ZMI 2000
Chassis and Control Board
P/N's 8010-0100-04/05 and 8030-0220-03
Operating Manual
OMP-0420D

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ZYGO CUSTOMER SUPPORT

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MANUAL REVISION INFORMATION

The document (OMP) number and the applicable revision letter for this manual appear on the title page. The publication date appears below.

Revision	*Publication Date*	*Revision*	*Publication Date*
original	November 1997		
B	January 1999		
C	December 2001		
D	July 2002		

MANUAL NOTATIONS

Warning! Denotes a hazard that could cause injury to personnel, and can also cause damage to the equipment.

Note: Provides helpful information.

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ZYGO STATEMENT OF WARRANTY AND PRODUCT SUPPORT

Zygo Corporation provides this warranty to protect its customers from defects in product workmanship or product materials. This warranty covers all products manufactured by Zygo Corporation. Zygo warrants that the equipment purchased will be free from any defects in material and/or workmanship under normal operating conditions for a period of one year from the date of shipment.

In addition, being committed to providing our customers with superior service, Zygo will support all standard products for a period of five years after the sale of the last newly-manufactured unit. Beyond this five-year period, we will continue to support these products on a "best-effort" basis.

WARRANTY SERVICE

Zygo's responsibility under this warranty shall be limited to the repair or replacement (at Zygo's option) of defective equipment at no cost to the buyer, except for transportation, cleaning, and recalibration charges.

Zygo will perform warranty service by: (1) sending replacement parts with appropriate installation instructions to the buyer, the buyer returning his defective part to Zygo or; (2) repairing the product at a Zygo repair facility after it has been returned freight prepaid, or; (3) at the buyer's request, dispatching a service representative to the buyer's facility. The buyer shall pay Zygo's travel and living expenses as well as travel time.

Defective products or parts will be repaired or replaced with new or like-new parts. These replacement parts will be warranted for a period of 90 days after they are shipped, or for the remainder of the original warranty period, whichever is longer. Warranty service will be performed only if the buyer notifies Zygo within 14 days of discovering any defects. Equipment or parts that are to be returned to Zygo must be issued a Return Authorization number. This number can be obtained by contacting the Zygo Service Department. Should Zygo's subsequent inspection reveal that the parts were not defective, all expenses incurred by Zygo shall be charged back to the buyer. Defective equipment that is replaced shall become the property of Zygo.

Warranty period begins when the product is shipped from Zygo. Replacement parts, service workmanship, used equipment, and refurbished equipment are warranted for a period of 90 days.

RETURNS

Unused and undamaged products, in their original shipping containers, may be returned for credit within 30 days of receipt. All such products will be subject to a restocking fee equal to 20 percent of the purchase price. Custom products are not returnable.

EXCLUSIONS

The above warranty and product support statement applies only to equipment that is an integral part of a Zygo manufactured product. It does not apply to peripheral equipment manufactured by others, such as: computers, printers, vibration isolation tables, etc. In such cases, the warranty and the support that the original manufacturer supplies will apply.

In addition, warranty service does not include or apply to any product or part which, in Zygo's judgment:

a. Has been repaired by others, improperly installed, altered, modified, or damaged in any way.
b. Malfunctions because the customer has failed to perform maintenance, calibration checks or good operating procedures.
c. Is expendable or consumable (such as panel lights, fuses, batteries, windows, and filters) if such items were operable at the time of initial use.
d. Requires replacement because of decomposition due to chemical action.
e. Fails because of poor facility, operating conditions, or utilities.

Other than expressly described above, Zygo makes no express or implied warranties, including any regarding merchantability or fitness for a particular purpose relating to the use or performance of the equipment. Zygo will not be liable for personal injury or property damage (unless caused solely by its own negligence), loss of profit or other incidental or consequential damages arising out of the use or inability to use the equipment. Nor does this warranty apply to any equipment which has been subject to misuse, neglect or accident; or repaired or altered by other than service representatives qualified by Zygo.

01/96

CE NOTICE

Marking by the CE symbol indicates compliance of this Zygo Corp. instrument to EMC (electromagnetic compatibility) Directive and the Low Voltage Directive of the European Union. Such marking indicates that this system meets the following technical standards:

- EN 55011 – “Limits and methods of measurements of radio disturbance characteristics of ISM (Industrial Scientific & Medical) radio frequency equipment.” Class A, for use in typical commercial environments.
- EN 55022 – “Limits and methods of measurements of radio disturbance characteristics of ITE (Information Technology Equipment).” Class A, for use in typical commercial environments.
- EN 50082-1 1992 – “Electromagnetic compatibility generic immunity standard for the residential, commercial and light industrial environments.”
- EN 61010-1 1993 + A2: 1995 – “Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements.”

A Declaration of Conformity in accordance with the preceding directives and standards has been made and is on file at Zygo Corporation, Middlefield, Connecticut, USA.

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Chapter 1
INTRODUCTION

In This Chapter

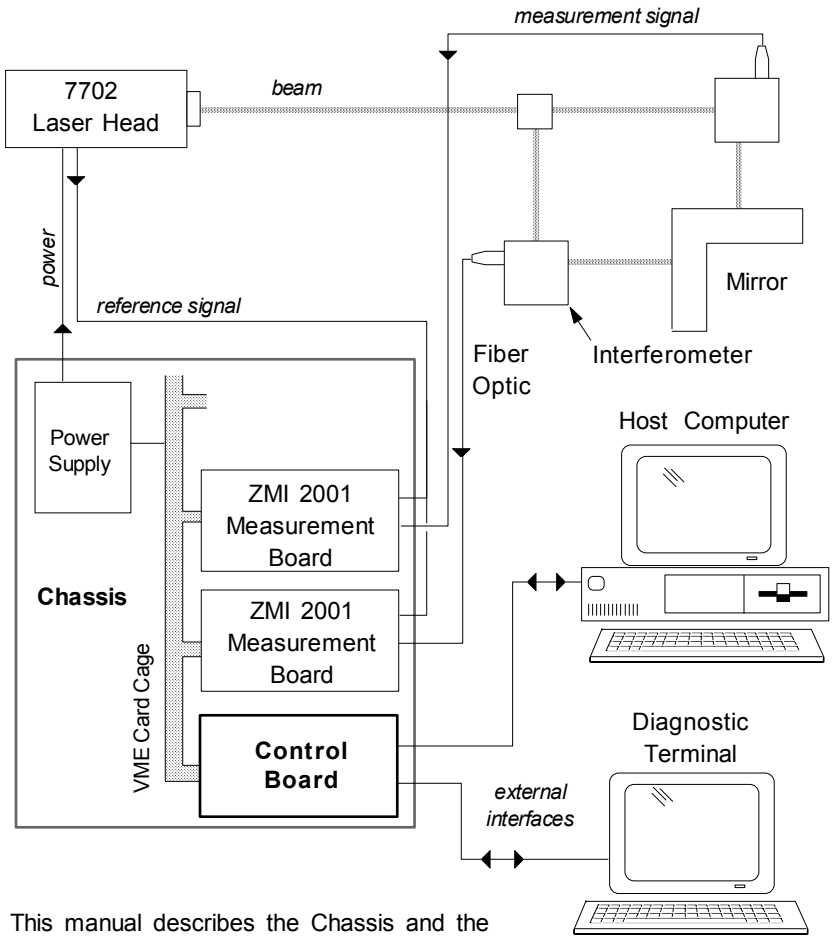
- What This Manual Covers
- Overview
- ZMI System Chassis
- ZMI System Control Board
- Electrical Safety
- Specifications
- Safety Labels

What This Manual Covers

This manual describes the installation and use of two of the components that make up a Zygo ZMI 2000 System: the Chassis and the Control Board. Both components are part of a complete Displacement Measuring Interferometer system. Refer to Figure 1-1.

The information presented in this manual assumes that you are familiar with the VMEbus specification and interferometry principles. The manual is arranged as follows:

Chapter 1	Describes the features and specifications of the Chassis and the Control Board.
Chapter 2	Describes installation of the Chassis and the Control Board.
Chapter 3	Provides information to create your own program for measurement system control.
Chapter 4	Provides a dictionary of commands.
Chapter 5	Provides maintenance information.
Appendix A	Provides syntax drawings of commands



This manual describes the Chassis and the Control Board. Also covered are the software commands used with the computer and terminal. The ZMI 2001 Measurement Board is described in Zygo manual OMP-0403.

Typical ZMI 2000 System Diagram

Figure 1-1

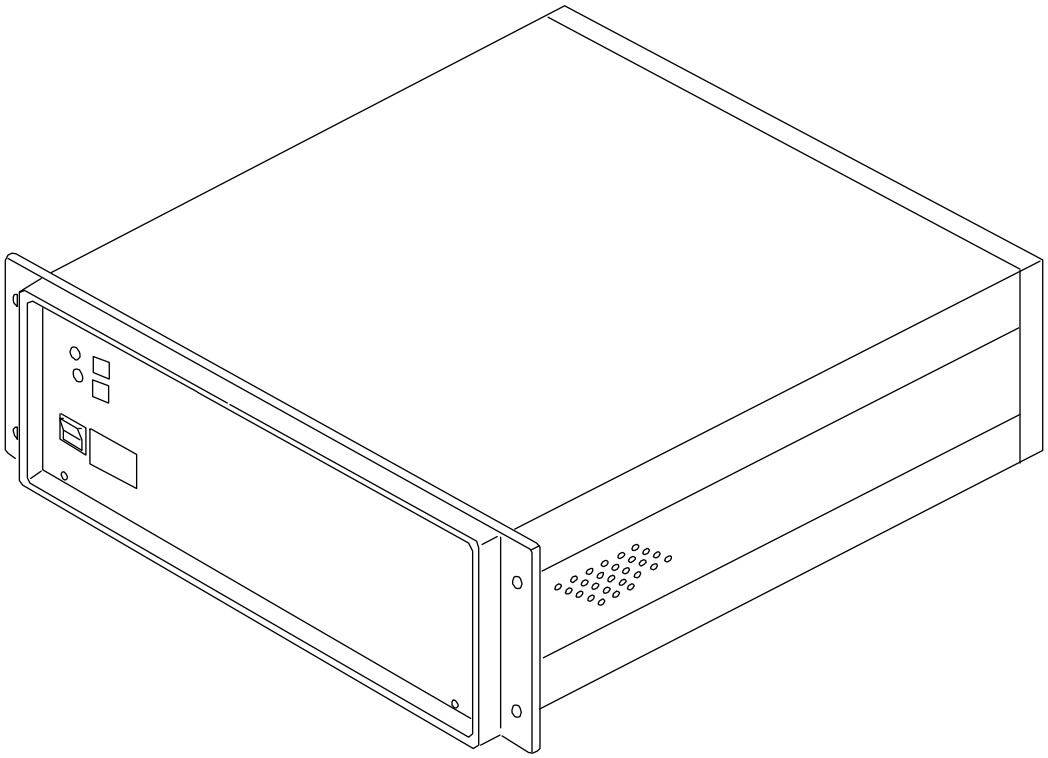
OVERVIEW

The Chassis and the Control Board are parts of a VME-based displacement measurement system. The Chassis serves as an enclosure for one Control Board and up to six other VME boards, such as the Zygo ZMI 2001 Measurement Board. The Chassis provides power to its VME card cage and the Zygo Laser Head. The back panel of the Chassis permits easy interconnection of external devices.

The Control Board serves as a VME master board that controls the actions of other VME slave cards, and provides multiple interfaces to the host computer and other equipment. Actual position information is output by the Zygo ZMI 2001 Measurement Board, which is described in Zygo manual OMP-0403.

ZMI 2000 CHASSIS

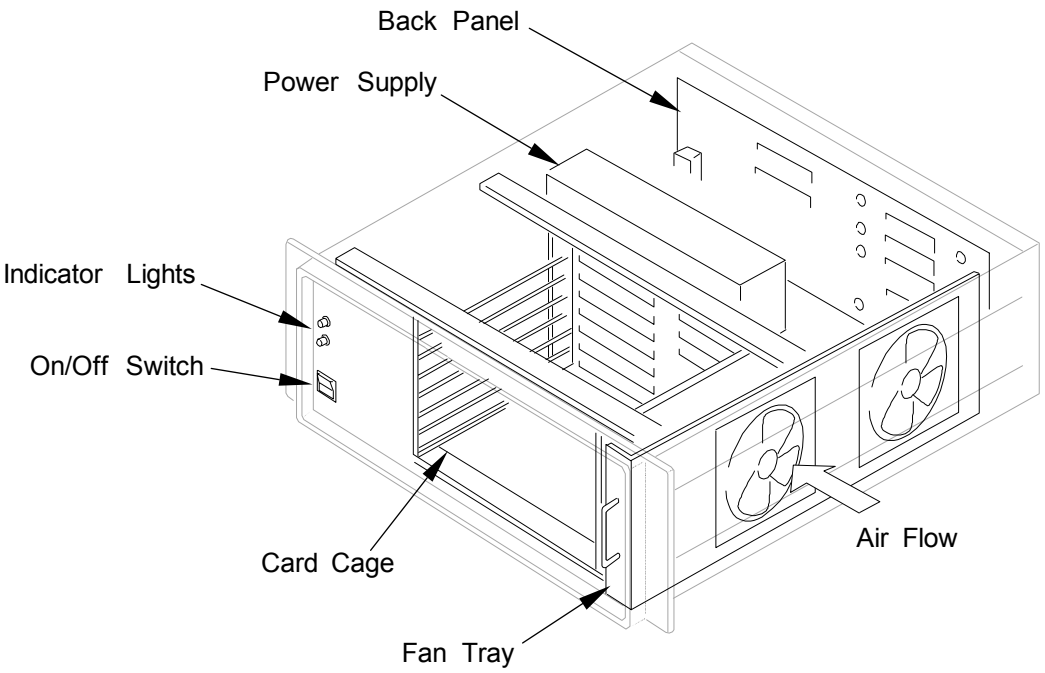
The ZMI 2000 Chassis, part number 8010-0100-04, -05, shown in Figure 1-2, serves as an enclosure for the power supply and circuit boards for the ZMI measurement system. The Chassis has an all-metal case for RFI shielding and heat dissipation. The Chassis has integral 19-inch flanges for direct mounting into racks or cabinets; optional handles are available. Removable front and top covers provide accessibility to interior electronics. Rubber feet included with the Chassis may be installed for bench-top usage. Cooling is provided by two internal, filtered fans, mounted on a fan tray.



ZMI 2000 Chassis

Figure 1-2

The Chassis can be configured for either 100/120 or 220/240 volt operation; see Chapter 2 for more information. The power supply provides +5 volts to the VME backplane and ±15 volts to the laser head. It does not supply ±12 volts to the backplane as specified by the VME specification. The seven-slot VME card cage can support a measurement system with one ZMI System Control Board and up to six ZMI 2001 Measurement Boards. See Figure 1-3 for an internal look at the Chassis.



