# THE UNIDEX® 600 HARDWARE MANUAL

**P/N: EDU154 (V1.9)**


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)

**www.aerotech.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.aerotech.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 PC-based motion controller is a product of Aerotech, Inc.
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The UNIDEX 600 Motion Controller
Hardware Manual Revision History:

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# 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
April, 1999

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.

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# 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 U600 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.

## APPENDIX A: GLOSSARY OF TERMS

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

## APPENDIX B: WARRANTY AND FIELD SERVICE

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

## INDEX

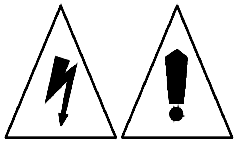
The index contains a page number reference of topics discussed in this manual. Locator page references in the index contain the chapter number (or appendix letter) followed by the page number of the reference.

## 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
- 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.



**DANGER WARNING**

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

> To minimize the possibility of electrical shock and bodily injury when any electrical circuit is in use, ensure that no person comes in contact with the circuitry.

> 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.

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# 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.

The U600 is available in four combinations: U600BASE-8MB, U600BASE-32MB, U600ULTRA-8MB, and U600ULTRA-32MB. The BASE card supports up to 8 million machine counts per second data rate on its encoder channels, while the ULTRA doubles this to 16 million machine counts per second. The ULTRA card adds (to the base features) support for 4 stepper axes (Clock/Direction), an RS-232C port, and an RS-422 port.

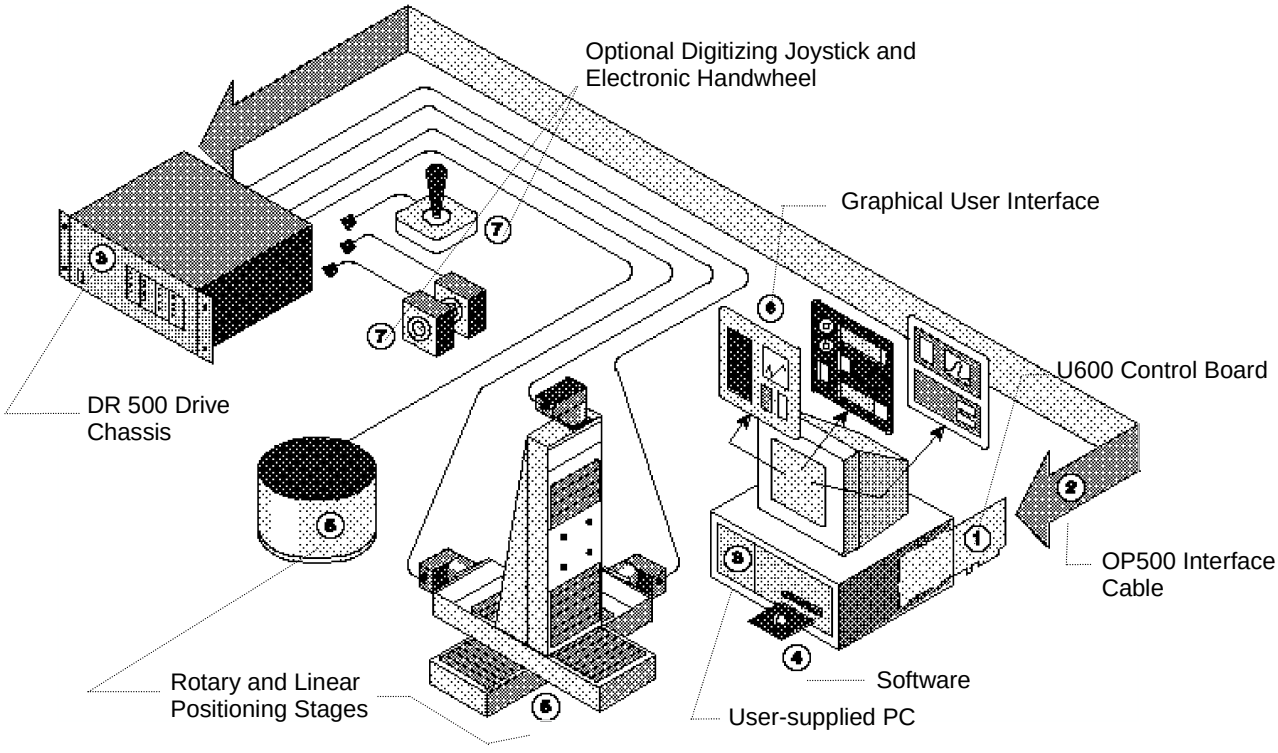
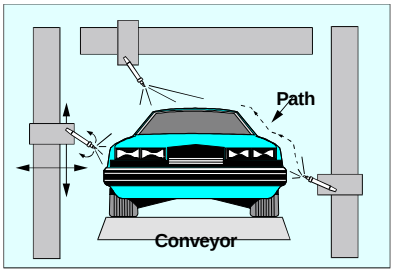


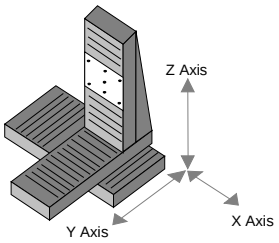

**Figure 1-1. The UNIDEX 600 System Diagram**




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).



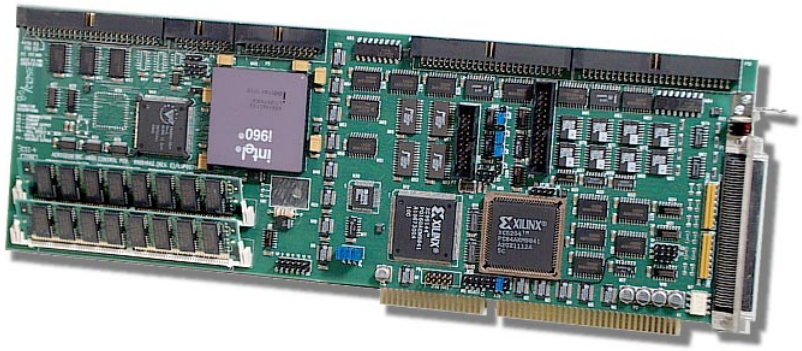



**Figure 1-2. UNIDEX 600 Motion Control Card**

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, and Windows 95 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 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**

| Options & 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. |
| 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 |
| 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") |
| SDK600-NT | Software Development kit for Windows NT/95 containing OLE custom controls |
| MMI600-NT | CNC MMI development kit for Windows NT/95 |
| UTIL600-NT | Standard utilities, libraries, and U600 firmware for Windows NT/95 |

## 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.

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

To minimize the possibility of electrical shock and bodily injury when any electrical circuit is in use, ensure that no person comes in contact with the circuitry.

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.

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# 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 PC bus-based controller
- U600 software (on CD ROM), with manuals in .PDF format (installed to \U600\Manual*.PDF)
- UNIDEX 600 packing slip (listing products shipped with the order)

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 DR Series 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**

| Equipment | Minimum | Recommended |
|---|---|---|
| Computer (microprocessor) | IBM PC Pentium 200 MHz (or higher) or 100% compatible | Pentium 400 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 |
| Windows | Windows NT 4.0 / Windows 2000 | Windows NT 4.0 / Windows 2000 |

## 2.4. Cooling Requirements

Table 2-2 shows that a U600BASE-8MB 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.

UNIDEX 600 controllers are now equipped with integral heatsink and cooling fans that should meet all required cooling requirements, except under extreme conditions.

**Table 2-2. 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] | BASE | 38 | 57 | 74 | 76 | 81 | 84 |
| | ULTRA | 30 | 47 | 62 | 64 | 69 | 71 |
| Max Ambient Temp. without Heatsink | BASE | 18 | 33 | 47 | 57 | 66 | 67 |
| | ULTRA | 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).

## 2.4.1. Power Consumption

This section is a reminder to the user if the user is installing all Aerotech boards into their PC. Table 2-3 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 2-3. Board Power Consumption**

| **Power Consumption** | | | |
|---|---|---|---|
| **Board** | **+12 Volts** | **-12 Volts** | **+5 Volts** |
| U600BASE-8MB | .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.

## 2.5. 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.

**WARNING**

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 U600 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 U600 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 U600 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 U600 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 U600 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 U600 board is illustrated in Figure 2-1.

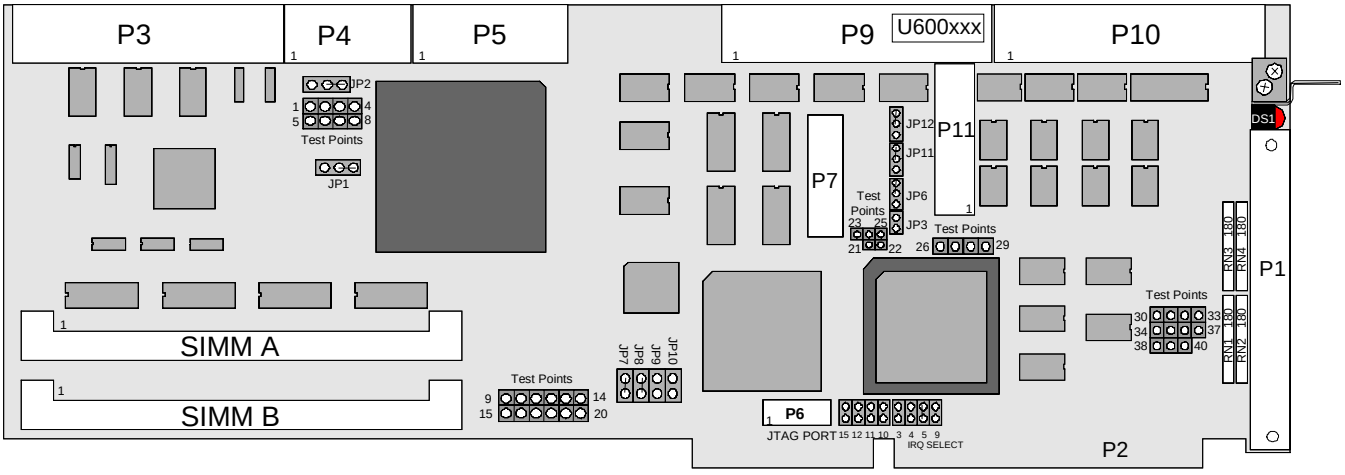
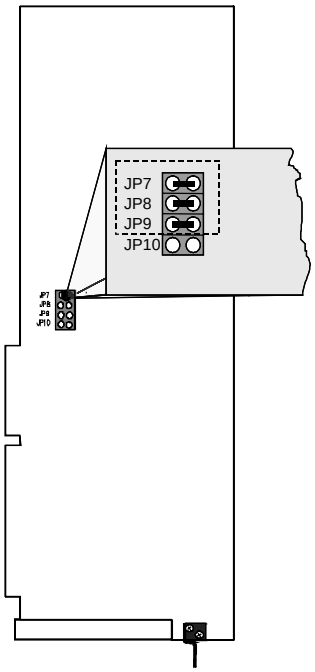



**Figure 2-1. The UNIDEX 600 PC Board**

## 2.6. 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.




### 2.6.1. Base Address Jumpers (JP7, JP8, and JP9)

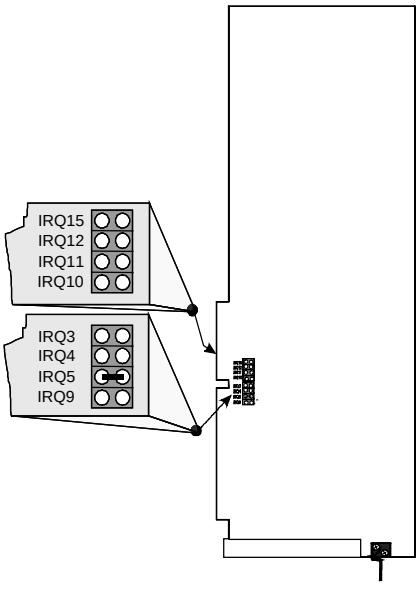
Input/Output (I/O) base addresses for the UNIDEX 600 are assigned in hexadecimal address ranges. The U600 control board occupies 15 consecutive memory locations in the input/output (I/O) channel memory of the PC holding the U600 control board. The U600 control board is factory configured for address 0x220-0x22F. The U600 device driver is also set to this default address. If the U600 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 2-4.

Each U600 control board must have a distinct address in the same PC.

**Table 2-4. 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 | | | |




### 2.6.2. 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 2-5. This table shows the available interrupt request (IRQ) lines that may be assigned using the PC bus interrupt jumpers.

The default interrupt configuration has JP4E installed. In this configuration, the UNIDEX 600 generates interrupt requests to the host computer on IRQ5.

**Table 2-5. PC Bus Interrupt Jumper Settings**

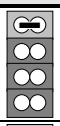
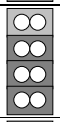
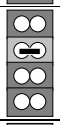
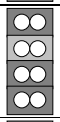
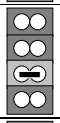
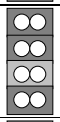
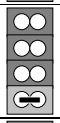
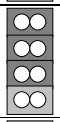
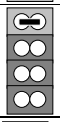
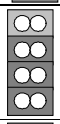
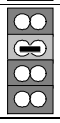
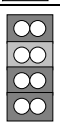
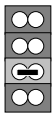
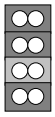
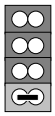
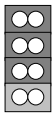
| Jumper | State | Jumper Settings | Function |
|---|---|---|---|
| JP4A | IN |   | Interrupt IRQ3(COM2) |
| | OUT |   | IRQ3 not selected (default) |
| JP4B | IN |   | Interrupt IRQ4 (COM1) |
| | OUT |   | IRQ4 not selected (default) |
| JP4C | IN |   | Interrupt IRQ5 (default) |
| | OUT |   | IRQ5 not selected |
| 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) |
| | OUT |   | IRQ3 not used (default) |

**Table 2-5. PC Bus Interrupt Jumper Settings (Cont'd)**

| Jumper | State | Jumper Settings | Function |
|---|---|---|---|
| JP5C | IN | JP5A  | Interrupt IRQ11 |
| | OUT | JP5A  | IRQ11 not used (default) |
| JP5D | IN | JP5A  | Interrupt IRQ10 |
| | OUT | JP5A  | IRQ10 not used (default) |

## 2.7. 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.

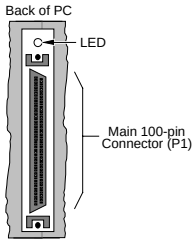
The UNIDEX 600 PC control board may not fit in some smaller models of PC's.

