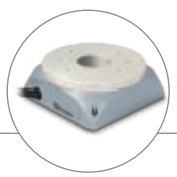
MDC2100

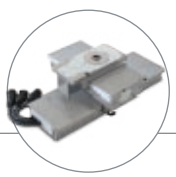
Reference & Maintenance Manual

Primatics


Linear Positioning


Rotary Positioning


Motion Controls


Engineered Solutions

32114 Mallard Ave.
PO Box 409
Tangent, OR 97389-0409
U.S.A.

Phone: [541] 791-9678
Fax: [541] 791-9410
Toll Free: [888] 754-3111
Web: www.primatics.com
E-mail: info@primatics.com

MDC2100 Manual
Revision Information

Publication Date	Notes
December 2003	First Release
April 2005	Updated look & formatting
November 2006	Manual Maintenance & Pinout Update
December 2006	Modified Table 7.3

Notice: Any descriptions, drawings, and specifications contained herein are subject to change. Primatics is not responsible for errors or omissions herein or for incidental damages in connection with the furnishing or use of this information. This document shall not be reproduced, photocopied, or duplicated, in whole or in part, without prior written approval of Primatics Corporation.

For additional specifications, dimensioned drawings and additional information, refer to the MDC2100 Datasheet available from our website at www.primatics.com.

Manual Revision Information 1
1) Overview..... 3
2) Introduction – About the MDC2100 Family..... 4
3) Model Configuration 5
4) Personal Safety 6
5) Installation..... 7
5.1) Locating the MDC2100 7
5.2) Front Panel Indicators and Controls..... 8
5.3) Rear Panel Information 9
5.3.1) Communication Ports: RS-232, Ethernet 9
5.3.2) The I/O Port Pinout 10
5.3.3) Auxiliary Encoder Option 11
5.4) The Safety Port 12
5.4.1) Stop Loop and Stop Switch 12
5.5) Axis Information 13
6) Operations..... 15
6.1) Fault Detection and Motor Power Control 15
6.2) Motor Output Signals..... 16
6.2.1) Brushless Servo Motor..... 16
6.3) Encoder Input 17
6.4) Limit, Home & Temp Sensors..... 18
6.5) Brake Release Output..... 18
7) The Galil DMC Interface 19
7.1) The I / O Port 19
7.2) Overview..... 19
7.2.1) MDC Digital Inputs and Outputs 20
7.3) The MDCOptima Application Programming Interface 21
7.3.1) The API..... 21
7.3.2) Motor Power Control 21
7.3.3) Brakes 22
7.4) Software Installation 23
7.4.1) Set the Controller Parameters..... 23
7.4.2) Setting Motion Control Parameters for each axis 23
7.4.3) Loading the API 23
7.4.4) Example 1 – Brushless Servo - Trapezoidal Drive 23
7.5) Appendices..... 26
7.5.1) Appendix A – MDCOptima API..... 26
8) Troubleshooting & Service 28
8.1) Troubleshooting Help..... 28
8.2) Service..... 28

1) Overview

This user guide is designed to help you install and maintain your MDC Series motion control. Follow these steps to ensure correct installation and maximum life:

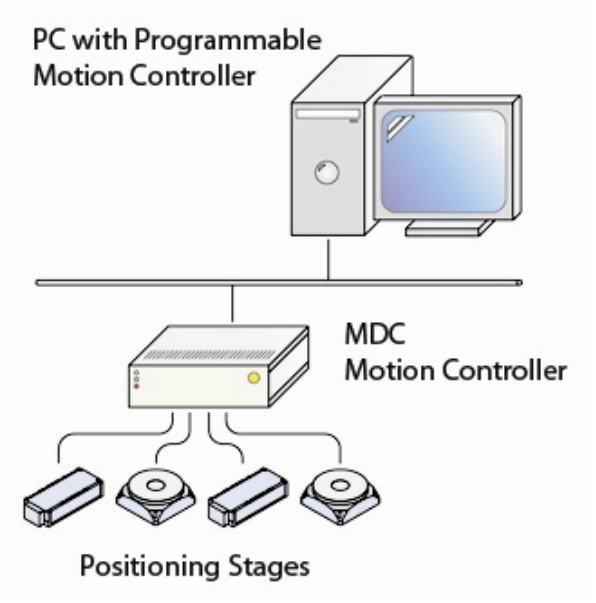
Step 1 Review this entire user manual. Become familiar with all installation procedures prior to integrating your system.

Step 2 Review the safety summary to develop an understanding of standard safety practices when installing and operating automated equipment.

Step 3 Review installation procedures. For best results, follow these procedures carefully.

