OmniPulse™ DDC Series 2

DC to DC Motor Control
Technical Manual

MAGNETEK

Firmware Number: 44301
Part Number: 144-47014 R1
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PRODUCT SAFETY INFORMATION

Magnetek, Inc. (Magnetek) offers a broad range of radio remote control products, control products, 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 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 related 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.

WARRANTY INFORMATION

FOR INFORMATION ON MAGNETEK'S PRODUCT WARRANTIES BY PRODUCT TYPE, PLEASE VISIT www.columbusmckinnon.com/magnetek.

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

Read and understand this manual before installing, operating or servicing this product. Install the product according to this manual and local codes.

The following conventions indicate safety messages in this manual. Failure to heed these messages could cause fatal injury or damage products and related equipment and systems.

DANGERS, WARNINGS and CAUTIONS

Throughout this document DANGERS, WARNING and CAUTION statements have been deliberately placed to highlight items critical to the protection of personnel and equipment.

DANGER

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

WARNING

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

CAUTION

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

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

DANGERS, WARNINGS and CAUTIONS SHOULD NEVER BE DISREGARDED.

Registered Trademarks

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Table of Contents

1 Introduction

WARNING

Do not touch any circuitry components while the main power is on.

Do not check signals during operation.

Do not connect the main output terminals (T1, T2, T3, T4) to the incoming DC source.

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

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

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

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

Install adequate branch 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.

This manual provides technical information on OmniPulse™ DDC Series 2 parameter settings, drive functions, troubleshooting, and installation details. Use this manual to expand drive functionality and to take advantage of higher performance features. This manual is available for download on the website at www.columbusmckinnon.com/magnetek.

1.1 General Information

The OmniPulse DDC Series 2 (DDC-S2) provides stepped or stepless control of DC series, shunt, and compound motors typically used for hoist, bridge, and trolley crane motions. While the DDC-S2 firmware is catered towards crane and hoist applications, it is also suitable for general-purpose DC motor applications. A static regulating system automatically provides torque and speed regulation in all four motor quadrants.

1.2 Key Features

- 5 to 500 horsepower range
- Four-quadrant operation for motoring and regenerative operations in both directions
- Adjustable and repeatable speed and torque control
- X-Press programming for short setup times
- Micro-Speed™ control for precise positioning
- Electronic Programmable Limit Switch (EPLS), Hook Height Measurement for accurate lifting position limits
- EtherNet/IP for Network Communications to other controllers and Impulse Link 5 PC software
- Numerous safety circuits for maximum protection of personnel and components
- Programmable smooth acceleration and deceleration for repeatable speed control
- DataLogger Series 4 (DLS4) display keypad for user-friendly monitoring, data logging, and troubleshooting
- Solid-state design that eliminates wearing parts and reduces maintenance downtime
- Elimination of speed resistors and contactors, reducing space and weight requirements and boosting system efficiency
- Modular construction, with easy access to drive components

Table 1-1: Typical Equipment List

Quantity	Item Description
1	Controls in a NEMA type enclosure (dependent on environment and requirements)
1	Optional Type “F” master switch (and/or other optional operator controls)
1 or 2	Optional holding brake(s)
1	Optional power limit switch and resistor
1 or more	Optional over-travel control limit switch(es)
1	Optional DB power loss resistor
1	Optional incremental encoder, 2-channel, differential line driver, 5-12V DC

1.3 Receiving Check List

Upon receipt, check each item against the packing slip to ensure the item matches the order.
If shipping damage is noted, contact and file a claim with the carrier immediately.

If there is a discrepancy between the packing slip, purchase order and received items, contact Magnetek to resolve.

1.4 Assessing the System Requirements

It is important to know how the drive will be utilized before working on installation and wiring. Please know the requirements for the following components:

- Speed control method(s) - i.e., stepped, analog, serial communications
- Power source rating and motor ratings

WARNING

Maximum motor speed should never be set to exceed the motor's and driven machine's capability.

- Power source location
- Wire size
- Grounding location and method
- Control wiring sources - i.e., cab, pendant, radio

1.5 Assessing the Drive Environment

When choosing a location for OmniPulse DDC Series 2, perform the following steps:

1. Ensure that the drive-to-motor wiring distance is less than 150 ft unless appropriate reactors, filters, and/or inverter duty motor is used.
2. Ensure that the drive circuit wiring is protected or isolated from:
    - Ambient temperatures outside the range of +14°F to +149°F (-10°C to +65°C)
    - Rain or moisture
    - Corrosive gases or liquids
    - Metal chips
    - Direct sunlight
    - Severe mechanical vibration
3. Ensure that the drive is housed in an appropriate NEMA-rated enclosure.

1.6 General Specifications

Table 1-2: Drive Ratings

200 – 320 Volts			360 – 600 Volts		
Model Number	**Max. FLA (A)**	**NEMA Rating**	**Model Number**	**Max. FLA (A)**	**NEMA Rating**
LN2067-DDC-S2	67	2	HN2067-DDC-S2	67	2
LN3133-DDC-S2	133	3	HN3133-DDC-S2	133	3
LN4200-DDC-S2	200	4	HN4200-DDC-S2	200	4
LN5400-DDC-S2	400*	5	HN5400-DDC-S2	400*	5
LN5400F-DDC-S2	400	6~8L	HN5400F-DDC-S2	400	6~8L

* NEMA 5 (400 A) drive is used as the master drive with up to four follower drives (LN5400F-DDC-S2 or HN5400F-DDC-S2).

Table 1-3: Electrical Ratings

Description		Specification
Power		
Current Range		67 Amps to 2000 Amps continuous (can control motors as low as 2.5A with 20 Amp External CT Board)
1 Minute Overload Capability 3 Second Overload Capability		150% continuous rating heatsink temperature < 110°C 200% continuous rating heatsink temperature < 85°C
Supply Bus Voltage +10% to -20% (including DC source ripple)		200 to 320 VDC (Low Voltage models) 360 to 600 VDC (High Voltage models)
Grounding Configurations		Full Floating, Grounded Positive, or Grounded Negative
DV/DT Rise		1500 volts per microsecond maximum
Switching Frequency		1 kHz
Control I/O		
Digital Inputs	DDC-S2-CONTROL	12 inputs (24 VDC)
	DDC-230VIF	9 inputs* (200-300 VDC)
Digital Outputs	DDC-S2-CONTROL	4 relay outputs (up to 120 VAC or 30 VDC, 5A)
	DDC-230VIF	3 programmable (230 VDC, 1A)
Analog Inputs	DDC-S2-CONTROL	2 inputs (0-10 VDC or 4-20 mA, 250Ω)
Analog Outputs	DDC-S2-CONTROL	2 outputs (0-10 VDC, -10 to +10 VDC or 4-20 mA, 250Ω)
Communication		
RS-232		Onboard Display, Door Mount Display, or PC Serial Communications
RS-485		PLC or PC Serial Communications
EtherNet/IP		PLC or PC Industrial Ethernet Communications
USB		PC Channel (mounts as COM port)

* Inputs shared with DDC-S2-CONTROL

Description	Specification
Protective Functions	
Power Loss	Up to one second Ride-Through capability, depending on load
Undervoltage	Trip @ less than 50% V_{IN} when greater than one second (default)
Drive Armature Short Circuit	Current Control Overload Trip IGBT Individual Overload Trip IGBT Overcurrent Safe Failure Mode
Drive Thermal	Heat Sink Overtemperature Alarm and Shutdown Ambient Overtemperature Shutdown
Motor Overload	Trip when armature current is greater than 110%
Motor Continuity	Motor connections are verified at the start of each cycle before the brake is released in hoist mode only.
Emergency Power Loss Dynamic Braking	Standard on Hoist application Optional on Traverse application
Fuse Protection	DC BUS Power Fuse Interface Board Fused
Charge Indicator	Visual indicator on drive unit indicating charge state on the capacitor bank. Backlight display indicates control voltage presence.
Motor Ground Detection	On hoist applications, both motor armature and series field detected. On travel applications, motor armature detected. Trip level is hardware set by LK12 on the Gate Driver Board.

Table 1-4: Environmental Specifications

Description	Specification
Temperature	
Ambient Operating Temperature	-10°C (no frost) to +65°C
Storage Temperature	-40°C to +65°C
Relative Humidity	< 90% No Condensation
Altitude	
Altitude	3300 Feet (1000 meters), 3000 meters max. with derate
Deration	
Temperature	2% per °C above 50°C
Altitude	1% for each 100 meters above 1000
EMC	
Immunity and Emissions	Complies with EN50081-2
Vibration/Shock	
Vibration	Complies with EN 60068-2-64
Shock	Complies with EN 60068-2-27

2 Installation

WARNING

- When preparing to mount the OmniPulse DDC Series 2 drive, lift it by its base. Never lift the drive by the front cover, as doing so may cause drive damage or personal injury.
- Mount the drive on nonflammable material.
- The OmniPulse DDC Series 2 drive generates heat. For the most effective cooling possible, mount it vertically. For more details, refer to the heat loss data in ***Table 2-5 on page 26***.
- When mounting units in an enclosure, install a fan or other cooling device to keep the enclosure temperature below 65°C (149°F).

Failure to observe these warnings may result in equipment damage.

This chapter explains the following:

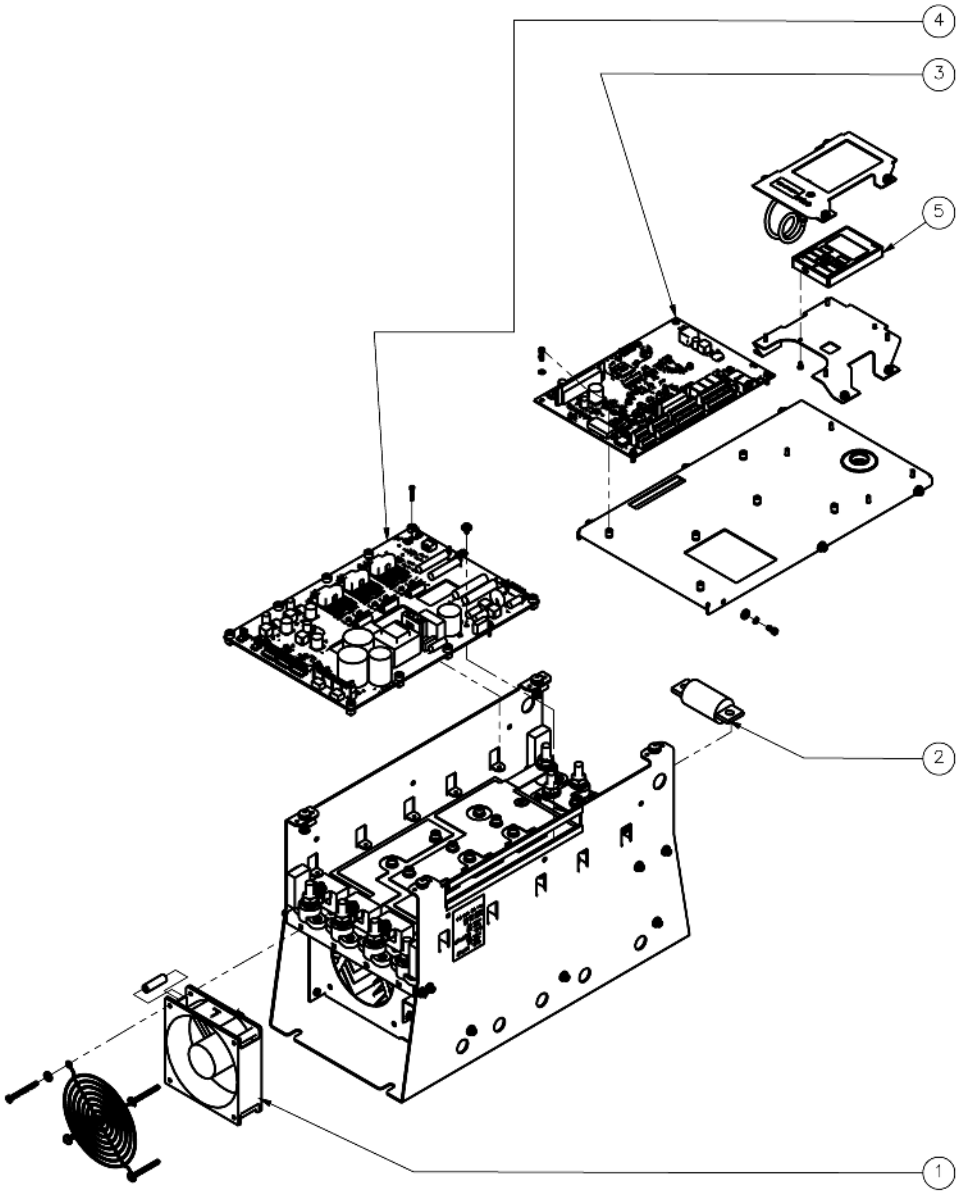
- Choosing a location
- Standard components and external devices
- Drive environment
- Drive installation

2.1 Choosing a Location

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

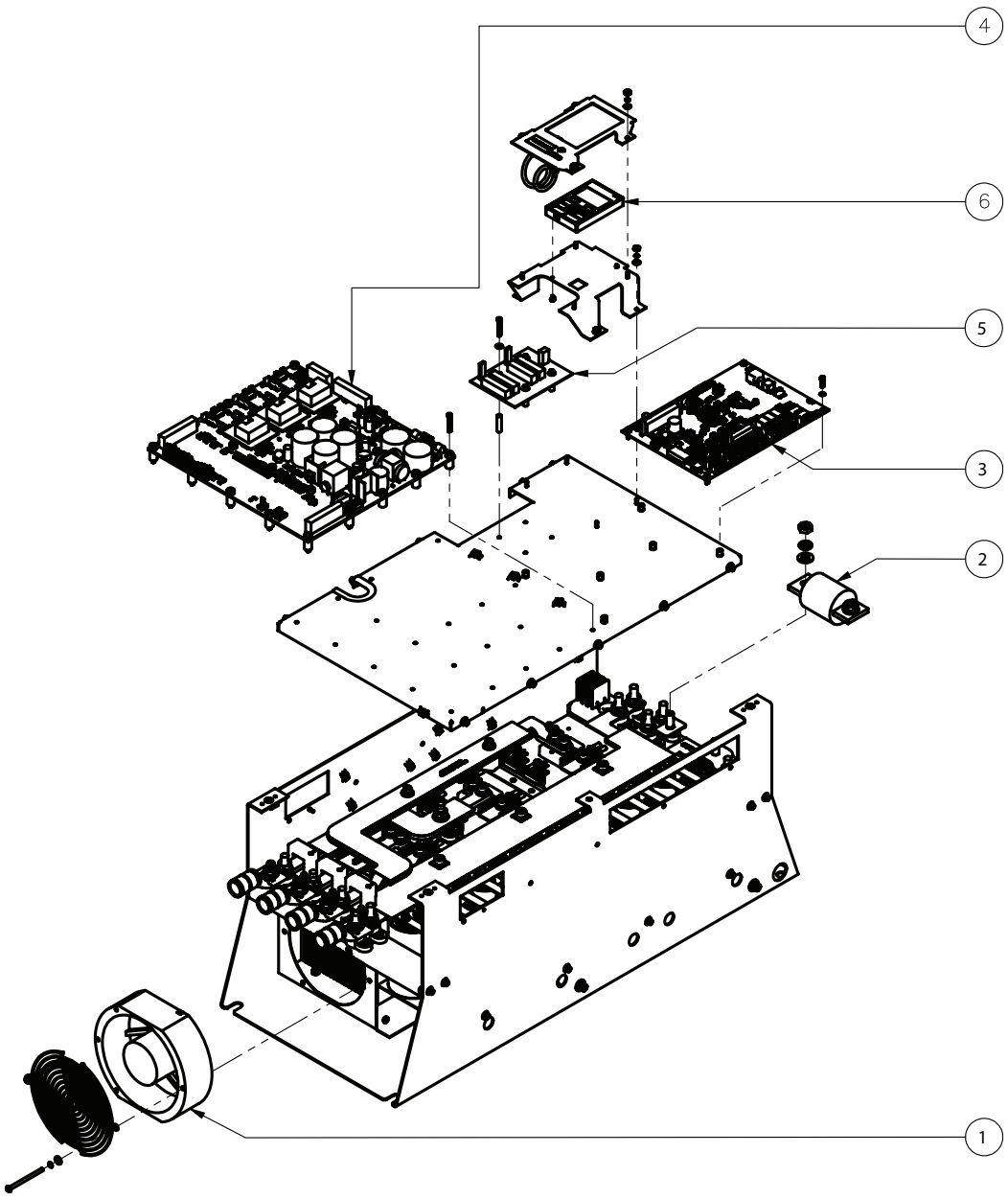
- Extreme cold and heat. Use only within the ambient temperature range:
  -10°C to +65°C (+14°F to 149°F)
- Direct sunlight (not for use outdoors)
- Rain, moisture
- High humidity
- Oil sprays, splashes
- Salt spray
- Dust or metallic particles in the air
- Corrosive gases (e.g., sulfurized gas or liquids)
- Radioactive substances
- Combustibles (e.g., thinner, solvents, etc.)
- Physical shock, vibration
- Magnetic noise (e.g., welding machines, power devices, etc.)

2.2 Standard Drive Components



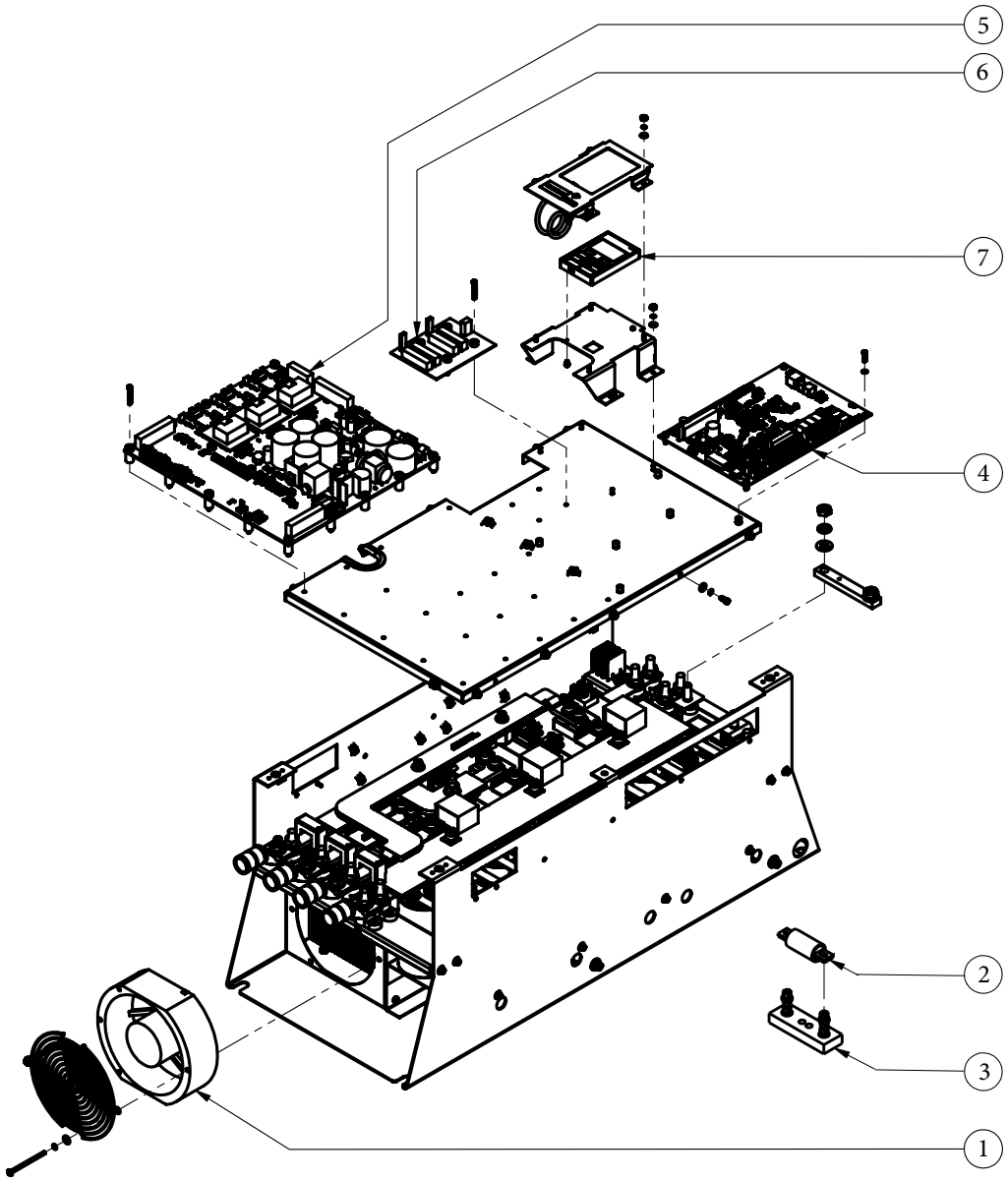
Item	Catalog Number	Part Number	Component Description
1	FAN-NEMA-2/3-24VDC-95CFM	144-45266	Fan, 24VDC, 4 in., 95 CFM
2	FUSE-NEMA-2/3-150A-500V	144-45065	Fuse, 150A, 500V, 2.75 in.
3	DDC-S2-CONTROL	144-47016	Control Board
4	DDC-LN3-GATE6	144-47030	NEMA 2 & 3 Gate Driver Board, Low Voltage
5	DLS4-SPARE	144-27084	DLS4 Display Keypad

Figure 2-1: Small Chassis – NEMA 2 & 3 Drive



Item	Catalog Number	Part Number	Component Description
1	FAN-NEMA-4/5-24VDC-290CFM	144-45090	Fan, 24VDC, 4 in., 290 CFM
2	FUSE-NEMA-4/5-500A-500V	144-45066	Fuse, 500A, 500V, 3.25 in.
3	DDC-S2-CONTROL	144-47016	Control Board
4	DDC-LN5-GATE7	144-45384	NEMA 4 & 5 Gate Driver Board, Low Voltage
5	DDC-DISCHARGE	144-45064	Discharge Board, NEMA 4 & 5, Low Voltage
6	DLS4-SPARE	144-27084	DLS4 Display Keypad

Figure 2-2: Large Chassis – NEMA 4 & 5 Low-Voltage Drive



Item	Catalog Number	Part Number	Component Description
1	FAN-NEMA-4/5-24VDC-290CFM	144-45090	Fan, 24VDC, 4 in., 290 CFM
2	FUSE-NEMA-4/5-400A-700V	144-45550	Fuse, 400A, 700V, 3.25 in.
3	FUSE-BLOCK-NEMA-4/5-HV	144-45551	Fuse Block, NEMA 4 & 5, High Voltage
4	DDC-S2-CONTROL	144-47016	Control Board
5	DDC-HN5-GATE7	144-45385	NEMA 4 & 5 Gate Driver Board, High Voltage
6	DDC-S2-HV-ISO	144-47020	NEMA 2 - 5, Isolation Board, High Voltage
7	DLS4-SPARE	144-27084	DLS4 Display Keypad

Figure 2-3: Large Chassis – NEMA 4 & 5 High-Voltage Drive

2.2.1 Optional Drive Components

- DDC-230VIF External 230VDC Interface Board
- DDC-EXT-CT External CT Board(s)

2.2.2 As-Required External Components

- Power Limit Switch and Resistor
- Holding Brake(s)
- External dynamic braking power loss resistor(s)
- RPM (regenerative power) module
- Overtravel limit switches
- Collision avoidance sensor(s)

2.2.3 Required External Devices

- DC Motor wound with Class H or greater insulation that is rated to handle the winding stress associated with pulse width modulated voltages, otherwise an output filter should be used to protect the motor from premature insulation failure.
- User input device (pendant, joystick, PC, PLC, radio, etc.)
- External circuit protection devices (fuses or circuit breakers)
- Adequate surge suppressors on contactor coils

2.2.4 Series Mill Motor Ratings

Table 2-1: 600 Series Mill Motor Ratings

Duty	Frame	230 VDC		360 VDC*		Rated Amps
		HP	RPM	HP	RPM	
1/2 Hour Rating (Hoist)	602	10	675	16	1060	44
	603	13-1/2	620	21	973	57
	604	19	560	30	879	77
	606	33	515	52	809	129
	608	45	470	71	738	175
	610	65	445	102	699	248
	612	100	430	157	675	375
	614	135	400	212	628	500
	616	200	400	314	628	730
	618	265	385	416	604	955
	620	360	340	565	534	1296
	622	500	310	785	487	1800
	624	660	300	1036	471	2376
1 Hour Rating (Traverse)	602	7-1/2	800	12	1256	31
	603	10	725	16	1138	41
	604	15	650	24	1021	59
	606	25	575	39	903	95
	608	35	525	55	824	131
	610	50	500	78	785	184
	612	75	475	118	746	274
	614	100	460	157	722	360
	616	150	450	236	706	536
	618	200	410	314	644	712
	620	275	370	432	581	1017
	622	375	340	589	534	1350
	624	500	320	785	502	1800

* Estimates only

NOTE: *For 300 VDC estimates, multiply 230 VDC hp and RPM ratings by 1.3.*

Table 2-2: 800 Series Mill Motor Ratings

Duty	Frame	230 VDC		360 VDC*		Rated Amps
		HP	RPM	HP	RPM	
1/2 Hour Rating (Hoist)	802A	6-1/2	750	10	1178	29
	802B	10	675	16	1060	45
	802C	13-1/2	675	21	1060	57
	803	19	620	30	973	77
	804	26	580	41	911	98
	806	39	500	61	785	145
	808	65	450	102	707	246
	810	90	440	141	691	335
	812	135	420	212	659	500
	814	200	400	314	628	730
	816	265	400	416	628	955
	818	325	360	510	565	1140
	820	390	340	612	534	1404
	822	500	310	785	487	1800
1 Hour Rating (Traverse)	802A	5	900	8	1413	21
	802B	7-1/2	800	12	1256	31
	802C	10	800	16	1256	41
	803	15	725	24	1138	59
	804	20	650	31	1020	75
	806	30	575	47	903	112
	808	50	525	78	824	184
	810	70	500	110	785	260
	812	100	475	157	746	360
	814	150	460	235	722	533
	816	200	450	314	707	712
	818	250	410	392	644	900
	820	300	370	471	581	1080
	822	375	340	589	534	1370

* Estimates only

Table 2-3: Typical DB Resistor Values for DDC Hoist 30 Min. Mill Motors

Motor Frame	230 V 30 Min. HP	Rated Amps	DB Ohms 230 V	DB Ohms 300 V	DB Ohms 360 V	DB Cont. Amps
602	10	44	2.88	3.75	4.50	24
603	13-1/2	57	2.22	2.89	3.47	31
604	19	77	1.64	2.14	2.57	42
606	33	129	0.98	1.28	1.53	71
608	45	175	0.72	0.94	1.13	96
610	65	248	0.51	0.67	0.80	136
612	100	375	0.34	0.44	0.53	206
614	135	500	0.25	0.33	0.40	275
616	200	730	0.17	0.23	0.27	402
618	265	955	0.13	0.17	0.21	525
620	360	1296	0.10	0.13	0.15	713
622	500	1800	0.07	0.09	0.11	990
802A	6-1/2	29	4.36	5.69	6.83	16
802B	10	45	2.81	3.67	4.40	25
802C	13.5	57	2.22	2.89	3.47	31
803	19	77	1.64	2.14	2.57	42
804	26	98	1.29	1.68	2.02	54
806	39	145	0.87	1.14	1.37	80
808	65	246	0.51	0.67	0.80	135
810	90	335	0.38	0.49	0.59	184
812	135	500	0.25	0.33	0.40	275
814	200	730	0.17	0.23	0.27	402
816	265	955	0.13	0.17	0.21	525
818	325	1140	0.11	0.14	0.17	627
820	390	1404	0.09	0.12	0.14	772
822	500	1800	0.07	0.09	0.11	990

2.2.5 DB Resistor Sizing General Formula

$$\text{Watts} = \frac{(DC)(W)(FPM)(EFF)}{44}$$

E_{RTD} = Rated Motor Volts
I_{RTD} = Rated Motor Current
DC = Duty cycle (.5 = Class 170, .33 = Class 160, 1.0 = CONT)
W = Load Weight in lbs.
FPM = Feet per Minute lowering speed, generally 50% of rated FPM
EFF = System Efficiency, generally .9 for hoist

$$R_{OHMS} = \frac{.5\ E_{RTD}}{I_{RTD}} = \frac{125}{MTR_{FLA}} \quad \text{for 250 VDC MTR}$$

$$I_{CONT} = \sqrt{\frac{\text{Watts}}{R_{OHMS}}}$$

2.3 Storage

2.3.1 Long-Term Storage

Applying power to OmniPulse DDC Series 2 for 30 to 60 minutes every six months is recommended, as the electrolytic DC Bus capacitors require reformation if the drive is left unpowered for long periods of time, especially if stored in an area of high temperatures. Capacitor reforming is required if controllers are stored without power for more than 1 to 2 years.

NOTE: *Bus cap reforming alone may not restore full control functionality after 1 to 2 years of storage without power.*

The DDC-S2 power section contain large bus capacitors that have the potential to be reformed; however, printed circuit boards also contain electrolytic capacitors that may not function after several years without power. Magnetek recommends replacing the PCBs in the event the DDC-S2 functionality is not restored after reforming the bus capacitors.

2.3.2 Bus Capacitor Reforming Procedure

1. Connect the control inputs L1 (+), 7 (+), 8 (-), and L2 (-) to a rectifier with a variac input as shown in ***Figure 2-4 on page 22***.
2. Make sure the variac voltage setting is at its minimum so that when input power is applied to the variac, the output of the rectifier will be at or near 0 VDC.
3. Apply power to the variac, listening for abnormal sounds and watching for abnormal visual indications in the control. If the variac has an output current indication, make sure the current is near zero minimum output voltage applied.
4. Slowly ramp the variac output voltage according to the plot in ***Figure 2-5 on page 22*** until nominal rated input voltage is reached. Keep in mind that while increasing the variac output voltage, the current will momentarily increase as is necessary to charge the capacitors.
5. Keep the rated voltage constant for 30 to 60 minutes while monitoring the drive control board for abnormalities.

6. Once 30 to 60 minutes has elapsed, remove power and install drive for intended use.
   If any abnormal indications occur during this process, it is recommended that the process be repeated.
   Otherwise, this completes the capacitor reforming procedure.

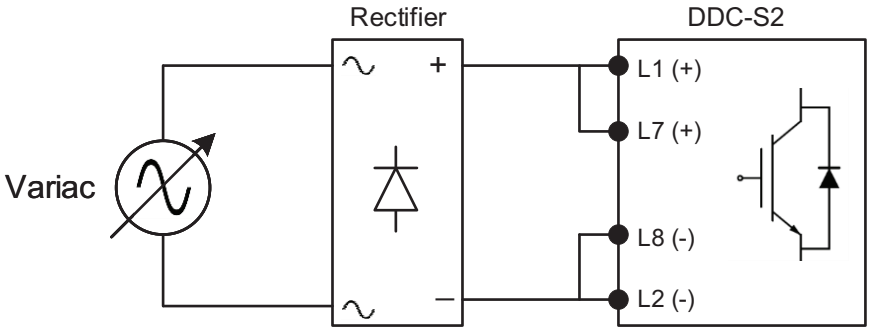


Figure 2-4: DC Bus Capacitor Reforming Connections

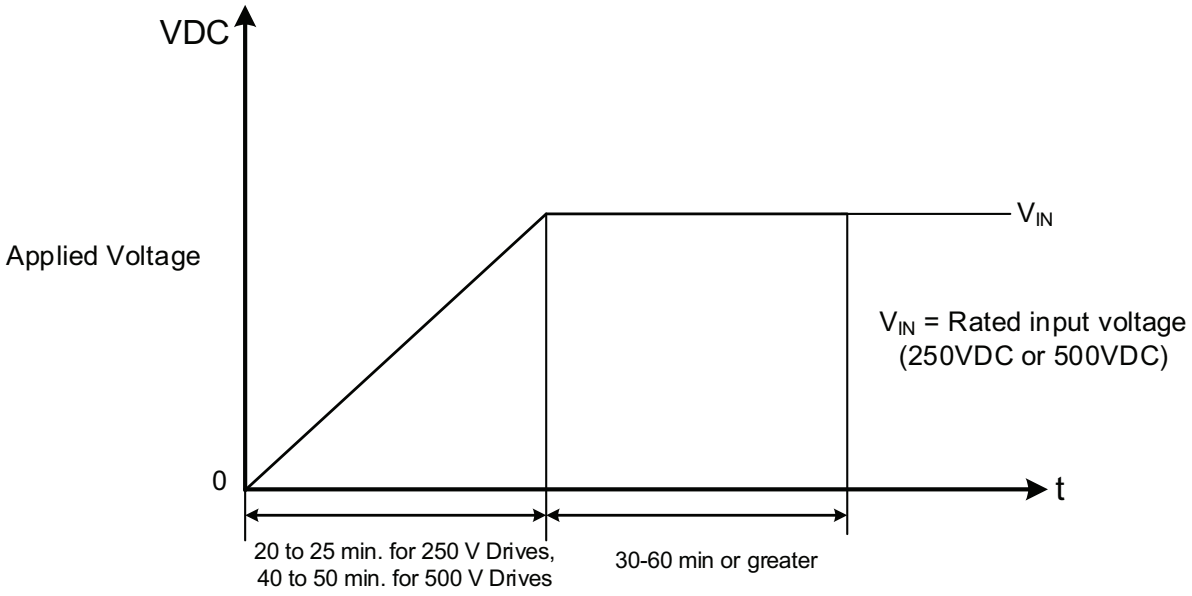


Figure 2-5: DC Bus Capacitor Reforming Timing Diagram

2.4 Drive Installation

Adhere to the following guidelines during the installation of one or more OmniPulse DDC-S2 drive(s):

1. Ensure the drive will be used in a proper environment. ***See Section 1.5 on page 10***.
2. Select the necessary components to complete a drive system applicable to the system design and load requirements.
3. Determine the sizes and connection locations for the drive components and external devices.
4. Ensure the drive is installed with the proper orientation to maintain proper cooling. ***See Figure 2-6 on page 24*** and ***Figure 2-7 on page 25***.
5. Use a heater or air conditioner to maintain the temperature ratings of the drive as listed under the environmental specifications in ***Table 1-4 on page 12***.
6. Evaluate and select a power supply for which its type, configuration, and capacity can meet the requirements of the DDC-S2 drive electrical ratings. (See the specifications listed in ***Table 1-2 on page 11*** and ***Table 1-3 on page 11***).
7. Apply best engineering practices in wire layout and routing, such as ensuring that the drive control circuit and power circuit wires are perpendicular to each other at any point they cross.
8. Keep the drive control circuitry and power circuitry separated on the terminal block or strip.
9. Keep power and control festoon wiring in separate cables.
10. Ensure the drive can be properly grounded to meet requirements set forth by local codes, ordinances, and/or agency standards.
11. Before drive power up, review all electrical connections to the motor, drive power terminals, control board, and other external devices (Interface board, External CT boards, etc.) as illustrated throughout ***Section 3 on page 27***.

2.5 Drive Derating Data

2.5.1 Temperature Derating

To ensure the maximum performance life, the drive output current must be derated when the drive is installed in areas with high ambient temperature. Derate drive output current by 2% for every 1°C above 50°C.

2.5.2 Altitude Derating

Drives are affected by altitudes above 1000 m. Derate the drive output current by 1% for every 100 m above 1000 m, up to 3,000 m altitude.

2.6 Chassis Dimensions and Weight

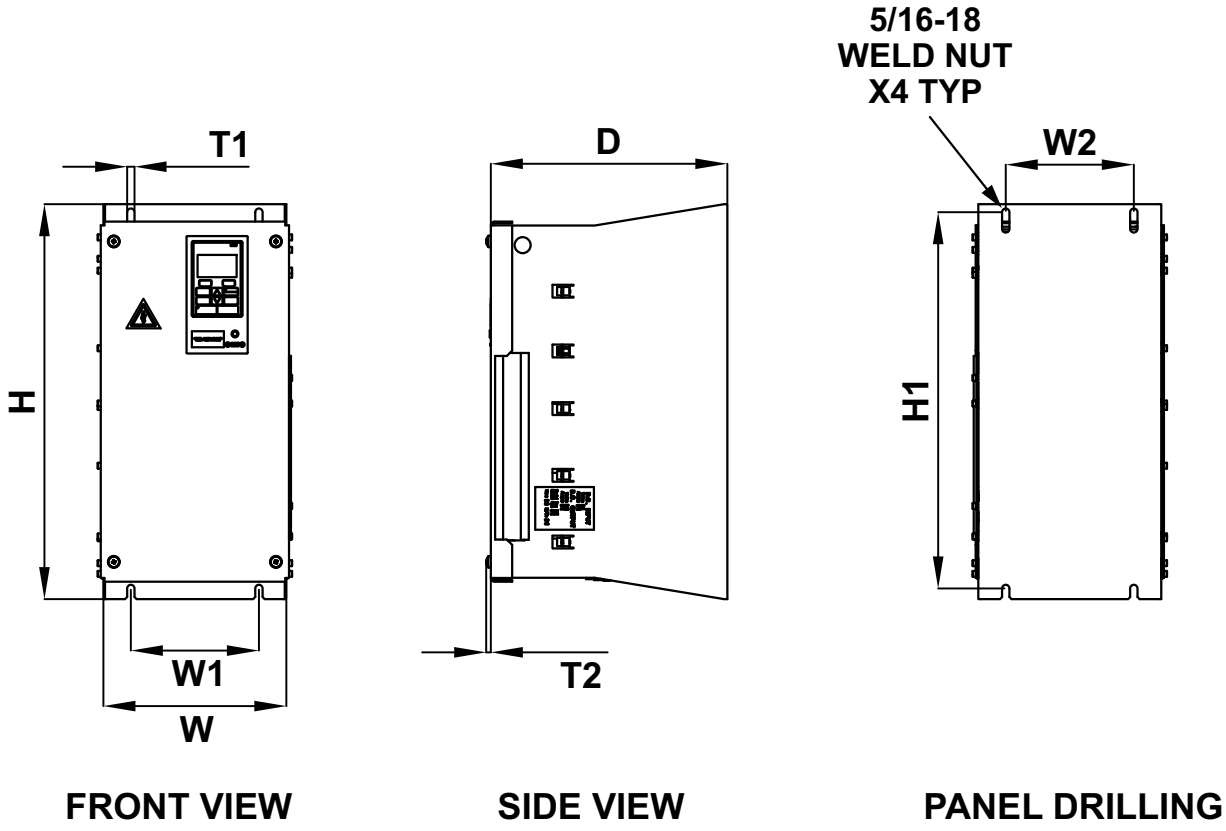


Figure 2-6: Small Chassis (NEMA 2 & 3)

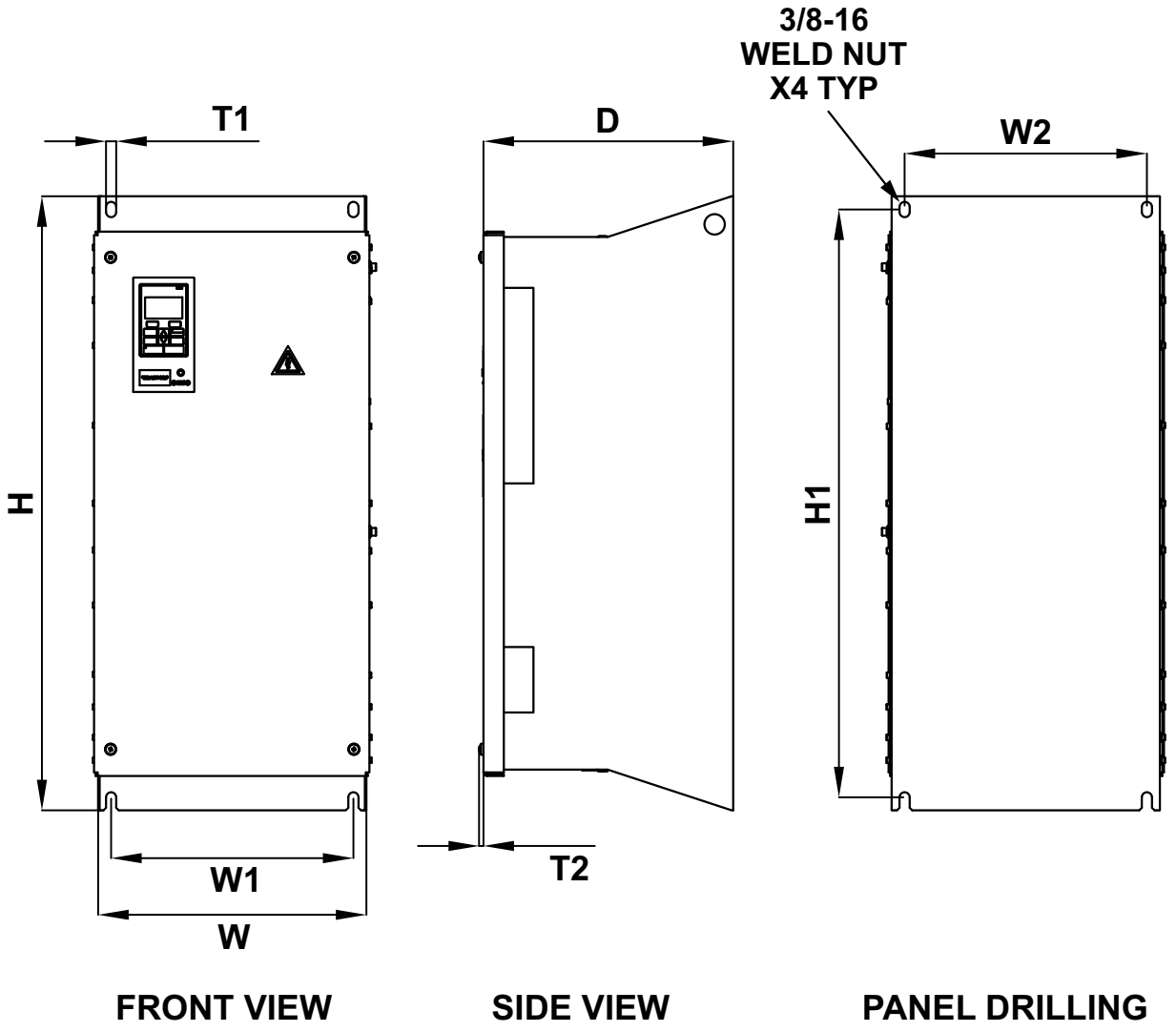


Figure 2-7: Large Chassis (NEMA 4 & 5)

Table 2-4: NEMA Chassis Dimensions

Model	Figure Number	Dimensions (inches)								Weight
		W	H	D	W1	W2	H1	T1	T2	
NEMA 2 & 3	2-6	8.57	18.50	11.30	7.60	6.00	17.50	0.34	0.22	47 lbs
NEMA 4 & 5	2-7	13.17	30.16	12.48	11.95	11.90	28.87	0.50	0.22	115 lbs

2.7 Heat and Watt Loss

Table 2-5: Heat Loss

NEMA Size	Max. Current Rating	Watts/Amp @ Max. Rating	
		Hoist	Travel
2	67	5	7
3	133	5	7
4	200	4	6
5	400	4	6
6	800	4	6
7	1200	4	6
8S	1600	4	6
8L	2000	4	6

NOTE: *Add 15% Watts for power wiring and current carrying devices for total controller Watts. Convert to BTU/HR by multiplying by 3.41.*

Example: Calculated generated Watts and BTU/HR using a magnet rated at 44 Amps

$$\text{Watts} = (44 \text{ Amps} \times 5 \frac{\text{Watts}}{\text{Amp}}) \times 1.15 = 253 \text{ Watts}$$

$$\text{BTU/HR} = 253 \text{ Watts} \times 3.41 \frac{\text{BTU/HR}}{\text{Watt}} = 863 \text{ BTU/HR}$$

3 Wiring

3.1 Power Circuit Wiring

3.2 Hoist Mode

There are two possible configurations for the DDC-S2 drive. It can be wired and configured for hoisting applications as shown in ***Figure 3-1 on page 27***. In hoist mode, the drive supplies motor current through terminals T1, T2 and T3 only. This allows some or all of the armature current to pass directly to the field winding when the torque is in the hoisting direction. This substantially reduces the heating of the IGBTs in the T2 leg. Furthermore, many existing installations use this motor configuration, thus allowing the DDC-S2 to be fitted without altering connections to collector rails, power limit switch, series brake, or the dynamic braking circuit.

