THE UNIDEX® 600 HARDWARE MANUAL

P/N: EDU154 (V1.5)

AEROTECH, Inc. • 101 Zeta Drive • Pittsburgh, PA. 15238-2897 • USA
Phone (412) 963-7470 • Fax (412) 963-7459
Product Service: (412) 967-6440; (412) 967-6870 (Fax); (412) 967-6427 (BBS)

www.aerotechinc.com

If you should have any questions about the UNIDEX 600 board or comments regarding the documentation, please refer to Aerotech online at:

http://www.aerotechinc.com.

For your convenience, a product registration form is available at our web site.

Our web site is continually updated with new product information, free downloadable software and special pricing on selected products.

The UNIDEX 600 Motion Controller
Hardware Manual Revision History:

Rev 1.0	December 08, 1995
Rev 1.0a	April 17,1996
Rev 1.1	Sept 25,1996
Rev 1.2	November 22, 1996
Rev 1.3	February 14, 1997
Rev 1.4	July 15, 1997
Rev 1.5	May 5, 1998

TABLE OF CONTENTS

∇ ∇ ∇

LIST OF FIGURES

∇ ∇ ∇

LIST OF TABLES

∇ ∇ ∇

DECLARATION OF CONFORMITY

Manufacturer's Name and Address

Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238-2897

Declares that the product:

Product Name: UNIDEX 600

Conforms to the following product specifications :

EMC: EN 55011: 1991 Class B Emissions
EN 50082-1: 1992 Immunity
IEC 801-2: 1984
IEC 801-3: 1984
IEC 801-4: 1988

and complies with EMC directive 89/336/EEC.

Pittsburgh, PA
May, 1998

David F. Kincel
Quality Assurance Manager

Ron Rekowski
Engineer Verifying Compliance

General notes concerning the test setup.

This product was tested at Washington Laboratories, LTD. in Gaithersburgh, MD on December 12, 1995. The report number is WLL 2987F.

The UNIDEX 600 was tested in a CE compliant class B personal computer and controlled two DC motors and one brushless AC motor through a DR500 drive chassis. The following modifications ensure compliance with the EMC directive 89/336/EEC.

- Add ferrites, P/N TDK ZCAT3035-13304 or equivalent on the DIO and OP500 cable. There is a ferrite located on each end of each cable.
- A 25-pin Sub-D filter, P/N SCI-56-725-001 or equivalent is installed on axis limit connectors of the DR500 that interfaces to each motor.
- Add 1 ferrite, P/N TDK ZCAT3035-13304 and two toroids located on the power cord of the DR500.
- A Schaffner filter, P/N FN2080-10-06 is installed on the DR500 AC power input.
- Bond shields of all cables to the DR500 chassis.
- Add ferrite to each motor cable at the DR500, P/N Steward 28B-029-0A0 or equivalent.

Failure to follow the described procedures may cause excessive emissions or reduced immunity.

▽ ▽ ▽

PREFACE

This section gives you an overview of topics covered in each of the sections of this manual as well as conventions used in this manual. This manual contains information on the following topics:

CHAPTER 1: OVERVIEW

This chapter contains an overview of the UNIDEX 600 motion controller as well as a sample system diagram. This chapter also contains precautionary notes about installing and using the UNIDEX 600 motion controller.

CHAPTER 2: GETTING STARTED

This chapter contains information about the components of the UNIDEX 600 system, unpacking and inspecting the equipment, and minimum hardware and software requirements for proper operation.

CHAPTER 3: HARDWARE CONFIGURATION

This chapter contains information about the hardware of the UNIDEX 600 system. This includes a discussion of the hardware components and individual jumper configurations.

CHAPTER 4: TECHNICAL DETAILS

This chapter supplies a variety of technical specifications for the UNIDEX 600. These specifications include test points, jumper configurations, encoder signal specifications, pinouts, outputs, bus specifications, and others.

CHAPTER 5: TROUBLESHOOTING

This chapter provides a reference tool if problems with the UNIDEX 600 arise.

CHAPTER 6: ENCODER EXPANSION CARD

This chapter contains information about the installation and configuration of the encoder expansion cards.

APPENDIX A: GLOSSARY OF TERMS

Appendix A contains a list of definitions of terms used in this manual.

APPENDIX B: OS/2

Appendix B contains quick, to the point information for OS/2 users.

APPENDIX C: WARRANTY AND FIELD SERVICE

Appendix C contains the warranty and field service policy for Aerotech products.

INDEX

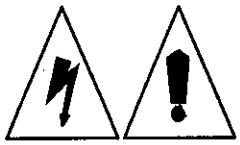
The index contains a page number reference of topics discussed in this manual. Locator page references in the index contain the chapter number (or appendix letter) followed by the page number of the reference. Locator page numbers may appear in one of four possible styles: standard serif font (e.g., 3-1) for normal references, boldface font (e.g., **3-1**) for references to illustrations, italic font (e.g., *3-1*) for references to tables, or boldface italic font (e.g., ***3-1***) for references to illustrations within tables.

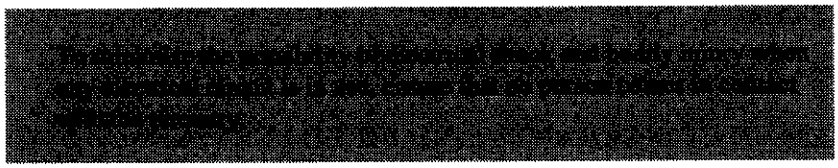
CUSTOMER SURVEY FORM

A customer survey form is included at the end of this manual for the reader's comments and suggestions about this manual. Reader's are encouraged to critique the manual and offer their feedback by completing the form and either mailing or faxing it to Aerotech.

Throughout this manual the following conventions are used:

- The terms UNIDEX 600 and U600 are used interchangeably throughout this manual
- The text <ENTER> is used to indicate that the Enter/Return key on the keyboard is to be pressed.
- Hexadecimal numbers are listed using a preceding "0x" (for example, 0x300, 0x12F, 0x01EA, etc.,) to distinguish them from decimal numbers
- Within the index, a bold locator page number (e.g., Components, **1-1**) indicates that the reference is part of an illustration. An italic locator page number (e.g., OP500 Cable Pinouts, *5-7*) indicates that the reference is part of a table. Text references are shown in a standard serif font (e.g., Software Setup, 3-1).
- Graphic icons or keywords may appear in the outer margins to provide visual references of key features, components, operations or notes.
- Danger and/or Warning symbols (see left) appear in the outer margins next to important precautions. Failure to observe these precautions could result in serious injury and/or damage to the equipment.
- The following statements apply wherever a Warning or Danger symbol appears within this manual. Failure to observe these precautions could result in serious injury to those performing the procedures and/or damage to the equipment.





When this controller is installed within a system, mechanical motion will occur. Care must be exercised that all personnel remain clear of any moving parts.

To minimize the possibility of bodily injury, make certain that all electrical power switches are in the off position prior to making any mechanical adjustments.

- This manual uses the symbol "∇ ∇ ∇" to indicate the end of a chapter.

Although every effort has been made to ensure consistency, subtle differences may exist between the illustrations in this manual and the component and/or software screens that they represent.

∇ ∇ ∇

CHAPTER 1: INTRODUCTION

In This Section:

1.1. Overview of the UNIDEX 600

The UNIDEX 600 is an ISA bus-based 16-bit motion control card that integrates with amplifiers, positioning stages and any number of optional accessories to form a complete, programmable, customized control system. A typical system is illustrated in Figure 1-1.

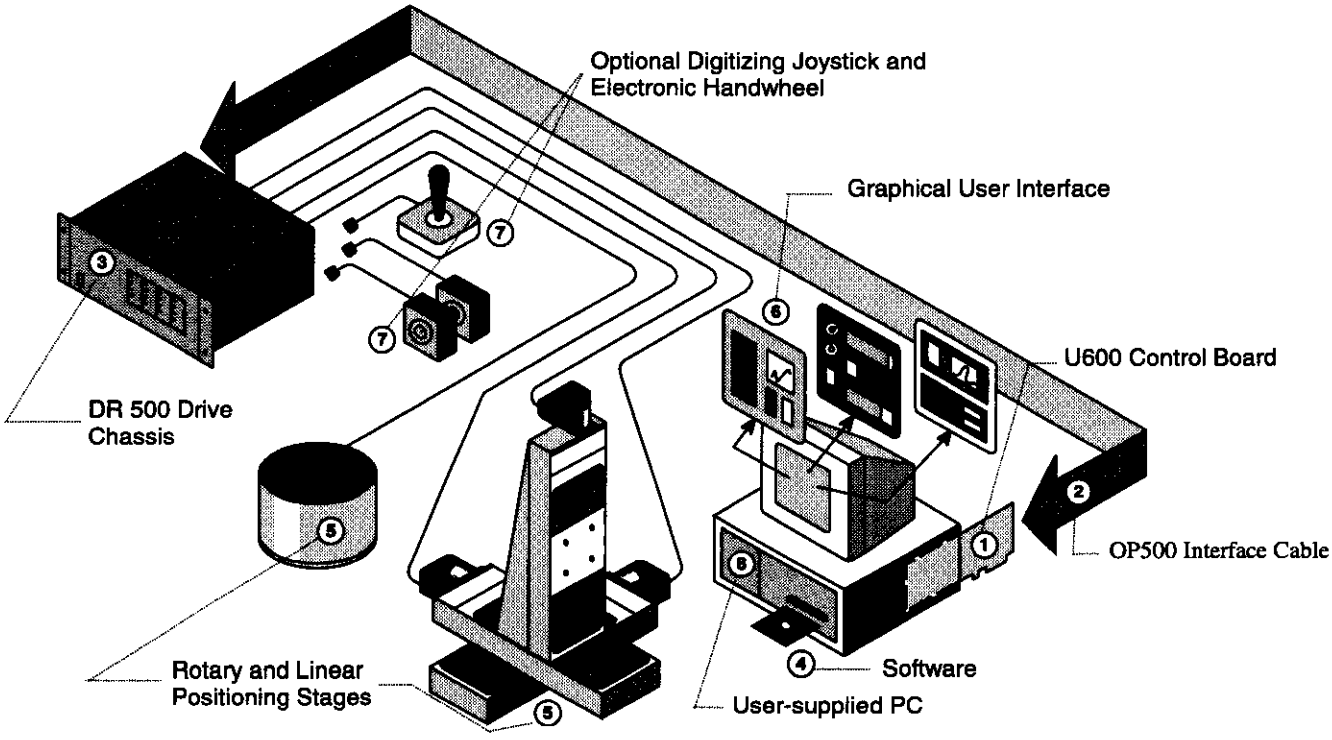
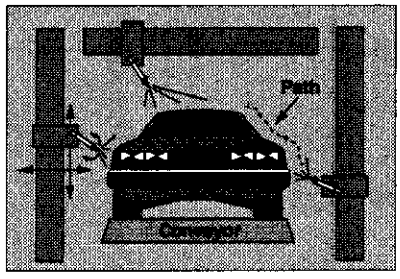
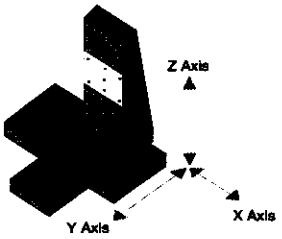


Figure 1-1. The UNIDEX 600 System Diagram



The UNIDEX 600 provides outstanding performance in a variety of demanding applications that require one or more of the following capabilities:

- Synchronous coordination of a large number of axes
- High speed, complex shape generation
- Control of multiple processes or multiple machines



The U600 control card, shown in Figure 1-2, contains 8 megabytes of Dynamic Random Access Memory (DRAM) and has the ability to contain up to 32 megabytes per card. The DRAM is managed by a burst memory controller and is accessible by the host through the PC bus. The U600 and user software provides full CNC RS-274/RS-447 G-code control of four axes per card (16 axes per card with Encoder Expansion cards).

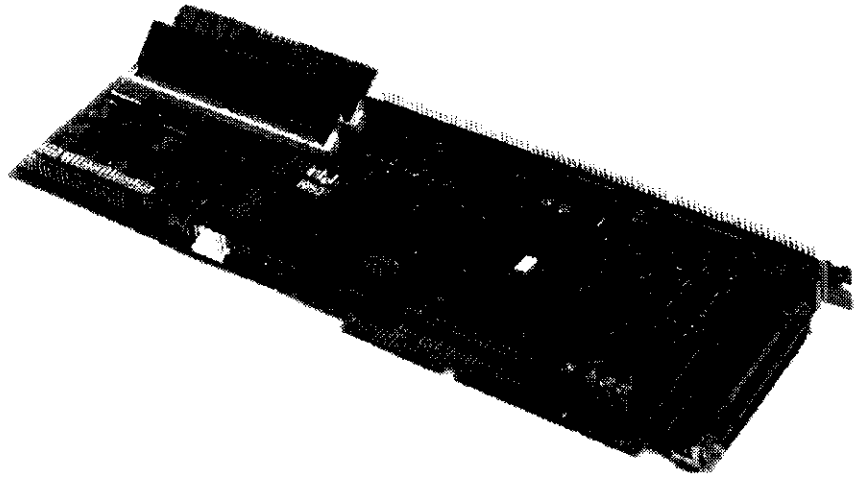


Figure 1-2. UNIDEX 600 Motion Control Card

The U600 offers flexibility, meaning the user can write application-specific "C" programs using Aerotech's software library of over 350 functions, or via Aerotech's 32 bit custom controls contained in Aerotech's Software Development Kit for Windows NT/95 (P/N SDK600-NT). The U600 provides support for Windows NT, Windows 95, and OS/2 applications that can even run simultaneously with the user's machine application programs.

1.2. Options and Accessories

The UNIDEX 600 supports a variety of options that include ISA bus digital I/O cards, iSBX option cards, and Aerotech's option cards. Table 1-1 lists some of the Aerotech options and accessories that can be used with the U600 motion controller. Refer to the *Aerotech Motion Control Product guide* for other available options and accessories.

Table 1-1. Options and Accessories Available for the UNIDEX 600

Option/Accessories	Description
BB500/	Breakout module when not using the DR500 chassis, requires OP500 cable
BB501/	Breakout module to interface with the BA Series amplifiers, requires OP500 cable
PB16/	Opto 22 I/O mounting rack for 8 IN/8 OUT
PB24/	Opto 22 I/O mounting rack for 16 IN/8 OUT
JBV/	Joystick with digitizing capability
PSO-PC/	Programmable, PC bus-based, position synchronized, laser firing control card used to provide output signals based on the positions of up to three axes.

Table 1-1. Options and Accessories Available for the UNIDEX 600 (Cont'd)

Options & Accessories	Description
RMX-PC/	Four-channel, PC bus resolution multiplier card (512*resolution) to multiply sinusoidal position feedback up to 512 times
4EN-PC/	Four-axis encoder and drive interface expansion card. Includes extension bus interconnect cabling 40 IN, 40 OUT of digital I/O, 4 12-bit A/D inputs, 8 channels of 16-bit D/A drive interface, 4 channels of encoder position feedback, CW, CCW, and home limit inputs
DR500/	External drive chassis for use with the U600 (refer to the *Aerotech Motion Control Product Guide* for available styles, types, and pricing information)
RDP-PC-n/	Resolver-to-digital 4-channel converter full length ISA I/O card format with 2 active channels
ISBX-ENC1/	Fifth encoder channel, input only, iSBX card
ISBX-IO48/	48 additional I/O points, iSBX card
OP500/	Interconnection cable from the controller to the DR500 chassis
BRKBPS-x/	Fail-safe brake control logic and power supply; specify axis (-x)
DIOSR/	Input/output extension cable (also required with AC brushless motor operation as Hall effect inputs)
HW500/	3.6 inch handwheel assembly and cable (25-pin male "D")
HW500-SBX/	3.6 inch handwheel assembly and cable that connects to iSBX-ENC (25-pin male "D")
SDK600-NT	Software Development kit for Windows NT/95 containing OLE custom controls
MMI600-NT	CNC MMI development kit for Windows NT/95
MMISRC600-NT	CNC MMI source code for Windows NT/95
UTIL600-NT	Standard utilities, libraries, and U600 firmware for Windows NT/95
UTIL600-OS/2	Standard utilities, libraries, and U600 firmware for OS/2
MMI600-OS/2	CNC MMI (mainmeu.exe) for OS/2

1.3. Safety Procedures and Warnings

The following statements apply wherever the Warning or Danger symbol appears within this manual. Failure to observe these precautions could result in serious injury to those performing the procedures and/or damage to the equipment.

∇ ∇ ∇

CHAPTER 2: GETTING STARTED

In This Section:

2.1. Introduction

This chapter steps the operator through unpacking the U600, system requirements for the PC, static precautions, and board inspection techniques. The user should read this section before attempting to install the UNIDEX 600 hardware. Hardware installation and hardware configuration are discussed in the chapters that follow.

2.2. Unpacking the UNIDEX 600 System

Before unpacking any components, visually inspect the containers of the U600 system for any evidence of shipping damage. If any such damage exists, notify the shipping carrier immediately.

All electronic equipment is wrapped in antistatic material and packaged with desiccant (a drying agent used to reduce moisture). Make certain that the antistatic material is not damaged during unpacking.

Remove the packing list from the UNIDEX 600 container. Make certain that the items listed on the packing slip are contained within the package. The following items should be found in every UNIDEX 600 system:

- The UNIDEX 600 Hardware Manual, Library Reference Manual, and User's Guide
- The UNIDEX 600 PC bus-based controller
- U600 software (on a double-sided, high-density floppy diskette)
- UNIDEX 600 packing slip (listing products shipped with the order)

If the user purchases the MMI software, Aerotech provides a second disk with the MMI software and an Operators Manual P/N EDU159.

The following list of additional items may be included with the UNIDEX 600 system, depending on the options and accessories that have been specified:

- The DR500 drive chassis (amplifier chassis with power supply)
- The OP500 interface cable (to connect the UNIDEX 600 to the DR500)
- The BB500 or BB501 breakout module (if the DR500 drive chassis is not used)
- Motor connector cables (to connect the motors to the DR500 drive chassis)
- JBV joystick and cable (with digitizing capability)
- Handwheel assembly and cable

2.3. Minimum Hardware Requirements and Recommended System Configurations

Minimum hardware requirements and recommended system configurations for the UNIDEX 600 are shown in Table 2-1.

Table 2-1. Minimum Hardware Requirements and Recommendations

[illegible]	[illegible]	[illegible]
Computer (microprocessor)	IBM PC Pentium 90 MHz (or higher) or 100% compatible	Pentium 133 MHz or higher
Computer Memory	16 MB of memory (conventional & extended)	32 MB of memory (conventional & extended)
Graphics Display	800x600	800x600
Free Hard Disk Space	10 MB	20 MB or more
Mouse	Any mouse supported by the computer	Any mouse supported by the computer
Floppy Disk Drives	3 1/2" DSHD	3 1/2" DSHD
OS/2	WARP 3.0 or higher	WARP 3.0 or higher
Windows	Windows 95/NT 4.0	Windows 95/NT 4.0

[illegible]

2.3.1. Power Consumption

This section is a reminder to the user if the user is installing all Aerotech boards into their PC. Table 2-2 lists the amount of current drawn by each board depending on the voltage. This information allows the user to ensure the power supply within the PC can handle the current consumption.

Table 2-2. Board Power Consumption

	Power Consumption*		
Board	+12 Volts	-12 Volts	+5 Volts
U600-8MB-33P	.02 Amps	.02 Amps	3.1 Amps
4EN-PC	.02 Amps	.02 Amps	1.6 Amps
PSO-PC	.3 Amps	.75 Amps	3.7 Amps
RDP-PC (2 axis)*	.1 Amps	.15 Amps	.4 Amps

* Reference Oscillator unloaded, add appropriate power per driven resolver.

2.4. Inspection of the UNIDEX 600 Control Board

Before touching the UNIDEX 600 control board, be sure to observe the electrostatic discharge precautions that are listed below.

The U600 board is sensitive to static electricity. To greatly reduce the possibility of board damage due to electrostatic discharge, adhere to the following precautions.

1. Do not remove the UNIDEX 600 PC board from the antistatic bag until it is ready to be installed. When removing a card from a system, immediately place the card in an antistatic bag.
2. Make certain that anyone who is handling the board (or any associated components) is wearing a properly grounded static strap.
3. When handling the UNIDEX 600 control board, hold the card by its edges and the mounting brackets. Avoid touching board components and the edge connectors that plug into the expansion slots.
4. Do not slide the UNIDEX 600 control board over any surface.
5. Avoid plastic, Styrofoam or vinyl in the work area.
6. Static charge buildup may be removed from an object by touching the object to a properly grounded piece of metal.

The UNIDEX 600 PC board was tested and inspected before being shipped from Aerotech, Inc. Vibration during shipment, however, may have loosened certain board components.

Immediately prior to installing the board into the system PC, visually inspect the UNIDEX 600 board. Make certain that all socketed ICs are firmly seated in their sockets. If a chip has become loose, carefully reinstall it into its socket. Be sure to observe the proper antistatic precautions mentioned above. The UNIDEX 600 board is illustrated in Figure 2-1.

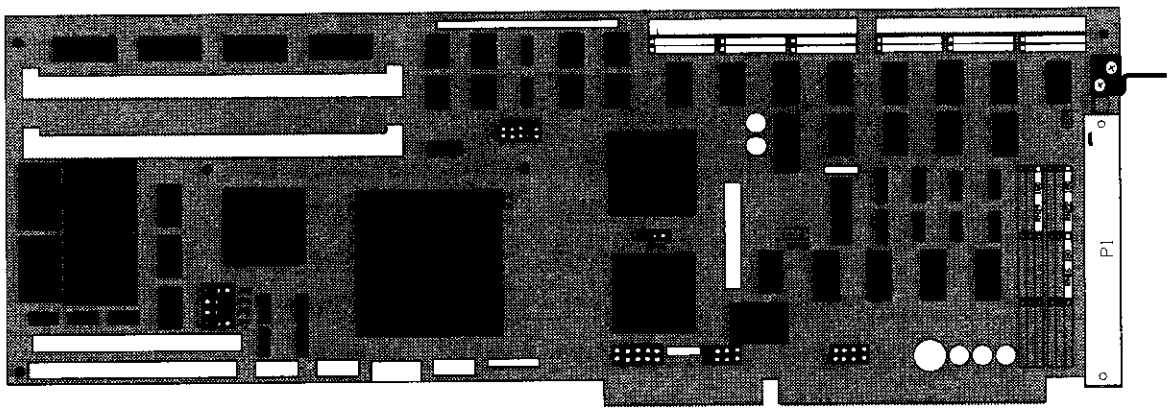
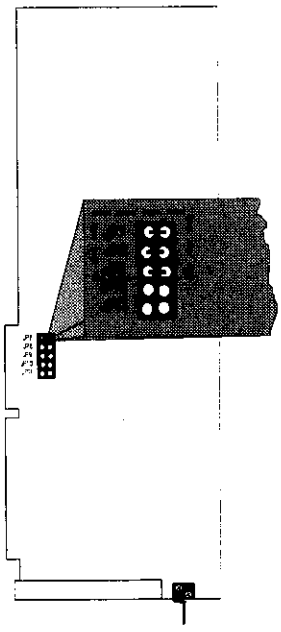


Figure 2-1. The UNIDEX 600 PC Board



2.5. UNIDEX 600 Control Board Jumper Configurations

This section summarizes the jumper and termination configurations of the UNIDEX 600 control board. The control board jumpers of the UNIDEX 600 board are configured at the factory according to the application specifications. If no specifications are available, the default jumper settings are used. For more details on jumper settings, refer to Chapter 3: Hardware Configuration.

2.5.1. Base Address Jumpers (JP7, JP8, and JP9)

Input/Output (I/O) base addresses for the UNIDEX 600 are assigned in hexadecimal address ranges. The UNIDEX 600 control board occupies 15 consecutive memory locations in the input/output (I/O) channel memory of the PC holding the UNIDEX 600 control board. The UNIDEX 600 control board is factory configured for address 0x220-0x22F. The UNIDEX 600 device driver is also set to this default address. If the UNIDEX 600 control board does not initialize properly or exhibits sporadic operation, there may be another board in the computer that is set to the same address. Use the diagnostic utility or CMOS setup program that comes with the PC to analyze which addresses are used, then try another UNIDEX 600 address (remember to reset/reboot the device driver). The default setting for the base address jumpers is address range (0x220-0x22F).

The address of a UNIDEX 600 board is set from jumpers JP7-JP9. These jumpers are located near the center of the control board. Each jumper has two pins. For each jumper, a plastic cap jumper is connected to create a unique base address. The combinations of base address jumper settings are shown in Table 2-3.

Table 2-3. Base Address Jumper Settings

PC I/O Base Address	JP9	JP8	JP7
0x220 - 22F (default)	1-2	1-2	1-2
0x230-23F	1-2	1-2	2-3
0x300-30F	1-2	2-3	1-2
0x310-31F	1-2	2-3	2-3
0x33033F	2-3	1-2	1-2
0x340-34F	2-3	1-2	2-3
0x350-35F	2-3	2-3	1-2
0x360-36F	2-3	2-3	2-3

2.5.2. PC Bus Interrupt Jumpers (JP4A through JP5D)

The UNIDEX 600 generates interrupt requests to the host PC. The interrupt level is jumper selectable and is outlined in Table 2-4. This table shows the available interrupt request (IRQ) lines that may be assigned using the PC bus interrupt jumpers.

The default interrupt configuration has JP5A installed. In this configuration, the UNIDEX 600 generates interrupt requests to the host computer on IRQ15.

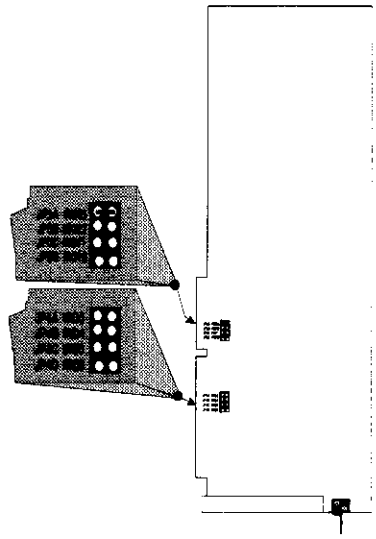


Table 2-4. PC Bus Interrupt Jumper Settings

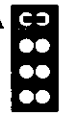
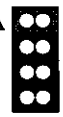
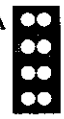
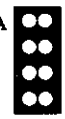
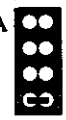
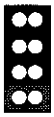
Jumper	State	Jumper Settings	Function
JP4A	IN		Interrupt IRQ3(COM2)
	OUT		IRQ3 not selected (default)
JP4B	IN		Interrupt IRQ4 (COM1)
	OUT		IRQ4 not selected (default)
JP4C	IN		Interrupt IRQ5 (LPT)
	OUT		IRQ5 not selected (default)
JP4D	IN		Interrupt IRQ9 (AT unassigned)
	OUT		IRQ9 not selected (default)
JP5A	IN		Interrupt IRQ15 (AT unassigned) (default)
	OUT		IRQ15 not selected
JP5B	IN		Interrupt IRQ3 (AT unassigned)

Table 2-4. PC Bus Interrupt Jumper Settings (Cont'd)

	OUT	JP5A 	IRQ3 not used (default)
JP5C	IN	JP5A 	Interrupt IRQ11
	OUT	JP5A 	IRQ11 not used (default)
JP5D	IN	JP5A 	Interrupt IRQ10
	OUT	JP5A 	IRQ10 not used (default)

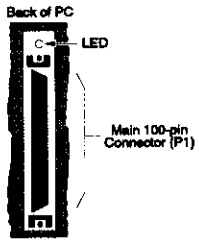
2.6. Installing the UNIDEX 600 PC Board

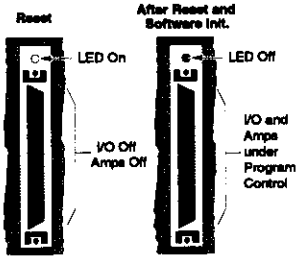
The UNIDEX 600 control board is a full-sized AT card that is installed into any of the PC's unused 16-bit expansion slots.

The procedure for installation of the UNIDEX 600 PC board is outlined in the steps that follow.

1. Turn OFF the power to the computer system unit and unplug the unit's power cord from the power source.

2. Open the computer cabinet. (Refer to the PC's User Manual for directions for opening the cabinet.)
3. Select an unused 16-bit (full-sized) expansion slot on the computer mother board.
4. Locate the bracket of the selected expansion slot. Remove the screw and pull the bracket out of the expansion slot.
5. Observing anti-static safeguards, line up the UNIDEX 600 PC board with the expansion slot and guide rails. Lower the board into the slot until each of its edge connectors rests on an expansion slot receptacle. Using evenly distributed pressure, push the board straight down until it is fully inserted into the expansion slot.
6. Secure the board to the chassis by reinstalling the bracket screw that was removed in step 4.





The LED (visible from the rear of the system) of the UNIDEX 600 board must come ON during system initialization and then go OFF and remain OFF. During subsequent system software resets, the LED should come ON for approximately 1 second, and then turn OFF.

The LED should remain ON following system power up. This should disable any amplifiers and set the output bus to the high impedance state.

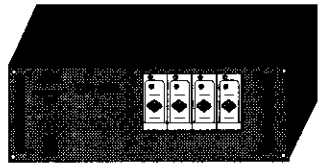
If the LED does not come ON or if it stays ON following software initialization, refer to the Troubleshooting section of this manual for help.

2.7. Installing Additional Aerotech Components

System installation varies with the number and types of components that have been purchased from Aerotech, Inc. to complement the UNIDEX 600 PC bus controller. The following descriptions may not be applicable to all systems.

2.7.1. The DR500 Drive Rack and OP500 Cable

The DR500 drive chassis is an integral part of the UNIDEX 600 control system. It houses up to four Aerotech amplifiers (DC servo, AC brushless, or microstepping), provides power for the drive section of the servo system, and acts as a breakout for all control and I/O signals. The DR500 is available in rack mount, panel mount and desktop configurations. The individual amplifiers (a maximum of four) are inserted into the front of the DR500 panel. The back of the DR500 has all the cable connectors as well as descriptions for each. The rear panel connector layout of the DR500 is illustrated in Figure 2-2. For more information, refer to the DR500 Drive Chassis Operations and Technical Manual (part number EDA120). Refer to the *Aerotech Motion Control Product Guide* for available styles, part numbers and pricing information.



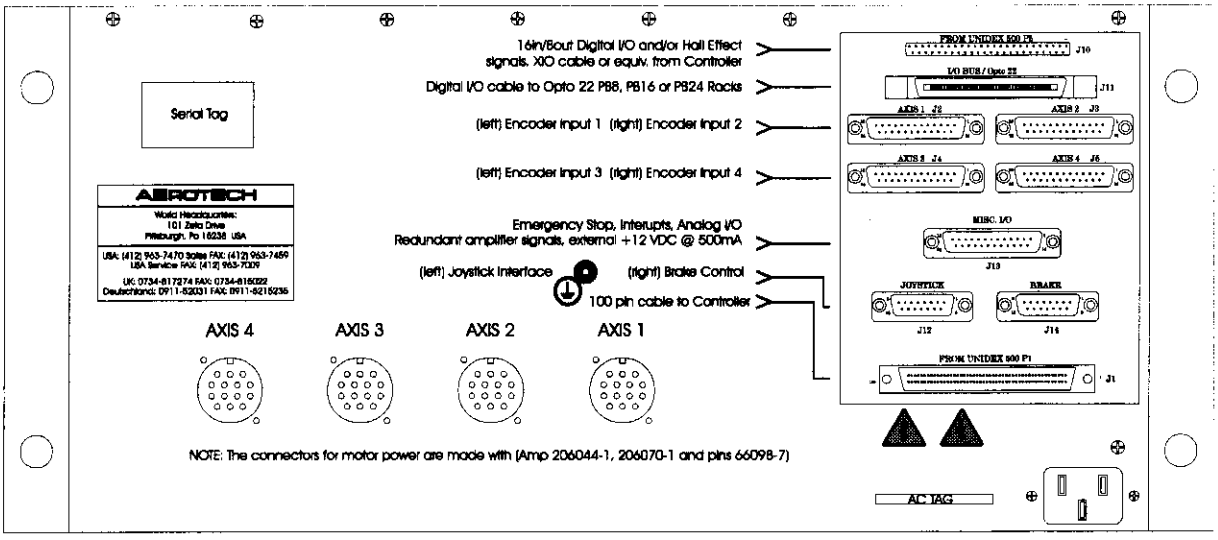


Figure 2-2. Rear Panel Connectors of the DR500 Amplifier Chassis

The OP500 cable is used to connect the UNIDEX 600 PC board to the DR500 drive chassis. One end of this cable connects to the UNIDEX 600 PC board and the other end connects to the J1 connector located on the back of the DR500 chassis. See Figure 2-2.

2.7.2. The UNIDEX 600 BB500 Breakout Module

The main connector of the UNIDEX 600 is a 100-pin interface that is intended to connect directly to the DR500. If a DR500 is not used in a particular application, then the signals from this 100-pin connector (explained in detail in Chapter 4: Technical Details) need to be accessed individually or "broken out" and routed to the appropriate amplifiers, motors, etc. The BB500 Breakout Module provides an easy method of accessing the signals of the 100-pin output connector of the UNIDEX 600 PC board.

The BB500 is connected to the 100-pin connector of the UNIDEX 600 (accessible from the rear of the PC) using the OP500 cable. Connections from a user-supplied drive rack may then be made to the terminal blocks on the BB500. The BB500 is illustrated in Figure 2-3.