2) Introduction – About the MDC2100 Family

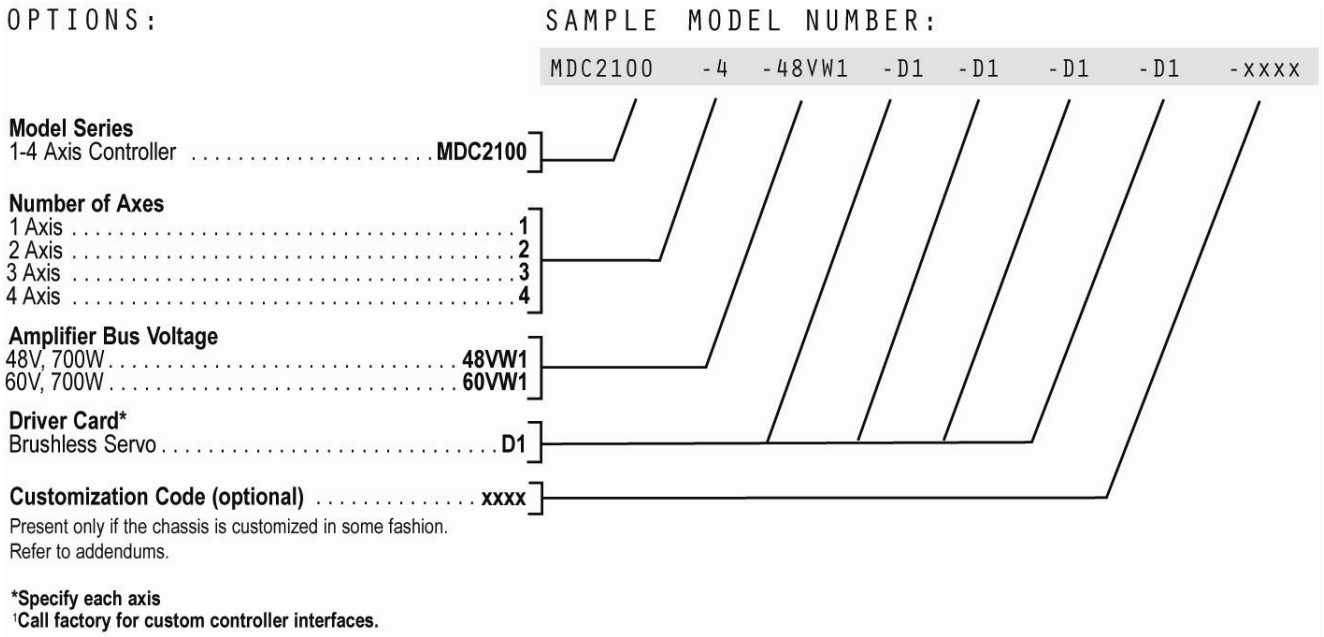
This manual is intended for use by application engineers and technicians involved with Primatics positioning equipment.



The MDC2100 is a complete motion control system in a small package. It combines a programmable motion controller (Galil DMC-21x3), servo drives, power supplies, and all necessary wiring into a single package. The MDC2100 is optimized for controlling Primatics positioning stages and mechanisms, but can also be used with third party positioning stages or axes. A variety of cable assemblies are available to connect positioning stages or axes to the MDC. The diagram to the left shows the role of a MDC in a motion control system.

The integrated Galil DMC-21x3 programmable motion control card makes the MDC a powerful element in a motion control system. The DMC-21x3 can be programmed via its integrated RS-232 or 10BaseT Ethernet connection and operates as a stand alone system using the Galil's internal program memory storage capability. The Galil DMC-21x3 is a multi-tasking, multi-axis, high performance motion controller. Refer to the Galil DMC-21x3 programming and users manuals for more information.

3) Model Configuration



4) Personal Safety

Please review before installing your motion system

Observe common industrial safety practices when installing and operating automated equipment.

- Have power connections made by qualified personnel.
- Keep fingers and other items out of any opening in the stage while it is in operation since injury or damage may result.
- Provide a safe access route and adequate room for servicing.
- Perform the recommended periodic maintenance described in this document.
- Verify that the work envelope is free of obstructions before the positioning stage is powered.
- Insure that for servo motors the encoder must be working properly and the polarity of the encoder needs to match the polarity of the motor before enabling the servo drive. Improper feedback connections can cause a motor run-away condition that has the potential to damage the stage and injure an operator.
- Only trained operators of the positioning stage should be allowed near the work environment.
- Identify emergency stop circuits and actuators in the workcell. In an emergency press the yellow stop button on the drive chassis front panel. This cuts power to all axes amplifiers.
- Note the places in the workcell where pinch points occur, and provide adequate safety clearance or safety curtain.
- Never operate the motor in a location that could be splashed by water, exposed to corrosive or flammable gases or is near combustible substances since this may cause an electric shock, fire or malfunction.
- Never touch the motor, driver, or peripheral devices when the power is on or immediately after the power is turned off. The high temperature of these parts may cause burns.

5) Installation

5.1) Locating the MDC2100

A typical motion system consists of the MDC, axis cables and positioning stages. The Motion Controller Card is housed inside the MDC. The MDC also includes Motor Drive Connectors for each axis of travel; these Motor Drive Connectors connect to stages with axis cables. Figure 5-1 shows a typical system.