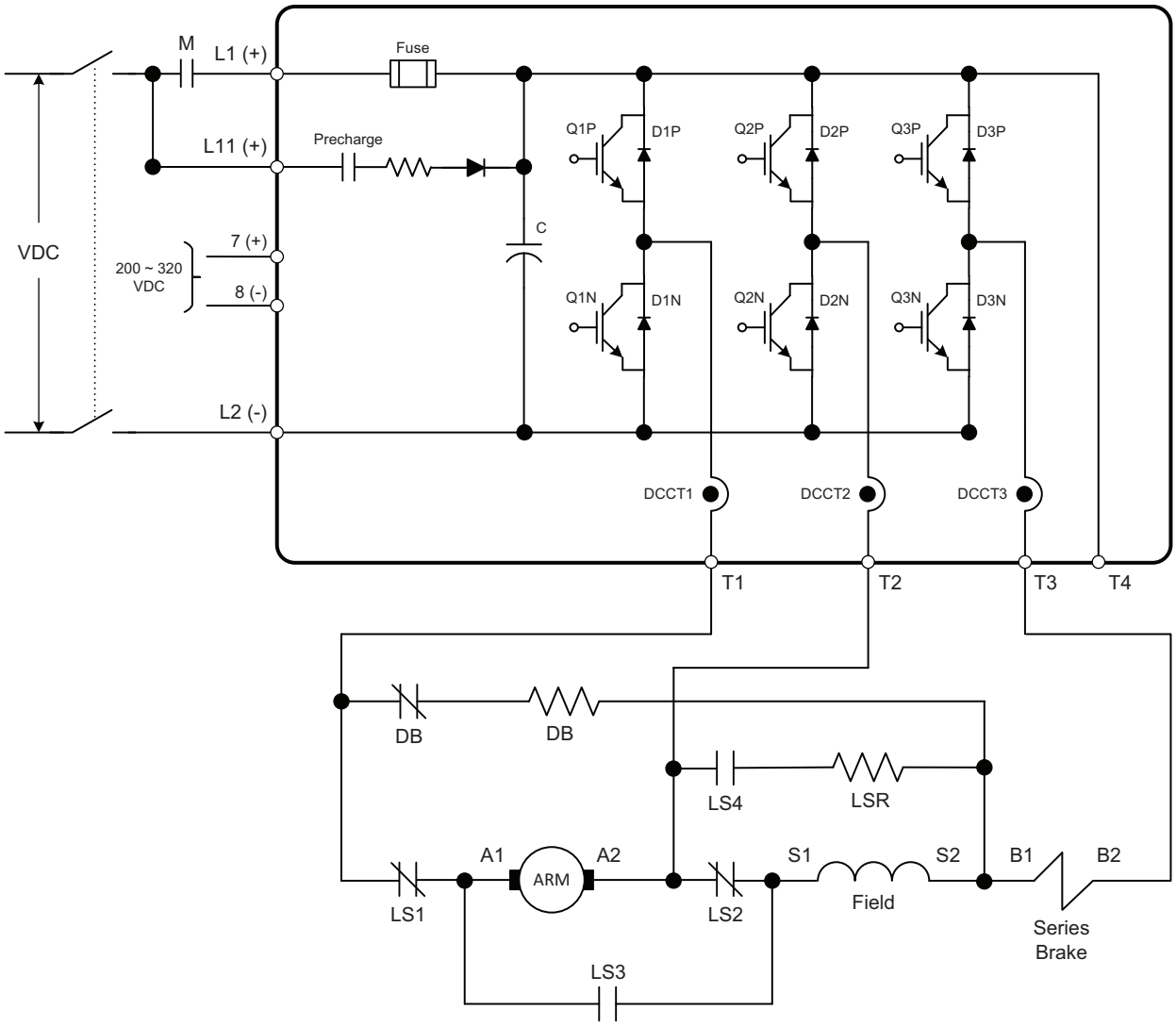


Figure 3-1: Configuration for a Hoist

3.3 Traverse and General-Purpose Mode

The DDC-S2 can also be configured for bridge, trolley, and general-purpose separately excited configurations as shown in ***Figure 3-2 on page 28***. In this mode, it supplies the armature current through T1 and T2 and supplies the field current through T3 and T4. This configuration also complies with the motor circuit arrangements normally found in existing installations.

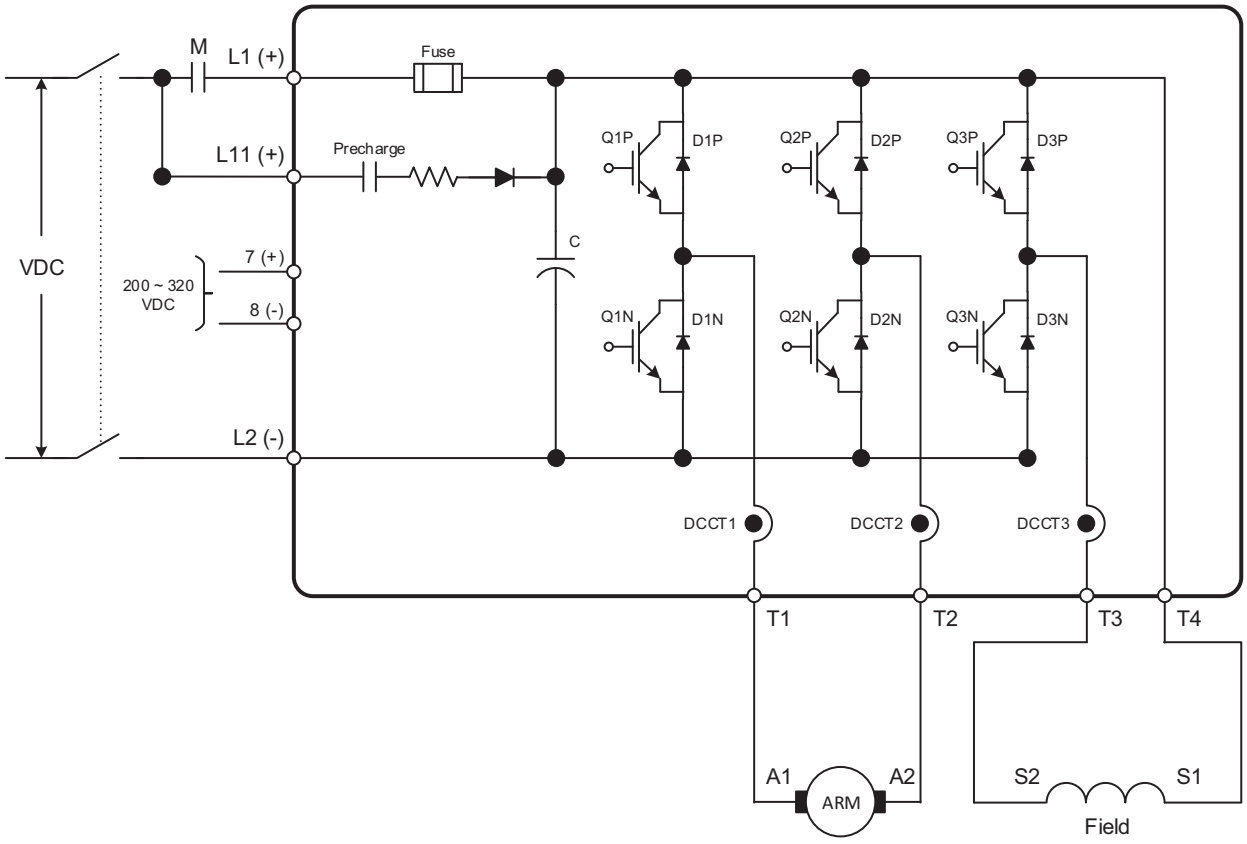


Figure 3-2: Configuration for Traverse and General-Purpose

3.4 Power Circuit Wiring Procedures

Wire all equipment according to the control panel drawing included with the equipment. Observe all notes on diagrams and follow all NEC and local codes.

NOTE: *Do not connect the motor to the drive at this time.*

CAUTION

Observe local codes for correct wire size, grounding, etc. Input must be between 200 - 320 Volts DC for standard low-voltage (LV) drives and 360 - 600 Volts DC for high-voltage (HV) drives.

To wire the power circuit for OmniPulse DDC Series 2:

1. Run the incoming DC bus wires through an appropriate enclosure hole.
2. Connect the bus wires from the circuit protection to Terminals L2 (-), L1 (+), and L11 (+) as shown in ***Figure 3-1 on page 27*** and ***Figure 3-2 on page 28***.
3. Connect control power wires to terminals 7 and 8.
4. From Terminals T1, T2, T3, and T4, connect the power output wires to the motor.

Classification	Terminal	Description	Voltage
DC Bus Voltage	L1	DC bus (+)	200 – 320 VDC (LV) 360 – 600 VDC (HV)
	L2	DC bus (-)	
	L11	Precharge (+)	
Control Voltage	7	Control (+)	200 – 300 VDC
	8	Control (-)	
Output	T1	Drive output to armature and field of motor	200 – 300 VDC (LV) 360 – 600 VDC (HV)
	T2		
	T3		
	T4		

3.4.1 Grounding

The OmniPulse DDC Series 2 will operate properly on a floating ungrounded system, on a grounded positive system, or on a grounded negative system.

If a grounded system exists, it is recommended that the unit be grounded in accordance with NEC and local codes.

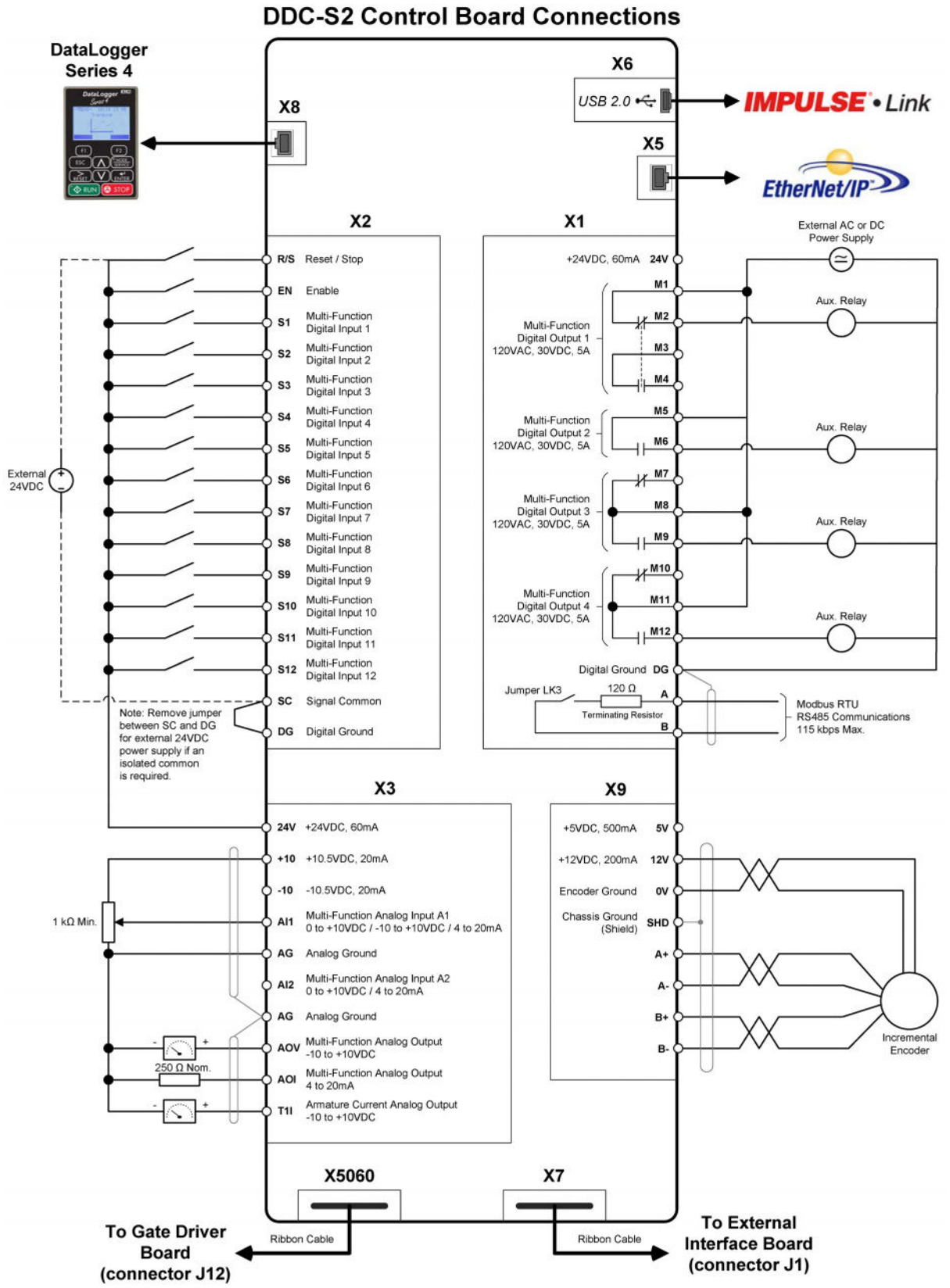


Figure 3-3: Control Board Schematic

DDC-S2 Interface Board Connections

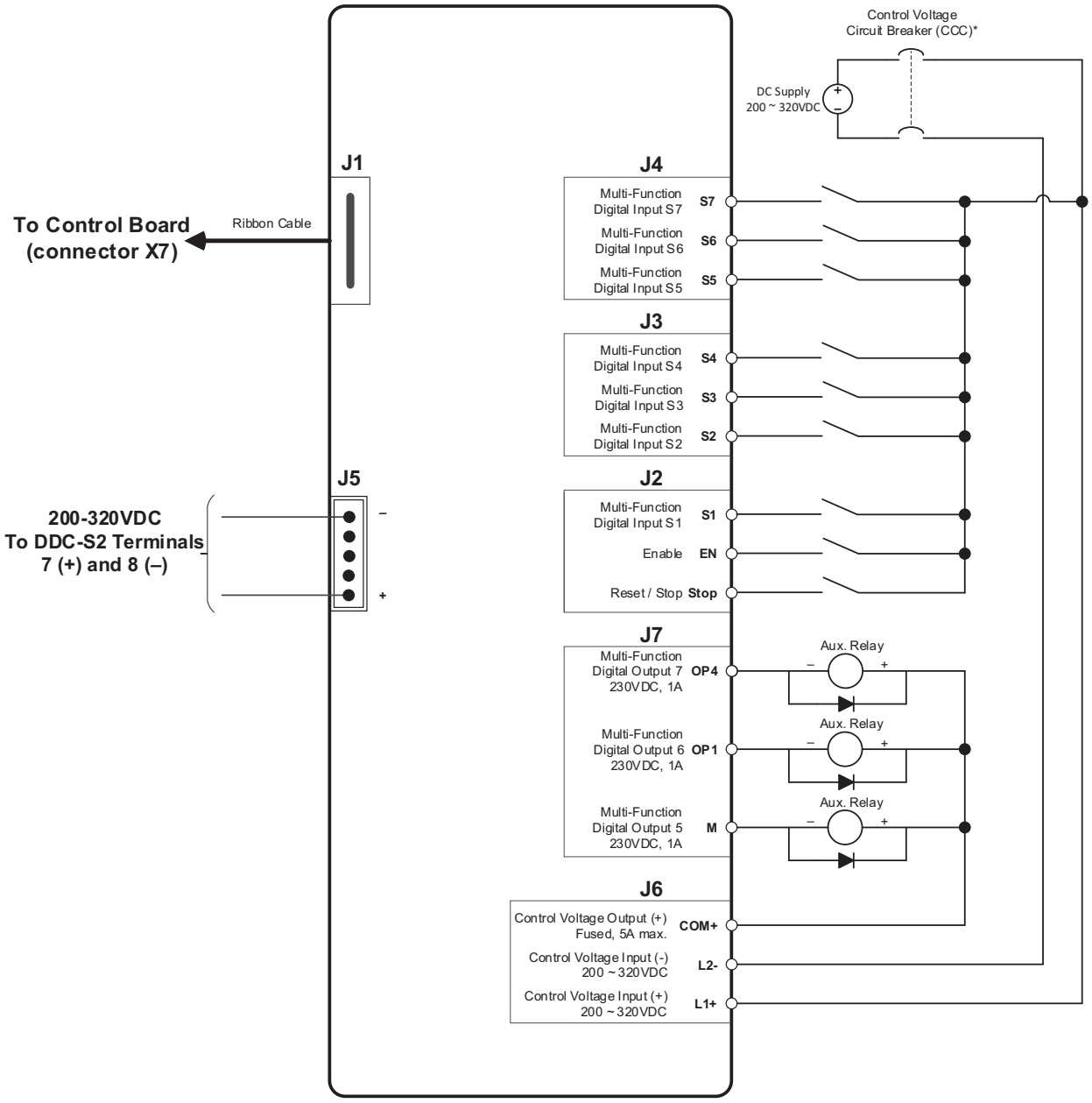


Figure 3-4: Interface Board Schematic

** In order to comply with most safety standards, branch circuit protective devices should be used between the incoming DC power supply and the OmniPulse DDC Series 2 drive. These devices can be circuit breakers or fuses rated to interrupt DC current.*

3.5 Control Board

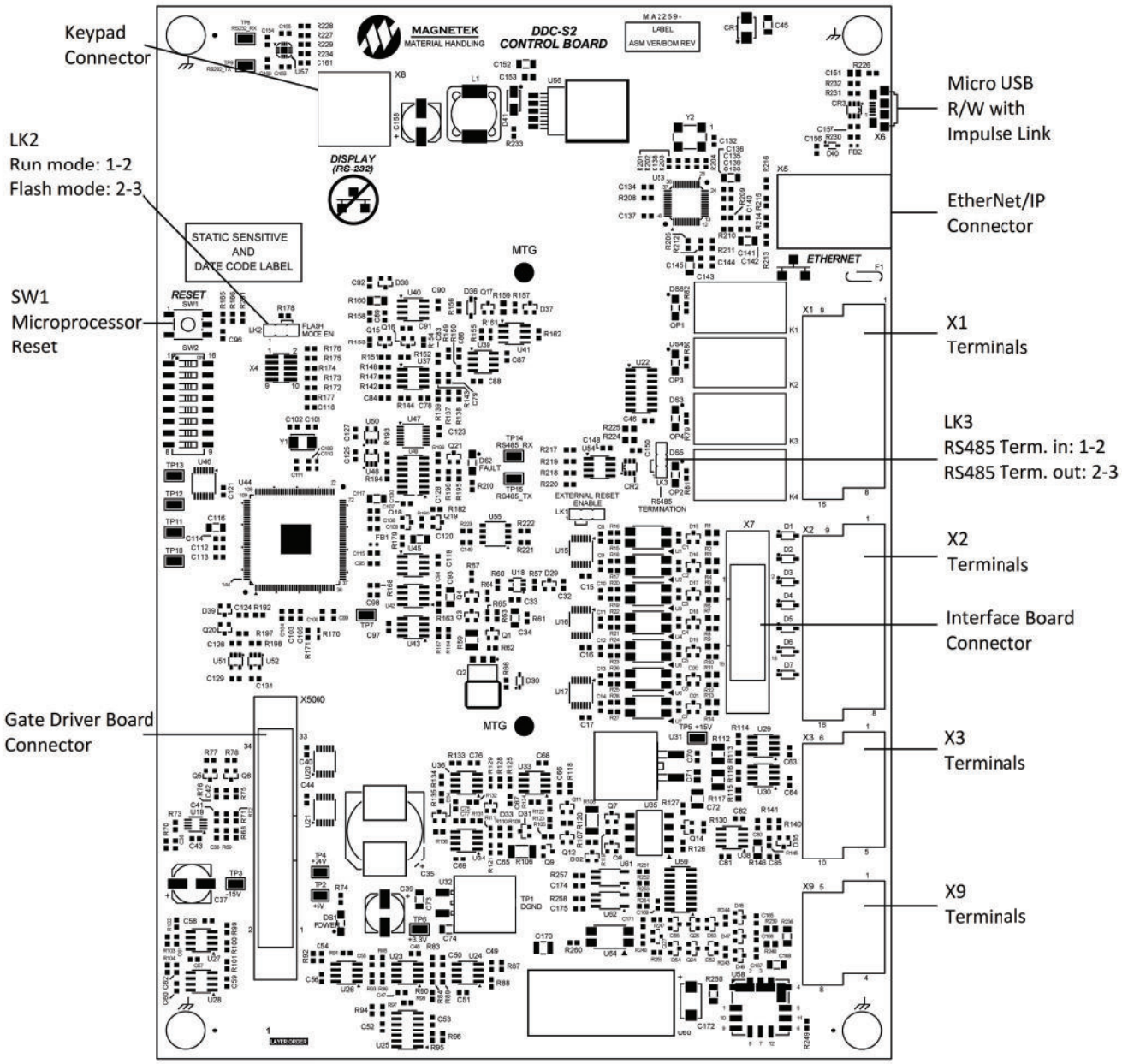


Figure 3-5: Control Board and Terminal Designations (Model Number DDC-S2-CONTROL)

3.5.1 Control Board Jumper Settings

The functions of the jumper settings are shown in the table below.

Table 3-1: Jumper Setting Functions

Jumper	Function
LK1	External Reset Enable 1-2: Microprocessor reset from Interface Board S1 “Reset” button 2-3: Fault reset from Interface Board S1 “Reset” button (default)
LK2	Reflash Mode 1-2: Drive operates normally (default) 2-3: Microprocessor is in reflash mode to update firmware
LK3	RS-485 Termination 2-3: No terminating resistance (default) 1-2: Terminating Resistance of 120 ohms

3.5.2 Control Circuit Terminals

Table 3-2: Control Circuit Terminal Descriptions

Classification	Terminal	Signal Function	Description	Signal Level
Digital Input Signals	R/S	RESET/STOP	Stops outputting current to the motor and resets any faults	Photo-coupler isolation 24VDC, 3.7 mA
	EN	ENABLE	Input required to run motor	
	S1	MFDI 1	Multi-function digital inputs (H01-01 to H01-12)	
	S2	MFDI 2		
	S3	MFDI 3		
	S4	MFDI 4		
	S5	MFDI 5		
	S6	MFDI 6		
	S7	MFDI 7		
	S8	MFDI 8		
	S9	MFDI 9		
	S10	MFDI 10		
	S11	MFDI 11		
	S12	MFDI 12		
	SC	Signal Common		0V
	DG	Digital Ground		0V

Classification	Terminal	Signal Function	Description	Signal Level
Analog Input Signals	+10	Power supply for analog inputs	Positive supply for analog inputs	+10.5 VDC, 20 mA
	-10	Power supply for analog inputs	Negative supply for analog inputs	-10.5 VDC, 20 mA
	AI1	MFAI 1	Multi-function analog input (H03-02)	-10 to +10 V (20kΩ), 0 to +10 V (20kΩ), 4 to 20 mA (250Ω)
	AI2	MFAI 2	Multi-function analog input (H03-06)	0 to +10 V (20kΩ), 4 to 20 mA (250Ω)
	AG	Analog Common	Common for analog signal	0 V
Digital Output Signals	24V	24 VDC Supply	24 VDC Common	24 VDC, 60 mA
	M1, M2	MFDO 1 (N.C.)	Multi-function digital output (H02-01)	Form D Relay: 120 VAC (48 VAC for CE), 30 VDC, 1 A
	M3, M4	MFDO 1 (N.O.)		
	M5	MFDO 2	Multi-function digital output (H02-02)	Form A Relay: 120 VAC (48 VAC for CE), 30 VDC, 1 A
	M6			
	M7	MFDO 3	Multi-function digital output (H02-03)	Form C Relay: 120 VAC (48 VAC for CE), 30 VDC, 1 A
	M8			
	M9			
	M10	MFDO 4	Multi-function digital output (H02-04)	Form C Relay: 120 VAC (48 VAC for CE), 30 VDC, 1 A
	M11			
	M12			
Analog Output Signal	AOV	MFAO 1 Voltage Output	Multi-function analog output (H04-01)	-10 to +10 VDC 0 to +10 VDC
	AOI	MFAO 1 Current Output	Multi-function analog output (H04-01)	4 to 20 mA
	AG	Analog Ground	Analog signal ground	0V
	T1I	Arm. Current Analog Output	Bipolar signal representing armature current (10V = 200% of drive rated current)	-10 to +10 VDC
RS-485	A	Receive/Transmit (-)	Serial communication lines	RS-485 Line Driver 115.2 kbps (max)
	B	Receive/Transmit (+)		
	DG	Shield connection	Serial Communication Shield	0V
EtherNet/IP	X5	Ethernet Communications	Allows drive control using EtherNet/IP or Modbus/TCP Protocol	10/100 Mbps

Table 3-3: Control Circuit Torque and Wire Specifications

Terminal Symbol	Terminal Screw	Clamping Torque lb-in (Nm)	Wire Range AWG (mm^2)
TB	M3	4.2 to 5.3 (0.5 to 0.6)	26 to 16 (Stranded: 0.14 to 1.5) (Solid: 0.14 to 1.5)

3.6 Gate Driver Boards

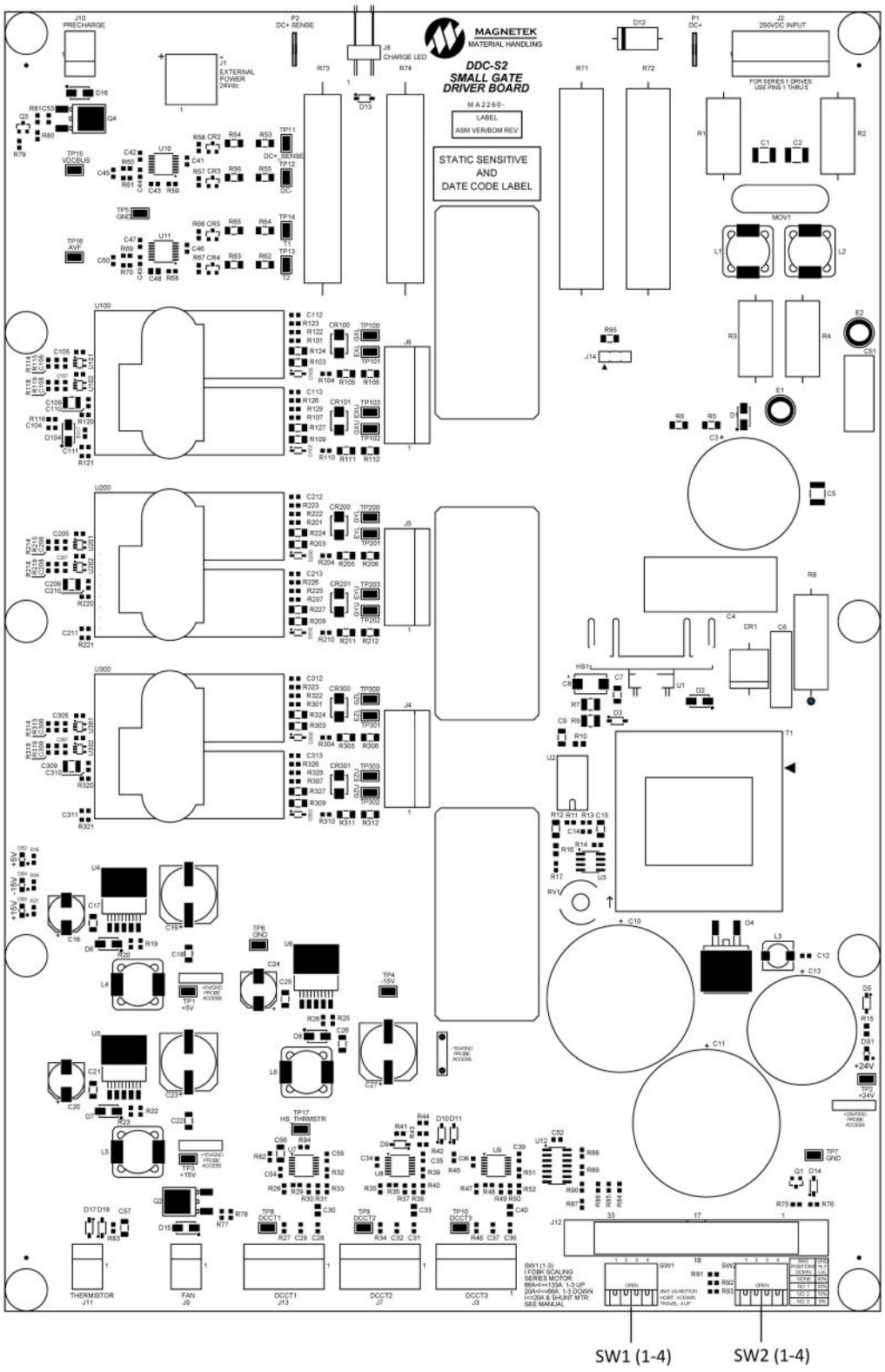


Figure 3-6: Small Chassis Gate Driver Board (Model Number DDC-LN3-GATE6)

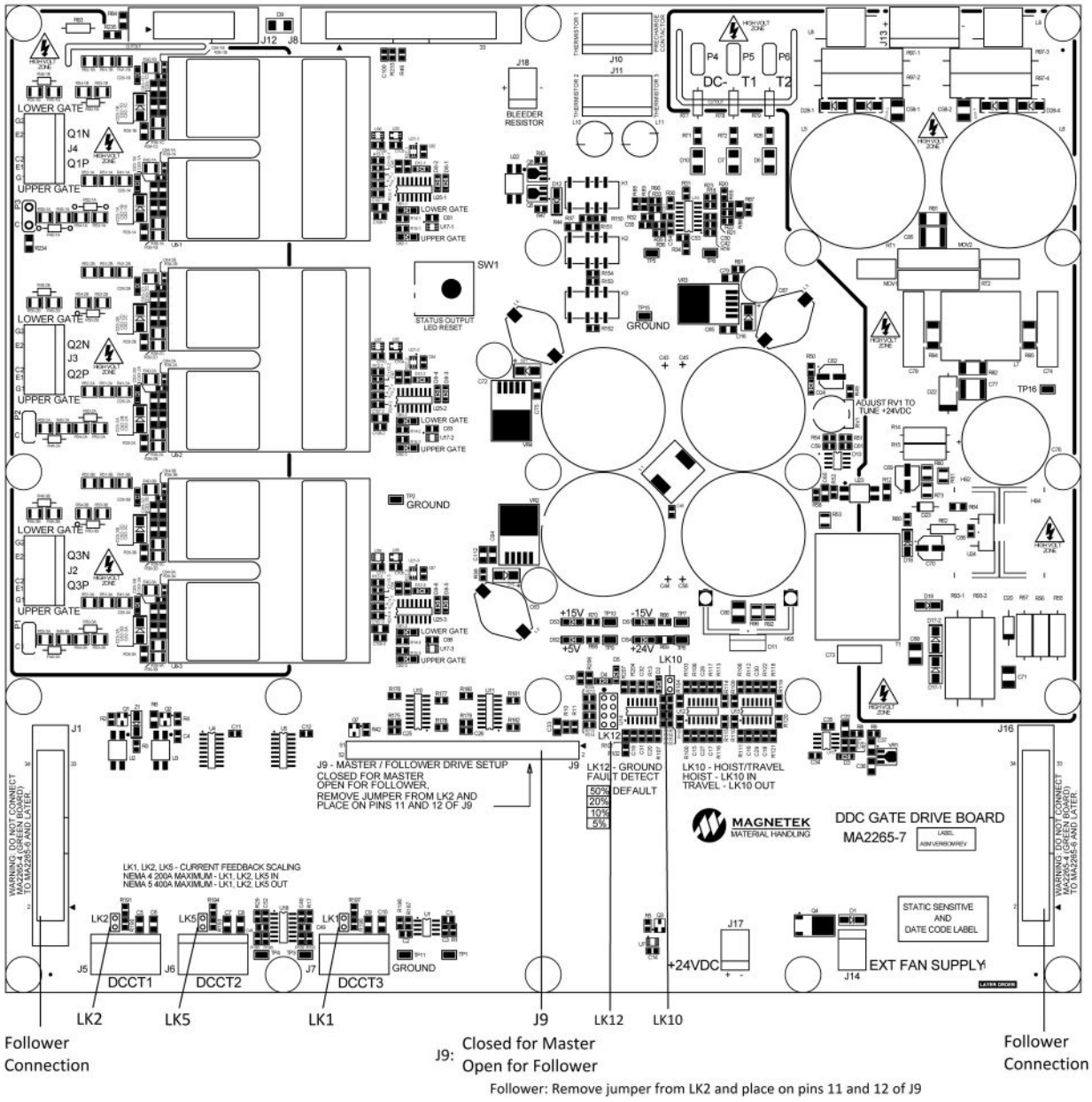


Figure 3-7: Large Chassis Gate Driver Board (Model Number DDC-LN5-GATE7)

Table 3-4: Small Chassis MA2260-6 and Newer Gate Driver Board Switch Settings

Gate Driver Board Current Feedback Scaling				
Rated Amps (Armature and/or Field)	**External CT Required?**	**Armature**		**Field**
		SW1 (1)	**SW1 (2)**	**SW1 (3)**
20 to 67 (NEMA 2)	No	Down (Closed)	Down (Closed)	Down (Closed)
68 to 133 (NEMA 3)	No	Up (Open)	Up (Open)	Up (Open)
2.5 to 20	Yes	Up (Open)	Up (Open)	Up (Open)
< 2.5	Yes	-	-	Down (Closed)

Ground Fault Detection Settings						
Motion	**SW1 (4)**	**GF Sensitivity**				
		SW2*	**50%**	**20%**	**10%**	**5%**
		Pos. #	**(Default)**			
Hoist	Down (Closed)	**2**	Up	Down	Up	Up
		3	Up	Up	Down	Up
Travel	Up (Open)	**4**	Up	Up	Up	Down

* *Switch 2 Position 1 has no function.*

Table 3-5: Small Chassis Legacy Gate Driver Board Jumper Settings

Gate Driver Board Current Feedback Scaling				
Rated Amps (Armature and/or Field)	**External CT Required?**	**Armature**		**Field**
		LK1	**LK3**	**LK2**
20 to 67 (NEMA 2)	No	In	In	In
68 to 133 (NEMA 3)	No	Out	Out	Out
2.5 to 20	Yes	Out	Out	Out
< 2.5	Yes	-	-	In

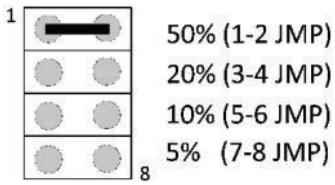
Ground Fault Detection Settings		
Motion	**LK10**	**Ground Fault Sensitivity**
Hoist	In	Fixed at 50%
Travel	Out	

Table 3-6: Large Chassis Gate Driver Board Jumper Settings

Gate Driver Board Current Feedback Scaling

Rated Amps (Armature and/or Field)	External CT Required?	Armature		Field
		LK2	LK5	LK1
20 to 133 (NEMA 2/3 High Voltage)	No	Out	Out	Out
134 to 200 (NEMA 4)	No	In	In	In
201 to 400 (NEMA 5)	No	Out	Out	Out
2.5 to 20	Yes	Out	Out	Out
< 2.5	Yes	-	-	In

Ground Fault Detection Settings

Motion	LK10	GF Sensitivity		
		Setting	LK12 Jumper Positions	
Hoist	In	50% (Default)	1 to 2	
		20%	3 to 4	
Travel	Out	10%	5 to 6	
		5%	7 to 8	

Master / Follower Settings

Drive Type	J9 Jumper Placement
Master (NEMA 4/5)	All Jumpers Placed
Follower (NEMA 6/7/8)	11 – 12

3.7 Interface Board (230 VDC)

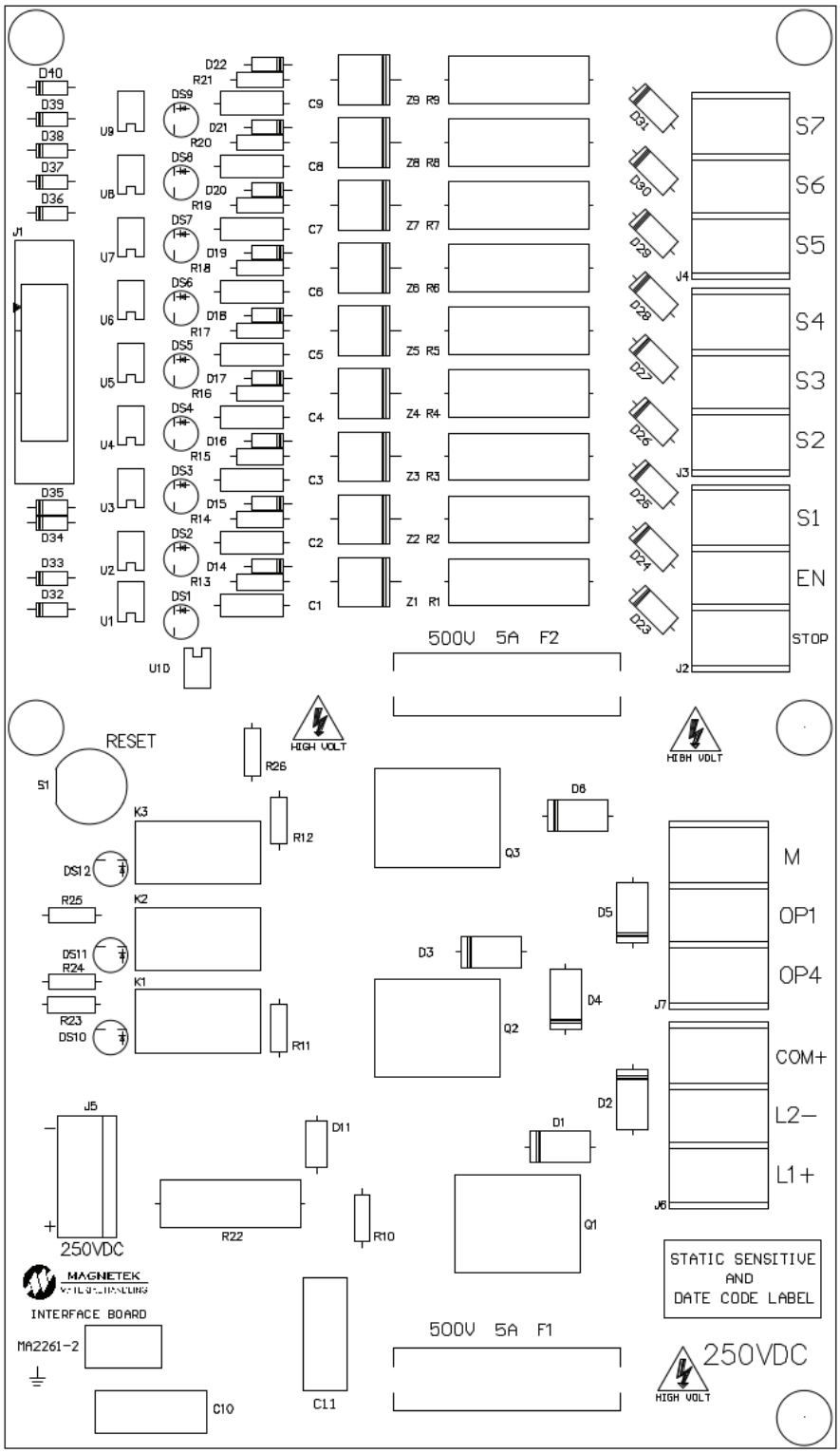


Figure 3-8: Interface Board (Model Number DDC-230VIF)

