero because encoder wiring is faulty or brake hasn't released.	1. Ensure that brake has released 2. Check encoder wiring.
PUF	**DC Bus Fuse Open Fault.** The DC fuse is blown or the output transistors are damaged.	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 determined; otherwise, damage to the drive may result.*
RH	**Braking Resistor Unit Overheat Fault.** The braking resistor unit temperature has exceeded the allowable value (protects only built-in–type resistors, not external resistors).	Reduce the regenerative load.
rr	**Braking Resistor Failure Fault.** Braking transistor fails.	Contact Electromotive Systems.
SC	**Load Short Circuit Fault.**	1. Check the motor coil resistance. 2. Check the motor installation.

Fault Code	Fault or Indicator Name/Description	Corrective Action
SLC	**Slack Cable Fault.** A hoist slack cable condition occured.	
SVE	**Zero-Servo Fault.**	Check Zero-Servo sequence set-up.
SVR	**Noisey Encoder Fault.**	Check encoder and encoder wiring.
THM	**Thermistor Fault.** Thermistor is not connected, or thermistor connection is faulty.	Reconnect or replace thermistor.
UL1	**Upper Limit 1—SLOW DOWN Indicator.** Upper Limit 1—SLOW DOWN switch status is changed.	
UL2	**Upper Limit 2—STOP Indicator.** Upper Limit 2—STOP switch status is changed.	
Uu	**Undervoltage Fault.** Undervoltage status occurs for more than 2 sec during STOP. Input voltage drops below 210V or less for 230V class and 420V or less for 460V class.	1. Check the power source wiring. 2. Replace any bad branch fuses. 3. Adjust the line voltage.
Uu1	**Undervoltage 1 Fault.** Undervoltage status occurs for more than 2 sec during RUN command. Input voltage drops below 210V or less for 230V class and 420V or less for 460V class.	Same action as for Uu.
Uu2	**Undervoltage 2 Fault.** Control circuit voltage is too low during operation.	Same action as for Uu.

Drive-Motor Troubleshooting

If you find that the drive-motor system is stalling or not accelerating properly, troubleshoot the problem by using the information in the following table.

Problem/Symptom	Corrective Action
Frequency reference for analog input is drifting; not stable.	1. Stabilize the analog source. 2. If this adjustment does not work, increase Acceleration Time 1 and Deceleration Time 1.
Motor does not rotate—power supply voltage is not applied to Terminals L1, L2, and L3, or charge LED is not on.	1. Turn ON power supply. 2. Turn OFF power supply, and then ON again. 3. Check power supply voltage. 4. Make sure terminal screws are tight. 5. Check for the following: • Voltage output to output Terminals T1, T2, and T3. • Fault displayed on keypad display.
Motor does not rotate—voltage output to output Terminals T1, T2, and T3 is incorrect. (Use rectifier-type volt meter.)	Turn OFF power supply, and then ON again.
Motor does not rotate—fault displayed.	Refer to "Drive Faults and Indicators."
Motor does not rotate after FWD or REV command is entered.	Check control wiring.
Motor does not rotate—other.	1. Check wiring. 2. Check frequency setting and voltage. 3. Check reference and run source selections.
Motor rotation direction is wrong.	1. Check T1, T2, and T3 motor leads and phase order. 2. Check FWD/UP and REVERSE/DOWN wiring.
Motor rotates, but infinitely variable speed not available.	1. Check wiring for frequency setting circuit. 2. Check reference and RUN source selections. 3. Reduce the load if load could be too heavy.
Motor rpm's are too high or too low.	1. Check motor ratings (number of poles, voltage, etc.) against motor nameplate specifications. 2. Check accel/decel speed change ratios for gears. 3. Check the maximum frequency set value.
Motor rpm's are too high or too low and voltage between motor terminals is not reduced much.	Check V/f characteristics values.
Motor rpm not stable during operation.	1. Reduce the load if load could be too heavy. 2. Reduce the load *variation* if it could be too large and/or increase the inverter motor capacity.
Motor rpm not stable during operation—3- and open-phase power supply.	Check wiring.
Motor rpm not stable during operation—single-phase power supply used.	Connect AC reactor to power supply.

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 (always located just left of the main power terminal strip) 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 below, and ensure that the reading falls within the normal reading range.

Test equipment - Analog ohmmeter set RX1 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	–	Cross 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) (4001–4034)	B2	B1	10 Ω	0.5 V
	B1	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 accurante resistance measurements.

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

appendix **A**

IMPULSE•VG+ Series 2 Parameters

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The Initialize Parameters

Parmtr Code	Display	Function	Range	Initial Value	Access Level
A1-00	Select Language	Determines language used on display.			Factory
	0 English				
A1-01	Access Level	Determines parameters that user can view or program.			User Program
	0 Operation Only				
	1 User Program				
	2 Advanced Level				
	3 Factory Level				
A1-02	Control Method	Determines control method.			User Program
	3 Flux Vector				
A1-03	Motion	Determines motion application.			Password 1
	0 Traverse				
	1 Standard Hoist				
	2 NLB Hoist				
A1-04	Speed Ref	Determines speed control mode.			User Program
	0 5-SPD Multi-Step				
	1 2-Step Inf Var				
	2 3-Step Inf Var				
	3 Uni-Polar Analog				
	4 Bi-Polar Analog				
	5 2-SPD Multi-Step				
	6 3-SPD Multi-Step				
A1-05	Init Parameters	Resets parameter settings to user defaults.			User Program
	0000 No Initialize				
	1110 User Initialize				
A1-06	Enter Password 1	Password input.		0000	User Program
A1-07	Select Pass. 1	Password defined.		0000	User Program
A2-01	User Select Parameters	Determines parameters that can be set at User Program Access Level.		0–0x5ff	User Program

Application Parameters

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Preset Reference					
B1-01	Reference 1	Sets the frequency of Minimum Speed/Speed 1.	0.00–60.00 Hz	6	Advanced
B1-02	Reference 2	Sets the Speed 2 frequency.	0.00–60.00 Hz	15	Advanced
B1-03	Reference 3	Sets the Speed 3 frequency.	0.00–60.00 Hz	30	Advanced
B1-04	Reference 4	Sets the Speed 4 frequency.	0.00–60.00 Hz	45	Advanced
B1-05	Reference 5	Sets the Speed 5 frequency.	0.00–60.00 Hz	60	Advanced
B1-06	Reference 6	Sets the Speed 6 frequency.	0.00–60.00 Hz	1	Advanced
B1-07	Reference 7	Sets the Speed 7 frequency.	0.00–60.00 Hz	1	Advanced
B1-08	Reference 8	Sets the Speed 8 frequency.	0.00–60.00 Hz	1	Advanced
B1-09	Jog Reference	Jog Control and Inching Control frequency reference.	0.00–60.00 Hz	6	Advanced
B1-10	Ref Priority	Determines whether the digital or analog frequency reference is used.		0	Advanced
	0 Digital Ref Only				
	1 Analog Ref Only				
	2 Higher Ref Sel				
Reference Limits					
B2-01	Ref Upper Limit	Percentage of Maximum Output Frequency, which determines the maximum frequency at which the drive will run.	0.0–110.0%	100	Advanced
B2-02	Ref Lower Limit	Percentage of Maximum Output Frequency, which determines the minimum frequency at which the drive will run.	0.0–109.0%	2	Advanced
B2-03	Upper Lim Gain	Upper Limit Gain by multi-function input.	0–255%	100	Advanced
Sequence/Reference Source					
B3-01	Reference Source	Source from where the frequency reference is generated.		1	Advanced
	0 Operator				
	1 Terminals				
	2 Serial Com				
	3 Option PCB				