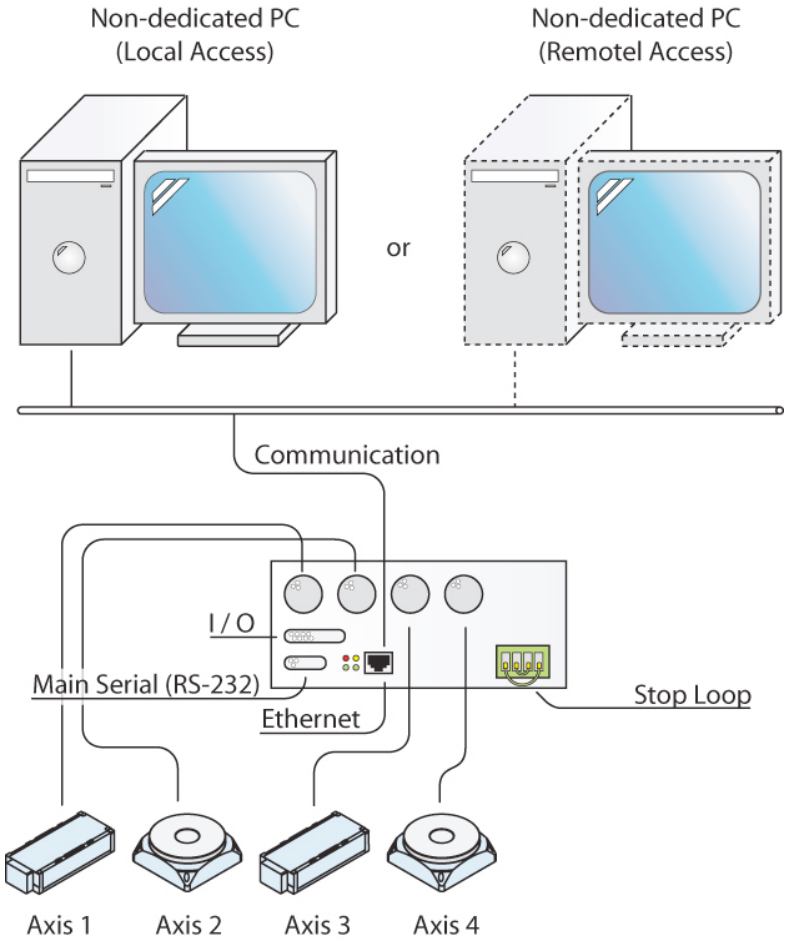


Figure 5-1: MDC2100 Motion System

The MDC must be placed in a convenient location for connection to both the PC and your stages. Access to the front panel controls and the rear panel connectors must be considered before installation. There are no user serviceable parts in the chassis, but axis cards and motion control interface cards are “plug-in” assemblies that can be removed and installed from the rear of the chassis.

Figure 5-2: Dimensions of MDC2100

5.2) Front Panel Indicators and Controls

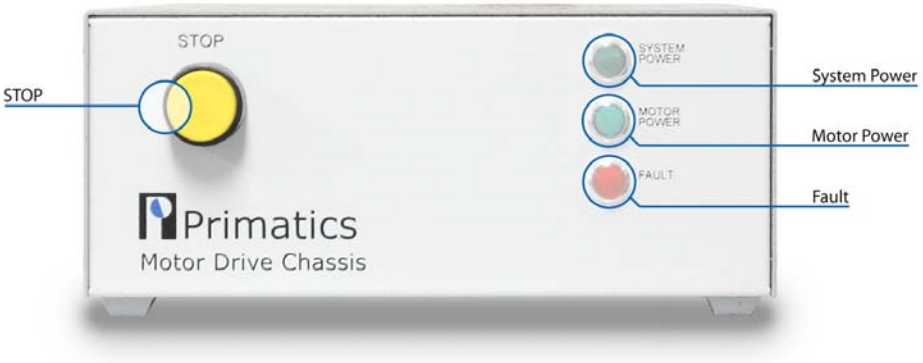


Figure 5-3: Front Panel

SYSTEM POWER is illuminated whenever power is applied to the chassis, and the power switch on the rear is turned on.

MOTOR POWER is illuminated when the internal motor power supply is turned on.

FAULT is illuminated whenever any condition exists that prevents the motor power supply to be turned on.

STOP is connected into the STOP loop described in 5.4.

5.3) Rear Panel Information

All connections to the MDC are made at the rear of the chassis. Connections include AC power, communications to the DMC-21x3, I/O from the DMC-21x3, and signals for the attached positioning stages or axes.

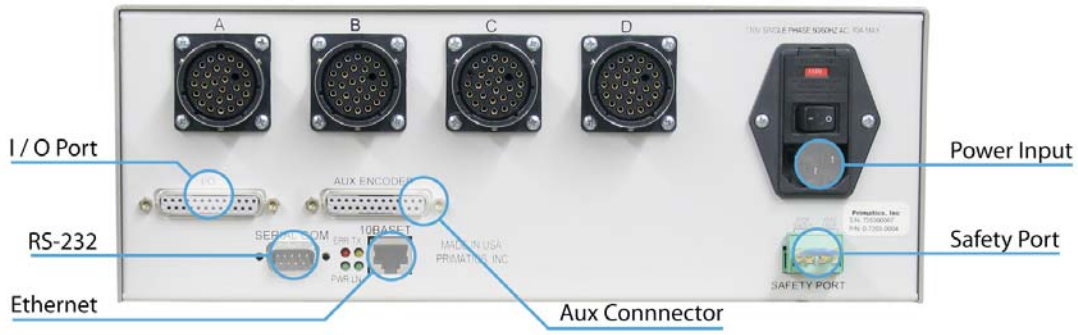


Figure 5-4: Galil Communications Connections

5.3.1) Communication Ports: RS-232, Ethernet

Communication to the integrated Galil DMC-21x3 can use either the RS-232 port or Ethernet port as indicated. The RS-232 port operates at 19.2K. The Ethernet port is a 10BaseT port. Refer to the Galil DMC-21x3 User Manual, Chapter 4 for detailed information about both of these interfaces. The factory default IP address is 192.168.0.60.

5.3.2) The I/O Port Pinout

The third connector is the I/O connector located on the rear of the MDC chassis. This port provides access to certain Input, Output, Status, and Control signals from the Galil motion control card. The pin definition for this port is shown Table 5-1 below.

Please note that many of the signals in the I/O Port are TTL logic levels. Power supply signals are included in the port for users that want to provide external signal conditioning. If you want internal signal conditioning for your application, contact the factory.