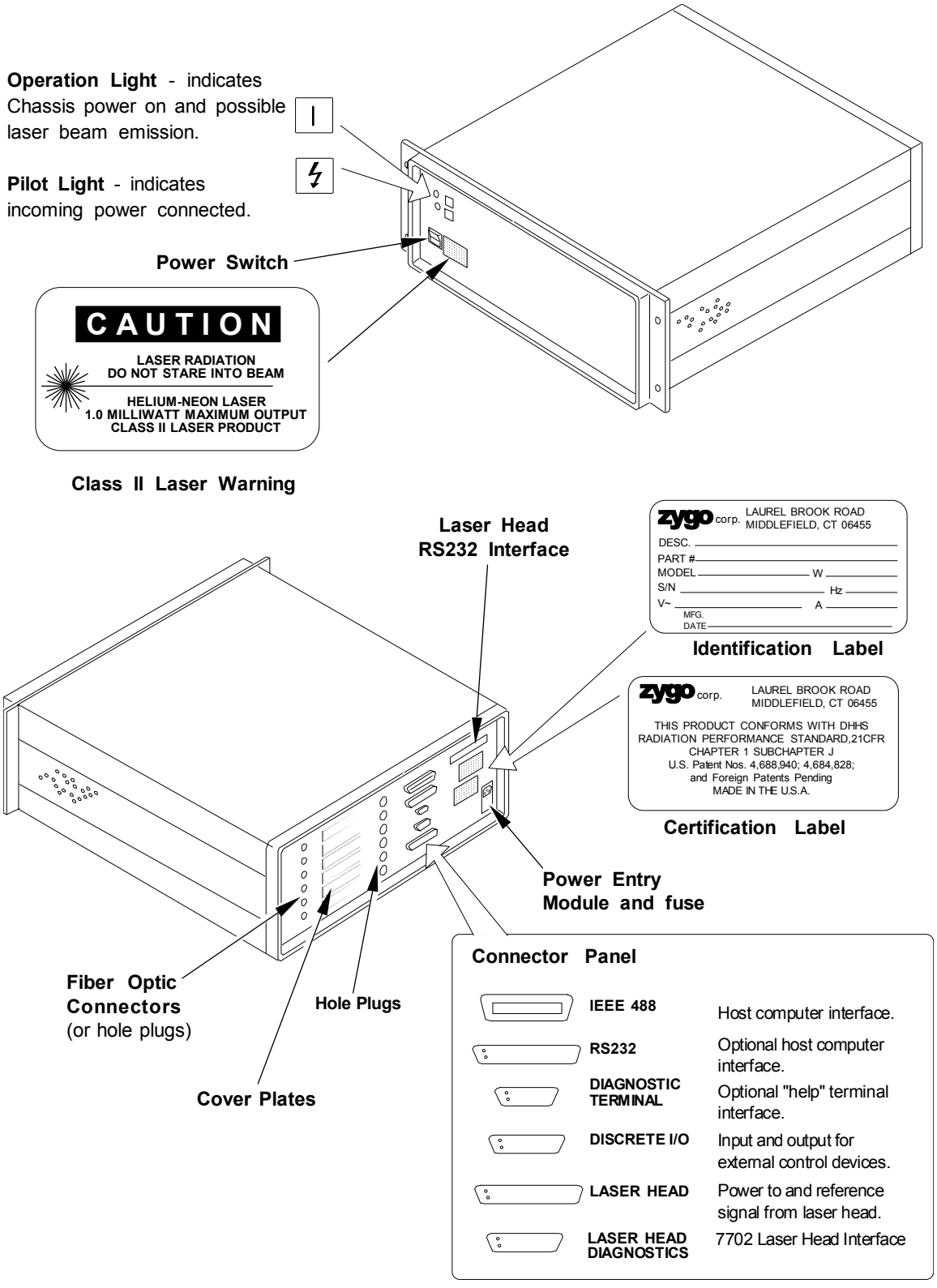
Chassis Internal View

Figure 1-3

The Chassis based measuring system is turned on and off with the power switch on the front of the Chassis. The neon pilot light ⚡ indicates that power is connected to the Chassis. The green operation light I indicates that the power switch is on, the laser head and boards are receiving power, and that the laser head may be emitting a beam.

The Chassis back panel serves as an interconnection hub. It provides for the input from six fiber optic measurement cables; one fiber optic reference cable; and the interface ports for the Control Board.

Figure 1-4 illustrates the Chassis controls, connectors, and labels. Additional specifications on the Chassis are located at the end of this chapter.

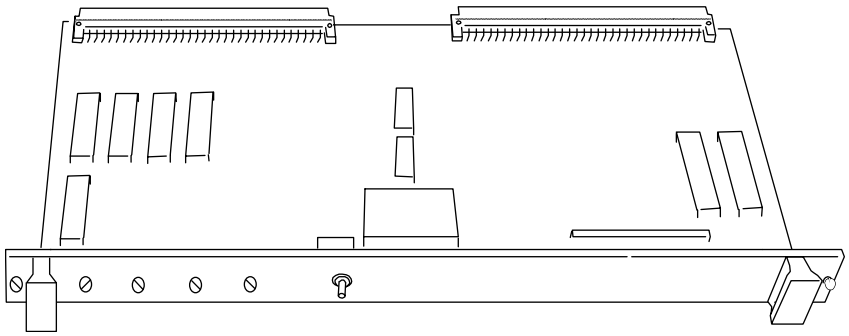


Chassis Controls, Connectors, and Labels

Figure 1-4

ZMI 2000 CONTROL BOARD

The ZMI 2000 Control Board, part number 8030-0200-03, shown in Figure 1-5, oversees the input and output of data and commands. The Control Board complies electrically and mechanically with Revision C.1 of the VMEbus specification. The Control Board should occupy the bottom slot of the Chassis card cage.



ZMI Control Board

Figure 1-5

The Control Board can serve as a VME master and system controller or just a master. It outputs VME SYSRESET* and SYSCLK signals. In addition, the Control Board performs bus arbitration and bus error detection. It supports A16 and A24 addressing capabilities with D8(E0) and D16 data transfer capabilities. It does not support the SYSFAIL*, ABORT*, ACFAIL*, HALT*, or BCLR* functions. It has limited VME interrupt support for Zygo Measurement Boards only.

The board contains a Motorola 68HC000 microprocessor, which is controlled by resident software stored in EPROM (Erasable Programmable Read Only Memory). This software directs operation, communication, and diagnostic routines.

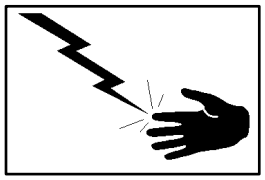
The Control Board provides the interface link between ZMI 2001 Measurement Boards and external host computers and other devices. The hardware interfaces provided by the Control Board are described in Table 1-1. Additional specifications on the Control Board are located at the end of this chapter.

Interface	*Description*
VMEbus	The card cage interface to other VME boards in the system. It supports A16 and A24 addressing.
IEEE 488	GPIB (General Purpose Interface Bus) port for an external host computer. It conforms to the IEEE 488.1-1987 specifications. 24-pin GPIB connector.
RS232	RS232 serial port for an external host computer in lieu of the IEEE 488 port. DB-25 receptacle connector; use shielded cable only.
Diagnostic Terminal	RS232 serial port for connection to a VT100 compatible video display terminal for initial system setup and host software development. DB-9 receptacle connector; use shielded cable only.
Laser Head	Provides power to and returns the electrical reference signal from the Zygo Laser Head. DB-25 receptacle connector.
Discrete I/O	Port for discrete inputs and outputs from external control devices. DB-15 receptacle connector.
Laser Head Diagnostics	RS232 serial port for interfacing a Model 7702 Laser Head. DB-9 receptacle connector.

Note: The P2 connector on the ZMI 2001 Measurement Board provides a user-configurable interface for applications that do not use a host computer. For more information, see the Zygo *ZMI 2001 Measurement Board Manual*, OMP-0403.

Table 1-1 Chassis Interfaces

ELECTRICAL SAFETY



Failure to follow the recommendations in this manual regarding electrical safety can result in damage to the Chassis and Control Board and may void the warranty. Please be sure to observe all precautions as indicated.

⚠ **Warning!** Remove power from the Chassis before installing the board or when connecting and disconnecting cables.

Use proper handling techniques when touching the ZMI 2000 Control Board to prevent the board from being damaged by electrostatic discharge (ESD). The board should be stored in a static shield bag and handled only by individuals using a static control wrist grounding strap.

Where to go from here…

To install the Chassis or Control Board, see instructions in Chapter 2.

Chapter 3 provides operating information.

Chapter 4 is a dictionary of commands.

Chapter 5 describes how to contact Zygo for technical assistance.

To review sample programs that show how to use the ZMI 2000 for data acquisition, refer to Appendix A.

SPECIFICATIONS

The general specifications for the ZMI 2000 Chassis and the Control Board are shown over the following pages. For specifications on cables refer to the *ZMI Cable Guide*, OMP-0333.

Zygo ZMI 2000 Chassis
P/N 8010-0100-04/-05

Physical Characteristics:
Dimensions: See Figure
Clearance required for cables: 135 mm (5.3 in.)
Weight (with Control Board) : 12.7 kg (28 lb)

Electrical:
Incoming Power: 100/120/220/240 VAC ±10%, 50/60 Hz
Fuse Rating: 250V 5A for 100/120 VAC operation
250V 2-1/2A for 220/240 VAC operation
Heat Dissipation: 300 watts maximum
Power Supply Output Voltages: +15 VDC @ 3A,
-15 VDC @ 3A, + 5 VDC @ 25A

AC Line Transient Tolerance:
2000 V @ 1 nanosecond rise/fall times

AC Line Voltage: 100 - 120 VAC,
220 - 240 VAC

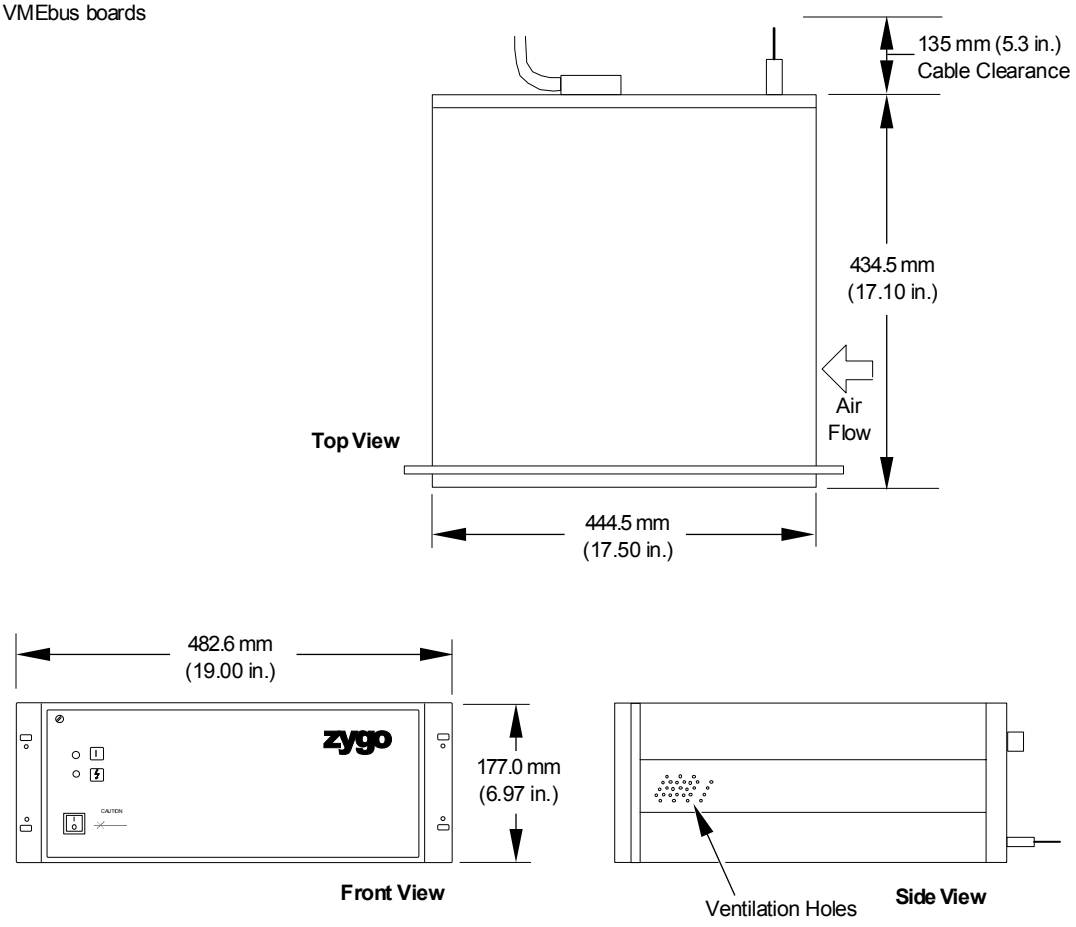
Circuit Boards:
1 VMEbus Control Board and up to
6 VMEbus boards

Backplane: VME
(conforms to VMEbus Rev C.1 standard)

Interface Connectors:
IEEE-488: GPIB external (host) computer
RS-232: external (host) computer(1)
RS-232: diagnostic display terminal and laser head(1)
RS-232 laser head (1)
DB15: discrete I/O

Ventilation:
60 linear fpm by 2 fans, right to left (front view)

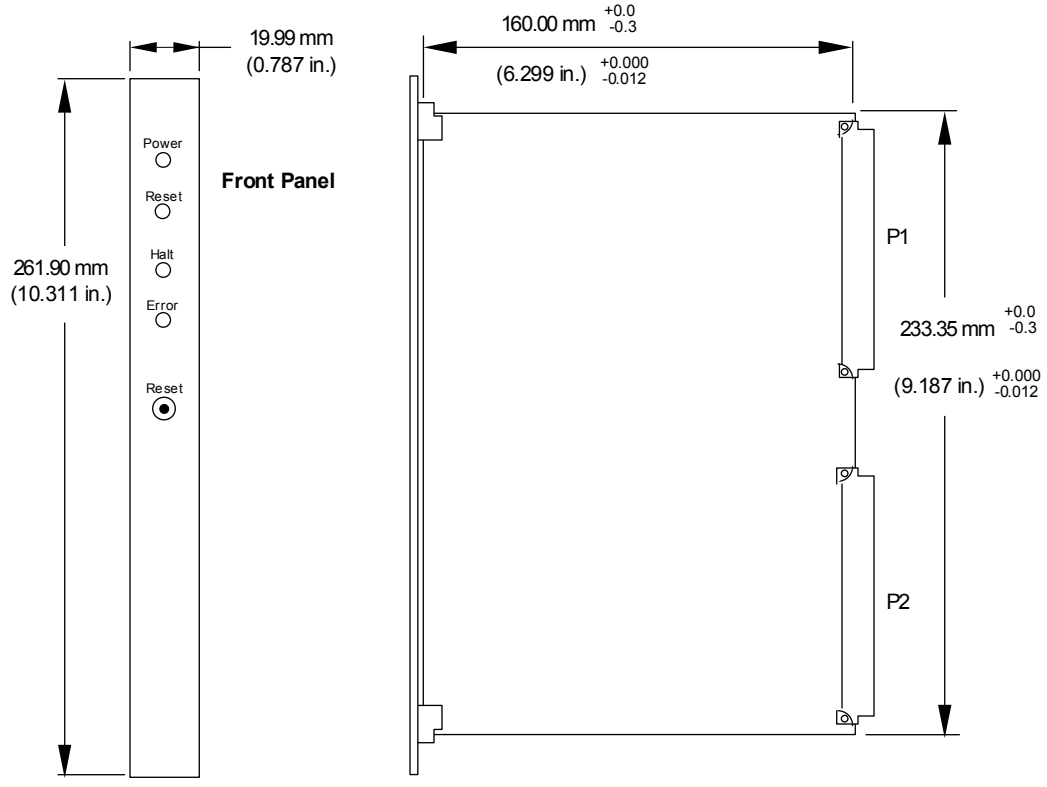
Environmental:
Operating Temperature:
0° to 40° C (32° to 104° F)
Non-operating Temperature:
-40° to 75° C (-104° to 167° F)
Operating Humidity: 0 to 90% (noncondensing)
Non-operating Humidity: 0 to 90% (non-condensing)
(1) Use shielded RS232 Cable Only.