Parmtr Code	Display	Function	Range	Initial Value	Access Level
B3-02	Run Source	Source from where the RUN command is generated.		1	Advanced
	0 Operator				
	1 Terminals				
	2 Serial Com				
	3 Option PCB				
B3-03	Stopping Method	Determines stopping method. *WARNING! Changing stopping method to other than "No Load Brake" for NLB hoist applications may result in an unsafe operation.*		*	Advanced
	0 Ramp to Stop (A1-03=0)*				
	1 Coast to Stop (A1-03=1)*				
	4 Ramp w/Timer (Traverse mode only)				
	5 Hoist 2-Step				
	6 No Load Brake (A1-03=2)*				
	** Initial value is determed by motion (A1-03)*				
B3-05	Zero-Speed Oper			0	Advanced
	0 RUN at Freq Ref				
	1 Stop				
	2 RUN at Min.Freq (E1- 09)				
	3 RUN at Zero RPM				
B3-06	Cntl Input Scans			1	Advanced
	0 2ms–2 scans				
	1 5ms–2 Scans				
B3-07	LOC/REM RUN Sel	Determines action after switching remote.		0	Advanced
	0 Cycle Extrn RUN				
	1 Accept Extrn RUN				

MOP Sequence

B4-01	MOP Ref Memory	Determines whether Hold Reference memory is selected.		0	Advanced
	0 Disabled				
	1 Enabled				
B4-02	Trim Control Lvl	Sets Trim Control speed level	0–100%	10	Advanced

Acceleration/Deceleration

B5-01	Accel Time 1	Sets time from 0 Hz to Maximum Frequency.	0.0–25.5 sec	5.0	Advanced
B5-02	Decel Time 1	Sets time from Maximum Frequency to 0Hz.	0.0–25.5 sec	3.0	Advanced
B5-03	Accel Time 2	Sets alternate accel. time. Enabled by multifunction input =1B.	0.0–25.5 sec	1.0	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
B5-04	Decel Time 2	Sets alternate decel. time. Enabled by multifunction input =1B.	0.0–25.5 sec	1.0	Advanced
B5-05	Acc Time N Chg	Sets acceleration time at Speed Switch Hz.	0.0–25.5 sec	1.0	Advanced
B5-06	Dec Time N Chg	Sets deceleration time at Speed Switch Hz.	0.0–25.5 sec	1.0	Advanced
B5-07	Hoist 2 Stop	Sets deceleration time at STOP for DOWN/REVERSE direction.	0.0–25.5 sec	0.3	Advanced
B5-08	Fault Stop Time	Sets decel time to complete rest at STOP.	0.0–25.5 sec	0.3	Advanced
B5-09	Acc/Dec Units	Determines acceleration and deceleration time interval and range.		1	Advanced
	0 0.01seconds				
	1 0.1sec onds				
B5-10	Acc/Dec SW Freq	Determines acceleration/ deceleration switching level.	0.0–150.0 Hz	120.0	Advanced
B5-11	SW Freq Compare	Determines when Acceleration Time and Deceleration Time at Speed Switch Hz is enabled;		1	Advanced
	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	For T Lim Accel	Determines acceleration time at FORWARD when Torque Limit Acc/Dec is multi-function input = 14	0.0–25.5 sec	0	Advanced
B5-13	For T Lim Decel	Determines deceleration time at FORWARD when Torque Limit Acc/Dec is multi-function input = 14	0.0–25.5 sec	0	Advanced
B5-14	Rev T Lim Accel	Determines acceleration time at REVERSE when Torque Limit Acc/ Dec is multi-function input = 14	0.0–25.5 sec	0.5	Advanced
B5-15	Rev T Lim Decel	Determines deceleration time at REVERSE when Torque Limit Acc/ Dec is multi-function input = 14	0.0–25.5 sec	0	Advanced

Phase Loss Protection

B6-01	Ph Loss In Sel	Determines whether Phase Loss Detection Input is enabled.		0	Advanced
	0 Disabled				
	1 Enabled				
B6-02	Ph Loss In Lvl	Determines Phase Loss Detection Input level	0.0–25.5%	7.5	Factory
B6-03	Ph Loss Out Sel	Determines whether Phase Loss Detection Output is enabled.		1	Advanced
	0 Disabled				
	1 Enabled				
B6-04	Ph Loss Out Lvl	Determines Phase Loss Detection Output level	0.0–20.0%	5.0	Factory

Parmtr Code	Display	Function	Range	Initial Value	Access Level
SVR Function					
B7-01	Svr Delay Timer	Noisy Encoder Detection system	0–2000 ms	70	Advanced
Jump Frequencies					
B8-01	Jump Freq 1	First of three jump frequencies; part of Jump Bandwidth.	0.0–150.0 Hz	0	Advanced
B8-02	Jump Freq 2	Second of three jump frequencies; part of Jump Bandwidth.	0.0–150.0 Hz	0	Advanced
B8-03	Jump Freq 3	Third of three jump frequencies; part of Jump Bandwidth.	0.0–150.0 Hz	0	Advanced
B8-04	Jump Bandwidth	Jump frequency reference bandwidth; combines Jump Frequencies 1, 2, and 3.	0.0–20.0 Hz	1.0	Advanced

Special Function Parameters

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Quick Stop/Reverse Plug Simulation					
C1-01	Quick Stop 0/1 *0 Disabled* *1 Enabled*	Determines whether Quick Stop is enabled.		0	Advanced
C1-02	Quick Stop Time	Deceleration time during Quick Stop function.	0.0–25.5 sec	1.0	Advanced
C1-03	Plug Reverse 0/1 *0 Disabled* *1 Enabled*	Determines whether Reverse Plug Simulation is enabled.		0	Advanced
C1-04	PlgRev Dec Time	Deceleration time during Plug Reverse Simulation.	0.0–25.5 sec	1.0	Advanced
C1-05	PlgRev ACC Time	Acceleration time during Plug Reverse Simulation.	0.0–25.5 sec	1.0	Advanced
Micro-Positioning Control					
C2-01	MS Gain 1	For Micro-Positioning Control—the number multiplied by the Analog or Digital Speed Reference to achieve slow-speed operation.	0.00–2.55	1.00	Advanced
C2-02	MS Gain 2	For Micro-Positioning Control—an alternate number multiplied by the Analog or Digital Speed Reference to achieve slow-speed operation.	0.00–2.55	1.00	Advanced
Upper and Lower Travel Limits					
C3-01	Up Limit1 Speed	Speed at Upper Limit input.	0–150 Hz	6	Advanced
C3-02	UL 1 Decel Time	Decel time to Upper Limit Speed.	0.0–25.5 sec	1.0	Advanced
C3-03	UL 2 Stop Time	Decel time to STOP when Upper Limit is Input	0.0–25.5 sec	0.5	Advanced
C3-04	Low Limit1 Speed	Speed at Lower Limit input.	0–150 Hz	6	Advanced
C3-05	LL 1 Decel Time	Decel time to Lower Limit Speed.	0.0–25.5 sec	1.0	Advanced
C3-06	LL 2 Stop Time	Decel time to STOP when Lower Limit is input.	0.0–25.5 sec	0.5	Advanced
C3-07	LL2/UL2 Action *0 Decel to Stop* *1 BB to Stop*	Determines whether stopping method at Upper Limit input is Decel to Stop at STOP or Immediate Stop at STOP.		1	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Zero-Servo Input					
C4-01	Zero Servo Timer	Maximum duration of Zero Servo action at multi-function input.	0–255 sec	10	Advanced
C4-02	Zero Servo Gain	Zero Servo multiplier.	0–100	5	Advanced
C4-03	Zero Servo Count	Zero Servo completion width.	0–16383	10	Advanced
Load Check					
C5-01	Load Check 0/1 *0 Disabled* *1 Enabled*	Determines whether Load Check is enabled.		0	Advanced
C5-02	LC Alarm Action *0 Alarm Only* *1 Decel to Stop* *2 Coast Stop* *3 Fault Stop*	Action at Load Check alarm or fault. "BB to Stop" is Immediate Stop at STOP.		2	Advanced
C5-03	Min Torque Ref	Minimum current/torque reference during acceleration that triggers Load Check	0–100%	60	Advanced
C5-04	Look Speed 1	First Load Check frequency reference.	0–150 Hz	6	Advanced
C5-06	Vec Torque Ref	Load Check reference at LS1, 2 and 3.	0–300%	125	Advanced
C5-07	Look Speed 2	Second Load Check frequency reference.	0–150 Hz	20	Advanced
C5-09	Look Speed 3	Third Load Check frequency reference.	0–150 Hz	60	Advanced
C5-11	I Ref for > LS 3	Load Check Current when Output Frequency > Look Speed 3.	30–200% IRC	160	Advanced
C5-12	LC Setting Time	Time for holding Output Frequency to stabilize Output Current.	0–2.55 sec	0.20	Advanced
C5-13	LC Test Time	Time (after the LC Setting Time) for comparing Output Current with Reference Current.	0–2.55 sec	0.10	Advanced
C5-14	LC Fault Speed	Maximum lowering speed After Load Check fault.	0–150 Hz	6	Advanced
Ultra-Lift					
NOTE:	*This drive features "Ultra-Lift," even though "Swift Lift" appears on the display.*				
C6-01	Ultra-Lift *0 Disabled* *1 Enable Automatic* *2 Enable by MFI*	Determines whether Ultra-Lift is enabled. For more information, see "Ultra-Lift, see Ultra-Lift (C6-01)" in Chapter 2.		0	Advanced
C6-02	Ultra-Lift ForSpd	Maximum Output Frequency during Ultra-Lift—FORWARD.	0–150 Hz	60	Advanced
C6-03	Ultra-Lift RevSpd	Maximum Output Frequency during Ultra-Lift—REVERSE.	0–150 Hz	60	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
C6-04	Ultra-Lift For T	Maximum Output torque below which Ultra-Lift–FORWARD is enable.	0–100%	50	Advanced
C6-05	Ultra-Lift Rev T	Maximum output torque below which Ultra-Lift—REVERSE is enabled.	0–255%	30	Advanced
C6-06	UL Enabling Spd	Threshold frequency at which Ultra-Lift is enabled.	0–150 Hz	60	Advanced
C6-07	UL Delay Time	Delay time at enabling speed prior to torque-compare function.	0.0–30.0 sec	2.0	Advanced
C6-08	SFS Acc Gain	Speed feedback acceleration multiplier.	0.1–9.9	1.0	Advanced