IMPORTANT

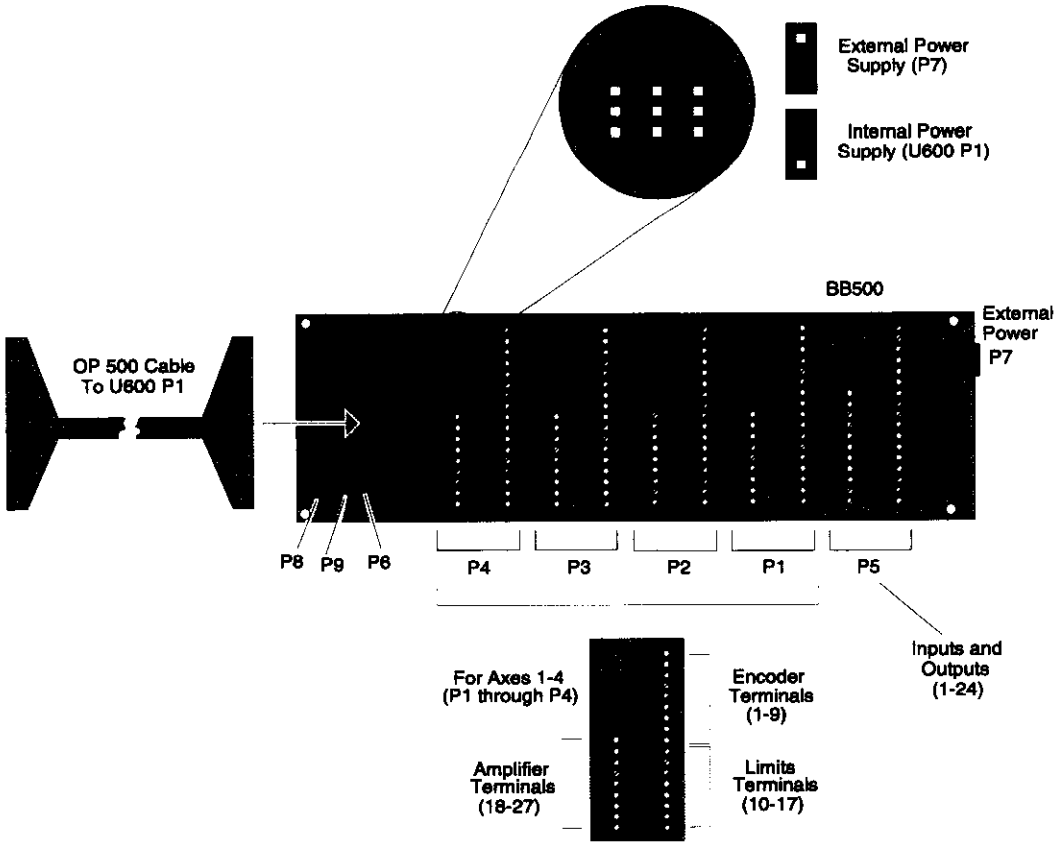


Figure 2-3. Components of the BB500 Breakout Module

The BB500 can be powered internally (by way of an interconnecting cable that links the UNIDEX 600 and the BB500) or from an external source using a keyed, pluggable connector. The power source (either internal or external) is selected by using a set of jumpers on the BB500 board. Inputs, outputs, encoder signals, limit signals and amplifier signals are available on the BB500. The BB500 also generates a third current signal so that brushless motors can be used. For more information, refer to Chapter 4: Technical Details. Refer to the *Aerotech Motion Control Product Guide* for available styles, part numbers and pricing information.

Another version of the BB500 (the BB501) is available for applications that use brushless amplifiers from the Aerotech BA SERIES. For additional information about the BB500

and BB501 breakout modules, refer to Chapter 3. For information on using Aerotech's BA SERIES line of brushless motors, refer to the *BA Series Users Manual, P/N EDA 121.*

2.7.3. The PB8, PB16 and PB24 I/O Boards

The PB8, PB16 and PB24 options are interface boards that provide optical isolation of UNIDEX 600 inputs and outputs (up to 16 outputs and 16 inputs) in the form of terminal blocks. An OPTO-22 option board is connected to the P9 connector (the Opto 22 I/O bus) of the UNIDEX 600 card using a 50-pin ribbon cable (provided). The PB8 provides 8 outputs, the PB16 provides 8 inputs and 8 outputs, and the PB24 provides 16 inputs and 8 outputs. The PB8, PB16 and PB24 options are also available on the DR500. Refer to Figure 2-4 and Figure 2-5.

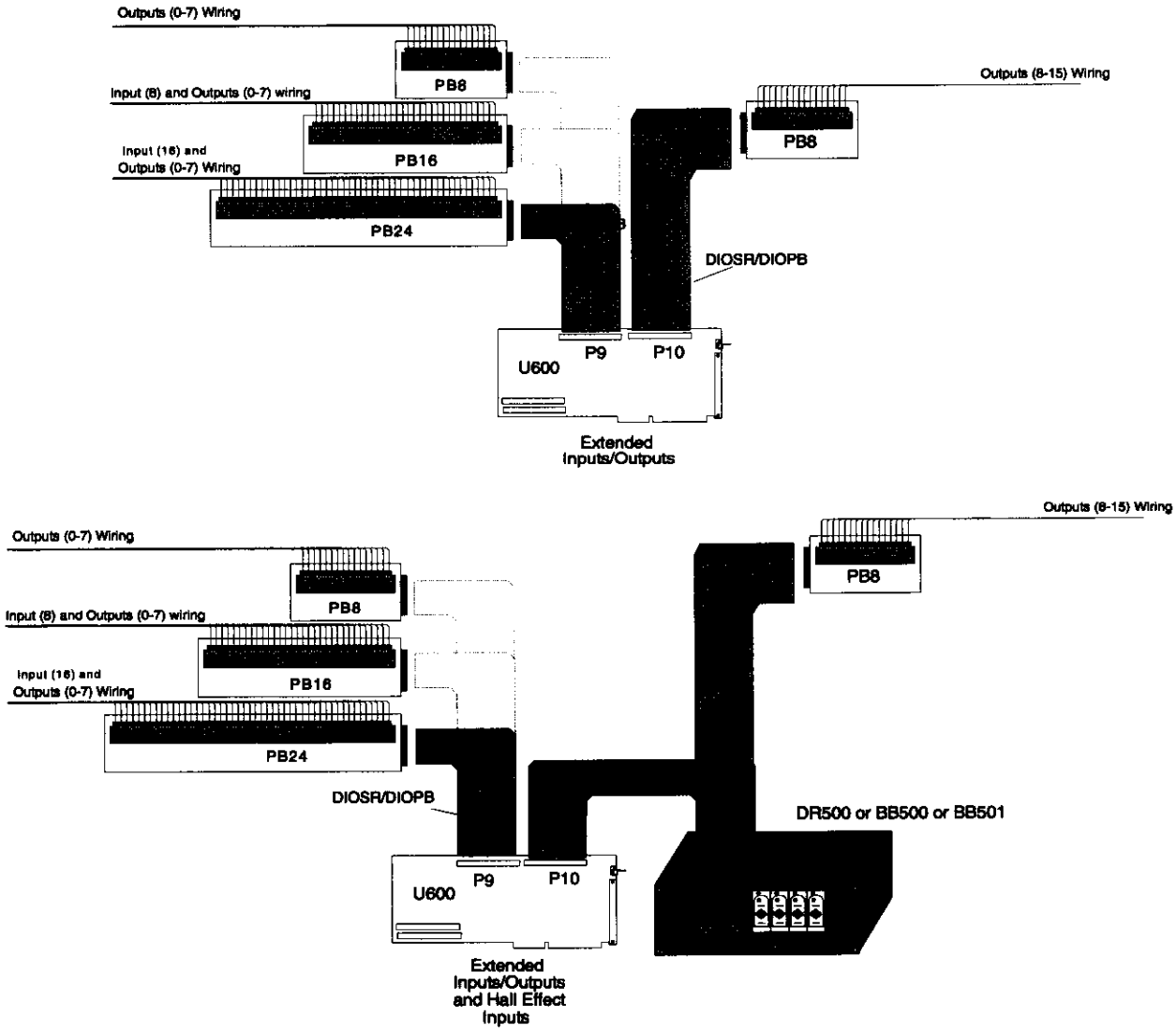


Figure 2-4. Sample Uses of the PB# Boards and the DIO500 Cable

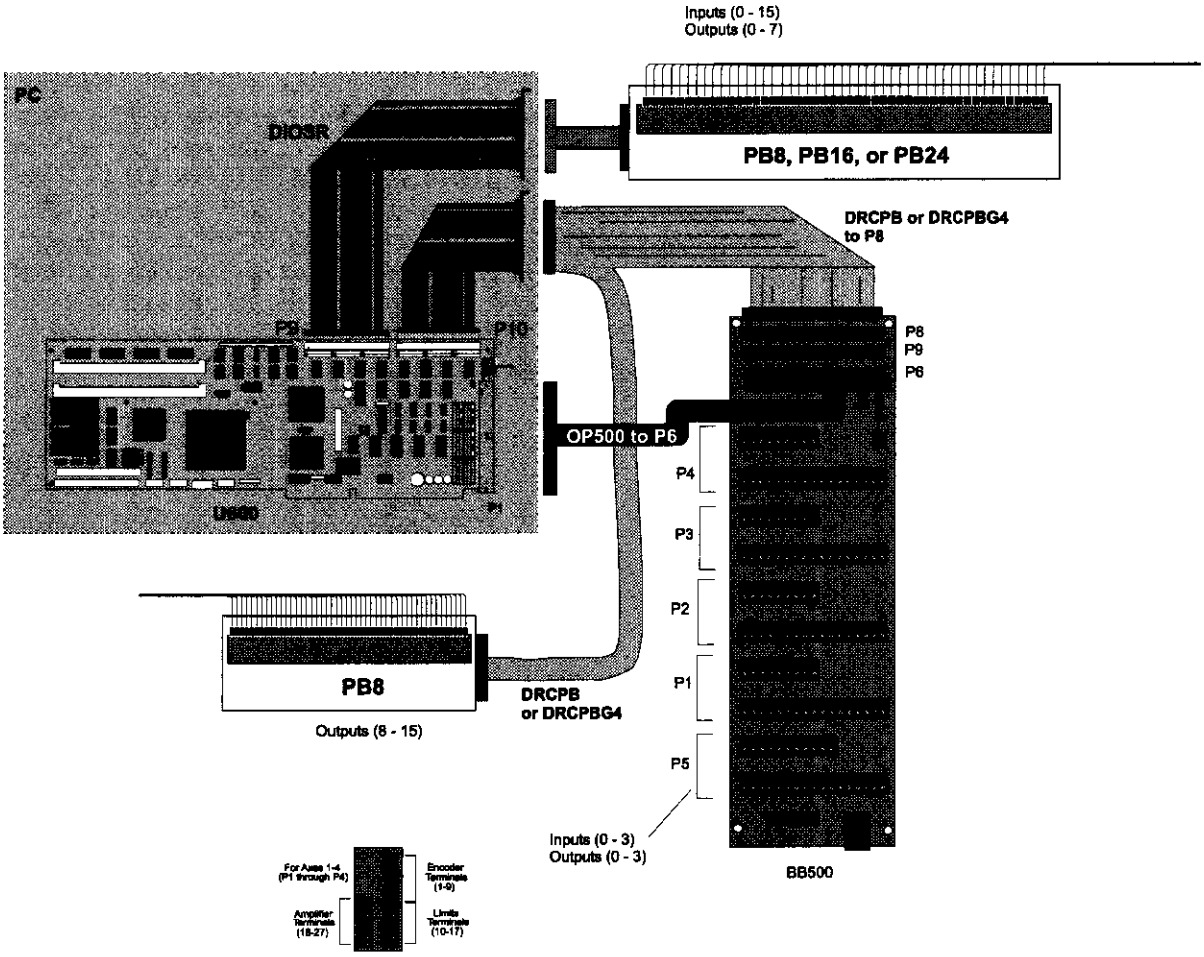
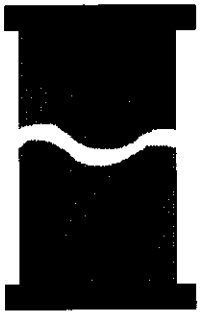


Figure 2-5. Sample Uses of the PB# Boards and the DRCPB and DRCPBG4 Cables

For more information, refer to Chapter 4: Technical Details and the *Aerotech Motion Control Product Guide*.

2.7.4. The DIO I/O Cable



DIO is the extended I/O cable option of the UNIDEX 600. This cable serves two purposes. One such use is to allow more than four user inputs or outputs (as is the case when the PB8, PB16 or PB24 I/O board is used). The other use is for applications that use brushless motors with Hall effect sensors. In such cases, the necessary Hall effect signals are not available through the standard OP500 cable; therefore, the DIO is connected between the U600 and the DR500. Different versions of the DIO I/O cable are available for (1) directly connecting the U600 and a PB8, PB16 or PB24 interface board to allow additional inputs/outputs, (2) connecting the U600 to the DR500 (to provide Hall effect inputs and extra I/O) with an additional connection for an optional PB8, PB16 or PB24 I/O board, and (3) connecting the U600 to the BB501 (to provide Hall offset inputs and extra I/O). Refer to Figure 2-4 and Figure 2-5. For additional information, refer to the *Aerotech Motion Control Product Guide.*

∇ ∇ ∇

CHAPTER 3: HARDWARE CONFIGURATION

In This Section:

3.1. Introduction

This chapter explains how to configure and install the UNIDEX 600 PC board as well as optional hardware accessories. Configuration of the PC board includes jumper settings and pull-up termination resistor settings. The installation portion discusses proper installation techniques for the PC board as well as several optional accessories.

3.2. Minimum Hardware Requirements and Recommended System Configurations

Minimum hardware requirements and recommended system configurations for the UNIDEX 600 are shown in Table 3-1.

Table 3-1. Minimum Hardware Requirements and Recommendations

Equipment	Minimum	Recommended
Computer	IBM Pentium PC, 90 MHz or higher and 100% compatibles	Pentium 133 MHz or higher
Computer Memory	16 MB of memory (conventional & extended)	32 MB of memory (conventional & extended)
Graphics Display	800x600	800x600
Free Hard Disk Space	10 MB	20 MB or more
Mouse	Any mouse supported by the computer	Any mouse supported by the computer
Floppy Disk Drives	3 1/2" double-sided, high density	3 1/2" double-sided, high density
OS/2	WARP 3.0 or higher	WARP 3.0 or higher
Windows	Windows 95/NT 4.0	Windows 95/NT 4.0

3.2.1. Power Consumption

This section is a reminder to the user if the user is installing all Aerotech boards into their PC. Table 3-2 lists the amount of current drawn by each board depending on the voltage. This information allows the user to ensure the power supply within the PC can handle the current consumption.

Table 3-2. Board Power Consumption

U600-8MB-33P	.02 Amps	.02 Amps	3.1 Amps
4EN-PC	.02 Amps	.02 Amps	1.6 Amps
PSO-PC	.3 Amps	.75 Amps	3.7 Amps
RDP-PC (2 axis)*	.1 Amps	.15 Amps	.4 Amps

* Reference Oscillator unloaded, add appropriate power per driven resolver.

3.3. UNIDEX 600 Control Board Jumper Configurations

This section outlines the jumper and termination configurations of the UNIDEX 600 control board. Descriptions are based on six functional groups of jumpers:

- Base address jumpers
- PC bus interrupt jumper
- iSBX expansion port interrupt jumper
- iSBX clock signal jumpers
- Multi-board synchronization jumpers
- Encoder type configurations

The control board jumpers of the UNIDEX 600 board are configured at the factory according to the application specifications. If no specifications are available, the default jumper settings are used. The locations of the UNIDEX 600 control board jumpers are shown in Figure 3-1 on page 3-3.

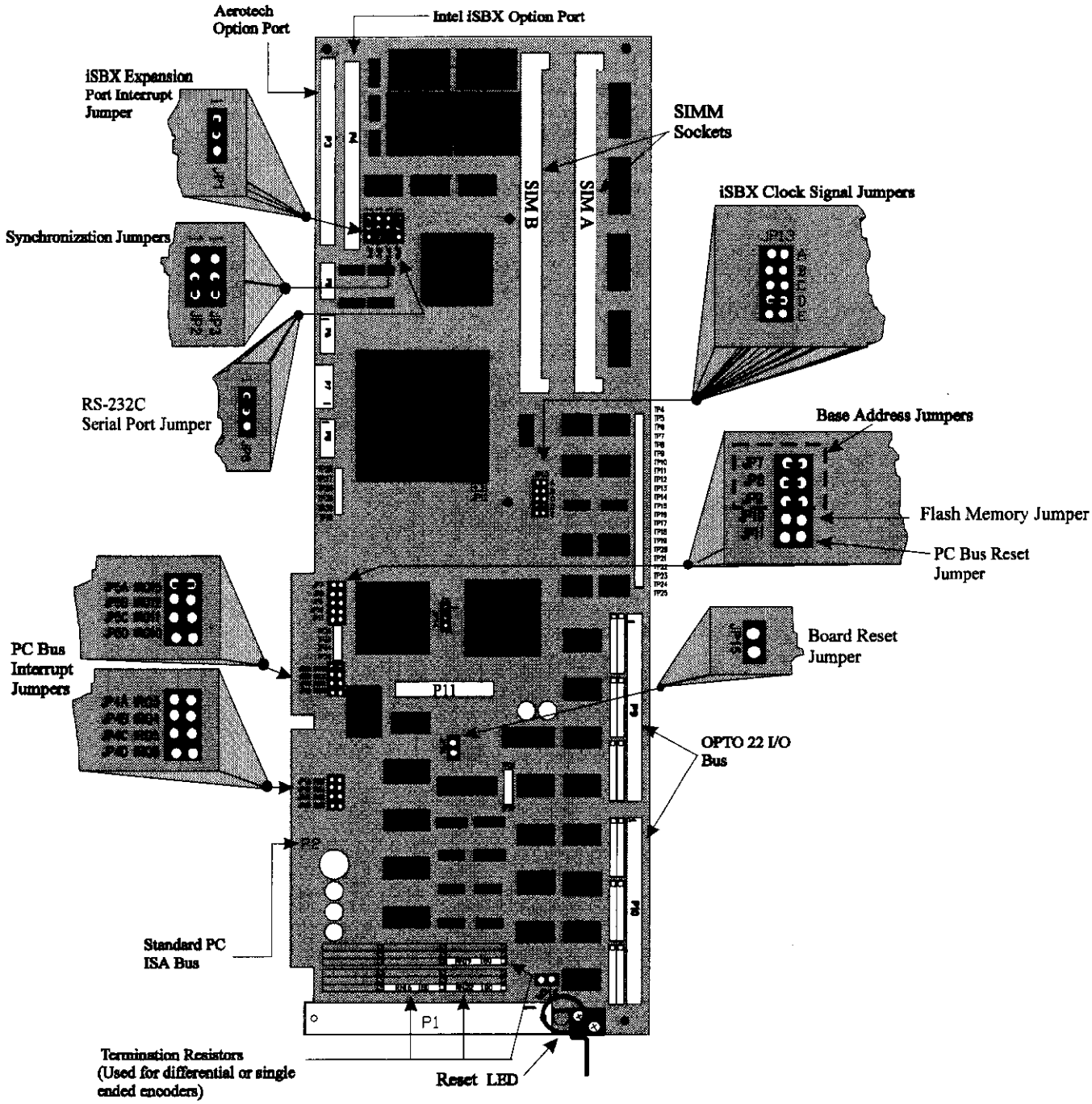
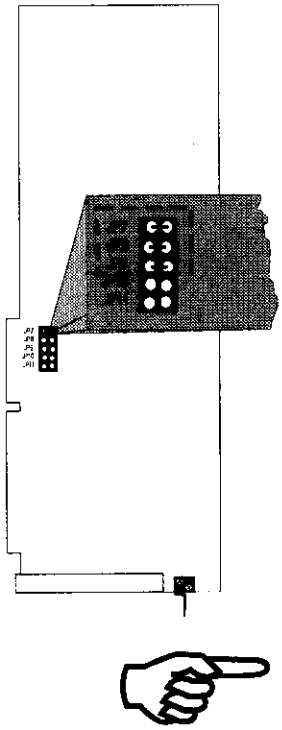


Figure 3-1. UNIDEX 600 PC Board



3.3.2. Base Address Jumpers (JP7, JP8, and JP9)

Input/Output (I/O) base addresses for the UNIDEX 600 are assigned in hexadecimal address ranges. The UNIDEX 600 control board occupies 15 consecutive memory locations in the input/output (I/O) channel memory of the PC holding the UNIDEX 600 control board. The UNIDEX 600 control board is factory configured for address 0x220-0x22F. The UNIDEX 600 device driver is also set to this default address. If the UNIDEX 600 control board does not initialize properly or exhibits sporadic operation, there may be another board in the computer that is set to the same address. Use the diagnostic utility or CMOS setup program that comes with the PC to analyze which addresses are used, then try another UNIDEX 600 address (remember to reset/reboot the device driver). The default setting for the base address jumpers is address range (0x220-0x22F).

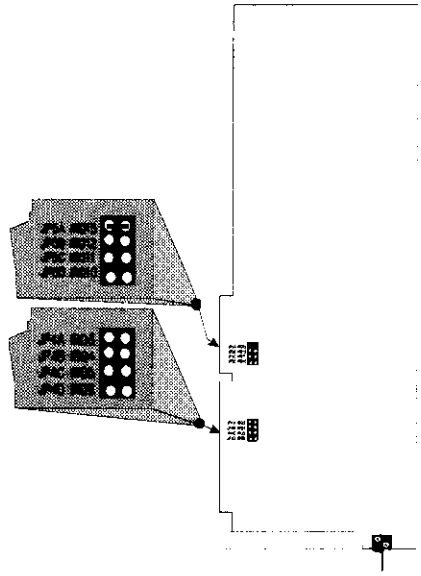
The address of a UNIDEX 600 board is set from jumpers JP7-JP9. These jumpers are located near the center of the control board. Each jumper has two pins. For each jumper, a plastic cap jumper is connected to create a unique base address. The combinations of base address jumper settings are shown in Table 3-3. The locations of the UNIDEX 600 control board jumpers are shown in Figure 3-1 on page 3-3.

Table 3-3. Base Address Jumper Settings

PC I/O Base Address	JP9	JP8	JP7
0x220 - 22F (default)	▣	▣	▣
0x230-23F	▣	▣	▣
0x300-30F	▣	▣	▣
0x310-31F	▣	▣	▣
0x330-33F	▣	▣	▣
0x340-34F	▣	▣	▣
0x350-35F	▣	▣	▣
0x360-36F	▣	▣	▣

3.3.3. PC Bus Interrupt Jumpers (JP4A through JP5D)

The UNIDEX 600 generates interrupt requests to the host PC. The interrupt level is jumper selectable and is outlined in Table 3-4. This table shows the available interrupt request (IRQ) lines that may be assigned using the PC bus interrupt jumpers. The locations of the UNIDEX 600 control board jumpers are shown in Figure 3-1 on page 3-3.

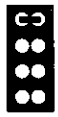
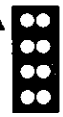
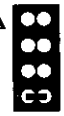
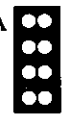


The default interrupt configuration has JP5D installed. In this configuration, the UNIDEX 600 generates interrupt requests to the host computer on IRQ10.

Table 3-4. PC Bus Interrupt Jumper Settings

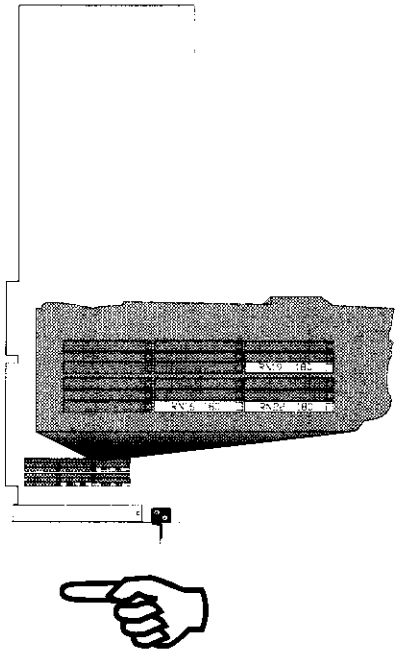
Jumper	State	Jumper Settings	Function
JP4A	IN	JP4A	Interrupt IRQ3(COM2)
	OUT	JP4A	IRQ3 not selected (default)
JP4B	IN	JP4A	Interrupt IRQ4 (COM1)
	OUT	JP4A	IRQ4 not selected (default)
JP4C	IN	JP4A	Interrupt IRQ5 (LPT)
	OUT	JP4A	IRQ5 not selected (default)
JP4D	IN	JP4A	Interrupt IRQ9 (AT unassigned)
	OUT	JP4A	IRQ9 not selected (default)

Table 3-4. PC Bus Interrupt Jumper Settings (Cont'd)

JP5A	IN	JP5A 	Interrupt IRQ15 (AT unassigned) (default)
	OUT	JP5A 	IRQ15 not selected
JP5B	IN	JP5A 	Interrupt IRQ12 (AT unassigned)
	OUT	JP5A 	IRQ12 not used (default)
JP5C	IN	JP5A 	Interrupt IRQ11
	OUT	JP5A 	IRQ11 not used (default)
JP5D	IN	JP5A 	Interrupt IRQ10
	OUT	JP5A 	IRQ10 not used (default)

3.3.4. Encoder Type Configuration for Differential or Single Ended Encoders (RN16, RN19 and RN22)

The UNIDEX 600 is equipped with three resistor networks (RN16, RN19 and RN22) as standard. These resistor networks work as termination resistors when using differential encoders. This is the default configuration of the U600 board.



The following tables describe the resistor networks and their connections. By default, the four encoder interfaces are configured with 180 Ω termination resistor networks. For single-ended encoder configuration, see section 4.3.2.

If an application does not require termination resistors for all four axes, then single 180 Ω resistors must be re-installed for the remaining axes (as appropriate) where the resistor network was removed. The 180 Ω termination resistor(s) are not provided.

The locations of the UNIDEX 600 termination resistors are shown in Figure 3-1 on page 3-3. For additional information, refer to Chapter 4: Technical Details.

Table 3-5. Termination Resistor Configuration for Axis 1 Encoders

RN #	Main Pinouts	Axis Signals	RN Pin Numbers	180 Ω Resistor *
RN19	12	MRK1-	1	
	11	MRK1+	2	
RN22	8	SIN1-	2	
	7	SIN1+	1	
RN22	10	COS1-	4	
	9	COS1+	3	

* Use a 180 Ω termination resistor for standard differential encoders.

Table 3-6. Termination Resistor Configuration for Axis 2 Encoders

RN #	Motor Pinouts	Axis Signals	26LS32 Pinouts	180 Ω Resistor *
RN19	20	MRK2-	3	
	19	MRK2+	4	
RN22	16	SIN2-	6	
	15	SIN2+	5	
RN22	18	COS2-	8	
	17	COS2+	7	

* Use a 180 Ω termination resistor for standard differential encoders.

Table 3-7. Termination Resistor Configuration for Axis 3 Encoders

RN #	Motor Pinouts	Axis Signals	26LS32 Pinouts	180 Ω Resistor *
RN19	28	MRK3-	5	
	27	MRK3+	6	
RN16	24	SIN3-	2	
	23	SIN3+	1	
RN16	26	COS3-	4	
	25	COS3+	3	

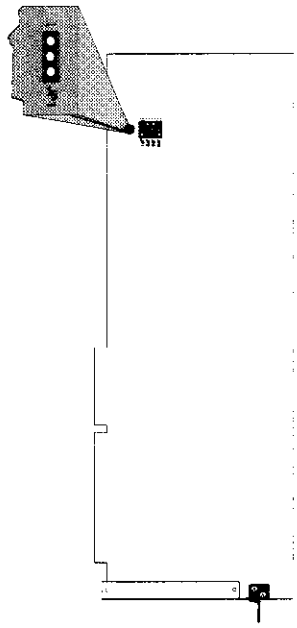
* Use a 180 Ω termination resistor for standard differential encoders.

Table 3-8. Termination Resistor Configuration for Axis 4 Encoders

RN #	Motor Pinouts	Axis Signals	26LS32 Pinouts	180 Ω Resistor *
RN19	36	MRK4-	7	
	35	MRK4+	8	
RN16	32	SIN4-	6	
	31	SIN4+	5	
RN16	34	COS4-	8	
	33	COS4+	7	

* Use a 180 Ω termination resistor for standard differential encoders.

3.3.5. iSBX Expansion Port Interrupt Jumper (JP1)



The iSBX specification offers two different interrupt levels from the iSBX expansion board. These interrupt levels make interrupt requests to the base board (the U600 control card). The U600 only allows one of these two levels to request an interrupt of the U600. The interrupt levels are jumper selectable through JP1 and are outlined in Table 3-9. JP1 permits the user to select the interrupt level that causes an interrupt to the U600.

Table 3-9. iSBX Expansion Port Interrupt Jumper Settings

Interrupt Level	Setting (JP1)
Level 1 (MINTR1)	1
Level 0 (MINTR0)	1
No Interrupt (default)	1

Revision B boards and below: JP1 must not be installed.

3.3.6. RS-232C Serial Port Jumper (JP6)

The RS-232C specification allows the DCD and CTS inputs on serial ports 1 and 2 to be set to true (active). The signals are jumper selectable and can be either a +12 volt or -12 volt bias depending on the setting of jumper JP6, refer to Table 3-10.

Table 3-10. RS-232C Serial Port Jumper Settings

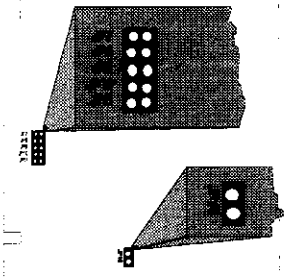
RS-232C Voltage Bias	Setting JP6
+12V bias to CTS and DCD inputs on serial ports 1 and 2	1
-12V bias to CTS and DCD inputs on serial ports 1 and 2	1
No bias	1

3.3.7. Flash Memory Jumper (JP10)

The flash memory specification allows the UNIDEX 600 to boot up through the optional on-board flash memory. If the option is present on the board, it is jumper selectable through jumper JP10, refer to Table 3-11.

Table 3-11. Flash Memory Jumper Settings

Flash Memory	Setting (JP10)
Enable flash memory option	
Disable flash memory option (default)	

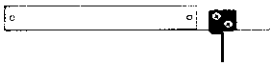


3.3.8. PC Bus Reset Jumper (JP11)

The PC bus reset specification allows the UNIDEX 600 to be reset through the ISA bus reset signal. This is jumper selectable and is dependant on the configuration of jumper JP11, see Table 3-12.

Table 3-12. PC Bus Reset Jumper Settings

PC Bus Reset	Setting (JP11)
Do not reset UNIDEX 600 on AT Bus reset	
Reset the UNIDEX 600 on AT Bus reset (default)	

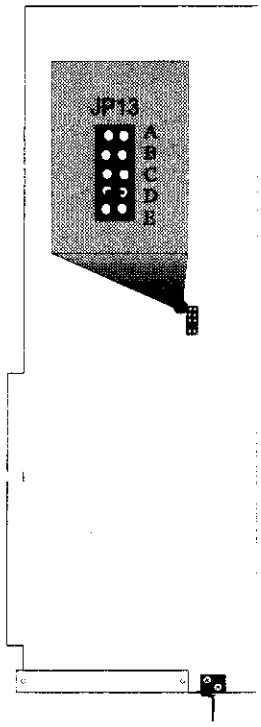


3.3.9. External Reset Jumper (JP15)

The UNIDEX 600 can be reset to its power-up state externally by pulling connector P10, pin 25 to common. The external reset is jumper selectable through JP15 and is outlined in Table 3-13.

Table 3-13. External Reset Jumper Settings

External Reset	Setting (JP15)
Enable UNIDEX 600 board reset through P10-25	
No external reset through P10-25 (default)	

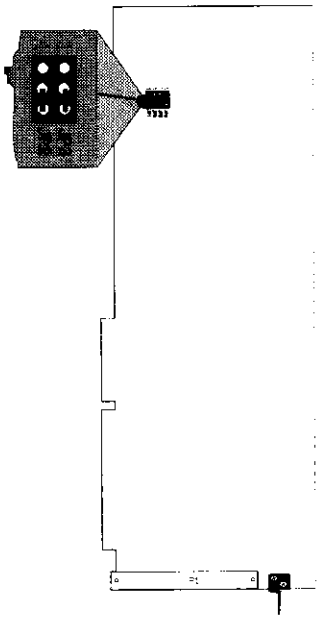


3.3.10. iSBX Clock Signal Jumpers (JP13A through JP13E)

The iSBX specification provides a user definable pin. The U600 allows the user to select the clock signal to drive the pin by selecting one of the JP13 jumpers. The available clock signal selections are outlined in Table 3-14.

Table 3-14. iSBX Clock Signal Jumper Settings

Clock Signal	Jumper Settings
10 Megahertz clock	JP13 A
10 Kilohertz clock	JP13 B
20 kilohertz clock	JP13 C
40 Kilohertz clock (default)	JP13 D
80 Kilohertz clock	JP13 E



3.3.11. Multi-board Synchronization Jumpers (JP2 &JP3)

The U600 provides the capability to synchronize multiple boards in a system. These boards can be synchronized for two types of synchronization through the settings of jumpers JP2 and JP3. Each type has a similar user hardware interface comprised of an associated jumper, synchronized input, and a buffered synchronized output.

The first mode is servo loop synchronization, refer to Figure 3-2. This mode permits synchronization of the servo loop interrupt that reads the position and velocity from the feedback device(s) and updates the commanded output to the motor. This interrupt (a rate of 4 kilohertz [.25 milli-seconds]) can be generated from a source on the U600 board in the normal mode as well as the "Master" mode by setting jumper JP3 to 1-2, shown in Figure 3-2. The on-board 4-kilohertz signal produced in the "Master" mode is sent to connector P7 pin 2 on the U600 board. The signal connects to a "Slave" U600 control board through its connector P7 pin 1. The "Slave" U600 control board jumper JP3 is set to position 2-3 so its on-board servo loop interrupt is generated by the master U600 control board. This effectively synchronizes the update of the motor commands on the boards. The master synchronized signal from connector P7 pin 1 is buffered and sent to P7 pin 2 of the slave board and is now the synchronized input to the next slave board.

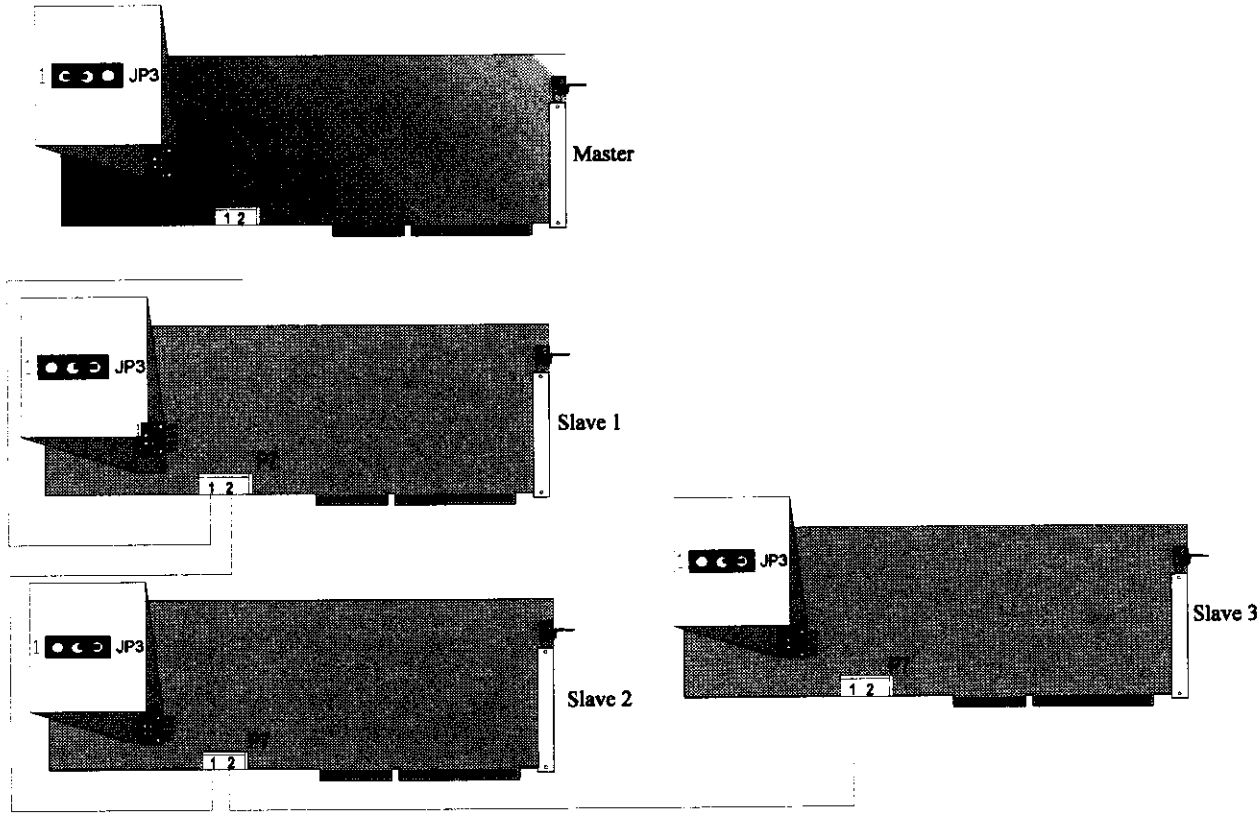


Figure 3-2. Servo Loop Synchronization

The second mode is command synchronization, refer to Figure 3-3. This permits synchronization between U600 boards for user timing requirements or motion command start synchronization. It is a (active high) hardware trigger via connector P7 or P1 and is similar to the servo loop synchronization mode. Jumper JP2 is set to position 2-3 on the "Master" and "Slave" boards and the trigger is applied to either P7 pin 5 or P1 pin 98 from an external trigger source, refer to Figure 3-3. This trigger is buffered by the master board and used to drive P7 pin 6, then applied to P7 pin 5 or P1 pin 98 of the subsequent slave boards. This simultaneously triggers each board for synchronized execution of the desired command.