Control Board
P/N 8030-0200-03

Microprocessor: Motorola 68HC000
Power Requirement: + 5 VDC @ 1A
Interfaces:
VME bus
IEEE-488
RS232
Inputs/Outputs:
3 discrete differential inputs
5 discrete open collector outputs
1 discrete open collector error output
Compliance: UL94VO, UL796
VME Compliance:
VMEbus Specification Rev. C.1
6U Size
A16, A24 - short or standard address range
D08(EO), D16 - 8-bit (even or odd) or 16-bit data transfer
SGL(3) - single level bus request on level 3
BTO(64) - bus data transfer watchdog timer, 64 µs timeout

Environmental:
Operating Temperature:
0° to 55° C (32° to 151° F)
Non-operating Temperature:
-40° to 75° C (-40° to 167° F)
Operating Humidity: 0 to 90% (non-condensing)
Non-operating Humidity: 0 to 90% (non-condensing)
Cooling Requirements:
60 linear fpm minimum for 0° to 40° C (32° to 104° F)
250 linear fpm minimum for 0° to 55° C (32° to 151° F)
Maximum Transfer Rates:
RS232 Control Port: 19.2 k baud
Diagnostic port: 19.2 k baud
IEEE-488: 23 k bytes/sec (2.9 k time/position samples per second)



SAFETY LABELS

The following table describes the general meaning of safety labels found on the instrument. Specific warnings are covered in the applicable section within this manual. Failure to follow the safety labels and the recommendations in this manual could result in damage to personnel and the instrument, and may void the warranty.

Label	*Meaning*
	General hazard. Proceed with caution. Refer to the manual for instructions.
	Electrical shock hazard. Proceed with caution, there is a risk of electrical shock.
	Disconnect power.
	Refer to the manual for instructions.
	Earth ground.
	Protective conductor terminal.

Chapter 2

INSTALLATION

In This Chapter

CE NOTE REGARDING INSTALLATION

The Chassis is intended for Category 2 Installation per EN 61010-1, Clause 5.4.1, of the Low Voltage Directive of the European Union.

CHECKLIST

The following list is provided as a summary of the installation procedures.

☐ Inspect all packages for signs of shipping damage. Report any damage to the carrier and to the Zygo Customer Support.

☐ Check that the shipment is complete.

☐ If you have purchased all the components at the time of the original order, then the Chassis and boards are factory configured per your order. Just plug in the line cord.

- ☐ If you are adding Measurement Board Kits, configure the boards and install the internal cables.
- ☐ If necessary, configure the DIP switches on the Control Board for your selected interface. You may also want to review the connector pin assignments.
- ☐ Check and, if necessary, configure the Chassis power connector module for the incoming voltage.
- ☐ Connect the output from the Chassis to your host computer using either the IEEE-488 port, the RS-232 port, or the Measurement Board P2 output.
- ☐ If you are using a host computer you must write an application program to control your VME measurement system. See Chapter 3, Chapter 4, and Appendix A.

UNPACKING

Inspect all packages for signs of shipping damage. Report any damage to the carrier and notify your Zygo representative, as described in Chapter 5. If necessary, retain the shipping material for the carrier's inspection.

Ensure that your order is complete. If purchased as a unit, the ZMI 2000 System Chassis *may* include:

- Control Board (pre-installed)
- ZMI 2001 Measurement Boards (pre-installed)
- Line Cord
- Chassis Feet

ZMI 2001 Measurement Board kits may be purchased separately and added later. These kits include:

- ZMI 2001 Measurement Board
- Internal Chassis cabling for on-board fiber optic detector
- Static Wrist Strap

Cabling

External Cabling is available separately. Refer to the *Zygo Cable Guide*, OMP-0333, for more information.

INSTALLING THE CHASSIS

All Zygo ZMI 2000 System Chassis components purchased at the same time as the Chassis are factory installed and tested. In this case, installation is simply connecting the Chassis to incoming line power and other external devices.

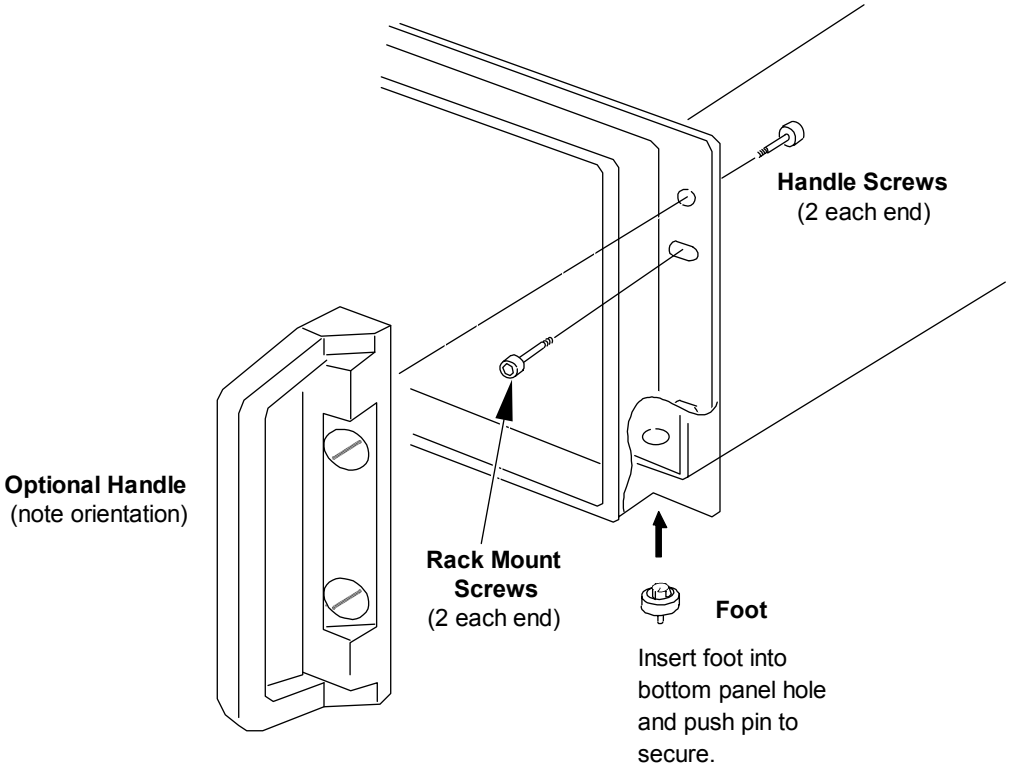
The Chassis can mount directly in a 19-inch rack or cabinet. To install the feet included with the Chassis or the optional handles refer to the subsection titled "Installing Chassis Feet and the Optional Handles". (Installation of the feet and handles is optional.)

To add ZMI 2001 Measurement Board kits, refer to the procedure in the subsection titled "Installing ZMI 2001 Measurement Board Kits".

If you want to change the Chassis interface port settings, refer to the section titled "Installing the Control Board".

Installing Chassis Feet and the Optional Handles

To install the feet or handles, refer to Figure 2-1.



Installing Chassis Feet and Handles

Figure 2-1

Installing ZMI 2001 Measurement Board Kits

This section describes how to add ZMI 2001 Measurement Board Kits to the Chassis. Refer to Figure 2-2.

> **Note:** All Measurement Boards purchased at the time of the original order are factory installed; if this is the case, this section is not applicable to you.

To install the ZMI 2001 Measurement Board Kit, perform the following procedures. Instructions are provided for installing the fiber optic detector cables.

Boards must be positioned in specific slots in the chassis; start with the slot above the Control Board. The cables should be routed through the recommended cable clamps on the card cage.

Output from the Measurement Boards can be directed through the backplane or through the Control Board. See "Installing Output Cable Assemblies" for more information on output options.

Preparation

1. Loosen four captive screws on the Chassis front panel and remove the panel.
2. Remove four screws on the Chassis top cover and remove the cover.

Installing an Internal Fiber Optic Cable

1. Remove the hole plug, that corresponds to the axis number, from the hole in the Chassis back panel. Holes for fiber optic cables are labeled *Fiber Optic 1…6*.
2. Insert the Fiber Optic Feed-Thru into the hole from the outside of the Chassis so the threaded portion is on the inside. Secure the Feed-Thru in place with the nut.
3. Connect the internal Fiber Optic Cable to the Feed-Thru and route the cable through the appropriate pair of cable clamps to the front of the card cage. The cable connects to the Measurement Board Measurement Signal port.

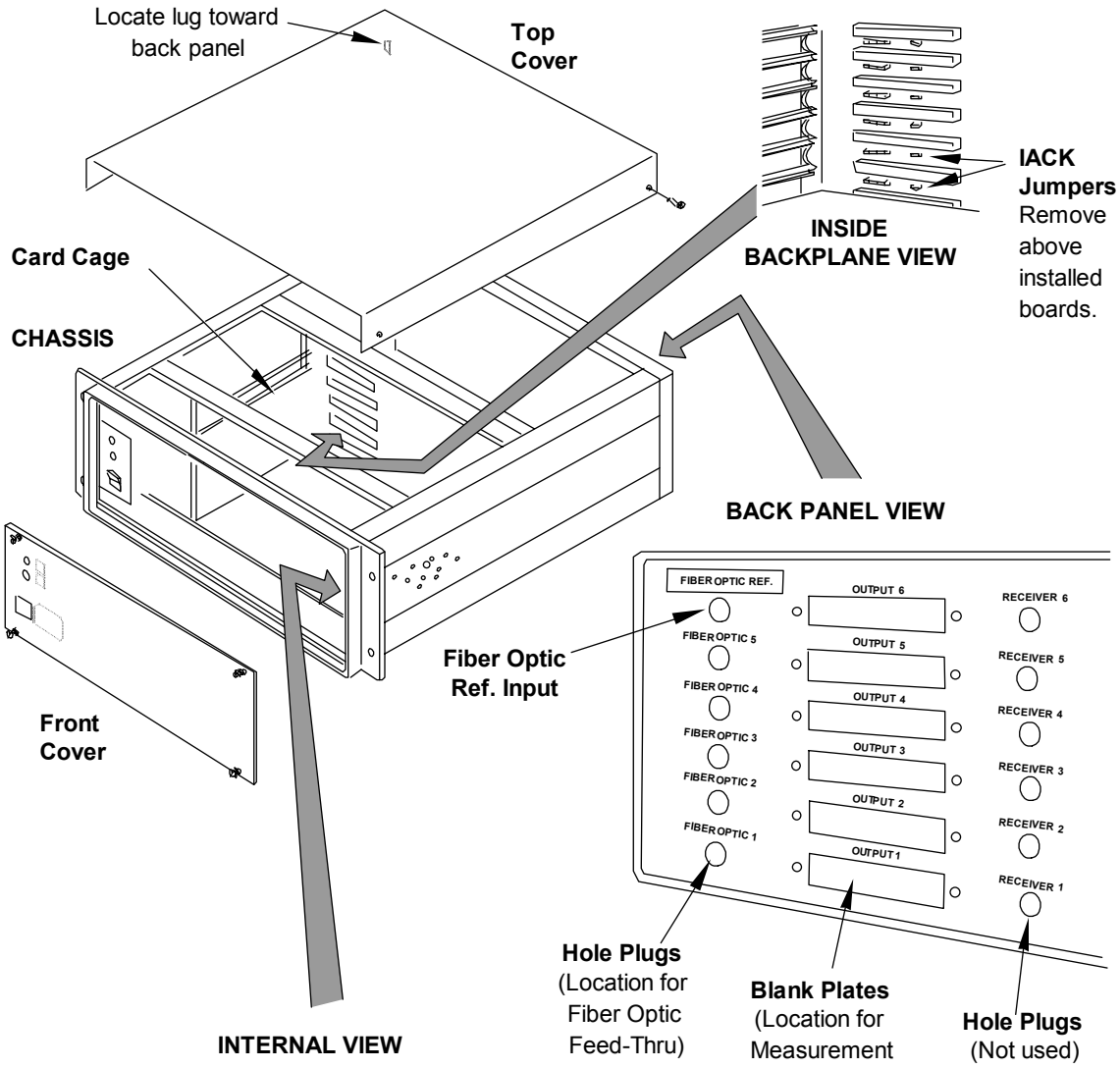
Installing the ZMI 2001 Measurement Board

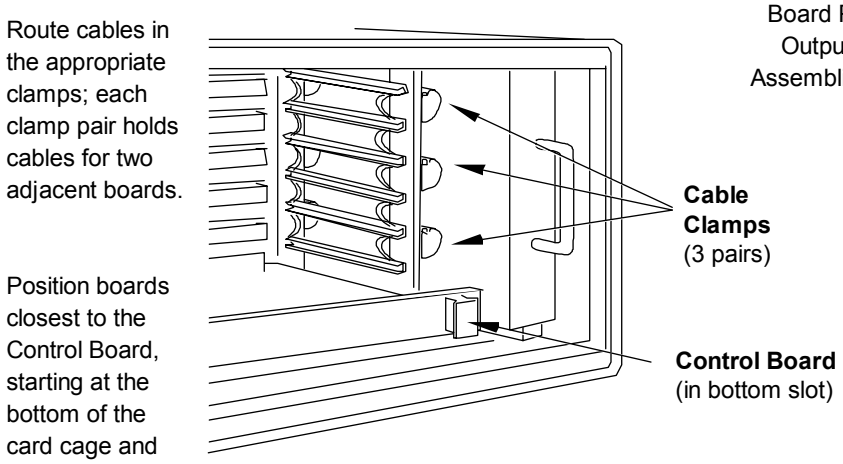
WARNING!
Use proper handling techniques when touching the board to prevent it from being damaged by electrostatic discharge (ESD). The board should be stored in a static shield bag and handled only by individuals using a static control wrist grounding strap.