Torque Limit

C7-01	Torq Limit Fwd	FORWARD torque limit.	0–300%	150	Advanced
C7-02	Torq Limit Rev	REVERSE torque limit.	0–300%	150	Advanced
C7-03	Torq Lmt Fwd Rgn	Regenerative torque limit at FORWARD.	0–300%	150	Advanced
C7-04	Torq Lmt Rev Rgn	Regenerative torque limit at REVERSE.	0–300%	150	Advanced
C7-07	T–Lim Gain MFI	Gain of torque limits for hoist testing	0.00–2.55	1.25	Advanced

Hoist Without Mechanical Load Brake Sequence

C8-01	Torq Comp Time	Time for torque to build to 300% at start	0.00–2.55 sec	0.20	Advanced
C8-02	IFB OK Timer	Time period during which Output Current must be OK.	0.00–2.55 sec	0.20	Advanced
C8-03	Brake Rel Torq	Brake Open command is output at this torque value	0–300%	100	Advanced
C8-04	Roll Back Timer	Time period during which the roll back is checked	0.00–2.55 sec	0.20	Advanced
C8-05	Roll Back Count	Detection counts for excessive roll back	0–16536 pulses	200	Advanced
C8-06	BE3/Alt Torq T	Time period during which C8-07 is measured.	0.00–2.55 sec	0.50	Advanced
C8-07	BE3 Det Count	Detection count for Encoder/ Seized-Brake Fault (BE3). It is the encoder pulse count, during the time period of C8-06, below which the BE3 fault is triggered.	0–16536 pulses	200	Advanced
C8-08	Alt Rev T Limit	For a LOWER command in the NLB Hoist Motion Mode only— Torque limit for time period of C8-06 to prevent driving through a brake that has failed closed.	0–100%	10	Advanced
C8-09	Zero Speed Level	Determines speed reference at which Zero-Speed Level activates.	0–150 Hz	2	Advanced
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.	255 sec	10.0	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
C8-11	Brake Delay Time	The delay time between Immediate Stop at STOP and Brake Set.	0.00–25.5 sec	0.30	Advanced
C8-12	BE6 Detect Timer	Time period during which the electric brake is set and tested for sustaining the load.	0.00–25.5 sec	1.00	Advanced
C8-13	BE6 Max Count	Total pulse counts must be < C8-13 during C8-12, otherwise BE6 Fault.	0–16536 pulses	200	Advanced
C8-15	Load Float Ext. T	Load float extention time enabled by MFI=46.	0–255 sec	10	Advanced

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

C9-01	ESI G5IN4 Setup	Determines whether the G5IN4 Digital Multi-Function Inputs are enabled. Enabling this parameter enables you to use the optional G5IN4 Control Input Card to program one of 14 parameter sets for four additional input terminals.		0	Advanced
	0 Disabled				
	1 Enabled				
C9-02	ESI G5IN4	Determines the four settings for G5IN4 Digital Multi-Function Inputs. To program this parameter, see "G2IN4 Digital Multifunction Inputs (C9-01 and C9-02)" in Chapter 2.	0001–000E		Advanced

Weight Measurement

C10-01	Load Weight 0/1	Determines whether Load Weight is enabled.		0	Advanced
	0 Disabled				
	1 Enabled at C5-04				
	2 Enabled at MFI				
	3 Both Auto & MFI				
C10-02	TRO Pri Delay	Torque Output calculation primary delay time.	0–1000 msec	200	Advanced
C10-03	LW Display Hold			0	Advanced
	0 Hold Display				
	1 Hold Disp 3 sec				
C10-04	LW Conversion	Multiplier of torque output calculation for display. Data is n0000, so multiplier is 10000; "n" is decimal point.	00000–39999	0	Advanced
C10-05	Full Load TRO	Percentage of Torque Output that is defined as Full-Load Torque Output.	0.0–200.0%	100	Advanced
C10-06	No Load TRO	Percentage of Torque Output that is defined as No-Load Torque Output.	0.0–200.0%	0	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
C10-07	Line 2 Display	Determines "weight" measurement units in which the parameter settings will be expressed. The unit abbreviations appear on line 2 of the display.		0	Advanced
	0 tons				
	1 pounds				
	2 kilograms				
	3 metric tons				
	4 percent R Load				

Slack Cable Detection

C11-01	Slack Cable 0/1	(For Hoist Application) Determines whether Slack Cable Detection is enabled. Slack Cable Detection is not executed, unless both of the following are true: • The ouput frequency is between C11-04 and C11-06 • The Slack Cable Detection delay time is between C11-05 and C11-07.		0	Advanced
	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.		2	Advanced
	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.			
C11-03	SLC Detect Torq	Percentage of Output Torque below which the enabled Slack Cable Detection is activiated—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	Advanced
C11-04	SLC Detect Spd 1	The minimum 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	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
C11-05	SLC Delay Time 1	The minimum 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	Advanced
C11-06	SLC Detect Spd 2	The maximum 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	Advanced
C11-07	SLC Delay Time 2	The maximum 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	Advanced
C11-08	Snap Shaft 0/1 *0 Disabled* *1 Enabled*	Do not use.		0	Advanced
C11-09	Action at SS *0 Brake/Fault Out.* *1 Brake/No Flt Out.* *2 Warning Out Only.*	Do not use.	0–2	0	Advanced
C11-10	SS Detect Torq	Do not use.	0–100%	5	Advanced
C11-11	SS Delay Time	Do not use.	0–2000msec	5	Advanced