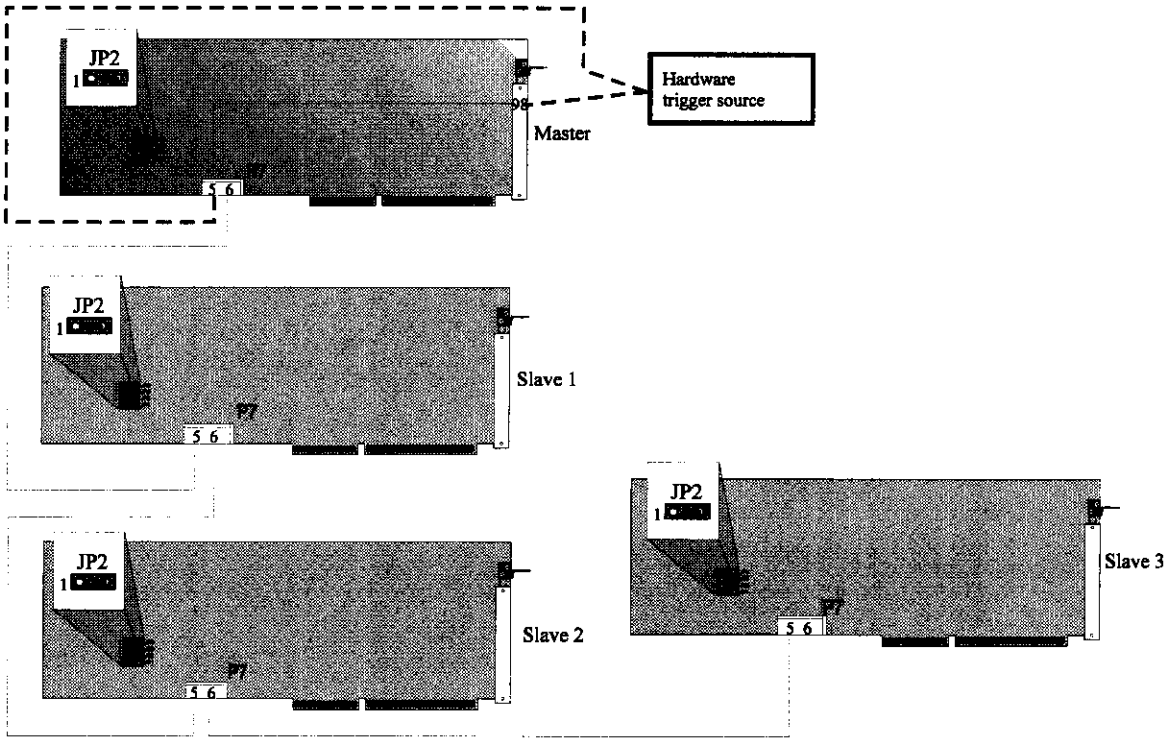


Figure 3-3. Command Synchronization

3.3.12. OS/2 Device Driver Configuration

The UNIDEX 600 default configuration of the device driver is at address 0x220 with its 16K byte memory window mapped to DC00:0000. The user only sets the U600's I/O address. Configuration of the DRAM memory window is under software control of the device driver during boot-up time.

Conflicts may arise with a user's PC due to BIOS CMOS settings. The block of memory selected for communication with the U600 must disable memory shadowing. Some PCs may also require that "hidden refresh" be disabled if it is present on their PC.

The device driver (PC9601.SYS) allows the user to use command line arguments for configuration. Additional U600 cards within a single PC require PC9602.SYS - PC9604.SYS respectively. These command line arguments are:

- Window address
- I/O Bus address
- IRQ Level
- DRAM size/type

The Window address is the starting address of the 16K byte window into the U600's DRAM address space. However, the address specified is the starting address inside the PC's address space. The default is window #1 = DC00:0000. The user can modify this by entering the following line in the CONFIG.sys file.

Example: Device = C:\U31\PC9601.sys W0

This selects window # 0 = D800:0000.

All possible starting addresses for the window are:

D800:0000	window # 0
DC00:0000	window # 1
CC00:0000	window # 2
C000:0000	window # 3
E000:0000	window # 4
E400:0000	window # 5
E800:0000	window # 6
EC00:0000	window # 7

The I/O address is the starting address for the U600's I/O registers used to configure and communicate with the U600. The default address is 220. The other available I/O address settings are 230, 300, 310, 330, 340, 350, and 360. The following is an example modifying the address setting from the user's CONFIG.sys file. The I/O address jumpers must also be changed on the U600 card.

Example: Device = C:\U31\PC9601.sys I300

The IRQ level indicates the interrupt level number generated by the U600 as a service request to the PC. This interrupt level must match the level set by one of the PC bus interrupt jumpers on the U600 control board. The default jumper setting is IRQ10 (jumper in). The following is an example modifying the interrupt level by adding this command line switch to the device driver line in the user's CONFIG.sys file. The interrupt level must be specified as a single character hexadecimal number following the "Q". The IRQ levels 1 to 9 are represented as 1 to 9; levels 10, 11, 12, and 15 are represented as A, B, C, and F.

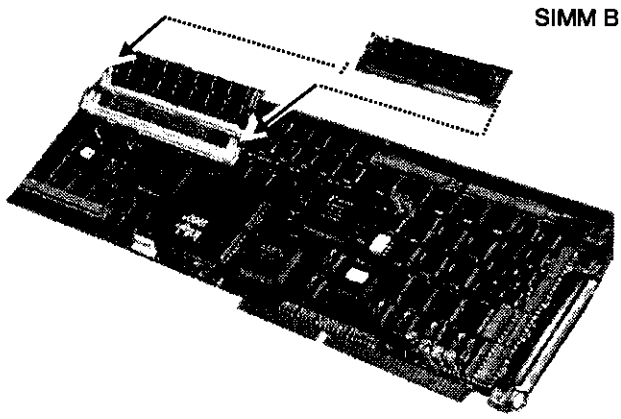
Example: Device = C:\U31\PC9601.sys QF

In this example, the selected interrupt level is IRQ15.

Some IRQ levels are pre-assigned to existing devices in the user's PC. The user may require the use of diagnostic software (e.g., MSD.exe) to find an available IRQ level, or use trial and error.

3.3.12.1. The Single In-line Memory Module (SIMM) Sockets

The Single In-line Memory Module (SIMM) sockets on the U600 board accept industry standard 72-pin DRAM SIMM modules. The user can configure the U600 to have 8, 16, or 32 Megabytes of DRAM. Refer to Figure 3-4 for installation of the DRAM SIMM module.



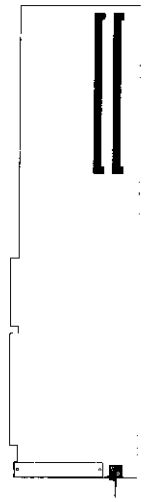


Figure 3-4. DRAM SIMM Module Installation

3.4. Installing the UNIDEX 600 PC Board

The UNIDEX 600 control board is a full-sized AT card that installs into any of the PC's unused 16-bit expansion slots.

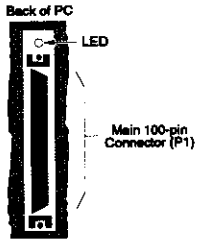
[redacted]

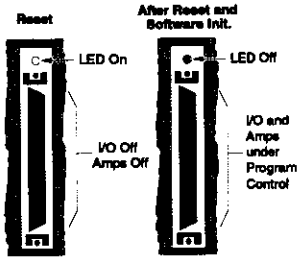
The procedure for installation of the UNIDEX 600 PC board is outlined in the steps that follow.

1. Turn OFF the power to the computer system unit and unplug the unit's power cord from the power source.

[redacted]

2. Open the computer cabinet. See the sample in Figure 3-5. (Refer to the PC's User Manual for directions for opening the cabinet.)
3. Select an unused 16-bit (full-sized) expansion slot on the computer motherboard.
4. Locate the bracket of the selected expansion slot. Remove the screw and pull the bracket out of the expansion slot.
5. Observing anti-static safeguards, line up the UNIDEX 600 PC board with the expansion slot and guide rails. Lower the board into the slot until each of its edge connectors rests on an expansion slot receptacle. Using evenly distributed pressure, push the board straight down until it is fully inserted into the expansion slot.
6. Secure the board to the chassis by reinstalling the bracket screw that was removed in step 4.
7. Close and secure the PC's cover.
8. Reconnect the PC's power cord to the power source.
9. Move the PC's power switch to the ON position and note the status of the UNIDEX 600 board's LED.





The LED (visible from the rear of the system) of the UNIDEX 600 board must come ON during system initialization and then go OFF and remain OFF. During subsequent system software resets, the LED should come ON for approximately 5 seconds, and then turn OFF.

The LED should remain ON following system power up. This should disable any amplifiers and set the output bus to the high impedance state.

If the LED does not come ON or if it stays ON following software initialization, refer to the Troubleshooting section of this manual for help.

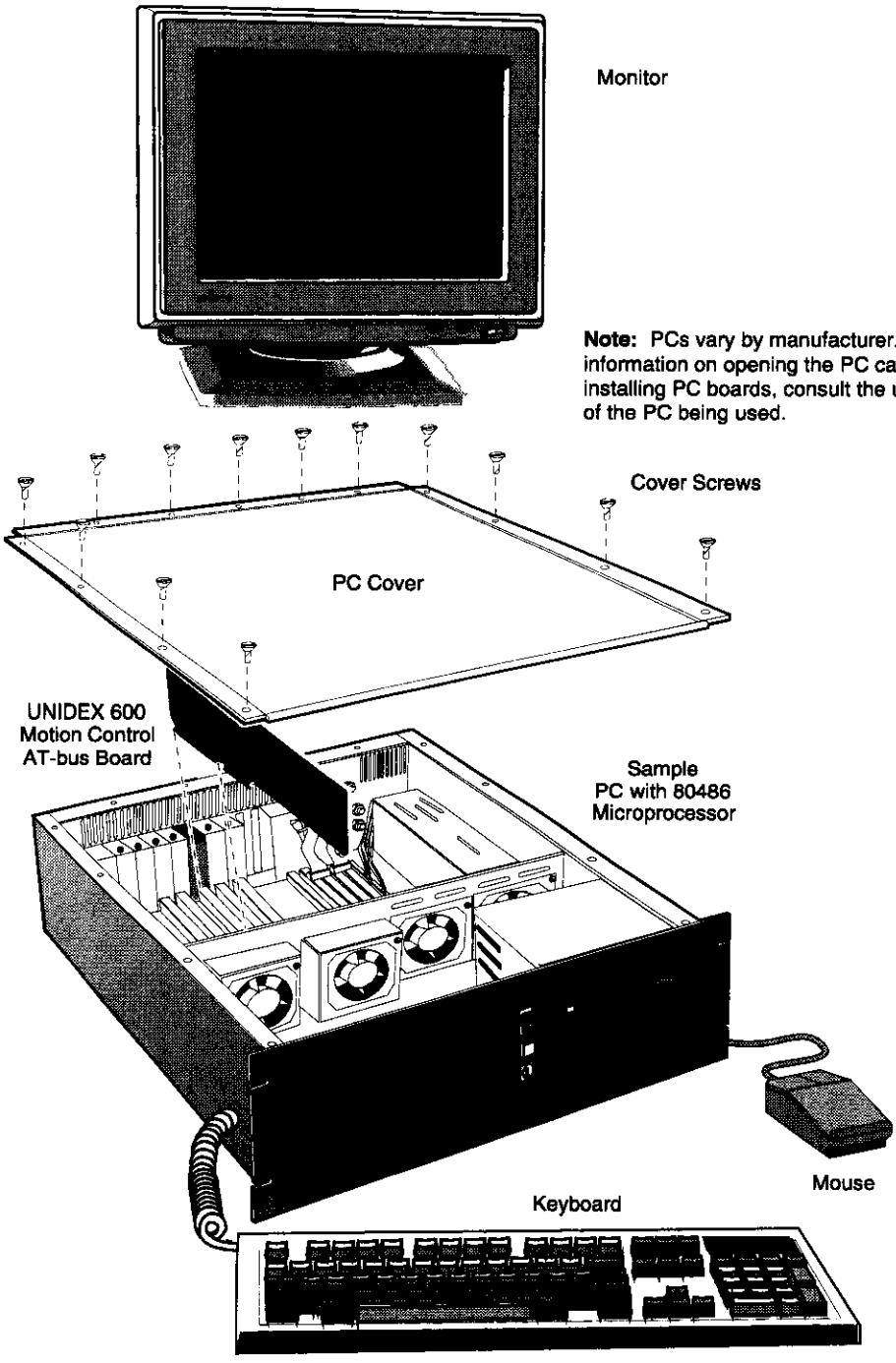
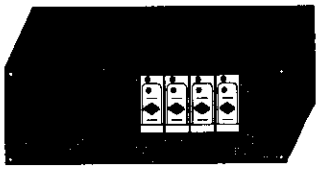


Figure 3-5. Installation of the UNIDEX 600 Motion Controller Board

3.5. Installing Additional Aerotech Components

System installation varies with the number and types of components that have been purchased from Aerotech, Inc. to complement the UNIDEX 600 PC bus controller. The following descriptions may not be applicable to all systems.

3.5.1. The DR500 Drive Rack and OP500 Cable



The DR500 drive chassis is an integral part of the UNIDEX 600 control system. It houses up to four Aerotech amplifiers (DC servo, AC brushless, or microstepping), provides power for the drive section of the servo system, and acts as a breakout for all control and I/O signals. The DR500 is available in rack mount, panel mount and desktop configurations. The individual amplifiers (a maximum of four) are inserted into the front of the DR500 panel. The back of the DR500 has all the cable connectors as well as descriptions for each. The rear panel connector layout of the DR500 is illustrated in Figure 3-6. For more information, refer to the *DR500 Drive Chassis Operations and Technical Manual, P/N EDA120.* Refer to the *Aerotech Motion Control Product Guide* for available styles, part numbers and pricing information.

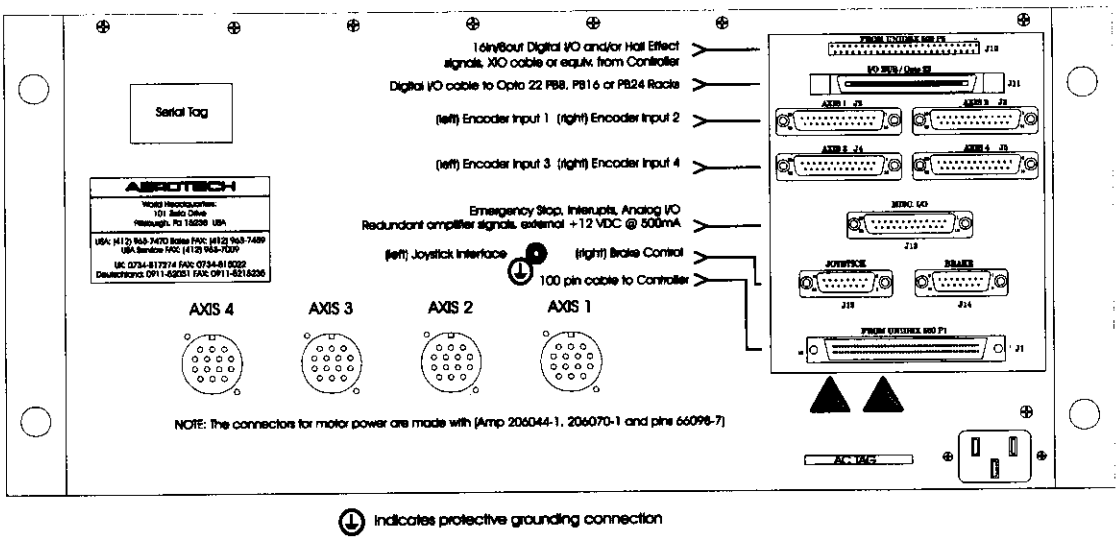


Figure 3-6. Rear Panel Connectors of the DR500 Amplifier Chassis

The OP500 cable is used to connect the UNIDEX 600 PC board to the DR500 drive chassis. One end of this cable connects to the UNIDEX 600 PC board and the other end connects to the J1 connector located on the back of the DR500 chassis. See Figure 3-6.

3.5.2. The UNIDEX 600 BB500 Breakout Module

The main connector of the UNIDEX 600 is a 100-pin interface that is intended to connect directly to the DR500. If a DR500 is not used in a particular application, then the signals from this 100-pin connector (explained in detail in Chapter 4: Technical Details) need to be accessed individually or "broken out" and routed to the appropriate amplifiers, motors, etc. The BB500 Breakout Module provides an easy method of accessing the signals of the 100-pin output connector of the UNIDEX 600 PC board.

The BB500 is connected to the 100-pin connector of the UNIDEX 600 (accessible from the rear of the PC) using the OP500 cable. Connections from a user-supplied drive rack may then be made to the terminal blocks on the BB500. The BB500 is illustrated in Figure 3-7.

Care should be exercised when connecting a drive rack to the BB500 breakout module. Be sure that signal lines are properly connected.

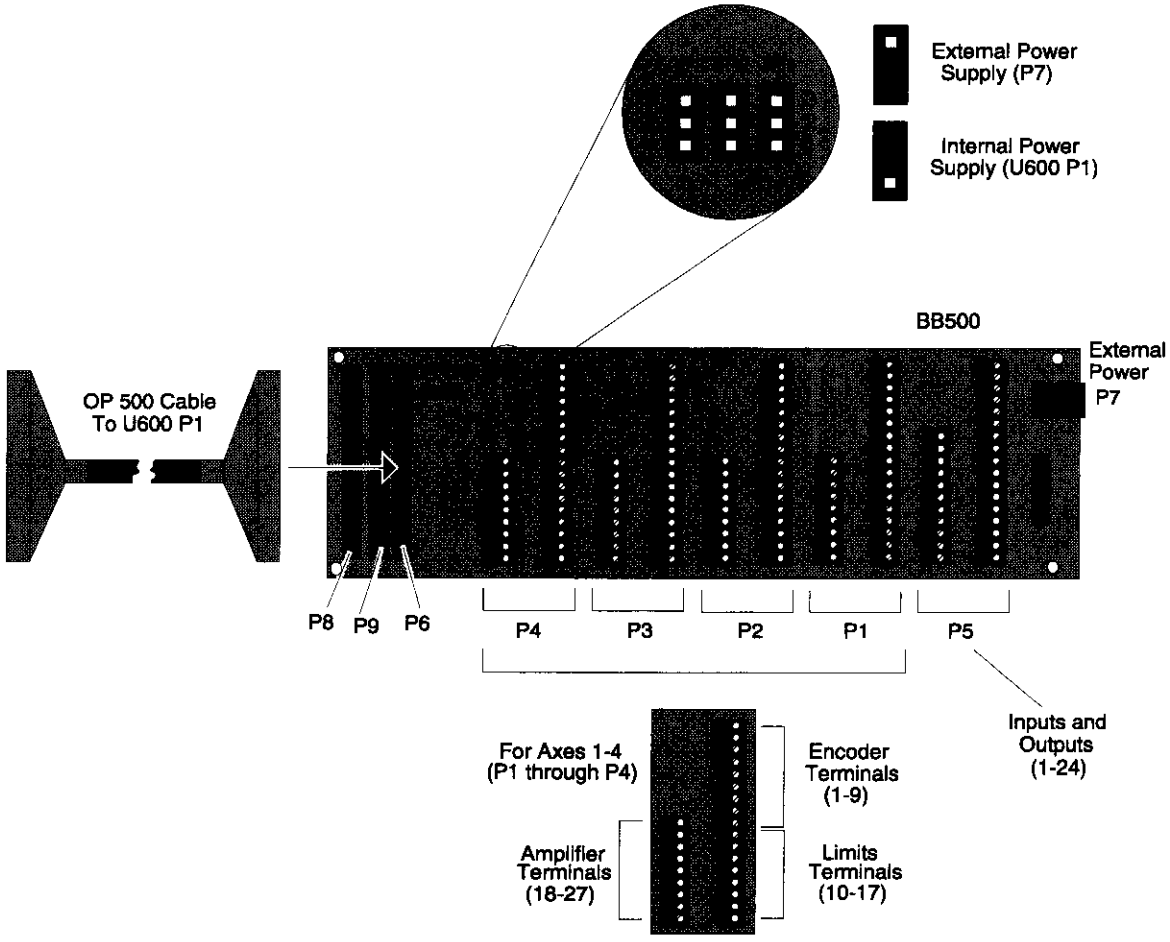


Figure 3-7. Components of the BB500 Breakout Module

For additional information regarding hardware and wiring configurations, refer to the *BB500 Interface Board Option Manual, P/N EDO109*. Refer to the *Aerotech Motion Control Product Guide* for available styles, part numbers and pricing information.

Another version of the BB500 (the BB501) is available for applications that use brushless amplifiers from the Aerotech BA SERIES. Referring to Figure 3-8, the difference between the BB501 and the BB500 is the BB501 provides easy connection for applications using brushless amplifiers versus the terminal blocks on the BB500. For additional information regarding hardware and wiring configurations, refer to the *BB501 Interface Board Option Manual, P/N EDO107*. For information on using Aerotech's BA SERIES line of brushless amplifiers, refer to the *BA SERIES User's Manual, P/N EDA 121*.

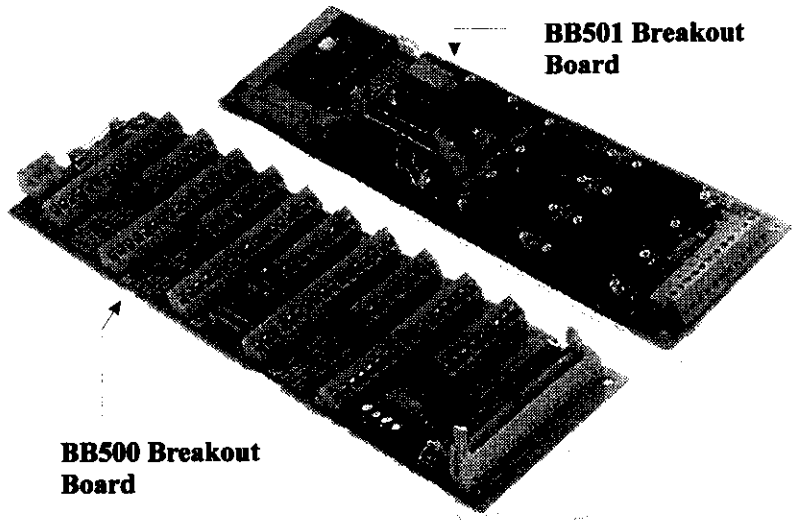


Figure 3-8. BB500 and BB501 Breakout Boards

3.5.3. The PSO-PC Position Synchronization Board

The PSO-PC option consists of a controller card that is installed into the same computer system as the UNIDEX 600 controller card. The PSO-PC card is electrically connected to the expansion port (P3) of the UNIDEX 600 controller card. This card provides versatile, on-the-fly synchronization of a laser's pulse and power output with the motion of axes controlled by the UNIDEX 600. This option is useful in applications requiring a series of precision micron-width laser cuts, with less concern for system dynamics such as acceleration, deceleration and velocity. The PSO-PC card takes into account the effects of acceleration and deceleration of the stages, and adjusts the laser output to ensure highly accurate laser cuts based on an output profile that is downloaded to the PSO-PC card through software. A sample configuration is illustrated in Figure 3-9. For more hardware information, refer to the *PSO-PC Options Manual, P/N EDO105*. The PSO board programming is accomplished in the library interface via the AerPSOxxxx functions. In the CNC interface, the user can use the PSOC, PSOD, etc. CNC commands to program PSO functionality.

When using the PSO-PC option board with the U600, the PSO-PC's address must be set to 310 and its dual port RAM to D800-DBFF.

OS/2 users using the PSO-PC card, require the U600ZPSO.EXE program be executed while in the U31 directory to load (its firmware) the file U31PSO.IMG into the PSO card.

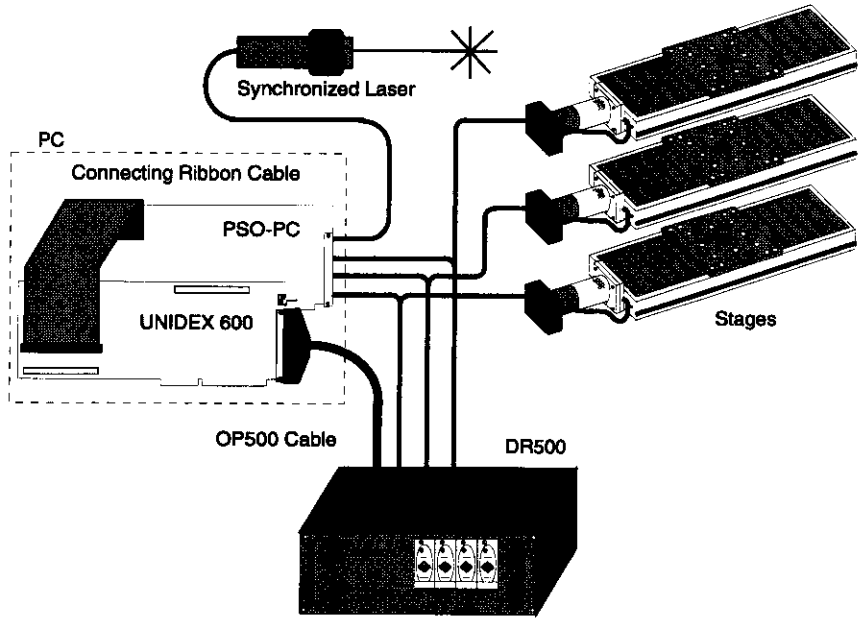


Figure 3-9. Overview of the PSO-PC Option

3.5.4. The RDP-PC Resolver-to-digital Board

The RDP-PC option is a resolver-to-digital card used for receiving resolver or Inductosyn feedback. A resolver is a two-phase, AC-excited rotary variable transformer that outputs sinusoidally related signals. These signals (when processed by the RDP-PC), yield very accurate shaft position information. Single-speed resolvers provide absolute position information over one shaft revolution. Inductosyns are essentially multi-pole resolvers and are available in both rotary and linear varieties. Rotary and linear Inductosyns typically have pole spacings of 0.5 degrees and 2 mm, respectively, providing positioning resolutions as fine as 0.05 arc seconds and 30.5 nanometers when combined with the RDP-PC converter. Standard R/D converter accuracy is ±8 arc min/electrical cycle. Features of the RDP-PC include software selectable 10, 12, 14 or 16-bit resolution, ratiometric tracking conversion and real-time position and velocity information.

3.5.4.1. RDP Board Hardware Setup

The RDP board connects between the UNIDEX 600 and a feedback device, such as an inductosyn or resolver. Before the RDP board can be installed into the PC, it must be properly configured.

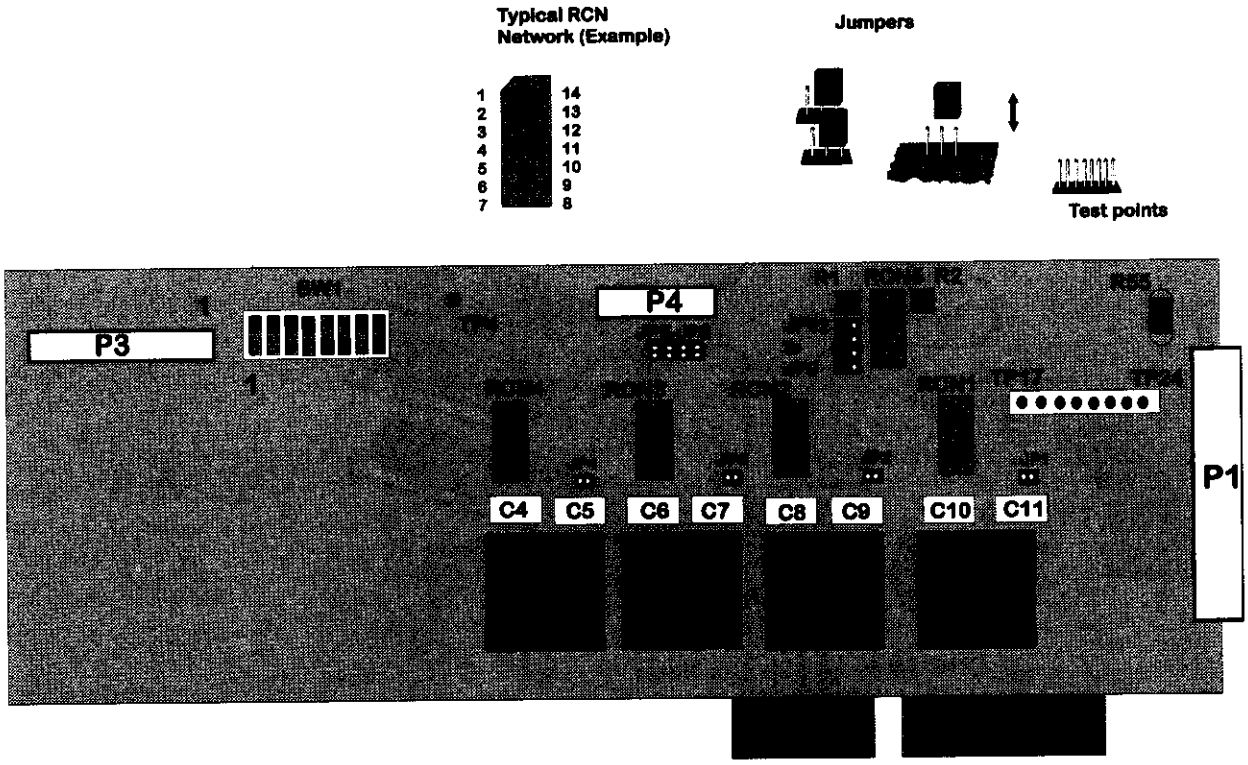


Figure 3-10. RDP-PC Board

The first step is to configure the jumpers on the board, refer to the following tables for jumper settings. See Figure 3-10 for jumper locations.

Table 3-15. Jumper Settings for Converter Demodulator Adjust Mode (RDP)

Axis	Enable	Disable
1	Install JP1	Remove JP1 (default)
2	Install JP2	Remove JP2 (default)
3	Install JP3	Remove JP3 (default)
4	Install JP4	Remove JP4 (default)

The jumpers JP1-JP4 should only be enabled when adjusting the phase offset pot (R1) for rotary inductosyn.

Table 3-16. Jumper Settings for Over temperature Thermistor Input (RDP)

Axis	Disable	Enable
1	Install JP5 (default)	Remove JP5
2	Install JP6 (default)	Remove JP6
3	Install JP7 (default)	Remove JP7
4	Install JP8 (default)	Remove JP8

Table 3-17. RDP Board Extension Bus Address Settings

Extension Bus Address	Dip Switch Settings
RDP board # 1 use if one board installed (default)	SW1  1
RDP board # 2	SW1  1
RDP board # 3	SW1  1
RDP board # 4	SW1  1

Table 3-18. Inductosyn or Resolver Jumper Settings

Axis	Resolver	Inductosyn
#1	Set JP9 to 1-2 (default)	Set JP9 to 2-3
#2	Set JP10 to 1-2 (default)	Set JP10 to 2-3
#3	Set JP11 to 1-2 (default)	Set JP11 to 2-3
#4	Set JP12 to 1-2 (default)	Set JP12 to 2-3

The next step is to configure the resistor network RCN5 (see Figure 3-10) for the oscillator frequency that will be used, refer to Table 3-19.

Table 3-19. Oscillator Frequency Configuration for RCN5

	RCN5						
Description	Pins 1-14	Pins 2-13	Pins 3-12	Pins 4-11	Pins 5-10	Pins 6-9	Pins 7-8
Standard 10 kHz (default)	1.96 kΩ 1%	1.96 kΩ 1%	6.2 kΩ	3.9 kΩ	1500 pF	OPEN	OPEN
7.5 kHz	1.1 kΩ 1%	1.1 kΩ 1%	6.2 kΩ	3.9 kΩ	1500 pF	OPEN	OPEN
5 kHz	560 Ω 1%	560 Ω 1%	6.2 kΩ	3.9 kΩ	1500 pF	OPEN	OPEN
Linear inductosyn 10 kHz	1.96 kΩ 1%	1.96 kΩ 1%	6.2 kΩ	3.9 kΩ	OPEN	OPEN	OPEN

In addition, capacitors 4 through 11 must be configured for the oscillator frequency that will be used, refer to Table 3-20.

Table 3-20. Oscillator Frequency Configuration for Capacitors RDP board

Axis	10 kHz	7.5 kHz	5 kHz
Axis #1 C10, C11	Install a 270 pF capacitor (default)	Install a 390 pF capacitor	Install a 560 pF capacitor
Axis #2 C8, C9	Install a 270 pF capacitor (default)	Install a 390 pF capacitor	Install a 560 pF capacitor
Axis #3 C6, C7	Install a 270 pF capacitor (default)	Install a 390 pF capacitor	Install a 560 pF capacitor
Axis #4 C4, C5	Install a 270 pF capacitor (default)	Install a 390 pF capacitor	Install a 560 pF capacitor

The configuration of the resistor networks RCN1 through RCN4 and the bit resolution entered in the axis configuration screen determines the bit resolution used, refer to Table 3-21.

