OmniPulse DDC

DC to DC Crane Control Instruction Manual

MAGNETEK
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ELECTROMOTIVE SYSTEMS

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General Information

Parts of this product may be covered by patent US006710574B2.

Electrical Safety

Warning Symbols

For your own safety, please pay special attention to the instructions marked with these warning symbols:

= Dangerous Voltage

= General Warnings

= General Caution

Warnings

	1	ONLY A QUALIFIED ELECTRICIAN SHOULD PERFORM THE ELECTRICAL INSTALLATION.
	2	Internal components and circuit boards (except the isolated I/O terminals) are at utility potential when the OmniPulse DDC is connected to the line. This voltage is extremely dangerous and may cause death or severe injury if you come in contact with it.
	3	When the OmniPulse DDC is connected to the utility, the line connections L1, L2, L11+ and capacitor connections are live even if the motor is not running.
	4	The drive control I/O terminals are isolated from the line potential through the interface board. The interface board may have dangerous external voltages connected through the control disconnect even when main power is removed by the main disconnect.
	5	An upstream disconnect/protection device is to be used as noted in the National Electric Code (NEC).
	6	Only spare parts obtained from a Magnetek authorized dealer can be used.

Safety Instructions

⚠	**1**	The OmniPulse DDC is meant only for fixed installation. Do not make any connections or measurements when the OmniPulse DDC is connected to the utility.
	2	After disconnecting the utility (main and control disconnects opened), wait until the unit charge indicator on the drive enclosure is extinguished. Wait at least 5 minutes before doing any work on the OmniPulse DDC connections. Do not open the cover before this time has run out.
	3	Do not make any voltage withstand or megger tests on any part of the OmniPulse DDC.
	4	Disconnect the motor cables from the OmniPulse DDC before meggering the motor cables.
	5	Do not touch the IC-circuits on the circuit boards. Static voltage discharge may destroy the components.
	6	Before connecting to the utility, make sure that the cover of the OmniPulse DDC is fastened.
	7	Make sure that nothing but the DC motor is connected to the motor terminal, with the exception of factory recommended circuits such as power limit switch, power loss DB circuit and series brake.

Grounding

The OmniPulse DDC will operate properly on a floating (ungrounded DC power bus), or on a grounded power bus system positive or negative. It is recommended that if a grounded system exists, the unit should be grounded to that system in accordance with NEC and local codes.

Running the Motor

⚠	**1**	Before running the motor, make sure that the motor is mounted and wired properly.
	2	Maximum motor speed should never be set to exceed the motor's and driven machine's capability.
	3	Before reversing the rotations of the motor shaft, make sure that this can be done safely.

Receiving

General Information

Magnetek's OmniPulse DDC provides step or stepless control of DC series and shunt motors used for hoist, bridge, and trolley crane motions. A static regulating system automatically provides torque and speed regulation in all four motor quadrants.

Some outstanding standard features include:

- 5 to 500 horsepower range

- Adjustable and repeatable control

- Programmable variable speed control for fine spotting accuracy and reduced mechanical stresses

- Modular construction, with easily accessible front wired components.

- Decreased power consumption — current amplification feature gives motors high currents or torque at low voltages or speed

- Numerous safety circuits for maximum protection of personnel and components

- Programmable smooth acceleration and deceleration for repeatable speed control

- Drive display for ease of monitoring and troubleshooting with computer diagnostic capability

- Solid-state design eliminates wearing parts and reduces maintenance time

- Eliminates need for acceleration resistors and contactors, reducing space and weight requirements on the crane

Table 1: Typical Equipment List

Quantity	Item Description
1	Crane controller in NEMA Type 1 enclosure (standard) or optional NEMA Type1 gasketed, NEMA Type 3, NEMA Type 4 or NEMA Type 12 enclosure, or open panel
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 overtravel control limit switch(es)
1	Optional DB power loss resistor

Receiving Check List

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

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

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

Disclaimer of Warranty

Magnetek hereafter referred to as Company, assumes no responsibility for improper programming of a drive by untrained personnel. A drive should only be programmed by a trained technician who has read and 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.

⚠ **WARNING**

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

Storage

Long Term Storage

Powering up the OmniPulse DDC every six months is quite beneficial. Over longer periods of time without power, the controls' electrolytic DC bus capacitors require reformation, 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. This process can be avoided by powering up the control bi-annually for 30 to 60 minutes.

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

Controls contain large bus capacitors that have the potential to be reformed. However, printed circuit boards also contain electrolytic capacitors that may not function after several years without power. Magnetek recommends replacing the PCBs should the control's functionality not be restored after bus cap reforming.

Capacitor Reforming

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

In the event that a capacitor has been stored in a high ambient environment for more than 1 or 2 years, a voltage treatment reformation process to electrolytic capacitors may have to be performed. When stored above room temperatures for long periods of time, the anode foil may react with the electrolyte, increasing the leakage current. After storage, the application of even normal voltages to these capacitors may result in higher than normal leakage currents. In most cases the leakage current levels will decrease in a short period of time as the normal chemical reaction within the capacitor occurs. However, in extreme cases, the amount of gas generated may cause the safety vent to open.

Capacitors, when used in controls that are stored for long periods of time, should be subjected to a voltage treatment/reforming process as noted below, which will reform the dielectric and return the leakage current to the initial level.

Control Bus Capacitor Reforming Procedure

1. Connect the control inputs L11 (+), L7 (+), L8 (-) and L2 (-) to a rectifier with variac input.

2. Make sure the variac voltage setting is turned down so that when input power is applied to the variac, the output of the rectifier will be at or near 0 volts DC.

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 very near zero with zero or a steady output voltage applied.

4. Slowly turn the variac up, increasing the variac's output voltage to nominal rated input voltage over a time period of 10 to 20 minutes. In other words, ramp the voltage up at a rate of approximately 10 to 20 volts/minute to 200 VDC.

5. Let the output voltage remain at rated voltage for 30 to 60 minutes while keeping close watch for abnormal signs within the control. While increasing the variac's output voltage, the current will momentarily increase as current is necessary to charge the capacitors.

    a. For 400 VDC units: after 30 to 60 minutes has elapsed remove power from the variac, allow for the DC bus to discharge and disconnect terminals L7 and L8.

    b. Repeat steps 2-5, ramping the input voltage up to 400 VDC.

6. Once 30 to 60 minutes elapse, remove power and install control 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.

Installation

⚡	**⚠ DANGER**
	Hazard of Electrical Shock or Burn
	Up to 600 volts may exist in this controller. Use extreme care to avoid unpleasant or lethal shock. Disconnect input power before wiring and/or servicing motor or control.

Mounting

Mount and secure components as instructed below and in accordance with information on the dimension and control drawing included with the equipment.

Control Panel

Refer to the referenced dimension drawing for dimensions and mounting hole locations. Use all mounting holes. Install controller in a ventilated, clean, dry atmosphere. Maximum ambient temperature must not exceed 122°F (50°C) and avoid contaminated atmospheres (metal chips, water spray, acids, etc.) unless the design is suitable for these environments.

Wiring

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 controller at this time.

⚠ **CAUTION**

Observe local codes for correct wire size, grounding, etc. Input must be between 200 – 320 volts DC for standard drives and 360 – 600 VDC for high voltage drives.

Operating Principles

Principle of Operation

Solid-State Control

The OmniPulse DDC is a controller designed specifically for crane hoist and travel applications that use series-field DC motors. Unlike typical systems that use resistors to regulate motor current, the OmniPulse DDC uses high-speed power semiconductor switches with controlled ON/OFF duty cycles in order to control the speed and torque of the motor. When the semiconductor switches are fully ON, their voltage drop is typically less than 2V; therefore, the power they dissipate is a small fraction of the power that they control. Unlike resistive current control in switched stages, control by semiconductors can be made smooth and step-less. Furthermore, characteristics can easily be varied to suit a specific application or process.

Four-Quadrant Operation and Regeneration

OmniPulse DDC is a four-quadrant controller. This means that it can produce either positive or negative torque regardless of whether the motor is running in the forward direction or the reverse. The controller is therefore able to absorb energy from the motor when it is providing torque in such a direction as to decelerate a high inertia or when it is providing a resisting torque during lowering of a heavy load. The efficiency of the controller is sufficiently high to allow it to recover some energy from the load and return it to the DC supply.

Pulse Width Modulation

In the OmniPulse DDC, the semiconductors used for power control are Insulated Gate Bipolar Transistors (IGBTs). Pulse Width Modulation (PWM) is used to produce an output voltage on each terminal that is a proportion of the DC supply voltage by controlling the duty cycles of the top and bottom IGBTs of each half bridge. In Figure 1, the voltage that appears across the motor winding is the difference between that of two terminals and may be made positive or negative as desired. The pulse frequency, typically 1 kHz, is high enough for the inductance of the motor windings to act as a very effective smoothing choke. The currents that flow have a small amount of high frequency ripple but are substantially the same as if they had been derived from a smooth DC source.
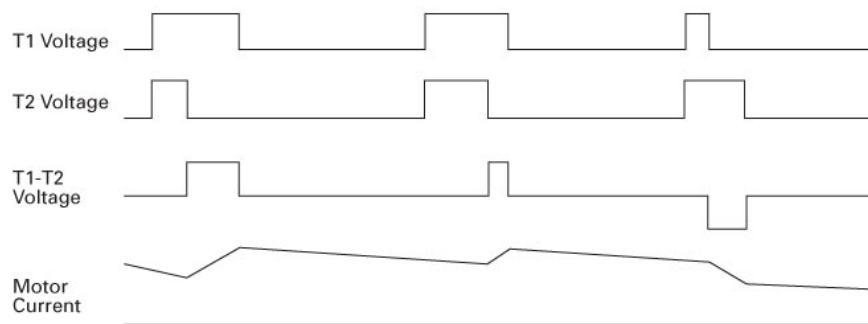
Figure 1: Pulse Width Modulation

Controller Configurations

There are two possible configurations for the controller. The controller in the hoist configuration, shown in Figure 2, 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 usual direction for balancing the load on the hoist. This substantially reduces the heating in the semiconductor device that controls T2. Furthermore, many existing installations already use this motor configuration, thus allowing the OmniPulse DDC controller to be fitted without altering connections to collector rails, the limit switch, the series brake or the dynamic brake circuit.

In the bridge and trolley configuration, shown in Figure 3, the controller supplies the armature current through T1 and T2 while supplying the field current through T3 and T4. This arrangement results in equal capabilities in either direction of the motion. This configuration also complies with the motor circuit arrangements normally found in existing installations.

Figure 2: OmniPulse DDC Configuration as a Hoist Controller

Figure 3: OmniPulse DDC Configuration as a Bridge or Trolley Controller

Current and Speed Loops

Figure 4 shows the essential elements of the control system. Two current controllers determine the duty cycles, PWM T1, PWM T2, and PWM T3, of the three IGBT half-bridges. These interact in such a way as to ensure the correct relative voltages between the terminals. DCCT1, DCCT2 and DCCT3 are used to provide feedback signals for the current loops. DCCT3 measures and updates the field current directly. The armature current is directly measured and updated by DCCT1 and DCCT2. The Field Current Reference and the Armature Current Reference drive the current loops. The current loops act very rapidly to follow any changes in demand and typically settle in 5 ms or less.

The speed controller calculates the two current references. Measuring the armature voltage in order to determine the counter EMF derives feedback for the speed loop. A speed demand is derived from the operator's control. This may be a multi-position switch or a step-less potentiometer control. The operator's demand is first restricted to a limited rate of change. The acceleration or deceleration is limited to a value that is safe for the application and that can be achieved without excessively overloading the motor. The speed loop characteristics are adjusted to match the mechanical dynamics of the crane.
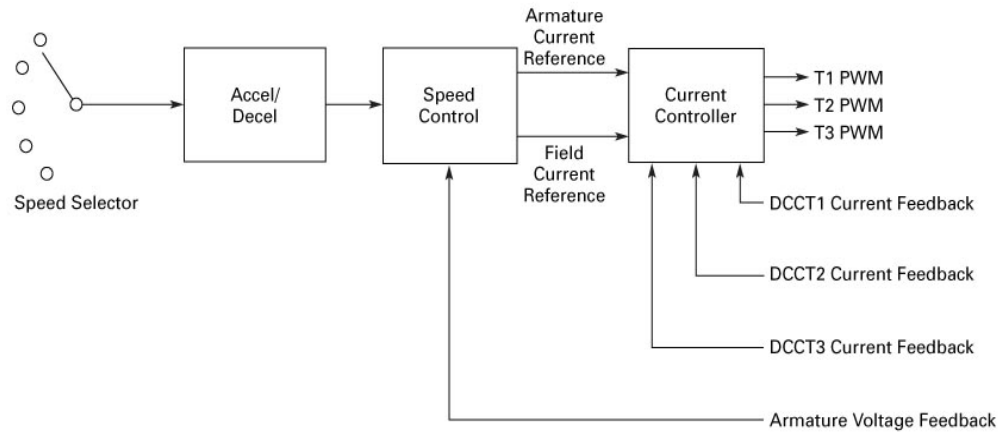
Figure 4: Arrangement of the Current and Speed Control Functions

OmniPulse DDC Hoist Connections and Controller Diagram
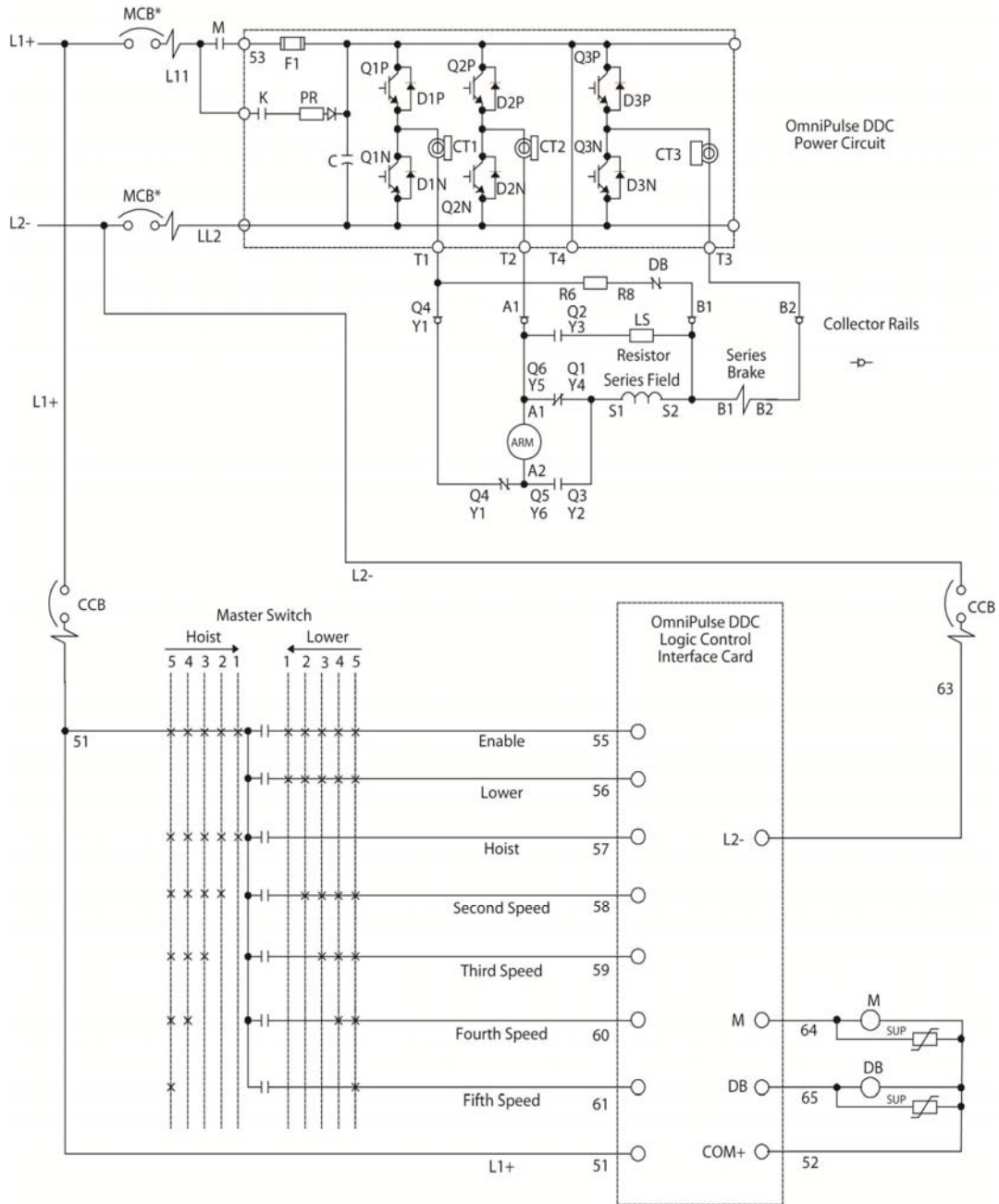
Figure 5: Typical Hoist Diagram

NOTE: MCB is selected to function as a disconnect only. It is not suitable for branch motor circuit protection.
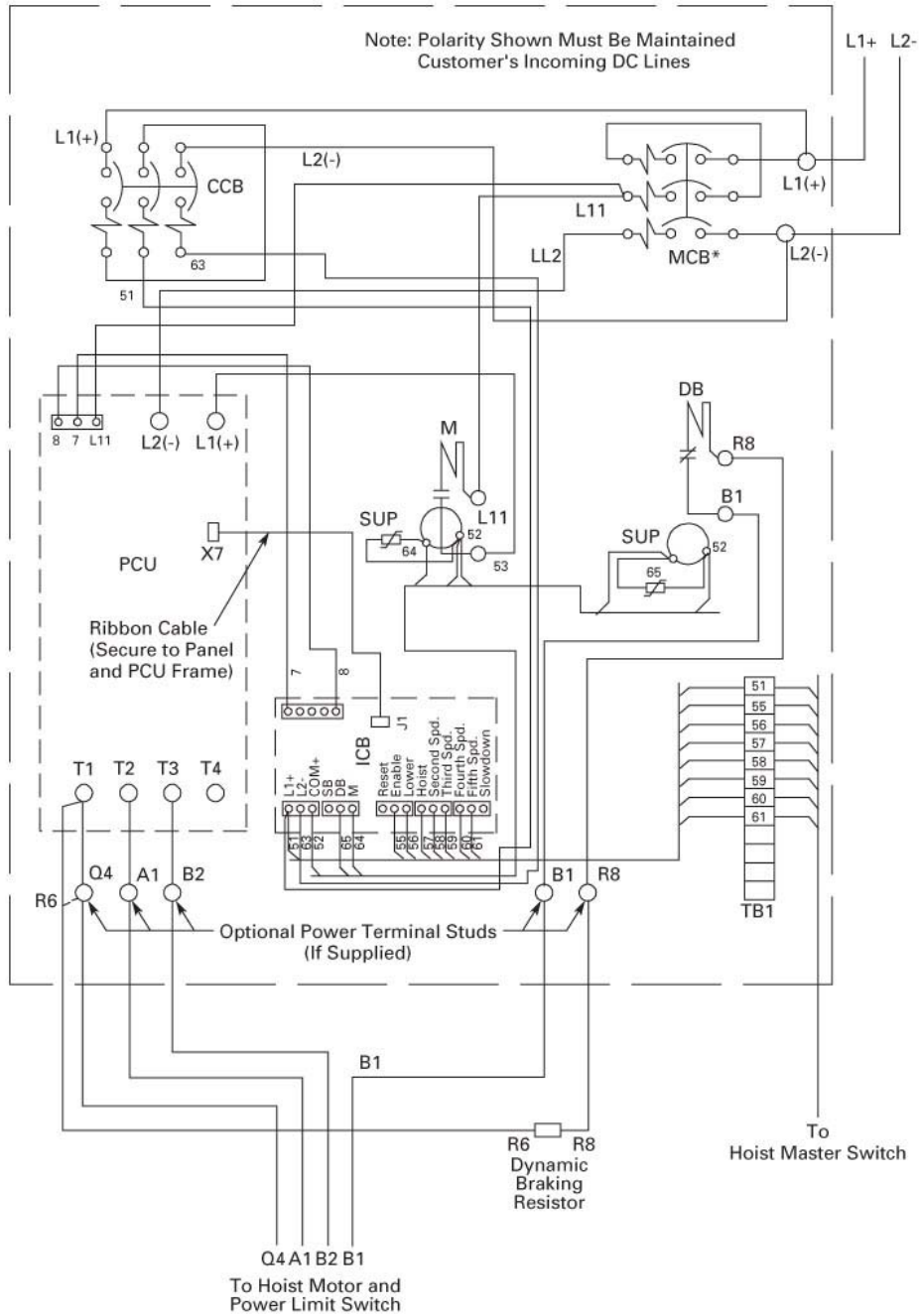
Figure 6: Typical Hoist Controller Connections

MCB is selected to function as a disconnect only. It is not suitable for branch motor circuit protection.

OmniPulse DDC Traverse Connections and Controller Diagram
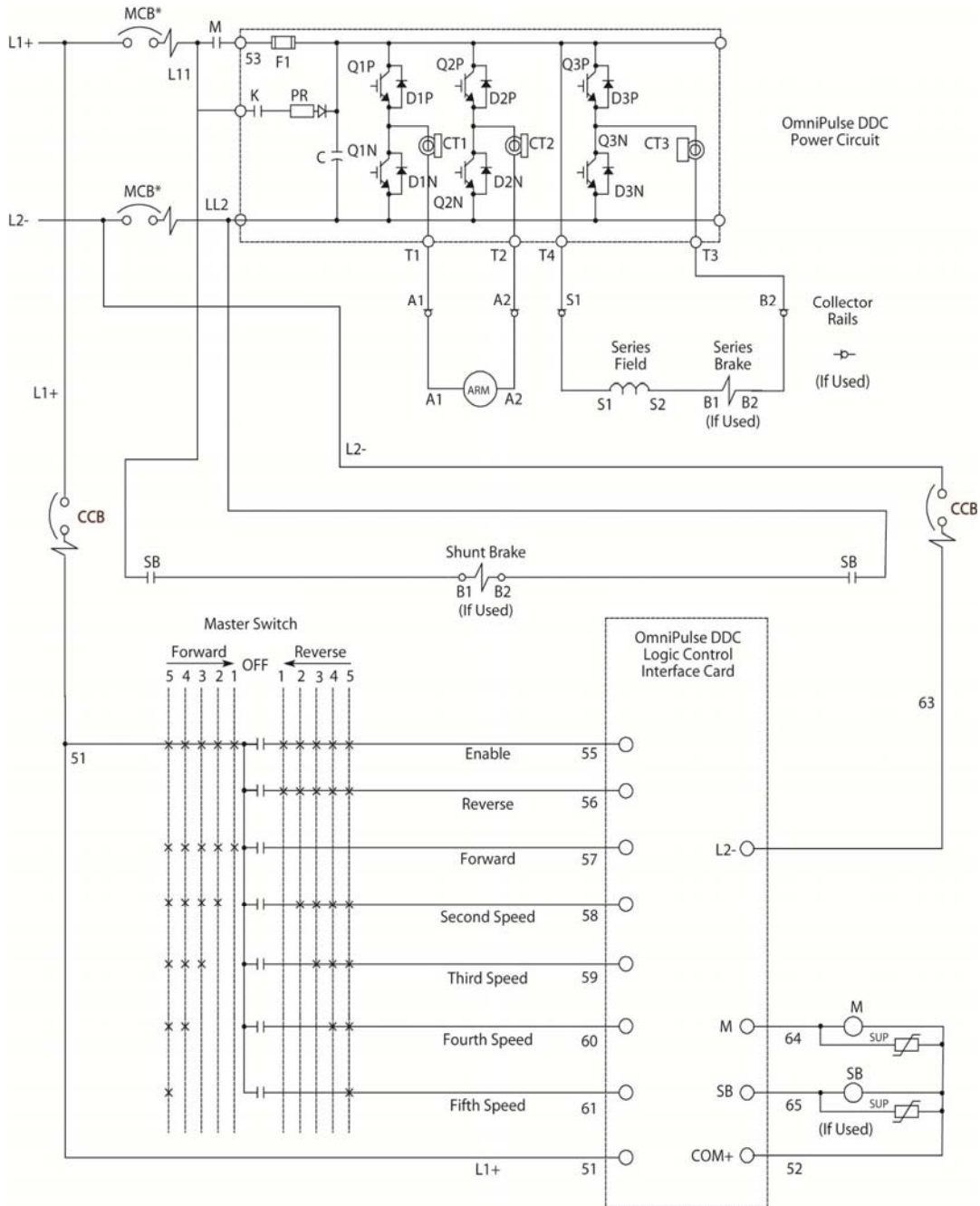
Figure 7: Typical Traverse Diagram

NOTE: MCB is selected to function as a disconnect only. It is not suitable for branch motor circuit protection.
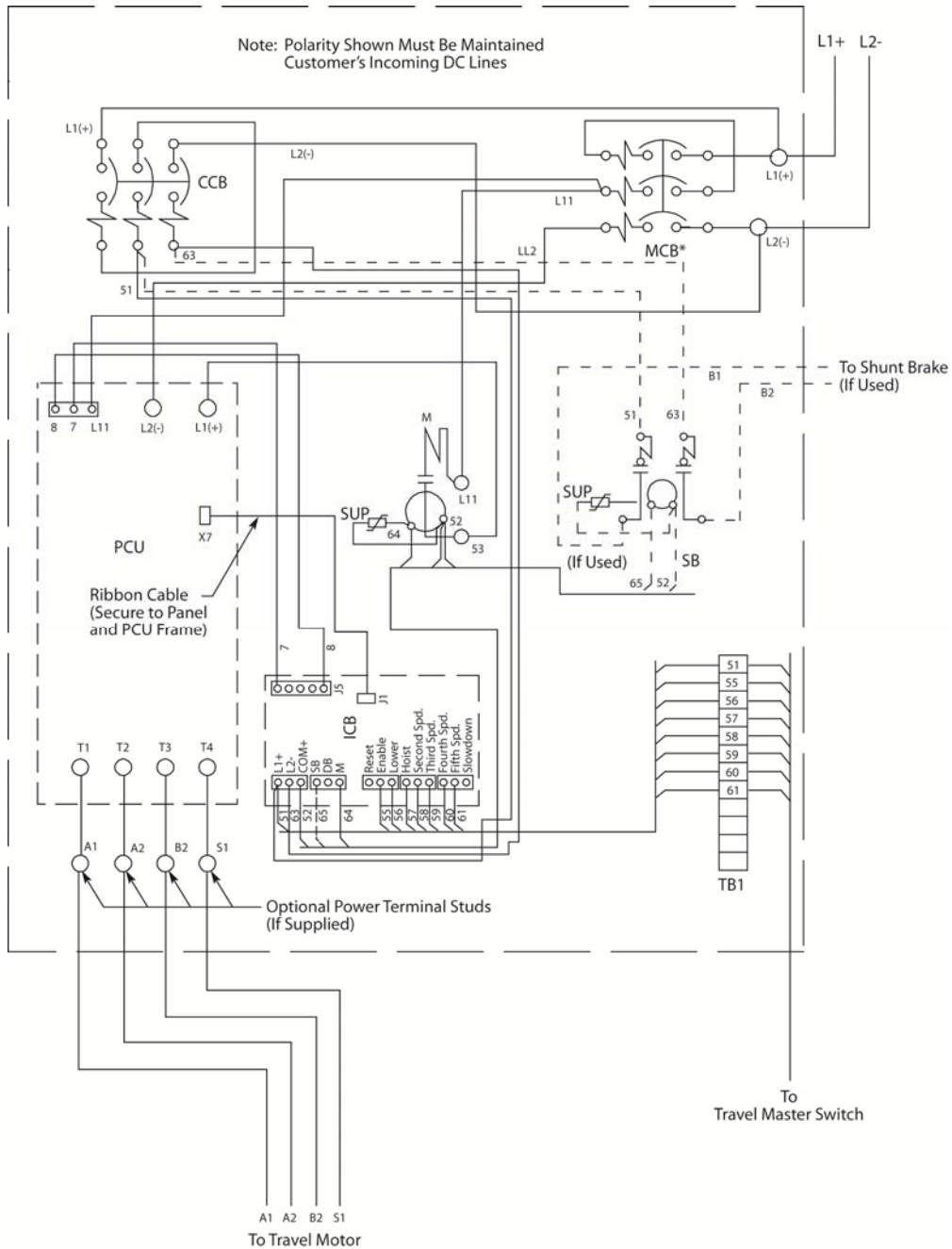
Figure 8: Typical Bridge or Trolley Controller Connections

NOTE: MCB is selected to function as a disconnect only. It is not suitable for branch motor circuit protection.

Specifications

Voltage Ratings

Table 2: Voltage Ratings

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

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

Electrical Ratings

Table 3: Electrical Ratings

Description		Specification
Power		
Current Range		67 amps to 2000 amps continuous
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%		200 to 320 VDC Standard 360 to 600 VDC Optional
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-CONTROL	9 inputs (24 VDC)
	DDC-230VIF	9 inputs (200-300 VDC)
Digital Outputs	DDC-CONTROL	3 outputs (24 VDC, 50 mA)
	DDC-230VIF	2 programmable, 1 main line (230 VDC, 1A)
Analog Inputs	DDC-CONTROL	2 inputs (0-10 VDC or 4-20 mA, 250Ω)
Analog Outputs	DDC-CONTROL	2 outputs (0-10 VDC or 4-20 mA, 250Ω)
Communication		
RS-232		Onboard Display, Door Mount Display, or Laptop Channel
RS-485		Remote Display or PLC Channel
Protective Functions		
Reverse Polarity		Software and hardware detection
Power Loss		One second Ride-Through capability
Undervoltage		Trip @ less than 50% V_{in} when greater than one second
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 Enclosure Overtemperature Shutdown
Motor Overload		Electronic Time trip
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 and is non-adjustable.

Environmental Specifications

Table 4: Environmental Specifications

Description	Specification
Temperature	
Ambient Operating Temperature	-10°C (no frost) to +40°C enclosed at 60% duty
	-10°C to +65°C* internal enclosure temperature
Storage Temperature	-40°C to +65°C
Relative Humidity	< 90% No Condensation
Altitude	
Altitude	3300 Feet (1000 meters) 3000 meters Maximum
Deration	
Temperature	2% per °C above 50°C
Altitude	1% for each 100 meters above 1000
Maximum Drive Deration	20% Total
EMC	
Immunity	Designed to meet the requirements of EN50081-2
Emissions	Designed to meet the requirements of EN50081-2
Vibration/Shock	
Vibration	Designed to meet the requirements of IEC 721-3-3
Shock	Designed to meet the requirements of IEC 68-2-27

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

Parts List			
ITE	QT	MAGNETEK PART NUMBER	DESCRIPTION
3	1	144-45266	FAN–24VDC–4"–95CFM
46	1	144-13251	CONTRL BOARD
56	1	144-45063	DISPLAY BOARD
67	1	144-45065	FUSE 150A/500V 2.75"
69	1	144-45058	DRIVER BOARD WITH POWER SUPPLY
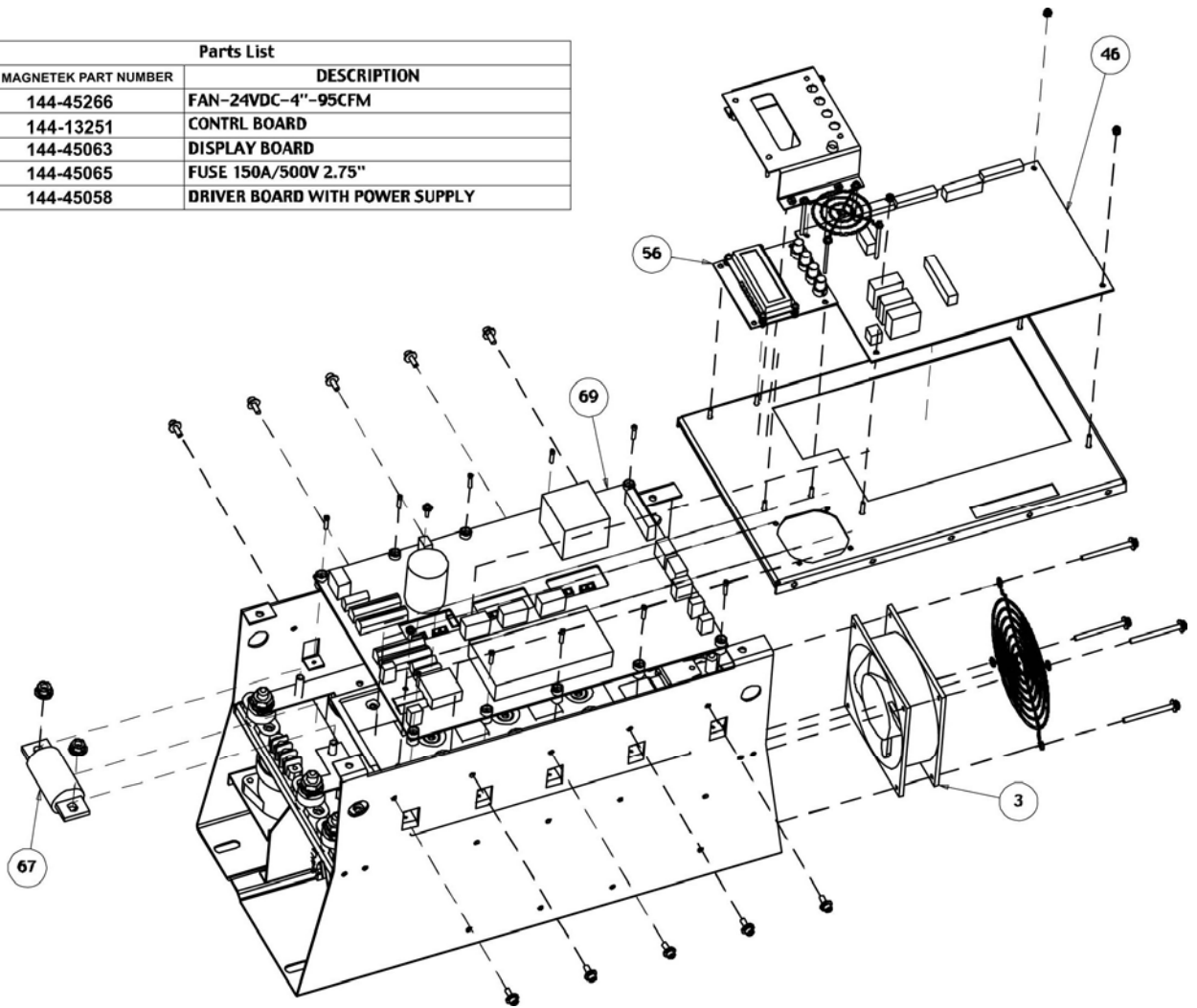
Figure 9: Exploded View – NEMA 2-3 Drive Chassis