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

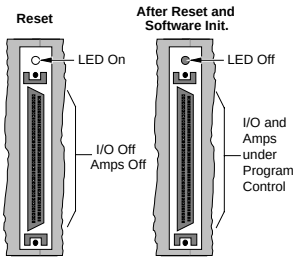
1. Turn OFF the power to the computer system unit and unplug the unit's power cord from the power source.

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. (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.




The LED (visible from the rear of the system) of the UNIDEX 600 board should come ON when power is first applied, then go OFF during system initialization 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.

## 2.8. 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.

### 2.8.1. The DR500 Drive Rack and OP500 Cable

The DR500 drive chassis is an integral part of the U600 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 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.

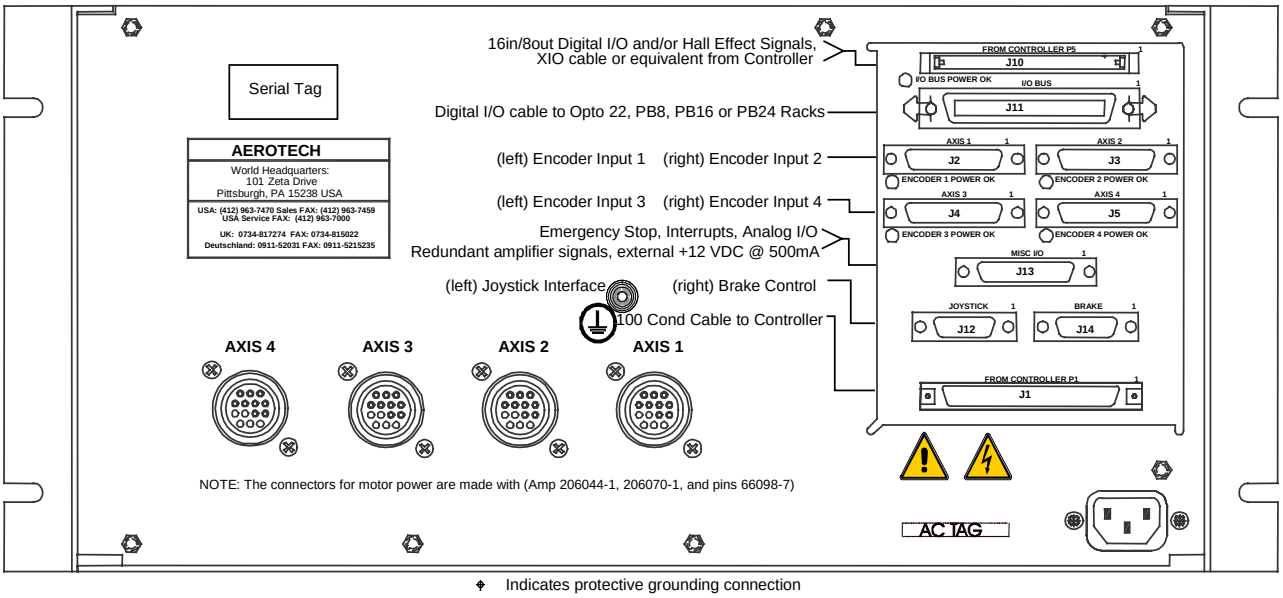



**Figure 2-2. Rear Panel Connectors of the DR500 Amplifier Chassis**

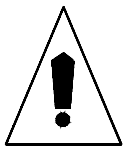
The OP500 cable is used to connect the UNIDEX 600 PC board to the DR500 drive chassis. One end of this cable connects to the UNIDEX 600 PC board and the other end connects to the J1 connector located on the back of the DR500 chassis. See Figure 2-2.

### 2.8.2. 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.

Care should be exercised when connecting a drive rack to the UNIDEX 600 breakout module. Be sure that signal lines are properly connected.




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

### 2.8.3. 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 2-3 and Figure 2-4.

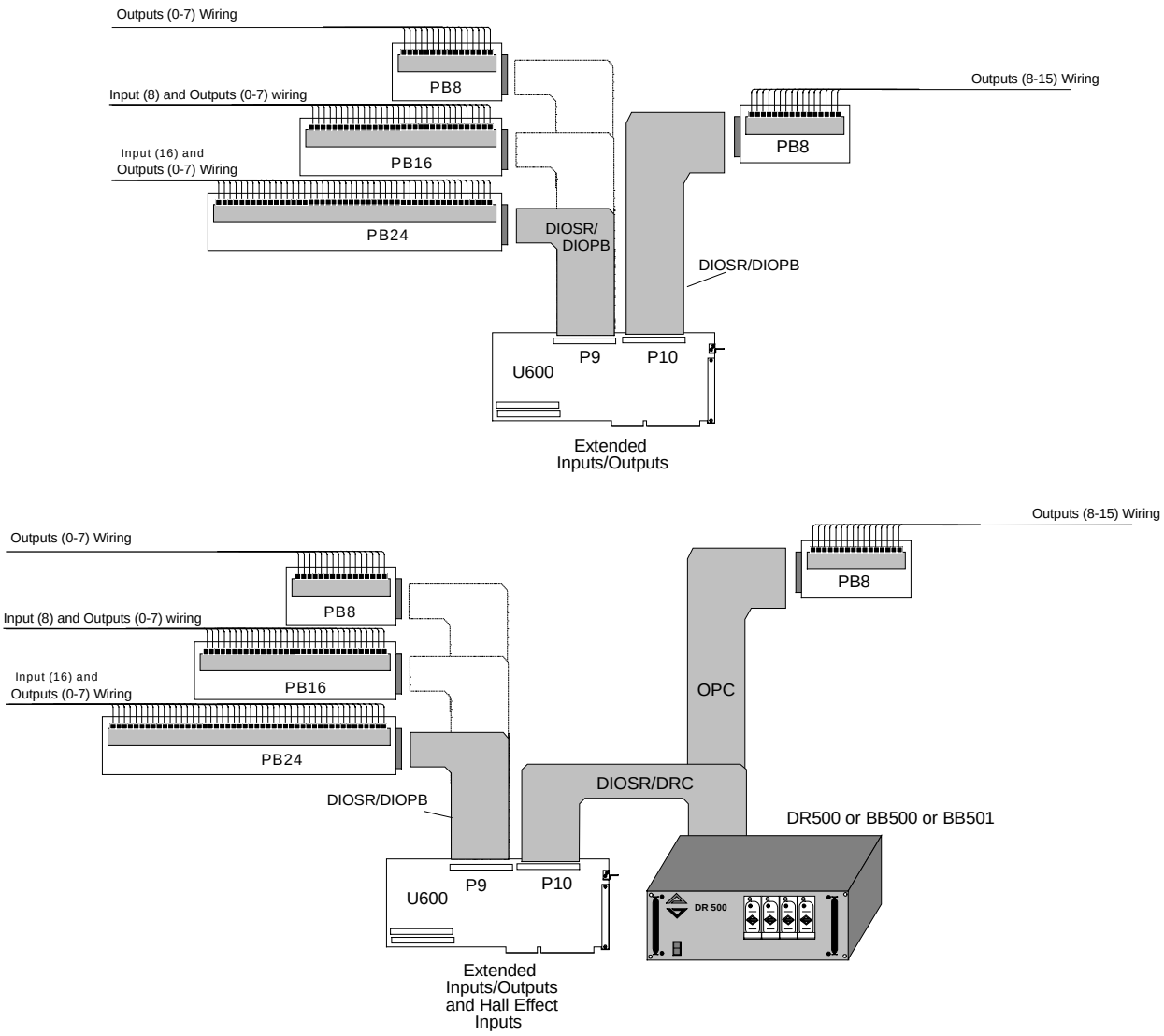



**Figure 2-3. Sample Uses of the PB# Boards and the DIOSR/DRC Cables**

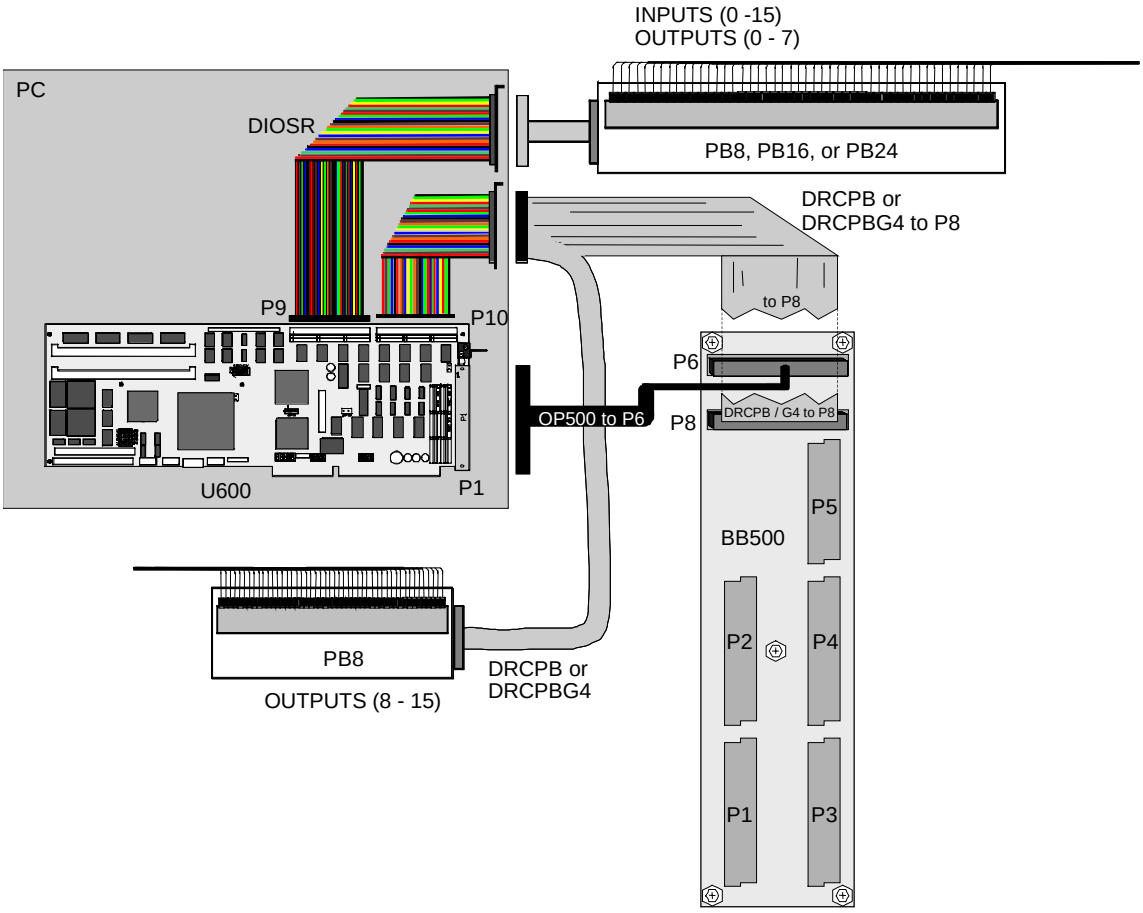
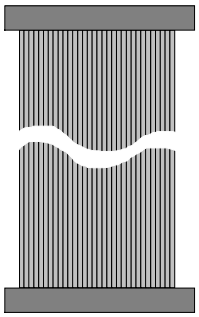



**Figure 2-4. Sample Uses of the PB# Boards and the DRCPB and DRCPBG4 Cables**

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



## 2.8.4. DRC I/O Cable

The DRC I/O cable serves two purposes when used with the DR500 Drive Chassis. The primary 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 DRC cable is connected between the UNIDEX 600/U500 and the DR500. Different versions of the DRC I/O cable are available for (1) directly connecting the UNIDEX 600/U500 and a PB8, PB16, or PB24 interface board to allow additional inputs/outputs; or (2), connecting the U600/U500 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. Refer to Figure 2-3 and Figure 2-4.

The second purpose is to allow more than four user inputs or outputs (as in the case when the PB8, PB16, or PB24 I/O board is used).

Figure 2-5 is an illustration of the DRC I/O cable. For additional information, refer to the *Aerotech Motion Control Product Guide*.