Table 3-21. Bit Resolution Configuration RCN1 through RCN4 on RDP Board

16 Bit Resolution 1K BW	8.2 kΩ	390 pF	1800 pF	360 kΩ	62 kΩ	OPEN	OPEN
16 Bit Resolution 750 BW	8.2 kΩ	680 pF	3300 pF	270 kΩ	62 kΩ	OPEN	OPEN
16 Bit Resolution 500 BW	8.2 kΩ	1500 pF	8200 pF	180 kΩ	62 kΩ	OPEN	OPEN
14 Bit Resolution 500 BW	33 kΩ	1500 pF	8200 pF	180 kΩ	56 kΩ	OPEN	OPEN
12 Bit Resolution 1K BW	130 kΩ	390 pF	1800 pF	360 kΩ	62 kΩ	OPEN	OPEN
12 Bit Resolution 750 BW	130 kΩ	680 pF	3300 pF	270 kΩ	62 kΩ	OPEN	OPEN
10 Bit Resolution 500 BW	510 kΩ	470 pF	2200 pF	560 kΩ	180 kΩ	OPEN	OPEN

To connect the RDP board to the UNIDEX 600 board, connect the 50-pin ribbon cable from P3 of the RDP board to P3 of the UNIDEX 600 board, refer to Figure 3-11.

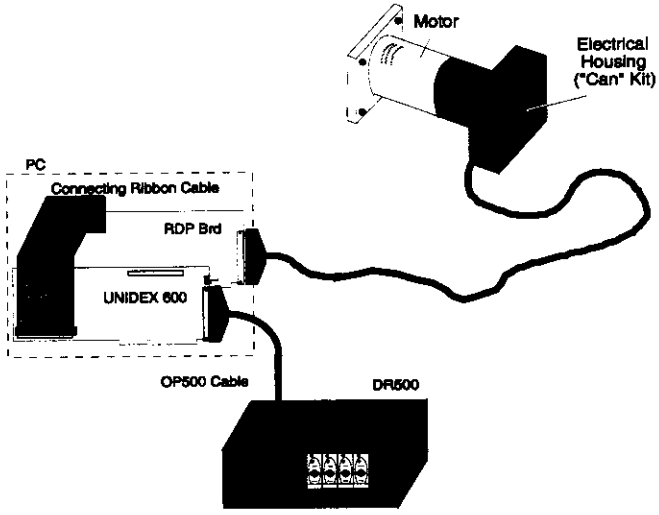
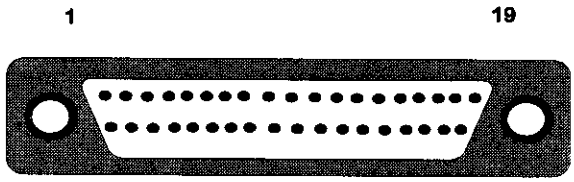


Figure 3-11. RDP Board Connection to UNIDEX 600 Board

Resolvers or inductosyns connect to the RDP board through P1 on the back of the board, see Figure 3-12. The pinouts for the connector are listed in Table 3-22.

Table 3-22. RDP Board Pinouts

Pin #	Axis #	Signal	Pin #	Axis #	Signal
1	4	Shield	20	4	COS -
2	4	COS +	21	4	SIN -
3	4	SIN +	22	-	Ground
4	4	Ground	23	4	Over-Temp thermistor input
5	4	REF +	24	-	Ground
6	3	REF +	25	3	Over-Temp thermistor input
7	3	Shield	26	3	Ground
8	3	COS +	27	3	COS -
9	3	SIN +	28	3	SIN -
10	2	Over-Temp thermistor input	29	-	Ground
11	2	REF +	30	2	Ground
12	2	Shield	31	-	Ground
13	2	COS +	32	2	COS -
14	2	SIN +	33	2	SIN -
15	1	Over-Temp thermistor input	34	-	Ground
16	1	REF +	35	1	Ground
17	1	Shield	36	1	COS -
18	1	COS +	37	1	SIN -
19	1	SIN +			



DC-37P

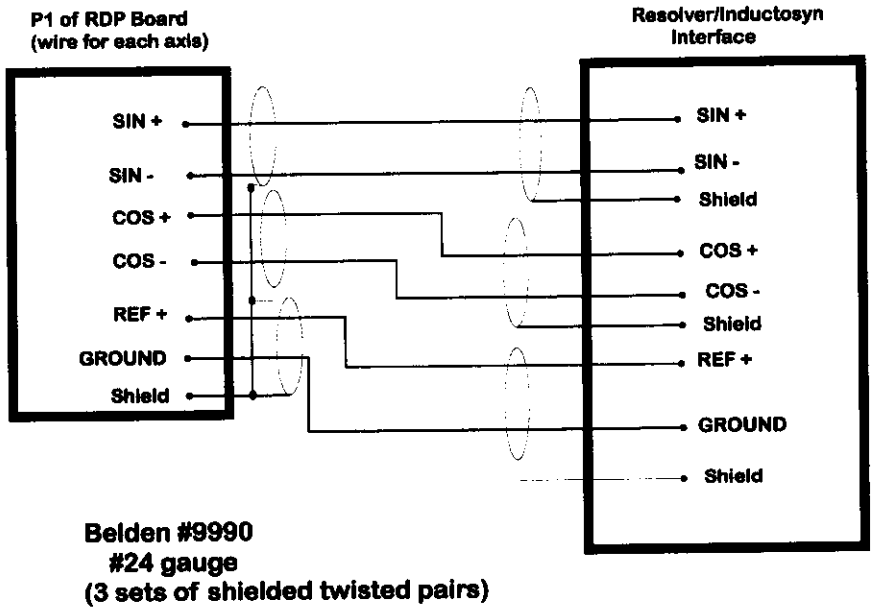


Figure 3-12. Suggested Cabling from RDP Board to Resolver/Inductosyn

Once a resolver or inductosyn is connected to the RDP board, the user must verify that a sinusoidal signal is being sent from the feedback device and adjust the amplitude if necessary. The signals can be monitored from the test points listed in Table 3-23.

Table 3-23. RDP Board Test Points

TP17	4	COS
TP18	3	COS
TP19	2	COS
TP20	1	COS
TP21	1	SIN
TP22	2	SIN
TP23	3	SIN
TP24	4	SIN
TP4	-	Ground

To verify that a sinusoid signal is being received from the axis with a resolver or inductosyn, perform the following steps.

1. Connect an oscilloscope (O-scope) to the COS signal of the axis being tested and connect the ground of the O-scope to TP4. Move the resolver or inductosyn; a COS signal (sinusoid) should be observed on the O-scope.
2. Connect the O-scope to the SIN signal of the axis being tested. Move the resolver or inductosyn again verifying that a SIN signal (sinusoid) is seen on the O-scope.
3. Verify that the amplitude of the sinusoidal signal of the axis being tested is within specification. Connect an O-scope to either the SIN or COS signal, connect the ground lead to TP4. Move the resolver or inductosyn and observe the amplitude increase and decrease.
    - Notice that when the COS signal's amplitude is at maximum, the SIN signal's amplitude is at minimum and vice-versa.
4. Stop moving the resolver or inductosyn when the amplitude of the sinusoid is at its maximum. All resolvers and inductosyns should be connected to the system at this point in the test (due to reference oscillator loading).
    - The maximum should be 2 volts RMS which is ≈2.8284 volts peak or ≈5.6568 volts peak to peak.
5. If it is not 2 volts RMS, then adjust the R2 potentiometer until it is.

For rotary inductosyns, to null the phase offset perform the following.

1. Disable the axis being tested.
2. Set the appropriate converter demodulator adjust mode jumper (JP1 through JP4) for the axis being tested to the "enabled" configuration.
3. Connect an O-scope to pin #1 of the appropriate RCN# (where RCN1 = Axis #1, RCN2 = Axis #2, etc.). For example, if checking axis #1, then connect the O-scope to pin #1 of RCN1. Connect the ground lead to TP4.
4. Adjust the phase offset pot (R1) until the ideal rectified signal is present, refer to Figure 3-13. Get as close as possible.
    - A different capacitor may be needed for pins 5 and 10 of RCN5.
    - The R1 pot adjusts the phase offsets for all four axes (only applies if they are rotary inductosyns), so if more than one rotary inductosyn is being used, they have to be of the same type.
5. Return the previously set jumper (JP1 through JP4) to the "disabled" configuration.

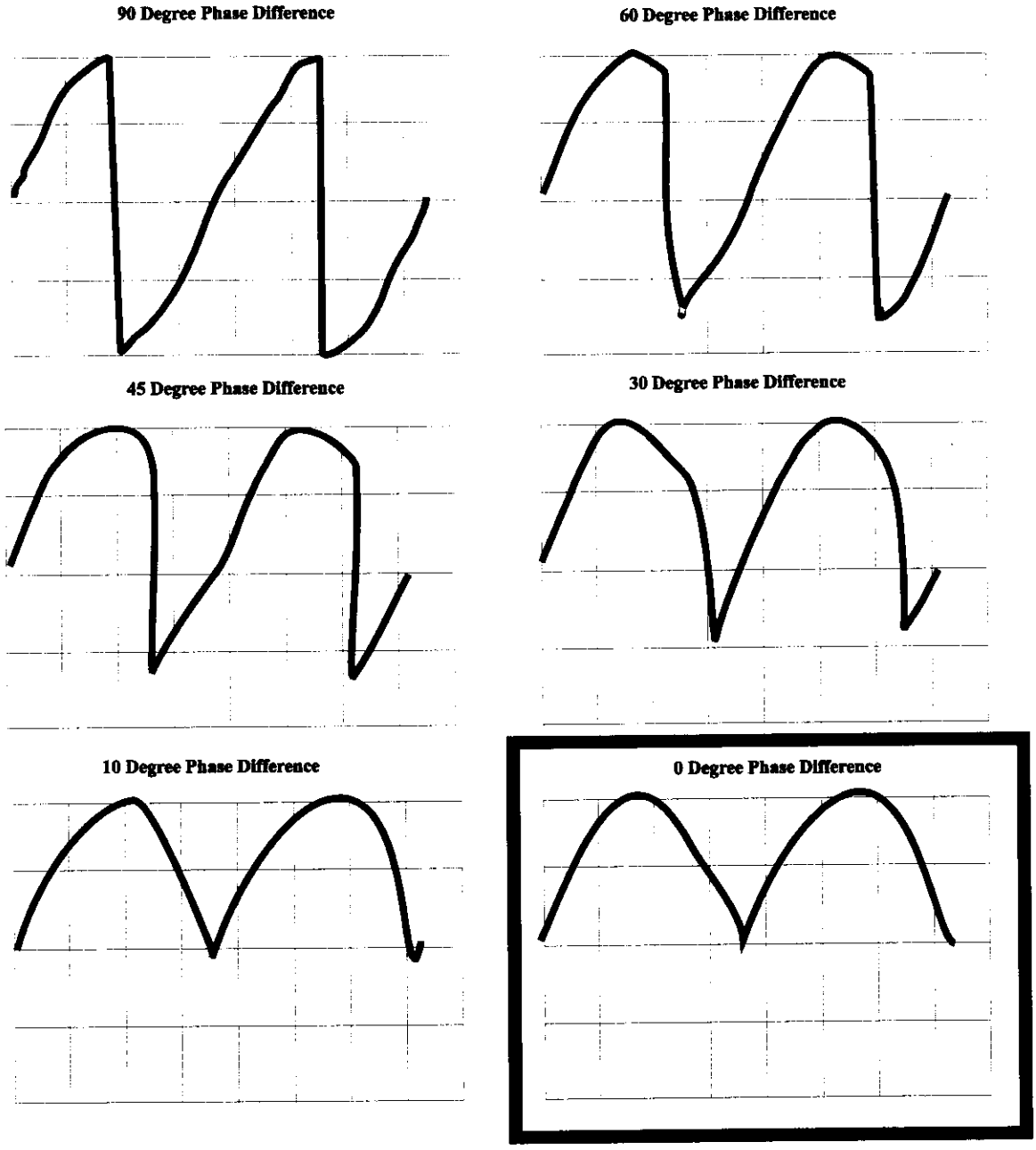
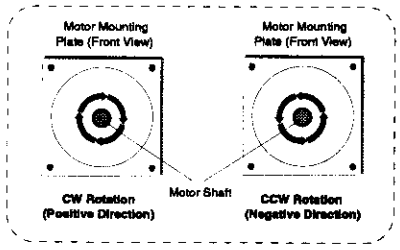


Figure 3-13. Rectified Signals with the Most Ideal Signal

3.5.4.2. RDP Board Software setup

To setup the RDP board and configure it for input from the primary or secondary feedback device, go to the Main Page on the software interface and select Setup. From there, select Axis Configuration and use the Wizard that guides the user through the procedure of configuring each axis.



To verify that the resolver or inductosyn works after properly adjusting the gain, perform the following.

1. While in the MMI 600 Manual Page, with the axis disabled, turn the motor shaft clockwise. The Position Display should count positively. Turning the motor shaft counter-clockwise should make the Position Display count negatively. Otherwise, the SIN+ and SIN- lines must be swapped.
2. After completing the first test, the next procedure determines whether the resolver or inductosyn is losing counts.

The motor must already be tuned. If not, the following test cannot be performed.

In addition, this test assumes that the X axis is being tested which can be easily modified if working with any other axis.

3. Execute the following program and verify that the axis does not mis-position. While in the Manual Page, enter the following command lines on the MDI line.

```
DRIVE.X=1          ;enable drive
G91                ;set incremental mode
:loop
G0 X10
G0 X-10
GOTO loop
```

3.5.5. The RMX-PC Multiplier Board

The RMX-PC option is a 2 channel PC card that provides ultra high resolution positioning through a multiplication of the encoder feedback signal (up to 512 times). This option is used in conjunction with the UNIDEX 600 card and is ideal for high-resolution applications such as wafer inspection. As the speed of the mechanical positioning system increases, the RMX-PC seamlessly switches from the fine to the coarse tracking control loop. The RMX-PC board is also used as the PC interface board for the LZR3000 laser interferometer system from Aerotech. For more information, refer to the *Aerotech Motion Control Product Guide* and the *LZR3000 Operation and Technical Manual, P/N EDU142*. The RMX-PC board is illustrated in Figure 3-14.

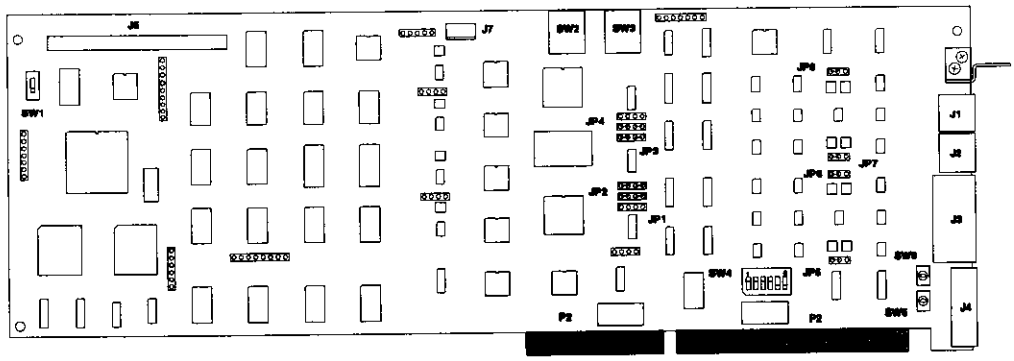
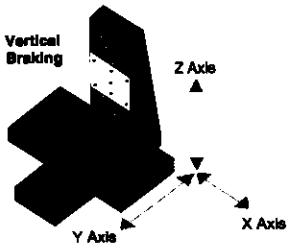


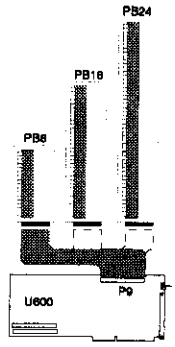
Figure 3-14. The RMX-PC (LZR2100 PC Measurement Board)

3.5.6. The BRK/BPS Fail-safe Brake



The BRK/BPS option is an integral part of the UNIDEX 600 system that provides a fail-safe way to maintain position on a vertical axis when power is removed from the axis. This is accomplished using a normally on electromagnetic brake that is coupled to the load. To disable the brake, a 24 VDC source (typical) is applied to the brake when the axis is enabled for motion by the UNIDEX 600. This option includes a brake board used to sense the switching on the motor leads of the pulse width modulated (PWM) amplifiers, and a power supply to drive the electromagnetic brake into its inactive mode. For more information, refer to the *Aerotech Motion Control Product Guide* and the *DR500 Manual, P/N EDA120*.

3.5.7. The PB8, PB16 and PB24 I/O Boards



The PB8, PB16 and PB24 options are interface boards that provide optical isolation of UNIDEX 600 inputs and outputs (up to 16 outputs and 16 inputs) in the form of terminal blocks. An OPTO-22 option board connects to the P9 connector (the Opto 22 I/O bus) of the UNIDEX 600 card using a 50-pin ribbon cable (provided). The PB8 provides 8 outputs, the PB16 provides 8 inputs and 8 outputs, and the PB24 provides 16 inputs and 8 outputs. The PB8, PB16 and PB24 options are also available on the DR500.

The additional 8 outputs (Out 8 through 15) are provided through the P10 connector with a PB-8 or a PB24. If the Hall effect inputs are used (with brushless motors), which are located on the P10 connector of the UNIDEX 600, refer to Section 4.21 for more information on the Hall effect inputs.

Refer to Figure 3-15 and Figure 3-16.

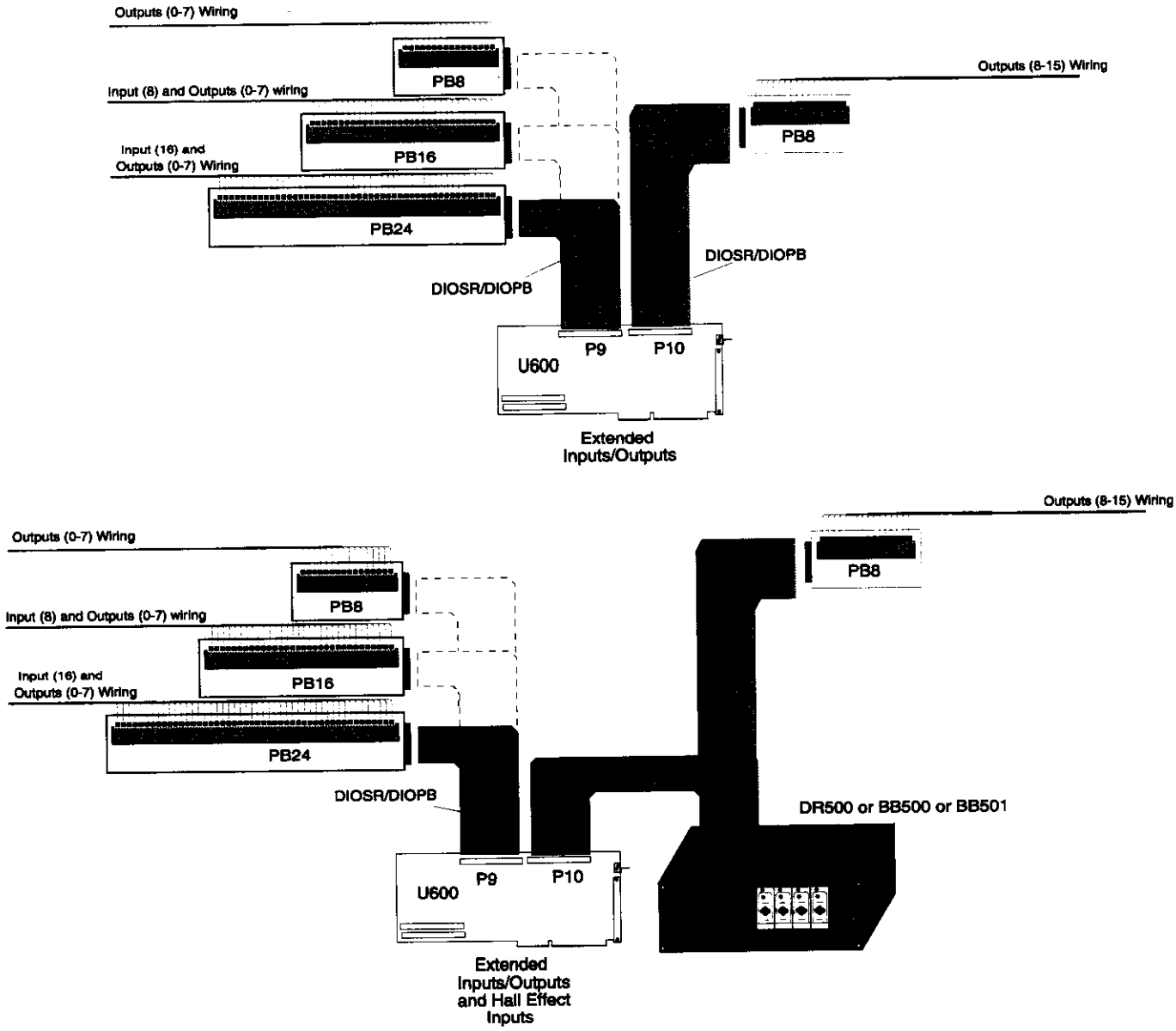


Figure 3-15. Sample Uses of the OPTO-22 Boards and the DIO500 Cable

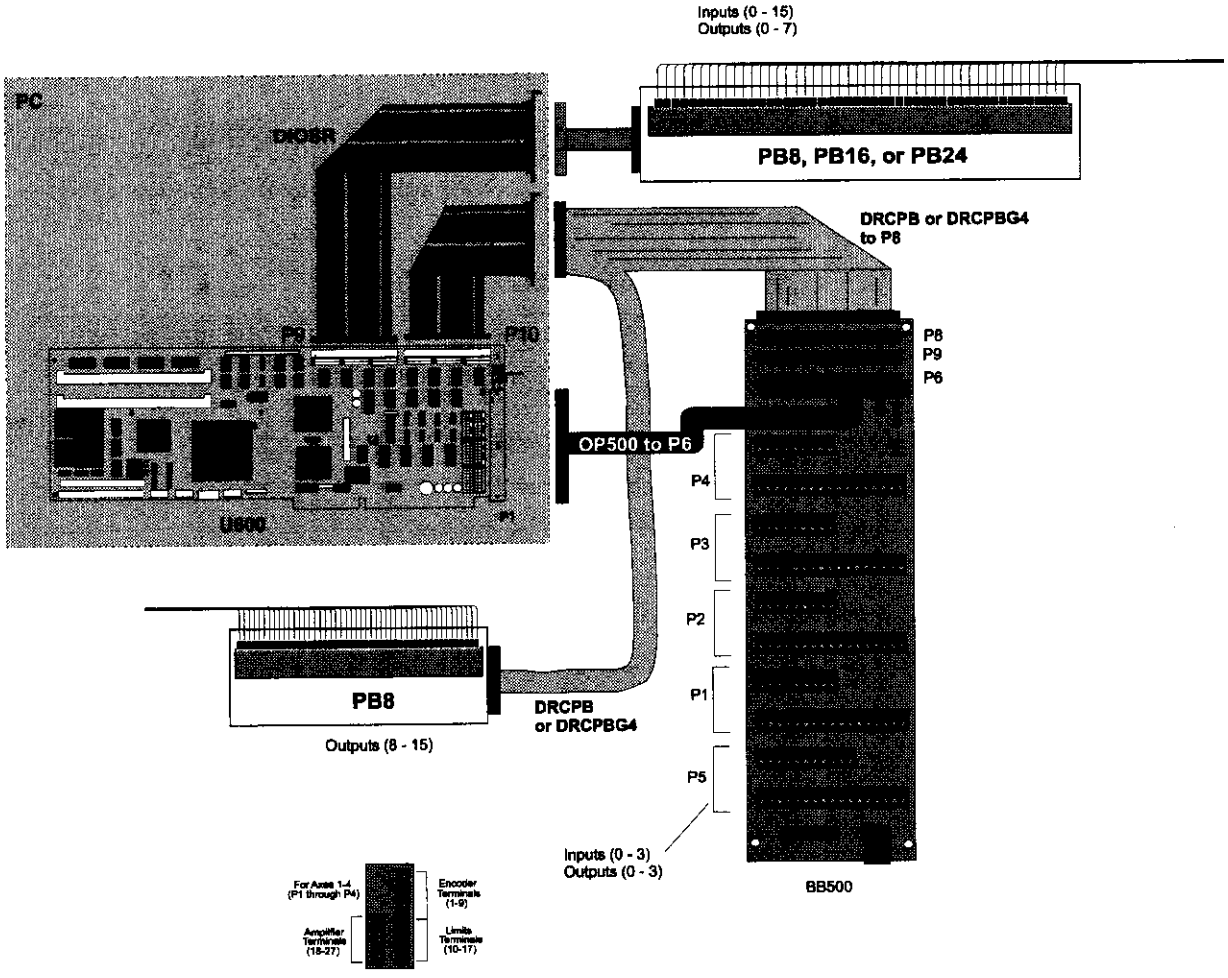


Figure 3-16. Sample Uses of the PB# Boards and the DRCPB and DRCPBG4 Cables

For more information, refer to Chapter 4: Technical Details and the *Aerotech Motion Control Product Guide*.

3.5.7.1. Opto Isolated Drive Interface

Using the BB500 and the PB24 board, the user can have an opto-isolated drive interface. The drive signals are shown in Table 3-24 below and connect to P9 of the BB500, refer to Figure 3-17. This allows an opto-22 board to be connected to the BB500 isolating all the drive signals listed in Table 3-24.

Table 3-24. BB500 Opto-isolated Drive Signals (P9)

Axis	P9 Pin #	Signal	UDC Position Number	I/O Module Required
4	1	Drive Enable	23	Output
4	3	Mode 4	22	Output
4	5	Fault 4	21	Input
4	7	Home Limit	20	Input
4	9	Counterclockwise (CCW)	19	Input
4	11	Clockwise (CW)	18	Input
3	13	Drive Enable	17	Output
3	15	Mode 3	16	Output
3	17	Fault 3	15	Input
3	19	Home Limit	14	Input
3	21	Counterclockwise (CCW)	13	Input
3	23	Clockwise (CW)	12	Input
2	25	Drive Enable	11	Output
2	27	Mode 2	10	Output
2	29	Fault 2	9	Input
2	31	Home Limit	8	Input
2	33	Counterclockwise (CCW)	7	Input
2	35	Clockwise (CW)	6	Input
1	37	Drive Enable	5	Output
1	39	Mode 1	4	Output
1	41	Fault 1	3	Input
1	43	Home Limit	2	Input
1	45	Counterclockwise (CCW)	1	Input
1	47	Clockwise (CW)	0	Input
1	49	Power		
	2 through 50	Common		

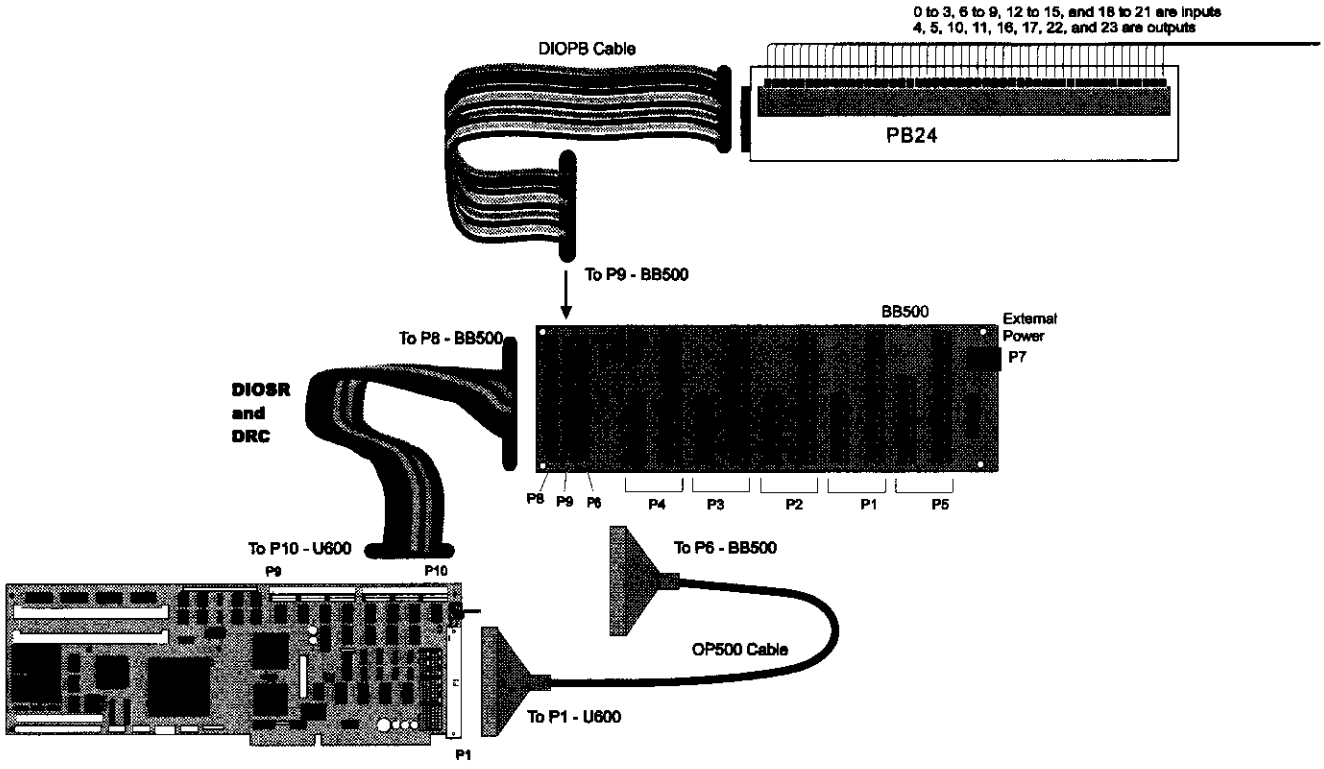
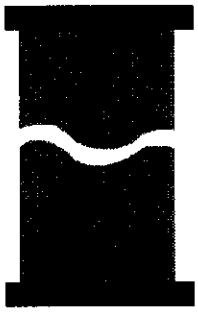


Figure 3-17. Opto-Isolated Limit, Drive Fault inputs and the Mode, Drive Enable Outputs

3.5.8. The DIO I/O Cables



DIO is the extended I/O cable option of the UNIDEX 600. This cable serves two purposes. One such use is to allow more than four user inputs or outputs (as is the case when the PB8, PB16 or PB24 I/O board is used). The other use is for applications that use brushless motors with Hall effect sensors. In such cases, the necessary Hall effect signals are not available through the standard OP500 cable, therefore the DIO is connected between the U600 and the DR500. Different versions of the DIO I/O cable are available for (1) directly connecting the U600 and a PB8, PB16 or PB24 interface board to allow additional inputs/outputs, (2) connecting the U600 to the DR500 (to provide Hall effect inputs and extra I/O) with an additional connection for an optional PB8, PB16 or PB24 I/O board, and (3) connecting the U600 to the BB501 (to provide Hall effect inputs and extra I/O). Refer to Figure 3-15. For additional information, refer to the *Aerotech Motion Control Product Guide*.

∇ ∇ ∇

CHAPTER 4: TECHNICAL DETAILS

In This Section:

4.1. Test Points

Test points are located at the top of the UNIDEX 600 control board. They are used as an aid in troubleshooting the motion control board and to gain easy access to the UNIDEX 600 signals.

This chapter arranges test points into functional groups. These functional groups are divided as follows:

- User Related Test Points
- Encoder Test Points

Test points for these functional groups are listed and explained in the tables that follow.

Table 4-1. User Test Points

Test Point	Description
TP4	Signal common
TP19	High Speed Position Latch input after RC filter
TP24	Emergency Stop input after Opto-Isolator
TP26	Multi-board servo loop synchronization signal
TP28	Command Synchronization Trigger

Table 4-2. UNIDEX 600 Encoder Signal Test Points

Test Point	Description
P11-1	Channel 1 sine after RS-422 differential receiver
P11-2	Channel 1 cosine after RS-422 differential receiver
P11-5	Channel 2 sine after RS-422 differential receiver
P11-6	Channel 2 cosine after RS-422 differential receiver
P11-9	Channel 3 sine after RS-422 differential receiver
P11-10	Channel 3 cosine after RS-422 differential receiver
P11-13	Channel 4 sine after RS-422 differential receiver
P11-14	Channel 4 cosine after RS-422 differential receiver
TP39	Channel 1 marker after RS-422 differential receiver
TP38	Channel 2 marker after RS-422 differential receiver
TP37	Channel 3 marker after RS-422 differential receiver
TP36	Channel 4 marker after RS-422 differential receiver

4.2. Jumper Configurations

The following list contains a summary of all of the jumpers on the UNIDEX 600 PC Board. Relative Jumper locations and the default settings are illustrated in Figure 4-1 and listed in Table 4-3. An asterisk (*) following a jumper setting indicates the default position. Also, if a complete motion control system was purchased from Aerotech the jumpers will be properly configured for you by our system test department.

Table 4-3. Jumper Configurations

Jumper Number	Setting	Explanation
JP1	None*	JP1 must be removed on revision B boards and below
	1-2	iSBX / Expansion Port interrupt MINT1
	2-3	iSBX / Expansion Port interrupt MINT0
JP2	1-2*	Software Trigger Multiple UNIDEX 600 Synchronization
	2-3	Hardware Multiple UNIDEX 600 Sync. from P7-5 or P1-98
JP3	1-2*	Master servo loop synchronization mode
	2-3	Slave servo loop synchronization mode from another UNIDEX 600 via P7-1
JP4A	IN	Interrupt IRQ3 (COM 2)
	OUT*	Interrupt 3 not used by UNIDEX 600
JP4B	IN	Interrupt IRQ4 (COM 1)
	OUT*	Interrupt 4 not used by UNIDEX 600
JP4C	IN	Interrupt IRQ5 (LPT)
	OUT*	Interrupt 5 not used by UNIDEX 600
JP4D	IN	Interrupt IRQ9 (AT unassigned)
	OUT*	Interrupt 9 not used by UNIDEX 60
JP5A	IN*	Interrupt IRQ15 (AT unassigned)
	OUT	Interrupt 15 not used by UNIDEX 600
JP5B	IN	Interrupt IRQ12 (AT unassigned)
	OUT*	Interrupt 12 not used by UNIDEX 600
JP5C	IN	Interrupt IRQ11
	OUT*	Interrupt 11 not used by UNIDEX 600
JP5D	IN	Interrupt IRQ10
	OUT*	Interrupt 10 not used by UNIDEX 600
JP6	OUT*	No bias on ports 1 and 2 RS-232C DCD,CTS signals
	1-2	Bias ports 1 and 2 RS-232C DCD, CTS signals at +12 Volts
	2-3	Bias ports 1 and 2 RS-232C DCD, CTS signals at -12 Volts
JP10	IN	Enable flash memory option (if present)
	OUT*	Disable flash memory option
JP11	OUT*	Reset UNIDEX 600 on AT Bus reset
	IN	Do not reset UNIDEX 600 on AT Bus reset
JP12	OUT*	Factory set (DO NOT CHANGE!)
JP14	1-2*	Factory set (DO NOT CHANGE!)
JP15	IN	UNIDEX 600 board reset through P10-25
	OUT*	No external reset through P10-25
JP16	IN	P1-51 driven by 20 kHz. active low complement to P1-2
	OUT*	P1-51 not driven
JP13A	OUT	Set iSBX option to 10 MHz
JP13B	OUT	Set iSBX option to 10 kHz

Table 4-3. Jumper Configurations (Cont'd)

Jumper Number	Setting	Explanation
JP13C	OUT	Set iSBX option to 20 kHz
JP13D	IN*	Set iSBX option to 40 kHz
JP13E	OUT	Set iSBX option to 80 kHz

PC I/O Base Address Jumper Settings

PC I/O Base Address	JP9	JP8	JP7
0x220 - 22F (default)			
0x230-23F			
0x300-30F			
0x310-31F			
0x330-33F			
0x340-34F			
0x350-35F			
0x360-36F			

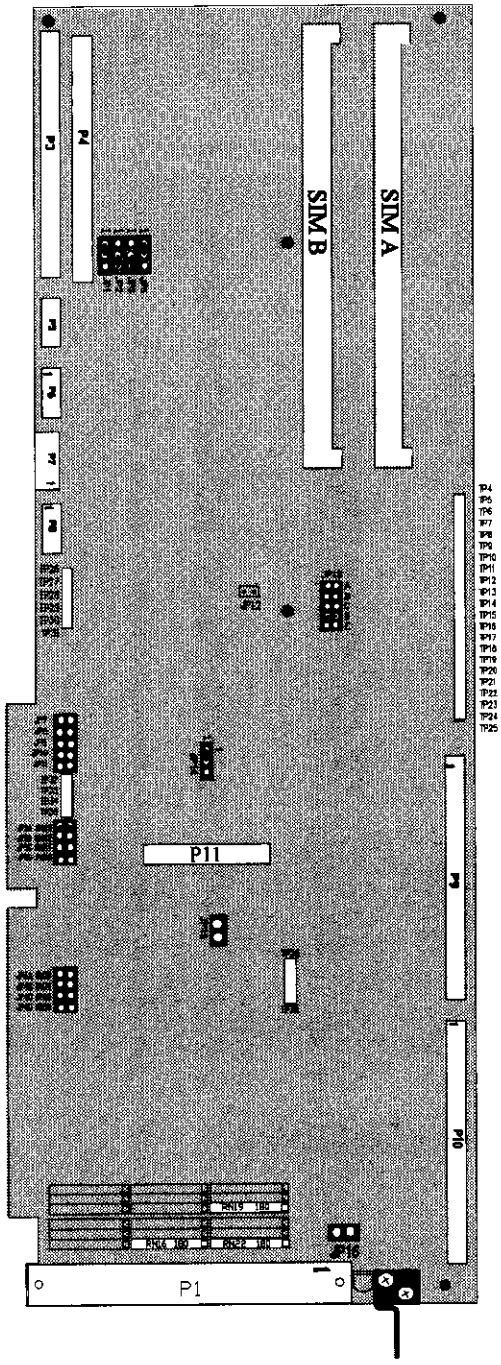


Figure 4-1. UNIDEX 600 PC Board Jumper Locations

The jumpers listed in Table 4-4 are used to set up the PC base address.