Parts List			
ITEM	QT	MAGNETEK PART NUMBER	DESCRIPTION
16	1	144-45350	CONTROL BOARD
17	1	144-45354	LV DRIVER BOARD WITH POWER SUPPLY
		144-45242	HV DRIVER BOARD WITH POWER SUPPLY
18	1	144-45064	DC BUS DISCHARGE BOARD
30	1	144-45063	DISPLAY BOARD
46	1	144-45066	FUSE 500A/500V 3.25IN
88	1	144-45090	FAN-24VDC-6.75"-235CFM
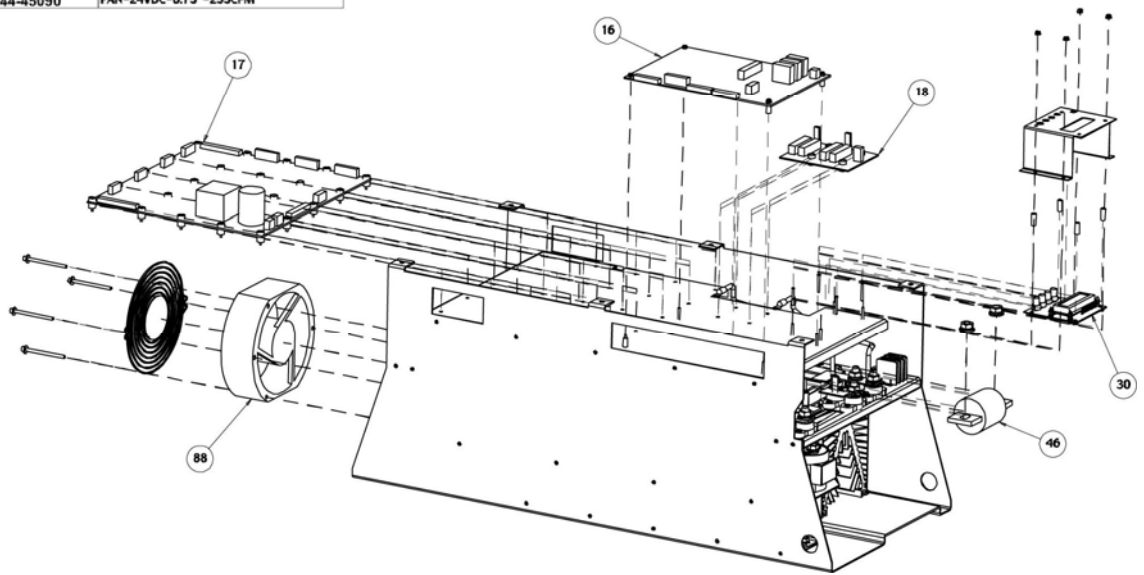
Figure 10: Exploded View – NEMA 4-5 and High Voltage Drive Chassis
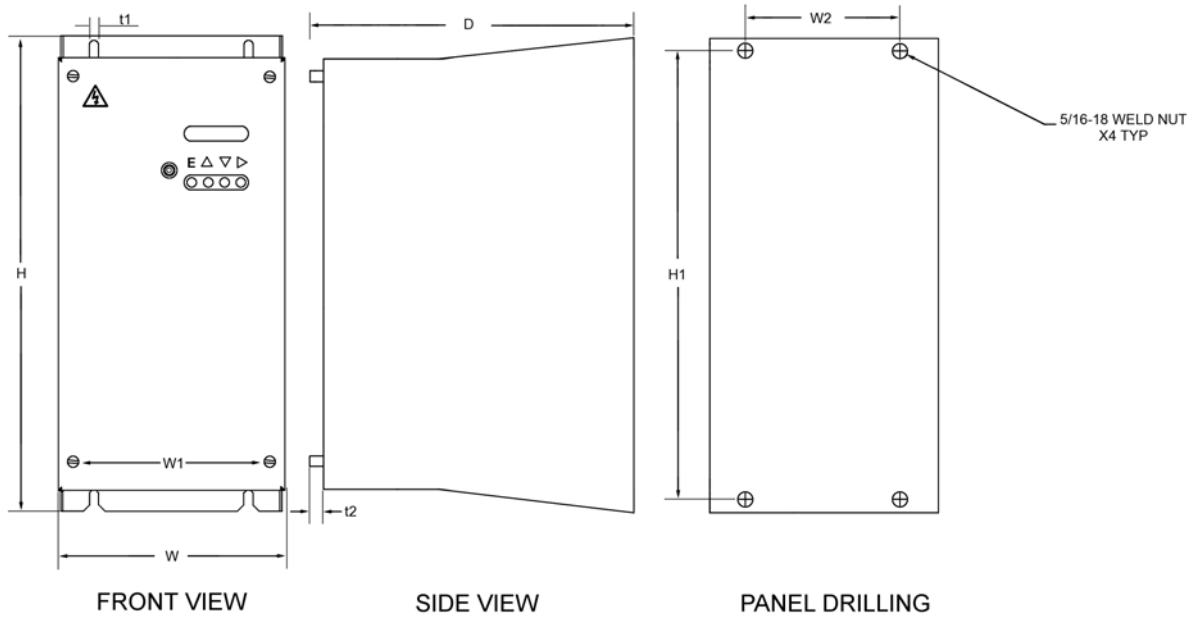
Figure 11: Chassis NEMA 2-3
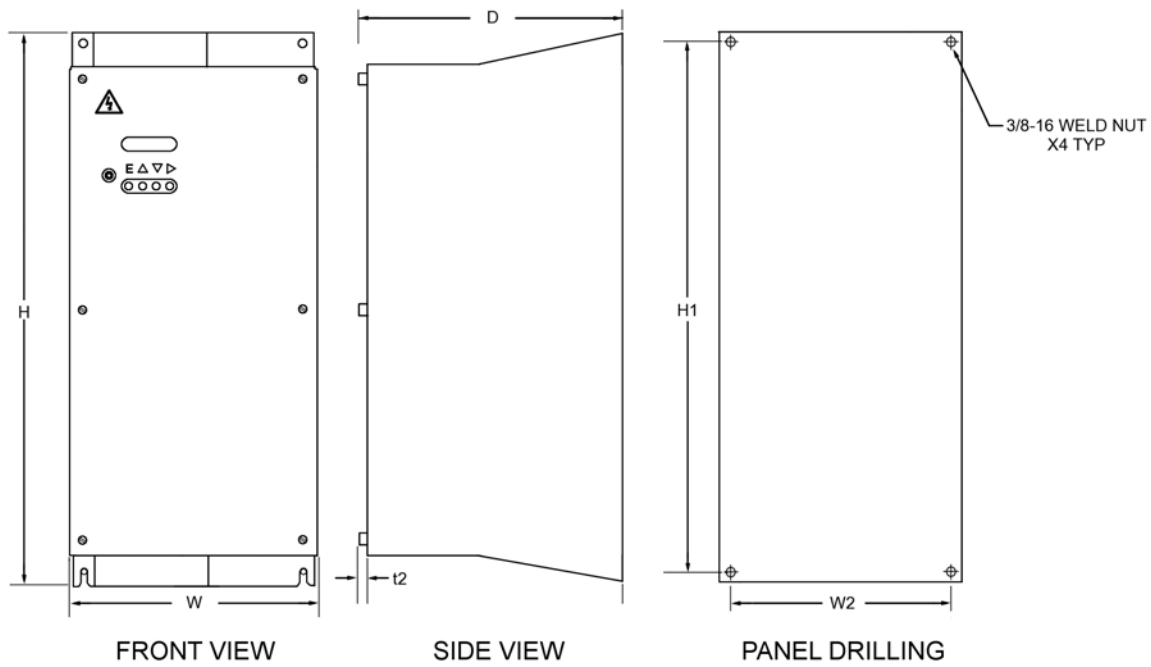
Figure 12: Chassis NEMA 4-5 and High Voltage

Table 5: NEMA Chassis Dimensions

Model	Figure Number	Dimensions (in)								Weight
		W	H	D	W1	W2	H1	t1	t2	
NEMA 2-3	11	8.57	18.50	12.50	7.00	6.00	17.50	.35	.50	47 lbs.
NEMA 4-5	12	13.17	30.00	14.17	--	11.90	28.87	--	.50	122 lbs.

Thermal Characteristics Watts/Amps

Table 6: Thermal Characteristics

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 1/2 hour frame 602 motor rated at 44 amps 10 hp.

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

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

Series Mill Motor Ratings

600 Series Mill Motor Ratings

Table 7: 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.

800 Series Mill Motor Ratings

Table 8: 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

Table 9: 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

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

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

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

Electrical Information

Control Board Terminals

Connector X1

Table 10: Control Board Terminal X1

Pin	Name	Signal Format	Description
1	+24 V		+24 V source
2	PROG_OP2	Open-collector negative logic	Programmable logic output 24 VDC 50 mA
3	PROG_OP3	Open-collector negative logic	Programmable logic output 24 VDC 50 mA
4	PROG_OP4	Open-collector negative logic	Programmable logic output 24 VDC 50 mA. Shared function with 230 VDC SB output on Interface Card
5	GND		Logic ground
6	AOUT1(4/20 mA)	4–20 mA	Programmable analog output 1 current loop output
7	GND		Logic ground
8	RS485A/RS232TX	RS485/RS232	RS485A or RS232 transmit
9	RS485B/RS232RX	RS485/RS232	RS485B or RS232 receive
10	GND		Logic ground

Connector X2

Table 11: Control Board Terminal X2

Pin	Name	Signal Format	Description
1	RESET	Isolated 24 V positive logic.	Selects RESET or STOP
2	ENABLE	Isolated 24 V positive logic.	Enable input
3	REVERSE	Isolated 24 V positive logic.	Selects LOWER or REVERSE motion
4	FORWARD	Isolated 24 V positive logic.	Selects HOIST or FORWARD motion
5	SPEED2	Isolated 24 V positive logic.	Selects SECOND SPEED
6	SPEED3	Isolated 24 V positive logic.	Selects THIRD SPEED
7	SPEED4	Isolated 24 V positive logic.	Selects FOURTH SPEED
8	SPEED5	Isolated 24 V positive logic.	Selects FIFTH SPEED
9	PROG_IP	Isolated 24 V positive logic.	Programmable logic input
10	DIP COMMON		Isolated input common

Connector X3

Table 12: Control Board Terminal X3

Pin	Name	Signal Format	Description
1	+24 V		24 V source (0.2 A max, not isolated from logic ground).
2	+10 V		+10 V analog reference (10 mA max)
3	-10 V		-10 V analog reference (10 mA max)
4	ANALOG IP 1(+)	+10 V or 4–20 mA differential	Programmable analog input 1 – high
5	ANALOG IP 1(-)		Programmable analog input 1 – low
6	ANALOG GND		Analog ground
7	ANALOG IP 2	0–10 V or 4–20 mA	Programmable analog input 2
8	ANALOG GND		Analog ground
9	AOUT1(0/10 V)	0V–+10 V	Programmable analog output 1
10	CURRENT	0V–+10 V	Armature current signal absolute
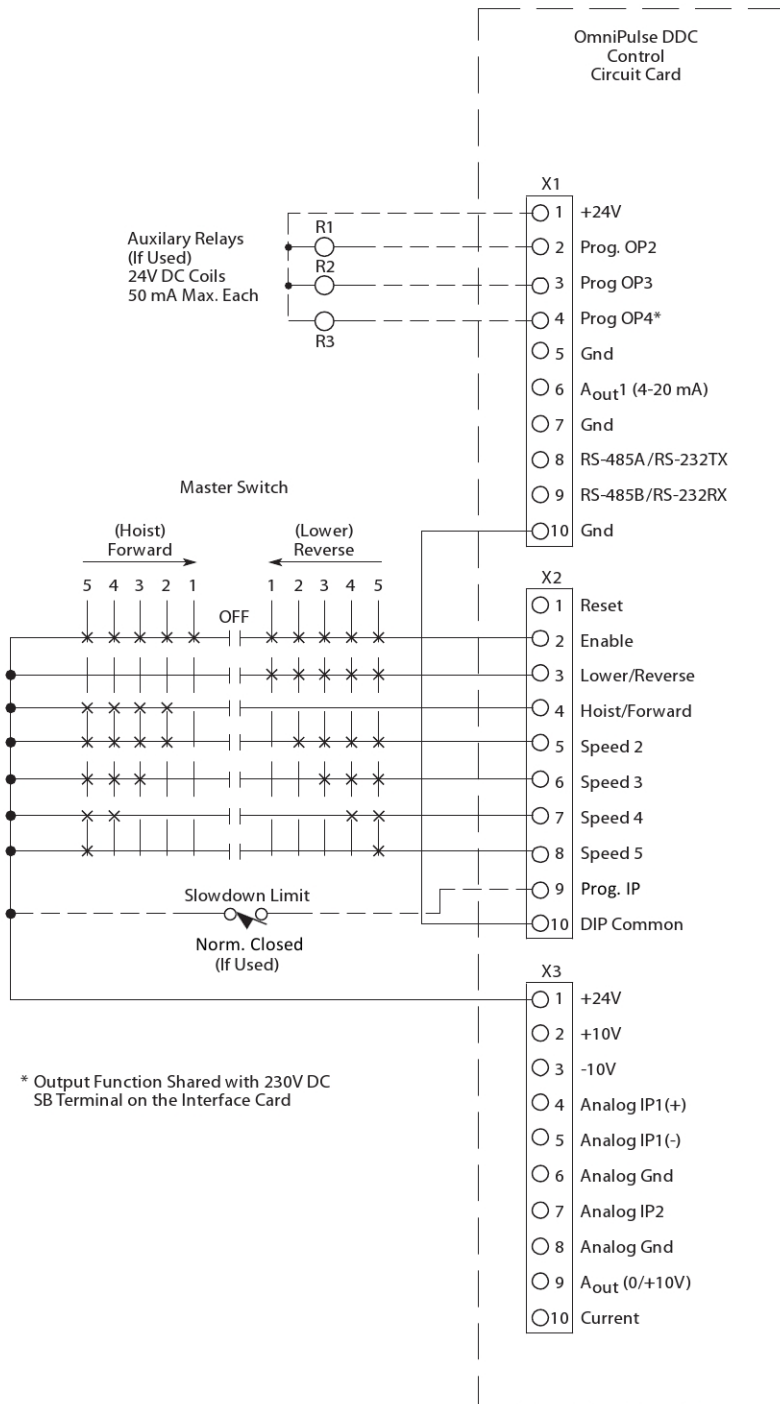
Figure 13: Multi-Step Control Interface 24 VDC Logic Connections
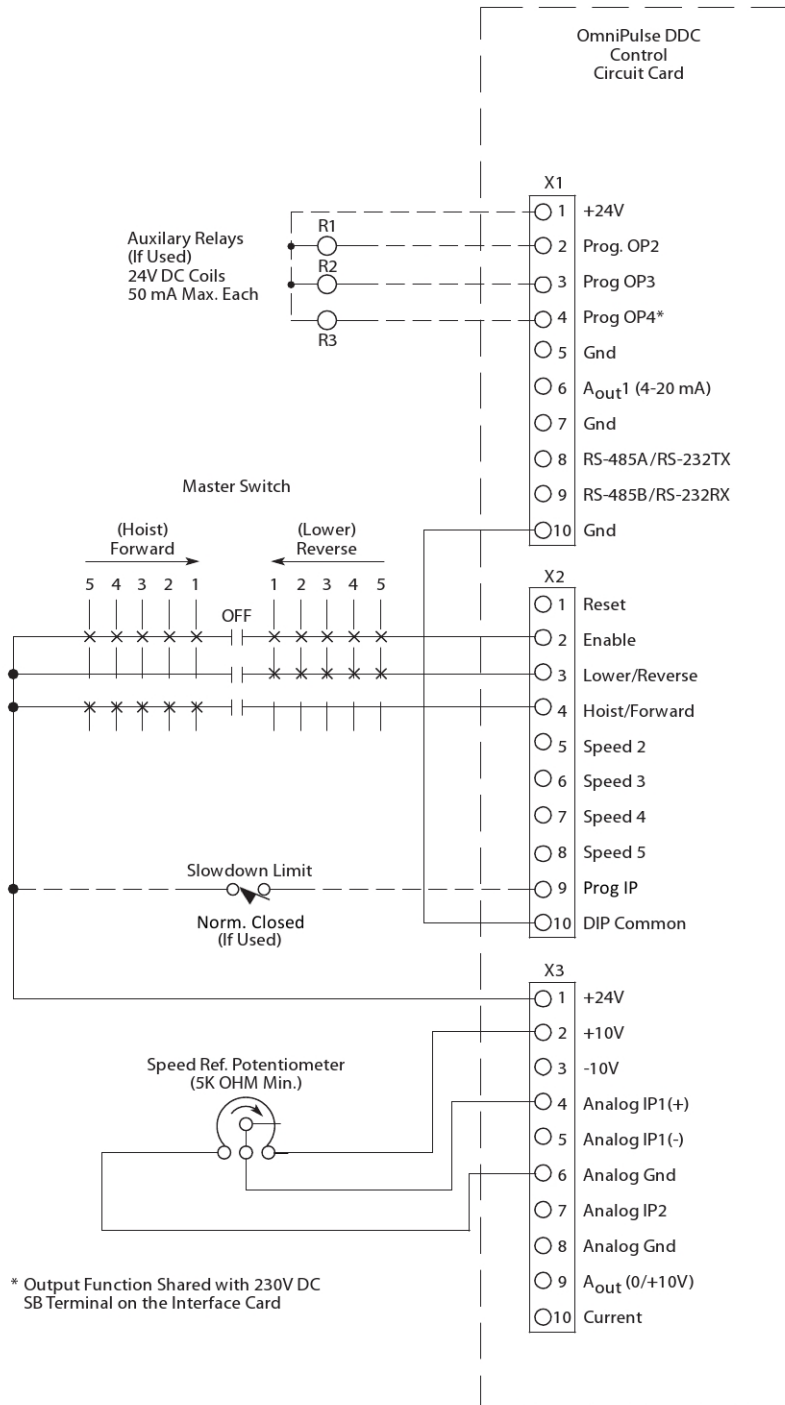
Figure 14: Joystick Control Interface 24 VDC Logic Connections

Controller Setup

Using the Digital Display

Each OmniPulse DDC drive has a display for monitoring the DDC operation and adjusting parameters. The OmniPulse DDC has a 2-line LCD to display information. Four pushbuttons are used to control the display and to carry out adjustments. The control LED is not provided on the backlighted display units.

2-Line x 16-Character LCD
The LCD has the following appearance at power-up. This is the first screen of the MAIN MENU.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Line 1							M	A	G	N	E	T	E	K		
Line 2				O	M	N	I	P	U	L	S	E		D	D	C

Figure 15: 2-Line x 16-Character LCD

Keypad Operation and Navigation

In the display mode, the keys have the following functions:

▶   RIGHT Key

This key is used to select the menu to be displayed. Up to 7 sub-menus, A to G, are accessed in sequence by pressing this key. When the last menu is reached, the display rotates back to the main menu.

▲   UP Key

This key is used to select a parameter within the selected menu. Each press of the UP key increments to the next parameter. The selection rolls over from the last parameter to the first.

▼   DOWN Key

This key is used to select a parameter within the selected menu. Each press of the DOWN key decrements to the previous parameter. The selection rolls over from the first parameter to the last.

E   ENTER Key

This key is used to switch from the display mode to the parameter adjustment mode.

In the Parameter Adjustment mode the keys have the following functions:

▶   RIGHT Key

This key is used to position the flashing cursor within the numerical data field to select the digit to be adjusted.

▲   UP Key

This key is used to increment the selected digit. On incrementing from 9 to 0 the next left digit is incremented if it is present.

▼   DOWN Key

This key is used to decrement the selected digit. On decrement from 0 to 9, the next left digit will decrement if it is present.

E   ENTER Key

This key is used to store the new value and return to the display mode.

Charge and Control Indicator Light

> ## ⚠ WARNING
>
> The charge indicator light on the display indicates the capacitor bank condition. When the light is on the capacitor bank has voltage, which can be harmful to personnel. The capacitor bank will fully discharge in 6 minutes when both the main and control circuit breaker or knife switch is opened.

The control backlight LCD display unit indicates the presence of control voltage to the drive unit. This light will be on whenever the control circuit breaker or knife switch is closed.

DDC Menu Map
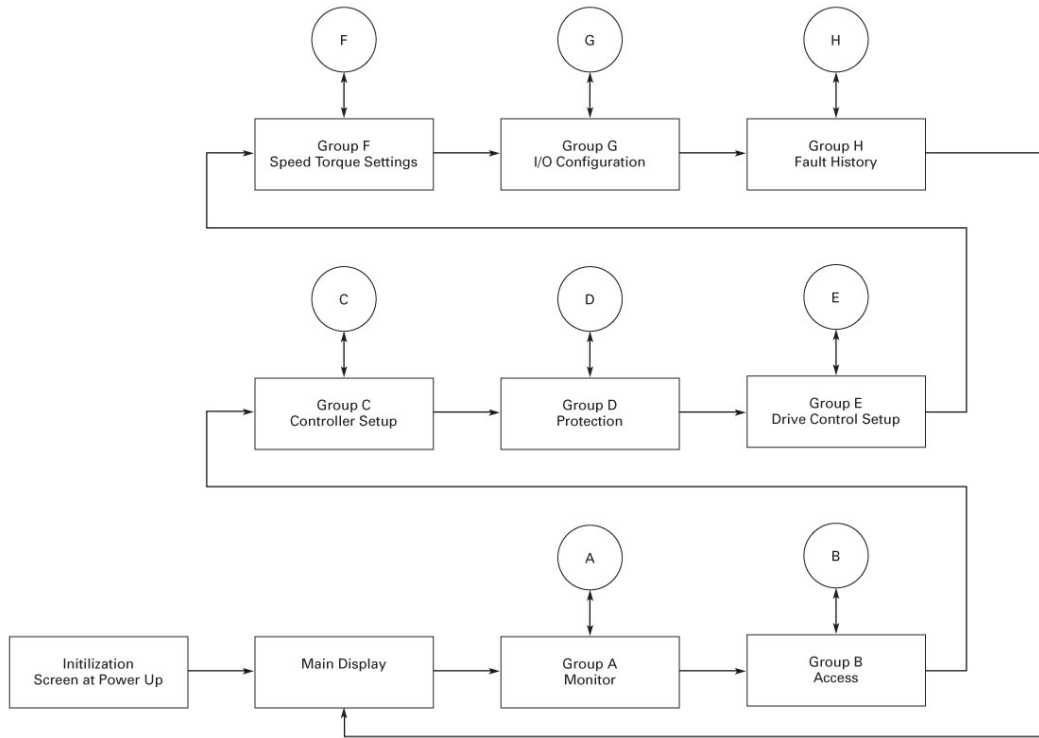
Figure 16: Display Navigation Map
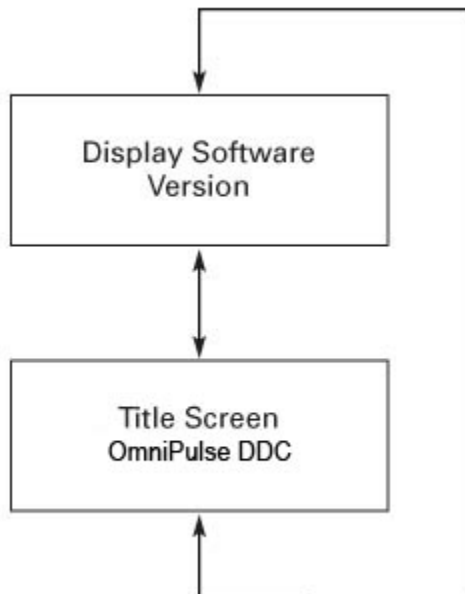
Figure 17: Main Display Sub Menu

A12		A25			
No. of Operations X 100		Overload Level			

A11		A24		A31	
No. of Operations Units		Ambient Temp.		Sequence Status	

A10	A23	A30
Energy Used	Heatsink Temp.	Fault Status

A09	A22	A29
Input Power	Logic Outputs	Control Status

A08	A21	A28
Hook Load	Logic Inputs	T3 Duty Cycle

A07	A20	A27
Motor Torque	Lower Current Limit	T2 Duty Cycle

A06	A19	A26
Motor RPM	Upper Control Limit	T1 Duty Cycle

A05	A18
Calculated Flux	Speed Ref.

A04	A17
Motor CEMF	Field Current Ref.

A03	A16
DC Bus Voltage	Armature Current Ref.

A02	A15
Armature Voltage	Analog Input 2

A01	A14
Field Current	Analog Input 1

A

A00	A13
Armature Current	Elapsed Hours

Figure 18: Group A – Monitor Sub Menu
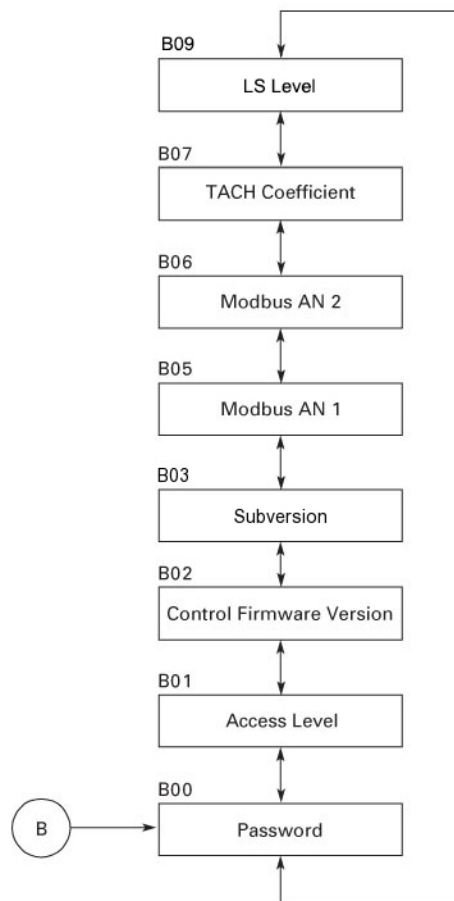
Figure 19: Group B – Access Menu
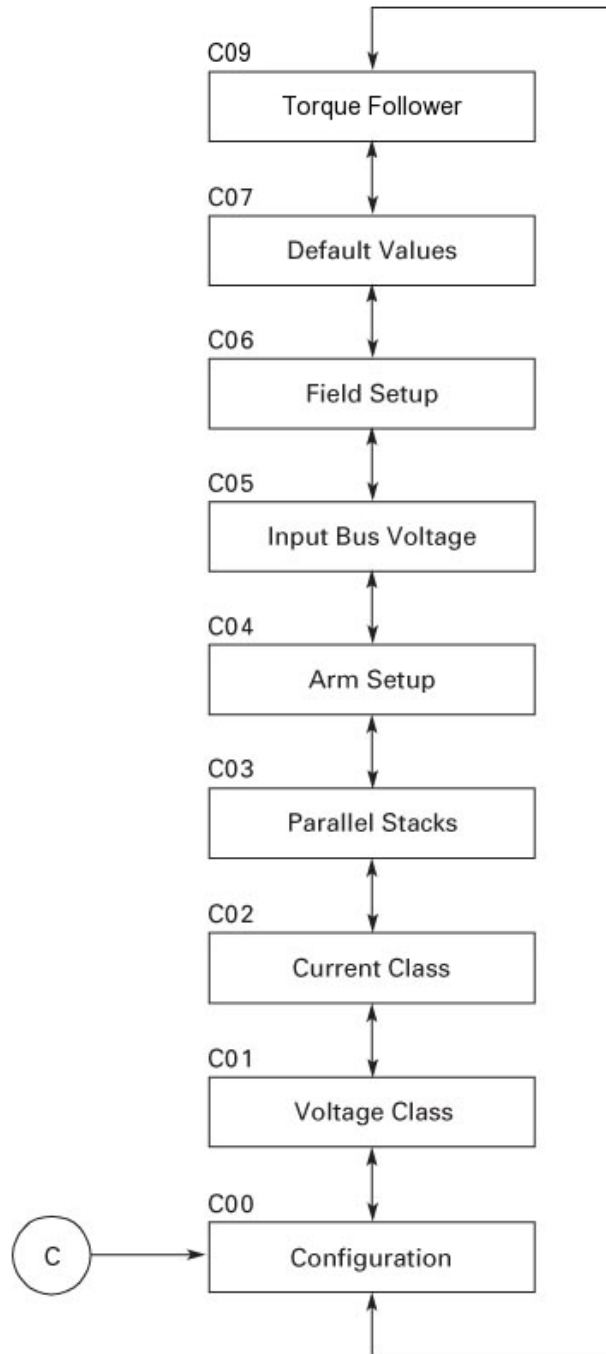
Figure 20: Group C – Controller Rating Setup Sub Menu
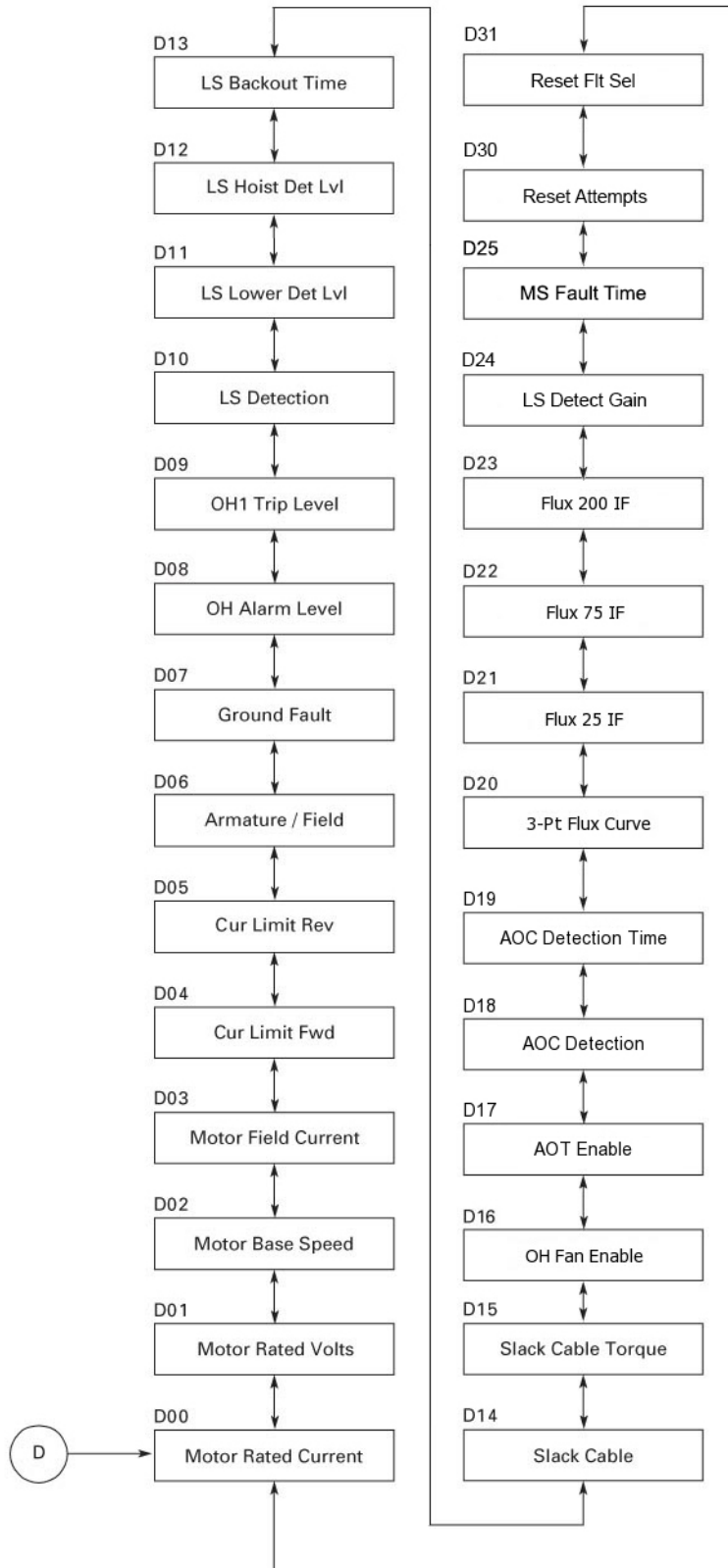
Figure 21: Group D – Protection Sub Menu
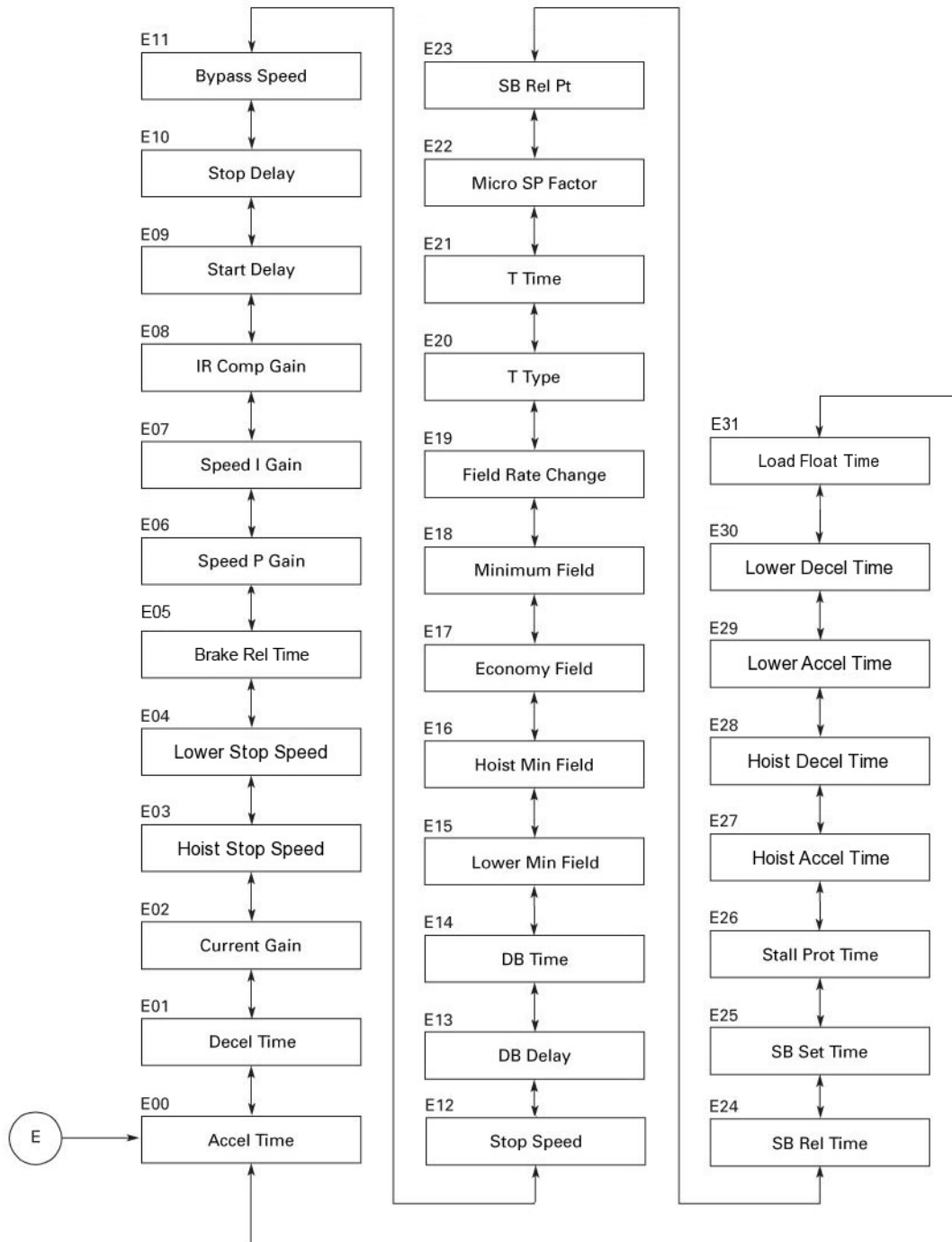
Figure 22: Group E – Drive Control Setup Sub Menu
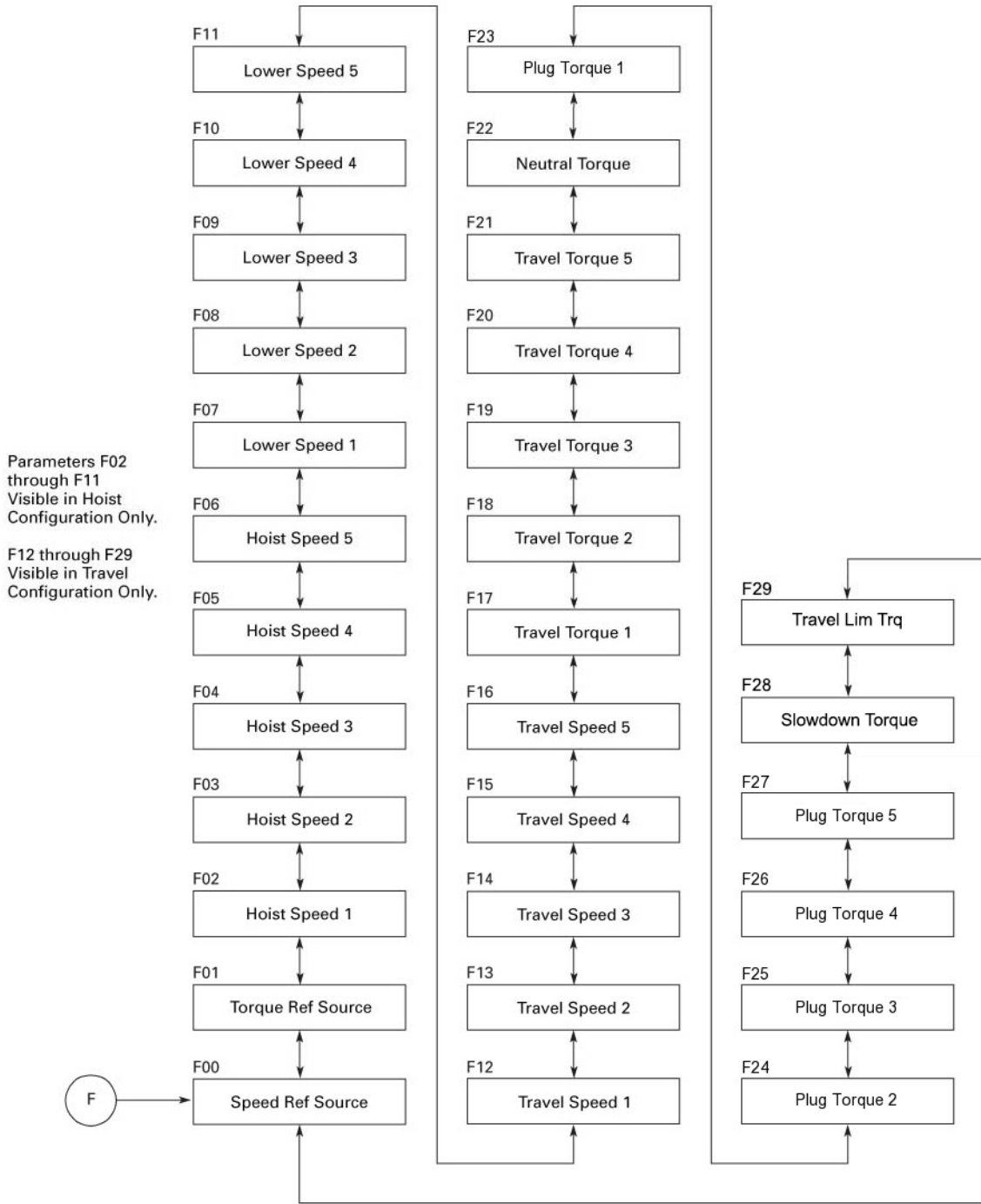
Figure 23: Group F – Speed and Torque Sub Menu
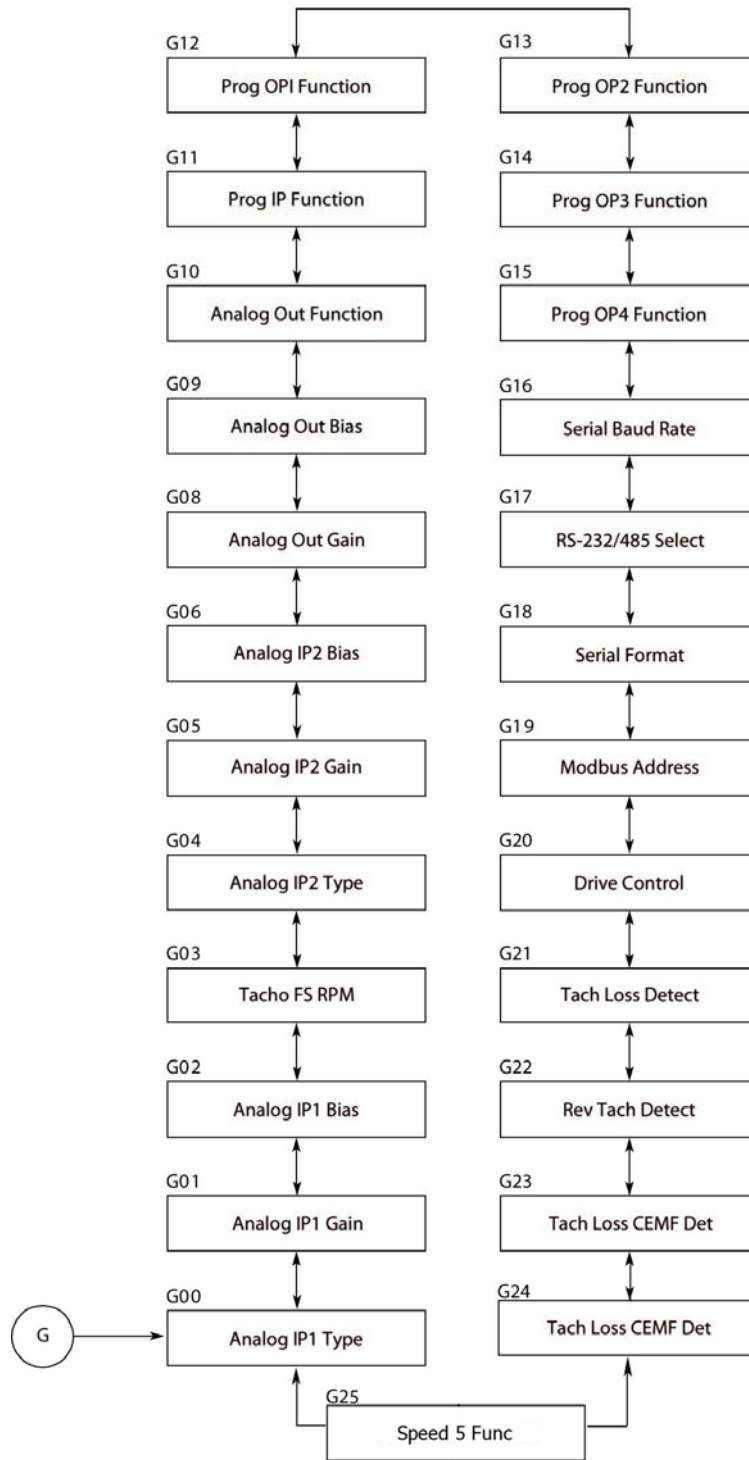
Figure 24: Group G – I/O Configuration Sub Menu
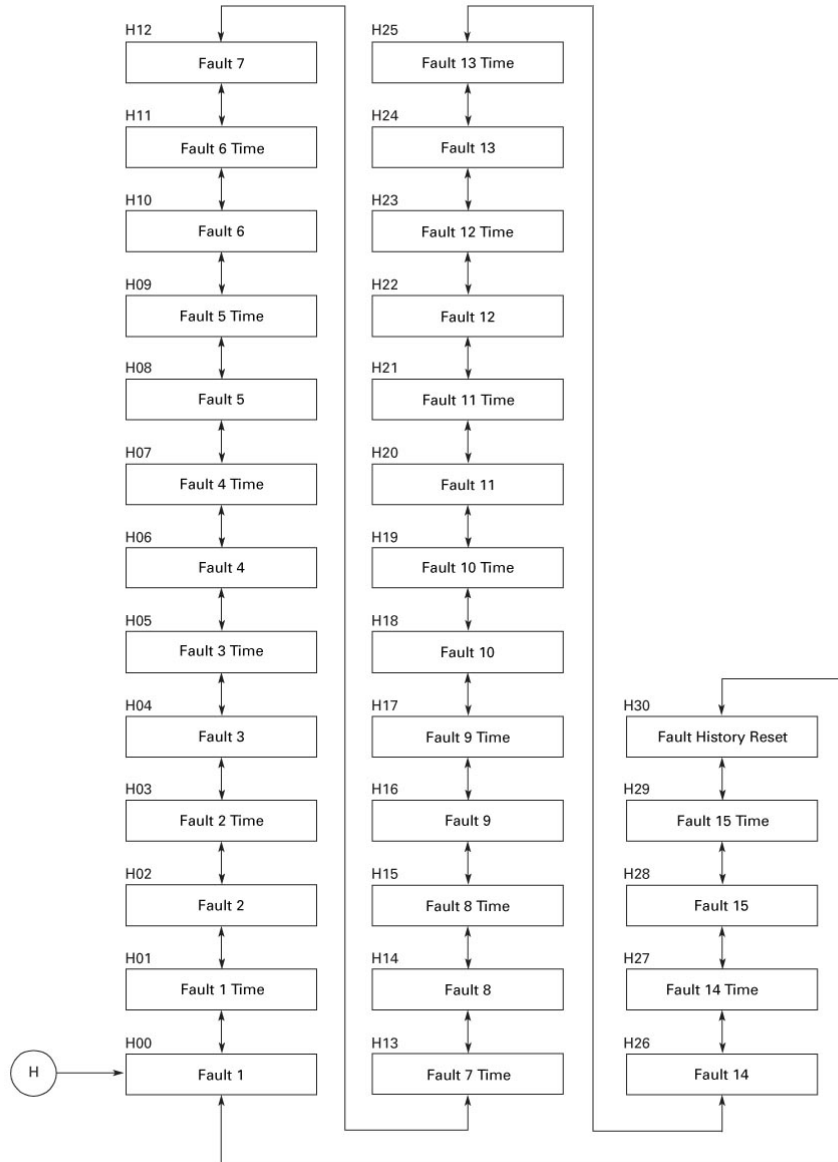
Figure 25: Group H – Fault Sub Menu