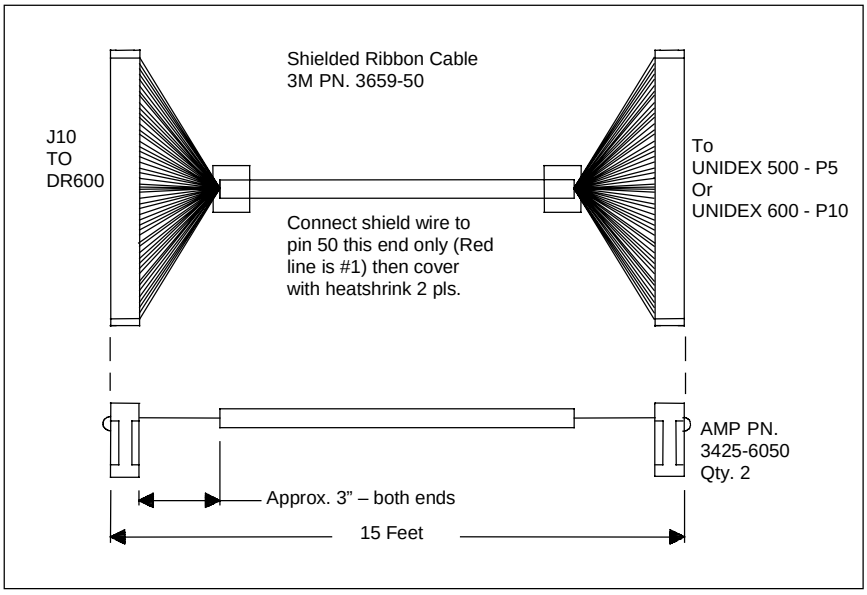



**Figure 2-5. DRC I/O Cable**

∇ ∇ ∇

# 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, 200 MHz or higher and 100% compatibles | Pentium 400 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 |
| Windows | Windows NT 4.0 / Windows 2000 | Windows NT 4.0 / Windows 2000 |

### 3.2.1. Power Consumption

This section is a reminder for 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**

| Power Consumption | | | |
|---|---|---|---|
| **Board** | **+12 Volts** | **-12 Volts** | **+5 Volts** |
| U600BASE-8MB | .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 U600 control board. Descriptions are based on six functional groups of jumpers:

- Base address jumpers
- PC bus interrupt jumper
- 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.

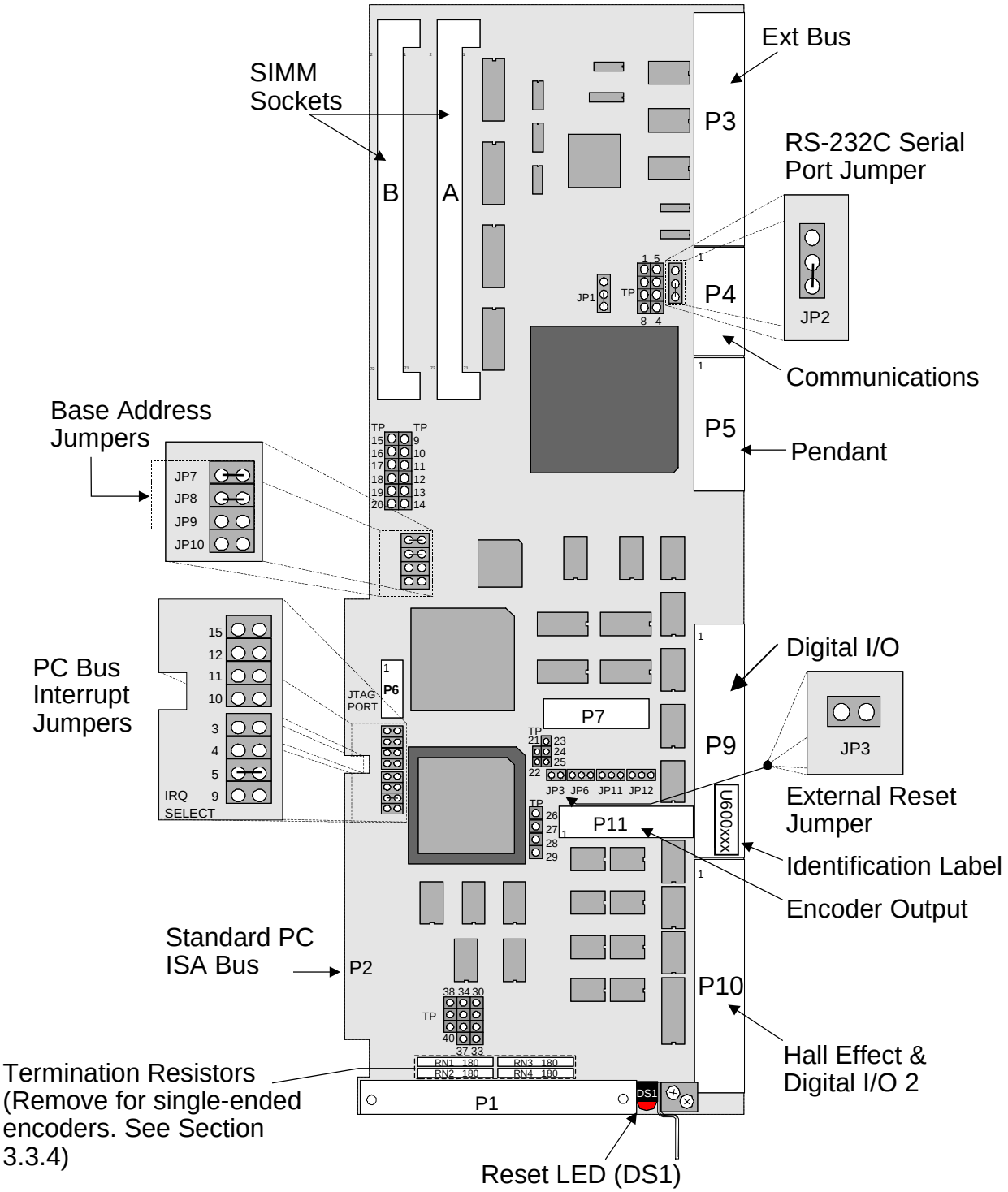
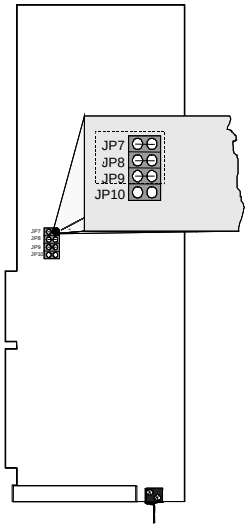



**Figure 3-1. UNIDEX 600 PC Board**




### 3.3.1. Base Address Jumpers (JP7, JP8, and JP9)

Input/Output (I/O) base addresses for the UNIDEX 600 are assigned in hexadecimal address ranges. The U600 control board occupies 15 consecutive memory locations in the input/output (I/O) channel memory of the PC holding the U600 control board. The U600 control board is factory configured for address 0x220-0x22F. The U600 device driver is also set to this default address. If the U600 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).

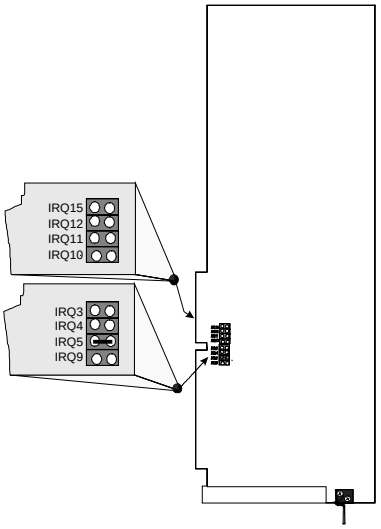
The address of a UNIDEX 600 board is set from jumpers JP7-JP9. These jumpers are located near the center of the control board. Each jumper has two pins. For each jumper, a plastic cap jumper is connected to create a unique base address. The combinations of base address jumper settings are shown in Table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

Each U600 control board must have a distinct address in the same PC.

**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 | ○ | ○ | ○ |

### 3.3.2. 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 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 JP4E installed. In this configuration, the UNIDEX 600 generates interrupt requests to the host computer on IRQ5.

**Table 3-4. PC Bus Interrupt Jumper Settings**

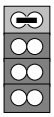
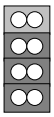
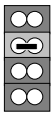
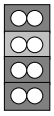
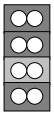
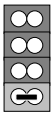
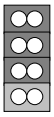
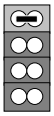
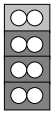
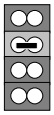
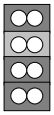
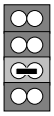
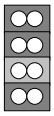
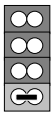
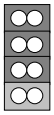
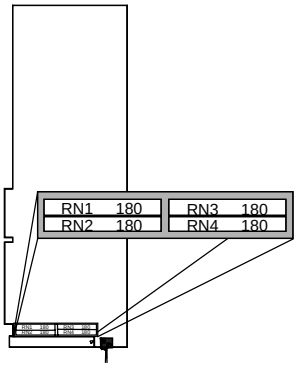
| Jumper | State | Jumper Settings | Function |
|---|---|---|---|
| JP4A | IN | JP4A  | Interrupt IRQ3(COM2) |
| | OUT | JP4A  | IRQ3 not selected (default) |
| JP4B | IN | JP4A  | Interrupt IRQ4 (COM1) |
| | OUT | JP4A  | IRQ4 not selected (default) |
| JP4C | IN | JP4A  | Interrupt IRQ5 (default) |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

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

| Jumper | State | Jumper Settings | Function |
|---|---|---|---|
| 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) |

### 3.3.3. Encoder Type Configuration for Differential or Single Ended Encoders (RN3, RN4, RN1 and RN2)




The UNIDEX 600 is equipped with four resistor networks (RN1, RN2, RN3 and RN4) 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. Each axis has its own resistor network; axes one through four are networks RN3, RN4, RN1, and RN2 respectively.

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 * |
|---|---|---|---|---|
| RN3 | 12 | MRK1- | 4 | |
| | 11 | MRK1+ | 3 | |
| RN3 | 8 | SIN1- | 2 | |
| | 7 | SIN1+ | 1 | |
| RN3 | 10 | COS1- | 8 | |
| | 9 | COS1+ | 7 | |

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

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

| RN # | Main Pinouts | Axis Signals | RN Pin Numbers | 180 Ω Resistor * |
|---|---|---|---|---|
| RN4 | 20 | MRK2- | 8 |  |
| | 19 | MRK2+ | 7 | |
| RN4 | 16 | SIN2- | 6 |  |
| | 15 | SIN2+ | 5 | |
| RN4 | 18 | COS2- | 4 |  |
| | 17 | COS2+ | 3 | |

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

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

| RN # | Main Pinouts | Axis Signals | RN Pin Numbers | 180 Ω Resistor * |
|---|---|---|---|---|
| RN1 | 28 | MRK3- | 6 |  |
| | 27 | MRK3+ | 5 | |
| RN1 | 24 | SIN3- | 2 |  |
| | 23 | SIN3+ | 1 | |
| RN1 | 26 | COS3- | 8 |  |
| | 25 | COS3+ | 7 | |

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

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

| RN # | Main Pinouts | Axis Signals | RN Pin Numbers | 180 Ω Resistor * |
|---|---|---|---|---|
| RN2 | 36 | MRK4- | 2 |  |
| | 35 | MRK4+ | 1 | |
| RN2 | 32 | SIN4- | 6 |  |
| | 31 | SIN4+ | 5 | |
| RN2 | 34 | COS4- | 4 |  |
| | 33 | COS4+ | 3 | |

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

### 3.3.4. RS-232C Serial Port Jumper (JP2)

The RS-232C specification (U600ULTRA only) requires 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 3-9.

**Table 3-9. RS-232C Serial Port Jumper Settings**

| RS-232C Voltage Bias | Setting JP2 |
|---|---|
| +12V bias to CTS and DCD inputs on serial ports 1 and 2 |  |
| -12V bias to CTS and DCD inputs on serial ports 1 and 2 |  |
| No bias |  |

### 3.3.5. Processor Configuration Jumper (JP10)

The UNIDEX 600 controller may optionally have a clock-doubled processor. This jumper (JP10) is part of the board configuration for the processor. This is jumper selectable, but should not be changed by the user, see Table 3-10.

**Table 3-10. Processor Configuration Jumper Settings**

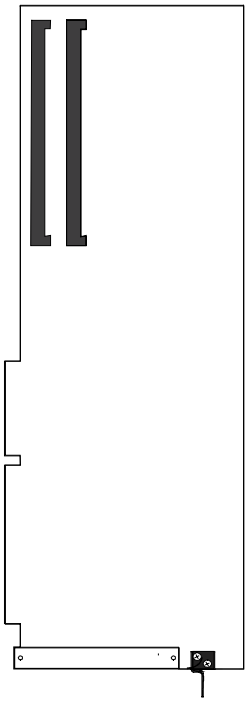
| Processor Configuration | Setting (JP10) |
|---|---|
| U600BASE-xxMB (default) |  |
| U600ULTRA-xxMB |  |

### 3.3.6. External Reset Jumper (JP3)

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 JP3 and is outlined in Table 3-11.

**Table 3-11. External Reset Jumper Settings**

| External Reset | Setting (JP3) |
|---|---|
| Enable UNIDEX 600 board reset through P10-25 |  |
| No external reset through P10-25 (default) |  |



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

The Single In-line Memory Module (SIMM) sockets on the U600 board accept industry standard 32 bit wide, non-parity 72-pin DRAM SIMM modules. The user can configure the U600 to have 8, 16, or 32 Megabytes of DRAM. Refer to Figure 3-2 for installation of the DRAM SIMM module.