Each UNIDEX 600 PC Board must have a unique I/O address.

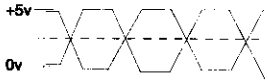
Table 4-4. PC I/O Base Address Jumper Settings

PC I/O Base Address	JP5	JP6	JP7
0x220 - 22F (default)			
0x230-23F			
0x300-30F			
0x310-31F			
0x330-33F			
0x340-34F			
0x350-35F			
0x360-36F			

Each of the following sections describes the signals on the UNIDEX 600 board. Refer to the appropriate manual (the *DR500 Operation & Technical Manual, P/N EDA120*, the *DR500 Interface Board Option Manual, P/N EDA107*, or the *DR500 Navigator Board Option Manual, P/N EDA109*) for interface information and signal locations on these boards.

4.3. Encoder Signal Specifications

4.3.1. Differential Encoders



The UNIDEX 600 accepts differential RS-422 type square wave encoder signals. A "times 4" multiplication is always performed on the encoder fundamental line count. For example, if the encoder line count is 1,000 lines, the effective machine resolution is 4,000 machine steps (or counts) per revolution.

The marker and quadrature signal inputs are 26LS32 type RS-422 receivers. The sine and cosine signals are pulled to +5 volts through 10K ohm resistors see Figure 4-2.

4.3.2. Single Ended Encoders

Single ended encoders may be used with the UNIDEX 600 by connecting a 4.7K ohm 1/4 watt resistor from the unused differential input to signal common, removing the 180 ohm termination resistor and disabling the encoder feedback fault in the Faultmask axis parameters as illustrated below in Figure 4-2. In this configuration, only a single-ended active high (or active low) signal is provided. See Table 4-5 through Table 4-8 that indicates which resistor networks (RNs) to remove.

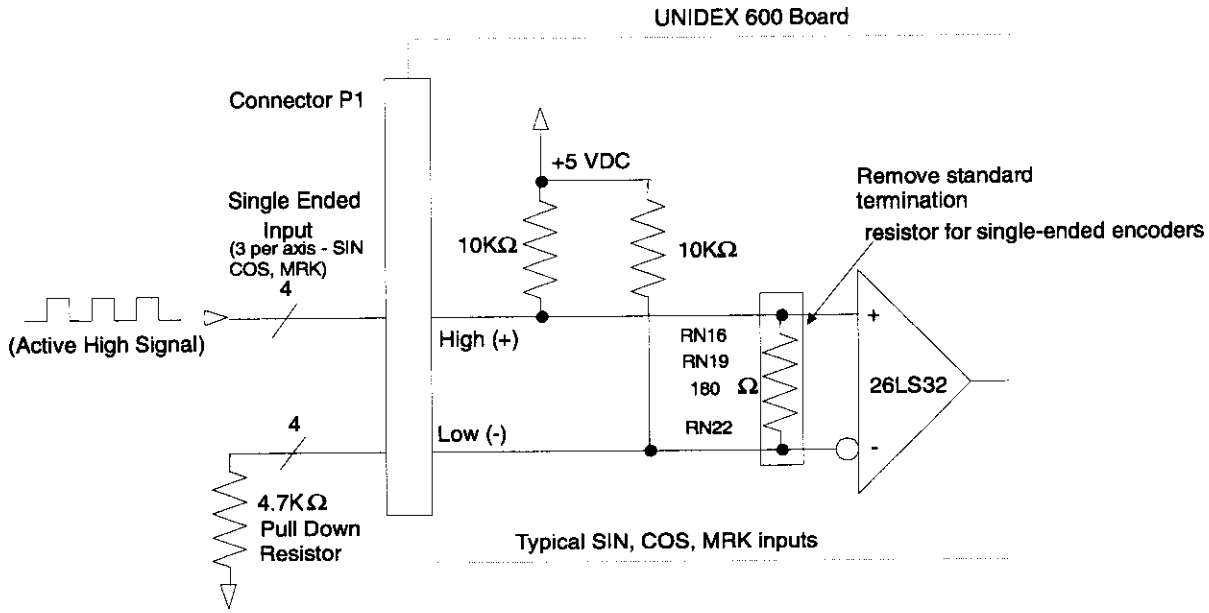
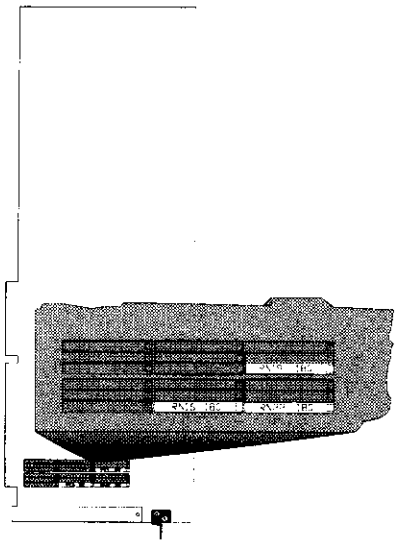


Figure 4-2. Electrical Characteristics of an Encoder Interface (Showing Configuration of Optional Single-ended Encoder

The removable termination resistors for axes 1-4 are grouped into three in-line resistor networks (RN16, RN19 and RN22). If your application mixes differential and single-ended encoders, you must provide separate 180-ohm resistors to replace the termination resistors that have been removed as part of the resistor network(s).



Resistor networks **RN16, RN19 and RN22** provide termination resistors for axes 1, 2, 3 and 4. The following tables show the important configuration information for each individual axis. Included are the resistor network number, main pinouts (connector P1), axis signals, and resistor network pin numbers.

Table 4-5. Termination Resistor Configuration for Axis 1 Encoder

RN #	P1 Pinout	Axis Signal	RN Pin Number	180 Ω Resistor *
RN19	11 12	MRK1+ MRK1-	2 1	
RN22	7 8	SIN1+ SIN1-	1 2	
RN22	9 10	COS1+ COS1-	3 4	

* Use a 180 Ω termination resistor for standard differential encoders.

Table 4-6. Termination Resistor Configuration for Axis 2 Encoders

RN #	P1 Pinout	Axis Signal	RN Pin Number	180 Ω Resistor *
RN19	20 19	MRK2- MRK2+	3 4	
RN22	16 15	SIN2- SIN2+	6 5	
RN22	18 17	COS2- COS2+	8 7	

* Use a 180 Ω termination resistor for standard differential encoders.

Table 4-7. Termination Resistor Configuration for Axis 3 Encoders

RN #	P1 Pinout	Axis Signal	RN Pin Number	180 Ω Resistor *
RN19	28 27	MRK3- MRK3+	5 6	
RN16	24 23	SIN3- SIN3+	2 1	
RN16	26 25	COS3- COS3+	4 3	

* Use a 180 Ω termination resistor for standard differential encoders.

Table 4-8. Termination Resistor Configuration for Axis 4 Encoders

RN #	P1 Pinout	Axis Signal	RN Pin Number	180 Ω Resistor *
RN19	36 35	MRK4- MRK4+	7 8	
RN16	32 31	SIN4- SIN4+	6 5	
RN16	34 33	COS4- COS4+	8 7	

* Use a 180 Ω termination resistor for standard differential encoders.

4.4. Reserved Outputs

These outputs are not used at this time, they are reserved for future applications, refer to Figure 4-3. If P10 (of the U600) is connected to J10 of the DR500, the DR500 may be configured for these signals to be present at J11 Pins 15 and 16 respectively. These signals are available on the BB501 board via opto-isolators at TB4, pins 6 - 7 and pins 8 - 9, respectively. These signals are not available on the BB500.

Refer to the *DR500 Operation and Technical, P/N EDA120* and the *BB501 Interface Board Option Manual, P/N EDO107* for more information.

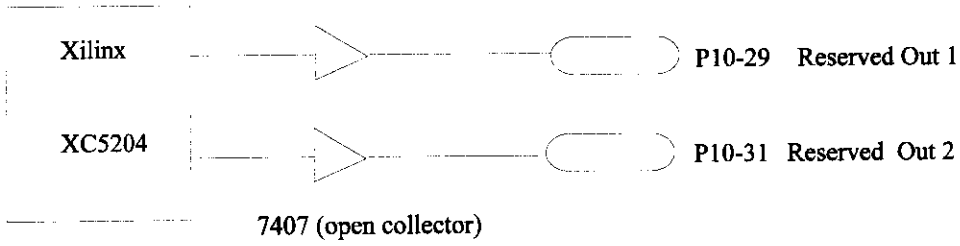


Figure 4-3. Reserved Outputs

4.5. Encoder Signal Pinouts

Table 4-9 identifies the encoder signals and the corresponding P1 connector pin number and termination locations.

Table 4-9. Encoder Signals and Pinouts

Signal Name	P1 Pin Number	Termination Location
Channel 1		
Sine, Positive	7	RN-22-1
Sine, Negative	8	RN-22-2
Marker, Positive	11	RN-19-2
Marker, Negative	12	RN-19-1
Cosine, Positive	9	RN-22-3
Cosine, Negative	10	RN-22-4
Channel 2		
Sine, Positive	15	RN-22-5
Sine, Negative	16	RN-22-6
Marker, Positive	19	RN-19-4
Marker, Negative	20	RN-19-3
Cosine, Positive	17	RN-22-7
Cosine, Negative	18	RN-22-8
Channel 3		
Sine, Positive	23	RN-16-1
Sine, Negative	24	RN-16-2
Marker, Positive	27	RN-19-6
Marker, Negative	28	RN-19-5
Cosine, Positive	25	RN-16-3
Cosine, Negative	26	RN-16-4
Channel 4		
Sine, Positive	31	RN-16-5
Sine, Negative	32	RN-16-6
Marker, Positive	35	RN-19-8
Marker, Negative	36	RN-19-7
Cosine, Positive	33	RN-16-7
Cosine, Negative	34	RN-16-8

4.6. Limit and Amplifier Fault Inputs

The UNIDEX 600 contains three limit inputs per axis; two over travel and one home. In addition, each axis has one amplifier fault input and three Hall effect inputs.

The inputs are TTL level signals pulled up to +5 volts with a 10K ohm resistor. Open collector drivers or opto-isolators are the preferred electrical interface to this bus. Refer to Figure 4-4 for electrical characteristics of the limit/amplifier inputs.

To avoid damage to the UNIDEX 600, the input level should never exceed +5 volts or go below 0 volts.

The active polarity of the limit and amplifier fault inputs is software selectable. Limit and amplifier fault inputs are summarized in Table 4-10.

Table 4-10. Limit and Amplifier Fault Inputs

Axis	Function	Signal	Location
1	Clockwise Rotation Limit Switch	CW1	P1 - 39
	Counter-Clockwise Rotation Limit Switch	CCW1	P1 - 40
	Home Limit Switch	HOME1	P1 - 47
	Amplifier Fault	AFAULT1	P1 - 73
	Hall Effect 1A	Hall 1A	P10 - 21
	Hall Effect 1B	Hall 1B	P10 - 23
	Hall Effect 1C	Hall 1C	P10 - 19
2	Clockwise Limit Switch	CW2	P1 - 41
	Counter-Clockwise Rotation Limit Switch	CCW2	P1 - 42
	Home Limit Switch	HOME2	P1 - 48
	Amplifier Fault	AFAULT2	P1 - 74
	Hall Effect 2A	Hall 2A	P10 - 15
	Hall Effect 2B	Hall 2B	P10 - 17
	Hall Effect 2C	Hall 2C	P10 - 13
3	Clockwise Limit Switch	CW3	P1 - 43
	Counter-Clockwise Rotation Limit Switch	CCW3	P1 - 44
	Home Limit Switch	HOME3	P1 - 49
	Amplifier Fault	AFAULT3	P1 - 75
	Hall Effect 3A	Hall 3A	P10 - 9
	Hall Effect 3B	Hall 3B	P10 - 11

Table 4-10. Limit and Amplifier Fault Inputs (cont'd)

Axis	Function	Signal	Location
	Hall Effect 3C	Hall 3C	P10 - 7
4	Clockwise Limit Switch	CW4	P1 - 45
	Counter-Clockwise Rotation Limit Switch	CCW4	P1 - 46
	Home Limit Switch	HOME4	P1 -50
	Amplifier Fault	AFAULT4	P1 - 76
	Hall Effect 4A	Hall 4A	P10 - 3
	Hall Effect 4B	Hall 4B	P10 - 5
	Hall Effect 4C	Hall 4C	P10 - 1

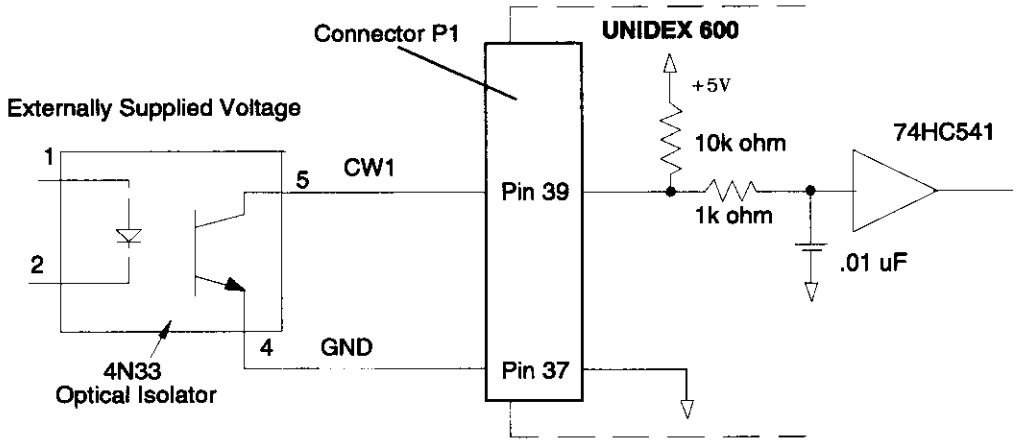


Figure 4-4. Electrical Characteristics of the UNIDEX 600 Hall Effect, Limit and Amplifier Fault Inputs

4.7. Serial Ports

The serial ports 1 and 2 are reserved for future applications, for example, the UNIDEX 600 Series teach pendant. Refer to Figure 4-5 for pinouts.

These signals are only available directly off the UNIDEX 600, and not the BB500, BB501, or DR500.

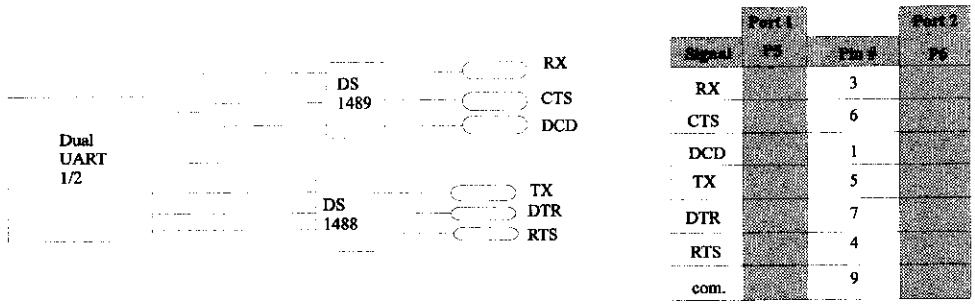


Figure 4-5. Serial Ports 1 and 2 Pinouts

4.8. Emergency Stop Sense Input

The UNIDEX 600 has an optically isolated emergency stop input (refer to Figure 4-6). The user must provide an external power supply to drive the on-board opto-isolator. External voltages and resistances are enumerated in Table 4-11. This input is used to sense the activation of an external E-stop circuit.

Refer to the DR500 Operation and Technical, P/N EDA120 and the BB501 Interface Board Option Manual, P/N EDO107 for interface information and signal location.

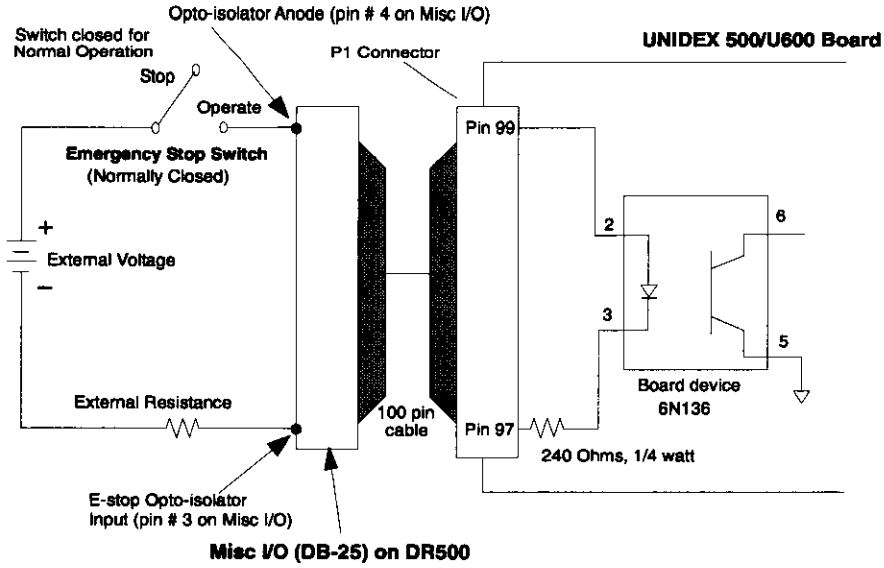


Figure 4-6. Electrical Characteristics of the UNIDEX 600 Emergency Stop Interface

Table 4-11. External Voltages and Resistances for the Emergency Stop Input

External Voltage	External Resistance (in Ohms)
5 VDC	0 Ω
12 VDC	290 Ω, 1/4 watt
24 VDC	1KΩ, 1/2 watt

The U600 requires a parameter change before it recognizes the E-stop circuit. Refer to the UNIDEX 600 User's Guide, P/N EDU137 for more details.

4.9. External Reset Input

The UNIDEX 600 can be reset to its power-up state externally by pulling connector P10, pin 25 to common through jumper JP15. Refer to Figure 4-7. If P10 (of the U600) is connected to J10 of the DR500, the DR500 may be configured for this signal to be present at J11 Pin 13. This signal is available on the BB501 board via TB4, pin 4. This signal is not available on the BB500.

Refer to the *DR500 Operation and Technical, P/N EDA120* and the *BB501 Interface Board Option Manual, P/N EDO107* for more information.

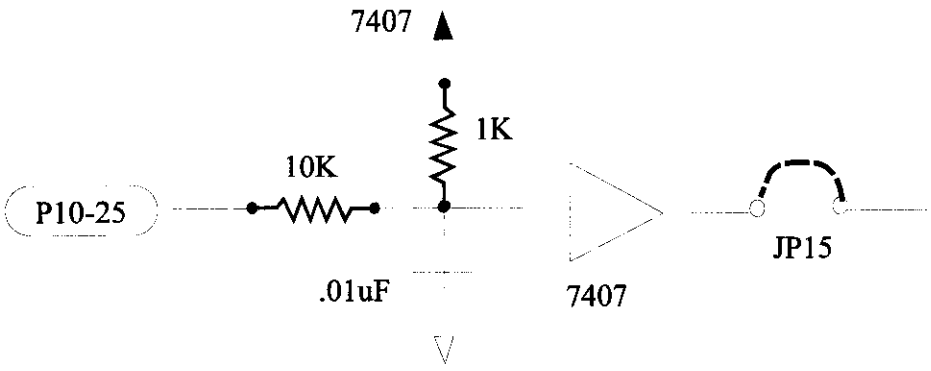


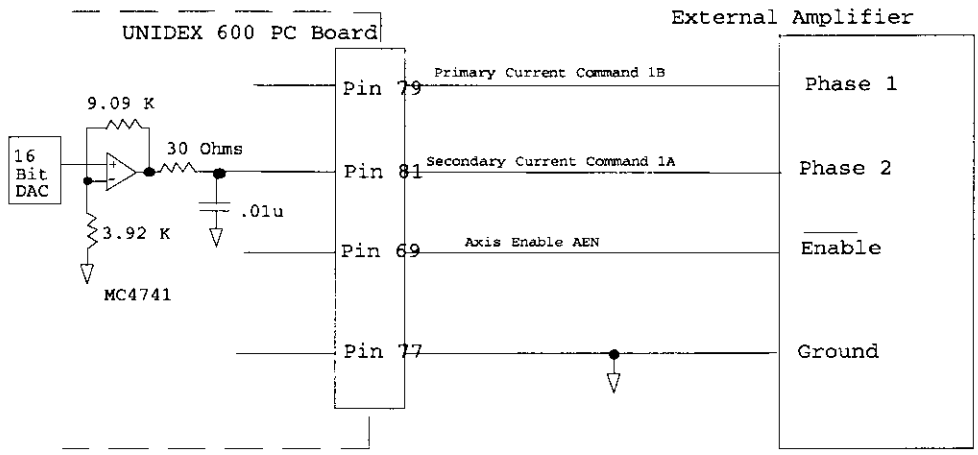
Figure 4-7. External Reset Circuit

4.10. Current Command Output

The UNIDEX 600 has eight 16 bit current command outputs. The output range is +/- 10 volts into a 10K ohm load. AC servomotors and steppers require two current phases. Brush motors or self-commutating amplifiers require only one (primary). Refer to Figure 4-8 and Table 4-12 for electrical characteristics of the current command interface.

The UNIDEX 600 must always be connected to an amplifier with an opto-isolated power stage.

To avoid damage to the system, the UNIDEX 600 must not be connected to an Amplifier with a non-isolated power stage.



NOTE: Secondary Current Command 1A is only required for Brushless motors

Figure 4-8. Electrical Characteristics of the UNIDEX 600 Current Command Output

Table 4-12. Current Command Output Signals and Pin Locations

Axis	Function	Signal	Location	Alternate	Location
Axis 1	Primary Current Cmd Axis 1	ICMD1B	P1-79	A50	Pin 7
	Secondary Current Cmd Axis 1	ICMD1A	P1-80	A50	Pin 1
Axis 2	Primary Current Cmd Axis 2	ICMD2B	P1-81	A50	Pin 8
	Secondary Current Cmd Axis 2	ICMD2A	P1-82	A50	Pin 14
Axis 3	Primary Current Cmd Axis 3	ICMD3B	P1-83	A51	Pin 7
	Secondary Current Cmd Axis 3	ICMD3A	P1-84	A51	Pin1
Axis 4	Primary Current Cmd Axis 4	ICMD4B	P1-85	A51	Pin 8
	Secondary Current Cmd Axis 4	ICMD4A	P1-86	A51	Pin 14

4.11. Digital Input Bus Specifications

The UNIDEX 600 has 16 inputs. The inputs are TTL level signals pulled up to +5 volts with a 10K ohm resistor. Open collector drivers or opto-isolators are the preferred electrical interface to this bus. Refer to Figure 4-9 for electrical characteristics of the input bus. See Table 4-13 for UNIDEX 600 inputs and locations. Refer to Section 2.7.3. for interconnection examples.

To avoid damage to the UNIDEX 600, the input level should never exceed +5 volts or go below 0 volts.

Inputs IN0-IN3 are accessible through both the main P1 connector and the P9 connector.
Inputs IN4-IN15 are accessible only through the P9 connector.

UNIDEX 600's P9 and P10 connector's are compatible with a PB24 Opto interface board.
Inputs are read using M Codes.

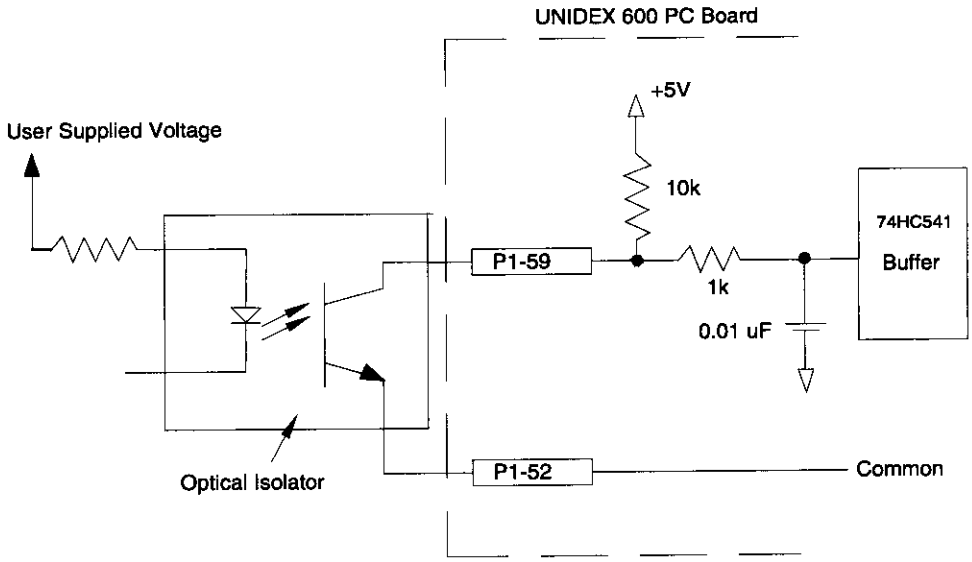


Figure 4-9. Electrical Characteristics of the UNIDEX 600 Input Bus Interface

Table 4-13. UNIDEX 600 Inputs and Locations

Input #	Location(s)	Input #	Location	Input #	Location	Input #	Location(s)
0	P9 - 31 / P1 - 59	5	P9 - 21	10	P9 - 11	15	P9 - 1
1	P9 - 29 / P1 - 60	6	P9 - 19	11	P9 - 9	Common	P9 2-50 (even)
2	P9 - 27 / P1 - 61	7	P9 - 17	12	P9 - 7	+5 volts	P9 - 49
3	P9 - 25 / P1 - 62	8	P9 - 15	13	P9 - 5		
4	P9 - 23	9	P9 - 13	14	P9 - 3		

4.12. Output Bus Specifications

The UNIDEX 600 has 16 TTL level outputs. Refer to Figure 4-10 for electrical characteristics of the output bus. Outputs 0-3 are accessible through both the main P1 connector and the P9 connector. Refer to Section 2.7.3. for interconnection examples.

The UNIDEX 600 connector is compatible with a PB24 Opto interface board. Outputs are activated using M Codes. Table 4-14 lists the UNIDEX 600 outputs and their respective locations. The 74F534 device can sink up to 24 mA of current.

Table 4-14. UNIDEX 600 Outputs and Locations

Output #	Location	Output #	Location
0	P9 - 47 / P1 - 63	9	P10 - 45
1	P9- 45 / P1 - 64	10	P10 - 43
2	P9- 43 / P1 - 65	11	P10 - 41
3	P9 - 41 / P1 - 66	12	P10 - 39
4	P9 - 39	13	P10 - 37
5	P9 - 37	14	P10 - 35
6	P9 - 35	15	P10 - 33
7	P9 - 33	Common	P10 2-50 even pins
8	P10 - 47	+5 Volts	P10 - 49

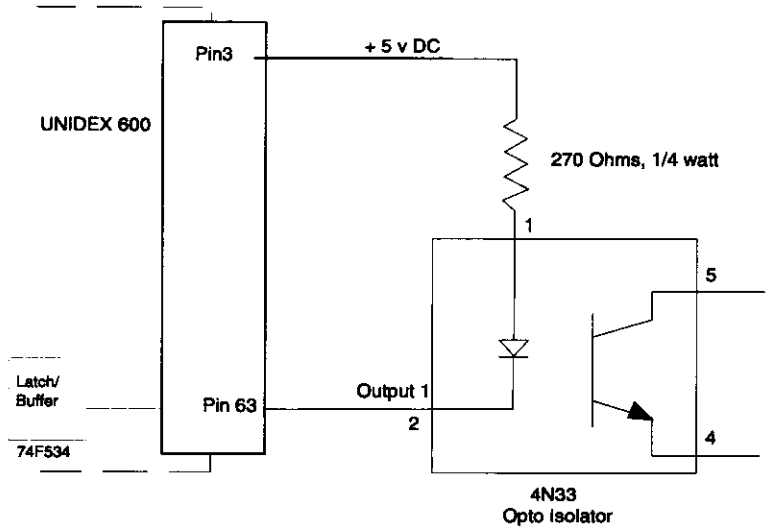


Figure 4-10. Electrical Characteristics of the UNIDEX 600 Output Bus Interface

4.13. Amplifier Enable Outputs

Each axis has one open collector amplifier enable output (refer to Table 4-15 and Figure 4-11). The active polarity of this signal is selectable by the configuration of jumpers 10-13. (Refer to Chapter 3 for additional jumper information.)

Each output is an open collector of a P5240AN opto-isolator with absolute maximum ratings of 30 volts and 40 mA sink capability.

Exceeding the amplifier output ratings may cause damage to the UNIDEX 600 control board.

Table 4-15. Amplifier Enable Output Locations

Signal	Location
Amplifier Enable 1 (AEN1)	P1 - 69
Amplifier Enable 2 (AEN2)	P1 - 70
Amplifier Enable 3 (AEN3)	P1 - 71
Amplifier Enable 4 (AEN4)	P1 - 72

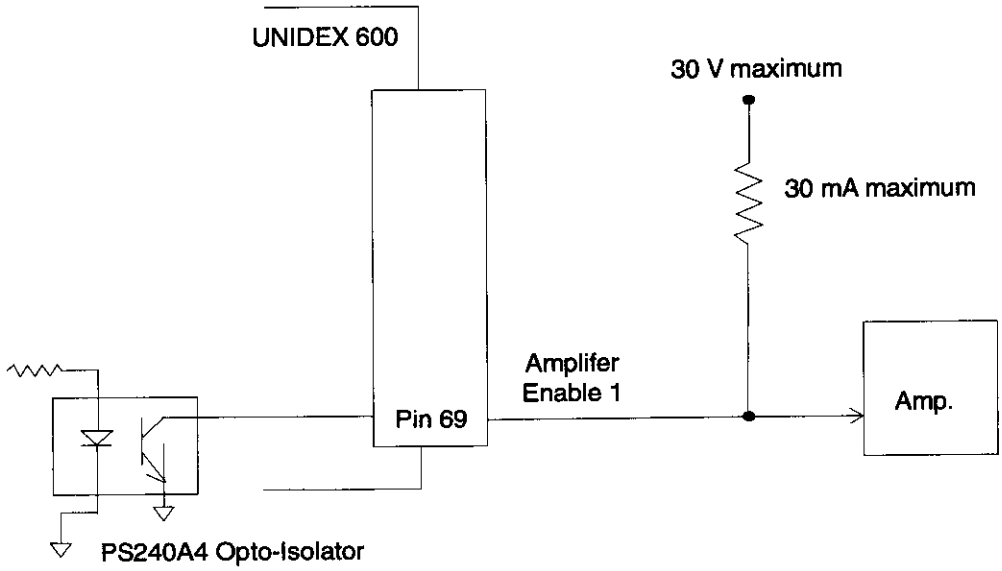


Figure 4-11. Electrical Characteristics of the UNIDEX 600 Amplifier Enable Output

4.14. The Brake Output

The UNIDEX 600 is equipped with a fail-safe brake signal output using a high voltage open collector driver (7407). Refer to Figure 4-12.

When the UNIDEX 600 is in the reset state, this output is in the high impedance state. When the brake is activated, this signal is pulled low. This output signal is referenced to the UNIDEX 600 signal common.

Refer to the *DR500 Operation and Technical, P/N EDA120* and the *BB501 Interface Board Option Manual, P/N EDO107* for interface information and signal location.

The maximum rating for the brake output signals are as follows:

Maximum Voltage	30 volts
Maximum Current Sink	40 mA

The brake signal is output through pin 94 of the P1 connector.

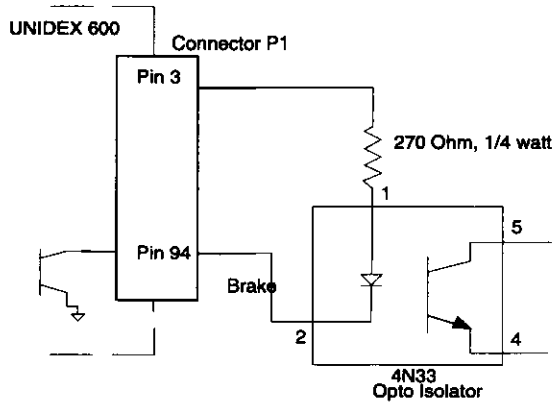


Figure 4-12. Electrical Characteristics of the Brake Signal Output

4.15. Opto 22 I/O Bus

UNIDEX 600's P9 connector provides a simple interface to the PB24 Opto 22 Interface Board (8 outputs/16 inputs). The P10 connector provides an additional 8 outputs (as well as the 12 hall effect sensor inputs and the high speed position latch input) also compatible with a PB24 Opto 22 Interface Board (8 outputs/12 hall effect inputs and 1 position latch input). Refer to Section 2.7.3. for interconnection examples.