Parameter Tables

Group A: Monitoring

Table 13: Motor Current and Voltage

Variable Number	Name	Function	Unit
A00	Armature Current	Displays the value of motor armature current derived from controller terminal T1 current measurement.	0.1 A
A01	Field Current	Displays the value of motor field current derived from controller terminal T3 measurement.	0.1 A
A02	Armature Voltage	Displays the value of the armature voltage measurement derived from controller terminals T1 and T2.	0.1 V
A03	DC Bus Voltage	Displays the voltage on the controller DC bus capacitors.	0.1 V

Table 14: Motor Speed and Torque Calculation

Variable Number	Name	Function	Unit
A04	Motor CEMF	Displays the motor counter EMF as a percentage of the motor rated voltage. 100%=DO1 value	0.1%
A05	Flux	Calculated motor flux as percentage of the full-field value.	0.1%
A06	Motor RPM	Calculated motor speed in RPM.	1 RPM
A07	Motor Torque	Displays the calculated motor torque (% Flux x % Arm I) as a percentage.	0.1%
A08	Hook Load	Displays calculated hook load in % for Hoist Configuration Only	0.1%

Table 15: Power, Energy, and Operation Cycles

Variable Number	Name	Function	Unit
A09	Input Power	Displays instantaneous power input from the main DC supply.	kW
A10	Energy Used	Displays the accumulated energy used by the controller.	0.1 kWh
A11	No of Operations	Operation Counter (99 max. count after which counter resets to zero).	1
A12	No of Operations x 100	Operation Counter (increments 1 for every 100 operations up to 65,535 after which it resets to zero).	100
A13	Elapsed Hours	Accumulated time controller is enabled.	1 hr

Table 16: Analog Input Status

Variable Number	Name	Function	Unit
A14	Analog Input 1	Displays the % full scale of analog input 1.	0.1%
A15	Analog Input 2	Displays the % full scale of analog input 2.	0.1%

Table 17: Current and Speed

Variable Number	Name	Function	Unit
A16	Armature Current Ref (Advanced Tool)	Displays the armature calculated current reference as a percentage of the motor rated current.	0.1%
A17	Field Current Ref (Advanced Tool)	Displays the field calculated current reference as a percentage of motor rated current.	0.1%
A18	Speed Reference (Advanced Tool)	Displays the calculated speed reference before and after acceleration and deceleration control as a percentage of the motor rated speed at full load.	0.1%
A19	Upper Control Limit (Advanced Tool)	Displays the forward current limit applied to the speed controller.	0.1%
A20	Lower Control Limit (Advanced Tool)	Displays the reverse current limit applied to the speed controller.	0.1%

Table 18: Logic I/O Status

Variable Number	Name	Function
A21	Logic Inputs	Displays the status of the logic inputs (X2 terminal control card). 13 12 11 10 9 8 7 6 5 4 3 2 1 Display Bit Position Enable Forward (Hoist) Reverse (Lower) Speed 2 Speed 3 Speed 4 Speed 5 Not Used Programmable Input Module Fault Module Out of Service Power Out of Service Ground Fault
A22	Logic Outputs	Displays the status of the logic outputs. X X X 5 4 3 2 1 M contactor on Interface Board OP1 (DB) on Interface Board OP2 on Control Board X1 – 2 OP3 on Control Board X1 – 3 OP4 on Control Board X1 – 4 on Interface Board (SB)
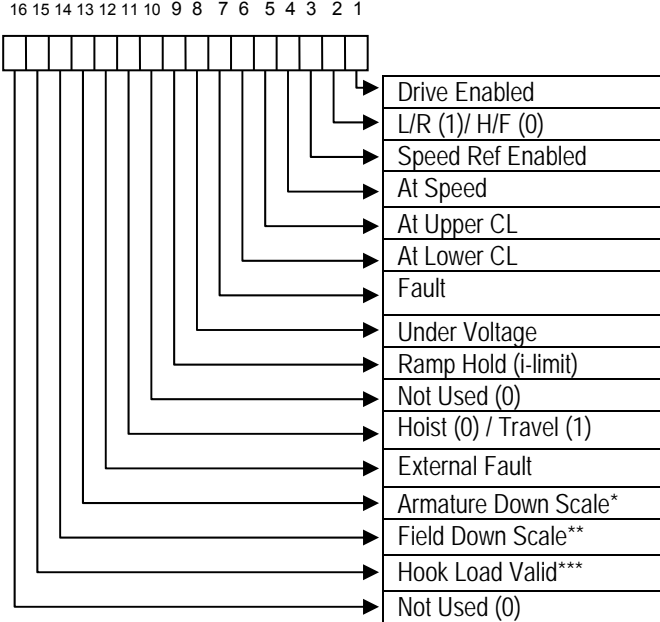
A21 Details
Bits 1 through 7 and Bit 9 change to 1 when input is present. Bit 8 is not used.
Bit 7 = Programmable (refer to G25)
Bit 9 = Programmable (refer to G11))
Bit 10 = 0 when fault occurs
Bit 11 = 0 when follower module is out of service in multi-module system
Bit 12 = 0 when the control power is low; 1 = Power supply normal
Bit 13 = 0 when grounded fault is detected and enabled; 1 when not detected or disabled.

A22 Details
Bit 2 = Programmable (refer to G12)
Bit 3 = Programmable (refer to G13)
Bit 4 = Programmable (refer to G14)
Bit 5 = Programmable (refer to G15)

Table 19: Controller Status

Variable Number	Name	Function	Unit
A23	Heatsink Temp	Displays the temperature of the semiconductor heatsink reading.	0.1°C
A24	Ambient Temp	Displays the ambient temperature at the electronic control card 144-45060 reading. Fault at 75 ˚C reset at 65 ˚C	0.1°C
A25	Overload Level	Displays the accumulated value of armature current overload. This register increments above 110% current and decrements when current falls below 110%. Fault occurs when value reaches 18000.	1
A26	T1 Duty Cycle (Advanced Tool)	Displays the PWM duty cycle (% time ON) at terminal T1 (connected to armature terminal A1).	0.1%
A27	T2 Duty Cycle (Advanced Tool)	Displays the PWM duty cycle (% time ON) at terminal T2 (connected to armature terminal A2).	0.1%
A28	T3 Duty Cycle (Advanced Tool)	Displays the PWM duty cycle (% time ON) at terminal T3 (connected to field terminal S2).	0.1%
A29	Control Status (Advanced Tool)	Displays control status register flags.	

* Ext CT Board Armature
** Ext CT Board Field
*** Based A08 Value

A29 Details

Bit 1	Drive Enabled	0 = Ready Mode 1 = Run Mode
Bit 2	Direction Input	0 = Hoist/Forward and 1 = Lower/Reverse
Bit 3	Speed Ref Enabled	1 = Ramp for speed reference enabled
Bit 4	At Speed	1 = A18 value reached
Bit 5	At Upper CL	1 = A19 value reached
Bit 6	At Lower CL	1 = A20 value reached
Bit 7	Fault	1 = Drive in FAULT status mode
Bit 8	Under Voltage	1 = Drive Fault is Under Voltage
Bit 9	Ramp Hold	1 = CL reached acceleration now on CL not time
Bit 10	Not used	
Bit 11	Drive Configuration	0 = Hoist configuration and 1 = Travel configuration
Bit 12	External Fault	1 = External Fault input activated
Bit 13	Armature Down Scale	1 = External CT board (144-45076) being used in armature circuit
Bit 14	Field Down Scale	1 = External CT board (144-45076) being used in field circuit
Bit 15	Hook Load Valid	1 = Hook Load estimated displayed in A08 parameter Hoist configuration only
Bit 16	Not used	

Table 19: Controller Status (continued)

Variable Number	Name	Function	Unit
A30	Fault Status (Advanced Tool) (Displays the active trip before reset)	0 = No fault 1 = Control Supply Under voltage (CUV) 2 = Under voltage (UV1) 3 = Heatsink Over temperature Alarm (Temp Alarm) 4 = Heatsink Over temperature Trip (Temp Trip) 5 = Short Circuit (SC) (IGBT driver module) 6 = Over voltage Trip (OV) 7 = External Fault 8 = Feedback error (Fdbk Error) 9 = Motor Stall 10 = Slack Cable (SLC) 11 = Field Loss 12 = Limit Switch (LS) 13 = Motor Overload (MOL) 14 = Master Switch not in Off Position (MS) 15 = Change of Setting Locks out drive if current ratings (C02, D00) are changed "on the fly". To clear, power down the drive or reset the drive with the microprocessor reset switch SW1 on the Interface board. 16 = Ambient Temp 17 = Ground Fault 18 = Module out of service (MOS) 19 = Open Armature	
A31	Sequence Status (Advanced Tool)	Displays the 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 13 = LS Back Out 14 = Memory Update 15 = Rescue Mode 16 = Latched Fault	

Group B: Access

Table 20: Group B - Access

Parameter No.	Parameter Name	Factory Default	Min. Max.	Unit	Access Level*
B00	Password	0	0 65535	1	0
B01	Access Level Monitor User Engineer	Monitor	0 2	—	0
B02	Control Firmware Version	Monitor	—	—	0
B03	Subversion	Monitor	---	---	0
B05	Modbus AN 1	Analog Reference which is transmitted via Modbus for analog input 1	—	—	0
B06	Modbus AN 2	Analog Reference which is transmitted via Modbus for analog input 2	—	—	0
B07	TACH Coefficient	Monitor	—	—	0
B09	LS Level	Monitor	—	0.1%	0

⚠ WARNING

This product requires passwords to make parameter changes. It is the responsibility of the purchaser/user to safeguard these passwords and make them available only to qualified trained personnel. Improper parameter setup can damage equipment, pose a hazard to personnel and result in unexpected operation. Note that once entered, the password remains active until the drive is either powered down or is reset using the S1 (Reset) button on the Interface Card.

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*Parameter groups B through H (**Tables 20** through **26**) indicate the access level required to change the parameter. Access levels are defined as:

0 = Monitor: permits monitoring of drive operation.
1 = User: permits adjustment of performance settings.
2 = Engineer: permits adjustment of application settings.

Modbus AN1 and AN2 (B05 and B06)

These are the monitor parameters for Modbus analog control. The values displayed are the analog signals being transmitted to the drive from the Modbus Master.

TACH Coefficient (B07)

When a TACH feedback device is used the drive regulator will blend the TACH feedback and the internal CEMF feedback together. This enhancement to the regulator provides automatic switchover to full CEMF speed control should the tach signal be lost, allowing the current operation to continue. The use of the TACH Coefficient minimizes large speed changes possible when the TACH signal is lost at higher speeds. The maximum speed differential between the TACH and CEMF is 30%.

If the CEMF feedback is less than 10% of the TACH feedback the coefficient will be one. A coefficient of 1 allows the TACH feedback signal to dominate the speed feedback signal. If the CEMF feedback is greater than 30% of the TACH feedback the coefficient will be zero. This allows the CEMF feedback to dominate the speed feedback signal. The coefficient changes linearly between 1 and zero when the CEMF and TACH feedback are greater than 10% but less than 30% difference.

Parameter G21 must be set to 0 (Disabled) for the automatic switchover from Tach of CEMF feedback control. Caution should be used when selecting this feature at operating speeds below 25% as an increase in speed can occur as the software switches from Tach to CEMF feedback. Parameter G03 must be greater than 0 to enable the Tach Feedback control. If Parameter G21 is set to 1 (Enabled) the drive will fault on Tach signal loss. See parameter G21 for more information.

LS Level (B09)

LS Level is a troubleshooting tool for setting the correct limit switch settings (ex. D11, D12, E05). If the limit switch is not detecting properly, adjust D12 to a percentage below what is seen in this parameter at the point where the hoist reaches the limit switch.

Group C: Controller Rating Setup

Table 21: Group C – Controller Rating Setup

Parameter No.	Parameter Name	Factory Default	Min. Max.	Unit	Access Level
C00	Configuration	Set by DIP SW Position 3	0 = Hoist 1 = Travel	1	0
C01	Voltage Class	Set by DIP SW Position 4	0 = 200/360 V 1 = 400/720 V	1	0
C02	Current Class	Set by DIP SW Position 1 & 2	0 = N2: 67 A 1 = N3: 133 A 2 = N4: 200 A 3 = N5: 400 A *Note 1	1	0
C03	Parallel Stacks	1	1 5 *Note 1	1	2
C04	Armature Setup	0	0 = Internal CT 1 = Ext CT 20 A 2 = Ext CT10 A 3 = Ext CT 5 A *Note 2	1	2
C05	Input Bus Voltage	250	200 – 360 200 – 720 *Note 3	1 V	2
C06	Field Set Up	0	0 = Series Field Int CT 1 = Shunt Field EXT CT 20 A 2 = Shunt Field Ext CT 10 A 3 = Shunt Field Ext CT 5 A 4 = Shunt Field Ext CT 2.5 A	1	2
C07	Default Values	No Action	0 = No Action 1 = Store User 2 = Restore User 3 = Restore Factory	1	1
C09	Torque Follower	Disabled	0= Disable 1= Enabled	1	2

Configuration (C00)

Configures the main function of the drive as either a Hoist or Travel Motion. This parameter is determined by SW1 position 3 on the control card. Reference Figure 30 and Table 28 for the proper setting.

Note 1: When current class C02 switches are set to 400 A and the C03 value is greater than 1 the current class display will change with the C03 setting. When the DIP switches are set for 67 Amp and C04 and C06 External CT is selected the C02 will display N1:33A after the drive is reset.
Note 2: Internal CT default setting can only be changed when Current Class C02 is set to N2:67A setting.
Note 3: Input Bus voltage range is dependent upon Voltage Class setting displayed in parameter C01.
Note 4: C09 is not visible in Hoist Mode.

Voltage Class (C01)

This parameter defines the measurement scaling for the DC bus voltage and the motor armature voltage, and it must match the nameplate rating of the controller. Incorrect setting of this parameter will result in incorrectly scaled values for motor voltages. Failure to set this parameter correctly will cause incorrect voltages to be indicated on the display and may also cause poor speed loop performance. Reference **Figure 30** and **Table 28** for proper setting of position 4 on SW1.

Current Class (C02)

This parameter defines the measurement scaling for motor armature current and motor field current, and it must match the nameplate rating of the controller. Failure to set this parameter correctly will result in the motor being operated at the wrong current. This will cause incorrect currents to be indicated on the display and will also cause the current limits and motor overload protection to operate incorrectly. Reference **Figure 30** and **Table 28** for proper settings of position 1 and 2 on SW1. When SW1-1 and SW2-2 are on (400 A setting) the current class display changes when parameter C03 is greater than 1 (see the table in Parallel Stacks description).

Parallel Stacks (C03)

This parameter is used when parallel converter units are combined with a NEMA 5 400 A unit to obtain current capacities above 400 A. This parameter must be equal to the total number of converter units including the master. Failure to set this parameter correctly will result in the motor being operated at the wrong current. This will cause incorrect currents to be indicated on the display and will also cause the current limits and motor overload protection to operate incorrectly. Parameter can only be changed if the 400 A switch position is on.

Controller Amps	Parameter Value	C02 Value
400	1	NEMA 5: 400 amps
800	2	NEMA 6: 800 amps
1200	3	NEMA 7: 1200 amps
1600	4	NEMA 8S: 1600 amps
2000	5	NEMA 8L: 2000 amps

Armature Setup (C04)

This parameter defines where the current signals are derived, either internal CTs or external CTs. External CTs require the use of the External CT field board on the T1 and T2 terminals.

The external CTs are only used with the NEMA Size 2 drives that are connected to motors below 5 horsepower. The shunt board is mounted externally to the drive on the control panel. Refer to **Figure 31** and **Table 29** for jumper setting information.

When using the external CTs it is necessary to make sure that the jumper settings and the parameter setting (D00) agree to avoid operational problems. Also make sure that the jumper connections on driver board are according to **Table 30**. Whenever the external CT is selected the C02 parameter will display

NEMA 1 33A. This is another quick check for the proper link settings on driver board. 133 AMP to 400 AMP switch positions will not allow the parameter to change from Internal CT.

Input Bus Voltage (C05)

Parameter specifies the nominal bus voltage of the DC supply system. It also sets the undervoltage trip point (50%) and the overvoltage trip point (140%). The maximum overvoltage trip point is limited to 420 V in the low voltage drive and 840 V in the high voltage drive. Default setting is determined by SW1 DIP Switch position 4 setting.

Field Setup (C06)

This parameter identifies the use of the internal CT or the external CT for motor fields. The physical link setting on the external CT board is found in **Table 29**. The parameter setting must match the jumper setting to obtain proper current scaling. An incorrect setting will result in improper current readings that will impact the controller control loops.

The external CT is used for all shunt motor applications. The external CTs are also used with series motors and the NEMA Size 2 drive that are connected to motors below 5 horsepower.

When using the external CTs it is necessary to make sure that the jumper settings and the parameter setting agree to avoid operational problems. Also make sure that the jumper connections on driver boards are set according to Table 30. For all NEMA 2/3 drives the shunt board is mounted externally to the drive on the control panel. On the NEMA 4/5 drive the board is mounted internally for shunt field applications (**refer to Figure 31**).

For most series or compound motors this parameter is set to internal CT. If the motor is below 5 horsepower, verify that the external CT board link is set to the proper current value that matches the field current parameter D03.

Default Values (C07)

Provides the ability to store and restore the user parameter setup into the flash memory of the drive. This also provides the ability to load factory default settings. Access to store and restore is provided by the engineering password level.

To store the user settings, select Store User Setting after all of the parameters are set and checked for accuracy.

To restore the user settings, select Restore User Setting.

To restore the factory settings, select the Restore Factory Setting. It will be necessary to reset the parameters for proper operation for the specific drive and motor used since the default settings are not drive specific as the user settings are. This parameter is useful when first setting up the drive or changing the control card.

The default settings will not become effective until the controller is powered down or reset through the S1 switch on the interface card.

⚠ WARNING

Before installing a control board, whether from another drive or from inventory, follow the proper setup procedure. Incorrect drive setup can cause equipment damage or personnel injury.

Torque Follower (C09)

Torque Follower can be enabled in the traverse motion. The Analog Output (G10) on a master drive can be configured to output Motor Torque and connect to Analog Input 1 (G00) in +10 V / -10 V mode. The Torque Reference source (F01) should be set to Analog Input 1. Refer to the diagram below to set up the Torque Follower.

Master Parameters:

G10 = Motor Torque
G09 = 200%
G08 = 0.50

Follower Parameters:

F01 = Analog Input 1
G01 = 4.0
G02 = -200%
C09 = 1
E00 = 0.2 sec less then master
E01 = 0.2 sec longer than master
E12 = 5% higher than master
S2 position 2(B) DIP switch ON

Figure 26: Torque Follower Control Setup

Group D: Protection

Table 22: Group D - Protection

Parameter No.	Parameter Name	Factory Default	Min. Max.	Unit	Access Level
D00	Motor Rated Armature Current	1/2 C02 Value *Note 1	1 2000	1 A	2
D01	Motor Rated Volts	230	200 – 360 200 – 720 *Note 2	1 V	2
D02	Motor Base Speed	400	0 5000	1 RPM	2
D03	Motor Field Current	0.0	0 C06 CT Rtg	1.0 A	2
D04	Current Limit FWD	125	100 200	0.1%	2
D05	Current Limit REV	100	25 100	0.1%	2
D06	Armature / Field	1.5	1.1 3.0	0.1	2
D07	Ground Fault	Disabled	0 = Enabled 1 = Disabled	1	2
D08	OH Alarm Level	85	70 85	1°C	2
D09	OH Trip Level	90	70 115	1°C	2
D10	LS Detection	0	0 = Disabled 1 = Hook Load Sense 2 = LS Relay 3 = HLS No Fault 4 = ELS No Fault	1	2
D11	LS Lower Det Lvl	25	2.0 50.0	0.1%	2
D12	LS Hoist Det Lvl	15	2.0 50.0	0.1%	2
D13	LS Backout Time	500	0.0 2500	1 ms	2
D14	Slack Cable	Disabled	0 = Disabled 1 = Enabled	1	2
D15	Slack Cable Torque	0.1	-50 50	0.1%	2
D16	OH Fan Enable	60	0 70	1°C	2
D17	AOT Enable	75	0 95	1°C	2
D18	AOC Detection Level	20 (Hoist) 0 (Travel)	0% 100%	0.1%	2
D19	AOC Detection Timer	100	0 2500	1 ms	2
D20	3-Pt Flux Curve	Disabled	0 = Disabled 1 = Enabled	1	2

Parameter No.	Parameter Name	Factory Default	Min. Max.	Unit	Access Level
D21	Flux 25 IF	53.8	0% 100%	0.1%	2
D22	Flux 75 IF	93.5	0% 125%	0.1%	2
D23	Flux 200 IF	117.9	0% 150%	0.1%	2
D24	LS Detect Gain	1000	1 5000	—	2
D25	MS Fault Time	75	0 500	1 ms	2
D30	Reset Attempts	3	0 10	—	2
D31	Reset Flt Sel	0104	0000 FFFF	—	2

NOTE: Parameters D04, D05, and D10 through D15 are not visible in the Travel Mode. Parameter D03 is not visible if Parameter C04 is set to Internal CT.

Note 1: When the drive DIP switches are set for 400 amps and C03>1, the default setting for D00 is 200 amps, not ½ of the C02 display value. When DIP switches are set for 67 amps and C04 and C06 External CT is selected, the default value for D00 will be ½ of the Ext CT selected. D03 must be set manually to the proper current, as default is always 0.

Note 2: Input Bus voltage range is dependent upon Voltage Class setting displayed in parameter C01.

Motor Rated Current (D00)

This parameter is the armature current setting and must be set to the full load motor nameplate rating. The default setting is 50% of the drive Current Class rating parameter C02.

Motor Rated Voltage (D01)

This parameter is normally set to the motor nameplate voltage rating. The default value is Input Bus Voltage parameter C05. This parameter value is used with the motor base speed parameter to calculate the display RPM and regulator speed loop.

Rectified Systems
When applying a standard 230 VDC motor to a 300 or 360 VDC rectified system it will be necessary to adjust this parameter and the Motor RPM parameter to obtain the correct display reading. For the 300 V system, the values should be 1.3 times the nominal motor ratings. For the 360 V system, the values should be 1.57 times the nominal ratings. The multiplication factor is the ratio of the rectified volts over the nominal motor volts. The motor current does not change much, so it can remain at the motor rated value.

⚠ 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 faults from overvoltage.

Motor Base Speed (D02)

Parameter to be set to the motor nameplate rated RPM. Default value is 400 RPM. This parameter is used to calculate the A06 Motor RPM display value. If this value is incorrect, the display reading will not be accurate.

Motor Field Current (D03)

NOTE: D03 is not visible if C06 is set to Internal CT.

This parameter must be set to the rated series (INT CT) or field (EXT CT) motor current. Check the field current in the A01 parameter against the clamp on meter reading for the field. The two values need to be within 10%. If they are not, check the link jumper setting on the shunt board and the driver board (see **Tables 29**, **30** and **31** for proper link setting). Also check that the setting of parameter C06 does not exceed the link jumper setting for proper scaling to occur.

NOTE: The DDC drive is set up to operate only on 230 VDC when using the shunt External CT board. The link jumper on the field board must be in the correct position to match the rated field amps to obtain the proper CT scaling.

Current Limit FWD and Current Limit REV (D04 and D05)

These parameters determine the armature current limit. Forward (Hoist) limit is applied for hoist and dynamic lowerings. Reverse (Lower) limit is for power lowering and deceleration. These parameters are not visible or programmable in Travel mode. Once the current limit is reached the drive may take longer to accelerate or decelerate the motor. The 'Current Limit REV' sets the current limit for the power lowering motor operation. The other motor quadrants use 'Current Limit FWD' value.

Armature/Field (D06)

This parameter limits the maximum ratio of armature current to field current in field weakening operation to ensure that the commutation capability of the motor is not exceeded at high speeds. Operation of the motor above its base speed requires the field to be weakened in order to maintain the armature voltage at approximately the same level as the supply voltage. The controller weakens the field automatically when speeds in excess of the base speed are required if the proper parameters are set to accomplish this operation.

For example, if the Current Limit FWD value (parameter D04) is set to 150%, the Minimum Field value (parameters E15, E16, or E18) is set to 40% and the Armature/Field value (parameter D06) is set to 2.0. A current limit of 150% will be applied when the field current is between 100% and 150% and the motor is at or below base speed.

Above base speed, the field current will be weakened below 100% in order to sustain acceleration above base speed. The Armature/Field ratio will limit the armature current to 2.0 times the field current or 150% of the D00 parameter. At the top speed in our example the field current will reach the minimum of 40%. Under this condition the armature current limit will be 80%.