Swing Control (Do not use for IMPULSE•VG+ Series 2)

Tuning Parameters

Parmtr Code	Display	Function	Range	Initial Value	Access Level
DC Injection					
D1-01	DCInj Start Freq	At START, the DC Injection braking frequency.	0.0–10.0 Hz	1.5	Advanced
D1-03	DCInj Time @Start	At START, the DC Injection braking time.	0.00–10.00 sec	0	Advanced
D1-04	DCInj Time @Stop	At STOP, the DC Injection braking time.	0.00–10.00 sec	0.05	Advanced
D1-05	DC Injection P Gain		0.00–1.00	0.05	Factory
D1-06	DC Injection Integral Time		0–1000 msec	100	Factory
D1-07	DC Injection Limit		0.0–30.0%	15.0	Factory
Automatic Slip Compensation					
D2-01	Slip Comp Gain	Slip compensation multiplier.	0.0–2.5	0	Advanced
Automatic Speed Regulator (ASR) Tuning					
D4-01	ASR P Gain 1	ASR Proportional Gain 1.	1.00–300.00	20	Advanced
D4-02	ASR I Time 1	ASR Integral Time 1.	0.00–10.000 sec	0.5	Advanced
D4-03	ASR P Gain 2	ASR Proportional Gain 2.	1.00–300.0	20	Advanced
D4-04	ASR I Time 2	ASR Integral Time 2.	0.000–10.000 sec	0.5	Advanced
D4-06	ASR Delay Time	ASR Output Primary Delay Time.	0.000–0.500 sec	0.004	Advanced
D4-07	ASR Gain SW Freq	ASR Gain Switching Frequency.	0.0–150.0 Hz	0	Advanced
D4-08	ASR I Limit	ASR Integral Limit.	0–400%	400	Advanced
Torque Control					
D5-01	Torque Control *0 Speed Control* *1 Torque Control*	Determine whether Speed or Torque Control is selected.		0	Advanced
D5-02	Torque Ref Filter	Primary delay time for Torque Reference Input.	0–1000 msec	0	Advanced
D5-03	Speed Limit Sel *1 Analog Input* *2 Program Setting*	Speed Limit Selection		1	Advanced
D5-04	Speed Lmt Value	Speed Limit Value	-120–120%	0	Advanced
D5-05	Speed Lmt Bias	Speed Limit Bias	0–120%	10	Advanced
D5-06	Ref Hold Time	Speed/Torque Switching Timer	0–1000 msec	0	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Droop Control					
D6-01	Droop Quantity		0.0–100.0	0	Advanced
D6-02	Droop Delay Time		0.03–2.00 sec	0.05	Advanced
Dwell Function					
D8-01	Dwell Ref @Start		0.0–150.0 Hz	0	Advanced
D8-02	Dwell Time @Start		0.0–10.0 sec	0	Advanced
D8-03	Dwell Ref @Stop		0.0–150.0 Hz	0	Advanced
D8-04	Dwell Time @Stop		0.0–10.0 sec	0	Advanced
S-Curve Acceleration/Deceleration					
D9-01	SCrv Acc @ Start		0.00–2.50 sec	0.20	Advanced
D9-02	SCrv Acc @ End		0.00–2.50 sec	0.20	Advanced
D9-03	SCrv Dec @ Start		0.00–2.50 sec	0.20	Advanced
D9-04	SCrv Dec @ End		0.00–2.50 sec	0	Advanced
Carrier Frequency					
D10-01	Carrier Freq Max *3 2.0 kHz* *4 2.5 kHz* *5 5.0 kHz* *6 10.0 kHz*	Carrier frequency upper limit		4	Advanced
Factory Tuning					
D12-01	ACR Feedbk Gain	Automatic current regulator multiplier.	0.50–2.00	1.00	Factory
D12-02	ACR q Gain	Automatic current regulator q multiplier.	0.00–6.00	0.3	Factory
D12-03	ACR q I Time	Automatic current regulator q I time.	0.0–1000.0 msec	10.00	Factory
D12-04	ACR q Limit	Automatic current regulator q limit.	0–150%	100	Factory
D12-05	ACR d Gain	Automatic current regulator d multiplier.	0.00–6.00	0.30	Factory
D12-06	ACR d I Time	Automatic current regulator d I time.	0.0–1000.0 msec	10.0	Factory
D12-07	ACR d Limit	Automatic current regulator d limit.	0–150%	100	Factory
D12-12	AVR Time	Automatic voltage regulator time.	0–1000 msec	1000	Factory

Parmtr Code	Display	Function	Range	Initial Value	Access Level
D12-13	PWM Method	Determines the pulse-width modulation method.		0	Factory
	0 2- or 3-Phase Auto-Modulation				
	1 2-Phase Modulation				
	2 3-Phase Modulation				
D12-14	IGBT Volt Drop	IGBT voltage drop.	0.0–10.0 VDC	0.1	Factory
D12-15	ON-Delay Time	ON-delay time.	2.5–20.0 µsec	3.0	Factory
D12-16	ON-Delay Comp	ON-delay compensation time.	0.0–20.0 µsec	3.0	Factory
D12-17	DCCT Filter Time	DCCT filter time.	0–1000 µsec	0	Factory
D12-20	Simulation Mode	Determines whether automatic current regulator speed-up is selected as the simulation mode.		0	Factory
	0 Normal				
	1 ACR Speed Up				
D12-27	Inverter Rated Current	Inverter rated current.	0.0–150.0 A	6.00	Factory
D12-28	DCCT Gain	DCCT multiplier.	0.000–2.000	1.148	Factory
D12-29	Phase SW Level	Phase switching level.	0.5–3.0	1.5	Factory
D12-30	Carrier in tune			0	Advanced
	0 Fc = 2kHz				
	1 Fc = D10-01				

Motor Parameters

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Voltage/Frequency Pattern					
E1-01	Input Voltage		310–510V	200	User Program
E1-02	Motor Selection	Identifies motor as fan-cooled or blower-cooled.		1	User Program
	0 Std Fan Cooled				
	1 Std Blower Cooled				
E1-04	Max Frequency	Maximum frequency.	40.0–400.0 Hz	60.0	User Program
E1-05	Max Voltage	Maximum voltage.	0.0–255.0V	460.0	User Program
E1-06	Base Frequency	Motor Base Frequency	0.0–150.0 Hz	60.0	User Program
E1-07	Mid Frequency A	Midpoint output Frequency A.	0.0–150.0 Hz	0.0	Factory
E1-08	Mid Voltage A	Midpoint output Voltage A	0.0–255.0V	0.0	Factory
E1-09	Min Frequency	Minimum frequency.	0.0–150.0 Hz	0.0	Advanced
E1-10	Min Voltage	Minimum voltage.	0.0–255.0V	0.0	Factory
E1-11	Mid Frequency B	Midpoint output Frequency B.	0.0–150.0 Hz	0	Advanced
E1-12	Mid Voltage B	Midpoint output Voltage B.	0.0–255.0V	0	Advanced
E1-13	Base Voltage	Motor Base Voltage	0.0–255.0V	0.0	User Program
Motor Set-up					
E2-00	Motor Selection		0–0	0	User Program
E2-01	Motor Rated FLA	Motor-rated current.	0.01–1500.0 A	*	User Program
E2-02	Motor Rated Slip	Motor-rated slip frequency.	0.00–20.00 Hz	*	User Program
E2-03	No-Load Current	Motor no-load current.	0.0–1500.0 A	*	User Program
E2-04	Number of Poles	Number of motor poles.	2–48 poles	*	User Program
E2-05	Term Resistance	Motor terminal resistance.	0.000–65.000 Ω	*	Advanced
E2-06	Leak Inductance	Leakage Inductance	0.0–30.0%	*	Advanced
E2-07	Saturation Comp1	Core-Saturation Compensation Coefficient 1	0.00–0.50	*	Advanced
E2-08	Saturation Comp 2	Core-Saturation Compensation Coefficient 2	0.00–0.75	*	Advanced
E2-09	Mechanical Loss	Motor mechanical loss.	0.0–10.0%	0	Advanced
	* Initial value is determined by 02-04.				
Motor 2 Method					
E3-01	Control Method	Motor 2 control method	0–2	2	Advanced
	0 V/f control				
	2 Open loop vector				

