
# MagnePulse® DMC Series 2 Digital Magnet Controller **Technical Manual**

MAGNETEK

Firmware Number: 41330
Part Number: 144-47031 R0
February 2021

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# SERVICE INFORMATION

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# PRODUCT SAFETY

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

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

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

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

## Product Warranty Information

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

## WARRANTY INFORMATION

FOR INFORMATION ON MAGNETEK'S PRODUCT WARRANTIES BY PRODUCT TYPE, PLEASE VISIT WWW.COLUMBUSMCKINNON.COM/MAGNETEK.

**WARNING**

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

# DANGER, WARNING, CAUTION and NOTE Statements

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

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

**DANGERS, WARNINGS and CAUTIONS**

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

**DANGER**

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

**WARNING**

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

**CAUTION**

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

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

**DANGERS, WARNINGS and CAUTIONS SHOULD NEVER BE DISREGARDED.**

**Registered Trademarks**

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# Table of Contents

# 1 Introduction

**WARNING**

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

Do not check signals during operation.

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

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

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

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

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

Install adequate branch circuit protection per applicable codes. Failure to do so may result in equipment damage and/or personal injury.

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

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

## 1.1 General Information

Magnetek's MagnePulse DMC Magnet Controller provides reduced and reversing current control of DC industrial lifting magnets.

## 1.2 Key Features

- 2.5 to 2000 Amp DC magnet control capacity
- Reversible current for magnet cleaning
- Programmable current control for increased accuracy, efficiency, and longer magnet life
- X-Press Programming™ for short setup times
- Modular construction, with easily accessible front wired components
- Decreased power consumption – reduced current maintains full load
- Numerous safety circuits for maximum protection of personnel and components
- DLS4 display keypad for user-friendly monitoring, data logging, and troubleshooting
- Solid-state design that eliminates wearing parts and reduces maintenance downtime

**Table 1-1: Typical Equipment List**

| Quantity | Item Description |
|---|---|
| 1 | Magnet controller in NEMA Type 1 enclosure (standard) or optional NEMA Type 1 gasketed, NEMA Type 3, NEMA Type 4 or NEMA Type 12 enclosure, or open panel |
| 1~10 | Industrial Lifting Magnet(s) |
| 1 | Operator Controls |
| 1 | Dynamic Braking (DB) Transistor |
| 1 | Dynamic Braking (DB) Resistor |

## 1.3 Receiving Checklist

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, purchase order and received items, contact Magnetek to resolve.

## 1.4 Assessing the System Requirements

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

- Magnet control method(s) - i.e., stepped, analog, serial communications
- Power source and magnet ratings, including the number of magnets to be controlled
- Power source location
- Wire size
- Grounding location and method
- Control wiring source and voltage rating - i.e., cab, pendant, radio, 24VDC, 120VAC, 230VDC, etc.

## 1.5 Assessing the Drive Environment

When choosing a location for MagnePulse DMC Series 2, perform the following steps:

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

## 1.6 General Specifications

**Table 1-2: Voltage and Current Ratings**

| 200 – 320 Volts | | | 360 – 600 Volts | | |
|---|---|---|---|---|---|
| Model Number | Max. Cold Magnet Amps | NEMA Rating | Model Number | Max. Cold Magnet Amps | NEMA Rating |
| LN2067-DMC-S2 | 67 | 2 | HN2067-DMC-S2 | 67 | 2 |
| LN3133-DMC-S2 | 133 | 3 | HN3133-DMC-S2 | 133 | 3 |
| LN4200-DMC-S2 | 200 | 4 | HN4200-DMC-S2 | 200 | 4 |
| LN5400-DMC-S2 | 400* | 5 | HN5400-DMC-S2 | 400* | 5 |
| LN5400F-DMC-S2 | 400 | 6~8L | HN5400F-DMC-S2 | 400 | 6~8L |

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

## Table 1-3: DMC-S2 Models with Remote Keypad Assemblies

| Model Number | Part No. | Model Number | Part No. |
|---|---|---|---|
| LN2067-DMC-S2-RK | 144-47055 | HN2067-DMC-S2-RK | 144-47059 |
| LN3133-DMC-S2-RK | 144-47056 | HN3133-DMC-S2-RK | 144-47060 |
| LN4200-DMC-S2-RK | 144-47057 | HN4200-DMC-S2-RK | 144-47061 |
| LN5400-DMC-S2-RK* | 144-47058 | HN5400-DMC-S2-RK* | 144-47062 |

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

## Table 1-4: Electrical Ratings

| Description | | Specification |
|---|---|---|
| **Power** | | |
| Current Range | | 67 Amps to 2000 Amps, continuous (can control magnets as low as 2.5A with 20 Amp external CT board) |
| 1 Minute Overload Capability<br>3 Second Overload Capability | | 150% continuous rating heatsink temperature < 230°F (110°C)<br>200% continuous rating heatsink temperature < 185°F (85°C) |
| Supply Bus Voltage<br>+10% to -20% (including DC source ripple) | | 200 to 320 VDC (Low-Voltage models)<br>360 to 600 VDC (High-Voltage models) |
| Grounding Configurations | | Full Floating, Grounded Positive, or Grounded Negative |
| DV/DT Rise | | 1500 volts per microsecond maximum |
| Switching Frequency | | 1 kHz |
| **Control I/O** | | |
| Digital Inputs | DMC-S2-CONTROL | 12 inputs (24 VDC) |
| | DMC-230VIF | 9 inputs (200-300 VDC) - Inputs shared with DMC-S2-CONTROL |
| | DMC-120A60IF | 8 inputs (120 VAC, +10/-15%, 60±3 Hz) |
| Digital Outputs | DMC-S2-CONTROL | 4 relay outputs (up to 120 VAC or 30 VDC, 5A) |
| | DMC-230VIF | 3 relay outputs (230 VDC, 1A) |
| | DMC-120A60IF | 2 relay outputs, 1 main line (120 VAC/30 VDC, 1A) |
| Analog Inputs | DMC-S2-CONTROL | 2 inputs (0-10 VDC or 4-20 mA, 250Ω) |
| Analog Outputs | DMC-S2-CONTROL | 2 outputs (0-10 VDC, -10 to +10 VDC or 4-20 mA, 250Ω) |
| **Communication** | | |
| RS-232 | | Onboard Display, Door Mount Display, or PC Channel |
| RS-485 | | PC Channel or PLC Channel |
| USB | | PC Channel (mounts as COM port) |
| **Protective Functions** | | |
| Power Loss | | Power loss ride-through duration is dependent on magnet and drive size. |
| Undervoltage | | Adjustable trip level: 125VDC for low voltage, 250VDC for high voltage (default) |
| Drive Short-Circuit Protection | | Current Control Overload Trip<br>IGBT Individual Overload Trip<br>IGBT Overcurrent Safe Failure Mode |

## Table 1-4: Electrical Ratings (Continued)

| Description | Specification |
|---|---|
| Drive Thermal | Heat Sink Overtemperature Alarm and Shutdown<br>Ambient Overtemperature Shutdown |
| Magnet Overload | Trip when magnet current is greater than 110% |
| Magnet Continuity | Magnet connections are verified at the start of each cycle. |
| Fuse Protection | DC bus Power Fuse<br>Interface Board Fused |
| Charge Indicator | Visual indicator on drive unit indicating charge state on the capacitor bank.<br>Backlight display indicates control voltage presence. |
| Magnet Ground Fault Detection | Trip level is hardware set and adjustable. |

## Table 1-5: Environmental Specifications

| Description | Specification |
|---|---|
| **Temperature** | |
| Ambient Operating Temperature | 14°F (no frost) to 149°F (-10°C [no frost] to +65°C) |
| Storage Temperature | -40°F to 149°F (-40°C to +65°C) |
| Relative Humidity | < 90% No Condensation |
| **Altitude** | |
| Altitude | 1000 meters (3300 feet), 3000 meters (9900 feet) max. with derate |
| **Deration** | |
| Temperature | 2% per °C above 50°C (122°F) |
| Altitude | 1% for every 100 meters above 1000 meters |
| **EMC** | |
| Immunity and Emissions | Complies with EN50081-2 |
| **Vibration/Shock** | |
| Vibration | Complies with EN 60068-2-64 |
| Shock | Complies with EN 60068-2-27 |

# 2 Installation

**WARNING**

- When preparing to mount the MagnePulse DMC Series 2 drive, lift it by its base. Never lift the drive by the front cover, as doing so may cause drive damage or personal injury.
- Mount the drive on nonflammable material.
- The MagnePulse DMC Series 2 drive generates heat. For the most effective cooling possible, mount it vertically. For more details, refer to the heat loss data in ***Table 2-2 on page 23***.
- When mounting units in an enclosure, install a fan or other cooling device to keep the enclosure temperature below 149°F (65°C).

Failure to observe these warnings may result in equipment damage.

This chapter explains the following:

- Choosing a location
- Components and external devices
- Drive environment
- Drive installation

This section will also cover information on the components that interconnect with MagnePulse DMC Series 2.

## 2.1 Choosing a Location

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

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

## 2.2 Standard MagnePulse DMC Series 2 Drive Components

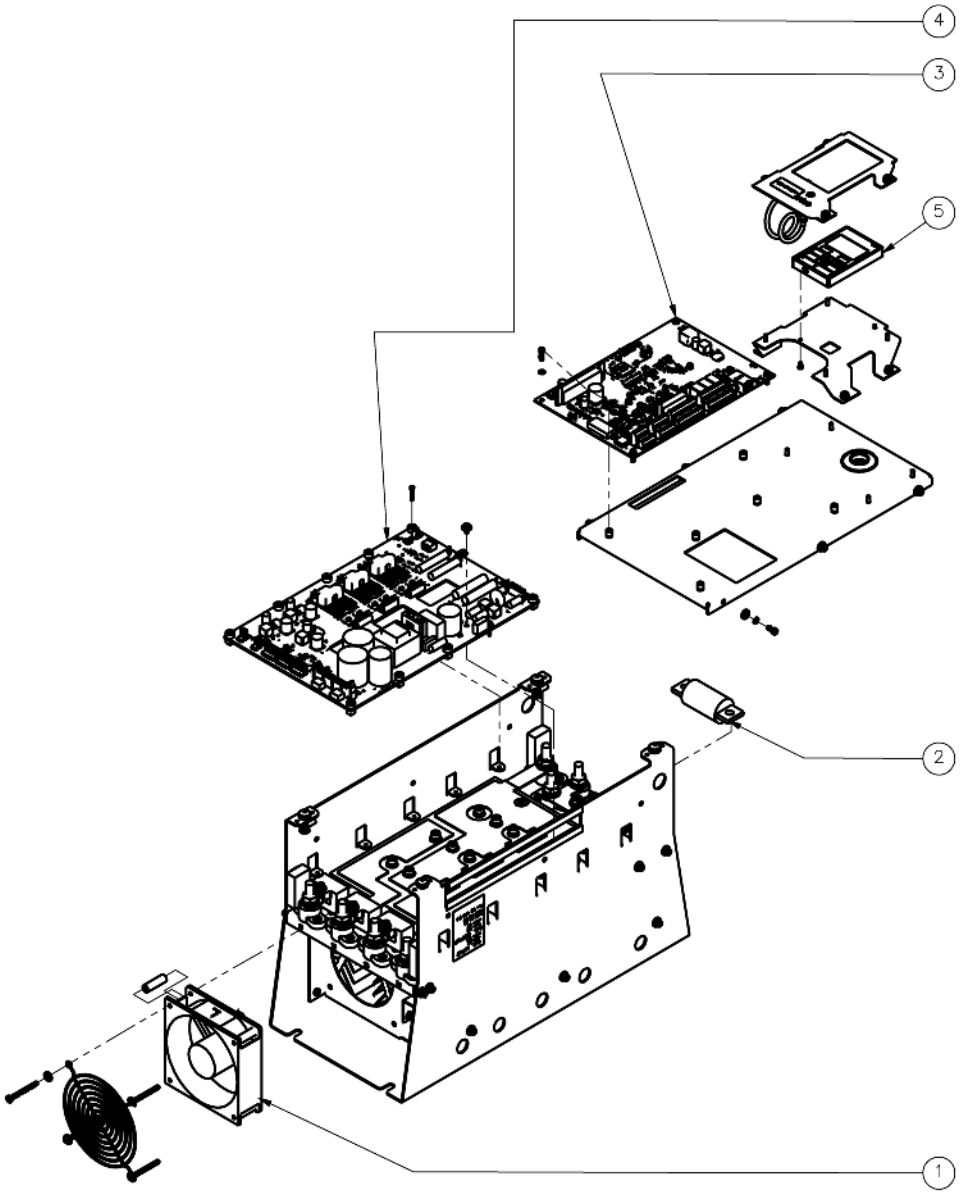



**Figure 2-1: DMC-S2 Small Chassis Drive**

| Item No. | Catalog Number | Part Number | Component Description |
|---|---|---|---|
| 1 | FAN-NEMA-2/3-24VDC-95CFM | 144-45266 | Fan, 24VDC, 4 in., 95 CFM |
| 2 | FUSE-NEMA-2/3-150A-500V | 144-45065 | Fuse, 150A, 500V, 2.75 in. |
| 3 | DMC-S2-CONTROL | 144-47043 | Control Board |
| 4 | DDC-LN3-GATE6 | 144-47030 | NEMA 2 & 3 Gate Driver Board, Low Voltage |
| 5 | DLS4-SPARE | 144-27084 | DLS4 Display Keypad |

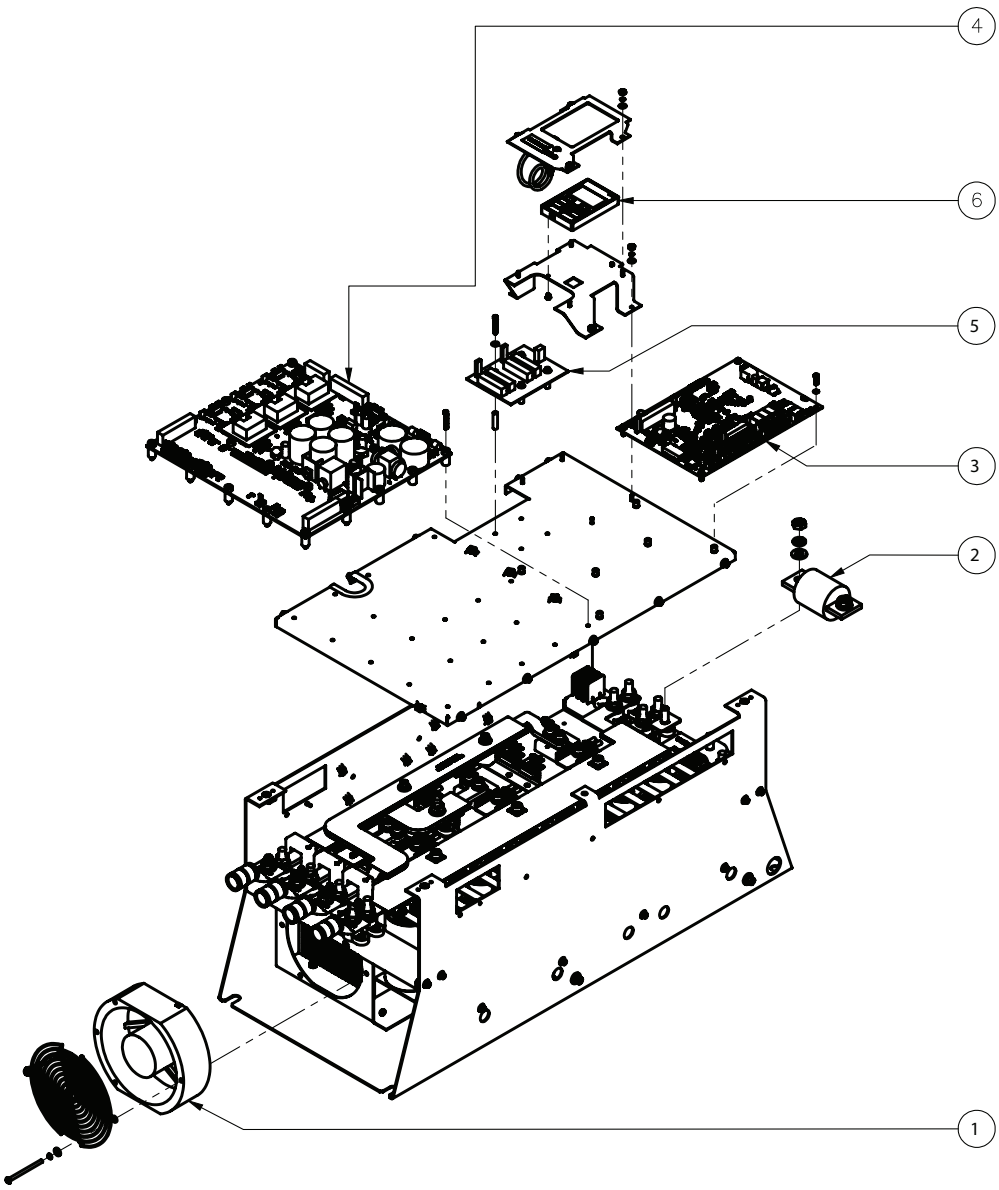



**Figure 2-2: DMC-S2 Large Chassis Drive (Low Voltage)**

| Item No. | Catalog Number | Part Number | Component Description |
|---|---|---|---|
| 1 | FAN-NEMA-4/5-24VDC-290CFM | 144-45090 | Fan, 24VDC, 4 in., 290 CFM |
| 2 | FUSE-NEMA-4/5-500A-500V | 144-45066 | Fuse, 500A, 500V, 3.25 in. |
| 3 | DMC-S2-CONTROL | 144-47043 | Control Board |
| 4 | DDC-LN5-GATE7 | 144-45384 | NEMA 4 & 5 Gate Driver Board, Low Voltage |
| 5 | DLS4-SPARE | 144-27084 | DLS4 Display Keypad |
| 6 | DDC-DISCHARGE | 144-45064 | Discharge Board |

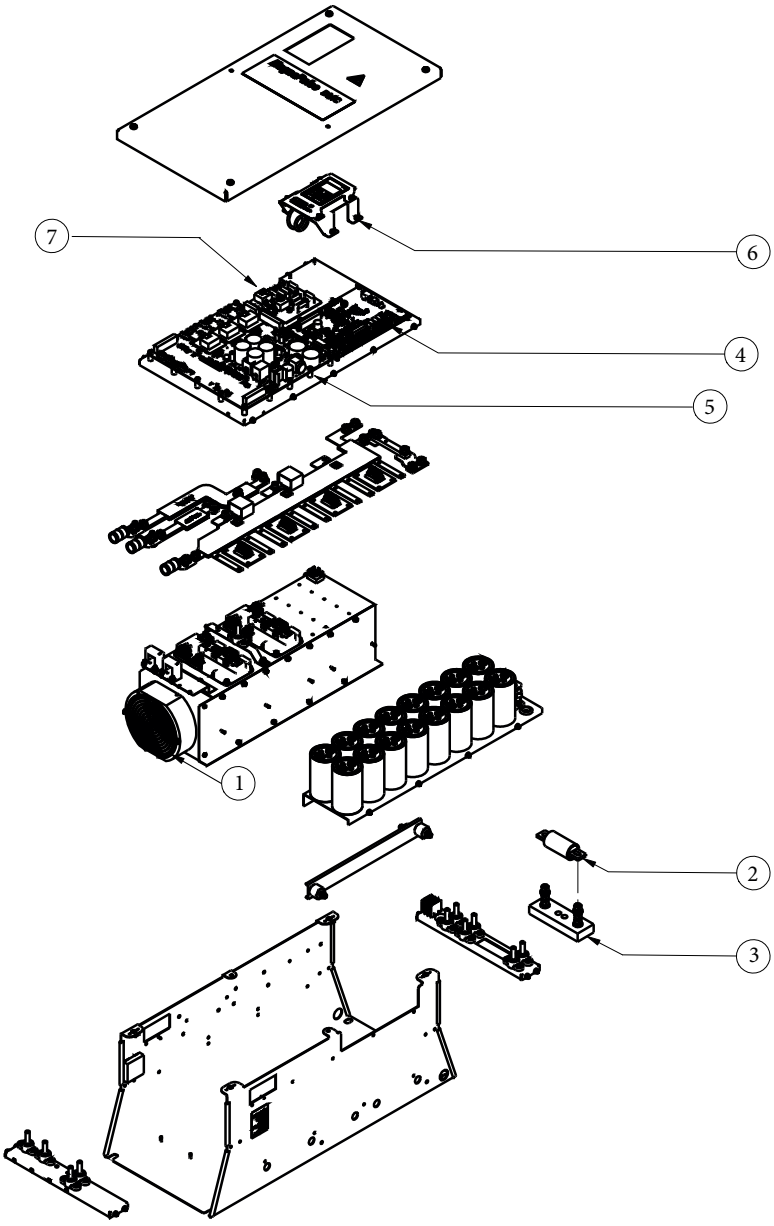



**Figure 2-3: DMC-S2 Large Chassis Drive (High Voltage)**

| Item No. | Catalog Number | Part Number | Component Description |
|---|---|---|---|
| 1 | FAN-NEMA-4/5-24VDC-290CFM | 144-45090 | Fan, 24VDC, 4 in., 290 CFM |
| 2 | FUSE-NEMA-4/5-400A-700V | 144-45550 | Fuse, 400A, 700V |
| 3 | FUSE-HOLDER-NEMA-4/5-HV | 144-45551 | Fuse Holder |
| 4 | DMC-S2-CONTROL | 144-47043 | Control Board |
| 5 | DDC-HN5-GATE7 | 144-45385 | NEMA 4 & 5 Gate Driver Board, High Voltage |
| 6 | DLS4-SPARE | 144-27084 | DLS4 Display Keypad |
| 7 | DDC-S2-HV-ISO | 144-47020 | Isolation Board |

### 2.2.1 Optional Drive Components

| Catalog Number | Part Number | Component Description |
|---|---|---|
| DMC-120A60IF | 144-45357 | 120VAC/60Hz Interface Board |
| DDC-230VIF | 144-45007 | 230VDC Interface Board |
| DDC-EXT-CT | 144-45076 | External CT Board |

### 2.2.2 As-Required External Components

- DB Transistor
- DB Resistor
- External bus dissipation power loss resistor(s) and switchgear

### 2.2.3 Required External Devices

- DC Magnet
- User input device (pendant, joystick, PC, PLC, radio, or infrared control)
- External circuit protection devices (fuses or circuit breakers)
- Adequate surge suppressors on contactor coils

## 2.3 Discharge Resistors, Dynamic Braking Units (DBU), and DBU Resistors

**Table 2-1: Recommended DC Bus Discharge Resistors**

| 200 – 320V Models | | | 360 – 600V Models | | |
|---|---|---|---|---|---|
| **Model** | **Max. Cold Magnet Amps** | **Discharge Resistor** | **Model** | **Max. Cold Magnet Amps** | **Discharge Resistor** |
| LN2067-DMC-S2 | 67 | EDB2009CT | HN2067-DMC-S2 | 67 | EDB4007CT |
| LN3133-DMC-S2 | 133 | | HN3133-DMC-S2 | 133 | |
| LN4200-DMC-S2 | 200 | EDB4007CT | HN4200-DMC-S2 | 200 | |
| LN5400-DMC-S2 | 400* | | HN5400-DMC-S2 | 400* | |
| LN5400F-DMC-S2 | 400 | | HN5400F-DMC-S2 | 400 | |

** The 400 Amp controller is used as the master drive with up to four follower controllers (LN5400F-DMC-S2 or HN5400F-DMC-S2)*

**Table 2-2: Recommended DBU and DBU Resistor***

| Model | Max. Cold Magnet Amps | DBU | DBU Resistors |
|---|---|---|---|
| LN2067-DMC-S2 | 67 | CDBR-2022D | EDB2067-DMCWL |
| LN3133-DMC-S2 | 133 | CDBR-2055D | EDB2133-DMCWL |
| LN4200-DMC-S2 | 200 | CDBR-2110D | EDB2200-DMCWL |
| LN5400-DMC-S2 | 400 | CDBR-2110D (qty. 2) | EDB2200-DMCWL (qty. 2) |

** Consult factory for DBU and DBU Resistor selections for high voltage DMC-S2 models.*

# 2.4 Storage

## 2.4.1 Long-Term Storage

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

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

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

## 2.4.2 Bus Capacitor Reforming Procedure

1. Connect the control inputs L1 (+), 7 (+), 8 (-) and L2 (-) to a rectifier with a variac input as shown in ***Figure 2-4 on page 19***.
2. Make sure the variac voltage setting is at its minimum so that when input power is applied to the variac, the output of the rectifier will be at or near 0 VDC.
3. Apply power to the variac, listening for abnormal sounds and watching for abnormal visual indications in the control. If the variac has an output current indication, make sure the current is near zero minimum output voltage applied.
4. Slowly ramp the variac output voltage according to the plot in ***Figure 2-5 on page 20*** until nominal rated input voltage is reached. Keep in mind that while increasing the variac output voltage, the current will momentarily increase as is necessary to charge the capacitors.
5. Keep the rated voltage constant for 30 to 60 minutes while monitoring the drive control board for abnormalities.
6. Once 30 to 60 minutes has elapsed, remove power and install drive for intended use.
   If any abnormal indications occur during this process, it is recommended that the process be repeated. Otherwise, this completes the capacitor reforming procedure.

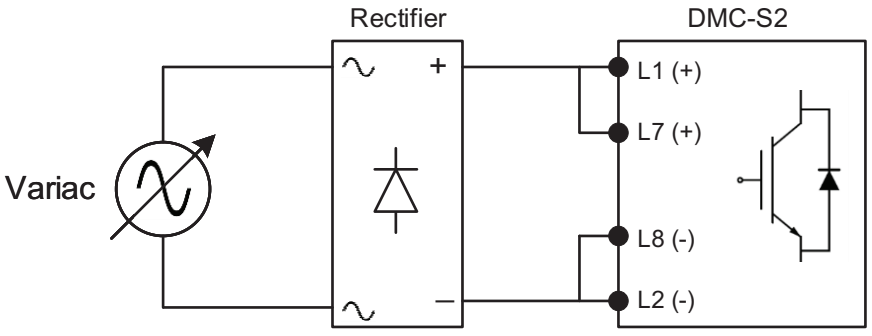



**Figure 2-4: DC Bus Capacitor Reforming Connections**

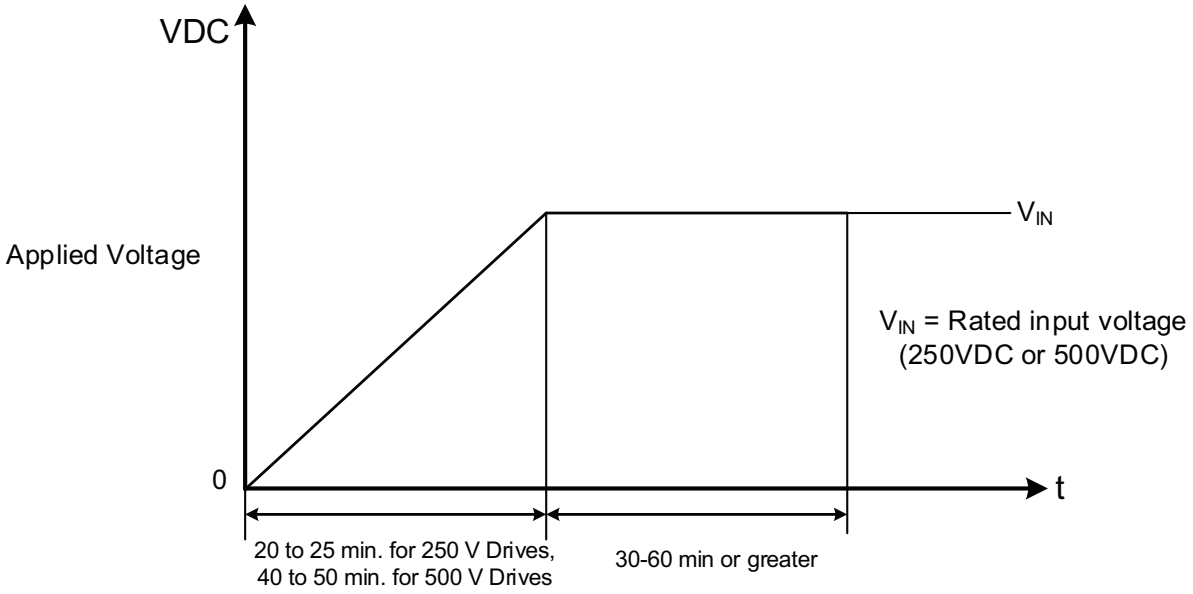



**Figure 2-5: DC Bus Capacitor Reforming Timing Diagram**

## 2.5 Installing the Drive

Adhere to the following guidelines during the installation of one or more MagnePulse•DMC-S2 Drive(s):

1. Ensure the drive will be used in a proper environment. ***See Section 1.5 on page 11.***
2. Select the necessary components to complete a drive system applicable to the system design and load requirements.
3. Determine the sizes and connection locations for the drive components and external devices.
4. Ensure the drive is installed with the proper orientation on the subpanel to maintain proper cooling. ***See Figure 2-6 on page 21*** and ***Figure 2-7 on page 22***).
5. Use a heater or air conditioner to maintain the temperature ratings of the drive as listed under the environmental specifications in ***Table 1-5 on page 13***.
6. Evaluate and select a power supply for which its type, configuration, and capacity can meet the requirements of the DMC-S2 drive electrical ratings (see the specifications listed in ***Table 1-4 on page 12***).
7. Apply best engineering practices in wire layout and routing, such as ensuring that the drive control circuit and power circuit wires are perpendicular to each other at any point they cross.
8. Keep the drive control circuitry and power circuitry separated on the terminal block or strip.
9. Keep power and control festoon wiring in separate cables.
10. Ensure the drive can be properly grounded to meet requirements set forth by local codes, ordinances, and/or agency standards.
11. Before drive power up, review all electrical connections to the magnet, drive power terminals, control board, and other external devices (interface board, external CT boards, etc.) as illustrated throughout ***Section 3 on page 24***.

## 2.6 Drive Derating Data

### 2.6.1 Temperature Derating

To ensure the maximum performance life, the drive output current must be derated when the drive is installed in areas with high ambient temperature or if drives are mounted side-by-side in a cabinet. Derate drive output current by 2% for every °C above 50°C (122°F).

### 2.6.2 Altitude Derating

Drives are affected by altitudes above 1000 m. Derate the drive output current by 1% for every 100 m above 1000 m, up to 3000 m altitude.