1. Remove the IACK P1 backplane jumpers above each slot where boards will be installed. It is not necessary to remove jumpers above unused slots.
2. Set interrupt level select jumper, JN6, on all Measurement Boards to IRQ3*, pins 5-6. Configure the rest of the switches and jumpers on the Measurement Board as described in OMP-0403, Chapter 2.
3. Insert the board into the VME backplane component side up; ensure that it is seated firmly. Thread the board front panel screws into the card cage frame.
4. Connect the laser head fiber optic reference cable, identified by the "R" cable marker, to the Ref connector on axis 1 Measurement Board. Connect the reference jumper cable, 1115-801-115, from the Ref Out connector to the next Measurement Board Ref In connector. Ensure that each Measurement Board has an incoming reference signal.
5. To install a Measurement Board output cable assembly, see the next section.

Reinstalling Chassis Covers

1. Replace the Chassis top cover and install the four screws. Ensure that the ground lug on the cover is positioned toward the back panel.
2. Replace the Chassis front panel and tighten the four captive screws.





Installing ZMI 2001 Measurement Board Kits

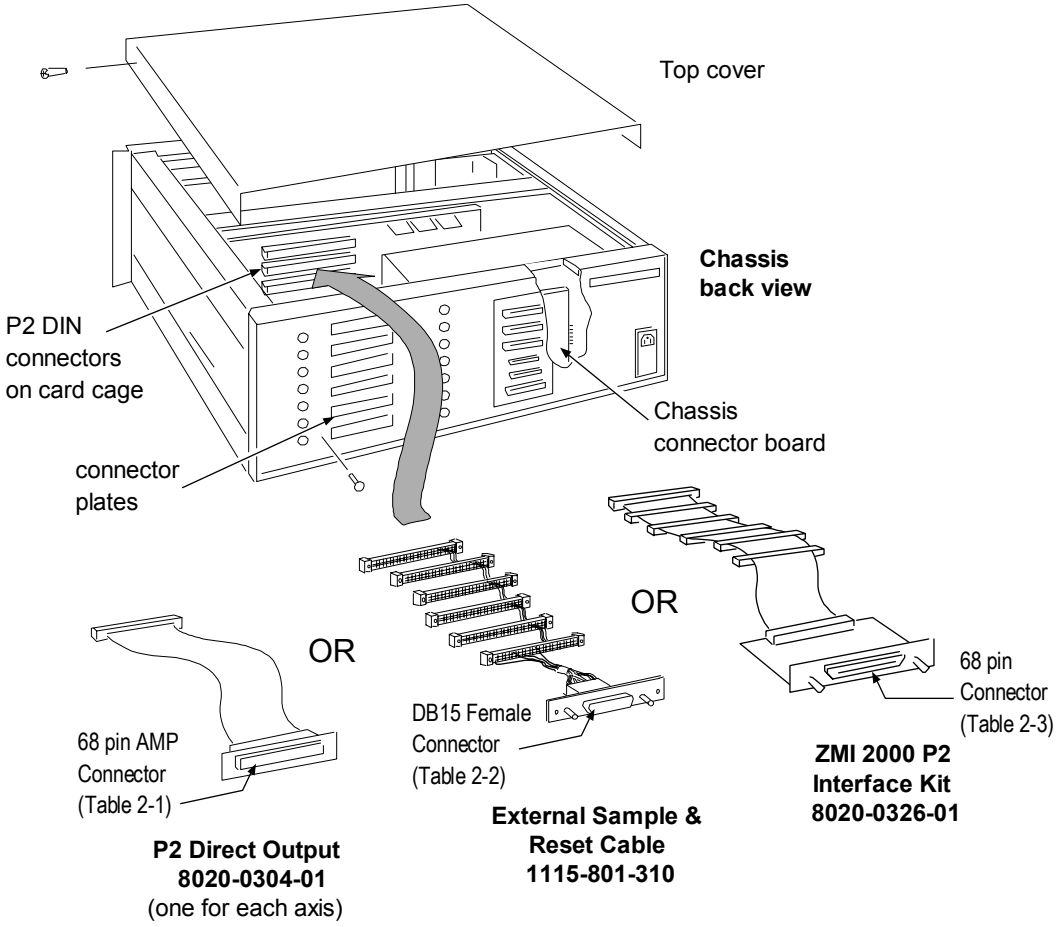
Figure 2-2

INSTALLING OUTPUT CABLE ASSEMBLIES

Output cable assemblies are available to transfer signals directly from the Measurement Boards to an external device. All connect directly to the P2 connectors on the card cage.

- **P2 Direct Output Assembly** Zygo P/N 8020-0304-01, provides a direct transfer of P2 signals to the Chassis back panel.
- **External Sample and Reset Cable Assembly** Zygo P/N 1115-801-310, connects up to six measurement boards together for common control of external sample commands.
- **ZMI 2000 P2 Interface Kit** Zygo P/N 8020-0326-01, provides a shared connector for P2 output from ZMI 2001 and 2002 Measurement Boards. It includes a P2 interface cable, P2 interface board, and a ZC transition board cable for power.

> ⚠ **WARNING!**
> Use proper handling techniques when touching the output cable assemblies, boards, and connectors to prevent them from being damaged by electrostatic discharge (ESD). Touch components only if you are wearing a static control wrist grounding strap.

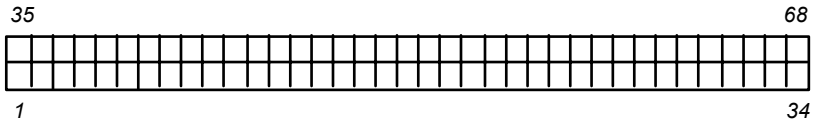


Output Assembly Connections

Figure 2-3

Installing the P2 Direct Output Assembly (8020-0304-01)

1. Connect the cable to the card cage P2 DIN connector and latch it in place.
2. Remove the two screws from the connector plate (labeled *Output 1…6*), that corresponds to the axis number, from the hole in the Chassis back panel.
3. Attach the connector to the Chassis back panel with the screws.



AMP Connector part number 749611-7. Refer to this number if ordering a mating connector.

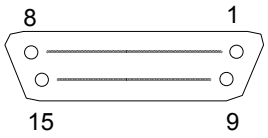
Pin	*Signal*	*Pin*	*Signal*	*Pin*	*Signal*	*Pin*	*Signal*
1	Reserved	18	P2_A6	35	P2_D26	52	P2_D2
2	P2_IDE*	19	Reserved	36	P2_D18	53	P2_D11
3	GND	20	P2_A7	37	P2_D27	54	P2_D3
4	GND	21	GND	38	P2_D19	55	P2_D12
5	P2_A8	22	GND	39	P2_D28	56	P2_D4
6	P2_A0	23	P2_INT1*	40	P2_D20	57	P2_D13
7	P2_A9	24	P2_INT0*	41	P2_D29	58	P2_D5
8	P2_A1	25	P2_INT3*	42	P2_D21	59	P2_D14
9	P2_A10	26	P3_INT2*	43	P2_D30	60	P2_D6
10	P2_A2	27	GND	44	P2_D22	61	P2_D15
11	P2_A11	28	GND	45	P2_D31	62	P2_D7
12	P2_A3	29	P2_D24	46	P2_D23	63	GND
13	P2_R/W*	30	P2_D16	47	P2_D8	64	GND
14	P2_A4	31	P2_D25	48	P2_D0	65	P2_SCLK1
15	P2_RESET*	32	P2_D17	49	P2_D9	66	P2_SCLK0
16	P2_A5	33	+	50	P2_D1	67	+
17	GND	34	+	51	P2_D10	68	+

+ indicates no connection * indicates active low signal

Table 2-1 P2 Direct Output Assembly 8020-0304-01 Pin Assignment and Signals

Installing the External Sample and Reset Cable Assembly (1115-801-310)

1. Connect the cable to the card cage P2 DIN connector and latch it in place.
2. Remove the two screws from the connector plate (labeled *Output 1…6*) on the Chassis back panel where you want to locate the connector.
3. Attach the connector to the Chassis back panel with the screws.



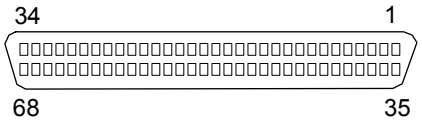
DB15 Female Connector

Pin	*Signal Name*
1	P2_INT5*
2	P2_INT4*
3	P2_INT3*
4	P2_INT2*
5	P2_INT1*
6	P2_SCLK0
7	P2_Reset*
8	P2_SCLK1
9	P2_INT6*
10	GND
11	GND
12	GND
13	GND
14	GND
15	GND

Table 2-2 External Sample and Reset Connector Pin Assignment and Signals

Installing the ZMI 2000 P2 Interface Kit (8020-0326-01)

1. Connect the P2 interface cable (1115-801-379) to the P2 Interface Board and to the card cage P2 DIN connectors; latch each card cage connector in place.
   Connect the cable to P2 slots with ZMI Measurement Boards and empty slots. However, if a slot has a board other than a Measurement Board do not connect the cable to that particular P2 connector.
2. Connect the ZC transition board cable (1115-801-065) from the Chassis connector board to the P2 Interface Board J4 connector.
3. Remove the two screws from the connector plate (labeled *Output 1…6*) on the Chassis back panel where you want to locate the connector.
4. Attach the connector to the Chassis back panel with the screws.



MicroD 68-pin Female SCSI-3 Connector

(AMP Connector part number 787170-7)

Pin	*Signal*	*Pin*	*Signal*	*Pin*	*Signal*	*Pin*	*Signal*
1	P2_INT0	18	P2_D19	35	P2_INT0*	52	P2_D27
2	P2_IOE	19	P2_D20	36	P2_IOE*	53	P2_D28
3	P2_RESET	20	P2_D21	37	P2_RESET*	54	P2_D29
4	P2_SCLK0	21	GND	38	P2_SCLK0*	55	GND
5	P2_INT1	22	P2_D22	39	P2_INT1*	56	P2_D30
6	P2_SCLK1	23	P2_D23	40	P2_SCLK1*	57	P2_D31
7	P2_INT2	24	P2_D0	41	P2_INT2*	58	P2_D8
8	P2_RW	25	GND	42	GND	59	GND
9	P2_A0	26	P2_D1	43	P2_A1	60	P2_D9
10	P2_A2	27	P2_D2	44	P2_A3	61	P2_D10
11	P2_A4	28	P2_D3	45	P2_A5	62	P2_D11
12	P2_A6	29	GND	46	P2_A7	63	GND
13	GND	30	P2_D4	47	GND	64	P2_D12
14	P2_D16	31	P2_D5	48	P2_D24	65	P2_D13
15	P2_D17	32	P2_D6	49	P2_D25	66	P2_D14
16	P2_D18	33	P2_D7	50	P2_D26	67	P2_D15
17	GND	34	GND	51	GND	68	GND

* indicates complement signal in differential pair.

Table 2-3 ZMI 2000 P2 Interface Board Pin Assignment and Signals

INSTALLING THE CONTROL BOARD

Typically, the ZMI Control Board is installed in the Chassis at the factory. However, if it is necessary to reconfigure or replace the board, refer to the following procedure.

> ⚠ **WARNING!**
> Use proper handling techniques when touching the board to prevent it from being damaged by electrostatic discharge (ESD). The board should be stored in a static shield bag and handled only by individuals using a static control wrist grounding strap.

1. Configure DIP switches as described in the section titled "DIP Switch Settings".
2. Insert the board into the VME backplane component side up; ensure that it is seated firmly. Thread the captive front panel screws into the card cage frame.

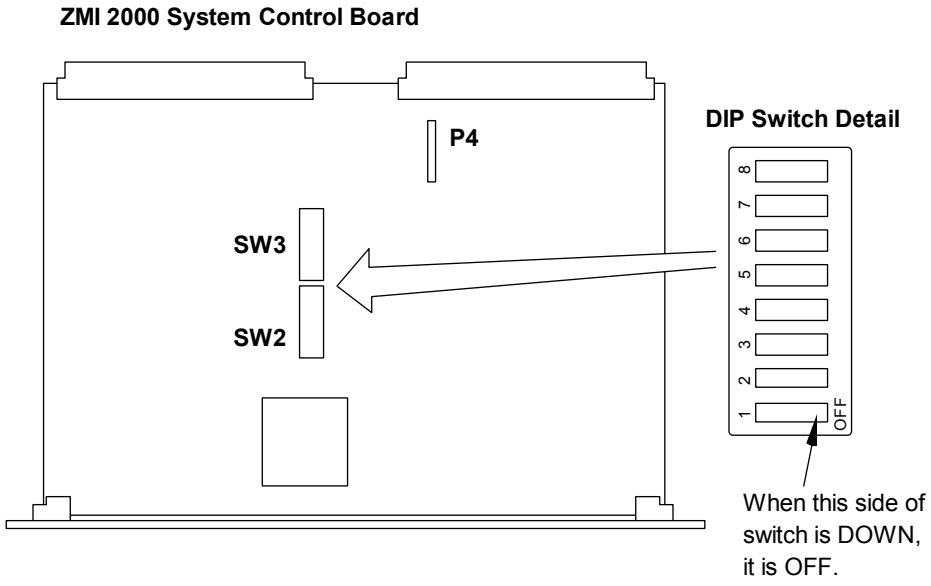
The Control Board coordinates the measurement output of the installed Measurement Boards and relays this information through the IEEE 488 port or the RS232 port to a host computer.

DIP Switch Settings

Two 8-position DIP switches, SW2 and SW3, control the interface port settings for the ZMI 2000 System Control Board. Figure 2-4 shows their location on the board.

