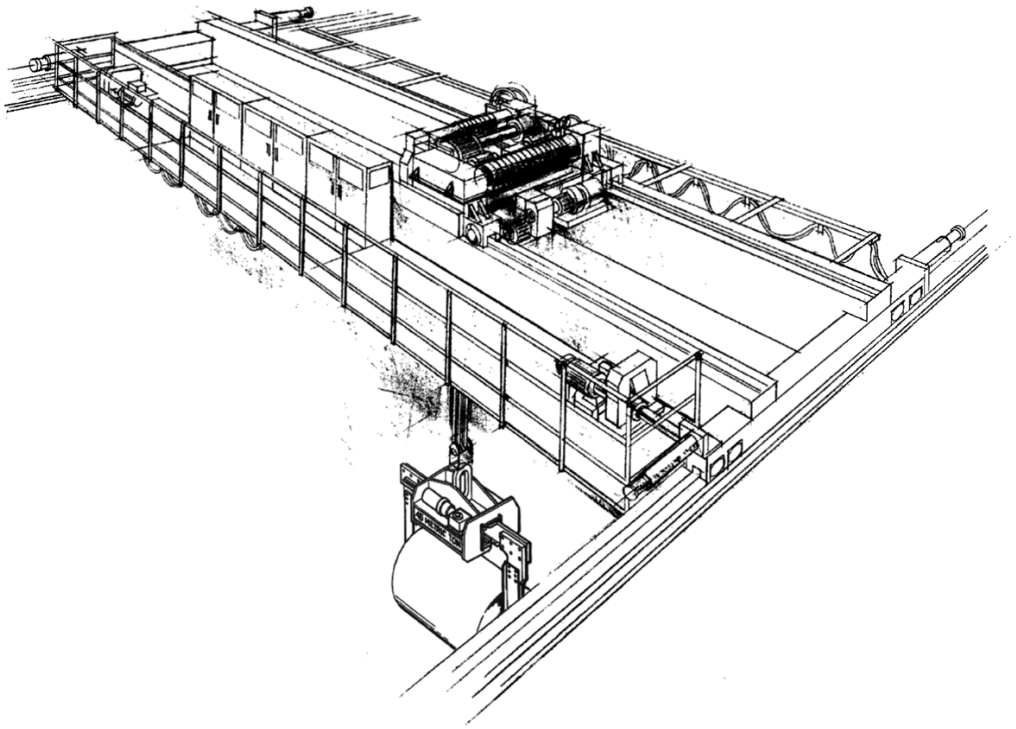

IMPULSE®•T

Adjustable Frequency Crane Controls

Instruction Manual

MAGNETEK
MATERIAL HANDLING

Software #5073 October 2015
Part Number: 144-26158 R3

Distributed by Tri-State Equipment Company Inc.
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PREFACE AND SAFETY

PRODUCT SAFETY INFORMATION

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

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

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

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

PRODUCT WARRANTY INFORMATION

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

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

WARNING

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

DANGER, *WARNING*, *CAUTION*, and *NOTE* Statements

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

DANGER

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

WARNING

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

CAUTION

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

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

Contents:

Chapter 6: Troubleshooting

Appendix A: Parameter Listing

Chapter 1

Introduction

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WARNING

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

Do not touch any circuitry components while the main AC power is on. In addition, you must wait until the red “CHARGE” LED is out before performing any service on that unit (as you look at the face of the circuitry, the “CHARGE” LED is located inside the left side of the drive). 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 (U/T1, V/T2, W/T3) to the incoming, three-phase AC source.

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

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

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

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

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

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

Introduction

The IMPULSE•T drive is the next generation of Magnetek, Inc. drives, providing compact and economical crane control. The drive maintains a similar footprint size to previous generation drives. The drive includes:

- Volts/Hertz Control
- Up to 8 Discrete Speed References
- 1 multi-function digital output
- 120 VAC interface card (standard)
- Multi-function analog input (0–10 VDC, 4-20 mA, 0–20 mA)
- 40:1 speed range
- DC injection braking, ramp to stop
- Electronic reversing of motor leads

IMPULSE•T General Specifications

230V Class - Standard

Specification	Specification Values and Information for Each 230V-Class Model		
	2006-T	2010-T	2012-T
Rated output current (A)	6.0	9.6	12.0
Capacity (kVA)	2.3	3.7	4.6

460V Class - Standard

Specification	Specification Values and Information for Each 460V-Class Model			
	4002-T	4004-T	4005-T	4009-T
Rated output current (A)	2.1	4.1	5.4	8.8
Capacity (kVA)	1.6	3.1	4.1	6.7

230V and 460V Classes

Specification	Specification Value and Information for All Models
Certification	cULus, CE, RoHS
Rated input power supply volts & freq	3-phase 200–240 V or 380–480 V; 50/60 Hz
Allowable input voltage fluctuation	-15% or +10% of nominal
Allowable input frequency fluctuation	±5% of nominal
Control method	Fully digital; sine-wave, pulse-width modulated
Maximum output voltage (VAC)	Max output voltage 3-phase, 200–240 V; 380–480 V (proportional to input voltage).
Rated frequency (Hz)	Up to twice motor nameplate RPM, 60 Hz standard (150 Hz, consult factory)
Output speed control range	40:1 - V/f
Output frequency accuracy	±0.01%—with digital reference command ±0.5%—with analog reference command; 10 bits/10 V
Frequency reference resolution	Digital: 0.01 Hz
Output frequency resolution	0.01 Hz
Overload capacity	120% of rated output current of the drive for 1 minute
Remote frequency reference sources	0–10 VDC (2kΩ); 4–20 mA (250Ω), 0–20 mA
Accel/decel times	0.0 to 25.5 seconds
Braking torque	125% or more with dynamic braking
Motor overload protection	UL recognized electronic thermal overload relay; field-programmable
Overcurrent protection level	200% of drive rated current
Circuit protection	Ground fault
Overvoltage protection level	Approximately 410 VDC (230 V Class), 820 VDC (460 V Class)
Undervoltage protection level	Approximately 190 VDC (230 V Class), 380 VDC (460 V Class)
Heatsink overtemperature	Thermostat trips at 184–212°F (90–100°C), dependent on drive capacity
Stall prevention	Separate functions for accel
Other protection features	Lost output phase, failed-oscillator, mechanical overload, and internal braking transistor failure.
DC bus voltage indication	Charge LED is on until DC bus voltage drops below 50 VDC
Location	Indoors; requires protection from moisture, corrosive gases, and liquids
Ambient operating temperature	14° to 122°F (-10° to 50°C) for open chassis

Specification	Specification Value and Information for All Models
Storage temperature	-4° to 140°F (-20° to 60°C)
Humidity	95% relative; noncondensing
Vibration	1 G less than 20 Hz; 0.2 G for 20–55 Hz
Elevation	3300 Ft. (1000 m) or less

AC Reactor Specifications

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

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

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

Table 1-1: 230V Class

Model Number - Finned	230 V Part Number	Maximum Amps of Reactor
2006-T	REA230-2	8
2010-T	REA230-3	12
2012-T	REA230-3	12

Table 1-2: 460V Class

Model Number - Finned	460 V Part Number	Maximum Amps of Reactor
4002-T	REA460-1	2
4004-T	REA460-3	4
4005-T	REA460-3	4
4009-T	REA460-5	8

IMPULSE•T External Resistor Specifications

Table 1-3: External Resistor Specifications

	IMPULSE•T	Traverse	
		Resistor Part No.	Resistor Part No.
	Model Number - Finned	CMAA Class C	CMAA Class D
230 Volts	2006-T	EDB2003CT	EDB2004DTP*
	2010-T	EDB2006CT	EDB2006DTP*
	2012-T	EDB2009CT	EDB2011DTP*
460 Volts	4002-T	EDB4001CT	EDB4002DTP*
	4004-T	EDB4003CT	EDB4004DTP*
	4005-T	EDB4004CT	EDB4005DTP*
	4009-T	EDB4007CT	EDB4007DTP*

* External resistor

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Chapter 2

Installation

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Assessing the System Requirements

WARNING

- When preparing to mount the IMPULSE•T drive, lift it by its base. Never lift it by the front cover.
- Mount the drive on nonflammable material.
- The IMPULSE•T drive generates heat. For the most effective cooling possible, mount it vertically. For more details, refer to the “IMPULSE•T Ratings and Dimensions” in this chapter.
- When mounting units in an enclosure, install a fan or other cooling device to keep the enclosure temperature below 122°F (50°C).

Failure to observe these warnings may result in equipment damage.

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

- Motion **(traverse only)**
- Motor HP, RPM, and FLA
- Speed control method (2-speed, 3-speed, multi-step, etc.)
- Stopping method (Decelerate/Ramp to Stop)
- Wire size
- Grounding location and method

Choosing a Location

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

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

IMPULSE•T System Components And External Devices

Optional Drive Components

- 120 VAC Interface Card (Part Number T-IF-120VAC)
- 24 VAC Interface Card (Part Number T-IF-24VAC)
- 48 VAC Interface Card (Part Number T-IF-48VAC)
- Quick Start Guide (Part Number 144-25086)

As-Required Drive Components

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

Required External Devices

- Motor
- User input device (pendant, joystick, PC, PLC, radio, or infrared control)
- External circuit protection devices (fuses or circuit breakers). See “Suggested Circuit Protection Specifications and Wire Size” on page 3-7.
- R-C surge suppressors on contactor coils

IMPULSE•T Ratings and Dimensions

Table 2-1: Ratings and Dimensions

Voltage	Model	W	H	D	W1	H1	d	Wt. in Lbs.	Total Heat Loss (W)**
				Dimensions in Inches					
230V	2006-T	2.7	5.0	5.0	2.2	4.6	M4	2.4	44.7
	2010-T	4.3	5.0	5.1	3.8	4.6	M4	3.8	77.5
	2012-T	4.3	5.0	5.4	3.8	4.6	M4	3.8	91.7
460V	4002-T	4.3	5.0	3.9	3.8	4.6	M4	2.7	32.4
	4004-T	4.3	5.0	5.4	3.8	4.6	M4	3.8	47.3
	4005-T	4.3	5.0	6.1	3.8	4.6	M4	3.8	66.3
	4009-T	4.3	5.0	6.1	3.8	4.6	M4	3.8	95.1

NOTE: Applications such as high duty cycles in conjunction with high ambient temperatures or other unique environmental conditions can impact drive ratings. Please consult factory. Due to ongoing improvements, data is subject to change without notice.

** Heat loss for carrier frequency of 2.0 kHz.

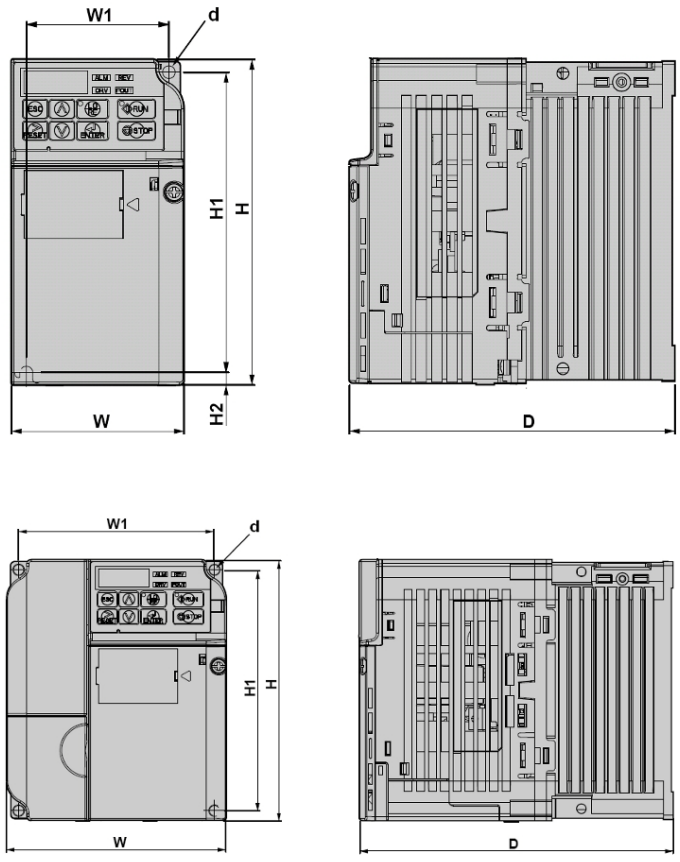

Figure 2-1: Dimensions

Installing the Drive

The following figure shows the minimum clearances when mounting the drive in standard or side-by-side installations.