Table 5-1: I/O Port Pinout:
Connector: DB25S Mate: DB25P

Pin	Name	Description
1	USER IN 1	TTL input
14	USER IN 2	TTL input
2	USER IN 3	TTL input
15	USER IN 4	TTL input
3	USER OUT 1	TTL output
16	USER OUT 2	TTL output
4	USER OUT 3	TTL output
17	AIN 1	Analog Input 1
5	AIN 2	Analog Input 2
18	AIN 3	Analog Input 3
6	AIN 4	Analog Input 4
19	AIN 5	Analog Input 5
7	AIN 6	Analog Input 6
20	AIN 7	Analog Input 7
8	AIN 8	Analog Input 8
21	ABORT	TTL input. Abort input of Galil card. Active low.
9	ENC CMP	TTL output. Encoder Compare output of Galil card.
22	ERROR	TTL output. Error output
10	USER OUT 4	TTL output
23	NC	No connection
11	+12VDC	Power supply, 12VDC, 150mA max.
24	-12VDC	Power supply, -12VDC, 100mA max.
12	GND	DC common for power supplies and signals
25	GND	see pin 12
13	5VDC	Power supply, 5VDC, 200mA max.

5.3.3) Auxiliary Encoder Option

An available option for the MDC2100 is the Auxiliary Encoder Connector. This allows connection to secondary encoders for dual-loop operation.

Table 5-2: Auxiliary Encoder Pinout:
Connector: DB25S Mate: DB25P

Pin	Name	Description
1	5VDC	Encoder Power
14	DCCOM	Power Common
2	AUXA A+	Auxiliary Encoder Axis A, A+
15	AUXA A-	Auxiliary Encoder Axis A, A-
3	AUXA B+	Auxiliary Encoder Axis A, B+
16	AUXA B-	Auxiliary Encoder Axis A, B-
4	5VDC	Encoder Power
17	DCCOM	Power Common
5	AUXB A+	Auxiliary Encoder Axis B, A+
18	AUXB A-	Auxiliary Encoder Axis B, A-
6	AUXB B+	Auxiliary Encoder Axis B, B+
19	AUXB B-	Auxiliary Encoder Axis B, B-
7	5VDC	Encoder Power
20	DCCOM	Power Common
8	AUXC A+	Auxiliary Encoder Axis C, A+
21	AUXC A-	Auxiliary Encoder Axis C, A-
9	AUXC B+	Auxiliary Encoder Axis C, B+
22	AUXC B-	Auxiliary Encoder Axis C, B-
10	5VDC	Encoder Power
23	DCCOM	Power Common
11	AUXD A+	Auxiliary Encoder Axis D, A+
24	AUXD A-	Auxiliary Encoder Axis D, A-
12	AUXD B+	Auxiliary Encoder Axis D, B+
25	AUXD B-	Auxiliary Encoder Axis D, B-
13	CHASSIS	Chassis Connection

5.4) The Safety Port

At the rear of the MDC chassis is a pluggable terminal strip labeled Safety Port. The Safety Port provides connection access to two features: the Stop Loop and the Stop Switch.

5.4.1) Stop Loop and Stop Switch

To enhance the safety of an application, the motor power supply in the MDC uses an external Stop Loop to control the state of its motor power circuit. For normal operation of the motor power supply, the Stop Loop found on pins 3 and 4 of the Safety Port must form a closed circuit. An open Stop Loop will generate internal STOP and hardware faults, killing power to the motors.

The Stop Switch on the front panel of the MDC chassis is a normally closed switch connected between pins 1 and 2 of the Safety Port. If no external devices are to be connected to the Stop Loop, the Stop Switch must be connected as shown in Figure 5-5.

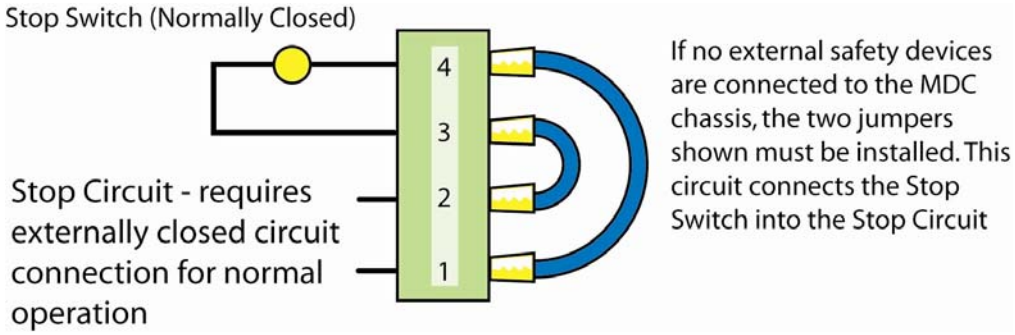


Figure 5-5: Stop Switch and Stop Loop connections (pins 1, 2, 3 and 4 of Safety Port)

To connect the MDC safety system to external devices, such as an external STOP switch, light curtain, etc, insert the normally closed circuit from the safety devices into one of the two loops show in Figure 5-5. Assure that the safety circuit is a dry contact.

5.5) Axis Information

Primatics linear and rotary stages are connected to the MDC chassis using the Servo Axis Cable accessory. The standard cable is 12 ft. long, but cables up to 50 ft. in length can be used. Connect the cable from the appropriate axis connector at the rear of the MDC chassis to the stage. The Axis connectors are associated to Galil axes A through D. Only those connectors for the ordered configuration are present. For example: a 2-axis MDC2100 will have connectors for axes A & B only.