## 2.7 Chassis Dimensions and Weight

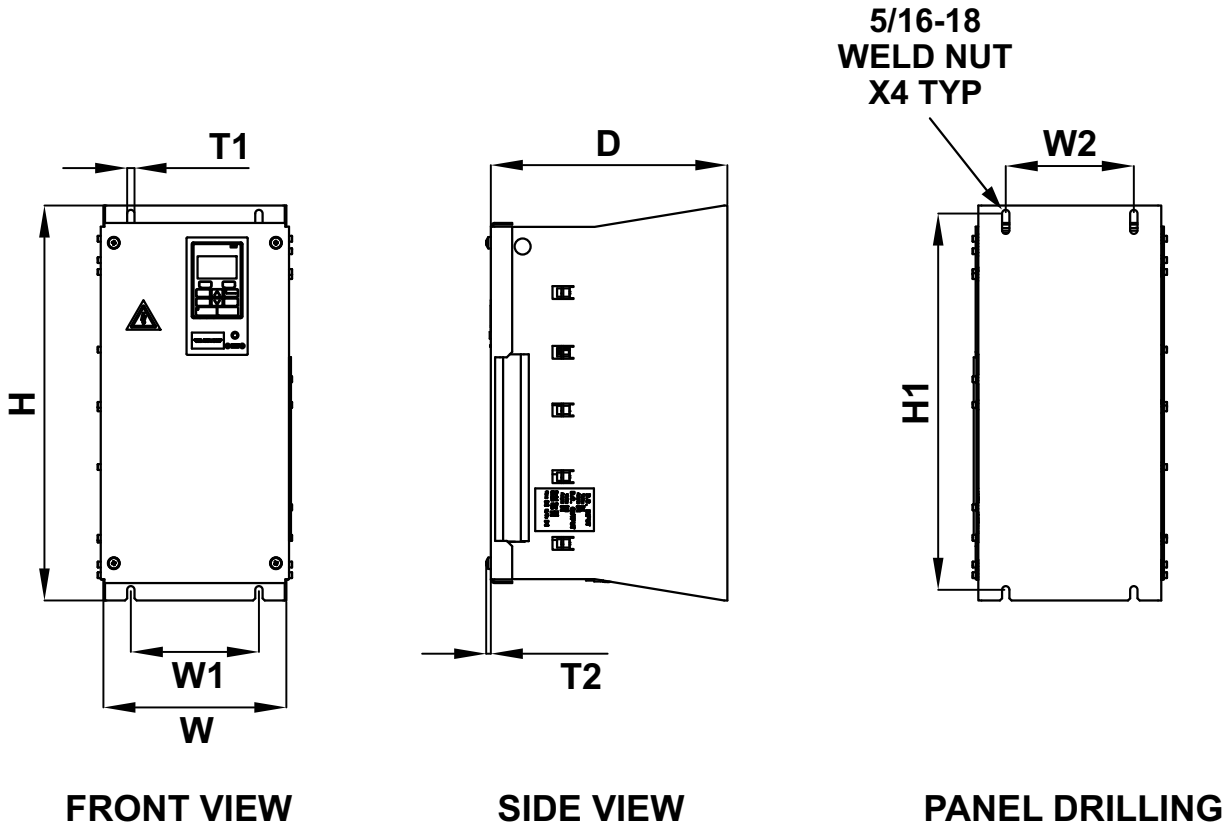



**Figure 2-6: Small Chassis (NEMA 2 & 3)**

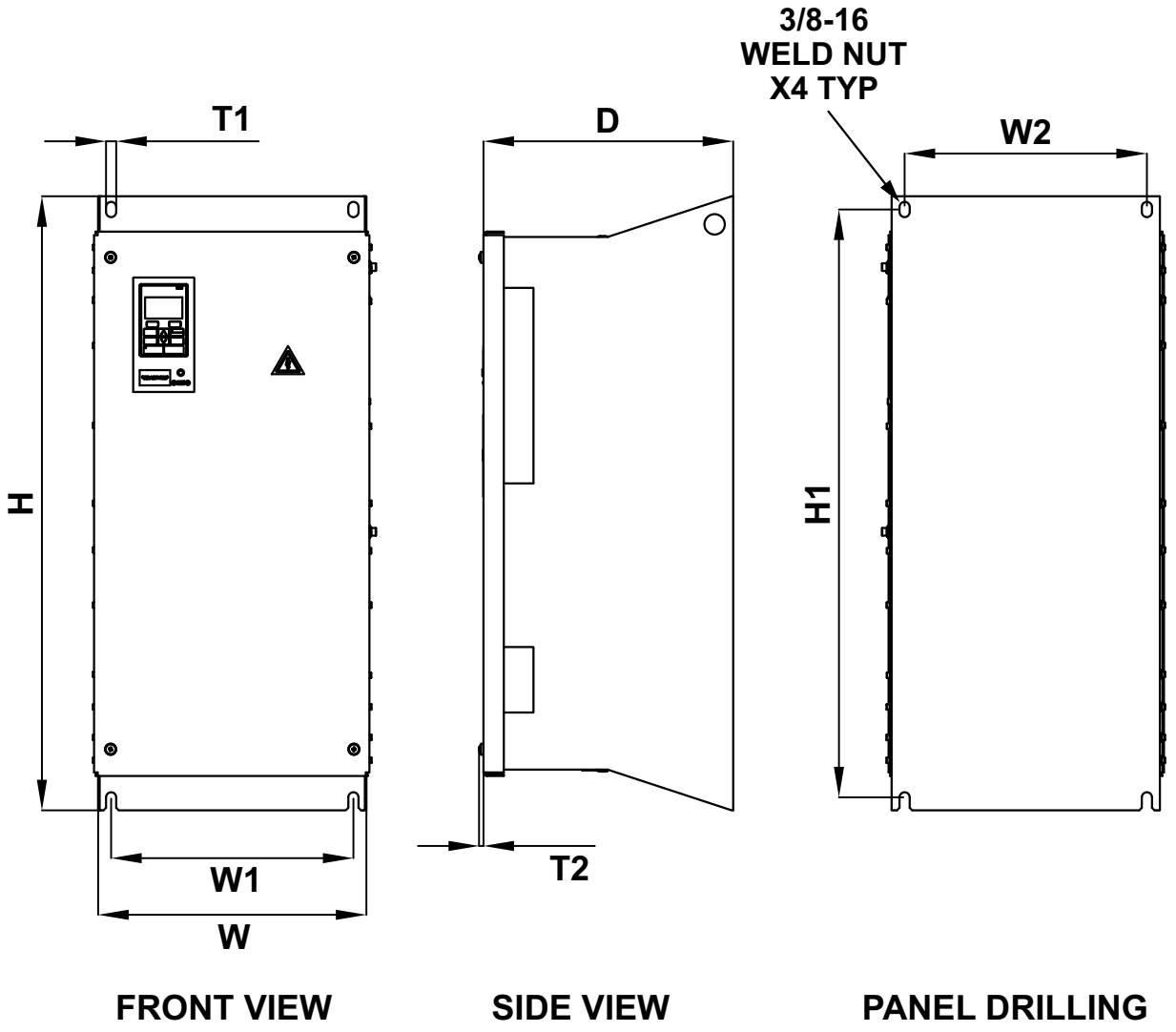



**Figure 2-7: Large Chassis (NEMA 4 & 5)**

**Table 2-1: Chassis Dimensions**

| Model | Figure Number | Dimensions inches (mm) | | | | | | | | Weight lb (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | W | H | D | W1 | W2 | H1 | T1 | T2 | |
| NEMA 2 & 3 | 2-6 | 8.57 (218) | 18.50 (470) | 11.30 (287) | 7.60 (193) | 6.00 (152) | 17.50 (445) | 0.34 (8.6) | 0.22 (5.6) | 47 (21.3) |
| NEMA 4 & 5 | 2-7 | 13.17 (335) | 30.16 (776) | 12.48 (317) | 11.95 (304) | 11.90 (302) | 28.87 (733) | 0.50 (12.7) | 0.22 (5.6) | 115 (52.2) |

## 2.8 Heat and Watt Loss

**Table 2-2: Heat Loss**

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

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

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

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

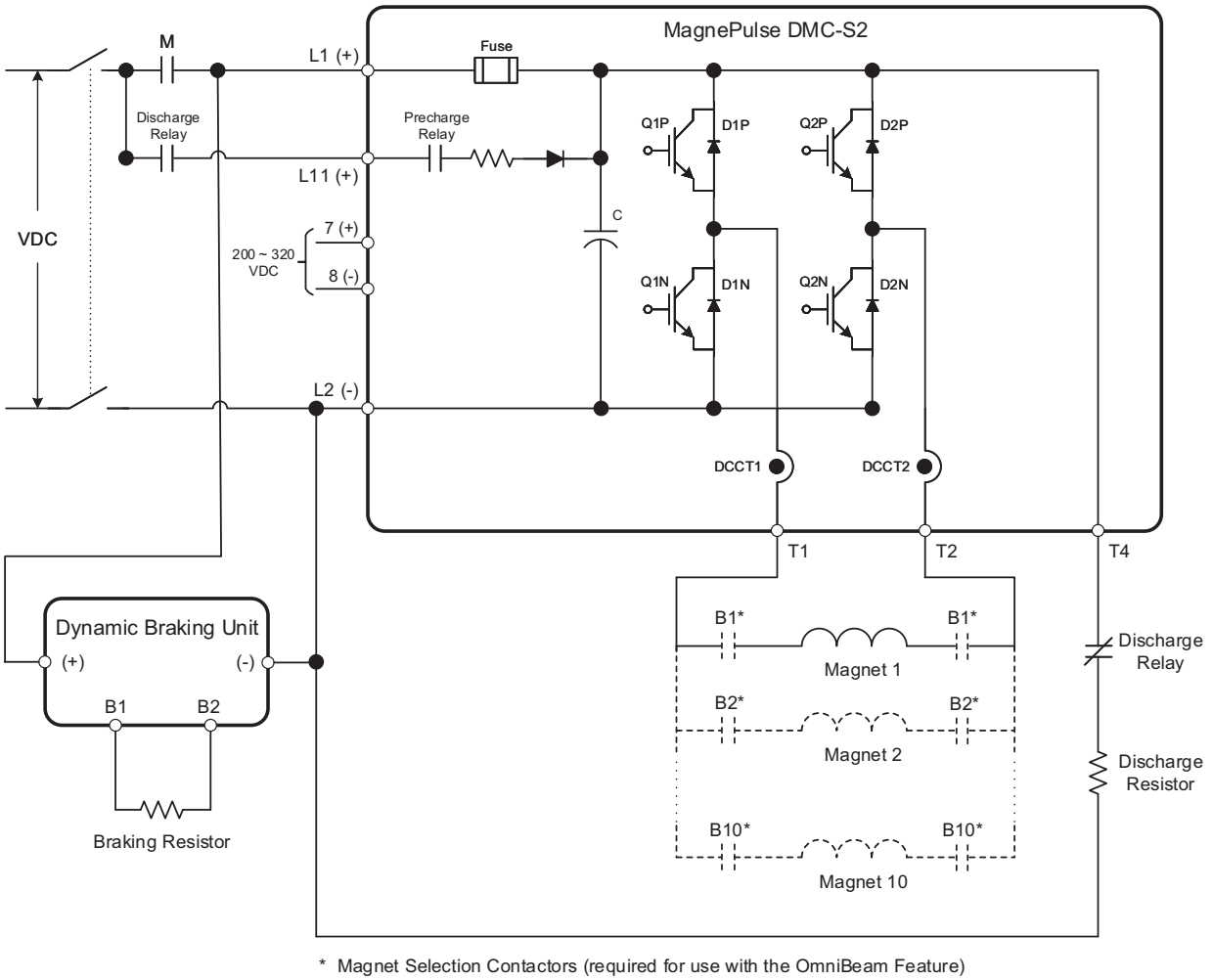
$$\text{BTU/HR} = 253 \text{ Watts} \times 3.41 \frac{\text{BTU/HR}}{\text{Watt}} = 863 \text{ BTU/HR}$$

# 3 Wiring

## 3.1 Power Circuit Wiring

The power circuit wiring for the DMC-S2 drive is shown in ***Figure 3-1 on page 24*** using ***Table 3-1 on page 25*** as a reference. The drive supplies bi-directional DC current to one or more magnets through terminals T1 and T2. A dynamic braking unit and resistor is incorporated in the DMC-S2 system to keep the DC bus voltage at nominal levels during the magnet discharge period.

A normally closed DC bus discharge relay contact and discharge resistor should be wired across the DC bus (T4 to L2-) to ensure prompt dissipation of stored energy in the DC bus capacitors and magnet(s) when the power to the drive has been removed. A normally open discharge contact is used in the DC bus precharge circuitry to avoid damage to the precharge resistors if the discharge relay were to de-energize when the control voltage is still present at terminals 7 and 8.




* Magnet Selection Contactors (required for use with the OmniBeam Feature)

**Figure 3-1: DMC-S2 Power Wiring Schematic**

### 3.1.1 Power Circuit Wiring Guidelines

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 magnet(s) to the drive at this time.*

**CAUTION**

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

Wire the power circuit for MagnePulse DMC-S2 as shown in ***Figure 3-1 on page 24***. A summary of the power circuit terminals and associated connections are listed in ***Table 3-1***.

**Table 3-1: DMC-S2 Power Circuit Terminals**

| Classification | Terminal | Description | Voltage |
|---|---|---|---|
| DC Bus Voltage | L1 | DC Bus (+) | 200 - 320 VDC (LV)<br>360 - 600 VDC (HV) |
| | L2 | DC Bus (-) | |
| | L11 | Precharge (+) | |
| Control Voltage | 7 | Control (+) | 200 - 320 VDC |
| | 8 | Control (-) | |
| Output | T1 | Magnet (+) | 200 - 320 VDC (LV)<br>360 - 600 VDC (HV) |
| | T2 | Magnet (-) | |
| | T4 | DC Bus Discharge (+) | |

### 3.1.2 Grounding

The MagnePulse DMC-S2 will operate properly on a floating ungrounded system, a grounded positive system, or a grounded negative system.

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

## 3.2 Control Circuit Wiring

The DMC-S2 drive can be operated using a variety of device types and signal levels. For low-voltage control systems, connect the associated inputs and outputs to the DMC-S2 control board as shown in ***Figure 3-2 on page 26***. An optional 230VDC or 120VAC 60Hz interface board may also be used for control inputs and outputs as shown in ***Figure 3-3 on page 27*** and ***Figure 3-4 on page 28***.

** Digital inputs on the optional 230VDC or 120VAC interface boards form a parallel connection with the 24VDC digital inputs on the DMC-S2 control board.*

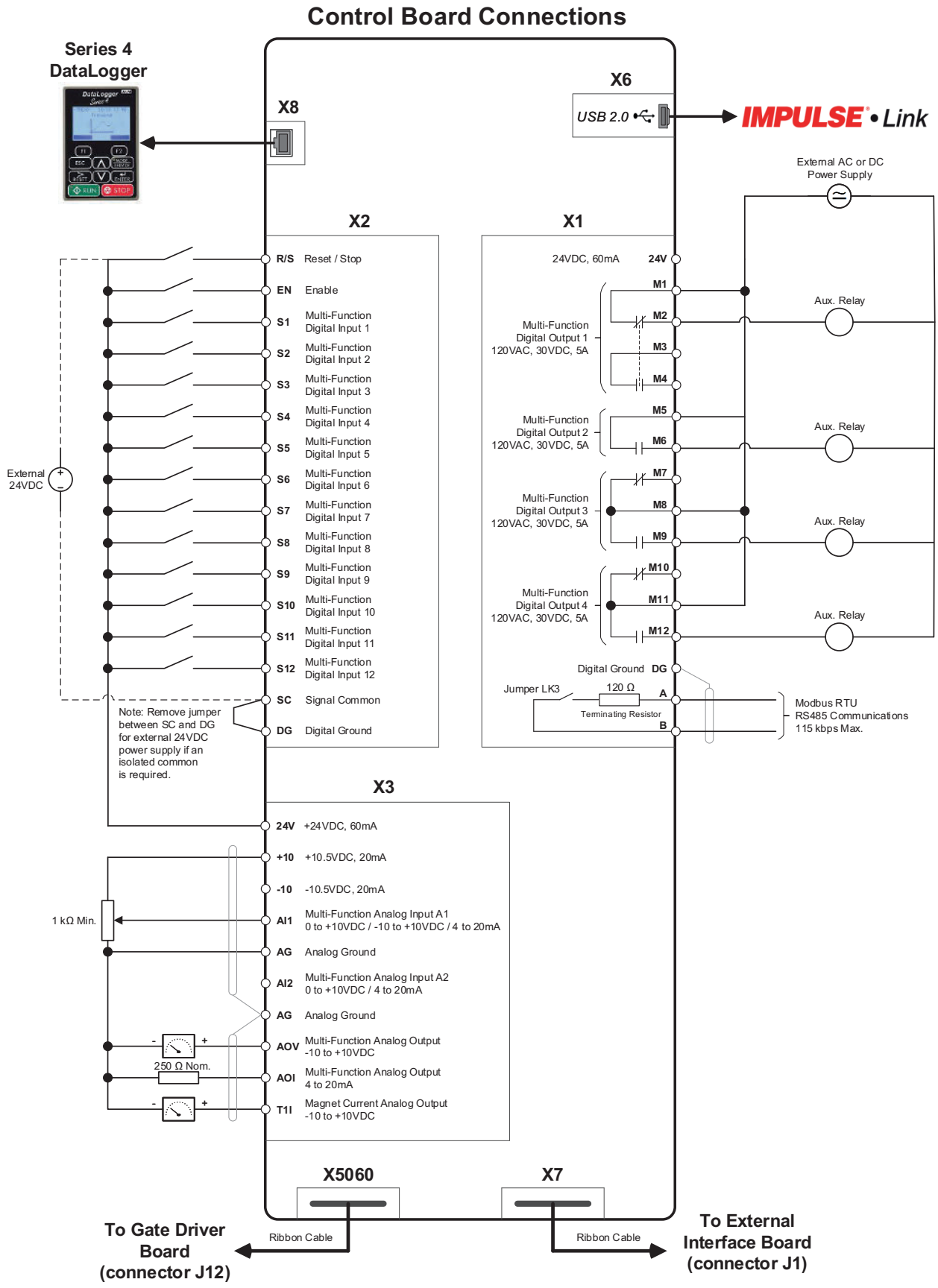



**Figure 3-2: Control Board Schematic**

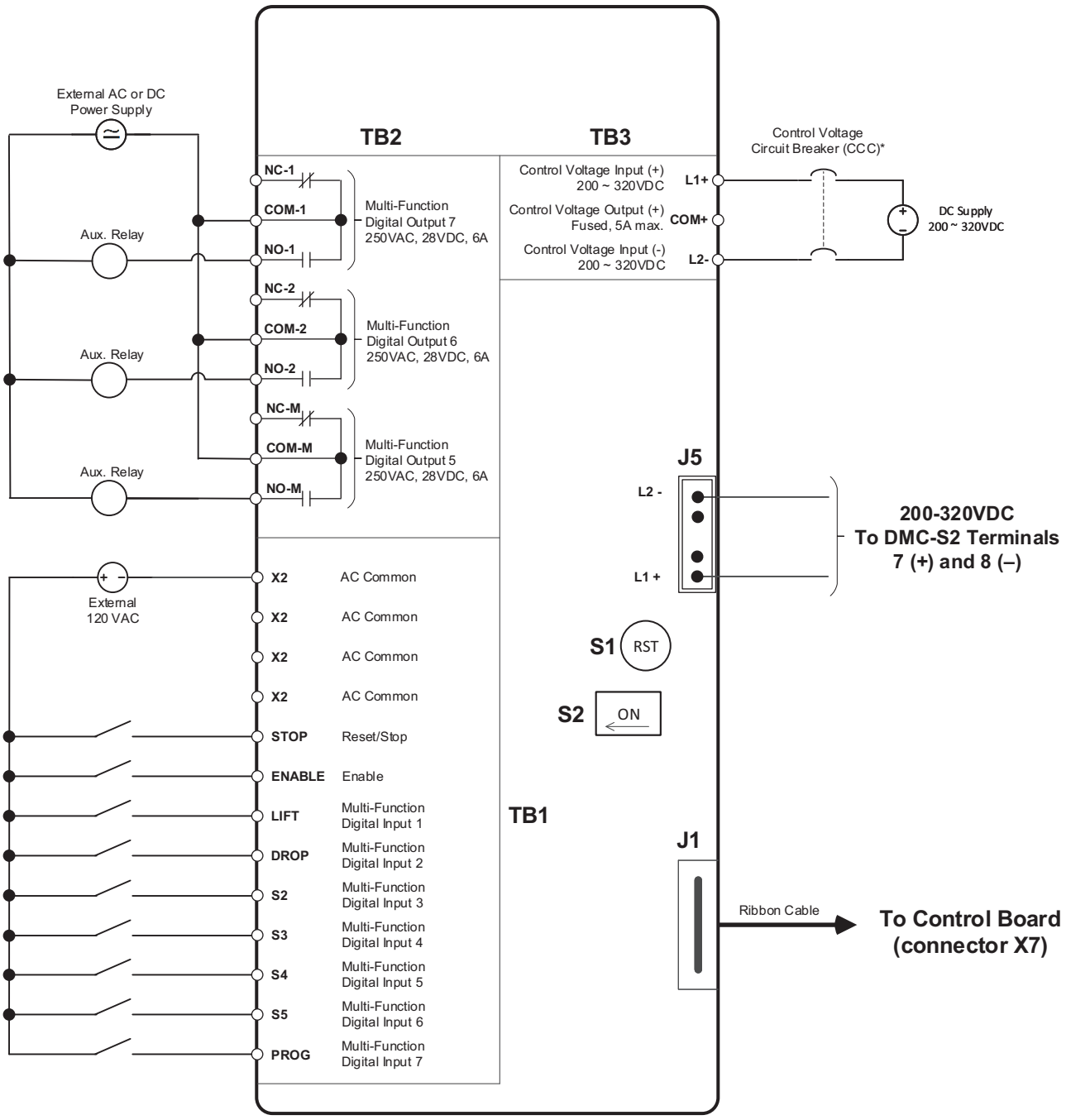



**Figure 3-3: 120VAC Interface Board Schematic**

** To comply with most safety standards, branch circuit protective devices should be used between the incoming DC power supply and the MagnePulse DMC-S2 drive. These devices can be circuit breakers or fuses rated to interrupt DC current.*

## 230VDC Interface Board Connections

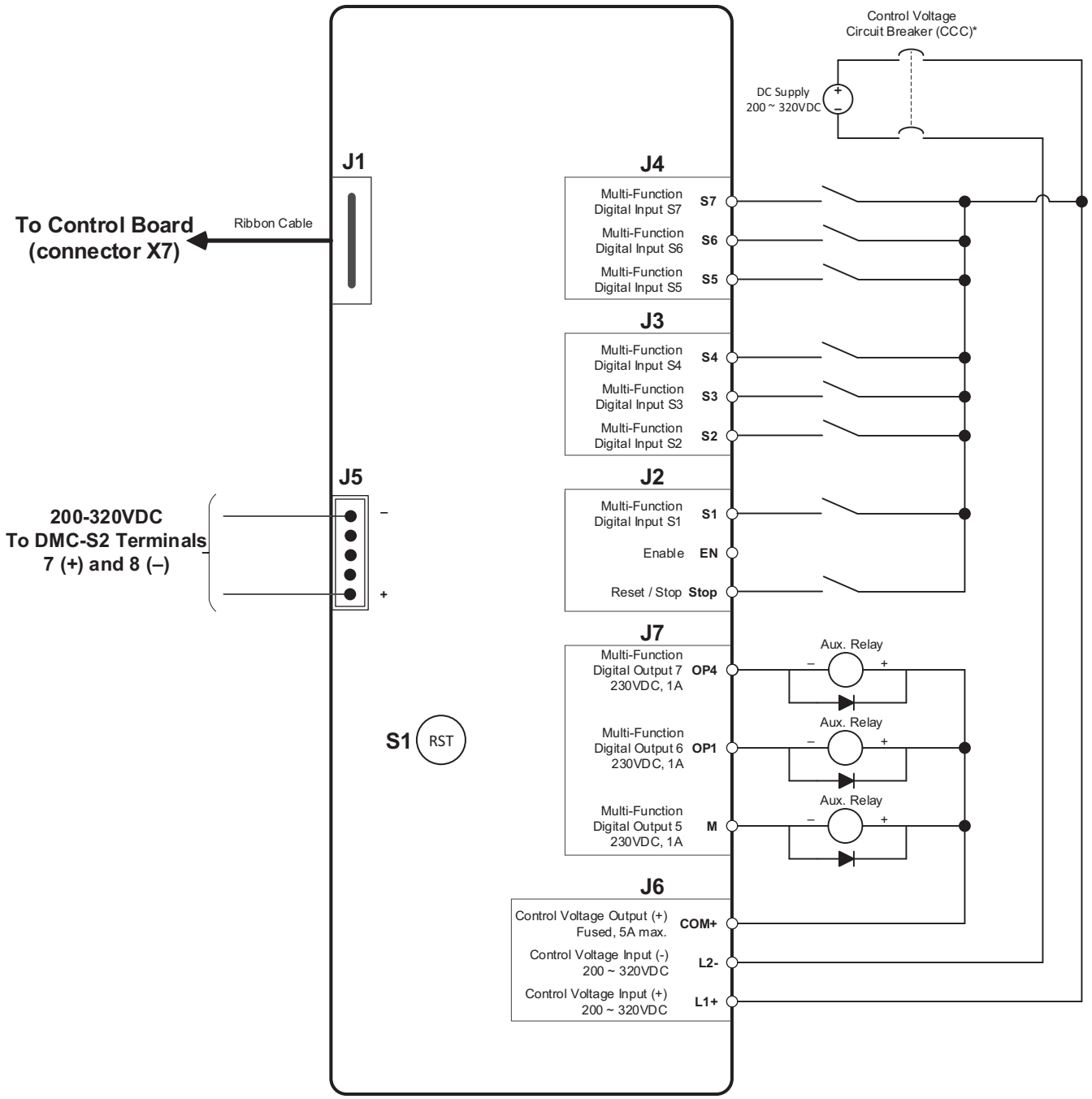



**Figure 3-4: 230VDC Interface Board Schematic**

** To comply with most safety standards, branch circuit protective devices should be used between the incoming DC power supply and the MagnePulse DMC-S2 drive. These devices can be circuit breakers or fuses rated to interrupt DC current.*

## 3.3 Control Board

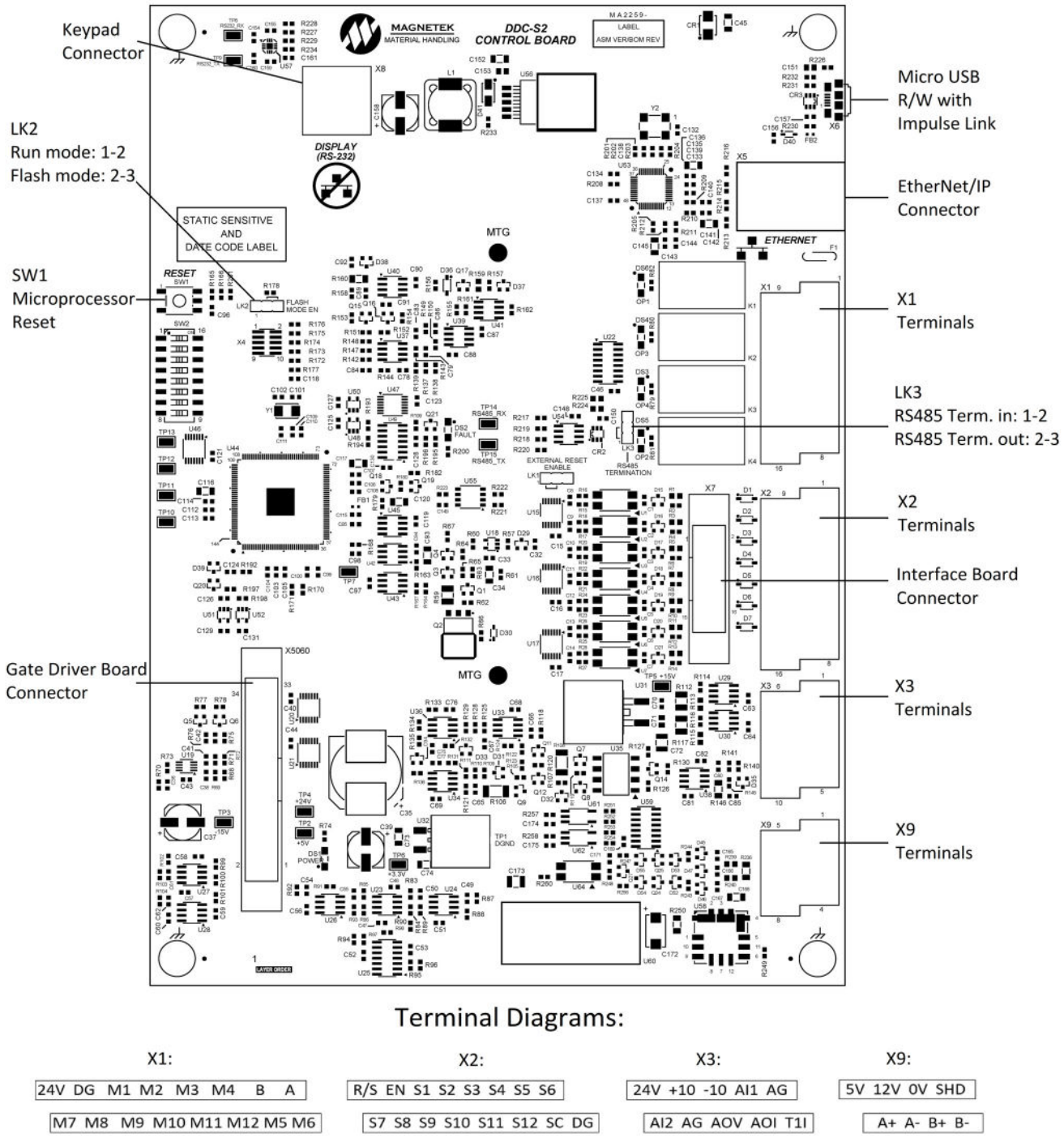



**Figure 3-5: Control Board and Terminal Designations (Model Number: DMC-S2-CONTROL)**

### 3.3.1 Control Board Jumper Settings

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

**Table 3-2: Jumper Setting Functions**

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

## 3.4 Control Circuit Terminals

**Table 3-3: Control Circuit Terminals**

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

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

## Table 3-4: Control Circuit Torque and Wire Specifications

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

## 3.5 Gate Driver Board

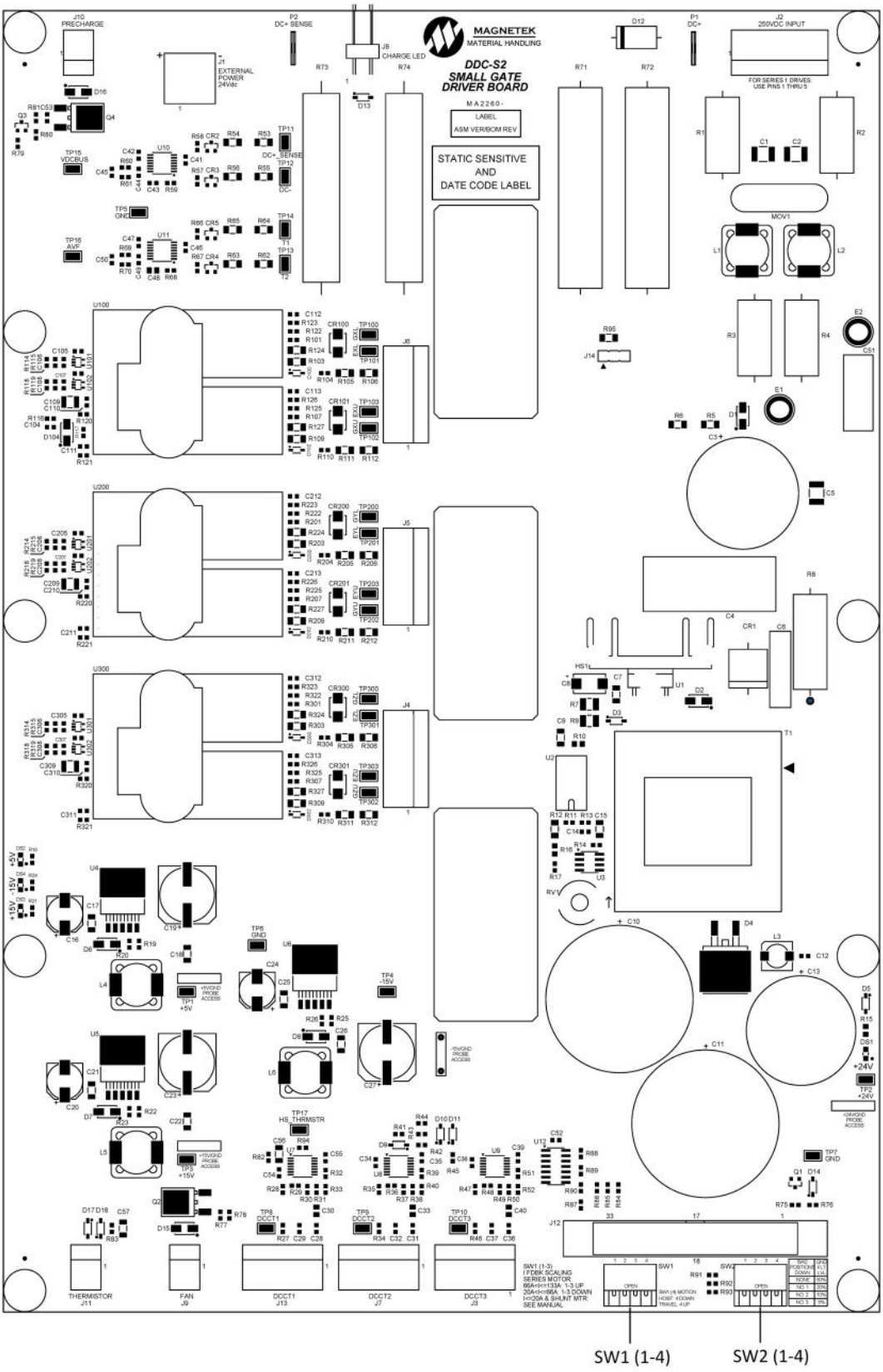



**Figure 3-6: Small Chassis Gate Driver Board (Model Number: DDC-LN3-GATE6)**

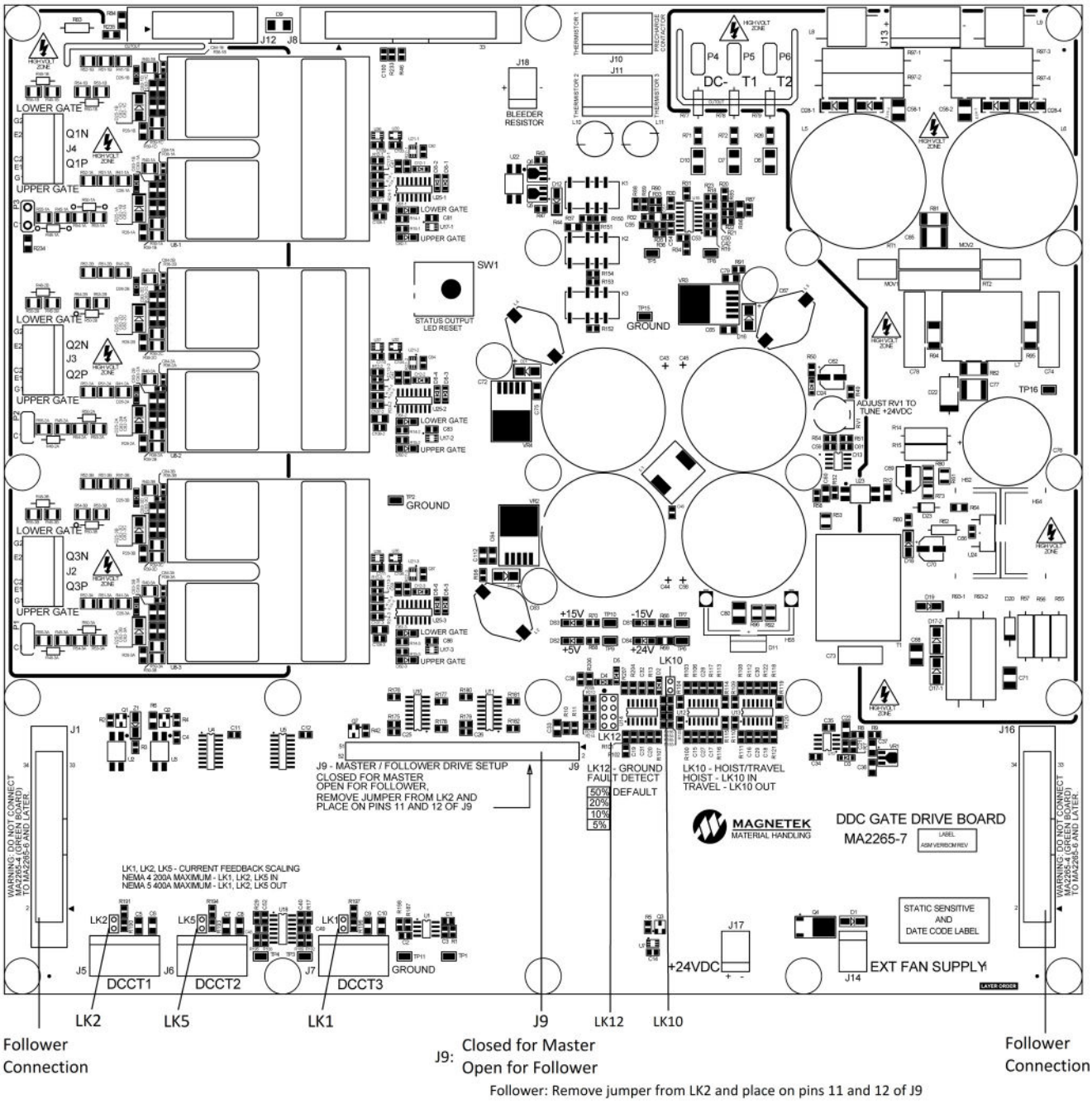



**Figure 3-7: Large Chassis Gate Driver Board (Model Number: DDC-LN5-GATE7)**

## Table 3-5: Small Chassis MA2260-6 and Newer Gate Driver Board Switch Settings

| Gate Driver Board Current Feedback Scaling | | | | |
|---|---|---|---|---|
| **Rated Amps** | **External CT Required?** | **Switch Settings** | | |
| | | **SW1 (1)** | **SW1 (2)** | **SW1 (3)*** |
| 20 to 67 (NEMA 2) | No | Down (Closed) | Down (Closed) | - |
| 68 to 133 (NEMA 3) | No | Up (Open) | Up (Open) | - |
| 2.5 to 20 | Yes | Up (Open) | Up (Open) | - |

| Ground Fault Detection Settings | | | | | | |
|---|---|---|---|---|---|---|
| **Ground Fault Configuration** | | **Ground Fault Sensitivity** | | | | |
| | | **SW2* Pos. #** | **50% (Default)** | **20%** | **10%** | **5%** |
| SW1 (4) | Up (Open) | **2** | Up | Down | Up | Up |
| | | **3** | Up | Up | Down | Up |
| | | **4** | Up | Up | Up | Down |