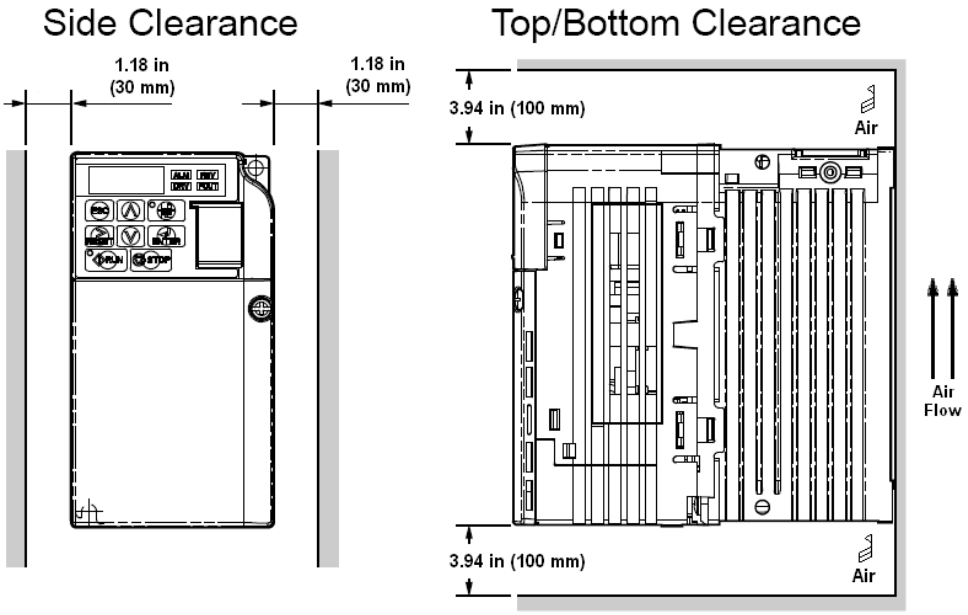

Figure 2-2: Standard Installation

Chapter 3

Wiring

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IMPULSE•T Wiring Practices

WARNING

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

- Connect the incoming three-phase AC source to terminals R/L1, S/L2, and T/L3.
- Connect the motor leads to terminals U/T1, V/T2, and W/T3.
- Ensure that the drive-to-motor wiring distance is less than 150 ft (45.72 m) unless appropriate reactors and/or filters are used.
- Install a line reactor between the output of the drive in applications that require a disconnecting means between the drive's output and the motor. Use a "make before break" auxiliary contact with the disconnect means and the hardware base block of the drive.
- Use contacts between the PLC output and the drive 120/24/48 VAC input card. If using a solid state output from a PLC (TRIAC) to a 120/24/48 VAC input card, use a 5KΩ, 5 Watt resistor between the signal and X2.
- If the power source is 500 kVA or greater, or more than 10 times the inverter kVA rating, ensure that there is at least 3 percent impedance between the power source and the drive input. To accomplish this, you can install a DC reactor between inverter terminals +1 and +2, or use an AC line reactor on the input of the drive. If you don't provide enough impedance, excessive peak currents could damage the input power supply circuit.
- Comply with "Suggested Circuit Protection Specifications and Wire Size" on page 3-7.
- Use time delay fuses, which are sized at 150% of drive's continuous-rated current, for drive input protection.
- Use appropriate R-C or MOV type surge absorbers across the coil of all contactors and relays in the system. Failure to do so could result in noise-related, nuisance fault incidents.
- Use external dynamic braking resistors for all applications.
- Do not ground the drive with any large-current machines.
- Before you use any welding or high-current machines near the crane, disconnect all line and ground wiring.
- Do not let the wiring leads come in contact with the drive enclosure.
- Do not connect power factor correction capacitors to the drive input or output.
- Hard-wire the drive and motor (e.g., festoon cable). Do not use sliding collector bars.
- If you have a user input device or interface board that is remote, use shielded cable between the drive input terminals and the interface output terminals or user input device(s).
- Before turning on the drive, check the output circuit (U/T1, V/T2, and W/T3) for possible short circuits and ground faults.
- Increase the wire size by one size for every 250 ft (76.2 m) between the drive and motor; suggested for center driven cranes, trolleys, and bridges (voltage drop is significant at low frequencies).
- When using more than one transformer for the drive's power, properly phase each transformer.

- To reverse the direction of rotation, interchange any two motor leads (U/T1, V/T2, or W/T3). Changing R/L1, S/L2, or T/L3 will not affect the shaft rotation direction or change parameter B3-04.
- Use shielded cable for all low-level DC speed reference signals (0 to 10 VDC, 4 to 20 mA). Ground the shield only at the drive side.
- Please observe National Electrical Code (NEC) guidelines when wiring electrical devices.

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

IMPULSE•T Typical Connection Diagram

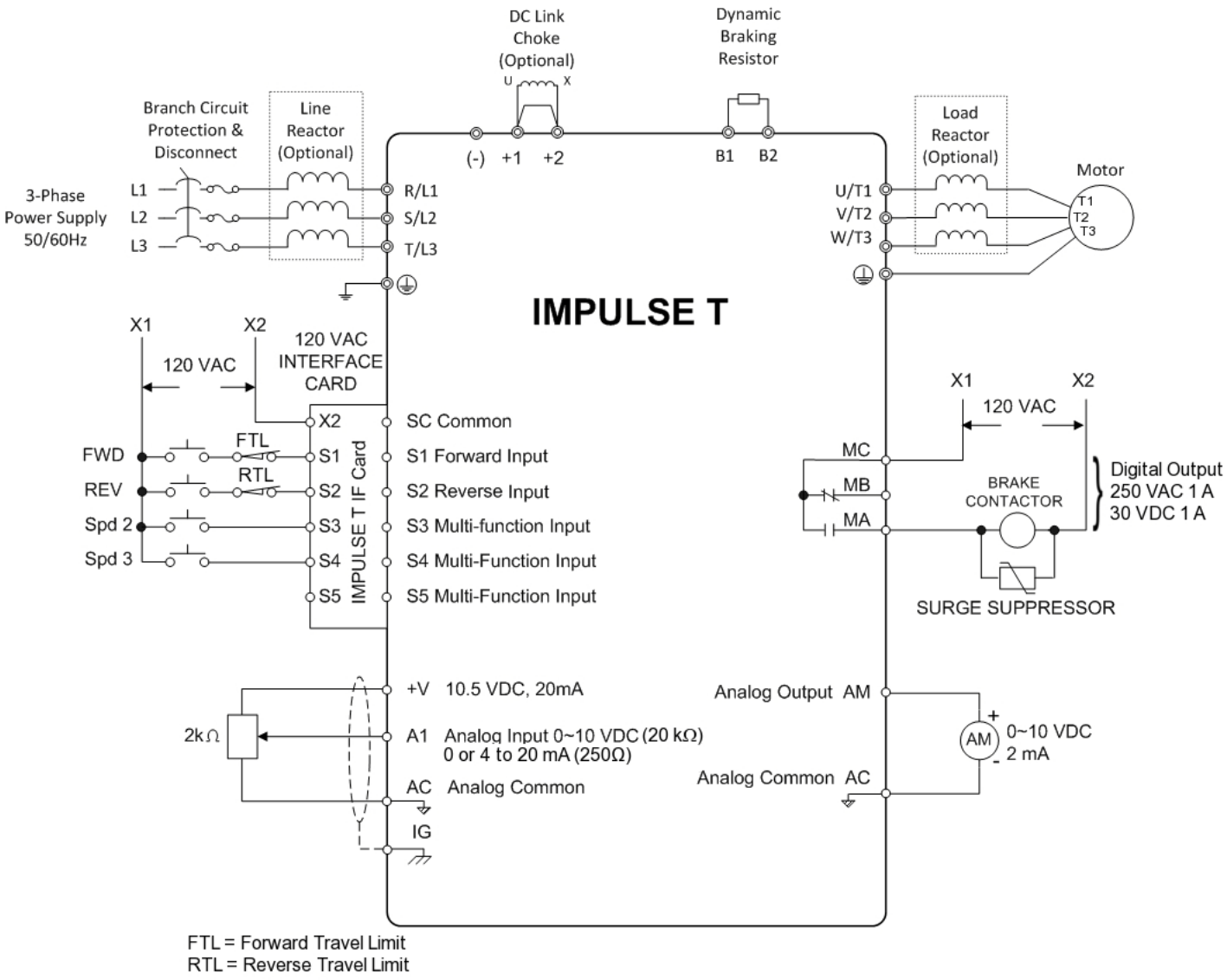

Figure 3-1: IMPULSE•T Typical Connection Diagram

Terminal Description

Table 3-1: Control Circuit Terminals

Type			Terminal	Name	Function (Signal Level)			
Main Circuit			R/L1, S/L2, T/L3	AC power supply input	AC power supply input			
			U/T1, V/T2, W/T3	Inverter output	Inverter output			
			B1, B2	Braking resistor connection	Braking resistor connection			
			+2, +1	DC reactor connection	When connecting optional DC reactor, remove the main circuit short-circuit bar between +2 and +1.			
			+1, (–)	DC power supply input	DC power supply input (+1: positive; (–): negative)			
			⏚	Grounding	Ground to local grounding codes			
Control Circuit	Input	Sequence	S1	Multi-function input selection 1	FWD run when closed, stop when open	H1-01–H1-05	120 VAC ±10%	
			S2	Multi-function input selection 2	REV run when closed, stop when open			
			S3	Multi-function input selection 3	Inputs are programmable			
			S4	Multi-function input selection 4				
			S5	Multi-function input selection 5				
			X2*	Multi-function input selection common	Common for control signal			
		Analog Input Signal	+V	+10.5 VDC Power supply output	For analog command +10 V power supply		+10 V (Allowable current 20 mA max)	
			A1	Master frequency reference	0 to +10 V/0 to 100%		0 to +10 V/(2K Ohm)	
					4 to 20 mA/0 to 100% 0 to 10 V/0 to 100% 0 to 20 mA/0 to 100%	H3-01	4 to 20 mA (250 Ohm), 0 to +10V/ (2k Ohm)	
			AC	Frequency reference common	0V	0 to ±10V. Max ±5% 2 mA or less		
	Output	Multi-function contact output	MA	NO contact output	Factory setting: brake output	H2-01	Dry contact capability: 250 VAC 1 A or less, 30 VDC 1 A or less	
			MB	NC contact output				
			MC	Contact output common				
			AM	Analog monitor output	Factory setting: output frequency 0 to +10 V	H4-01	+10 VDC, 2 mA or less, 8-bit resolution	
			AC	Analog monitor common	0 V			

* SC when the 24 VDC input option is used.

Suggested Circuit Protection Specifications and Wire Size

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

CAUTION

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

Table 3-2: Wiring Size (AWG/KCMIL)

Model #	Continuous Input Amps	Fuses (3)			Power Circuit Wiring (1)		Control Wiring		Control Relay		Ground	
		Rated Current (A) Input Fuse	Time Delay Input Fuse Class	Inverse Time Molded/Case Circuit Breaker(3)	Applicable Gauge (AWG)	Recomm. Gauge (AWG)	Applicable Gauge (AWG)	Recomm. Gauge (AWG)	Applicable Gauge (AWG)	Recomm. Gauge (AWG)	Applicable Gauge (AWG)	Recomm. Gauge (2) (AWG)
230VClass												
2006-T	7.3	10	CC	15	18 to 14	14	24 to 18	18	24 to 16	16	18 to 14	14
2010-T	10.8	15	CC	15	14 to 10	14	24 to 18	18	24 to 16	16	18 to 14	12
2012-T	13.9	20	CC	20	14 to 10	14	24 to 18	18	24 to 16	16	18 to 14	12
460VClass												
4002-T	2.1	3	CC	15	14 to 10	14	24 to 18	18	24 to 16	16	18 to 14	14
4004-T	4.3	6	CC	15	14 to 10	14	24 to 18	18	24 to 16	16	18 to 14	14
4005-T	5.9	8	CC	15	14 to 10	14	24 to 18	18	24 to 16	16	18 to 14	14
4009-T	9.4	12	CC	15	14 to 10	14	24 to 18	18	24 to 16	16	18 to 14	12

References:

(1) NFPA 70 National Electrical Code 2008. Table 610-14(a).

(2) NFPA 70 National Electrical Code 2008. Table 250-122.

(3) NFPA 70 National Electrical Code 2008. Table 430.52.

Grounding

1. Connect terminal ⏚ to the common panel ground. Use ground wiring as specified in "Suggested Circuit Protection and Wire Size" on page 3-7, and keep the length as short as possible.
   - Ground Resistance: 230 V class; 100Ω or less, 460 V or greater class; 10Ω or less.
   - Never run the IMPULSE•T drive ground wires in common with welding machines or other high-current electrical equipment.
   - When more than one drive is used for the same system, ground each drive directly, or daisy-chain to the ground pole. Do not loop the ground wires.