Switch	*Position*	*Function*
SW2	1, 2, 3, 4, 5	Selects GPIB address.
SW2	6, 7	Reserved.
SW2	8	Disable/enable VME interrupt handler.
SW3	1	Enable/disable Control Board power-on self test.
SW3	2	Reserved.
SW3	3, 4, 5	RS232C Control port baud rate.
SW3	6, 7, 8	RS232C diagnostic terminal port baud rate.

Table 2-4 Control Board DIP Switch Assignments



DIP Switch Default Settings

Switch	SW2	SW3
1	off	off
2	off	-
3	off	on
4	on	off
5	on	on
6	off	on
7	off	off
8	off	on

Control Board DIP Switch Locations

Figure 2-4

SW2 and SW3 Definitions

SW2 determines the GPIB address and VME functions as shown below.

SW2 Switch	1	2	3	4	5
GPIB address value when ON	16	8	4	2	1

For example, when switches 1-5 are set to - OFF/OFF/OFF/ON/ON - the GPIB address is 3.

SW2 Switch	6	7	8
Function when ON	Reserved	Reserved	Disable VME interrupt handler

SW2 positions 6 and 7 are set at Zygo and should not be changed. SW2 position 8 enables or disables the Control Board VME interrupt handler; set to OFF for the Control Board to process Measurement Board interrupts. This feature is used with the External Sample command set described in Chapter 3.

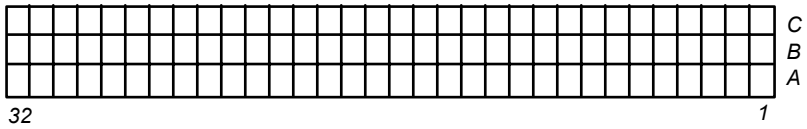
SW3, position 1, when ON the Control Board performs self test each time the power is turned on or the front panel RESET button is pressed. SW3, positions 3 through 8, determine the baud rate for the RS-232 ports as shown below. Note that SW3, position 2, is not used.

	RS232 Control Port			*Diagnostic Terminal Port*		
Baud Rate	3	4	5	6	7	8
100	off	off	off	off	off	off
300	off	off	on	off	off	on
1200	off	on	off	off	on	off
2400	off	on	on	off	on	on
4800	on	off	off	on	off	off
9600	on	off	on	on	off	on
19200	on	on	off	on	on	off
reserved	on	on	on	on	on	on

Control Board P1 and P2 Pin Assignments

VME signal pins on the Control Board P1 and P2 connector are shown the next two tables. VME signal pins that are not used by the Control Board are not connected and are indicated by a dash (–).

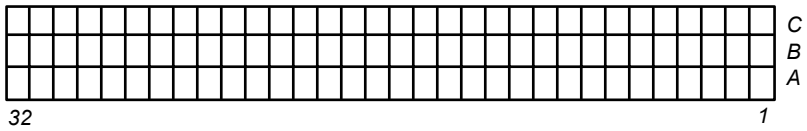
P1 Connector Pin Out - Pin View



Pin #	*Row A*	*Row B*	*Row C*
1	D0	BSSY*	D8
2	D1	-	D9
3	D2	-	D10
4	D3	-	D11
5	D4	-	D12
6	D5	-	D13
7	D6	-	D14
8	D7	-	D15
9	GND	-	GND
10	SYSCLK	BG3*	-
11	GND	BG3OUT*	BERR*
12	DS1*	-	SYSRESET*
13	DS0*	-	-
14	WRITE*	-	AM5
15	GND	BR3*	A23
16	DTACK*	AM0	A22
17	GND	AM1	A21
18	AS*	AM2	A20
19	GND	AM3	A19
20	IACK*	GND	A18
21	IACKIN*	-	A17
22	IACKOUT*	-	A16
23	AM4	GND	A15
24	A7	-	A14
25	A6	-	A13
26	A5	-	A12
27	A4	-	A11
28	A3	IRQ3*	A10
29	A2	IRQ2*	A9
30	A1	IRQ1*	A8
31	-	-	-
32	+5V	+5V	+5V

Table 2-5 Control Board P1 Pin Assignment

P2 Connector Pin Out - Pin View



Pin #	*Row A*	*Row B*	*Row C*
1	GND	+5V	V_BIAS
2	Trigger Input +	GND	Trigger Input -
3	User Input 0 +	RESERVED	User Input 0 -
4	User Input 1 +	-	User Input 1 -
5	User Input 2 +	-	User Input 2 -
6	GND	-	GND
7	Error Output	-	User Output 0
8	User Output 1	-	User Output 2
9	User Output 3	-	User Output 4
10	Reserved	-	GND
11	GND	-	GND
12	RxD_LH	GND	TxD_LH
13	GND	+5V	GND
14	RxD_DT	-	TxD_DT
15	GND	-	GND
16	GND	-	DCD0
17	DSR0	-	DTR0
18	RTS0	-	CTS0
19	RxD0	-	TxD0
20	GND	-	GND
21	DIO5	-	DIO1
22	DIO6	GND	DIO2
23	DIO7	-	DIO3
24	DIO8	-	DIO4
25	REN	-	EOI
26	GND	-	DAV
27	GND	-	NRFD
28	GND	-	NDAC
29	GND	-	IFC
30	GND	-	SRQ
31	GND	GND	ATN
32	GND	+5V	NC

Table 2-6 Control Board P2 Pin Assignment

CHASSIS CONNECTOR PANEL PIN ASSIGNMENTS

Located on the back panel of the Chassis are a series of connectors for interfacing to other equipment. Refer to Figure 2-5.

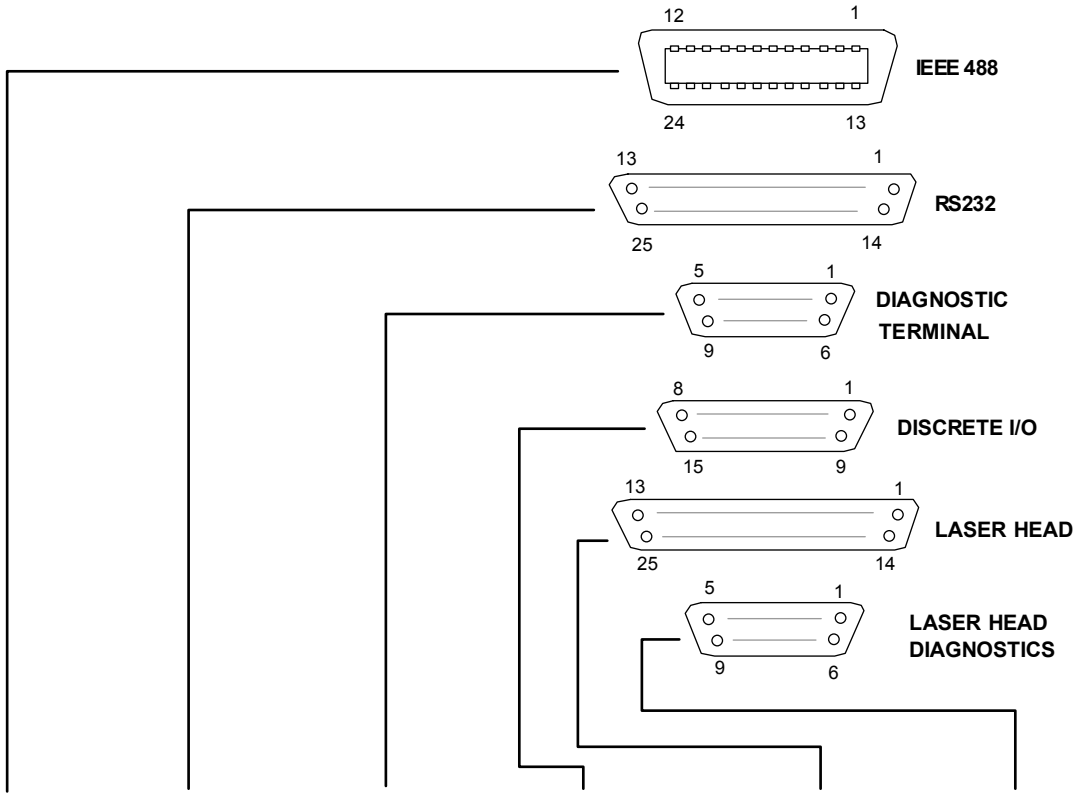
Name	*Connector Type*	*Connects to…*
IEEE 488	GPIB, 24-pin	Host computer
RS232	DB-25 receptacle	Host computer
DIAGNOSTIC TERMINAL	DB-9 receptacle	Optional “help” terminal
DISCRETE I/O	DB-15 receptacle	User I/O signals
LASER HEAD	DB-25 receptacle	Zygo’s Laser Head
LASER HEAD DIAGNOSTIC	DB-9 receptacle	Host Computer

Table 2-7 Chassis Connectors

Serial (RS232 and Diagnostic Terminal) Port Parameters

Parameter	*RS232*	*DIAGNOSTIC TERMINAL*
Function	RS-232 port for connection to host or control computer.	RS-232 port for connection to VT100 display terminal for Help screens.
Connector type	DB-25 female	DB-9 female
Parameters	8-bit, no parity, 1 stop bit	8-bit, no parity, 1 stop bit
Protocol	XON/XOFF	XON/XOFF
Baud Rate	9600, change with SW3 (3-4-5)	9600, change with SW3 (6-7-8)
Miscellaneous parameters	Full duplex, carriage return and line feed termination, local echo on	Full duplex, carriage return and line feed termination, local echo off

Table 2-8 Serial Port Parameters



IEEE 488	RS232	Diagnostic Terminal	Discrete I/O	Laser Head	Laser Head Diagnostics
1 DIO1	1 Frame GND ‡	2 RxD	1 reserved	1 RTS	2 RxD
2 DIO2	2 RxD ‡	3 TxD	2 reserved	2 CTS	3 TxD
3 DIO3	3 TxD ‡	5 Signal GND	3 User Input0	3 DSR	5 Signal GND
4 DIO4	4 CTS		4 User Input0*	4 DTR	
5 EOI*	5 RTS		5 User Input1	5 TxD	
6 DAV*	6 DSR		6 User Input1*	6 RxD	
7 NRFD*	7 Signal GND ‡		7 User Input2	7 GND	
8 NDAC*	8 DCD		8 User Input2*	8 GND	
9 IFC*	20 DTR		9 GND	9 GND	
10 SRQ*			10 Error Output*	10 ECL Shield	
11 ATN*			11 User Output0	11 REF	
12 Main Shield			12 User Output1	12 -15V	
13 DIO5			13 User Output2	13 -15V	
14 DIO6			14 V_BIAS	14 +15V	
15 DIO7			15 Main Shield	15 TTL REF	
16 DIO8				16 TTL REF*	
17 REN*				17 Service*	
18 GND				18 Unstable*	
19 GND				19 LTO*	
20 GND				20 LTO	
21 GND				21 +15V	
22 GND				22 ECL REF	
23 GND				23 ECL REF*	
24 Signal GND				24 REF Shield	
				25 Main Shield	

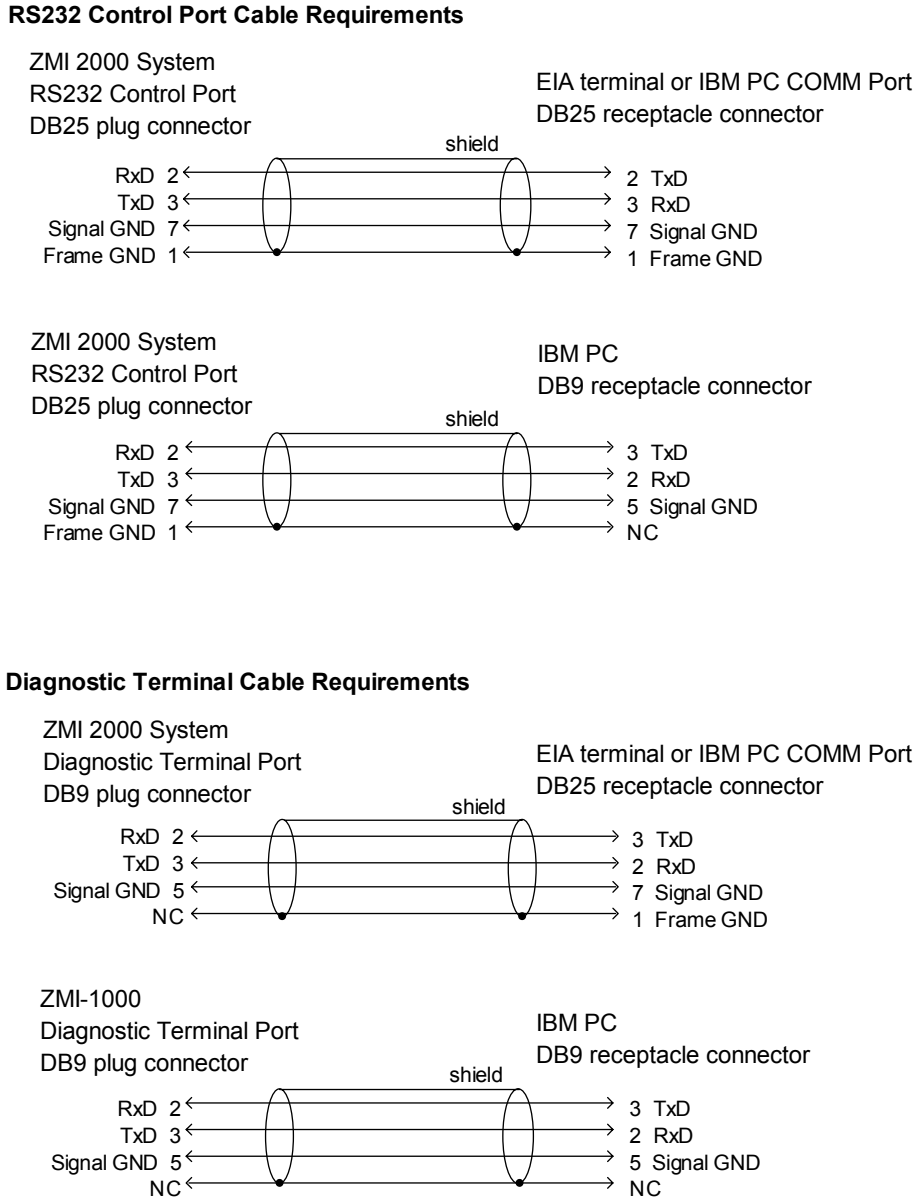
‡ minimum requirement for software handshake.

Chassis Connector Panel Pin Assignments

Figure 2-5

RS-232 Cable Requirements

Zygo recommends that all cables be shielded, and that the shields be connected to a metal back shell. See Figure 2-6.



RS-232 Cable Requirements

Figure 2-6

CONTROL BOARD DISCRETE I/O

Three discrete inputs and three discrete outputs are available to the user through the Discrete I/O connector on the Chassis back panel.