FIELD WEAKENING ARMATURE FIELD RATIO
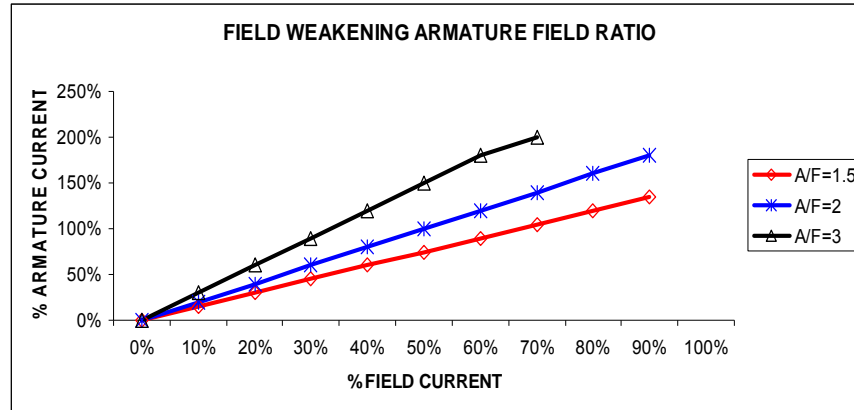
Ground Fault (D07)

This parameter enables the fixed ground fault protection. Link 10 on the driver board needs to be set for the proper control mode (Hoist or Travel) and the parameter must be changed to Enabled. In the Hoist mode both the armature and series field are monitored. In the Travel mode or in shunt field applications only the Armature is monitored for grounds. The trip setting is non-adjustable and the fixed trip level is 50% of the drive continuous current rating displayed in parameter C02.

OH Alarm Level (D08)

This parameter sets the temperature level at which the semiconductor heatsink provides a warning of possible shutdown. When this temperature level is reached, the drive will cut back the current and allow only 150% maximum current for the one minute cycle and not the 200% for three seconds. The level is adjustable from 70 to 85ºC. In the Hoist mode parameters D04 and D05 set the maximum current limit and in the Travel mode parameters F17 through F27 set the maximum current limit for each speed step. If any of these values is set below 150%, the cut back of current will not occur.

OH Trip Level (D09)

This parameter sets the heatsink temperature where the drive will fault and shut down until the heatsink cools below the reset level of 90°C. The trip level is adjustable from 70 to 115ºC.

LS Detection (D10)

This parameter enables the power limit switch detection by software or traditional external voltage (LSR) relay. The external voltage relay option (LS Relay) should be considered whenever the hook plus any attachment loads are below 10%, or when the light-hook load varies due to different attachments. The parameter setup also provides a choice to enable a limit switch fault when the limit switch condition is detected. When No Fault is chosen the drive will shut down, set the brake, disable the hoist function and permit lowering only whenever a limit switch trip is detected but no record of the incident will be logged into the fault log. This parameter is visible only in the Hoist mode.

LS Lower Det Lvl (D11)

This parameter specifies the voltage threshold trip point when lowering from a tripped power limit switch. Parameter setting is ignored if the LS Detection is set to Disabled or LS Relay. This parameter is visible only in the Hoist mode.

LS Hoist Det Lvl (D12)

This parameter specifies the voltage threshold trip point when hoisting into a tripped power limit switch condition. Parameter setting is ignored if the LS Detection is set to Disabled or LS Relay. This parameter is visible only in the Hoist mode.

Setup Tip

If a false limit switch trip occurs, increase (D12) LS Hoist Det Lvl parameter for loaded hook and (D11) LS Lower Det Lvl parameter for unloaded hook. If loaded hook runs too fast or too far out of the tripped power limit switch, adjust (D13) LS Back Out Time parameter.

If the load differential between an empty hook and unloaded hook is small, false trip indication of the power limit can occur. In these applications, an external LS relay should be used for detection.

LS Backout Time (D13)

This parameter specifies the time allotted to the crane operator to lower the hoist out of the limit switch. This parameter is visible only in the hoist mode.

Slack Cable and Slack Cable Torque (D14 and D15)

These parameters enable or disable slack cable detection. When enabled, this function will stop the drive in the lowering direction whenever the motor torque is below Slack Cable Torque setting. In the hoist, direction speed is restricted to the slowest speed until the motor torque rises above the detection setting. Normal operation will be permitted above the Slack Cable Torque detection setting. This function is useful to prevent the pay out of excess cable from the drum when the hook block load is removed. These parameters are only visible in the Hoist mode.

OH Fan Enable (D16)

This parameter specifies heatsink temperature that the fan will turn on at. Lowering this parameter increases the semiconductor life expectancy, but decreases the fan's life expectancy.

AOT Enable (D17)

This parameter detects when the unit's ambient temperature rises above the set temperature value. When it reaches that level a fault will appear causing the motor to shut down and brakes will set.

AOC Detection Level (D18)

This parameter sets the armature open circuit detection level as a percentage of Armature Current (A00). At the beginning of the run cycle the armature current is checked before the brake is released to ensure the brake will hold. A setting of zero will disable this fault in the traverse motion.

AOC Detection Timer (D19)

This is the time allowed to let the armature current reach the AOC Detection Level (D18). The higher the AOC Detection Level is, the more time it takes for the armature current to reach that level. Increase the AOC Detection Timer or decrease the AOC Detection Level to eliminate nuisance AOC faults.

3-Pt Flux Curve (D20)

Four parameters, D20–D23, can be used to select the curve that calculates motor speed and torque. Each DC motor has a unique Flux-Field Current curve and deviations from that curve can cause velocity oscillations. To minimize these oscillations the following curve can be enabled via parameter D20 and modified using parameters D21–D23. The curve is calculated based on two separate lines following the formula y=mx+b. Those lines are between 25% field current and 75% field current, and a second between 75% field current and 200% field current. As D21–D23 are changed, so do the slopes and y-intercepts of the two lines. An example of the flux curve calculated using the default values is shown in the following example.
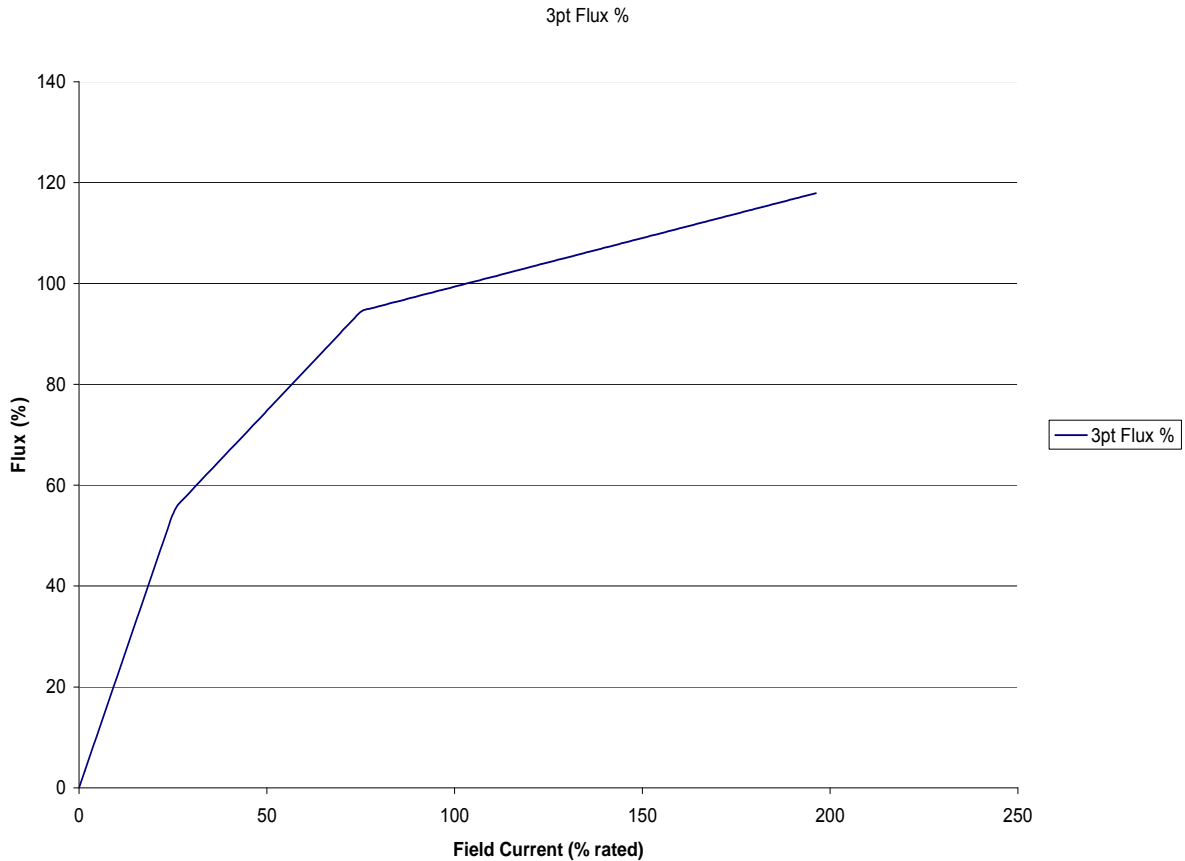
3pt Flux %

D20: 3-Pt Flux Curve
When the 3-Pt Flux Curve is disabled the pre-programmed flux curve is used (this settings is acceptable for most mill duty DC motors). When enabled the flux curve is calculated based off D21–D23. The default settings of D21–D23 closely approximate the pre-programmed curve.

D21: Flux 25 IF
D21 selects the percentage flux at 25% field current.

D22: Flux 75 IF
D22 selects the percentage flux at 75% field current.

D23: Flux 200 IF
D23 selects the percentage flux at 200% field current.

Setup Tip

Velocity oscillations are most common above base speed on DC mill motors, and tuning should occur at five to six speed references between 120% and 170% of base speed to ensure a smooth acceleration. This is critical when the minimum field is set below 50.0%.

To start tuning, 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 velocity oscillations occur at any speed adjust D22 down in 2.0% increments. If the motor speed still oscillates, start adjusting D22 up from the default value in increments of 2.0%.

Once the setting for D22 (which provides the minimum velocity oscillation) has been selected, set the minimum field to 25% and adjust D21 as described for parameter D22. 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.

D23 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%).

D21–D23 should not need to be moved more than 20% from their default value.

LS Detect Gain (D24)

This parameter sets the scaling factor gain for the limit switch fault. This parameter should only be adjusted after D11 and D12 have been properly set by using B09 for reference. By increasing this parameter, the LS fault will be more sensitive.

MS Fault Time (D25)

This is the time allowed to have both directional inputs on before the drive will fault on a Master Switch fault. This time is monitored after the drive initializes. Once the above condition is met for the programmed time, the MS fault will be logged in the history, and the fault will need to be reset in order to resume operation. A setting of 0 disables this feature.

NOTE: This is different than when an MS fault appears during the Initialize state. If an MS fault appears then, the drive will be able to clear the fault when the joystick is centered or the run commands are removed. The fault is not logged in this situation.

Reset Attempts (D30)

This parameter sets how many automatic reset attempts are allowed for the faults selected in D31. If the reset attempts max out, a drive reset is needed.

Reset Flt Sel (D31)

This parameter selects what faults can be automatically reset when the fault condition is gone.

	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

Bit	Fault
0	CUV
1	UV1
2	OT1
3	OV
4	EXF
5	FDBK
6	Mot_Stall
7	FL
8	AOT
9	GF
10	AOC
11	Not used
12	Not used
13	Not used
14	Not used
15	Not used

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

Example: In this example, FL, Mot_Stall, OV, and UV1 need to be resettable. UV1 corresponds to Bit 1, and should be set to a value of 1. OV corresponds to Bit 3, and should also be set to 1. Bits 1 and 3 contribute to the final value of Digit 1, resulting in a binary value of 1010. Per the binary to hexadecimal conversion chart, the binary value 1010 will convert to A. Mot_Stall and FL correspond to Bits 6 and 7, so both should be set to 1. They contribute to the final value of Digit 2, resulting in a binary value of 1100, which converts into the hex value of C. Since the other bits are set to 0 for the other Digits (resulting in a binary and hex value of 0), the final value to be entered into Parameter D31 is 00CA.

	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					AOC	GF	AOT	FL	MotStall	FDBK	EXF	OV	OT1	UV1	CUV	

Group E: Drive Control Setup

Table 23: Group E – Drive Control Setup

Parameter No.	Parameter Name	Factory Default	Min. Max.	Unit	Access Level
E00	Accel Time	5	0.2 20.0	0.1 sec	1
E01	Decel Time	5	0.2 20.0	0.1 sec	1
E02	Current Gain	0.5	0.1 2.0	0.1	2
E03	Hoist Stop Speed	15.0	0.0 100.0	0.1%	2
E04	Lower Stop Speed	15.0	0.0 100.0	0.1%	2
E05	Brake Rel Time	0	0 2500	1 ms	2
E06	Speed P Gain	5.0	1.0 50.0	0.1	2
E07	Speed I Gain	0.10	0.00 1.00	0.01	2
E08	IR Comp Gain	0.00	0.00 0.20	0.01	2
E09	Start Delay	300	0.0 2500	1 ms	2
E10	Stop Delay	0.0	0 2500	1 ms	2
E11	Bypass Speed	0.0	0.0 25	0.1%	2
E12	Stop Speed	0.0	0.0 100.0	0.1%	2
E13	DB Delay	300 (Hoist) 0 (Travel)	0.0 2500	1 ms	2
E14	DB Time	300 (Hoist) 0 (Travel)	0.0 2500	1 ms	2
E15	Lower Min Field	50	25 100	0.1%	2
E16	Hoist Min Field	50	25 100	0.1%	2
E17	Economy Field	50(Hoist) 25 (Travel)	H: 50.0–100.0 T: 25.0–100.0	0.1%	2
E18	Minimum Field	50 (Hoist) 25 (Travel)	25.0 100.0	0.1%	2
E19	Field Rate	32	16 127	1	2

Table 23: Group E – Drive Control Setup (continued)

Parameter No.	Parameter Name	Factory Default	Min. Max.	Unit	Access Level
E20	T Type	On Delay TC	On Delay TC On Delay TO Off Delay TC Off Delay TO		2
E21	T Time	1000	1 10000	1 ms	2
E22	MicroSP Factor	1.00	0.1 1.0	0.1	2
E23	SB Rel PT	40 (Hoist) 0 (Travel)	H: 10–40 T: 10–40	0.1%	2
E24	SB On Delay Time	0.0	0.0 2500	1 ms	2
E25	SB Time	0 .0	60000	1 ms	2
E26	Stall Prot Time	0.0	0 20.0	1 sec	2
E27	Hoist Accel Time	5	0.2 20.0	0.1 sec	1
E28	Hoist Decel Time	5	0.2 20.0	0.1 sec	1
E29	Lower Accel Time	5	0.2 20.0	0.1 sec	1
E30	Lower Decel Time	5	0.2 20.0	0.1 sec	1
E31	Load Float Time	0.0	0.0 20.0	0.1 sec	2

NOTE: Parameters E03, E04, E15, E16, and E27–30 are not visible in the Travel configuration. Parameters E00, E01, and E12 are not visible in the Hoist configuration.

Accel Time and Decel Time (Travel: E00 and E01; Hoist: E27 through E30)

These parameters set the minimum time for a speed increase or decrease of a magnitude equal to the base speed of the motor. A setting of 5 seconds will accelerate or decelerate a motor from zero speed to base speed in 5 seconds. To go from zero speed to 50% of base speed will take 2.5 seconds. Going from zero speed to 200% base speed will take 10 seconds. The decel time works similarly. Decel from 200% speed to zero speed would take 10 seconds. Parameters E00 and E01 are used in the travel motion, and E27–30 are used in the hoist motion.

Current Gain (E02)

This parameter specifies the scaling factor gain for the armature and field control loops. This parameter simultaneously adjusts the proportional and integral gain for both motor armature and field. The default value of one works well for the entire standard mill motor 600 and 800 frames. When using a motor with inductance higher than the standard mill frame motor, increase this value. For motors that have inductance lower than the standard mill frame motor, decrease this value.

When the current gain is set properly, the motor will produce a smooth 1 kHz tone. A low frequency buzz sound indicates the current gain parameter value is set too high and needs to be decreased. Unstable

current loop behavior is most likely to occur at high current levels because magnetic saturation reduces inductance.

Too low of a value results in poor and unstable speed response. Measure the steady state first point no load armature current with a clamp-on meter and compare this measurement with the Armature and Field Current Ref values in parameter A16 and A17. If the values do not match, then increase the current gain value. The setup will be faster if you start with a high current gain and work your way back down until the smooth 1 kHz tone is produced rather than taking the additional measurements.

Brake Rel Time (E05)

This parameter sets the amount of time for the brake to mechanically release. To get better speed regulation, increase or decrease the IR Comp Gain (E08).

Speed P Gain (E06)

This parameter sets the speed proportional gain and acts as the damper to the speed loop. If this value is set too high the armature current will vary erratically while the controller is operating close to its speed setpoint. This may cause unwanted vibration, noise, and wear of mechanical drive train components. If the proportional gain is too low, the speed response will appear to be sluggish or, depending on the level of integral gain, may exhibit an overshoot of the speed setpoint or an underdamped oscillatory response. The default value works well for most overhead crane applications.

Speed I Gain (E07)

This parameter sets the integral gain and acts as the spring to the speed loop and is used to make the controller compensate quickly for changes in load. This value should only be increased as a last resort and its effect on the speed loop is great. Make loop adjustments with the speed proportional gain first before attempting to change the default value. The integral gain overshoot of the speed setpoint cannot be brought under control using the proportional gain.

Setup Tip

Drives controlling motors that are mechanically coupled need to have the Speed I Gain set to 0 to reduce the interaction between the independent drive control loops.

IR Comp Gain (E08)

The speed loop IR compensation gain tightens up the speed regulation from no load to full load. This parameter affects the dynamic response of the speed loop. IR compensation should be set to zero whenever fast speed loops are necessary. The speed loop adjustment is based on the per unit armature resistance value, which is typically .07 for mill motors. The closer this value is to the actual motor armature resistance, the tighter the regulation will be. This feature is useful in applications that require accurate speed control at low speeds with good compensation for varying loads in preference to a fast and overshoot-free dynamic response.

Start Delay (E09)

This parameter allows time for the main contactor to close before the control loops activate and accelerate the motor. This delay will be present at the start of every requested cycle, except during plugging operations. If arcing occurs on the contact tips or UV trip occurs, extend the time to eliminate.

Stop Delay (E10)

The stop delay parameter is intended to provide time to assure that the brake has fully set and the current to the drive has been turned off before a start of a new run request. To obtain the quickest ready state, set this parameter to zero. The stop delay time will be added to the start delay time if the operator requests a rapid restart after the stop speed point has been reached.

Bypass Speed (E11)

This parameter defines an instant speed reference to the drive speed control loop without applying the acceleration time ramp. Setting this parameter permits a faster response on starting but will also increase the shock load to the mechanical system. Care should be taken to make sure that the value does not introduce damaging shock loads to the mechanical drive train.

Setup Tip
Stop Delay and Bypass Speed should be set to zero unless there are operational requirements for their use. Exercise care when using the Bypass Speed as this can introduce rope stretch or mechanical shock to the gears.

Stop Speed (Hoist: E03 and E04; Traverse: E12)

This parameter sets the speed value that will initiate the stop sequence in the software. When the Motor CEMF (A04) reaches this value, the SB relay output is de-energized and the Shunt Brake Time (E25) begins. After the E25 time is completed the DB output is de-energized and the DB Delay time (E13) begins, followed by the DB Time (E14) and Stop Delay (E10) times. After the E10 time is completed the drive can be started. Parameter E12 is used in the travel motion, and E03 and E04 are used in the hoist motion.

DB Delay (E13)

This parameter allows time for the DB contactor to close when the stop speed is reached on a commanded shutdown. If arcing at DB Contactor occurs, increase (E13) DB Delay.

DB Time (E14)

This parameter adjusts the time allowed for the dynamic braking to occur when an off sequence is commanded. During this time the field current remains established while the armature current is turned off. This provides immediate braking action when the DB contactor tips close.

The DB Delay and DB Time will not be executed in the Hoist direction if the hoist speed (Armature Voltage Feedback, Monitor Function A04 CEMF%) is greater than 15%. When Monitor Function A18 equals the Stop Speed Parameter (E12) value the DB contactor will close without delay.

DB contactor operation in the lowering direction or in the travel configuration mode will be as described in the Stop Speed section.

Setup Tip
To improve DB performance while a series brake is setting, time the delay between the OmniPulse DDC interface board LED DS11 and the closure of the DB contactor tips. Enter that time in parameter E13 and decrease E14 until DB performance improves.

Lower Min Field and Hoist Min Field (E15 and E16)

These parameters set the minimum field reference (maximum speed) in the lowering and hoist direction whenever the Hoist configuration is set. These parameters are not visible in the Travel configuration. Reduce this parameter gradually until the desired maximum motor RPM or operating speed is obtained with operator's control set to the maximum speed position. These parameters work in conjunction with Hoist speed parameters F02 through F10. Parameters are not visible in Travel mode.

Min. Field Value	Approximate Motor Speed
25%	300%
50%	233%
75%	167%
100%	100%
NOTE: Actual motor speed may be lower than the approximate speeds indicated in the table. With full voltage applied to a series motor, the final speed obtained is determined by the loading on the motor.	

Economy Field (E17)

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.

The economy field parameter is used by the drive's proprietary constant horsepower software. This unique software design maximizes productivity and safety by controlling the maximum motor speed based on the measured motor loading regardless of the commanded speed reference. When set up properly, maximum safe productivity is automatically possible based on motor load and not operator discretion.

Setup Tip

In order for the Economy Field to operate properly, the Lower, Hoist, and Minimum Field settings need to be equal to or lower than the Economy Field setting when in Hoist mode. In the Travel mode the Minimum Field parameter E18 must be equal to or less than the Economy Field setting.

Minimum Field (E18)

This parameter establishes the minimum field reference that may be applied by the controller when operating above the motor base speed. Reduce this parameter gradually until the desired maximum motor RPM set by the speed reference is achieved. These parameters work in conjunction with Travel Speed parameters F12 through F16 and the Armature/Field Ratio parameter D06.

Min Field Value	Approximate Motor Speed
25%	300%
50%	233%
75%	167%
100%	100%
NOTE: Actual motor speed may be lower than the approximate speeds indicated in the table. With full voltage applied to a series motor, the final speed obtained is determined by the loading on the motor.	

Field Rate Change (E19)

This parameter limits the rate of change of the field current during weak field operation. The maximum value of 127 allows a field rate of change of up to 50% per second. The minimum value of 16 allows a field rate of change of up to 0.1% per ms. The default value of 32 allows a field rate of change of 0.2% per ms.

Reduce E19 for greater speed loop stability and minimum undershoot or overshoot. Increase E19 for a faster speed loop response and to prevent a pause in acceleration when the motor base speed is reached.

T Type and T Time (E20 and E21)

These parameters are associated with the programmed output parameters G12, G13, G14, or G15. It is possible to set up more than one of these outputs to the timing function. However, the type of timer and time will be the same for all of the outputs set up in the Timer function mode.

The T Type parameter selects the type of timer on delay or off delay timed open or timed closed. The T Time sets the amount of time delay.

On Delay TC will cause the programmable output to turn on after the T Time is executed from the start command. When the drive is in the off or ready state, the output is turned off.

On Delay TO will cause the programmable output to turn off after the T Time is executed from the start command. When the drive is in the off or ready state, the output is turned on.

Off Delay TC will cause the programmable output to turn on after the T Time is executed during an off command when the speed reference (A18) reaches zero. At a start command the output is turned off immediately. The output remains on in the OFF position after T Time has expired.

Off Delay TO will cause the programmable output to turn off after the T Time is executed during an off command when the speed reference (A18) reaches zero. At a start command the output is turned on immediately. The output remains off in the OFF position after T Time has expired.
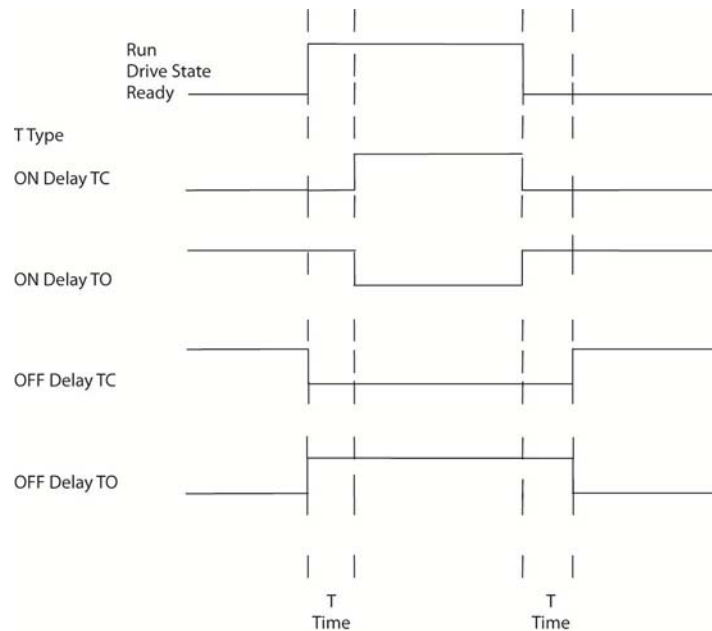
Figure 27: T Type and T Time

MicroSP Factor (E22)

This parameter is associated with the G11 Prog IP Func. When the hardware programmable input is activated the input speed reference is reduced by the factor set in this parameter. A factor of 1 will provide full speed reference while a factor of .5 will reduce all speed reference input signals to 50% of the value set by parameter or analog voltage. This function is used whenever precise spotting requirements are necessary for an application. It is enabled when the input is closed and disabled when the input opens.

SB Rel PT (E23)

This function is unique to the programmable SB function mode only. This parameter establishes a release point for the shunt brake function (SB output energized) based upon the motor field current value. A setting of 0% will turn on the SB output after the start delay (E09) time is executed. A setting of 40% will turn on the SB output after the start delay is executed and the motor field current reaches 40%.

SB On Delay Time (E24)

Timer is unique to the programmable SB function mode only. Time starts when the SB Rel PT value is reached. This time parameter will further delay the switching on of the SB programmable output.

SB Time (E25)

This parameter controls the stopping action and brake setting of a series brake and enables the independent control of the shunt brake so it can be set while the drive continues to provide motor torque. The SB Time parameter (E25) is used to enable an alternate stop sequence in the Hoisting direction when the drive is configured for a Hoist application. The alternate stop sequence in conjunction with DB resistor tap changes reduces the hook drift down when the series brake is set.
The alternate stop sequence is enabled when parameter E25 = 0. Stopping action in the hoist direction is conditional on the motor speed represented by the Armature Voltage Feedback (AVF).

> If AVF > 15% of D01 the DB Delay (E13), DB Time (E14) are not executed and the field current is removed which sets the series brake on a commanded stop from a hoist direction.

> If AVF ≤ 15% of D01 DB Delay (E13) and DB Time (E14) will be executed before the Field current is removed to set the series brake.

When E25 > 0, the set delay time (E25) begins when the (E12) stop speed parameter is reached during a commanded OFF. If the operator moves the controller from OFF to any speed point during the (E25) execution time, the stop sequence will be aborted and normal operation will commence. The stop sequence cannot be aborted after the (E25) time has completed. Timed parameters E13, E14, and E10 will be executed in their proper order.

Setup Tip

The SB time should be set as close as possible to the actual mechanical time constant to set the brake fully. Longer time periods can result in driving through the brake which reduces the lining life. Shorter times can result in the drift down of a load on a hoist.

Stall Prot Time (E26)

Feature monitors armature current and volts for the time specified in the parameter. If armature current is greater than 100% and if monitor function A04 CEMF% is less than 20% for the motor stall time period, the drive will fault on Motor Stall. If Tach Feedback (G03) is greater than 0, the drive will fault when the Armature current is above 100% and the Tach Feedback signal is less than 5%. The drive will shut down and the fault will be recorded in the fault history. A time setting of 0 seconds will turn this monitoring function off.

Load Float Time (E31)

A Load Float Time setting greater than zero enables the Load Float feature. The load float timer is enabled at Stop Speed E12 and will hold the speed reference at zero for the duration of the timer while the master switch is at neutral.

Caution

Long, 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 enabled.

Group F: Speed and Torque Settings

Table 24: Group F – Speed and Torque Settings

Parameter No.	Parameter Name	Factory Default	Min./Max.	Unit	Access Level
F00	Speed Ref Source	Cntr Switch	Cntr Switch Analog Ref 1 Analog Ref 2 Ser An Ref 1 Ser An Ref 2	—	2
F01	Torque Ref Source	Cntr Switch	Cntr Switch Analog Ref 1 Analog Ref 2 Ser An Ref 1 Ser An Ref 2	—	2
F02	Hoist Speed 1	20	0/300	0.1%	1
F03	Hoist Speed 2	40	0/300	0.1%	1
F04	Hoist Speed 3	60	0/300	0.1%	1
F05	Hoist Speed 4	80	0/300	0.1%	1
F06	Hoist Speed 5	100	0/300	0.1%	1
F07	Lower Speed 1	20	0/200	0.1%	1
F08	Lower Speed 2	40	0/200	0.1%	1
F09	Lower Speed 3	60	0/200	0.1%	1
F10	Lower Speed 4	80	0/200	0.1%	1
F11	Lower Speed 5	100	0/200	0.1%	1
F12	Travel Speed 1	20	0/300	0.1%	1
F13	Travel Speed 2	40	0/300	0.1%	1
F14	Travel Speed 3	60	0/300	0.1%	1
F15	Travel Speed 4	80	0/300	0.1%	1
F16	Travel Speed 5	100	0/300	0.1%	1
F17	Travel Torque 1	20	0/200	0.1%	1
F18	Travel Torque 2	40	0/200	0.1%	1
F19	Travel Torque 3	60	0/200	0.1%	1
F20	Travel Torque 4	80	0/200	0.1%	1
F21	Travel Torque 5	100	0/200	0.1%	1
F22	Neutral Torque	2	2/200	0.1%	1
F23	Plug Torque 1	20	0/200	0.1%	1
F24	Plug Torque 2	40	0/200	0.1%	1
F25	Plug Torque 3	60	0/200	0.1%	1
F26	Plug Torque 4	80	0/200	0.1%	1
F27	Plug Torque 5	100	0/200	0.1%	1
F28	Slowdown Torque	75	0/200	0.1%	1
F29	Travel Lim Trq	100	0/200	0.1%	1

NOTE: Parameters F01 and F12 through F29 are not visible in Hoist configuration. Parameters F02 through F11 are not visible in Travel configuration.

Speed Reference Source (F00)

This parameter selects the source of the speed reference. Cntr Switch setting allows inputs through the 230 VDC interface card or 24 VDC control card. Discrete speed settings for hoist are set through parameters F02 through F11, travel speed setting F12 through F16, travel torque setting F17 through F22, and plug torque setting F23 through 27, depending upon the configuration chosen in C00.

The Analog Reference 1 setting directs the software to look at terminals X3-4, X3-5 and X3-6 on the control board for its voltage input. Analog Reference 2 directs the software to terminals X3-6 and X3-7 on

the control card for the voltage input. Parameters G00 through G06 must also be set to operate properly.

Ser An 1 and Ser An 2 references are commanded using the RTU1 function codes 6 and 3 through the communication port. Reference section 3.15 in Appendix A. The values received by the microprocessor can be monitored in parameters B05 and B06. Parameters G16 through G20 must also be set up properly to enable MODBUS communication and control.

Torque Reference Source (F01)

This parameter selects the source of the torque reference and is only available when the travel mode is selected. CNTR Switch setting allows inputs through the 230 VDC interface card or 24 VDC control card. The Analog Reference 1 setting directs the software to look at terminals X3-4, X3-5 and X3-6 on the control board for its voltage input. Analog Reference 2 directs the software to terminals X3-6 and X3-7 on the control card for the voltage input. Parameters G00 through G06 must also be set to operate properly. Parameter F12 sets the maximum speed obtainable throughout the analog voltage range.

Setup Tip

It is suggested that parameter F12 be set to 100% when higher no-load speeds are required. This value can be increased up to 300%. Caution needs to be observed as maximum speed is applied in the hoist and lower directions.

Ser An 1 and Ser An 2 references are commanded using the RTU1 function codes 6 and 3 through the communication port (reference Section 3.15 in Appendix A). The values received by the microprocessor can be monitored in parameters B05 and B06. Parameters G16 through G20 must also be set up properly to enable MODBUS communication and control.

This parameter is not visible in the Hoist configuration.

Caution

It is not recommended that a drive be set up to use the same speed and torque analog reference source. This can cause inconsistent control operation, which makes it more difficult for the crane operator.

Hoist and Lower Speeds 1 through 5 (F02 through F11)

When F00 is set to CNTR switch, parameters F02 through F11 define the operating speeds in percent of rated motor speed. These parameters are only visible when the Hoist configuration is chosen. They are not visible in the Travel configuration. The maximum no-load speeds obtainable are also limited by the Lower Min Field (E15) and Hoist Min Field (E16) parameters. Refer to these parameter descriptions for additional information. In the hoist configuration, the maximum speed is further restricted at high hook loads in order to ensure that the capability of the motor is not exceeded.

Travel Speed 1 through 5 (F12 through F16)

When F00 is set to CNTR switch, parameters F12 through F16 define the forward and reverse discrete operating speeds. Settings are in percent of motor speed. These parameters are only visible when the Travel configuration is chosen. They are not visible in the Hoist configuration. The maximum speeds obtainable depend upon the Minimum Field (E18) parameter setting.

Travel Torque 1 through 5, Neutral Torque, and Plug Torque 1 through 5 (F17 through F27)

When F01 torque reference source is set to CNTR Switch, these parameters set up variable acceleration

and plugging torque limits based on the master switch displacement. F23 though F27 are applicable for regen mode, and are typically used when decelerating; inversely, F17 through F21 are used when accelerating. The greater value of Travel Torque 5 (F21) or Plug Torque 5 (F27) will set the max torque limit (including analog torque references). Various levels of torque limit can be set for each of the switch positions, including the neutral or OFF position.

When the Neutral Torque is set, the drive will apply a stopping current limit up to this value while following the deceleration ramp defined by E01. Setting F22 to 2% will turn off the deceleration ramp of the drive. Slowdown and stopping will be the same as in the DC contactor system (coast). Assigning a value to F22 will apply a current limit to the drive control loops to slowdown or stop on the specified deceleration ramp set in parameter E01. If the value in F22 is insufficient to meet the current demands for the deceleration ramp specified, stopping will be on current limit and may be longer than the specified deceleration time.

For Stepless Master Switch (Analog)

When F00 speed reference source is set to Analog Reference 1 or 2 it is important to adjust F17 torque setting. F17 torque will be applied throughout the analog voltage range. F17 acts as fixed current limit for acceleration and plugging actions.

Setup Tip

It is suggested that parameter F21 be set to 100%. If more acceleration current or plugging torque is required, this value (or F27) can be increased up to 200%. Caution needs to be observed when increasing this parameter as the higher settings can possibly cause over voltage conditions or mechanical problems. Parameter F22 will still function as described above on deceleration and stopping.

Slowdown Torque (F28)

This parameter specifies the torque reference that will slow down the motor to first speed. This parameter is only used when slowdown is programmed in G11 or G25 and that digital input is de-energized. In the event that the operator reverse plugs during slowdown, the torque reference will be at least F28. This parameter is not visible in Hoist configuration.