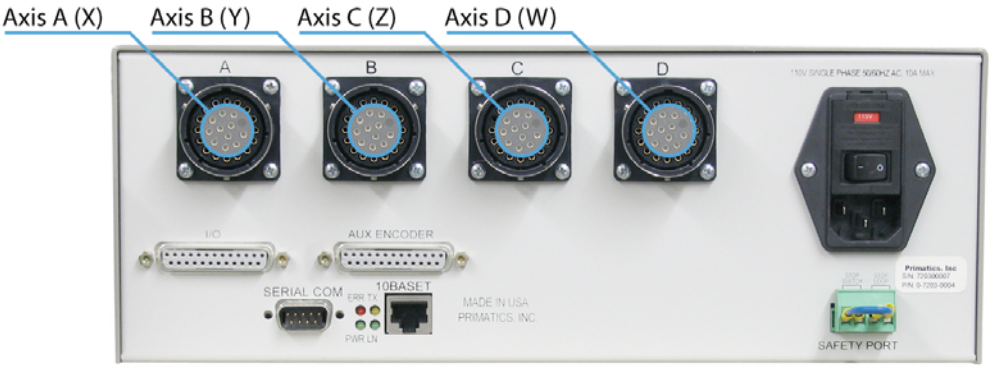


Figure 5-6: Axis Connectors and Galil Association

Table 5-3 shows the pin-out of the Axis connectors.

Table 5-3: Servo Axis Connector Pin-out
Connector: FCI UTG020-S Mate: FCI UTG620-28PN

Pin	Name	Function
A	MOT A	Motor phase A
B	MOT B	Motor phase B
C	MOT C	Motor phase C
D	MOT SHLD	Shield for motor signals, connect to motor case.
E	ENC 5V	Encoder power supply, 5VDC
F	ENC A+	Encoder channel A+
G	ENC A-	Encoder channel A-
H	ENC B+	Encoder channel B+
J	ENC B-	Encoder channel B-
K	ENC SHLD	Shield for encoder signals, connect to encoder case.
L	LIMIT 12V	Power supply for limit switches, 12VDC
M	LIMIT COM	power supply return for limit switches.
N	HOME	Home signal input
P	BRAKE+	Failsafe brake power output, 24VDC to release brake
R	BRAKE-	return for brake power output
S	SHIELD	Shield for cable
T	HALL V+	Limit switch power output, 5VDC
U	HALL V-	return for limit switch power output
V	ENC V-	Return for Encoder power
W	ENC I+	Encoder channel I+
X	ENC I-	Encoder channel I-
Y	FLS	Forward limit switch input. Connect to LIMIT COM for normal operation.
Z	RLS	Reverse limit switch input. Connect to LIMIT COM for normal operation.
a	not used	
b	HALL A	Hall sensor A input
c	HALL B	Hall sensor B input
d	TEMP	Motor temperature switch input. Connect to LIMIT COM for normal operation.
e	HALL C	Hall sensor C input

6) Operations

6.1) Fault Detection and Motor Power Control

For the MDC, a fault is any condition that will prevent power from being applied to the motor drives. There are two DC power systems in the MDC chassis: the Logic supply and the Motor supply. The Logic supply provides DC power to all internal circuits as well as externally connected encoders, limit and home sensors, and optional brakes. The Logic supply is on anytime AC power is supplied and the power switch is on. This condition is indicated with the illumination of the SYSTEM POWER indicator on the front panel.

The Motor supply provides the DC power to all of the motor drives. This power supply is on only if there are no fault conditions, and the motion controller has turned on the supply through its I/O signals. A fault condition will override the signals from the motion controller and turn off the motor supply. If a fault condition occurs, the source of the fault must be removed, and the condition must be re-set using I/O signals from the motion controller.

A Fault condition is indicated by the illuminated FAULT indicator on the front panel. This condition is caused when any of the following occur:

- System power turn-on
- Power Supply Fault
- STOP LOOP on SAFETY PORT is open

The state of the Fault as well as the cause of the fault may be determined through input signals to the motion controller.

6.2) Motor Output Signals

6.2.1) Brushless Servo Motor

The brushless servo motor drives control current through the three phases of a brushless motor. The motor is commutated with hall sensors. Figure 6-1 shows the timing diagram for the motor phases and commutation sensors.

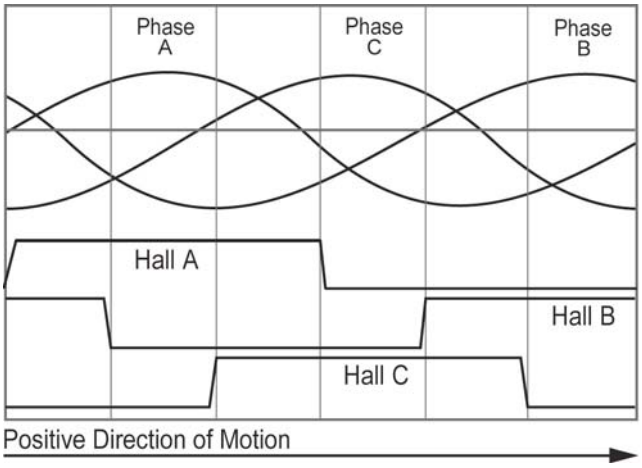


Figure 6-1: Motor commutation chart

6.3) Encoder Input

The encoder input is necessary to operate the motor. The encoder inputs are compatible with RS-422 differential signals commonly used on industrial encoders. Figure 6-2 shows the timing diagram for the encoder input.