* *Switch 1 Position 3 and Switch 2 Position 1 has no function.*

## Table 3-6: Small Chassis Legacy Gate Driver Board Jumper Settings

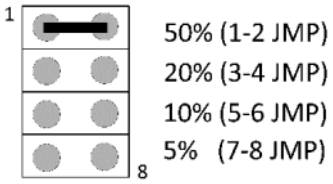
| Gate Driver Board Current Feedback Scaling | | | | |
|---|---|---|---|---|
| **Rated Amps** | **External CT Required?** | **Jumper Settings** | | |
| | | **LK1** | **LK3** | **LK2*** |
| 20 to 67 (NEMA 2) | No | In | In | - |
| 68 to 133 (NEMA 3) | No | Out | Out | - |
| 2.5 to 20 | Yes | Out | Out | - |

| Ground Fault Detection Settings | | |
|---|---|---|
| **Ground Fault Configuration** | | **Ground Fault Sensitivity** |
| LK10 | Out | Fixed at 50% |

* *Jumper LK2 has no function.*

## Table 3-7: Large Chassis Gate Driver Board Jumper Settings

| Gate Driver Board Current Feedback Scaling | | | | |
|---|---|---|---|---|
| **Rated Amps** | **External CT Required?** | **Jumper Settings** | | |
| | | **LK2** | **LK5** | **LK1*** |
| 20 to 133 (NEMA 2/3 High Voltage) | No | Out | Out | - |
| 134 to 200 (NEMA 4) | No | In | In | - |
| 201 to 400 (NEMA 5) | No | Out | Out | - |
| 2.5 to 20 | Yes | Out | Out | - |

| Ground Fault Detection Settings | | | | |
|---|---|---|---|---|
| **Ground Fault Configuration** | | **Ground Fault Sensitivity** | | |
| | | **Setting** | **LK12 Jumper Positions** |  |
| LK10 | Out | 50% (Default) | 1 to 2 | |
| | | 20% | 3 to 4 | |
| | | 10% | 5 to 6 | |
| | | 5% | 7 to 8 | |



| Master / Follower Settings | |
|---|---|
| **Drive Type** | **J9 Jumper Placement** |
| Master (NEMA 4/5)<br>Follower (NEMA 6/7/8) | All Jumpers Placed<br>11 - 12 |

* *Jumper LK1 has no function.*

## 3.6 Interface Board (120 VAC)

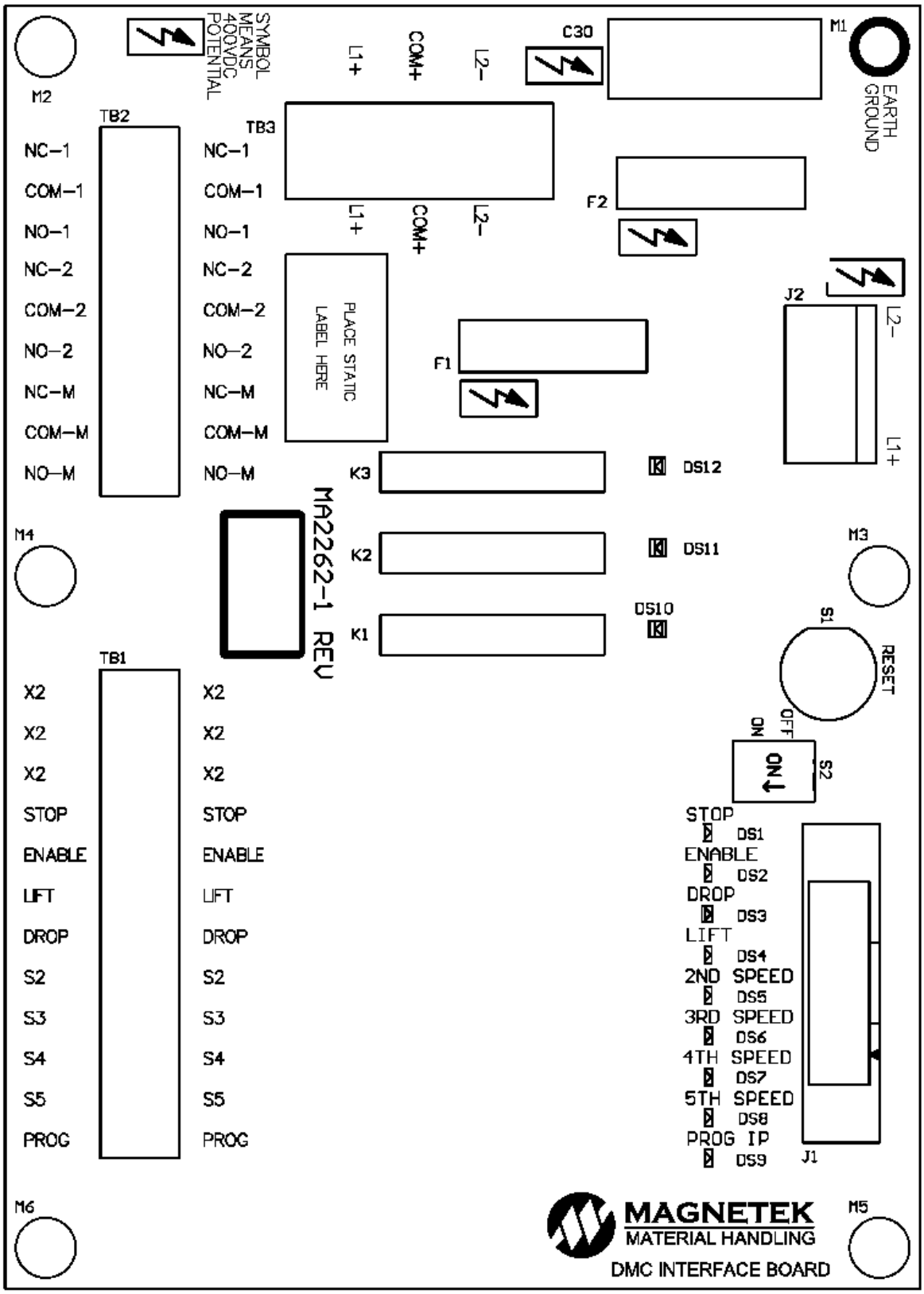



**Figure 3-8: 120VAC Interface Board (Model Number: DMC-120A60IF)**

# 3.7 Interface Board (230 VDC)

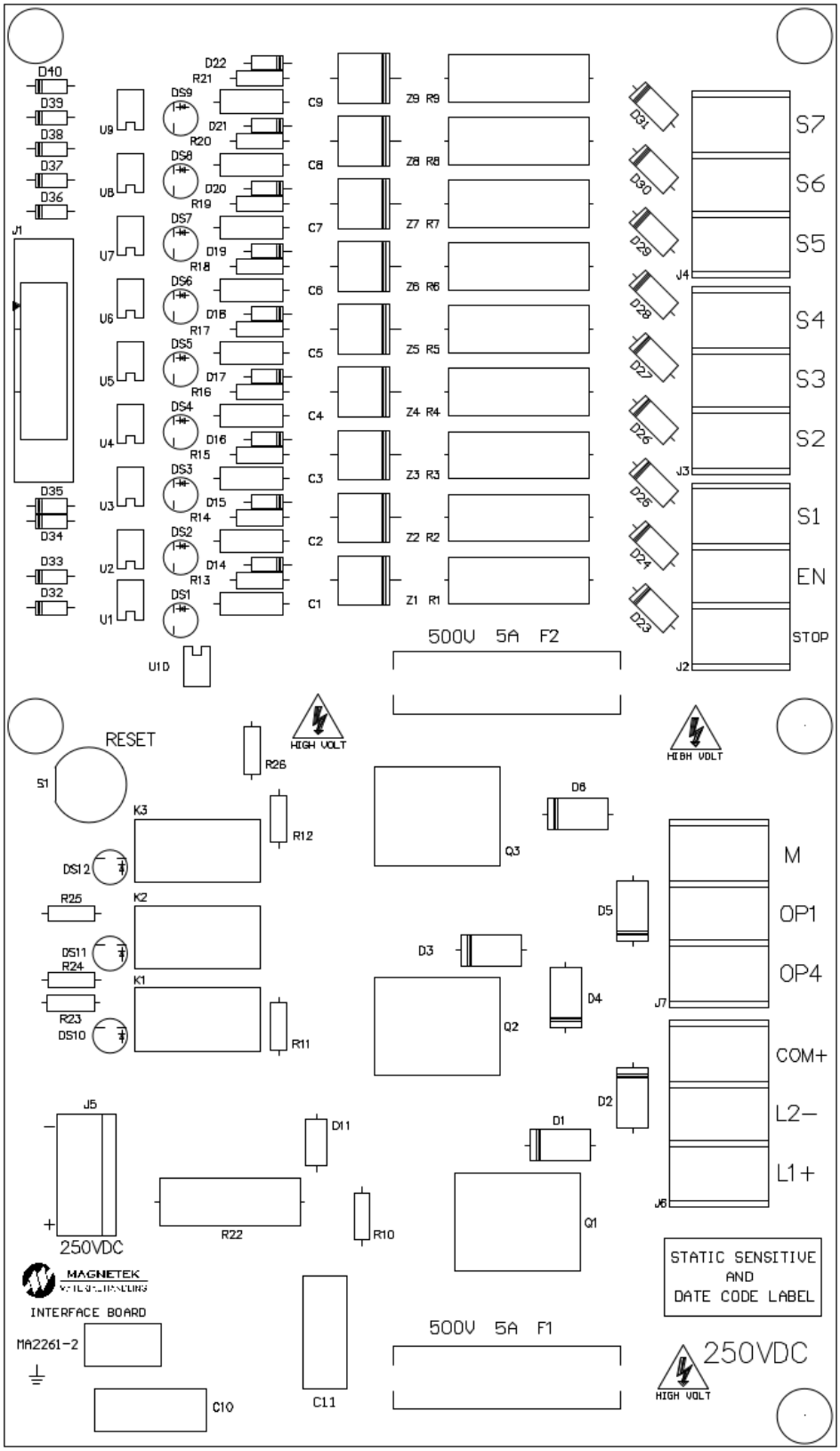



**Figure 3-9: 230VDC Interface Board (Model Number: DDC-230VIF)**

# 3.8 External CT Board and Wiring

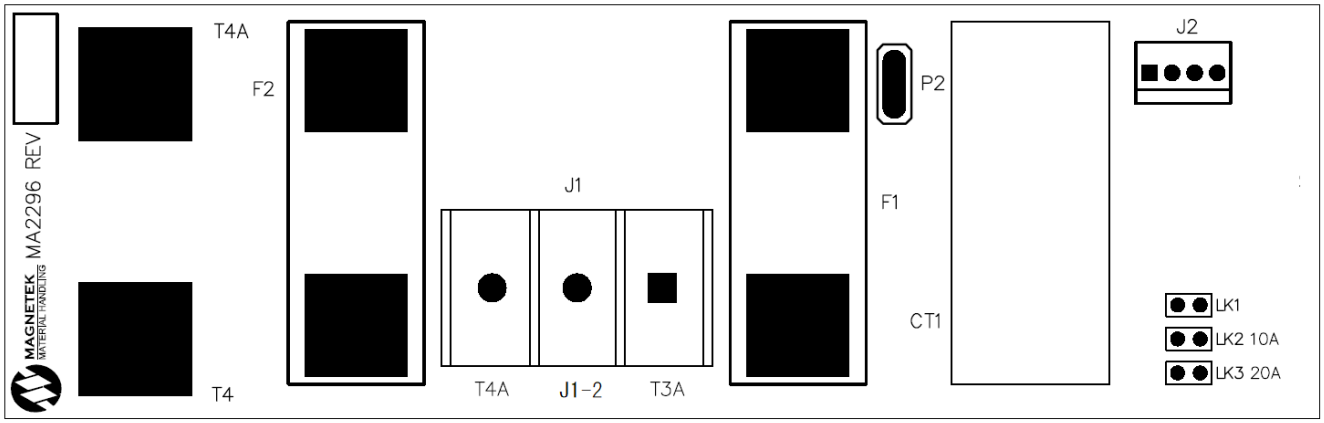



**Figure 3-10: External CT Board (Model Number: DDC-EXT-CT)**

**Table 3-8: External CT Board Jumper Settings***

| Magnet Amps | LK1** | LK2 | LK3 | Low-Voltage NEMA 2 CT Turns | High-Voltage NEMA 2 CT Turns |
|---|---|---|---|---|---|
| 2.5 – 5 | - | Out | Out | 2 | 3 |
| 5 – 10 | - | In | Out | 2 | 3 |
| 10 – 20 | - | In | In | 2 | 3 |

** Each drive circuit requires two external CTs.* ***See Figure 3-10 on page 38*** *and* ***Figure 3-11 on page 39****.*

*** Jumper LK1 has no function.*

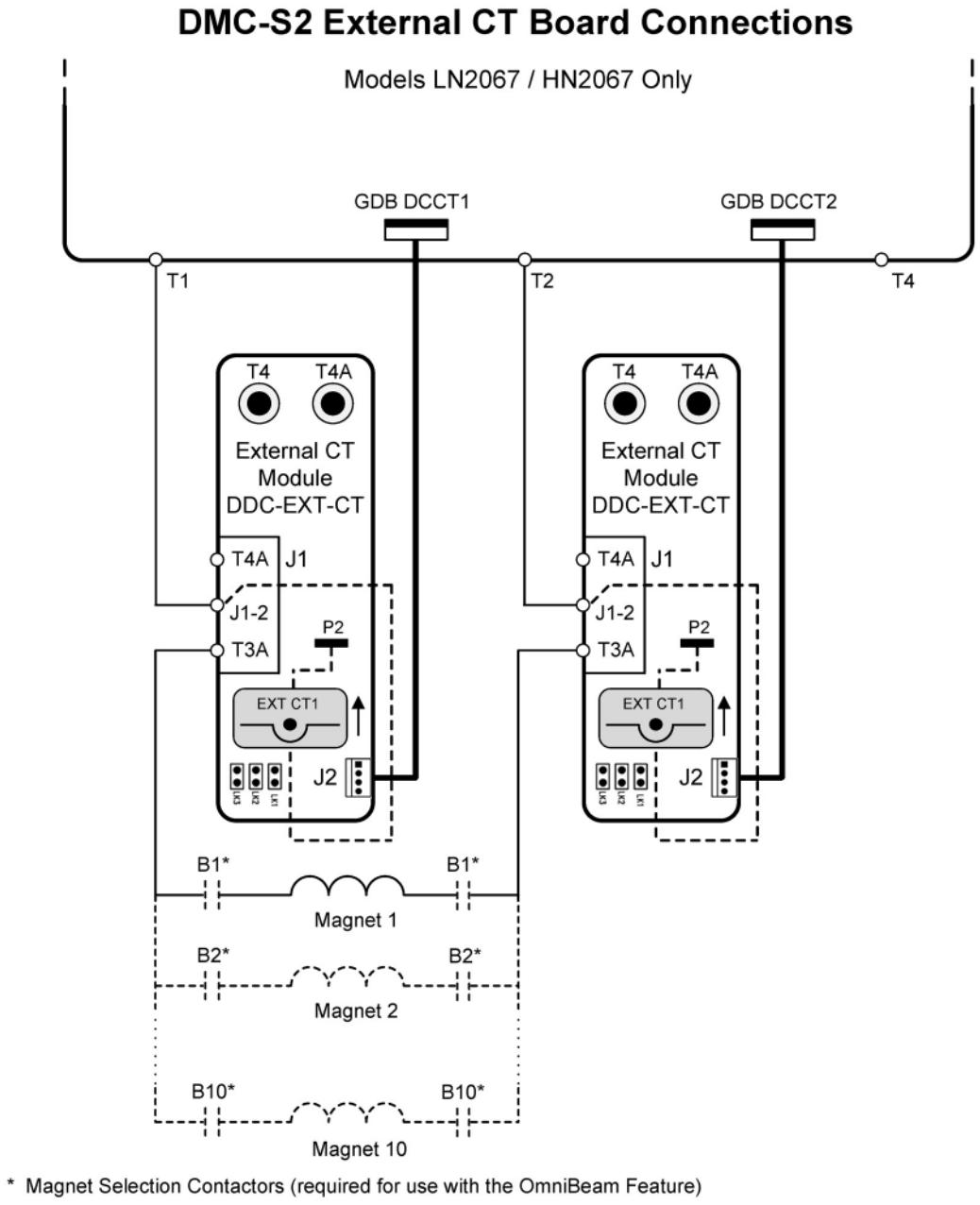



**Figure 3-11: External CT Board Schematic**

# 4 Getting Started

## 4.1 Overview

With its easy-to-use keypad and X-Press Programming, the DMC Series 2 makes it easy to get up and running right away. In addition to explaining the keypad and X-Press Programming, this chapter explains how to use the keypad, get into the Programming Mode, and set the Magnet Configuration.

## 4.2 Checks Before Powering

After drive mounting and interconnections are completed, verify:

- Correct power and control connections according to the system design documents and specifications.
- Correct input power supply voltage levels and current ratings.
- No short-circuit conditions are present.
- All debris are cleared around the vicinity of the electrical controls, especially for loose wire clippings.
- The magnet area is free of metal and electronic products.
- The magnet is resting on a solid surface.

## 4.3 Precautions

- Even with small loading, never use a magnet whose nameplate amperage exceeds the drive rated current.

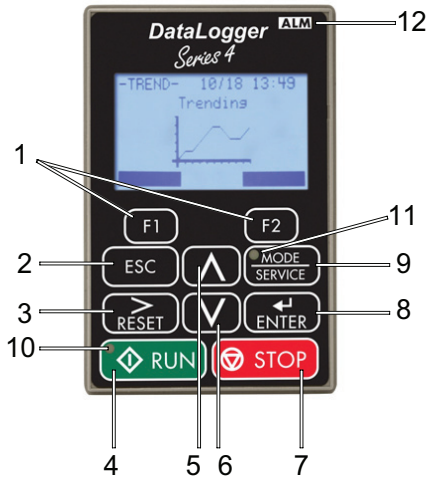
## 4.4 DLS4 Keypad

With five 16-character lines available, the DLS4 keypad makes it possible to monitor drive operation, change parameter settings, and view fault codes. In addition, the parameter description is included on the top line of the display. ***See Table 4-1 on page 43*** to view the top level menu structure for the DMC-S2. The logging capabilities of the DLS4 simplify troubleshooting by logging detailed operational histories that are necessary for cost-saving preventive maintenance. The DLS4 keypad has a battery that is used to maintain power to a real time clock when it is not supplied power from the drive. This ensures the date and time are retained. ***See Section 6.3.1 on page 95*** for instructions when the display notifies the user that the battery level is low. The DLS4 keypad enables you to:

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

## 4.4.1 Keypad LED and Button Functions

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




| | | |
|---|---|---|
| 1 | F1<br>F2 | F1 will move the cursor to the left when editing a parameter. Likewise, F2 will move the cursor to the right when editing a parameter. |
| 2 | ESC | • Returns to the previous display.<br>• Returns to the parameter (disregards edits). |
| 3 | RESET | • Moves the cursor to the right.<br>• Resets the current fault when the fault condition is cleared. |
| 4 | RUN | This button has no function. |
| 5 | ∧ | Scrolls up to display the next item, selects parameter numbers, and increments setting values. |
| 6 | ∨ | Scrolls down to display the previous item, selects parameter numbers, and decrements setting values. |
| 7 | STOP | This button has no function. |
| 8 | ENTER | • Enters parameter values and settings.<br>• Selects a menu item to move between displays. |
| 9 | MODE SERVICE | Displays the phone number for the Magnetek Service Department. |
| 10 | RUN | Lit while the drive is outputting current to the magnet. |
| 11 | MODE SERVICE | Lit when the Enable digital input is on. |
| 12 | ALM | • Off during normal operation (no fault or alarm).<br>• On continuously when the drive detects a fault.<br>• Flashing when the drive detects an alarm. |

## 4.4.2 Settings Accessible with the DLS4

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

Before shipping the drive, Magnetek programmed initial settings in the drive's software so that most, if not all, of the crane system requirements are supported. If it is necessary to change the initial settings, Magnetek recommends that only qualified crane system technicians program the drive. Parameter access can be restricted using the Password and Access Level features. For more information on these security features, ***see Section 4.5.1 on page 44*** and ***Section 4.5.4 on page 56***.

Two other features to be aware of are Initialize Parameters (A01-05) and Store Values (O03-01). Both of these features are related and revert back to previously saved parameter settings. This is especially helpful when a number of programming changes were made but the previous settings may still be needed. To program these features, ***see Section 4.5.3 on page 55*** and Store Values (O03-01) in ***Table 5-1 on page 58***.

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

## 4.4.3 DLS4 Keypad Menu Structure

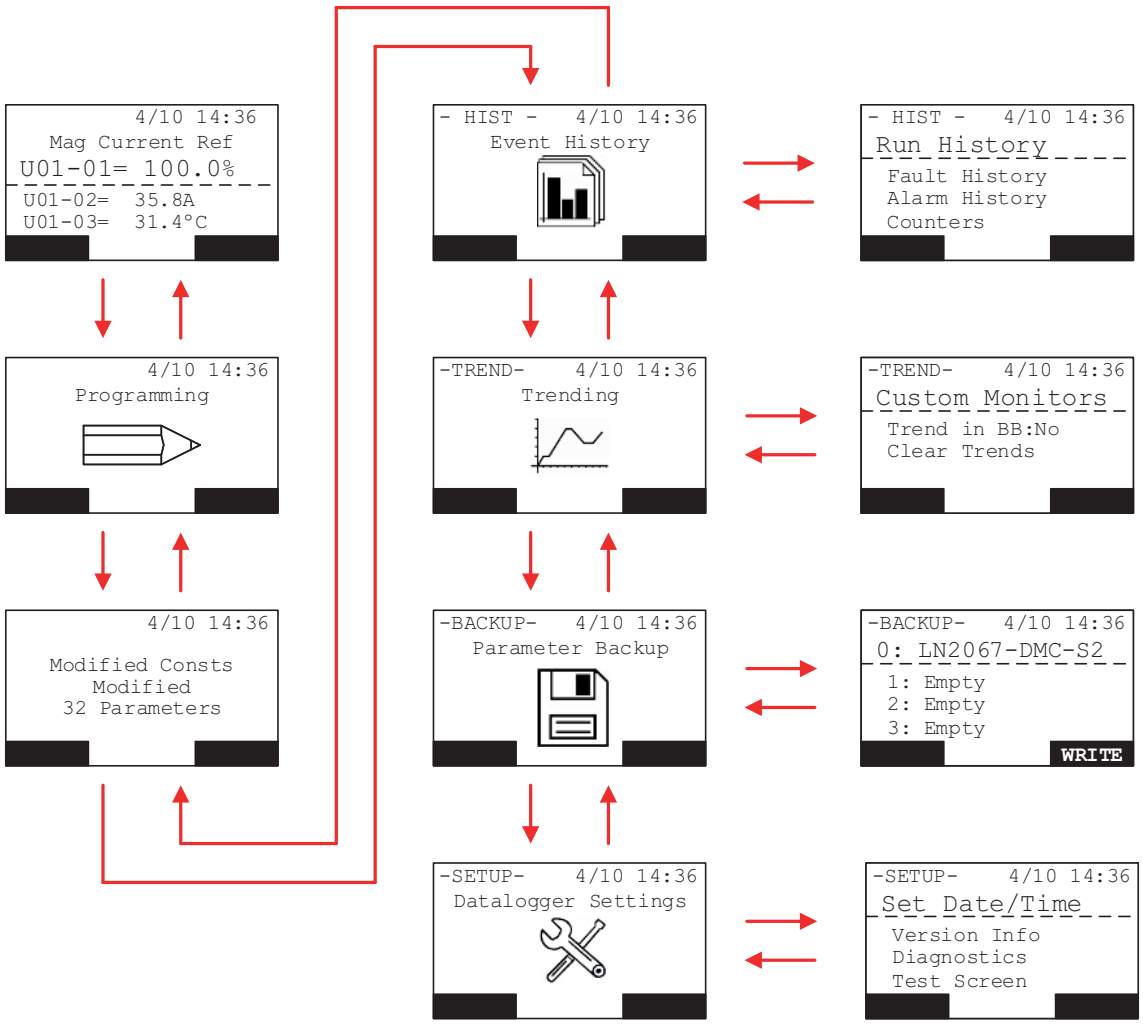



**Figure 4-1: Keypad Menu Map**

## Table 4-1: DMC-S2 Parameter Menu Structure

| Menu Level | Group | | Function | Page Number |
|---|---|---|---|---|
| Programming | Initialization | A01 | Access Level, Magnet Config, References | ***44*** |
| | Application | B01 | Stepped Current References | ***58*** |
| | | B02 | Magnet Setup | ***59*** |
| | | B03 | Run/Reference Source | ***62*** |
| | Magnet Functions | C01 | Magnet Control Setup | ***65*** |
| | | C02 | Magnet Protection | ***72*** |
| | | C12 | Timer Function | ***73*** |
| | Terminal I/O | H01 | Digital Inputs | ***74*** |
| | | H02 | Digital Outputs | ***76*** |
| | | H03 | Analog Inputs | ***78*** |
| | | H04 | Analog Outputs | ***79*** |
| | | H05 | Serial Communications | ***80*** |
| | Protection | L01 | Drive Protection | ***81*** |
| | | L02 | DC Bus Levels | ***82*** |
| | | L08 | Magnet Protection | ***82*** |
| | | L09 | Fault Reset | ***85*** |
| | Operator | O02 | Drive Configuration | ***86*** |
| | | O03 | Maintenance History | ***87*** |
| Monitor | | U01 | Monitors | ***88*** |
| | | U02 | Fault Trace | ***91*** |
| | | U03 | Fault History | ***93*** |
| | | U04 | Maintenance | ***94*** |

# 4.5 Initialization

## 4.5.1 Parameter Access Level (A01-01)

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

**Table 4-2: Parameter Access Level Settings**

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

## 4.5.2 X-Press Programming

X-Press Programming automatically configures several commonly used parameters and features when the Magnet Configuration (A01-03) or Current Reference (A01-04) are programmed. ***See Table 4-5 on page 45*** through ***Table 4-15 on page 55*** for X-Press Programming defaults.

### 4.5.2.1 Magnet Configuration (A01-03)

Set this parameter to match the number of magnets being controlled by the drive.

**Table 4-3: Magnet Configuration Settings**

| Setting | Description |
|---|---|
| 1 | 1 Magnet |
| 2 | 2 Magnets |
| 3 | 3 Magnets |
| 4 | 4 Magnets |
| 5 | 5 Magnets |
| 6 | 6 Magnets |
| 7 | 7 Magnets |
| 8 | 8 Magnets |
| 9 | 9 Magnets |
| 10 | 10 Magnets |

### 4.5.2.2 Current Reference (A01-04)

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

**Table 4-4: Current Reference Settings**

| Setting | Description |
|---|---|
| 0 | **Analog** – Analog reference |
| 1 | ***Lift / Lift-Drop*** – Enables the Lift / Lift-Drop Sequence in the C1 Parameter Group (default). |
| 2 | **2-Step** – Defines Terminal S3 as Lift / Clean Current 2 |
| 3 | **3-Step** – Defines Terminals S3-S4 as Lift / Clean Currents 2 & 3, respectively. |
| 4 | **4-Step** – Defines Terminals S3-S5 as Lift / Clean Currents 2 - 4, respectively. |
| 5 | **5-Step** – Defines Terminals S3-S6 as Lift / Clean Currents 2 - 5, respectively. |
| 6 | **Serial** – RS485 Communications |

**WARNING**

When changing A01-03 or A01-04, the digital inputs, analog inputs, reference/run source parameters, among others, will be overwritten by X-Press Programming (***Table 4-5 on page 45*** through ***Table 4-15 on page 55***). All parameter settings must be verified for proper operation.