Travel Lim Trq (F29)

This parameter is used when the travel limit is programmed in G11 or G25, and that digital input signal is de-energized. This parameter specifies the torque reference that will be used while stopping the motor. The drive will ignore any further run commands until it has finished the stopping sequence and set the brake. Run commands after the stopping sequence is complete will be limited to Speed 1 until the Travel Limit is re-energized. External relay logic is required to open the directional input in order to prevent further travel beyond the desired limit after the drive has completed the stopping sequence. Setting this torque value too high may cause overvoltage conditions. This parameter is not visible in Hoist configuration.

Group G: I/O Configuration

Table 25: Group G – I/O Configuration

Parameter No.	Parameter Name	Factory Default	Min. Max.	Unit	Access Level
G00	Analog IP1 Type	0/+10	0/+10 V ± 10 V 4/20 mA	1 V	2
G01	Analog IP1 Gain	1.00	0.00 10.00	0.01	2
G02	Analog IP1 Bias	0.0	-10.0 +10.0	0.1%	2
G03	Tacho FS RPM	0	0 2000	1 RPM	2
G04	Analog IP2 Type	0/+10	0/+10 V 4/20 mA	1 V	2
G05	Analog IP2 Gain	1.00	0.00 10.00	0.01	2
G06	Analog IP2 Bias	0.0	-10.0 +10.0	0.1%	2
G08	Analog Out Gain	1.00	0.00 10.00	0.01	2
G09	Analog Out Bias	0.0	-100.0 +100.0	0.1%	2
G10	Analog Out Func	Motor Speed	Motor Speed Motor Torque Hook Load Line Voltage	—	2
G11	Prog IP Func	Not Used	Not Used External LS Slowdown Ext Fault Micro Speed Travel Limit	—	2
G12	Prog. OP1 Func	DB Contactor	DB Contactor Shunt Brake Cntr Ready Cntr Fault Timer	—	2
G13	Prog. OP2 Function	Cntr Fault	DB Contactor Shunt Brake Cntr Ready Cntr Fault Timer	—	2
G14	Prog. OP3 Function	Cntr Ready	DB Contactor Shunt Brake Cntr Ready Cntr Fault Timer	—	2
G15	Prog. OP4 Function	Shunt Brake	DB Contactor Shunt Brake Cntr Ready Cntr Fault Timer	—	2

Table 25: Group G – I/O Configuration (continued)

Parameter No.	Parameter Name	Factory Default	Min. Max.	Unit	Access Level
G16	Serial Baud Rate	19200	2400 4800 9600 19200	—	2
G17	RS232/485 Select	RS232	RS232 RS485	—	2
G18	Serial Format	8E1	8E1 8-bit even parity 1 stop bit 8O1 8-bit odd parity 1 stop bit 8N1 8-bit no parity 1 stop bit 8N2 8-bit no parity 2 stop bits	—	2
G19	Modbus Address	1	1 31	1	2
G20	Drive Control	Hwd-IO	Hwd-IO Serial Comm	—	2
G21	Tach Loss Detect	Disabled	0 Disabled 1 Enabled	—	2
G22	REVTACH	Enabled	0 Disabled 1 Enabled	1	2
G23	Tach Loss CEMF Det	25	0 100	0.1%	2
G24	Tach Loss FB Det	10	0 100	0.1%	2
G25	Speed 5 Func	Speed 5	Speed 5 External LS Slowdown Ext Fault Micro Speed Travel Limit	—	2

Analog IP1 and IP2 Type (G00 and G04)

These parameters define the signal format for the analog inputs.

If the 4 to 20 mA signal is chosen for analog input 2, SW2-D on the control board must be moved to the ON position to connect the 250 ohm resistor to ground.

The SW2 switch on control board must be set up properly for analog input 1 usage. Refer to **Table 27** for setting information of SW2 switch.

Analog IP1 and IP2 Gain (G01 and G05)

Sets the input 1 scaling gain factor. A value of one means that 100% of the voltage or current signal equals 100% speed or torque command. A value of 3 means that 100% of the voltage or current signal equals 300% speed or torque command. The gain setting interacts with minimum field values. The minimum field values parameters E15, E16, and E18 define the absolute maximum speed obtainable at full analog input.

Analog Speed VS Ref Volts
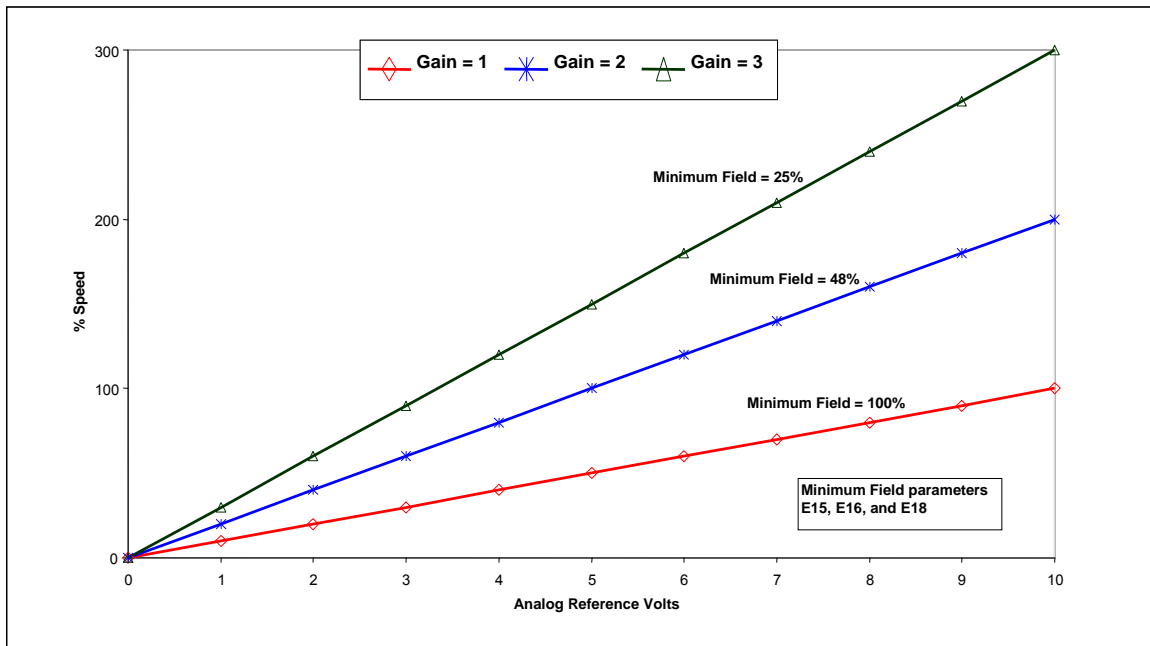
Analog IP1 and IP2 Bias (G02 and G06)

This parameter allows the input signal to be offset by plus or minus 10%. The bias compensates for signal variances. It also can be used to limit the commanded current range below 10%.

Tacho FS RPM (G03)

Whenever a tach is used as the speed feedback device, this parameter must be set to achieve proper scaling between the feedback signal and drive regulator calculations. A value of zero turns tach feedback off. The value entered should be the RPM at full scale input.

Refer to monitoring parameter B07 and parameters G21 through G23 for more detail information on how the Tach feedback functions.

Reference **Figure 32** for connecting the Tach feedback circuit and scaling.

Analog Output Gain (G08)

Determines the analog output scaling factor. A value of "1" means that 100% of the output variable produces a 10 V signal at terminal X3-9 or a 20 mA signal at terminal X1-6. A value of "3" means that 33.3% of the output variable produces a 10V signal at terminal X3-9 or a 20 mA signal at terminal X1-6 and analog ground terminal X3-6.

Analog Out Bias (G09)

This parameter allows the output signal to be offset by plus or minus 100%. The bias compensates for signal variances.

Analog Out Func (G10)

This parameter selects the output function to be monitored via 0 to 10 V signal at terminal X3-9 or the 4 to 20 mA signal available at terminal X1-6.

Setting	Display	Function	Scale	Motion
0	Motor Speed	Outputs the measured motor speed.	100% = 100% speed	Hoist and Travel
1	Motor Torque	Outputs the calculated motor torque.	100% = 100% motor rated torque	Hoist and Travel
2	Hook Load	Outputs the measured hook load in %.	100% = 100% motor rated torque	Hoist
3	Line Voltage	Outputs measured DC Bus voltage.	100% = 1000V	Hoist and Travel

Prog IP and Speed 5 Func (G11 and G25)

Parameters G11 and G25 set up the function of the Prog IP and Speed 5 inputs. These inputs are available on the 230 VDC and 24 VDC input options. Each input should be programmed to different features, as the drive does not distinguish between the two and either input will have the same effect whether one input is active or both are active.

G11 (Prog IP)

Setting	Display	Function	Motion
0	Not Used	No function.	Hoist and Travel
1	External LS (N.C.)	Drive will shut down and record the event in the fault log.	Hoist and Travel
2	Slowdown (N.C.)	Motor speed is reduced to Travel Speed 1 setting (F12). Declaration is at F28 torque level.	Travel
3	Ext Fault 1 (N.C.)	Drive will shut down and record the event in the fault log.	Hoist and Travel
4	Micro Speed	Forces the Speed Reference to be scaled by parameter E22. This allows for more precise movements.	Hoist and Travel
5	Brake Stand	Prevents the motor from driving into the brakes. This minimizes wear and tear on controls and brakes.	Travel
6	Travel Limit (N.C.)	Forces regen torque to F29 torque level. Relay logic must be used to open the Forward or Reverse signal to the drive. Only one direction should be opened to allow backing out of the travel limit.	Travel

G25 (Speed 5 Input)

Setting	Display	Function	Motion
0	Speed 5	Sets speed reference to Speed 5.	Hoist and Travel
1	External LS (N.C.)	Drive will shut down and record the event in the fault log.	Hoist and Travel
2	Slowdown (N.C.)	Motor speed is reduced to Travel Speed 1 setting (F12). Declaration is at F28 torque level.	Travel
3	Ext Fault 2 (N.C.)	Drive will shut down and record the event in the fault log.	Hoist and Travel
4	Micro Speed	Forces the Speed Reference to be scaled by parameter E22. This allows for more precise crane movements.	Hoist and Travel
5	Brake Stand	Prevents the motor from driving into the brakes. This minimizes wear and tear on controls and brakes.	Travel
6	Travel Limit (N.C.)	Forces regen torque to F29 torque level. Relay logic must be used to open the Forward or Reverse signal to the drive. Only one direction should be opened to allow backing out of the travel limit.	Travel

Program OP1, OP2, OP3, and OP4 (G12 through G15)

These parameters set the function for the programmable outputs. Programmable function selections are: DB Contactor, Shunt Brake, Controller Ready, Controller Fault or Timer.

Prog OP1 is a 230 VDC output and is located only on the Interface Card terminal DB. In the hoist configuration Prog OP1 can be assigned only to the DB Contactor function and is not programmable. The default setting is DB Contactor.

Prog OP2 is a 24 V 50 mA open-collector output on terminal X1-2 of the control card. The default setting is Controller Fault.

Prog OP3 is a 24 V 50 mA open-collector output on terminal X1-3 of the control card. The default setting is Controller Ready.

Prog OP4 is a shared function. This is a 24 V 50 mA open-collector output on terminal X1-4 of the control card, and also a 230 VDC output on the interface card terminal SB. The default setting is Shunt Brake.

Setting	Display	Function	Motion
0	DB Contactor	Output will energize upon a run command and de-energize when the drive is commanding the DB Contactor to close according to the setup parameters E13, E14, and E25.	Hoist and Travel
1	Shunt Brake	Output will energize after the start delay according to parameters E23 and E24. It will de-energize when the drive is commanding the Shunt Brake to close according to E25.	Hoist and Travel
2	Cntr Ready	Output will energize when drive is ready and not faulted.	Hoist and Travel
3	Cntr Fault	Output will energize when drive is faulted.	Hoist and Travel
4	Timer	Output will close according to timer function programming in E20 and E21.	Hoist and Travel

Serial Baud Rate (G16)

Parameter selects the baud rate for the serial communication. The X1 terminal on Control board is used to make the connections to the drive. An inexpensive adapter cable will need to be made to connect the drive to a laptop computer using a 232 D connector. Make the connections as indicated for 232 computer communications in **Figure 28**.
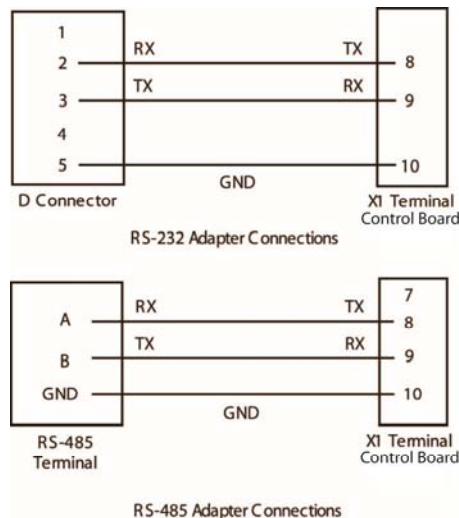
Figure 28: Serial Connections

RS-232/RS-485 Select (G17)

Parameter selects serial communication configuration. Terminal X1-8, X1-9 and X1-10 are configured with this selection. Use the proper adapter connection. If RS-485 is selected, make sure that the LK2 setting is correct for the resistor termination for the network. Reference **Figure 30**.

Serial Format (G18)

Parameter selection formats the data to be received and transmitted. Eight bit with or without parity and number of stop bits can be selected.

MODBUS Address (G19)

Sets the MODBUS Address for the drive configured in an RS-485 MODBUS network.

Drive Control (G20)

Directs drive control to board I/O (Hwd-IO) or MODBUS RTU-1 Control (Serial COMM1). It is possible to change from serial communication to hardware I/O through the MODBUS parameter change. It is not possible to change from hardware I/O to serial communication unless the parameter is changed manually.

Tach Loss Detect and Tach Loss Trip Setting (G21 through G24)

When set to Disabled, the speed regulator will automatically shift from Tach Feedback to CEMF control. Refer to parameter B07 for details on switchover function. When set to Enabled, the drive will fault on Tach Loss when the following condition occur: The CEMF Monitor Function A04 has to be greater than the value set in parameter G22 and the Tach input monitor function A14 has to be less than G23 setting. This condition generally happens when there is no Tach signal, the setting of AN1 is incorrect, or there is a defective AN1 circuit connection. Tach Loss Fault requires reset to clear fault.

If G22 REV TACH Detect is disabled, the absolute values of G23 and G24 are compared, disregarding the sign direction of these inputs.

Group H: Fault History

Table 26: Group H – Fault History

Parameter No.	Parameter Name	Access Level
H00	Fault 1	0
H01	Fault 1 Time	0
H02	Fault 2	0
H03	Fault 2 Time	0
H04	Fault 3	0
H05	Fault 3 Time	0
H06	Fault 4	0
H07	Fault 4 Time	0
H08	Fault 5	0
H09	Fault 5 Time	0
H10	Fault 6	0
H11	Fault 6 Time	0
H12	Fault 7	0
H13	Fault 7 Time	0
H14	Fault 8	0
H15	Fault 8 Time	0
H16	Fault 9	0
H17	Fault 9 Time	0
H18	Fault 10	0
H19	Fault 10 Time	0
H20	Fault 11	0
H21	Fault 11 Time	0
H22	Fault 12	0
H23	Fault 12 Time	0
H24	Fault 13	0
H25	Fault 13 Time	0
H26	Fault 14	0
H27	Fault 14 Time	0
H28	Fault 15	0
H29	Fault 15 Time	0
H30	Fault History Reset	2

Fault History Reset (H30)

This parameter will clear all fault information from the H menu when selected. Entering a value of 1 in H30 clears all of the fault history. The "Time" parameters are the elapsed time corresponding to parameter A13 at which the fault occurred.

UV1 and **CUV** faults are active faults only; an MS fault during the drive initialize state is also an active fault. These faults are not recorded in the fault history logs.
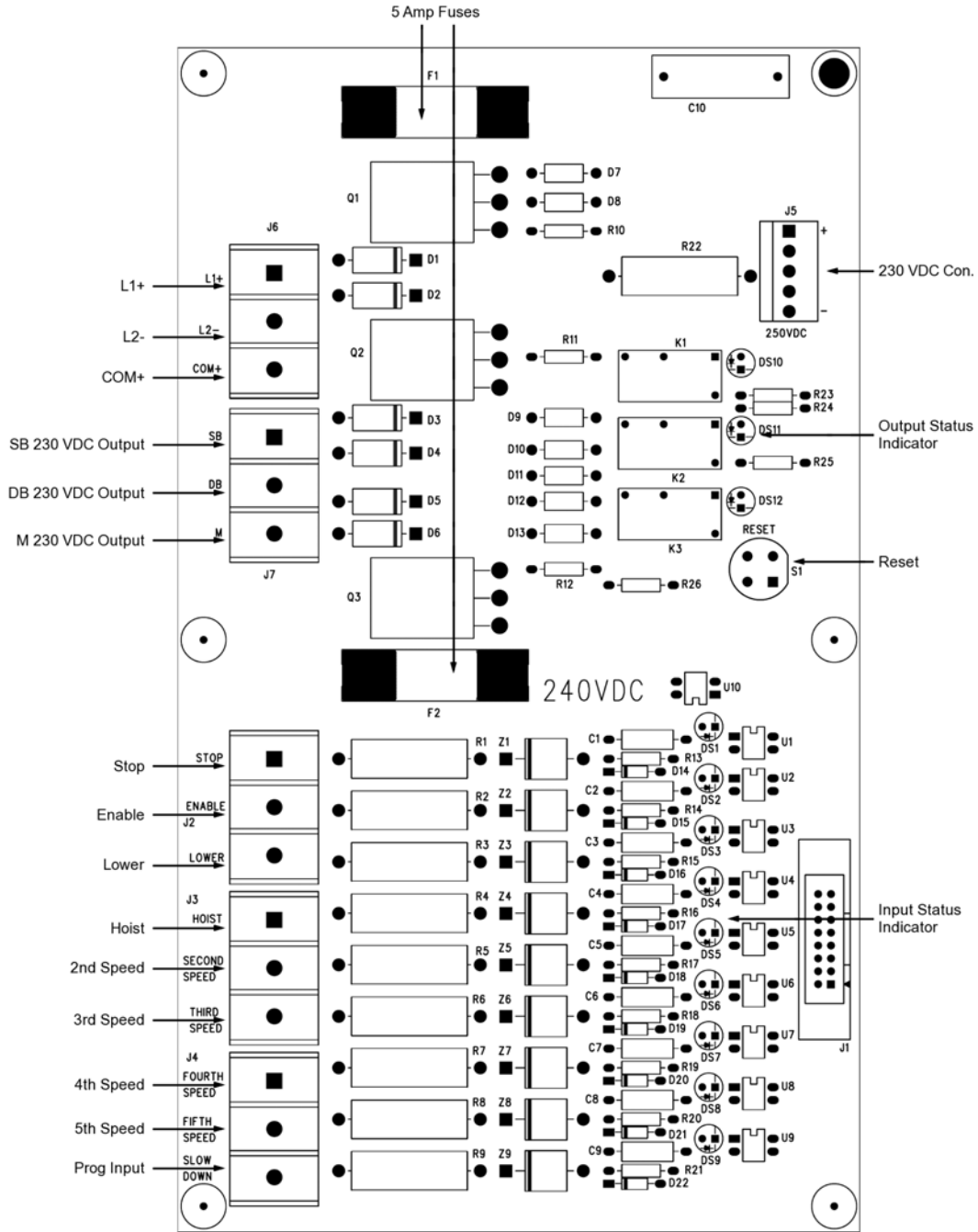
Figure 29: Interface Circuit Board (Model Number DDC-230VIF)
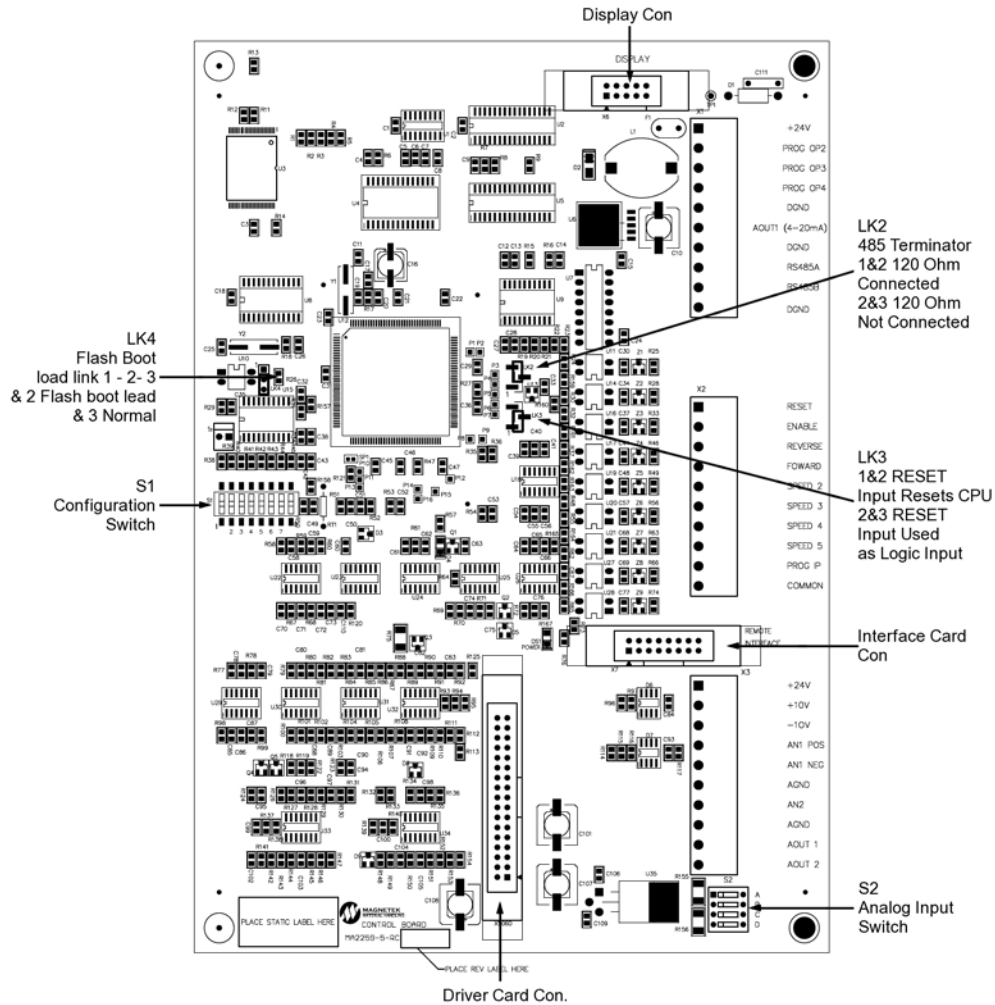
Figure 30: Control Card (Model Number DDC-CONTROL)

Table 27: S2 DIP Switch Settings

SW POS	OFF ← (OPEN)	ON → (CLOSED)
A	AN1 -10/+10 V	AN1 4/20 mA
B	AN1 Diff	AN1 Non Diff
C	AN1 X1	AN1 X2
D	AN2 0/+10 V	AN2 4/20 mA

Table 28: S1 DIP Switch Settings

S1 Positions 1 and 2 — Current Rating

Current Class	Switch Setting	
N2 67 A	S1–1 OFF	S1–2 OFF
N3 133 A	S1–1 ON	S1–2 OFF
N4 200 A	S1–1 OFF	S1–2 ON
N5 400 A	S1–1 ON	S1–2 ON

SW1 Position 3 — Configuration

Configuration	Switch Setting
Hoist	S1–3 OFF
Travel	S1–3 ON

SW1 Position 4 — Voltage Rating

Voltage Class	Switch Setting
200/360 V	S1–4 OFF
400/720 V	S1–4 ON
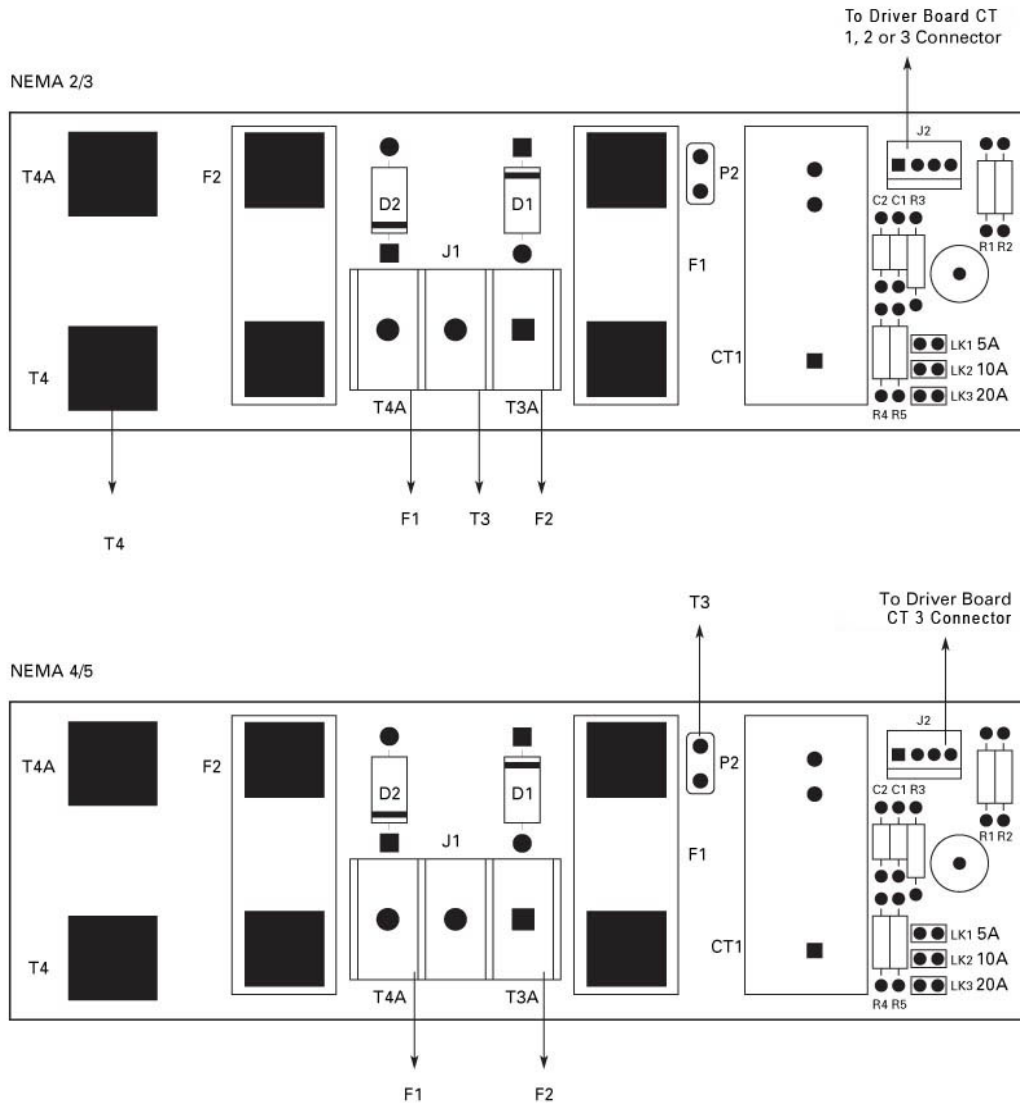
Figure 31: External CT Board/Shunt Board (Model Number DDC-EXT-CT)

NOTE: Jumper settings for the shunt board are found in **Table 29**. *Jumper settings for the driver boards are found in* **Table 30**.

Table 29: Jumper Setting for Shunt Board

Amps	LK1	LK2	LK3	N2/3 CT Turns	N4/5 CT Turns
Shunt Motor					
2.5	Closed	Open	Open	2	3
5	Closed	Open	Open	2	3
10	Open	Closed	Open	2	3
20	Open	Closed	Closed	2	3
Series Motor (1 to 5 hp)					
5	Open	Open	Open	2	–
10	Open	Closed	Open	2	–
20	Open	Closed	Closed	2	–

Table 30: Drive Board Settings for Use with Shunt Board

Series Motor (1 to 5 hp) Driver Board		
	NEMA 2	
Amps	**LK1**	**LK2**	**LK3**
5	Closed	Closed	Open
10	Closed	Closed	Open
20	Closed	Closed	Open

Shunt Motor Driver Board					
	NEMA 2			**NEMA 3**		
Amps	**LK1**	**LK2**	**LK3**	**LK1**	**LK2**	**LK3**
2.5	Closed	Closed	Closed	Open	Open	Closed
5	Closed	Closed	Open	Open	Open	Open
10	Closed	Closed	Open	Open	Open	Open
20	Closed	Closed	Open	Open	Open	Open

Shunt Motor Driver Board					
	NEMA 4			**NEMA 5**		
Amps	**LK1**	**LK2**	**LK5**	**LK1**	**LK2**	**LK5**
2.5	Closed	Closed	Closed	Open	Open	Closed
5	Closed	Closed	Open	Open	Open	Open
10	Closed	Closed	Open	Open	Open	Open
20	Closed	Closed	Open	Open	Open	Open

X1

+24V	○ 1
Prog. OP2	○ 2
Prog. OP3	○ 3
Prog. OP4	○ 4
GND	○ 5
A_{out} (4 – 20mA)	○ 6
GND	○ 7
RS-485/RS-232TX	○ 8
RS-485/RS-232RX	○ 9
GND	○ 10

Z1 and Z2 6.8V 1W Zenars these protect the analog input if S2 is not set properly.

Resistor must have a low temperature coefficient.

Calculating RES Value:

1. Determine tach voltage at rated motor speed.

2. Calculate resistance R.

$$R = 250 * (((V_{tach} * 1.1) / 5) - 1)$$

3. Calculate power.

$$P = ((V_{tach} * 1.1) - 5)^2 / R$$

X2

Reset	○ 1
Enable	○ 2
Lower/Reverse	○ 3
Hoist/Forward	○ 4
Speed 2	○ 5
Speed 3	○ 6
Speed 4	○ 7
Speed 5	○ 8
Slowdown	○ 9
DIP Common	○ 10

X3

+24V	○ 1
+10V	○ 2
-10V	○ 3
Analog IP1(+)	○ 4
Analog IP1(-)	○ 5
Analog GND	○ 6
Analog IP2	○ 7
Analog GND	○ 8
A_{out} (0/+10V)	○ 9
Arm Current (0/+10V)	○ 10

Close S2-A, S2-B, and S2-C on control board.

Figure 32: Tach Feedback Connections

Table 31: Gate Drive Board Link Settings

The current feedback scaling is determined by SIP jumpers LK1, LK2, and LK3 or LK5:

Current Class	Current Feedback Scaling
NEMA 2 67 A maximum	LK1, LK2, LK3 IN
NEMA 3 133 A maximum	LK1, LK2, LK3 OUT
NEMA 4 200 A maximum	LK1, LK2, LK5 IN
NEMA 5 400 A maximum	LK1, LK2, LK5 OUT

If ground fault detection is enabled, SIP jumper LK10 must be correctly positioned:

Configuration	DIP switch setting
HOIST	LK10 IN
TRAVEL	LK10 OUT

Earlier Printed Circuit Board Revisions

Driver Board rev1 and 2 (used on 200/360 V NEMA 2 and NEMA 3):

LK10 does not exist. In the TRAVEL or HOIST configuration set Parameter D07 "Ground Fault" to "Disabled".

Driver Board Rev 1 and 2 (used on 200/360 V NEMA 4 and NEMA 5):

LK10 does not exist. In the TRAVEL or HOIST configuration set D07 "Ground Fault" to "Disabled".
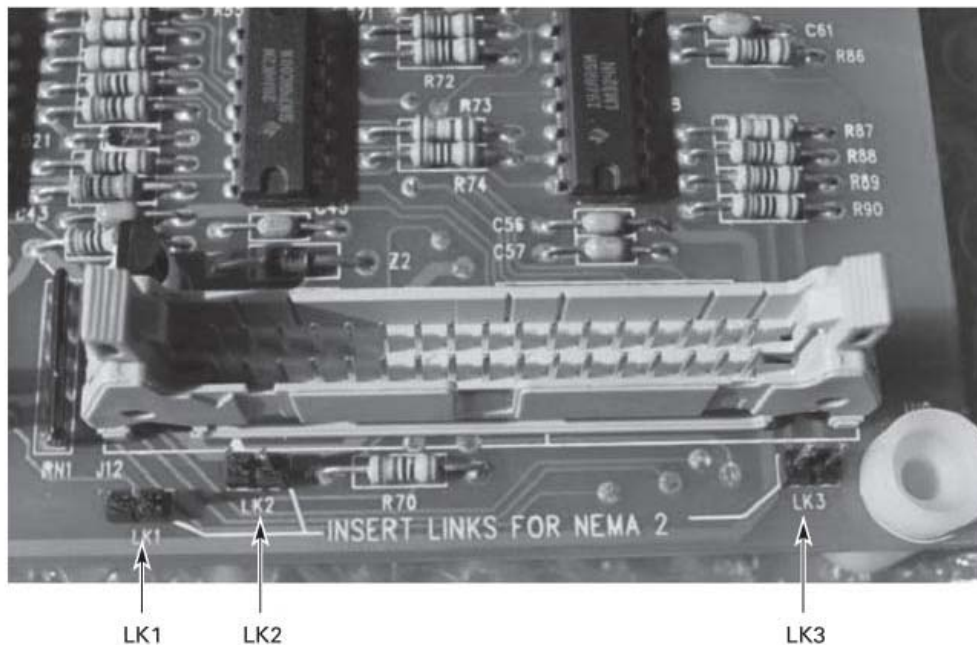
Figure 33: Driver Board (used on 200/360 VDC NEMA Size 2 and 3)
Model Number DDC-LN3-GATE
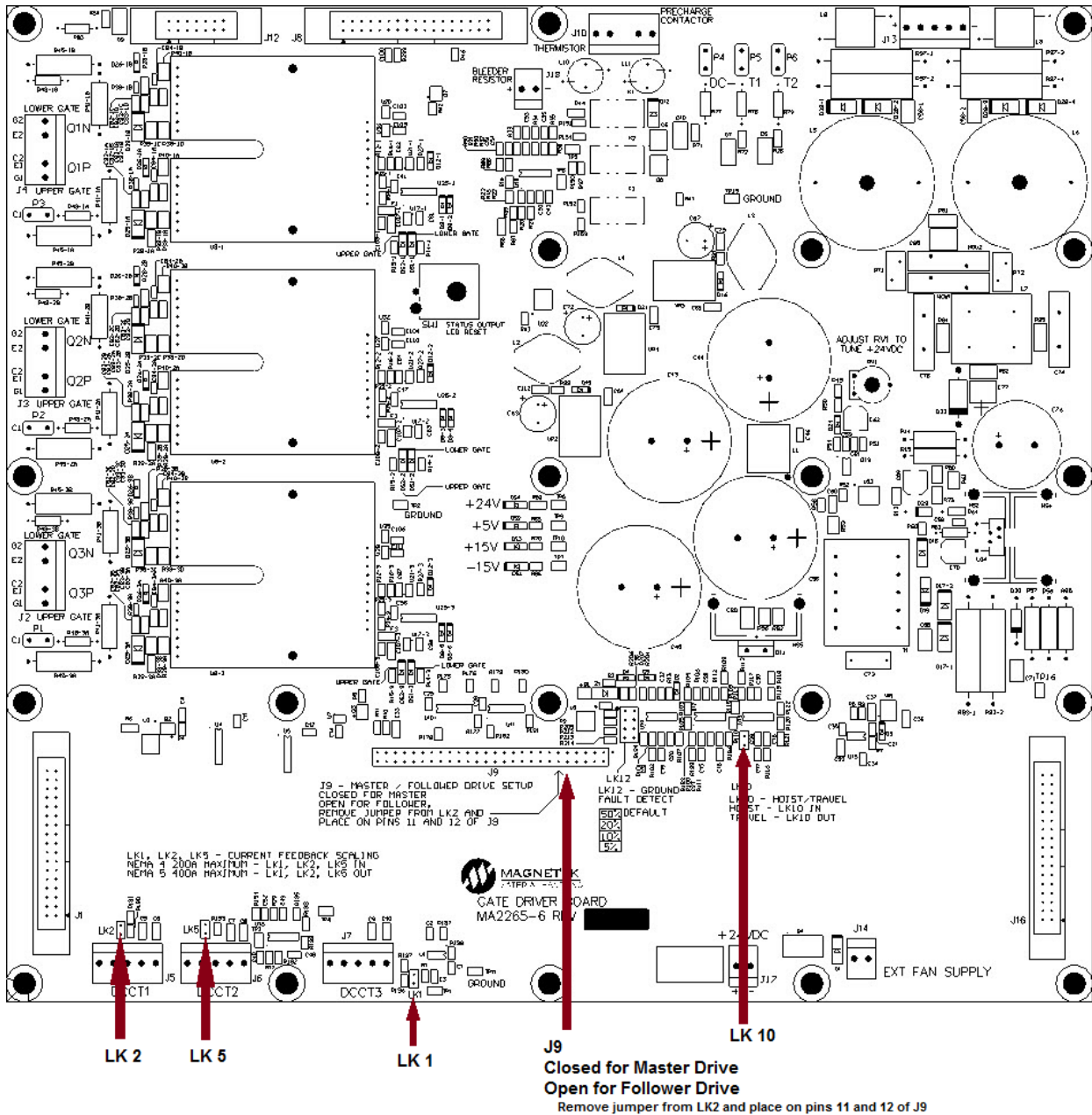
**Figure 34: Driver Board (used on 200/360 VDC NEMA Size 4 and 5)
Model Number DDC-LN5-GATE6**

NOTE: When using a follower drive, do not use a DDC-HN5-GATE or DDC-LN5-GATE (green driver board) with a DDC-LN5-GATE6 or DDC-HN5-GATE6 (black driver board).