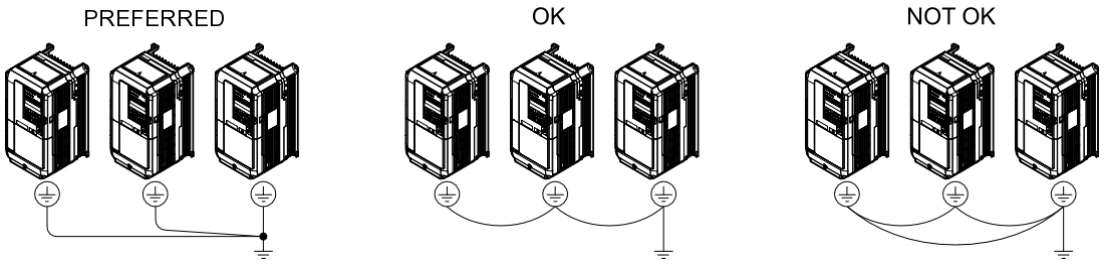

Figure 3-2: Grounding the Drive

Figure 3-3: Grounding the Motor

Wiring the Control Circuit

Control Circuit Terminals

The IMPULSE•T is shipped standard with a 120 VAC interface card, allowing direct connection of 120 VAC user input devices. The interface card connects to drive terminals S1–S5 and SC. The user input device then connects to terminals S1–S5 and X2 on the interface card. Terminals S1 and S2 are factory programmed for the forward and reverse run commands; however, they can be programmed for speed control and other functions like the remaining terminals. The figure below shows the control terminal arrangement for the IMPULSE•T along with the 120 VAC interface card.

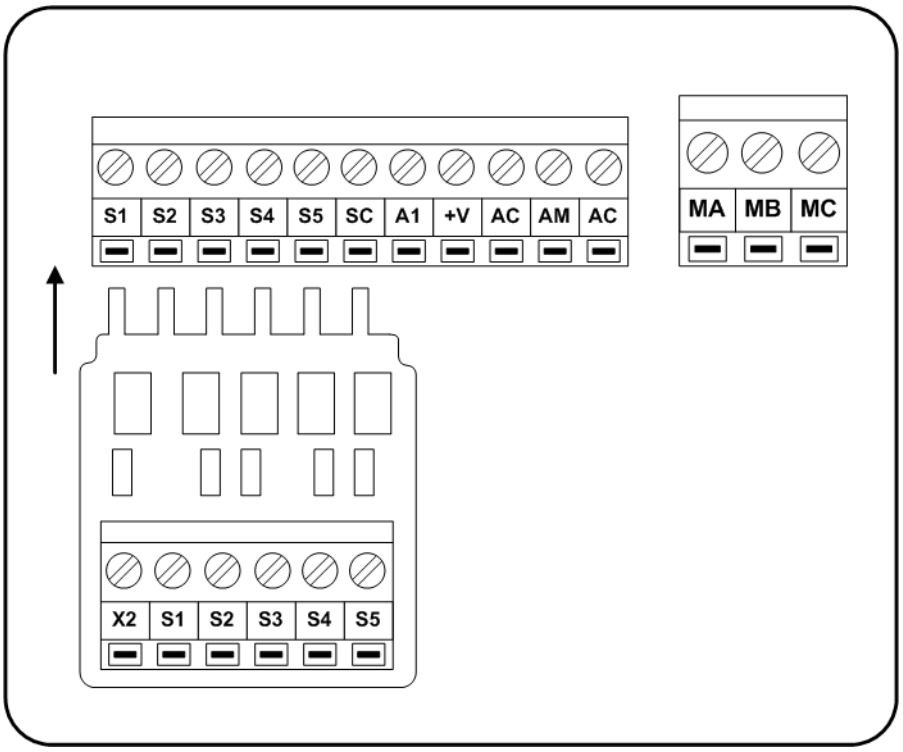

Figure 3-4: IMPULSE•T 120 VAC Interface Card

Control Board DIP Switches

There are three switch settings on the controller board that are used for controller input (S1–S5) polarity and analog input signal control method. The figure below shows the location of these switches and their function along with the default settings.

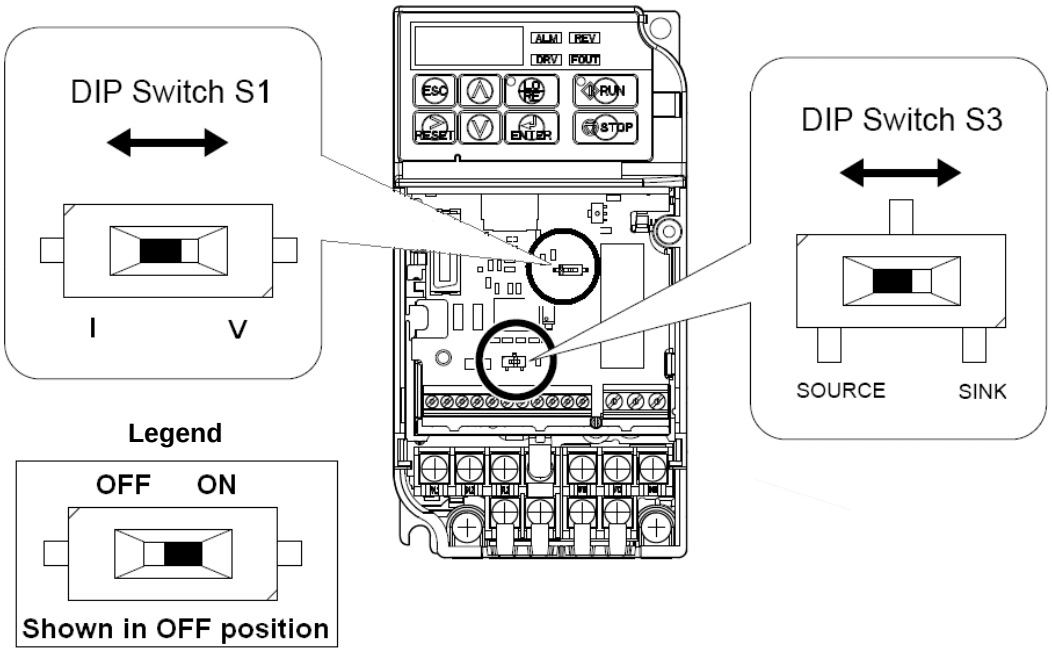

Figure 3-5: DIP Switches

Table 3-3: Dip Switch Settings

Name	Function	Settings
DIP Switch 1	Input method for analog input A1	**V:** 0–10 VDC input (internal resistance: 20K Ohm) (**Default**) **I**: (0) 4–20 mA input (internal resistance: 250 Ohm)
DIP Switch 3	Controller input signal polarity (S1–S5) on the controller board	**SINK**: Must remain in this position for use with the 120 VAC and 24 VAC interface cards (**Default**) **SOURCE**: Consult Factory

IMPULSE•T Power Terminal Arrangement

Table 3-4: Terminal Arrangement

230V	Arrangement	460V	Arrangement
2006-T	1	4002-T	2
2010-T	2	4004-T	2
2012-T	2	4005-T	2
--	--	4009-T	2

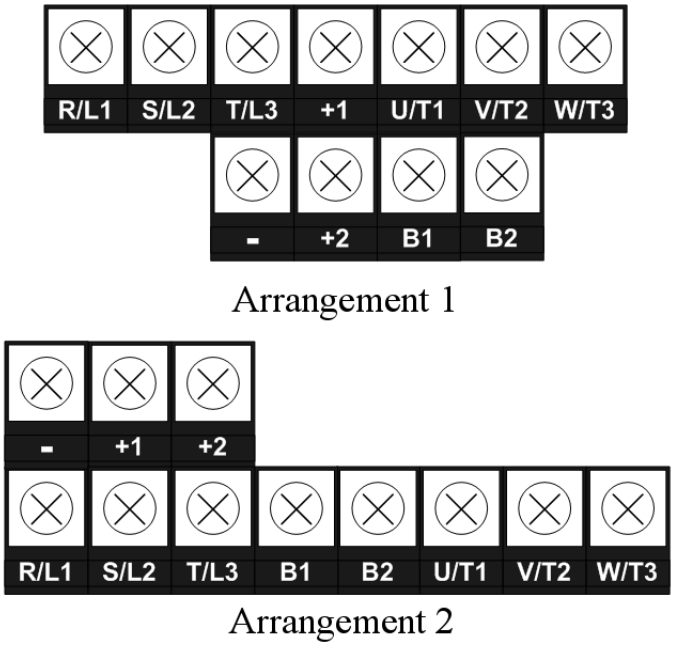

Figure 3-6: IMPULSE•T Power Terminal Arrangement

Chapter 4

Getting Started

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Overview

With its easy-to-use keypad, IMPULSE•T makes it easy to get up and running right away. This chapter explains how to navigate through the drive's menus along with the function and meaning of each button and indicator. The keypad will make it possible to view fault codes and change parameter settings. Parameter settings, with their parameter codes, are displayed in most cases. The keypad enables you to:

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

WARNING

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

Checks Before Powering

After mounting and interconnections are completed, verify:

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

WARNING

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

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

Precautions

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

DANGER

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

Using the Keypad

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

Keypad Functions

The keypad has a 5-digit LED display. Both numeric and alpha-numeric data can appear on the display.

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

NOTE: The STOP key is always active and will cause any run command to come to an immediate stop, following the B3-03 stopping method.

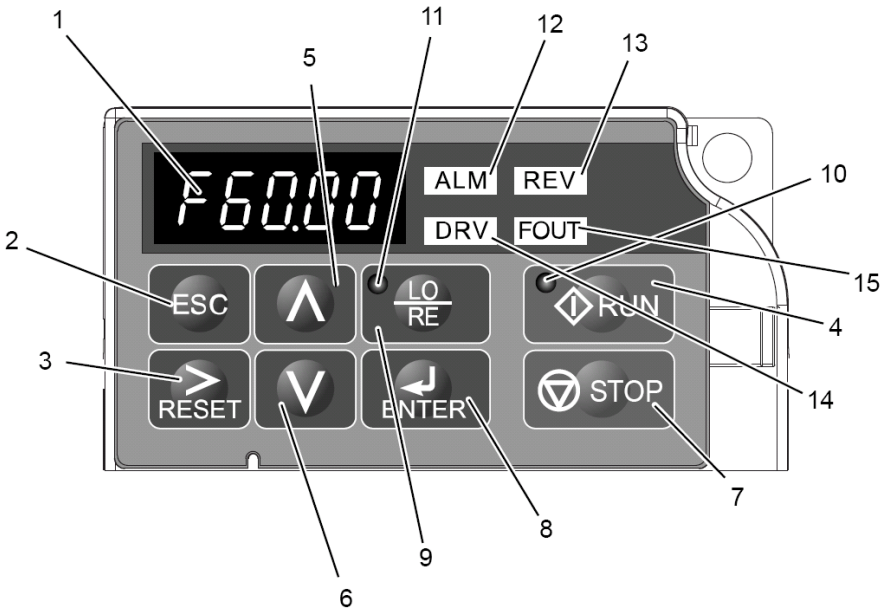


Figure 4-1: Keypad Display

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.

Table 4-1: Keys and Displays on the LED Operator

No.	Display	Name	Function
1		Data Display Area	Displays the frequency reference, parameter number, etc.
2		ESC Key	Returns to the previous menu (before ENTER Key is pressed), or cursor position
3		RESET Key	Moves the cursor to the right. Resets the drive to clear a fault situation.
4		RUN Key	Pressing the key initiates the RUN command when LOCAL mode operation is selected. Starts the auto-tuning process.
5		Up Arrow Key	Scrolls up to select next parameter group or parameter settings. It also increases the value of the blinking digit of a parameter setting.
6		Down Arrow Key	Scrolls down to select next parameter group or parameter settings. It also decreases the value of the blinking digit of a parameter setting.
7		STOP Key	Stops the drive by initiating a base block STOP command. *NOTE: Stop priority circuit.*
8		ENTER Key	Selects modes or parameters. Displays each parameter's set value. By pressing this key again, the set value is stored.
9		LO/RE Selection Key	Selects local or remote operation.