Using the Discrete Inputs

The inputs are level sensitive and are sampled by the firmware. They are differential pairs received on the Control Board by 26LS32A differential RS422 line receivers.

Zygo recommends driving the inputs with a differential pair for best performance. However, single ended TTL level signals can be used by connecting the V_BIAS output signal on pin 14 to one of the differential inputs and connecting the external signal to the other input. See Table 2-9 for different operation configurations using V_BIAS. Remember to connect the GND signal on pin 9 to the host system ground to establish a common reference.

V_BIAS connected to:	*External Signal connected to:*	*External Signal Level*	*Input Level read by Control Board*
input -	input +	0	0
input -	input +	1	1
input +	input -	0	1
input +	input -	1	0

Table 2-9 V_BIAS Configurations

The discrete input states can be read with the INPUT? command and used as a trigger for the MTSAMPLE command. See Chapter 4.

Using the Discrete Outputs

The discrete outputs are driven by 7407 open collector drivers. The Control Boards are shipped from Zygo with a SIP resistor pack installed in the on board connector, P4. The SIP pack pulls each output up to +5 volts through a 470 ohm resistor. See Figure 2-4 for the P4 connector location.

The outputs may be pulled up to different voltages by removing the SIP pack then pulling up the outputs through a resistor externally. Remember to limit the sink current to less than 40 milliamps and not to exceed +30 volt DC, as dictated by the 7407 specification. Also, connect the GND signal on pin 9 to the external power supply ground to establish a common reference.

The discrete outputs are high at power-on reset. The OUTPUT command controls the discrete outputs. See Chapter 4.

Using the Error Output

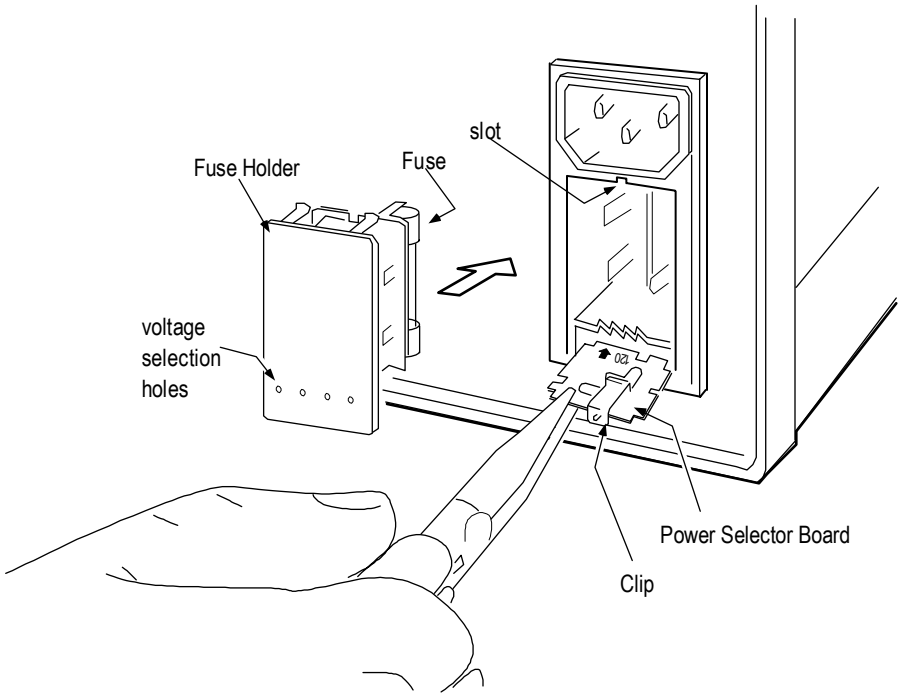
The discrete error output is also driven by a 7407 open collector driver and is also pulled up by the SIP resistor pack installed in P4. This output is set low when the Control Board registers an error condition. Issuing the *CLS or ERROR? commands reset this output. The output is also cleared by a power-on reset or the RESTART command.

CHASSIS AC LINE VOLTAGE AND FUSE SELECTION

The ZMI 2000 Chassis can be set to operate at 100, 120, 230, or 240 VAC by configuring the power connector module located on the rear of the Chassis.

> ⚠ **WARNING!**
> The power connector module configuration sets the operating voltage for the Chassis. If the module is set incorrectly, electronic components may be damaged when power is applied.

1. Locate the power connector module at the lower right side of the Chassis rear panel. Check the small row of holes across the lower section of the module. A white plastic pin should be visible in one of the four holes. Look closely above the pin; the adjacent voltage imprinted on the plastic plate must match the voltage available to the system. If the pin indicates the correct voltage, it is not necessary to open the module. If the indicated voltage is NOT correct, continue to step 2.
2. Unplug the power cord from the module.
3. Insert a small screwdriver into the slot below the power cord connector and gently pry out the fuse holder.
4. To check the fuse:
   a. Pull the fuse from its holder.
   b. Examine the fuse; it must be rated for 5A if the line voltage is 100 or 120 VAC, or 2.5A if the voltage is 230 or 240 VAC.
   c. Replace the correct fuse and set the fuse holder aside.
5. To set the power selector board for AC line voltage:
   a. The power selector circuit board is positioned in a slot at the bottom of the opening. A plastic clip is also visible on the outer edge of the board. This clip must be positioned in slots on the board to select the voltage.
   b. Using needle-nose pliers, pull out the circuit board.
   c. Orient the clip in the slots so the pin end points *away from* the correct voltage. Seat the clip in its slot.
   d. Position the board so that the small tip on the clip faces outward.
   e. Using needle-nose pliers, gently press the board back into place.
6. Press the fuse holder into place, making sure that the small pin on the clip aligns with the hole below the correct voltage.
7. Plug the power cord into the Chassis.



Chassis Power Selector

Figure 2-7

Chapter 3

OPERATION

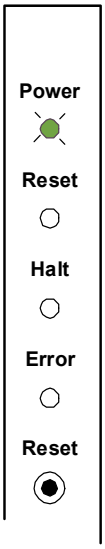
In This Chapter

- Control Board LED's
- Overview
- Using the Diagnostic Terminal
- ZMI 2000 System Service Requests

- Status Byte
- Standard Event Register
- Detecting ZMI 2000 System Errors Using SRQ

CONTROL BOARD LED's

The Control Board indicator lights are shown in Figure 3-1. Control Board operation is explained in the remainder of this Chapter.



Power LED - when on indicates board is receiving +5 volts; green.

Reset LED - when on indicates a hardware Reset is active; red.

Halt LED - when on indicates the microprocessor has stopped and the board is not functioning; amber.

Error LED - when on indicates that an error has occurred but the board is still functional; red. At power-on (if SW3, switch 1 is on) and during the *TST? command, this LED will flash once if the EPROM test is okay; twice if the SRAM test is okay, and three times if the EEPROM test is okay. The ERROR? command will turn off this LED.

Reset Switch - when pressed performs a hardware reset of the board to clear error conditions.

*During normal operation only the **Power** LED is on.*

Control Board LED's

Figure 3-1

OVERVIEW

This chapter describes some of the operational features of the ZMI 2000 System. The hardware connection and configuration of the Control Board is described in Chapter 2.

It is necessary for you to write and execute a program on your host computer to get data to and from the VMEbus measurement system to a host computer through the ZMI 2000 System Control Board IEEE-488 or RS-232 interface. Your customized program must use the set of commands described in Chapter 4. These commands execute software stored in EPROM on the ZMI 2000 System Control Board.

The software performs the following functions:

Component	*Functions*
ZMI 2000 System Control Board	• Configures after power-on reset. • Interfaces with a host computer. • Reads and writes to user VMEbus boards. • Tests after power-on reset or on command.
ZMI 2001 Measurement Board	• Configures after power-on reset or on command. • Reads measurement data. • Reads status. • Writes control information.
Diagnostic Terminal	• Outputs device status.

It is possible for the ZMI 2000 System to receive commands from both the IEEE-488 and RS232 control ports, but Zygo does not recommend this configuration, because of the complexity involved in synchronizing the host computers with the ZMI 2000 System.

USING THE DIAGNOSTIC TERMINAL

A VT100 display terminal connected to the Chassis Diagnostic Terminal port serves as a simple tool to set up and check the ZMI 2000 System. Set the parameters of the terminal to those listed in Table 2-7. The terminal is used by entering commands and reading the output.

The Diagnostic Terminal can also be used to help debug the host computer program because it displays the received commands and the ZMI 2000 System responses sent. However, it does slow down the System; it is recommended as a diagnostic tool only.

To activate the diagnostic port, press any terminal key. A summary of some diagnostic functions are listed below.

Function	*Type*
Get Help Screen	**h** <CR>
Enter a single command	**c** zmi command <CR>
Enter multiple commands	**cc** <CR> zmi command zmi command etc…
Quit multiple commands	<ESC>
Toggle status reports	**t** status code <CR>
List status codes	**t** <CR>
Device clear	<ctrl>**C** or **SC** <CR>
Turn off diagnostic port	**q** <CR>
Delete previous character sent	<backspace>

ZMI 2000 SYSTEM SERVICE REQUESTS

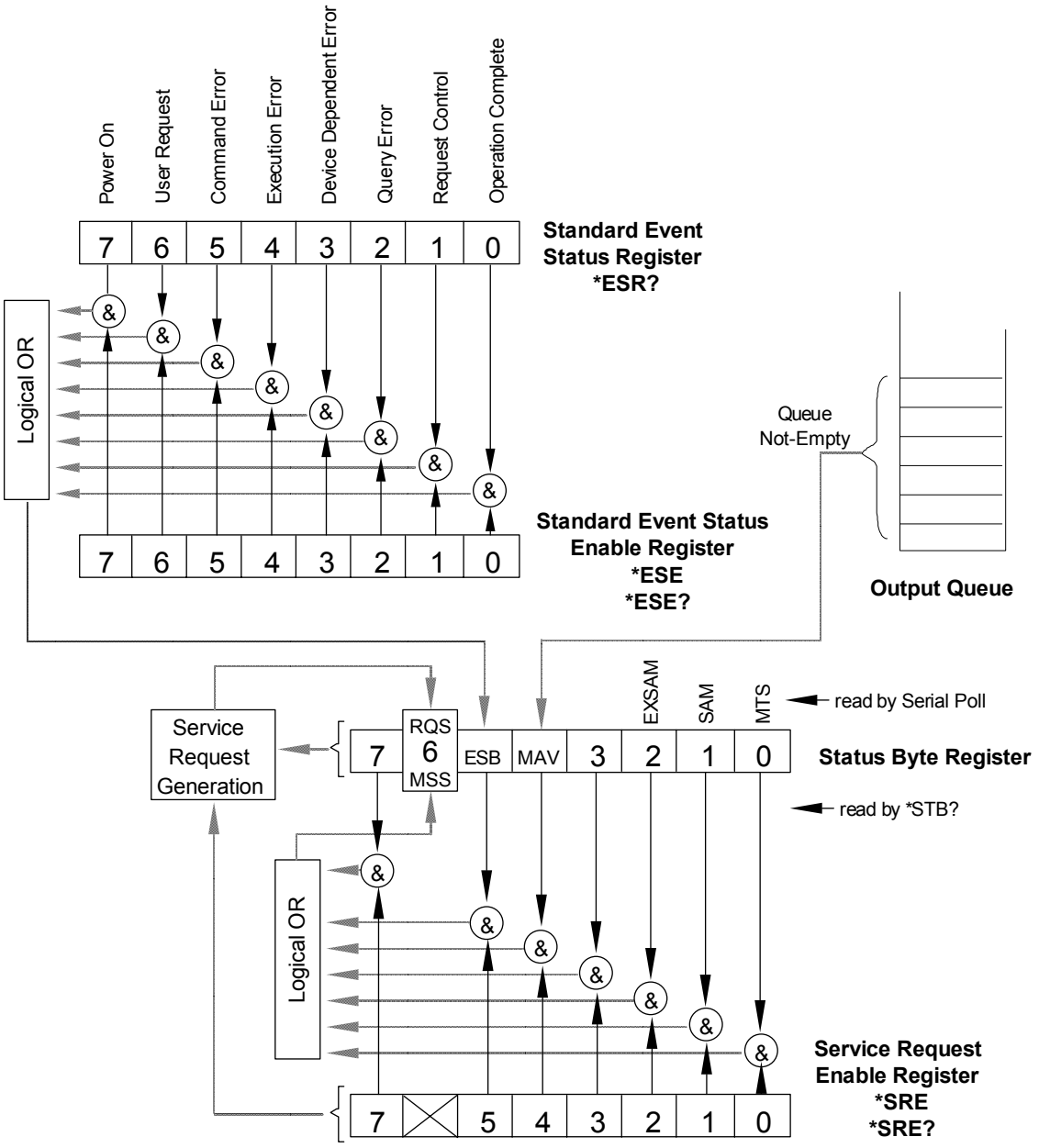
The ZMI 2000 System can be configured to request service from the host for error detection.

When using the IEEE 488 interface, the Control Board issues a service request, SRQ, to the host. If more than one device is connected to the interface, then host responses by performing a serial poll to determine which device requested service. If the ZMI 2000 System is the only device connected to the interface, then the host reads the status byte using the *STB? command to determine what event cause the SRQ.

When using the RS232 control port, the Control Board outputs the ASCII escape character, 0x1B, to request service from the host. Because the ZMI 2000 System is the only device connected to the serial port, the host simply determines what event caused the service request by reading the status byte.

An SRQ is issued when one or more of the 7 maskable bits in the Status Byte Register is set and the corresponding Service Request Enable Register is also set. The Service Request Enable Register is programmed with the *SRE command and can be read with the *SRE? command.

Figure 3-2 depicts the interaction between the Standard Event Status Register, the Standard Event Status Enable Register, the Service Request Enable Register, and the Status Byte Register.



Service Request Interaction

Figure 3-2

Status Byte

As mentioned before, the status byte can be read with the *STB? command. Tables 3-1 and 3-2 describe the individual status bits. See the IEEE 488.2 specification for more details.

MSB							LSB
7	6	5	4	3	2	1	0

Table 3-1 Bit Order

Bit Number	*Bit Mnemonic*	*Status Indication When Bit Is Set*
0		Reserved.
1		Reserved.
2		Reserved.
3		Reserved
4	MAV	Message AVailable in the send buffer.
5	ESB	Event Status Bit summary message is the result of a logical AND between the standard event status register and the Standard Event Status Enable Register.
6	RQS or MSS	ReQuest Service indicates if SRQ bus signal is active. Master Summary Status indicates that there is one or more reasons to request service.
7		Reserved

Table 3-2 Status Byte Register Bit Definitions

Standard Event Status Register

The standard event status register provides status on the operations of the device. Tables 3-2 and 3-3 describe the individual status bits. See the IEEE 488.2 specification for more details.