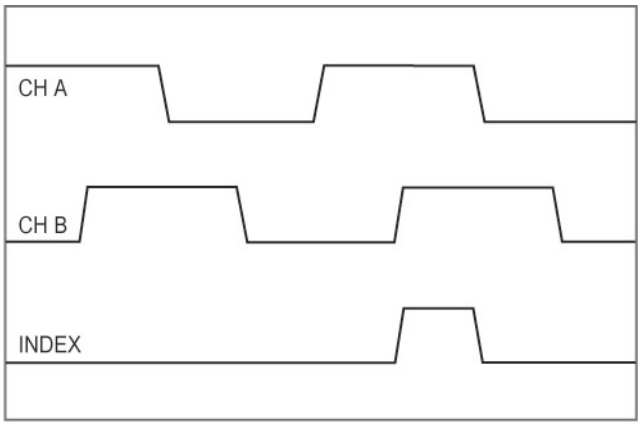


Figure 6-2: Encoder signal timing diagram for positive motion

6.4) Limit, Home & Temp Sensors

The MDC2100 supports monitoring a forward limit, reverse limit, and home sensor for each axis. Figure 6-3 shows an equivalent schematic for the limit, home, and temperature inputs. Note that the MDC2100 has a 12V supply available to power external sensor circuits.

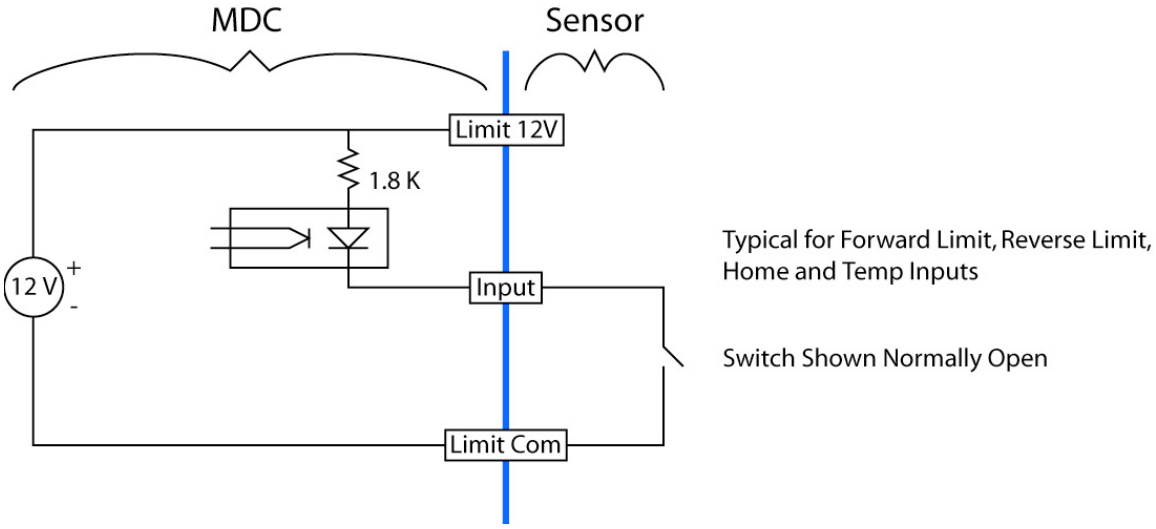


Figure 6-3: Sensor Input Circuit Diagram

6.5) Brake Release Output

Each axis includes a circuit to energize (supply power to) a fail-safe brake. A fail-safe brake will hold an axis from moving when no power is applied to the brake. The brake release output will supply 24VDC to a brake when the output is on. The brake release output is on only when all of these conditions are satisfied:

- Motor power supply is on
- The drive amplifier is enabled by the motion controller
- The drive amplifier has no faults
- The brake release enable output bit from the motion controller is on

7) The Galil DMC Interface

7.1) The I / O Port

This port provides access to certain Input, Output, Status, and Control signals from the Galil motion control card. The pin definition for this port is shown in Table 7-1.

Please note that many of the signals in the I/O Port are TTL logic levels. Power supply signals are included in the port for users that want to provide external signal conditioning. If you want internal signal conditioning for your application, contact the factory.

Table 7-1) I/O Port Pinout:
Connector: DB25S Mate: DB25P

Pin	Name	Description
1	USER IN 1	TTL input
14	USER IN 2	TTL input
2	USER IN 3	TTL input
15	USER IN 4	TTL input
3	USER OUT 1	TTL output
16	USER OUT 2	TTL output
4	USER OUT 3	TTL output
17	ANALOG IN 1	AIN 1 of Galil card
5	ANALOG IN 2	AIN 2 of Galil card
18	ANALOG IN 3	AIN 3 of Galil card
6	ANALOG IN 4	AIN 4 of Galil card
19	ANALOG IN 5	AIN 5 of Galil card
7	ANALOG IN 6	AIN 6 of Galil card
20	ANALOG IN 7	AIN 7 of Galil card
8	ANALOG IN 8	AIN 8 of Galil card
21	ABORT	TTL input. Abort input of Galil card. Active low.
9	ENC CMP	TTL output. Encoder Compare output of Galil card.
22	ERROR	TTL output. Error output
10	NC	No connection
23	NC	No connection
11	+12VDC	Power supply, 12VDC, 100mA max.
24	-12VDC	Power supply, -12VDC, 100mA max.
12	GND	DC common for power supplies and signals
25	GND	see pin 12
13	5VDC	Power supply, 5VDC, 200mA max.

7.2) Overview

The Galil DMC 21x3 series controllers provide motion control for up to four axes of motion. Cards that support 1 to 4 axes of motion supply eight inputs and eight outputs. Output bits 4-8 and input bits 5-8 are dedicated to internal functions leaving 3 uncommitted outputs and 4 uncommitted inputs available to the user through I/O connector 1.

7.2.1) MDC Digital Inputs and Outputs

Five outputs are dedicated to programmatic operation of the MDC2100. **Motor Power Enable** and **Reset Faults** are used to control the motor power circuit. The **Brake Release Enable** is used to enable the release of failsafe brakes.