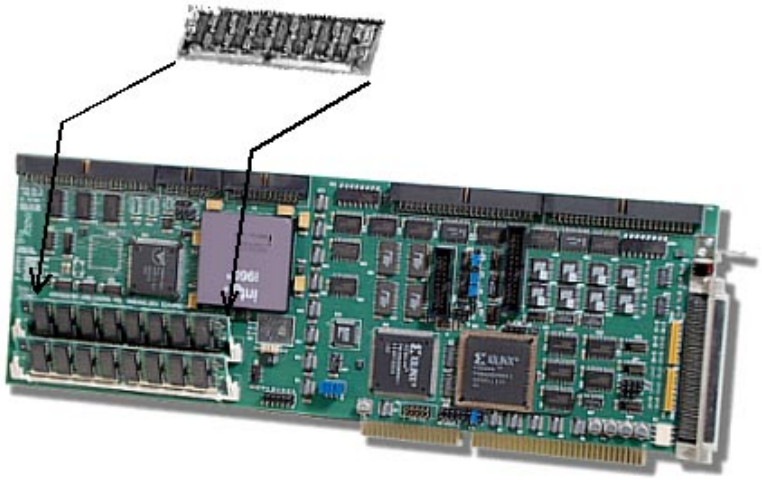


**Figure 3-2. RAM SIMM Module Installation**

## 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.

The UNIDEX 600 PC control board may not fit in some smaller models of PC's.

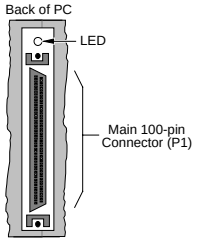
The procedure for installation of the UNIDEX 600 PC board is outlined in the steps that follow.

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

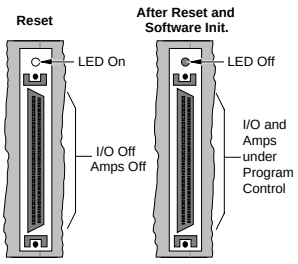
The possibility of electrical shock exists. Make certain that the computer system's power switch is in the OFF position and the power cord is disconnected before opening the computer's cabinet.

DANGER

2. Open the computer cabinet. See the sample in Figure 3-3. (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 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 should come ON when power is first applied, then go OFF during system initialization 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.

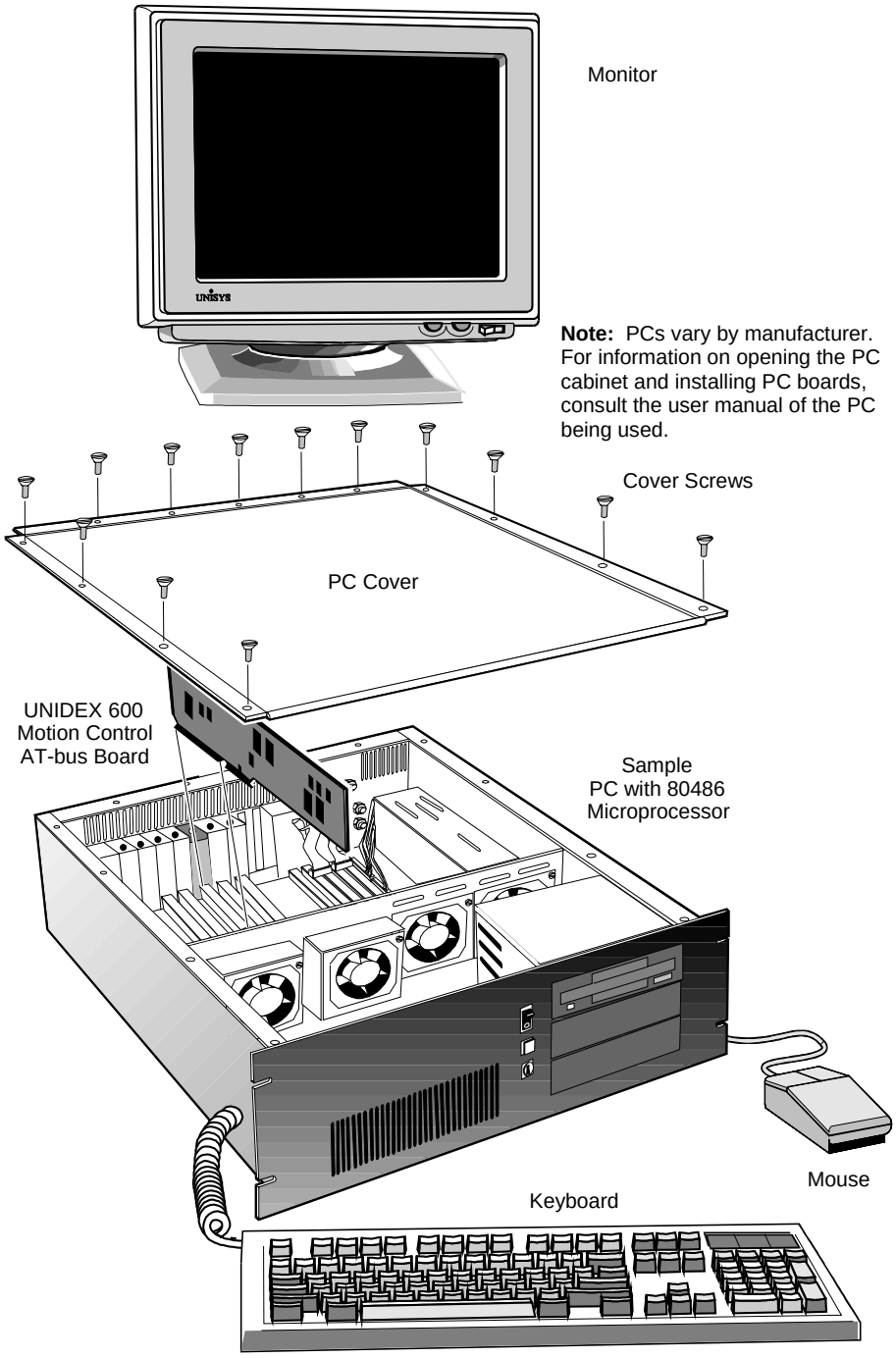


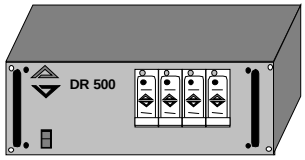

**Figure 3-3. Installation of the UNIDEX 600 Motion Controller Board**

## 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 U600 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 3-4. 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.



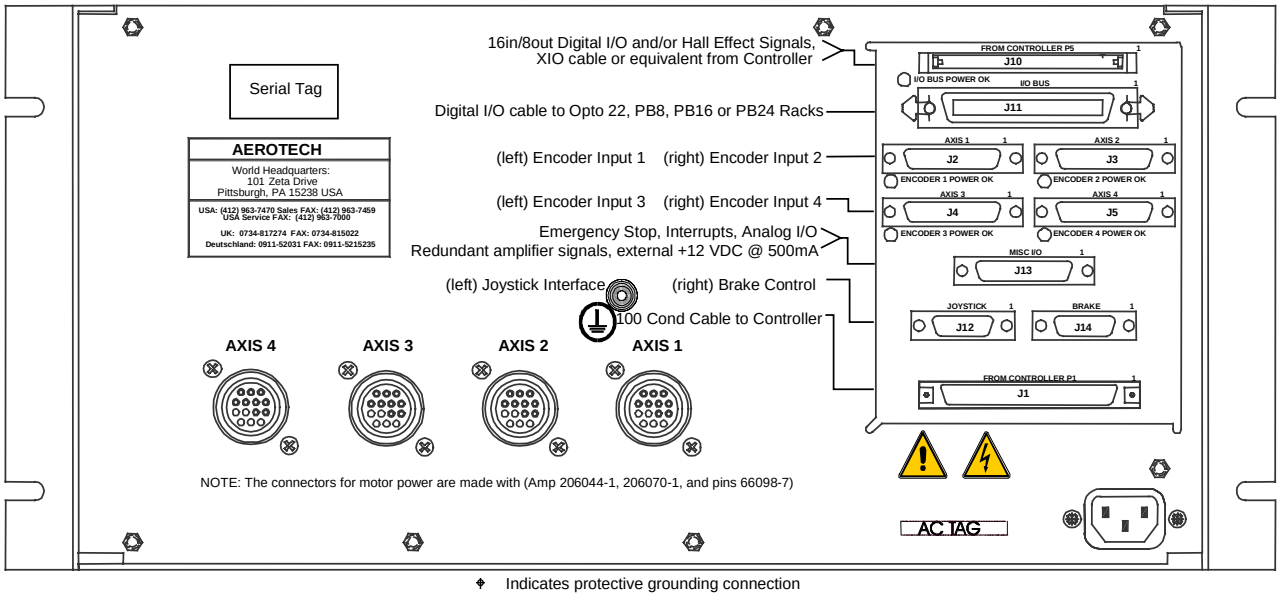




**Figure 3-4. Rear Panel Connectors of the DR500 Amplifier Chassis**

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 3-4.

### 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 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.


IMPORTANT

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

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. 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*.

### 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 3-5. 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 dual-port RAM must be set to D800:0000.

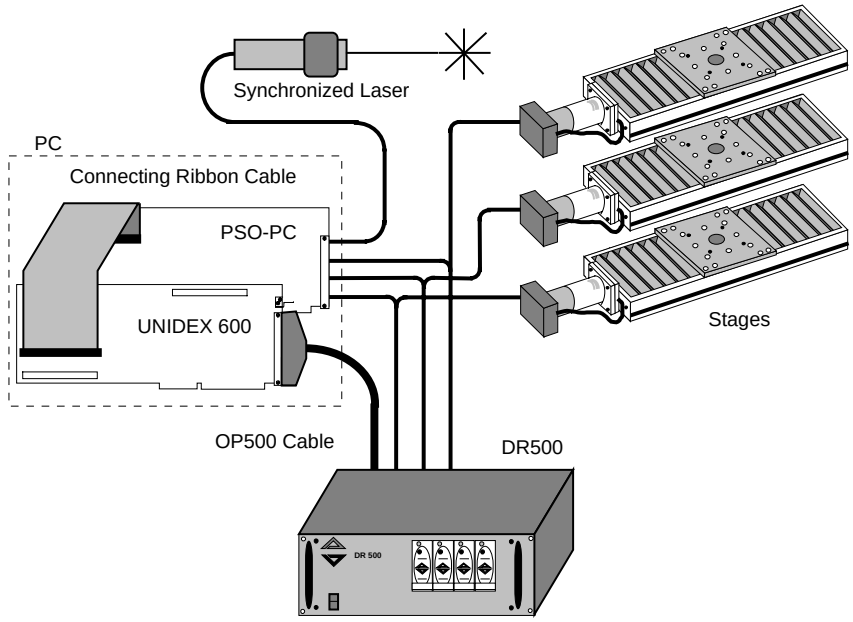
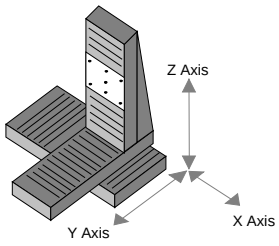



**Figure 3-5. Overview of the PSO-PC Option**

### 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. Refer to the *RDP-PC Option Manual, P/N EDO112* for hardware and software setup.

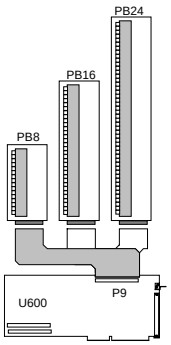



### 3.5.5. The BRK/BPS Fail-safe Brake

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*.

The physical brake device is available separately as a DR500 option.