3.8 External CT Board / Shunt Board

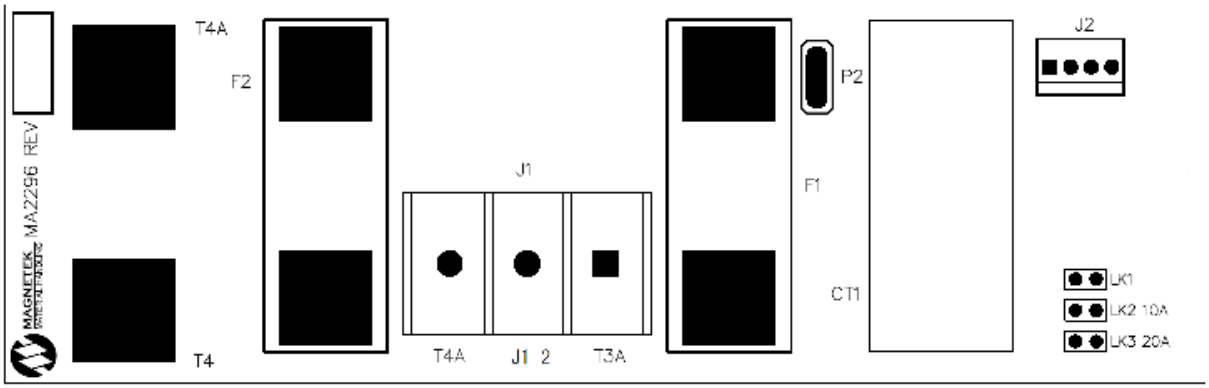
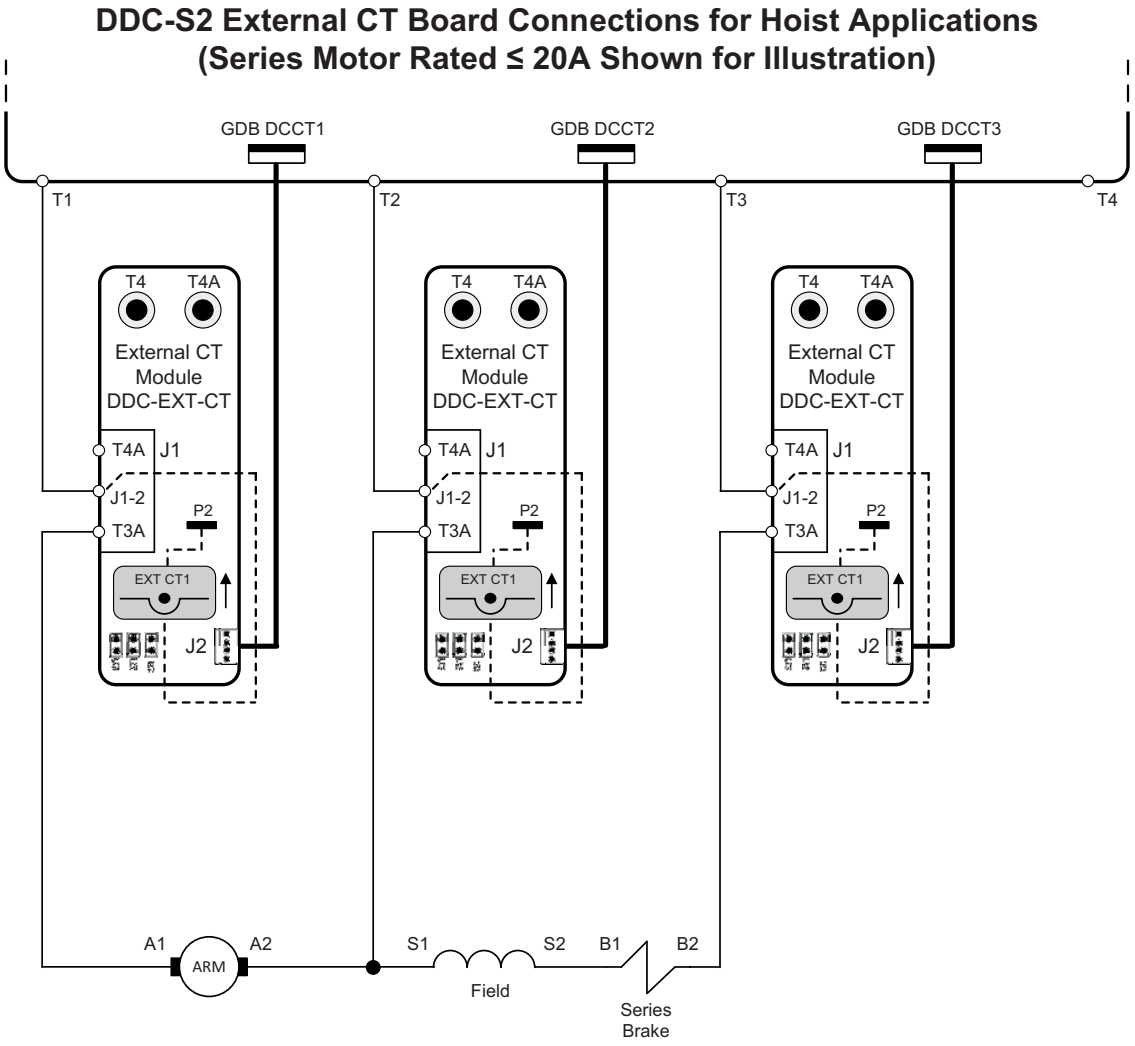


Figure 3-9: External CT Board/Shunt Board (Model Number DDC-EXT-CT)



NOTE: Power Limit Switch and DB components and circuitry omitted for clarity.

Figure 3-10: External CT Configuration for a Hoist

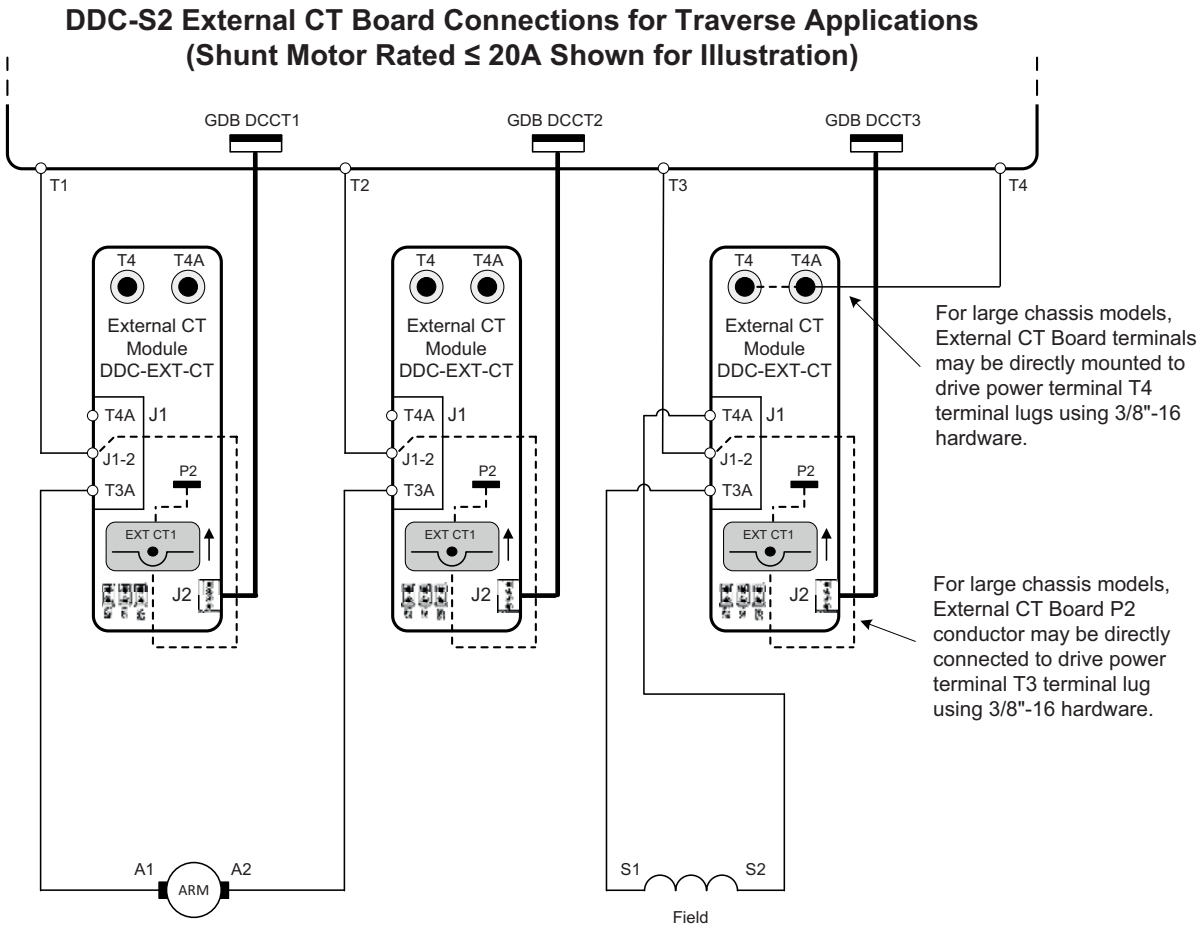


Figure 3-11: External CT Configuration for a Bridge or Trolley

Table 3-7: External CT Board Jumper Settings*

Rated Amps	LK1**	LK2	LK3	Low-Voltage NEMA 2/3 CT Turns	High-Voltage NEMA 2/3/4/5 CT Turns
Shunt Motor Field Rating < 2.5 Amps					
< 2.5	-	Out	Out	2	3
Series or Shunt Motor, Armature and/or Field Ratings from 2.5 to 20 Amps					
2.5 – 5	-	Out	Out	2	3
5 – 10	-	In	Out	2	3
10 – 20	-	In	In	2	3

** Armature circuit requires two external CTs. Field circuit requires one external CT.* ***See Figure 3-10 on page 40*** *and* ***Figure 3-11 on page 41****.*

*** Jumper LK1 has no function.*

4 Getting Started

4.1 Overview

With its easy-to-use keypad and X-Press Programming, the DDC Series 2 makes it easy to get up and running right away. In addition to explaining the keypad and X-Press Programming, this chapter explains how to navigate the settings, get into the Programming Mode, and set the motion and speed reference.

4.2 Checks Before Powering

After drive mounting and interconnections are completed, verify:

- Correct connections.
- Correct input power supply.
- No short circuit conditions.
- No loose screw terminals (check especially for loose wire clippings).
- Proper load conditions.

4.3 Precautions

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

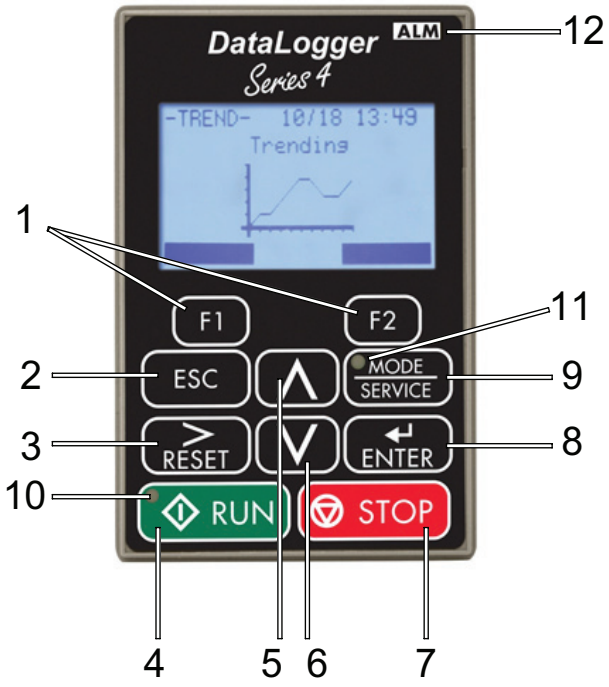
4.4 DataLogger Series 4 (DLS4) Keypad

With five 16-character lines available, the DLS4 keypad makes it possible to monitor drive operation, change parameter settings, and view fault codes. In addition, the parameter description is included on the top line of the display. The logging capabilities of the DLS4 simplify troubleshooting by logging detailed operational histories that are necessary for cost-saving preventive maintenance. The DLS4 keypad has a battery that is used to maintain power to a real time clock when it is not supplied power from the drive. This ensures the date and time are retained. ***See Section 6.2.1 on page 102*** for instructions when the display notifies the user that the battery level is low. The DLS4 keypad enables you to:

- Program the various drive parameters.
- Monitor the functions of the drive.
- Read alpha-numeric fault-diagnostic indications.
- Log events, trend data, and store parameter sets.

4.4.1 Keypad LED and Button Functions

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



1	F1 F2	F1 will move the cursor to the left when editing a parameter. Likewise, F2 will move the cursor to the right when editing a parameter.
2	ESC	• Returns to the previous display. • Returns to the parameter (disregards edits).
3	RESET	• Moves the cursor to the right. • Resets the current fault when the fault condition is cleared.
4	RUN	This button has no function.
5		Scrolls up to display the next item, selects parameter numbers, and increments setting values.
6		Scrolls down to display the previous item, selects parameter numbers, and decrements setting values.
7	STOP	This button baseblocks the drive.
8	ENTER	• Enters parameter values and settings. • Selects a menu item to move between displays.

9		Displays the phone number for the Magnetek Service Department.
10		• On while the drive is operating the motor. • Flashing when Run command is applied without the Enable input
11		Lit when the Enable digital input is on.
12		• Off during normal operation (no fault or alarm). • On continuously when the drive detects a fault. • Flashing when the drive detects an alarm.

4.5 Parameters

There are numerous parameters that determine how the DDC-S2 drive functions. These parameters are programmed into the drive's software as measurable values or options, both of which will be referred to in this manual as settings. While some of these parameters are associated with one setting, others are tied to a number of possible settings.

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

Before shipping the drive, Magnetek programmed initial settings in the drive's software so that most, if not all, of the crane system requirements are supported. If it is necessary to change the initial settings, Magnetek recommends that only qualified crane system technicians program the drive. This can be accomplished by using the Password and Access Level features. For more information on these security features, ***see Section 4.5.2 on page 47***.

Two other features to be aware of are Initialize Parameters (A01-05) and Store Values (O03-01). Both of these features are related and revert back to previously saved parameter settings. This is especially helpful when a number of programming changes were made but the previous settings may still be needed. To program these features, ***see Restore Values (A01-05) on page 51*** and Store Values (O03-01) in ***Table 5-47 on page 94***.

NOTE: *The drive is limited to 65 modified parameters.*

4.5.1 DLS4 Keypad Menu Structure

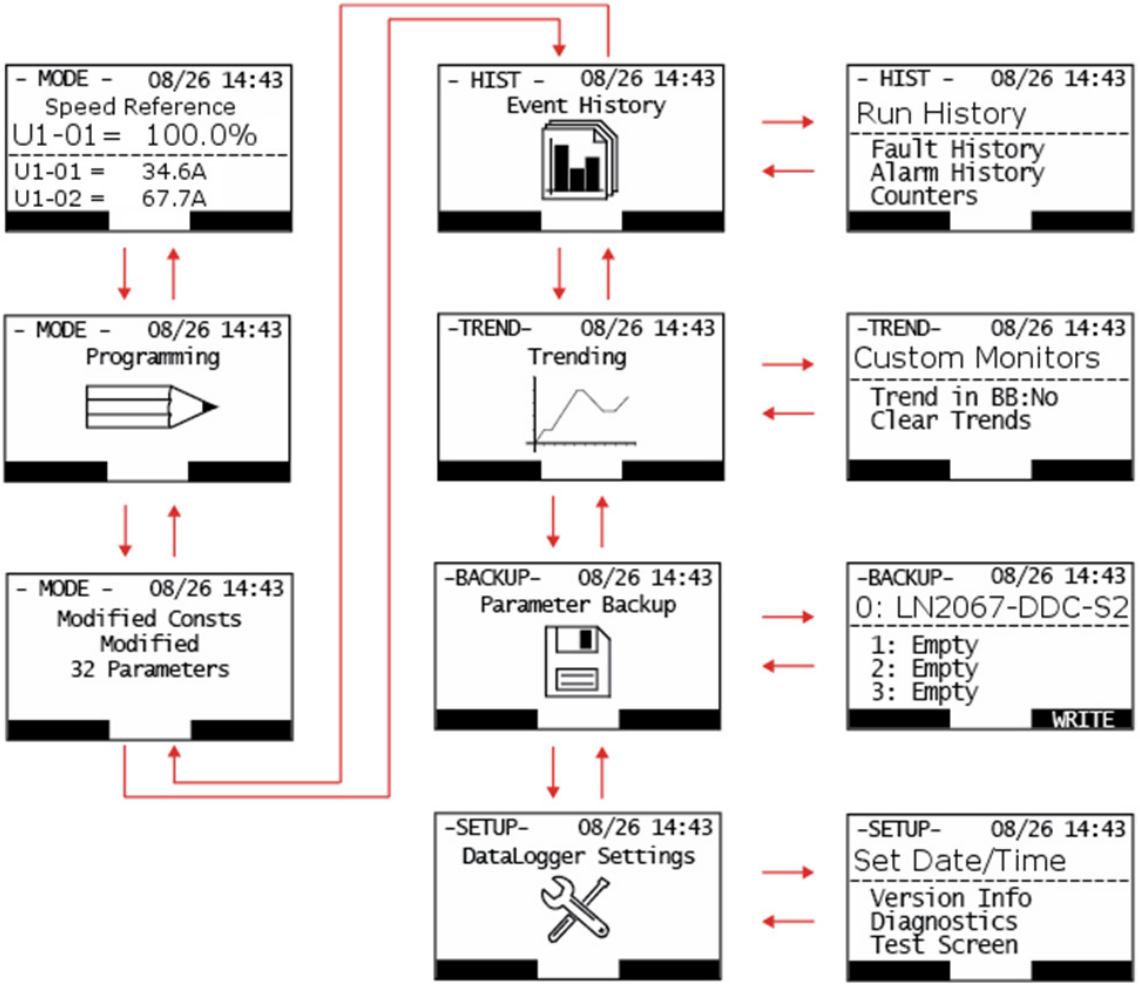


Figure 4-1: Keypad Menu Map

Table 4-1: Parameter Menu Structure

Menu Level	Group		Function	Page Number
Programming	Initialization	A01	Access Level, Motion, and Speed Reference	***47***
	Application	B01	Hoist Speeds	***53***
		B02	Traverse Speeds and Torques	***54***
		B03	Reference Source	***55***
		B05	Accel/Decel Times	***57***
	Special Functions	C02	Micro-Speed™	***58***
		C03	Travel Limits	***59***
		C07	Current Limits	***64***
		C08	Brake Control	***64***
		C11	Slack Cable	***66***
		C12	Timer Function	***67***
	Drive Settings	D01	Start/Stop Sequence	***68***
		D04	Automatic Speed Regulator (ASR)	***70***
	Motor Settings	E01	Field Settings	***71***
		E02	Motor Settings	***75***
	Motor Feedback and Networking	F01	Encoder Feedback	***76***
		F02	Tachometer Feedback	***76***
		F07	EtherNet/IP	***79***
	Terminal I/O	H01	Digital Inputs	***80***
		H02	Digital Outputs	***82***
		H03	Analog Inputs	***83***
		H04	Analog Outputs	***84***
		H05	Serial Communications	***86***
	Protection	L01	Drive Protection	***87***
		L02	DC Bus Levels	***88***
		L08	Motor Protection	***89***
		L09	Fault Reset	***90***
	Operator	O02	Drive Configuration	***92***
		O03	Maintenance History	***94***
Monitors		U01	Status	***95***
		U02	Fault Trace	***98***
		U03	Fault History	***99***
		U04	Maintenance	***100***
		U06	Ethernet/IP	***104***

4.5.2 Initialization

4.5.2.1 Parameter Access Level (A01-01)

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

Table 4-2: Parameter Access Level Settings

Setting	Description
0	**Monitor Only** Access to parameters A01-01, A01-08, and all monitor parameters only
1	**Basic Mode** Access to a limited number of parameters such as speed/torque presets and acceleration/deceleration times
2	**Advanced Mode** All parameters can be viewed and edited

4.5.2.2 X-Press Programming

X-Press Programming™ automatically configures several commonly used parameters and features when the Motion (A01-03) or Speed Reference (A01-04) are programmed. ***See Table 4-5 on page 48***, ***Table 4-6 on page 49***, and ***Table 4-7 on page 50*** for X-Press Programming defaults.

4.5.2.3 Motion (A01-03)

Set this parameter to match the motion of the application.

Table 4-3: Motion Settings

Setting	Description
0	Hoist
1	Traverse/General Purpose

4.5.2.4 Speed Reference (A01-04)

This parameter will automatically define the input terminals for the selections listed below.

Table 4-4: Speed Reference Settings

Setting	Description
0	**2-SPD Multi-Step** – Defines Terminal S3 = 2nd speed
1	**3-SPD Multi-Step** – Defines Terminals S3 and S4 as speeds 2 and 3, respectively
2	**5-SPD Multi-Step** – Defines Terminals S3-S6 as speeds 2-5 (default)
5	**Uni-Polar Analog** – Terminals S1 and S2 = Run Command. Defines Terminal A1 as Analog Reference 1 with a range of 0-10V or 4-20mA. Sets Speed and Torque Reference to Analog Reference 1

WARNING

When changing A01-03 or A01-04, the digital inputs, analog inputs, speed reference parameters, among others, will be overwritten by X-Press Programming™ (***Table 4-6 on page 49*** and ***Table 4-7 on page 50***). All parameter settings must be verified for proper operation.

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

Input	A01-04 =			
	0 2-Spd Multi-Step	**1** 3-Spd Multi-Step	**2** 5-Spd Multi-Step	**5** Uni-Polar Analog
Terminal S1	REV	REV	REV	REV
Terminal S2	FWD	FWD	FWD	FWD
Terminal S3	Step 2	Step 2	Step 2	-
Terminal S4	-	Step 3	Step 3	-
Terminal S5	-	-	Step 4	-
Terminal S6	-	-	Step 5	-
Terminal S7	-	-	-	-
Terminal A1	-	-	-	Spd Ref

4.5.2.5 Parameters Changed by X-Press Programming

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

Parameter	Description	Units	A01-04 =			
			0 2-Spd Multi-Step	**1** 3-Spd Multi-Step	**2** 5-Spd Multi-Step	**5** Uni-Polar Analog
B01-01	Hoist Speed 1	%	20	20	20	0
B01-02	Hoist Speed 2	%	100	60	40	0
B01-03	Hoist Speed 3	%	0	100	60	0
B01-04	Hoist Speed 4	%	0	0	80	0
B01-05	Hoist Speed 5	%	0	0	100	0
B01-06	Lower Speed 1	%	20	20	20	0
B01-07	Lower Speed 2	%	100	60	40	0
B01-08	Lower Speed 3	%	0	100	60	0
B01-09	Lower Speed 4	%	0	0	80	0
B01-10	Lower Speed 5	%	0	0	100	0
B03-01	Speed Source 1	-	1	1	1	2
B03-02	Run Source 1	-	1	1	1	1
C07-02	I/T Limit REV	%	100	100	100	100
C08-12	DB Delay	ms	300	300	300	300
C08-13	DB Time	ms	300	300	300	300
C08-16	SB Rel PT	%	40	40	40	40
E01-03	Economy Field	%	75	75	75	75
E01-04	Minimum Field	%	75	75	75	75
E02-07	Motor Connection	-	0	0	0	0
F07-15	I Ref Enabled	-	0	0	0	0
H01-03	MFDI S3	-	0	0	0	F
H01-04	MFDI S4	-	F	1	1	F
H01-05	MFDI S5	-	F	F	2	F
H01-06	MFDI S6	-	F	F	3	F
H01-07	MFDI S7	-	F	F	F	F
H03-01	Term A1 Signal	-	0	0	0	0
H03-02	Term A1 Select	-	F	F	F	0
L08-01	AOC Detect Level	%	20	20	20	20

Table 4-7: Traverse (A01-03 = 1)

Parameter	Description	Units	A01-04 =			
			0 2-Spd Multi-Step	**1** 3-Spd Multi-Step	**2** 5-Spd Multi-Step	**5** Uni-Polar Analog
B02-01	Speed 1	%	20	20	20	0
B02-02	Speed 2	%	100	60	40	0
B02-03	Speed 3	%	0	100	60	0
B02-04	Speed 4	%	0	0	80	0
B02-05	Speed 5	%	0	0	100	0
B02-06	Mtr Torque 1	%	20	20	20	0
B02-07	Mtr Torque 2	%	100	60	40	0
B02-08	Mtr Torque 3	%	0	100	60	0
B02-09	Mtr Torque 4	%	0	0	80	0
B02-10	Mtr Torque 5	%	0	0	100	0
B02-11	Neutral Torque	%	2	2	2	2
B02-12	Plug Torque 1	%	20	20	20	0
B02-13	Plug Torque 2	%	100	60	40	0
B02-14	Plug Torque 3	%	0	100	60	0
B02-15	Plug Torque 4	%	0	0	80	0
B02-16	Plug Torque 5	%	0	0	100	0
B03-01	Speed Source 1	-	1	1	1	2
B03-02	Run Source 1	-	1	1	1	1
B03-03	Trq Source 1	-	1	1	1	2
C08-12	DB Delay	ms	0	0	0	0
C08-13	DB Time	ms	0	0	0	0
C08-16	SB Rel PT	%	0	0	0	0
E01-03	Economy Field	%	75	75	75	75
E01-04	Minimum Field	%	75	75	75	75
E02-07	Motor Connection	-	1	1	1	1
F07-15	I Ref Enabled	-	1	1	1	1
H01-03	MFDI S3	-	0	0	0	F
H01-04	MFDI S4	-	F	1	1	F
H01-05	MFDI S5	-	F	F	2	F
H01-06	MFDI S6	-	F	F	3	F
H01-07	MFDI S7	-	F	F	F	F
H03-01	Term A1 Signal	-	0	0	0	0
H03-02	Term A1 Select	-	F	F	F	0
L08-01	AOC Detect Level	%	0	0	0	0

4.5.2.6 Restore Values (A01-05)

Use this parameter to reset the drive to its factory default settings or a user set.

Table 4-8: Restore Parameter Values

Setting	Description
0	**No Action** (factory default)
1	**User Settings** Resets parameters to the values saved by the user as User Settings (O03-01 = 1)
2	**As Built** Resets parameters to the values saved by the factory according to the As Built drawing
3	**Factory Defaults** Resets parameters to the factory defaults

4.5.2.7 Password Entry (A01-08)

This parameter enables the user to enter a password that allows higher levels of parameter access (see A01-01) other than the monitor parameter group.

Table 4-9: Password

Setting	Description
0	**Locked** A01-01 is locked to a value of 0 - **Monitor Only** access
2004	**Advanced Mode** A01-01 unlocked up to the Advanced Parameter Access level

Table 4-10 on page 51 lists parameters that must be configured for the OmniPulse DDC Series 2 to operate safely. To gain access to these parameters, the password must be entered in parameter A01-08. The default password is: 2004.

Table 4-10: Quick Start Parameter Settings

Parameter	Display	Function	Range	Default
A01-01	Access Level	Parameter access security level.	0-2	2
	0 Monitor Only	Access to only parameters A01-01, A01-08, and all U monitor parameters.		
	1 User	Access to a limited number of parameters such as speed/ torque presets and acceleration/deceleration times.		
	2 Advanced	All parameters can be viewed and edited.		
A01-03	Motion	Defines the type of motion the DDC-S2 will be controlling.	0-1	0
	0 Hoist			
	1 Traverse			
A01-04	Speed Ref	Defines the source of the speed reference.	0-5	2
	0 2-Spd Multi-Step	Terminal S3 = 2nd speed.		
	1 3-Spd Multi-Step	Terminals S3 and S4 as speeds 2 and 3, respectively.		
	2 5-Spd Multi-Step	Terminals S3-S6 as speeds 2-5, respectively.		
	5 Uni-Polar Analog	Terminals S1 and S2 = Run Command. Defines Terminal A1 as Analog Reference 1 with a range of 0-10V. Sets Speed and Torque Reference to Analog Reference 1.		

Parameter	Display	Function	Range	Default
A01-08	Password	Access level password. (Enter 2004 to unlock Advanced Mode)	0-9999	2004
B05-01	Hoist Accel Time	Hoisting acceleration time when in hoist mode.	0.0-25.0 sec	5.0
B05-02	Hoist Decel Time	Hoisting deceleration time when in hoist mode.	0.0-25.0 sec	1.5
B05-03	Lower Accel Time	Lowering acceleration time when in hoist mode.	0.0-25.0 sec	5.0
B05-04	Lower Decel Time	Lowering deceleration time when in hoist mode.	0.0-25.0 sec	1.5
B05-05	Trav Accel Time	Acceleration time when in traverse mode.	0.0-25.0 sec	5.0
B05-06	Trav Decel Time	Deceleration time when in traverse mode.	0.0-25.0 sec	5.0
E02-01	Rated Current	Motor rated armature current as listed on the motor nameplate. Also defines the rated field current if a series motor is connected.	1-2000 Amps	1/2 of drive current selected by O02-04
E02-02	Field Current	Motor rated field current as listed on the motor nameplate. Visible only when an external CT board is used to monitor field current (Field Setup O02-07 not equal to 0).	Dependent on O02-04 and O02-07	
E02-03	Motor Rated Volt	Motor rated voltage as listed on the motor nameplate. This parameter is used with the motor base speed (E01-04) to calculate the display RPM.	LV: 200-360 VDC	250
			HV: 400-720 VDC	500
E02-04	Motor Base Speed	Motor rated speed as listed on the nameplate	0-5000 RPM	400
O02-04	Drive Model	Selects the appropriate DDC-S2 drive model based on the system voltage and connected hardware.	0-17	0
	0 LN2067-DDC-S2	67 ADC, 250 VDC (Small Chassis)		
	1 LN3133-DDC-S2	133 ADC, 250 VDC (Small Chassis)		
	2 LN4200-DDC-S2	200 ADC, 250 VDC		
	3 LN5400-DDC-S2	400 ADC, 250 VDC		
	4 LN6800-DDC-S2	800 ADC, 250 VDC, 2 Parallel Stacks		
	5 LN71200-DDC-S2	1200 ADC, 250 VDC, 3 Parallel Stacks		
	6 LN8S1600-DDC-S2	1600 ADC, 250 VDC, 4 Parallel Stacks		
	7 LN8L2000-DDC-S2	2000 ADC, 250 VDC, 5 Parallel Stacks		
	10 HN2067-DDC-S2	67 ADC, 500 VDC		
	11 HN3133-DDC-S2	133 ADC, 500 VDC		
	12 HN4200-DDC-S2	200 ADC, 500 VDC		
	13 HN5400-DDC-S2	400 ADC, 500 VDC		
	14 HN6800-DDC-S2	800 ADC, 500 VDC, 2 Parallel Stacks		
	15 HN71200-DDC-S2	1200 ADC, 500 VDC, 3 Parallel Stacks		
	16 HN8S1600-DDC-S2	1600 ADC, 500 VDC, 4 Parallel Stacks		
	17 HN8L2000-DDC-S2	2000 ADC, 500 VDC, 5 Parallel Stacks		

NOTE: *When connecting parallel stacks, do NOT mix and match OmniPulse Series 1 drives with OmniPulse Series 2. Combining different series drives may cause a short circuit condition and/or damage to the drives.*

5 Programming Advanced Features

5.1 Introduction

This chapter features parameters that are available for reading and writing when the DDC-S2 drive is in Advanced Mode. The Monitor Mode parameters, which are available for reading with any access level, are described at the end of this chapter.

5.2 Application

5.2.1 Preset Reference

- B01 Hoist Mode Speed References
- B02 Traverse Mode Speed References
- B03 Run/Speed/Torque Reference Source
- B05 Acceleration/Deceleration

5.2.1.1 Hoist Mode Speed References (B01-01 through B01-10)

Parameters B01-01 through B01-10 define the operating speeds in percent of motor base speed (E02-04) when the motion is configured for Hoist Mode. The maximum speeds are also limited by the field current parameters (E01-01 through E01-04).

Table 5-1: Hoist Mode Speed Reference Settings

Parameter	Display	Function	Range	Default
B01-01	Hoist Speed 1	Hoist Speed 1	0.0-300.0%	20.0*
B01-02	Hoist Speed 2	Hoist Speed 2	0.0-300.0%	40.0*
B01-03	Hoist Speed 3	Hoist Speed 3	0.0-300.0%	60.0*
B01-04	Hoist Speed 4	Hoist Speed 4	0.0-300.0%	80.0*
B01-05	Hoist Speed 5	Hoist Speed 5	0.0-300.0%	100.0*
B01-06	Lower Speed 1	Lower Speed 1	0.0-200.0%	20.0*
B01-07	Lower Speed 2	Lower Speed 2	0.0-200.0%	40.0*
B01-08	Lower Speed 3	Lower Speed 3	0.0-200.0%	60.0*
B01-09	Lower Speed 4	Lower Speed 4	0.0-200.0%	80.0*
B01-10	Lower Speed 5	Lower Speed 5	0.0-200.0%	100.0*

** Initial value is determined by X-Press Programming (**Table 4-6 on page 49** or **Table 4-7 on page 50**).*

5.2.1.2 Traverse Mode Speed and Torque References (B02-01 through B02-16)

Parameters B02-01 through B02-05 define the operating speeds in percent of motor base speed (E02-04) when the motion is configured for Traverse Mode. The maximum speeds are also limited by the economy (E01-03) and minimum (E01-04) field current parameters.

Parameters B02-06 through B02-16 define motoring, plugging, and neutral torque references based on the master switch position. Motor torque 1 through 5 are applied during motoring operation (acceleration and running forward or reverse). Neutral torque is applied when the master switch has been set to the OFF position or has been reduced by one or more steps (during deceleration, excluding plugging). Plugging torques 1 through 5 are applied during periods of plugging (any time the master switch direction is opposite of the motor direction).

Table 5-2: Traverse Mode Speed Reference Settings

Parameter	Display	Function	Range	Default
B02-01	Speed 1	Traverse Speed 1	0.0-300.0%	20.0*
B02-02	Speed 2	Traverse Speed 2	0.0-300.0%	40.0*
B02-03	Speed 3	Traverse Speed 3	0.0-300.0%	60.0*
B02-04	Speed 4	Traverse Speed 4	0.0-300.0%	80.0*
B02-05	Speed 5	Traverse Speed 5	0.0-300.0%	100.0*
B02-06	Mtr Torque 1	Motoring Torque 1	0.0-200.0%	20.0*
B02-07	Mtr Torque 2	Motoring Torque 2	0.0-200.0%	40.0*
B02-08	Mtr Torque 3	Motoring Torque 3	0.0-200.0%	60.0*
B02-09	Mtr Torque 4	Motoring Torque 4	0.0-200.0%	80.0*
B02-10	Mtr Torque 5	Motoring Torque 5	0.0-200.0%	100.0*
B02-11	Neutral Torque	Neutral Torque	0.0-200.0%	2.0*
B02-12	Plug Torque 1	Plugging Torque 1	0.0-200.0%	20.0*
B02-13	Plug Torque 2	Plugging Torque 2	0.0-200.0%	40.0*
B02-14	Plug Torque 3	Plugging Torque 3	0.0-200.0%	60.0*
B02-15	Plug Torque 4	Plugging Torque 4	0.0-200.0%	80.0*
B02-16	Plug Torque 5	Plugging Torque 5	0.0-200.0%	100.0*

** Initial value is determined by X-Press Programming (**Table 4-6 on page 49** or **Table 4-7 on page 50**).*

5.2.1.3 Reference Source 1 Selection (B03-01 through B03-03)

B03-01, B03-02, and B03-03 determine the source from where the speed, RUN command, and torque references are generated, respectively.

Table 5-3: Reference Source 1 Selection Settings

Parameter	Display	Function	Range	Default	Motion
B03-01	Speed Source 1	Speed reference source.	1-5	1*	H/T
	1 Terminals	Multi-function digital input terminals on the 230 VDC interface board or the 24 VDC control board.			
	2 Analog Ref 1	Speed determined by Multi-Function Analog Input set to Analog Ref 1.			
	3 Analog Ref 2	Speed determined by Multi-Function Analog Input set to Analog Ref 2.			
	4 Serial Comm	RS485 Serial Communications (A, B).			
	5 Ethernet Comm	EtherNet/IP Communications on the X5 connector.			
B03-02	Run Source 1	RUN command source.	1, 2, 5	1*	H/T
	1 Terminals	Multi-function digital input terminals on the 230 VDC interface board or the 24 VDC control board.			
	2 Serial Comm	RS485 Serial Communications (A, B).			
	5 Ethernet Comm	EtherNet/IP Communications on the X5 connector.			
B03-03	Torque Source 1	Torque reference source.	1-5	1*	T
	1 Terminals	Multi-function digital input terminals on the 230 VDC interface board or the 24 VDC control board.			
	2 Analog Ref 1	Torque determined by Multi-Function Analog Input set to Analog Ref 1.			
	3 Analog Ref 2	Torque determined by Multi-Function Analog Input set to Analog Ref 2.			
	4 Serial Comm	RS485 Serial Communications (A, B).			
	5 Ethernet Comm	EtherNet/IP Communications on the X5 connector.			

** Initial value is determined by X-Press Programming (**Table 4-6 on page 49** or **Table 4-7 on page 50**).*

5.2.1.4 Master Switch Fault Time (B03-05)

B03-05 sets the time allowed for both directional inputs to be on simultaneously before the drive will fault on a Master Switch fault (MS). To disable this feature, set B03-05 to 0.

Table 5-4: MS Fault Time Setting

Parameter	Display	Function	Range	Default	Motion
B03-05	MS Fault Time	Time allowed for FWD and REV to be on simultaneously before tripping on an MS fault.	0-200 ms	75	H/T

***NOTE:** To disable this feature, set B03-05 to 0.*

5.2.1.5 Reference Source 2 Selection (B03-15 through B03-17)

B03-15, B03-16, and B03-17 determine the source from where the speed, RUN command, and torque references are generated, respectively, when Reference Source 2 is enabled using a multi-function digital input (H01-xx = 1F).

Table 5-5: Reference Source 2 Selection Settings

Parameter	Display	Function	Range	Default	Motion
B03-15	Speed Source 2	Speed reference source. Enabled by MFDI when H01-xx = 1F.	1-5	1	H/T
	1 Terminals	Multi-function digital input terminals on the 230 VDC interface board or the 24 VDC control board.			
	2 Analog Ref 1	Speed determined by Multi-Function Analog Input set to Analog Ref 1.			
	3 Analog Ref 2	Speed determined by Multi-Function Analog Input set to Analog Ref 2.			
	4 Serial Comm	RS485 Serial Communications (A, B).			
	5 Ethernet Comm	EtherNet/IP Communications on the X5 connector.			
B03-16	Run Source 2	RUN command source. Enabled by MFDI when H01-xx = 1F.	1, 2, 5	1	H/T
	1 Terminals	Multi-function digital input terminals on the 230 VDC interface board or the 24 VDC control board.			
	2 Serial Comm	RS485 Serial Communications (A, B).			
	5 Ethernet Comm	EtherNet/IP Communications on the X5 connector.			
B03-17	Torque Source 2	Torque reference source. Enabled by MFDI when H01-xx = 1F.	1-5	1	T
	1 Terminals	Multi-function digital input terminals on the 230 VDC interface board or the 24 VDC control board.			
	2 Analog Ref 1	Multi-function analog inputs A1 or A2 on the control board.			
	3 Analog Ref 2	Multi-function analog inputs A1 or A2 on the control board.			
	4 Serial Comm	RS485 Serial Communications (A, B).			
	5 Ethernet Comm	EtherNet/IP Communications on the X5 connector.			