Table 7-2) Controller Digital Outputs

	MDC 1 Outputs
1	User Output 1
2	User Output 2
3	User Output 3
4	Unused
5	MDC1 Motor Power Enable
6	MDC1 Reset Faults
7	Unused
8	MDC1 Brake Release Enable

Table 7-3) Inputs

	MDC 1 Inputs
1	User Input 1
2	User Input 2
3	User Input 3
4	User Input 4
5	MDC 1 Motor Power is Off
6	MDC 1 Hardware Fault
7	MDC 1 ESTOP Fault
8	MDC 1 Logic Power Fault

7.3) The MDCOptima Application Programming Interface

7.3.1) The API

The application programming interface (API) for the MDC Optima is a set of programs, which reside on the controller card. The programs provide motor power control, and brake control. For each program, a variable with the same name is provided to indicate routine completion. The program variable is set to 1 when the routine completes execution. A program running on the PC can set the variable to zero, execute an API routine and then poll the value of the variable to determine when the routine has finished. Appendix A contains a program listing.

7.3.2) Motor Power Control

Table 7-4) Motor Power Control Programs

Program	Description
CF	Clear faults
MPOFF	Turn motor power off
MPON	Turn motor power on

The **CF** program attempts to reset the hardware faults. First the ESTOP fault and logic power fault latches are reset and then the hardware fault latch is reset. The fault latch cannot be reset if faults are still active.

The **MPOFF** program is used to turn off motor power to all axes. It turns off the enable motor power output, turning motor power off to all motor drivers (amplifiers). In addition, the Galil motor off (MO) command is issued to all axes. This turns off the amplifier enable signal and opens the servo loop for each axis.

The **MPON** program is used to turn motor power on for all axes. First it issues a Galil motor off command for all axes. This is done so that the actuators will not jump when motor power is applied. Next, the enable motor power is turned off and then on. If there are no faults, this action will turn on the motor power relay, providing power to the motor drivers. The user must then issue the Galil servo here (SH) command to activate the amplifier enable signal and close the servo loop at the current position for all axes to be powered up.

Note: The API programs TA, TD, ELA, ELB & DIM1 are not used with the MDC2100

7.3.3) Brakes

Table 7-5) Brake Programs

Program	Description
DBR1	Disable brake release, drive 1
EBR1	Enable brake release, drive 1
TBR1	Tell brake release status, drive 1

Each axis has a failsafe brake circuit. The brake release signal for an axis is activated if motor power is on, the amplifier is enabled and not faulted, **and** the brake release is enabled. The **DBR1** program turns off the enable brake release output for the MDC2100, disabling the brake release for axes A and B. The **EBR1**program turns on the brake release output. The **TBR1** program is used to obtain the state of the brake release output. It sets the variable **TBR1VA**L to 1 if the enable brake release output is on and 0 otherwise.

7.4) Software Installation

This section discusses the steps required to configure motion cards for the Primatics motor drive chassis and stages. The MDCOptima API is provided on the disk labeled Primatics MDCOptima API (Part Number 0-6950-0001). One file on the disc contains motion control parameters, another file contains controller API and utility programs and another file is called README.TXT and has instructions on how to use the other two files, configure the motion control card, turn on power, close the servo loop, home the axes, set the cycle speeds, and start and stop the program. The motion control parameters used at the factory are supplied with each stage. Some parameters will need to be modified depending on the particular application (e.g. tuning parameters).

7.4.1) Set the Controller Parameters

Set the BA command to specify which axes require sinusoidal commutation. Use the CN command to specify the limit switch polarity.

7.4.2) Setting Motion Control Parameters for each axis

Appendix A contains a sample motion control parameters sheet provided with PLG and PLR series stages. Using the Galil DMC Terminal Program or the Set-up and Configure Form of the Servo Design Kit enter the motion control parameters. Don't forget to save the setting in nonvolatile memory.

7.4.3) Loading the API

To use the API, it must be included with the application code and downloaded to the motion card. The examples below are in the form of a DMC Terminal program session. In these terminal sessions, the characters typed by the user are in regular type and the controller response is in bold italics.

7.4.4) Example 1 – Brushless Servo - Trapezoidal Drive

It is an example of a controller with one brushless servo – trapezoidal drive. The drive is connected to the A (X) axis. The stage has an encoder ratio of 800 counts/mm and equipped with a failsafe brake. The following instructions are issued via the DMC Terminal program:

7.4.4.1) Controller configuration

Instruction	Interpretation
BA	All axes are cleared for sinusoidal commutation (The servo driver is of Trapezoidal type).
CN 1	Limit switches active high

7.4.4.2) Axis A configuration

Instruction	Interpretation
MTA=1	Motor type is servo
CEA=0	Main encoder and auxiliary encoder are normal quadrature.
DVA=0	Dual loop filter mode is disabled
KDA=20	Derivative constant
KPA=4	Proportional constant
KIA=1	Integrator
ILA=2	Integrator limit
TLA=9.998	Torque limit
OFA=0	Offset
ERA=800	Error limit
OEA=1	Off on error enabled
FAA=0	Acceleration feedforward
FVA=0	Velocity feedforward
ACA=2400000	Set acceleration (3000mm/sec)
DCA=2400000	Set deceleration (3000mm/sec)
MO;BN	Save parameters

7.4.4.3) Preparing the axis to move

Instruction	Interpretation
XQ#CF	Clear latched faults
XQ#TD	Obtain MDC0200 status
TDVAL= ***17.000***	Bit 0 is 1 indicating motor power is off. Bits 1, 2, and 3 are 0 indicating that there is no hardware, system power or ESTOP faults.
XQ#MPON	Enable MDC0200 power.
XQ#TD	Obtain MDC0200 status
TDVAL= ***16***	Bit 0 is 0 indicating motor power is on.
SHA	Close servo loop
XQ#TA	Obtain amplifier status
TAVAL= ***30***	Bit 0 is 0 indicating the A axis amplifier is OK.
XQ#EBR1	Activate the MDC1 failsafe brake release enable signal. Now, the axis A failsafe brake will release since motor power is on, the SH command has been issued, and the amplifier is OK.