UNIDEX 600's P9 and P10 connectors are a 50 pin header, the PB24 connector is a standard edge card type connector. A 1-to-1 ribbon cable can be made to connect the two. The mating connectors are:

50 pin ribbon cable header P/N# 3M 3425-6050
Aerotech P/N ECK 332 (or equivalent)

50 pin cable edge connector P/N# 3M 3415-0001
Aerotech P/N ECK 310 (or equivalent)

Refer to Table 4-16 for connection information. Refer to Figure 4-13 for an illustration of the electrical characteristics of the Opto 22 interface and Figure 4-4 for an illustration of the electrical characteristics of the Hall effect inputs.

The following table lists the UNIDEX 600 Interface to the PB8, PB16 and the PB24 Opto 22 Interface Boards.

Table 4-16. UNIDEX 600 Opto 22 Connection Information

Interface Cable Assembly (model OPC)	PB8, PB16A, PB16C and PB24 Board					
Opto Interface (P9)	Control Connection (edge connector on Opto board)	Module Position	Connection Description	Type of Module	Field Connection (barrier strip)	
49	49		+5V int supply			
47	47	0	Out 0	output	1 and 2	
45	45	1	Out 1	output	3 and 4	
43	43	2	Out 2	output	5 and 6	PB8
41	41	3	Out 3	output	7 and 8	
39	39	4	Out 4	output	9 and 10	
37	37	5	Out 5	output	11 and 12	
35	35	6	Out 6	output	13 and 14	
33	33	7	Out 7	output	15 and 16	↓
31	31	8	In 0	input	17 and 18	
29	29	9	In 1	input	19 and 20	PB
27	27	10	In 2	input	21 and 22	16A
25	25	11	In 3	input	23 and 24	and
23	23	12	In 4	input	25 and 26	16C
21	21	13	In 5	input	27 and 28	
19	19	14	In 6	input	29 and 30	
17	17	15	In 7	input	31 and 32	↓
15	15	16	In 8	input	33 and 34	
11	13	17	In 9	input	35 and 36	
11	11	18	In 10	input	37 and 38	
9	9	19	In 11	input	39 and 40	PB24
7	7	20	In 12	input	41 and 42	

Table 4-16. UNIDEX 600 Opto 22 Connection Information Cont'd

Opto Interface (P9)	Control Connection (edge connector on Opto board)	Module Position	Connection Description	Type of Module	Field Connection (barrier strip)	
5	5	21	In 13	input	43 and 44	|
3	3	22	In 14	input	45 and 46	|
1	1	23	In 15	input	47 and 48	↓

All even pins (2-50) are signal common.	**WARNING !** Type of module (input or output) cannot be interchanged. To do so may damage the UNIDEX 600

Typical Modules: IDC5, IDC5B, IAC5, IAC5A, ODC5, ODC5A, OAC5, and OAC5A.

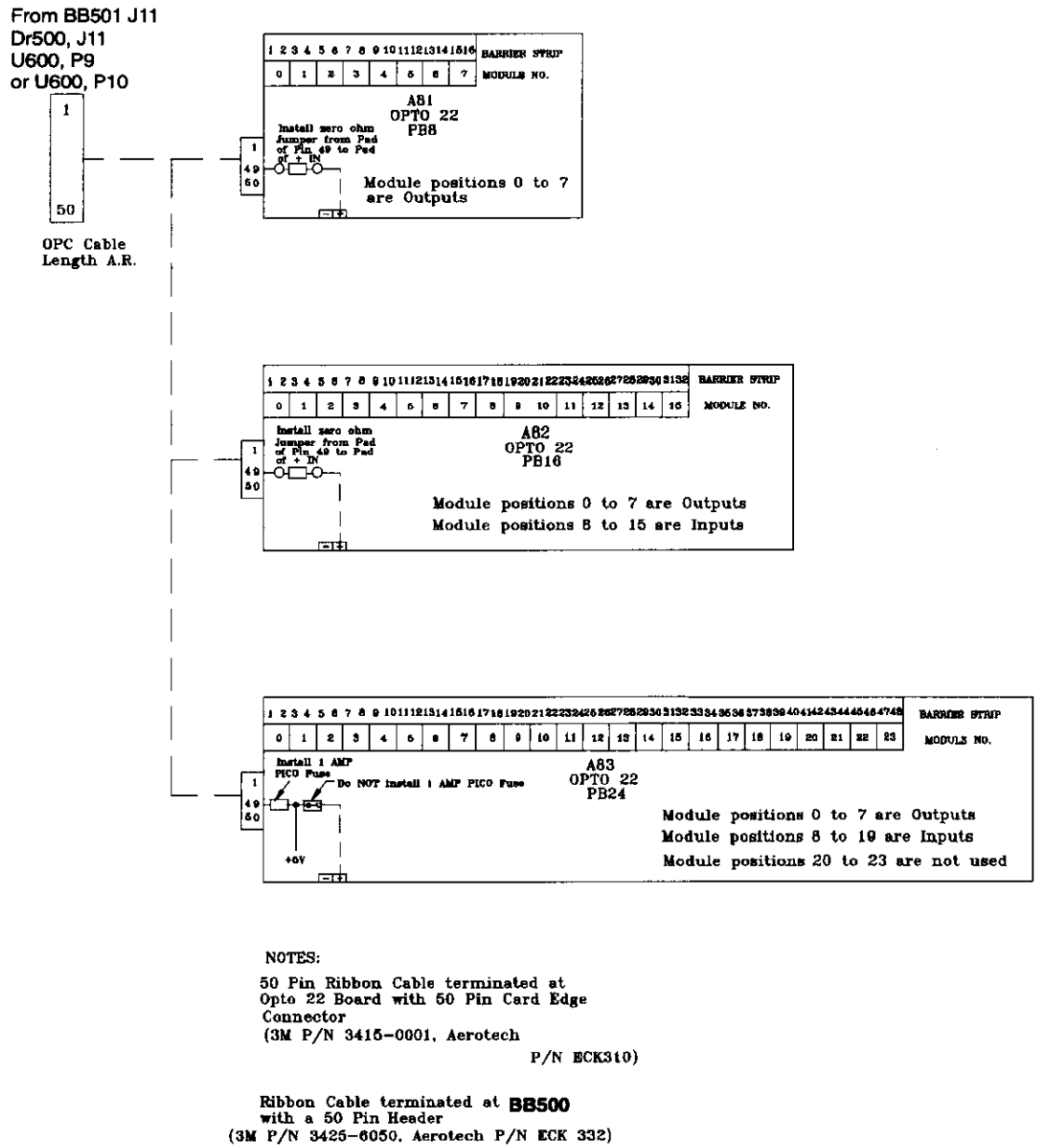


Figure 4-13. Electrical Characteristics of the UNIDEX 600 Opto 22 Connections

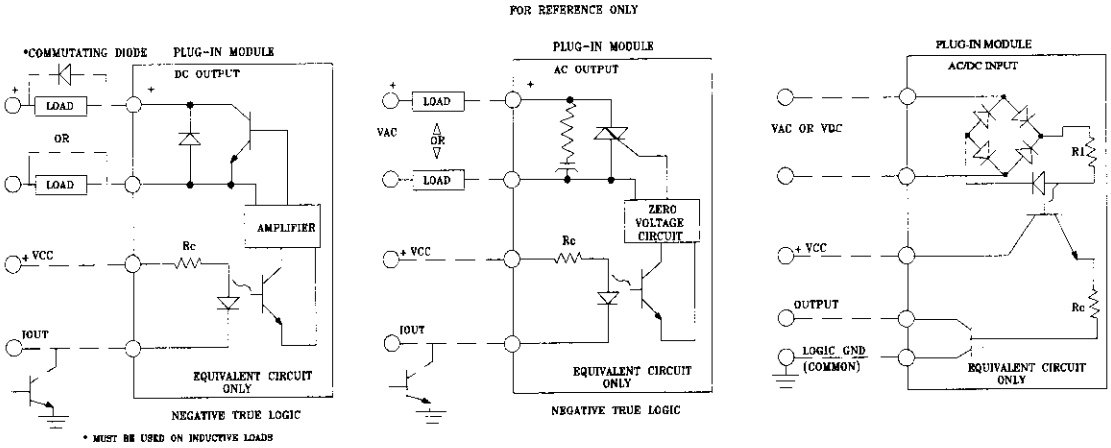


Figure 4-13. Electrical Characteristics of the UNIDEX 600 Opto 22 Connections (continued)

4.16. Main Connector Pinout of the UNIDEX 600

The UNIDEX 600's main interface connector (P1) is accessible from the rear of the PC. The connector is a 100-pin "AMPLIMITE" high density female connector. The mating connector is an "AMPLIMITE" series connector, part number 759879-9. This connector accepts two 50-pin ribbon cables and is non-shielded.

Refer to Table 4-17 for the main connector pinouts.

Table 4-17. Main Connector Pinouts for the UNIDEX 600

Pin	Function	Descr.	Pin	Function	Descr.
1	Common	ILOCKS	2	*Reserved*	*Reserved*
3	+5 Volts	+5	4	+5 Volts	+5
5	Encoder Common	Common	6	Encoder Common	Common
7	Encoder Sine Positive, Axis 1	SIN1+	8	Encoder Sine Ground, Axis 1	SIN1-
9	Encoder Cosine Positive, Axis 1	COS1+	10	Encoder Cosine Ground, Axis 1	COS1-
11	Marker Pulse, Axis 1	MRK1+	12	Marker Pulse, Axis 1	MRK1-
13	Encoder Common	Common	14	Encoder Common	Common
15	Encoder Sine Positive, Axis 2	SIN2+	16	Encoder Sine Ground, Axis 2	SIN2-
17	Encoder Cosine Positive, Axis 2	COS2+	18	Encoder Cosine Ground, Axis 2	COS2-
19	Marker Pulse, Axis 2	MRK2+	20	Marker Pulse, Axis 2	MRK2-
21	Encoder Common	Common	22	Encoder Common	Common
23	Encoder Sine Positive, Axis 3	SIN3+	24	Encoder Sine Ground, Axis 3	SIN3-
25	Encoder Cosine Positive, Axis 3	COS3+	26	Encoder Cosine Ground, Axis 3	COS3-
27	Marker Pulse, Axis 3	MRK3+	28	Marker Pulse, Axis 3	MRK3-
29	Encoder Common	Common	30	Encoder Common	Common
31	Encoder Sine Positive, Axis 4	SIN4+	32	Encoder Sine Ground, Axis 4	SIN4-
33	Encoder Cosine Positive, Axis 4	COS4+	34	Encoder Cosine Ground, Axis 4	COS4-
35	Marker Pulse, Axis 4	MRK4+	36	Marker Pulse, Axis 4	MRK4-
37	Encoder Common	Common	38	Encoder Common	Common
39	Clockwise Limit, Axis 1	CW1	40	Counter clockwise Limit, Axis 1	CCW1
41	Clockwise Limit, Axis 2	CW2	42	Counter clockwise Limit, Axis 2	CCW2
43	Clockwise Limit, Axis 3	CW3	44	Counter clockwise Limit, Axis 3	CCW3
45	Clockwise Limit, Axis 4	CW4	46	Counter clockwise Limit, Axis 4	CCW4
47	Home Limit, Axis 1	HOME1	48	Home Limit, Axis 2	HOME2
49	Home Limit, Axis 3	HOME3	50	Home Limit, Axis 4	HOME4
51	Reserved	Reserved	52	Limits Common	Common
53	+12 Volts	+12	54	+12 Volts	+12
55	-12 Volts	-12	56	-12 Volts	-12
57	Mode Axis 1	MODE1	58	Mode Axis 2	MODE2
59	Input 0	IN0	60	Input 1	IN1
61	Input 2	IN2	62	Input 3	IN3
63	Output 0	OUT0	64	Output 1	OUT1
65	Output 2	OUT2	66	Output 3	OUT3
67	Mode Axis 3	MODE3	68	Mode Axis 4	MODE4
69	Amplifier Enable 1	AEN1	70	Amplifier Enable 2	AEN2
71	Amplifier Enable 3	AEN3	72	Amplifier Enable 4	AEN4
73	Amplifier Fault 1	AFLT1	74	Amplifier Fault 2	AFLT2
75	Amplifier Fault 3	AFLT3	76	Amplifier Fault 4	AFLT4
77	Limits Common	Common	78	Limits Common	Common
79	Axis 1 Primary Current Cmd	ICMD1B	80	Axis 1 Secondary Current Cmd	ICMD1A
81	Axis 2 Primary Current Cmd	ICMD2B	82	Axis 2 Secondary Current Cmd	ICMD2A
83	Axis 3 Primary Current Cmd	ICMD3B	84	Axis 3 Secondary Current Cmd	ICMD3A
85	Axis 4 Primary Current Cmd	ICMD4B	86	Axis 4 Secondary Current Cmd	ICMD4A
87	Common	Common	88	Common	Common
89	Joystick Potentiometer 1 Input	JSW1	90	Joystick Potentiometer 2 Input	JSW2
91	Joystick Button A Input	JSA	92	Joystick Button B Input	JSB
93	Joystick Interlock	JSC	94	Brake Output	BRAKE
95	Analog Input 0	AIN0	96	Analog Input 1	AIN1
97	E - Stop Cathode (See P1-99)	ESTOP	98	User Interrupt/Cmd Trigger	UINT
99	E-Stop Anode (See P1-97)	OPTOA	100	Interlock Receive	ILOCKR

4.17. High Speed Position Latch

The U600 provides an input for an external trigger to latch the axis positions within 60 nanoseconds. This is accomplished by taking the input at connector P10-27 to common. It is internally pulled up to the +5 V supply and then filtered with a 1K Ω resistor and a .01 µF capacitor, refer to Figure 4-14. This captures the positions of all the axes on that board. If using 4EN-PC expansion boards, the trigger input of these boards has to be driven by the trigger source. Also, this captures the positions of the axes on that board.

If P10 (of the U600) is connected to J10 of the BB501, this signal will be available at TB4, pin 5 . If P10 (of the U600) is connected to J10 of the DR500, the DR500 may be configured for this signal to be present at J11, pin 14. This signal is not available on the BB500.

Refer to the *DR500 Operation and Technical, P/N EDA120* and the *BB501 Interface Board Option Manual, P/N EDO107* for more information.

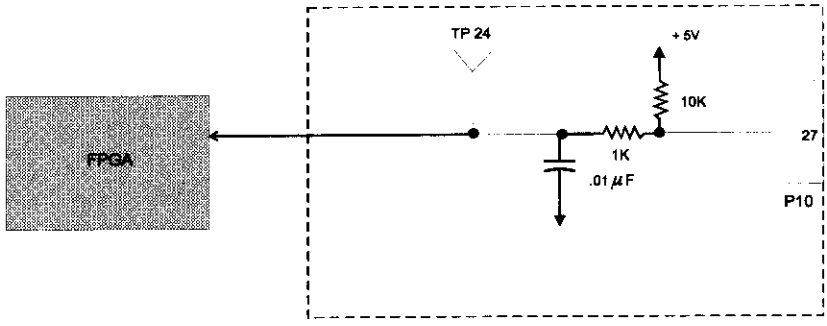
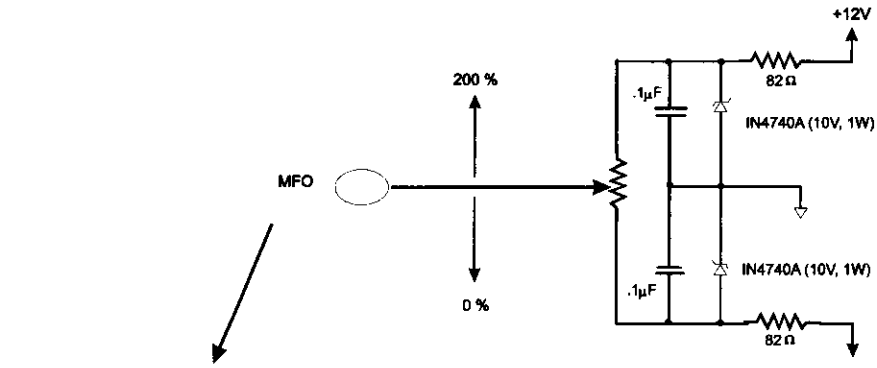


Figure 4-14. Electrical Characteristics of U600 High Speed Position Latch

4.18. U600 Manual Feedrate Override/Manual Spindle Override

The U600 provides the user with the ability to manually override the programmed feedrate using an external potentiometer, refer to Figure 4-15. While the voltage at the analog input varies from -10V to +10V, the MFO/MSO varies from 0% to 200% respectively. For OS/2 users, the hardware input is fixed at Analog input 0 (AIN0). This input simultaneously varies the programmed feedrate and spindle feedrate. For Windows NT/95, each override may be assigned a separate input by the *AnalogMFOInput* and *AnalogMSOInput* task parameters, respectively. Figure 4-15 electrical schematic applies to all users, however, the chart indicates the mandatory location for OS/2 users. The potentiometer should be a minimum of 10k ohms.



MFO	[illegible]	+12V	-12V
U600	P1-95	P1 53 & 54	P1 - 55 & 56
DR500	J13-24	*	*
BB500	P5-18	P7 - 4	P7- 3
BB501	TB1-3	*	*

* Unavailable

Figure 4-15. Manual Feedrate Override Circuit

4.19. Mode (Aux) Output Specifications

The U600 contains one for each of the first four axes used to control AS16010 drive modules. These may also be used by the user (refer to the U600 Series User's Guide, P/N EDU157, Appendix C: Parameters [AUX axis parameter] or P/N EDU152 for OS/2 users) if the drives are not in the system. They are driven by an open-collector buffer (7407). Refer to the *DR500 Operation and Technical, P/N EDA120*, the *BB501 Interface Board Option Manual, P/N EDO107*, and the *BB500 Interface Board Option Manual, P/N EDO109* for interface information and signal locations.

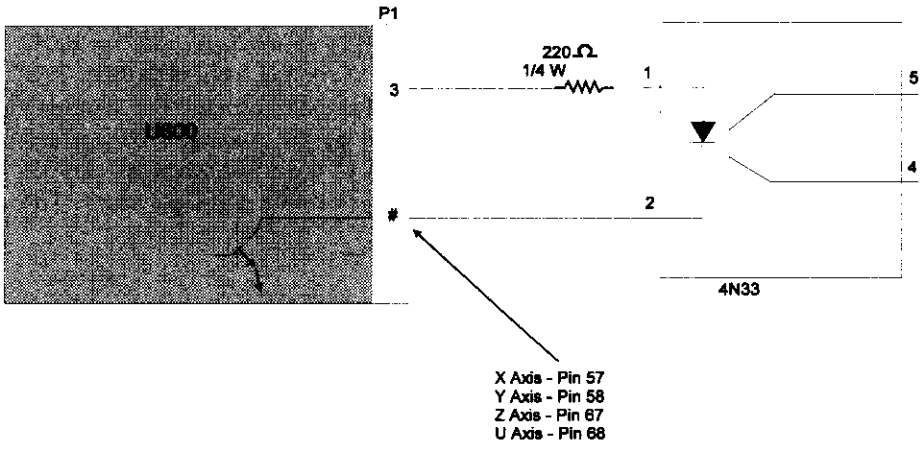


Figure 4-16. Electrical Characteristics of the Mode (Aux) Output

4.20. Multi-board Synchronization Specifications

The pinouts for the multi-board synchronization connector are listed in Table 4-18.

Table 4-18. Multi-board Synchronization Connector Pinouts

Pin #	Description
1	Servo loop interrupt from "Master" control board.
2	Servo loop interrupt output from "Master" to "Slave".
3	Common.
4	Common.
5	Command synchronization input (also available from P1 - 98)
6	Command synchronization output from "Master" and "Slave".

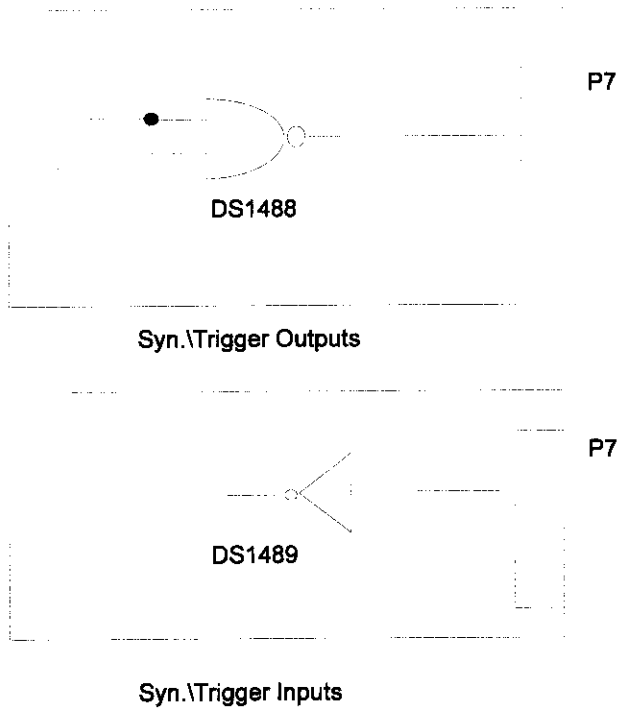


Figure 4-17. Multi-board Synchronization Electrical Characteristics

4.21. ~~iSBX~~ Connector Pinout ~~(P4)~~

The pinouts for the ~~iSBX~~ connector are listed in Table 4-19.

Table 4-19. ~~iSBX~~ Connector Pinouts

Pin #	Description	Pin #	Description
1	MA3	26	D4
2	Common	27	OPT1
3	MA4	28	D3
4	Common	29	OPT0
5	MCLK	30	D2
6	MRESET	31	MA11
7	MA5	32	D1
8	MA2	33	D16
9	MA6	34	D0
10	MA1	35	D17
11	MINTR1	36	D18
12	MA0	37	D19
13	MINTR0	38	D20
14	IOWR	39	D21
15	MA7	40	D22
16	IORD	41	D23
17	MA8	42	D14
18	Common	43	MWAIT
19	MCS1	44	D12
20	D7	45	D15
21	MCS0	46	D10
22	D6	47	D13
23	MA9	48	D8
24	D5	49	D11
25	MA10	50	D9

4.22. ~~Expansion~~ Bus Pin Description (P8)

This bus interfaces with the Aerotech resolver, PC-PSO (laser firing), and encoder expansion cards. Pinouts for the Expansion bus are listed in Table 4-20.

Table 4-20. E~~xpansion~~ Bus Pin Outs

Pin #	Description	Pin #	Description
43	MD8	44	MD9
41	MDA	42	MDB
39	MDC	40	MDD
37	MDE	38	MDF
35	Common	36	+5v
33	MD0	34	MDRQT
31	MD1	32	MDACK
29	MD2	30	OPT0
27	MD3	28	OPT1
25	MD4	26	TDMA
23	MD5	24	*reserved*
21	MD6	22	MCS0
19	MD7	20	MSC1
17	Common	18	+5v
15	IORD	16	MWAIT
13	IOWRT	14	MINTR0
11	MA0	12	MINTR1
9	MA1	10	*reserved*
7	MA2	8	MPST
5	RESET	6	MCLK
3	Common	4	+5v
1	+12v	2	-12v

4.23. Analog Inputs

The U600 has four analog inputs. Two of these inputs are normally used for the joystick and the other two for optional MFO/MSO inputs. For OS/2 users, AIN0 must be the combination MFO/MSO input. For Windows NT/95 users, each may be assigned separately and enabled with the *AnalogMFOInput* and *AnalogMSOInput* task parameters. The analog inputs are 12 bit bipolar inputs (+10 to -10 Volts) converted to signed 15 bit numbers. The A/D converter is an AD7874 converter. Refer to Figure 4-18. Refer to the

DR500 Operation and Technical, P/N EDA120, the *BB501 Interface Board Option Manual, P/N EDO107*, and the *BB500 Interface Board Option Manual, P/N EDO109* for interface information and signal locations.

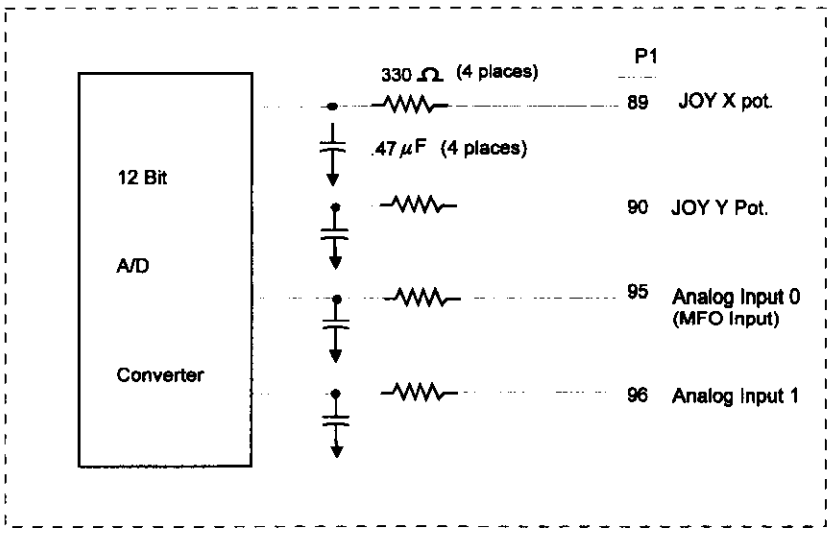


Figure 4-18. Electrical Characteristics of Analog Input

4.24. Joystick Interface

The user can connect their own joysticks and switches to the UNIDEX 600, refer to Figure 4-19. The joy interlock input in the logic low state indicates the connection of the joystick. The zero velocity null-point for each joystick connection is approximately 2.5 volts. Refer to the *DR500 Operation and Technical, P/N EDA120*, the *BB501 Interface Board Option Manual, P/N EDO107*, and the *BB500 Interface Board Option Manual, P/N EDO109* for interface information and signal locations.

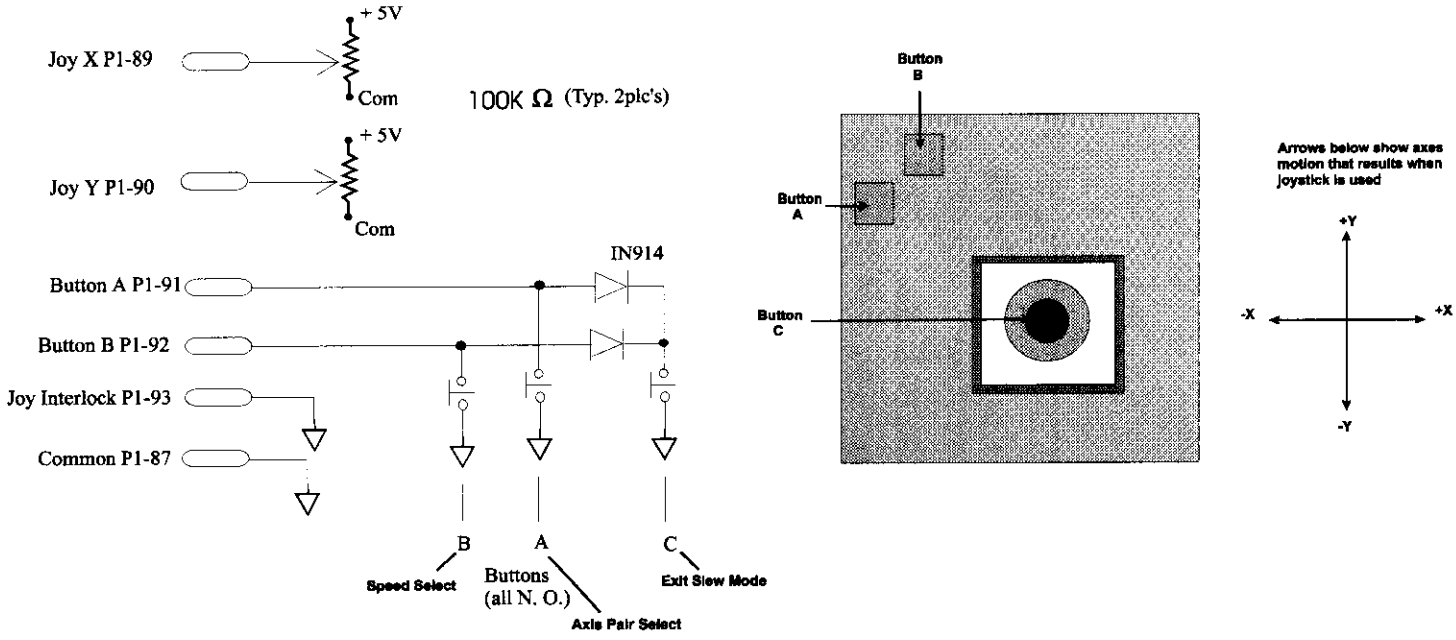


Figure 4-19. Joystick Interface

4.25. Opto 22 Outputs and Hall Sensor Inputs (P10) Pinouts

Table 4-21 lists the pinouts for the OPTO 22 outputs and hall sensor inputs (P10).

Table 4-21. Pinouts for Opto 22 Outputs and Hall Sensor Inputs (P10)

Pin	Description	Pin	Description
1	HALL 4C	2	Common
3	HALL 4A	4	Common
5	HALL 4B	6	Common
7	HALL 3C	8	Common
9	HALL 3A	10	Common
11	HALL 3B	12	Common
13	HALL 2C	14	Common
15	HALL 2A	16	Common
17	HALL 2B	18	Common
19	HALL 1C	20	Common
21	HALL 1A	22	Common
23	HALL 1B	24	Common
25	User Reset Input	26	Common
27	Position Latch Input	28	Common
29	Reserved Out 1	30	Common
31	Reserved Out 2	32	Common
33	OUT15	34	Common
35	OUT14	36	Common
37	OUT13	38	Common
39	OUT12	40	Common
41	OUT11	42	Common
43	OUT10	44	Common
45	OUT9	46	Common
47	OUT8	48	Common
49	+5	50	Common

4.26. UNIDEX 600 Breakout Block (BB500)

The UNIDEX 600 Breakout Block (BB500) provides access to amplifier signals, encoder signals, limits, inputs and outputs when the DR500 drive rack is not used. Connector P6 of the BB500 connects to the P1 connector of the UNIDEX 600 card using a 100-pin cable that is supplied with the BB500. In this configuration, four inputs and four outputs are available. If using brushless motors, the user must purchase the DIO500 and connect it between P10 of the UNIDEX 600 and P8 of the BB500. Refer to Figure 4-20.

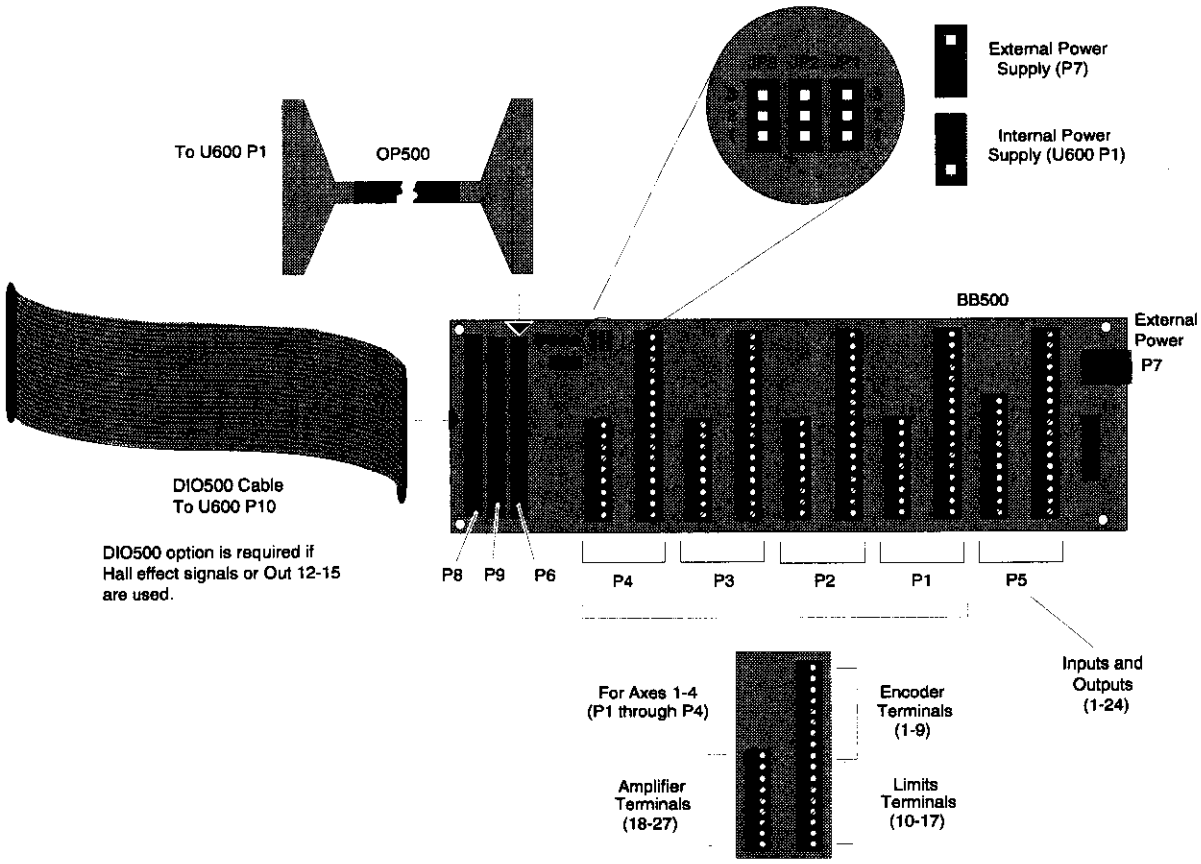


Figure 4-20. UNIDEX 600 Breakout Block (BB500)

Table 4-22 lists the pinouts for the BB500 Breakout Box terminal blocks. Terminal block P1 has connectors for axis 1, terminal block P2 for axis 2, etc.

Table 4-22. BB500 Pinouts

TB	#	Description	TB	#	Description
P1,	1	Encoder SIN +	P5	1	IN0
P2,	2	Encoder SIN -		2	IN1
P3,	3	Encoder COS +		3	IN2
and	4	Encoder COS -		4	IN3
P4	5	Encoder MRK +		5	OUT0
	6	Encoder MRK -		6	OUT1
	7	Encoder ENC +5V		7	OUT2
	8	Encoder COM		8	OUT3
	9	Encoder Shield		9	OUT12
	10	CW Limit		10	OUT13
	11	CCW Limit		11	OUT14
	12	Home Limit		12	OUT15
	13	Hall B		13	Brake Output
	14	Hall A		14	E-Stop Cathode
	15	Hall C		15	User Interrupt
	16	+12V		16	E-Stop Anode
	17	COM		17	COM
	18	Axis enable AEn		18	AIN0 (MFO)
	19	Axis fault AFlt		19	AIN1
	20	Primary I Cmd		20	Joystick Pot 1
	21	Secondary I Cmd		21	Joystick Pot 2
	22	Phase C		22	Joystick Button A
	23	+5V		23	Joystick Button B
	24	-12V		24	Joystick Interlock
	25	COM		25	+12 Volts
	26	Shield		26	-12 Volts
	27	Mode Output		27	COM
P7	1	External Power (+12V)		28	COM
	2	External Power (-12V)			
	3	External Power (+5V)	P6	From U600 P1 connector (1-100)	
	4	External Power (COM)	P8	From U600 P10 connector (1-50)	
			P9	Opto Drive Interface	

4.27. Servo Loop

The UNIDEX 600 Series motion controllers have a dual control loop with an inner velocity loop and an outer position loop. The loop is updated every 1 or 1/4 ms. Refer to Figure 4-21 for an illustration of the Servo Loop.