### 3.5.6. 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 3-6 and Figure 3-7.

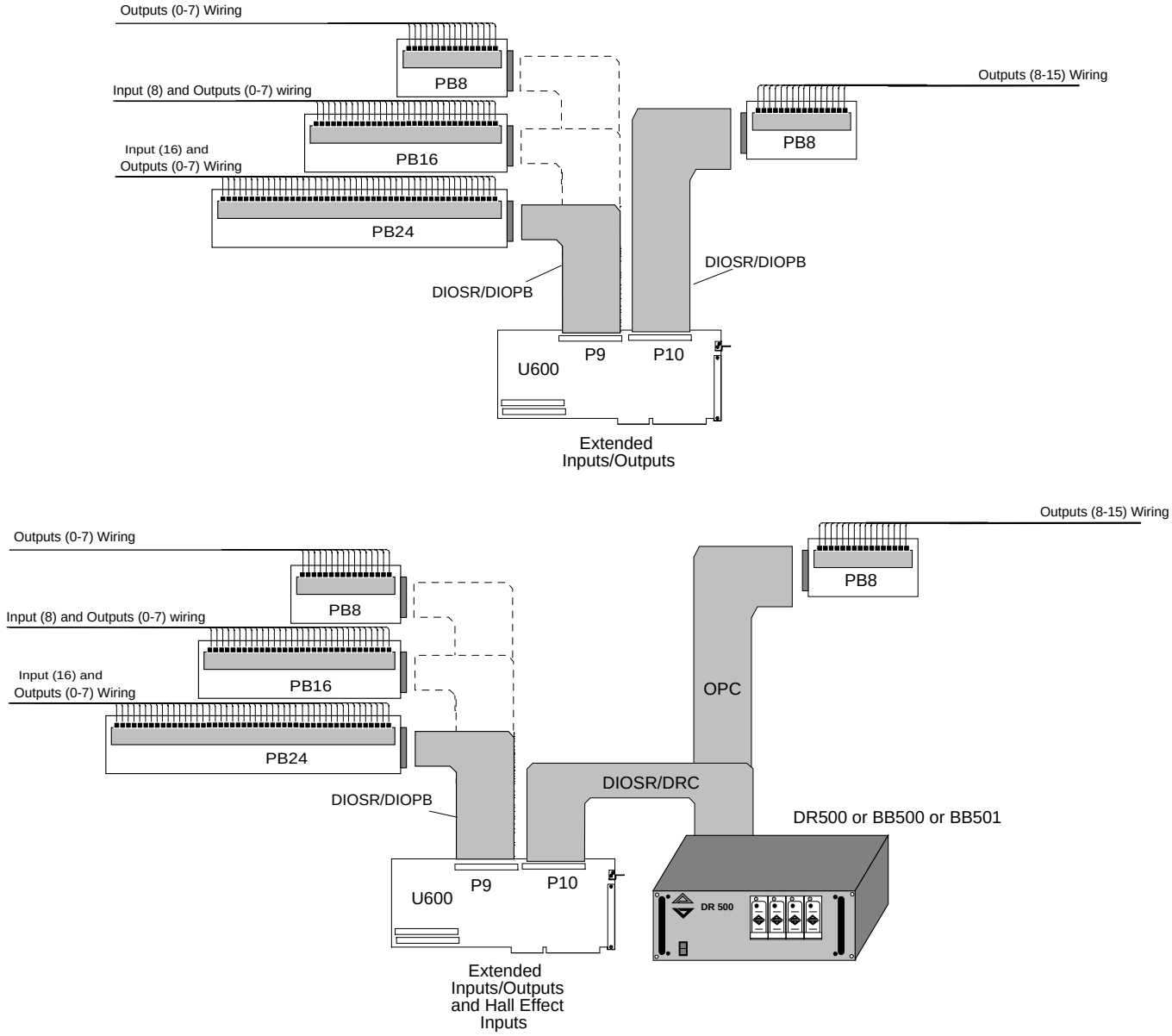



**Figure 3-6. Sample Uses of the OPTO-22 Boards and the DRC Cable**

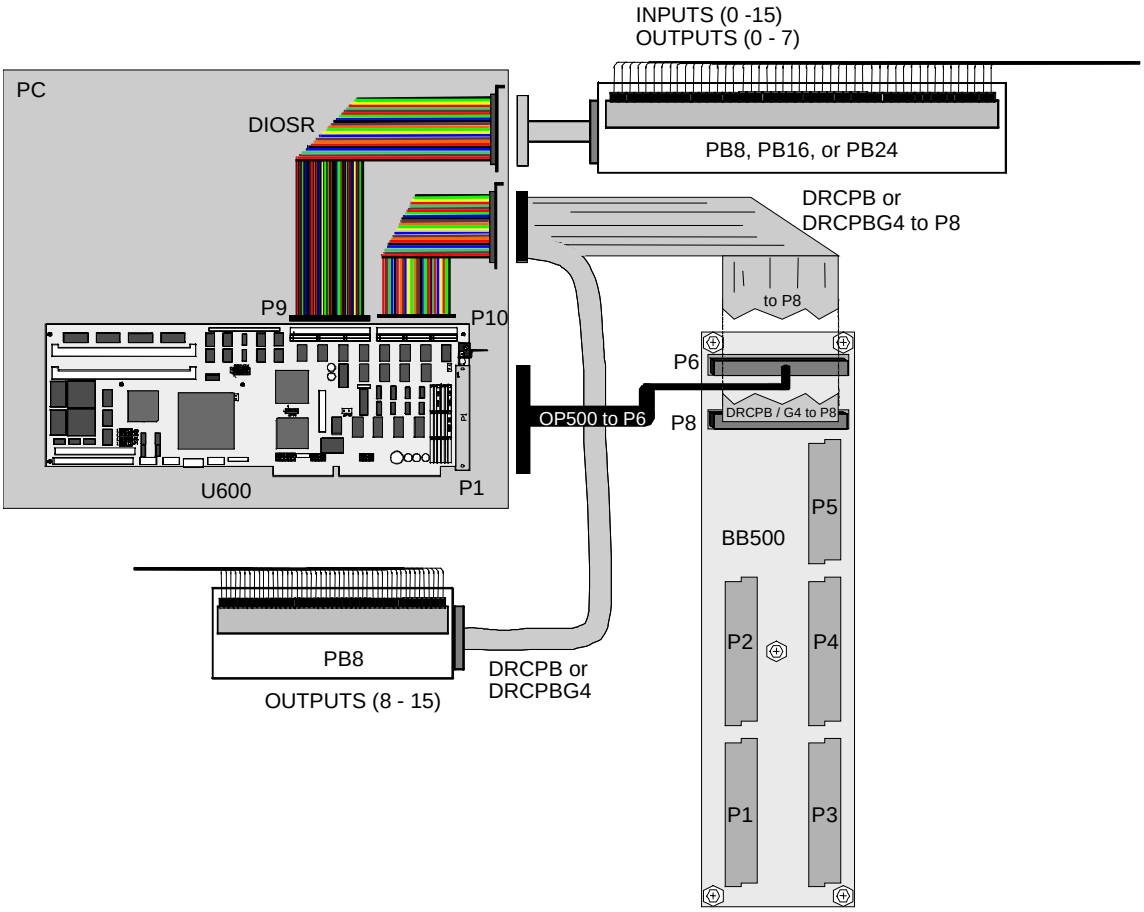
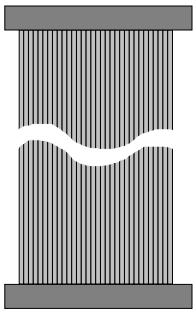



**Figure 3-7. Sample Uses of the PB# Boards and the DRCPB and DRCPBG4 Cables**

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

### 3.5.7. DRC I/O Cable



The DRC I/O cable serves two purposes when used with the DR500 Drive Chassis. The primary 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 DRC cable is connected between the UNIDEX 600/U500 and the DR500. Different versions of the DRC I/O cable are available for (1) directly connecting the UNIDEX 600/U500 and a PB8, PB16, or PB24 interface board to allow additional inputs/outputs; or (2), connecting the U600/U500 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. Refer to Figure 3-6. For additional information, refer to the *Aerotech Motion Control Product Guide*.

The second purpose is to allow more than four user inputs or outputs (as in the case when the PB8, PB16, or PB24 I/O board is used).

Figure 3-8 is an illustration of the DRC I/O cable. For additional information, refer to the *Aerotech Motion Control Product Guide*.

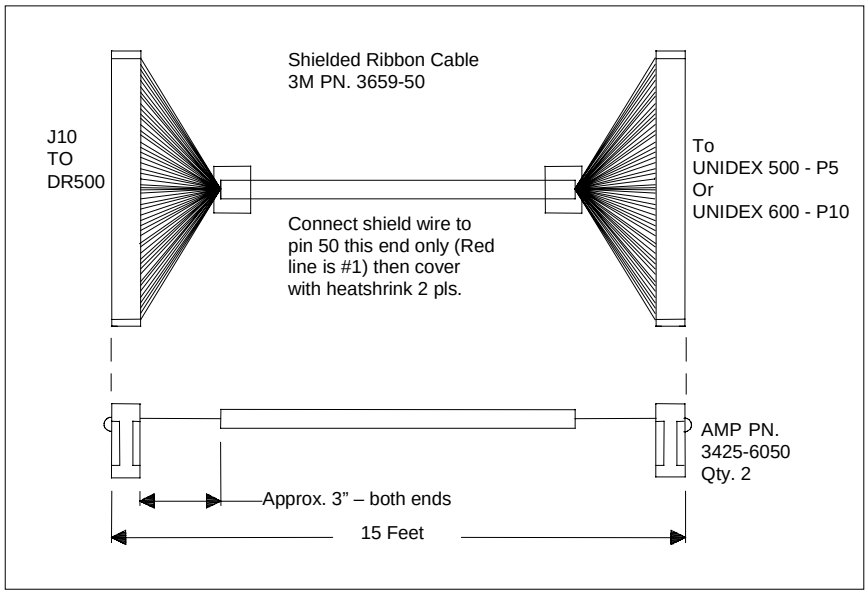



**Figure 3-8. DRC I/O Cable**

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# 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 |
| TP22 | High Speed Position Latch input after RC filter |
| TP38 | Emergency Stop input after Opto-Isolator |
| TP30 | Axis 1 primary command |
| TP31 | Axis 1 secondary command |
| TP32 | Axis 2 primary command |
| TP33 | Axis 2 secondary command |
| TP35 | Axis 3 primary command |
| TP34 | Axis 3 secondary command |
| TP36 | Axis 4 primary command |
| TP37 | Axis 4 secondary command |

**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 |
| TP29 | Channel 1 marker after RS-422 differential receiver |
| TP28 | Channel 2 marker after RS-422 differential receiver |
| TP27 | Channel 3 marker after RS-422 differential receiver |
| TP26 | 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, our system test department will properly configure the jumpers for you.

**Table 4-3. Jumper Configurations**

| Jumper # | Setting | Explanation |
|---|---|---|
| JP1 | OUT* | Factory test use only |
| JP2 | OUT*<br>1-2<br>2-3 | No bias on ports 1 and 2 RS-232C DCD,CTS signals<br>Bias ports 1 and 2 RS-232C DCD, CTS signals at +12 Volts<br>Bias ports 1 and 2 RS-232C DCD, CTS signals at -12 Volts |
| JP3 | IN<br>OUT* | UNIDEX 600 board reset through P10-25<br>No external reset through P10-25 |
| JP4A | IN<br>OUT* | Interrupt IRQ3 (COM 2)<br>Interrupt 3 not used by UNIDEX 600 |
| JP4B | IN<br>OUT* | Interrupt IRQ4 (COM 1)<br>Interrupt 4 not used by UNIDEX 600 |
| JP4C | IN*<br>OUT | Interrupt IRQ5 (LPT)<br>Interrupt 5 not used by UNIDEX 600 |
| JP4D | IN<br>OUT* | Interrupt IRQ9 (AT unassigned)<br>Interrupt 9 not used by UNIDEX 600 |
| JP5A | IN*<br>OUT | Interrupt IRQ15 (AT unassigned)<br>Interrupt 15 not used by UNIDEX 600 |
| JP5B | IN*<br>OUT | Interrupt IRQ12 (AT unassigned)<br>Interrupt 12 not used by UNIDEX 600 |
| JP5C | IN<br>OUT* | Interrupt IRQ11<br>Interrupt 11 not used by UNIDEX 600 |
| JP5D | IN<br>OUT* | Interrupt IRQ10<br>Interrupt 10 not used by UNIDEX 600 |
| JP6 | 1-2*<br>2-3 | Position latch input from P10-27<br>Position latch input from Input3 (P9-25 or P1-62) |
| JP10 | IN*<br>OUT | U600BASE-xxMB (default) DO NOT CHANGE<br>U600ULTRA-xxMB |
| JP11 | 1-2<br>2-3* | Output3 (P1-66 or P9-41) is Output3<br>Output3 (P1-66 or P9-41) is reserved Output2 (P10-31) |
| JP12 | 1-2<br>2-3* | Output2 (P1-62 or P9-43) is Output2<br>Output2 (P1-62 or P9-43) is reserved Output1 (P10-29) |

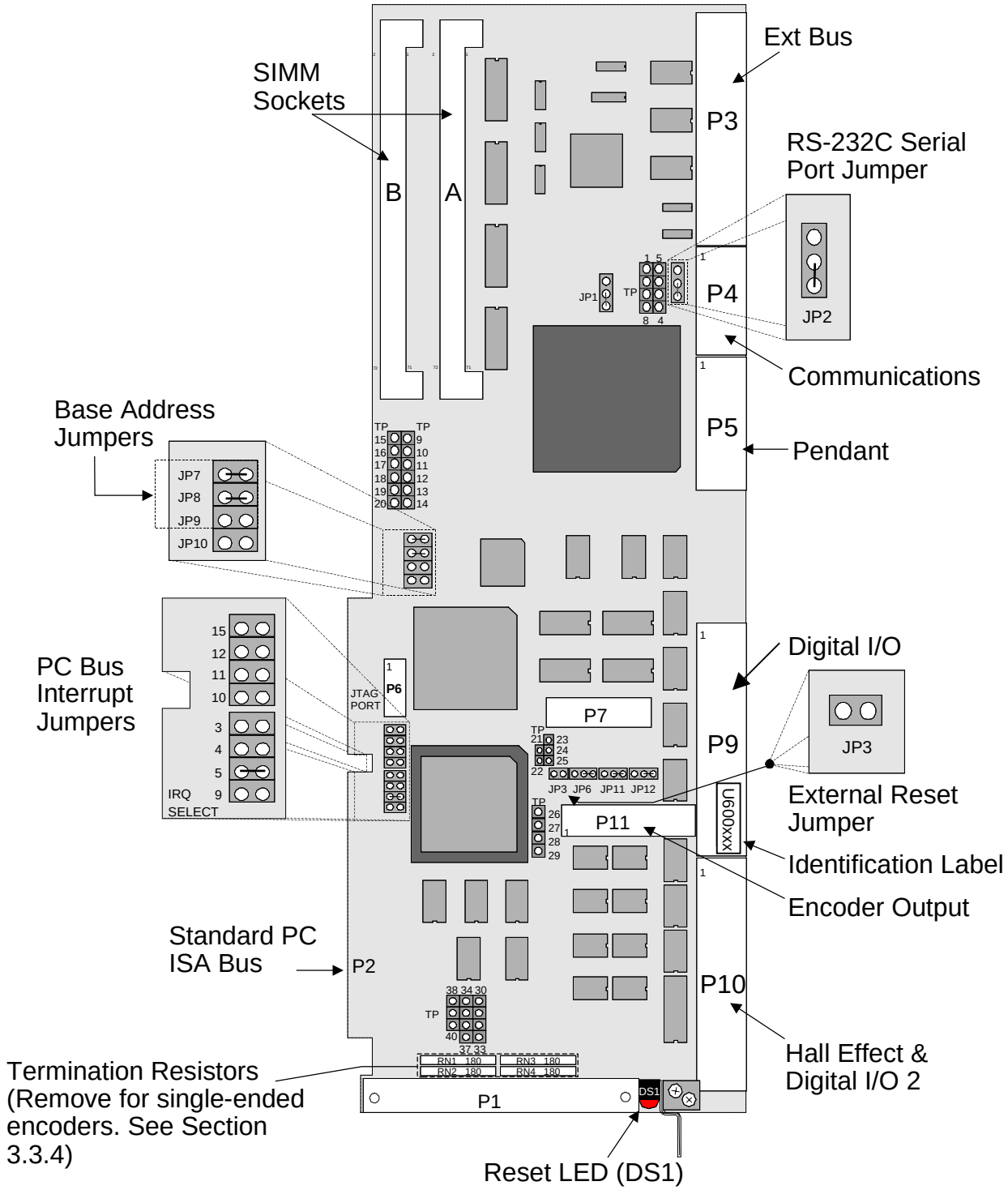



**Figure 4-1. UNIDEX 600 PC Board Jumper Locations**

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.