Table 4-2: LO/RE LED and RUN LED Indications

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

Table 4-3: Function LEDs

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

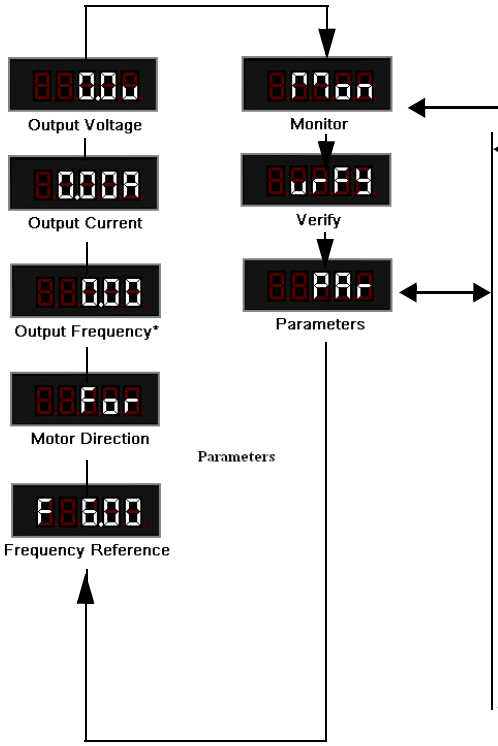
Parameters

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

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

By default, the IMPULSE•T is configured for a common crane system. If you find it necessary to change the initial settings, it is recommended that you only allow qualified crane system technicians to program the drive. This can be accomplished by using the Access Level feature. For more information on the security feature, see Table 4-4.

IMPULSE•T Structure of Parameters



Group		Function
Monitor	U1	Monitor
	U2	Fault
	U4	Maintenance
Initialize	A1	Initialization Parameters
Application	B1	Preset References
	B2	Reference Limits
	B3	Sequence/Reference Source
	B5	Acceleration/Deceleration
Tuning	D1	DC Injection Braking
	D9	S-Curve Acceleration/ Deceleration
Motor	E1	V/f Pattern
	E2	Motor Set-up
Terminal	H1	Digital Inputs
	H2	Digital Outputs
	H3	Analog Inputs
	H4	Analog Outputs
Protection	L1	Motor Overload Protection
	L3	Stall Prevention
	L8	Hardware Protection
	L9	Automatic Reset
Operator	O2	Keypad Key Selection

**View after power-up*

Parameter Modes

All parameters are organized under three modes:

Operation Mode

Drive operation is enabled. Drive status LED lights.

Programming Mode

Access to parameters, control method, motion, speed control mode, and passwords are selected. Parameters are set/read.

Verify Constants Mode

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

Initialization Set-up

Parameter Access Level (A1-01)

This parameter controls the level of access for all the parameters in the drive. Using this parameter controls the “masking” of parameters according to the access level selected. There are two access levels available - ADVANCED and OPERATION ONLY. When the access level is set to ADVANCED (A1-01 = 0002), it will allow access to all parameters outlined in this manual.

Changing the access level to Operation Only (A1-01 = 0000) limits access to A1-01, U1-xx, U2-xx, and U4-xx monitors.

Table 4-4: Parameter Access Level Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
A1-01*	Parameter Access Level		0000, 0002	0000	O/Adv
	0000	Operation Only			
	0002	Advanced Level - Advanced programming for traverse applications			

* O = Operation only

When the access is set to OPERATION ONLY, no parameters can be modified or viewed (except parameters shown in the Verify menu).

Select Motion (A1-03)

Set this parameter to match the motion of application. See Table 4-8 for details.

Table 4-5: Select Motion Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
A1-03	Select Motion		00	00	Adv
	00	Traverse - Decelerate to stop upon removal of RUN command			

Speed Reference Selection (A1-04)

This parameter will automatically define the input terminals for the selections listed below. See Table 4-8 (X-Press Programming) for details.

Table 4-6: Speed Reference Settings

Setting	Description
00	2-Speed Multi-Step
01	3-Speed Multi-Step
02	5-Speed Multi-Step
03	2-Step Infinitely Variable
04	Uni-Polar Analog

Initialize Parameters (A1-05)

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

Table 4-7: Initial Parameter Settings

Setting	Description
0000	No Initialize (factory default)
2220	Initialize drive to factory default values

X-Press Programming

Recommended Parameter Settings

Table 4-8: Traverse (A1-03= 00)

A1-04	Speed Reference	B1-01	B1-02	B1-03	B1-04	B01.05	B01.06	B01.07	B01.08	B2-02	B3-03	B5-01	B5-02
		Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Speed 6	Speed 7	Speed 8	Ref. Lower Limit	Stopping Method	Accel Time 1	Decel Time 1
00	2-Speed Multi-Step	6.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	00	5.0	5.0
01	3-Speed Multi-Step	6.00	30.00	60.00	0.00	0.00	0.00	0.00	0.00	0.0	00	5.0	5.0
02	5-Speed Multi-Step	6.00	15.00	30.00	45.00	60.00	0.00	0.00	0.00	0.0	00	5.0	5.0
03	2-Step Infinitely Variable	6.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.0	00	5.0	5.0
04	Uni-Polar Analog	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	00	5.0	5.0

A1-04	Speed Reference	D9-01	D9-02	D9-03	H1-01	H1-02	H1-03	H1-04	H1-05	H2-01	H3-01
		S-Curve Accel at Start	S-Curve Accel at End	S-Curve Decel at Start	Terminal S1 Select	Terminal S2 Select	Terminal S3 Select	Terminal S4 Select	Terminal S5 Select	Terminal MA/MB/MC Select	Terminal A1 Signal
00	2-Speed Multi-Step	1.50	1.50	1.50	80	81	00	0F	0F	000	00
01	3-Speed Multi-Step	1.50	1.50	1.50	80	81	00	01	0F	000	00
02	5-Speed Multi-Step	1.50	1.50	1.50	80	81	00	01	02	000	00
03	2-Step Infinitely Variable	1.50	1.50	1.50	80	81	05	0F	0F	000	00
04	Uni-Polar Analog	1.50	1.50	1.50	80	81	0F	0F	0F	000	00

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Chapter 5

Programming Features

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Application

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

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

Preset Reference

Table 5-1:Preset Reference Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
B1-01	Frequency Reference 1	Sets the frequency of Minimum Speed/Speed 1.	0.00–E1-04 Hz	6.00	Adv
B1-02	Frequency Reference 2	Sets the Speed 2 frequency.	0.00–E1-04 Hz	30.00	Adv
B1-03	Frequency Reference 3	Sets the Speed 3 frequency.	0.00–E1-04 Hz	60.00	Adv
B1-04	Frequency Reference 4	Sets the Speed 4 frequency.	0.00–E1-04 Hz	0.00	Adv
B1-05	Frequency Reference 5	Sets the Speed 5 frequency.	0.00–E1-04 Hz	0.00	Adv
B1-06	Frequency Reference 6	Sets the Speed 6 frequency.	0.00–E1-04 Hz	0.00	Adv
B1-07	Frequency Reference 7	Sets the Speed 7 frequency.	0.00–E1-04 Hz	0.00	Adv
B1-08	Frequency Reference 8	Sets the Speed 8 frequency.	0.00–E1-04 Hz	0.00	Adv

Table 5-2:Multi-Input Speed Reference Selection

Speed Reference	Forward/Reverse Terminal 1 or 2 H1-01–06 = 80 or 81	Multi-Step Speed 2 H1-01–06 = 0	Multi-Step Speed 3 H1-01–06 = 1	Multi-Step Speed 4 H1-01–06 = 2
STOP	OFF	--	--	--
B1-01 Speed Ref 1	ON	OFF	OFF	OFF
B1-02 Speed Ref 2	ON	ON	OFF	OFF
B1-03 Speed Ref 3	ON	ON	ON	OFF
B1-04 Speed Ref 4	ON	ON	ON	ON
B1-05 Speed Ref 5	ON	ON	OFF	ON
B1-06 Speed Ref 6	ON	OFF	ON	OFF
B1-07 Speed Ref 7	ON	OFF	ON	ON
B1-08 Speed Ref 8	ON	OFF	OFF	ON

Reference Limits

These parameters will limit the frequency range as a percentage of maximum output frequency (E1-04).

Table 5-3:Reference Limit Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
B2-01	Frequency Reference Upper Limit	Sets as a percentage of the maximum output frequency (E1-04), which determines the maximum frequency at which the drive is able to run.	0.0–110.0%	100.0	Adv
B2-02	Frequency Reference Lower Limit	Sets as a percentage of the maximum output frequency (E1-04), which determines the minimum master frequency reference only.	0.0–110.0%	0.0	Adv

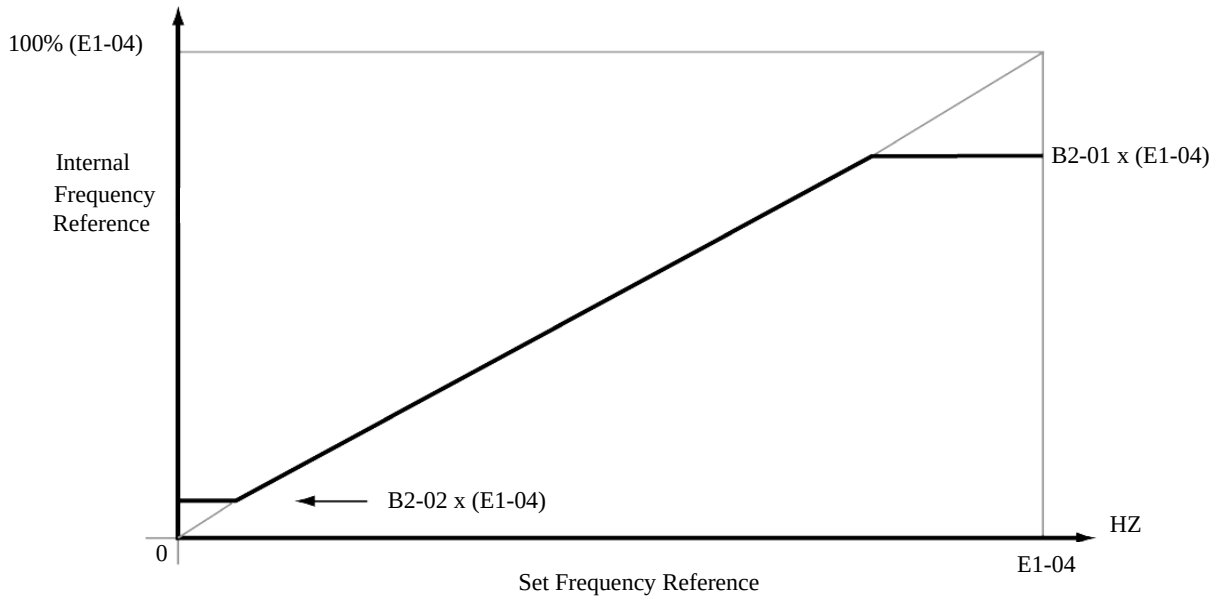


Figure 5-1: Setting Frequency Upper and Lower Limits

Sequence/Reference Source

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

Table 5-4:Sequence/Reference Source Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
B3-01	Reference Source	Source from where the frequency reference is generated.	00, 01	00	Adv
	00 Digital Operator	Digital Operator (Keypad)*			
	01 Terminals	Analog input terminals			
B3-02	Run Source	Source from where the RUN command is generated.	00, 01	01	Adv
	00 Digital Operator	Digital Operator (Keypad).			
	01 Terminals	Control circuit terminal.			

* LO/RE will light up when Run Source is assigned to the operator.

WARNING

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

Stopping Method

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

Table 5-5:Stopping Method Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
B3-03	Stop Method	Determines stop method.	00	00	Adv
	00 Decel to Stop	Used to stop when motion is traverse (Fig 5-2 & 5-3)			

Decel to Stop (B3-03 = 00)

Upon removal of the FWD or REV run command, the motor decelerates at a rate determined by the time set in deceleration time 1 (B5-02) and DC injection braking is applied after the DC injection start frequency, 0.5 Hz, has been reached. If the deceleration time is set too short or the load inertia is too large, an overvoltage fault (OV) may occur during deceleration. In this case, increase the deceleration time or install an optional braking transistor and/or braking resistor.

Braking torque: without braking resistor, approximately 20% of motor rated torque; with braking option, approximately 120% of motor rated torque.