Parmtr Code	Display	Function	Range	Initial Value	Access Level
E3-02	Motion 2	Motor 2 motion crane or hoists	0–2	1	Advanced
	0 Traverse				
	1 Standard Hoist				
	2 NLB Hoist				

Motor 2 Voltage/Frequency Pattern

E4-01	V/f 2 Max freq	Maximum frequency for Motor 2.	40.0–400.0 Hz	60.0	Adv
E4-02	V/f 2 Max voltage	Maximum voltage for Motor 2.	0.0–255.0V	230.0	Adv
E4-03	V/f 2 Base Freq	Base Frequency for Motor 2.	50.0–400.0 Hz	60.0	Adv
E4-04	V/f 2 Mid Freq	Midpoint output frequency for Motor 2.	50.0–400.0 Hz	3.0	Factory
E4-05	V/f 2 Mid Voltage	Midpoint output voltage for Motor 2.	0.0–255.0V	12.6	Factory
E4-06	V/f 2 Min Freq	Minimum output frequency for Motor 2.	0.0–400.0 Hz	0.5	Factory
E4-07	V/f 2 Min Voltage	Minimum output voltage for Motor 2.	0.0–255.0V	2.3	Factory

Motor 2 Set-up

E5-01	Motor2 Rated FLA	Motor-rated current for Motor 2.	0.0–1500.0 A	*	Adv
E5-02	Motor2 Slip Freq	Motor-rated slip frequency for Motor 2.	0.00–20.0 Hz	*	Adv
E5-03	Motor2 No Load 1	Motor no-load current for Motor 2.	0.0–1500.0 A	*	Adv
E5-04	Motor2 # Poles	Number of motor poles for Motor 2.	2–48 poles	4	Adv
E5-05	Motor2 Term Ohms	Motor terminal resistance for Motor 2.	0.000–65.000Ω	*	Adv
E5-06	Motor2 Leak	Leakage inductance for Motor 2.	0.0–30.0%	*	Adv
	** Based upon inverter models.*				

Option Parameters

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Encoder (PG) Option Set-up					
F1-01	PG Pulses/Rev	Determines speed of encoder.	0–60000 pulses/ rev	1024	Advanced
F1-02	PG fdbk Loss Sel	Determines stopping method or alarm output when PG line break is detected.		1	Advanced
	0 Ramp to Stop				
	1 Coast to Stop				
	2 Fast-Stop				
	3 Alarm Only				
F1-03	PG Overspeed Sel	Determines stopping method or alarm output when motor overspeed is detected.		1	Advanced
	0 Ramp to Stop				
	1 Coast to Stop				
	2 Fast-Stop				
	3 Alarm Only				
F1-04	PG Deviation Sel	Determines stopping method when PG deviation is detected.		1	Advanced
	0 Ramp to Stop				
	1 Coast to Stop				
	2 Fast-Stop				
	3 Alarm Only				
F1-05	PG Rotation Sel	Determines PG rotation.		0	Advanced
	0 Fwd = C.C.W.				
	1 Fwd = C.W				
F1-06	PG Output Ratio	PG division rate (pulse output)		1	Advanced
F1-07	PG Ramp PI/I Sel			0	Advanced
	0 Disabled				
	1 Enabled				
F1-08	PG Overspd Level	Motor overspeed detection level.	0–120%	115	Advanced
F1-09	PG Overspd Time	Motor overspeed detection time.	0–2.0 sec	0	Advanced
F1-10	PG Deviate Level	Excessive speed deviation Level	0–50%	10	Advanced
F1-11	PG Deviate Time	Excessive speed deviation Time	0–10.0 sec	0.5	Advanced
F1-12	PG #Gear Teeth1	Number of gear teeth—Option 1	0–1000	0	Advanced
F1-13	PG #Gear Teeth2	Number of gear teeth—Option 2	0–1000	0	Advanced
F1-14	PGO Detect Time	PG detection time.	0.0–10.0 sec	2.0	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
AI-14 Set-up					
F2-01	AI-14 Input Sel	Determines whether the 3-channel input selection is individual or additional.		0	Advanced
	0 3ch Individual				
	1 3ch Additional				
Digital Input Option Set-up					
F3-01	DI Input	Determines digital input option.		0	Advanced
	0 BCD 1%				
	1 BCD 0.1%				
	2 BCD 0.01%				
	3 BCD 1Hz				
	4 BCD 0.1Hz				
	5 BCD 0.01Hz				
	6 BCD (5DG) 0.01 Hz				
	7 Binary				

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Analog Output Option Set-up					
F4-01	AO Ch1 Select	Analog output option Channel 1 selection.	1–35	2	Advanced
	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 13 Level				
	16 Term 14 Level				
	17 Term 16 Level				
	18 Mot SEC Current				
	19 Mot EXC Current				
	20 SFS Output				
	21 ASR Input				
	22 ASR Output				
	23 Speed Deviation				
	24 PID Feedback				
	26 Voltage Ref (Vq)				
	27 Voltage Ref (Vd)				
	29 Load Weight				
	31 Not used				
	32 ACR (q) Output				
	33 ACR (d) Output				
	35 Friction Torq				
F4-02	AO Ch1 Gain	Analog output Channel 1 multiplier.	0–2.50	1.00	Advanced
F4-03	AO Ch2 Select	Analog output option Channel 2 selection. (Same as F4-01)	1-35	3	Advanced
F4-04	AO Ch2 Gain	Analog output Channel 2 multiplier.	0–2.50	0.50	Advanced
DO-02 Digital Output Set-up					
F5-01	DO-02 Ch1 Select	Determines the DO-02 digital output Channel 1 selection. (Same as H2-01)	0–FF	0	Advanced
F5-02	DO-02 Ch 2 Select	Determines the DO-02 digital output Channel 2 selection. (Same as H2-01)	0–FF	1	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
DO-08 Digital Output Set-up					
F6-01	DO-08 Selection	Determines whether the DO-08 digital output is 8-channel–individual or binary.		0	Advanced
	0 8ch Individual				
	1 Binary Output				
	2 Srl Com Output				
PO-36F Set-up					
F7-01	PO-36F Selection	Determines the PO-36F pulse monitor card factor.		1	Advanced
	0 1 X Output Freq				
	1 6 X Output Freq				
	2 10 X Output Freq				
	3 12 X Output Freq				
	4 36 X Output Freq				