Start-Up Procedures

The control panels are factory tested before shipment. However, certain additional tests and adjustments must be made on site to ensure safe operation for the specific motor and application.

NOTE: If the drive does not operate during start-up despite correct adjustments, check for:
(1) wiring errors, (2) loose connections, (3) grounds in wiring between motor, controller, pushbuttons, and master switch, (4) motor overload or motor malfunctions, (5) incorrect line voltage or polarity.

Preliminary Checks

1. Be sure dirt, wire fragments, shipping wedges, etc., are removed from the controller if present.

2. Check that wiring is correct, screws are tight and vent holes are clear.

⚠ CAUTION

Never use a megger to check wiring unless **ALL** electronic boards are removed, IGBTs and diodes are jumpered from anode to cathode or disconnected.

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3. If motor megger check is required, ensure that all motor leads are disconnected at the motor conduit box.

4. Check to ensure that the motor shafts are free to rotate and personnel are out of possible danger.

5. Check to ensure the proper release of all holding brakes.

⚡	**1**	This equipment is applicable to high voltage systems. Only qualified technicians should install the OmniPulse DDC control panels.
	2	Safety glasses should be worn at all times. Proper clothing should also be worn.
	3	Personnel should shield any machinery that can be caused to move by the motor being controlled to prevent contact.
	4	Mobile machinery should be raised to prevent the drive wheels from contacting the driving surface.
	5	Whenever voltage has been disconnected from the controller, the capacitor bank can take up to 5 minutes for the voltage to reduce to a safe level.

Operator Controls

The operator controls must be wired as shown in the schematic diagram shipped with the control panel.

Cable Connections

Power supply and motor connections should be verified before being connected securely to the controller.
DDC Hoist & Lowering Motions

6. Check Installation:

   a. Confirm that the motor is connected for Hoist duty: T1 Arm (A2), T2 Arm (A1) / Field (S1) common, Field (S2) and brake (B1), T3 (B2).

   b. Verify that all connections are correct.

   c. Verify input polarity is correct.

7. Apply Control Power by closing the control breaker or knife switch.

   d. Confirm that the display is working.

8. Restore User Settings (C07) parameter and set the following parameters:

> ### ⚠ WARNING
>
> Only qualified personnel should make parameter changes. Improper parameter settings can result in equipment damage or personnel injury.

   a. Check parameters C04 and C06 for proper use of internal or external CTs.

   b. From motor nameplate, enter the current, voltage and RPM values in parameter Group D (D00, D01, D02, and D03).

   c. Confirm other parameter settings to the suggested values in Parameter Settings for Hoist/Lowering Duty, **Table 32**.

9. Turn off the control power by opening the control circuit breaker or knife switch.

10. Apply Main Power:

   a. Close the Main circuit breaker or knife switch.

   b. Close the control circuit breaker or knife switch.

   c. Monitor the bus with a voltmeter and confirm that the DC bus voltage increases and that the Main LED and display are lit.

   d. Check the AC ripple voltage on the bus by setting the voltmeter to AC volts. If the AC ripple voltage is above 40 volts, a DC line choke wired into the L1 line is recommended. Consult Magnetek for selection guidance.

11. Run the control at low speed/low current limit:

   a. Run at first speed hoist direction then lower.

   b. Confirm that M contactor picks up and that the tips close before controller becomes active. (Increase E09, Start Delay, if contactor arcs on closing or UV trip occurs.)

   c. Confirm that current loops are stable (smooth 1 kHz sound).

   d. Confirm that no speed overshoot occurs.

   e. Confirm that armature and field currents approximately match expected values and that clamp meter measurement agrees with display Group A monitor parameters A00 and A01. If the readings are greater than 10% check the current link settings on the driver board (**Table 31**).

12. Set current limits in Group D to obtain desired performance:

    a. Increase the forward current limit D04 to a value between 100% and 150%.

    b. Increase the reverse current limit D05 to a value between 80% and 100%.

    c. Confirm that rate of acceleration during hoisting is satisfactory. Adjust Group E parameter E27 and E29 (Accel Time) to desired rate.

    d. Note the motor will not run at top speed until the next step is completed.

13. Top Speed adjustment requires that parameters F02 through F11 be set up first if the Ctrl switch reference source (F00) is selected.

    a. Set up lower minimum field (E15) to obtain desired lowering top speed (EMPTY HOOK).

    b. Reduce lower minimum field (E15) parameter gradually until the desired maximum motor RPM or lowering velocity is obtained with operator's control set to the maximum speed position.

    c. Follow the same procedure for the empty hook hoisting direction by gradually adjusting (E16) Hoist Minimum Field parameter.

    d. Note settings of E15 and E16 must be equal to or less than the economy field (E17) setting for economy field to operate properly.

14. Confirm that the transition to Dynamic OFF position braking occurs smoothly.

    a. If arcing at DB Contactor occurs, adjust (E13) DB Delay and/or (E14) DB Time parameters.

    b. These parameters can also be adjusted to reduce the effect of roll-back when the control turns off. Adjusting to accomplish this will introduce some arcing on the DB contacts.

    c. On hoists with hoisting speeds greater than 33 FPM, this method is not practical and other means of eliminating roll-back are necessary.

    d. Confirm that the DC bus voltage does not rise above 390 volts during DB braking.

⚠ **CAUTION**

Using extreme caution, confirm that there are no motor commutation problems (sparking) at high speed during hard acceleration or deceleration.

15. Set parameter D10 limit switch detection to the proper setting for the application design. Drive empty hook into the upper power limit switch and confirm it is not possible to move hook up, but that it is possible to lower hook.

    a. If a false limit switch trip occurs, adjust (D11) LS Lower Det Lvl parameter for loaded hook or (D12) LS Hoist Det Lvl parameter for unloaded hook.

    b. If loaded hook runs too fast or too slow out of the tripped power limit switch, adjust (D13) LS Back Out Time parameter.

    c. If the load differential between an empty hook and unloaded hook is small, false trip indication of the power limit can occur when Hook Load Sense is used. In these applications, an external LS relay should be used for detection.

    d. Adjust (D24) LS Detect Gain if accurate detection isn't obtained by adjusting D11-D13.

16. If the Slack Cable feature is enabled:

    a. Confirm that motor stops and does not pay out cable.

    b. If not, adjust the (D15) Slack Cable Torque parameter.

    c. Confirm that while hoisting under slack cable condition the motor speed is reduced until the cable is tight again.

17. Make final adjustments to the intermediate speeds to suit operator requirements.

    a. Adjust intermediate speeds (F02 through F11) for the best operator feel.

18. Store user-setting values in (C07) Default Values parameter.

19. Confirm that the heatsink temperature (A23) and cabinet ambient temperature (A24) are satisfactory following a period of typical intensive usage lasting at least 1 hour.

20. Record user settings.

Table 32: Hoist Motion Parameter Settings

Parameter No.	Parameter Name	Factory Default	Suggested Setting	User Setting
C00	Configuration	Set by D1P Pos 3	Hoist	
C01	Voltage Class	Set by D1P Pos 4	App Specific	
C02	Current Class	Set by D1P Pos 1 & 2	App Specific	
C03	Parallel Stacks	1	App Specific	
C04	Armature Setup	Int CT	App Specific	
C05	Input Bus Voltage	250	Meas. Line Volts	
C06	Field Setup	Int CT	App Specific	
C07	Default Values	No Action	NA	
D00	Motor Rated Current	1/2 C02 Value	FLA from Mtr NP	
D01	Motor Rated Volts	250 V	Rated volts from Mtr NP	
D02	Motor Base Speed	400 RPM	RPM from Mtr NP	
D03	Motor Field Current	C06 Ext CT	Shunt Field Amps from Mtr NP	
D04	Current Limit Fwd	125%	125%	
D05	Current Limit Rev	100%	50%	
D06	Armature/Field	1.5	1.5	
D07	Ground Fault	Disabled	Disabled	
D08	OH Alarm Level	85°C	85°C	
D09	OH1 Trip Level	90°C	90°C	
D10	LS Detection	Disabled	Hook Sense	
D11	LS Lower Det Lvl	25%	25%	
D12	LS Hoist Det Lvl	15%	15%	
D13	LS Backout Time	500 ms	500 ms	
D14	Slack Cable	Disabled	Disabled	
D15	Slack Cable Torque	0.1%	0.1%	
D16	OH Fan Enable	60°C	60°C	
D17	AOT Enable	75°C	75°C	
D18	AOC Detection Level	20%	20%	
D19	AOC Detection Timer	100 ms	100 ms	
D20	3-Pt Flux Curve	Disabled	Disabled	
D21	Flux 25 IF	53.8%	53.8%	
D22	Flux 75 IF	93.5%	93.5%	
D23	Flux 200 IF	117.9%	117.9%	
D24	LS Detect Gain	1000	1000	
D25	MS Fault Time	75 ms	75 ms	
D30	Reset Attempts	3	3	
D31	Reset Flt Sel	0104	0104	

Table 32: Hoist Motion Parameter Settings (continued)

Parameter No.	Parameter Name	Factory Default	Suggested Setting	User Setting
E02	Current Gain	0.5	1	
E03	Hoist Stop Speed	15.0%	15.0%	
E04	Lower Stop Speed	15.0%	15.0%	
E05	Brake Rel Time	0 ms	0 ms	
E06	Speed P Gain	5.0	5.0	
E07	Speed I Gain	0.1	0.1	
E08	IR Comp Gain	0.00	0.00	
E09	Start Delay	300 ms	300 ms	
E10	Stop Delay	0.0 ms	0.0 ms	
E11	Bypass Speed	0.0%	0.0%	
E13	DB Delay	300 ms	300 ms	
E14	DB Time	300 ms	300 ms	
E15	Lower Min Field	50%	50%	
E16	Hoist Min Field	50%	50%	
E17	Economy Field	50%	50%	
E18	Minimum Field	50%	50%	
E19	Field Rate Change	32	32	
E20	T Type	ON Delay TC	On Delay TC	
E21	T Time	1000 ms	1000 ms	
E22	Micro SP Factor	1.00	1.00	
E23	SB Rel PT	40%	10%	
E24	SB On Delay Time	0.0 ms	0.0 ms	
E25	SB Set Time	0.0 ms *	300 ms	
E26	Stall Prot Time	0.0 s	0.0 s	
E27	Hoist Accel Time	5.0 s	5.0 s	
E28	Hoist Decel Time	5.0 s	5.0 s	
E29	Lower Accel Time	5.0 s	5.0 s	
E30	Lower Decel Time	5.0 s	5.0 s	
E31	Load Float Time	0.0 s	0.0s	

Table 32: Hoist Motion Parameter Settings (continued)

Parameter No.	Parameter Name	Factory Default	Suggested Setting	User Setting
F00	Speed Ref Source	Cntr Switch	Cntr Switch	
F02	Hoist Speed 1	20%	20%	
F03	Hoist Speed 2	40%	40%	
F04	Hoist Speed 3	60%	60%	
F05	Hoist Speed 4	80%	80%	
F06	Hoist Speed 5	100%	100%	
F07	Lower Speed 1	20%	20%	
F08	Lower Speed 2	40%	40%	
F09	Lower Speed 3	60%	60%	
F10	Lower Speed 4	80%	80%	
F11	Lower Speed 5	100%	100%	
F28	Slowdown Torque	75%	75%	
F29	Travel Lim Trq	100%	100%	

* Factory Default setting for Series Brake

Table 32: Hoist Motion Parameter Settings (continued)

Parameter No.	Parameter Name	Factory Default	Suggested Setting	User Setting
G00	Analog IP1 Type	0/+10V	0/+10V	
G01	Analog IP1 Gain	1.00	1.00	
G02	Analog IP1 Bias	0.0%	0.0%	
G03	Tacho FS RPM	0 RPM	0 RPM	
G04	Analog IP2 Type	0/+10V	0/+10V	
G05	Analog IP2 Gain	1.00	1.00	
G06	Analog IP2 Bias	0.0%	0.0%	
G08	Analog Out Gain	1	1	
G09	Analog Out Bias	0.0%	0.0%	
G10	Analog Out Function (X3-9 or X1-6)	Motor Speed	Motor Speed	
G11	Prog. 1P Function (X2-9 or SD on IFC)	Not Used	Not Used	
G12	Prog. OP1 Function (DB on IFC)	DB Contactor	DB Contactor	
G13	Prog. OP2 Function (X1-2)	Controller Fault	Controller Fault	
G14	Prog. OP3 Function (X1-3)	Controller Ready	Controller Ready	
G15	Prog. OP4 Function (X1-4 or SB on IFC)	Shunt Brake	Shunt Brake	
G16	Serial Baud Rate	19200	19200	
G17	RS-232/485 Select	RS-232	RS-232	
G18	Serial Format	8E1	8E1	
G19	Modbus Address	1	1	
G20	Drive Control	Hwd-IO	Hwd-IO	
G21	Tach Loss Detect	Disabled	Disabled	
G22	REV Tach Det	Enabled	Enabled	
G23	Tach Loss CEMF Det	25%	25%	
G24	Tach Loss FB Det	10%	10%	
G25	Speed 5 Func	Speed 5	Speed 5	

⚠ WARNING

Only qualified personnel should make parameter changes. Improper parameter settings can result in equipment damage or personnel injury.

DDC Travel Motion

1. Check Installation:

    a. Confirm the motor is connected for travel motion: T1 (A1), T2 (A2) armature, T3 (S2), T4 (S1) field.

    b. Verify that all connections are correct.

    c. Verify the input polarity.

2. Apply Control Power by closing the control breaker or knife switch.

    a. Confirm that the display is working.

3. Restore User Settings (C07) parameter and set the following parameters:

⚠ WARNING

Only qualified personnel should make parameter changes. Improper parameter settings can result in equipment damage or personnel injury.

---

    a. Check parameters C04 and C06 for proper use of internal or external CTs.

    b. From motor nameplate, enter the current, voltage and RPM values in parameter Group D (D00, D01, D02, and D03).

    c. Confirm other parameter settings to the suggested values in Parameter Settings for Travel Motion, **Table 33.**

4. Turn off the control power by opening the control circuit breaker or knife switch.

5. Apply Main Power:

    a. Close the main circuit breaker or knife switch.

    b. Close the control circuit breaker or knife switch.

    c. Monitor the bus with a voltmeter and confirm that the DC bus voltage increases and that the main light and the display are lit.

    d. Check the AC ripple voltage on the bus by setting the voltmeter to AC volts. If the AC ripple voltage is above 40 volts a DC line choke wired into the L1 line is recommended. Consult Magnetek for selection guidance.

6. Run at low speed/low current limit:

    a. Run at first speed.

    b. Confirm that M contactor picks up and that the tips close before controller becomes active (increase (E09) Start Delay parameter if contactor arcs on closing or UV trip occurs).

    c. Confirm that current loops are stable (smooth 1 kHz sound).

    d. Confirm that no speed overshoot occurs.

    e. Confirm that torque is present during plug braking. Note that current limits for plugging torque are set by parameters F23 through F27.

    f. Confirm that armature and field currents approximately match the expected values and that the clamp meter measurement agrees with display Group A monitor parameters A00 and A01. If the readings are greater than 10%, check the current link settings on the driver board (**Table 31**).

7. Set current limits in Group D to obtain desired performance:

    a. Increase the current limits for each step as necessary by setting the F17 to F27 parameters.

    b. Confirm that rate of acceleration during travel is satisfactory. Adjust Group E parameter E00 (Accel Time) to the desired rate.

    c. Note that the motor will not run at top speed until the next step is completed.

8. Top Speed adjustment requires that parameters F12 through F16 be set up first if the Cntr switch reference source (F00) is selected.

    a. Set up minimum field to obtain desired top speed. Reduce minimum field (E18) gradually until the desired maximum motor RPM or travel velocity is obtained with operator's control lever set in maximum position. Note that E18 setting must be equal to or less than the E17 setting for economy field to operate properly.

    b. Confirm that the transition to plug braking occurs smoothly. Adjust the torque (current limits) using parameters F17 to F27.

    c. During plug braking, confirm that the DC bus voltage does not rise above 390 volts for low voltage drives. For high voltage drives, the DC bus must not rise above 700 volts for models with DDC-HN5-GATE, or 800 volts for models with DDC-HN5-GATE6.

⚠ CAUTION

Using extreme caution, confirm that there are no motor commutation problems (sparking) at high speed during hard acceleration or deceleration.

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9. Set Accel/Decel times.

    a. Adjust Accel and Decel times (E00) and (E01) if necessary to obtain smoother operation at low speed.

10. Adjust the intermediate speeds to suit operator requirements. Adjust intermediate speeds (F12 through F16) for best operator feel.

    a. Adjust intermediate torques (F17 through F27) to provide progressively increasing levels of acceleration and deceleration current limits.

    b. Set neutral position torque if decelerating torque is required in the OFF or Neutral position. A setting of 2% is coast mode to stop.

11. Store user-setting values in (C07) Default Values parameter.

12. Confirm that the heatsink temperature (A23) and cabinet ambient temperature (A24) are satisfactory following a period of typical intensive usage lasting at least 1 hour.

13. Record user settings.

Table 33: Travel Motion Parameter Settings

Parameter No.	Parameter Name	Factory Default	Suggested Setting	User Setting
C00	Configuration	Set by D1P Pos 3	Travel	
C01	Voltage Class	Set by D1P Pos 4	App Specific	
C02	Current Class	Set by D1P Pos 1 & 2	App Specific	
C03	Parallel Stacks	1	App Specific	
C04	Armature Setup	Int CT	Int CT	
C05	Input Bus Voltage	250 V	Meas. Line Volts	
C06	Field Setup	Int CT	Int CT	
C07	Default Values	No Action	NA	
C09	Torque Follower	Disabled	Disabled	
D00	Motor Rated Current	1/2 C02 Value	FLA from Mtr NP	
D01	Motor Rated Volts	230	Rated volts from Mtr NP	
D02	Motor Base Speed	400	RPM from Mtr NP	
D03	Motor Field Current	0	Shunt Field Current from Mtr NP	
D06	Armature/Field	1.5	1.5	
D07	Ground Fault	Disabled	Disabled	
D08	OH Alarm Level	85°C	85°C	
D09	OH1 Trip Level	90°C	90°C	
D16	OH Fan Enable	60°C	60°C	
D17	AOT Enable	75°C	75°C	
D18	AOC Detection Level	0%	0%	
D19	AOC Detection Timer	100 ms	100 ms	
D20	3-Pt Flux Curve	100 ms	100 ms	
D21	Flux 25 IF	Disabled	Disabled	
D22	Flux 75 IF	93.5%	93.5%	
D23	Flux 200 IF	117.9%	117.9%	
D25	MS Fault Time	75 ms	75 ms	
D30	Reset Attempts	3	3	
D31	Reset Flt Sel	0104	0104	
E00	Accel Time	5 sec	2 sec	
E01	Decel Time	5 sec	2 sec	
E02	Current Gain	0.5	1.0	
E05	Brake Rel Time	0 ms	0 ms	
E06	Speed P Gain	5.0	5.0	
E07	Speed I Gain	0.10	0.10	
E08	IR Comp Gain	0.00	0.00	
E09	Start Delay	300 ms	300 ms	
E10	Stop Delay	0 ms	0 ms	
E11	Bypass Speed	0.0%	0.0%	
E12	Stop Speed	15.0%	15%	

Parameter No.	Parameter Name	Factory Default	Suggested Setting	User Setting
E13	DB Delay	0 ms	0 ms	
E14	DB Time	0 ms	0 ms	
E17	Economy Field	25%	50%	
E18	Minimum Field	25%	25%	
E19	Field Rate Change	32	32	
E20	T Type	ON Delay TC	On Delay TC	
E21	T Time	1000 ms	1000 ms	
E22	Micro SP Factor	1.00	1.00	
E23	SB Rel PT	0%	0%	
E24	SB On Delay Time	0.0 ms	0.0 ms	
E25	SB Set Time	0 ms	300 ms	
E26	Stall Prot Time	5.0 sec	5.0 sec	
E31	Load Float Time	0.0 sec	0.0 sec	

Table 33: Travel Motion Parameter Settings (continued)

Parameter No.	Parameter Name	Factory Default	Suggested Setting	User Setting
F00	Speed Ref Source	Cntr Switch	Cntr Switch	
F01	Torque Ref Source	Cntr Switch	NA	
F12	Travel Speed 1	20%	20%	
F13	Travel Speed 2	40%	40%	
F14	Travel Speed 3	60%	60%	
F15	Travel Speed 4	80%	80%	
F16	Travel Speed 5	100%	100%	
F17	Travel Torque 1	20%	50%	
F18	Travel Torque 2	40%	100%	
F19	Travel Torque 3	60%	125%	
F20	Travel Torque 4	80%	150%	
F21	Travel Torque 5	100%	150%	
F22	Neutral Torque	2%	2%	
F23	Plug Torque 1	20%	20%	
F24	Plug Torque 2	40%	40%	
F25	Plug Torque 3	60%	60%	
F26	Plug Torque 4	80%	80%	
F27	Plug Torque 5	100%	100%	
F28	Slowdown Torque	75%	75%	
F29	Travel Lim Trq	100%	100%	
G00	Analog IP1 Type	0/+10V	0/+10V	
G01	Analog IP1 Gain	1.00	1.00	
G02	Analog IP1 Bias	0.0%	0.0%	
G03	Tacho FS RPM	0 RPM	0 RPM	
G04	Analog IP2 Type	0/+10V	0/+10V	
G05	Analog IP2 Gain	1.00	1.00	
G06	Analog IP2 Bias	0.0%	0.0%	
G08	Analog Out Gain	1.00	1.00	
G09	Analog Out Bias	0.0%	0.0%	
G10	Analog Out Function	Motor Speed	Motor Speed	
G11	Prog. 1P Function (X2-9 or SD on IFC)	Not Used	Not Used	

Table 33: Travel Motion Parameter Settings (continued)

Parameter No.	Parameter Name	Factory Default	Suggested Setting	User Setting
G12	Prog. OP1 Function (DB on IFC)	DB Contactor	DB Contactor	
G13	Prog. OP2 Function (X1-2)	Controller Fault	Controller Fault	
G14	Prog. OP3 Function (X1-3)	Controller Ready	Controller Ready	
G15	Prog. OP4 Function (X1-4 or SB on IFC)	Shunt Brake	Shunt Brake	
G16	Serial Baud Rate	19200	19200	
G17	RS-232/485 Select	RS-232	RS-232	
G18	Serial Format	8E1	8E1	
G19	Modbus Address	1	1	
G20	Drive Control	Hwd-IO	Hwd-IO	
G21	Tach Loss Detect	Disabled	Disabled	
G22	REV Tach Det	Enabled	Enabled	
G23	Tach Loss CEMF Det	25%	25%	
G24	Tach Loss FB Det	10%	10%	
G25	Speed 5 Func	Speed 5	Speed 5	

⚠ WARNING

Only qualified personnel should make parameter changes. Improper parameter settings can result in equipment damage or personnel injury.

Troubleshooting

Fault Codes and Corrective Action

In this troubleshooting section "check" means investigating whether an item is functioning and in an acceptable physical condition, and then taking corrective action (adjusting, fixing, replacing, etc.) as necessary. In the Corrective Action Column, it may not be necessary to perform all of the steps to correct the problem. There are two types of faults in the OmniPulse DDC. They are defined as "Active Fault" and "Major Fault". A Major Fault will be recorded in the Fault History and requires centering of the master switch to reset the Fault. An Active Fault is generally a status type Fault that may not require a reset and is not stored in the Fault History.

Table 34: Fault Codes and Corrective Actions

Fault Code - Text	Type of Fault	Description	Corrective Action
CUV - Control Pwr Loss	Active	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. Verify power supply LEDs are on. 5. For NEMA sizes 4 and above, check TP6 = +24 VDC, TP7 = -15 V, TP10 = +15 VDC, TP9 = +5 VDC 6. Check control board terminals X1 pin1 and X3 pin1 for 24 VDC. 7. Replace control board. 8. Replace gate drive board.
UV1 - Undervoltage	Active	Indicates that the main DC supply voltage is too low or that the M contactor did not close.	1. Check DC bus voltage shown by monitor function A03. 2. Ensure that the incoming power supply voltage is not dropping below tolerance. 3. Ensure Power is present at the drive and it is turned on. 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 drive board.

Table 34: Fault Codes and Corrective Action (continued)

Fault Code - Text	Type of Fault	Description	Corrective Action
OT1 – Heatsink Temp	Major	Indicates that an excessive heatsink temperature rise has occurred.	1. Reduce duty, current or torque limits and speeds and/or combination of some or all of above. 2. Check Gate Driver board for short circuit LED (see page 112 for details). 3. Ensure that heatsink temperature (monitor A23) is below 90° C. 4. Ensure that the heatsink cooling fans are operating properly. 5. Ensure that heatsink is free of dirt and debris. 6. Ensure that ambient temperature is within specifications.
SC - Short Circuit	Major	Indicates that the drive has detected an output short circuit. Fault will occur when 15 Volt power supply is below 13 VDC.	1. For NEMA sizes 4 and above, check TP6 = +24 VDC, TP7 = -15 V, TP10 = +15 VDC, TP9 = +5 VDC 2. Disconnect motor from drive. 3. Check for shorts in the wiring and motor using a digital meter or continuity tester. 4. Perform Diode and IGBT test per Transistor and Diode Check Table. ***Never megger the drive. 5. Check for a short circuit in the motor or wiring using a megger.
OV – Over Voltage	Major	Indicates excessive DC input voltage or supply not able to accept reverse current flow during regeneration.	1. Ensure that the incoming supply voltage is not rising above tolerance. 2. Check DC bus voltage shown by monitor function A03. 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.

Table 34: Fault Codes and Corrective Action (continued)

OC – Over Current	Major	Indicates current loops failed to maintain current within maximum limits.	1. Check that displayed Armature Current Function A00 equals Actual Armature Current using a clamp on amp meter. 2. Disconnect motor from drive. 3. Check for a short circuit in the motor or wiring using a megger. 4. Perform Diode and IGBT test per Transistor and Diode Check Table. ***Never megger the drive.
AOT – Over Ambient	Major	The ambient temperature monitored by the control board is 70° C or greater.	1. Monitor ambient temperature by A24. 2. Decrease ambient temperature. 3. Ensure that fans are functional. 4. Ensure heatsink is free of dirt and debris. 5. Reduce Duty Cycle. 6. Reduce Load and or duty cycle. 7. Add air conditioner.
AOC – Arm Open Cct	Major	Indicates that the motor armature loop is open or that current is not passing from drive terminals T1 to T2.	1. Monitor A00 for Armature current feedback. 2. Check motor circuit and wiring. 3. Perform Diode and IGBT test per Transistor and Diode Check Table. 4. Modify parameters D18 and/or D19.
FL - Field Loss	Major	Indicates that the motor field loop is open or that current is not passing from drive terminals T2 to T3.	1. Monitor A01 for Field Current feedback. 2. Check motor circuit and wiring. 3. Perform Diode and IGBT test per Transistor and Diode Check Table.
LS - Limit Switch	Major	In order to back out of power limit switch back-out mode, the armature current test at the start of a movement is disabled. Pulses of field current approximately 100% for 1 second are used to back out of the limit switch. Center OFF and lower to initiate each pulse.	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. Increase Limit Switch detection levels (D11 and D12).

Table 34: Fault Codes and Corrective Action (continued)

Motor Stall	Major	Enabled software function detected a stall condition.	1. Brake(s) released? 2. Reduce the load. 3. Extend the Acceleration time, Function E00. 4. Disable Stall Protection (E26 = 0).
MOL - Motor Overload	Major	The motor current is too high for a significant period of time.	1. Monitor A25 for the accumulated overload level. 2. Check for a dragging brake. 3. Check for a weak motor field. 4. Check that displayed Armature Current Function A00 equals 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.
MOS – Module out of Service	Major	Indicates that one or more follower units are out of service.	1. Verify the setting in parameter C03. 2. Ensure that follower drive is powered up correctly. 3. Ensure that the gate drive board data bus cable is connected between master and follower(s) (J1 and J16). 4. Verify on follower(s) gate drive board that bus connecter J9 has only pins 11 and 12 jumpered.
PER - Parameter exceeds Rating	Major	Parameter value exceeds ratings.	1. Set Correct Value
EXT - External, Limit Switch	Major	External limit switch detection activated. Reset limit switch.	1. Reset External Limit Switch. 2. Ensure External Limit Switch Wiring.
SLC - Slack Cable	Major	Slack cable condition detected. Only hoisting is permitted until reset.	1. May not require corrective action. 2. Check that Slack Cable Torque Function D15 is set properly.

Table 34: Fault Codes and Corrective Action (continued)

Fault Code - Text	Type of Fault	Description	Corrective Action
MS - Master Switch	Active	Drive inputs not in OFF position when drive powered up.	1. Is the master switch centered? 2. Ensure input logic wiring is functioning correctly. 3. Check that Logic Inputs on Function A21 are functioning properly. 4. Check that programmable input Function G11 is set properly.
	Major	Both directional inputs are on at the same time.	1. Ensure input logic wiring is functioning correctly. 2. Check that Logic Inputs on Function A21 are functioning properly. 3. Check ground connections.
External Fault	Major	External fault input activated.	1. May not require corrective action. 2. Verify that the External device that signaled the External fault is functioning properly. 3. Check that programmable input Function G11 or G25 is set properly. 4. Verify External Fault Logic circuitry is functioning correctly.
FDBK	Major	TACH feedback lost or armature voltage exceeded fault level.	1. Verify the settings of G21–G24. 2. Ensure tachometer is properly mounted. 3. Check tachometer wiring.
Ground Fault	Major	A Ground Fault has been detected.	1. Check the motor circuit for shorts to ground. 2. Check that displayed Armature Current Function A00 equals Actual Armature Current using a clamp on amp meter. 3. Check for a short circuit in the motor or wiring using a megger. Ensure that the motor is disconnected from the drive.
CRC – Change of Settings	Major	DIP switches have been changed or a parameter setting has been corrupted.	1. If the DIP switch settings changed, at least one parameter must be modified, or there should be a Factory Default Reset. 2. If no DIP switch settings changed, review the parameter settings to ensure proper operation of the drive. 3. Power down the drive, or reset the drive with the microprocessor reset switch SW1 on the interface board.

Short Circuit Check

When a short circuit occurs, the Gate Driver Board (DDC-LN5-GATE6 or DDC-HN5-GATE6) 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.
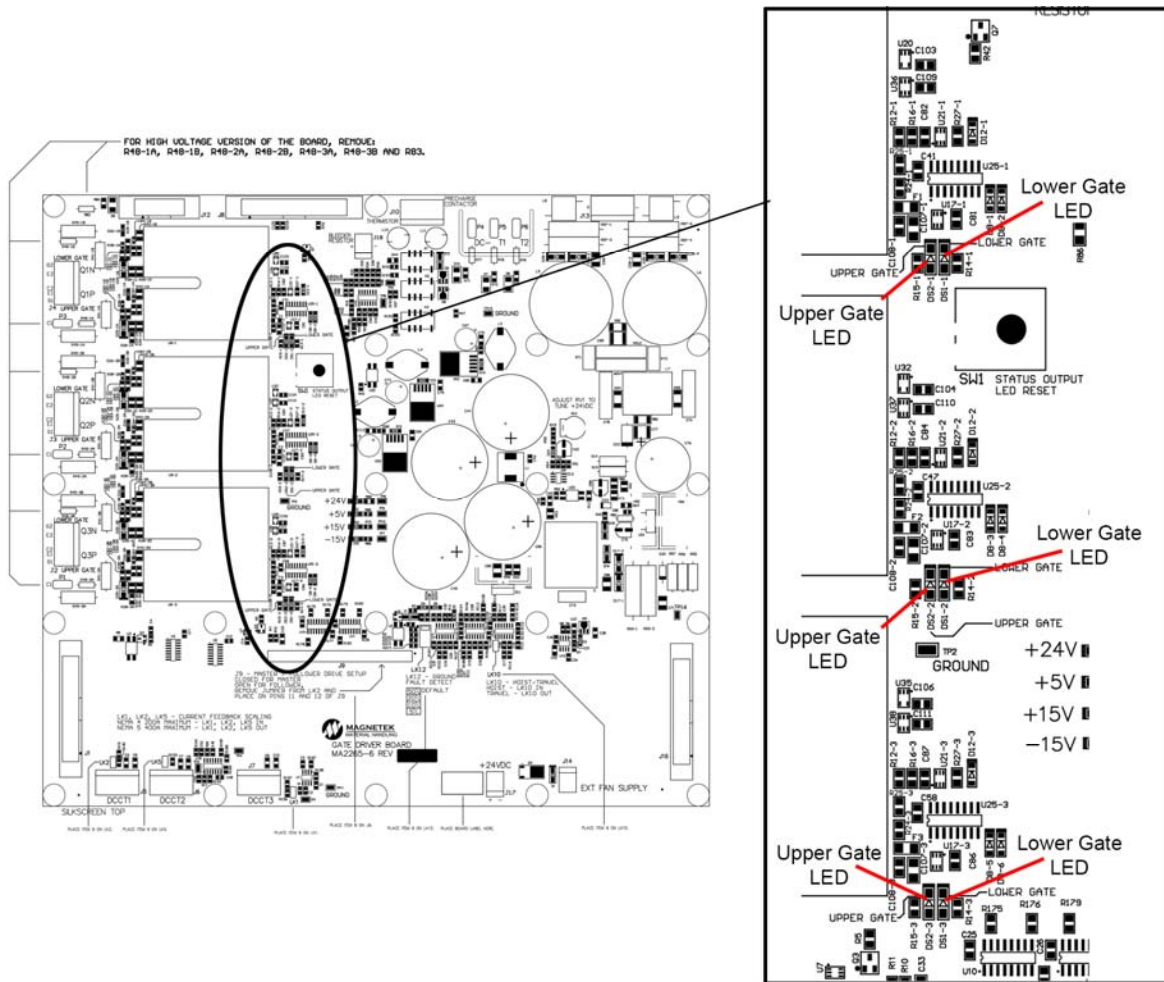

Figure 35: Gate Driver LED locations

Transistor and Diode Check

⚡ ⚠ DANGER

Make sure that the MCB or MKS and CCB or CKS are in the open position and that the charge light and control light on the drive are off.