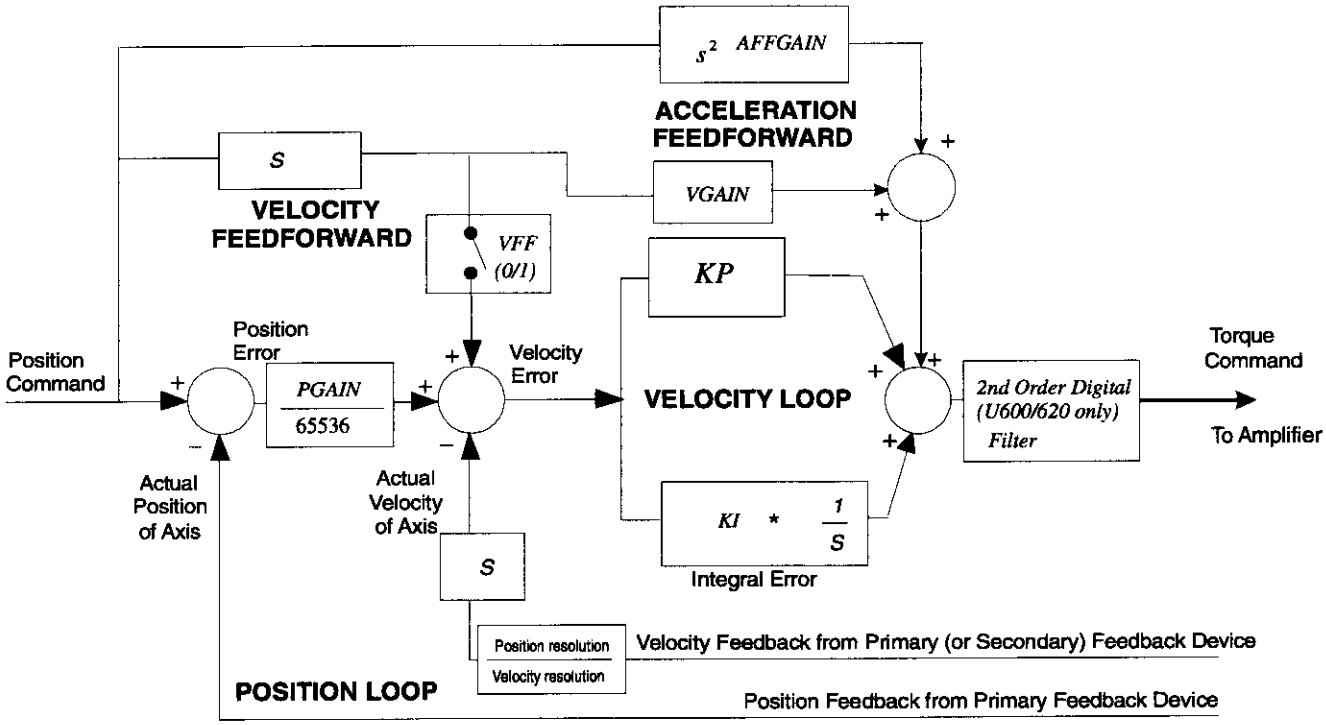


Figure 4-21. UNIDEX 600 Series Servo Loop (Torque Mode)

4.27.1. Servo Loop Overview

The control loop gain settings are programmable and are dependent on the load and the desired response. If the system load changes, the servo loop must be retuned. If the load increases, the gains should be increased to retain the same level of performance. If the load decreases, the gains should also be decreased. When tuning the U600 servo loops, it is desirable to use the highest gain setting possible without causing oscillation (instability). This provides the *tightest* control (i.e., the least amount of error).

The UNIDEX 600 utility software contains a graphics tool (PLOT.EXE or AerPlot.exe) used to display the effects of the servo loop gain settings. Refer to the *U600 Series User's Guide, P/N EDU157* (OS/2 users reference the *System Utilities Manual P/N EDU145*) for more information on using this graphics tool.

4.27.2. Servo Loop Phasing

The UNIDEX 600 expects positive clockwise (CW) motor rotation for a negative voltage output from the D/A. Axes using tachometer feedback with Aerotech's amplifiers; the tachometer should be phased to produce a positive voltage for positive (CW) motor rotation. Motor rotation direction can be verified with the aerdebug utility by monitoring the POS or IVEL parameters. Refer to Figure 4-22 for additional information.

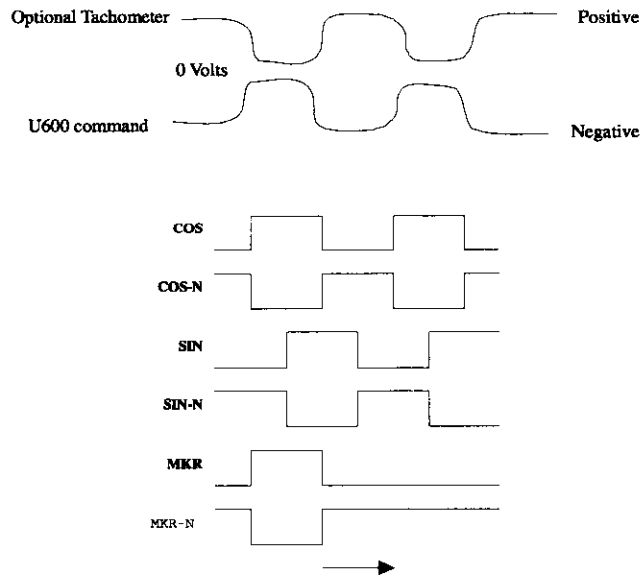
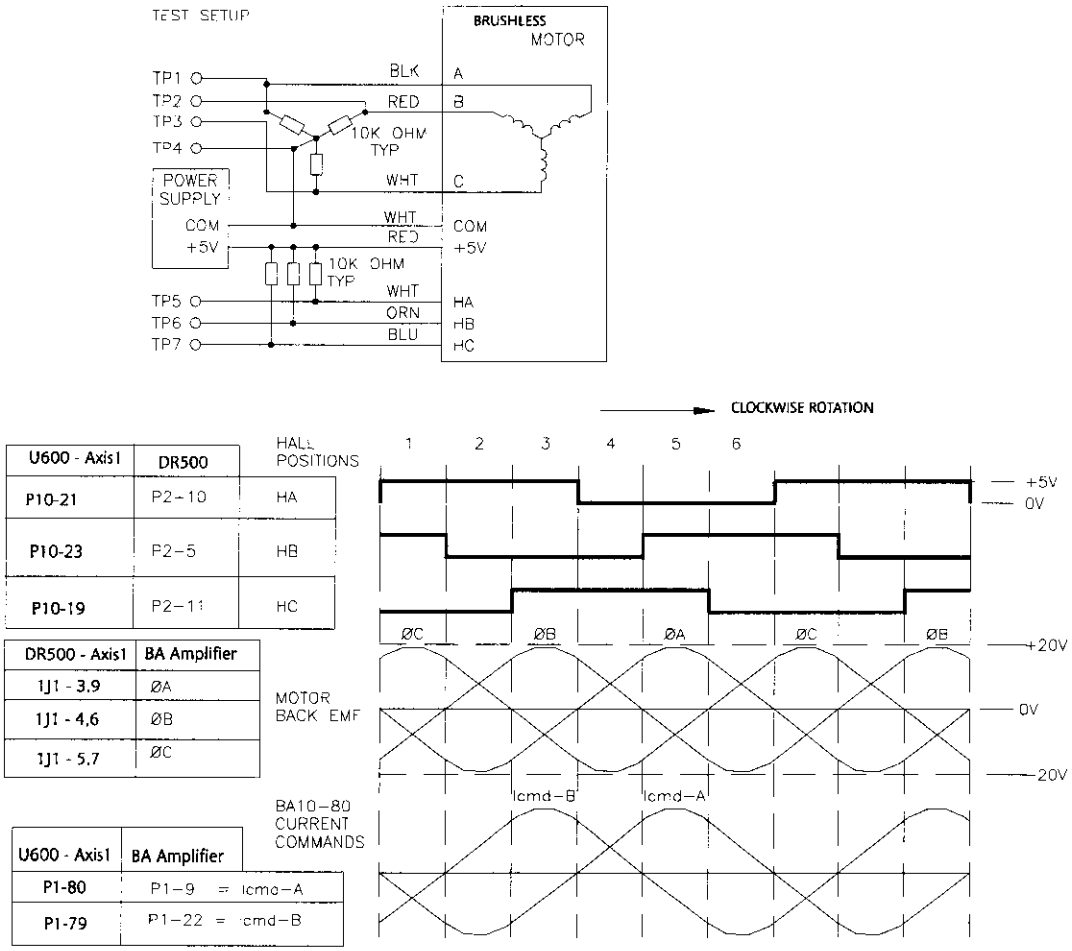


Figure 4-22. CW Motor Rotation Viewed from Mounting Flange End

In addition, motor phasing must be considered when using brushless motors with Hall effect sensors. Figure 4-23 demonstrates the relationship between the Hall effect sensors, the back EMF of the motor, and the current command output by the U600. The relationship between the current command and the Hall effect feedback may be shifted through the application of a commutation offset.



U600 - Axis1	DR500	
P10-21	P2-10	HA
P10-23	P2-5	HB
P10-19	P2-11	HC

DR500 - Axis1	BA Amplifier
1J1 - 3,9	ØA
1J1 - 4,6	ØB
1J1 - 5,7	ØC

U600 - Axis1	BA Amplifier
P1-80	P1-9 = Icmd-A
P1-79	P1-22 = Icmd-B

NOTES:

1. ALL VOLTAGE MEASUREMENTS ARE MADE WITH REFERENCE TO TP4, SIGNAL COMMON/NEUTRAL.
2. CLOCKWISE ROTATION IS VIEWED LOOKING INTO FRONT OF THE MOTOR SHAFT

Figure 4-23. Brushless Motor Phasing

4.28. Cooling Requirements

Table 4-23 shows that a U600-8MB-33P with the specified heatsink operating in an enclosure at 57 degrees C requires 200 ft/min. (1.01 m/sec) of airflow for proper operation and 600 ft/min. (3.04 m/sec) of airflow without a heatsink.

Table 4-23. UNIDEX 600 Airflow (Cooling) Requirements

	Airflow ft/min. (m/sec.)						
	Speed	0 (0)	200 (1.01)	400 (2.03)	600 (3.04)	800 (4.06)	1000 (5.07)
Max Ambient Temp. with Heatsink [1]	-33P	38	57	74	76	81	84
	-66P	30	47	62	64	69	71
Max Ambient Temp. without Heatsink	-33P	18	33	47	57	66	67
	-66P	14	26	39	47	55	57

[1]Heatsink is .285" high unidirectional (A1 alloy 6061, 50 mil fin width, 150 mil center-to-center fin spacing).

∇ ∇ ∇

CHAPTER 5: TROUBLESHOOTING

In This Section:

If you have technical support questions, please have the following information available before calling:

1. The current version of the software is indicated on the installation disk.
2. Your customer order number. If you have purchased a DR500 from Aerotech this number will be on the rear of the DR500 in the upper left hand corner on a system serial tag.
3. We may also need to know the type of PC you are using (brand name, CPU, available memory), the current version of the operating system, and the contents of your CONFIG.SYS files.
4. If you are developing your own application, we will need to know what compiler and version number you are using (e.g., Borland C v3.1, Microsoft Visual C, etc.).
5. If at all possible, try to be in front of the system where the problems are occurring.

5.1. Installation, Board Startup and Communication Problems

Some common problems that relate to installation, startup and communications are listed and diagnosed in Table 5-1.

Table 5-1. Troubleshooting for Common Installation, Startup and Communication Problems

Problem	Possible Causes / Solutions	See Section
Installation program fails (the install directory and subdirectories were created, but nothing was installed)...	Be sure you have at least 4 MB of memory available.	
Initialization failure, communication failure or "Error Downloading Firmware !" error occurs...	The UNIDEX 600 board is not installed. The UNIDEX 600 board is not seated properly. The software address does not match the hardware address. Another device in the PC is set to the same base address as the U600 board. Select a unique base address.	2.1-2.4, 3.4, 4-2
The board initializes properly, but later fails.	The UNIDEX 600 board is not seated properly. Another device in the PC is set to the same base address as the U600 board. Select a unique base address.	2.4, 3.4, 4.2
The LED never lights up after power up ...	The UNIDEX 600 board is not seated properly. Another device in the PC is set to the same base address as the U600 board. Select a unique base address. The power supply has been overloaded and has shut down. Install a larger power supply or remove unnecessary expansion cards to correct the problem.	2.4, 3.4, 4.2 PC Manual
The LED lights after power up and remains on even after attempts to initialize ...	The software base address does not match the base address jumper settings on the UNIDEX 600 board. Another device in the PC is set to the same base address as the U600 board. Select a unique base address.	2.4, 3.4, 4.2
The PC power supply goes dead when the UNIDEX 600 is installed ...	The power supply has been overloaded and has shut down. Install a larger power supply to correct the problem or remove unnecessary expansion cards. External wiring problems exist. Remove the main interface cable and recheck. The UNIDEX 600 board is faulty.	4.11, PC Manual

5.2. Servo Related Problems

Some common problems that relate to the use of servo motors are listed and diagnosed in Table 5-2.

Table 5-2. Troubleshooting for Servo Related Problems

Problem	Possible Causes / Solutions	See Section
The motor has no torque ...	The axis is not enabled. The motor wiring is faulty. The amplifier fuse is blown. The amplifier is faulty.	Refer to U600 Series MMI Operator's Manual P/N EDU159
The motor buzzes or makes an unusual noise ...	The PID servo loop gains are not adjusted properly.	Refer to U600 Series MMI Operator's Manual P/N EDU159
The motor runs away when it is enabled ...	The feedback device is not connected. The wrong feedback channel has been specified. Verify feedback. The wrong feedback device has been specified. Verify feedback.	Refer to U600 Series MMI Operator's Manual P/N EDU159
A position or integral trap error occurs when the motor is enabled ...	The feedback device is not connected. The wrong feedback channel has been specified. Verify feedback. The motor has no torque. (See above)	Refer to U600 Series MMI Operator's Manual P/N EDU159
A position or integral trap error occurs when motion is commanded ...	The feedback device is not connected. The wrong feedback channel has been specified. Verify feedback. The wrong feedback device has been specified. Verify feedback. The motor has no torque. (See above)	Refer to U600 Series MMI Operator's Manual P/N EDU159
The amplifier does not enable ...	An amplifier fault has occurred. This could be due to an improperly wired or shorted motor. The amplifier is faulty.	Refer to U600 Series MMI Operator's Manual P/N EDU159

5.3. Problems Involving Fault Conditions

Some common problems relating to fault conditions are listed and diagnosed in Table 5-3.

Table 5-3. Troubleshooting for Problems Involving Fault Conditions

Problem	Possible Causes / Solutions	See Section
A position or integral trap error occurs when the axis is enabled ...	The feedback device is not connected. The wrong feedback channel has been specified. Verify the feedback. The wrong feedback device has been specified. Verify the feedback. The motor has no torque (the appropriate axis is not enabled, the motor wiring is faulty, the amplifier fuse is blown or the amplifier is faulty).	Refer to U600 Series MMI Operator's Manual P/N EDU159
A position or integral trap error occurs when motion is commanded ...	The feedback device is not connected. The wrong feedback channel has been specified. Verify the feedback. The wrong feedback device has been specified. Verify the feedback. The motor has no torque (the appropriate axis is not enabled, the motor wiring is faulty, the amplifier fuse is blown or the amplifier is faulty).	Refer to U600 Series MMI Operator's Manual P/N EDU159
A velocity trap occurs ...	The feedback device is faulty.	Refer to U600 Series MMI Operator's Manual P/N EDU159
Driver Interlock Open message is displayed ...	The OP500 cable is not inserted properly (e.g., there is no connection between pins 1 and 100). Check the cables and then acknowledge the fault.	
An emergency stop condition occurs ...	The emergency stop input is in the active state. Disable the emergency stop parameter if an emergency stop input is not desired.	Refer to U600 Series MMI Operator's Manual P/N EDU159
A clockwise (CW) or counter-clockwise (CCW) limit condition always exists ...	Limits are not connected to the UNIDEX 600. The active polarity IO Level parameter for the limits is set wrong.	Refer to U600 Series MMI Operator's Manual P/N EDU159
An axis is in a CW or CCW limit condition ...	The commanded motion extended past the limit. Acknowledge the fault and then move the axis out of the limit. The system has been powered up in a limit condition. Acknowledge the fault and move out of the limit. The active limit polarity parameter IO Level is set incorrectly. Software limits are improperly set.	Refer to U600 Series MMI Operator's Manual P/N EDU159

Table 5-3. Troubleshooting for Problems Involving Fault Conditions (Cont.)

Problem	Possible Causes / Solutions	See Section
An over current trap (RMS over current fault) error has occurred ...	If the motor makes unusual noises or oscillates, the gain parameters may need to be adjusted. The RMS current trap parameter is set too low. The RMS current trap time is set too short. The amplifier gain parameter is set too low. The mechanical system is damaged or jammed. The motor/amplifier may be undersized for the load.	Refer to U600 Series MMI Operator's Manual P/N EDU159
A feedback trap has occurred ...	The incorrect feedback channel has been specified. The incorrect feedback device has been specified. The feedback device is not connected. Verify feedback is present Single ended encoders are connected. Set the fault mask to ignore encoder faults. A sinusoidal encoder is connected. The UNIDEX 600 accepts square wave encoders only. One or more encoder connections are broken. The encoder is faulty. A resolver-to-digital tracking loop error has occurred. One or more resolver connections are broken. The resolver reference has not been adjusted properly.	Refer to U600 Series MMI Operator's Manual P/N EDU159
A feedrate trap has occurred ...	The commanded feedrate may have exceeded the rapid feedrate parameter (machine parameters).	Refer to U600 Series MMI Operator's Manual P/N EDU159

5.4. Homing Related Problems

Some common problems relating to the homing process are listed and diagnosed in Table 5-4.

Table 5-4. Troubleshooting for Homing Related Problems

Problem	Possible Causes / Solutions	See Section
The axis takes a long time to home ...	The home feedrate parameter (machine parameters) is set too low. The maximum acceleration/deceleration parameter (axis parameters) is set too low.	Refer to U600 Series MMI Operator's Manual P/N EDU159
The axis runs into a limit during the home cycle ...	The homing direction/type parameter is wrong. (machine parameters) The home switch is not connected.	Refer to U600 Series MMI Operator's Manual P/N EDU159
Software limits are not working ...	The home cycle may not have completed yet.	Refer to U600 Series MMI Operator's Manual P/N EDU159

∇ ∇ ∇

CHAPTER 6: ENCODER EXPANSION CARD

In This Section:

This chapter contains information about the installation and configuration of the encoder expansion cards used with UNIDEX 600 control system. Configuration of the board includes jumper settings and connector pinouts. Use of the board covers the expansion board test points.

See ED0111, 4ENPC manual also

6.1. Expansion Card Jumper Settings

This section outlines the jumper configurations of the encoder expansion card. Descriptions are based on two functional groups of jumpers:

- Amplifier enable jumpers
- Board select jumpers

The expansion board jumper settings are configured at the factory according to the application specifications. If no specifications are available, the default jumper settings are used. The location of the expansion board jumpers are shown in Figure 6-1.

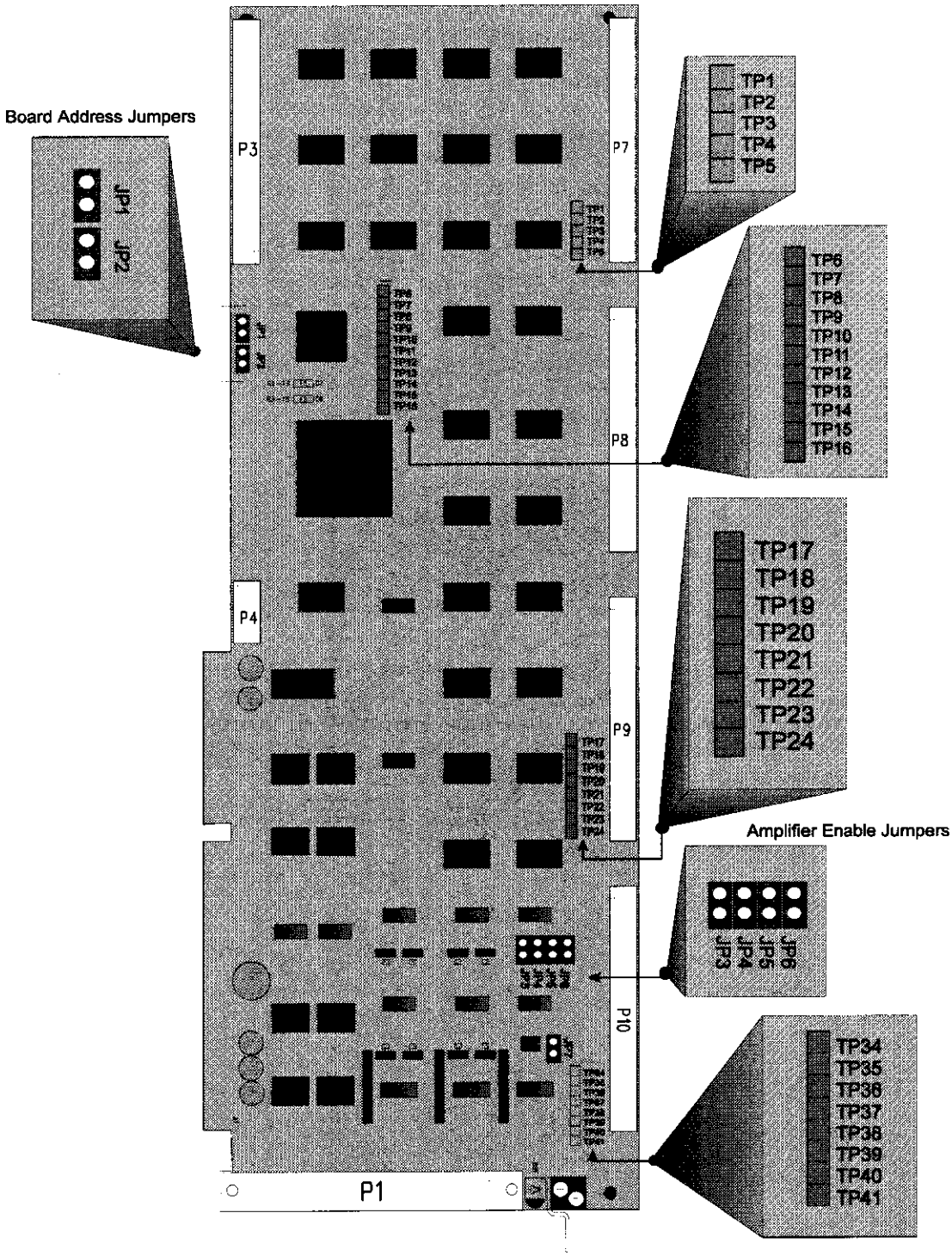


Figure 6-1. Encoder Expansion Card

6.2. Amplifier Enable Jumpers (JP3, JP4, JP5, and JP6)

If an Aerotech DR500 drive rack has been purchased with the U600 system, the encoder expansion board is factory configured for the amplifiers. If an Aerotech drive rack is not being used, the amplifier enable jumpers may need to be reconfigured. It is vital for the user to verify these jumper settings. This safety measure is necessary to ensure that all amplifiers default to disabled (off) after the UNIDEX 600 is initially powered up or reset.

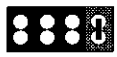
The encoder expansion board has four amplifier enable outputs, each corresponding to a particular axis of the system. Each axis (1-4) has an associated active polarity jumper (JP6-JP3, respectively) that is selectable. The encoder expansion board is shipped with the amplifier enable jumpers installed. In this configuration, the amplifier enable outputs are in the high impedance state during reset and pulled low when the drive is enabled. These outputs are also in the high impedance state when the axis is disabled by software. The axes are software disabled by default when the system is initialized or reset. Select a polarity for each axis so the associated amplifier is not active when the UNIDEX 600 is in a reset state.

Amplifier polarity should be set so the amplifiers are disabled after a system reset (when the UNIDEX 600's LED is ON). The amplifiers should remain disabled until the user has enabled them.

Amplifier enable jumpers JP6-JP3 are located near the P10 connector of the expansion board. The settings for these jumpers are listed in Table 6-1. This table shows each of the four jumpers (JP6-JP3), the corresponding axes (1-4), an illustration of both "In" and "Out" jumper settings, and the corresponding open collector amplifier output function (i.e., the impedance) during reset and when enabled.

Each axis has one 7406-type, open collector driver with absolute maximum ratings of 30 volts and 40 mA sink capability.

Table 6-1. Amplifier Enable Jumper Settings

Jumper	Axis	In/Out	Settings	Output Function (Impedance)
JP3	4	IN (default)		High (no connection) during reset, Low (pulled to ground) when enabled
		OUT		Low (pulled to ground) during reset, High (no connection) when enabled
JP4	3	IN (default)		High (no connection) during reset, Low (pulled to ground) when enabled
		OUT		Low (pulled to ground) during reset, High (no connection) when enabled
JP5	2	IN (default)		High (no connection) during reset, Low (pulled to ground) when enabled
		OUT		Low (pulled to ground) during reset, High (no connection) when enabled
JP6	1	IN (default)		High (no connection) during reset, Low (pulled to ground) when enabled
		OUT		Low (pulled to ground) during reset, High (no connection) when enabled

If an Aerotech drive rack is not being used, the user may need to reconfigure the amplifier enable jumpers for the amplifiers being used. To determine the appropriate amplifier enable jumper settings for each axis, the user must review the specifications of the amplifiers. Specifically, the user must determine the impedance (high or low) that is required to enable the amplifier. For amplifiers that require a low impedance to be enabled (and therefore a high impedance during reset), the user should keep the associated amplifier enable jumper installed. Conversely, for amplifiers that require a high impedance to be enabled (and therefore a low impedance during reset), the user should remove the associated amplifier enable jumper. Refer to the amplifier's documentation for the necessary information.

6.3. Board Select Jumpers (JP1, JP2)

The UNIDEX 600 supports up to three encoder expansion boards on its expansion bus. Each board must have a unique address that is determined by the configuration of the board select jumpers JP1 and JP2. This board also determines the mapping of its user I/O points within the U600's virtual I/O (see section 6.6).

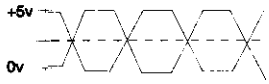
The address of an expansion board is set from jumpers JP1-JP2. These jumpers are located near connector P3 on the board. Each jumper has two pins. For each jumper, a plastic cap jumper is connected to create a unique base address. The combinations of board address jumper settings are shown in Table 6-2. The locations of the expansion board jumpers are shown in Figure 6-1 on page 6-3.

Each Encoder Expansion board must have a unique address in the same PC.

Table 6-2. Encoder Board Address Jumper Settings

Board Address	JP1	JP2	Encoder/DAC Channel Numbers
4 Board 1 (default)			5 through 8
Board 2			9 through 12
Board 3			13 through 16

6.3.1. Differential Encoders



The UNIDEX 600 accepts differential RS-422 type square wave encoder signals. A "times 4" multiplication is always performed on the encoder fundamental line count. For example, if the encoder line count is 1,000 lines, the effective machine resolution is 4,000 machine steps (or counts) per revolution.

The marker and quadrature signal inputs are 26LS32 type RS-422 receivers. The sine and cosine signals are pulled to +5 volts through 10K ohm resistors see Figure 6-2.

6.3.2. Single Ended Encoders

Single ended encoders may be used with the UNIDEX 600 by connecting a 4.7K ohm 1/4 watt resistor from the unused differential input to signal common, removing the 180 ohm termination resistor and disabling the encoder feedback fault in the Faultmask axis parameters as illustrated below in Figure 6-2. In this configuration, only a single-ended active high (or active low) signal is provided. See Table 6-3 through Table 6-6 that indicate which resistor networks (RNs) to remove.

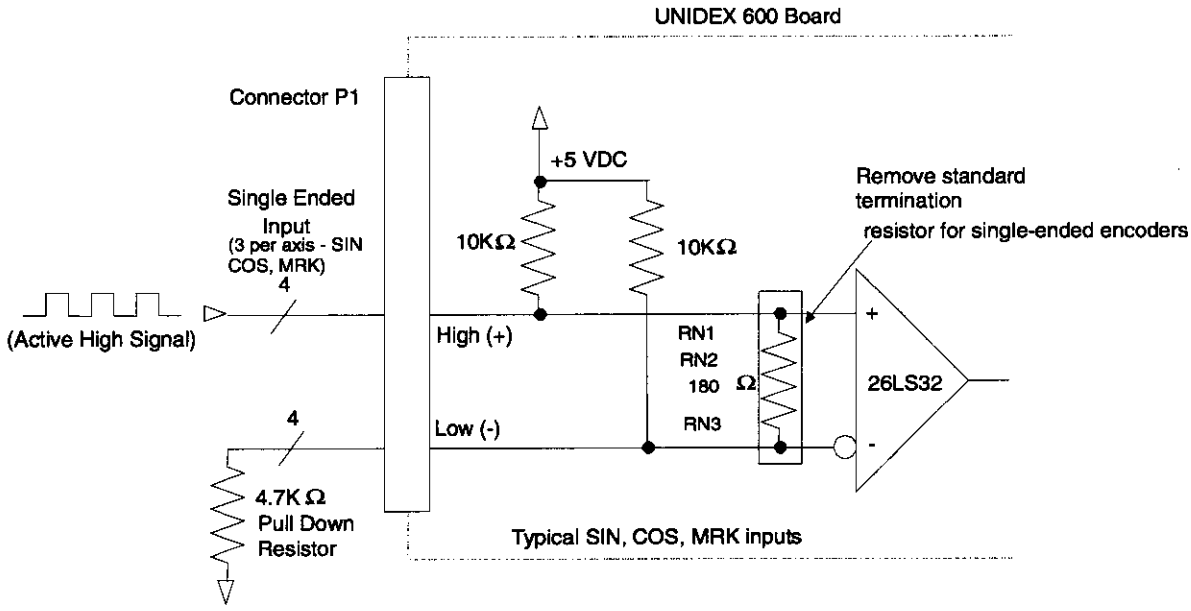
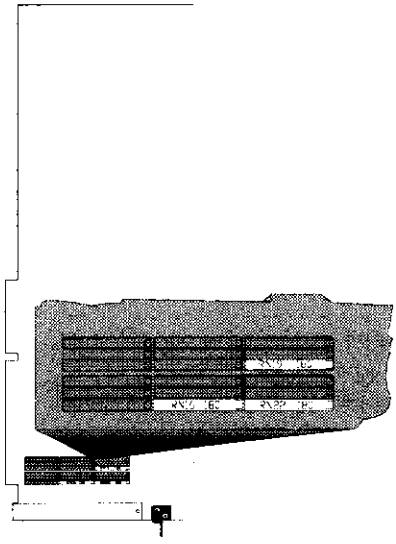


Figure 6-2. Electrical Characteristics of an Encoder Interface (Showing Configuration of Optional Single-ended Encoder

The removable termination resistors for axes 1-4 are grouped into three in-line resistor networks (RN1, RN2 and RN3). If your application mixes differential and single-ended encoders, you must provide separate 180 ohm resistors to replace the termination resistors that have been removed as part of the resistor network(s).



Resistor networks **RN1, RN2** and **RN3** provide termination resistors for axes 1, 2, 3 and 4. The following tables show the important configuration information for each individual axis. Included are the resistor network number, main pinouts (connector P1), axis signals, and resistor network pin numbers.

Table 6-3. Termination Resistor Configuration for Axis 1 Encoder

RN #	P1 Pinout	Axis Signal	RN Pin Number	180 Ω Resistor *
RN3	11 12	MRK1+ MRK1-	1 2	
RN2	7 8	SIN1+ SIN1-	1 2	
RN2	9 10	COS1+ COS1-	3 4	

* Use a 180 Ω termination resistor for standard differential encoders.

Table 6-4. Termination Resistor Configuration for Axis 2 Encoders

RN #	P1 Pinout	Axis Signal	RN Pin Number	180 Ω Resistor *
RN3	20 19	MRK2- MRK2+	4 3	
RN2	16 15	SIN2- SIN2+	6 5	
RN2	18 17	COS2- COS2+	8 7	

* Use a 180 Ω termination resistor for standard differential encoders.

Table 6-5. Termination Resistor Configuration for Axis 3 Encoders

RN #	P1 Pinout	Axis Signal	RN Pin Number	180 Ω Resistor *
RN3	28 27	MRK3- MRK3+	6 5	
RN1	24 23	SIN3- SIN3+	2 1	
RN1	26 25	COS3- COS3+	4 3	

* Use a 180 Ω termination resistor for standard differential encoders.

Table 6-6. Termination Resistor Configuration for Axis 4 Encoders

RN #	P1 Pinout	Axis Signal	RN Pin Number	180 Ω Resistor *
RN3	36 35	MRK4- MRK4+	8 7	
RN1	32 31	SIN4- SIN4+	6 5	
RN1	34 33	COS4- COS4+	8 7	

* Use a 180 Ω termination resistor for standard differential encoders.

6.4. Encoder Card Test Points

Test points are located at various areas on the encoder expansion card. They are used as an aid in troubleshooting the encoder expansion card and to gain access to UNIDEX 600 signals.

Use of these test points is explained in Table 6-7.

Table 6-7. Encoder Expansion Card Test Points

Test Point	Meaning
TP1	+ 5 Volts
TP2	+12 Volts
TP3	- 12 Volts
TP4	Common
TP5	- 5 Volts
TP20	Position latch input after RC filter
TP21	Axis 4 marker pulse
TP22	Axis 3 marker pulse
TP23	Axis 2 marker pulse
TP24	Axis 1 marker pulse
TP34	Axis 4 cosine
TP35	Axis 4 sine
TP36	Axis 3 cosine
TP37	Axis 3 sine
TP38	Axis 2 cosine
TP39	Axis 2 sine
TP40	Axis 1 cosine
TP41	Axis 1 sine

All other test points are for factory use only.

6.5. Encoder Card Connectors

6.5.1. Opto 22 Input Bus Connector (P8)

The pinouts for the opto 22 bus connector are listed in Table 6-8.

Table 6-8. Opto 22 Bus Connector Pinouts (Encoder Expansion Card)

Pin #	Description	Pin #	Description
1	IN39	2	Common
3	IN38	4	Common
5	IN37	6	Common
7	IN36	8	Common
9	IN35	10	Common
11	IN34	12	Common
13	IN33	14	Common
15	IN32	16	Common
17	IN31	18	Common
19	IN30	20	Common
21	IN29	22	Common
23	IN28	24	Common
25	IN27	26	Common
27	IN26	28	Common
29	IN25	30	Common
31	IN24	32	Common
33	IN23	34	Common
35	IN22	36	Common
37	IN21	38	Common
39	IN20	40	Common
41	IN19	42	Common
43	IN18	44	Common
45	IN17	46	Common
47	IN16	48	Common
49	+ 5 Volts	50	Common

See Section 6.6 for mapping of these I/O points within the U600's virtual I/O space.