7.4.4.4) Home using encoder latching

Instruction	Interpretation
CN,-1	Home switch active low
SPA=40000	Set speed to 50mm/sec
FEA;BGA	Move to the home sensor transition neighborhood
AMA;TPA ***-39921***	When the motion is complete, report the current position
XQ#ELA	Route encoder index signal to input 1 and arm latch
SPA=20000	Set the move speed (do not exceed 20000 counts/sec)
PRA=-8000	Setup a relative move of –10mm
BGA	Initiate move
AMA;TPA ***-47921***	When the motion is complete, report the current position
MG _ALA ***0.0***	The latch is not armed indicating the encoder index transition was detected.
RLA ***-41239***	Report the latched position.
PAA=_RLA	Setup a move to the latched position
BGA;AMA	Start move and wait for move completion
DPA=0	Define the latched position to be the home position

7.5) Appendices

7.5.1) Appendix A – MDCOptima API

```
NO ==========================
NO    Primatics, Inc.
NO    MDCOptima API
NO    Version 1.0
NO ==========================
NO -- Terminology
NO MDC0200 Motor Drive Chassis
NO x   Axis A,B,C,D,E,F,G,H
NO d   MDC0200 1,2
NO -- Programs
NO #CF Clear faults, both MDCs
NO #DBRd Turn off brake release enable, MDC0200 d
NO #DIMd Disable input multiplexer MDC0200 d
NO #EBRd Enable brake release MDC0200 d
NO #ELx Enable latching of index pulse x axis
NO #MPOFF Turn motor power off, both MDCs
NO #MPON Turn motor power on, both MDCs
NO #TA Axes amplifier status
NO  TAVAL - Bitwise amp status
NO    Bits 0 - 7 = Axes A - H, 1=Faulted
NO #TBRd Tell if brake release enable is on, MDC0200 d
NO  TBRdVAL - 1=Enable brake release output is on
NO #TD MDC0200 1 & 2 status
NO  TDVAL - Bitwise MDC0200 status
NO    Bits 0-3=MDC1, 4-7=MDC2
NO    Bit   Description       1=
NO    0,4   Motor Power On?   Off
NO    1,5   Hardware Ok?      Faulted
NO    2,6   Logic Power Ok?   Faulted
NO    3,7   ESTOP Ok?         Faulted
NO -- Labels
NO #TBR1A,#TBR2A
NO -- Variables used
NO Completion codes
NO    CF,DBR1,DBR2,DIM1,DIM2,EBR1,EBR2
NO    ELA,ELB,ELC,ELD,ELE,ELF,ELG,ELH
NO    MPOFF,MPON,TA,TBR1,TBR2,TD
NO Status variables
NO    TAVAL, TBR1VAL, TBR2VAL, TDVAL
#CF
CB6;WT100;SB6;WT100;CB14;WT100;SB14;WT100;
CB6;WT100;SB6;WT100;CB14;WT100;SB14;WT100;CF=1;EN
#DBR1
CB8;DBR1=1;EN
#DBR2
CB16;DBR2=1;EN
#DIM1
CB4;DIM1=1;EN
```

```
#DIM2
CB12;DIM2=1;EN
#EBR1
SB8;EBR1=1;EN
#EBR2
SB16;EBR2=1;EN
#ELA
SB4;CN,,-1;ALA;ELA=1;EN
#ELB
SB4;CN,,-1;ALB;ELB=1;EN
#ELC
SB4;CN,,-1;ALC;ELC=1;EN
#ELD
SB4;CN,,-1;ALD;ELD=1;EN
#ELE
SB12;CN,,-1;ALE;ELE=1;EN
#ELF
SB12;CN,,-1;ALF;ELF=1;EN
#ELG
SB12;CN,,-1;ALG;ELG=1;EN
#ELH
SB12;CN,,-1;ALH;ELH=1;EN
#MPOFF
MO;CB5;CB13;MPOFF=1;EN
#MPON
MO;CB5;CB13;WT 50;SB5;SB13;MPON=1;EN
#TA
SB7;SB15;TAVAL=@INT[_TI0/16]+(_TI1&$F0);TA=1;EN
#TBR1
TBR1VAL=1;JP #TBR1A, _OP0&128;TBR1VAL=0
#TBR1A;TBR1=1;EN
#TBR2
TBR2VAL=1;JP #TBR2A, _OP0&32768;TBR2VAL=0
#TBR2A;TBR2=1;EN
#TD
CB7;CB15;TDVAL=@INT[_TI0/16]+(_TI1&$F0);TD=1;EN
```

8) Troubleshooting & Service

8.1) Troubleshooting Help

For further assistance contact the factory:
M-F 8AM to 5PM Pacific Time

Phone:	[541] 791-9678
Fax:	[541] 791-9410
Toll Free:	[888] 754-3111
Web:	www.primatics.com
E-mail:	service@primatics.com

8.2) Service

Should your device require factory service, contact the factory for a Return Materials Authorization (RMA). When inquiring about an RMA please have the following information available:

- Your contact information (name, phone, email, address)
- Unit Serial Number (located on label near the power switch)
- Symptom of problem
- History of troubleshooting steps already taken