Bit Number	*Bit Mnemonic*	*Status Indication When Bit Is Set*
0	OPC	OPeration Complete - used in conjunction with the *OPC command to determine when all operations are complete.
1		Reserved.
2	QYE	QuerY Error - indicates when a query error has occurred.
3	DDE	Device Dependent Error - indicates when a device dependent error has occurred.
4	EXE	EXecution Error - indicates when a execution error has occurred.
5	CME	CoMmand Error - indicates when a command error has occurred.
6		Reserved.
7	PON	Power ON indicates device power has made a off-to-on cycle.

Table 3-3 Standard Event Status Register Bit Definitions

Detecting ZMI 2000 System Errors Using SRQ

There are three different methods to detect errors during operation.

1) The host software can read the standard event status register using *ESR? or read the error number using ERROR? after each command to determine if an error has occurred.

2) The discrete Error Out* signal can be connected to the host. The host can then sample this signal or interrupt on this signal. The host knows an error occurred when the signal goes active.

3) The host can configure the ZMI 2000 System to issue an SRQ when an error occurs. To accomplish this the host must issue the following commands:

```
*ESE 60
*SRE 32
```

4) Now, the host can read the error number using the ERROR? command when the SRQ signal goes active.

Chapter 4
COMMAND DICTIONARY

In This Chapter

- Overview
  - Characters Used in this Chapter
  - Using Commands
  - Data Formats
  - Summary of Commands
- Command Dictionary
- Examples

OVERVIEW

A host computer is used to control the ZMI 2000 System. Commands are sent from the computer to the ZMI 2000 System Control Board. This chapter describes the commands in detail and the meaning of the ZMI 2000 System responses.

The system software complies with ANSI/IEEE Standard 488.1-1987 and ANSI/IEEE 488.2-1987. A copy of either standard is available from:

The Institute of Electrical & Electronics Engineers, Inc.
345 East 47th Street
New York, NY 10017

Characters Used in this Chapter

Character	*Description*	*Sample*
*	Common commands that comply with the ANSI/IEEE 488.2-1987 standard.	*CLS
?	Generates a response from a device.	*ESE?
< >	Command parameter.	<state>
x	Any parameter value other than those listed.	
...	Means continuation.	<1,…n>
' '	Single quotes indicate ASCII character string.	'0' - '9'
H	Hexadecimal number.	H30 - H39
B	Binary number.	B10101
Q	Octal number.	Q170
#	Start of a number string.	#H100
b	Used to describe a bit (0 or 1).	b0
^	Control character.	^C

Using Commands

This chapter refers to the ZMI 2000 System Control Board, ZMI 2001 Measurement Board, and the Laser Head, globally as a “device”.

All commands are case insensitive. Uppercase or lowercase may be used. Mixing uppercase and lowercase is allowed. For example:

IDN? = idn? = iDN?

The hexadecimal characters A-F may be uppercase, lowercase, or mixed. For example:

BGET? #H2D,#Ha000

All commands are sequentially executed. The command names are unique and consist of one to twelve characters. Any unknown command generates a command error. Commands are sent to the device as an ASCII string. Parameter and response values are ASCII coded decimal numbers. The ASCII character range H30 - H39 corresponds to ASCII characters '0' through '9'. A space must be placed between commands and their associated parameters. A space may or may not be placed after a parameter separating comma.

Data Formats

Parameter and response data have different data types. The following table describes some of the response data types referred to in the command dictionary. Data format syntax drawings are provided in Appendix A. (NL) refers to new line or linefeed character terminator. All formats are in accord with IEEE-488.2-1987 specifications.

Data Type	*Description*	*Examples*
NR1	Integer or whole number expressed without a decimal point. The number is positive unless it has a minus sign, in which case it is a negative number.	0 (NL) -213534565 (NL) 10003 (NL)
Hexadecimal	Values as ASCII coded hex strings. 32-bit signed and unsigned integers are output as a string of 8 ASCII coded hex digits.	#H01B4 (NL) #HFFF738C (NL)

Summary of Commands

Table 4-1 provides a listing of Common Commands and Device Specific Commands.

Common Commands	
*CLS	Clear Status. Clears the Standard Event Status Register, Standard Event Status Enable Register, Service Request Enable Register, Status Byte Register, error codes, Error LED, and terminates active operations.
*ESE	Set the Standard Event Status Enable Register bits.
*ESE?	Read Standard Event Status Enable Register.
*ESR?	Read Standard Event Status Register.
*IDN?	Read Control Board Identification Information.
*SRE	Service Request Enable.
*SRE?	Determine the current contents of the Service Request Enable Register.
*STB?	Read the Status Byte Register, which includes the Master Summary Status (MSS) bit.
*TST?	Invokes a device self-test.

Device Specific Commands	
ERROR?	Read error message.
INPUT?	Return the value of the specified discrete input.
OUTPUT	Set the specified discrete output to the specified value.
RESTART	Emulates a device hardware reset.
BGET?	Get byte (8 bits) from VMEbus.
BPUT	Put byte on VMEbus.
WGET?	Get word (16 bits) from VMEbus.
WPUT	Put word on VMEbus.
LGET?	Get long word (32 bits) from VMEbus.
LPUT	Put long word on VMEbus.

Table 4-1 Summary of Commands

COMMAND DICTIONARY

The commands listed in Table 4-1 are explained in greater detail in this section.

Dictionary Format

Where applicable, each command description includes the command syntax, functional description, response specification, and an example.

Command Syntax

*CLS

Functional Description

The Clear Status command is a mandatory common command. The *CLS command clears the following:

- Standard Event Status Register
- Standard Event Status Enable Register
- Service Request Enable Register
- Status Byte Register
- error codes
- Error LED

*CLS should be executed at the start of any ZMI 2000 System program. This command also clears the IEEE 488 input queue and terminates any active operations.

Command Syntax

```
*ESE <enable mask>
```

Functional Description

Standard Event Status Enable, a mandatory common command. The *ESE command sets the Standard Event Status Enable Register bits.

See also Figure 3-2 and Table 3-3.

Parameter Specification

`<enable mask>`

Type: Decimal numeric program data

Range: '0' - '255'

Command Syntax

```
*ESE?
```

Functional Description

Read Standard Event Status Enable Register, a mandatory common command. The *ESE? Command allows the programmer to determine the current contents of the Standard Event Status Enable Register.

See also Figure 3-2 and Table 3-3.

Parameter Specification

Type: NR1 Numeric response data
Range: '0' - '255'

Command Syntax

```
*ESR?
```

Functional Description

Read Standard Event Status Register, a mandatory common command. The *ESR? command allows the programmer to determine the current contents of the Standard Event Status Register.

See also Figure 3-2 and Table 3-3.

Response Specification

Type: NR1 Numeric response data

Range: '0' - '255'

Command Syntax

```
*IDN?
```

Functional Description

Read Identification Information, a mandatory common command. The *IDN? command reads the device identification information over the host computer interface. The output includes the manufacturer, model name, Control Board serial number, and Control Board software revision level.

Response Specification

Type: Arbitrary ASCII response data

Format: Manufacturer, model, serial number, software level

Example

Command: *IDN?

Response: Zygo,VMEbus Control Board,006,E

Command Syntax

```
*SRE <enable mask>
```

Functional Description

Service Request Enable, a mandatory common command. The *SRE command sets the Service Request Enable Register bits.

See also Figure 3-2 and Table 3-2.

Parameter Specification

`<enable mask>`

Type: Decimal numeric program data
Range: '0' - '63' and '128' - '191'

Command Syntax

```
*SRE?
```

Functional Description

Read Service Request Enable Status, a mandatory common command. The *SRE? command allows the programmer to determine the current contents of the Service Request Enable Register.

See also Figure 3-2 and Table 3-2.

Response Specification

Type: NR1 Numeric response data

Range: '0' - '63' and '128' - '191'

Command Syntax

*STB?

Functional Description

Read Status Byte, a mandatory common command. The *STB? command allows the user to read the status byte and master summary status bit. This command is executed immediately, however, the resultant output is placed in the output queue after the current command has finished using the output queue.

See also Figure 3-2 and Table 3-2.

Response Specification

Type: NR1 Numeric response data

Range: '0' - '255'

Command Syntax

```
*TST?
```

Functional Description

Execute Self-Test and Read Status, a mandatory common command. The *TST? command invokes a device self-test. It is the same test executed when the Control Board is first powered-on, if this feature is enabled.

The character '0' is placed in the output queue if no errors were detected. The character '1' is placed in the output queue if an error(s) is found. The last error number of the first error encountered may be read with the ER? command.

The Power-On-Self Test and the *TST? command perform the same set of power-on-self-test routines. However, the *TST? command provides output (or summary information) and the Power-On-Self Test does not. The routine is executed at power up or when a RESTART command is issued. This test verifies the EPROM integrity by computing its checksum, performing a write/read test on the static RAM, and verifying the EEPROM checksum.

Response Specification

Type: NR1 Numeric response data

Range: '0' or '1'.

Command Syntax

ER[ROR]?

Functional Description

Read Error Message, a device specific command. The first error encountered is output as an ASCII coded decimal value.

Response Specification

Type: NR1 Numeric response data

Each error number is described in the following list. The letters under Type are as follows: CE is command error, EE is execution error, and DDE is device-dependent error.

Number	*Error*	*Type*
0	No Error.	-
4	No Such Command.	CE
6	Too Many Command Arguments.	CE
7	Missing Command Argument.	CE
8	Invalid Command Argument.	CE
10	Invalid Address.	EE
11	Data Runs Past Allowed Address Space.	EE
12	Invalid Address Modifier.	EE
13	Bus Error.	DDE
14	Reserved.	-
15	Reserved.	-
16	Reserved.	-
17	Invalid Format Specification.	EE
18	Data Too Large To Fit In Register.	EE
19	Reserved.	-
20	Reserved.	-
22	Reserved.	-
24	Reserved.	-
25	Invalid Setup Number.	EE
26	Reserved.	-

continued

Number	*Error*	*Type*
28	Serial Control Port Framing Error.	DDE
30	Serial Control Port Overrun Error.	DDE
31	Serial Diagnostic Port Framing Error.	DDE
33	Serial Diagnostic Port Overrun Error.	DDE
34	Must Deactivate The Trigger Input.	DDE
35	I/O Command Parameter Out of Range.	DDE
36	Reserved.	-
38	Reserved.	-
39	Reserved.	-
40	Reserved.	-
41	Reserved.	-
42	Reserved.	-
43	Reserved.	-
44	Reserved.	-
45	EPROM Failed Checksum.	DDE
46	Static RAM Failed the Write/Read Test.	DDE
47	EPROM Failed the Checksum Test.	DDE
48	Reserved.	-
49	Reserved.	-
50	Reserved.	-
51	Reserved.	-
52	Reserved.	-

Command Syntax

`IN[PUT]? <input number>`

Functional Description

Get discrete input value, a device specific command. The INPUT? command returns the current value of the specified discrete input. The inputs accept both differential and single ended TTL signals.

Also see "Using the Discrete Inputs" in Chapter 2.

Parameter Specification

`<input number>`

Type: Decimal numeric program data

Range: '0' - '2'

Response Specification

Type: NR1 Numeric response data

Range: '0' or '1'

Command Syntax

`OUT[PUT] <output number>,<value>`

Functional Description

Control Board Discrete Output, a device specific command. The OUTPUT command sets the specified discrete output to the specified value. A '0' value corresponds to a low voltage level at the output. A '1' corresponds to a high voltage level at the outputs.

See also "Using the Discrete Outputs" in Chapter 2.

Parameter Specification

`<output number>`

Type: Decimal numeric program data

Range: '0' - '2'

`<value>`

Type: Decimal numeric program data

Range: '0' or '1'

Example

Enter: `OUT 0,1`

Changes the discrete output 0 to a high voltage state.

Enter: `OUTPUT 2,0`

Changes the discrete output 2 to a low voltage state.

Command Syntax

```
RESTART
```

Functional Description

Emulates a device hardware reset; it is the same as turning power off and then on. RESTART sets the Control Board to its default settings; addresses and switch settings are re-read.

Command Syntax

`BG[ET]? <address modifier>,<address>`

Functional Description

Get Byte, a device specific command. The BG? command gets a byte (8 bits) from the VMEbus address defined by <address modifier> and <address>.

Parameter Specification

`<address modifier>`

Type: Non-Decimal numeric program data
Range: '#H2D', '#H3D'

`<address>`

Type: Non-Decimal numeric program data
Range: for #H2D: '#H0' - '#HFFFF'
for #H3D: '#H0' - '#HFFFFFF'

Response Specification

Type: Hexadecimal numeric response data

Range: '#H0' - '#HFF'

Example

Suppose the memory values starting at hexadecimal address A000 in the VMEbus short address space are:

A000 8F A1 12 78 DB 1F 72 88 65 41 03 00 34 90 CD BB

Command: BGET? #H2D,#HA000

Obtains the 8 bit memory value at H2D and address HA000; the response is:

#H8F

Command Syntax

```
BP[UT] <address modifier>,<address>,<byte>
```

Functional Description

Put Byte, a device specific command. The BP command writes the <byte> (8 bits) value at the address defined by the <address modifier> and <address>.

Parameter Specification

`<address modifier>`

Type: Non-Decimal numeric program data
Range: '#H2D', '#H3D'

`<address>`

Type: Non-Decimal numeric program data
Range: for #H2D: '#H0' - '#HFFFF'
for #H3D: '#H0' - '#HFFFFFF'

`<byte>`

Type: Non-Decimal numeric program data
Range '#H0' - '#HFF'

Example

Suppose the memory values at hexadecimal address A000 in the VMEbus short address space are as shown:

A000 8F A1 12 78 DB 1F 72 88 65 41 03 00 34 90 CD BB

Command: BPUT #H2D,#HA000,#H0

Writes an 8 bit value at H2D and address HA000; the outcome is:

A000 00 A1 12 78 DB 1F 72 88 65 41 03 00 34 90 CD BB

Command Syntax

WG[ET]? <address modifier>,<address>

Functional Description

Get Word, a device specific command. The WG? command gets a word (16 bits) from the VMEbus address defined by <address modifier> and <address>. The command executes by reading individual bytes.