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

| Input | A01-04 = | | | | | | |
|---|---|---|---|---|---|---|---|
| | **0** Analog | **1** Lift/ Lift-Drop | **2** 2-Step | **3** 3-Step | **4** 4-Step | **5** 5-Step | **6** Serial |
| Terminal S1 | Lift | Lift | Lift | Lift | Lift | Lift | - |
| Terminal S2 | Drop | Drop | Drop | Drop | Drop | Drop | - |
| Terminal S3 | - | - | Step 2 | Step 2 | Step 2 | Step 2 | - |
| Terminal S4 | - | - | - | Step 3 | Step 3 | Step 3 | - |
| Terminal S5 | - | - | - | - | Step 4 | Step 4 | - |
| Terminal S6 | - | - | - | - | - | Step 5 | - |
| Terminal S7 | - | - | - | - | - | - | - |
| Terminal A1 | Current Ref | - | - | - | - | - | - |

### 4.5.2.3 Parameters Changed by X-Press Programming

**Table 4-6: Magnet Configuration (A01-03 = 1 Magnet)**

| Parameter | Description | A01-04 = | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **0** Analog | **1** Lift/ Lift-Drop | **2** 2-Step | **3** 3-Step | **4** 4-Step | **5** 5-Step | **6** Serial |
| B03-01 | Ref Source 1 | 2 | 1 | 1 | 1 | 1 | 1 | 4 |
| B03-02 | Run Source 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| H01-01 | MFDI 1 | 80 | 80 | 80 | 80 | 80 | 80 | F |
| H01-02 | MFDI 2 | 81 | 81 | 81 | 81 | 81 | 81 | F |
| H01-03 | MFDI 3 | F | F | 0 | 0 | 0 | 0 | F |
| H01-04 | MFDI 4 | F | F | F | 1 | 1 | 1 | F |
| H01-05 | MFDI 5 | F | F | F | F | 2 | 2 | F |
| H01-06 | MFDI 6 | F | F | F | F | F | 3 | F |
| H01-07 | MFDI 7 | F | F | F | F | F | F | F |
| H01-08 | MFDI 8 | F | F | F | F | F | F | F |
| H01-09 | MFDI 9 | F | F | F | F | F | F | F |
| H01-10 | MFDI 10 | F | F | F | F | F | F | F |
| H01-11 | MFDI 11 | F | F | F | F | F | F | F |
| H01-12 | MFDI 12 | F | F | F | F | F | F | F |

## Table 4-7: Magnet Configuration (A01-03 = 2 Magnets)

| Parameter | Description | A01-04 = | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **0** Analog | **1** Lift/ Lift-Drop | **2** 2-Step | **3** 3-Step | **4** 4-Step | **5** 5-Step | **6** Serial |
| B03-01 | Ref Source 1 | 2 | 1 | 1 | 1 | 1 | 1 | 4 |
| B03-02 | Run Source 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| H01-01 | MFDI 1 | 80 | 80 | 80 | 80 | 80 | 80 | 10 |
| H01-02 | MFDI 2 | 81 | 81 | 81 | 81 | 81 | 81 | 11 |
| H01-03 | MFDI 3 | 10 | 10 | 0 | 0 | 0 | 0 | F |
| H01-04 | MFDI 4 | 11 | 11 | 10 | 1 | 1 | 1 | F |
| H01-05 | MFDI 5 | F | F | 11 | 10 | 2 | 2 | F |
| H01-06 | MFDI 6 | F | F | F | 11 | 10 | 3 | F |
| H01-07 | MFDI 7 | F | F | F | F | 11 | 10 | F |
| H01-08 | MFDI 8 | F | F | F | F | F | 11 | F |
| H01-09 | MFDI 9 | F | F | F | F | F | F | F |
| H01-10 | MFDI 10 | F | F | F | F | F | F | F |
| H01-11 | MFDI 11 | F | F | F | F | F | F | F |
| H01-12 | MFDI 12 | F | F | F | F | F | F | F |

## Table 4-8: Magnet Configuration (A01-03 = 3 Magnets)

| Parameter | Description | A01-04 = | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **0** Analog | **1** Lift/ Lift-Drop | **2** 2-Step | **3** 3-Step | **4** 4-Step | **5** 5-Step | **6** Serial |
| B03-01 | Ref Source 1 | 2 | 1 | 1 | 1 | 1 | 1 | 4 |
| B03-02 | Run Source 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| H01-01 | MFDI 1 | 80 | 80 | 80 | 80 | 80 | 80 | 10 |
| H01-02 | MFDI 2 | 81 | 81 | 81 | 81 | 81 | 81 | 11 |
| H01-03 | MFDI 3 | 10 | 10 | 0 | 0 | 0 | 0 | 12 |
| H01-04 | MFDI 4 | 11 | 11 | 10 | 1 | 1 | 1 | F |
| H01-05 | MFDI 5 | 12 | 12 | 11 | 10 | 2 | 2 | F |
| H01-06 | MFDI 6 | F | F | 12 | 11 | 10 | 3 | F |
| H01-07 | MFDI 7 | F | F | F | 12 | 11 | 10 | F |
| H01-08 | MFDI 8 | F | F | F | F | 12 | 11 | F |
| H01-09 | MFDI 9 | F | F | F | F | F | 12 | F |
| H01-10 | MFDI 10 | F | F | F | F | F | F | F |
| H01-11 | MFDI 11 | F | F | F | F | F | F | F |
| H01-12 | MFDI 12 | F | F | F | F | F | F | F |

## Table 4-9: Magnet Configuration (A01-03 = 4 Magnets)

| Parameter | Description | A01-04 = | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **0** Analog | **1** Lift/ Lift-Drop | **2** 2-Step | **3** 3-Step | **4** 4-Step | **5** 5-Step | **6** Serial |
| B03-01 | Ref Source 1 | 2 | 1 | 1 | 1 | 1 | 1 | 4 |
| B03-02 | Run Source 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| H01-01 | MFDI 1 | 80 | 80 | 80 | 80 | 80 | 80 | 10 |
| H01-02 | MFDI 2 | 81 | 81 | 81 | 81 | 81 | 81 | 11 |
| H01-03 | MFDI 3 | 10 | 10 | 0 | 0 | 0 | 0 | 12 |
| H01-04 | MFDI 4 | 11 | 11 | 10 | 1 | 1 | 1 | 13 |
| H01-05 | MFDI 5 | 12 | 12 | 11 | 10 | 2 | 2 | F |
| H01-06 | MFDI 6 | 13 | 13 | 12 | 11 | 10 | 3 | F |
| H01-07 | MFDI 7 | F | F | 13 | 12 | 11 | 10 | F |
| H01-08 | MFDI 8 | F | F | F | 13 | 12 | 11 | F |
| H01-09 | MFDI 9 | F | F | F | F | 13 | 12 | F |
| H01-10 | MFDI 10 | F | F | F | F | F | 13 | F |
| H01-11 | MFDI 11 | F | F | F | F | F | F | F |
| H01-12 | MFDI 12 | F | F | F | F | F | F | F |

## Table 4-10: Magnet Configuration (A01-03 = 5 Magnets)

| Parameter | Description | A01-04 = | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **0** Analog | **1** Lift/ Lift-Drop | **2** 2-Step | **3** 3-Step | **4** 4-Step | **5** 5-Step | **6** Serial |
| B03-01 | Ref Source 1 | 2 | 1 | 1 | 1 | 1 | 1 | 4 |
| B03-02 | Run Source 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| H01-01 | MFDI 1 | 80 | 80 | 80 | 80 | 80 | 80 | 10 |
| H01-02 | MFDI 2 | 81 | 81 | 81 | 81 | 81 | 81 | 11 |
| H01-03 | MFDI 3 | 10 | 10 | 0 | 0 | 0 | 0 | 12 |
| H01-04 | MFDI 4 | 11 | 11 | 10 | 1 | 1 | 1 | 13 |
| H01-05 | MFDI 5 | 12 | 12 | 11 | 10 | 2 | 2 | 14 |
| H01-06 | MFDI 6 | 13 | 13 | 12 | 11 | 10 | 3 | F |
| H01-07 | MFDI 7 | 14 | 14 | 13 | 12 | 11 | 10 | F |
| H01-08 | MFDI 8 | F | F | 14 | 13 | 12 | 11 | F |
| H01-09 | MFDI 9 | F | F | F | 14 | 13 | 12 | F |
| H01-10 | MFDI 10 | F | F | F | F | 14 | 13 | F |
| H01-11 | MFDI 11 | F | F | F | F | F | 14 | F |
| H01-12 | MFDI 12 | F | F | F | F | F | F | F |

## Table 4-11: Magnet Configuration (A01-03 = 6 Magnets)

| Parameter | Description | A01-04 = | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **0** Analog | **1** Lift/ Lift-Drop | **2** 2-Step | **3** 3-Step | **4** 4-Step | **5** 5-Step | **6** Serial |
| B03-01 | Ref Source 1 | 2 | 1 | 1 | 1 | 1 | 1 | 4 |
| B03-02 | Run Source 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| H01-01 | MFDI 1 | 80 | 80 | 80 | 80 | 80 | 80 | 10 |
| H01-02 | MFDI 2 | 81 | 81 | 81 | 81 | 81 | 81 | 11 |
| H01-03 | MFDI 3 | 10 | 10 | 0 | 0 | 0 | 0 | 12 |
| H01-04 | MFDI 4 | 11 | 11 | 10 | 1 | 1 | 1 | 13 |
| H01-05 | MFDI 5 | 12 | 12 | 11 | 10 | 2 | 2 | 14 |
| H01-06 | MFDI 6 | 13 | 13 | 12 | 11 | 10 | 3 | 15 |
| H01-07 | MFDI 7 | 14 | 14 | 13 | 12 | 11 | 10 | F |
| H01-08 | MFDI 8 | 15 | 15 | 14 | 13 | 12 | 11 | F |
| H01-09 | MFDI 9 | F | F | 15 | 14 | 13 | 12 | F |
| H01-10 | MFDI 10 | F | F | F | 15 | 14 | 13 | F |
| H01-11 | MFDI 11 | F | F | F | F | 15 | 14 | F |
| H01-12 | MFDI 12 | F | F | F | F | F | 15 | F |

## Table 4-12: Magnet Configuration (A01-03 = 7 Magnets)

| Parameter | Description | A01-04 = | | | | | |
|---|---|---|---|---|---|---|---|
| | | **0** Analog | **1** Lift/ Lift-Drop | **2** 2-Step | **3** 3-Step | **4** 4-Step | **6** Serial |
| B03-01 | Ref Source 1 | 2 | 1 | 1 | 1 | 1 | 4 |
| B03-02 | Run Source 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| H01-01 | MFDI 1 | 80 | 80 | 80 | 80 | 80 | F |
| H01-02 | MFDI 2 | 81 | 81 | 81 | 81 | 81 | F |
| H01-03 | MFDI 3 | 10 | 10 | 0 | 0 | 0 | 12 |
| H01-04 | MFDI 4 | 11 | 11 | 10 | 1 | 1 | 13 |
| H01-05 | MFDI 5 | 12 | 12 | 11 | 10 | 2 | 14 |
| H01-06 | MFDI 6 | 13 | 13 | 12 | 11 | 10 | 15 |
| H01-07 | MFDI 7 | 14 | 14 | 13 | 12 | 11 | 16 |
| H01-08 | MFDI 8 | 15 | 15 | 14 | 13 | 12 | F |
| H01-09 | MFDI 9 | 16 | 16 | 15 | 14 | 13 | F |
| H01-10 | MFDI 10 | F | F | 16 | 15 | 14 | F |
| H01-11 | MFDI 11 | F | F | F | 16 | 15 | F |
| H01-12 | MFDI 12 | F | F | F | F | 16 | F |

## Table 4-13: Magnet Configuration (A01-03 = 8 Magnets)

| Parameter | Description | A01-04 = | | | | |
|---|---|---|---|---|---|---|
| | | **0** Analog | **1** Lift/ Lift-Drop | **2** 2-Step | **3** 3-Step | **6** Serial |
| B03-01 | Ref Source 1 | 2 | 1 | 1 | 1 | 4 |
| B03-02 | Run Source 1 | 1 | 1 | 1 | 1 | 2 |
| H01-01 | MFDI 1 | 80 | 80 | 80 | 80 | 10 |
| H01-02 | MFDI 2 | 81 | 81 | 81 | 81 | 11 |
| H01-03 | MFDI 3 | 10 | 10 | 0 | 0 | 12 |
| H01-04 | MFDI 4 | 11 | 11 | 10 | 1 | 13 |
| H01-05 | MFDI 5 | 12 | 12 | 11 | 10 | 14 |
| H01-06 | MFDI 6 | 13 | 13 | 12 | 11 | 15 |
| H01-07 | MFDI 7 | 14 | 14 | 13 | 12 | 16 |
| H01-08 | MFDI 8 | 15 | 15 | 14 | 13 | 17 |
| H01-09 | MFDI 9 | 16 | 16 | 15 | 14 | F |
| H01-10 | MFDI 10 | 17 | 17 | 16 | 15 | F |
| H01-11 | MFDI 11 | F | F | 17 | 16 | F |
| H01-12 | MFDI 12 | F | F | F | 17 | F |

## Table 4-14: Magnet Configuration (A01-03 = 9 Magnets)

| Parameter | Description | A01-04 = | | | |
|---|---|---|---|---|---|
| | | **0** Analog | **1** Lift/ Lift-Drop | **2** 2-Step | **6** Serial |
| B03-01 | Ref Source 1 | 2 | 1 | 1 | 4 |
| B03-02 | Run Source 1 | 1 | 1 | 1 | 2 |
| H01-01 | MFDI 1 | 80 | 80 | 80 | 10 |
| H01-02 | MFDI 2 | 81 | 81 | 81 | 11 |
| H01-03 | MFDI 3 | 10 | 10 | 0 | 12 |
| H01-04 | MFDI 4 | 11 | 11 | 10 | 13 |
| H01-05 | MFDI 5 | 12 | 12 | 11 | 14 |
| H01-06 | MFDI 6 | 13 | 13 | 12 | 15 |
| H01-07 | MFDI 7 | 14 | 14 | 13 | 16 |
| H01-08 | MFDI 8 | 15 | 15 | 14 | 17 |
| H01-09 | MFDI 9 | 16 | 16 | 15 | 18 |
| H01-10 | MFDI 10 | 17 | 17 | 16 | F |
| H01-11 | MFDI 11 | 18 | 18 | 17 | F |
| H01-12 | MFDI 12 | F | F | 18 | F |

**Table 4-15: Magnet Configuration (A01-03 = 10 Magnets)**

| Parameter | Description | A01-04 = | | |
|---|---|---|---|---|
| | | **0** Analog | **1** Lift/Lift-Drop | **6** Serial |
| B03-01 | Ref Source 1 | 2 | 1 | 4 |
| B03-02 | Run Source 1 | 1 | 1 | 2 |
| H01-01 | MFDI 1 | 80 | 80 | 10 |
| H01-02 | MFDI 2 | 81 | 81 | 11 |
| H01-03 | MFDI 3 | 10 | 10 | 12 |
| H01-04 | MFDI 4 | 11 | 11 | 13 |
| H01-05 | MFDI 5 | 12 | 12 | 14 |
| H01-06 | MFDI 6 | 13 | 13 | 15 |
| H01-07 | MFDI 7 | 14 | 14 | 16 |
| H01-08 | MFDI 8 | 15 | 15 | 17 |
| H01-09 | MFDI 9 | 16 | 16 | 18 |
| H01-10 | MFDI 10 | 17 | 17 | 19 |
| H01-11 | MFDI 11 | 18 | 18 | F |
| H01-12 | MFDI 12 | 19 | 19 | F |

## 4.5.3 Restore Values (A01-05)

Use this parameter to reset the drive to its factory default settings, the “As Built” settings, or a user set of stored settings.

**Table 4-16: Restore Parameter Values**

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

### 4.5.4 Password Entry (A01-08)

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

**Table 4-17: Password**

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

***Table 4-18 on page 56*** lists parameters that must be configured for the MagnePulse DMC-S2 to operate safely. To gain access to these parameters, the password must be entered in parameter A01-08. The default password is: 2004.

**Table 4-18: Quick Start Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| A01-01 | Access Level | Parameter access security level. | 0-2 | 2 |
| | *0 Monitor Only* | Access to only parameters A01-01, A01-08, and all U monitor parameters. | | |
| | *1 User* | Access to a limited number of parameters such as magnet setup and current presets. | | |
| | *2 Advanced* | All parameters can be viewed and edited. | | |
| A01-03 | Magnet Config | Defines the number of magnets being controlled by the drive. | 1-10 | 1 |
| | *1 1 Magnet* | | | |
| | *2 2 Magnets* | | | |
| | *3 3 Magnets* | | | |
| | *4 4 Magnets* | | | |
| | *5 5 Magnets* | | | |
| | *6 6 Magnets* | | | |
| | *7 7 Magnets* | | | |
| | *8 8 Magnets* | | | |
| | *9 9 Magnets* | | | |
| | *10 10 Magnets* | | | |

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| A01-04 | Curr Reference | Defines the source of the current reference. | 0-6 | 1 |
| | *0 Analog* | Analog reference. | | |
| | *1 Lift/Lift-Drop* | Enables the Lift / Lift-Drop Sequence in the C1 Parameter Group (default). | | |
| | *2 2-Step* | Defines Terminal S3 as Lift / Clean Current 2. | | |
| | *3 3-Step* | Defines Terminals S3-S4 as Lift / Clean Currents 2 & 3, respectively. | | |
| | *4 4-Step* | Defines Terminals S3-S5 as Lift / Clean Currents 2 - 4, respectively. | | |
| | *5 5-Step* | Defines Terminals S3-S6 as Lift / Clean Currents 2 - 5, respectively. | | |
| | *6 Serial* | RS485 Communications. | | |
| A01-08 | Password | Sets the access level password. (Enter 2004 to unlock Advanced Mode.) | 0-9999 | Advanced |
| B02-01 | Mag 1 Current | Sets the full load nameplate current for Magnet 1. | 0-2000 A | 20 |
| B02-02 | Mag 1 Sec2RatedI | Sets the time required to achieve rated magnet current with rated magnet voltage applied. Lower values will allow for faster current response. | 0.00-10.00 sec | 1.00 |
| B02-03 | Mag 1 Resistance | Set to the magnet's cold resistance value (Approx. 77°F [25ºC]). The cold resistance is used to calculate the magnet temperature. | 0.00-60.00 Ohms | 4.00 |
| C01-01 | Lift Current | Percentage of Magnet Rated Current to lift. | 0.0-100.0% | 100.0 |
| C01-02 | Hold Current | Percentage of Magnet Rated Current to hold. | 0.0-100.0% | 75.0 |
| C01-03 | Dribble Current | Lower Limit of current that will stop the dribble rate reduction. | -100.0-100.0% | -10.0 |
| C01-04 | Clean Current | Percentage of Magnet Rated Current to drop. | 0.0-100.0% | 15.0 |
| C02-01 | Mag Rated V | Magnet Rated Volts. | 200-720 VDC | 230 |

# 5 Programming Advanced Features

## 5.1 Introduction

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

## 5.2 Magnet Application Parameters

- B01 Stepped Current Mode References
- B02 Magnet Setup
- B03 Run/Reference Source

### 5.2.1 Stepped Current Control Mode References (B01-01 through B01-10)

Parameters B01-01 through B01-10 define the current reference as a percentage of magnet rated current (see parameters B02-01 through B02-30). The parameters will be visible only when the Current Reference selection in A01-04 is set for values of 2 through 5 (2-step through 5-step). The operation of the stepped current mode is illustrated in ***Figure 5-6 on page 68***.

**Table 5-1: Stepped Current Mode Reference Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| B01-01 | Lift Current 1 | Sets percent of rated magnet current for the lift input. | 0.0-100.0% | 100.0* |
| B01-02 | Lift Current 2 | Sets percent of rated magnet current for the lift input. | 0.0-100.0% | 80.0* |
| B01-03 | Lift Current 3 | Sets percent of rated magnet current for the lift input. | 0.0-100.0% | 60.0* |
| B01-04 | Lift Current 4 | Sets percent of rated magnet current for the lift input. | 0.0-100.0% | 40.0* |
| B01-05 | Lift Current 5 | Sets percent of rated magnet current for the lift input. | 0.0-100.0% | 20.0* |
| B01-06 | Clean Current 1 | Sets percent of rated magnet current for the drop input. | 0.0-100.0% | 20.0* |
| B01-07 | Clean Current 2 | Sets percent of rated magnet current for the drop input. | 0.0-100.0% | 40.0* |
| B01-08 | Clean Current 3 | Sets percent of rated magnet current for the drop input. | 0.0-100.0% | 60.0* |
| B01-09 | Clean Current 4 | Sets percent of rated magnet current for the drop input. | 0.0-100.0% | 80.0* |
| B01-10 | Clean Current 5 | Sets percent of rated magnet current for the drop input. | 0.0-100.0% | 100.0* |

* *Initial value is determined by X-Press Programming (**Table 4-5 on page 45** through **Table 4-15 on page 55**).*

## 5.2.2 Magnet Setup (B02-01 through B02-31)

Parameters B02-01 through B02-31 define the characteristics of up to 10 magnets that can be controlled by a single drive. Enter the rated nameplate current and magnet DC resistance measured at 77°F (25ºC) for each magnet. ***See Table 5-2 on page 59*** for details of each parameter.

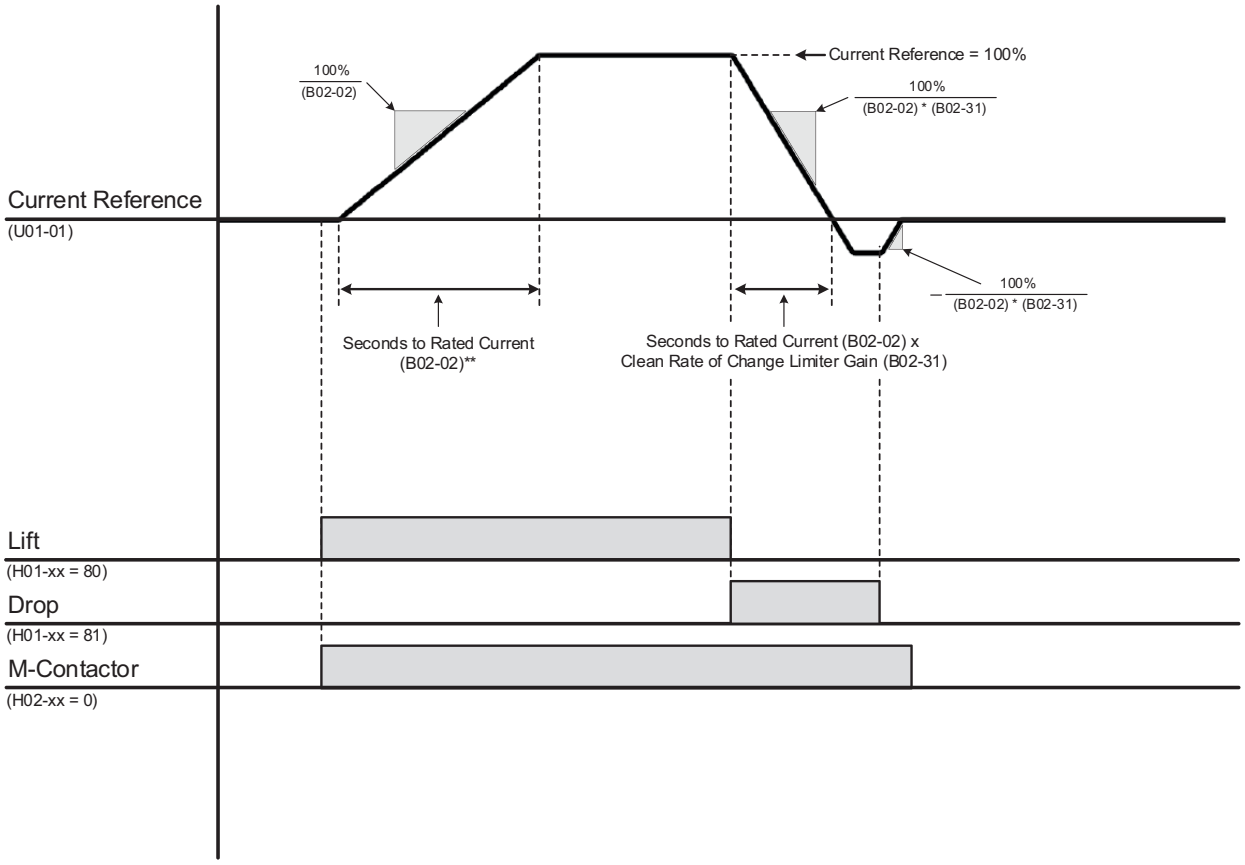
If the time to reach magnet rated current (from 0% to 100% with rated voltage applied) is known, enter the values in the appropriate parameters for additional stability of magnet current and DC bus voltage. The magnet clean current rate of change can be entered in B02-31. The timing diagram in ***Figure 5-1 on page 61*** illustrates how the time to rated current and clean rate of change parameters affect the magnet current reference.

**Table 5-2: Magnet Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| B02-01 | Mag 1 Current | Magnet 1 full load nameplate rated current. | 0-2000 A | * |
| B02-02 | Mag 1 Sec2RatedI | Magnet 1 current reference time to reach rated magnet rated current. Higher values allow for smaller, slower voltage spikes on the DC bus. Lower values will allow for faster current response. | 0.00-10.00 sec | 1.00 |
| B02-03 | Mag 1 Resistance | Magnet 1 cold resistance value (measured at 77°F [25ºC]). The cold resistance is used to calculate current magnet temperature. | 0.00-60.00 Ω | 4.00 |
| B02-04 | Mag 2 Current | Magnet 2 full load nameplate rated current. | 0-2000 A | * |
| B02-05 | Mag 2 Sec2RatedI | Magnet 2 current reference time to reach rated magnet rated current. | 0.00-10.00 sec | 1.00 |
| B02-06 | Mag 2 Resistance | Magnet 2 cold resistance value (77°F [25ºC]). | 0.00-60.00 Ω | 4.00 |
| B02-07 | Mag 3 Current | Magnet 3 full load nameplate rated current. | 0-2000 A | * |
| B02-08 | Mag 3 Sec2RatedI | Magnet 3 current reference time to reach rated magnet rated current. | 0.00-10.00 sec | 1.00 |
| B02-09 | Mag 3 Resistance | Magnet 3 cold resistance value (77°F [25ºC]). | 0.00-60.00 Ω | 4.00 |
| B02-10 | Mag 4 Current | Magnet 4 full load nameplate rated current. | 0-2000 A | * |
| B02-11 | Mag 4 Sec2RatedI | Magnet 4 current reference time to reach rated magnet rated current. | 0.00-10.00 sec | 1.00 |
| B02-12 | Mag 4 Resistance | Magnet 4 cold resistance value (77°F [25ºC]). | 0.00-60.00 Ω | 4.00 |
| B02-13 | Mag 5 Current | Magnet 5 full load nameplate rated current. | 0-2000 A | * |
| B02-14 | Mag 5 Sec2RatedI | Magnet 5 current reference time to reach rated magnet rated current. | 0.00-10.00 sec | 1.00 |
| B02-15 | Mag 5 Resistance | Magnet 5 cold resistance value (77°F [25ºC]). | 0.00-60.00 Ω | 4.00 |
| B02-16 | Mag 6 Current | Magnet 6 full load nameplate rated current. | 0-2000 A | * |
| B02-17 | Mag 6 Sec2RatedI | Magnet 6 current reference time to reach rated magnet rated current. | 0.00-10.00 sec | 1.00 |
| B02-18 | Mag 6 Resistance | Magnet 6 cold resistance value (77°F [25ºC]). | 0.00-60.00 Ω | 4.00 |
| B02-19 | Mag 7 Current | Magnet 7 full load nameplate rated current. | 0-2000 A | * |

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| B02-20 | Mag 7 Sec2RatedI | Magnet 7 current reference time to reach rated magnet rated current. | 0.00-10.00 sec | 1.00 |
| B02-21 | Mag 7 Resistance | Magnet 7 cold resistance value (77°F [25ºC]). | 0.00-60.00 Ω | 4.00 |
| B02-22 | Mag 8 Current | Magnet 8 full load nameplate rated current. | 0-2000 A | * |
| B02-23 | Mag 8 Sec2RatedI | Magnet 8 current reference time to reach rated magnet rated current. | 0.00-10.00 sec | 1.00 |
| B02-24 | Mag 8 Resistance | Magnet 8 cold resistance value (77°F [25ºC]). | 0.00-60.00 Ω | 4.00 |
| B02-25 | Mag 9 Current | Magnet 9 full load nameplate rated current. | 0-2000 A | * |
| B02-26 | Mag 9 Sec2RatedI | Magnet 9 current reference time to reach rated magnet rated current. | 0.00-10.00 sec | 1.00 |
| B02-27 | Mag 9 Resistance | Magnet 9 cold resistance value (77°F [25ºC]). | 0.00-60.00 Ω | 4.00 |
| B02-28 | Mag 10 Current | Magnet 10 full load nameplate rated current. | 0-2000 A | * |
| B02-29 | Mag 10 Sec2RatedI | Magnet 10 current reference time to reach rated magnet rated current. | 0.00-10.00 sec | 1.00 |
| B02-30 | Mag 10 Resistance | Magnet 10 cold resistance value (77°F [25ºC]). | 0.00-60.00 Ω | 4.00 |
| B02-31 | Clean ROCL Gain | Clean current reference rate of change gain as a percentage of magnet time to rated current. For multiple magnets (OmniBeam), the lowest magnet time to rated current setting will be used for the clean rate of change limiter. | 1-100% | 50 |

* *Initial value is determined by O02-04 (Drive Model) selection & O02-06 (Magnet Setup).*




*** For OmniBeam applications, the slowest rate (highest value of Seconds to Rated Current) takes priority.*

**Figure 5-1: Magnet time to rated current and magnet clean rate of change limiter functional diagram**

## 5.2.3 Magnet Reference and Run Source Selection

### 5.2.3.1 Current Reference and Run Source 2 Selection (B03-01 and B03-02)

B03-01 and B03-02 determine the source from where the Current Reference and Run command references are generated, respectively.

**Table 5-3: Reference Source 1 Selection Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| B03-01 | Ref Source 1 | Source from where the Current Reference is generated. | 0-4 | 1* |
| | *1 Terminals* | Multi-function digital input terminals on the 120 VAC interface board, 230 VDC interface board, or the 24 VDC control board. | | |
| | *2 Analog Ref 1* | Reference determined by Multi-Function Analog Input set to Analog Ref 1. | | |
| | *3 Analog Ref 2* | Reference determined by Multi-Function Analog Input set to Analog Ref 2. | | |
| | *4 Serial Comm* | Serial Communications (Terminals A & B on the control board). | | |
| B03-02 | Run Source 1 | Source from where the RUN command is generated. | 1, 2 | 1* |
| | *1 Terminals* | Multi-function digital input terminals on the 120 VAC interface board, 230 VDC interface board, or the 24 VDC control board. | | |
| | *2 Serial Comm* | Serial Communications (Terminals A & B on the control board). | | |

** Initial value is determined by X-Press Programming (**Table 4-5 on page 45** through **Table 4-15 on page 55**).*

### 5.2.3.2 Master Switch Fault Time (B03-05)

B03-05 sets the time allowed for both directional inputs to be on simultaneously before the drive will fault on a Master Switch (MS) fault.

**Table 5-4: MS Fault Time Setting**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| B03-05 | MS Fault Time | Sets the time allowed for Lift and Drop to be on simultaneously before tripping on an MS fault. | 0-200 ms | 75 |

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

#### 5.2.3.3 Current Reference and Run Source 2 Selection (B03-15 and B03-16)

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

**Table 5-5: Reference Source 2 Selection Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| B03-15 | Ref Source 2 | Source from where the Current Reference is generated. Enabled by an MFDI when H01-xx = 1F. | 0-4 | 1* |
| | *1 Terminals* | Multi-function digital input terminals on the 120 VAC interface board, 230 VDC interface board, or the 24 VDC control board. | | |
| | *2 Analog Ref 1* | Reference determined by Multi-Function Analog Input set to Analog Ref 1. | | |
| | *3 Analog Ref 2* | Reference determined by Multi-Function Analog Input set to Analog Ref 2. | | |
| | *4 Serial Comm* | Serial Communications (Terminals A & B on the control board). | | |
| B03-16 | Run Source 2 | Source from where the RUN command is generated. Enabled by an MFDI when H01-xx = 1F. | 1, 2 | 1* |
| | *1 Terminals* | Multi-function digital input terminals on the 120 VAC interface board, 230 VDC interface board, or the 24 VDC control board. | | |
| | *2 Serial Comm* | Serial Communications (Terminals A & B on the control board). | | |

# 5.3 Magnet Function Parameters

- C01 Magnet Control Setup
- C02 Magnet Protection
- C12 Timer Functions

## 5.3.1 Lift and Lift-Drop Magnet Control Modes (A01-04 = 1)

The Lift and Lift-Drop Magnet Control Modes use a predefined set of sequences to control the DMC-S2 output current to one or more magnets. The Lift and Lift-Drop Mode can be configured through X-Press Programming by setting the current reference Lift/Lift-Drop (A01-04 = 1).

Fully adjustable levels of current (percentage of magnet rated current), time, and rate allow the magnet(s) to operate at their optimal level of lifting force while minimizing magnet heating. The sequence steps of the Lift and Lift-Drop Control Modes are defined in Table 5-6 and illustrated in ***Figure 5-2 on page 66*** and ***Figure 5-3 on page 66***. Reissuing the Lift command during the Hold, Dribble, or Clean sequence will automatically restart the Lift or Lift-Drop sequence.

For OmniBeam applications, the actual drive output current is the sum of all selected magnet rated currents (see the Magnet Setup parameters B02-01 through B02-30 beginning on ***page 59***).

**Table 5-6: Lift and Lift-Drop Control Mode Sequence**

| Lift Mode (C01-14 = 1) | Lift-Drop Mode (C01-14 = 0) | Sequence Description | Magnet Current Level Settings | Time and Rate Settings |
|---|---|---|---|---|
| 1 | 1 | Lift | C01-01 (Lift Current) | C01-06 (Lift Time) |
| 2 | 2 | Hold | C01-02 (Hold Current) | - |
| - | 3 | Dribble (Lift-Drop Mode Only) | C01-03 (Dribble Current) | C01-07 (Dribble Rate) |
| 3 | 4 | Clean | C01-04 (Clean Current) | C01-08 (Clean Time) |

#### 5.3.1.1 Lift Current and Lift Time (C01-01 and C01-06)

Lift Current sets the initial magnet current when a lift command is first issued or reapplied during the Lift or Lift-Drop sequence. During setup, this value should be set to a level of current necessary to magnetize the heaviest load at the highest foreseeable magnet operating temperature.

Lift time sets the time the Lift Current is active before entering the Hold Current sequence. This period begins at the end of the Start Delay (C02-03).

#### 5.3.1.2 Hold Current (C01-02)

Hold Current sets a reduced level of magnet current during the Hold sequence to aid in magnet cooling. During setup, this level should be set to a level of current necessary to hold the heaviest load at the highest foreseeable magnet operating temperature.

The hold sequence is activated either when the Lift Time (C01-06) has expired or when a multi-function digital input is programmed for “Hoisting” (H01-xx = 8). ***See Figure 5-4 on page 67*** for a timing diagram that illustrates the function of the Hoisting input.

#### 5.3.1.3 Dribble Current and Dribble Rate (C01-03 and C01-07)

Dribble Current sets the final (minimum) level of magnet current during the Dribble sequence (Lift-Drop Mode only). Once achieved, the magnet current is no longer reduced.

Dribble Rate sets the rate of reduction in magnet current once Lift command input is removed.

***NOTE:*** *Dribble may also be referred to as “fanning.”*

#### 5.3.1.4 Clean Current and Clean Time (C01-04 and C01-08)

Clean Current sets a value of current to demagnetize the magnet (usually a low value of current of reverse polarity) to rapidly drop the load and clean the magnet.

#### 5.3.1.5 Cast Rate (C01-05)

Cast Rate is a feature similar to the Dribble function, however it is activated with a multi-function digital input (H01-xx = 4). Casting can be activated only during the Hold sequence to dribble (fan) the load. ***See Figure 5-4 on page 67*** for a timing diagram that illustrates the Cast Rate function.

#### 5.3.1.6 Decreased Lift (C01-09)

Decreased Lift reduces the Lift or Hold current settings (depending on the active sequence) by the percentage set in C01-09 with the use of a multi-function digital input (H01-xx = 5). ***See Figure 5-5 on page 67*** for a timing diagram that illustrates the Decreased Lift function.