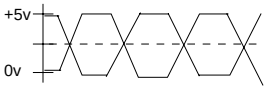
**Table 4-4. PC I/O Base Address Jumper Settings**

| PC I/O Base Address | JP9 | JP8 | 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 *BB501 Interface Board Option Manual, P/N EDO107*, or the *BB500 Interface Board Option Manual, P/N EDO109*) 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. Table 4-5 through Table 4-8 indicates which resistor networks (RNs) to remove.

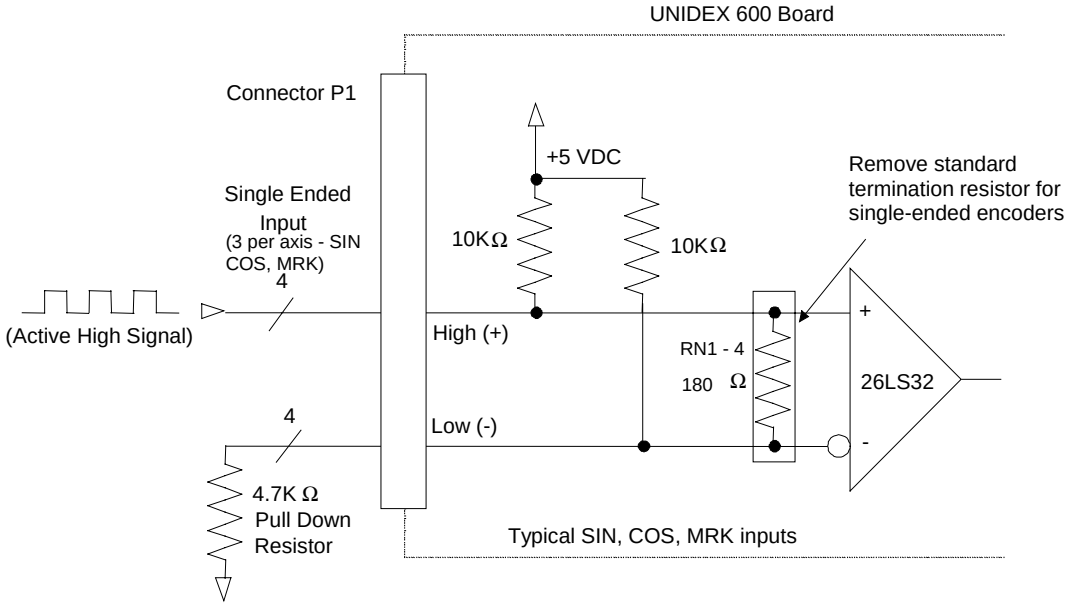



**Figure 4-2. Electrical Characteristics of an Encoder Interface (Showing Configuration of Optional Single-ended Encoder)**

The removable termination resistors for axes 1-4 are grouped into three in-line resistor networks (RN3, RN4, RN1, and RN2).

Resistor networks **RN3, RN4, RN1, and RN2** provide termination resistors for axes 1, 2, 3 and 4, respectively. 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.

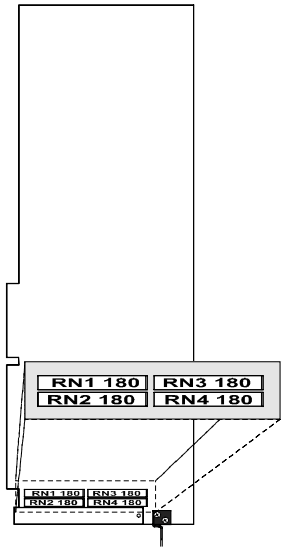



**Table 4-5. Termination Resistor Configuration for Axis 1 Encoder**

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

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

| RN # | P1 Pinout | Axis Signal | RN Pin # | 180 Ω Resistor * |
|---|---|---|---|---|
| RN4 | 20<br>19 | MRK2-<br>MRK2+ | 8<br>7 | |
| RN4 | 16<br>15 | SIN2-<br>SIN2+ | 6<br>5 | |
| RN4 | 18<br>17 | COS2-<br>COS2+ | 4<br>3 | |

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

| RN # | P1 Pinout | Axis Signal | RN Pin # | 180 Ω Resistor * |
|---|---|---|---|---|
| RN1 | 28<br>27 | MRK3-<br>MRK3+ | 6<br>5 | |
| RN1 | 24<br>23 | SIN3-<br>SIN3+ | 2<br>1 | |
| RN1 | 26<br>25 | COS3-<br>COS3+ | 8<br>7 | |

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

| RN # | P1 Pinout | Axis Signal | RN Pin # | 180 Ω Resistor * |
|---|---|---|---|---|
| RN2 | 36<br>35 | MRK4-<br>MRK4+ | 2<br>1 | |
| RN2 | 32<br>31 | SIN4-<br>SIN4+ | 6<br>5 | |
| RN2 | 34<br>33 | COS4-<br>COS4+ | 4<br>3 | |

* 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. These signals are available on the BB501 board via opto-isolators at TB4, pins 6 - 7 and pins 8 - 9, respectively.

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

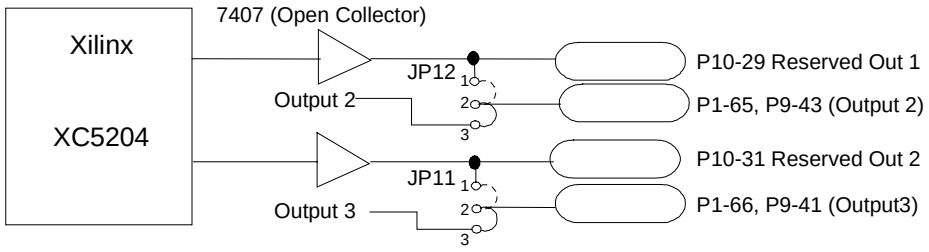



**Figure 4-3. Reserved Outputs**

## 4.5. Encoder Signal Pinouts

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

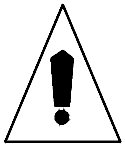
**Table 4-9. Encoder Signals and Pinouts**

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

## 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 |
| | 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 |

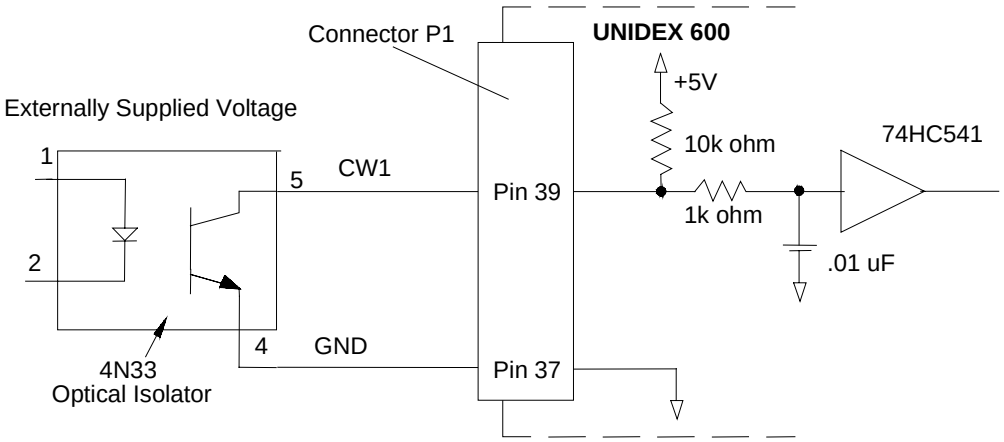



**Figure 4-4. Electrical Characteristics of the UNIDEX 600 Hall Effect, Limit and Amplifier Fault Inputs**

## 4.7. Serial Ports (RS-232C and RS-422)

The serial ports 1 and 2 are reserved for future applications (i.e., the UNIDEX 600 Series teach pendant). RS-232C and RS-422 are only available on the U600ULTRA-xxMB. Refer to Figure 4-5 for pinouts.

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

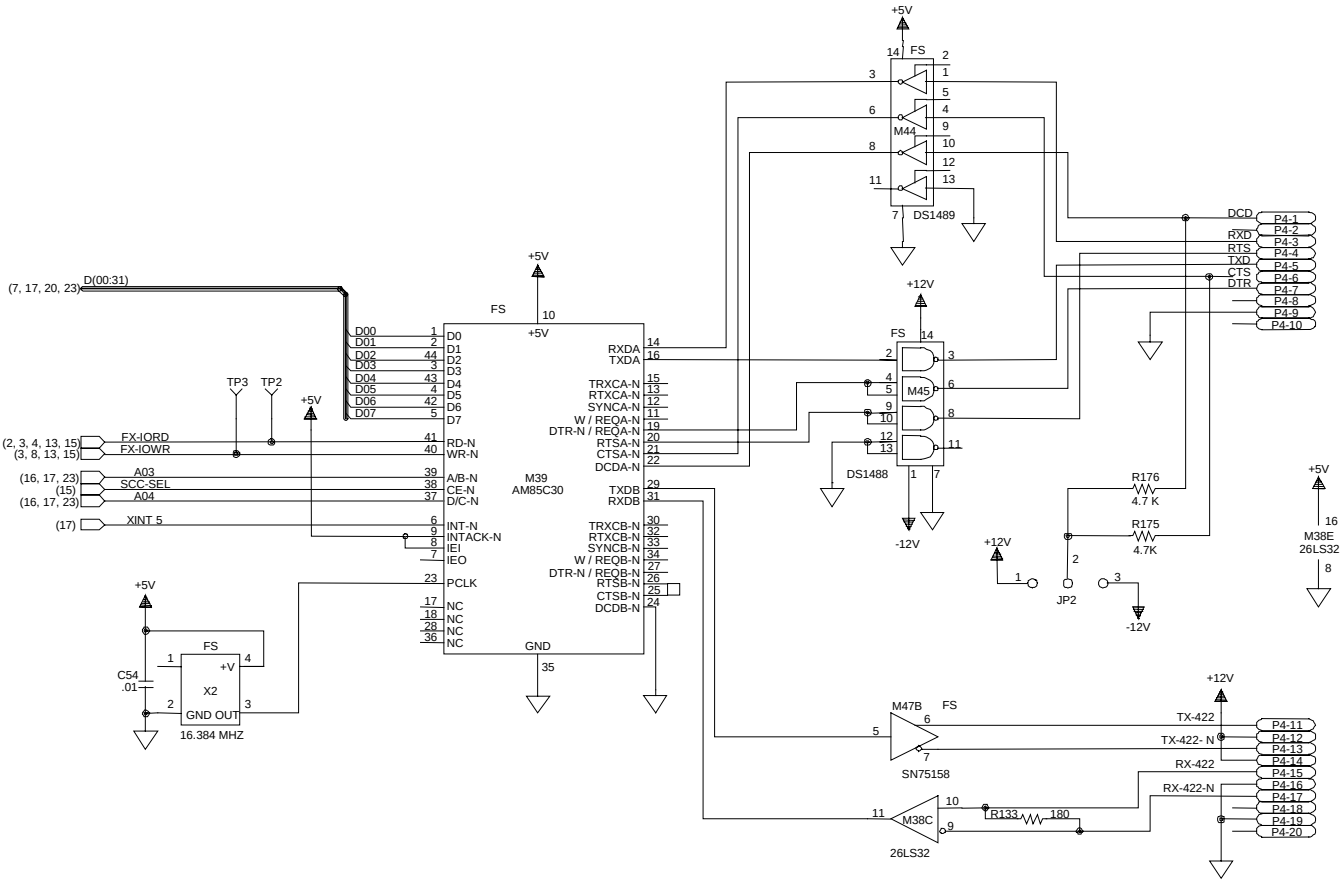



**Figure 4-5. Serial Ports 1 and 2 Pinouts**

## 4.8. Emergency Stop Sense Input

The UNIDEX 600 has an optically isolated global 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 resistance are enumerated in Table 4-11. This input is used to sense the activation of an external E-stop circuit.

In addition, each task on the U600 may have a separate E-stop input only affecting that task. Refer to the on-line help for more details.

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.