5.2.1.6 Acceleration/Deceleration (B05-01 through B05-16)

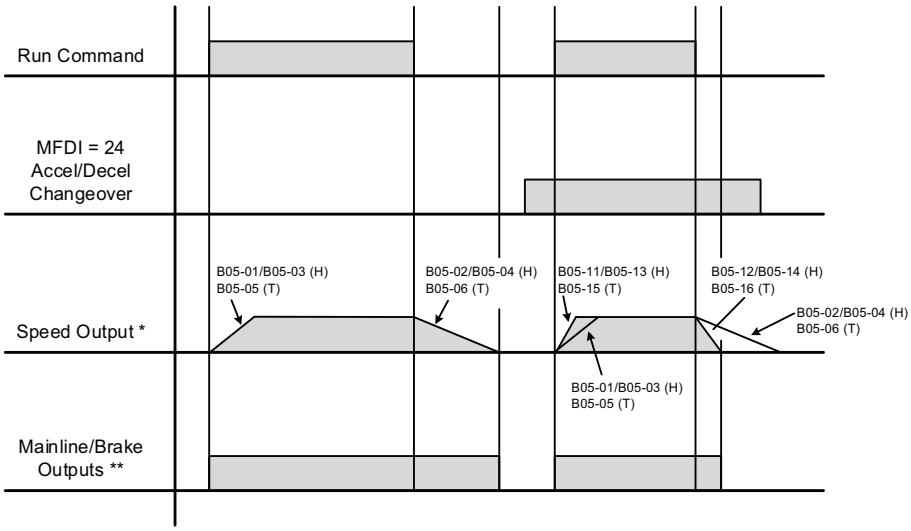
Acceleration time sets the time for the output speed to accelerate from 0% to 100% of motor base speed (E02-04). Deceleration time sets the time for the output speed to decelerate from 100% to 0% of motor base speed (E02-04).

For example, a setting of 5 seconds will accelerate or decelerate a motor from zero speed to E02-04 speed in 5 seconds. An acceleration from 0% to 50% speed will be accomplished in 2.5 seconds. Likewise, a deceleration from 200% to 0% speed will be accomplished in 10 seconds.

Table 5-6: Acceleration/Deceleration Parameter Settings

Parameter	Display	Function	Range	Default	Motion
B05-01	Hoist Accel Time	Hoisting acceleration time when in hoist mode.	0.2-25.0 sec	5.0	H
B05-02	Hoist Decel Time	Hoisting deceleration time when in hoist mode.	0.2-25.0 sec	1.5	H
B05-03	Lower Accel Time	Lowering acceleration time when in hoist mode.	0.2-25.0 sec	5.0	H
B05-04	Lower Decel Time	Lowering deceleration time when in hoist mode.	0.2-25.0 sec	1.5	H
B05-05	Trav Accel Time	Acceleration time when in traverse mode.	0.2-25.0 sec	5.0	T
B05-06	Trav Decel Time	Deceleration time when in traverse mode.	0.2-25.0 sec*	5.0	T
B05-11	Hoist Acc Time 2	Hoisting acceleration time 2. Enabled by an MFDI when H01-xx = 24.	0.2-25.0 sec	5.0	H
B05-12	Hoist Dec Time 2	Hoisting deceleration time 2. Enabled by an MFDI when H01-xx = 24.	0.2-25.0 sec	5.0	H
B05-13	Lower Acc Time 2	Lowering acceleration time 2. Enabled by an MFDI when H01-xx = 24.	0.2-25.0 sec	5.0	H
B05-14	Lower Dec Time 2	Lowering deceleration time 2. Enabled by an MFDI when H01-xx = 24.	0.2-25.0 sec	5.0	H
B05-15	Trav Accel Time2	Traverse acceleration time 2. Enabled by an MFDI when H01-xx = 24.	0.2-25.0 sec	5.0	T
B05-16	Trav Decel Time2	Traverse deceleration time 2. Enabled by an MFDI when H01-xx = 24.	0.2-25.0 sec*	5.0	T

** Trav Decel Time is dependent on B02-11 Neutral Torque when no run command is active. Increase B02-11 to more accurately follow the decel time.*



** Speed output ramp may be longer than B05-xx time if the DDC-S2 drive is in torque limit during acceleration / deceleration*
*** See the Start / Stop sequence for details of the mainline and brake output states.*

Figure 5-1: Normal Accel/Decel Time and Accel/Decel Changeover

5.3 Special Functions

5.3.1 Micro-Speed (C02-01 and C02-02)

Micro-Speed provides a reduced speed range operation for precise positioning. Enabled by a Multi-Function Input, it multiplies the normal speed reference by the Micro-Speed Gain. Two Micro-Speed Gains are available: Gain 1 (C02-01) and Gain 2 (C02-02). They can be adjusted and enabled independently. ***See Figure 5-2 on page 5-58*** for a timing diagram of the Micro-Speed function.

Table 5-7: Micro-Speed Parameter Settings

Parameter	Display	Function	Range	Default
C02-01	MicroSpd Gain 1	The multiplier of the digital or analog speed reference to achieve slow-speed operation. Enabled by an MFDI when H01-xx = E.	H: 0.01-1.00 T: 0.01-2.55	1.00
C02-02	MicroSpd Gain 2	The multiplier of the digital or analog speed reference to achieve slow-speed operation. Enabled by an MFDI when H01-xx = 10.	H: 0.01-1.00 T: 0.01-2.55	1.00

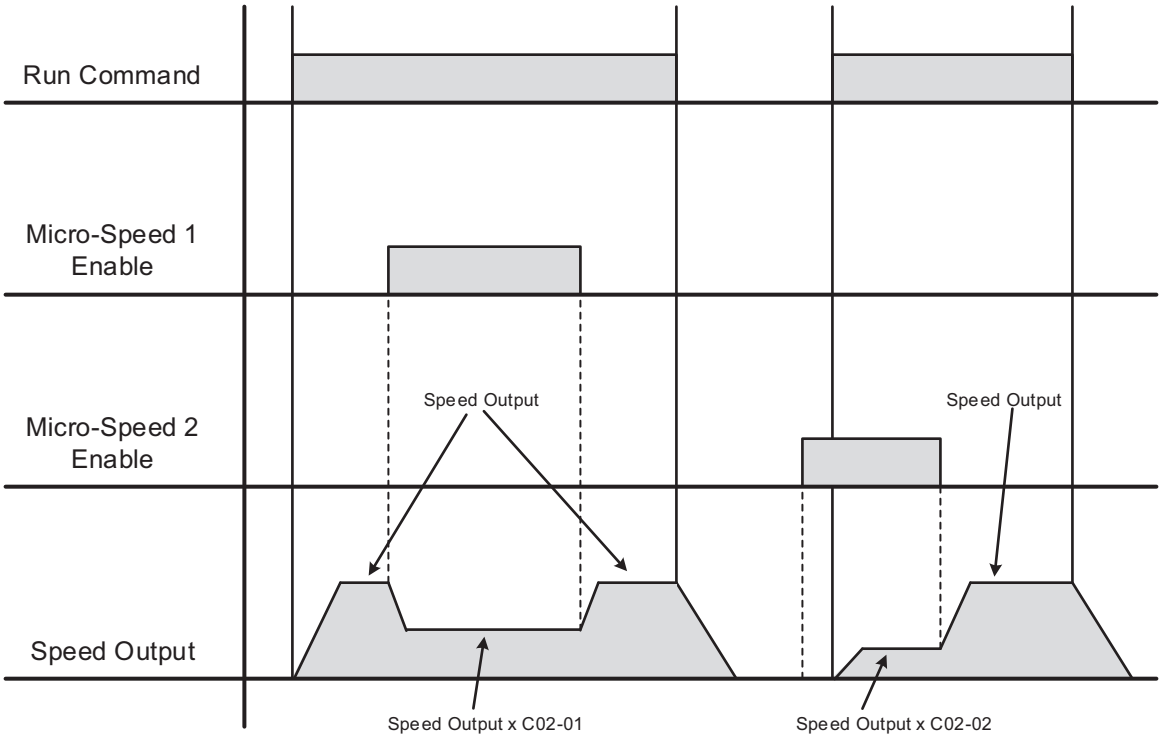


Figure 5-2: Micro-Speed Control

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

5.3.2 Travel Limits

5.3.2.1 End of Travel Slowdown/Stop Limits (C03-01 through C03-08)

This function automatically slows and stops a crane or hoist when it reaches the end of travel limits. Two types of limit inputs, slowdown and stop, are available in Hoist or Traverse Mode. ***See Table 5-29 and Table 5-30 on page 81*** to configure an MFDI for End of Travel Limits.

Table 5-8: End of Travel Slowdown/Stop Limit Settings

Parameter	Display	Function	Range	Default	Motion
C03-01	UL1 Speed	Maximum speed when Upper Limit 1 or Legacy Slowdown is detected (MFDI = 06, 0A, 1E).	0.0-100.0%	10.0	H/T
C03-04	LL1 Speed	Maximum speed when Lower Limit 1 or Legacy Slowdown is detected (MFDI = 08, 0C, 1E).	0.0-100.0%	10.0	H/T
C03-07	Slowdown Torque	Torque reference when a slowdown limit is active in Travel Mode. (MFDI = 06, 08, 0A, 0C, 1E).	0.0-200.0%	75.0	T
C03-08	Stop Torque	Torque reference when a stop limit is active in Travel Mode. (MFDI = 07, 09, 0B, 0D, 1D).	0.0-200.0%	100.0	T

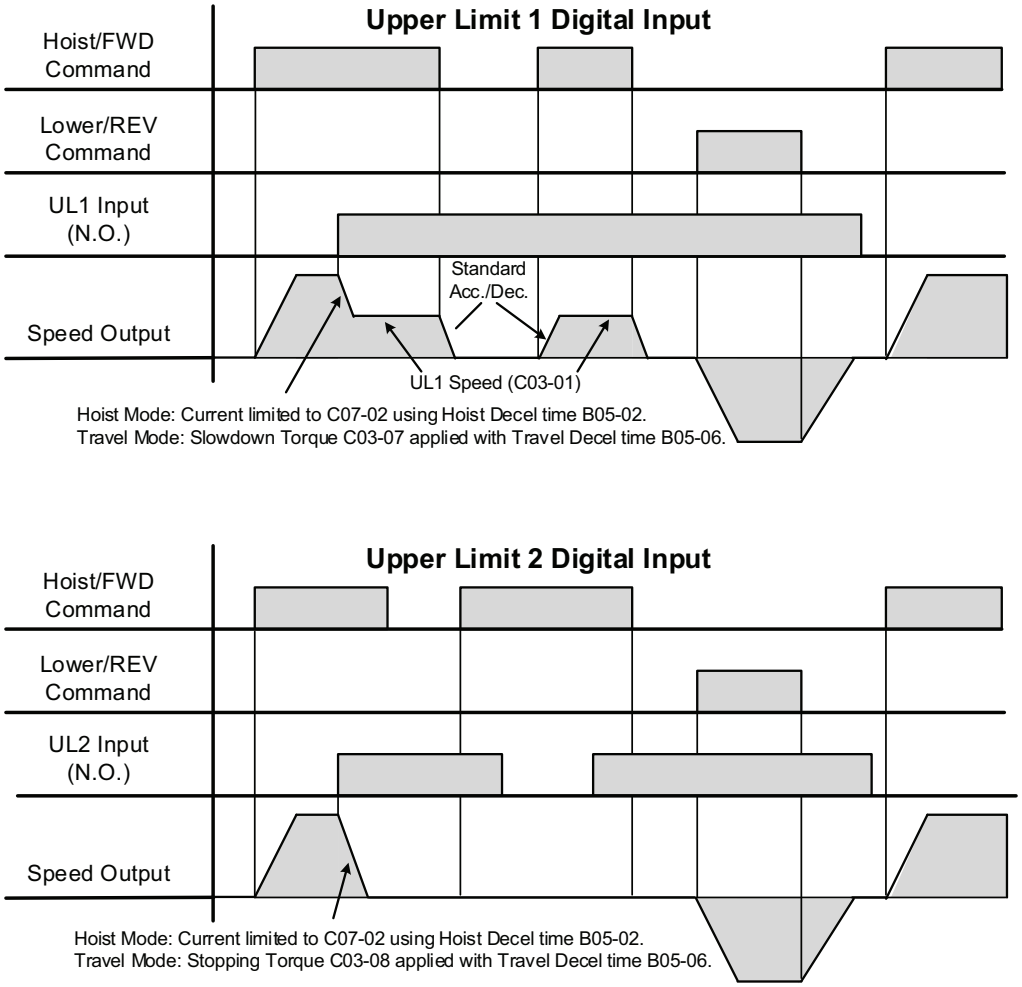
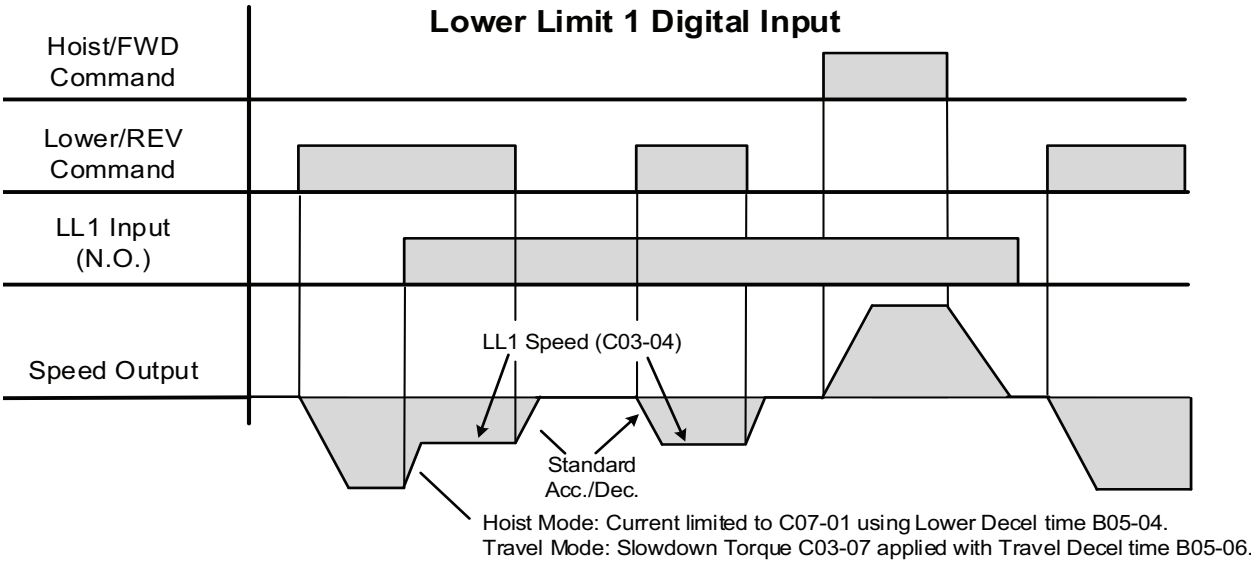


Figure 5-3: Upper Travel Limits



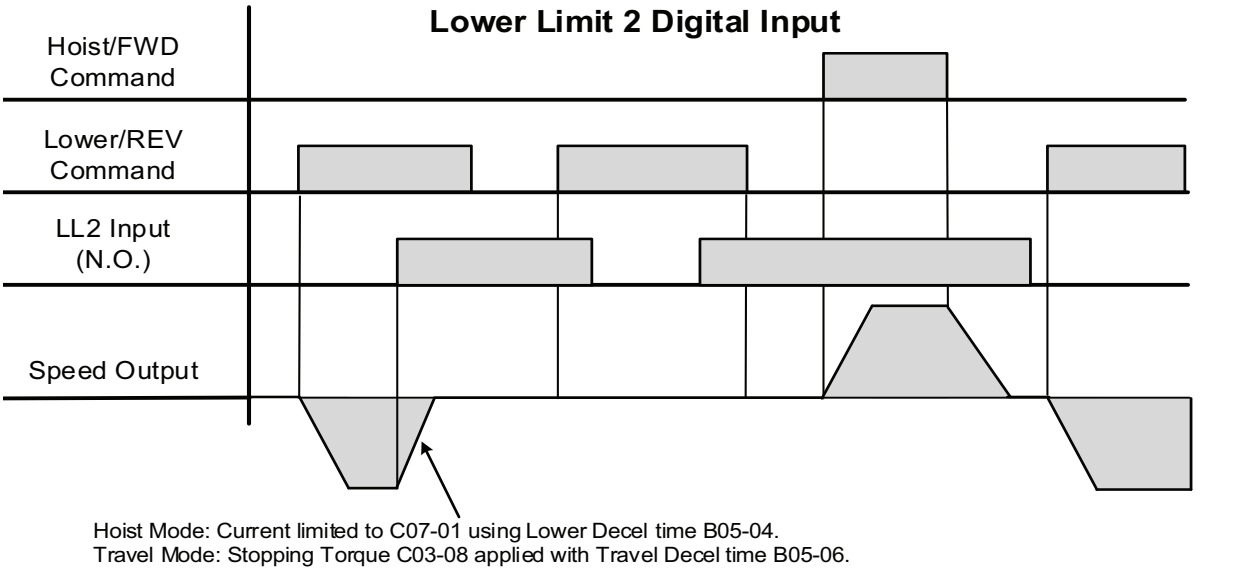


Figure 5-4: Lower Travel Limits

5.3.2.2 Hook Height Measurement (C03-13 through C03-15)

Hook Height Measurement provides a monitor parameter (U01-50) and analog output proportional to the hook's current position between a home position and a limit position. Hook height programming is used in conjunction with the Electronic Programmable Limit Switch parameters. See ***Figure 5-5 on page 62*** for Hook Height configuration. The physical limit switch must be normally open (N.O.) to prevent homing during a power-down or power loss.

Table 5-9: Hook Height Parameter Settings

Parameter	Display	Function	Range	Default
C03-13	Height Measure	Number of motor revolutions from the top of travel (FWD direction) to the bottom of travel (REV direction).	0-65535 Rev	250
C03-14	Hook Height Home	MFDI used for setting the Hook Height Home.	0-4	2
	0 *Home = UL2 N.O.*	*Motor Revolutions is set to 0 when UL2 N.O. is closed (H01-xx = 07).*		
	1 *Home = LL2 N.O.*	*Motor Revolutions is set to C03-13 when LL2 N.O. is closed (H01-xx = 09).*		
	2 *Home MFDI Upper*	*Home MFDI Upper Motor Revolutions is set to 0 when Hook Height Home is closed (H01-xx = 25).*		
	3 *Home MFDI Lower*	*Motor Revolutions is set to C03-15 when Hook Height Home is closed (H01-xx = 25).*		
	4 *Home = UL3 N.O.*	*Motor Revolutions is set to 0 when UL3 N.O. is closed (H01-xx = 22).*		
C03-15	Hook Height Out	Output voltage for the analog Hook Height monitor.	0, 1	0
	0 *0 Revs = 0%*	*U01-42 = 0%, MFAO = 0V*		
	1 *0 Revs = 100%*	*U01-42 = 100%, MFAO = 10V*		

NOTE: *Motor revolutions (U01-40) will not go negative. If 0 motor revolutions has been reached and the hoist continues in the Up (FWD) direction, the motor revolutions will remain at 0.*

NOTE: *An N.O. contact must be used for the Hook Height Home input.*

Table 5-10: Monitor Values at Hook Height Home Position

		C03-15 = 0	C03-15 = 1
C03-14	**U01-40**	**U01-42**	**U01-42**
0	0	0%	100%
1	C03-13	100%	0%
2	0	0%	100%
3	C03-13	100%	0%
4	0	0%	100%

5.3.2.3 Electronic Programmable Limit Switch (EPLS) (C03-16 through C03-19)

Using the motor revolutions (U01-40) from the Height measurement function, it is possible to program UL1, UL2, LL1, and LL2 positions without the use of rotary limit switches. When C03-16, C03-17, C03-18, or C03-19 has a value other than 0, the EPLS function will be enabled. Hook height measurement must be correctly set up before using EPLS.

Table 5-11: Electronic Programmable Limit Switch Parameter Settings

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

NOTE: *A setting of 0 disables the associated limit.*

Table 5-12: Limit Switch Outputs

H02-0x	Function
08 - Travel Limit	Output ON when keypad displays UL1, UL2, LL1, LL2, LIM1, or LIM2

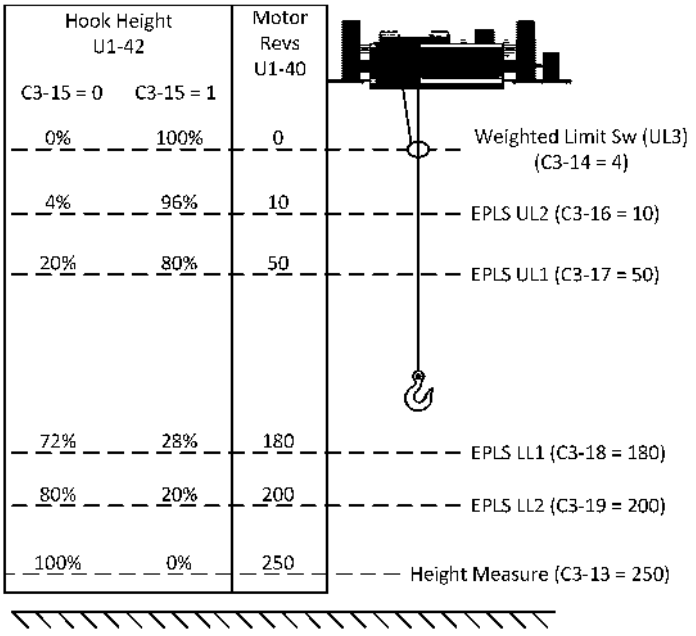


Figure 5-5: EPLS Example

5.3.2.4 Lower Limit/Upper Limit Bypass MFDI

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

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

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

Table 5-13: Electronic Programmable Limit Switch Bypass Parameter Settings

Functions Bypassed	H01-0x settings will bypass the functions in the leftmost column when the input is activated	
	28	29
Upper Limit 1 N.O. (MFDI = 06)		x
Upper Limit 2 N.O. (MFDI = 07)	x	x
Lower Limit 1 N.O. (MFDI = 08)		x
Lower Limit 2 N.O. (MFDI = 09)	x	x
Upper Limit 1 N.C. (MFDI = 0A)		x
Upper Limit 2 N.C. (MFDI = 0B)	x	x
Lower Limit 1 N.C. (MFDI = 0C)		x
Lower Limit 2 N.C. (MFDI = 0D)	x	x
UL2 Detected by EPLS (C03-16)	x	x
UL1 Detected by EPLS (C03-17)		x
LL1 Detected by EPLS (C03-18)		x
LL2 Detected by EPLS (C03-19)	x	x

x = Limit Bypass

5.3.2.5 Power Limit Switch (C03-20 through C03-23)

This function enables an upper stop limit when the drive is configured for Hoist Mode. This is achieved either by detecting a power limit switch trip by sensing an absence of armature current, or by a multi-function digital input. The LS MFDI method should be considered whenever the hook and any attached loads are less than 10% of the rated hoist capacity.

When the Hoist Power Limit Switch is triggered, the drive will stop outputting current to the motor and set the brake. An LS fault will be issued if a new lift is attempted and will clear automatically during LS backout. Only lowering is permitted until the power limit switch is reset or the LS MFDI is turned off.

Adjust the LS Backout Time (C03-23) for the desired lowering time when a power limit switch is tripped. This time must exceed the level of the Start Delay (D01-01) for the drive to output field current to release the brake and lower the load.

Table 5-14: Power Limit Switch Parameter Settings

Parameter	Display	Function	Range	Default	Motion
C03-20	LS Detection	Selects the type of upper Limit Switch detection when the drive is configured for Hoist Mode.	0-4	0	H
	0 Disabled				
	1 Hook Load Sense	LS fault detected by software (current and voltage sense).			
	3 HLS No Fault	LS fault detected by software (current and voltage sense). Fault not logged in Fault History.			
	4 ELS No Fault	LS fault detected by external limit switch (H01-xx = 22 or 23). Fault not logged in Fault History.			
C03-23	LS Backout Time	Specifies the time allotted to lower the hoist out of a tripped power limit switch.	0.0-10.0 sec	0.5	H

5.3.3 Current Limits (C07-01 and C07-02)

The Current Limit Function limits the armature current the drive is capable of outputting in Hoist Mode.

Table 5-15: Torque Limit Parameter Settings

Parameter	Display	Function	Range	Default
C07-01	I Limit Hoist	Positive Hoisting Current Limit	0.0-200.0%	125.0
C07-02	I Limit Lower	Positive Lowering Current Limit	0.0-200.0%	100.0

5.3.4 Brake Control (C08-04 through C08-21)

Brake Control parameters are used to set up the action and coordination of the holding brake (series or shunt) and, if Hoist Mode is selected, the Dynamic Brake contactor. ***See Figure 5-7 on page 5-69*** and ***Figure 5-8 on page 69*** for brake control timing information.

5.3.4.1 Brake Release Time (C08-04)

In Hoist Mode, the Brake Release Time sets the required time for field current to establish and release the brake before outputting armature voltage to start the desired motion. In Traverse Mode, the output of field voltage will start once the Start Delay (D01-01) plus the Brake Release Time is complete. When the motion is configured for Hoist Mode, lengthen this time to prevent nuisance LS fault trips.

5.3.4.2 Load Float Time (C08-10)

Load Float will attempt to maintain the motor shaft at a stationary position with the brake open for the C08-10 time. Load Float begins when the motor CEMF is zero, and the brake sets when the Load Float time is complete. A FWD or REV run command will take priority over this function.

CAUTION

Long and frequent Load Float times can cause motor overheating. Ensure the hoist is operated within the motor's specified duty cycle when the Load Float feature is in use.

5.3.4.3 Shunt Brake Time (C08-11)

Once the stop speed (D01-03, D01-04, D01-05, depending on the motion and direction) has been reached, the Shunt Brake MFDO will be deenergized and the Shunt Brake Time will begin. This delay allows time for the shunt brake to close before the Dynamic Brake contactor MFDO is deenergized.

5.3.4.4 Dynamic Brake Delay (C08-12)

This parameter allows time for the Dynamic Braking contactor to close when the stop speed is reached and C08-11 time has elapsed on a commanded shutdown. Armature output voltage will remain present during this time. If arcing occurs at the DB Contactor, increase the C08-12 DB Delay.

5.3.4.5 Dynamic Brake Time (C08-13)

The Dynamic Brake Time allows the load to be dynamically braked and slowed before the Mainline Contactor MFDO is deenergized.

5.3.4.6 Shunt Brake Release Point (C08-16)

In Hoist Mode, the Shunt Brake MFDO will energize when both the armature and field current are equal to or greater than the SB Release Point. In Traverse Mode, the Shunt Brake MFDO will energize when only the field current is equal to or greater than the SB Release Point.

5.3.4.7 Shunt Brake On Delay (C08-21)

The Shunt Brake On Delay starts when the Shunt Brake Release Point (C08-16) is satisfied. The Shunt Brake MFDO is energized when the SB On Delay is complete.

Table 5-16: Brake Control Parameter Settings

Parameter	Display	Function	Range	Default
C08-04	Brake Rel Time	Delays the release of a series brake.	0-2500 ms	0
C08-10	Load Float Time	Time that brake will remain open and motor will maintain zero speed at end of the deceleration time.	0.0-20.0 sec	0.0
C08-11	SB Time	Time that allows shunt brake to close before deenergizing the DB Contactor MFDO.	0-2500 ms	0
C08-12	DB Delay	Time that allows the DB contactor to close before setting armature output voltage to zero.	0-2500 ms	H: 300 T: 0
C08-13	DB Time	DB time before the mainline contactor MFDO is deenergized.	0-2500 ms	H: 300 T: 0
C08-16	SB Release Pt	Percentage of motor current required to energize the Shunt Brake MFDO.	0.0-40.0%	H: 40.0 T: 0.0
C08-21	SB On Delay	Delays the release of the Shunt Brake after the SB Release Point is reached.	0-2500 ms	0

See Figure 5-7 on page 5-69 *and* ***Figure 5-8 on page 69*** *for timing diagrams that illustrate the drive start and stop sequence and brake control.*

5.3.5 Rescue Mode (C08-25)

The purpose of Rescue Mode is to ensure safe handling of faults that occur as a result of a short-circuited IGBT and to allow continued operation at limited performance in cases where the remaining IGBTs are still able to provide some hoisting capability. In the event of a short-circuited IGBT (namely the lower IGBT of the T3 leg), a short-circuit (SC) fault will occur; however, a heavy load may continue to drift downward due to abnormal current flowing through the series brake, thus keeping it from setting.

The Rescue Mode state is entered if field or armature current is detected when the DDC-S2 drive is in the Fault or Ready state. Abnormal currents indicate that it is highly probable that either the upper IGBT of the T1 leg or the lower IGBT of the T3 leg has short-circuited. The display will show a short circuit (SC) warning until a run command is given. When a run command is given U01-06 will display “15: Rescue”.

During the rescue state the M contactor is held closed and the DB contactor is held open, and the hoist may be operated with limited functionality. The hoist speed is controlled using armature voltage feedback and is limited by applying a fixed reference of approximately 20% when the user provides a hoist command, 7% when no run command is provided, and 0% when the user provides a lowering command. A hoist command will slowly lift the load, and a lowering command will slowly lower the load. The brake will set once the load reaches the floor. The user must ensure that the load is either put down or is held by the brake before removing power from the hoist.

To exit Rescue Mode, the power to the DDC-S2 drive must be cycled.

Table 5-17: Rescue Mode Parameter Settings

Parameter	Display	Function	Range	Default	Motion
C08-25	Rescue Mode	Determines whether the Rescue Mode function is enabled.	0-1	0	H
	0 Disabled				
	1 Enabled				

5.3.6 Slack Cable Detection (C11-01 through C11-04)

In Hoist Mode, Slack Cable (SLC) is useful to prevent the pay-out of excess cable from the drum when the load has reached the floor. If enabled, the SLC function will slow the drive in the lowering direction and issue a Slack Cable alarm (SLC) whenever the motor torque is less than C11-03 (Slack Cable Torque) during the C11-02 detection time. If SLC is triggered, a hoist motion is allowed, which will clear the Slack Cable alarm condition. Normal operation will continue unless the Slack Cable detection condition is triggered again.

Slack Cable Detection Setup Procedure

- Lower the hoist without load at a constant speed. Monitor and record the torque reference (U01-09). Repeat the above operation several times to ensure an accurate reading.
- Set C11-03 = (U01-09)-2%.
- Set the Slack Cable Detection Time (C11-02) to the maximum permissible lowering time once the load has reached the floor.
- Set C11-01 = 1 to enable Slack Cable Detection, or C11-01 = 2 to enable Slack Cable Detection with an MFDI (H01-xx = 11).

Table 5-18: Slack Cable Parameter Settings

Parameter	Display	Function	Range	Default	Motion
C11-01	Slack Cable	Determines whether Slack Cable Detection is enabled.	0-2	0	H
	0 Disabled				
	1 Enabled				
	2 Enabled by MFDI				
C11-03	Slack Cable Torq	Percentage of Output Torque below which the enabled Slack Cable Detection is activated.	-50.0-50.0%	0.1	H
C11-04	SLC Detect Time	Time required for the motor torque to remain less than the SLC Torque level (C11-03) before the drive faults on SLC.	0.0-5.0 sec	2.0	H

5.3.7 Timer Function (C12-03 and C12-04)

The Timer Function provides either an on- or off-delay timer for an input and output pair, which serve as general-purpose I/O. Chattering of sensors, switches, contactors, etc., can be prevented by setting a delay time. ***See Figure 5-6 on page 5-67*** for a timing diagram that illustrates the timer function.

- The timer function is enabled when the timer function MFDI (H01-0x = 15) and the timer function MFDO (H02-0x = 05) are set respectively.
- When the timer function input ON time is longer than the value set for C12-03 (timer function On-Delay Time), the timer function output turns on.
- When the timer function input OFF time is longer than the value set for C12-04 (timer function Off-Delay Time), the timer function output turns off.

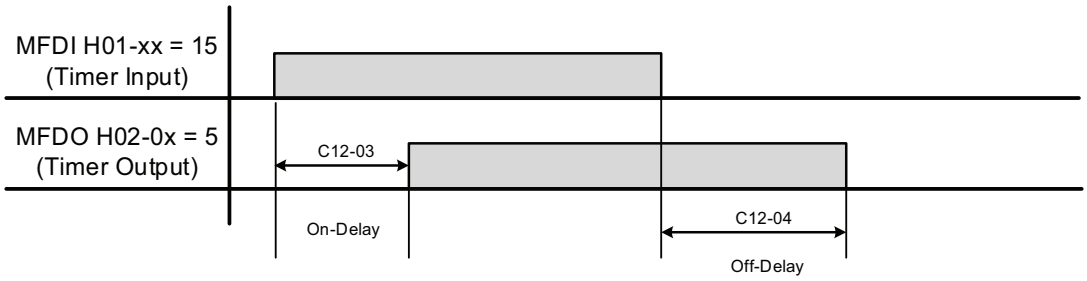


Figure 5-6: Timer Function Timing Diagram

Table 5-19: Timer Function Parameter Settings

Parameter	Display	Function	Range	Default
C12-03	Timer On Delay	Timer function output On-delay time (dead zone) for the timer function input.	0.0-6000.0 sec	0.0
C12-04	Timer Off Delay	Timer function output Off-delay time (dead zone) for the timer function input.	0.0-6000.0 sec	0.0

5.4 Drive Settings

5.4.1 Start and Stop Sequence (D01-01 through D01-05)

The Start and Stop Sequence are drive settings that work in conjunction with the Brake Control parameters. These parameters affect the timing and motor speeds at which the mainline and braking contactors are energized and deenergized. ***See Figure 5-7 on page 5-69*** and ***Figure 5-8 on page 69*** for timing diagrams that illustrate the drive start and stop sequence and brake control.

5.4.1.1 Start Delay (D01-01)

The Start Delay allows time for the main contactor to close and DB contactor to open before the drive outputs voltage and accelerates the motor. The D01-01 time occurs at the start every time a run command is issued. If arcing occurs on the contact tips or an undervoltage (UV) fault occurs, extend the D01-01 time.

5.4.1.2 Stop Delay (D01-02)

The stop delay parameter provides a delay at the end of the stop sequence to allow for the brake to set and motor current to return to zero before the start of the next run command. Setting this parameter to zero will allow the drive to obtain the fastest ready state. The stop delay time will be added to the start delay time if a run command is issued after the stop speed point has been reached.

5.4.1.3 Stop Speed (D01-03, D01-04, D01-05)

The Stop Speed parameter (D01-03, D01-04, D01-05, depending on the motion and direction) sets the speed value that will initiate the stop sequence during the deceleration period. When the Motor CEMF (U01-23) reaches this value, the Shunt Brake relay output is deenergized and the Shunt Brake Time (C08-11) begins. After the SB time is complete, the Dynamic Brake output is deenergized and the DB Delay (C08-12) begins, followed by the DB Time (C08-13) and the Stop Delay (D01-02).

Table 5-20: Start and Stop Sequence Parameter Settings

Parameter	Display	Function	Range	Default	Motion
D01-01	Start Delay	Delay between M/DB contactors closing at the start of a run command and when the initial output of armature voltage occurs.	0-2500 ms	300	H/T
D01-02	Stop Delay	Delay required between consecutive run commands after the stop sequence has been initiated.	0-2500 ms	0	H/T
D01-03	Hoist Stop Speed	Defines the speed point that initiates the stop sequence in the Hoisting direction.	0.0-100.0%	15.0	H
D01-04	Lower Stop Speed	Defines the speed point that initiates the stop sequence in the Lowering direction.	0.0-100.0%	15.0	H
D01-05	Stop Speed	Defines the speed point that initiates the stop sequence in the FWD and REV direction when drive is configured for Traverse Mode.	0.0-100.0%	2.0	T

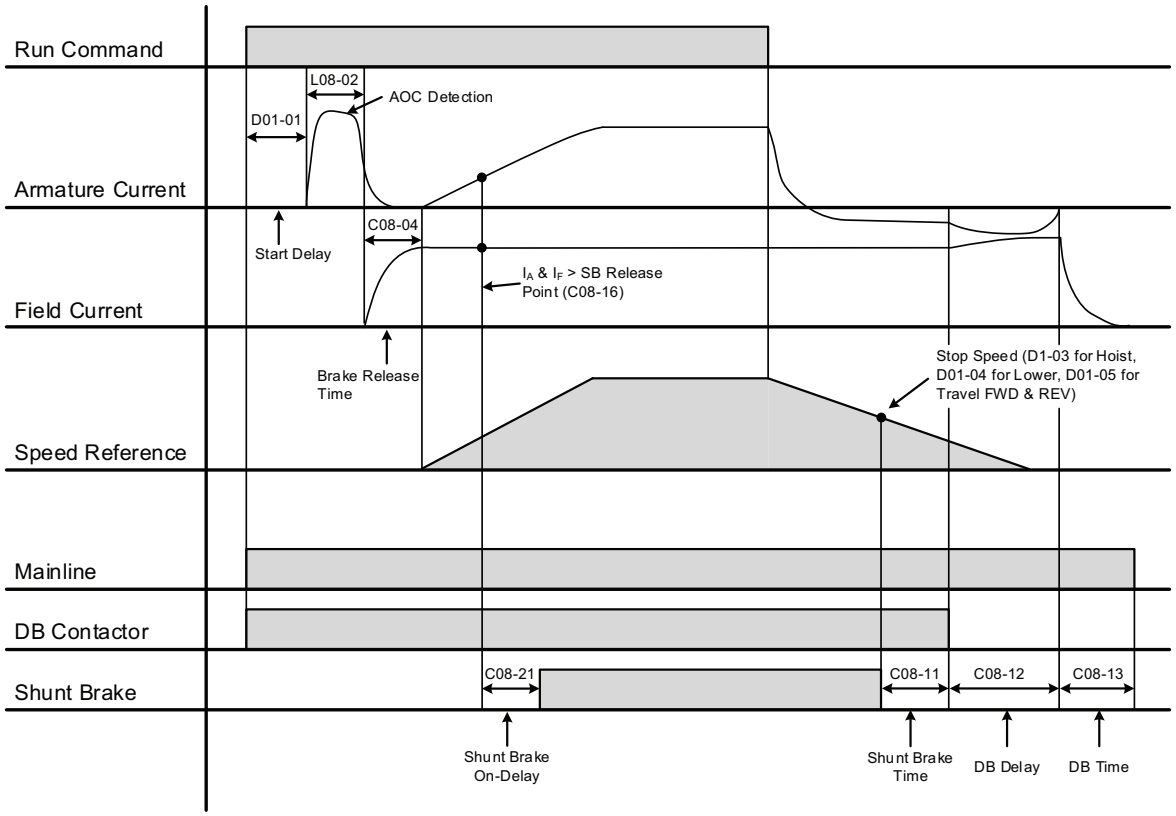


Figure 5-7: Hoist Mode Start and Stop Sequence Timing Diagram

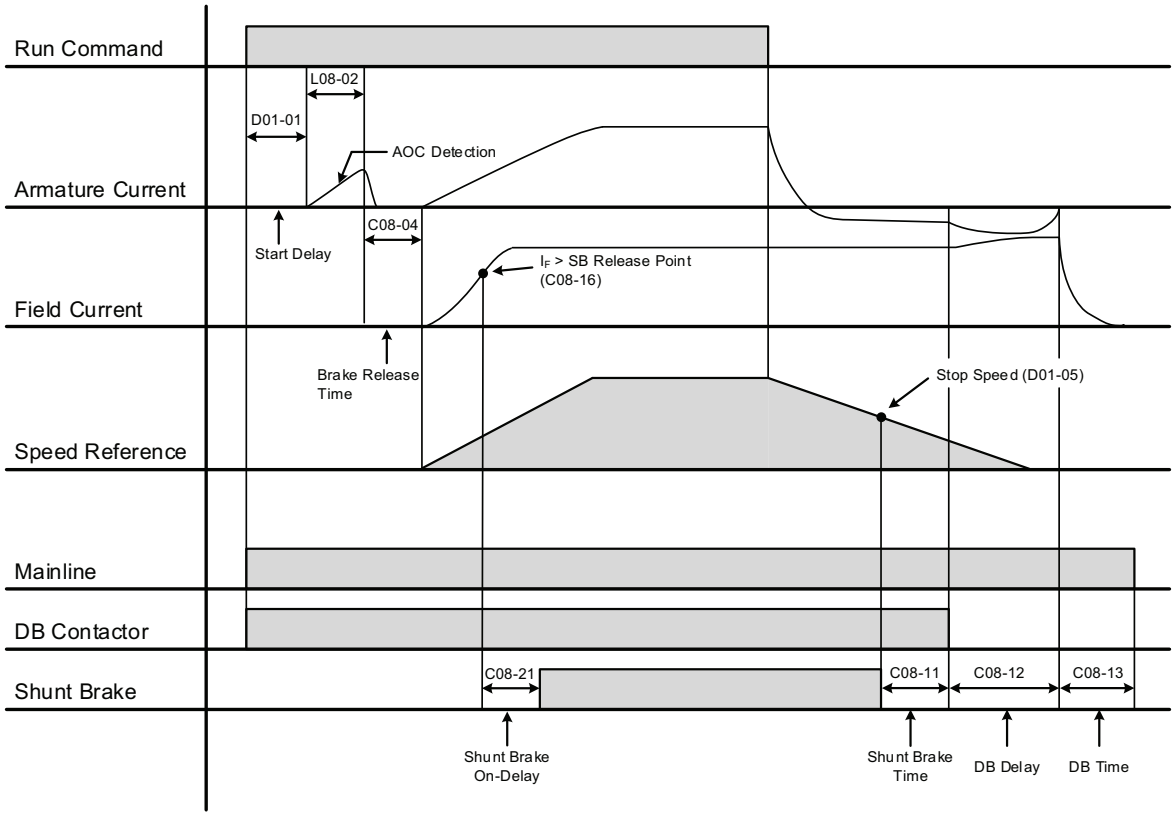


Figure 5-8: Traverse Mode Start and Stop Sequence Timing Diagram

5.4.2 Automatic Speed Regulator (D04-01 through D04-10)

These parameters affect the regulation of the motor speed and should only be adjusted if the motor response is sluggish or if oscillations are occurring.