Terminal Parameters

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Digital Inputs					
H1-01	Terminal 3 Sel *(parameter)*	Assigns one of the following 48 multi-function digital input parameters to Terminal 3, 4, 5, 6, 7, or 8.	0–45	0	Advanced
	0 Multi-Step Ref 2	*Multi-Step Speed 2*			
	1 Multi-Step Ref 3.	*Multi-Step Speed 3.*			
	2 Multi-Step Ref 4	*Multi-Step Speed 4.*			
	3 Multi-Step Ref 5	*Multi-Step Speed 5.*			
	4 Speed Hold 2	*Hold function (2nd step of Three-Step Infinitely Variable).*			
	5 Accel Command	*Acceleration function (2nd step of Two-Step Infinitely Variable or 3rd step of Three-Step Infinitely Variable).*			
	6 Upper Lmt 1 N/O	*Upper Limit—SLOW DOWN; Normally Open.*			
	7 Upper Lmt 2 N/O	*Upper Limit—STOP; Normally Open.*			
	8 Lower Lmt 1 N/O	*Lower Limit—SLOW DOWN; Normally Open.*			
	9 Lower Lmt 2 N/O	*Lower Limit—STOP; Normally Open.*			
	A Upper Lmt 1 N/C	*Upper Limit—SLOW DOWN; Normally Closed.*			
	B Upper Lmt 2 N/C	*Upper Limit—STOP; Normally Closed.*			
	C Lower Lmt 1 N/C	*Lower Limit—SLOW DOWN; Normally Closed.*			
	D Lower Lmt 2 N/C	*Lower Limit—STOP; Normally Closed.*			
	E M-Speed Gain 1	*Micro-Positioning Control Multiplier 1.*			
	F Not used				
	10 M-Speed Gain 2	*Micro-Positioning Control Multiplier 2.*			
	11 Load Float	*Load Float*			
	12 M-Spd Gn 1 & LF	*Micro-Positioning Control Multiplier 1 and Load Float*			
	13 Ultra-Lift	*Ultra-Lift enable.*			
	14 Torq Lmt Acc/Dec	*Torque Limit Acceleration/ Deceleration.*			
	15 Alt T-Lim Gain	*Alternate Torque Limit Multiplier.*			
	16 Forward Jog	*Jog Control FORWARD command.*			
	17 Reverse Jog	*Jog Control REVERSE command.*			

Parmtr Code	Display	Function	Range	Initial Value	Access Level
	1B Multi-Acc/Dec 1	*Acceleration and Deceleration Changeover Time.*			
	1C Reference SW	*Digital/Analog Reference Changeover*			
	1D Term 13/16 Swtch	*Terminal 13/16 Switch.*			
	1E Option/Inv Sel	*Option/Inverter Speed Reference Changeover (Option Speed Reference at closed).*			
	1F Program Lockout	*Program Lockout.*			
	24 External Fault	*External Fault. See "External Fault response selection" in Chapter 2.*			
	30 Term 13/14 Swtch	*Terminal 13/14 Switch.*			
	31 Fault Reset N/O	*Fault Reset; Normally Open.*			
	32 Fault Reset N/C	*Fault Reset; Normally Closed.*			
	34 Trim Ctl Increase	*Trim Control Increase*			
	35 Trim Ctl Decrease	*Trim Control Decrease*			
	36 Brake Ans Back	*Brake Answer-Back*			
	37 Ext BaseBlk N/O	*Immediate Stop at STOP Command; Normally Open.*			
	38 Ext BaseBlk N/C	*Immediate Stop at STOP Command; Normally Closed.*			
	39 Spd/Trq Ctl Chng	*Speed- and Torque-Control Changeover*			
	3A Zero Servo Cmd	*Zero Servo Command*			
	3C ASR Intgrl Reset	*Automatic Speed Regulator Integral Reset.*			
	3D Motor 2 Enable	*Enables second motor to be used in application while disabling the first motor.*			
	3E ASR Gain Switch	*Automatic Speed Regulator Multiplier Changeover.*			
	3F KEB Ridethru N/O	*Kinetic Energy Braking Ride-Through; Normally Open.*			
	40 KEB Ridethru N/C	*Kinetic Energy Braking Ride-Through*			
	41 DCInj Activate	*DC Injection Brake.*			
	43 Alt S-Ref UpLmt	*Alternate Upper Limit Frequency Reference*			
	44 Weight Measure	*Weight Measurement Command.*			
	45 Serial/Inv Swtch	*Serial/Inverter Run and Speed Reference Changeover*			
	46 Load Float Ext	*Extend Load Float time*			
	47 M-Spd Gn1 and LF-E	*Micro-Speed Gain 1 and Load Float extent.*			
	48 Swing Stop Cntl	*Swing Stop Control*			
	49 Hoist Load Det				
H1-02	Terminal 4 Sel *(input parameter)*	Same as H1-01.	0–49	1	Advanced
H1-03	Terminal 5 Sel *(input parameter)*	Same as H1-01.	0–49	2	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
H1-04	Terminal 6 Sel *(input parameter)*	Same as H1-01.	0–49	3	Advanced
H1-05	Terminal 7 Sel *(input parameter)*	Same as H1-01.	0–49	24	Advanced
H1-06	Terminal 8 Sel *(input parameter)*	Same as H1-01.	0–49	E	Advanced

Digital Outputs

H2-01	Terminal 9 Sel *(input parameter)*	Assigns one of the following 48 multi-function digital output parameters to Terminal 9, 25, or 26 on the G5IF Control Voltage Interface Card. (Same as F5-01).	0–40	0	Advanced
	0 Brake Output	*Electric brake output.*			
	1 Zero Speed	*Zero-Speed Control output.*			
	2 Fref/Fout Agree1	*Output when Frequency Reference and Frequency Output agree.*			
	3 Fref/Set Agree 1	*Output when Frequency Reference and Set agree.*			
	4 Freq Detect 1	*Frequency Detection 1.*			
	5 Freq Detect 2	*Frequency Detection 2.*			
	6 Inverter Ready	*Inverter-ready output.*			
	7 DC Bus Undervolt	*DC Bus undervoltage output.*			
	8 BaseBlk 1	*First output for Immediate Stop at STOP.*			
	9 Option Reference	*Option reference.*			
	A Remote Operation	*Remote operation output.*			
	B Trq Det 1 N.O.	*Output for Torque Detection 1; Normally Open.*			
	C Loss of Ref	*Loss of Frequency Reference output.*			
	D DB Overheat	*Indicates dynamic braking unit is overheating.*			
	E Fault	*Fault output.*			
	F Not Used	*Do not use.*			
	10 Minor Fault	*Minor fault output.*			
	11 Reset Cmd Active	*Reset command active.*			
	13 Fref/Fout Agree 2	*Frequency Reference/Frequency Output Agree 2.*			
	14 Fref/Set Agree 2	*Frequency Reference/Frequency Set Agree 2.*			
	15 Freq Detect 3	*Frequency Detection 3.*			
	16 Freq Detect 4	*Frequency Detection 4.*			
	17 Trq Det 1 N.C.	*Torque Detection 1; Normally Closed.*			
	18 Trq Det 2 N.O.	*Torque Detection 2; Normally Open.*			
	19 Trq Det 2 N.C.	*Torque Detection 2; Normally Closed.*			

Parmtr Code	Display	Function	Range	Initial Value	Access Level
	1A Forward Dir	*FORWARD or UP direction output.*			
	1B Reverse Dir	*REVERSE or DOWN direction output.*			
	1C Speed Increasing	*Output when speed is increasing.*			
	1D BaseBlk 2	*Immediate Stop at STOP out.*			
	1E Motor A/B Change	*Motor A/B Changeover.*			
	1F Regenerating	*Regenerating.*			
	20 Auto-Rst Enabled	*Auto-Reset Enabled.*			
	21 Overload (OL1)	*OL1 Overload fault code.*			
	22 OH Prealarm	*OH prealarm output.*			
	30 Current Trq LIM	*Current Torque Limit*			
	31 Speed Limit	*Speed Limit*			
	33 Zero Servo End	*Zero-Servo End*			
	34 During RUN 2	*During Run 2.*			
	35 Load Check Fault	*Load Check fault output.*			
	36 Slack Cable Det	*Slack Cable Detection output.*			
	37 Upper Lmt input	*Output for Upper Limit—SLOW DOWN input.*			
	38 Lower Lmt input	*Output for Lower Limit—SLOW DOWN input.*			
	39 Up/Low Lmt input	*Upper/Lower Limit—SLOW DOWN input.*			
	3A Snap Shaft Det	*Snap Shaft Detection output.*			
	3B During RUN 1	*Output for RUN 1.*			
	40 Fault Annunciate	*Enables you to assign a set of six fault outputs to Terminals 25 and/or Terminal 26. In addition, you can select whether each fault output is enabled. To program this parameter, see "Digital Outputs—Fault Annunciate (H2-01, H2-02, and H2-03)," Chapter 2.*	00–FF		
H2-02	Terminal 25 Sel *(input parameter)*	*Same as H2-01.*	0–40	0	Advanced
H2-03	Terminal 26 Sel *(input parameter)*	*Same as H2-01.*	0–40	7F	Advanced