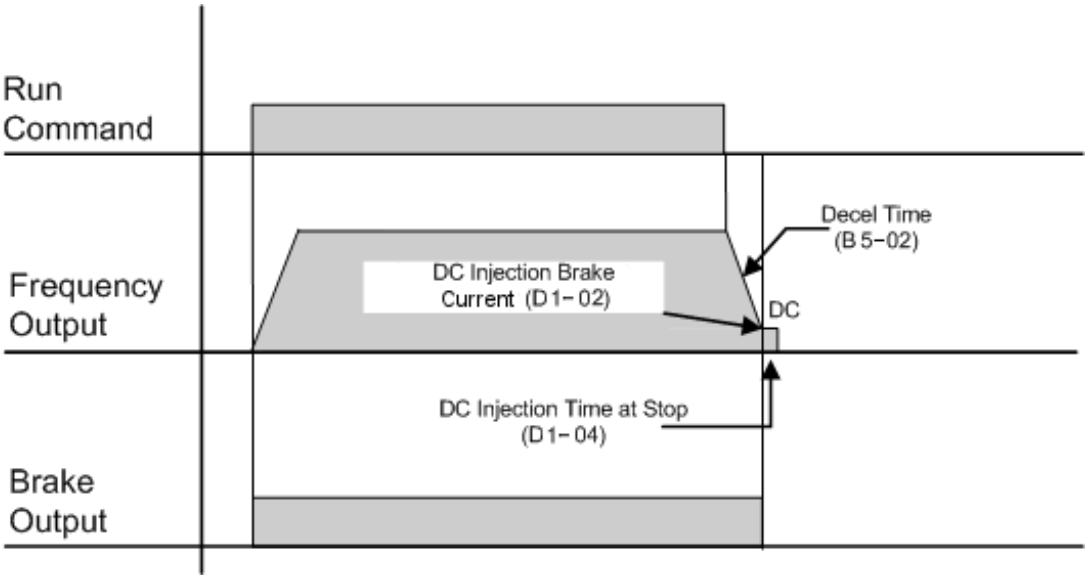


Figure 5-2: B3-03 = 00 (Decel to Stop) without DC Injection

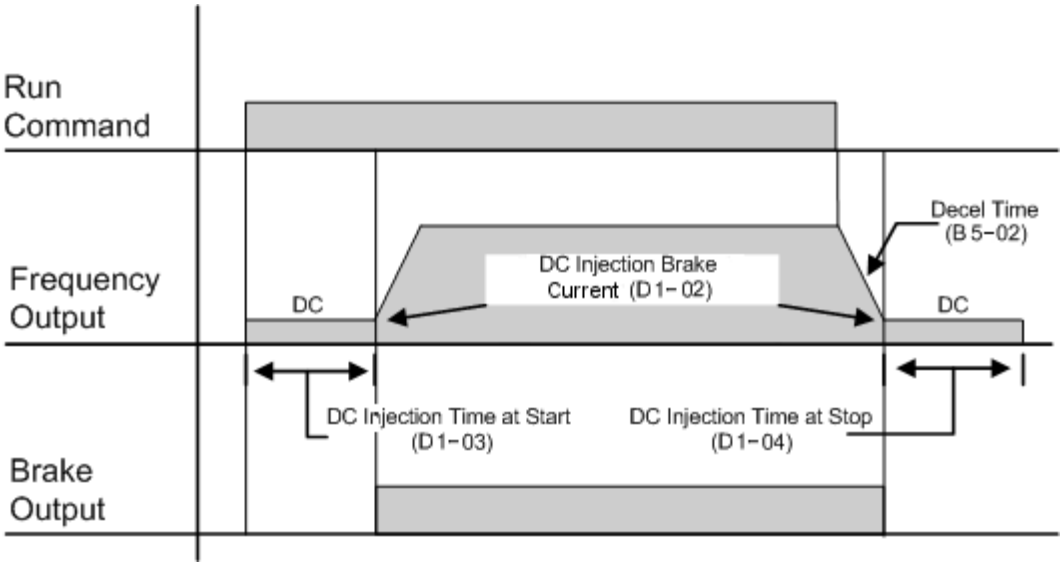


Figure 5-3: B3-03 = 00 (Decel to Stop) with DC Injection

Motor Rotation Change

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

Table 5-6:Motor Rotation Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
B3-04	Reverse Oper *00 Normal Rotation* *01 Exchange Phases*	Reverse motor direction	00, 01	00	Adv

Acceleration/Deceleration

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

Table 5-7:Acceleration/Deceleration Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
B5-01	Accel Time	Sets acceleration time.	0.0–25.5 sec	5.0	Adv
B5-02	Decel Time	Sets deceleration time.	0.0–25.5 sec	5.0	Adv

Tuning

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

- D1 DC Injection
- D9 S-Curve Acceleration/Deceleration

DC Injection

DC Injection can be used to stop a motor whose rotational direction is uncertain at start-up. With Decel to Stop enabled (B3-03 = 00), the IMPULSE•T drive controls motor deceleration according to the Decel Time setting upon removal of the run command until output frequency reaches the DC Injection Braking Start Frequency (0.5 Hz). Then the drive output is turned off and DC injection current is applied to the motor. The effective DC injection time and current should be set to provide adequate stopping without excessive motor heating. The DC injection voltage is determined by the DC injection braking current and motor impedance.

Table 5-8:DC Injection Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
D1-02	DC Injection Current	% of Inverter rated current	0–75%	50	Adv
D1-03	DC Injection Time @ Start	DC Injection braking time.	0.00–10.00 sec	0.00	Adv
D1-04	DC Injection Time @ Stop	DC Injection braking time at stop.	0.00–10.00 sec	0.50	Adv

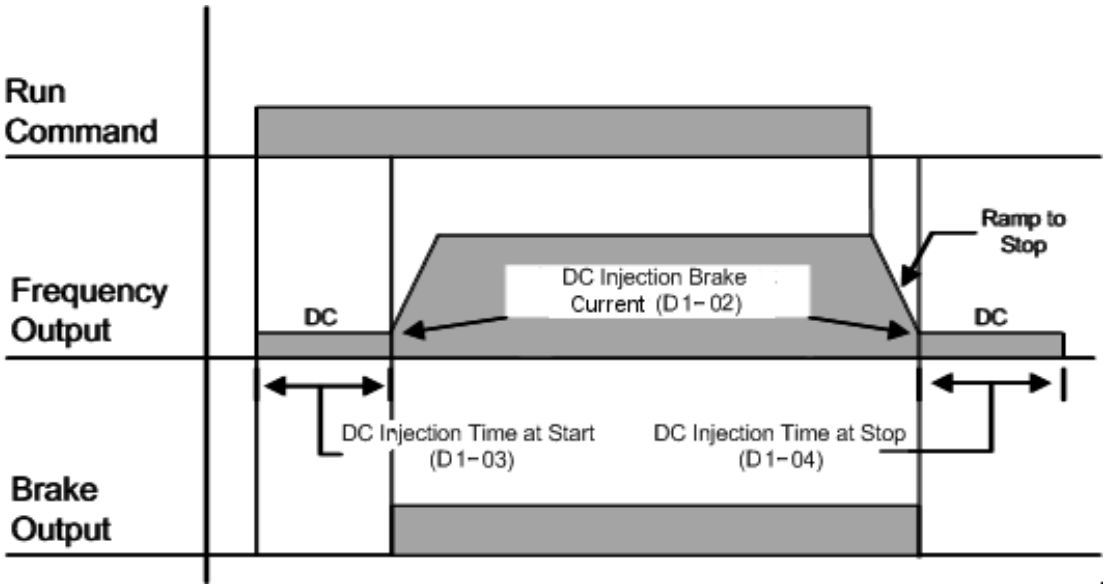


Figure 5-4: DC Braking Sequence

S-Curve Acceleration/Deceleration

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

Table 5-9: S-Curve Acceleration/Deceleration Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
D9-01	S-Curve Accel @ Start	Sets S-Curve time at Accel start	0.00–10.0 sec	1.50	Adv
D9-02	S-Curve Accel @ End	Sets S-Curve time at Accel end	0.00–10.0 sec	1.50	Adv
D9-03	S-Curve Decel @ Start	Sets S-Curve time at Decel start	0.00–10.0 sec	1.50	Adv
D9-04	S-Curve Decel @ End	Sets S-Curve time at Decel end	0.00–10.0 sec	0.20	Adv

The S-Curve function will add time to the acceleration and deceleration.

Total time to acceleration from minimum frequency to maximum frequency (total acceleration) is:

$$\text{TotalAccelerationTime(s)} = \text{B5-01} + \left[\frac{(\text{D9-01} + \text{D9-02})}{2}\right]$$

Total time to deceleration from maximum frequency to minimum frequency (total deceleration) is:

$$\text{TotalDecelerationTime(s)} = \text{B5-02} + \left[\frac{(\text{D9-03} + \text{D9-04})}{2}\right]$$

CAUTION

Accel/Decel times will be extended.

Motor Parameters

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

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

Voltage/Frequency Pattern

Table 5-10: Input Voltage Parameter Settings

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

(1) Initial value determined by drive capacity.

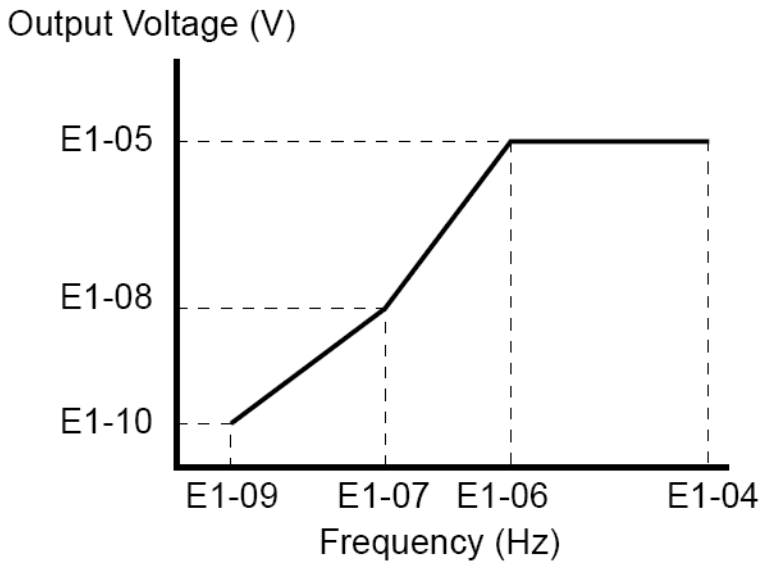


Figure 5-5: E1-01 Input Voltage

Factory setting is 230 (230 VAC) or 460 (460 VAC).

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

$$E1\text{-}05 \geq E1\text{-}08 \geq E1\text{-}10$$

$$E1\text{-}04 \geq E1\text{-}06 \geq E1\text{-}07 \geq E1\text{-}09$$

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

Table 5-11: Inverter Voltage

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

Table 5-12: V/f Parameters

Parameter Code	Name	Function	Range	Initial Value	Access Level
E1-04	Max Frequency	Maximum Frequency	40.0–E1-04 Hz	60	Adv
E1-05	Max Voltage	Maximum Voltage	230: 0–255 V 460: 0–510 V	230 460(2)	Adv
E1-06	Base Frequency	Motor Base Frequency	0.0–E1-04 Hz	60	Adv
E1-07	Mid Frequency A	Midpoint Output Frequency A	0.0–E1-04 Hz	3.0	Adv
E1-08	Mid Voltage A	Midpoint Frequency Voltage A	230: 0–255 V 460: 0–510 V	15.0 30.0(2)	Adv
E1-09	Min Frequency	Minimum Frequency	0.0–E1-04 Hz	1.3	Adv
E1-10	Min Voltage	Minimum Voltage	230: 0–255 V 460: 0–510 V	8.1 16.2(2)	Adv

(2) Initial value determined by drive capability

Table 5-13: Sample Voltage/Frequency Pattern Options for 230 V Class

	E1-04	E1-05	E1-06	E1-07	E1-08	E1-09	E1-10
	Hz	V	Hz	Hz	V	Hz	V
1[3]	60.0	230.0	60.0	3.0	15.0	1.3	8.1
2	60.0	230.0	60.0	3.0	16.1	1.3	9.2
3	60.0	230.0	60.0	3.0	17.3	1.3	10.4
4	60.0	230.0	60.0	3.0	18.4	1.3	11.5
5	60.0	230.0	60.0	3.0	19.6	1.3	12.7
6	60.0	230.0	60.0	3.0	20.7	1.3	13.8
7	60.0	230.0	60.0	3.0	21.9	1.3	15.0
8	60.0	230.0	60.0	3.0	23.0	1.3	16.1
9	60.0	230.0	60.0	3.0	24.2	1.3	17.3
10	72.0	230.0	60.0	3.0	16.1	1.3	9.2
11	72.0	230.0	60.0	3.0	17.8	1.3	10.9
12	72.0	230.0	60.0	3.0	19.6	1.3	12.7
13	90.0	230.0	60.0	3.0	16.1	1.3	9.2
14	90.0	230.0	60.0	3.0	17.8	1.3	10.9
15	90.0	230.0	60.0	3.0	19.6	1.3	12.7

Table 5-14: Sample Voltage/Frequency Pattern Options for 460 V Class

	E1-04	E1-05	E1-06	E1-07	E1-08	E1-09	E1-10
	Hz	V	Hz	Hz	V	Hz	V
1[3]	60.0	460.0	60.0	3.0	30.0	1.3	16.2
2	60.0	460.0	60.0	3.0	32.2	1.3	18.4
3	60.0	460.0	60.0	3.0	34.5	1.3	20.7
4	60.0	460.0	60.0	3.0	36.8	1.3	23.0
5	60.0	460.0	60.0	3.0	39.1	1.3	25.3
6	60.0	460.0	60.0	3.0	41.4	1.3	27.6
7	60.0	460.0	60.0	3.0	43.7	1.3	29.9
8	60.0	460.0	60.0	3.0	46.0	1.3	32.2
9	60.0	460.0	60.0	3.0	48.3	1.3	34.5
10	72.0	460.0	60.0	3.0	32.2	1.3	18.4
11	72.0	460.0	60.0	3.0	35.6	1.3	21.8
12	72.0	460.0	60.0	3.0	39.1	1.3	25.3
13	90.0	460.0	60.0	3.0	32.2	1.3	18.4
14	90.0	460.0	60.0	3.0	35.6	1.3	21.8
15	90.0	460.0	60.0	3.0	39.1	1.3	25.3

[3] Default

Motor Set-up

E2-01 sets the full load current (FLA) for the motor. Initial value is determined by O2-04 (kVA selection).