5.4.2.1 Speed Proportional Gain (D04-01)

This parameter sets the proportional gain of the speed regulator. If D04-01 is set too high, the armature current may be erratic when the motor speed is near its setpoint. This may cause unwanted vibration, noise, and wear of mechanical components. If D04-01 is set too low, the speed response may be sluggish, or, depending on the integral gain, cause an overshoot or oscillations in motor speed. The default value is satisfactory for most overhead crane applications.

5.4.2.2 Speed Integral Gain (D04-02)

This parameter sets the integral gain of the speed regulator. D04-02 is used for compensation of sudden changes in load and has a strong influence on the motor speed response, and should only be increased as a last resort. Make loop adjustments with the speed proportional gain first before attempting to change the default value.

5.4.2.3 Minimum Speed (D04-04)

This parameter defines a minimum speed reference before initiating the acceleration ramp. Setting a value greater than zero permits a faster response when starting, but will also increase the shock load to the mechanical system. Use caution to make sure the value does not introduce excessive shock to the mechanical drive train.

5.4.2.4 Clamp Speed Integration Term to Current Limit (D04-10)

This parameter enables an anti-windup function for the speed regulator integral term. This assists in achieving smoother motor acceleration and deceleration by minimizing the delay caused by the rate of change limiter.

Table 5-21: Automatic Speed Regulator Parameter Settings

Parameter	Display	Function	Range	Default
D04-01	Speed P Gain	Speed regulator proportional gain.	1.00-50.00	5.00
D04-02	Speed I Gain	Speed regulator integral gain.	0.00-1.00*	0.10
D04-04	Minimum Speed	Minimum speed reference used at the beginning of the start sequence before the acceleration ramp activates.	0.0-25.0%	0.0
D04-10	Speed I Clamp	Anti-windup function for speed regulator integral term.	0-1	1
	0 Disabled			
	1 Enabled			

** Set this value to zero for mechanically coupled, multi-drive/multi-motor applications.*

5.5 Motor Settings

5.5.1 Field Settings (E01-01 through E01-08)

The motor field setting parameters are used to adjust the maximum motor speed and optimize the dynamic response of the motor.

5.5.1.1 Lower and Hoist Minimum Field (E01-01 and E1-02)

These two parameters can be adjusted to weaken the field current for a specific direction in Hoist Mode to obtain a motor speed greater than motor base speed (if the Speed Reference >100 %). Be aware that the Minimum Field parameter (E01-04) takes precedence over E01-01 and E01-02. For example, the field current would only be reduced to the greater of E01-01/E01-04 or E01-02/E01-04, depending on the direction).

5.5.1.2 Economy Field (E01-03)

This parameter establishes a starting field current for motions that require less than rated current and may be used to minimize motor heating during light load operations. Increasing the economy field level allows the full motor torque to be produced more rapidly, while decreasing the level can increase productivity by controlling the maximum motor speed based on the measured motor loading, regardless of the commanded speed reference.

In order for the Economy Field to operate correctly, the Minimum Field Setting (E01-04) and the Hoist/Lower Minimum Field settings (E01-01/E01-02, Hoist Mode only) need to be less than or equal to the Economy Field setting.

5.5.1.3 Minimum Field (E01-04)

The Minimum Field parameter sets the minimum field current that may be applied when operating the motor above its base speed (E02-04). Reduce this parameter gradually until the desired maximum speed set by the speed reference is achieved. ***See Table 5-22 on page 71*** for guidelines in selecting a value for the Minimum Field setting.

Table 5-22: Example Minimum Field Settings

Minimum Field Setting	Approximate Motor Speed
100%	100%
75%	167%
50%	233%
25%	300%

NOTE: *The actual motor speed may be lower than the motor speeds listed in the table. With full voltage applied to a series motor, the final speed obtained is determined by the size of load applied to motor.*

5.5.1.4 Armature/Field Ratio (E01-05)

The Armature/Field parameter limits the maximum ratio of armature current to field current when the motor is operating above its base speed (E02-04) to ensure that the commutation capability of the motor is not exceeded at high speeds. ***See Figure 5-9 on page 5-72*** for a plot of various Armature/Field Ratio settings.

The field current will be weakened below 100% to sustain acceleration above base speed. The armature current will be limited to E01-05 times the motor rated field current.

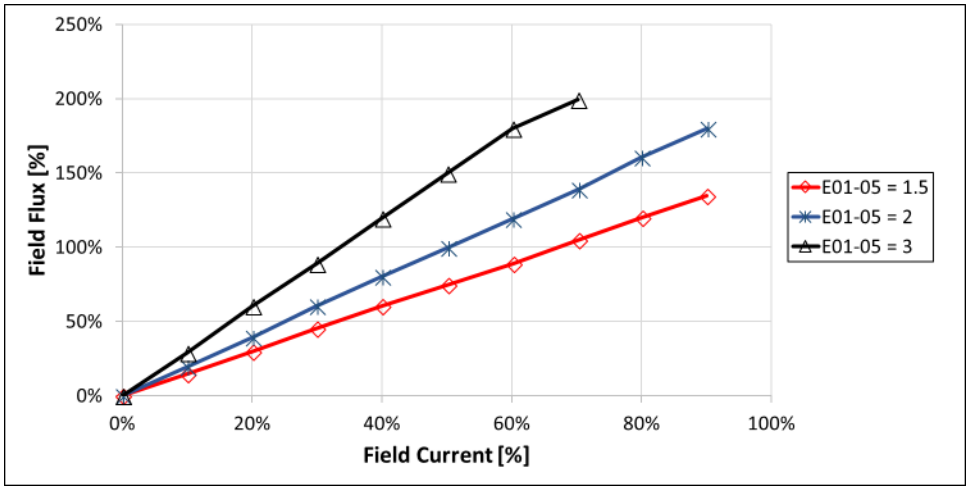


Figure 5-9: Armature/Field Ratio Example Curves

5.5.1.5 3-Point Flux Curve (E01-06 through E01-09)

The 3-Point Flux Curve allows the user to configure a custom, linear-piecewise curve defining the field flux per unit field current appropriate for the DC motor connected to the drive. This may help minimize oscillations in motor speed due to a mismatch between the motor characteristic and the field current output from the drive at various speeds. ***See Figure 5-10 on page 5-73*** for an example of a 3-Point Flux Curve diagram.

When the 3-Point Flux Curve is disabled, the pre-programmed flux curve is used (acceptable for most mill duty DC motors). The default settings in E01-07 through E01-09 closely approximate the pre-programmed curve.

Setup Guidelines for 3-Point Flux Curve

Oscillations in motor speed are most common when the motor is operating above base speed on DC mill motors. Therefore, field current adjustments should be made at five to six speed references between 120% and 170% motor speed to ensure smooth acceleration. This is critical when the minimum field is set below 50.0%.

Set the minimum field to 75% and apply a run command to a speed reference above base speed to the unloaded (or lightly loaded) motor. If oscillations occur at any speed, reduce E01-08 in 2.0% increments. If oscillations have not subsided, increase E01-08 from its default value in 2.0% increments.

Once the setting for E01-08 has been selected such that oscillations have minimized, set the minimum field to 25% and adjust E01-07 as previously described for parameter E01-08. Once the velocity oscillations have been minimized at 25% field current, verify that the oscillations do not occur at various speeds above the motor's base speed.

E01-09 is the least critical of the three parameters above base speed, but can be used to increase the accuracy of the speed regulation for heavy loading (>50.0%).

E01-07 through E01-09 should not need to be adjusted more than 20% from their default value.

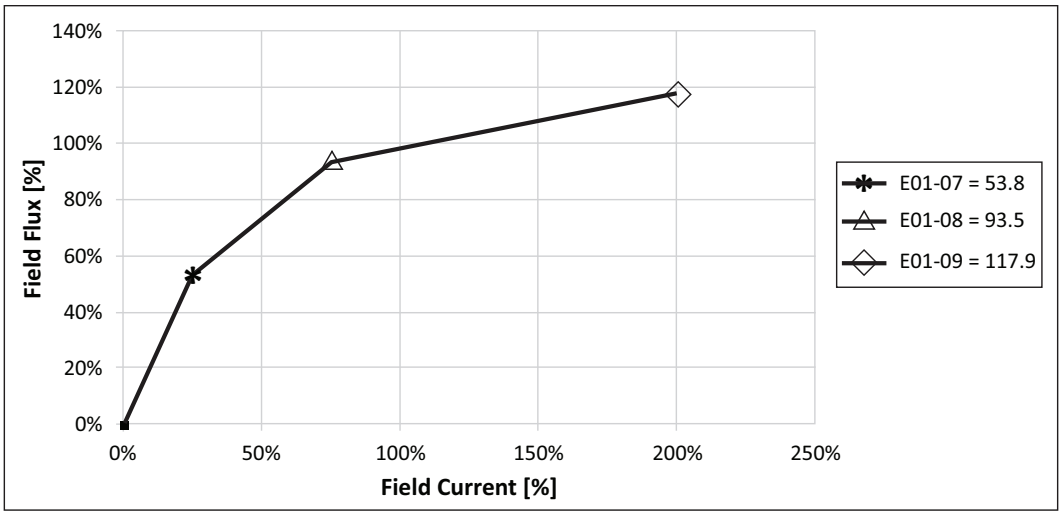


Figure 5-10: 3-Point Flux Curve Example

5.5.1.6 Field Rate of Change (E01-10)

The Field Rate of Change parameter limits the rate of change of the field current. The rate of change in the field current can be adjusted from 0.1% per millisecond (E01-10 = 16) to 0.8% per millisecond (E01-10 = 127). Reduce E01-10 for greater speed loop stability and to minimize undershoot or overshoot situations. Increase E01-10 for a faster speed response and to prevent a delay when transitioning to speeds above the base speed of the motor.

WARNING

Motors and drive machinery must be capable of operating above motor base speed. Consult the motor/ gearbox/hoist manufacturer before reducing E01-03 (Economy Field) and E01-04 (Minimum Field) parameter settings. Failure to observe this warning may result in damage to equipment and possible injury or death to personnel.

Table 5-23: Motor Field Parameter Settings

Parameter	Display	Function	Range	Default	Motion
E01-01	Lower Min Field	Minimum field current in the lowering direction as a percentage of motor rated field current. E01-04 takes precedence over this parameter.	25.0-100.0%	50.0	H
E01-02	Hoist Min Field	Minimum field current in the hoisting direction as a percentage of motor rated field current. E01-04 takes precedence over this parameter.	25.0-100.0%	50.0	H
E01-03	Economy Field	Minimum field current as a percentage of motor rated field current to maximize productivity and minimize motor heating.*	Hoist: 50.0-100.0% Traverse: 25.0-100.0%	75.0	H/T
E01-04	Minimum Field	Minimum field current as a percentage of motor rated field current.	25.0-100.0%	75.0	H/T
E01-05	Armature/Field	Maximum armature to field current ratio to preserve the commutation capability of the motor.	1.1-3.0	1.5	H/T
E01-06	3-Pt Flux Curve *0 Disabled* *1 Enabled*	Determines whether a custom motor field flux curve is enabled or disabled.	0-1	0	H/T
E01-07	Flux 25 IF	Selects the percentage of field flux at 25% of rated field current.	0.0-100.0%	53.8	H/T
E01-08	Flux 75 IF	Selects the percentage of field flux at 75% of rated field current.	0.0-125.0%	93.5	H/T
E01-09	Flux 200 IF	Selects the percentage of field flux at 200% of rated field current.	0.0-150.0%	117.9	H/T
E01-10	Field Rate	Limits the rate of change in motor field current.	16-127	32	H/T

** Care should be taken when reducing the E01-03, as unstable oscillations in motor torque and speed may occur if this value is set too low.*

5.5.2 Motor Settings

The E02 group is used to set motor ratings based on the motor nameplate data and define several drive related motor constants. The default setting for most E02 group parameters is determined by the Drive Model (O02-04) selection. At a minimum, the motor rated current, voltage and speed should be set in the appropriate parameter.

5.5.2.1 Rectified Systems

For rectified systems that produce an average DC voltage greater than the nameplate voltage of the DC motor, increase the motor rated voltage (E02-03) and motor base speed (E02-04). To obtain the new values, multiply the motor rated voltage and motor base speed by the ratio of the rectified voltage to the motor base voltage and enter the values into E02-03 and E02-04 respectively. The effects on the motor current are minimal, therefore E02-01 or E02-02 can remain at the motor nameplate values.

CAUTION

When applying this drive to rectified systems make sure that the rectifier has the ability to handle the regenerative energy produced by the motor. If it does not, additional equipment will be necessary to prevent drive overvoltage faults.

Table 5-24: Motor Parameter Settings

Parameter	Display	Function	Range	Default
E02-01	Rated Current	Motor rated armature current as listed on the motor nameplate. Also defines the rated field current if a series motor is connected.	*	*
E02-02	Field Current	Motor rated field current as listed on the motor nameplate. Visible only when an external CT board is connected to the drive to monitor field current (Field Setup O02-07 not equal to 0).	*	*
E02-03	Motor Rated Volt	Motor rated voltage as listed on the motor nameplate. This parameter value is used with the motor base speed (E01-04) to calculate the display RPM.	*	*
E02-04	Motor Base Speed	Motor rated speed as listed on the motor nameplate.	0-5000 RPM	400
E02-05	Current Gain	Simultaneously sets the proportional and integral gain of the current regulator.**	0.1-2.0	0.5**
E02-06	IR Comp Gain	Sets the per unit armature resistance of the motor to improve the motor dynamic response. Increase this value to dampen oscillations, decrease this value if changes in motor speeds are sluggish.	0.00-2.00	0.00
E02-07	Motor Connection *0 3 Wire (Hoist)* *1 4 Wire (Traverse)*	Defines the type of motor connection at terminals T1, T2, T3, and T4. Select 3 wire for connections to only T1, T2, and T3 (typically hoists with series motor), otherwise select 4 wire.	0-1	*

** Initial value is determined by O02-04 (Drive Model) selection, O02-06 (Armature Setup), and O02-07 (Field Setup).*

*** Increase this value for motors with a higher inductance than standard mill duty motors. Decrease this value for lower inductance motors, or until a smooth 1 kHz tone is generated from the motor.*

5.6 Motor Feedback

5.6.1 Encoder Feedback Set-up (F01-01 through F01-04)

5.6.1.1 Wiring the Encoder Circuit

A shaft-mounted encoder is required to provide speed and shaft position feedback to the DDC-S2 drive. Before wiring the encoder circuit, refer to the specifications listed in ***Table 5-25 on page 76***. Adhere to the following guidelines during encoder installation:

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

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

- Connect the encoder to the Encoder Interface terminals on the DDC-S2 control board. Refer to ***Figure 3-3 on page 30*** for additional information.

NOTE: *Use twisted-pair, shielded cable 100 Ω impedance (Magnetek R-20/6, R-22/6, Belden 9730, or Brand Rex T-11651). Strip the encoder wires .25 in. (5.5 mm). Keep the wiring length less than 300 feet (for cable lengths greater than 300 feet, contact Magnetek for information on available fiber optic cable). Ground only one end of the shielded cable.*

- Whenever possible, the encoder cable should be wired in a continuous run between the motor and drive. If it cannot be a direct run, the splice should be in its own junction box and isolated from the power wires.

Table 5-25: Encoder Interface Specifications

Power supply	+5 or +12 VDC, 200 mA; If current demand is greater than 200 mA (consult factory if inrush currents exceed 200 mA), an auxiliary power supply is required.
Output type	Differential Quadrature (A+, A-, B+, and B- channels; Z is not required)
Compatible Types	Line Driver (TTL/RS422) Push-Pull (HTL) Open Collector (PNP or NPN)
Maximum input frequency	300 kHz
Mounting method	Encoder must be direct-coupled to motor shaft, using a zero-backlash-type coupling.

Table 5-26: Encoder (PG) Setup Parameter Settings

Parameter	Display	Function	Range	Default
F01-01	PG Feedback	Enables encoder feedback detection.	0-1	0
	0 Disabled			
	1 Enabled			
F01-02	PG Pulses/Rev	Sets the encoder pulses per revolution	0-60000 ppr	1024
F01-03	PG Rotation Sel	Changing this parameter has the same effect as swapping A+ and A- encoder wires.	0-1	0
	0 Fwd = C.C.W.			
	1 Fwd = C.W.			
F01-04	PGO-H Det Time	Delay time for PGO-1-H detection. A setting of zero disables PGO-1-H detection.	0-100 ms	15
F01-05	PG Signal Sel	Set the PG detection method to 2 or 4 channel.	0-1	1
		0 Two Channel		
		1 Four Channel		

5.6.2 Tachometer Feedback (F02-01 through F02-05)

Whenever a tachometer is used as the speed feedback device, F02-02 must be set to the motor RPM at full scale tachometer feedback (+10 V). ***See Figure 5-11 on page 5-78*** for wiring and setup instructions for connecting a tachometer to the DDC-S2 drive. The tachometer loss detection settings control whether the drive will fault in the event of a lost or corrupt tachometer signal or switch automatically to use the CEMF feedback for motor speed control.

If tachometer loss detection is enabled (F02-02 = 1), the CEMF monitor U01-23 must be greater than the setting in F02-04 and the Analog Reference 1 monitor (U01-15 or U01-16) must be less than the setting in F02-05 for a tachometer loss fault to occur.

The resistance and minimum power requirement of R can be determined as follows:

1. Determine the tachometer voltage at rated motor speed.
2. Calculate the resistance using the following equation:

$$R = 250\left(\frac{1.1\times V_{Tach}}{5} - 1\right)$$

3. Calculate the power requirement of the resistor using the following equation:

$$P_R = \frac{\left(1.1\times V_{Tach} - 5\right)^2}{R}$$

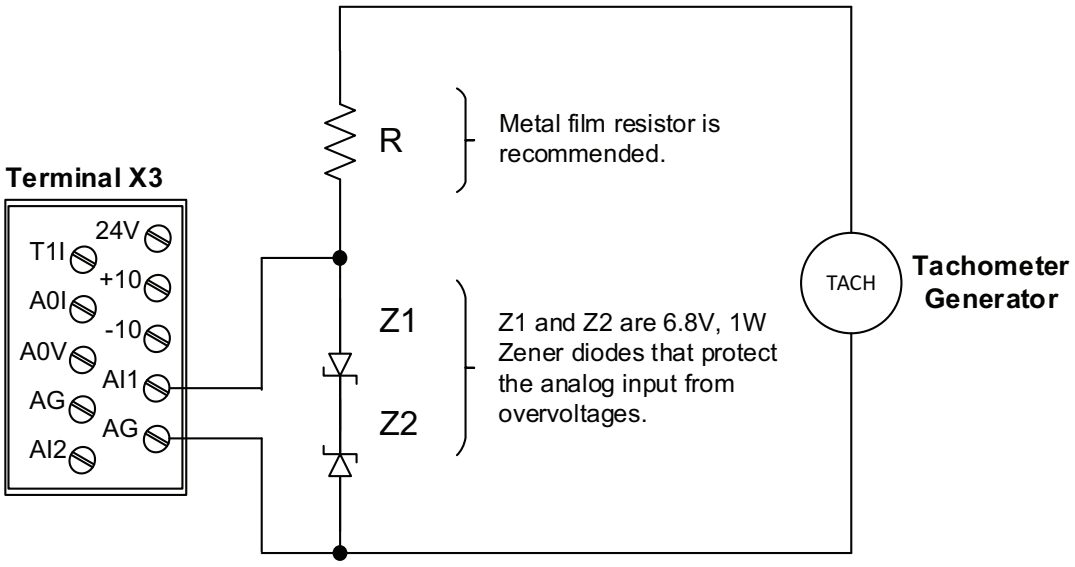


Figure 5-11: Tachometer Feedback Wiring and Setup

Table 5-27: Tachometer Feedback Parameter Settings

Parameter	Display	Function	Range	Default
F02-01	Tach FS RPM	Defines the maximum motor speed when the input voltage from the tachometer is at 10V. Tachometer feedback disabled when F02-01 = 0.	0-2000 RPM	0
F02-02	Tach Lost Detect	Determines whether the drive faults or continues operating if the tachometer feedback signal is lost or corrupted.	0-1	0
	0 Disabled	No fault occurs and speed control switches to CEMF feedback when the tachometer signal is lost or corrupted.		
	1 Enabled	Drive will fault immediately if the tachometer feedback is lost or corrupted by comparing the CEMF and the tachometer feedback to the settings in F02-04 and F02-05.		
F02-03	Tach Reverse	Determines whether the polarity of the motor tachometer signal and CEMF is compared for tachometer loss detection.	0-1	0
	0 Disabled	Absolute values used for comparison for tach loss detection.		
	1 Enabled	Tach loss detection polarity sensitive.		
F02-04	TachLostCEMF Det	Condition for tachometer feedback loss fault satisfied when U01-23 is greater than this setting.	0.0-100.0%	25.0
F02-05	Tach Loss FB Det	Condition for tachometer feedback loss fault satisfied when Analog Reference 1 is less than this setting.	0.0-100.0%	10.0

5.6.3 Ethernet Communications Setup (EtherNet/IP & Modbus TCP/IP) (F07-01 through F07-15)

See Appendix B: EtherNet/IP Communications on page 117 for details on EtherNet/IP setup and configuration.

Table 5-28: EtherNet/IP Communications Setup

Parameter	Display	Function	Range	Default
F07-01	IP Address 1	IP Address 1	0-255	192
F07-02	IP Address 2	IP Address 2	0-255	168
F07-03	IP Address 3	IP Address 3	0-255	0
F07-04	IP Address 4	IP Address 4	0-255	100
F07-05	Subnet Mask 1	Subnet Mask 1	0-255	255
F07-06	Subnet Mask 2	Subnet Mask 2	0-255	255
F07-07	Subnet Mask 3	Subnet Mask 3	0-255	255
F07-08	Subnet Mask 4	Subnet Mask 4	0-255	0
F07-09	Gateway IP 1	Gateway IP 1	0-255	192
F07-10	Gateway IP 2	Gateway IP 2	0-255	168
F07-11	Gateway IP 3	Gateway IP 3	0-255	0
F07-12	Gateway IP 4	Gateway IP 4	0-255	1

Parameter	Display	Function	Range	Default
F07-13	IP Address 0: Custom 1: DHCP	Sets how the IP Address is set at startup	0-1	1
F07-14	ComLoss Timeout	Sets the timeout value for communication loss detection in tenths of a second. A value of 0 disables the connection timeout. Example: An entered value of 100 represents 10.0 seconds.	0-1000	10
F07-15	I Ref Enabled 0: Disabled 1: Enabled	Allows the current reference to be controlled using serial or EtherNet/IP communications.	0-1	0

5.7 Terminal I/O

- H1 Digital Inputs
- H2 Digital Outputs
- H3 Analog Inputs
- H4 Analog Output
- H5 Serial Communications

5.7.1 Digital Inputs (H01-01 through H01-12)

The DDC-S2 has 12 multi-function digital inputs for the control of numerous functions. All 12 24VDC MFDIs (S1 to S12) are located on the control board. There are seven parallel-connected 250VDC MFDIs (S1 to S7) located on the interface board. ***Table 5-30 on page 81*** lists the function selections for the MFDIs and indicates the motion that each function can be enabled. An “Over Limit” error will be displayed on the DLS4 if a function is programmed for more than one terminal at the same time.

Table 5-29: Digital Inputs Parameter Settings

Parameter	Display	Function	Range	Default
H01-01	Term S1 Select	Selects the multi-function inputs. ***See Table 5-30 on page 5-81***.	0-81	81 (Run REV)
H01-02	Term S2 Select	***See Table 5-30 on page 5-81***.	0-81	80 (Run FWD)
H01-03	Term S3 Select	***See Table 5-30 on page 5-81***.	0-81	*
H01-04	Term S4 Select	***See Table 5-30 on page 5-81***.	0-81	*
H01-05	Term S5 Select	***See Table 5-30 on page 5-81***.	0-81	*
H01-06	Term S6 Select	***See Table 5-30 on page 5-81***.	0-81	*
H01-07	Term S7 Select	***See Table 5-30 on page 5-81***.	0-81	*
H01-08	Term S8 Select	***See Table 5-30 on page 5-81***.	0-81	F (Not Used)
H01-09	Term S9 Select	***See Table 5-30 on page 5-81***.	0-81	F (Not Used)
H01-10	Term S10 Select	***See Table 5-30 on page 5-81***.	0-81	F (Not Used)
H01-11	Term S11 Select	***See Table 5-30 on page 5-81***.	0-81	F (Not Used)
H01-12	Term S12 Select	***See Table 5-30 on page 5-81***.	0-81	F (Not Used)

** Initial value is determined by X-Press Programming (**See Table 4-6 on page 49** or **Table 4-7 on page 50**).*

Parameter	Display	Function	Range	Default
H01-13	Term Enable	Sets the source for the Enable bit requirement	0-1	0
	0: Term/Serial	Set to 0 to require EN input for running.		
	1: Auto	Set to 1 for setting the Enable bit automatically in the software.		
H01-14	Stop/Reset	Sets the Stop/Reset input for Normally Open (default) or Normally Closed. Note that Normally Closed cannot be used when LK1 (External Reset) is set to the IN position.	0-1	0
	0: Normally Open			
	1: Normally Closed			

** Initial value is determined by X-Press Programming (**See Table 4-6 on page 49** or **Table 4-7 on page 50**).*

Table 5-30: Multi-Function Digital Inputs (MFDI) Selectable for H01-xx

Display		Function	Motion
0	*Multi-Step Ref 2*	Multi-Step Reference 2	H/T
1	*Multi-Step Ref 3*	Multi-Step Reference 3	H/T
2	*Multi-Step Ref 4*	Multi-Step Reference 4	H/T
3	*Multi-Step Ref 5*	Multi-Step Reference 5	H/T
6	*Upper Lmt 1 N.O.*	Upper Limit - Slow Down; Normally Open. UL1 - blinking	H/T
7	*Upper Lmt 2 N.O.*	Upper Limit - Stop; Normally Open. UL2 - blinking	H/T
8	*Lower Lmt 1 N.O.*	Lower Limit - Slow Down; Normally Open. LL1 - blinking	H/T
9	*Lower Lmt 2 N.O.*	Lower Limit - Stop; Normally Open. LL2 - blinking	H/T
A	*Upper Lmt 1 N.C.*	Upper Limit - Slow Down; Normally Closed. UL1 - blinking	H/T
B	*Upper Lmt 2 N.C.*	Upper Limit - Stop; Normally Closed. UL2 - blinking	H/T
C	*Lower Lmt 1 N.C.*	Lower Limit - Slow Down; Normally Closed. LL1 - blinking	H/T
D	*Lower Lmt 2 N.C.*	Lower Limit - Stop; Normally Closed. LL2 - blinking	H/T
E	*M-Speed Gain 1*	Micro-Speed positioning control multiplier 1. Gain is set by parameter C02-01. (Has Priority over Micro-Speed 2)	H/T
F	*Not Used*	No function - Terminal is disabled	H/T
10	*M-Speed Gain 2*	Micro-Speed positioning control multiplier 2. Gain is set by parameter C02-02.	H/T
11	*SLC Enable*	Input On: Slack Cable detection is Enabled. Input Off: Slack Cable detection is Disabled.	H
13	*Brake Stand*	If a foot brake is in use, Brake Stand prevents pushing through a brake by disabling the drive when the input is on. This prevents unwanted wear and tear on the brake.	T
15	*Timer Function*	Functions with timer parameter parameters C12-03 & C12-04, which control timer function output (H02-0x = 5).	H/T
1D	*Travel Limit (L)*	Stopping Limit when input is off, UL2 and LL2 take precedence over this input.	H/T
1E	*Slowdwn Lim (L)*	Slowdown Limit when input is off, UL1 and LL1 take precedence over this input.	H/T
1F	*Reference 2*	Run/Speed/Torque Source 2: Input on = source from B03-15 through B03-17. Input off = source from B03-01 through B03-03.	H/T
20	*Ext Fault N.C.*	External fault is triggered when input is turned off.	H/T
22	*Weight Lmt N.O.*	Input On: Baseblocks the drive immediately. Display shows UL3. Input Off: Drive OK to run normally.	H/T

	Display	Function	Motion
23	*Weight Lmt N.C.*	Input Off: Drive OK to run normally. Input On: Baseblocks the drive immediately. Display shows UL3.	H/T
24	*Acc/Dec 2*	Acceleration/Deceleration Time Changeover 2 using B05-11 through B05-16	H/T
25	*Hook Height Home*	Sets the MFDI to be used for setting the Hook Height Home position.	H/T
26	*Phantom Fault NO*	Input On: Stops motion Input Off: Drive OK to run normally	H/T
27	*Phantom Fault NC*	Input On: Drive OK to run normally Input Off: Stops motion	H/T
28	*LL2/UL2 Bypass*	Bypass Upper/Lower Limit 2	H/T
29	*LL/UL Bypass*	Bypass Upper/Lower Limit	H/T
80	*Run Fwd*	Forward/Hoist Run Command	H/T
81	*Run REV*	Lower/Reverse Run Command	H/T

5.7.2 Digital Outputs (H02-01 through H02-07)

The DDC-S2 has seven multi-function digital outputs (MFDO) for indicating various conditions. The first four MFDOs are relay outputs located on the control board. The remaining three MFDOs are solid state 250VDC outputs located on the interface board. ***Table 5-32 on page 82*** lists the function selections for the multi-function digital outputs and indicates the control methods during which each function can be enabled.

Table 5-31: Digital Outputs Parameter Settings

Parameter	Display	Function	Range	Default
H02-01	M1/M2 M3/M4 Sel	Selects the multi-function outputs. ***See Table 5-32 on page 5-82***.	0-F	0 (DB Contactor)
H02-02	M5/M6 Sel	***See Table 5-32 on page 5-82***.	0-F	4 (Ctrl Fault)
H02-03	M7/M8/M9 Sel	***See Table 5-32 on page 5-82***.	0-F	3 (Ctrl Ready)
H02-04	M10/M11/M12 Sel	***See Table 5-32 on page 5-82***.	0-F	1 (Shunt Brake)
H02-05	OP M Sel	***See Table 5-32 on page 5-82***.	0-F	2 (M Contactor)
H02-06	OP1/DB Sel	***See Table 5-32 on page 5-82***.	0-F	0 (DB Contactor)
H02-07	OP4/SB Sel	***See Table 5-32 on page 5-82***.	0-F	1 (Shunt Brake)

Table 5-32: Multi-Function Digital Outputs (MFDO) Selectable for H02-0x

	Display	Function
0	*DB Contactor*	Controls the DB contactor according to the motion and the start-stop sequence parameters in the C8 and D1 groups.
1	*Shunt Brake*	Controls a shunt brake coil according to the motion and start-stop sequence parameters in the C8 and D1 groups.
2	*M Contactor*	ON/CLOSED: when a run command is issued and OFF/OPEN when the run command is removed and the drive stops outputting voltage to the motor.
3	*Ctrl Ready*	ON/CLOSED: After the drive has performed initialization process and no faults are detected.
4	*Ctrl Fault*	ON/CLOSED: When the drive is in a fault condition. OFF/OPEN: When the drive is not in a fault condition.

Display		Function
5	*Timer Function*	ON/CLOSED: When H01-xx = 15 is active for longer than C12-03 time.
		OFF/OPEN: When H01-xx = 15 is not active.
6	*FWD Direction*	ON/CLOSED: During Forward/Up operation.
		OFF/OPEN: When running in Reverse/Down direction or baseblock.
7	*REV Direction*	ON/CLOSED: During Reverse/Down operation.
		OFF/OPEN: When running in Forward/Up direction or baseblock.
8	*Travel Limit*	ON/CLOSED: When any upper or lower limit is active.
		OFF/OPEN: When no travel limits are active.
B	*Slack Cable*	ON/CLOSED: Slack Cable detected by controller.
		OFF/OPEN: No Slack Cable detected controller.
C	*Ctrl Alarm*	ON/CLOSED: When the drive is in an alarm condition.
		OFF/OPEN: When the drive is not in an alarm condition.
F	*Not Used*	No function - Terminal is disabled.

5.7.3 Analog Inputs (H03-01 through H03-08)

The DDC-S2 has two analog inputs for receiving analog references and limits. ***See Table 5-33 on page 5-83*** and ***Table 5-34 on page 84*** for information on configuring analog inputs and selecting their function.

Each analog input has an adjustable gain and bias. In ***Figure 5-12 on page 84***, a gain setting of 1 sets the scaling such that 100% of the voltage or current signal equates to 100% speed or torque command. Likewise, a gain setting of 3 sets the scaling such that 100% of the voltage or current signal equates to 300% speed or torque command. Keep in mind that the minimum field values (E01-01 through E01-04) should be adjusted to define the absolute maximum speed obtainable at full analog input.

Table 5-33: Analog Inputs Parameter Settings

Parameter	Display	Function	Range	Default
H03-01	Term A1 Signal	Terminal A1 signal type selection.	0-2	*
	0 0-10 V			
	1 -10 - 10 V			
	2 4-20 mA			
H03-02	Term A1 Select	Sets the function of terminal A1 (***see Table 5-34 on page 84***).	0-F	*
H03-03	Term A1 Gain	Gain multiplier for terminal A1.	-999.9-999.9%	100.0
H03-04	Term A1 Bias	Signal offset for terminal A1.	-200.0-200.0%	0.0
H03-05	Term A2 Signal	Terminal A2 signal type selection.	0, 2	0
	0 0-10 V			
	2 4-20 mA			
H03-06	Term A2 Select	Sets the function of terminal A2 (***see Table 5-34 on page 84***).	0-F	1
H03-07	Term A2 Gain	Gain multiplier for terminal A2.	-999.9-999.9%	100.0
H03-08	Term A2 Bias	Signal offset for terminal A2.	-200.0-200.0%	0.0

** Initial value is determined by X-Press Programming (**See Table 4-6 on page 4-49** or **Table 4-7 on page 50**).*

Table 5-34: Multi-Function Analog Inputs Selectable for H03-0x

	Display	Function	Motion
0	*Analog Ref 1*	Sets the MFAI to Analog Reference 1.	H/T
1	*Analog Ref 2*	Sets the MFAI to Analog Reference 2.	H/T
4	*Ref Upper Limit*	Sets a speed reference limit.	H/T
5	*Current Limit*	Sets a current reference limit.	T
6	*Tach Feedback*	Feedback for motor tachometer.	H/T
F	*Not Used*	No function - Terminal is disabled.	H/T

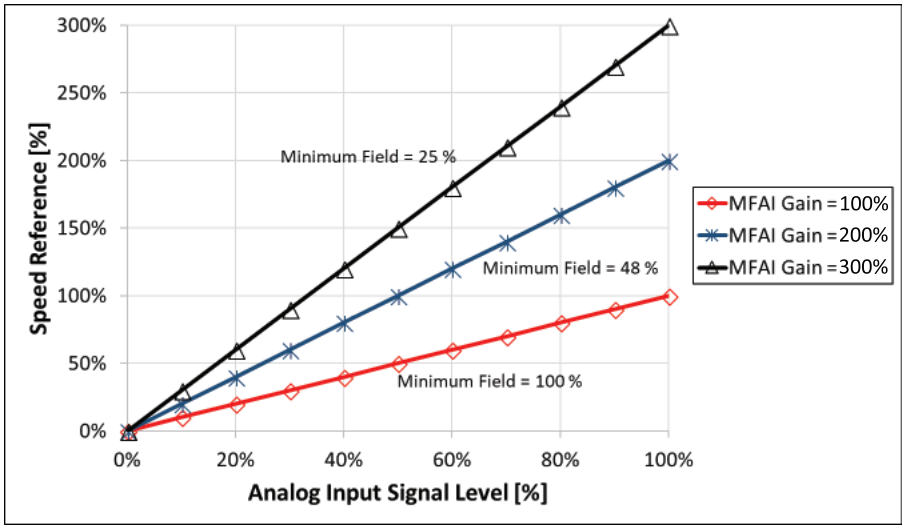


Figure 5-12: Speed Reference Versus Analog Input Gain

5.7.4 Analog Outputs (H04-01 through H04-07)

The DDC-S2 has one built-in analog output for monitoring drive conditions. ***See Table 5-35 on page 84*** and ***Table 5-36 on page 85*** for information on configuring the analog output and selecting its function.

Table 5-35: Analog Output Parameter Settings

Parameter	Display	Function	Range	Default
H04-01	MFAO Select	Sets the function of the multi-function analog output terminals AOV and AOI (*see* ***Table 5-36 on page 85***).	0-999	101
H04-02	MFAO Gain	Gain multiplier for the analog output signal terminals AOV and AOI.	-999.9-999.9%	100.0
H04-03	MFAO Bias	Bias multiplier for the analog output signal terminals AOV and AOI.	-200.0-200.0%	0.0
H04-07	MFAO Signal	MFAO signal type selection (0 and 1 for Terminal AOV, 2 for Terminal AOI).	0-2	0
	0 0-10 V			
	1 -10 - 10 V			
	2 4-20 mA			

Table 5-36: Multi-Function Analog Output (MFAO) Selectable for H04-01

Display		Function	Motion
101	*Speed Reference*	Motor speed reference calculated by the speed regulator.	H/T
102	*Armature Current*	Measured motor armature current.	H/T
103	*Field Current*	Measured motor field current.	H/T
104	*Armature Voltage*	Measured motor armature voltage.	H/T
105	*DC Bus Voltage*	Measured DC bus voltage.	H/T
106	*Sequence Status*	Current state of the sequence status. Outputs (0.5V) * (the value of the Sequence State); see U01-06 for drive states in ***Table 6-2 on page 6-3***.	H/T
107	*Motor RPM*	Calculated (CEMF method) or measured (tach feedback) motor speed feedback.	H/T
108	*Motor Torque*	Calculated motor torque.	H/T
115	*Analog Ref 1*	Analog reference 1 value.	H/T
116	*Analog Ref 2*	Analog reference 2 value.	H/T
123	*Motor CEMF*	Calculated motor CEMF.	H/T
124	*Flux*	Calculated motor flux.	H/T
125	*Hook Load*	Percentage of load currently hung from the hook (includes hook weight).	H
126	*Input Power*	Estimated total power being drawn from the DC supply.	H/T
128	*Arm Current Ref*	Motor armature current reference calculated by the current regulator.	H/T
129	*Field CurrentRef*	Motor field current reference calculated by the current regulator.	H/T
142	*Hook Height*	Hook height as determined by the EPLS and Hook Height Measurement Setup.	
405	*Heatsink Temp*	Measured temperature of the heatsink. 10 VDC = 100°C.	H/T
407	*Motor OL Lvl*	Status of the calculated motor overload level before tripping. A value of 100% is the tripping point.	H/T
408	*Drive OL Lvl*	Status of the calculated drive overload level before tripping. A value of 100% is the tripping point.	H/T
409	*T1 Duty Cycle*	Duty cycle of the upper IGBT of the T1 leg.	H/T
410	*T2 Duty Cycle*	Duty cycle of the upper IGBT of the T2 leg.	H/T
411	*T3 Duty Cycle*	Duty cycle of the upper IGBT of the T3 leg.	H/T
412	*LS Level*	Per unit maximum field voltage during a raise or lower when the hoist trips the power limit switch.	H/T
628	*EIP Analog Out*	Outputs a signal relative to the value set in the corresponding EtherNet/IP assembly register.	

5.7.5 Serial Communications (H05-01 through H05-09)

The DDC-S2 uses RS-485 on terminals A (TX-/RX-) and B (TX+/RX+) on the control board (X1) to communicate over a network using the Modbus RTU protocol. Cycle power after changing serial format parameters. ***See Figure 5-13 on page 5-86*** for connecting a DDC-S2 drive to an RS-485 network. Additional information on Modbus communications is provided in ***Appendix A – Appendix A: Modbus RTU Communications on page A-116***.