Parameter Specification

<address modifier>

Type: Non-Decimal numeric program data

Range: '#H2D', '#H3D'

<address>

Type: Non-Decimal numeric program data

Range: for #H2D: '#H0' - '#HFFFF'
for #H3D: '#H0' - '#HFFFFFF'

Response Specification

Type: Hexadecimal numeric response data

Range: '#H0' - '#HFFFF'

Example

Suppose the memory values starting at hexadecimal address A000 in the VMEbus short address space are:

A000 8F A1 12 78 DB 1F 72 88 65 41 03 00 34 90 CD BB

Command: WGET? #H2D,#HA000

Obtains the 16 bit memory value at H2D and address HA000; the response is:

#H8FA1

Command Syntax

```
WP[UT] <address modifier>,<address>,<word>
```

Functional Description

Put Word, a device specific command. The WP command writes the <word> (16 bits) value at the address defined by the <address modifier> and <address>. The command executes by reading individual bytes.

Parameter Specification

`<address modifier>`

Type: Non-Decimal numeric program data
Range: '#H2D', '#H3D'

`<address>`

Type: Non-Decimal numeric program data
Range: for #H2D: '#H0' - '#HFFFF'
for #H3D: '#H0' - '#HFFFFFF'

`<word>`

Type: Hexadecimal numeric response data
Range: '#H0' - '#HFFFF'

Example

Suppose the memory values at hexadecimal address A000 in the VMEbus short address space are as shown:

A000 8F A1 12 78 DB 1F 72 88 65 41 03 00 34 90 CD BB

Command: WPUT #H2D,#HA000,#H0

Writes a 16 bit memory value at H2D and address HA000; the outcome is

A000 0 00 12 78 DB 1F 72 88 65 41 03 00 34 90 CD BB

Command Syntax

LG[ET]? <address modifier>,<address>

Functional Description

Get Long, a device specific command. The LG command gets a long word (32 bits) from the VMEbus address defined by <address modifier> and <address>. The command executes by reading individual bytes.

Parameter Specification

<address modifier>

Type: Non-Decimal numeric program data

Range: '#H2D', '#H3D'

<address>

Type: Non-Decimal numeric program data

Range: for #H2D: '#H0' - '#HFFFF'
for #H3D: '#H0' - '#HFFFFFF'

Response Specification

Type: Hexadecimal numeric response data

Range: '#H0' - '#HFFFFFFFF'

Example

Suppose the memory values starting at hexadecimal address A000 in the VMEbus short address space are:

A000 8F A1 12 78 DB 1F 72 88 65 41 03 00 34 90 CD BB

Command: LGET? #H2D,#HA000

Obtains the 32 bit memory value at H2D and address HA000; the response is:

#H8FA11278

Command Syntax

```
LP[UT] <address modifier>,<address>,<long>
```

Functional Description

Put Long, a device specific command. The LP command writes the <long> (32 bits) value at the address defined by the <address modifier> and <address>. The command executes by reading individual bytes.

Parameter Specification

`<address modifier>`

Type: Non-Decimal numeric program data
Range: '#H2D', '#H3D'

`<address>`

Type: Non-Decimal numeric program data
Range: for #H2D: '#H0' - '#HFFFF'
for #H3D: '#H0' - '#HFFFFFF'

`<long>`

Range: '#H0' - '#HFFFFFFFF'

Example

Suppose the memory values at hexadecimal address A000 in the VMEbus short address space are as shown:

A000 8F A1 12 78 DB 1F 72 88 65 41 03 00 34 90 CD BB

Command: LPUT #H2D,#HA000,#H0

Writes a 32 bit memory value at H2D and address HA000; the outcome is:

A000 00 00 00 00 DB 1F 72 88 65 41 03 00 34 90 CD BB

EXAMPLE DIAGNOSTIC COMMANDS

The ZMI 2000 System firmware is limited to "PUT" and "GET" commands. These commands can be used to read from any of the ZMI 2001 Measurement Board registers. The length of the PUT and GET commands can be 8 bits, 16 bits or 32 bits long.

The following examples assume the ZMI 2001 Measurement Board is in A16 address mode with SW1at address 0, SW2 at 0, SW3 at 4 and SW4 at 0.

The binary value shown below represents a sample position value in registers 14 and 16. Sample Position register 14 contains the most significant bits, MSB (0110 1111 1001 0000) and register 16 holds the least significant bits, LSB (1010 0011 0101 1100)

0110 1111 1001 0000 1010 0011 0101 1100

A request for a long (32 bit) read from the MSB Sample Position register (register 14) is written as follows:

LGET? #H2D, #H4014

The resultant value will be the equivalent of the 32 bits of data shown above. A 16 bit acquisition (WGET) from register 14 will output the first 16 bits (0110 1111 1001 0000) and an 8 bit request (BGET) will output the first 8 bits of information (0110 1111). The data is sent in a hexadecimal format.

Other Examples

Clear errors on Measurement Board:	WPUT #H2D, #H4000, #H01
Put value "FFFF" into User Excess Velocity Register:	WPUT #H2D, #H4018, #HFFFF
Enable User Excess Velocity MUX register to be read (OE M1):	WPUT #H2D, #H4006, #H0100
Read the enabled MUX register:	WGET? #H2D, #H400E
Enable address 0 x 1 of the EEPROM to be read:	WPUT #H2D, #H401C, #H81
Enable EEPROM Data RD MUX register to be read (OE M5):	WPUT #H2D, #H4006, #H0500

Chapter 5

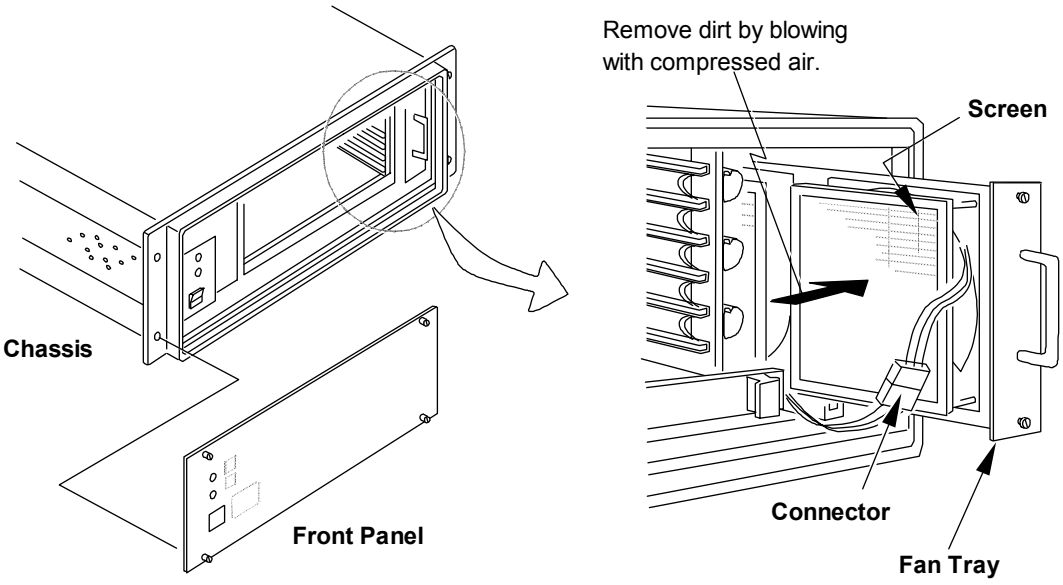
MAINTENANCE AND CUSTOMER SUPPORT

CHASSIS MAINTENANCE

The ZMI 2000 System Chassis is basically maintenance free. Occasionally, clean the Chassis covers with a mild, soap-based cleaner. Also, remove dust from the Chassis fan screens.

Cleaning the Fan Screens

1. Turn off power to the Chassis and disconnect the AC power cord.
2. Loosen four captive screws on the Chassis front panel and remove the panel.
3. Loosen two captive screws on the fan tray; slide out the tray a few inches.
4. Disconnect the fan connector and completely remove the fan tray by pulling it straight out.
5. Using compressed air, remove built-up dirt by blowing air through the fans in reverse direction of normal airflow.
6. Slide the fan tray into the Chassis and join the connector. Secure the captive screws, reinstall the front panel and connect the Chassis to power.



Cleaning Fan Screens

Figure 5-1

CUSTOMER SUPPORT

If you have difficulties, please refer to the provided manuals. They are designed to help you through the most common problems. If you still have questions or need assistance, contact the Zygo Customer Support directly.

Preparing for Customer Support

Before communicating with Customer Support, please have the following information *written down* so that we can provide you with the quickest possible solution to your problem.

- The equipment model number and serial number. If it is software related, the software version number.
- A description of the problem and the sequence of events that led up to your discovering the problem. Note any software error messages.
- Your company's name and complete shipping address.

Returning Equipment to Zygo

To return equipment to Zygo Corporation it is necessary to have an RA (return authorization) number. Contact Zygo Corporation for an RA number and instructions on packing and shipping equipment.

Note: Do *not* return equipment to Zygo without an RA number.

Appendix A
SYNTAX DRAWINGS

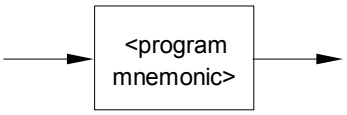
INTRODUCTION

This section provides illustrations of the data formats for the commands used when programming the ZMI 2000 System. The format for many of the commands is listed in either the Parameter or Response section of the command description (Chapter 4 of this manual).

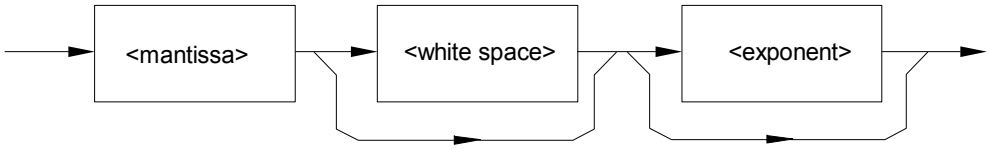
Note: Syntax elements are connected by lines with directional arrows to indicate the flow. Flow through the diagram proceeds from left-to-right. When an element is repeatable, a reverse right-to-left path is shown around and above the element. When an element can be by-passed, a left-to-right path is shown around and below the element. When there is a choice of elements, the path branches.

For additional information, consult the "IEEE Standard Codes, Formats, Protocols and Common Commands" guide available from IEEE. See Chapter 4 of this manual for the address for IEEE standards.

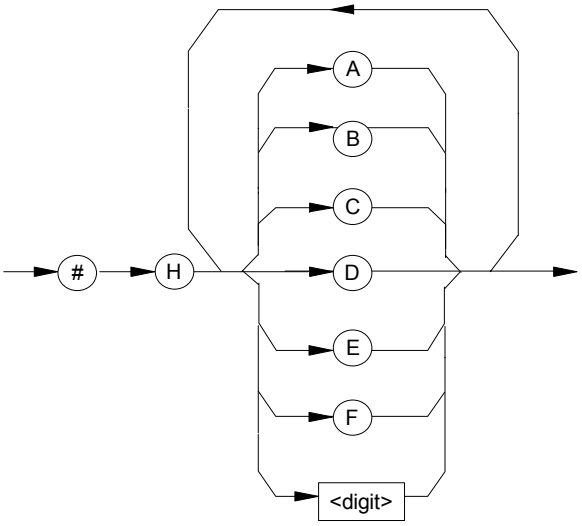
<CHARACTER PROGRAM DATA>



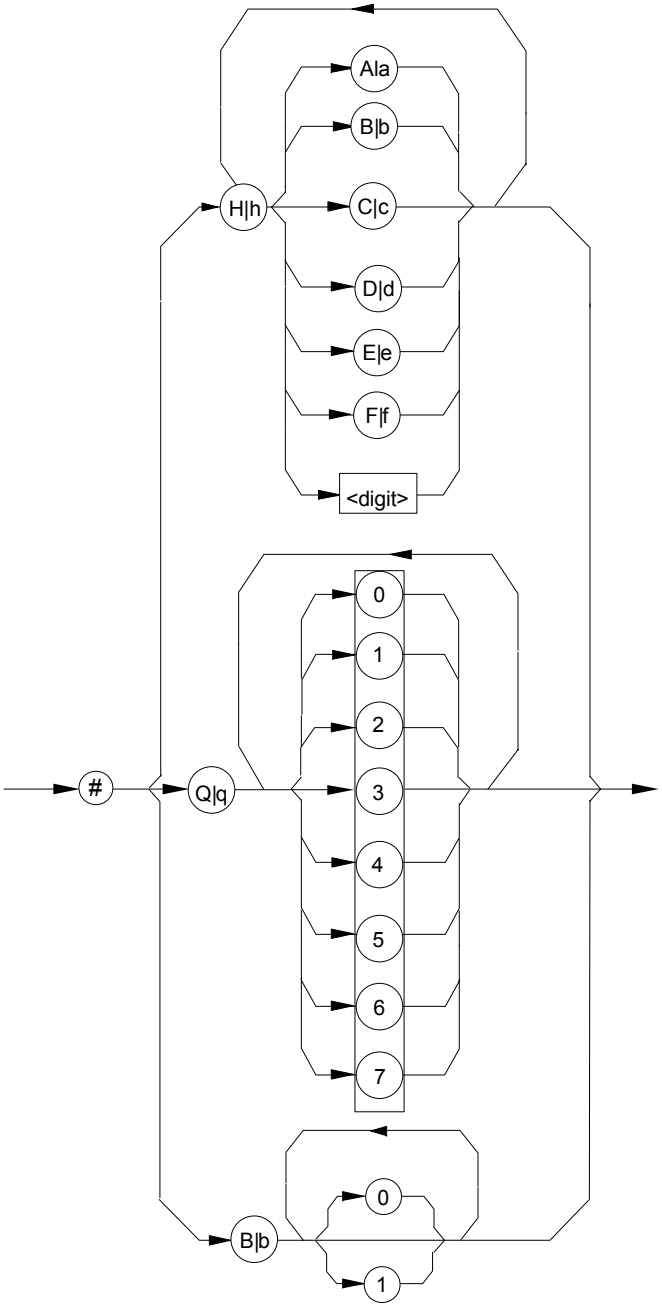
<DECIMAL NUMERIC PROGRAM DATA>



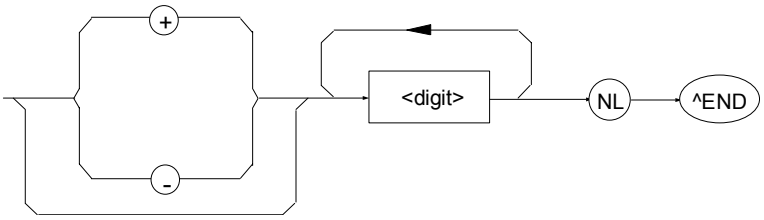
<HEXADECIMAL NUMERIC RESPONSE DATA>



<NON DECIMAL NUMERIC PROGRAM DATA>



<NR1 NUMERIC RESPONSE DATA>



<ARBITRARY ASCII RESPONSE DATA>