Table 5-15:Motor Set-up Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
E2-01	Motor Rated FLA	Motor-rated current full load amps	0.12–19.2 A	*	Adv

* Initial value is determined by O2-04 (kVA Selection)

Terminal Parameters

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

- H1 Digital Inputs
- H2 Digital Output
- H3 Analog Input
- H4 Analog Output

Digital Inputs

The IMPULSE•T has five multi-function contact inputs for the set-up of numerous functions. The following table lists the function selections for the multi-function contact inputs (terminals S1 to S5) and indicates the control modes during which each function can be enabled. An OPE03 error will occur if a function is programmed in more than one terminal at the same time.

Table 5-16:Digital Inputs Parameter Settings

Parameter Code	Name	Function	Reference Page Number	Range	Initial Value	Access Level
H1-01	Terminal S1 Select	Selects the multi-function inputs. Setting for S1.	--	00–81	80	Adv
H1-02	Terminal S2 Select	Setting for S2.	--	00–81	81	Adv
H1-03	Terminal S3 Select	Setting for S3.	--	00–81	00	Adv
H1-04	Terminal S4 Select	Setting for S4.	--	00–81	01	Adv
H1-05	Terminal S5 Select	Setting for S5.	--	00–81	0F	Adv
	00 Multi-Step Ref 2	*Multi-Step Speed 2. (B1-02)*	*5-3*			
	01 Multi-Step Ref 3	*Multi-Step Speed 3. (B1-03)*	*5-3*			
	02 Multi-Step Ref 4	*Multi-Step Speed 4. (B1-04)*	*5-3*			
	05 Accel Command	*Acceleration function (2nd step of Two-Step Infinitely Variable or 3rd step of Three-Step Infinitely Variable).*	*5-3*			
	0F Not used	*No function - terminal is disabled*	*--*			
	20 thru 2F External Fault	*Desired setting is possible. Input mode: N.O./N.C., Detection mode: Always/ During Run (See external fault response selection Table 5-17)*	*5-14*			
	32 Ext BB N.O.	*N.O.: Baseblock by ON. Immediate stop at STOP command; normally open*	*--*			
	33 Ext BB N.C.	*N.C.: Baseblock by OFF. Immediate stop at STOP command; normally closed*	*--*			
	3F Fault Reset	*Reset by ON*	*--*			
	80 Forward Run	*Forward Run Command (B1-01)*	*5-3*			
	81 Reverse Run	*Reverse Run Command (B1-01)*	*5-3*			

External Fault Response Selection

It is sometimes desirable to have at least one external fault input to the drive. To properly program a multi-function input (H1-01 to H1-05), an external fault response must be selected. The table below shows the possible selections for an external fault response.

Table 5-17:External Fault Response Selection

External Fault Selection							
Input Level Selection		**Detection Method**		**External Fault Action**			**MFI Setting Result**
N.O.(1)	N.C.(1)	Always	During Run	Ramp to Stop	Coast to Stop	Alarm Only	
√		√		√			20
√		√			√		24
√		√					28
√		√				√	2C
√			√	√			22
√			√		√		26
√			√				2A
√			√			√	2E
	√	√		√			21
	√	√			√		25
	√	√					29
	√	√				√	2D
	√		√	√			23
	√		√		√		27
	√		√				2B
	√		√			√	2F

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

Digital Output

The IMPULSE•T has one multi-function control output (one relay) for indicating various conditions. The following table lists the function selections for the multi-function contact outputs.

Table 5-18:Digital Output Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
H2-01	Output Contactor (MC-MB-MA) Select	Digital Output Function	000–010	000	Adv
	000 Brake Release	*Closed when the drive provides a voltage or frequency is output*			
	006 Drive Ready	*Closed when a drive is ready and not in a fault state*			
	00E Fault	*Closed during a major fault.*			
	00F Not Used	*No function*			
	010 Minor Fault	*Closed during minor fault or alarm*			

Analog Input

The IMPULSE•T has one analog input for the external input of references and limits.

Table 5-19:Analog Input Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
H3-01	Terminal A1 Signal Level Selection	Voltage Selection Analog Terminal A1	00–03	00	Adv
	00 0 to 10 VDC (lower limit)				
	01 0 to 10 VDC (no lower limit)				
	02 4 to 20 mA				
	03 0 to 20 mA				
H3-03	Terminal A1 Gain	Gain multiplier for Terminal A1 analog input signal	-999.9 – 999.9%	100.0	Adv
H3-04	Terminal A1 Bias	Bias multiplier for Terminal A1 analog input signal	-999.9 – 999.9%	0.0	Adv
H3-13	Analog Input Filter Time Constant	Analog input filter average time for Terminal A1	0.00–2.00 sec	0.03	Adv

Analog Output

The IMPULSE•T has one analog output for the external monitoring of drive conditions.

Table 5-20: Analog Output Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
H4-01	Terminal AM Select	Analog output selection for Terminal AM.	101–113	103	Adv
	101 Frequency Reference				
	102 Output Frequency				
	103 Output Current				
	106 Output Voltage				
	107 DC Bus Voltage				
	113 A1 Terminal Input Level				
H4-02	Terminal AM Gain	Gain multiplier for Terminal AM analog output signal	-999.9–999.9%	100.0	Adv
H4-03	Terminal AM Bias	Bias multiplier for Terminal AM analog output signal	-999.9–999.9%	0.0	Adv

Protection Parameters

The IMPULSE•T has the ability to protect both the drive's hardware and motor by allowing various means to detect and take corrective action when a condition occurs. These include motor overload detection, torque detection, the ability to perform a self-diagnostic check, and then resume operation after a fault is cleared.

- L1 Motor Overload Protection
- L3 Stall Prevention
- L8 Hardware Protection
- L9 Automatic Reset

Motor Overload Protection

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

The electronic thermal overload function estimates motor temperature, based on inverter output current, frequency, and time to protect the motor from overheating. This time is based on a "hot start" for the motor (see Figure 5-6 "Motor Protection Operation Time"). When the thermal overload fault is activated, an "OL1" fault occurs, shutting OFF the inverter output and preventing excessive overheating in the motor. As long as the inverter is powered up, it continues to calculate the motor temperature.

Table 5-21:Motor Overload Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
L1-01	Motor Overload Fault Select	Enable/disable motor overload detection. The OL1 function derates the motor any time it is running below base speed.	00–02	02	Adv
	00 Disable				
	01 Standard Fan Cooled	A motor with limited cooling capability below rated (base) speed when running at 100% load (< 10:1).			
	02 Standard Blower Cooled	A motor that is blower cooled (> 10:1).			

Parameter Code	Name	Function	Range	Initial Value	Access Level
L1-02	Motor Overload Time Const	Time for OL1 fault when motor current is ≥ 150% of the motor rated current. Hot start	0.1–5.0 min	1.0	Adv

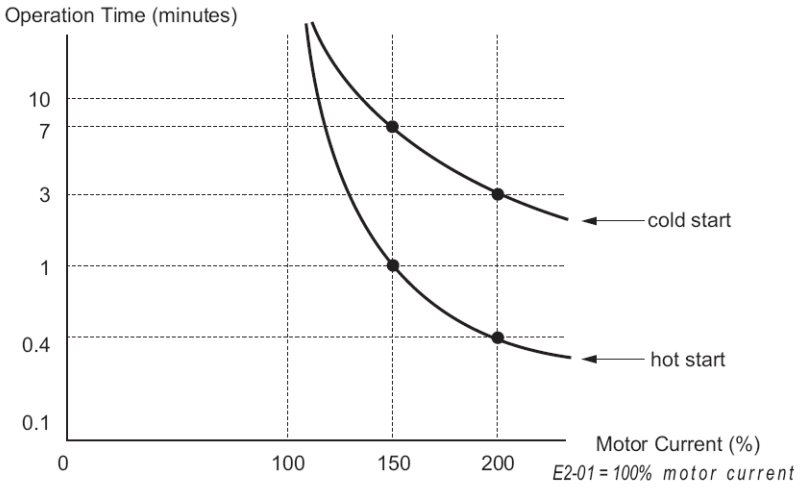


Figure 5-6: Motor Protection Operation Time

L1-13	Overload Operation Selection *00 Disable* *01 Enable*	Determines whether or not to hold the Electrothermal value when power is interrupted	00–01	01	Adv

Stall Prevention

CAUTION

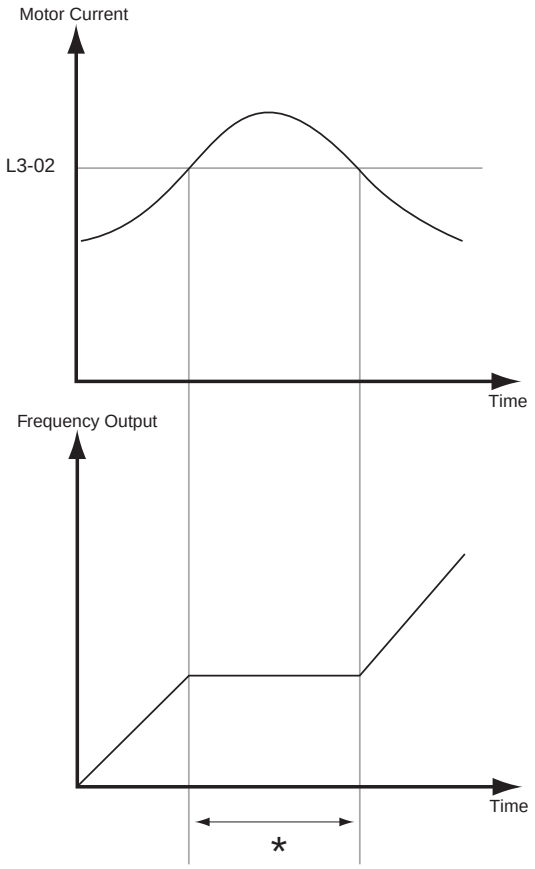
This function automatically adjusts the output frequency, acceleration and/or deceleration rates in order to continue operation without tripping or “stalling” the inverter.

Table 5-22:Stall Prevention Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
L3-01	Stall Prevention Accel Select	Enable/disable stall prevention during acceleration.	00, 01	01	Adv
	00 Disable	Disable stall prevention during acceleration.			
	01 General Purpose	Stall prevention/current limit during acceleration is enabled (factory default).			
L3-02	Stall Prevention Accel Level	Stall prevention level during acceleration.	0–150	120	Adv

NOTE: The acceleration rate is automatically extended according to motor current to prevent stalling during acceleration. The acceleration time may be longer than the set value (B5-01).

The stall prevention/current limit level during acceleration is set as a percentage of inverter rated current. During acceleration, if the output current exceeds this current limit level (L3-02), acceleration stops and frequency is maintained. When the output current decreases below this current level (L3-02), acceleration resumes. See Figure 5-7 below.



*Controls the acceleration rate to prevent the inverter from tripping.