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

NOTE: On travel setup, disconnect T3 or T4 cable from the drive before making measurements.

Table 35: Transistors and Diode Check

Diode Check	Positive Probe	Negative Probe	Reading
D1P	T1	L1	.312
D2P	T2	L1	.312
D3P	T3	L1	.312
D1N	L2	T1	.312
D2N	L2	T2	.312
D3N	L2	T3	.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

Use the IGBT auxiliary connection on the NEMA 4/5 drives. Remove the connectors from P1, P2 and P3 on the 144-45059 driver board and do a continuity check from the connector wire to T4 terminal. Typical measurement is about 0.3 ohms. Replace the IGBT if the reading is open.

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

Charts

⚡

> ⚠ **WARNING**
>
> This section is intended only for trained service personnel.

> ⚠ **WARNING**
>
> Extreme care must be exercised, as dangerous voltages can be present while following these troubleshooting procedures.
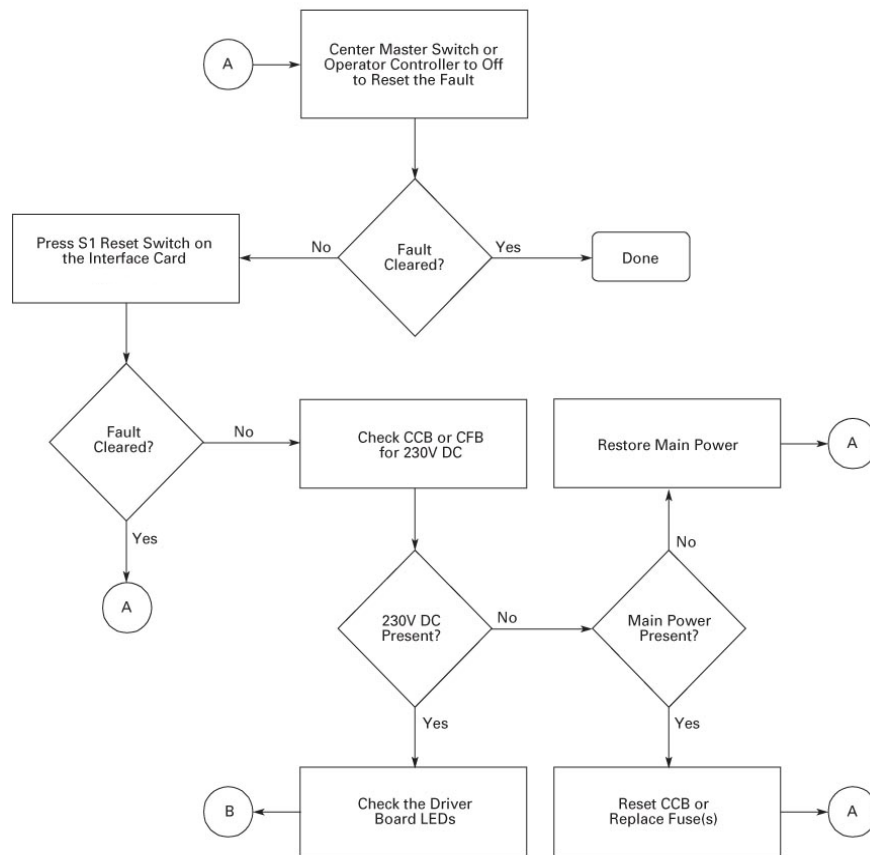
Figure 36: "CUV" Fault Control Power Loss (Active Fault)
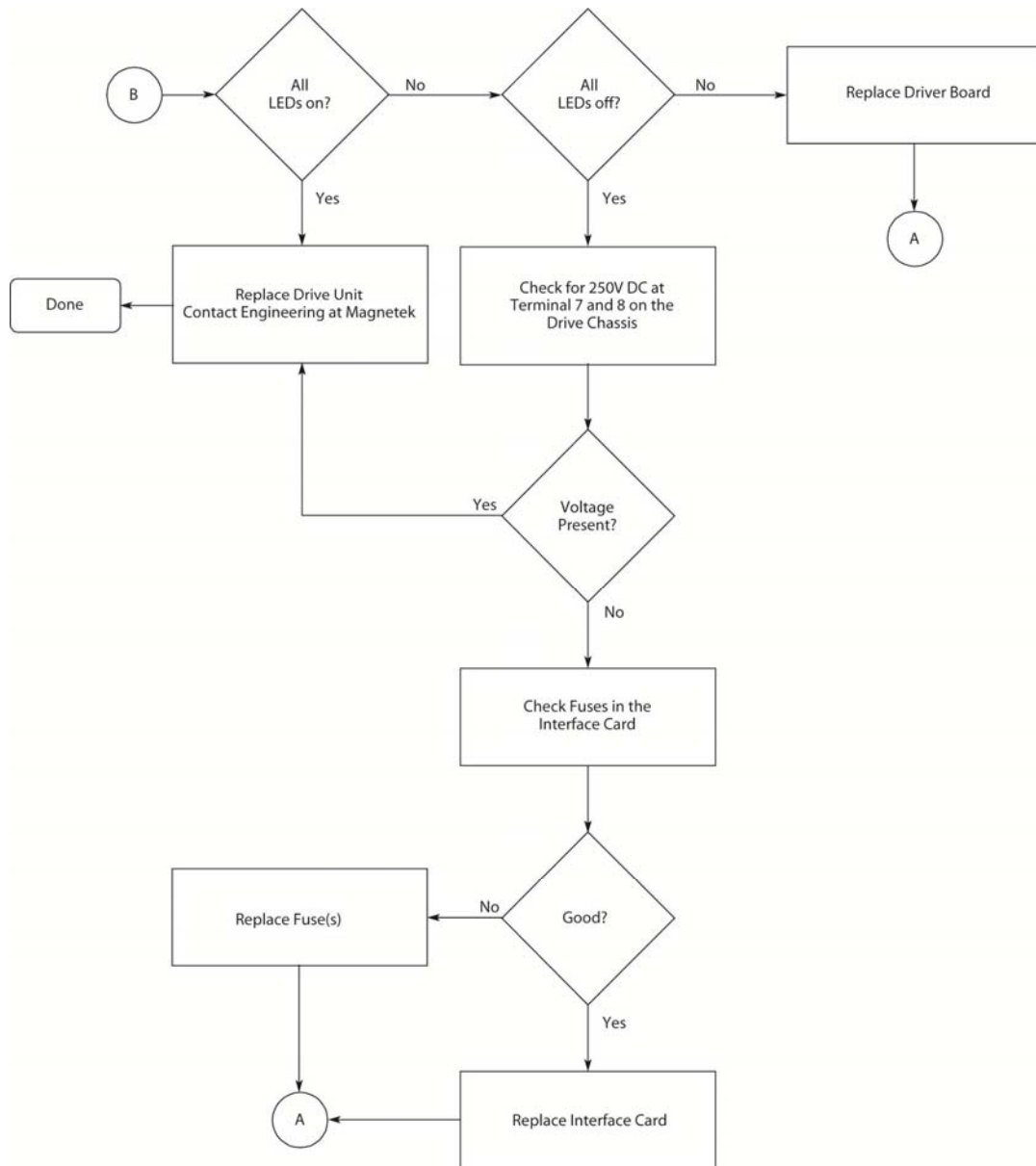
Figure 37: "CUV" Fault Control Power Loss (Active Fault) (continued)
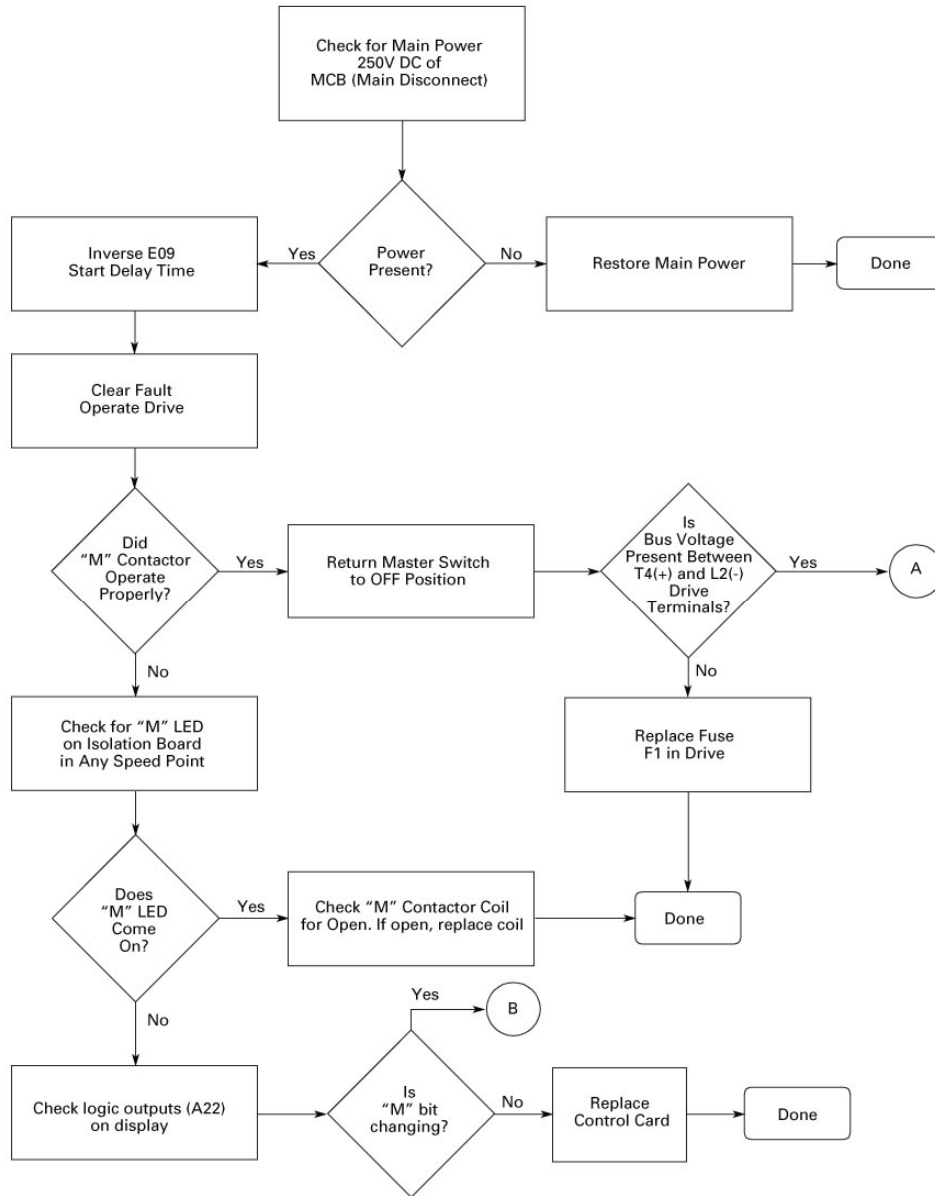
Figure 38: UV1 'Undervoltage' — Main DC Supply Low (Active Fault)
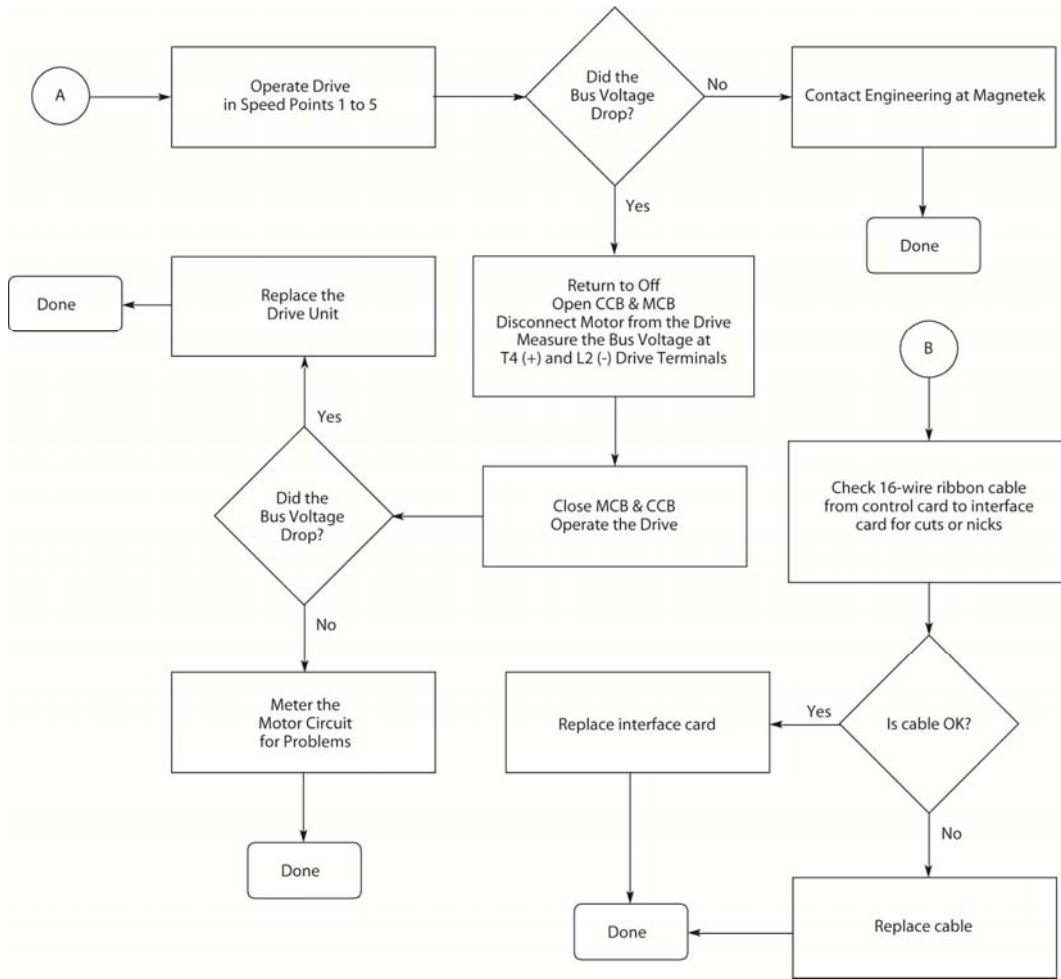
Figure 39: UV1 'Undervoltage' — Main DC Supply Low (Active Fault) (continued)
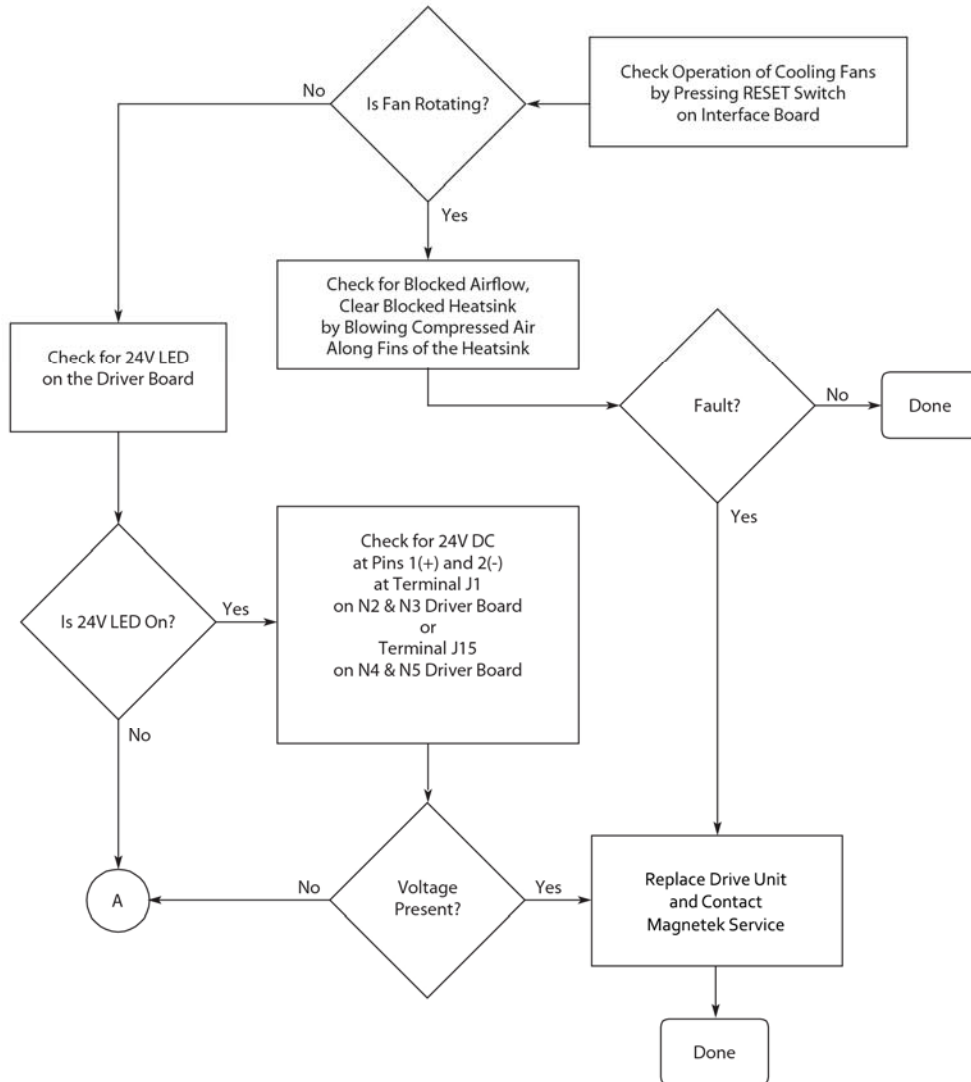
Figure 40: OT1 Heatsink Temperature Exceeded
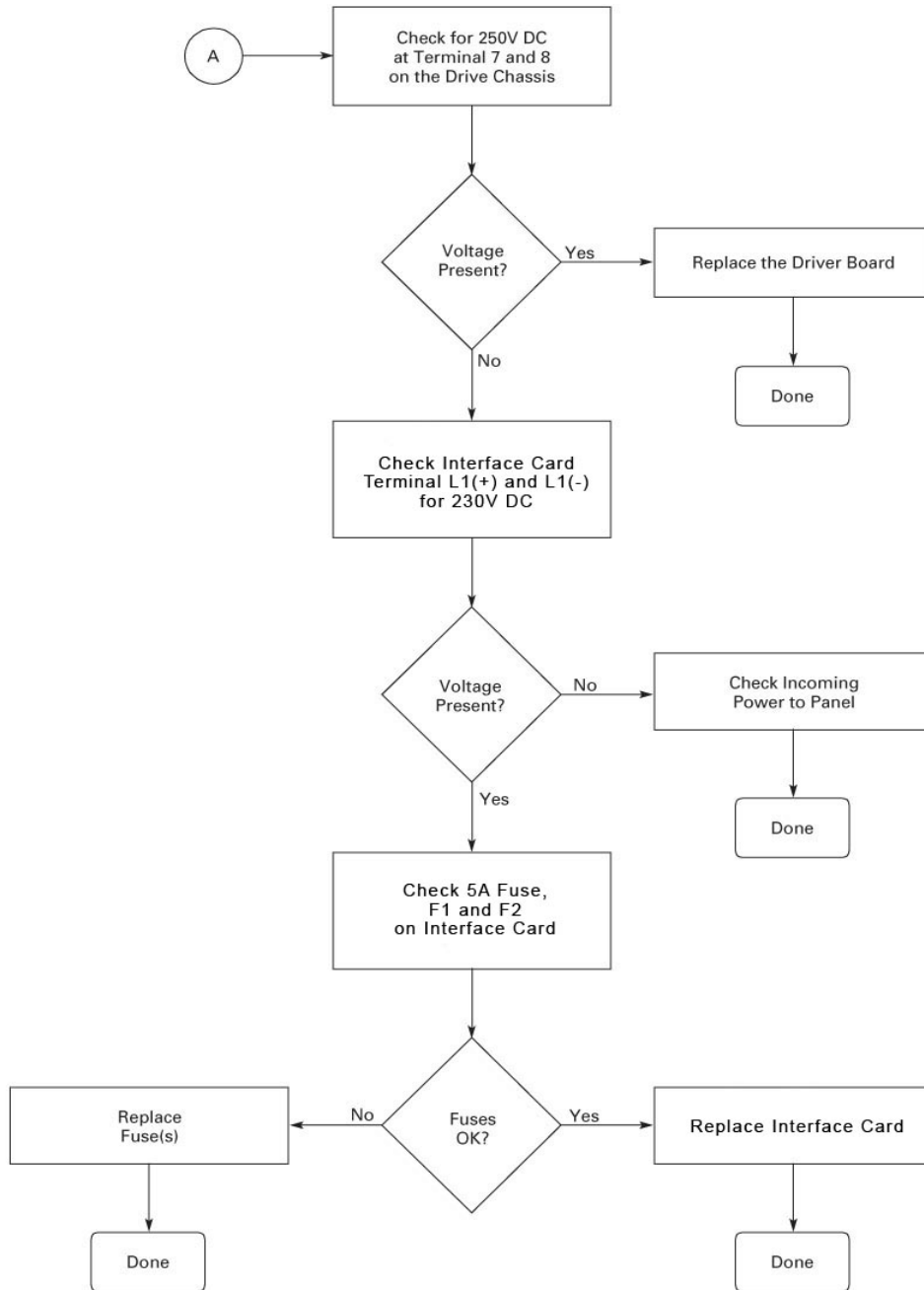
Figure 41: OT1 Heatsink Temperature Exceeded (continued)
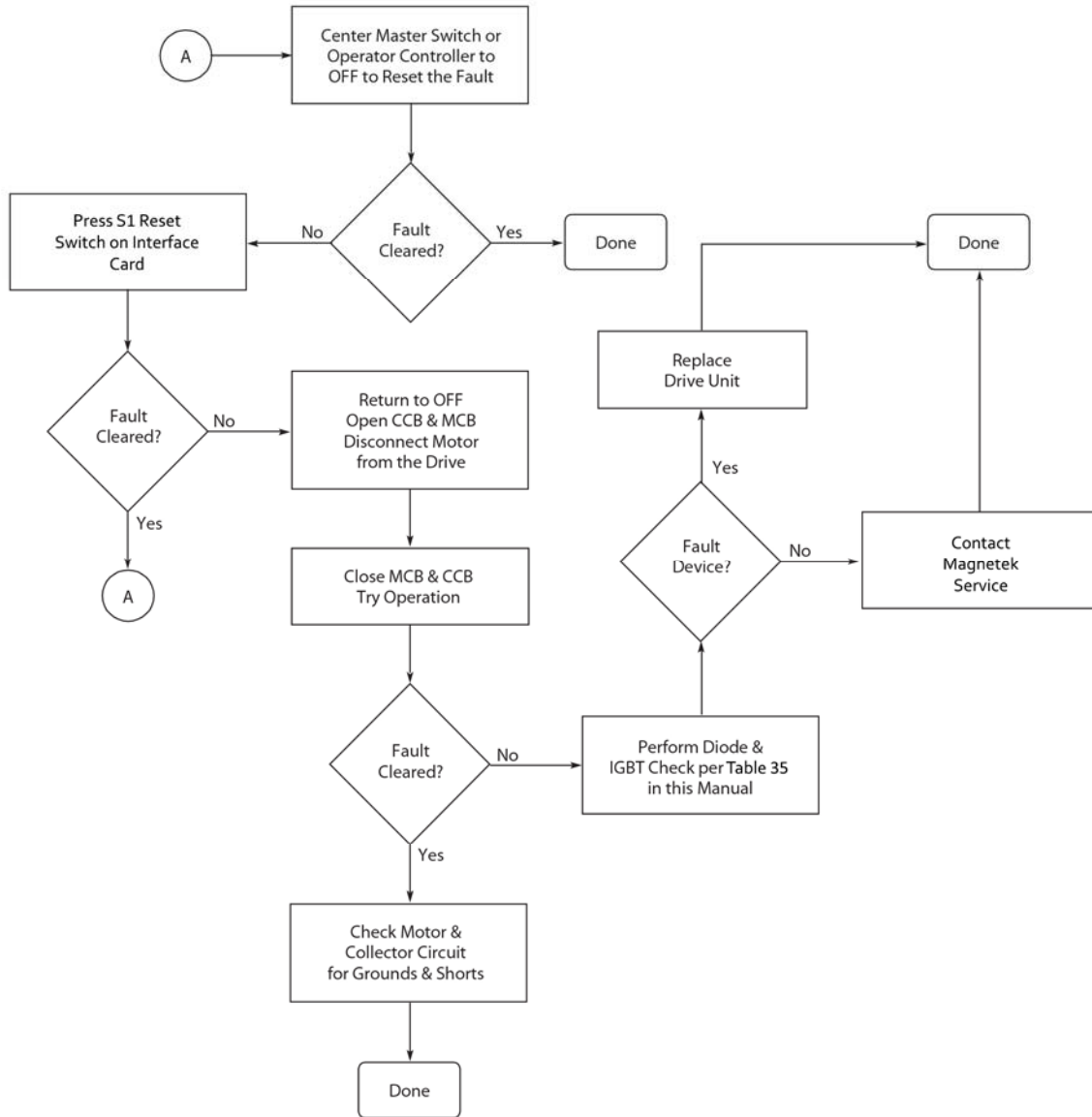
Figure 42: SC Short Circuit