### 5.3.1.7 Current Deviation and Current Regulator Settings (C01-10 through C01-13)

These parameters apply to all magnet control modes. ***See Section 5.3.2 on page 68*** for information on these parameters.

### 5.3.1.8 Auto Clean (C01-14)

The Auto Clean parameter is used to set the magnet control method. The Lift-Drop Mode is selected when Auto Clean is disabled (default). The Lift Mode is selected when Auto Clean is enabled, which will activate the Clean sequence immediately when the Lift command is removed.

### 5.3.1.9 Maintain Clean (C01-15)

The Maintain Clean function will keep the clean cycle enabled if the clean (drop) command is removed. If Auto Clean (C01-14) is enabled, Maintain Clean should remain enabled. ***See Figure 5-4 on page 67*** for a timing diagram that illustrates the Maintain Clean function.

**Table 5-7: Lift & Lift-Drop Mode Configuration Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| C01-01 | Lift Current | Lift Sequence current | 0.0-100.0% | 100.0 |
| C01-02 | Hold Current | Hold Sequence current | 0.0-100.0% | 75.0 |
| C01-03 | Dribble Current | Minimum level of current during the Dribble Sequence. | -100.0-100.0% | -10.0 |
| C01-04 | Clean Current | Clean Sequence Current | 0.0-100.0% | 15.0 |
| C01-05 | Cast Rate | Rate of decrease in current when Casting MFDI is enabled (H01-xx = 4). | 0.0-100.0%<br>Per second | 1.0 |
| C01-06 | Lift Time | Lift Sequence duration | 0.20-30.0 sec | 15.0 |
| C01-07 | Dribble Rate | Rate of decrease in current when Lift command is removed (Lift-Drop Mode only). | 0.0-100.0%<br>Per second | 2.0 |
| C01-08 | Clean Time | Clean Sequence duration | 0.20 to 30.0 sec | 0.8 |
| C01-09 | Decreased Lift | Percentage of decrease in Lift or Hold current when Decreased Lift MFDI is enabled (H01-xx = 5). | 0-100% | 10 |
| C01-10 to C01-13 | *Applies to all magnet control modes.* ***See Section 5.3.2 on page 68*** *for information on these parameters.* | | | |
| C01-14 | Auto Clean | Clean sequence activated upon removal of Lift command.<br>*0 Disabled*<br>*1 Enabled* | 0-1 | 0 |
| C01-15 | Maintain Clean | Clean sequence is maintained upon removal of the Clean (Drop) command.<br>*0 Disabled*<br>*1 Enabled* | 0-1 | 1 |

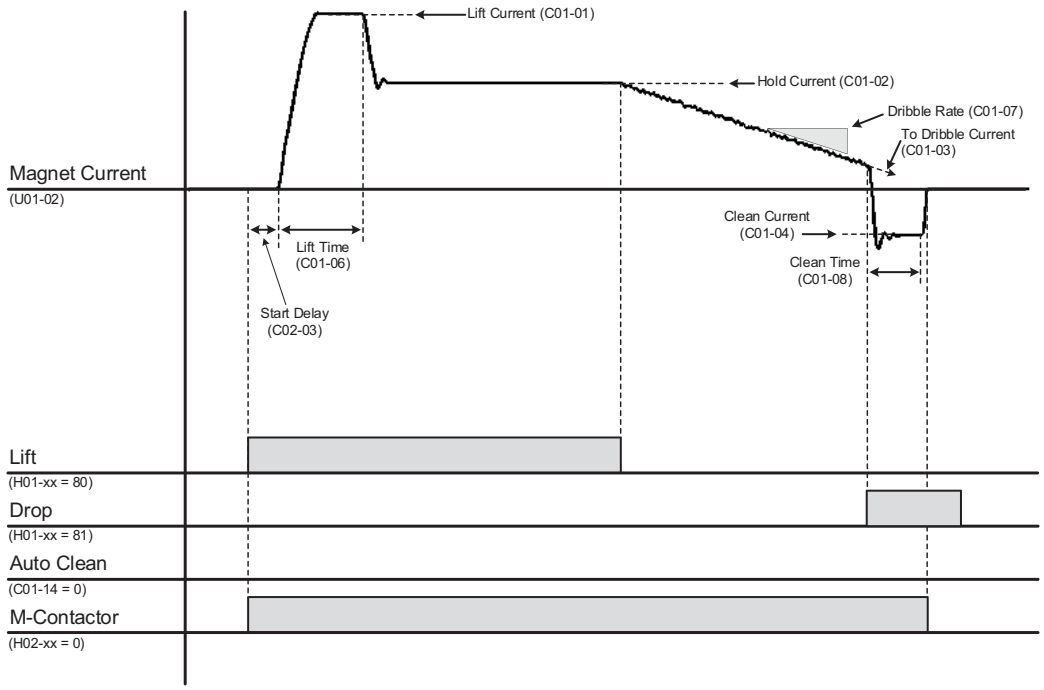



**Figure 5-2: Lift-Drop Mode Sequence Diagram**

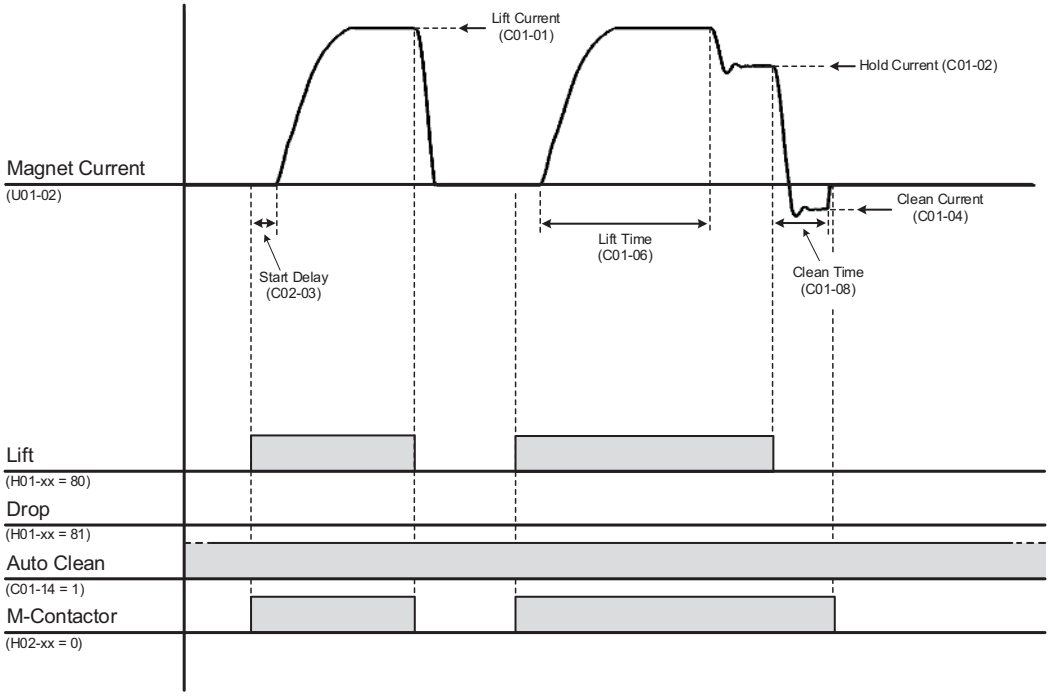



**Figure 5-3: Lift Mode Sequence Diagram**

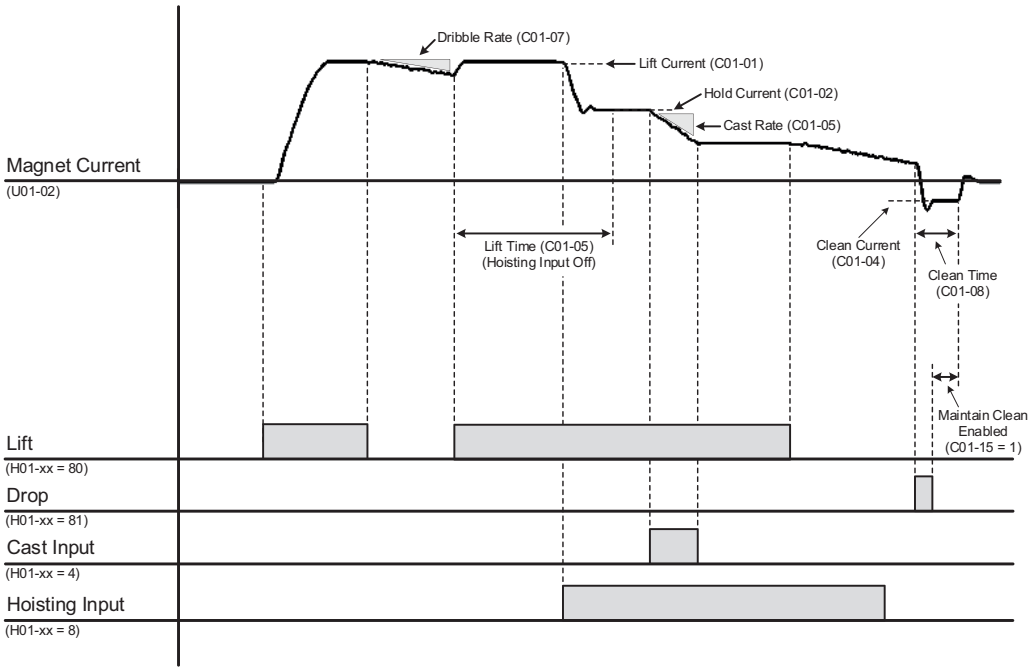



**Figure 5-4: Cast Function, Hoisting Input, and Maintain Clean Functions in the Lift-Drop Control Mode**

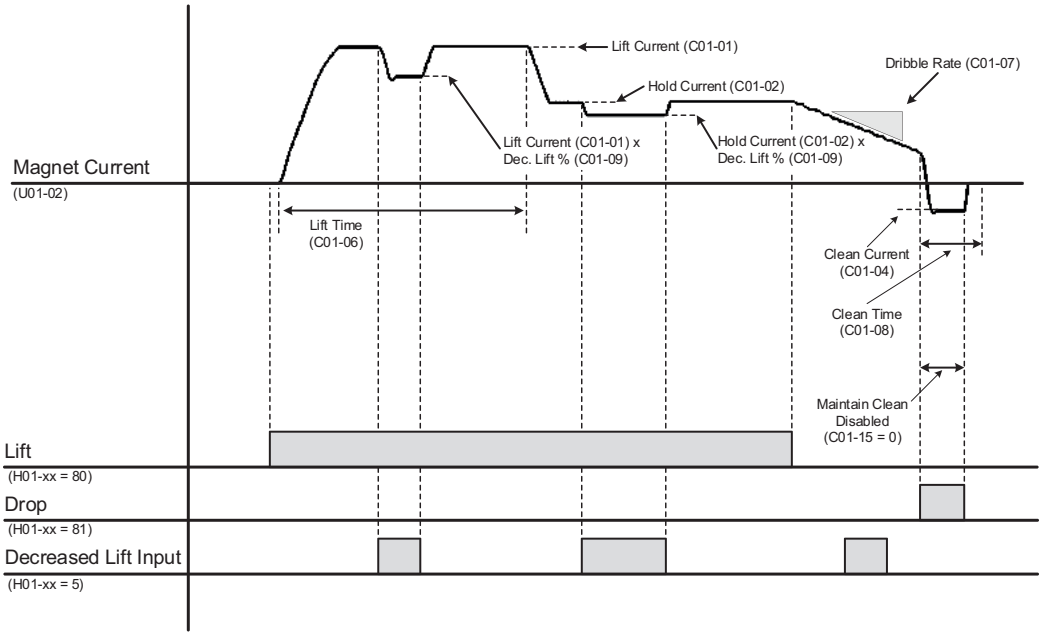



**Figure 5-5: Decreased Lift and Maintain Clean Functions in the Lift-Drop Control Mode**

## 5.3.2 Stepped Current Magnet Control Mode (A01-04 = 2 through 5)

The Stepped Current Magnet Control Mode parameters are used to set discrete levels of current depending on the status of the of the directional and stepped reference multi-function digital inputs. The Stepped Current Mode can be configured through X-Press Programming by setting the current reference to 2-, 3-, 4-, or 5-step (A01-04 = 2 through 5). The Stepped Current Mode is illustrated in ***Figure 5-6 on page 68***.

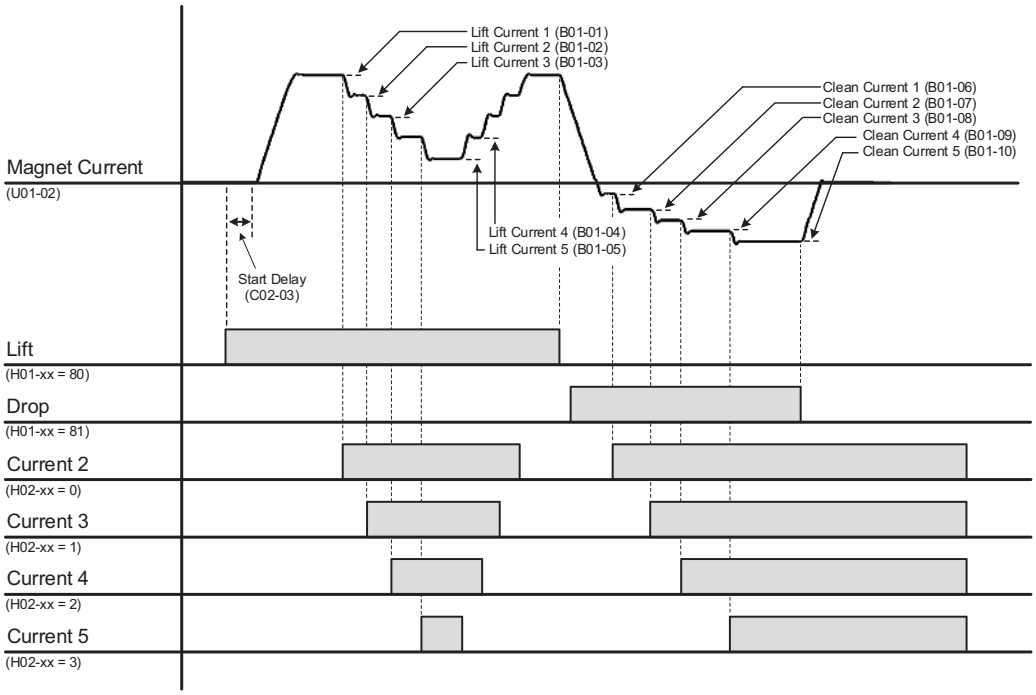



**Figure 5-6: Stepped Current Mode Sequence Diagram**

## 5.3.3 Analog and Serial Magnet Control Mode (A01-04 = 0 or 6)

The DMC-S2 drive allows controlling the magnet current reference using a multi-function analog input or using an external controller to write the current reference to the appropriate Modbus register (***See Appendix A: Modbus RTU Communications on page 111***).

For additional flexibility in control, the Lift and Drop commands may be issued from the terminals or over a serial network while the current reference is sourced from an analog input or serial communications. ***See Section 5.2.3 on page 62***. ***Figure 5-7*** illustrates a timing diagram from which the current reference is sourced from a multi-function analog input.

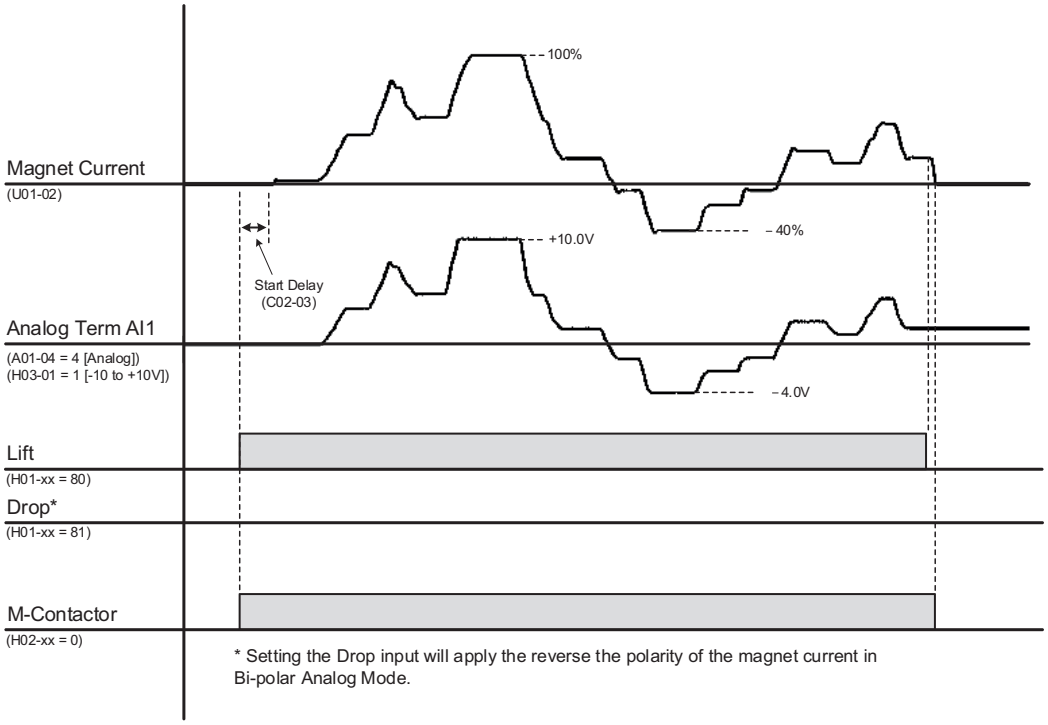



**Figure 5-7: Bi-polar Magnet Current Control Using a Multi-function Analog Input and Terminals for a Run Source**

## 5.3.4 Magnet Current Deviation and Current Regulator

### 5.3.4.1 Magnet Current Deviation Detection Level and Time (C01-10 and C01-11)

This feature is used to monitor for deviations in magnet current and can serve useful in diagnosing failing or open magnet windings and wiring connections as well as unexpected drops in the DC bus voltage.

A current deviation alarm (I-DEV) will be triggered if the magnet current feedback level deviates from the magnet current reference greater than the level set in C01-10 for a period longer than the time set in C01-11. The alarm will be automatically cleared when the current deviation condition subsides.

### 5.3.4.2 Magnet Current Regulator Settings (C01-12 and C01-13)

Sets the magnet current regulator gain levels.

Increase the proportional gain (C01-12) to increase the responsiveness of the output current (sluggish response). Decrease this value if the magnet currents are erratic or oscillating.

Increase the integral gain (C01-13) to remove steady-state error between the magnet current reference and magnet current feedback. Decrease this value if the magnet currents are erratic or oscillating.

**Table 5-8: Magnet Current Deviation and Regulator Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| C01-10 | I Dev Level | Magnet current deviation level. Percentage of magnet rated current(s). | 0.0-100.0% | 5.0 |
| C01-11 | I Dev Time | Magnet current deviation time. | 0-9000 ms | 5000 |
| C01-12 | P Gain | Current regulator proportional gain. | 0.0-50.0% | 1.0 |
| C01-13 | I Gain | Current regulator integral gain. | 0.0-50.0% | 0.2 |

## 5.3.5 Magnet Protection

The following section describes parameters in the DMC-S2 drive for aiding in protecting the magnet system against thermal and electrical overload and open circuits. Other parameters in this section allow for protecting auxiliary electronic and electromechanical devices, such as the M contactor, battery backup system, magnet selection relays, etc.

**WARNING**

A faulted DMC-S2 drive will stop the drive resulting in a loss of magnet current. Loss of the load may occur.

### 5.3.5.1 Magnet Rated Voltage (C02-01)

Nameplate voltage of magnet(s). This parameter value is used to scale the magnet voltage feedback.

### 5.3.5.2 Magnet Voltage Limit (C02-02)

This parameter will limit the output voltage to the magnet if the magnet current feedback is less than the current reference. Setting C02-02 to 0 will disable this feature.

### 5.3.5.3 Start Delay (C02-03)

The Start Delay allows time for the main contactor to close and DB contactor to open before the drive outputs current to the magnet(s). The C02-04 time occurs every time a lift command is issued. If arcing occurs on the contact tips or an undervoltage (UV) fault occurs, extend the C02-03 time.

### 5.3.5.4 Stop Delay (C02-04)

The Stop Delay provides a delay at the end of the stop sequence to allow for the magnet current to return to zero before the start of the next lift command. Setting this parameter to zero will allow the drive to obtain the fastest ready state.

### 5.3.5.5 Magnet Over Temperature Alarm Level (C02-05)

Sets the magnet temperature that triggers the magnet temperature alarm (MOT1). This feature is used to notify the operator that an over temperature condition may occur during the current lift and should find a safe place to lower the load. Setting C02-05 to zero will disable the MOT1 feature.

### 5.3.5.6 Magnet Over Temperature Fault Level (C02-06)

Sets the magnet temperature that trigger the magnet temperature fault (MOT2). Setting C02-06 to zero will disable the MOT2 fault feature.

### 5.3.5.7 Magnet Open Circuit Detection Level (C02-07)

Sets the magnet current level that will trigger a magnet open circuit (MOC) fault. Setting this parameter to zero disables the MOC feature.

### 5.3.5.8 Magnet Open Circuit Detection Time (C02-08)

Sets the maximum duration allowed for the magnet current feedback to measure less than MOC detection level set in C02-07 before triggering an MOC fault.

### 5.3.5.9 Power Loss Ride Through (C02-09 and C02-10)

The Power Loss Ride Through (PLR) feature takes advantage of stored energy in the magnet to restore the DC bus voltage during intermittent loss of drive input power. The effectiveness of PLR depends on several factors, including the rated magnet inductance, the magnet current level at the time of the input power loss, and the model of the DMC-S2 drive.

The Power Loss Detection Level (C02-09) defines the DC bus voltage that will initiate the Power Loss Ride Through (PLR) state. Once initiated, the drive will turn off all power IGBTs and allow the magnet energy to recharge the DC bus capacitors until the DC bus voltage increases to a value greater than the Power Loss Recovery Level (C02-10 as a percentage of C02-09). This will restart the DMC-S2 to recharge the magnet. This cyclic process will continue until the magnet and DC bus voltage is restored or energy levels are depleted.

If the DC bus voltage drops below the undervoltage threshold (L02-01), the DMC-S2 drive will trip on an undervoltage fault (UV). A setting of zero in parameter C02-09 disables the Power Loss Ride Through feature.

### 5.3.5.10 Zero Current Delay Time (C02-11)

Sets the delay time to allow the magnet current to reduce to zero before de-energizing the M-contactor. The value in C02-11 should be set to a value greater than the total time required to return the magnet current to zero at the end of a magnet lift or drop cycle.

If the current reference selection in A01-04 is configured for stepped, analog, or serial magnet control, increasing this value allows time for switching between lift and drop commands while keeping the M-contactor energized.

### 5.3.5.11 Battery Backup Configuration (C02-12)

Defines the operation of the DMC-S2 drive when a multi-function digital input programmed to “Battery Enable” (H01-xx = 7) is energized. When a digital input originating from a battery backup system changes from off (normal) to on (batteries discharging), the drive will operate according to the selection in C02-12. The digital input will also trip the “Battery Enabled” alarm condition, which automatically clears when the input is turned off.

***NOTE:*** *When battery is enabled, the control undervoltage (CUV) and DC bus undervoltage faults will be ignored unless C02-12 is set for zero (disabled).*

### 5.3.5.12 Battery Required Voltage Level (C02-13)

Sets the voltage level that will trigger a multi-function digital output programmed for “Battery Required N.C.” (H02-xx = 10) to change state. Use this output to notify a battery backup system to start discharging due to a drop in DC bus voltage. The output will automatically turn on when the DC Bus voltage exceeds the C02-13 level.

### 5.3.5.13 OmniBeam Latch (C02-14)

Sets whether the magnet selection digital outputs (H02-xx = 02 through 0B) remain latched once the magnet selection digital inputs are turned on (H01-xx = 10 through 19). If C02-14 = 0 (disabled), the enable outputs and current reference will follow the respective enable inputs during run,** as they do when drive is not running (ready state).

**WARNING ****

** The power contacts of magnet selection relays/contactors should not be opened while the DMC-S2 drive is outputting current to the magnet(s). Disconnecting highly inductive, current carrying loads, such as lifting magnets, may cause damage to relay contacts and the DMC-S2 drive.

## Table 5-9: Magnet Protection Parameter Settings

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| C02-01 | Mag Rated V | Magnet rated voltage | 0-720V | 230: LV<br>460: HV |
| C02-02 | Mag V Limit | Magnet maximum voltage applied by drive. A value of zero sets the DC bus voltage as the limit. | 0.0-200.0% | 125.0 |
| C02-03 | Start Delay | Delay between M-contactor closing and initial output of magnet voltage. | 0-2500ms | 300 |
| C02-04 | Stop Delay | Delay required between consecutive lift commands. | 0-2500ms | 0 |
| C02-05 | Mag OT Alm Lvl | Magnet over temperature alarm level. A value of zero disables MOT alarm. | 0.0-500.0ºC | 0.0 |
| C02-06 | Mag OT Flt Lvl | Magnet over temperature fault level. A value of zero disabled MOT fault. | 0.0-500.0ºC | 0.0 |
| C02-07 | MOC Det level | Magnet open circuit detection level. A value of zero disables MOC detection. | 0.0-100.0% | 0.0 |
| C02-08 | MOC Detect Time | Maximum time for magnet current to reach C02-07 level before triggering MOC fault. | 0-2500ms | 0 |
| C02-09 | Power Loss Lvl | Minimum DC bus level before PLR is triggered. A value of zero disables PLR. | 0.0-700.0V | 200.0: LV<br>400.0: HV |
| C02-10 | PwrL Recover Lvl | DC bus voltage as a percentage of C02-09 required to restart normal drive operation following PLR event. | 102-200% | 110 |
| C02-11 | Zero I Time | Delay to maintain closure of M-contactor until magnet current reaches zero. | 0-2500ms | 500 |
| C02-12 | Battery Sel | Battery Backup Configuration: Action to take with Battery Enable MFDI (H01-xx = 07):<br>*0 Disabled*<br>*1 Full Control (normal drive operation)*<br>*2 Full Lift (100% current reference)*<br>*3 No New Lifts (after run cycle completes)* | 0-3 | 0 |
| C02-13 | Battery Req Lvl | Minimum DC bus voltage before triggering Battery Required N.C. MFDO (H02-xx = 10). A value of zero disables this feature. | 0.0-700.0V | 0.0 |

## 5.3.6 Timer Function (C12-03 and C12-04)

The Timer Function provides either an on- or off-delay timer for an input and output pair, which serve as general-purpose I/O. Chattering of sensors, switches, contactors, etc., can be prevented by setting a delay time. ***See Figure 5-8 on page 73*** for a timing diagram that illustrates the timer function.

- The timer function is enabled when the timer function MFDI (H01-0x = 1A) and the timer function MFDO (H02-0x = 0C) are set respectively.
- When the timer function input ON time is longer than the value set for C12-03 (timer function On-Delay Time), the timer function output turns on.
- When the timer function input OFF time is longer than the value set for C12-04 (timer function Off Delay Time), the timer function output turns off.

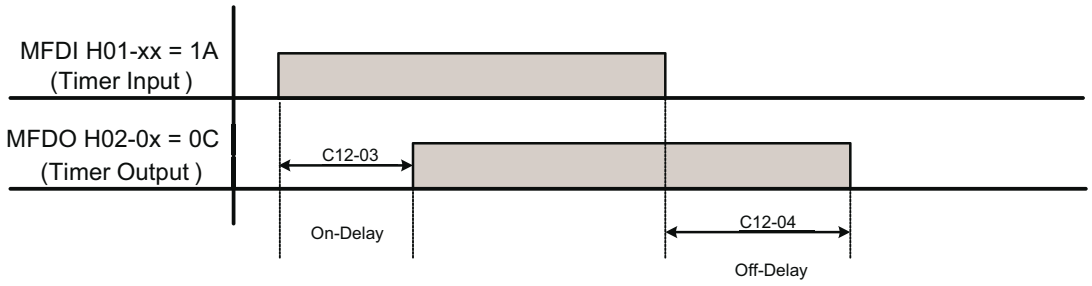



**Figure 5-8: Timer Function Timing Diagram**

**Table 5-10: Timer Function Parameter Settings**

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

# 5.4 Terminal Parameters

- H01 Digital Inputs
- H02 Digital Outputs
- H03 Analog Inputs
- H04 Analog Output
- H05 Serial Communications Setup

## 5.4.1 Digital Inputs (H01-01 through H01-12)

The DMC-S2 has 12 multi-function digital inputs for the control of numerous functions. All 12 24VDC MFDIs (S1 to S12) are located on the control board. There are seven parallel-connected 120VAC/250VDC MFDIs (S1 to S7) located on the respective interface board. ***Table 5-12 on page 75*** lists the function selections for the MFDIs and indicates the motion that each function can be enabled. An “Over Limit” error will be displayed on the DLS4 if a function is programmed for more than one terminal at the same time.

**Table 5-11: Digital Inputs Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| H01-01 | Term S1 Select | Selects the multi-function inputs. ***See Table 5-12 on page 75***. | 0-81 | 80 (Lift)* |
| H01-02 | Term S2 Select | ***See Table 5-12 on page 75***. | 0-81 | 81 (Drop)* |
| H01-03 | Term S3 Select | ***See Table 5-12 on page 75***. | 0-81 | F (Not Used)* |
| H01-04 | Term S4 Select | ***See Table 5-12 on page 75***. | 0-81 | F (Not Used)* |
| H01-05 | Term S5 Select | ***See Table 5-12 on page 75***. | 0-81 | F (Not Used)* |
| H01-06 | Term S6 Select | ***See Table 5-12 on page 75***. | 0-81 | F (Not Used)* |
| H01-07 | Term S7 Select | ***See Table 5-12 on page 75***. | 0-81 | F (Not Used)* |
| H01-08 | Term S8 Select | ***See Table 5-12 on page 75***. | 0-81 | F (Not Used)* |
| H01-09 | Term S9 Select | ***See Table 5-12 on page 75***. | 0-81 | F (Not Used)* |
| H01-10 | Term S10 Select | ***See Table 5-12 on page 75***. | 0-81 | F (Not Used)* |
| H01-11 | Term S11 Select | ***See Table 5-12 on page 75***. | 0-81 | F (Not Used)* |
| H01-12 | Term S12 Select | ***See Table 5-12 on page 75***. | 0-81 | F (Not Used)* |
| H01-14 | Stop/Reset | Sets the Stop/Reset input for Normally Open or Normally Closed.<br>***NOTE:*** *Jumper LK1 on Control Board must be set to positions 2 & 3 (default).* ***See Section 3.3.1 on page 30***.<br>*0: Normally Open*<br>*1: Normally Closed* | 0-1 | 0 |

* *Initial value is determined by X-Press Programming (**Table 4-5 on page 45** through **Table 4-15 on page 55**).*

## Table 5-12: Multi-Function Digital Inputs (MFDI) Selectable for H01-xx

| Value | Display | Function |
|---|---|---|
| *0* | *Current 2* | Stepped Current Reference 2 |
| *1* | *Current 3* | Stepped Current Reference 3 |
| *2* | *Current 4* | Stepped Current Reference 4 |
| *3* | *Current 5* | Stepped Current Reference 5 |
| *4* | *Cast* | Enables the Cast feature |
| *5* | *Decreased Lift* | Enables the Decreased Lift feature |
| *6* | *Mag OT Alm* | External input to trigger a magnet over temperature alarm |
| *7* | *Battery Enable* | Drive initiates battery backup enabled operation as defined in parameter C02-12. DMC-S2 drive ignores CUV and UV faults if C02-12 ≠ 0. |
| *8* | *Hoisting* | Enables the Hoisting feature |
| *9* | *No New Lifts* | No new lifts allowed on next run command. Input off = new lifts allowed. Input on = no new lifts. |
| *F* | *Not Used* | No function - Terminal is disabled |
| *10* | *Enable Magnet 1* | Enables the control of magnet 1 (when A01-03 = 1) |
| *11* | *Enable Magnet 2* | Enables the control of magnet 2 (when A01-03 = 2) |
| *12* | *Enable Magnet 3* | Enables the control of magnet 3 (when A01-03 = 3) |
| *13* | *Enable Magnet 4* | Enables the control of magnet 4 (when A01-03 = 4) |
| *14* | *Enable Magnet 5* | Enables the control of magnet 5 (when A01-03 = 5) |
| *15* | *Enable Magnet 6* | Enables the control of magnet 6 (when A01-03 = 6) |
| *16* | *Enable Magnet 7* | Enables the control of magnet 7 (when A01-03 = 7) |
| *17* | *Enable Magnet 8* | Enables the control of magnet 8 (when A01-03 = 8) |
| *18* | *Enable Magnet 9* | Enables the control of magnet 9 (when A01-03 = 9) |
| *19* | *Enable Magnet 10* | Enables the control of magnet 10 (when A01-03 = 10) |
| *1A* | *Timer Function* | Functions with timer parameter parameters C12-03 & C12-04, which control timer function output (H02-0x = 0C). |
| *1F* | *Ref/Run 2* | Reference/Run Source 2: Input on = source from B03-15 & B03-16. Input off = source from B03-01 & B03-02. |
| *20* | *Ext Fault N.C.* | External fault is triggered when input is turned off |
| *21* | *Ext Fault N.O.* | External fault is triggered when input is turned on |
| *26* | *Phantom Fault NO* | Input On: Stops drive, reduces output current to zero<br>Input Off: Drive OK to run normally |
| *26* | *Phantom Fault NC* | Input On: Drive OK to run normally<br>Input Off: Stops drive, reduces output current to zero |
| *3F* | *Fault Reset* | Fault reset when input is turned on |
| *80* | *Lift* | Magnet Lift Command |
| *81* | *Drop* | Magnet Drop Command |

## 5.4.2 Digital Outputs (H02-01 through H02-07)

The DMC-S2 has seven multi-function digital outputs (MFDO) for indicating various conditions. The first four MFDOs are relay outputs located on the control board. The remaining three MFDOs are solid state 250VDC outputs located on the interface board. ***Table 5-14 on page 76*** lists the function selections for the MFDOs and indicates the control methods during which each function can be enabled.