Analog Inputs

H3-01	Term 13 Signal	Voltage for Terminal 13 analog input signal.		0	Advanced
	0 0VDC to 10VDC				
	1 -10VDC to +10VDC				
H3-02	Terminal 13 Gain	Gain multiplier for Terminal 13 analog input signal.	0000.0–1000.0%	100.0	Advanced
H3-03	Terminal 13 Bias	Bias multiplier for Terminal 13 analog input signal.	-100.0–100.0%	0	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
H3-04	Term 16 Signal	Voltage for Terminal 13 analog input signal.		0	Advanced
	0 0VDC to 10VDC				
	1 -10VDC to +10VDC				
H3-05	Terminal 16 Sel	Assigns one of the following 16 multi-function analog input parameters to Terminal 16.		0	Advanced
	0 Aux Reference				
	1 Frequency Gain				
	2 Frequency Bias				
	5 Accel/Decel Change				
	7 Overtorque level				
	9 Reference Lower Limit				
	A Jump Frequency				
	B PID Feedback				
	10 Forward Torque Limit				
	11 Reverse Torque Limit				
	12 Regen Torque Limit				
	13 Torque Reference				
	14 Torque Compensation				
	15 Speed Limit				
	16 Term 16 SW Ref				
	17 Hoist Motor Current				
	1F Not used				
H3-06	Terminal 16 Gain	Gain multiplier for Terminal 16 analog input signal.	0000.0–1000.0%	100.0	Advanced
H3-07	Terminal 16 Bias	Bias multiplier for Terminal 16 analog input signal.	-100.0–100.0%	0	Advanced
H3-08	Term 14 Signal	Terminal 14 Signal Level Selection		2	Advanced
	0 0 to +10VDC				
	1 -10 to +10VDC				
	2 4 to 20mA				
H3-09	Terminal 14 Sel	Assigns one of the following 16 multi-function analog input parameters to Terminal 16. (Same as H3-05)		1F	Advanced
H3-10	Terminal 14 Gain		0000.0–1000.0%	100.0	Advanced
H3-11	Terminal 14 Bias		-100.0–100.0%	0	Advanced
H3-12	Filter Avg Time	Filter average time.	0.00–2.00 sec	0	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Analog Outputs					
H4-01	Terminal 21 Sel	Assigns one of the following 24 multi-function analog output parameters to Terminal 21. (Same as F4-01)		3	Advanced
H4-02	Terminal 21 Gain		0.00–2.50	1.00	Advanced
H4-03	Terminal 21 Bias		-10.0–10.0	0	Advanced
H4-04	Terminal 23 Sel	Same as H4-01 except assigned to Terminal 23.			Advanced
H4-05	Terminal 23 Gain		0.00–2.50	0.50	Advanced
H4-06	Terminal 23 Bias		-10.0–10.0%	0	Advanced
H4-07	AO Level Select			0	Advanced
	0 0 to +10VDC				
	1 -10 to +10VDC				
Serial Communication Set-up					
H5-01	Serial Com Adr	Serial communication address.	0-20	1F	Advanced
H5-02	Serial Baud Rate			3	Advanced
	0 1200 Baud				
	1 2400 Baud				
	2 4800 Baud				
	3 9600 Baud				
H5-03	Serial Com Sel	Determines serial communication parity.	0–2	0	Advanced
	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	Advanced
	0 Ramp 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	Advanced
	0 Disabled				
	1 Enabled				

Protection Parameters

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Motor Overload					
L1-01	MOL Fault Select	Determines whether Motor Overload Detection is enabled.		1	Advanced
	0 Disabled				
	1 Coast to Stop				
L1-02	MOL Time Const	Motor Overload Detection time constant.	0.1–5.0 min	1.0	Advanced
Stall Prevention					
L3-04	StallP Decel Sel	Determines whether Stall Prevention Decel is enabled.		1	Advanced
	0 Disabled				
	1 General Purpose				
Reference Detection (Speed Agree)					
L4-01	Spd Agree Level	Speed Agree Level.	0.0–150.0 Hz	0	Advanced
L4-02	Spd Agree Width	Speed Agree Width.	0.0–20.0 Hz	2.0	Advanced
L4-03	Speed Agree Lvl ±	Speed Agree Level ±	-150.0 to +150 .0 Hz	0	Advanced
L4-04	Speed Agree Wdth±	Speed Agree Width ±	0.0–20.0 Hz	2.0	Advanced
L4-05	Ref Loss Sel			0	Advanced
	0 Stop				
	1 Run @ 80% PrevRef				
Torque Detection					
L6-01	*Torq Det 1 Sel*	Determines Torque Detection 1 setting.		0	Advanced
	0 Disabled				
	1 @Spd Agree—Alm				
	2 At RUN—Alarm				
	3 @Spd Agree—Flt				
	4 At RUN—Fault				
L6-02	Torq Det 1 Lvl	*Torque Detection 1 Level.*	0–300%	150	Advanced
L6-03	Torq Det 1 Time	*Torque Detection 1 Time.*	0.0–10.0 sec	0.1	Advanced

Parmtr Code	Display	Function	Range	Initial Value	Access Level
L6-04	Torq Det 2 Sel	Determines Torque Detection 1 setting.		0	Advanced
	0 Disabled				
	1 @Spd Agree—Alm				
	2 At RUN—Alarm				
	3 @Spd Agree—Flt				
	4 At RUN—Fault				
L6-05	Torq Det 2 Lvl	*Torque Detection 2 Level.*	0–300	150%	Advanced
L6-06	Torq Det 2 Time	*Torque Detection 2 Time.*	0.0–10.0 sec	0.1	Advanced

Hardware Protection

L8-01	DB Resistor Prot	Indicates whether DB resistor protection is provided.		0	Advanced
	0 Not Provided				
	1 Provided				
L8-02	OH Pre-Alarm Lvl		50–110%	95	Advanced
L8-03	OH Pre-Alarm Sel			3	Advanced
	0 Ramp to Stop				
	1 Coast to Stop				
	2 Fast - Stop				
	3 Alarm Only				
L8-04	OH1 Fault Level		50–110%	105	Factory
L8-09	Short Circuit Sel			1	Factory
	0 Disabled				
	1 Enabled				
L8-10	Ground Fault Sel			1	Factory
	0 Disabled				
	1 Enabled				
L8-11	Inverter Overload Selection			1	Factory
	0 Disabled				
	1 Enabled				
L8-12	AVR Selection			1	Advanced
	0 Disabled				
	1 Enabled				
L8-13	Aging Mode			0	Advanced
	0 Disabled				
	1 Enabled				
L8-14	UV3 Detection Selection			1	Factory
	0 Disabled				
	1 Enabled				

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Automatic Reset					
L9-01	Reset Select *0 Disabled* *1 Enabled*			0	Advanced
L9-02	Reset Attempts		0–10	0	Advanced
L9-03	Reset Time		0.0–10.0 sec	2.0	Advanced
L9-04	Reset Flt Sel 1	Reset Fault Select 1.	0000–FFFF	0	Advanced
L9-05	Reset Flt Sel 2	Reset Fault Select 2.	0000–FFFF	0	Advanced