NOTE: Ten SC faults within a 5 minute time period requires a manual reset or power down of the drive. The (SC) Short Circuit Lockout Fault LED on the control board (**Figure 30**) will be on if this condition occurs. The SC Lockout LED will come on momentarily during power up and then remain off until the SC Lockout Fault occurs.
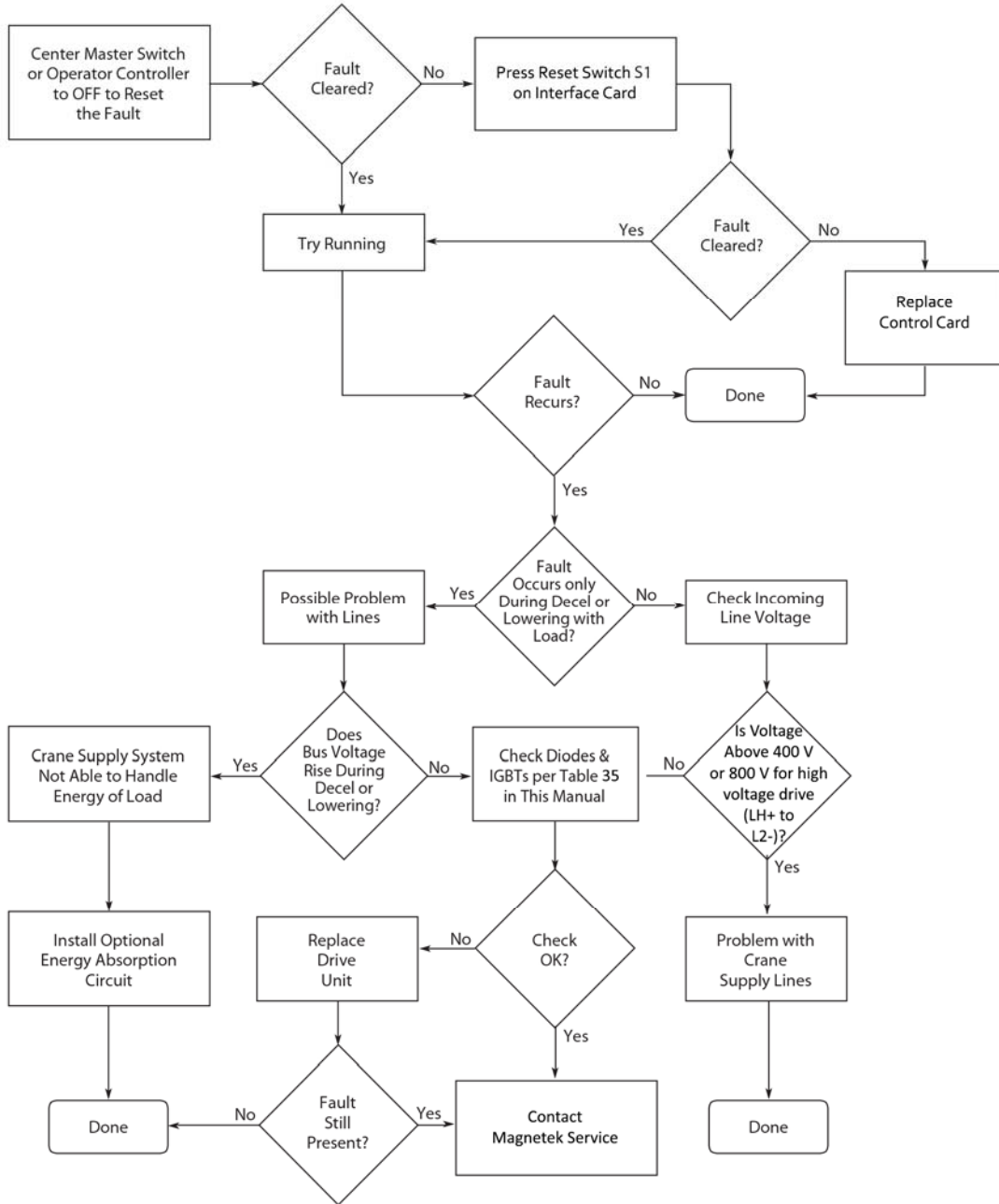
Figure 43: OV Overvoltage Fault
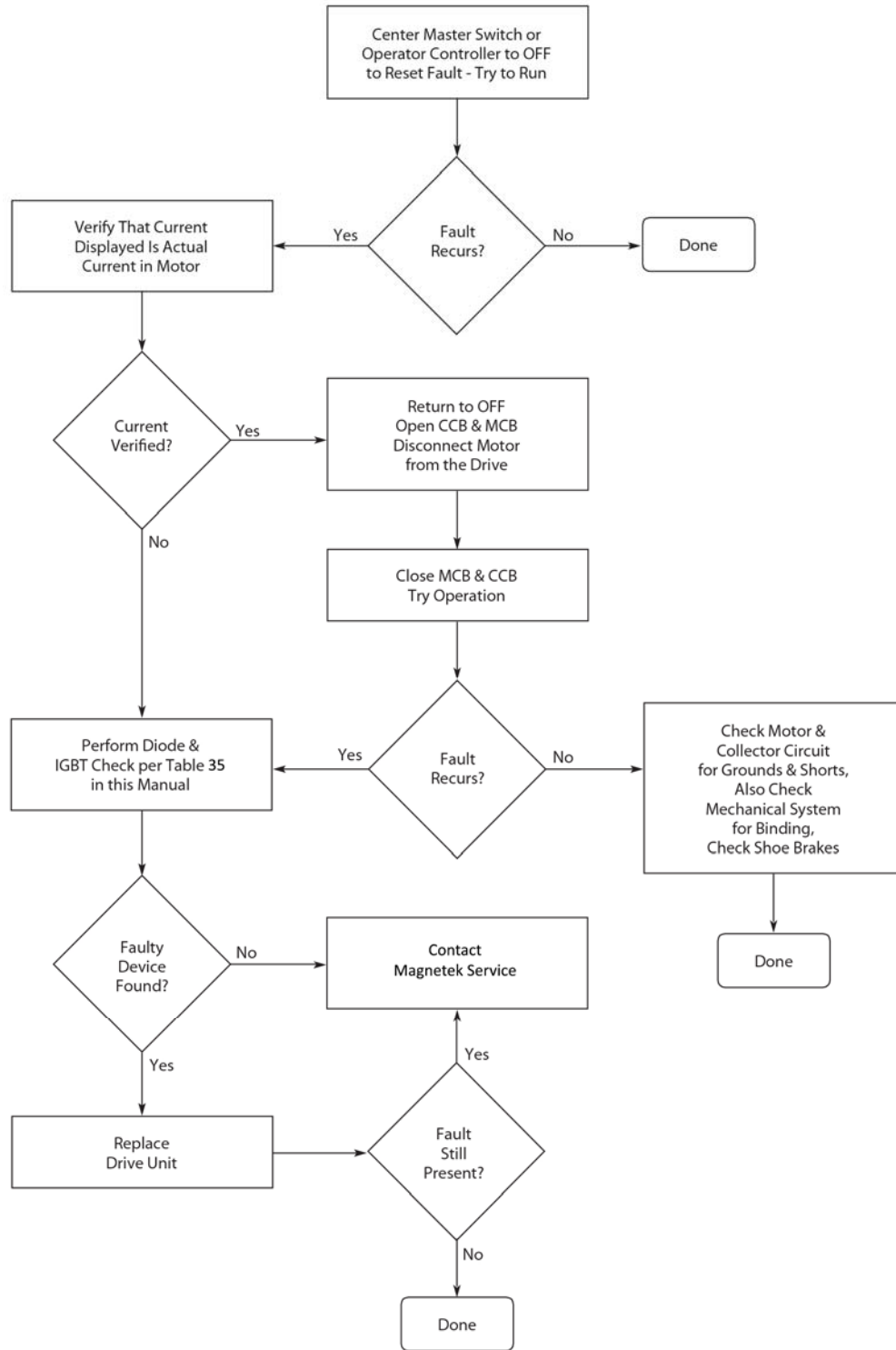
Figure 44: OC Overcurrent
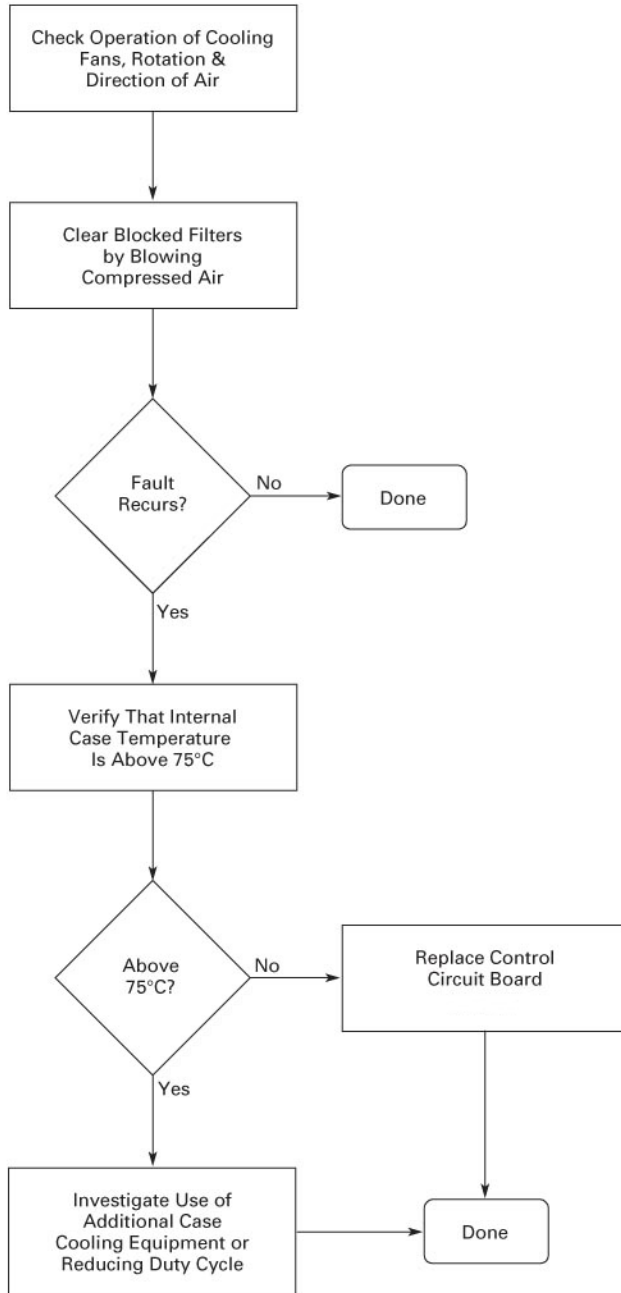
Figure 45: OA Ambient Overtemperature
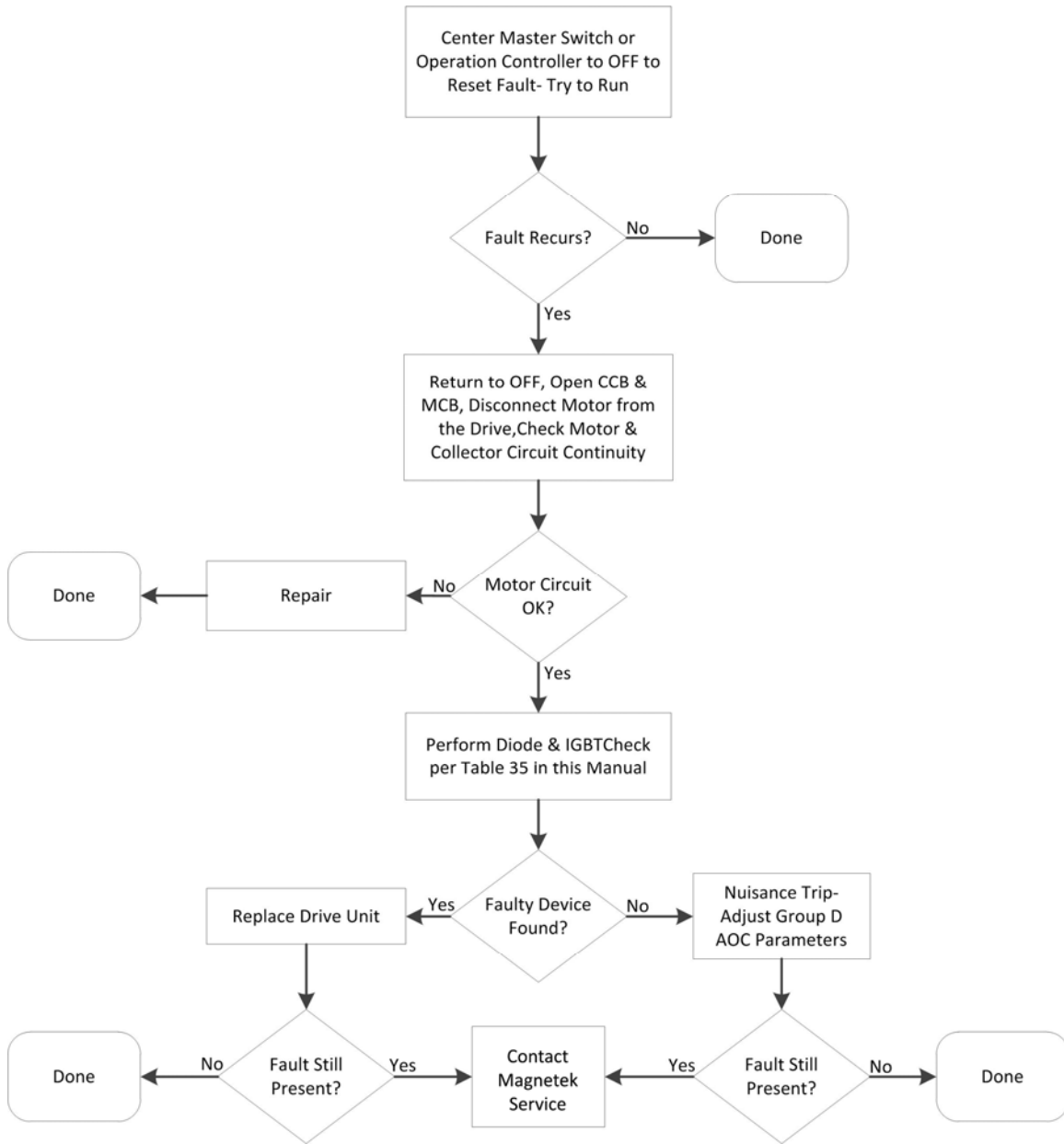
Figure 46: AOC Armature Open Circuit
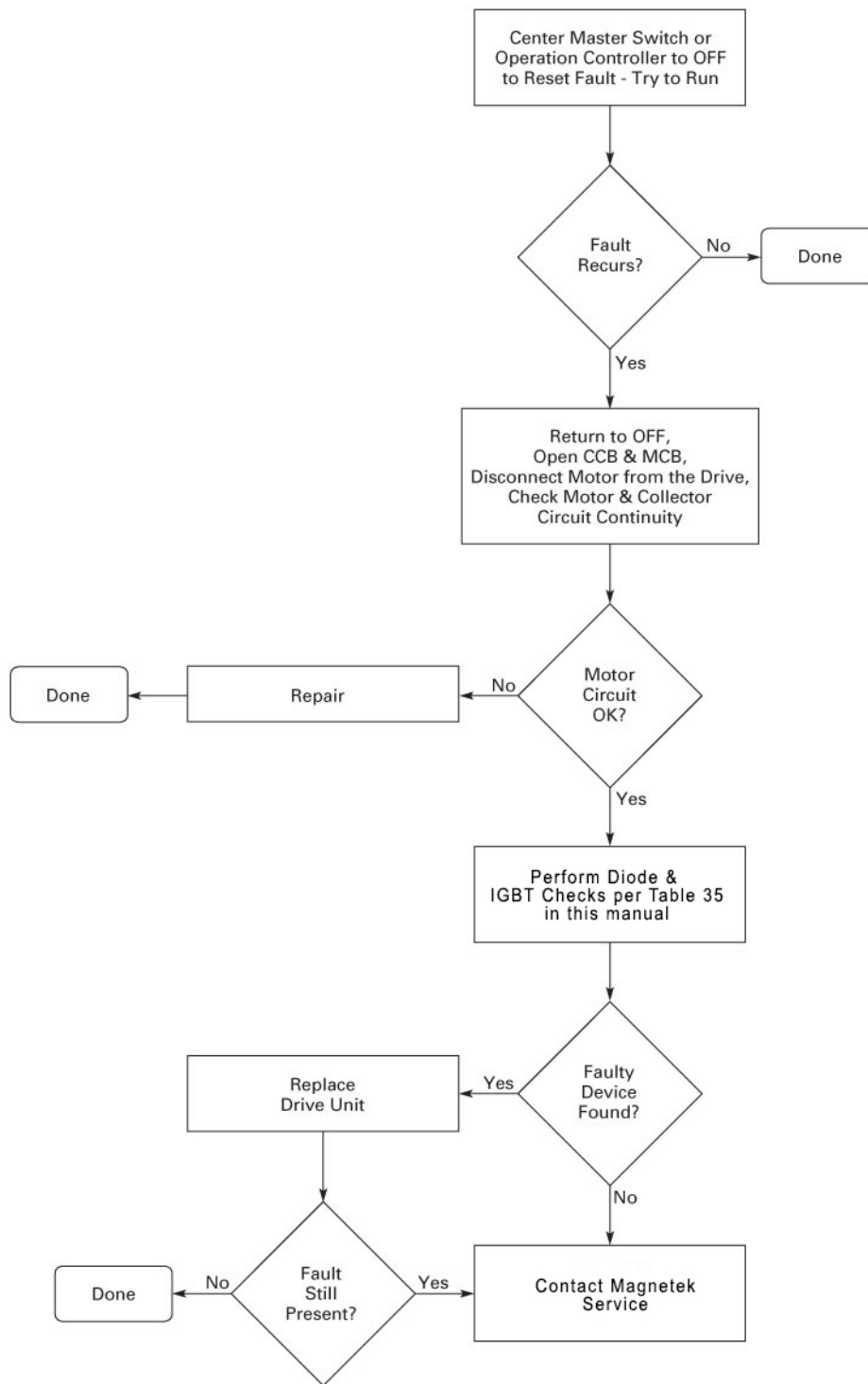
Figure 47: FL Field Loss
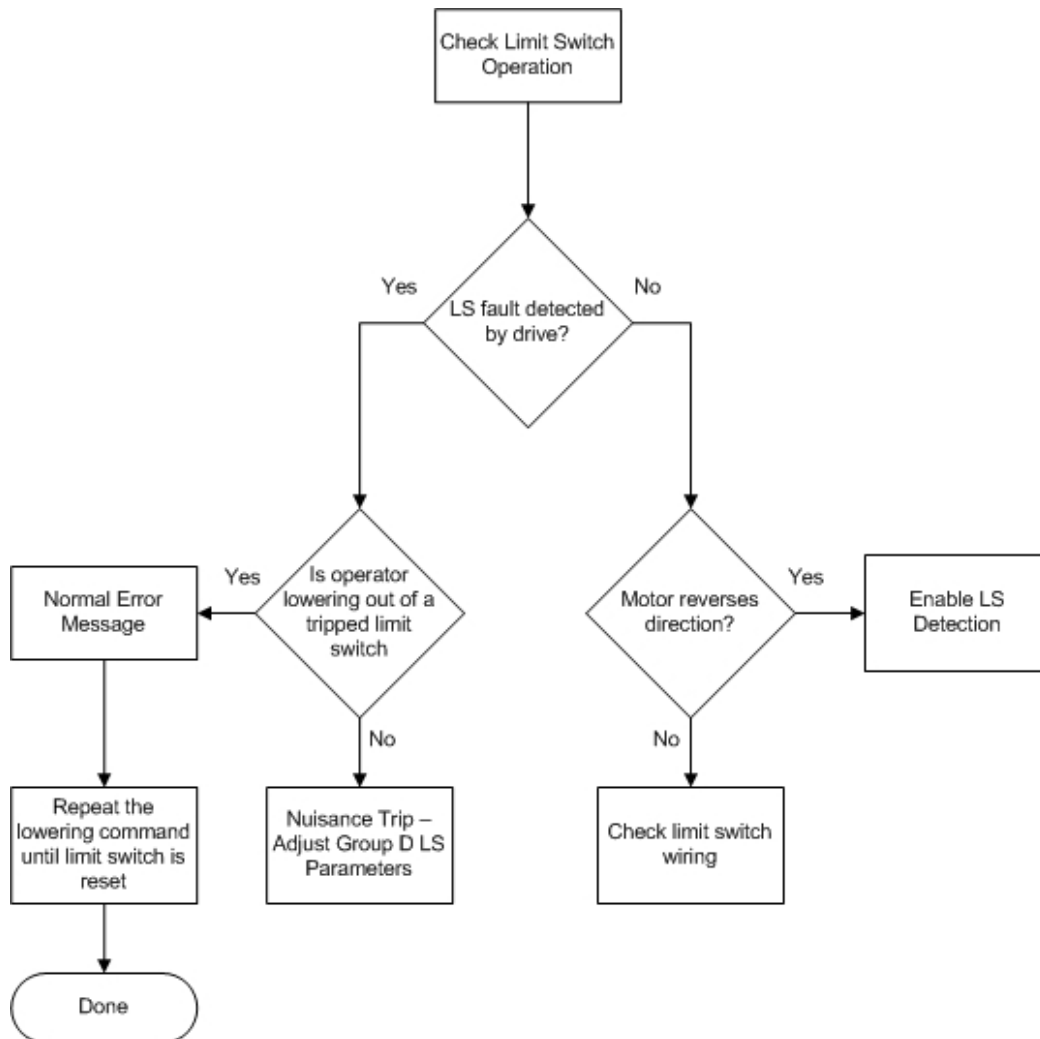
Figure 48: LS Limit Switch
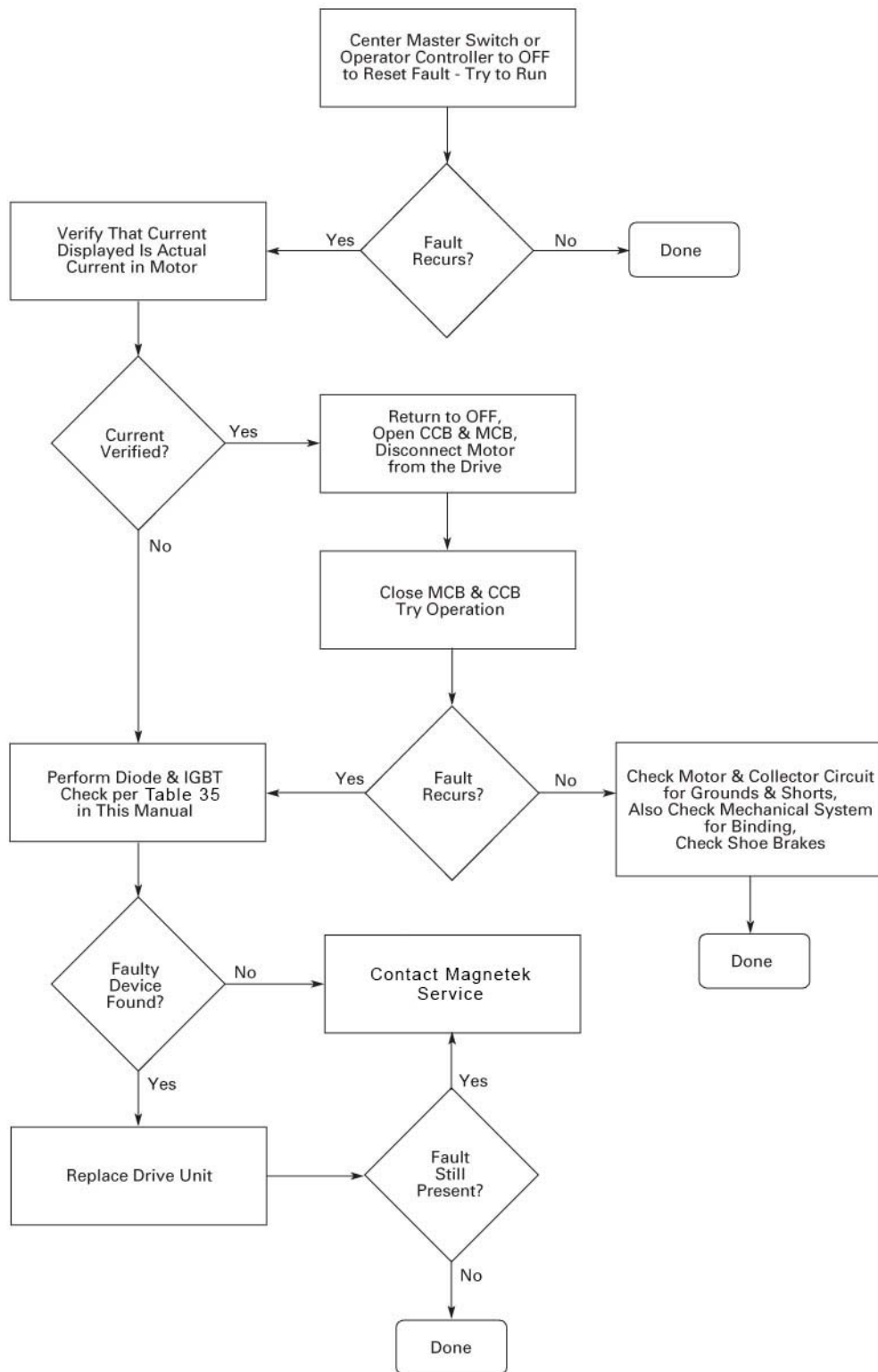
Figure 49: MOL Motor Overload

Appendix A – MODBUS RTU1 Communication

OmniPulse DDC Display Software version 2.00 and OmniPulse DDC Control Software version 3.xx are required to enable MODBUS RTU1 communication.

Parameters G16 through G20 and control board hardware settings must be set up to establish proper communication.

1. Protocol:

   1.1. The protocol implemented for drive communications is Modbus RTU1, as specified in the following documents:

   1.2. Modicon Modbus Protocol Reference Guide PI-MBUS-300 Rev. J

   1.3. MODBUS over Serial Line Specification & Implementation guide V1.0

2. Communications

   2.1. Electrical Specification

   2.2. Physical layer communications shall follow ANSI/TIA/EIA-232-F-1997 and ANSI/TIA/EIA-485-1998 specifications. RS-485 will be Two-Wire, or half duplex.

   2.3. Data rate options

   2.4. 9600 bps and 19.2 Kbps is implemented.

   2.5. 19.2 Kbps will be the default data rate.

   2.6. Addressing

3. Functionality

   3.1. Command set

   3.2. Parameter download

   3.3. Parameter download shall be accomplished using the MODBUS Read General Reference Function code (4).

   3.4. Parameter upload

   3.5. Parameter upload shall be accomplished using the MODBUS Write General Reference Function code (16).

   3.6. Parameter setting

   3.7. Parameter upload shall be accomplished using the MODBUS Write General Reference Function code (16).

   3.8. Diagnostic counters

   3.9. Network diagnostics will be accomplished using the MODBUS Diagnostics function code.

   3.10. Diagnostic sub functions are appropriate to the implementation.

   3.11. Control Commands

   3.12. Network direction control will be accomplished using the MODBUS Force Single Coil Function code (5) for writing, and Read Coil Status function code (1) for verification.

   3.13. Network Run/Stop control will be accomplished using the MODBUS Force Single Coil Function code (5) for writing, and Read Coil Status function code (1) for verification.

   3.14. Network discrete Speed Reference control will be accomplished using the MODBUS Force Single Coil Function code (5) for writing, and Read Coil Status function code (1) for verification.

3.15. Network analog Speed Reference control will be accomplished using the MODBUS Preset Single Register Function code (6) for writing, and Read Holding Register function code (3) for verification.

3.16. Parameter read and write access is limited to 10 values at a time in order to maintain control loop functionality.

4. Addressing

   4.1. Parameter Download (Read General Reference Function code (20)) and Upload and Setting (Write General Reference Function code (16)).

   4.1.1. Parameter Menus "A – D"

Parameter "A" Menu A00 – A31	Register (in hex)	Parameter "B" Menu B00 – B07	Register (in hex)	Parameter "C" Menu C00 – C09	Register (in hex)	Parameter "D" Menu D00 – D23	Register (in hex)
A00	00	B00	20	C00	40	D00	60
A01	01	B01	21	C01	41	D01	61
A02	02	B02	22	C02	42	D02	62
A03	03	B03	23	C03	43	D03	63
A04	04	B05	25	C04	44	D04	64
A05	05	B06	26	C05	45	D05	65
A06	06	B07	27	C06	46	D06	66
A07	07	B09	29	C07	47	D07	67
A08	08			C09	49	D08	68
A09	09					D09	69
A10	0A					D10	6A
A11	0B					D11	6B
A12	0C					D12	6C
A13	0D					D13	6D
A14	0E					D14	6E
A15	0F					D15	6F
A16	10					D16	70
A17	11					D17	71
A18	12					D18	72
A19	13					D19	73
A20	14					D20	74
A21	15					D21	75
A22	16					D22	76
A23	17					D23	77
A24	18					D24	78
A25	19					D25	79
A26	1A					D30	7E
A27	1B					D31	7F
A28	1C						
A29	1D						
A30	1E						
A31	1F						

4.1.2. Parameter Menus "E – H"

Parameter "E" Menu E00 – E31	Register (in hex)	Parameter "F" Menu F00 – F27	Register (in hex)	Parameter "G" Menu G00 – G25	Register (in hex)	Parameter "H" Menu H00 – H30	Register (in hex)
E00	80	F00	A0	G00	C0	H00	E0
E01	81	F01	A1	G01	C1	H01	E1
E02	82	F02	A2	G02	C2	H02	E2
E03	83	F03	A3	G03	C3	H03	E3
E04	84	F04	A4	G04	C4	H04	E4
E05	85	F05	A5	G05	C5	H05	E5
E06	86	F06	A6	G06	C6	H06	E6
E07	87	F07	A7	G08	C8	H07	E7
E08	88	F08	A8	G09	C9	H08	E8
E09	89	F09	A9	G10	CA	H09	E9
E10	8A	F10	AA	G11	CB	H10	EA
E11	8B	F11	AB	G12	CC	H11	EB
E12	8C	F12	AC	G13	CD	H12	EC
E13	8D	F13	AD	G14	CE	H13	ED
E14	8E	F14	AE	G15	CF	H14	EE
E15	8F	F15	AF	G16	D0	H15	EF
E16	90	F16	B0	G17	D1	H16	E0
E17	91	F17	B1	G18	D2	H17	F1
E18	92	F18	B2	G19	D3	H18	F2
E19	93	F19	B3	G20	D4	H19	F3
E20	94	F20	B4	G21	D5	H20	F4
E21	95	F21	B5	G22	D6	H21	F5
E22	96	F22	B6	G23	D7	H22	F6
E23	97	F23	B7	G24	D8	H23	F7
E24	98	F24	B8	G25	D9	H24	F8
E25	99	F25	B9			H25	F9
E26	9A	F26	BA			H26	FA
E27	9B	F27	BB			H27	FB
E28	9C	F28	BC			H28	FC
E29	9D	F29	BD			H29	FD
E30	9E					H30	FE
E31	9F						

4.2.   Control Commands (Force Single Coil Function code (05)).

Parameter	Coil Address High	Coil Address Low
Reset *	00	00
Enable	00	01
Lower (Reverse)	00	02
Hoist (Forward)	00	03
Second Speed	00	04
Third Speed	00	05
Fourth Speed	00	06
Fifth Speed	00	07

Force code 5 to address 0 forces all address to 0

4.3.   Control Commands (Read Coil Function code (01)).

Parameters	Coil Address High	Coil Address Low
Reset: 1 Enable: 1 Lower (Reverse): 1 Hoist (Forward): 1 Second Speed: 1 Third Speed: 1 Fourth Speed: 1 Fifth Speed: 1	00	00

4.4.   Speed Reference Commands (MODBUS Preset Single Register Function code (6) for writing, and Read Holding Register function code (3) for verification).

Parameters	Register Address High	Register Address Low
Analog IP1	00	00
Analog IP2	00	01

Parameter Listing

OmniPulse DDC Parameter Listing

Parameter No.	Parameter Name	Factory Default	Reference Page
A00	Armature Current	-	46
A01	Field Current	-	46
A02	Armature Voltage	-	46
A03	DC Bus Voltage	-	46
A04	Motor CEMF	-	46
A05	Flux	-	46
A06	Motor RPM	-	46
A07	Motor Torque	-	46
A08	Hook Load	-	46
A09	Input Power	-	46
A10	Energy Used (kW)	-	46
A11	Number of Operations	-	46
A12	Number of Operations Times 100	-	46
A13	Elapsed Hours	-	46
A14	Analog Input 1	-	47
A15	Analog Input 2	-	47
A16	Armature Current Ref	-	47
A17	Field Current Ref	-	47
A18	Speed Reference	-	47
A19	Upper Control Limit	-	47
A20	Lower Control Limit	-	47
A21	Logic Inputs	-	48
A22	Logic Outputs	-	48
A23	Heatsink Temp	-	49
A24	Ambient Temp	-	49
A25	Overload Level	-	49
A26	T1 Duty Cycle	-	49
A27	T2 Duty Cycle	-	49
A28	T3 Duty Cycle	-	49
A29	Control Status	-	49
A30	Fault Status	-	50
A31	Sequence Status	-	50

OmniPulse DDC Parameter Listing (continued)

Parameter No.	Parameter Name	Factory Default	Reference Page
B00	Password	0	51
B01	Access Level	Monitor	51
B02	Control Firmware Version	Monitor	51
B03	Subversion	Monitor	51
B05	Modbus AN 1	Modbus Analog Reference 1	51
B06	Modbus AN 2	Modbus Analog Reference 2	51
B07	TACH Coefficient	Monitor	51
B09	LS Level	Monitor	51
C00	Configuration	Set by D1P Pos 3	53, 97, 103
C01	Voltage Class	Set by D1P Pos 4	53, 97, 103
C02	Current Class	Set by D1P Pos 1 & 2	53, 97, 103
C03	Parallel Stacks	1	53, 97, 103
C04	Armature Setup	Int CT	53, 97, 103
C05	Input Bus Voltage	250	53, 97, 103
C06	Field Setup	Int CT	53, 97, 103
C07	Default Values	No Action	53, 97, 103
C09	Torque Follower (Travel mode only)	Disabled	53, 103
D00	Motor Rated Current	½ C02 Value	57, 97, 103
D01	Motor Rated Volts	C05 Value	57, 97, 103
D02	Motor Base Speed	400	57, 97, 103
D03	Motor Field Current	C06 Ext CT	57, 97, 103
D04	Current Limit Fwd (Hoist mode only)	125%	57, 97
D05	Current Limit Rev (Hoist mode only)	100%	57, 97
D06	Armature/Field	1.5	57, 97, 103
D07	Ground Fault	Disabled	57, 97, 103
D08	OH Alarm Level	85°C	57, 97, 103
D09	OH1 Trip Level	90°C	57, 97, 103
D10	LS Detection (Hoist mode only)	Disabled	57, 97
D11	LS Lower Det Lvl (Hoist mode only)	25%	57, 97
D12	LS Hoist Det Lvl (Hoist mode only)	15%	57, 97
D13	LS Backout Time	500	57, 97
D14	Slack Cable (Hoist mode only)	Disabled	57, 97
D15	Slack Cable Torque (Hoist mode only)	0.10%	57, 97, 103
D16	OH Fan Enable	60°C	57, 97, 103
D17	AOT Enable	75°C	57, 97, 103
D18	AOC Detection Level	20% (Hoist); 0% (Travel)	57, 97, 103
D19	AOC Detection Timer	100 ms	57, 97, 103
D20	3-Pt Flux Curve	Disabled	57, 97, 103
D21	Flux 25 IF	53.8%	58, 97, 103
D22	Flux 75 IF	93.5%	58, 97, 103
D23	Flux 200 IF	117.9%	58, 97, 103
D24	LS Detect Gain	1000	58, 97
D25	MS Fault Time	75 ms	58, 97
D30	Reset Attempts	3	58, 97, 103
D31	Reset Flt Sel	0104	58, 97, 103

OmniPulse DDC Parameter Listing (continued)

Parameter No.	Parameter Name	Factory Default	Reference Page
E00	Accel Time (Travel mode only)	5 sec	66, 103
E01	Decel Time (Travel mode only)	5 sec	66, 103
E02	Current Gain	0.5	66, 98, 103
E03	Hoist Stop Speed (Hoist mode only)	15%	66, 98
E04	Lower Stop Speed (Hoist mode only)	15%	66, 98
E05	Brake Rel Time	0 ms	66, 98, 103
E06	Speed P Gain	5	66, 98, 103
E07	Speed I Gain	0.1	66, 98, 103
E08	IR Comp Gain	0	66, 98, 103
E09	Start Delay	300 ms	66, 98, 103
E10	Stop Delay	0 ms	66, 98, 103
E11	Bypass Speed	0.00%	66, 98, 103
E12	Stop Speed (Travel mode only)	15%	66, 103
E13	DB Delay	300 ms (Hoist) 0 ms (Travel)	66, 98, 103
E14	DB Time	300 ms (Hoist) 0 ms (Travel	66, 98, 104
E15	Lower Min Field (Hoist mode only)	50%	66, 98
E16	Hoist Min Field (Hoist mode only)	50%	66, 98
E17	Economy Field	50%	66, 98, 104
E18	Minimum Field (Travel mode only)	50%	66, 98, 104
E19	Field Rate Change	32	66, 98, 104
E20	T Type	ON Delay TC	67, 98, 104
E21	T Time	1000 ms	67, 98, 104
E22	Micro SP Factor	1	67, 98, 104
E23	SB Rel PT	40%	67, 98, 104
E24	SB On Delay Time	0 ms	67, 98, 104
E25	SB Set Time	0 ms	67, 98, 104
E26	Stall Prot Time	5.0 sec	67, 98, 104
E27	Hoist Accel Time (Hoist mode only)	5.0 sec	67, 98
E28	Hoist Decel Time (Hoist mode only)	5.0 sec	67, 98
E29	Lower Accel Time (Hoist mode only)	5.0 sec	67, 98
E30	Lower Decel Time (Hoist mode only)	5.0 sec	67, 98
E31	Load Float Time	0.0 sec	67, 98, 104

OmniPulse DDC Parameter Listing (continued)

Parameter No.	Parameter Name	Factory Default	Reference Page
F00	Speed Ref Source	Cntr Switch	75, 99, 105
F01	Torque Ref Source	Cntr Switch	75, 105
F02	Hoist Speed 1 (Hoist mode only)	20%	75, 99
F03	Hoist Speed 2 (Hoist mode only)	40%	75, 99
F04	Hoist Speed 3 (Hoist mode only)	60%	75, 99
F05	Hoist Speed 4 (Hoist mode only)	80%	75, 99
F06	Hoist Speed 5 (Hoist mode only)	100%	75, 99
F07	Lower Speed 1 (Hoist mode only)	20%	75, 99
F08	Lower Speed 2 (Hoist mode only)	40%	75, 99
F09	Lower Speed 3 (Hoist mode only)	60%	75, 99
F10	Lower Speed 4 (Hoist mode only)	80%	75, 99
F11	Lower Speed 5 (Hoist mode only)	100%	75, 99
F12	Travel Speed 1 (Travel mode only)	20%	75, 105
F13	Travel Speed 2 (Travel mode only)	40%	75, 105
F14	Travel Speed 3 (Travel mode only)	60%	75, 105
F15	Travel Speed 4 (Travel mode only)	80%	75, 105
F16	Travel Speed 5 (Travel mode only)	100%	75, 105
F17	Travel Torque 1 (Travel mode only)	20%	75, 105
F18	Travel Torque 2 (Travel mode only)	40%	75, 105
F19	Travel Torque 3 (Travel mode only)	60%	75, 105
F20	Travel Torque 4 (Travel mode only)	80%	75, 105
F21	Travel Torque 5 (Travel mode only)	100%	75, 105
F22	Neutral Torque (Travel mode only)	2%	75, 105
F23	Plug Torque 1 (Travel mode only)	20%	75, 105
F24	Plug Torque 2 (Travel mode only)	40%	75, 105
F25	Plug Torque 3 (Travel mode only)	60%	75, 105
F26	Plug Torque 4 (Travel mode only)	80%	75, 105
F27	Plug Torque 5 (Travel mode only)	100%	75, 105
F28	Slowdown Torque	75%	75, 99, 105
F29	Travel Lim Trq	100%	75, 99, 105

OmniPulse DDC Parameter Listing (continued)

Parameter No.	Parameter Name	Factory Default	Reference Page
G00	Analog IP1 Type	0/+10 V	78, 100, 105
G01	Analog IP1 Gain	1	78, 100, 105
G02	Analog IP1 Bias	0.00%	78, 100, 105
G03	Tacho FS RPM	0 RPM	78, 100, 105
G04	Analog IP2 Type	0/+10 V	78, 100, 105
G05	Analog IP2 Gain	1	78, 100, 105
G06	Analog IP2 Bias	0.00%	78, 100, 105
G08	Analog Out Gain	1	78, 100, 105
G09	Analog Out Bias	0.00%	78, 100, 105
G10	Analog Out Function (X3-9 or X1-6)	Motor Speed	78, 100, 105
G11	Prog. 1P Function (X2-9 or SD on IFC)	Not Used	78, 100, 105
G12	Prog. OP1 Function (DB on IFC)	DB Contactor	78, 100, 106
G13	Prog. OP2 Function (X1-2)	Controller Fault	78, 100, 106
G14	Prog. OP3 Function (X1-3)	Controller Ready	78, 100, 106
G15	Prog. OP4 Function (X1-4 or SB on IFC)	Shunt Brake	78, 100, 106
G16	Serial Baud Rate	19200	79, 100, 106
G17	RS232/485 Select	RS232	79, 100, 106
G18	Serial Format	8-bit Even Parity	79, 100, 106
G19	Modbus Address	1	79, 100, 106
G20	Drive Control	Hwd-IO	79, 100, 106
G21	Tach Loss Detect	Disabled	79, 100, 106
G22	Rev Tach Detect	25%	79, 100, 106
G23	Tach Loss CEMF	25%	79, 100, 106
G24	Tach Loss FB Detect	10%	79, 100, 106
G25	Speed 5 Func	Speed 5	79, 100, 106

OmniPulse DDC Parameter Listing (continued)

Parameter No.	Parameter Name	Factory Default	Reference Page
H00	Fault 1	-	84
H01	Fault 1 Time (Hours)	-	84
H02	Fault 2	-	84
H03	Fault 2 Time (Hours)	-	84
H04	Fault 3	-	84
H05	Fault 3 Time (Hours)	-	84
H06	Fault 4	-	84
H07	Fault 4 Time (Hours)	-	84
H08	Fault 5	-	84
H09	Fault 5 Time (Hours)	-	84
H10	Fault 6	-	84
H11	Fault 6 Time (Hours)	-	84
H12	Fault 7	-	84
H13	Fault 7 Time (Hours)	-	84
H14	Fault 8	-	84
H15	Fault 8 Time (Hours)	-	84
H16	Fault 9	-	84
H17	Fault 9 Time (Hours)	-	84
H18	Fault 10	-	84
H19	Fault 10 Time (Hours)	-	84
H20	Fault 11	-	84
H21	Fault 11 Time (Hours)	-	84
H22	Fault 12	-	84
H23	Fault 12 Time (Hours)	-	84
H24	Fault 13	-	84
H25	Fault 13 Time (Hours)	-	84
H26	Fault 14	-	84
H27	Fault 14 Time (Hours)	-	84
H28	Fault 15	-	84
H29	Fault 15 Time (Hours)	-	84
H30	Fault Hist. Reset	-	84