Table 5-37: Serial Communication Setup Parameter Settings

Parameter	Display	Function	Range	Default
H05-01	Modbus Address	Sets the Modbus address of the DDC-S2 drive.	1-1F	1
H05-02	Serial Baud Rate	Sets the Modbus baud rate (must match baud rate of other devices on the network).	0-4	1
	0 9.6 kbps			
	1 19.2 kbps			
	2 38.4 kbps			
	3 57.6 kbps			
	4 115.2 kbps			
H05-03	Serial Format	Sets the number of data bits, parity type, and stop bits. Must match the serial format of other devices on the network.	2-3	3
	2 8 N 1			
	3 8 N 2			
H05-06	TX Wait Time	Minimizes the delay between sending data packets.	5-65 ms	5
H05-09	CE Detect Time	Sets the time required to detect a communications error. Adjustment may be needed when networking several drives. Disabling this parameter is not recommended.	0.0-10.0 sec	2.0

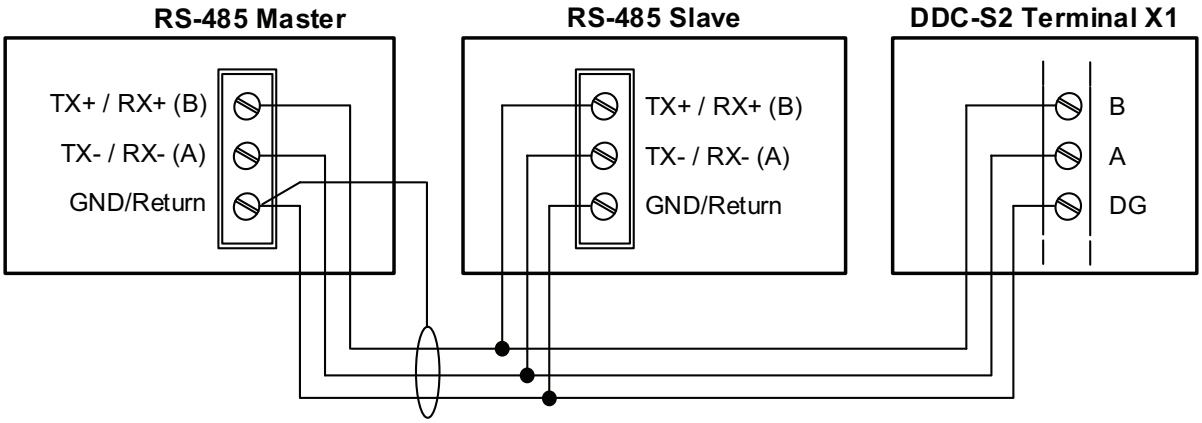


Figure 5-13: RS-485 Serial Network Connections

5.8 Protection

- L1 Drive Protection
- L2 DC Bus Levels
- L8 Motor Protection
- L9 Fault Reset

5.8.1 Drive Protection (L01-02 through L01-07)

CAUTION

Use extreme caution when modifying any protection parameter. Making adjustments to these parameters can cause premature failure, damage to equipment and potentially cause injury to personnel.

Table 5-38: Drive Protection Parameter Settings

Parameter	Display	Function	Range	Default
L01-02	OT Alarm Level	Level that causes the drive to issue a warning for Heatsink Overtemperature (OT1). Drive current limits will be more sensitive once the L01-02 level is reached.	70.0-85.0°C	85.0
L01-03	OT Fault Level	Level that causes the drive to fault on Heatsink Overtemperature (OT2)	70.0-115.0°C	90.0
L01-05	DOL Fault Sel *0 Disabled* *1 Enabled*	Determines whether drive overload protection is enabled or disabled. A DOL fault occurs when the drive current exceeds 150% rated current for one minute. Disabling this parameter is not recommended.	0-1	1
L01-06	OH Fan Enable	Heatsink temperature that the fan will be turned on. Lowering this parameter may increase the semiconductor life expectancy, but decreases the fan's life expectancy.	0.0-70.0°C	60.0
L01-07	AOT Detect Lvl	Level that causes the drive to fault on Ambient Overtemperature (AOT).	0.0-95.0°C	75.0

5.8.2 DC Bus Levels (L02-01 through L02-13)

The DC Bus Level parameter group specifies the DC Bus voltage levels that will cause the DDC-S2 drive to trip on an undervoltage or overvoltage (OV) fault.

Table 5-39: DC Bus Fault Level Parameter Settings

Parameter	Display	Function	Range	Default
L02-01*	UV Detect Level	Level that causes the drive to fault on DC Bus Undervoltage (UV1).	LV: 100-420 VDC HV: 200-840 VDC	LV: 125 HV: 250
L02-02*	OV Detect Level	Level that causes the drive to fault on DC Bus Overvoltage (OV).	LV: 200-420 VDC HV: 400-840 VDC	LV: 350 HV: 700
L02-10	Pre-Charge ON	Precharge contactor on time	0.00-10.00 sec	0.28
L02-11	Pre-Charge OFF	Precharge contactor off time	0.0-60.0 sec	10.0
L02-12	DC OK Level	The DC bus voltage must reach this level within the L01-10 time or the precharge contactor is opened for L01-11 time. The precharge contactor will also open if DC Bus voltage falls below 2x L02-12 level.	0-200 VDC	25
L02-13	P.C. Start Dly	Start delay on first attempt to check the DC Bus voltage level.	0-10.0 sec	0.1

** Range and default value is dependent on the drive model, which is determined by O02-04.*

5.8.3 Motor Protection (L08-01 through L08-09)

The DDC-S2 has several motor diagnostic and protection functions that are affected by these parameters. Functions that can be configured include Armature Open Circuit detection (AOC), Motor Overload protection (MOL), Motor Stall detection (STALL), and Ground Fault detection (GF).

Table 5-40: Motor Protection Parameter Settings

Parameter	Display	Function	Range	Default
L08-01	AOC Detect Level	Sets the armature open circuit detection level as a percentage of Motor Rated Current (E02-01). ***NOTE:*** *AOC Detection is automatically disabled when the Power Limit Switch function is enabled (C03-20).*	0.0-100.0%	H: 20.0 T: 0.0
L08-02	AOC Detect Timer	This is the time to allow the armature current to reach the L08-01 level. Increase the AOC Detection Timer or decrease the AOC Detection Level to eliminate nuisance AOC faults.	0-2500 ms	100
L08-03	AOC Torque Limit	Defines the torque limit during the AOC Detect time.	0.0-250.0%	100.0
L08-04	Stall Prot Time	Sets the time the drive checks for a CEMF less than 20% (or less than 5%, if tachometer feedback is used) when outputting greater than 100% armature current before tripping on a Motor Stall (STALL) fault. A setting of 0 disables Motor Stall Protection.	0.0-20.0 sec	0.0
L08-05	MOL Fault Sel *0 Disabled* *1 Enabled*	Determines whether Motor Overload (MOL) detection is enabled or disabled. If enabled, this function serves as a built-in electronic motor overload to protect the motor from overheating.	0-1	1
L08-09	Ground Fault *0 Disabled* *1 Enabled*	Determines whether Ground Fault (GF) detection is enabled or disabled. A ground fault occurs if the current output to the motor deviates from the current flowing back to the drive. ***NOTE:*** *Jumper LK10 on the Gate Driver Board must be set to the appropriate motion. Jumper LK12 on the Gate Driver Board sets the sensitivity of the Ground Fault Detection to either 50%, 20%, 10%, or 5%. The default value is 50%.*	0-1	1

5.8.4 Fault Reset (L09-01 and L09-02)

These parameters set how the drive handles the resetting of various drive faults. ***Table 5-42 on page 90*** shows the automatically reset fault assignment table for L09-01 (the hexadecimal value of 0 1 0 4 is the default - OT2 and AOT automatically reset).

Table 5-41: Automatically Resettable Fault Assignment Table

	Digit 4				Digit 3				Digit 2				Digit 1			
HEX	0				1				0				4			
Binary	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Table 5-42: List of Automatically Resettable Faults

Bit Position	Fault Identifier
0	CUV
1	UV1
2	OT2
3	OV
4	EXF
5	FDBK
6	STALL
7	FL
8	AOT
9	GF
10	AOC
11	CBF-03
12	Not Used
13	Not Used
14	Not Used
15	Not Used

Example of configuring L09-01 for a specific set of automatically resettable faults:

Resettable faults required: Field Loss (FL), Motor Stall (STALL), DC Bus overvoltage (OV) and DC Bus undervoltage (UV1)

Step 1: UV1 = Bit 1 and OV = Bit 3, therefore Digit 1 has a binary value of 1 0 1 0 (hexadecimal value of A; ***see Table 5-44 on page 91***)

Step 2: FL = Bit 7 and STALL = Bit 6, therefore Digit 2 has a binary value of 1 1 0 0 (hexadecimal value of C)

Step 3: All bits in Digits 3 and 4 are zero, therefore both digits have a binary value of 0 (hexadecimal value of 0)

Step 4: Program L09-01 to equal 00CA

Table 5-43: Example L09-01 Configuration of Resettable Faults

	Digit 4				Digit 3				Digit 2				Digit 1			
HEX	0				0				C				A			
Binary	0	0	0	0	0	0	0	0	**1**	**1**	0	0	**1**	0	**1**	0
Fault					**CBF03**	**AOC**	**GF**	**AOT**	**FL**	**STALL**	**FDBK**	**EXF**	**OV**	**OT2**	**UV1**	**CUV**

Table 5-44: Binary to Hexadecimal Conversion Table

Binary Value				Hex Value
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

Table 5-45: Fault Reset Parameter Settings

Parameter	Display	Function	Range	Default
L09-01	Reset Flt Sel	Selects the faults that will be automatically reset when the fault condition is cleared.	0000-FFFF	0 1 0 4
L09-02	Reset Attempts	Sets the number of automatic reset attempts for the faults selected in L09-01. If the reset attempts max out, a fault reset command is required by the operator.	0-10	3

5.9 Operator

- O2 Drive Configuration
- O3 Maintenance History

5.9.1 Drive Configuration (O02-03 through O02-07)

This section sets up the DDC-S2 input voltage, drive model and hardware configurations related to the type of motor connected.

5.9.1.1 Parameter Setup for Current Transducers (CT) (O02-06 and O02-07)

Parameters O02-06 and O02-07 configure the DC current transducer (DCCT) for armature and field current measurements respectively. The physical link settings on an external CT board are shown in ***Table 3-7 on page 39***. The O02-06 and O02-07 parameter settings must match the jumper settings to obtain proper current scaling. In addition, the jumper connections on the gate driver board must be set according to ***Table on page 41***.

Table 5-46: Drive Configuration Parameter Settings

Parameter	Display	Function	Range	Default
O02-03	Parallel Stacks	Sets the total number of DDC-S2 cubes to satisfy the current rating of the drive.	1-5	*
O02-04	Drive Model	Selects the appropriate DDC-S2 drive model based on the system voltage and connected hardware (and configurations).	0-17	0
	0 LN2067-DDC-S2	67 ADC, 250 VDC, 1 Stack (Small Chassis).		
	1 LN3133-DDC-S2	133 ADC, 250 VDC, 1 Stack (Small Chassis).		
	2 LN4200-DDC-S2	200 ADC, 250 VDC, 1 Stack.		
	3 LN5400-DDC-S2	400 ADC, 250 VDC, 1 Stack.		
	4 LN6800-DDC-S2	800 ADC, 250 VDC, 2 Parallel Stacks.		
	5 LN71200-DDC-S2	1200 ADC, 250 VDC, 3 Parallel Stacks.		
	6 LN8S1600-DDC-S2	1600 ADC, 250 VDC, 4 Parallel Stacks.		
	7 LN8L2000-DDC-S2	2000 ADC, 250 VDC, 5 Parallel Stacks.		
	10 HN2067-DDC-S2	67 ADC, 500 VDC, 1 Stack.		
	11 HN3133-DDC-S2	133 ADC, 500 VDC, 1 Stack.		
	12 HN4200-DDC-S2	200 ADC, 500 VDC, 1 Stack.		
	13 HN5400-DDC-S2	400 ADC, 500 VDC, 1 Stack.		
	14 HN6800-DDC-S2	800 ADC, 500 VDC, 2 Parallel Stacks.		
	15 HN71200-DDC-S2	1200 ADC, 500 VDC, 3 Parallel Stacks.		
	16 HN8S1600-DDC-S2	1600 ADC, 500 VDC, 4 Parallel Stacks.		
	17 HN8L2000-DDC-S2	2000 ADC, 500 VDC, 5 Parallel Stacks.		
NOTE: *When connecting parallel stacks, do NOT mix OmniPulse Series 1 drives with OmniPulse Series 2. Combining different series drives may cause a short circuit condition and/or damage.*				
O02-06	Armature Setup	Selects the configuration of the current transducer (CT) used to measure armature current.	0-3	0
	0 Int. CT	Uses CT internal to the drive.		
	1 Ext CT 20A	External CT board connected (***see Tables to 3-10 on page 3-40*** for jumper settings).		
	2 Ext CT 10A			
	3 Ext CT 5A			
O02-07	Field Setup	Selects the configuration of the current transducer (CT) used to measure field current.	0-4	0
	0 Series Int CT	Uses CT internal to the drive.		
	1 Shunt ExtCT 20A	External CT board connected (***see Tables to 3-10 on page 3-40*** for jumper settings).		
	2 Shunt ExtCT 10A			
	3 Shunt ExtCT 5A			
	4 Shunt ExtCT 2.5A			

** Range and/or default value is dependent on the drive model, which is determined by O02-04.*

5.9.2 Maintenance History (O03-01 through O03-11)

These parameters allow the operator to store and recall parameter settings and clear the DDC-S2 run and fault history.

Table 5-47: Maintenance History Parameter Settings

Parameter	Display	Function	Range	Default
O03-01	Store Values	Stores a copy of the parameters in a dedicated non-volatile memory location.	0-1	0
	0 No Action			
	1 Store User	Stores currently set parameters to User storage area (Set A01-05 = 1 to restore these parameter settings).		
O03-02	Run Hist Reset	Resets various historic data collected by the drive.	0-5	0
	0 No Action			
	1 Reset Run Time	Resets the total time drive has been in a running state.		
	2 Reset Fan Time	Resets total run time of the cooling fan.		
	3 Reset Brake Count	Resets total number of brake releases issued.		
	4 Reset Run Count	Resets total number of run commands issued.		
	5 Reset All	Resets all historic data.		
O03-11	Flt Hist Reset	Resets all fault history data.	0-1	0
	0 No Action			
	1 Reset Flt History			

6 Troubleshooting

Table 6-1: Motor Related Issues and Corrective Actions

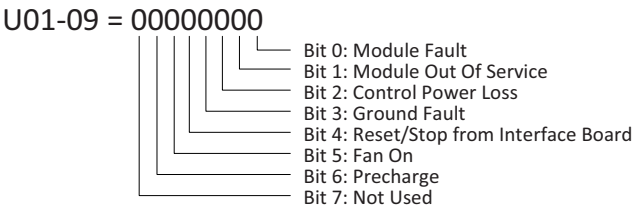
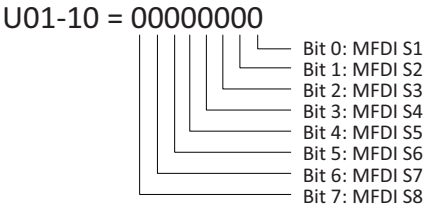
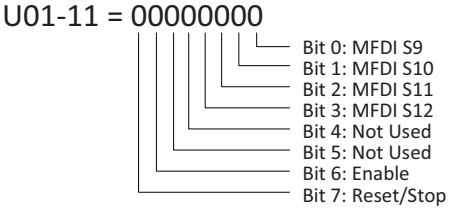
Symptom	Corrective Action
No motor rotation	1. Check all motor connections and jumper settings. 2. Verify that power is on (Charge LED). 3. Verify that the DLS4 keypad is not showing a fault. 4. Verify that Enable and Run MFDIs are on (U01-10/U01-11).
Motor rotation is wrong	1. Ensure correct motor lead connections at the drive and motor. 2. Verify that Hoist/Lower or FWD/REV commands are correct on the control or interface card by checking U01-10 bit 0 (Lower/REV) and bit 1 (Hoist/FWD).
Motor rotates, but at minimum speed only	1. Check wiring of all speed inputs. 2. Verify speed reference setting (A01-04). 3. Verify speed, run, and torque reference settings are correct (B03-01 through B03-03).
Motor RPM too high or too low	1. Verify jumper settings of external CT cards if used (measured motor currents closely match U01-02 and U01-03). 2. Compare motor nameplate specifications with the E02 group parameters. 3. Motor field current settings require adjustment (if operating motor above base speed).

6.1 Monitors

- U01 Status
- U02 Fault Trace
- U03 Fault History
- U04 Maintenance
- U06 Ethernet/IP

Table 6-2: Status Monitors

Parameter	Display	Function	Units
U01-01	Speed Reference	Speed output as a percentage of the motor rated speed.	%
U01-02	Armature Current	Motor armature current derived from terminal T1 current measurement.	A
U01-03	Field Current	Motor field current derived from terminal T3 current measurement.	A
U01-04	Armature Voltage	Motor armature voltage derived from terminals T1 and T2 measurement.	VDC
U01-05	DC Bus Voltage	Voltage on the drive DC bus capacitors.	VDC

Parameter	Display	Function	Units
U01-06	Sequence Status	Current sequence state: 0 = Initialization Power Up 1 = Locked Out 2 = Ready 3 = Start Delay 4 = Armature Circuit Test 5 = Load Sense 6 = In Motion 7 = Decelerating to Stop 8= Load Float 9 = Dynamic Brake A 10 = Dynamic Brake B 11 = Stop 12 = Fault Sequence 13 = LS Back Out 14 = Not Used 15 = Rescue Mode 16 = Fault Reset 17 = Latched Fault	
U01-07	Motor RPM	Calculated motor speed in RPM.	RPM
U01-08	Motor Torque	Calculated motor torque (% Flux x % Arm I) as a percentage.	%
U01-09	System IO	System status bits. Bits change to 1 when input is present. 	
U01-10	Logic Inputs Lo	Logic input bits. Bits change to 1 when input is present. 	
U01-11	Logic Inputs Hi	Logic input bits. Bits change to 1 when input is present. 	

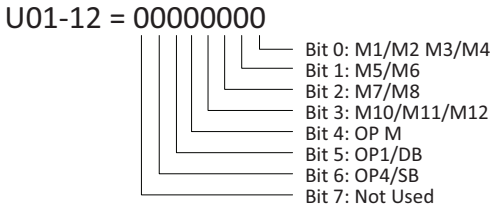
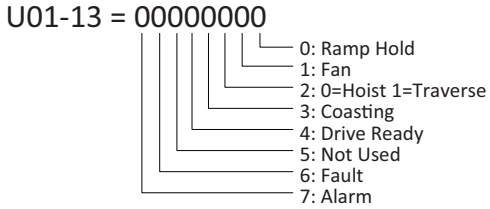
Parameter	Display	Function	Units
U01-12	Logic Outputs	Logic output bits. Bits change to 1 when output is present. 	
U01-13	Control Status	Control status bits. Bits change to 1 when status is active. 	
U01-14	Firmware Version	Firmware version and revision. Modbus read does not return Revision.	
U01-15	Analog Input 1	% full scale of analog input 1.	%
U01-16	Analog Input 2	% full scale of analog input 2.	%
U01-22	Input Speed	Commanded speed reference as a percentage of motor rated speed.	%
U01-23	Motor CEMF	Motor counter EMF as a percentage of the motor rated voltage. 100%= E02-01 value.	%
U01-24	Flux	Calculated motor flux as percentage of the full-field value.	%
U01-25	Hook Load	Calculated hook load in % for Hoist Configuration Only.	%
U01-26	Input Power	Instantaneous power input from the main DC supply.	kW
U01-27	Energy Used	Accumulated energy used by the controller.	kWh
U01-28	Arm Current Ref	Armature calculated current reference as a percentage of the motor rated current.	%
U01-29	Field CurrentRef	Field calculated current reference as a percentage of motor rated current.	%
U01-30	Upper Ctrl Limit	Forward current limit applied to the speed controller.	%
U01-31	Lower Ctrl Limit	Reverse current limit applied to the speed controller.	%
U01-34	Prm Out Of Range	Parameter that is out of range.	
U01-35	Tach Coefft	Tachometer coefficient displayed between 0 and 1.	
U01-38	Ctrl Source	Control Source selected for Run and Reference in hexadecimal form of OhOTRS where: S: Speed Source (B03-01 or B03-15) R: Run Source (B03-02 or B03-16) T: Torque Source (B03-03 or B03-17)	
U01-40	Motor Revs	Number of motor revolutions after Home with respect to Home	Revs
U01-41	Motor Pulses	PG Counter (unsigned)	Pulses
U01-42	Hook Height	Percentage of Hook Height is displayed	%
U01-43	PG Motor Spd	Calculated motor speed based on PG Feedback	RPM

Table 6-3: Fault Trace Monitors

Parameter	Display	Function	Units
U02-01	Fault Status	Active fault. 0001 = None 0002 = Undervoltage (UV1) 0003 = Control Power Loss (CUV) 0005 = Heatsink Over Temp Fault (OT2) 0006 = Short Circuit (SC) 0007 = Overvoltage (OV) 0008 = External Fault (EF) 0009 = Feedback Error (FDBK) 000A = Motor Stall (STALL) 000B = Slack Cable (SLC) 000C = Field Loss (FL) 000D = Limit Switch (LS) 000E = Motor Overload (MOL) 000F = Master Switch On (MS) 0010 = Drive Overload (DOL) 0011 = Ambient Over Temp (AOT) 0012 = Ground Fault (GF) 0013 = Module Out Of Service (MOS) 0014 = Armature Open Circuit (AOC) 0026 = Control Communication Timeout (COM) 0027 = Parameter Out Of Range (PRM) 0031 = Non-Critical EEPROM Fault (CBF-01) 0032 = Critical EEPROM Fault (CBF-02) 0033 = 24V Short Circuit (CBF-03) 0035 = Weighted Limit Switch (UL3)	
U02-02	Speed Reference	Speed reference as a percentage of the motor rated speed at full load when the fault was detected.	%
U02-03	Armature Current	Motor armature current derived from controller terminal T1 current measurement when the fault was detected.	A
U02-04	Field Current	Motor field current derived from controller terminal T3 measurement when the fault was detected.	A
U02-05	Armature Voltage	Armature voltage measurement derived from controller terminals T1 and T2 when the fault was detected.	VDC
U02-06	DC Bus Voltage	Voltage on the DC bus capacitors when the fault was detected.	VDC
U02-07	Sequence Status	Sequence state when the fault was detected.	%
U02-08	Flux	Calculated motor flux as percentage of the full-field value when the fault was detected.	%
U02-09	Motor RPM	Calculated motor speed in RPM value when the fault was detected.	RPM
U02-10	Motor Torque	Calculated motor torque (% Flux multiplied by % Arm I) as a percentage value when the fault was detected.	%
U02-11	Elapsed Hours/10	Accumulated time controller is outputting current.	Hr
U02-12	Analog Input 1	% full scale of analog input 1 value when the fault was detected.	%
U02-13	Logic Inputs Lo	Logic input bits when the fault was detected.	
U02-14	Logic Inputs Hi	Logic input bits when the fault was detected.	
U02-15	Logic Outputs	Logic output bits when the fault was detected.	
U02-16	Control Status	Control status bits when the fault was detected.	
U02-17	Last Fault	See U02-01 for more details on fault.	

Table 6-4: Fault History Monitors

Parameter	Display	Function	Units
U03-01	Fault 1	First most recent fault.	
U03-02	Fault 1 Time	Elapsed time of the first most recent fault.	Hr
U03-03	Fault 2	Second most recent fault.	
U03-04	Fault 2 Time	Elapsed time of the second most recent fault.	Hr
U03-05	Fault 3	Third most recent fault.	
U03-06	Fault 3 Time	Elapsed time of the third most recent fault.	Hr
U03-07	Fault 4	Fourth most recent fault.	
U03-08	Fault 4 Time	Elapsed time of the fourth most recent fault.	Hr
U03-09	Fault 5	Fifth most recent fault.	
U03-10	Fault 5 Time	Elapsed time of the fifth most recent fault.	Hr
U03-11	Fault 6	Sixth most recent fault.	
U03-12	Fault 6 Time	Elapsed time of the sixth most recent fault.	Hr
U03-13	Fault 7	Seventh most recent fault.	
U03-14	Fault 7 Time	Elapsed time of the seventh most recent fault.	Hr
U03-15	Fault 8	Eighth most recent fault.	
U03-16	Fault 8 Time	Elapsed time of the eighth most recent fault.	Hr
U03-17	Fault 9	Ninth most recent fault.	
U03-18	Fault 9 Time	Elapsed time of the ninth most recent fault.	Hr
U03-19	Fault 10	Tenth most recent fault.	
U03-20	Fault 10 Time	Elapsed time of the tenth most recent fault.	Hr
U03-21	Fault 11	Eleventh most recent fault.	
U03-22	Fault 11 Time	Elapsed time of the eleventh most recent fault.	Hr
U03-23	Fault 12	Twelfth most recent fault.	
U03-24	Fault 12 Time	Elapsed time of the twelfth most recent fault.	Hr
U03-25	Fault 13	Thirteenth most recent fault.	
U03-26	Fault 13 Time	Elapsed time of the thirteenth most recent fault.	Hr
U03-27	Fault 14	Fourteenth most recent fault.	
U03-28	Fault 14 Time	Elapsed time of the fourteenth most recent fault.	Hr
U03-29	Fault 15	Fifteenth most recent fault.	
U03-30	Fault 15 Time	Elapsed time of the fifteenth most recent fault.	Hr

Table 6-5: Maintenance Monitors

Parameter	Display	Function	Units
U04-01	Num Operations	Number of runs. The value is reset to 0 when 1000 operations are reached and U04-02 is incremented. Counter can be reset by parameter O03-02.	
U04-02	Operations X1000	Operation Counter (increments 1 for every 1000 operations up to 65,535 after which it resets to zero).	
U04-03	Elapsed Hours/10	Accumulated time controller is outputting current divided by 10.	Hr
U04-04	FanRun Hours/10	Cumulative operation time of the cooling fan. The default value for the fan operation time is reset in parameter O03-02. After the count reaches 99999, the value will reset to 0 and start counting again.	Hr
U04-05	Heatsink Temp	Heatsink temperature. The alarm level is determined by parameter L01-02 and faults at L01-03.	°C
U04-06	Ambient Temp	Ambient temperature at the control board. Fault at value selected in parameter L01-07 and auto-resets when the temp drops 10 degrees.	°C
U04-07	Motor OL Lvl	Accumulated value of armature current overload. This monitor increments above 110% current and decrements when current falls below 110%. A fault occurs when the monitor value reaches 100%.	%
U04-08	Drive OL Lvl	Accumulated value of drive overload current. This monitor increments above 110% drive rated current and decrements when current falls below 110%. A fault occurs when the monitor value reaches 100% (150% of drive rated current for 60 seconds or 200% immediately).	%
U04-09	T1 Duty Cycle	PWM duty cycle (% time ON) at terminal T1 (connected to armature terminal A1).	%
U04-10	T2 Duty Cycle	PWM duty cycle (% time ON) at terminal T2 (connected to armature terminal A2).	%
U04-11	T3 Duty Cycle	PWM duty cycle (% time ON) at terminal T3 (connected to field terminal S2).	%
U04-12	LS Level	Percent peak voltage when the hoist reaches the limit switch. If the limit switch is not detecting properly, adjust C03-22 to a percentage below what is seen in this parameter.	%
U04-13	Brake Counter	Number of times the brake has opened. The value is reset to 0 when 1000 cycles are reached and U04-14 is incremented. The counter can be reset by parameter O03-02.	
U04-14	Brake Cnt x1000	Brake counter (increments 1 for every 1000 cycles up to 65,535 after which it resets to zero).	
U04-24	485 RX Count	Number of packets (good or bad) received on the RS485 communication line	
U04-25	485 CRC Error	CRC errors on the RS485 communication line	
U04-26	485 MB_Addr	Last received address on the RS485 communication line	
U04-27	485_MB_Cmd	Last received command on the RS485 communication line	

Table 6-6: Ethernet/IP Monitors

Parameter	Display	Function
U06-80	IP Address 1	IP Address 1
U06-81	IP Address 2	IP Address 2
U06-82	IP Address 3	IP Address 3
U06-83	IP Address 4	IP Address 4
U06-84	Subnet 1	Subnet 1
U06-85	Subnet 2	Subnet 2
U06-86	Subnet 3	Subnet 3
U06-87	Subnet 4	Subnet 4
U06-88	Gateway 1	Gateway 1
U06-89	Gateway 2	Gateway 2
U06-90	Gateway 3	Gateway 3
U06-91	Gateway 4	Gateway 4
U06-92	Online Speed	Link Speed: 10: 10Mbps or 100: 100Mbps
U06-93	Online Duplex	Duplex Setting: 0: Half, 1: Full
U06-94	MAC 1	MAC Address 1
U06-95	MAC 2	MAC Address 2
U06-96	MAC 3	MAC Address 3
U06-97	MAC 4	MAC Address 4
U06-98	MAC 5	MAC Address 5
U06-99	MAC 6	MAC Address 6

6.2 Maintenance and Inspection

This section describes basic maintenance and inspection procedures to enable the drive to perform optimally. In this manual, “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.

Table 6-7: 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).

6.2.1 Replacing the Keypad Battery (Legacy DLS4 Keypads)

Legacy keypads include a user-replaceable battery that can be accessed by removing the round battery hatch located on the back of the DLS4. A flathead screwdriver or a thin, flat device less than 0.25" wide is required to open the hatch. Twist it in a counter-clockwise direction for about 1/8 of a turn to release the latch. When replacing the battery, ensure the new battery is seated with the text visible (facing upward). After replacing the battery, it will likely be necessary to reprogram the date and time. The latest DLS4 version (May 2020) includes a built-in rechargeable battery that does not require periodic replacement.

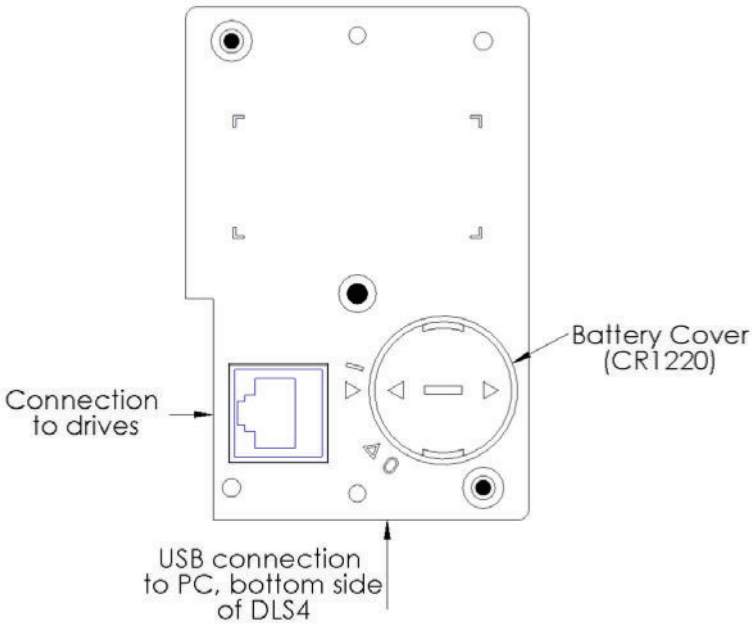


Figure 6-1: Back of DLS4 Keypad

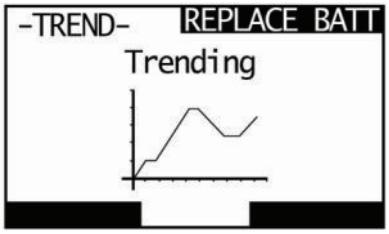


Figure 6-2: Replace Battery Message

Battery Type: Lithium Coin Cell, 3V, 12.5mm, CR1220

Suggested Brands: Panasonic, Energizer, or Duracell

The DLS4 keypad will detect if the battery charge is getting low or is fully drained. A “REPLACE BATT” message will appear on the top left corner of the screen when the battery should be replaced.

6.2.2 Firmware Updates

Firmware updates are available for free, which may incorporate new features and enhancements. The IMPULSE•Link 5 PC software is used to connect to the DDC-S2 and update its firmware. A USB-A male to USB Micro-B male cable is required to make this connection.

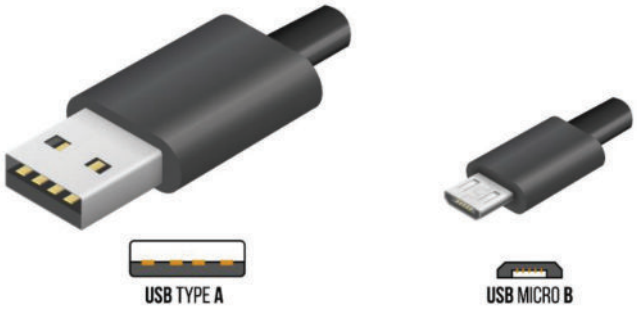


Figure 6-3

The IMPULSE•Link 5 Viewer software and the DDC-S2 firmware may be downloaded from the Software Downloads webpage at https://www.columbusmckinnon.com/en-us/software-downloads/

Follow these steps to update the firmware:

1. Plug the USB Micro-B end of the cable into the DDC-S2 Control Board. This is located on the right side of the drive, in the top right corner of the board. Plug the other end of the USB cable into a PC.

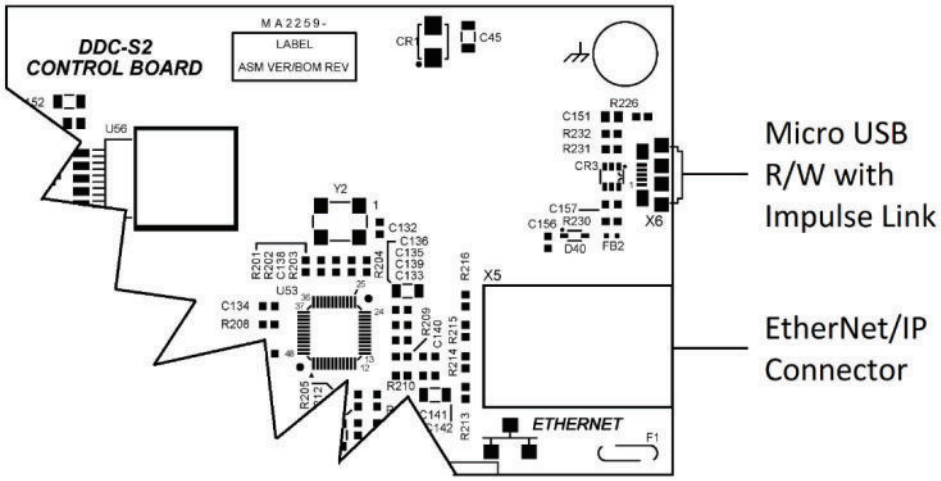


Figure 6-4

2. Open IMPULSE•Link 5 and click on the “Updates” tab. Next click on the button for “DDC-S2/DMC-S2 Flash Utility.” A new window will open with the flash utility.

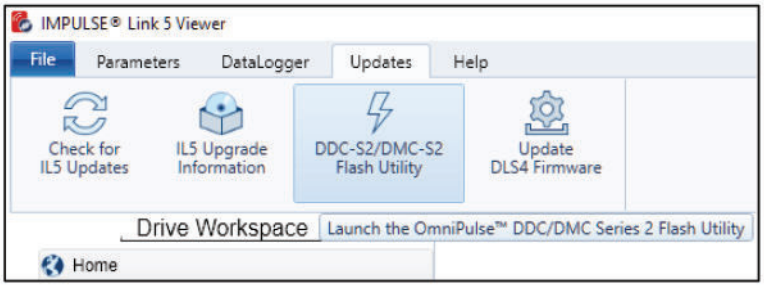


Figure 6-5

3. Click the “Load FW” button and navigate to the .hex firmware file that was downloaded from the Software Downloads webpage.

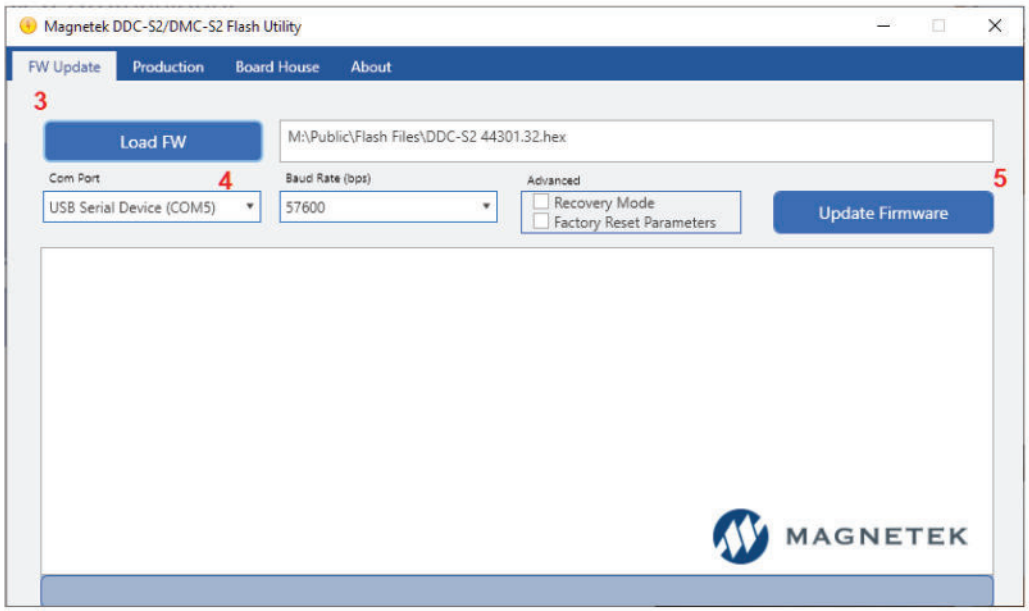


Figure 6-6

4. Click the drop-down box for “Com Port” and select the option that corresponds with the COM port that mounted for the DDC-S2 drive.
5. Click the “Update Firmware” button to initiate the firmware update. A visual progress bar will indicate when the process is complete.

6.3 Fault Codes and Corrective Action

Any fault that occurs while the drive is outputting current will be logged in the fault history. ***See Table 6-8 on page 105*** for the list of faults and when they may not be logged. Faults require a fault reset via a multifunction input or cycle power in order to clear the fault and continue operation.