**Table 5-13: Digital Outputs Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| H02-01 | !M1/M2 M3/M4 Sel | Selects the multi-function outputs. ***See Table 5-14 on page 76***. | 0-F | 0 (M Contactor) |
| H02-02 | M5/M6 Sel | ***See Table 5-14 on page 76***. | 0-F | E (Ctrl Fault) |
| H02-03 | M7/M8/M9 Sel | ***See Table 5-14 on page 76***. | 0-F | 11 (Ctrl Ready) |
| H02-04 | M10/M11/M12 Sel | ***See Table 5-14 on page 76***. | 0-F | 2 (Mag 1 En) |
| H02-05 | OP M Sel | ***See Table 5-14 on page 76***. | 0-F | 0 (M Contactor) |
| H02-06 | OP1/DB Sel | ***See Table 5-14 on page 76***. | 0-F | F (Not Used) |
| H02-07 | OP4/SB Sel | ***See Table 5-14 on page 76***. | 0-F | F (Not Used) |

**Table 5-14: Multi-Function Digital Outputs (MFDO) Selectable for H02-0x**

| Value | Display | Function |
|---|---|---|
| *0* | *M Contactor* | ON: When a lift command is issued and<br>OFF: When the drive stops outputting voltage to the magnet. |
| *1* | *Mag On* | ON: Magnet is energized.<br>OFF: Magnet is not energized. |
| *2* | *Magnet 1 En* | ON: Magnet 1 enabled by MFDI and current reference includes Magnet 1.<br>OFF: Magnet 1 is disabled. |
| *3* | *Magnet 2 En* | ON: Magnet 2 enabled by MFDI and current reference includes Magnet 2.<br>OFF: Magnet 2 is disabled. |
| *4* | *Magnet 3 En* | ON: Magnet 3 enabled by MFDI and current reference includes Magnet 3.<br>OFF: Magnet 3 is disabled. |
| *5* | *Magnet 4 En* | ON: Magnet 4 enabled by MFDI and current reference includes Magnet 4.<br>OFF: Magnet 4 is disabled. |
| *6* | *Magnet 5 En* | ON: Magnet 5 enabled by MFDI and current reference includes Magnet 5.<br>OFF: Magnet 5 is disabled. |
| *7* | *Magnet 6 En* | ON: Magnet 6 enabled by MFDI and current reference includes Magnet 6.<br>OFF: Magnet 6 is disabled. |
| *8* | *Magnet 7 En* | ON: Magnet 7 enabled by MFDI and current reference includes Magnet 7.<br>OFF: Magnet 7 is disabled. |
| *9* | *Magnet 8 En* | ON: Magnet 8 enabled by MFDI and current reference includes Magnet 8.<br>OFF: Magnet 8 is disabled. |

| Value | Display | Function |
|---|---|---|
| *A* | *Magnet 9 En* | ON: Magnet 9 enabled by MFDI and current reference includes Magnet 9.<br>OFF: Magnet 9 is disabled. |
| *B* | *Magnet 10 En* | ON: Magnet 10 enabled by MFDI and current reference includes Magnet 10.<br>OFF: Magnet 10 is disabled. |
| *C* | *Timer Function* | ON: When H01-xx = 1A is active for longer than C12-03 time.<br>OFF: When H01-xx = 1A is not active. |
| *D* | *Mag OT Alm* | ON: Magnet temperature has exceeded the value set in C02-05. |
| *E* | *Ctrl Fault* | ON: When the drive is in a fault condition.<br>OFF: When the drive is not in a fault condition. |
| *F* | *Not Used* | No function - Terminal is disabled. |
| *10* | *Battery Req N.C.* | ON: DC bus is at normal operating levels.<br>OFF: DC bus voltage has reduced to a value less than C02-13. |
| *11* | *Ctrl Ready* | ON: After the drive has performed initialization process and no faults are detected. |
| *12* | *Current Dev* | ON: Magnet current feedback has deviated from the current reference by more than C01-10 level. |
| *13* | *Zero Current* | ON: Magnet current = 0A.<br>OFF: Magnet current > 0A. |
| *14* | *Alarm* | ON: Alarm condition.<br>OFF: No alarm condition. |

## 5.4.3 Analog Inputs (H03-01 through H03-08)

The DMC-S2 has two analog inputs for receiving analog references and limits. ***See Table 5-15 on page 78*** and ***Table 5-16 on page 78*** for information on configuring analog inputs and selecting their function.

Each analog input has an adjustable gain and bias. As an example of using magnet output voltage and current reference, a gain setting of 1 sets the scaling such that 100% of the voltage or current signal equates to 100% of the magnet voltage or current command. Likewise, a gain setting of 3 sets the scaling such that 100% of the voltage or current signal equates to 300% of the magnet voltage or current command.

**Table 5-15: Analog Inputs Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| H03-01 | Term A1 Signal<br>*0 0-10 V*<br>*1 -10 - 10 V*<br>*2 4-20 mA* | Terminal A1 signal type selection. | 0-2 | * |
| H03-02 | Term A1 Select | Sets the function of terminal A1 (***Table 5-16 on page 78***). | 0-F | * |
| H03-03 | Term A1 Gain | Gain multiplier for terminal A1. | -999.9-999.9% | 100.0 |
| H03-04 | Term A1 Bias | Signal offset for terminal A1. | -200.0-200.0% | 0.0 |
| H03-05 | Term A2 Signal<br>*0 0-10 V*<br>*2 4-20 mA* | Terminal A2 signal type selection. | 0, 2 | 0 |
| H03-06 | Term A2 Select | Sets the function of terminal A2 (***Table 5-16 on page 78***). | 0-F | 1 |
| H03-07 | Term A2 Gain | Gain multiplier for terminal A2. | -999.9-999.9% | 100.0 |
| H03-08 | Term A2 Bias | Signal offset for terminal A2. | -200.0-200.0% | 0.0 |

* *Initial value is determined by X-Press Programming (**Table 4-5 on page 45** through **Table 4-15 on page 55**).*

**Table 5-16: Multi-Function Analog Inputs Selectable for H03-0x**

| Display | | Function |
|---|---|---|
| *0* | *Analog Ref 1* | Sets the MFAI to Analog Reference 1 |
| *1* | *Analog Ref 2* | Sets the MFAI to Analog Reference 2 |
| *2* | *Mag Temp* | Magnet temperature feedback |
| *F* | *Not Used* | No function - Terminal is disabled |

## 5.4.4 Analog Outputs (H04-01 through H04-07)

The DMC-S2 has one built-in analog output for monitoring drive conditions. ***See Table 5-17 on page 79*** and ***Table 5-18 on page 79*** for information on configuring the analog output and selecting its function.

**Table 5-17: Analog Output Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| H04-01 | MFAO Select | Sets the function of the multi-function analog output terminals AOV and AOI. ***See Table 3-3 on page 30***. | 0-999 | 101 |
| H04-02 | MFAO Gain | Gain multiplier for the analog output signal terminals AOV and AOI. | -999.9-999.9% | 100.0 |
| H04-03 | MFAO Bias | Bias multiplier for the analog output signal terminals AOV and AOI. | -200.0-200.0% | 0.0 |
| H04-07 | MFAO Signal<br>*0 0-10 V*<br>*1 -10 - 10 V*<br>*2 4-20 mA* | MFAO signal type selection (0 and 1 for Terminal AOV, 2 for Terminal AOI) | 0-2 | 0 |

**Table 5-18: Multi-Function Analog Output (MFAO) Selectable for H04-01**

| Display | | Function |
|---|---|---|
| *101* | *Mag Current Ref* | Magnet current reference calculated by the current regulator |
| *102* | *Magnet Current* | Measured magnet current |
| *103* | *Magnet Temperature* | Calculated or measured magnet temperature |
| *104* | *Magnet Voltage* | Measured magnet voltage |
| *105* | *DC Bus Voltage* | Measured DC bus voltage |
| *106* | *Sequence Status* | Current state of the sequence status. Outputs (0.5V) * (the value of the Sequence State); see U01-06 for drive states in ***Table 6-2 on page 88***. |
| *107* | *Num Active Mags* | Number of Active Magnets (0.5 V / magnet) |
| *108* | *Mag FB Rel* | Scaled magnet current feedback |
| *115* | *Analog Ref 1* | Analog reference 1 value |
| *116* | *Analog Ref 2* | Analog reference 2 value |
| *123* | *Mag Volt Ref* | Magnet voltage reference |
| *124* | *Mag Resistance* | Calculated magnet resistance |
| *125* | *Mag Rate/ms* | Magnet current rate of change level |
| *126* | *Input Power* | Estimated total power being drawn from the DC supply |
| *405* | *Heatsink Temp* | Measured temperature of the heatsink. 10 VDC = 212°F (100°C) |
| *407* | *Mag OL Lvl* | Status of the calculated magnet overload level before tripping. A value of 100% is the tripping point. |

| Display | | Function |
|---|---|---|
| *408* | *Drive OL Lvl* | Status of the calculated drive overload level before tripping. A value of 100% is the tripping point. |
| *409* | *T1 Duty Cycle* | Duty cycle of the upper IGBT of the T1 leg. |
| *410* | *T2 Duty Cycle* | Duty cycle of the upper IGBT of the T2 leg. |

## 5.4.5 Serial Communications (H05-01 through H05-09)

The DMC-S2 uses RS-485 on terminals A (TX-/RX-) and B (TX+/RX+) on the control board (X1) to communicate over a network using the Modbus RTU protocol. Cycle power after changing serial format parameters. ***See Figure 5-9 on page 80*** for connecting a DMC-S2 drive to an RS-485 network. Additional information on Modbus communications is provided in ***Appendix A: Modbus RTU Communications on page 111***.

**Table 5-19: Serial Communication Setup Parameter Settings**

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

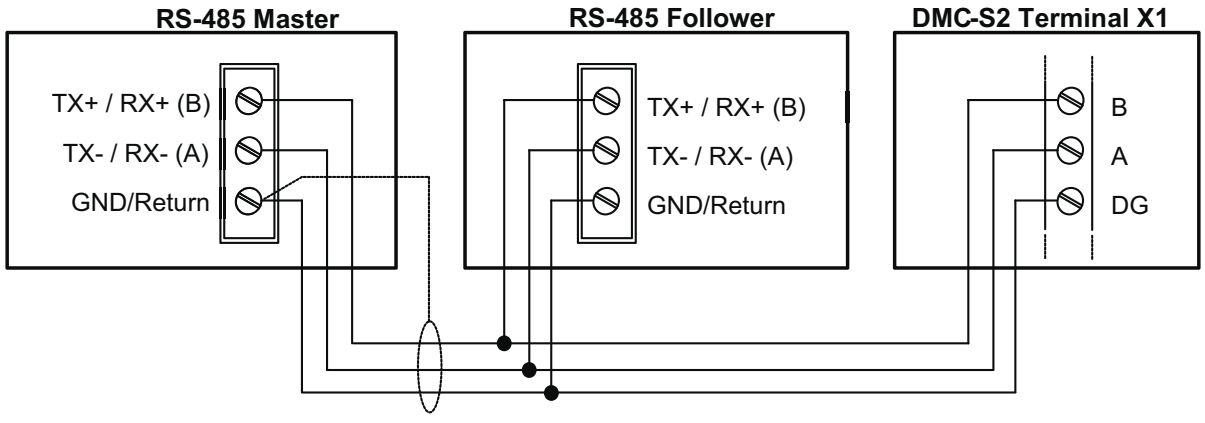



**Figure 5-9: RS-485 Serial Network Connections**

## 5.5 Protection

- L01 Drive Protection
- L02 DC Bus Levels
- L08 Ground Fault Protection
- L09 Fault Reset

**CAUTION**

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

### 5.5.1 Drive Protection Settings (L01-02 through L01-07)

**Table 5-20: Drive Protection Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| L01-02 | Ht Sk OT Alm Lvl | Level that causes the drive to issue a warning for Heatsink Overtemperature (OT1). Drive current limits will be more sensitive once the L01-02 level is reached. | 70°C-85°C | 85.0 |
| L01-03 | Ht Sk OT Flt Lvl | Level that causes the drive to fault on Heatsink Overtemperature (OT2). | 70°C-115°C | 90.0 |
| L01-06 | OH Fan Enable | Heatsink temperature that the fan will be turned on. Lowering this parameter may increase the semiconductor life expectancy, but decreases the fan's life expectancy. | 0°C-70°C | 60.0 |
| L01-07 | AOT Detect Lvl | Level that causes the drive to fault on Ambient Overtemperature (AOT). | 0°C-95°C | 75.0 |

## 5.5.2 DC Bus Levels (L02-01 through L02-13)

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

**Table 5-21: DC Bus Fault Level Parameter Settings**

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

** Range and default value is dependent on the drive model, which is determined by O02-04 in* ***Table 5-28 on page 86****.*

## 5.5.3 Ground Fault Protection (L08-09)

The DMC-S2 has a ground fault detection useful for identifying shorts between the magnet wiring and ground. Ground fault detection is enabled by default, and its sensitivity can be adjusted on the Gate Driver Board switch/ jumper settings. ***See Section 3 on page 24***.

**Table 5-22: Ground Fault Detection Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| L08-09 | Ground Fault | Determines whether Ground Fault (GF) detection is enabled or disabled. ***See Section 3 on page 24*** for information on Ground Fault Detection hardware setup.<br>*0 Disabled*<br>*1 Enabled* | 0-1 | 1 |

## 5.5.4 Fault Reset (L09-01 and L09-02)

These parameters set how the drive handles the resetting of various drive faults. ***Table 5-23 on page 83*** shows the automatically reset fault assignment table for L09-01 (the hexadecimal value of 0 0 4 4 is the default - **UV1**, **OV**, **MOT2**, and **GF** automatically reset).

**Table 5-23: Automatically Resettable Fault Assignment Table**

| | Digit 4 | | | | Digit 3 | | | | Digit 2 | | | | Digit 1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bit Position** | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **HEX** | **0** | | | | **0** | | | | **4** | | | | **4** | | | |
| **Binary** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0 | **1** | 0 | **1** | 0 | **1** | 0 |
| **Fault** | | | | | | | **CBF03** | **MOC** | **GF** | **AOT** | **MOT2** | **EXF** | **OV** | **OT2** | **UV1** | **CUV** |

**Table 5-24: List of Automatically Resettable Faults**

| Bit Position | Fault Identifier |
|---|---|
| 0 | CUV |
| 1 | UV1 |
| 2 | OT2 |
| 3 | OV |
| 4 | EXF |
| 5 | MOT2 |
| 6 | AOT |
| 7 | GF |
| 8 | MOC |
| 9 | CBF-03 |
| 10 | Not Used |
| 11 | Not Used |
| 12 | Not Used |
| 13 | Not Used |
| 14 | Not Used |
| 15 | Not Used |

Below is an example of configuring L09-01 for a specific set of automatically resettable faults:

Resettable faults required: Ground Fault (GF), Ambient Over Temperature (AOT), DC bus overvoltage (OV) and DC Bus undervoltage (UV1). ***See Table 5-25 on page 84*** for a binary to hexadecimal conversion table.

**Step 1:** **UV1** = Bit 1 and **OV** = Bit 3.

Therefore Digit 1 has a binary value of 1 0 1 0 (hexadecimal value of A).

**Step 2:** **GF** = Bit 7 and **AOT** = Bit 6.

Therefore Digit 2 has a binary value of 1 1 0 0 (hexadecimal value of C).

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

**Step 4:** Program L09-01 to equal **00CA**.

**Table 5-25: Example L09-01 Configuration of Resettable Faults**

| | **Digit 4** | | | | **Digit 3** | | | | **Digit 2** | | | | **Digit 1** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bit Position** | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **HEX** | **0** | | | | **0** | | | | **C** | | | | **A** | | | |
| **Binary** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0 | 0 | **1** | 0 | **1** | 0 |
| **Fault** | | | | | | | **CBF03** | **MOC** | **GF** | **AOT** | **MOT2** | **EXF** | **OV** | **OT2** | **UV1** | **CUV** |

## Table 5-26: Binary to Hexadecimal Conversion Table

| Binary Value | | | | Hexadecimal Conversion |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 2 |
| 0 | 0 | 1 | 1 | 3 |
| 0 | 1 | 0 | 0 | 4 |
| 0 | 1 | 0 | 1 | 5 |
| 0 | 1 | 1 | 0 | 6 |
| 0 | 1 | 1 | 1 | 7 |
| 1 | 0 | 0 | 0 | 8 |
| 1 | 0 | 0 | 1 | 9 |
| 1 | 0 | 1 | 0 | A |
| 1 | 0 | 1 | 1 | B |
| 1 | 1 | 0 | 0 | C |
| 1 | 1 | 0 | 1 | D |
| 1 | 1 | 1 | 0 | E |
| 1 | 1 | 1 | 1 | F |

## Table 5-27: Fault Reset Parameter Settings

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| L09-01 | Reset Flt Sel | Selects the faults that will be automatically reset when the fault condition is cleared. | 0000-03FF | 0044 |
| L09-02 | Reset Attempts | Sets the number of automatic reset attempts for the faults selected in L09-01. If the reset attempts max out, a fault reset command is required by the operator. | 0-10 | 3 |

# 5.6 Operator

- O02 Drive Configuration
- O03 Maintenance History

## 5.6.1 Drive Configuration

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

**Table 5-28: Drive Configuration Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| O02-03 | Parallel Stacks | Sets the total number of DMC-S2 cubes to satisfy the current rating of the drive. | 1-5 | * |
| O02-04 | Drive Model | Selects the appropriate DMC-S2 drive model based on the system voltage and connected hardware (and configurations). | 0-23 | 0 |
| | *0 LN2067-DMC-S2* | 67 ADC, 250 VDC, 1 Stack (Small Chassis) | | |
| | *1 LN3133-DMC-S2* | 133 ADC, 250 VDC, 1 Stack (Small Chassis) | | |
| | *2 LN4200-DMC-S2* | 200 ADC, 250 VDC, 1 Stack | | |
| | *3 LN5400-DMC-S2* | 400 ADC, 250 VDC, 1 Stack | | |
| | *4 LN6800-DMC-S2* | 800 ADC, 250 VDC, 2 Stacks | | |
| | *5 LN7200-DMC-S2* | 1200 ADC, 250 VDC, 3 Stacks | | |
| | *6 LN8S1600-DMC-S2* | 1600 ADC, 250 VDC, 4 Stacks | | |
| | *7 LN8S2000-DMC-S2* | 2000 ADC, 250 VDC, 5 Stacks | | |
| | *16 HN2067-DMC-S2* | 67 ADC, 500 VDC, 1 Stack | | |
| | *17 HN3133-DMC-S2* | 133 ADC, 500 VDC, 1 Stack | | |
| | *18 HN4200-DMC-S2* | 200 ADC, 500 VDC, 1 Stack | | |
| | *19 HN5400-DMC-S2* | 400 ADC, 500 VDC, 1 Stack | | |
| | *20 HN6800-DMC-S2* | 800 ADC, 500 VDC, 2 Stacks | | |
| | *21 HN7200-DMC-S2* | 1200 ADC, 500 VDC, 3 Stacks | | |
| | *22 HN8S1600-DMC-S2* | 1600 ADC, 500 VDC, 4 Stacks | | |
| | *23 HN8L2000-DMC-S2* | 2000 ADC, 500 VDC, 5 Stacks | | |

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

### 5.6.1.1 Parameter Setup for Current Transducers (CT) (O02-06)

Parameter O02-06 configures the DMC-S2 for the proper current scaling of the current transducers (DCCTs) selected based on the rated magnet current, which must match the hardware configuration The physical jumper settings for external CT boards are shown in ***Table 3-7 on page 35*** and the switch/jumper settings for internal CTs are shown in ***Table 3-4 on page 31*** through ***Table 3-6 on page 34***.

**Table 5-29: Current Transducer Parameter Settings**

| Parameter | Display | Function | Range | Default |
|---|---|---|---|---|
| O02-06 | Magnet Setup* | Selects the configuration of the current transducer (CT) used to measure magnet current. | 0-3 | 0 |
| | *0 Int. CT* | Uses CT internal to the drive. | | |
| | *1 Ext CT 20A* | Uses external CT boards configured for magnet(s) rated ≤ 20A. | | |
| | *2 Ext CT 10A* | Uses external CT boards configured for magnet(s) rated ≤ 10A. | | |
| | *3 Ext CT 5A* | Uses external CT boards configured for magnet(s) rated ≤ 5A. | | |

* ***See Table 3-4 on page 31*** *through* ***Table 3-7 on page 35*** *for gate driver board current feedback switch/jumper settings.*

## 5.6.2 Maintenance History (O03-01 through O03-11)

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

**Table 5-30: Maintenance History Parameter Settings**

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

# 6 Troubleshooting

## 6.1 Troubleshooting

**Table 6-1: Magnet Related Issues and Corrective Actions**

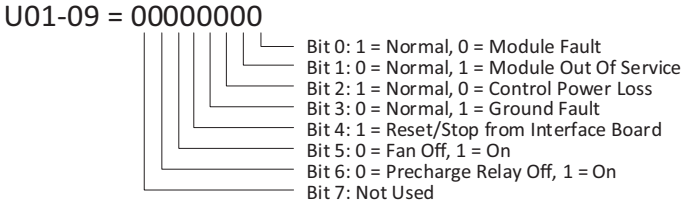
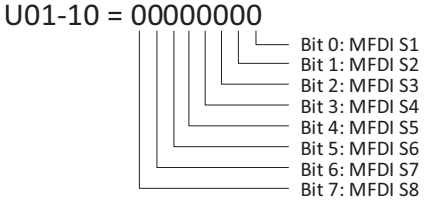
| Symptom | Corrective Action |
|---|---|
| Magnet inoperative | 1. Check all magnet connections and jumper/switch settings.<br>2. Check for magnet open circuit conditions (magnet, cables, contactors, etc.).<br>3. Verify that power is on (Charge LED for DC bus voltage and gate driver board power supply LEDs are lit).<br>4. Verify that the DLS4 keypad is not showing a fault.<br>5. Verify that Lift or Drop MFDIs are on (U01-10). |
| Magnet current is lower than expected (I-DEV alarm) | 1. Check the DC bus voltage (U01-05) to ensure the incoming power supply voltage is at a nominal value while the magnet is energized.<br>2. Check that all related magnet setup and configuration parameters are set correctly for single magnet or OmniBeam applications (B and C parameter groups).<br>3. When using OmniBeam, ensure that each magnet's enable contactor is in its correct state as determined by the selected magnets.<br>4. Verify the magnet terminal resistance is within the nameplate specifications. This may indicate a defective magnet winding or higher than rated magnet temperature. |

## 6.2 Monitors

- U01 Monitor
- U02 Fault Trace
- U03 Fault History
- U04 Maintenance

**Table 6-2: Monitors**

| Monitor | Display | Function | Units |
|---|---|---|---|
| U01-01 | Mag Curr Ref | Magnet current reference calculated as a percentage of magnet rated current. | % |
| U01-02 | Mag Current | Magnet current measured at the drive output terminals. | ADC |
| U01-03 | Magnet Temp | Magnet calculated temperature (Note: Temperature calculated using cold magnet resistance parameters and steady state magnet resistance). | ºC |
| U01-04 | Magnet Voltage | Displays the output voltage to the magnet. | VDC |
| U01-05 | DC Bus Voltage | Voltage across the DC bus capacitors (Terminals L1+ or T4 with respect to L2-). | VDC |

| Monitor | Display | Function | Units |
|---|---|---|---|
| U01-06 | Sequence Status | Sequence Status Displays the current sequence state:<br>0 = Initialization Power Up<br>1 = Locked Out<br>2 = Ready<br>3 = Start Delay<br>4 = Lift<br>5 = Hold<br>6 = Dribble<br>7 = Clean Off<br>8 = Zero Current<br>9 = Stop<br>10 = Fault Sequence<br>11 = Fault Reset<br>12 = Latched Fault<br>13 = Power Loss Ride Through | - |
| U01-07 | Num Active Mags | Number of magnets active. | - |
| U01-08 | Magnet FB Rel | Displays the relative magnet current feedback as a percentage of the magnets rated current. | % |
| U01-09 | System IO | Displays input and output information about the Control Board, Gate Driver and/or 120VAC/230VDC Interface Boards.<br>  | - |
| U01-10 | Logic Inputs Lo | Displays the status of the Multi-Function Digital Inputs (S1 through S8). Bits change to 1 when input is present.<br>  | - |

| Monitor | Display | Function | Units |
|---|---|---|---|
| U01-11 | Logic Inputs Hi | Displays the status of the Multi-Function Digital Inputs (S9 through S12, Enable, and Reset). Bits change to 1 when input is present.<br><br>U01-11 = 00000000<br>Bit 0: MFDI S9<br>Bit 1: MFDI S10<br>Bit 2: MFDI S11<br>Bit 3: MFDI S12<br>Bit 4: Not Used<br>Bit 5: Not Used<br>Bit 6: Enable<br>Bit 7: Reset | - |
| U01-12 | Logic Outputs | Displays the status of the Multi-Function Digital Outputs 1 through 7. Bits change to 1 when output is present.<br><br>U01-12 = 00000000<br>Bit 0: MFDO M1/M2 M3/M4<br>Bit 1: MFDO M5/M6<br>Bit 2: MFDO M7/M8<br>Bit 3: MFDO M10/M11/M12<br>Bit 4: MFDO OP M<br>Bit 5: MFDO OP1<br>Bit 6: MFDO OP4<br>Bit 7: Not Used | - |
| U01-13 | Control Status | Displays the status of magnet current level and polarity (lift vs. drop), as well as fault, alarm, and DC bus undervoltage information.<br><br>U01-13 = 00000000<br>0: Magnet Energized<br>1: 0 = Drop, 1 = Lift<br>2: Current Ref. Enable<br>3: At Current<br>4: Current Max.<br>5: Current Min.<br>6: Drive Fault<br>7: Drive Undervoltage | - |
| U01-14 | Firmware Version | Displays firmware version and revision. A Modbus read does not return Revision. | |
| U01-15 | Analog Input 1 | Displays the % full scale of analog input 1. | % |
| U01-16 | Analog Input 2 | Displays the % full scale of analog input 2. | % |
| U01-20 | Mag Rated I | Sum of the total active magnet rated currents. | ADC |
| U01-22 | Input Current | Current reference set point for the rate of change limiter. | % |
| U01-23 | Magnet Volt Ref | Magnet voltage reference calculated as percentage of magnet rated voltage. | % |
| U01-24 | Mag Resistance | Magnet calculated resistance. | Ohm |
| U01-25 | Mag Rate/ms | Lowest active magnet rate of change of current reference. | % |
| U01-26 | Input Power | Displays instantaneous power input from the main DC supply. | kW |
| U01-27 | Energy Used | Displays the accumulated energy used by the controller. | kWh |
| U01-28 | PwrLoss RT Count | Total times the Power Loss Ride Through Sequence State has been entered. | |
| U01-34 | Prm Out Of Range | Displays the parameter that is out of range. | -- |

## Table 6-3: Fault Trace Monitors

| Monitor | Display | Function | Units |
|---|---|---|---|
| U02-01 | Fault Status | Displays the active fault.<br>0001 = None<br>0002 = Undervoltage (UV)<br>0003 = Control Power Loss (CUV)<br>0004 = Heatsink Over Temp Fault (OT2)<br>0005 = Short Circuit (SC)<br>0006 = Overvoltage (OV)<br>0007 = External Fault (EXF)<br>0008 = Magnet Overtemperature 2 (MOT2)<br>0009 = Magnet Overload (MOL)<br>000A = Master Switch On (MS)<br>000B = Drive Overload (DOL)<br>000C = Ambient Over Temp (AOT)<br>000D = Ground Fault (GF)<br>000E = Magnet Open Circuit (MOC)<br>000F = Module Out Of Service (MOS)<br>0010 = Control Communication Timeout (COM)<br>0011 = Parameter Out Of Range (PRM)<br>0012 = Watchdog Reset Fault (CBF-00)<br>0013 = Non-Critical EEPROM Fault (CBF-01)<br>0014 = Critical EEPROM Fault (CBF-02)<br>0015 = 24V Short Circuit (CBF-03)<br>0016 = Heatsink Temp Feedback Loss (CBF-04) | - |
| U02-02 | Mag Current Ref | Magnet calculated current reference as a percentage of magnet rated current when the fault was detected. | % |
| U02-03 | Mag Current | Magnet current measured at the drive output terminals when the fault was detected. | ADC |
| U02-04 | Mag Temp | Magnet calculated temperature when the fault was detected (Note: Temperature calculated using cold magnet resistance parameters and steady state magnet resistance). | ºC |
| U02-05 | Mag Voltage | Average magnet voltage when the fault was detected. | VDC |
| U02-06 | DC Bus Voltage | DC bus capacitor voltage when the fault was detected. | VDC |
| U02-07 | Sequence Status | Displays the state of the DMC-S2 drive when the fault was detected. | - |
| U02-08 | Mag Resistance | Magnet calculated resistance when the fault was detected. | Ohm |

| Monitor | Display | Function | Units |
|---|---|---|---|
| U02-09 | Num Active Mag | Number of magnets active when the fault was detected. | - |
| U02-10 | Magnet FB Rel | Displays the relative magnet current feedback as a percentage of the magnet's rated current when the fault was detected. | % |
| U02-11 | Elapsed Hours/10 | Accumulated time controller is outputting current when the fault was detected. | Hr |
| U02-12 | Analog Input 1 | Displays the % full scale of analog input 1 value when the fault was detected. | % |
| U02-13 | Logic Inputs Lo | Displays logic input bits when the fault was detected. | - |
| U02-14 | Logic Inputs Hi | Displays logic input bits when the fault was detected. | - |
| U02-15 | Logic Outputs | Displays logic output bits when the fault was detected. | - |
| U02-16 | Control Status | Displays control status bits when the fault was detected. | - |
| U02-17 | Last Fault | See U02-01 for more details on fault. | - |

## Table 6-4: Fault History Monitors

| Monitor | Display | Function | Units |
|---|---|---|---|
| U03-01 | Fault 1 | Displays the first most recent fault. | |
| U03-02 | Fault 1 Time | Elapsed time of the first most recent fault. | Hr |
| U03-03 | Fault 2 | Displays the second most recent fault. | |
| U03-04 | Fault 2 Time | Elapsed time of the second most recent fault. | Hr |
| U03-05 | Fault 3 | Displays the third most recent fault. | |
| U03-06 | Fault 3 Time | Elapsed time of the third most recent fault. | Hr |
| U03-07 | Fault 4 | Displays the fourth most recent fault. | |
| U03-08 | Fault 4 Time | Elapsed time of the fourth most recent fault. | Hr |
| U03-09 | Fault 5 | Displays the fifth most recent fault. | |
| U03-10 | Fault 5 Time | Elapsed time of the fifth most recent fault. | Hr |
| U03-11 | Fault 6 | Displays the sixth most recent fault. | |
| U03-12 | Fault 6 Time | Elapsed time of the sixth most recent fault. | Hr |
| U03-13 | Fault 7 | Displays the seventh most recent fault. | |
| U03-14 | Fault 7 Time | Elapsed time of the seventh most recent fault. | Hr |
| U03-15 | Fault 8 | Displays the eighth most recent fault. | |
| U03-16 | Fault 8 Time | Elapsed time of the eighth most recent fault. | Hr |
| U03-17 | Fault 9 | Displays the ninth most recent fault. | |
| U03-18 | Fault 9 Time | Elapsed time of the ninth most recent fault. | Hr |
| U03-19 | Fault 10 | Displays the tenth most recent fault. | |
| U03-20 | Fault 10 Time | Elapsed time of the tenth most recent fault. | Hr |
| U03-21 | Fault 11 | Displays the eleventh most recent fault. | |
| U03-22 | Fault 11 Time | Elapsed time of the eleventh most recent fault. | Hr |
| U03-23 | Fault 12 | Displays the twelfth most recent fault. | |
| U03-24 | Fault 12 Time | Elapsed time of the twelfth most recent fault. | Hr |
| U03-25 | Fault 13 | Displays the thirteenth most recent fault. | |
| U03-26 | Fault 13 Time | Elapsed time of the thirteenth most recent fault. | Hr |
| U03-27 | Fault 14 | Displays the fourteenth most recent fault. | |
| U03-28 | Fault 14 Time | Elapsed time of the fourteenth most recent fault. | Hr |
| U03-29 | Fault 15 | Displays the fifteenth most recent fault. | |
| U03-30 | Fault 15 Time | Elapsed time of the fifteenth most recent fault. | Hr |

## Table 6-5: Maintenance Monitors

| Monitor | Display | Function | Units |
|---|---|---|---|
| U04-01 | Num Operations | Displays the number of runs. The value is reset to 0 when 1000 operations are reached and U04-02 is incremented. Counter can be reset by parameter O03-02. | - |
| U04-02 | Operations x1000 | Operation Counter (increments 1 for every 1000 operations up to 65,535 after which it resets to zero). | |
| U04-03 | Elapsed Hours/10 | Accumulated time drive is outputting current divided by 10. | Hr |
| U04-04 | FanRun Hours/10 | Displays the cumulative operation time of the cooling fan.<br>The default value for the fan operation time is reset in parameter O03-02. After the count reaches 99999, the value will reset to 0 and start counting again. | Hr |
| U04-05 | Heatsink Temp | Displays the heatsink temperature. The alarm level is determined by parameter L01-02 and faults at L01-03. | °C |
| U04-06 | Ambient Temp | Displays the ambient temperature at the control board. Fault at value selected in parameter L01-07 and auto-resets when the temp drops 10 degrees. | °C |
| U04-07 | Magnet OL Lvl | Displays the accumulated value of magnet current overload. This monitor increments above 110% current and decrements when current falls below 110%. A fault occurs when the monitor value reaches 100%. | % |
| U04-08 | Drive OL Lvl | Displays the accumulated value of drive overload current. This monitor increments above 110% drive rated current and decrements when current falls below 110%. A fault occurs when the monitor value reaches 100% (150% of drive rated current for 60 seconds or 200% immediately). | % |
| U04-09 | T1 Duty Cycle | Displays the PWM duty cycle (% time ON) at terminal T1 (connected to armature terminal A1). | % |
| U04-10 | T2 Duty Cycle | Displays the PWM duty cycle (% time ON) at terminal T2 (connected to armature terminal A2). | % |
| U04-24 | 485 RX Count | Number of packets (good or bad) received on 485 UART. | - |
| U04-25 | 485 CRC Error | CRC Errors on 485. | - |
| U04-26 | 485 MB_Addr | Last received Addr seen on 485. | - |
| U04-27 | 485 MB_Cmd | Last received CMD see on 485. | - |

# 6.3 Maintenance and Inspection

## 6.3.1 Recommended Maintenance and Inspection Procedure

This section describes basic maintenance and inspection procedures to enable the drive to perform optimally. **Ensure the drive is unpowered with the "CHARGE" LED completely extinguished before performing any maintenance procedures in *Table 6-6***.