Figure 5-7: Stall Prevention/Current Limit During Acceleration

Hardware Protection

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

Table 5-23:Hardware Protection Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
L8-05	Input Phase Loss Selection	Input phase loss detection	00, 01	01	Adv
	00 Disabled				
	01 Enabled				
L8-10	Fan Operation Selection	Cooling fan operation select	00, 01	00	Adv
	00 Fan On-Run	Fan will operate 60 seconds after Run Command is removed			
	01 Fan Always On	Fan will operate continuously when power is applied.			
L8-12	Ambient Temp	Adjusts Overload (OL2) Protection for high ambients	-10–50°C	50°	Adv
L8-18	Soft CLA Sel	Enables/disables the software current limit function. Limits output frequency when current exceeds 110% of drive rated current.	00, 01	01	Adv
	00 Disabled				
	01 Enabled				

Automatic Reset

When a fault occurs during operation, the IMPULSE•T can be programmed to automatically reset the fault and restart operation. These faults are:

- OC Overcurrent
- OL2 Drive Overload
- OL3 Overtorque 1
- PF Input Phase
- rH Braking Resistor Fault

The Automatic Reset sets the number of retry attempts before stopping operation. The reset attempt counter is returned to zero if no faults occur within a ten minute period.

Table 5-24:Automatic Reset Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Level Access
L9-02	Auto Reset Attempts	Sets the number of reset attempts. Reset attempt counter is returned to zero if no faults occur within a ten minute period.	00–10	03	Adv

Operator Parameters

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

- O2 Drive Selection
- U1 Monitor Parameters
- U2 Fault Trace
- U4 Maintenance

Drive Selection

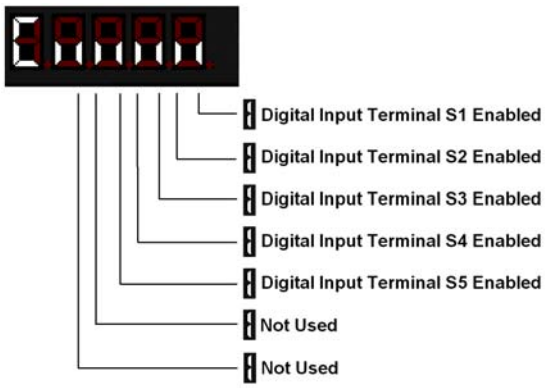
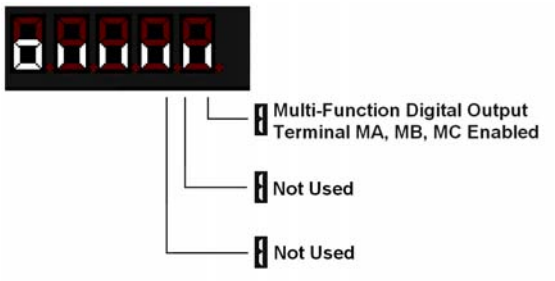
Table 5-25:Drive Selection Parameter Settings

Parameter Code	Name	Function	Range	Initial Value	Access Level
O2-04	kVA Selection	Determines the model number of the drive, which is based on the kVA rating. The following in this column are Magnetek model numbers.	60–97	*	Adv
	60 --	Not used			
	61 --	Not used			
	62 *2A0004*	2004-T			
	63 *2A0006*	2006-T			
	64 --	Not used			
	65 *2A0010*	2010-T			
	66 *2A0012*	2012-T			
	67 --	Not used			
	68 --	Not used			
	91 *4A0001*	4001-T			
	92 *4A0002*	4002-T			
	93 *4A0004*	4004-T			
	94 *4A0005*	4005-T			
	95 --	Not used			
	96 *4A0009*	4009-T			
	97 --	Not used			

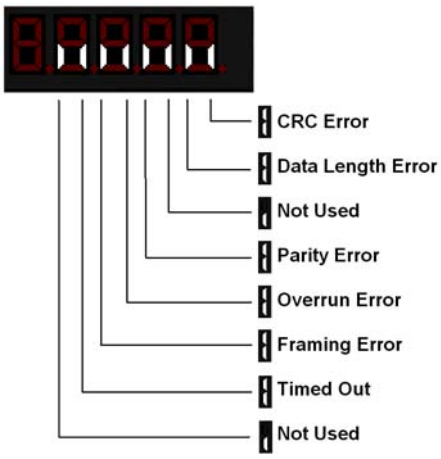
*Initial value determined by drive model.

Monitor Parameters

Table 5-26:Monitor Parameters

Parameter Code	Name	Function	Units	Access Level*
U1-01	Frequency Reference	Frequency Reference	Hz	O/Adv
U1-02	Output Frequency	Inverter Output Frequency	Hz	O/Adv
U1-03	Output Current	Inverter Output Current	A	O/Adv
U1-06	Output Voltage	Inverter Output Voltage (Reference)	VAC	O/Adv
U1-07	DC Bus Voltage	DC Bus Voltage (Measured)	VDC	O/Adv
U1-10	Input Terminal Status	Input Terminal Status	--	O/Adv
				
U1-11	Output Terminal Status	Output Terminal Status	--	O/Adv
				
U1-13	Terminal A1 Level	External Terminal input level	%	O/Adv
U1-14	Flash ID	Magnetek software ID number	--	O/Adv

*O = Operation; Adv = Advanced

Parameter Code	Name	Function	Units	Access Level*
U1-19	Memobus Communication Error	Displays content of MEMOBUS error 	--	O/Adv
U1-28	Software CPU	Flash ROM Software ID	--	O/Adv

*O = Operation; Adv = Advanced

Fault Trace

Table 5-27:Fault Trace Parameters

Parameter Code	Name	Function	Units	Access Level*
U2-01	Current Fault	Displays the most recent fault detected before being reset.	--	O/Adv
U2-02	Last Fault	Displays the most recent fault after being reset.	--	O/Adv

*O = Operation; Adv = Advanced

Maintenance

Table 5-28:Maintenance Parameter

Parameter Code	Name	Function	Units	Access Level*
U4-01	Elapsed Time	Displays cumulative operation time of drive.	hr	O/Adv
U4-04	Cooling Fan Maintenance	Displays cooling usage as a percent of expected life.	%	O/Adv
U4-05	Capacitor Maintenance	Displays capacitor usage as a percent of expected life.	%	O/Adv
U4-06	Soft Charge Bypass Relay Maintenance	Displays soft charge bypass relay usage.	%	O/Adv
U4-07	IGBT Maintenance	Displays IGBT usage as a percent of expected life.	%	O/Adv
U4-08	Heatsink Temperature	Displays heatsink temperature.	--	O/Adv
U4-09	LED Check	Lights all segments of the LED to verify that the display is working properly.	--	O/Adv
U4-13	Peak Hold Current	Displays the peak hold current during a run.	--	O/Adv

*O = Operation; Adv = Advanced

Chapter 6

Troubleshooting

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Troubleshooting the Drive

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

Maintenance and Inspection

This section describes basic maintenance and inspection procedures for the IMPULSE•T.

Table 6-1: Maintenance and Inspection

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

Alarm and Fault classes are described as follows:

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

Motor Faults and Corrective Actions

Table 6-2: Motor Faults and Corrective Actions

Symptom	Corrective Action
Analog frequency reference is not stable. (drifting)	1. Stabilize the analog source. 2. Increase B2-02. 3. Increase B5-01, B5-02.
No motor rotation.	1. Verify that power is on (Charge LED). 2. Verify that the keypad display is not showing a fault. 3. Verify that the run command is input to the drive (U1-10). 4. Check if motor stalled due to excessive current (U1-03).

Symptom	Corrective Action
Motor rotation is in the wrong direction.	1. Verify FWD/REV or UP/DN is wired correctly at the interface card. 2. Switch any two leads on U/T1, V/T2, or W/T3 going to the motor. 3. Check parameter B3-04.
Motor rotates, but at minimum speed only.	1. Check wiring of speed inputs and verify inputs (U1-10). 2. Verify speed reference setting (A1-04). 3. Verify reference and run source settings are correct (B3-01, B3-02). 4. Check if motor stalled due to excessive current (U1-03).
Motor RPM too high or too low.	1. Compare motor nameplate full load current with E2-01 parameters. 2. Check maximum frequency setting (E1-04). 3. Check minimum frequency setting (E1-09).

Drive Faults, Alarms, and Indicators

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

Fault Code	Fault or Indicator Name/Description	Corrective Action	Fault	Alarm
BB (flashing) Base Block	**External Base Block Indicator.** The flashing base block signal is the result of a multi-function input in the terminal strip. The base block indicates that the drive's IGBTs have been disabled. The motor will begin coasting when the base block input is received. If a RUN command is still present when the BB signal is removed, the output voltage will be restored to the previous operating level and operation will continue at the previously commanded frequency.	1. Check constants H1-01 through H1-05 for proper programming. 2. Check terminal status. (U1-10)		X
CALL (flashing)	**Serial Communication Transmission Error.** Control data is not received correctly after power supply is turned ON for 2 sec.	1. Check serial device connections. 2. Ensure drive is properly programmed for serial communication.		X
COF	**Current Offset Fault.** The drive automatically adjusts the current offset, the calculated value exceeded the allowable setting range	1. Press reset. 2. Check brake. 3. Check brake contact.	X	
CPF02	**A/D Conversion Error.** An A/D conversion error occurred.	1. Cycle power to the drive. 2. Ensure that the control board terminals and wiring are shielded from electrical noise. 3. Check resistance of potentiometer. 4. Replace the drive.	X	
CPF06	Drive specification mismatch during terminal board or control board replacement	1. Cycle power to the drive. 2. If the problem continues, replace the drive.	X	

Fault Code	Fault or Indicator Name/Description	Corrective Action	Fault	Alarm
CPF08	**EEPROM Serial Communications Fault.** EEPROM communications are not functioning properly.	1. Cycle power to the drive. 2. If the problem continues, replace the drive.	X	
CPF11	**RAM Fault.**	1. Cycle power to the drive. 2. Replace the drive.	X	
CPF12	**FLASH Memory Fault.** Problem with the ROM (FLASH memory).	1. Cycle power to the drive. 2. Replace the drive.	X	
CPF14	**Control Circuit Fault.** CPU Error (CPU operates incorrectly due to noise, etc.)	1. Cycle power to the drive. 2. Replace the drive.	X	
CPF17	**Timing Fault.** A timing error occurred during an internal process.	1. Cycle power to the drive. 2. Replace the drive.	X	
CPF18	**Control Circuit Fault.** CPU error (CPU operates incorrectly due to noise, etc).	1. Cycle power to the drive. 2. Ensure that the control board terminals and wiring are shielded from electrical noise. 3. Replace the drive.	X	
CPF20 or CPF21	RAM fault, FLASH memory error, watchdog circuit exception.	1. Cycle power to the drive. 2. Replace the drive.	X	
CPF22	**A/D Conversion Error.** A/D conversion error.	1. Cycle power to the drive. 2. Ensure that the control board terminals and wiring are shielded from electrical noise. 3. Check resistance of potentiometer.	X	
CPF23	**PWM Feedback Fault.** PWM feedback error.	1. Cycle power to the drive. 2. Replace the drive.	X	
CPF24	**Drive Capacity Signal Fault.** Entered a capacity that does not exist (checked when the drive is powered up).	1. Cycle power to the drive. 2. Replace the drive.	X	
CRST (flashing)	Cannot reset. External fault occurred and reset button was pressed before motor was completely stopped. Fault reset was being executed when a RUN command is executed during a fault.	1. Wait for motor to come to complete stop. 2. Reset fault before issuing a RUN command.		X
EF (flashing) External Fault	Both FORWARD/UP and REVERSE/DOWN commands are input at same time for 500 msec or longer.	1. Check control input wiring. 2. Check the sequence of operation.		X
EF0 Optional External Fault	External fault input from communication option card.	1. Check communication option card connection and signals. 2. Check external device for any fault(s)	X	
EF1 External Fault 1	External fault occurs on Terminal S1.	1. Check constant H1-01 for proper programming. 2. Check the conditions for input terminal S1 (U1-10).	X	X