NOTE: *A fault may be automatically reset when the condition is removed if L09-01 is programmed to do so.*

Table 6-8: Drive Faults

Fault Code	Description	Corrective Action	Alarm	Fault	Logged in History	
					During run	Sitting idle
AOC - Armature Open Circuit	Indicates that the motor armature loop is open or that current is not passing from drive terminals T1 to T2.	1. Monitor U01-02 for Armature current feedback. 2. Check motor circuit and wiring. 3. Perform Diode and IGBT test per Transistor and Diode Check Table. **Never megger the drive. 4. Modify parameters L08-01 and/or L08-02. 5. Ensure proper Limit Switch settings C03-20 through C03-24 if in hoist mode.		X	Yes	No
AOT - Ambient Overtemperature	The ambient temperature monitored by the control board is greater than the value programmed in L8-12.	1. Monitor ambient temperature by U04-06. 2. Decrease ambient temperature. 3. Ensure that fans are functional. 4. Ensure heatsink is free of dirt and debris. 5. Reduce Load and/or duty cycle. 6. Add air conditioner.		X	Yes	Yes
CBF-01 - Non-Critical EEPROM Fault	A non-critical error occurred in the EEPROM.	1. Reset the fault. 2. If the problem continues, replace the control board.		X	Yes	Yes
CBF-02 - Critical EEPROM Fault	A critical error occurred in the EEPROM. A parameter value may have been corrupted.	1. Reset the fault and check the modified constant list to verify parameter values are correct. 2. If the problem continues, replace the control board.		X	Yes	Yes
CBF-03 - 24V Short Circuit	Excessive current detected on 24V line.	1. Ensure pins on the X7 connector of the control board and J1 of the interface board are free of debris and the connector is securely fastened. 2. Cycle power to the drive. 3. If the problem continues, replace the interface board and/or the ribbon cable between the control board and interface board.		X	Yes	Yes

Fault Code	Description	Corrective Action	Alarm	Fault	Logged in History	
					During run	Sitting idle
COM - Control Communication Timeout	Serial communication timeout detected.	1. Check serial connections. 2. Increase detection time H05-09.		X	Yes	No
CUV - Control Power Loss	The 24 V power supply has fallen below 19 V.	1. Ensure Power is present at the drive and it is turned on. 2. Ensure that all connections on the gate driver board are in the correct position and securely fastened. 3. Ensure that all ribbon cables are securely fastened to the control board. 4. Check +24V LED DS4 on the gate driver board. 5. For large chassis drives, check TP6 = +24 VDC, TP7 = -15 V, TP10 = +15 VDC, TP9 = +5 VDC on the gate driver board. 6. Check control board terminal 24V on X1 and X3 for 24 VDC. 7. Replace control board. 8. Replace gate driver board.		X	Yes	No
DOL - Drive Overload	The current output at T2 has reached 150% of drive rated current for 60 seconds or 200% immediately.	1. Check motor wiring. 2. Ensure motor spins correct direction for given run command. 3. Reduce duty and/or current/torque limits.		X	Yes	No
EF - External Fault	An MFDI set to External fault has opened.	1. Verify External Fault Logic circuitry is functioning correctly. 2. Verify that the External device that signaled the External fault is functioning properly. 3. Check that the digital inputs H01-xx are set properly.		X	Yes	Yes
FDBK - Feedback Error	TACH feedback lost or armature voltage exceeded fault level.	1. Verify the settings of parameters F02-xx are set properly. 2. Ensure tachometer is properly mounted. 3. Check tachometer wiring to Figure 5-11.		X	Yes	No
FL - Field Loss	Indicates that the motor field loop is open.	1. Monitor U1-03 for Field Current feedback. 2. Check motor circuit and wiring. 3. Perform Diode and IGBT test per Transistor and Diode Check Table. 4. Verify the power limit switch settings are correct.		X	Yes	No

Fault Code	Description	Corrective Action	Alarm	Fault	Logged in History	
					During run	Sitting idle
GF - Ground Fault	A motor output terminal is shorted to ground. ***NOTE:*** *In traverse mode, the field is not monitored for GF.*	1. Check the motor circuit for shorts to ground. 2. Check that displayed Armature Current U01-02 equals the actual armature current using a clamp-on amp meter. 3. Check for a short circuit in the motor or wiring using a megger. ***Never megger the drive. 4. Ensure proper jumper settings on the gate driver board. ***See Figure 3-5 on page 32***.		X	Yes	No
LS - Limit Switch	The drive has detected the hook reached a power limit switch.	1. Jog hoist down until Power Limit Switch resets. 2. Ensure that Power Limit Switch is operating properly. 3. Verify Power Limit Switch circuit wiring. 4. Adjust Limit Switch detection parameters C03-20 through C03-24.	X	X	Yes	No
MOL - Motor Overload	The armature current has exceeded 110% for an extended period of time.	1. Monitor U04-07 for the accumulated overload level. 2. Check for a dragging brake. 3. Check for a weak motor field. 4. Check that displayed Armature Current U01-02 equals the actual armature current using a clamp-on amp meter. 5. Reduce the Current / Torque limits. 6. Perform Diode and IGBT test per Transistor and Diode Check Table. ***Never megger the drive. 7. Check for a short circuit in the motor or wiring using a megger.		X	Yes	No
MOS - Module Out of Service	Indicates that one or more follower units are out of service. LED on the gate driver board of the faulted drive will illuminate.	1. Verify the setting in parameters O02-04 and O02-03 are correct. 2. Ensure that follower drives are powered up correctly. 3. Ensure that the gate driver board data bus cable is connected between master and follower(s) (J1 and J16). 4. Verify on follower(s) gate driver board that bus connector J9 has only pins 11 and 12 jumpered.		X	Yes	Yes

Fault Code	Description	Corrective Action	Alarm	Fault	Logged in History	
					During run	Sitting idle
MS - Master Switch	Either a FWD, RVS, or Enable input was present at power up or the FWD and RVS command was given at the same time.	1. Return all inputs to their neutral position. 2. Check wiring for proper functionality. 3. Check that the digital inputs H01-xx are set properly. 4. Ensure MS Fault Time B03-05 is set to a reasonable number. The default time should be sufficient. 5. Check that Logic Inputs on monitors U01-10 and U01-11 are functioning properly.		X	Yes	No
OT1 - Heatsink Over Temp Alarm	The heatsink temperature has risen above the OT Alarm Level L01-02.	1. Reduce duty, current or torque limits and speeds and/or combination of some or all of above. 2. Ensure that the heatsink cooling fans are operating properly. 3. Ensure that heatsink is free of dirt and debris. 4. Ensure that ambient temperature is within specifications.	X		No	No
OT2 - Heatsink Over Temp Fault	The heatsink temperature has risen above the OT Fault Level L01-03.	1. Reduce duty, current or torque limits and speeds and/or combination of some or all of above. 2. Utilizing monitor U04-05, allow the heatsink temperature to fall 10 degrees below the level programmed in L01-03. 3. Ensure that the heatsink cooling fans are operating properly. 4. Ensure that heatsink is free of dirt and debris. 5. Ensure that ambient temperature is within specifications.		X	Yes	Yes
OV - Overvoltage	Indicates the bus voltage surpassed the value set in L02-02.	1. Ensure that the incoming supply voltage is not rising above tolerance. 2. Check DC bus voltage shown by monitor function U01-05. 3. If used, ensure that RPM is operational. 4. If used, check the RPM resistor and wiring. 5. Extend the deceleration time. 6. Decrease maximum speed. 7. Add RPM to bleed off excessive energy.		X	Yes	Yes

Fault Code	Description	Corrective Action	Alarm	Fault	Logged in History	
					During run	Sitting idle
PGO-H - Encoder Signal Loss	There has been a loss of an encoder signal/channel or the encoder signals are corrupted.	***See Section 6.4 on page 112***.		X	X	X
PRM - Parameter Out Of Range	Parameter value exceeds ratings.	1. Check U01-34 to see which parameter is out of range. 2. Set correct value.	X		No	No
SC - Short Circuit	Indicates that the drive has detected an output short circuit. Fault will also occur when 15 Volt power supply is below 13 VDC.	1. For large chassis drives, check short circuit diagnostic LEDs on gate driver board to see which IGBT circuit has a problem. Reset diagnostic LEDs by pressing button SW1. 2. Disconnect motor from drive. 3. Perform Diode and IGBT test per Transistor and Diode Check Table. 4. Check for a short circuit in the motor or wiring using a megger. ***Never megger the drive. 5. For NEMA sizes 4 and above, check TP6 = +24 VDC, TP7 = -15 V, TP10 = +15 VDC, TP9 = +5 VDC.		X	Yes	No
SLC - Slack Cable	Slack cable condition detected. Only hoisting is permitted until reset.	1. Slowly raise the hook. 2. Check that Slack Cable parameters C11-01 through C11-04 are set properly.	X	X	No	No
STALL - Motor Stall	Armature current has exceeded 100% and the drive detected little to no motor rotation.	1. Ensure the brake(s) releases when it should. 2. Reduce the load. 3. Extend the Acceleration time, parameters B05-xx. 4. Check that Stall Protection Time L08-04 is set properly.		X	Yes	No
Lim1 - Slowdown Limit	An MFDI set to 1E opened.	1. May not require corrective action. 2. Verify slowdown circuitry is functioning correctly. 3. Verify that the external device that signaled the limit is functioning properly. 4. Check that the digital inputs H01-xx are set properly.	X		No	No

Fault Code	Description	Corrective Action	Alarm	Fault	Logged in History	
					During run	Sitting idle
Lim2 - Stop Limit	An MFDI set to 1D opened.	1. Back out of the limit. 2. Verify stop circuitry is functioning correctly. 3. Verify that the external device that signaled the limit is functioning properly. 4. Check that the digital inputs H01-xx are set properly.	X		No	No
LL1 - Lower Limit 1	An MFDI set to LL1 has switched.	1. May not require corrective action. 2. Back out of the limit. 3. Verify limit circuitry is functioning correctly. 4. Verify that the external device that signaled the limit is functioning properly. 5. Check that the digital inputs H01-xx are set properly.	X		No	No
LL2 - Lower Limit 2	An MFDI set to LL2 has switched.	1. May not require corrective action. 2. Back out of the limit. 3. Verify limit circuitry is functioning correctly. 4. Verify that the external device that signaled the limit is functioning properly. 5. Check that the digital inputs H01-xx are set properly.	X		No	No
UL1 - Upper Limit 1	An MFDI set to UL1 has switched.	1. May not require corrective action. 2. Back out of the limit. 3. Verify limit circuitry is functioning correctly. 4. Verify that the external device that signaled the limit is functioning properly. 5. Check that the digital inputs H01-xx are set properly.	X		No	No
UL2 - Upper Limit 2	An MFDI set to UL2 has switched.	1. May not require corrective action. 2. Back out of the limit. 3. Verify limit circuitry is functioning correctly. 4. Verify that the external device that signaled the limit is functioning properly. 5. Check that the digital inputs H01-xx are set properly.	X		No	No

Fault Code	Description	Corrective Action	Alarm	Fault	Logged in History	
					During run	Sitting idle
UL3 - Weighted Limit Switch	An MFDI set to UL3 has switched.	1. Reset fault, enable limit bypass and back out of the limit. 2. Verify limit circuitry is functioning correctly. 3. Verify that the external device that signaled the limit is functioning properly. 4. Check that the digital inputs H01-xx are set properly.	X	X	Yes	No
UV1 - Undervoltage	Indicates that the main DC supply voltage has dropped below UV Detection Level L02-01 or that the M contactor did not close.	1. Check DC bus voltage shown by monitor function U01-05. 2. Ensure Power is present at the L1 and L2 terminals of the drive. 3. Ensure that the incoming power supply voltage is not dropping below tolerance. 4. Ensure that all connections on the gate driver board are in the correct position and securely fastened. 5. Ensure that all ribbon cables are securely fastened to the control board. 6. Replace control board. 7. Replace gate driver board. 8. Ensure that the start delay D01-01 is set to allow the M contactor to close. 9. Ensure the precharge contactor is functional.	X	X	Yes	No

6.4 Troubleshooting Encoder Faults

This section describes troubleshooting practices if an encoder related fault (PGO-H) is encountered.

Fault Code: PGO-H Pulse Generator Signal Fault

Definition:
An encoder pulse signal from one or both channels is missing or corrupted. This indicates that the drive has detected a problem with encoder feedback. The fault will typically occur if the drive fails to receive encoder feedback pulses while it is commanded to run or the encoder wiring has a discontinuity or is being corrupted with interference or noise.

Corrective Action:

1. Do NOT continue to operate the hoist in the event of a PGO-H fault.
2. Check the alignment of the encoder pulse wheel with the sensor head, the encoder shaft coupling (depending on the type of encoder used).
3. Check for a failed encoder sensor head. If one of these conditions exists, the drive will receive erratic pulses resulting in the PGO-H fault.
4. Repairs to the encoder wheel or shaft coupling should be made immediately before attempting to operate the hoist again.
5. If the encoder appears to have no mechanical problems, the encoder cable should be checked for damage and replaced if a problem is found. The following troubleshooting steps can be made to ensure no problems exist with encoder wiring:
    - Each of the encoder wires should be checked for continuity.
    - The wires should be checked for shorts between any two wires.
    - The wires should be checked for shorts to the shield or ground.
    - Visually inspect the cable for damage that may be causing intermittent problems.

6.5 Short-Circuit Check

The Gate Driver Board, models DDC-LN5-GATE8/DDC-HN5-GATE8 and later, can be used as a troubleshooting tool to narrow down where the short is located. This is especially helpful when there are multiple follower drives. Each drive (master and follower) has the same Gate Driver Board that will notify the user with LEDs if a short has occurred on that individual drive. To help further, there are two LEDs designated to show if the short occurred on the upper or lower gate for each IGBT. ***See Figure 6-7 on page 113*** to identify the location of the diagnostic LEDs. You can then narrow down which IGBT to focus on using the procedure described in the Transistor and Diode Check section.

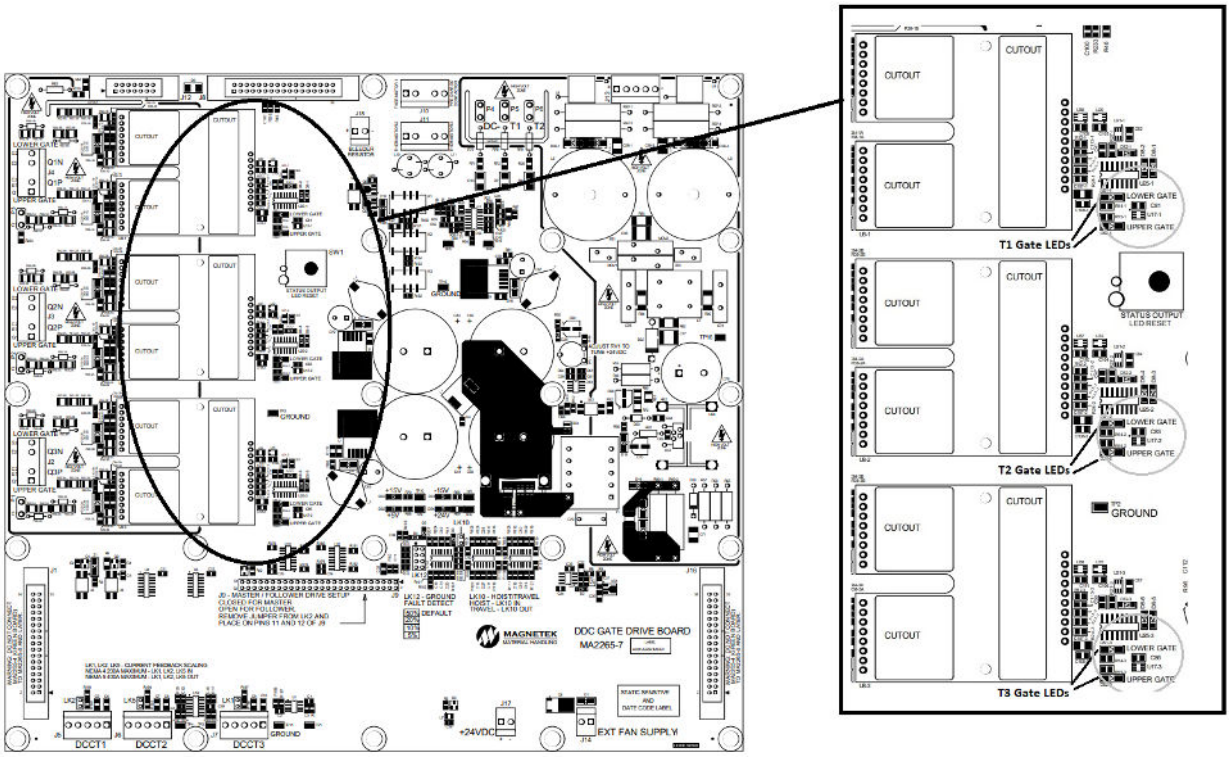


Figure 6-7: Gate Driver LED Locations

DANGER

Before performing the following checks, remove all power to the drive and allow bus capacitors to discharge.

Using a digital multimeter, set the instrument to the diode mode and make the following checks:

NOTE: *Disconnect the motor cables from the drive before making measurements.*

Table 6-9: Transistor and Diode Check

Diode Check	Positive Probe	Negative Probe	Reading
D1P	T1	L1	0.312
D2P	T2	L1	0.312
D3P	T3	L1	0.312
D1N	L2	T1	0.312
D2N	L2	T2	0.312
D3N	L2	T3	0.312

IGBT Check	Positive Probe	Negative Probe	Reading
Q1P	L1	T1	>.6
Q2P	L1	T2	>.6
Q3P	L1	T3	>.6
Q1N	T1	L2	>.6
Q2N	T2	L2	>.6
Q3N	T3	L2	>.6

NOTE: *If the BUS fuse is open, the IGBT check will indicate that all transistors are opened. Check the BUS fuse before taking readings.*

6.6 Large Chassis Gate Driver Board Test Point Measurements

The voltage test points listed in ***Table 6-10 on page 115*** and illustrated in ***Figure 6-8 on page 6-115*** can be used for troubleshooting the large chassis DDC-S2 drives.

DANGER

Before connecting or disconnecting any test equipment, remove all power to the drive and allow bus capacitors to discharge.

Table 6-10: DDC Large Chassis Gate Driver Board Test Point Locations (MA2265-7)

Test Point	Description
TP1	DDCT 3 Signal (4V = 600A)
TP2, TP11, TP15	0V Ground (Digital GND)
TP3	DDCT 1 Signal (4V = 600A)
TP4	DDCT 2 Signal (4V = 600A)
TP5	DC Bus Voltage Feedback (3V = Nominal)
TP6	+24VDC Power Supply
TP7	-15VDC Power Supply
TP8	Armature Voltage Feedback (4V = Max)
TP9	+5VDC Power Supply
TP10	+15VDC Power Supply

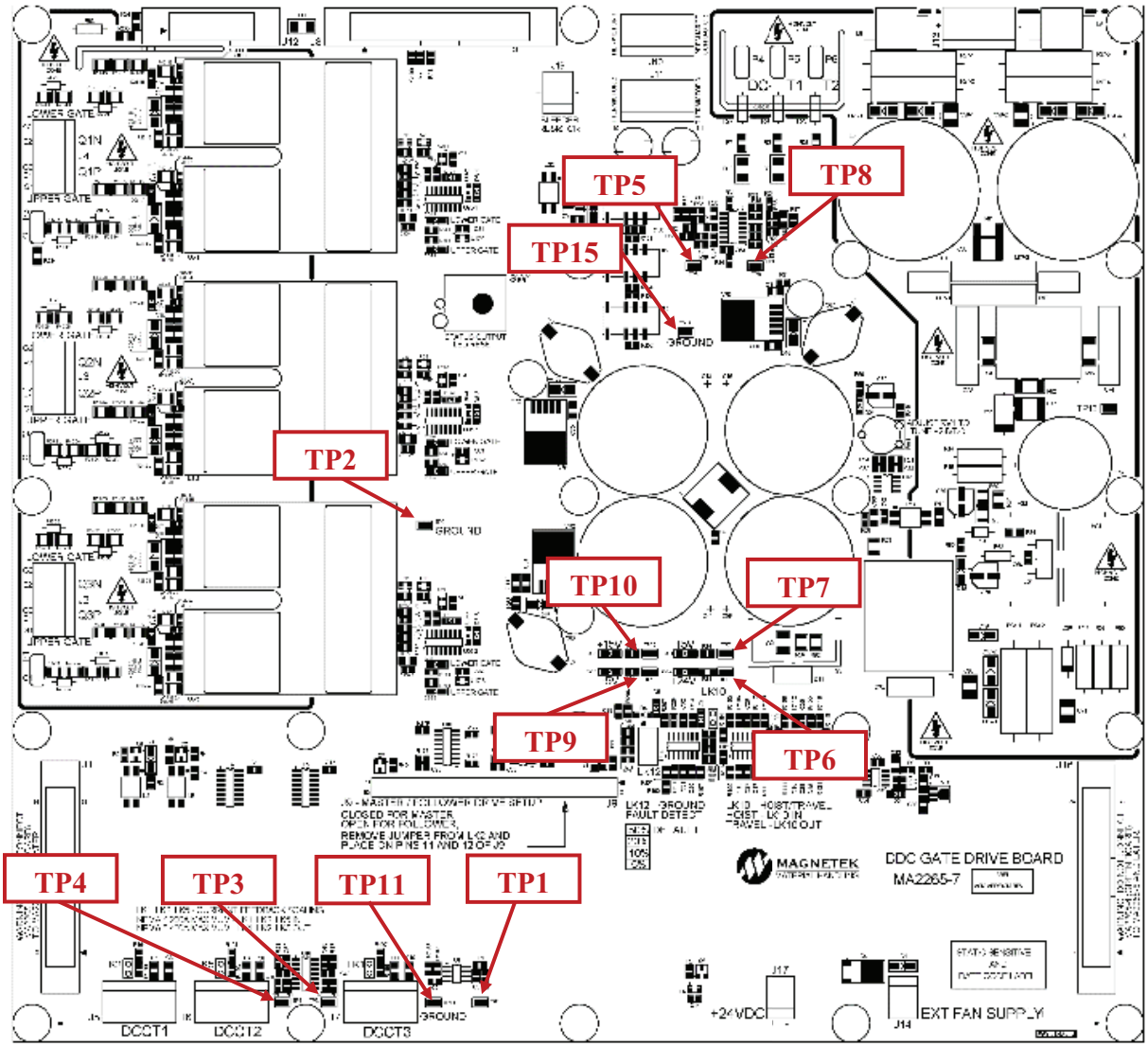


Figure 6-8: Gate Driver Board Test Point Locations

Appendix A: Modbus RTU Communications

The DDC-S2 can communicate with other devices using the Modbus RTU communications protocol. The drive will act as a slave device when connected to a Modbus RTU network using the built in RS-485 serial communications port as illustrated in ***Figure 5-13 on page 86***.

The RS-485 termination resistor (Jumper LK3 on the control board) as well as parameters H05-01 - H05-03, H05-06, and H05-09 must be set up to establish proper communication. To control the drive over Modbus, the run/speed/ torque reference priority parameter must be set to “Serial Communications.” See the B03 parameters.

Modbus RTU Available Function Codes

The DDC-S2 supports MODBUS Function Code 3 (Read Holding Registers) to read registers from the drive and Function Code 16 (Write Multiple Holding Registers) to write to registers to the drive.

Modbus Addressing (Command Registers)

The command registers are used by the Modbus RTU Master device to write run command, speed, and torque reference data to the drive. The following table lists the command register data allocation and the associated MODBUS addresses.

Table A-1: Modbus Addressing

Modbus Address	Bit	Function	Scale
0001**	0	Forward Run Command * (0 = Stop, 1 = Forward Run)	
	1	Reverse Run Command * (0 = Stop, 1 = Reverse Run)	
	2	Drive Enable	
	3	Fault Reset	
	4	Multi-Function Input 1	
	5	Multi-Function Input 2	
	6	Multi-Function Input 3	
	7	Multi-Function Input 4	
	8	Multi-Function Input 5	
	9	Multi-Function Input 6	
	A	Multi-Function Input 7	
	B	Multi-Function Input 8	
	C	Multi-Function Input 9	
	D	Multi-Function Input 10	
	E	Multi-Function Input 11	
	F	Multi-Function Input 12	
0002***	-	Speed Reference	A decimal value of 1000 represents 100.0%
0003***	-	Torque Reference	A decimal value of 1000 represents 100.0%

** Run Reference parameters B03-02 or B03-16 must be set to “2: Serial Comm”. The Forward Run or Reverse Run command bits must be set to zero upon establishing serial communications, otherwise an “MS Not Off” fault will be triggered.*

*** An MFDI set to FWD (80) or RVS (81) cannot be turned on using this command register.*

**** Speed Reference (B03-01 or B03-15) or Torque Reference (B03-03 or B03-17) must be set to “4: Serial Comm”. Parameter F07-15 (I Ref Enabled) must be enabled for the torque reference to be controlled from the serial network.*

Appendix B: EtherNet/IP Communications

General System Information

The DDC Series 2 is equipped to read multiple communication protocols. One such option connects the drive to an EtherNet/IP network and facilitates the exchange of data and allows controlling the drive via a PLC.

EtherNet/IP is a communications link to connect industrial devices (such as smart motor controllers, operator interfaces, and variable frequency drives) as well as control devices (such as programmable controllers and computers) to a network. EtherNet/IP is a simple, networking solution that reduces the cost and time to wire and install factory automation devices, while providing interchangeability of like components from multiple vendors.

EtherNet/IP is an open device network standard.

By enabling the option in a drive, it is possible to do the following from an EtherNet/IP master device:

- Drive operation
- Drive operation status monitoring
- Changing parameter settings

System Specifications

Table B-1: Option Specifications

Item	Specification
Model	DDC Series 2
Supported Messages	Explicit: Explicit Class 3, Unconnected I/O: Class 1, Listen Only, Input Only
I/O Assembly Instance	Input: 3 Types (4 to 44 Bytes) Output: 3 Types (4 to 44 Bytes)
DDC S2 Specification	Conformance Level A6
DDC S2 Profile	DC Drive
Connector Type	RJ45 8-Pin Straight Connector STP Cat 5e cable
IP Address Settings	Programmable from drive keypad or network

WARNING

It is highly recommended that the EtherNet/IP connection on the DDC-S2 drive(s) is made to a controller (PLC) through unmanaged switches in a star topology. Connecting the equipment through organizational networks that employ firewalls and other security measures may have adverse effects on the drive's operation, including the occurrence of intermittent communication loss faults. Supervisory nodes connected to the drive through an organizational network and used for drive programming and monitoring, e.g., IMPULSE Link 5, PLC configuration software, etc., are acceptable.

Configuration Methods

This section provides information on methods used to monitor and control the DDC-S2 drive with EtherNet/IP. The communications structure of the drive complies with the rules established by the Common Industrial Protocol (CIP), which allows for full-scale network integration across numerous industrial OEM devices. The writing/reading of parameters to/from a drive can be performed using specific assembly and general class objects listed in ***Tables B-2 and B-3 on page B-3***, respectively. For detailed information on CIP and its network implementation, please visit the ODVA website and associated documentation libraries at https://www.odva.org/.

DDC-S2 Drive Polled Configuration with Ethernet/IP

The assemblies in ***Table B-2*** and general class objects in ***Table B-3*** are available for polled I/O.

Table B-2: Supported Polled I/O Assemblies

Object Description	Assembly Number (decimal)	Type	Bytes
Basic Speed Control	20	Output	4
	70	Input	4
Extended Speed and Torque Control	23	Output	6
	73	Input	6
Detailed Speed and Torque Control - Magnetek Specific	101	Output	44
	151	Input	44

NOTE: *The convention in this manual is from the PLC perspective. As such, an assembly is called an "Output Assembly" when data is outputted from the PLC and received by the drive node (drive consumes). Likewise, an assembly is called an "Input Assembly" when data is outputted from the drive and received by the PLC (drive produces).*

Table B-3: General Class Objects

Object Description	Class Number (decimal)	Description	Type
Identity	1	Required General Use Object	Get
Message Router	2	Required General Use Object	Get
Assembly	4	General Use Object	Get
Connection Manager	6	Required General Use Object	Get/Set
Control Supervisor	41	Optional Application Specific Object	Get/Set
AC/DC Drive	42	Optional Application Specific Object	Get/Set
TCP/IP	245	Required Network Specific Object	Get/Set
Ethernet Link	246	Required Network Specific Object	Get/Set

Assembly Objects

Assembly objects provide the option of mapping data from attributes of different instances of various classes into one single attribute of an assembly object. This mapping is generally used for I/O messages to maximize the efficiency of the control data exchange on the network. Assembly mapping makes the I/O data available in one block; thus, there are fewer connection object instances and fewer transmissions on the network. The process data are normally combined from different application objects. An assembly object also can be used to configure a device with a single data block, alleviating the need to set individual parameters.

CIP makes a distinction between input and output assemblies. “Input” and “output” in this context are viewed from the perspective of the controlling element (e.g., a PLC/PAC). An input assembly in a device collects data from the input application (e.g., field wiring terminal, proximity sensor, etc.) and produces it on the network, where it is consumed by the controlling device and/or operator interface. An output assembly in a device consumes data that the controlling element sends to the network and writes that data to the output application (e.g., field wiring terminals, motor speed control, etc.). This data mapping is very flexible; even mapping of individual bits is permitted. Assemblies also can be used to transmit a complete set of configurable parameters instead of accessing them individually. These assemblies are called configuration assemblies.

Basic Speed Control Output - 20 (0x14)

Table B-4

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20	0	-	-	-	-	-	Fault Reset	-	FWD Run
	1	-							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							

Parameter	Data
FWD Run	Forward Run Command (Terminal S1) 0: Stop 1: Forward Run ***NOTE:*** *The Enable signal is not required when using this Assembly.*
Fault Reset	Fault Reset (0 to 1 transition: Fault Reset)
Speed Reference	Speed Command Sets the drive speed reference Setting range: -100.0 to 100.0% (-1000 to 1000 decimal)

Extended Speed/Torque Control Output - 23 (0x17)

Table B-5

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
23	0	-	-	-	-	-	Fault Reset	REV Run	FWD Run
	1	-							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							
	4	Torque Reference/Torque Limit (Low Byte)							
	5	Torque Reference/Torque Limit (High Byte)							

Parameter	Data
FWD Run	Forward Run Command (Terminal S1) 0: Stop 1: Forward Run ***NOTE:*** *The Enable signal is not required when using this Assembly.*
REV Run	Reverse Run Command (Terminal S2) 0: Stop 1: Reverse Run ***NOTE:*** *The Enable signal is not required when using this Assembly.*
Fault Reset	Fault Reset (0 to 1 transition: Fault Reset)
Speed Reference	Speed Command Sets the drive speed reference Setting range: 0 to 100.0% (0 to 1000, decimal)
Torque Reference/ Torque Limit	Torque Command Sets the drive torque reference Setting range: 0 to 100.0% (0 to 1000, decimal)

Detailed Speed/Torque Control Output - 101 (0x65)

Table B-6

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
101	0	Multi-Function Input 4	Multi-Function Input 3	Multi-Function Input 2	Multi-Function Input 1	Fault Reset	Enable	REV Run	FWD Run
	1	Multi-Function Input 12	Multi-Function Input 11	Multi-Function Input 10	Multi-Function Input 9	Multi-Function Input 8	Multi-Function Input 7	Multi-Function Input 6	Multi-Function Input 5
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							
	4	Torque Reference/Torque Limit (Low Byte)							
	5	Torque Reference/Torque Limit (High Byte)							
	6	Reserved							
	7	Reserved							
	8	Reserved							
	9	Reserved							
	10	-	-	-	-	-	-	-	-
	11	Reserved							
	12	-							
	13	-							
	14-29	Reserved							
	30	MB Request Data Address 1 (Low Byte)							
	31	MB Request Data Address 1 (High Byte)							
	32	MB Request Data Address 2 (Low Byte)							
	33	MB Request Data Address 2 (High Byte)							
	34	MB Request Data Address 3 (Low Byte)							
	35	MB Request Data Address 3 (High Byte)							
	36	MB Request Data Address 4 (Low Byte)							
	37	MB Request Data Address 4 (High Byte)							
	38	MB Request Data Address 5 (Low Byte)							
	39	MB Request Data Address 5 (High Byte)							
	40	MB Request Data Address 6 (Low Byte)							
	41	MB Request Data Address 6 (High Byte)							
	42-43	Reserved							

Table B-7

Parameter	Data
FWD Run	Forward Run Command (Terminal S1) 0: Stop 1: Forward Run
REV Run	Reverse Run Command (Terminal S2) 0: Stop 1: Reverse Run
Enable	Drive Enable 0: Drive disabled 1: Drive enabled
Fault Reset	Fault Reset (0 to 1 transition: Fault Reset)
Multi-Function Input 1 - 12	Command to terminals S1 through S12 (functions H01-01 to H01-12) 0: Off 1: On ***NOTE:*** *A Run cannot be commanded using an MFDI terminal over Modbus or EtherNet/IP. An MFDI set to FWD or RVS cannot be set using this command. All other MFDI terminals are logically OR'ed with this command.*
Speed Reference	Speed Command Sets the drive speed reference Setting range: 0 to 100.0% (0 to 1000 decimal)
Torque Reference/Torque Limit	Torque Command Sets the drive torque reference: Setting range: 0 to 100.0% (0 to 1000 decimal)
MB Request Data Address	These fields are used to read a parameter's current value. Set the low and high byte of the parameter's Modbus address, and the current value will be returned to the corresponding byte addresses in Assembly 151.

Basic Speed Control Input - 70 (0x46)

Table B-8

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70	0	-	-	-	-	-	Running 1 (FWD)	-	Faulted
	1	-							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							

Parameter	Data
Faulted	Faults 0: No Faults Occurred 1: Fault Occurred
Running 1 (FWD)	Forward Running 0: Stop or Reverse Running 1: Forward Running
Speed Reference	Drive speed reference (U01-01) Range: -100.0 to 100.0% (-1000 to 1000 decimal)

Extended Speed/Torque Control Input - 73 (0x49)

Table B-9

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
73	0	Speed Agree	NetRef	NetCtrl	Ready	REV Running	FWD Running	Warning	Faulted
	1	Drive Status							
	2	Speed Reference (Low Byte) (U01-01)							
	3	Speed Reference (High Byte) (U01-01)							
	4	Motor Torque (Low Byte) (U01-08)							
	5	Motor Torque (High Byte) (U01-08)							

Parameter	Data
Faulted	Drive Fault 0: No drive fault 1: Drive fault
Warning	Drive Alarm/Warning 0: No drive alarm 1: Drive alarm
FWD Running	Drive Running 0: Stopped 1: Drive is running in either the forward or reverse direction
REV Running	Reverse Running 0: Motor is not running in the reverse direction 1: Motor is running in the reverse direction
Ready	Drive Ready 0: Drive not ready 1: Drive ready
NetCtrl	Run Command from Network 0: Run command from terminals or serial takes priority 1: Run command from network takes priority
NetRef	Speed/Torque Reference from Network 0: Speed/Torque reference from terminals or serial takes priority 1: Speed/Torque reference from network takes priority
Speed Agree	Speed Agree 0: Speed does not agree with reference 1: Speed is in agreement with reference
Drive Status	1: Startup 2: Not Ready 3: Ready (Stopped) 4: Enabled and Running 5: Deceleration to Stop (Decelerating/Stopping) 6: Fault Stop (Fast Stop) 7: Fault
Speed Reference	Drive speed reference (U01-01) Range: -100.0 to 100.0% (-1000 to 1000 decimal)
Motor Torque	Drive torque reference (U01-08) Range: -100.0 to 100.0% (-1000 to 1000 decimal)

Detailed Speed/Torque Control Input - 151 (0x97)

Table B-10

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
151	0	Faulted	Alarm	Ready	Speed Agree	Fault Reset	REV Running	Zero Speed	Running
	1	OP4/SB Digital Output	OP1/DB Digital Output	M Contact Digital Output	M10-M11-M12 Digital Output	M7-M8-M9 Digital Output	M5-M6 Digital Output	M1-M2-M3-M4 Digital Output	UV Fault
	2	Motor RPM (Low Byte) (U01-07)							
	3	Motor RPM (High Byte) (U01-07)							
	4	Motor Torque (Low Byte) (U01-08)							
	5	Motor Torque (High Byte) (U01-08)							
	6	PG Count (Low Byte)							
	7	PG Count (High Byte)							
	8	Speed Reference (Low Byte) (U01-01)							
	9	Speed Reference (High Byte) (U01-01)							
	10	Armature Current (Low Byte) (U01-02)							
	11	Armature Current (High Byte) (U01-02)							
	12	Field Current (Low Byte) (U01-03)							
	13	Field Current (High Byte) (U01-03)							
	14	Armature Voltage (Low Byte) (U01-04)							
	15	Armature Voltage (High Byte) (U01-04)							
	16	DC Bus Voltage (Low Byte) (U01-05)							
	17	DC Bus Voltage (High Byte) (U01-05)							
	18	Alarm Code							
	19	Fault Code							
	20	MFDI 8 Status	MFDI 7 Status	MFDI 6 Status	MFDI 5 Status	MFDI 4 Status	MFDI 3 Status	MFDI 2 Status	MFDI 1 Status
	21					MFDI 12 Status	MFDI 11 Status	MFDI 10 Status	MFDI 9 Status
	22	Terminal A1 Analog Input (Low Byte) (U01-15)							
	23	Terminal A1 Analog Input (High Byte) (U01-15)							
	24	-	-	-	-	-	-	NetCtrl	NetRef
	25	Drive Status							
	26	Firmware (Low Byte) (U01-14)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
151	27	Firmware (High Byte) (U01-14)							
	28	Revision (Low Byte) (U01-14)							
	29	Revision (High Byte) (U01-14)							
	30	MB Response 1 (Low Byte)							
	31	MB Response 1 (High Byte)							
	32	MB Response 2 (Low Byte)							
	33	MB Response 2 (High Byte)							
	34	MB Response 3 (Low Byte)							
	35	MB Response 3 (High Byte)							
	36	MB Response 4 (Low Byte)							
	37	MB Response 4 (High Byte)							
	38	MB Response 5 (Low Byte)							
	39	MB Response 5 (High Byte)							
	40	MB Response 6 (Low Byte)							
	41	MB Response 6 (High Byte)							
	42-43	Reserved							

Parameter	Data
Running	Drive Running 0: Stop 1: Drive is being commanded to operate in either the forward or reverse direction
Zero Speed	Zero Speed 0: Drive Running 1: Motor is not rotating
REV Running	Reverse Running 0: Motor is not running in the reverse direction 1: Motor is running in the reverse direction
Fault Reset	Fault Reset 0: No fault reset 1: Commanded fault reset
Speed Agree	Speed Agree 0: Speed does not agree with reference 1: Speed is in agreement with reference
Ready	Drive Ready 0: Drive not ready 1: Drive ready
Alarm	Drive Alarm 0: No drive alarm 1: Drive alarm

Parameter	Data
Faulted	Drive Fault 0: No drive fault 1: Drive fault
UV Fault	Under Voltage Fault 0: No UV fault 1: UV fault
M1-M2-M3-M4 Digital Output	Digital Output 1 Status 0: M1-M2 Closed, M3-M4 Open 1: M1-M2 Open, M3-M4 Closed This function programmed by H02-01
M5-M6 Digital Output	Digital Output 2 Status 0: M5-M6 Open 1: M5-M6 Closed This function programmed by H02-02
M7-M8-M9 Digital Output	Digital Output 3 Status 0: M7-M8 Closed, M8-M9 Open 1: M7-M8 Open, M8-M9 Closed This function programmed by H02-03
M10-M11-M12 Digital Output	Digital Output 4 Status 0: Off 1: On This function programmed by H02-04
M Contact Digital Output	M Contact Status 0: M Contact Open 1: M Contact Closed This function programmed by H2-05
OP1/DB Digital Output	OP1/DB Output Status 0: Off 1: On This function programmed by H02-06
OP4/SB Digital Output	OP4/SB Sel Output Status 0: Off 1: On This is programmed by H02-07
Motor RPM	Motor RPM (U01-07) Range: -5000 to 5000 RPM (-5000 to 5000 decimal)
Motor Torque	Drive Torque reference (U01-08) Range: -100.0 to 100.0% (-1000 to 1000 decimal)
PG Count	Encoder feedback. Count follows the number edge detections (pulses per revolution x 4 for a standard encoder with 2 output channels). Range: 0 to 65,535 Pulses (0 to 65,535 decimal)

Parameter	Data
Speed Reference	Drive speed reference (U01-01) Range: -100.0 to 100.0% (-1000 to 1000 decimal)
Armature Current	Armature Current (U01-02) Range: -2000 to 2000 Amps (-20000 to 20000 decimal)
Field Current	Field Current (U01-03) Range: 0 to 2000 Amps (0 to 20000 decimal)
Armature Voltage	Armature Voltage (U01-04) Range: -720 to 720 Volts (-7200 to 7200 decimal)
DC Bus Voltage	Main circuit DC bus voltage (U01-05) Range: 0 to 720 Volts (0 to 7200 decimal)
Alarm Error Code	Displays the error code associated with the current alarm (***See Table B-11 on page 129***.)
Fault Error Code	Displays the error code associated with the current fault in U02-01 (***See Table B-11 on page 129***.)
Multi-Function Input 1 - 12	Terminals S1 through S12 (functions H01-01 to H01-12) 0: Off 1: On
Terminal A1 Analog Input	Terminal A1 Analog Input Range: -100.0 to 100.0% (-1000 to 1000 decimal)
NetCtrl	Run Command from Network 0: Run command from terminals or serial takes priority 1: Run command from network takes priority
NetRef	Speed/Torque Reference from Network 0: Depends on B03-01 and B03-03 (Speed Source 1 and Torque Source 1) 1: Speed/Torque reference from terminals or serial takes priority
Drive Status	Contains the value from the Control Supervisor (Class 0x29) Instance 1 Attribute 6 1: Startup 2: Not Ready 3: Ready (Stopped) 4: Enabled and Running 5: Stopping (Decelerating) 6: Fault Stop (Fast Stop) 7: Fault
Firmware	Firmware Major Version (decimal, unsigned)
Revision	Firmware Minor Version (hexadecimal)
MB Response	Current value of parameters requested in bytes 30 ~ 41 of Assembly 101.

Table B-11: Fault and Alarm Codes

Alarm Codes			Fault Codes		
Value (hex)	**Alarm ID**	**Description**	**Value (hex)**	**Display ID**	**Description**
2	UV1	Undervoltage	2	UV1	Undervoltage
3	CUV	Ctrl Powr Loss	3	CUV	Ctrl Powr Loss
4	OT1	Temp Alrm	5	OT2	Temp Trip
5	RUN	Can't Switch	6	SC	Short Circuit
6	SC	Short Circuit	7	OV	Overvoltage
7	OV	Overvoltage	8	EF	External Fault
8	EF	External Fault	A	STALL	Motor Stall
B	SLC	Slack Cable	B	SLC	Slack Cable
F	MS	MS Not Off	C	FL	Field Loss
13	MOS	Module OOS	D	LS	Limit Switch
28	UL3	Weighted Lim Sw	E	MOL	Motor Overld
29	UL2	Upper Limit 2	F	MS	MS Not Off
2A	UL1	Upper Limit 1	10	DOL	Drive Overld
2B	LL1	Lower Limit 1	11	AOT	Ambient Overtemp
2C	LL2	Lower Limit 2	12	GF	Ground Fault
2D	Lim2	Stop Lim	13	MOS	Module OOS
2E	Lim1	Slow Lim	14	AOC	Armature OpenCct
			25	PGO-H	PGO-Hardware
			26	COM	Ctrl Com Timeout
			30	CBF-00	Watchdog Reset
			31	CBF-01	Non-Crit EEP Flt
			32	CBF-02	Critical EEP Flt
			33	CBF-03	24V ShortCircuit
			34	CBF-04	Heatsink Tmp Flt
			35	UL3	Weighted Lim Sw

General Class Objects

Identity Object 1 (Class 0x01)

Identifiers such as device type, vendor ID, and serial number.
Magnetek EtherNet/IP Vendor ID: 1531

Table B-12: Services Supported

Service Code No. (hex)	Service Name
01	Get Attribute
05	Reset
0E	Get Attribute Single

Table B-13: Attributes Supported

Instance ID	Attribute	Name	Description	Get	Set	Size
0	1	Object Software Revision	Identity Object software revision	O	-	Word
1	1	Vendor ID	Manufacturer code	O	-	Word
1	1	Device Type	Device profile	O	-	Word
1	3	Product Code	Product codes determined by the manufacturer. See ***Table B-16 on page B-19*** for code based on drive model.	O	-	Word
1	4	Revision	Software revision for the option	O	-	Word
1	5	Status	Shows the communication status for the drive	O	-	Word
1	6	Serial Number	Option serial number	O	-	Long
1	7	Product Name	Product Name	O	-	String (14 Bytes)
1	8	State	Operation status of the drive 3: Drive ready 4: Fault	O	-	Byte

Table B-14

Model	O2-04	Product Code
LN2067-DDC-S2	00	440
LN3133-DDC-S2	01	441
LN4200-DDC-S2	02	442
LN5400-DDC-S2	03	443
LN6800-DDC-S2	04	444
LN71200-DDC-S2	05	445
LN8S1600-DDC-S2	06	446
LN8L2000-DDC-S2	07	447
HN2067-DDC-S2	10	450
HN3133-DDC-S2	11	451
HN4200-DDC-S2	12	452
HN5400-DDC-S2	13	453
HN6800-DDC-S2	14	454
HN71200-DDC-S2	15	455
HN8S1600-DDC-S2	16	456
HN8L2000-DDC-S2	17	457

Message Router Object 2 (Class 0x02)

Provides a messaging connection point through which a Client may address a service to any object class or instance in the physical device.