The term "Check" refers to the recommended steps to determine if an item or component is functioning properly and in acceptable physical condition. The term "Corrective Action" refers to procedures involving the adjustment, repair, replacement, etc. of an item or component necessary to return the DMC-S2 drive to an acceptable operating condition.

***NOTE:*** *One or more "Corrective Action" steps may not have to be performed to correct the problem.*

**Table 6-6: Recommended Maintenance and Inspection Procedures**

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

## 6.3.2 Replacing the DLS4 Keypad Battery

***NOTE:*** *Newer model keypads are equipped with an integrated battery and do not include a battery door. The following steps can be skipped for those cases.*

The battery is user-replaceable by removing the round battery hatch located on the back of the DLS4. A flathead screwdriver or a thin, flat device less than 0.25" wide is required to open the hatch. Twist it in a counter-clockwise direction for about 1/8 of a turn to release the latch. When replacing the battery, ensure the new battery is seated with the text visible (facing upward). After replacing the battery, it will likely be necessary to reprogram the date and time.

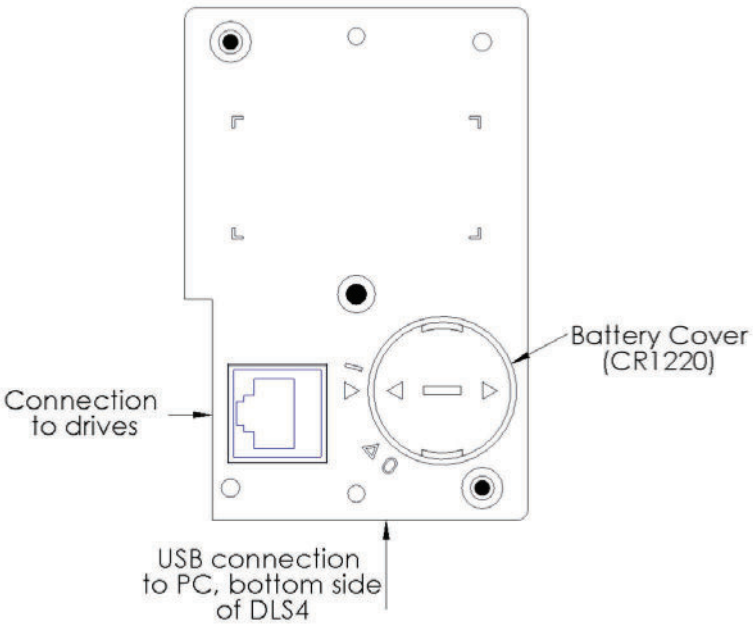



**Figure 6-1: Back View of the DLS4 Keypad**

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

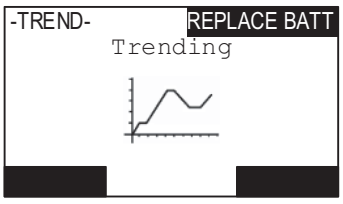



**Figure 6-2: Replace Battery Message**

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

**Suggested Brands:** Panasonic, Energizer, or Duracell

## 6.3.3 Firmware Updates

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

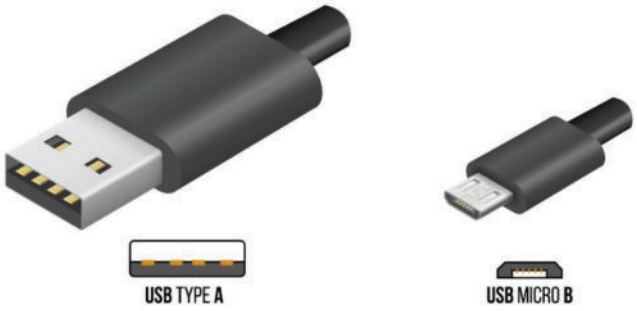



**Figure 6-3**

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

Follow these steps to update the firmware:

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

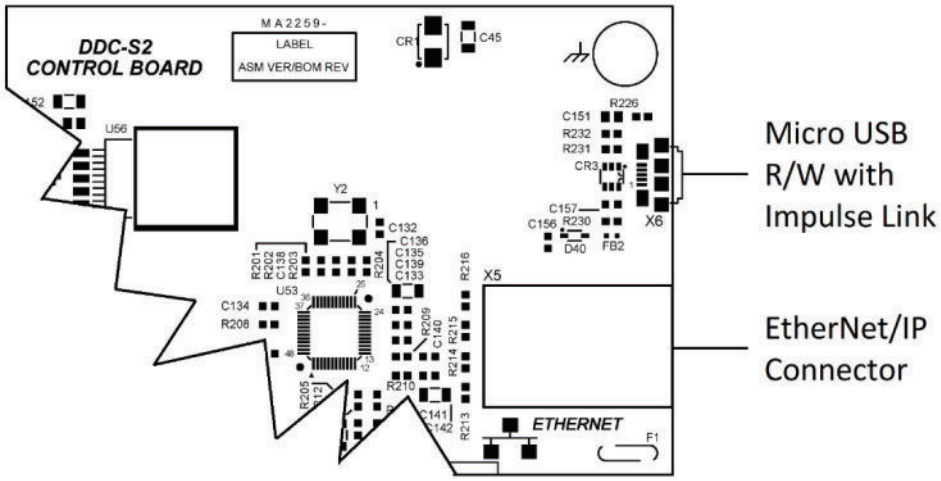



**Figure 6-4**

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

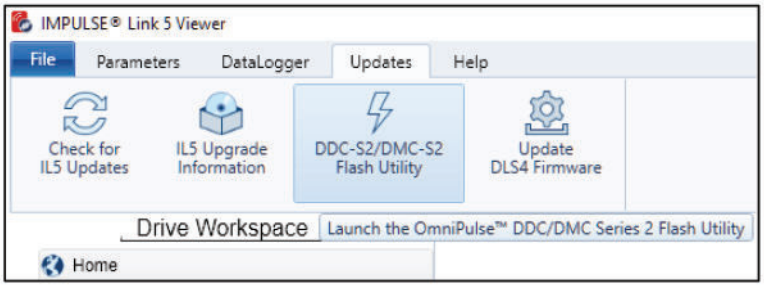



**Figure 6-5**

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

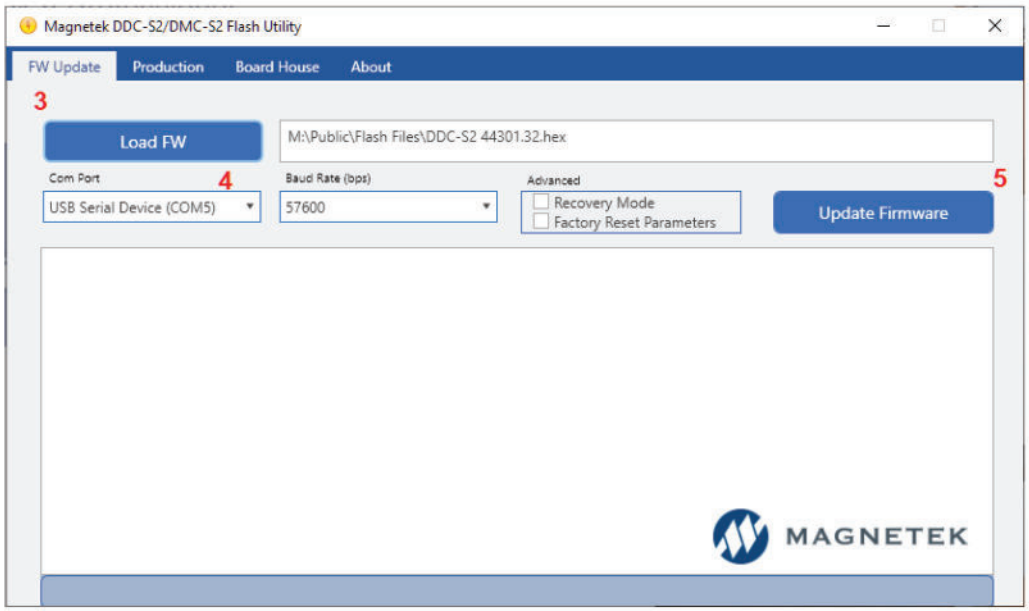



**Figure 6-6**

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

# 6.4 Fault and Alarm Codes and Corrective Action

Any fault that occurs while the drive is outputting current will be logged in the fault history. See Table 6-7 for the list of faults and when they may not be logged. Faults require a fault reset via a multifunction input or cycle power to continue operation.

Alarm conditions do not affect the operation of the drive, rather they provide a warning to the user that the drive has detected a condition that may or may not require additional action or that a drive fault is imminent.

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

**Table 6-7: DMC-S2 Fault and Alarm Codes and Information**

| Fault Code | Description | Corrective Action | Alarm | Fault | Logged in History | |
|---|---|---|---|---|---|---|
| | | | | | Drive Running | Drive Idle |
| **AOT**<br>Ambient Overtemperature | The ambient temperature monitored by the control board is greater than the value programmed in L01-07. | 1. Monitor ambient temperature by U04-06.<br>2. Decrease ambient temperature.<br>3. Ensure that fans and filters clean and functional (drive and enclosure).<br>4. Ensure heatsink is free of dirt and debris.<br>5. Reduce load and/or duty cycle.<br>6. Add air conditioner. | | X | Yes | Yes |
| **BAT**<br>Battery Enabled | Battery Enabled | 1. Indicates that an MFDI set for Battery Enable (H01-xx = 7) has been energized.<br>2. Warns the user that short circuit (SC) faults will not be activated or displayed while the drive and battery are on simultaneously (hardware-based short circuit detection is still active during this alarm, however the drive will continue to attempt to output current to the magnet to prevent any load from falling). | X | | No | No |
| **CAN'T RESET**<br>Fault Reset with Fault Condition | A fault reset is being issued while the fault condition still exists. | 1. Ensure that the fault condition has been removed from the system and the drive has been returned to a fully functional state.<br>2. Check the wiring for any MFDIs set for Fault Reset (H01-xx = 3F)<br>3. If network communications are active, verify that any bits assigned to Fault Reset are set to 0. | X | | No | No |
| **CBF-00**<br>Watchdog Reset | Processor reset due to Watchdog. This isn't displayed, only stored after reset. | 1. Reset the fault.<br>2. If the problem continues, replace the control board. | | X | Yes | Yes |

| Fault Code | Description | Corrective Action | Alarm | Fault | Logged in History | |
|---|---|---|---|---|---|---|
| | | | | | Drive Running | Drive Idle |
| **CBF-01** Non-Critical EEPROM Fault | A non-critical error occurred in the EEPROM. | 1. Reset the fault.<br>2. If the problem continues, replace the control board. | | X | Yes | Yes |
| **CBF-02** Critical EEPROM Fault | A critical error occurred in the EEPROM. A parameter value may have been corrupted. | 1. Reset the fault and check the modified parameter list to verify parameter values are correct.<br>2. If the problem continues, replace the control board. | | X | Yes | Yes |
| **CBF-03** 24V Short Circuit | Excessive current detected on 24V line supplying power to the 120VAC or 230VDC interface board (internal electronic protection limits current to 350 mA). | 1. Ensure pins on the J9 connector of the control board and J1 of the interface board are free of debris and the connector is securely fastened.<br>2. Cycle power to the drive.<br>3. If the problem continues, replace the interface board and/or the ribbon cable between the control board and interface board.<br>4. Monitor the 24VDC power supply on the control board. A defective power supply originating from the gate driver board may also produce this fault. | | X | Yes | Yes |
| **CBF-04** Heatsink Temp Feedback Loss | There was a loss of heatsink feedback from the heatsink thermistor. | 1. Ensure heatsink connection is secure: J10 on large chassis drive or J11 on small chassis drive.<br>2. Ensure heatsink thermistor wire assembly is intact.<br>3. If the condition continues, the thermistor, gate driver board, or control board may be defective.<br>4. Test for condition with new gate driver board.<br>5. Test for condition with new control board. | | X | Yes | Yes |
| **COM** Control Communication Timeout | Serial communication timeout detected. | 1. Verify serial parameter settings are correct for the serial network connected (H05-01 through H05-03).<br>2. Ensure termination resistors are installed per wiring guidelines.<br>3. Ensure correct shielding and grounding of serial cabling. | X | X | No | Yes |

| Fault Code | Description | Corrective Action | Alarm | Fault | Logged in History | |
|---|---|---|---|---|---|---|
| | | | | | Drive Running | Drive Idle |
| **CUV**<br>Control Power Loss | The 24 V power supply has fallen below 19 V. | 1. Ensure power is present at the drive and it is turned on.<br>2. Ensure that all connections on the gate driver board are in the correct position and securely fastened.<br>3. Ensure that all ribbon cables are securely fastened to the control board.<br>4. Check that +24V power supply LEDs on the gate driver boards (DS1 on small GDB, DS4 on large GDB) are illuminated.<br>5. For large chassis drives, check TP6 = +24 VDC, TP7 = -15 V, TP10 = +15 VDC, TP9 = +5 VDC on the gate driver board.<br>6. Check control board terminal 24V on X1 and X3 for 24 VDC.<br>7. Replace control board.<br>8. Replace gate driver board. | | X | Yes | No |
| **DOL**<br>Drive Overload | The drive has exceeded its current rating (150% for 60s or 200% immediately). | 1. Check for short-circuit conditions at the output terminals between T1 and T2.<br>2. Check for short-circuit conditions at the magnet terminals.<br>3. **With the DMC-S2 drive disconnected from all power wiring**, perform an IGBT/Diode check on the DMC-S2 power terminals. ***See Section 6.5 on page 108***. | | X | Yes | No |
| **EF**<br>External Fault | An MFDI set to External Fault (H01-xx = 20) External fault has opened. | 1. Verify External Fault Logic circuitry is functioning correctly.<br>2. Verify that the External device that signaled the External fault is functioning properly.<br>3. Check that the digital inputs H01-xx are set properly. | | X | Yes | Yes |

| Fault Code | Description | Corrective Action | Alarm | Fault | Logged in History | |
|---|---|---|---|---|---|---|
| | | | | | Drive Running | Drive Idle |
| **GF**<br>Ground Fault | A short to ground from magnet terminals T1 or T2 has been detected. | 1. Check the magnet circuit for shorts to ground.<br>2. **With the DMC-S2 drive disconnected from all power wiring***, perform an insulation test on the magnet(s) and associated cabling that originates from the drive output terminals.<br>***Never megger the drive!**<br>3. Check that displayed Magnet Current (U01-02) equals the actual magnet current using a clamp-on amp meter.<br>4. Ensure correct ground fault configuration switch/jumper settings on the gate driver board. | | X | Yes | No |
| **I-DEV**<br>Current Deviation | Magnet current feedback (U01-08) has deviated from the current reference (U01-01) above limits set in the drive. | 1. Check the DC bus voltage (U01-05) to ensure the incoming power supply voltage is at a nominal value while the magnet is energized.<br>2. Verify the measured magnet resistance values are within the nameplate specifications.<br>3. Verify the Magnet Time to Rated Current parameters in the B2 group are closely matched with the time constant of the magnets. Time to Rated current ~ 5*TCs where TC = $L_{MAG}/R_{MAG}$. | X | | No | No |
| **I-ERR**<br>Magnet I Set Err | A current level set for one or magnets is incorrect. | 1. Check that all magnet setup parameters are correct in the B2 parameter group.<br>2. Check that the drive has been configured for the correct model in parameter O02-04. | X | | No | No |
| **MOC**<br>Magnet Open Circuit | An open circuit has been detected at the drive output terminals indicating a possible magnet coil failure. | 1. Monitor U01-02 for magnet current feedback.<br>2. Make sure the correct magnet is selected when lift input is enabled in OmniBeam mode.<br>3. Check magnet circuit and wiring.<br>4. Perform diode and IGBT test per ***Table 6-8 on page 109***. | | X | Yes | No |
| **MOL**<br>Magnet Overload | Indicates the control board is not regulating current to the magnet properly and the magnet may be overloaded. | 1. Check magnet current rating parameters.<br>2. Check for correct gate driver board link settings. | | X | Yes | No |

| Fault Code | Description | Corrective Action | Alarm | Fault | Logged in History | |
|---|---|---|---|---|---|---|
| | | | | | Drive Running | Drive Idle |
| **MOS**<br>Module Out of Service | Indicates that one or more follower units are out of service. DS6 LED on the gate driver board of the faulted drive will illuminate. | 1. Verify the setting parameters O02-04 and O02-03 are correct.<br>2. Ensure that follower drives are powered up correctly.<br>3. Check the gate driver board connection between master and follower(s) (J1 and J16).<br>4. Verify on follower(s) gate driver board that bus connector J9 has a jumper installed on pins 11 and 12 only. | | X | Yes | Yes |
| **MOT1**<br>Magnet OverTemp1 | Magnet temperature has exceeded the alarm trip level or MFDI H01-xx set for “0D” has been activated. | 1. Ensure the correct setting of cold (77°F [25ºC]) magnet resistance in the Magnet Setup parameters (B2 group).<br>2. Ensure the proper temperature setpoint in ºC has been entered in C02-05.<br>3. Reduce the magnitude of the current once the load is intact with the magnet, e.g., holding current in Lift/Lift-Drop mode.<br>4. Check that the over temperature MFDI condition is not being disrupted due to defective wiring or connections.<br>5. Magnet temperature may be inaccurate if OmniBeam is in use. As an alternative, use a multifunction analog input to measure magnet temperature (H03-02, H03-06 = 2).<br>6. Exchange hot magnets with cold magnets more frequently. | X | | No | No |

| Fault Code | Description | Corrective Action | Alarm | Fault | Logged in History | |
|---|---|---|---|---|---|---|
| | | | | | Drive Running | Drive Idle |
| **MOT2**<br>Magnet OverTemp2 | Magnet temperature has exceeded the fault trip level. | 1. Ensure the correct setting of cold (77°F [25ºC]) magnet resistance in the Magnet Setup parameters (B2 group).<br>2. Ensure the proper temperature set point in ºC has been entered in C02-06.<br>3. Reduce the magnitude of the current once the load is intact with the magnet, e.g., holding current in Lift/Lift-Drop mode.<br>4. Magnet temperature may be inaccurate if OmniBeam is in use. As an alternative, use a multifunction analog input to measure magnet temperature (H03-02, H03-06 = 2).<br>5. Exchange hot magnets with cold magnets more frequently. | | X | Yes | Yes |
| **MS**<br>Master Switch | Either a Lift or Enable input was present at power-up or the Lift and Drop inputs were issued at the same time. | 1. Return all inputs to their neutral position.<br>2. Check that Logic Inputs on monitors U01-10 and U01-11 are functioning properly.<br>3. Check input wiring for proper functionality.<br>4. Check that the digital inputs in H01-xx are set to the correct values.<br>5. Ensure MS Fault Time in parameter B03-05 is set to a reasonable value. The default setting should be adequate for most applications. | X | X | Yes | No |
| **OT1**<br>Heatsink Over Temp Alarm | The heatsink temperature has risen above the OT Alarm Level L01-02. | 1. Reduce the magnet current settings in the B1 or C1 parameter groups.<br>2. Ensure that the heatsink cooling fans are operating properly.<br>3. Ensure that heatsink is free of dirt and debris.<br>4. Ensure that ambient temperature is within specifications. | X | | No | No |

| Fault Code | Description | Corrective Action | Alarm | Fault | Logged in History | |
|---|---|---|---|---|---|---|
| | | | | | Drive Running | Drive Idle |
| **OT2**<br>Heatsink Over Temp Fault | The heatsink temperature has risen above the OT Fault Level L01-03. | 1. Reduce the magnet current settings in the B1 or C1 parameter groups.<br>2. Utilizing monitor U04-05, allow the heatsink temperature to fall 10 degrees below the level programmed in L01-03.<br>3. Ensure that the heatsink cooling fans are operating properly.<br>4. Ensure that heatsink is free of dirt and debris.<br>5. Ensure that ambient temperature is within specifications. | | X | Yes | Yes |
| **OV**<br>DC Bus Overvoltage | Indicates the DC bus voltage surpassed the value set in L02-02. | 1. Ensure that the incoming supply voltage is not rising above tolerance.<br>2. Check DC bus voltage shown by monitor function U01-05.<br>3. Check that the CDBR or RPM is fully functional and all fitted DBRs are properly sized.<br>4. Check all DBR wiring and connections. | | X | Yes | Yes |
| **PRM**<br>Parameter Out Of Range | A parameter value exceeds its ratings. | 1. Check parameter U01-34 to see which parameter is out of range.<br>2. Set correct parameter value. | X | | No | No |
| **SC**<br>Short Circuit | Indicates that the drive has detected an output short-circuit. Fault will also occur when 15 Volt power supply is below 13 VDC. | 1. For large chassis drives, check short-circuit diagnostic LEDs on gate driver board to see which IGBT circuit has a problem. Reset diagnostic LEDs by pressing button SW1.<br>2. Disconnect magnet from drive and attempt a run command. If an SC is issued, conduct a diode and IGBT test (step 3).<br>3. Perform diode and IGBT test per ***Table 6-8 on page 109***.<br>4. With the DMC-S2 drive disconnected from all power wiring*, perform an insulation test on the magnet(s) and associated cabling that originates from the drive output terminals.<br>***Never megger the drive!**<br>5. For NEMA sizes 4 and above, check TP6 = +24 VDC, TP7 = -15 V, TP10 = +15 VDC, TP9 = +5 VDC. | | X | Yes | No |

| Fault Code | Description | Corrective Action | Alarm | Fault | Logged in History | |
|---|---|---|---|---|---|---|
| | | | | | Drive Running | Drive Idle |
| **PLR**<br>Power Loss Ride Through | The DC bus voltage has dropped below the PLR set point in C02-09 and the drive has entered the Power Loss Ride Through sequence. | 1. Verify the DC bus voltage shown in parameter U01-05 is within tolerance while the drive is running.<br>2. Check all incoming power feed components connections including rectifier diodes/ thyristors, terminal blocks, collector shoes, etc.<br>3. Ensure the settings in C02-09 and C02-10 are at their optimal levels for detecting and recovering from a power loss situation.<br>4. Verify that the contacts and coil of the M-contactor are fully functional and in satisfactory condition. | X | | Yes | No |
| **RUN**<br>Can't Switch | An attempt was made to change the source of the drive run command while the drive is running using a different run source. | 1. Check the wiring for any MFDI that is set for H01-xx = 1F (Ref/ Run2).<br>2. Ensure the proper settings for the “and run source” in B03-02 and B03-16.<br>3. If the run source is from the terminals, verify that the status of the Lift and Drop command MFDIs is set to 0 before switching sources.<br>4. If the run source is from the network, verify that the status of the Lift and Drop command bits is set to 0 before switching sources. | X | | No | No |

| Fault Code | Description | Corrective Action | Alarm | Fault | Logged in History | |
|---|---|---|---|---|---|---|
| | | | | | Drive Running | Drive Idle |
| **UV1**<br>Undervoltage | Indicates that the main DC supply voltage has dropped below UV Detection Level L02-01 or that the M-contactor did not close. | 1. Check DC bus voltage shown by monitor function U01-05.<br>2. Ensure power is present at the L11 and L2- terminals of the drive.<br>3. Ensure that the incoming power supply voltage is not dropping below tolerance.<br>4. Check that all connections on the gate driver board are in the correct position and securely fastened.<br>5. Check that all ribbon cables are securely fastened to the control board.<br>6. Ensure that the start delay C02-01 is set to allow the M-contactor to completely close.<br>7. Ensure the precharge contactor is fully functional.<br>8. Replace control board.<br>9. Replace gate driver board. | X | X | Yes | No |

## 6.5 Short-Circuit Check

The gate driver board, models DDC-LN5-GATE7/DDC-HN5-GATE7 and later, can be used as a troubleshooting tool to determine where a short circuit 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. There are two LEDs designated to show if the short occurred on the upper or lower gate for each IGBT. ***See Figure 6-7*** below to identify the location of the diagnostic LEDs. You can then narrow down which IGBT to focus on using ***Table 6-8 on page 109***.

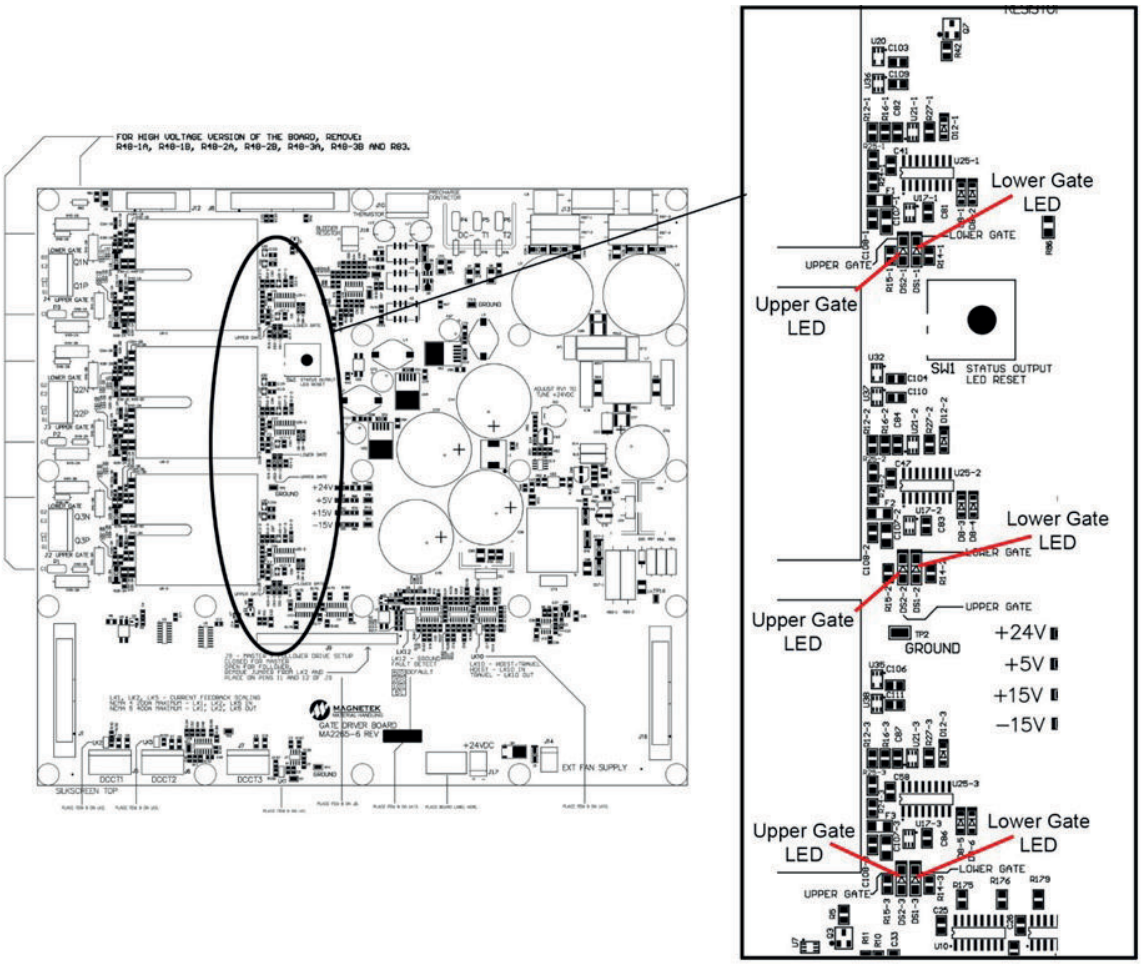



**Figure 6-7: Gate Driver LED Locations**

**DANGER**

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

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

**Table 6-8: Transistor and Diode Check**

| Diode Check | Positive Probe | Negative Probe | Reading |
|---|---|---|---|
| D1P | T1 | L1 | 0.312 |
| D2P | T2 | L1 | 0.312 |
| D1N | L2 | T1 | 0.312 |
| D2N | L2 | T2 | 0.312 |

| IGBT Check | Positive Probe | Negative Probe | Reading |
|---|---|---|---|
| Q1P | L1 | T1 | >.6 |
| Q2P | L1 | T2 | >.6 |
| Q1N | T1 | L2 | >.6 |
| Q2N | T2 | L2 | >.6 |

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

## 6.6 Large Chassis DMC-S2 Gate Driver Board Test Measurements

Using a digital multimeter, the voltage points listed in ***Table 6-9 on page 110*** and illustrated in ***Figure 6-8 on page 110*** can be used for troubleshooting the large chassis DMC-S2 drives.

**DANGER**

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

**Table 6-9: Large Chassis Gate Driver Board Test Points and Signal Descriptions for DDC-LN5-GATE7/DDC-HN5-GATE7**

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

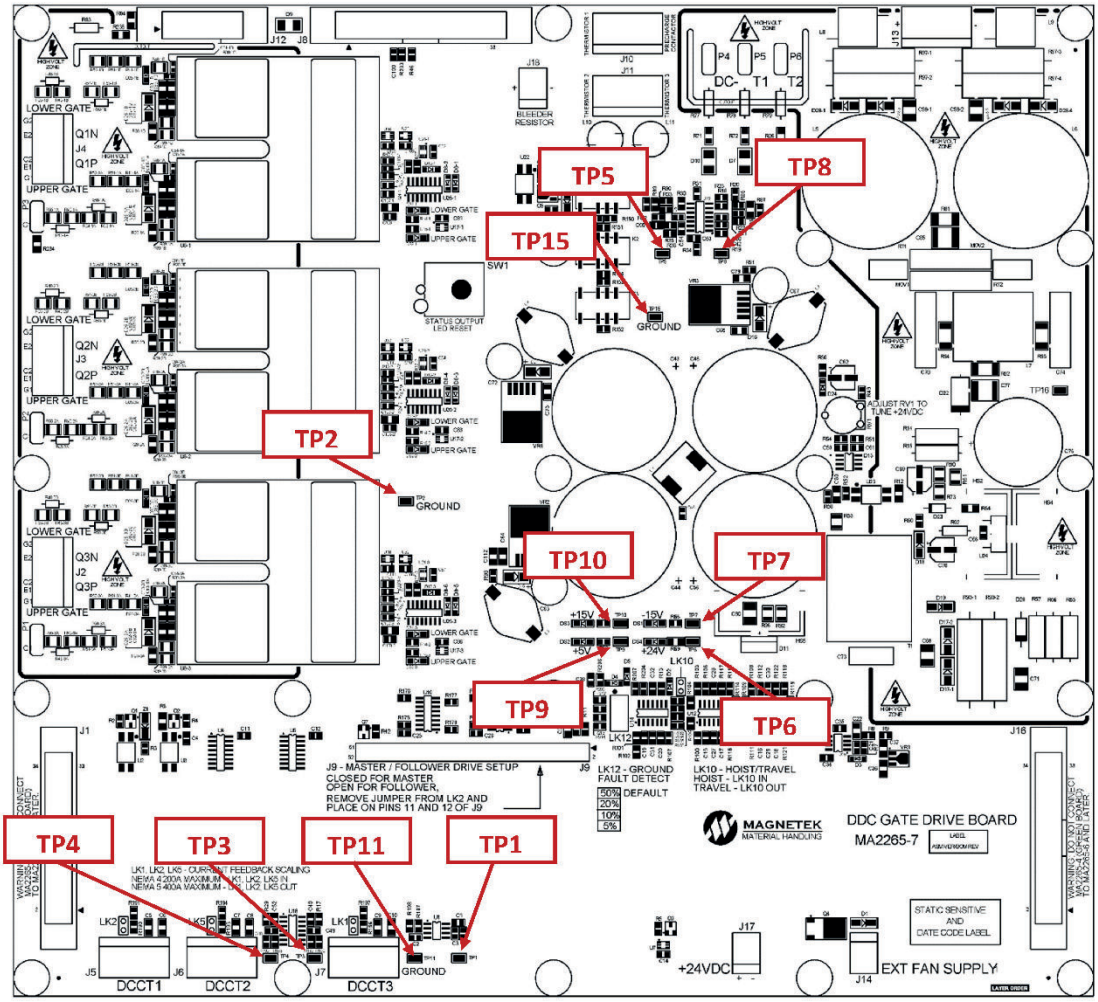



**Figure 6-8: Gate Driver Board Test Point Locations**

# Appendix A: Modbus RTU Communications

The DMC-S2 has the capability to communicate with other devices using the Modbus RTU communications protocol. The drive will act as a follower device when connected to a Modbus RTU network using the built in RS-485 serial communications port as illustrated in ***Figure 5-9 on page 80***.