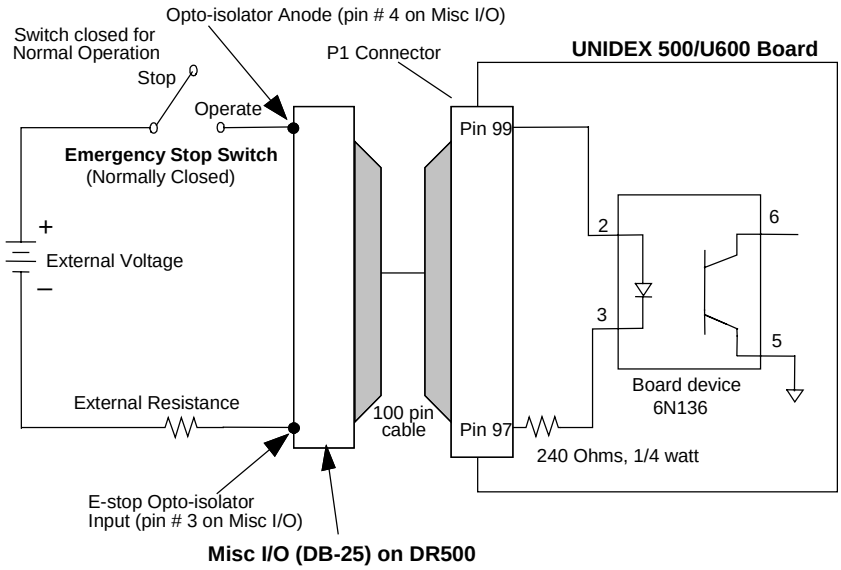



**Figure 4-6. Electrical Characteristics of the UNIDEX 600 Emergency Stop Interface**

**Table 4-11. External Voltages and Resistance 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.

## 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.

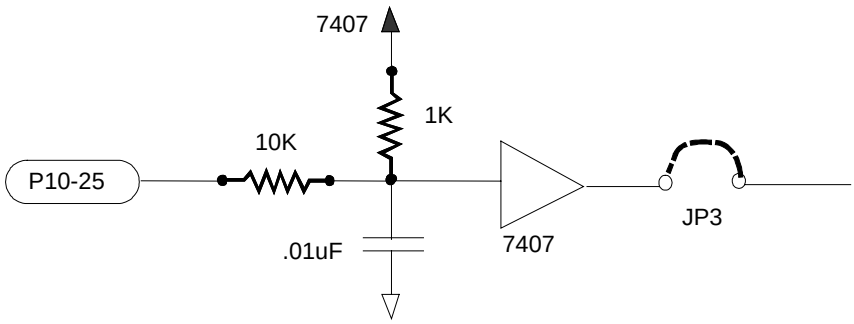


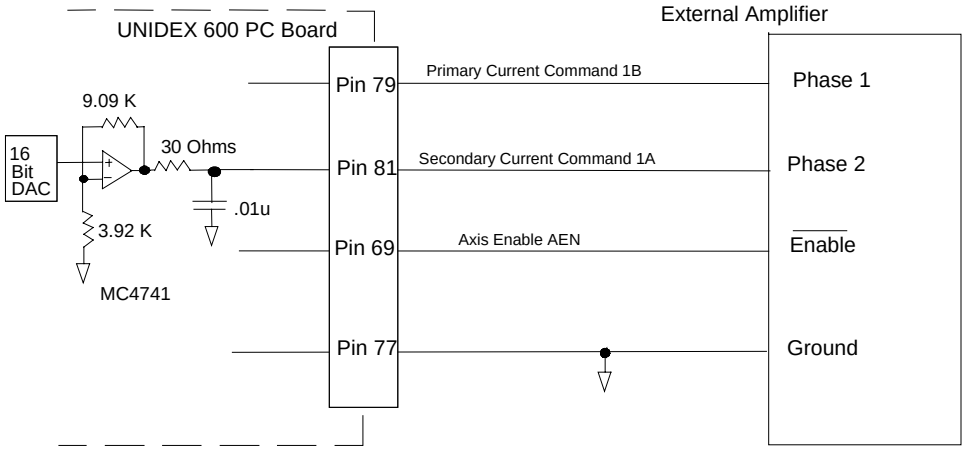

**Figure 4-7. External Reset Circuit**

## 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 | TP30 |
| | Secondary Current Cmd Axis 1 | ICMD1A | P1-80 | TP31 |
| Axis 2 | Primary Current Cmd Axis 2 | ICMD2B | P1-81 | TP32 |
| | Secondary Current Cmd Axis 2 | ICMD2A | P1-82 | TP33 |
| Axis 3 | Primary Current Cmd Axis 3 | ICMD3B | P1-83 | TP35 |
| | Secondary Current Cmd Axis 3 | ICMD3A | P1-84 | TP34 |
| Axis 4 | Primary Current Cmd Axis 4 | ICMD4B | P1-85 | TP36 |
| | Secondary Current Cmd Axis 4 | ICMD4A | P1-86 | TP37 |

## 4.11. Digital Input Bus Specifications

The U600 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 U600 inputs and locations. Refer to Section 2.7.3. for interconnection examples.

To avoid damage to the U600, the input level should never exceed +5 volts or go below 0 volts.
JP6 configures the signal accepted by Input 3, in order for it to drive the high-speed position latch or Input 3.

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.

U600's P9 and P10 connector's are compatible with a PB24 Opto interface board. Inputs are read using M Codes.

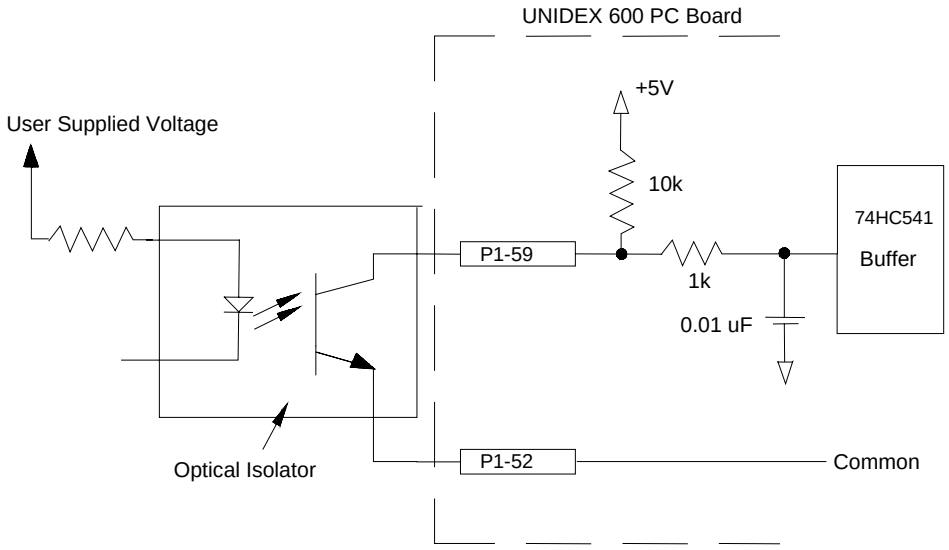



**Figure 4-9. Electrical Characteristics of the UNIDEX 600 Input Bus Interface**

**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.

*JP11 and JP12 configure the signals present at Outputs 2 and 3, refer to Table 4-14.

**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 |

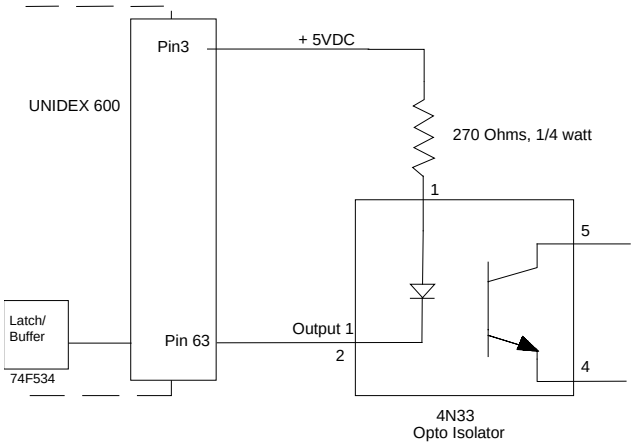



**Figure 4-10. Electrical Characteristics of the UNIDEX 600 Output Bus Interface**

## 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 via the software. (Refer to Chapter 3 for additional jumper information.)

Each output is an open collector of a PS2501L-4 opto-isolator with absolute maximum ratings of 30 volts and 30 mA sink capability.

Exceeding the amplifier output ratings may cause damage to the U600 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 |

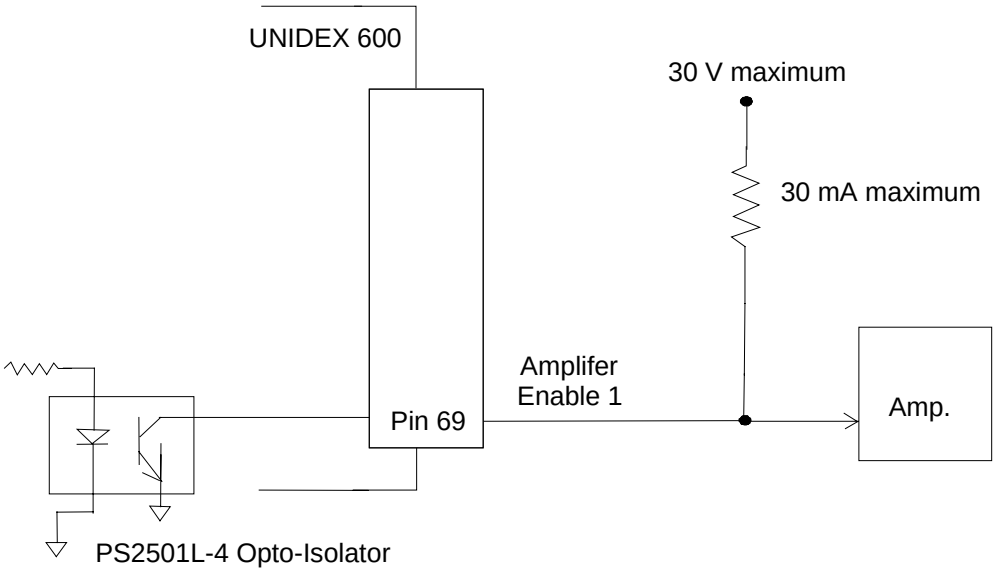



**Figure 4-11. Electrical Characteristics of the U600 Amplifier Enable Output**

## 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.

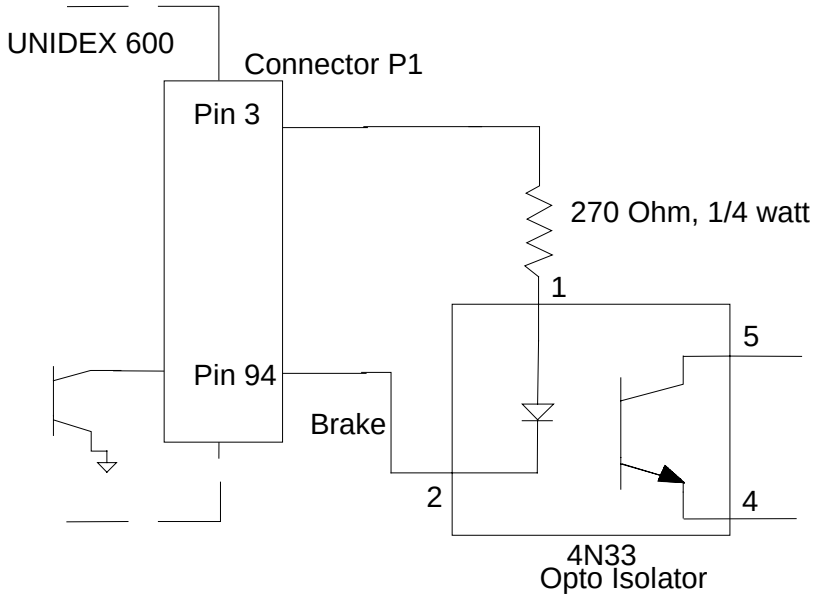



**Figure 4-12. Electrical Characteristics of the Brake Signal Output**

## 4.15. Opto 22 I/O Bu (P9)

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<br>Aerotech P/N ECK 332 (or equivalent) |
| 50 pin cable edge connector | P/N# 3M 3415-0001<br>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.

*Refer to JP11 and JP12 for configuring the signals present at Outputs 2 and 3. See JP6 for configuring the signal accepted by Input 3.