Fault Code	Fault or Indicator Name/Description	Corrective Action	Fault	Alarm
EF2 External Fault 2	External fault occurs on Terminal S2.	1. Check constant H1-02 for proper programming. 2. Check the conditions for input terminal S2 (U1-10).	X	X
EF3 External Fault 3	External fault occurs on Terminal S3.	1. Check constant H1-03 for proper programming. 2. Check the conditions for input terminal S3 (U-10).	X	X
EF4 External Fault 4	External fault occurs on Terminal S4.	1. Check constant H1-04 for proper programming. 2. Check the conditions for input terminal S4 (U1-10).	X	X
EF5 External Fault 5	External fault occurs on Terminal S5.	1. Check constant H1-05 for proper programming. 2. Check the condition for input terminal S5 (U1-10).	X	X
ERR EEPROM R/W Err	EEPROM Read/Write Error.	1. Cycle power. 2. Replace the drive.	X	
LF Output Phase Loss	An open phase occurred at the inverter output.	1. Check for broken wires in output cable. 2. Check for open winding in the motor. 3. Check for loose terminals.	X	
OC Over Current	Output current exceeds 200% of inverter rated output current.	1. Check for a phase-to-phase short in the motor or wiring using a megger. 2. Extend the acceleration/ deceleration time. 3. Check torque limit setting.	X	
OH (flashing) Heatsnk Over temp	**Overheat Pre-Alarm.** Heatsink is overheating. The temperature of the inverters heatsink has exceeded the internal detection level.	1. The inverter cooling fan has stopped. 2. Reduce the ambient temperature.		X
OH1 Heatsink MaxTemp	**Overheat Fault.** There are two situations that result in an overheat fault. The first occurs when the measured heat sink exceeded 105°C. The second is a result of a fault in the internal 24VDC cooling fan.	1. Ensure that the heat sink cooling fans are functioning. 2. Ensure that the heat sink is free from dirt and debris. 3. Ensure that the inverter's ambient temperature is within specification. 4. Replace the drive.	X	
OL1 Motor Overloaded	**Motor Overload Fault.** Inverter output exceeded the motor overload level.	1. Ensure drive is programmed with proper motor full load Amps (E2-01). 2. Reduce the load.	X	
OL2 INV Overload	**Inverter Overload Fault.** Inverter output exceeded the inverter overload level.	1. Reduce the load. 2. Extend the acceleration time.	X	

Fault Code	Fault or Indicator Name/Description	Corrective Action	Fault	Alarm
OL3 Overtorque Det 1	**Overtorque Detection Level 1 Fault.** Current is higher than set value (150%) for more than set time (0.1 sec).	1. Reduce the load.	X	X
OV DC Bus Overvolt	**Overvoltage Fault.** The DC bus voltage exceeded the overvoltage level. Detection level: 230V class—approx. 410V 460V class—approx. 820V	1. Extend the deceleration time. 2. Check the resistor. 3. Check the line voltage. 4. If on a load break hoist, check the gear box.	X	
OV (flashing) DC Bus Overvolt	**Overvoltage Fault.** Overvoltage occurs during stop. Main circuit DC voltage rises above the detection level while the drive output is off. Detection level: 410V or more for 230V, 820V or more for 460V.	1. Check the line voltage.		X
PF Input Pha Loss	**Input Phase Loss Fault.** Inverter input power supply has open phase.	1. Check the line voltage. 2. Remove power. 3. Retighten the input terminal screws. 4. Check line fuses.	X	
RH DynBrk Transistr	**Braking Transistor Resistor.** Internal Braking transistor failed.	1. Verify that the external braking resistor is connected to the proper terminals. 2. Confirm that the proper resistor is installed. 3. Check for a short circuit across the braking resistor.	X	
UV (flashing) DC Bus Undervolt	**Undervoltage Fault.** Undervoltage status occurs for more than 2 sec during STOP. Input voltage drops below 190V DC or less for 230V AC class, 380V DC or less for 460V AC class.	1. Check the power source wiring. 2. Replace any bad branch fuses. 3. Check collector system.		X
UV1 DC Bus Undervolt	**Undervoltage 1 Fault.** Undervoltage status occurs for more than 2 sec during RUN command. Input voltage drops below 190V DC or less for 230V AC class, 380V DC or less for 460V AC class.	1. Check power supply wiring. 2. Correct the line voltage. 3. Check collector system.	X	
UV3 Soft charge	**Soft charge circuit fault.** The pre-charge contactor opened during operation.	1. Check power supply wiring. 2. Correct the line voltage. 3. Check collector system. 4. Wait 30–45 seconds before restarting drive after auto shut down.	X	

Table 6-4: Operator Error Table

Code	Fault or Indicator Name/Description	Corrective Action
OPE02	**Parameter Setting Range Error.** Parameter settings are set outside the operating range.	1. Change the parameter setting.
OPE03 Terminal	**Multi-Function Input Setting Fault.** Set values other than “F” are duplicated.	1. Check the settings for H1-01 to H1-05, verify that the same input is not used twice.
OPE04 Terminal	**Parameters do not match.** The drive, control board, or terminal board has been replaced, and the parameter settings between the controller board or terminal board do not match.	1. Change parameter(s) to appropriate settings. 2. Set A1-05 = 2220.
OPE10 V/f Ptrn Setting	**V/f Pattern Parameter Error.**	1. Correct the settings of E1-04, E1-06, E1-07, and E1-09.

Appendix A

Advanced Parameter Listing

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IMPULSE•T Parameter Listing

Parameter	Parameter Name	Default	Range	Units	Reference Page
A1-01	Parameter Access Level 0000: Operator Only 0002: Advanced	0000	0000, 0002	--	4-10
A1-03	Select Motion 00: Traverse	00	00	--	4-10
A1-04	Speed Reference 00: 2 Speed Multi-Step 01: 3 Speed Multi-Step 02: 5 Speed Multi-Step 03: 2 Step Infinitely Variable 04: Analog - Uni-Polar	01	00–05	--	4-11
A1-05	Initialize 0000: No Initialize 2220: Initialize drive to factory default settings	0000	0000, 2220	--	4-11
B1-01	Frequency Reference 1	6.00	0.00–E1-04	Hz	5-3
B1-02	Frequency Reference 2	30.00	0.00–E1-04	Hz	5-3
B1-03	Frequency Reference 3	60.00	0.00–E1-04	Hz	5-3
B1-04	Frequency Reference 4	0.00	0.00–E1-04	Hz	5-3
B1-05	Frequency Reference 5	0.00	0.00–E1-04	Hz	5-3
B1-06	Frequency Reference 6	0.00	0.00–E1-04	Hz	5-3
B1-07	Frequency Reference 7	0.00	0.00–E1-04	Hz	5-3
B1-08	Frequency Reference 8	0.00	0.00–E1-04	Hz	5-3
B2-01	Frequency Reference Upper Limit	100.0	0.0–110.0	%	5-4
B2-02	Frequency Reference Lower Limit	0.0	0.0–110.0	%	5-4
B3-01	Reference Source 00: Digital Operator 01: Terminals	00	00, 01	--	5-5
B3-02	Run Source 00: Digital Operator 01: Terminals	01	00, 01	--	5-5
B3-03	Stop Method 00: Decel to Stop	00	00	--	5-5
B3-04	Reverse Oper 00: Normal Rotation 01: Exchange Phases	00	00, 01	--	5-7
B5-01	Accel Time	5.0	0.0–25.5	sec	5-7
B5-02	Decel Time	5.0	0.0–25.5	sec	5-7
D1-02	DC Injection Current	50	0–75	%	5-8
D1-03	DC Injection Time @ Start	0.00	0.00–10.00	sec	5-8
D1-04	DC Injection Time @ Stop	0.50	0.00–10.00	sec	5-8
D9-01	S-Curve Accel @ Start	1.50	0.00–10.00	sec	5-9
D9-02	S-Curve Accel @ End	1.50	0.00–10.00	sec	5-9
D9-03	S-Curve Decel @ Start	1.50	0.00–10.00	sec	5-9
D9-04	S-Curve Decel @ End	0.20	0.00–10.00	sec	5-9
E1-01	Input Voltage	230 460	230: 155–255 460: 310–510	V	5-10

* Initial value is determined by O2-04 (kVA selection).

Parameter	Parameter Name	Default	Range	Units	Reference Page
E1-04	Max Frequency	60	40.00–E1-04	Hz	5-11
E1-05	Max Voltage	230 460	230: 0.0–255.0 460: 0.0–510.0	V	5-11
E1-06	Base Frequency	60	0.00–E1-04	Hz	5-11
E1-07	Mid Frequency A	3.0	0.00–E1-04	Hz	5-11
E1-08	Mid Voltage A	15.0 30.0	230: 0.0–255.0 460: 0.0–510.0	V	5-11
E1-09	Min Frequency	1.3	0.00–E1-04	Hz	5-11
E1-10	Min Voltage	8.1 16.2	230: 0.0–255.0 460: 0.0–510.0	V	5-11
E2-01	Motor Rated FLA	*	0.12–19.2	A	5-12
H1-01	Terminal S1 Select (See reference page for further details) 00: Multi-Step Reference 2 01: Multi-Step Reference 3 02: Multi-Step Reference 4 05: Accel Command 0F: Not Used 20~2F: External Fault 32: Ext BB N.O. 33: Ext BB N.C. 3F: Fault Reset 80: Forward Run 81: Reverse Run	80	00–81	--	5-13
H1-02	Terminal S2 Select (See page 5-13 for further details)	81	00–81	--	5-13
H1-03	Terminal S3 Select (See page 5-13 for further details)	00	00–81	--	5-13
H1-04	Terminal S4 Select (See page 5-13 for further details)	01	00–81	--	5-13
H1-05	Terminal S5 Select (See page 5-13 for further details)	0F	00–81	--	5-13
H2-01	Output Contactor (MC-MB-MA) Select 000: Brake Release 006: Inverter Ready 00E: Fault 00F: Not used 010: Minor Fault	000	000–010	--	5-15
H3-01	Terminal A1 Signal Selection 00: 0 to 10 VDC (lower limit) 01: 0 to 10 VDC (no lower limit) 02: 4 to 20mA 03: 0 to 20mA	00	00–03	--	5-15
H3-03	Terminal A1 Gain	100.0	-999.9–999.9	%	5-15
H3-04	Terminal A1 Bias	0.0	-999.9–999.9	%	5-15
H3-13	Analog Input Filter Time Constant	0.03	0.00–2.00	sec	5-15
H4-01	Terminal AM Select 101: Frequency Reference 102: Output Frequency 103: Output Current 106: Output Voltage 107: DC Bus Voltage 113: A1 Terminal Input Level	103	101–113	--	5-16
H4-02	Terminal AM Gain	100.0	-999.9–999.9	%	5-16

* Initial value is determined by O2-04 (kVA selection).

Parameter	Parameter Name	Default	Range	Units	Reference Page
H4-03	Terminal AM Bias	0.0	-999.9–999.9	%	5-16
L1-01	Motor Overload Fault Select 00: Disable 01: Standard Fan Cooled 02: Standard Blower Cooler	02	00–02	--	5-17
L1-02	Motor Overload Time Const	1.0	0.1–5.0	min	5-18
L1-13	Overhead Operation Selection 00: Disable 01: Enable	01	00, 01	--	5-18
L3-01	Stall Prevention Accel Select 00: Disabled 01: General Purpose	01	00, 01	--	5-19
L3-02	Stall Prevention Accel Level	120	0–150	--	5-19
L8-05	Input Phase Loss Selection 00: Disabled 01: Enabled	01	00, 01	--	5-21
L8-10	Fan Operation Selection 00: Fan On - Run 01: Fan Always On	00	00, 01	--	5-21
L8-12	Ambient Temp	50	-10–50	°C	5-21
L8-18	Soft CLA Sel 00: Disabled 01: Enabled	01	00, 01	--	5-21
L9-02	Auto Reset Attempts	03	00–10	--	5-21
O2-04	kVA Selection 60: Not Used 61: 2001-T 62: 2004-T 63: 2006-T 64: Not Used 65: 2010-T 66: 2012-T 67: Not Used 68: Not Used 91: 4001-T 92: 4002-T 93: 4004-T 94: 4005-T 95: Not Used 96: 4009-T 97: Not Used	--	60–97	--	5-22
U1-01	Frequency Reference	--	--	Hz	5-23
U1-02	Output Frequency	--	--	Hz	5-23
U1-03	Output Current	--	--	A	5-23
U1-06	Output Voltage	--	--	VAC	5-23
U1-07	DC Bus Voltage	--	--	VDC	5-23
U1-10	Input Terminal Status	--	--	--	5-23
U1-11	Output Terminal Status	--	--	--	5-23
U1-13	Terminal A1 Level	--	--	%	5-23
U1-14	Flash ID	--	--	--	5-23
U1-19	Memobus Communication Error	--	--	--	5-24
U1-28	Software CPU	--	--	--	5-24
U2-01	Current Fault	--	--	--	5-24

* Initial value is determined by O2-04 (kVA selection).

Parameter	Parameter Name	Default	Range	Units	Reference Page
U2-02	Last Fault	--	--	--	5-24
U4-01	Elapsed Time	--	--	hr	5-24
U4-04	Cooling Fan Maintenance	--	--	%	5-24
U4-05	Capacitor Maintenance	--	--	%	5-24
U4-06	Soft Charge Bypass Relay Maintenance	--	--	%	5-24
U4-07	IGBT Maintenance	--	--	%	5-24
U4-08	Heatsink Temperature	--	--	--	5-24
U4-09	LED Check	--	--	--	5-24
U4-13	Peak Hold Current	--	--	--	5-24

* Initial value is determined by O2-04 (kVA selection).