6.5.2. Opto 22 Outputs and Hall Sensor Inputs (P10) Pinouts

Table 6-9 lists the pinouts for the OPTO 22 outputs and Hall sensor inputs (P10).

Table 6-9. Pinouts for Opto 22 Outputs and Hall Sensor Inputs (Expansion Card)

Pin	Description	Pin	Description
1	HALL 4C	2	Common
3	HALL 4A	4	Common
5	HALL 4B	6	Common
7	HALL 3C	8	Common
9	HALL 3A	10	Common
11	HALL 3B	12	Common
13	HALL 2C	14	Common
15	HALL 2A	16	Common
17	HALL 2B	18	Common
19	HALL 1C	20	Common
21	HALL 1A	22	Common
23	HALL 1B	24	Common
25	Reserved	26	Common
27	Position Latch Input	28	Common
29	Reserved	30	Common
31	Reserved	32	Common
33	OUT15	34	Common
35	OUT14	36	Common
37	OUT13	38	Common
39	OUT12	40	Common
41	OUT11	42	Common
43	OUT10	44	Common
45	OUT9	46	Common
47	OUT8	48	Common
49	+5	50	Common

See Section 6.6 for mapping of these I/O points within the U600's virtual I/O space.

6.5.3. Opto 22 Output Bus Connector (P7)

The pinouts for the opto output bus connector are listed in Table 6-10.

Table 6-10. Opto 22 Output Bus Connector Pinouts (Encoder Expansion Card)

Pin #	Description	Pin #	Description
1	OUT39	2	Common
3	OUT 38	4	Common
5	OUT 37	6	Common
7	OUT 36	8	Common
9	OUT 35	10	Common
11	OUT 34	12	Common
13	OUT 33	14	Common
15	OUT 32	16	Common
17	OUT 31	18	Common
19	OUT 30	20	Common
21	OUT 29	22	Common
23	OUT 28	24	Common
25	OUT 27	26	Common
27	OUT 26	28	Common
29	OUT 25	30	Common
31	OUT 24	32	Common
33	OUT 23	34	Common
35	OUT 22	36	Common
37	OUT 21	38	Common
39	OUT 20	40	Common
41	OUT 19	42	Common
43	OUT 18	44	Common
45	OUT 17	46	Common
47	OUT 16	48	Common
49	+ 5 Volts	50	Common

See Section 6.6 for mapping of these I/O points within the U600's virtual I/O space.

6.5.4. Main Connector Pinout of the Encoder Expansion Card

The encoder expansion card's main interface connector (P1) is accessible from the rear of the PC. The connector is a 100-pin "AMPLIMITE" high density female connector. The mating connector is an "AMPLIMITE" series connector, part number 759879-9. This connector connects to a BB500, BB501, or DR500 via an OP500 cable.

Refer to Table 6-11 for the main connector pinouts.

Table 6-11. Main Connector Pinouts for the Encoder Expansion Card

Pin	Function	Descr.	Pin	Function	Descr.
1	Common	ILOCKS	2	*Reserved*	*Reserved*
3	+5 Volts	+5	4	+5 Volts	+5
5	Encoder Common	COM	6	Encoder Common	COM
7	Encoder Sine Positive, Axis 1	SIN1+	8	Encoder Sine Ground, Axis 1	SIN1-
9	Encoder Cosine Positive, Axis 1	COS1+	10	Encoder Cosine Ground, Axis 1	COS1-
11	Marker Pulse, Axis 1	MRK1+	12	Marker Pulse, Axis 1	MRK1-
13	Encoder Common	COM	14	Encoder Common	COM
15	Encoder Sine Positive, Axis 2	SIN2+	16	Encoder Sine Ground, Axis 2	SIN2-
17	Encoder Cosine Positive, Axis 2	COS2+	18	Encoder Cosine Ground, Axis 2	COS2-
19	Marker Pulse, Axis 2	MRK2+	20	Marker Pulse, Axis 2	MRK2-
21	Encoder Common	COM	22	Encoder Common	COM
23	Encoder Sine Positive, Axis 3	SIN3+	24	Encoder Sine Ground, Axis 3	SIN3-
25	Encoder Cosine Positive, Axis 3	COS3+	26	Encoder Cosine Ground, Axis 3	COS3-
27	Marker Pulse, Axis 3	MRK3+	28	Marker Pulse, Axis 3	MRK3-
29	Encoder Common	COM	30	Encoder Common	COM
31	Encoder Sine Positive, Axis 4	SIN4+	32	Encoder Sine Ground, Axis 4	SIN4-
33	Encoder Cosine Positive, Axis 4	COS4+	34	Encoder Cosine Ground, Axis 4	COS4-
35	Marker Pulse, Axis 4	MRK4+	36	Marker Pulse, Axis 4	MRK4-
37	Encoder Common	COM	38	Encoder Common	COM
39	Clockwise Limit, Axis 1	CW1	40	Counter clockwise Limit, Axis 1	CCW1
41	Clockwise Limit, Axis 2	CW2	42	Counter clockwise Limit, Axis 2	CCW2
43	Clockwise Limit, Axis 3	CW3	44	Counter clockwise Limit, Axis 3	CCW3
45	Clockwise Limit, Axis 4	CW4	46	Counter clockwise Limit, Axis 4	CCW4
47	Home Limit, Axis 1	HOME1	48	Home Limit, Axis 2	HOME2
49	Home Limit, Axis 3	HOME3	50	Home Limit, Axis 4	HOME4
51	Reserved	Reserved	52	Limits Common	COM
53	+12 Volts	+12	54	+12 Volts	+12
55	-12 Volts	-12	56	-12 Volts	-12
57	Mode Axis 1	MODE1	58	Mode Axis 2	MODE2
59	Input 0	IN0	60	Input 1	IN1
61	Input 2	IN2	62	Input 3	IN3
63	Output 0	OUT0	64	Output 1	OUT1
65	Output 2	OUT2	66	Output 3	OUT3
67	Mode Axis 3	MODE3	68	Mode Axis 4	MODE4
69	Amplifier Enable 1	AEN1	70	Amplifier Enable 2	AEN2
71	Amplifier Enable 3	AEN3	72	Amplifier Enable 4	AEN4
73	Amplifier Fault 1	AFLT1	74	Amplifier Fault 2	AFLT2
75	Amplifier Fault 3	AFLT3	76	Amplifier Fault 4	AFLT4
77	Limits Common	COM	78	Limits Common	COM

Table 6-11. Main Connector Pinouts for the Encoder Expansion Card (Cont'd)

Pin	Function	Descr.	Pin	Function	Descr.
79	Axis 1 Primary Current Cmd	ICMD1B	80	Axis 1 Secondary Current Cmd	ICMD1A
81	Axis 2 Primary Current Cmd	ICMD2B	82	Axis 2 Secondary Current Cmd	ICMD2A
83	Axis 3 Primary Current Cmd	ICMD3B	84	Axis 3 Secondary Current Cmd	ICMD3A
85	Axis 4 Primary Current Cmd	ICMD4B	86	Axis 4 Secondary Current Cmd	ICMD4A
87	Common	COM	88	Common	COM
89	Joystick Potentiometer 1 Input	JSW1	90	Joystick Potentiometer 2 Input	JSW2
91	Joystick Button A Input	JSA	92	Joystick Button B Input	JSB
93	Joystick Interlock	JSC	94	Brake Output	BRAKE
95	Analog Input 0	AIN0	96	Analog Input 1	AIN1
97	NC		98	NC	
99	NC		100	Interlock Receive	ILOCKR

6.5.5. Encoder Expansion Bus Pin Description (P3)

The pinouts for the encoder expansion bus connector are listed in Table 6-12.

Table 6-12. Encoder Expansion Bus Pinouts

Pin #	Description	Pin #	Description
1	+12v	2	-12v
3	GND	4	+5v
5	RESET	6	MCLK
7	MA2	8	MPST
9	MA1	10	*reserved*
11	MA0	12	MINTR1
13	IOWRT	14	MINTR0
15	IORD	16	MWAIT
17	GND	18	+5v
19	MD7	20	MSC1
21	MD6	22	MCS0
23	MD5	24	*reserved*
25	MD4	26	TDMA
27	MD3	28	OPT1
29	MD2	30	OPT0
31	MD1	32	MDACK
33	MD0	34	MDRQT
35	GND	36	+5v

Table 6-12. Encoder Expansion Bus Pinouts (Cont'd)

Pin #	Description	Pin #	Description
37	MDE	38	MDF
39	MDC	40	MDD
41	MDA	42	MDB
43	MD8	44	MD9

6.5.6. Auxiliary Signals Connector (P4)

The pinouts in this connector are reserved outputs for future use. The pin descriptions is shown in Table 6-13.

Table 6-13. Auxiliary Output Pinouts Connector (P4)

Pin #	Description
1	Aux 1
2	Aux 2
3	Aux 3
4	Aux 4
5	Aux 5
6	Aux 6
7	Aux 7
8	Aux 8

6.5.7. Digital Inputs and Outputs Bus Pinouts (P9)

The pinouts for the digital inputs and outputs bus connector are listed in Table 6-14.

Table 6-14. Digital Inputs and Outputs Pinouts (P9)

Description	Pin#	Description	Pin#	Description	Pin#	Description	Pin#
IN0	31	IN 5	21	IN 10	11	IN 15	1
IN 1	29	IN 6	19	IN 11	9	COM	2-50 (even)
IN 2	27	IN 7	17	IN 12	7	+5 volts	49
IN 3	25	IN 8	15	IN 13	5		
IN 4	23	IN 9	13	IN 14	3		

Table 6-14. Digital Inputs and Outputs Pinouts (P9) (Cont'd)

Description	Pin#	Description	Pin#	Description	Pin#	Description	Pin#
OUT0	47	OUT 2	43	OUT 4	39	OUT 6	35
OUT 1	45	OUT 3	41	OUT 5	37	OUT 7	33

6.6. Virtual I/O Mapping

Each expansion board has forty user outputs and forty user inputs, numbered 0 to 39. All of these I/O points are accessed through the U600's programming commands based upon their virtual I/O point number. This virtual I/O point number is dependent on the expansion board number shown in Table 6-15. For example, if a program utilized input "16" on expansion board #3, its referenced virtual I/O point is "112," located in connector P8 pin 47. If another program utilized output "8" on expansion board #2, its referenced virtual I/O point is "64," located in connector P10 pin 47.

Table 6-15. Virtual Binary I/O Inputs and Outputs

INPUTS			
Board	Label	Virtual Binary Input #	Connector and Pin Numbers on the Respective Board
U600	IN0-15	0 through 15	P9 pins 31 - 1 (odd pins)
Expansion Board 1	IN0-15	16 through 31	P9 pins 31 - 1 (odd pins)
Expansion Board 1	IN16-39	32 through 55	P8 pins 47 - 1 (odd pins)
Expansion Board 2	IN0-15	56 through 71	P9 pins 31 -1 (odd pins)
Expansion Board 2	IN16-39	72 through 95	P8 pins 47 - 1 (odd pins)
Expansion Board 3	IN0-15	96 through 111	P9 pins 31 -1 (odd pins)
Expansion Board 3	IN16-39	112 through 135	P8 pins 47 - 1 (odd pins)
OUTPUTS			
U600	OUT0-7	0 through 7	P9 pins 47 - 33 (odd pins)
U600	OUT8-15	8 through 15	P10 pins 47 - 33 (odd pins)
Expansion Board 1	OUT0-7	16 through 23	P9 pins 47 - 33 (odd pins)
Expansion Board 1	OUT8-15	24 through 31	P10 pins 47 - 33 (odd pins)
Expansion Board 1	OUT16-39	32 through 55	P7 pins 47 -1 (odd pins)
Expansion Board 2	OUT-7	56 through 63	P9 pins 47 - 33 (odd pins)
Expansion Board 2	OUT8-15	64 through 71	P10 pins 47 - 33 (odd pins)
Expansion Board 2	OUT16-39	72 through 95	P7 pins 47 -1 (odd pins)
Expansion Board 3	OUT0-7	96 through 103	P9 pins 47 - 33 (odd pins)
Expansion Board 3	OUT8-15	104 through 111	P10 pins 47 - 33 (odd pins)
Expansion Board 3	OUT16-39	112 through 135	P7 pins 47 -1 (odd pins)

6.7. Installing the Encoder Expansion Card

The encoder expansion board is a full-sized AT card that is installed into any of the PC's unused 16-bit expansion slots.

The encoder expansion board may not fit in some smaller models of PC's.

The procedure for installation of the encoder expansion board is outlined in the steps that follow.

1. Turn OFF the power to the computer system unit and unplug the unit's power cord from the power source.

The possibility of electrical shock exists. Make certain that the computer system's power switch is in the OFF position and the power cord is disconnected before opening the computer's cabinet.

2. Open the computer cabinet. See the sample in Figure 6-3 (Refer to the PC's User Manual for directions for opening the cabinet.)
3. Select an unused 16-bit (full-sized) expansion slot on the computer mother board.
4. Locate the bracket of the selected expansion slot. Remove the screw and pull the bracket out of the expansion slot.
5. Take ribbon cable supplied with the encoder expansion card and connect it to P3 of the UNIDEX 600 control board while observing anti-static safeguards.
6. Connect the other end of the ribbon cable to P3 of the encoder expansion card.
7. Observing anti-static safeguards, line up the encoder expansion board with the expansion slot and guide rails. Lower the board into the slot until each of it's edge connectors rests on an expansion slot receptacle. Using evenly distributed pressure, push the board straight down until it is fully inserted into the expansion slot.
8. Secure the board to the chassis by reinstalling the bracket screw that was removed in step 4.
9. Tuck the ribbon cable away from any obstructions inside the PC.
7. Close and secure the PC's cover.
8. Reconnect the PC's power cord to the power source.
9. Move the PC's power switch to the ON position and note the status of the UNIDEX 600 board's LED.

The LED (visible from the rear of the system) of the UNIDEX 600 board must come ON during system initialization and then go OFF and remain OFF. During subsequent system software resets, the LED should come ON for approximately 5 seconds, and then turn OFF.

The LED should remain ON following system power up. This should disable any amplifiers and set the output bus to the high impedance state.

If the LED does not come ON or if it stays ON following software initialization, refer to the Troubleshooting section of this manual for help.

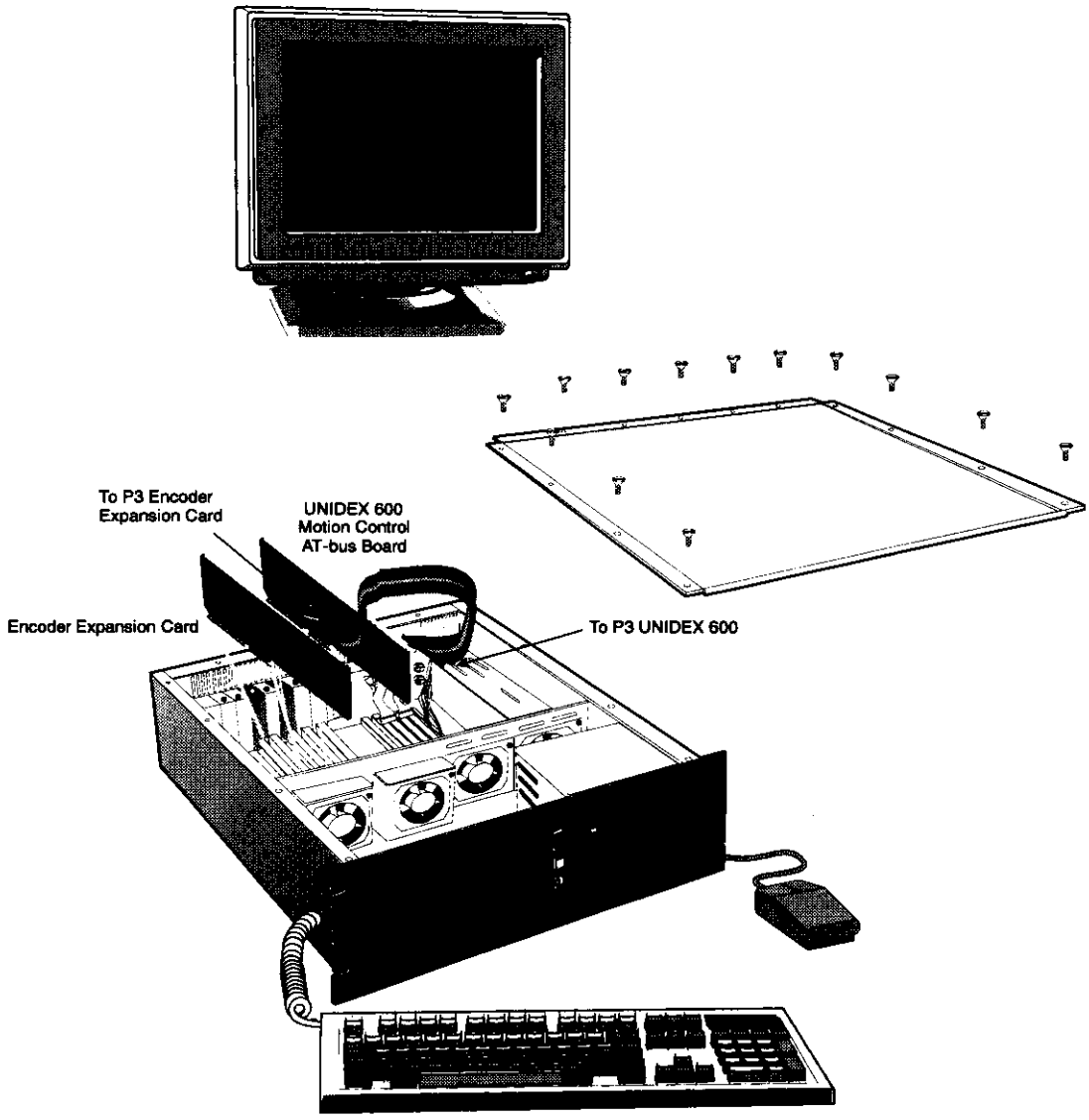


Figure 6-3. Installation of the Encoder Expansion Card

Appendix A

APPENDIX A: GLOSSARY OF TERMS

In This Section:
- Terms Used In This Manual
- Definitions

This appendix contains definitions of terms that are used throughout this manual.

amplifier - An amplifier is a hardware device having an output that is a function of the input signal.

axis - An axis is a direction along which movement occurs.

base address - A base address is a number that represents the memory location in the computer where input/output (I/O) information can be stored. All devices (e.g., the U600 card, network cards, tape backup cards, etc.) within a computer must have unique I/O base addresses. The default I/O base address of the U600 card is 0x300 (which represents the 16 memory locations 0x300 through 0x30F). This base address can be changed using base address jumpers JP4 through JP9 on the U600 card. The base address must also be configured in the UNIDEX 600 Startup software.

BB500 Breakout Module - The BB500 Breakout Module is a hardware device that connects directly to the U600 card to provide direct signal access (in the form of screw terminals) when a DR500 chassis is not used.

bit - The term bit is an acronym for "Binary digit" and represents a single binary number (i.e., a "1" or a "0"). In digital computers, a bit's two states can represent an off state and an on state, a high voltage and a low voltage, the numbers 0 and 1, etc.

brushless motor - Aerotech brushless motors are three-phase, rare earth permanent magnet servo motors which generate a sinusoidal back EMF voltage and are usually referred to as AC brushless motors. Another type, usually referred to as the DC brushless motors, generate a trapezoidal back EMF and produce more torque ripple.

byte - A byte is a common unit of information storage made up of eight binary digits (bits). A byte can be used to represent a single ASCII character (e.g., "A"= 10000001 [binary]) or binary numbers from 00000000 to 11111111 (from 0 to 255 decimal), depending on how it is used.

closed loop system - A closed loop system is a drive system that uses sensors for direct feedback of position and/or velocity. Contrast with open loop system

commutation - Commutation refers to the process by which every other cycle of an alternating current is reversed so that a single unidirectional current is supplied. In the case of motors, commutation refers to the switching of current to motor windings which causes the motor to rotate. In a DC servo motor, this is done mechanically using brushes and a commutator. A brushless motor is electronically commutated using a position feedback device such as an encoder that is mounted to the rotor. Stepping motors are electronically commutated without feedback (in an open loop fashion).

DR500 Chassis/Drive Rack - The DR500 Chassis (or Drive Rack) is a housing for the axis amplifiers (for microstepping, DC brush and brushless drivers) and the driver power supply. The DR500 is available in rack mount, panel mount and desktop packaging.

encoder - An encoder is a rotary device that transmits a pulsed signal based on the number of revolutions of the device.

Hall effect switch - A Hall effect switch is a solid state switch that is activated by a magnetic field. Some AC brushless motors use Hall effect switches.

handwheel - A handwheel is an encoder-based manual control input device that can be used to simplify machine setup or testing.

hexadecimal number format - Hexadecimal number format is a method of representing large numbers using base 16 rather than the standard base 10. In base 16 or hexadecimal number format (often abbreviated "hex"), the number positions represent powers of 16 (rather than powers of 10 in decimal). The decimal number positions (1's, 10's, 100's, 1,000's, 10,000's, etc.) are replaced with hexadecimal number positions (1's, 16's, 256's, 4096's, etc.). Also, while the individual numerals for the decimal system are 0-9, the numerals for the hexadecimal number system (which requires 16 unique "numerals") are 0-9 then A-F (where $A_{16}=10_{10}$, $B_{16}=11_{10}$, $C_{16}=12_{10}$, $D_{16}=13_{10}$, $E_{16}=14_{10}$, and $F_{16}=15_{10}$). For simplicity in this manual, hexadecimal numbers are written with a preceding "0x" rather than using the subscript 16. For example, the hexadecimal number 12A5 is written 0x12A5. Numbers without the preceding "0x" are assumed to be decimal unless otherwise indicated.

IRQ - IRQ (interrupt request) is a term associated with generating an interrupt request to the PC. A PC has many IRQs (e.g., IRQ3 and IRQ4 are typically configured as COM ports on the PC, IRQ7 is typically configured as the LPT port, et. al.). Although the U600 does not use such interrupts, custom software applications may. In these cases, the interrupt number used by the custom software program (to interrupt the PC) must be selected on the UNIDEX 600 board (using jumpers JP3A through JP3F) as well as configured in the U600 software.

iSBX expansion port - The iSBX expansion port (P4 on the UNIDEX 600 card) is a standard Intel interface that uses either an 8 or 16 bit data bus and is used primarily for communications-oriented additions to the system. The iSBX expansion port has a communications data rate of approximately 1 MB/sec (1,048,576 bytes per second).

joystick - A joystick is manual input control device that digitizes a path using two axes. A joystick offers direct motion control for easy machine setup and testing.

jumpers - Jumpers are hardware *ties* that you manually position into different sockets to configure the hardware platform. Jumpers on the UNIDEX 600 board are used to configure the base address, the encoder sampling frequency, termination resistors, and other features.

LED - LED is an acronym for light-emitting diode. An LED is a semiconductor diode that converts electrical energy into visible electromagnetic radiation. The UNIDEX 600 board has an LED (visible from the back of the PC after installation) that is used for diagnostic purposes.

OP500 - The OP500 is an optional cable that is used to connect the UNIDEX 600 controller card to the DR500 chassis.

open loop system - An open loop system is a drive system that does not employ feedback sensors to monitor position or velocity. Most stepper motor applications are open loop (that is, they have no feedback). The commanded position is the assumed motor position. Contrast with closed loop system.

operator - (1) An operator is one who uses the UNIDEX 600 system.

operator - (2) An operator is a programming element that is used to link terms in an expression. Programming operators include the standard arithmetic operators (e.g., +, -, * and /), comparison operators (e.g., < and >) and Boolean operators (e.g., AND, OR and NOT) and others.

position synchronized output card - The position synchronized output card is an optional PC-bus based card that can be used in conjunction with the U600 (via connection P3 on the U600 card) to provide programmable laser-firing control.

resolution multiplier card (RMX-PC) - The RMX-PC is a PC bus, 2-channel, 256-times resolution multiplier card that can be used with the UNIDEX 600. This card multiplies the sinusoidal position feedback by up to 256 times. It is ideal for high-resolution applications such as wafer inspection.

resolver - A resolver is a two-phase, rotary, electromagnetic transducer in which inductive coupling (between the rotor and stator windings) and trigonometric principles are employed to provide absolute position information over one electrical cycle (which is one revolution for "single-step" resolvers)

resolver-to-digital card (RDP-PC) - The RDP-PC card is an optional PC-based R/D card that is used to receive resolver or Inductosyn feedback. Resolution is selectable among 10-bit, 12-bit, 14-bit or 16-bit.

RMS current trap - RMS current trap is an error that occurs if the current being commanded to a motor exceeds a programmable limit (see parameters x48 and x49). RMS current trap is analogous to a software "fuse". Essentially, this fault functions the same as a physical fuse, but is done through software. One obvious advantage is that a "software fuse" does not have to be replaced like a physical fuse.

servo control system - A servo control system (servo loop) is a motion control system which continuously compares desired position/velocity to actual position/velocity and produces an error correction command. Servo systems use sensors to feedback actual position/velocity.

∇ ∇ ∇

APPENDIX B: OS/2

In This Section:

Appendix B

B.1. Introduction

If a complete system was purchased from Aerotech, the U600 control board will have the jumpers configured for the system components supplied with the U600. If a complete system was not purchased, configure the jumpers on the U600 board according to sections in Chapter 3: Hardware Configuration.

The IRQ and the I/O address jumpers may need to be set if the default I/O address 220 Hex and IRQ15 can not be used in the user's PC.

If this is the case, the device driver configuration in the CONFIG.SYS file must also be modified when installing the software from the UNIDEX 600 firmware and utilities disk.

B.2. OS/2 Minimum Hardware Requirements and Recommended System Configurations

Minimum hardware requirements and recommended system configurations for the UNIDEX 600 are shown in Table B-1.

Table B-1. Minimum Hardware Requirements and Recommendations

Equipment	Minimum	Recommended
Computer (microprocessor)	IBM PC Pentium 90 MHz (or higher) or 100% compatible	Pentium 133 MHz (or higher)
Computer Memory	16 MB of memory (conventional & extended)	32 MB of memory (conventional & extended)
Graphics Display	800x600	800x600
Free Hard Disk Space	10 MB	20 MB or more
Mouse	Any mouse supported by the computer	Any mouse supported by the computer
Floppy Disk Drives	3 1/2" DSHD	3 1/2" DSHD
OS/2	WARP 3.0 or higher	WARP 3.0 or higher

B.3. OS/2 Software Installation

The operator uses the software package as the interface to the UNIDEX 600 motion controller. This software program (which is stored on a floppy diskette) needs to be copied onto the hard disk drive of the same PC that holds the U600 PC board. This software installation process requires less than 5 minutes to complete.

B.3.1. Standard Installation (Firmware and Utilities)

To install the software, the operator must follow the steps listed below.

1. Insert the software disk 1 into the 3.5" floppy disk drive (e.g., drive A:\)
2. Type A:install and hit <ENTER> at the prompt. If a drive other than A:\ is used, substitute the appropriate letter. This starts the installation process. The user will be prompted for the format of the following required parameters:
   - 1st parameter - source disk a: (typically)
   - 2nd parameter - destination disk c: (typically)
   - 3rd parameter - OS/2 boot disk c (without a colon ":")

Do not specify a directory name, the software will load into a directory named "\U31".

The third parameter is only specified on the initial installation of the firmware disk when the user desires the install program modify the CONFIG.SYS file.

3. The required device driver statement is added to the CONFIG.SYS file by the install program and the following reminders for the user to make changes to the CONFIG.SYS file:

REM Remember you must append: ';C:\U31\DLL ' to your 'LIBPATH' statement.

REM Remember you must append: ';C:\U31\UTILITY' to your 'SET PATH' statement.

REM Be sure to read the file C:\U31\UPDATE.TXT for latest information.

Device = C:\U31\PC9601.SYS W1 I220 QF

REM Window 1(0xDC00), I/O base 0x220, IRQ15

The device driver configuration will be required if the default I/O address of 220 hex and IRQ 15 were not used when installing the U600 board in the PC.

4. Reboot PC to verify that the device driver loaded. This will load the UNIDEX 600 device driver and set the required environment variables, as defined in the CONFIG.SYS file.

While the PC reboots, the device driver loads displaying a message indicating the IRQ, I/O address, memory window starting address and a successful loading of the device driver.

When using the PSO-PC card, the U600PSO.EXE program must be executed while in the U31 directory to load (as firmware) the file U31\PSO.IMG into the PSO card.

After the software has been loaded, check the main U31 directory for a READ.ME file. A READ.ME file is an ASCII text file that contains important information that may not be included in the manual. To view the contents of a READ.ME, the operator can use any standard ASCII text editor (for example, EDIT, using the syntax EDIT READ.ME) or the TYPE command (using the syntax TYPE READ.ME | MORE, for example).

B.3.2. U600 CNC Software Installation (Optional)

To install the software, the operator must follow the steps listed below.

1. Insert the software disk labeled "UNIDEX 600 CNC Software" into the 3.5" floppy disk drive (e.g., drive A:\).
2. Type A:install and hit <ENTER> at the prompt. If a drive other than A:\ is used, substitute the appropriate letter. This starts the installation process. The user will be prompted for the format of the following required parameters:
   - 1st parameter - source disk a: (typically)
   - 2nd parameter - destination disk c: (typically)

Do not specify a directory name, the software will load into a directory named "U31".

The third parameter is only specified on the initial installation of the firmware disk when the user desires the install program modify the CONFIG.SYS file.

3. The required device driver statement is added to the CONFIG.SYS file by the install program and the following reminders for the user to make changes to the CONFIG.SYS file:

REM Remember you must append: ';C:\U31\DLL ' to your 'LIBPATH' statement.

REM Remember you must append: ';C:\U31\UTILITY' to your 'SET PATH' statement.

REM Be sure to read the file C:\U31\UPDATE.TXT for latest information.

Device = C:\U31\PC9601.SYS W1 I220 QF

REM Window 1(0xDC00), I/O base 0x220, IRQ15

The device driver configuration will be required if the default I/O address of 220 hex and IRQ 15 were not used when installing the U600 board in the PC.

4. Reboot PC to verify that the device driver loaded. This will load the UNIDEX 600 device driver and set the required environment variables, as defined in the CONFIG.SYS file.

While the PC reboots, the device driver loads displaying a message indicating the IRQ, I/O address, memory window starting address and a successful loading of the device driver.

B.3.3. Device Driver Configuration

The UNIDEX 600 default configuration of the device driver is at address 0x220 with its 16K byte memory window mapped to DC00:0000. The user only sets the U600's I/O address. Configuration of the DRAM memory window is under software control of the device driver during boot-up time.

Conflicts may arise with a user's PC due to BIOS CMOS settings. The block of memory selected for communication with the U600 must disable memory shadowing.

Some PCs may also require that "hidden refresh" be disabled if it is present on their PC.

The device driver (PC9601.SYS) allows the user to use command line arguments for configuration. Additional U600 cards within a single PC require PC9602.SYS - PC9604.SYS respectively. These command line arguments are:

- Window address
- I/O Bus address
- IRQ Level
- DRAM size/type.

The Window address is the starting address of the 16K byte window into the U600's DRAM address space. However, the address specified is the starting address inside the PC's address space. The default is window #1 = DC00:0000. The user can modify this by entering the following line in the CONFIG.sys file.

Example: Device = C:\U31\PC9601.sys W0

This selects window # 0 = D800:0000.

All possible starting addresses for the window are:

D800:0000 window # 0

DC00:0000	window # 1
CC00:0000	window # 2
C000:0000	window # 3
E000:0000	window # 4
E400:0000	window # 5
E800:0000	window # 6
EC00:0000	window # 7

D800:0000 is the default window for Aerotech's PSO card and should not be used if a PSO card is present in the system occupying this area of memory.

The I/O address is the starting address for the U600's I/O registers used to configure and communicate with the U600. The default address is 220. The other available I/O address settings are 230, 300, 310, 330, 340, 350, and 360. The following is an example modifying the address setting from the user's CONFIG.sys file. The I/O address jumpers must also be changed on the U600 card.

Example: Device = C:\U31\PC9601.sys I300

The IRQ level indicates the interrupt level number generated by the U600 as a service request to the PC. This interrupt level must match the level set by one of the PC bus interrupt jumpers on the U600 control board. The default jumper setting is IRQ10 (jumper in). The following is an example modifying the interrupt level by adding this command line switch to the device driver line in the user's CONFIG.sys file.

Example: Device = C:\U31\PC9601.sys QF

In this example the selected interrupt level is IRQ15.

Some IRQ levels are pre-assigned to existing devices in the user's PC. The user's may require the use of diagnostic software (e.g., MSD.exe) to find an available IRQ level, or use trial and error.

B.3.4. Executing Mainmenu.exe

Using mainmenu.exe with a UNIDEX 600 requires the use of a command line parameter that instructs mainmenu to communicate with a specific UNIDEX 600 card. The program should be started on an OS/2 command line with a "-C1" parameter, for example, C:\U31> mainmenu -C1. A command file is installed on the user's machine called MM.CMD. This has the "-C1" parameter within it. We recommand U600\620 users to start "mainmenu" with "MM" command and U630\631 users just type "mainmenu".

∇ ∇ ∇

Appendix C

APPENDIX C: WARRANTY AND FIELD SERVICE

In This Section:
- Laser Product Warranty
- Return Products Procedure
- Returned Product Warranty Determination
- Returned Product Non-warranty Determination
- Rush Service
- On-site Warranty Repair
- On-site Non-warranty Repair

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products which are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, whether or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability or any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Laser Products

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than (30) days after the issuance of a return authorization number will be subject to review.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an air freight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-warranty Determination

After Aerotech's examination, the buyer shall be notified of the repair cost. At such time the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special service rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-site Non-warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

Company Address

Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238-2897
USA

Phone: (412) 963-7470
Fax: (412) 963-7459
TWX: (710) 795-3125

∇ ∇ ∇

SYMBOLS

A

B

C

D

E

F

G

H

I

J

L

M

O

P

R

S

T

U

V

W

∇ ∇ ∇

READER'S COMMENTS

UNIDEX 600 Hardware Manual
P/N EDU 154, May 1998

Please answer the questions below and add any suggestions for improving this document. Is the information:

	Yes	No
Adequate to the subject?	____	____
Well organized?	____	____
Clearly presented?	____	____
Well illustrated?	____	____
Would you like to see more illustrations?	____	____
Would you like to see more text?	____	____

How do you use this document in your job? Does it meet your needs?
What improvements, if any, would you like to see? Please be specific or cite examples.

_____

_____

_____

_____

_____

Your name _____
Your title _____
Company name _____
Address _____
_____

Remove this page from the document and fax or mail your comments to the technical writing department of Aerotech.

AEROTECH, INC.
Technical Writing Department
101 Zeta Drive
Pittsburgh, PA. 15238-2897 U.S.A.
Fax number (412) 963-7009


AEROTECH®