The RS-485 termination resistor (Jumper LK3 on the control board) as well as parameters H05-01 - H05-03, H05-06, and H05-09 must be set up to establish proper communication. To control the drive over Modbus, the Run and Current reference parameters must be set to “Serial Communications.” See parameters B03-01 and B03-02 (B03-15 and B03-16 for Reference 2 priority using an MFDI).

**Modbus RTU Available Function Codes**

The DMC-S2 supports the use of MODBUS Function Code 3 (Read Holding Registers) to read one or more registers from the drive and Function Code 16 (Write Multiple Holding Registers) to write to one or more registers in the drive.

**Modbus Addressing (Command Registers)**

The command registers are used by the Modbus RTU Master device to write Lift/Drop run commands and current reference to the DMC-S2 drive. The following table lists the command register data allocation and the associated Modbus addresses.

**Table A-1: Modbus Addressing**

| Modbus Address | Bit | Function | Scale |
|---|---|---|---|
| 0001** | 0 | Lift Command *<br>(0 = Stop or Dribble, 1 = Lift) | |
| | 1 | Drop Command *<br>(0 = Stop, 1 = Drop) | |
| | 2 | Drive Enable | |
| | 3 | Fault Reset | |
| | 4 | Multi-Function Digital Input 1 | |
| | 5 | Multi-Function Digital Input 2 | |
| | 6 | Multi-Function Digital Input 3 | |
| | 7 | Multi-Function Digital Input 4 | |
| | 8 | Multi-Function Digital Input 5 | |
| | 9 | Multi-Function Digital Input 6 | |
| | A | Multi-Function Digital Input 7 | |
| | B | Multi-Function Digital Input 8 | |
| | C | Multi-Function Digital Input 9 | |
| | D | Multi-Function Digital Input 10 | |
| | E | Multi-Function Digital Input 11 | |
| | F | Multi-Function Digital Input 12 | |
| 0002*** | - | Current Reference | A decimal value of 1000 represents 100.0% Current Reference |

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

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

**** Current Reference (B03-01 or B03-15) must be set to 4: “Serial Comm.”*

# Appendix B: Parameter Listing

| Parameter | Name | Range | Default | Modbus | User Setting & Notes | Page |
|---|---|---|---|---|---|---|
| A01-01 | Access Level | 0 ~ 2 | 2 | 0100 | | ***56*** |
| A01-03 | Magnet Config | 1 ~ 10 | 1 | 0102 | | ***56*** |
| A01-04 | Curr Reference | 0 ~ 6 | 1 | 0103 | | ***57*** |
| A01-05 | Restore Values | 0 ~ 3 | 0 | 0104 | | ***57*** |
| A01-08 | Password | 0 ~ 9999 | 2004 | 0107 | | ***57*** |
| B01-01 | Lift Current 1 | 0.0 ~ 100.0 | 100.0% | 0280 | | ***58*** |
| B01-02 | Lift Current 2 | 0.0 ~ 100.0 | 80.0% | 0281 | | ***58*** |
| B01-03 | Lift Current 3 | 0.0 ~ 100.0 | 60.0% | 0282 | | ***58*** |
| B01-04 | Lift Current 4 | 0.0 ~ 100.0 | 40.0% | 0283 | | ***58*** |
| B01-05 | Lift Current 5 | 0.0 ~ 100.0 | 20.0% | 0284 | | ***58*** |
| B01-06 | Clean Current 1 | 0.0 ~ 100.0 | 20.0% | 0285 | | ***58*** |
| B01-07 | Clean Current 2 | 0.0 ~ 100.0 | 40.0% | 0286 | | ***58*** |
| B01-08 | Clean Current 3 | 0.0 ~ 100.0 | 60.0% | 0287 | | ***58*** |
| B01-09 | Clean Current 4 | 0.0 ~ 100.0 | 80.0% | 0288 | | ***58*** |
| B01-10 | Clean Current 5 | 0.0 ~ 100.0 | 100.0% | 0289 | | ***58*** |
| B02-01 | Mag 1 Current | 0 ~ 2000 | 33 A | 0290 | | ***59*** |
| B02-02 | Mag1 Sec2RatedI | 0.0 ~ 10.00 | 1.00 s | 0291 | | ***59*** |
| B02-03 | Mag 1 Resistance | 0.00 ~ 60.00 | 4.00 Ω | 0292 | | ***59*** |
| B02-04 | Mag 2 Current | 0 ~ 2000 | 33 A | 0293 | | ***59*** |
| B02-05 | Mag2 Sec2RatedI | 0.0 ~ 10.00 | 1.00 s | 0294 | | ***59*** |
| B02-06 | Mag 2 Resistance | 0.00 ~ 60.00 | 4.00 Ω | 0295 | | ***59*** |
| B02-07 | Mag 3 Current | 0 ~ 2000 | 20 A | 0296 | | ***59*** |
| B02-08 | Mag3 Sec2RatedI | 0.0 ~ 10.00 | 1.00 s | 0297 | | ***59*** |
| B02-09 | Mag 3 Resistance | 0.00 ~ 60.00 | 4.00 Ω | 0298 | | ***59*** |
| B02-10 | Mag 4 Current | 0 ~ 2000 | 20 A | 0299 | | ***59*** |
| B02-11 | Mag4 Sec2RatedI | 0.0 ~ 10.00 | 1.00 s | 029A | | ***59*** |
| B02-12 | Mag 4 Resistance | 0.00 ~ 60.00 | 4.00 Ω | 029B | | ***59*** |
| B02-13 | Mag 5 Current | 0 ~ 2000 | 20 A | 029C | | ***59*** |
| B02-14 | Mag5 Sec2RatedI | 0.0 ~ 10.00 | 1.00 s | 029D | | ***59*** |
| B02-15 | Mag 5 Resistance | 0.00 ~ 60.00 | 4.00 Ω | 029E | | ***59*** |
| B02-16 | Mag 6 Current | 0 ~ 2000 | 20 A | 029F | | ***59*** |

| Parameter | Name | Range | Default | Modbus | User Setting & Notes | Page |
|---|---|---|---|---|---|---|
| B02-17 | Mag6 Sec2RatedI | 0.0 ~ 10.00 | 1.00 s | 02A0 | | ***59*** |
| B02-18 | Mag 6 Resistance | 0.00 ~ 60.00 | 4.00 Ω | 02A1 | | ***59*** |
| B02-19 | Mag 7 Current | 0 ~ 2000 | 20 A | 02A2 | | ***59*** |
| B02-20 | Mag7 Sec2RatedI | 0.0 ~ 10.00 | 1.00 s | 02A3 | | ***60*** |
| B02-21 | Mag 7 Resistance | 0.00 ~ 60.00 | 4.00 Ω | 02A4 | | ***60*** |
| B02-22 | Mag 8 Current | 0 ~ 2000 | 20 A | 02A5 | | ***60*** |
| B02-23 | Mag8 Sec2RatedI | 0.0 ~ 10.00 | 1.00 s | 02A6 | | ***60*** |
| B02-24 | Mag 8 Resistance | 0.00 ~ 60.00 | 4.00 Ω | 02A7 | | ***60*** |
| B02-25 | Mag 9 Current | 0 ~ 2000 | 20 A | 02A8 | | ***60*** |
| B02-26 | Mag9 Sec2RatedI | 0.0 ~ 10.00 | 1.00 s | 02A9 | | ***60*** |
| B02-27 | Mag 9 Resistance | 0.00 ~ 60.00 | 4.00 Ω | 02AA | | ***60*** |
| B02-28 | Mag 10 Current | 0 ~ 2000 | 20 A | 02AB | | ***60*** |
| B02-29 | Mag10Sec2RatedI | 0.0 ~ 10.00 | 1.00 s | 02AC | | ***60*** |
| B02-30 | Mag 10Resistance | 0.00 ~ 60.00 | 4.00 Ω | 02AD | | ***60*** |
| B02-31 | Clean ROCL Gain | 1 ~ 100 | 50% | 02AE | | ***60*** |
| B03-01 | Ref Source 1 | 1 ~ 4 | 1 | 0300 | | ***62*** |
| B03-02 | Run Source 1 | 1 ~ 2 | 1 | 0301 | | ***62*** |
| B03-05 | MS Fault Time | 0 ~ 200 | 75 ms | 0303 | | ***62*** |
| B03-15 | Ref Source 2 | 1 ~ 4 | 1 | 0304 | | ***63*** |
| B03-16 | Run Source 2 | 1 ~ 2 | 1 | 0305 | | ***63*** |
| C01-01 | Lift Current | 0.0 ~ 100.0 | 100.0% | 0400 | | ***65*** |
| C01-02 | Hold Current | 0.0 ~ 100.0 | 75.0% | 0401 | | ***65*** |
| C01-03 | Dribble Current | -100.0 ~ 100.0 | -10.0% | 0402 | | ***65*** |
| C01-04 | Clean Current | 0.0 ~ 100.0 | 15.0% | 0403 | | ***65*** |
| C01-05 | Cast Rate | 0.0 ~ 100.0 | 1.0%/sec | 0404 | | ***65*** |
| C01-06 | Lift Time | 0.2 ~ 30.0 | 15.0 sec | 0405 | | ***65*** |
| C01-07 | Dribble Rate | 0.0 ~ 100.0 | 2.0%/sec | 0406 | | ***65*** |
| C01-08 | Clean Time | 0.2 ~ 30.0 | 0.8 sec | 0407 | | ***65*** |
| C01-09 | Decreased Lift | 0 ~ 100 | 10% | 0408 | | ***65*** |
| C01-10 | I Dev Level | 0.0 ~ 10.0 | 5.0% | 0409 | | ***65*** |
| C01-11 | I Dev Time | 0 ~ 9000 | 5000 ms | 040A | | ***65*** |
| C01-12 | P Gain | 0.0 ~ 50.0 | 1.0% | 040B | | ***65*** |
| C01-13 | I Gain | 0.0 ~ 50.0 | 0.2% | 040C | | ***65*** |

| Parameter | Name | Range | Default | Modbus | User Setting & Notes | Page |
|---|---|---|---|---|---|---|
| C01-14 | Auto Clean | 0 ~ 1 | 0 | 040D | | ***65*** |
| C01-15 | Maintain Clean | 0 ~ 1 | 1 | 040E | | ***65*** |
| C02-01 | Mag Rated V | 200 ~ 720 | 230 VDC | 0414 | | ***72*** |
| C02-02 | Mag V Limit | 0.0 ~ 200.0 | 125.0% | 0415 | | ***72*** |
| C02-03 | Start Delay | 0 ~ 2500 | 300 ms | 0416 | | ***72*** |
| C02-04 | Stop Delay | 0 ~ 2500 | 0 ms | 0417 | | ***72*** |
| C02-05 | Mag OT Alm Lvl | 0.0 ~ 500.0 | 0.0 deg | 0418 | | ***72*** |
| C02-06 | Mag OT Flt Lvl | 0.0 ~ 500.0 | 0.0 deg | 0419 | | ***72*** |
| C02-07 | MOC Det level | 0.0 ~ 100.0 | 0.0% | 041A | | ***72*** |
| C02-08 | MOC Detect Time | 0 ~ 2500 | 0 ms | 041B | | ***72*** |
| C02-09 | Power Loss Lvl | 0.0 ~ 700.0 | 200.0 VDC | 041C | | ***72*** |
| C02-10 | PwrL Recover Lvl | 102 ~ 200 | 110% | 041D | | ***72*** |
| C02-11 | Zero I Time | 0 ~ 2500 | 500 ms | 041E | | ***72*** |
| C02-12 | Battery Sel | 0 ~ 4 | 0 | 041F | | ***72*** |
| C02-13 | Battery Req Lvl | 0.0 ~ 700.0 | 0.0 VDC | 0420 | | ***72*** |
| C02-14 | OmniBeam Latch | 0 ~ 1 | 1 | 0421 | | ***72*** |
| C12-03 | Timer On Delay | 0.0 ~ 6000.0 | 0.0 sec | 04B0 | | ***73*** |
| C12-04 | Timer Off Delay | 0.0 ~ 6000.0 | 0.0 sec | 04B1 | | ***73*** |
| H01-01 | Term S1 Select | 0 ~ 81 | 81 | 0800 | | ***74*** |
| H01-02 | Term S2 Select | 0 ~ 81 | 80 | 0801 | | ***74*** |
| H01-03 | Term S3 Select | 0 ~ 81 | F | 0802 | | ***74*** |
| H01-04 | Term S4 Select | 0 ~ 81 | F | 0803 | | ***74*** |
| H01-05 | Term S5 Select | 0 ~ 81 | F | 0804 | | ***74*** |
| H01-06 | Term S6 Select | 0 ~ 81 | F | 0805 | | ***74*** |
| H01-07 | Term S7 Select | 0 ~ 81 | F | 0806 | | ***74*** |
| H01-08 | Term S8 Select | 0 ~ 81 | F | 0807 | | ***74*** |
| H01-09 | Term S9 Select | 0 ~ 81 | F | 0808 | | ***74*** |
| H01-10 | Term S10 Select | 0 ~ 81 | F | 0809 | | ***74*** |
| H01-11 | Term S11 Select | 0 ~ 81 | F | 080A | | ***74*** |
| H01-12 | Term S12 Select | 0 ~ 81 | F | 080B | | ***74*** |
| H01-14 | Stop/Reset | 0 ~ 1 | 0 | 0833 | | ***74*** |
| H02-01 | !M1/M2 M3/M4 Sel | 0 ~ F | 0 | 0810 | | ***76*** |
| H02-02 | M5/M6 Sel | 0 ~ F | E | 0811 | | ***76*** |

| Parameter | Name | Range | Default | Modbus | User Setting & Notes | Page |
|---|---|---|---|---|---|---|
| H02-03 | M7/M8/M9 Sel | 0 ~ F | 11 | 0812 | | ***76*** |
| H02-04 | M10/M11/M12 Sel | 0 ~ F | 2 | 0813 | | ***76*** |
| H02-05 | OP M Sel | 0 ~ F | 0 | 0814 | | ***76*** |
| H02-06 | OP1/DB Sel | 0 ~ F | F | 0815 | | ***76*** |
| H02-07 | OP4/SB Sel | 0 ~ F | G | 0816 | | ***76*** |
| H03-01 | Term A1 Signal | 0 ~ 2 | 0 | 0820 | | ***78*** |
| H03-02 | Term A1 Select | 0 ~ F | F | 0821 | | ***78*** |
| H03-03 | Term A1 Gain | -999.9 ~ 999.9 | 100.0% | 0822 | | ***78*** |
| H03-04 | Term A1 Bias | -200.0 ~ 200.0 | 0.0% | 0823 | | ***78*** |
| H03-05 | Term A2 Signal | 0 ~ 2 | 0 | 0824 | | ***78*** |
| H03-06 | Term A2 Select | 0 ~ F | 1 | 0825 | | ***78*** |
| H03-07 | Term A2 Gain | -999.9 ~ 999.9 | 100.0% | 0826 | | ***78*** |
| H03-08 | Term A2 Bias | -200.0 ~ 200.0 | 0.0% | 0827 | | ***78*** |
| H04-01 | MFAO Select | 0 ~ 999 | 101 | 0830 | | ***79*** |
| H04-02 | MFAO Gain | -999.9 ~ 999.9 | 100.0% | 0831 | | ***79*** |
| H04-03 | MFAO Bias | -200.0 ~ 200.0 | 0.0% | 0832 | | ***79*** |
| H04-07 | MFAO Signal | 0 ~ 2 | 0 | 0836 | | ***79*** |
| H05-01 | Modbus Address | 1 ~ 1F | 1 | 0840 | | ***80*** |
| H05-02 | Serial Baud Rate | 0 ~ 4 | 1 | 0841 | | ***80*** |
| H05-03 | Serial Format | 2 ~ 3 | 3 | 0842 | | ***80*** |
| H05-06 | TX Wait Time | 5 ~ 65 | 5 ms | 0843 | | ***80*** |
| H05-09 | CE Detect Time | 0.0 ~ 10.0 | 2.0 sec | 0844 | | ***80*** |
| L01-02 | OT Alarm Level | 70.0 ~ 85.0 | 85.0 deg | 0900 | | ***81*** |
| L01-03 | OT Fault Level | 70.0 ~ 115.0 | 90.0 deg | 0901 | | ***81*** |
| L01-05 | DOL Fault Sel | 0 ~ 1 | 1 | 0903 | | ***81*** |
| L01-06 | OH Fan Enable | 0.0 ~ 70.0 | 60.0 deg | 0904 | | ***81*** |
| L01-07 | AOT Detect Lvl | 0.0 ~ 95.0 | 75.0 deg | 0905 | | ***81*** |
| L02-01 | UV Detect Level | 100 ~ 420 | 125 VDC | 0910 | | ***82*** |
| L02-02 | OV Detect Level | 200 ~ 420 | 350 VDC | 0911 | | ***82*** |
| L02-10 | Pre-Charge ON | 0.00 ~ 10.00 | 0.28 s | 0290 | | ***82*** |
| L02-11 | Pre-Charge OFF | 0.0 ~ 60.0 | 10.0 | 0921 | | ***82*** |
| L02-12 | DC OK Level | 0 ~ 200 | 25 VDC | 0922 | | ***82*** |
| L02-13 | P.C. Start Delay | 0.00 ~ 10.0 | 0.10 s | 0923 | | ***82*** |

| Parameter | Name | Range | Default | Modbus | User Setting & Notes | Page |
|---|---|---|---|---|---|---|
| L08-09 | Ground Fault | 0 ~ 1 | 1 | 0978 | | ***82*** |
| L09-01 | Reset Flt Sel | 0 ~ 03FF | 0044 | 0980 | | ***85*** |
| L09-02 | Reset Attempts | 0 ~ 10 | 3 | 0981 | | ***85*** |
| O02-03 | Parallel Stacks | 1 ~ 5 | 1 | 0A12 | | ***86*** |
| O02-04 | Drive Model | 0 ~ 23 | 0 | 0A13 | | ***86*** |
| O02-06 | Magnet Setup | 0 ~ 3 | 0 | 0A15 | | ***87*** |
| O03-01 | Store Values | 0 ~ 3 | 0 | 0A20 | | ***87*** |
| O03-02 | Run Hist Reset | 0 ~ 5 | 0 | 0A21 | | ***87*** |
| O03-11 | Flt Hist Reset | 0 ~ 1 | 0 | 0A22 | | ***87*** |
| U01-01 | Mag Current Ref | - | - | 0040 | | ***88*** |
| U01-02 | Mag Current | - | - | 0041 | | ***88*** |
| U01-03 | Magnet Temp | - | - | 0042 | | ***88*** |
| U01-04 | Mag Voltage | - | - | 0043 | | ***88*** |
| U01-05 | DC Bus Voltage | - | - | 0044 | | ***88*** |
| U01-06 | Sequence Status | - | - | 0045 | | ***89*** |
| U01-07 | Num Active Magnets | - | - | 0046 | | ***89*** |
| U01-08 | Magnet FB Rel | - | - | 0047 | | ***89*** |
| U01-09 | GDB Interface | - | - | 0048 | | ***89*** |
| U01-10 | Logic Inputs Lo | - | - | 0049 | | ***89*** |
| U01-11 | Logic Inputs Hi | - | - | 004A | | ***90*** |
| U01-12 | Logic Outputs | - | - | 004B | | ***90*** |
| U01-13 | Control Status | - | - | 004C | | ***90*** |
| U01-14 | Firmware Version | - | - | 004D | | ***90*** |
| U01-15 | Analog Input 1 | - | - | 004F | | ***90*** |
| U01-16 | Analog Input 2 | - | - | 0050 | | ***90*** |
| U01-20 | Mag Rated I | - | - | 0053 | | ***90*** |
| U01-22 | Input Current | - | - | 0052 | | ***90*** |
| U01-23 | Magnet Volt Ref | - | - | 0051 | | ***90*** |
| U01-24 | Mag Resistance | - | - | 0060 | | ***90*** |
| U01-25 | Mag Rate/ms | - | - | 0061 | | ***90*** |
| U01-26 | Input Power | - | - | 0062 | | ***90*** |
| U01-27 | Energy Used | - | - | 0063 | | ***90*** |
| U01-28 | PwrLoss RT Count | - | - | 0064 | | ***90*** |

| Parameter | Name | Range | Default | Modbus | User Setting & Notes | Page |
|---|---|---|---|---|---|---|
| U01-34 | Prm Out Of Range | - | - | 006A | | ***90*** |
| U02-01 | Fault Status | - | - | 0080 | | ***91*** |
| U02-02 | Mag Current Ref | - | - | 0081 | | ***91*** |
| U02-03 | Mag Current | - | - | 0082 | | ***91*** |
| U02-04 | Mag Temp | - | - | 0083 | | ***91*** |
| U02-05 | Mag Voltage | - | - | 0084 | | ***91*** |
| U02-06 | DC Bus Voltage | - | - | 0085 | | ***91*** |
| U02-07 | Sequence Status | - | - | 0086 | | ***91*** |
| U02-08 | Mag Resistance | - | - | 0087 | | ***91*** |
| U02-09 | Num Active Mag | - | - | 0088 | | ***92*** |
| U02-10 | Magnet FB Rel | - | - | 0089 | | ***92*** |
| U02-11 | Elapsed Hours /10 | - | - | 008A | | ***92*** |
| U02-12 | Analog Input 1 | - | - | 008B | | ***92*** |
| U02-13 | Logic Inputs Lo | - | - | 008C | | ***92*** |
| U02-14 | Logic Inputs Hi | - | - | 008D | | ***92*** |
| U02-15 | Logic Outputs | - | - | 008E | | ***92*** |
| U02-16 | Control Status | - | - | 008F | | ***92*** |
| U02-17 | Last Fault | - | - | 00AE | | ***92*** |
| U03-01 | Fault 1 | - | - | 0090 | | ***93*** |
| U03-02 | Fault 1 Time | - | 0 Hr | 0091 | | ***93*** |
| U03-03 | Fault 2 | - | - | 0092 | | ***93*** |
| U03-04 | Fault 2 Time | - | 0 Hr | 0093 | | ***93*** |
| U03-05 | Fault 3 | - | - | 0094 | | ***93*** |
| U03-06 | Fault 3 Time | - | 0 Hr | 0095 | | ***93*** |
| U03-07 | Fault 4 | - | - | 0096 | | ***93*** |
| U03-08 | Fault 4 Time | - | 0 Hr | 0097 | | ***93*** |
| U03-09 | Fault 5 | - | - | 0098 | | ***93*** |
| U03-10 | Fault 5 Time | - | 0 Hr | 0099 | | ***93*** |
| U03-11 | Fault 6 | - | - | 009A | | ***93*** |
| U03-12 | Fault 6 Time | - | 0 Hr | 009B | | ***93*** |
| U03-13 | Fault 7 | - | - | 009C | | ***93*** |
| U03-14 | Fault 7 Time | - | 0 Hr | 009D | | ***93*** |
| U03-15 | Fault 8 | - | - | 009E | | ***93*** |

| Parameter | Name | Range | Default | Modbus | User Setting & Notes | Page |
|---|---|---|---|---|---|---|
| U03-16 | Fault 8 Time | - | 0 Hr | 009F | | ***93*** |
| U03-17 | Fault 9 | - | - | 00A0 | | ***93*** |
| U03-18 | Fault 9 Time | - | 0 Hr | 00A1 | | ***93*** |
| U03-19 | Fault 10 | - | - | 00A2 | | ***93*** |
| U03-20 | Fault 10 Time | - | 0 Hr | 00A3 | | ***93*** |
| U03-21 | Fault 11 | - | - | 00A4 | | ***93*** |
| U03-22 | Fault 11 Time | - | 0 Hr | 00A5 | | ***93*** |
| U03-23 | Fault 12 | - | - | 00A6 | | ***93*** |
| U03-24 | Fault 12 Time | - | 0 Hr | 00A7 | | ***93*** |
| U03-25 | Fault 13 | - | - | 00A8 | | ***93*** |
| U03-26 | Fault 13 Time | - | 0 Hr | 00A9 | | ***93*** |
| U03-27 | Fault 14 | - | - | 00AA | | ***93*** |
| U03-28 | Fault 14 Time | - | 0 Hr | 00AB | | ***93*** |
| U03-29 | Fault 15 | - | - | 00AC | | ***93*** |
| U03-30 | Fault 15 Time | - | 0 Hr | 00AD | | ***93*** |
| U04-01 | Num Operations | - | - | 00B0 | | ***94*** |
| U04-02 | Operations x1000 | - | - | 00B1 | | ***94*** |
| U04-03 | Elapsed Hours /10 | - | 0 Hr | 004E | | ***94*** |
| U04-04 | FanRun Hours /10 | - | 0 Hr | 00B3 | | ***94*** |
| U04-05 | Heatsink Temp | - | - | 00B4 | | ***94*** |
| U04-06 | Ambient Temp | - | - | 00B5 | | ***94*** |
| U04-07 | Mag OL Lvl | - | - | 00B6 | | ***94*** |
| U04-08 | Drive OL Lvl | - | - | 00BB | | ***94*** |
| U04-09 | T1 Duty Cycle | - | - | 00B7 | | ***94*** |
| U04-10 | T2 Duty Cycle | - | - | 00B8 | | ***94*** |
| U04-24 | 485 RX Count | - | - | 0054 | | ***94*** |
| U04-25 | 485 CRC Error | - | - | 0055 | | ***94*** |
| U04-26 | 485 MB_Addr | - | - | 0056 | | ***94*** |
| U04-27 | 485 MB_Cmd | - | - | 0057 | | ***94*** |

# Appendix C: DMC Series 1 to DMC Series 2 Parameter Reference

| DMC-S1 Param # | DMC-S2 Param # | Parameter Name |
|---|---|---|
| A00 | U01-02 | Mag Current |
| A02 | U01-04 | Mag Voltage |
| A03 | U01-05 | DC Bus Voltage |
| A04 | U01-24 | Mag Resistance |
| A05 | U01-03 | Magnet Temp |
| A08 | - | Control Ref |
| A09 | U01-26 | Input Power |
| A10 | U01-27 | Energy Used |
| A11 | U04-01 | Num Operations |
| A12 | U04-02 | Operations x1000 |
| A13 | U04-03 | Elapsed Hours/10 |
| A14 | U01-15 | Analog Input 1 |
| A15 | U01-16 | Analog Input 2 |
| A16 | U01-01 | Mag Current Ref |
| A17 | U01-08 | Magnet FB Rel |
| A21 | U01-10 | Logic Inputs Lo |
| A22 | U01-12 | Logic Outputs |
| A23 | U04-05 | Heatsink Temp |
| A24 | U04-06 | Ambient Temp |
| A25 | U04-07 | Magnet OL Lvl |
| A26 | U04-09 | T1 Duty Cycle |
| A27 | U04-10 | T2 Duty Cycle |
| A29 | U01-13 | Control Status |
| A30 | U02-01 | Fault Status |
| A31 | U01-06 | Sequence Status |
| B00 | A01-08 | Password |
| B01 | A01-01 | Access Level |
| B02 | U01-14 | Firmware Version |
| B03 | U01-80 | Revision |
| B05 | - | Modbus AN1 |
| B06 | - | Modbus AN2 |
| C01 | O02-04 | Drive Model |
| C02 | O02-04 | Drive Model |
| C03 | O02-03 | Parallel Stacks |
| C04 | O02-06 | Magnet Setup |
| C05 | L02-14 | DC Bus Input |
| C07 | A01-05 | Restore Values |
| D00 | C02-01 | Magnet Rated V |
| D01 | C02-02 | Magnet V Limit |
| D03 | C02-09 | Power Loss Lvl |
| D07 | L08-09 | Ground Fault |
| D08 | L01-02 | Ht Sk OT Alm Lvl |
| D09 | L01-03 | Ht Sk OT Flt Lvl |
| D11 | C02-03 | Start Delay |
| D12 | C02-04 | Stop Delay |
| D14 | C02-05 | Mag OT Alm Lvl |
| D15 | C02-06 | Mag OT Flt Lvl |
| D16 | L01-06 | OH Fan Enable |
| D17 | L01-07 | AOT Detect Level |
| D18 | C02-07 | MOC Det Level |
| D19 | C02-08 | MOC Detect Time |
| D30 | L09-02 | Reset Attempts |
| D31 | L09-01 | Reset Flt Select |
| E00 | C01-01 | Lift Current |
| E01 | C01-02 | Hold Current |
| E02 | C01-03 | Dribble Current |
| E03 | C01-04 | Clean Current |
| E04 | C01-05 | Cast Rate |
| E05 | C01-06 | Lift Time |
| E06 | C01-07 | Dribble Rate |

| DMC-S1 Param # | DMC-S2 Param # | Parameter Name |
|---|---|---|
| E07 | C01-08 | Clean Time |
| E08 | C01-10 | Decreased Lift |
| E09 | B01-01 | Lift Current 1 |
| E10 | B01-02 | Lift Current 2 |
| E11 | B01-03 | Lift Current 3 |
| E12 | B01-04 | Lift Current 4 |
| E13 | B01-05 | Lift Current 5 |
| E14 | B01-06 | Clean Current 1 |
| E15 | B01-07 | Clean Current 2 |
| E16 | B01-08 | Clean Current 3 |
| E17 | B01-09 | Clean Current 4 |
| E18 | B01-10 | Clean Current 5 |
| E20 | C01-11 | I Dev Time |
| E21 | C01-12 | P Gain |
| E22 | C01-13 | I Gain |
| E23 | C01-14 | Auto Clean |
| F00 | B03-01 | Ref Source 1 |
| F02 | B02-01 | Mag 1 Current |
| F03 | B02-02 | Mag1 Sec2RatedI |
| F04 | B02-03 | Mag 1 Resistance |
| F05 | B02-04 | Mag 2 Current |
| F06 | B02-05 | Mag2 Sec2RatedI |
| F07 | B02-06 | Mag 2 Resistance |
| F08 | B02-07 | Mag 3 Current |
| F09 | B02-08 | Mag3 Sec2RatedI |
| F10 | B02-09 | Mag 3 Resistance |
| F11 | B02-10 | Mag 4 Current |
| F12 | B02-11 | Mag4 Sec2RatedI |
| F13 | B02-12 | Mag 4 Resistance |
| F14 | B02-13 | Mag 5 Current |
| F15 | B02-14 | Mag5 Sec2RatedI |
| F16 | B02-15 | Mag 5 Resistance |
| F17 | B02-16 | Mag 6 Current |
| F18 | B02-17 | Mag6 Sec2RatedI |
| F19 | B02-18 | Mag 6 Resistance |
| G00 | H03-01 | Term A1 Signal |
| G01 | H03-03 | Term A1 Gain |
| G02 | H03-04 | Term A1 Bias |
| G04 | H03-05 | Term A2 Signal |
| G05 | H03-07 | Term A2 Gain |
| G06 | H03-08 | Term A2 Bias |
| G08 | H04-02 | MFAO Gain |
| G09 | H04-03 | MFAO Bias |
| G10 | H04-01 | MFAO Select |
| G11 | H01-07 | Term S7 Select |
| G12 | H02-01 | !M1/M2 M3/M4 Sel |
| G13 | H02-02 | M5/M6 Sel |
| G14 | H02-03 | M7/M8/M9 Sel |
| G15 | H02-04 | M10/M11/M12 Sel |
| G16 | H05-02 | Serial Baud Rate |
| G17 | - | RS232/485 Select |
| G18 | H05-03 | Serial Format |
| G19 | H05-01 | Modbus Address |
| G20 | B03-02 | Run Source 1 |
| G21 | - | SPEED IP Func |
| G22 | H01-14 | Stop/Reset |
| G23 | C01-15 | Maintain Clean |
| G25 | H01-13 | Term Enable |
| H00 | U03-01 | Fault 1 |
| H01 | U03-02 | Fault 1 Time |
| H02 | U03-03 | Fault 2 |
| H03 | U03-04 | Fault 2 Time |
| H04 | U03-05 | Fault 2 |
| H05 | U03-06 | Fault 3 Time |
| H06 | U03-07 | Fault 4 |
| H07 | U03-08 | Fault 4 Time |

| DMC-S1 Param # | DMC-S2 Param # | Parameter Name |
|---|---|---|
| H08 | U03-09 | Fault 5 |
| H09 | U03-10 | Fault 5 Time |
| H10 | U03-11 | Fault 6 |
| H11 | U03-12 | Fault 6 Time |
| H12 | U03-13 | Fault 7 |
| H13 | U03-14 | Fault 7 Time |
| H14 | U03-15 | Fault 8 |
| H15 | U03-16 | Fault 8 Time |
| H16 | U03-17 | Fault 9 |
| H17 | U03-18 | Fault 9 Time |
| H18 | U03-19 | Fault 10 |
| H19 | U03-20 | Fault 10 Time |
| H20 | U03-21 | Fault 11 |
| H21 | U03-22 | Fault 11 Time |
| H22 | U03-23 | Fault 12 |
| H23 | U03-24 | Fault 12 Time |
| H24 | U03-25 | Fault 13 |
| H25 | U03-26 | Fault 13 Time |
| H26 | U03-27 | Fault 14 |
| H27 | U03-28 | Fault 14 Time |
| H28 | U03-29 | Fault 15 |
| H29 | U03-30 | Fault 15 Time |
| H30 | U03-31 | Flt Hist Reset |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