Operator Parameters

Parmtr Code	Display	Function	Range	Initial Value	Access Level
Monitor Selection					
01-01	User Monitor Sel	Assigns one of the following 30 multi-function analog output parameters to Terminal 21.		6	Advanced
	4 Control Method				
	5 Motor Speed				
	6 Output Voltage				
	7 DC Bus Voltage				
	8 Output kWatts				
	9 Torque Reference				
	10 Input Term Sts	*Input Term Status*			
	11 Output Term Sts	*Ouput Term Status*			
	12 Int Ctl Sts 1	*Internal Control Status 1*			
	13 Elapsed Time	*Power-on/Running Time (by 02-08)*			
	14 FLASH ID	*Crane Software ID*			
	15 Term 13 Level	*Terminal 13 Level.*			
	16 Term 14 Level	*Terminal 14 Level.*			
	17 Term 16 Level	*Terminal 16 Level.*			
	18 Mot SEC Current	*Motor SEC Current.*			
	19 Mot EXC Current	*Motor EXC Current.*			
	20 SFS Output				
	21 ASR Input	*Automatic Speed Regulator Input.*			
	22 ASR Output	*Automatic Speed Regulator Output.*			
	23 Speed Deviation				
	24 PID Feedback	*Proportional, Integral, and Derivative (PID) Control Feedback.*			
	25 DI-16 Reference				
	26 Voltage Ref (Vq)				
	27 Voltage Ref (Vd)				
	28 CPU ID	*Control Processing Unit Identification Number.*			
	29 Load Weight				
	32 ACR(q) Output				
	33 ACR(d) Output				
	34 OPE Detected				
	35 Friction Torq	*Friction Torque.*			

Parmtr Code	Display	Function	Range	Initial Value	Access Level
01-02	Power-On Monitor			1	Advanced
	1 Frequency Ref				
	2 Output Freq				
	3 Output Current				
	4 User Monitor				
01-03	Display Scaling		0–39999	0	Advanced
01-04	Display Units			0	Advanced
	0 Hertz				
	1 RPM				
01-05	Address Display			0	Advanced
	0 Parameter Number				
	1 MEMOBUS Address				
Key Selection					
02-01	Mode/Service			0	Advanced
	0 Mode/Service				
	1 Remote / Local				
02-02	Oper Stop Key			0	Advanced
	0 BB, Brake Set				
	1 Decel tim1 Stop				
	2 Decel tim2 Stop				
	3 Decel Fault Stop				
02-03	User Defaults			0	Advanced
	0 No Change				
	1 Set Defaults				
	2 Clear all				

Parmtr Code	Display	Function	Range	Initial Value	Access Level
02-04	kVA Selection	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	0	Advanced
	0 20P4	Do not use.			
	1 20P7	2006-FVG+			
	2 21P5	2008-FVG+			
	3 22P2	2011-FVG+			
	4 23P7	2017-FVG+			
	5 25P5	2025-FVG+			
	6 27P5	2033-FVG+			
	7 2011	2054-FVG+			
	8 2015	2068-FVG+			
	9 2018	2080-FVG+			
	A 2022	Do not use.			
	B 2030	2130-FVG+			
	C 2037	2160-FVG+			
	D 2055	2224-FVG+			
	E 2075	2300-FVG+			
	20 40P4	Do not use.			
	21 40P7	4003-FVG+			
	22 41P5	4005-FVG+			
	23 42P2	Do not use.			
	24 43P7	4008-FVG+			
	25 44P0	4011-FVG+			
	26 45P5	4014-FVG+			
	27 47P5	4021-FVG+			
	28 4011	4028-FVG+			
	29 4015	4034-FVG+			
	2A 4018	4041-FVG+			
	2B 4022	4052-FVG+			
	2C 4030	4065-FVG+			
	2D 4037	4080-FVG+			
	2E 4045	4096-FVG+			
	2F 4055	4128-FVG+			
	30 4075	4165-FVG+			
	32 4110	4224-FVG+			
	34 4160	4302-FVG+			
	35 4220	4450-FVG+			
	36 4300	4605-FVG+			

Parmtr Code	Display	Function	Range	Initial Value	Access Level
02-05	Up/Down Freq Ref	*0 Disabled—ENTER Key Required* *1 Enabled—ENTER Key Not Required*		0	Advanced
	0 Disabled				
	1 Enabled				
02-06	Oper Detection			1	Advanced
	0 Disabled				
	1 Enabled				
02-07	Elapsed Time Set		0–65535	0	Advanced
02-08	Elapsed Time Run			0	Advanced
	0 Power-On Time				
	1 Running Time				
02-09	Init Mode Sel			1	Advanced
	1 American Spec.				

Clear History

03-01	Clear History 1			0	Advanced
	0 Not Clear				
	1 Clear				
03-02	Clear History 2			0	Advanced
	0 Not Clear				
	1 AC Count Clr				
	2 OL/LC Count Clr				
	3 Both Count Clr				

Monitor Parameters

Parmtr Code	Display	Function	Units	Initial Value	Access Level
Monitor					
U1-01	Frequency Reference		Hz		Operation
U1-02	Output Frequency		Hz		User Program
U1-03	Output Current		A		User Program
U1-04	Control Method				User Program
U1-05	Motor Speed				User Program
U1-06	Output Voltage		V		User Program
U1-07	DC Bus Voltage		V		User Program
U1-08	Output kWatts		kW		User Program
U1-09	Torque Reference				User Program
U1-10	Input Terminal Status				User Program
U1-11	Output Terminal Status				User Program
U1-12	Initial Ctl Status 1				User Program
U1-13	Elapsed Time		sec		User Program
U1-14	Flash ID				User Program
U1-15	Terminal 13 Level		V		Advance
U1-16	Terminal 14 Level		V/mA		Advance
U1-17	Terminal 16 Level		V		Advance
U1-18	Mot SEC Current		A		Advance
U1-19	Motor Excitation Current		A		Advance
U1-20	SFS Output		Hz		Advance
U1-21	ASR input				Advance
U1-22	ASR output				Advance
U1-23	Speed Deviation				Advance
U1-24	PID Feedback				Advance
U1-25	G5IN4 Monitor				Advance
U1-26	Voltage Reference (Vq)		V		Advance
U1-27	Voltage Reference (Vd)		V		Advance
U1-28	CPU ID				Advance
U1-29	Load Weight		C10-07		Advance
U1-32	ACR (q) Output		%		Advance
U1-33	ACR (d) Output		%		Advance
U1-34	OPE Detected		const#		Advance
U1-35	Friction Torq		%		Advance
U1-36	Motor Absolute Speed by PG				Advance

Parmtr Code	Display	Function	Units	Initial Value	Access Level
Fault Trace					
U2-01	Current Fault				User Program
U2-02	Last Fault				User Program
U2-03	Frequency Reference		Hz		User Program
U2-04	Output Frequency		Hz		User Program
U2-05	Output Current		A		User Program
U2-06	Motor Speed				User Program
U2-07	Output Voltage		V		User Program
U2-08	DC Bus Voltage		V		User Program
U2-09	Output kWatts		kW		User Program
U2-10	Torque Reference				User Program
U2-11	Input Terminal Sts				User Program
U2-12	Output Terminal Status				User Program
U2-13	Inverter Status				User Program
U2-14	Elapsed Time		sec		User Program
Fault History					
U3-01	Last Fault				User Program
U3-02	Fault Message 2				User Program
U3-03	Fault Message 3				User Program
U3-04	Fault Message 4				User Program
U3-05	Elapsed Time 1				User Program
U3-06	Elapsed Time 2				User Program
U3-07	Elapsed Time 3				User Program
U3-08	Elapsed Time 4				User Program
U3-09	Ac Operations				User Program
U3-10	OL/LC Count				User Program