Table B-15: Services Supported

Service Code No. (hex)	Service Name
01	Get Attribute All
0A	Multiple Service
0E	Get Attribute Single

Table B-16: Attributes Supported

Instance ID	Attribute	Name	Description	Get	Set	Size	Default
0	1	Object Software Revision	Identity Object software revision	O	-	Word	1
1	1	Implemented Object List	Implemented Object list. The first 2 bytes contain the number of implemented objects. In the following list of objects, every 2 bytes represent another implemented class number:	O	-		
1	2	Max Connection Number Supported	Maximum number of concurrent CIP (Class 1 or Class 3) connections supported.	O	-		
1	100	Total incoming Class 1 packets received during the last second	Total incoming Class 1 packets received during the last second	O	-		
1	101	Total outgoing Class 1 packets sent during the last second	Total outgoing Class 1 packets sent during the last second	O	-		
1	102	Total incoming Class 3 packets received during the last second	Total incoming Class 3 packets received during the last second	O	-		
1	103	Total outgoing Class 3 packets sent during the last second	Total outgoing Class 3 packets sent during the last second	O	-		
1	104	Total incoming unconnected packets received during the last second	Total incoming unconnected packets received during the last second	O	-		
1	105	Total outgoing unconnected packets sent during the last second	Total outgoing unconnected packets sent during the last second	O	-		
1	106	Total incoming EtherNet/IP packets received during the last second	Total incoming EtherNet/IP packets received during the last second	O	-		
1	107	Total outgoing EtherNet/IP packets sent during the last second	Total outgoing EtherNet/IP packets sent during the last second	O	-		
1	108	Total incoming Class 1 packets received	Total incoming Class 1 packets received	O	-		
1	109	Total outgoing Class 1 packets sent	Total outgoing Class 1 packets sent	O	-		
1	110	Total incoming Class 3 packets received	Total incoming Class 3 packets received	O	-		
1	111	Total incoming Class 3 packets Invalid Parameter Value	Total incoming Class 3 packets Invalid Parameter Value	O	-		
1	112	Total incoming Class 3 packets invalid format	Total incoming Class 3 packets invalid format	O	-		
1	113	Total outgoing Class 3 packets sent	Total outgoing Class 3 packets sent	O	-		

Instance ID	Attribute	Name	Description	Get	Set	Size	Default
1	114	Total incoming unconnected packets received	Total incoming unconnected packets received	O	-		
1	115	Total incoming unconnected packets Invalid Parameter Value	Total incoming unconnected packets Invalid Parameter Value	O	-		
1	116	Total incoming unconnected packets Invalid Format	Total incoming unconnected packets Invalid Format	O	-		
1	117	Total outgoing unconnected packets sent	Total outgoing unconnected packets sent	O	-		
1	118	Total incoming EtherNet/IP packets	Total incoming EtherNet/IP packets	O	-		
1	119	Total outgoing EtherNet/IP packets	Total outgoing EtherNet/IP packets	O	-		

Assembly Object 4 (Class 0x04)

The Assembly Object binds attributes of multiple objects, which enables each object's data to be sent or received over a single connection. Assembly objects can be used to bind input data or output data. The terms "input" and "output" are defined from the network's point of view. An input sends (produces) data on the network, and an output receives (consumes) data from the network. Only static assemblies are supported.

Table B-17: Services Supported

Service Code No. (hex)	Service Name
0E	Get Attribute Single
10	Set Attribute Single

Table B-18: Attributes Supported

Instance ID	Attribute	Name	Description	Get	Set	Size	Default
0	1	Object Software Revision	Show the EtherNet Object software revision	O	-	Word	0
20	3	Data	Same function as the Basic Speed Control	O	O	Array 4 Bytes	0
23	3	Data	Same function as the Extended Speed and Torque Control	O	O	Array 6 Bytes	0
70	3	Data	Same function as the Basic Speed Control	O	-	Array 4 Bytes	0
73	3	Data	Same function as the Extended Speed and Torque Control	O	-	Array 6 Bytes	0
101	3	Data	Same function as the High Speed/ Torque Control	O	O	Array 44 Bytes	0
151	3	Data	Same function as the High Speed/ Torque Status	O	-	Array 44 Bytes	0

Connection Manager Object 6 (Class 0x06)

The Connection Object provides for and manages the run-time exchange of messages.

Table B-19: Services Supported

Service Code No. (hex)	Service Name
0E	Get Attribute Single
10	Set Attribute Single
01	Get Attribute All
02	Set Attribute All
4E	Forward Close
54	Forward Open
5B	Large Forward Open

Table B-20: Attributes Supported

Instance ID	Attribute	Name	Description	Get	Set	Size	Default
0	1	Incoming Forward Open requests count	Total number of incoming connection open requests.	O	O		
1	2	Forward Open Format Failure count	The number of Forward Open requests rejected because of the unexpected format of the Forward Open request.	O	O		
1	3	Forward Open Resource Failure count	The number of Forward Open requests rejected because of insufficient resources.	O	O		
1	4	Forward Open Parameter Value count	The number of Forward Open requests rejected because of the parameter value sent with Forward Open.	O	O		
1	5	Incoming Forward Close requests count	Total number of incoming connection close requests.	O	O		
1	6	Forward Close Format Failure count	The number of Forward Close requests that has invalid format.	O	O		
1	7	Forward Close Matching Failure count	The number of Forward Close requests that could not be matched to an active connection.	O	O		
1	8	Timed out Connections count	The number of connections that has timed out because the other side stopped producing or there was a network interruption.	O	O		

TCP/IP Object 245 (Class 0xF5)

The TCP/IP interface object provides a mechanism for configuring a device's TCP/IP network interface. Examples of configurable items include the device's IP address, network mask and gateway address. Every EtherNet/IP must have at least one instance of this class.

Table B-21: Services Supported

Service Code No. (hex)	Service Name
01	Get Attribute All
0E	Get Attribute Single
10	Set Attribute Single

Table B-22: Attributes Supported

Instance ID	Attribute	Name	Description	Get	Set	Size	Default
0	1	Object Software Revision	Revision number of the TCP/IP Object	O	-	Word	1
1	1	Status	Bits 0-3 = Interface Status 0: Interface has not been configured 1: Interface Configuration is valid, obtained from BOOTP, DHCP, or NVRAM 2: Interface Configuration is valid and obtained from hardware settings 3: Reserved Bit 4 = Multicast Pending Bits 5-31 = Reserved	O	-	DWord	-
1	2	Configuration Capability	Bit 0 = BOOTP Client Bit 1 = DNS Client Bit 2 = DHCP Client Bit 3 = DHCP-DNS Update Bit 4 = Configuration Settable Bits 5-31 = Reserved	O	-	DWord	-
1	3	Configuration Control	Bits 0-3 = Startup Configuration 0: NVRAM 1: BOOTP 2: DHCP 3: Reserved Bit 4 =DNS Enabled (not supported) Bits 5-31 = Reserved	O	O	DWord	-

Instance ID	Attribute	Name	Description	Get	Set	Size	Default
1	4	Physical Link	Struct of: Path Size: Word Path: EPATH	O	-	Struct	
1	5	Interface Configuration	Struct of: IP Address = Long Subnet Mask = Long Gateway Address = Long Name Server1 = Long Name Server2 = Long Domain Name = STRING	O	O	Struct	-
1	6	Host Name	Host Name	O	O	String	Null

Ethernet Link Object 246 (Class 0xF6)

The Ethernet Link object maintains configuration parameters, various error counters and status information for the Ethernet IEEE 802.3 communications interface. Each device has exactly one instance of the Ethernet Link object for each Ethernet IEEE 802.3 communications interface.

Table B-23: Services Supported

Service Code No. (hex)	Service Name
01	Get Attribute All
0E	Get Attribute Single
10	Set Attribute Single

Table B-24: Attributes Supported

Instance ID	Attribute	Name	Description	Get	Set	Size	Default
0	1	Object Software Revision	Revision number of the Ethernet Link Object	O	-	Word	3
1	1	Interface Speed	Interface speed currently in use	O	-	UDINT	-
1	2	Interface Flags	Bit 0 = Link Status Bit 1 = Duplex (0: Half/1: Full) Bits 2-4 = Negotiation Status 0: In progress 1: Auto-negotiate failed 2: Speed found, duplex not found--no defaulted duplex 3: Successful 4: Not attempted Bit 5 = Manual Setting requires restart Bit 6 = Local hardware fault Bits 7-31 = Reserved	O	-	DWORD	-
1	3	Physical Address (MAC)	MAC layer address	O	-	Array of 6 Bytes	-
1	6	Interface Control	Struct of: Control Bits: Word Bit 0 = Auto-negotiate Bit 1 = Forced Duplex Mode Bits 2-15 = Reserved Forced Int Speed: Word	-	O	Struct	-

Appendix C: Parameter Listing

Parameter	Name	Range	Default	Modbus Address (hex)	User Setting & Notes	Page
A01-01	Access Level	0 ~ 2	2	0100		***47***
A01-03	Motion	0 ~ 1	0	0102		***47***
A01-04	Speed Ref	0 ~ 5	2	0103		***47***
A01-05	Restore Values	0 ~ 3	0	0104		***51***
A01-08	Password	0 ~ 9999	2004	0107		***51***
B01-01	Hoist Speed 1	0.0 ~ 300.0	20.0%	0280		***53***
B01-02	Hoist Speed 2	0.0 ~ 300.0	40.0%	0281		***53***
B01-03	Hoist Speed 3	0.0 ~ 300.0	60.0%	0282		***53***
B01-04	Hoist Speed 4	0.0 ~ 300.0	80.0%	0283		***53***
B01-05	Hoist Speed 5	0.0 ~ 300.0	100.0%	0284		***53***
B01-06	Lower Speed 1	0.0 ~ 200.0	20.0%	0285		***53***
B01-07	Lower Speed 2	0.0 ~ 200.0	40.0%	0286		***53***
B01-08	Lower Speed 3	0.0 ~ 200.0	60.0%	0287		***53***
B01-09	Lower Speed 4	0.0 ~ 200.0	80.0%	0288		***53***
B01-10	Lower Speed 5	0.0 ~ 200.0	100.0%	0289		***53***
B02-01	Speed 1	0.0 ~ 300.0	20.0%	0290		***54***
B02-02	Speed 2	0.0 ~ 300.0	40.0%	0291		***54***
B02-03	Speed 3	0.0 ~ 300.0	60.0%	0292		***54***
B02-04	Speed 4	0.0 ~ 300.0	80.0%	0293		***54***
B02-05	Speed 5	0.0 ~ 300.0	100.0%	0294		***54***
B02-06	Mtr Torque 1	0.0 ~ 200.0	20.0%	0295		***54***
B02-07	Mtr Torque 2	0.0 ~ 200.0	40.0%	0296		***54***
B02-08	Mtr Torque 3	0.0 ~ 200.0	60.0%	0297		***54***
B02-09	Mtr Torque 4	0.0 ~ 200.0	80.0%	0298		***54***
B02-10	Mtr Torque 5	0.0 ~ 200.0	100.0%	0299		***54***
B02-11	Neutral Torque	0.0 ~ 200.0	2.0%	029A		***54***
B02-12	Plug Torque 1	0.0 ~ 200.0	20.0%	029B		***54***
B02-13	Plug Torque 2	0.0 ~ 200.0	40.0%	029C		***54***
B02-14	Plug Torque 3	0.0 ~ 200.0	60.0%	029D		***54***
B02-15	Plug Torque 4	0.0 ~ 200.0	80.0%	029E		***54***
B02-16	Plug Torque 5	0.0 ~ 200.0	100.0%	029F		***54***
B03-01	Speed Source 1	1 ~ 5	1	0300		***55***
B03-02	Run Source 1	1 ~ 5	1	0301		***55***
B03-03	Torque Source 1	1 ~ 5	1	0302		***55***
B03-05	MS Fault Time	0 ~ 200	75 ms	0303		***55***

Parameter	Name	Range	Default	Modbus Address (hex)	User Setting & Notes	Page
B03-15	Speed Source 2	1 ~ 5	1	0304		***56***
B03-16	Run Source 2	1 ~ 5	1	0305		***56***
B03-17	Torque Source 2	1 ~ 5	1	0306		***56***
B05-01	Hoist Accel Time	0.2 ~ 25.0	5.0 sec	0320		***57***
B05-02	Hoist Decel Time	0.2 ~ 25.0	1.5 sec	0321		***57***
B05-03	Lower Accel Time	0.2 ~ 25.0	5.0 sec	0322		***57***
B05-04	Lower Decel Time	0.2 ~ 25.0	1.5 sec	0323		***57***
B05-05	Trav Accel Time	0.2 ~ 25.0	5.0 sec	0324		***57***
B05-06	Trav Decel Time	0.2 ~ 25.0	5.0 sec	0325		***57***
B05-11	Hoist Acc Time 2	0.2 ~ 25.0	5.0 sec	0326		***57***
B05-12	Hoist Dec Time 2	0.2 ~ 25.0	5.0 sec	0327		***57***
B05-13	Lower Acc Time 2	0.2 ~ 25.0	5.0 sec	0328		***57***
B05-14	Lower Dec Time 2	0.2 ~ 25.0	5.0 sec	0329		***57***
B05-15	Trav Accel Time2	0.2 ~ 25.0	5.0 sec	032A		***57***
B05-16	Trav Decel Time2	0.2 ~ 25.0	5.0 sec	032B		***57***
C02-01	MicroSpd Gain 1	0.01 ~ 2.55	1.00	0410		***58***
C02-02	MicroSpd Gain 2	0.01 ~ 2.55	1.00	0411		***58***
C03-01	UL1 Speed	0.0 ~ 100.0	10.0%	0420		***59***
C03-04	LL1 Speed	0.0 ~ 100.0	10.0%	0423		***59***
C03-07	Slowdown Torque	0.0 ~ 200.0	75.0%	0426		***59***
C03-08	Stop Torque	0.0 ~ 200.0	100.0%	0427		***59***
C03-13	Height Measure	0 ~ 65535	250 Rev	042D		***61***
C03-14	Hook Height Home	0 ~ 4	2	042E		***61***
C03-15	Hook Height Out	0 ~ 1	0	042F		***61***
C03-16	UL2 Revolutions	0 ~ 65535	0 Rev	0430		***62***
C03-17	UL1 Revolutions	0 ~ 65535	0 Rev	0431		***62***
C03-18	LL1 Revolutions	0 ~ 65535	0 Rev	0432		***62***
C03-19	LL2 Revolutions	0 ~ 65535	0 Rev	0433		***62***
C03-20	LS Detection	0 ~ 4	0	0428		***64***
C03-23	LS Backout Time	0.0 ~ 10.0	0.5 sec	042B		***64***
C07-01	I Limit Hoist	0.0 ~ 200.0	125.0%	0460		***64***
C07-02	I Limit Lower	0.0 ~ 200.0	100.0%	0461		***64***
C08-04	Brake Rel Time	0 ~ 2500	0 ms	0470		***65***
C08-10	Load Float Time	0.0 ~ 20.0	0.0 sec	0472		***65***
C08-11	SB Time	0 ~ 2500	0 ms	0473		***65***
C08-12	DB Delay	0 ~ 2500	300 ms	0474		***65***
C08-13	DB Time	0 ~ 2500	300 ms	0475		***65***

Parameter	Name	Range	Default	Modbus Address (hex)	User Setting & Notes	Page
C08-16	SB Release Pt	0.0 ~ 40.0	40.0%	0476		***65***
C08-21	SB On Delay	0 ~ 2500	0 ms	0477		***65***
C08-25	Rescue Mode	0 ~ 1	0	0479		***66***
C11-01	Slack Cable	0 ~ 2	0	04A0		***67***
C11-03	Slack Cable Torq	-50.0 ~ 50.0	0.1%	04A2		***67***
C11-04	SLC Detect Time	0.0 ~ 5.0	2.0 sec	04A3		***67***
C12-03	Timer On Delay	0.0 ~ 6000.0	0.0 sec	04B0		***67***
C12-04	Timer Off Delay	0.0 ~ 6000.0	0.0 sec	04B1		***67***
D01-01	Start Delay	0 ~ 2500	300 ms	0500		***68***
D01-02	Stop Delay	0 ~ 2500	0 ms	0501		***68***
D01-03	Hoist Stop Speed	0.0 ~ 100.0	15.0%	0502		***68***
D01-04	LowerStop Speed	0.0 ~ 100.0	15.0%	0503		***68***
D01-05	Stop Speed	0.0 ~ 100.0	2.0%	0504		***68***
D04-01	Speed P Gain	1.00 ~ 50.00	5.00	0530		***70***
D04-02	Speed I Gain	0.00 ~ 1.00	0.10	0531		***70***
D04-04	Minimum Speed	0.0 ~ 25.0	0.0%	0533		***70***
D04-10	Speed I Clamp	0 ~ 1	1	0539		***70***
E01-01	Lower Min Field	25.0 ~ 100.0	50.0%	0600		***74***
E01-02	Hoist Min Field	25.0 ~ 100.0	50.0%	0601		***74***
E01-03	Economy Field	25.0 ~ 100.0	75.0%	0602		***74***
E01-04	Minimum Field	25.0 ~ 100.0	75.0%	0603		***74***
E01-05	Armature/Field	1.1 ~ 3.0	1.5	0604		***74***
E01-06	3-Pt Flux Curve	0 ~ 1	0	0605		***74***
E01-07	Flux 25 IF	0.0 ~ 100.0	53.8%	0606		***74***
E01-08	Flux 75 IF	0.0 ~ 125.0	93.5%	0607		***74***
E01-09	Flux 200 IF	0.0 ~ 150.0	117.9%	0608		***74***
E01-10	Field Rate	16 ~ 127	32	0609		***74***
E02-01	Rated Current	1 ~ 2000	33 A	0610		***75***
E02-02	Field Current	0 ~ 2000	0 A	0611		***75***
E02-03	Motor Rated Volt	200 ~ 700	250 VDC	0612		***75***
E02-04	Motor Base Speed	0 ~ 5000	400 RPM	0613		***75***
E02-05	Current Gain	0.1 ~ 2.0	0.5	0614		***75***
E02-06	IR Comp Gain	0.00 ~ 2.00	0.00	0532		***75***
E02-07	Motor Connection	0 ~ 1	0	0615		***75***
F01-01	PG Feedback	0 ~ 1	0	0700		***77***
F01-02	PG Pulses/Rev	0 ~ 60000	1024 ppr	0701		***77***
F01-03	PG Rotation Sel	0 ~ 1	0	0702		***77***

Parameter	Name	Range	Default	Modbus Address (hex)	User Setting & Notes	Page
F01-04	PGO-H Det Time	0 ~ 100	15 ms	0703		***77***
F01-05	PG Signal Sel	0 ~ 1	1	0704		***77***
F02-01	Tach FS RPM	0 ~ 2000	0 RPM	0710		***79***
F02-02	Tach Lost Detect	0 ~ 1	0	0711		***79***
F02-03	Tach Reverse	0 ~ 1	0	0712		***79***
F02-04	TachLostCEMF Det	0.0 ~ 100.0	25.0%	0713		***79***
F02-05	Tach Loss FB Det	0.0 ~ 100.0	10.0%	0714		***79***
F07-01	IP Address 1	0 ~ 255	192	0720		***79***
F07-02	IP Address 2	0 ~ 255	168	0721		***79***
F07-03	IP Address 3	0 ~ 255	0	0722		***79***
F07-04	IP Address 4	0 ~ 255	100	0723		***79***
F07-05	Subnet Mask 1	0 ~ 255	255	0724		***79***
F07-06	Subnet Mask 2	0 ~ 255	255	0725		***79***
F07-07	Subnet Mask 3	0 ~ 255	255	0726		***79***
F07-08	Subnet Mask 4	0 ~ 255	0	0727		***79***
F07-09	Gateway IP 1	0 ~ 255	192	0728		***79***
F07-10	Gateway IP 2	0 ~ 255	168	0729		***79***
F07-11	Gateway IP 3	0 ~ 255	0	072A		***79***
F07-12	Gateway IP 4	0 ~ 255	1	072B		***79***
F07-13	IP Address	0 ~ 1	1	072C		***80***
F07-14	ComLoss Timeout	0 ~ 1000	10 sec	072D		***80***
F07-15	I Ref Enabled	0 ~ 1	0	072E		***80***
H01-01	Term S1 Select	0 ~ 81	81	0800		***80***
H01-02	Term S2 Select	0 ~ 81	80	0801		***80***
H01-03	Term S3 Select	0 ~ 81	0	0802		***80***
H01-04	Term S4 Select	0 ~ 81	1	0803		***80***
H01-05	Term S5 Select	0 ~ 81	2	0804		***80***
H01-06	Term S6 Select	0 ~ 81	3	0805		***80***
H01-07	Term S7 Select	0 ~ 81	F	0806		***80***
H01-08	Term S8 Select	0 ~ 81	F	0807		***80***
H01-09	Term S9 Select	0 ~ 81	F	0808		***80***
H01-10	Term S10 Select	0 ~ 81	F	0809		***80***
H01-11	Term S11 Select	0 ~ 81	F	080A		***80***
H01-12	Term S12 Select	0 ~ 81	F	080B		***80***
H01-13	Term Enable	0 ~ 1	0	080C		***80***
H01-14	Stop/Reset	0 ~ 1	0	0833		***80***
H02-01	M1/M2 M3/M4 Sel	0 ~ F	0	0810		***82***

Parameter	Name	Range	Default	Modbus Address (hex)	User Setting & Notes	Page
H02-02	M5/M6 Sel	0 ~ F	4	0811		***82***
H02-03	M7/M8/M9 Sel	0 ~ F	3	0812		***82***
H02-04	M10/M11/M12 Sel	0 ~ F	1	0813		***82***
H02-05	OP M Sel	0 ~ F	2	0814		***82***
H02-06	OP1/DB Sel	0 ~ F	0	0815		***82***
H02-07	OP4/SB Sel	0 ~ F	1	0816		***82***
H03-01	Term A1 Signal	0 ~ 2	0	0820		***83***
H03-02	Term A1 Select	0 ~ F	0	0821		***83***
H03-03	Term A1 Gain	-999.9 ~ 999.9	100.0%	0822		***83***
H03-04	Term A1 Bias	-200.0 ~ 200.0	0.0%	0823		***83***
H03-05	Term A2 Signal	0 ~ 2	0	0824		***83***
H03-06	Term A2 Select	0 ~ F	1	0825		***83***
H03-07	Term A2 Gain	-999.9 ~ 999.9	100.0%	0826		***83***
H03-08	Term A2 Bias	-200.0 ~ 200.0	0.0%	0827		***83***
H04-01	MFAO Select	0 ~ 999	101	0830		***84***
H04-02	MFAO Gain	-999.9 ~ 999.9	100.0%	0831		***84***
H04-03	MFAO Bias	-200.0 ~ 200.0	0.0%	0832		***84***
H04-07	MFAO Signal	0 ~ 2	0	0836		***84***
H05-01	Modbus Address	1 ~ 1F	1	0840		***86***
H05-02	Serial Baud Rate	0 ~ 4	1	0841		***86***
H05-03	Serial Format	2 ~ 3	3	0842		***86***
H05-06	TX Wait Time	5 ~ 65	5 ms	0843		***86***
H05-09	CE Detect Time	0.0 ~ 10.0	2.0 sec	0844		***86***
L01-02	OT Alarm Level	70.0 ~ 85.0	85.0°C	0900		***87***
L01-03	OT Fault Level	70.0 ~ 115.0	90.0°C	0901		***87***
L01-05	DOL Fault Sel	0 ~ 1	1	0903		***87***
L01-06	OH Fan Enable	0.0 ~ 70.0	60.0°C	0904		***87***
L01-07	AOT Detect Lvl	0.0 ~ 95.0	75.0°C	0905		***87***
L02-01	UV Detect Level	100 ~ 420	125 VDC	0910		***88***
L02-02	OV Detect Level	200 ~ 420	350 VDC	0911		***88***
L02-10	Pre-Charge ON	0 ~ 10.0	0.28 sec	0920		***88***
L02-11	Pre-Charge OFF	0 ~ 60.0	10.0 sec	0921		***88***
L02-12	DC OK Level	0 ~ 200	25 VDC	0922		***88***
L02-13	P.C. Start Dly	0 ~ 10.0	0.1 sec	0923		***88***
L08-01	AOC Detect Level	0.0 ~ 100.0	20.0%	0970		***89***
L08-02	AOC Detect Timer	0.0 ~ 2500	100 ms	0971		***89***
L08-03	AOC Torque Limit	0.0 ~ 250.0	100.0%	0972		***89***

Parameter	Name	Range	Default	Modbus Address (hex)	User Setting & Notes	Page
L08-04	Stall Prot Time	0.0 ~ 20.0	0.0 sec	0973		***89***
L08-05	MOL Fault Sel	0 ~ 1	1	0974		***89***
L08-09	Ground Fault	0 ~ 1	1	0978		***89***
L09-01	Reset Flt Sel	0 ~ FFFF	0104	0980		***91***
L09-02	Reset Attempts	0 ~ 10	3	0981		***91***
O02-03	Parallel Stacks	1 ~ 5	1	0A12		***93***
O02-04	Drive Model	0 ~ 17	0	0A13		***93***
O02-06	Armature Setup	0 ~ 3	0	0A15		***93***
O02-07	Field Setup	0 ~ 4	0	0A16		***93***
O03-01	Store Values	0 ~ 1	0	0A20		***94***
O03-02	Run Hist Reset	0 ~ 5	0	0A21		***94***
O03-11	Flt Hist Reset	0 ~ 1	0	0A22		***94***
U01-01	Speed Reference	-	-	0040		***95***
U01-02	Armature Current	-	-	0041		***95***
U01-03	Field Current	-	-	0042		***95***
U01-04	Armature Voltage	-	-	0043		***95***
U01-05	DC Bus Voltage	-	-	0044		***95***
U01-06	Sequence Status	-	-	0045		***96***
U01-07	Motor RPM	-	-	0046		***96***
U01-08	Motor Torque	-	-	0047		***96***
U01-09	System IO	-	-	0048		***96***
U01-10	Logic Inputs Lo	-	-	0049		***96***
U01-11	Logic Inputs Hi	-	-	004A		***96***
U01-12	Logic Outputs	-	-	004B		***97***
U01-13	Control Status	-	-	004C		***97***
U01-14	Firmware Version	-	-	004D		***97***
U01-15	Analog Input 1	-	-	004F		***97***
U01-16	Analog Input 2	-	-	0050		***97***
U01-22	Input Speed	-	-	0052		***97***
U01-23	Motor CEMF	-	-	0051		***97***
U01-24	Flux	-	-	0060		***97***
U01-25	Hook Load	-	-	0061		***97***
U01-26	Input Power	-	-	0062		***97***
U01-27	Energy Used	-	-	0063		***97***
U01-28	Arm Current Ref	-	-	0064		***97***
U01-29	Field Current Ref	-	-	0065		***97***
U01-30	Upper Ctrl Limit	-	-	0066		***97***

Parameter	Name	Range	Default	Modbus Address (hex)	User Setting & Notes	Page
U01-31	Lower Ctrl Limit	-	-	0067		***97***
U01-34	Prm Out of Range	-	-	006A		***97***
U01-35	Tach Coefft	-	-	006C		***97***
U01-38	Ctrl Source	-	-	006E		***97***
U01-40	Motor Revs	-	-	0070		***97***
U01-41	Motor Pulses	-	-	0071		***97***
U01-42	Hook Height	-	-	0072		***97***
U01-43	PG Motor Spd	-	-	0073		***97***
U02-01	Fault Status	-	-	0080		***98***
U02-02	Speed Reference	-	-	0081		***98***
U02-03	Armature Current	-	-	0082		***98***
U02-04	Field Current	-	-	0083		***98***
U02-05	Armature Voltage	-	-	0084		***98***
U02-06	DC Bus Voltage	-	-	0085		***98***
U02-07	Sequence Status	-	-	0086		***98***
U02-08	Flux	-	-	0087		***98***
U02-09	Motor RPM	-	-	0088		***98***
U02-10	Motor Torque	-	-	0089		***98***
U02-11	Elapsed Hours /10	-	-	008A		***98***
U02-12	Analog Input 1	-	-	008B		***98***
U02-13	Logic Inputs Lo	-	-	008C		***98***
U02-14	Logic Inputs Hi	-	-	008D		***98***
U02-15	Logic Outputs	-	-	008E		***98***
U02-16	Control Status	-	-	008F		***98***
U02-17	Last Fault	-	-	00AE		***98***
U03-01	Fault 1	-	-	0090		***99***
U03-02	Fault 1 Time	-	0 Hr	0091		***99***
U03-03	Fault 2	-	-	0092		***99***
U03-04	Fault 2 Time	-	0 Hr	0093		***99***
U03-05	Fault 3	-	-	0094		***99***
U03-06	Fault 3 Time	-	0 Hr	0095		***99***
U03-07	Fault 4	-	-	0096		***99***
U03-08	Fault 4 Time	-	0 Hr	0097		***99***
U03-09	Fault 5	-	-	0098		***99***
U03-10	Fault 5 Time	-	0 Hr	0099		***99***
U03-11	Fault 6	-	-	009A		***99***
U03-12	Fault 6 Time	-	0 Hr	009B		***99***

Parameter	Name	Range	Default	Modbus Address (hex)	User Setting & Notes	Page
U03-13	Fault 7	-	-	009C		***99***
U03-14	Fault 7 Time	-	0 Hr	009D		***99***
U03-15	Fault 8	-	-	009E		***99***
U03-16	Fault 8 Time	-	0 Hr	009F		***99***
U03-17	Fault 9	-	-	00A0		***99***
U03-18	Fault 9 Time	-	0 Hr	00A1		***99***
U03-19	Fault 10	-	-	00A2		***99***
U03-20	Fault 10 Time	-	0 Hr	00A3		***99***
U03-21	Fault 11	-	-	00A4		***99***
U03-22	Fault 11 Time	-	0 Hr	00A5		***99***
U03-23	Fault 12	-	-	00A6		***99***
U03-24	Fault 12 Time	-	0 Hr	00A7		***99***
U03-25	Fault 13	-	-	00A8		***99***
U03-26	Fault 13 Time	-	0 Hr	00A9		***99***
U03-27	Fault 14	-	-	00AA		***99***
U03-28	Fault 14 Time	-	0 Hr	00AB		***99***
U03-29	Fault 15	-	-	00AC		***99***
U03-30	Fault 15 Time	-	0 Hr	00AD		***99***
U04-01	Num Operations	-	-	00B0		***100***
U04-02	OperationsX1000	-	-	00B1		***100***
U04-03	Elapsed Hours /10	-	0 Hr	00B2		***100***
U04-04	FanRun Hours /10	-	0 Hr	00B3		***100***
U04-05	Heatsink Temp	-	-	00B4		***100***
U04-06	Ambient Temp	-	-	00B5		***100***
U04-07	Motor OL Lvl	-	-	00B6		***100***
U04-08	Drive OL Lvl	-	-	00B7		***100***
U04-09	T1 Duty Cycle	-	-	00B8		***100***
U04-10	T2 Duty Cycle	-	-	00B9		***100***
U04-11	T3 Duty Cycle	-	-	00BA		***100***
U04-12	LS Level	-	-	00BB		***100***
U04-13	Brake Counter	-	-	00BC		***100***
U04-14	Brake Cnt x1000	-	-	00BD		***100***
U04-24	485 RX Count	-	-	0053		***100***
U04-25	485 CRC Error	-	-	0056		***100***
U04-26	485 MB_Addr	-	-	0054		***100***
U04-27	485_MB_Cmd	-	-	0055		***100***
U06-80	IP Address 1	-	-	00D0		***104***

Parameter	Name	Range	Default	Modbus Address (hex)	User Setting & Notes	Page
U06-81	IP Address 2	-	-	00D1		***104***
U06-82	IP Address 3	-	-	00D2		***104***
U06-83	IP Address 4	-	-	00D3		***104***
U06-84	Subnet 1	-	-	00D4		***104***
U06-85	Subnet 2	-	-	00D5		***104***
U06-86	Subnet 3	-	-	00D6		***104***
U06-87	Subnet 4	-	-	00D7		***104***
U06-88	Gateway 1	-	-	00D8		***104***
U06-89	Gateway 2	-	-	00D9		***104***
U06-90	Gateway 3	-	-	00DA		***104***
U06-91	Gateway 4	-	-	00DB		***104***
U06-92	Online Speed	-	-	00DC		***104***
U06-93	Online Duplex	-	-	00DD		***104***
U06-94	MAC 1	-	-	00DE		***104***
U06-95	MAC 2	-	-	00DF		***104***
U06-96	MAC 3	-	-	00E0		***104***
U06-97	MAC 4	-	-	00E1		***104***
U06-98	MAC 5	-	-	00E2		***104***
U06-99	MAC 6	-	-	00E3		***104***

Appendix D: DDC Series 1 to DDC Series 2 Parameter Reference

The table below provides a cross reference from Series 1 parameters to Series 2 parameters.

DDC-S1 Param #	DDC-S2 Param #	Name
A00	U01-02	Armature Current
A01	U01-03	Field Current
A02	U01-04	Armature Voltage
A03	U01-05	DC Bus Voltage
A04	U01-23	Motor CEMF
A05	U01-24	Flux
A06	U01-07	Motor RPM
A07	U01-08	Motor Torque
A08	U01-25	Hook Load
A09	U01-26	Input Power
A10	U01-27	Energy Used
A11	U04-01	Num Operations
A12*	U04-02	OperationsX1000
A13*	U04-03	Run Hours /10
A14	U01-15	Analog Input 1
A15	U01-16	Analog Input 2
A16	U01-28	Arm Current Ref
A17	U01-29	Field Current Ref
A18	U01-01	Speed Reference
A19	U01-30	Upper Ctrl Limit
A20	U01-31	Lower Ctrl Limit
A21	U01-10, U01-11	Logic Inputs
A22	U01-12	Logic Outputs
A23	U04-05	Heatsink Temp
A24	U04-06	Ambient Temp
A25	U04-07	Motor OL Lvl
A26	U04-09	T1 Duty Cycle
A27	U04-10	T2 Duty Cycle
A28	U04-11	T3 Duty Cycle
A29	U01-13	Control Status
A30	U02-01	Fault Status
A31	U01-06	Sequence Status
B00	A01-08	Password
B01	A01-01	Access Level
B02	U01-14	Firmware Version
B07	U01-35	Tach Coefft
B09	U04-12	LS Level
C00	A01-03	Motion
C01	O02-04	Drive Model
C02	O02-04	Drive Model
C03	O02-03**	Parallel Stacks
C04	O02-06	Armature Setup
C06	O02-07	Field Setup
C07	A01-05	Default Values
D00	E02-01	Rated Current
D01	E02-03	Motor Rated Volt
D02	E02-04	Motor Base Speed
D03	E02-02	Field Current
D04	C07-01	I Limit FWD
D05	C07-02	I Limit REV
D06	E01-05	Armature/Field
D08	L01-02	OT Alarm Level
D09	L01-03	OT Fault Level
D10	C03-20	LS Detection
D13	C03-23	LS Backout Time
D14	C11-01	Slack Cable
D15	C11-03	Slack Cable Torq
D16	L01-06	OH Fan Enable
D17	L01-07	AOT Detect Lvl
D18	L08-01	AOC Detect Level
D19	L08-02	AOC Detect Timer
D20	E01-06	3-Pt Flux Curve
D21	E01-07	Flux 25 IF
D22	E01-08	Flux 75 IF
D23	E01-09	Flux 200 IF
D25	B03-05	MS Fault Time
D30	L09-02	Reset Attempts
D31	L09-01	Reset Flt Sel

** Minor difference in scaling between DDC-S1 and DDC-S2.*

*** This parameter is automatically set using O02-04.*

DDC-S1 Param #	DDC-S2 Param #	Name
E00	B05-05	Trav Accel Time
E01	B05-06	Trav Decel Time
E02	E02-05	Current Gain
E03	D01-03	Hoist Stop Speed
E04	D01-04	LowerStop Speed
E05	C08-04	Brake Rel Time
E06	D04-01	Speed P Gain
E07	D04-02	Speed I Gain
E08	E02-06	IR Comp Gain
E09	D01-01	Start Delay
E10	D01-02	Stop Delay
E11	D04-04	Bypass Speed
E12	D01-05	Stop Speed
E13	C08-12	DB Delay
E14	C08-13	DB Time
E15	E01-01	Lower Min Field
E16	E01-02	Hoist Min Field
E17	E01-03	Economy Field
E18	E01-04	Minimum Field
E19	E01-10	Field Rate
E22	C02-01	MicroSpd Gain 1
E23	C08-16	SB Release Pt
E24	C08-21	SB On Delay
E25	C08-11	SB Time
E26	L08-04	Stall Prot Time
E27	B05-01	Hoist Accel Time
E28	B05-02	Hoist Decel Time
E29	B05-03	Lower Accel Time
E30	B05-04	Lower Decel Time
E31	C08-10	Load Float Time
F00	B03-01	Speed Source 1
F01	B03-03	Torque Source 1
F02	B01-01	Hoist Speed 1
F03	B01-02	Hoist Speed 2
F04	B01-03	Hoist Speed 3
F05	B01-04	Hoist Speed 4
F06	B01-05	Hoist Speed 5
F07	B01-06	Lower Speed 1
F08	B01-07	Lower Speed 2
F09	B01-08	Lower Speed 3

DDC-S1 Param #	DDC-S2 Param #	Name
F10	B01-09	Lower Speed 4
F11	B01-10	Lower Speed 5
F12	B02-01	Speed 1
F13	B02-02	Speed 2
F14	B02-03	Speed 3
F15	B02-04	Speed 4
F16	B02-05	Speed 5
F17	B02-06	Mtr Torque 1
F18	B02-07	Mtr Torque 2
F19	B02-08	Mtr Torque 3
F20	B02-09	Mtr Torque 4
F21	B02-10	Mtr Torque 5
F22	B02-11	Neutral Torque
F23	B02-12	Plug Torque 1
F24	B02-13	Plug Torque 2
F25	B02-14	Plug Torque 3
F26	B02-15	Plug Torque 4
F27	B02-16	Plug Torque 5
F28	C03-07	Slowdown Torque
F29	C03-08	Stop Torq
G00	H03-01	Term A1 Signal
G01	H03-03	Term A1 Gain
G02	H03-04	Term A1 Bias
G04	H03-05	Term A2 Signal
G05	H03-07	Term A2 Gain
G06	H03-08	Term A2 Bias
G08	H04-02	MFAO Gain
G09	H04-03	MFAO Bias
G10	H04-01	MFAO Select
G11	H01-07	Term S7 Select
G12	H02-06	OP1/DB Sel
G13	H02-02	M5/M6 Sel
G14	H02-03	M7/M8/M9 Sel
G15	H02-07	OP4/SB Sel
G16	H05-02	Serial Baud Rate
G18	H05-03	Serial Format
G19	H05-01	Modbus Address
G20	F02-02	Tach Lost Detect
G21	F02-03	Tach Reverse
G22	F02-04	TachLostCEMF Det

DDC-S1 Param #	DDC-S2 Param #	Name
G23	F02-05	Tach Loss FB Det
G24	H01-08	Term S8 Select
H00	U03-01	Fault 1
H01	U03-02	Fault 1 Time
H02	U03-03	Fault 2
H03	U03-04	Fault 2 Time
H04	U03-05	Fault 3
H05	U03-06	Fault 3 Time
H06	U03-07	Fault 4
H07	U03-08	Fault 4 Time
H08	U03-09	Fault 5
H09	U03-10	Fault 5 Time
H10	U03-11	Fault 6
H11	U03-12	Fault 6 Time
H12	U03-13	Fault 7
H13	U03-14	Fault 7 Time
H14	U03-15	Fault 8
H15	U03-16	Fault 8 Time
H16	U03-17	Fault 9
H17	U03-18	Fault 9 Time
H18	U03-19	Fault 10
H19	U03-20	Fault 10 Time
H20	U03-21	Fault 11
H21	U03-22	Fault 11 Time
H22	U03-23	Fault 12
H23	U03-24	Fault 12 Time
H24	U03-25	Fault 13
H25	U03-26	Fault 13 Time
H26	U03-27	Fault 14
H27	U03-28	Fault 14 Time
H28	U03-29	Fault 15
H29	U03-30	Fault 15 Time
H30	O03-11	Flt Hist Reset

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