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

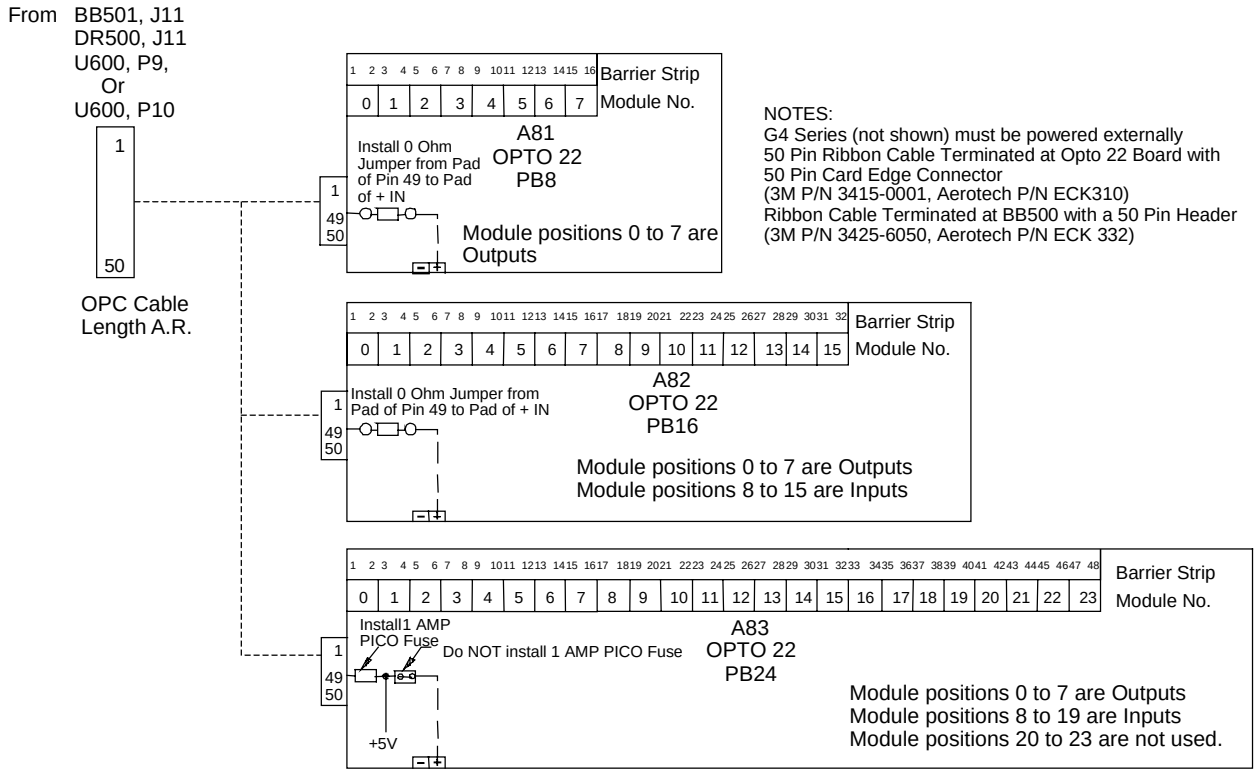
**Table 4-16. U600 Opto 22 Connection Information**

| 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 | |
| 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 U600

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



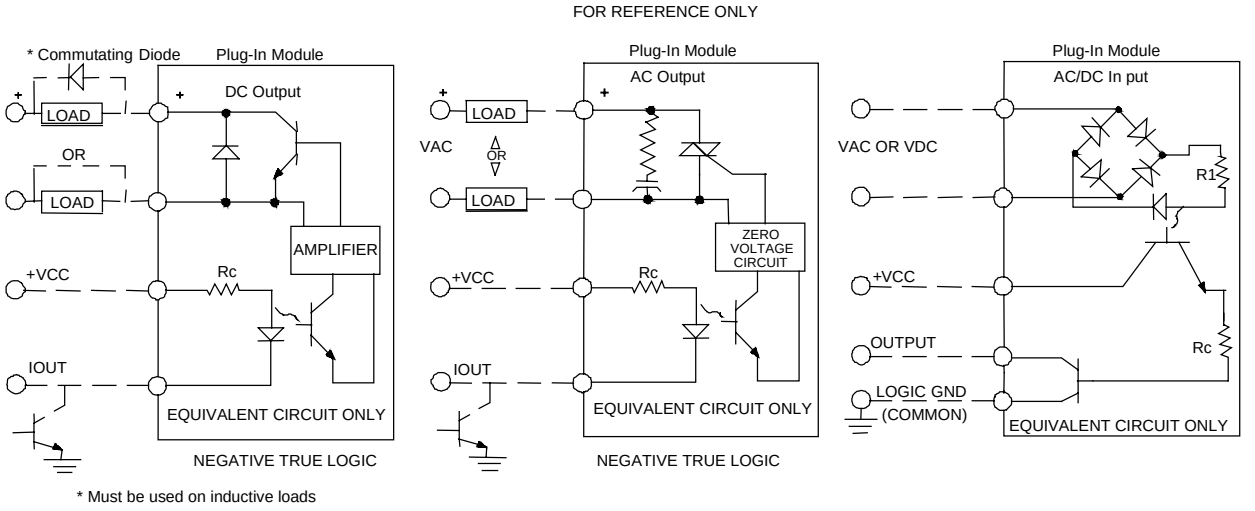




**Figure 4-13. Electrical Characteristics of the UNIDEX 600 Opto 22 Connections**

## 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 (Aux1 ) | MODE1 | 58 | Mode Axis 2 (Aux 2) | MODE2 |
| 59 | Input 0 | IN0 | 60 | Input 1 | IN1 |
| 61 | Input 2 | IN2 | 62 | Input 3 (See JP6) | IN3 |
| 63 | Output 0 | OUT0 | 64 | Output 1 | OUT1 |
| 65 | Output 2 (See JP12) | OUT2 | 66 | Output 3 (See JP11) | OUT3 |
| 67 | Mode Axis 3 (Aux 3) | MODE3 | 68 | Mode Axis 4 (Aux 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 | Reserved | Reserved |
| 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.

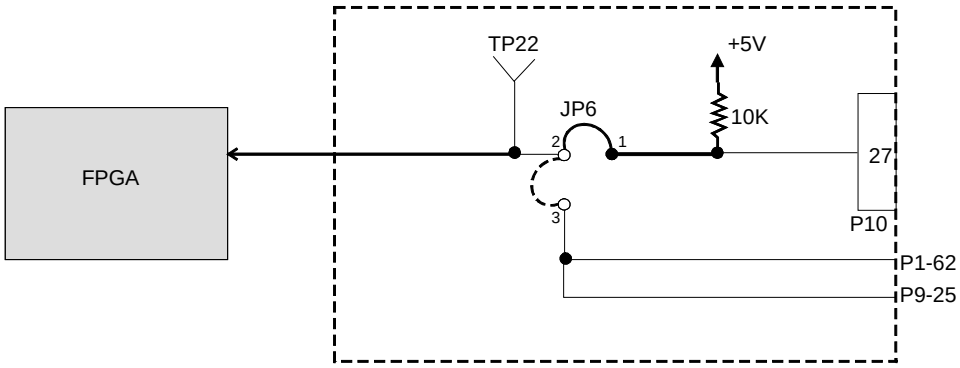
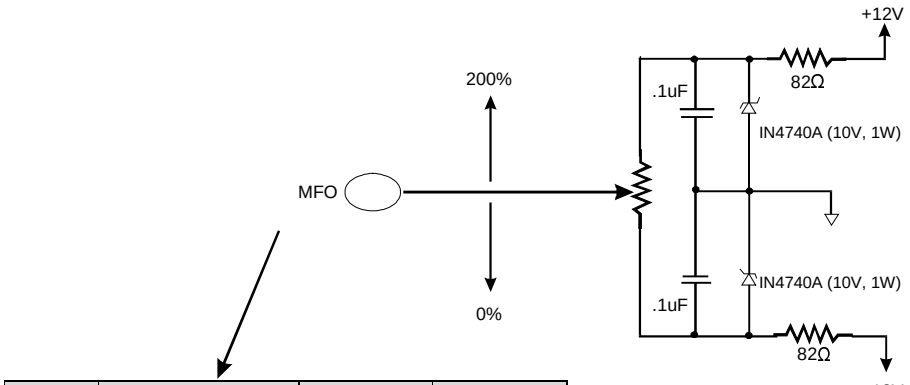



**Figure 4-14. Electrical Characteristics of U600 High Speed Position Latch**

## 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. This input simultaneously varies the programmed feedrate and spindle feedrate. Each task may be assigned a separate input by the *AnalogMFOInput* and *AnalogMSOInput* task parameters, respectively. The potentiometer should be a minimum of 10k ohms.




| MFO | AIN 0 Locations | +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] if the drives are not in the system. They are driven by an open-collector buffer (7406). 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.

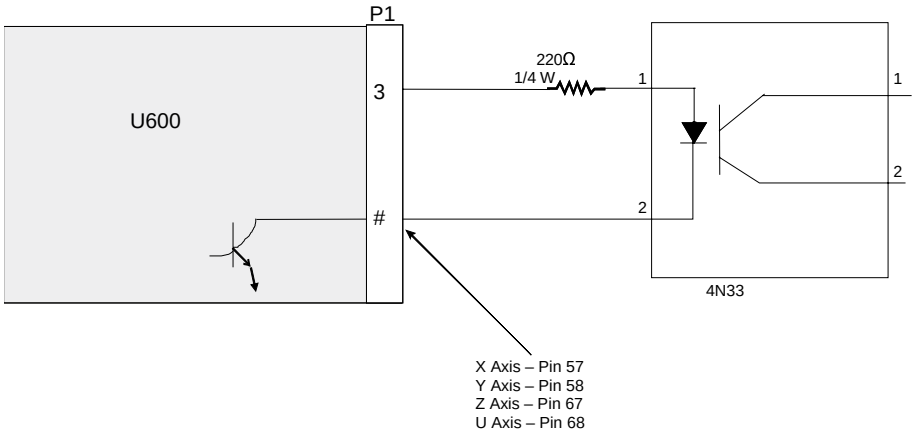



**Figure 4-16. Electrical Characteristics of the Mode (Aux) Output**

## 4.20. Expansion Bus Pin Description (P3)

This bus interfaces with the Aerotech resolver, PC-PSO (laser firing), and encoder expansion cards. Pinouts for the Expansion Bus are listed in Table 4-18.

**Table 4-18. Expansion Bus Pin Outs**

| 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 |

## 4.21. 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. Each task 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 4-17. 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.

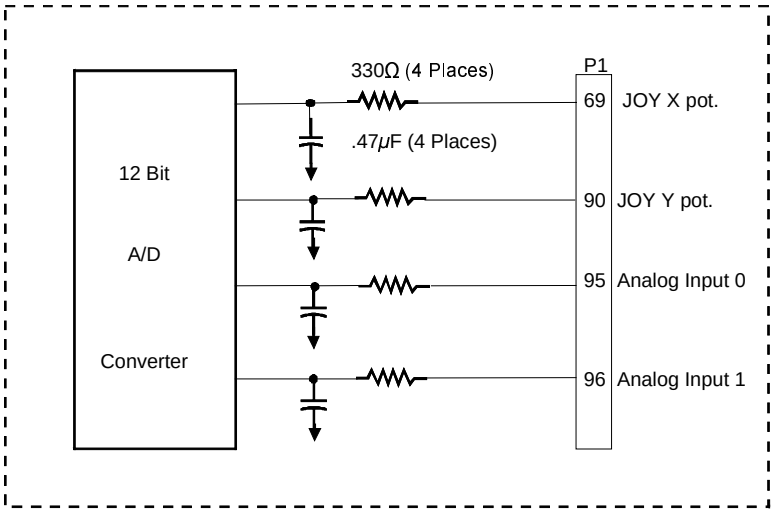



**Figure 4-17. Electrical Characteristics of Analog Input**

## 4.22. Joystick Interface

The user can connect their own joysticks and switches to the UNIDEX 600, refer to Figure 4-18. 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.

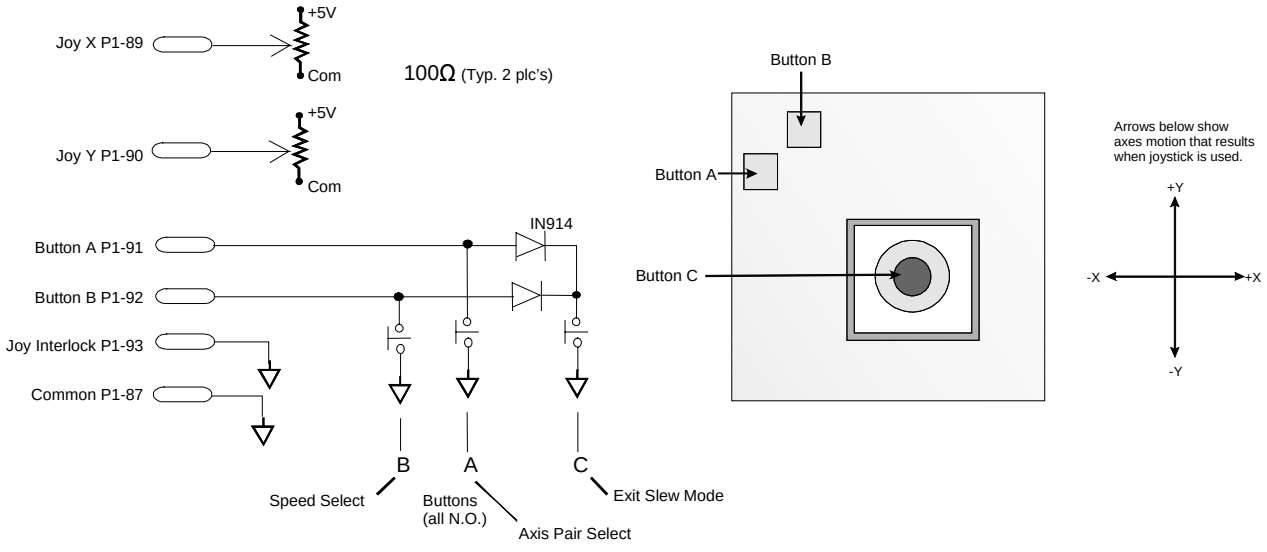



**Figure 4-18. Joystick Interface**

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

Table 4-19 lists the pinouts for the OPTO 22 outputs and hall sensor inputs (P10).

**Table 4-19. 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 (JP3) | User Reset Input | 26 | Common |
| 27 (JP6) | Position Latch Input | 28 | Common |
| 29 (JP12) | Reserved Out 1 | 30 | Common |
| 31 (JP11) | 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 |

## 4.24. 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 DRC cable and connect it between P10 of the UNIDEX 600 and P8 of the BB500. Refer to the BB500 User's Manual (EDO109) for more information.

## 4.25. 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 4-19 for an illustration of the Servo Loop.

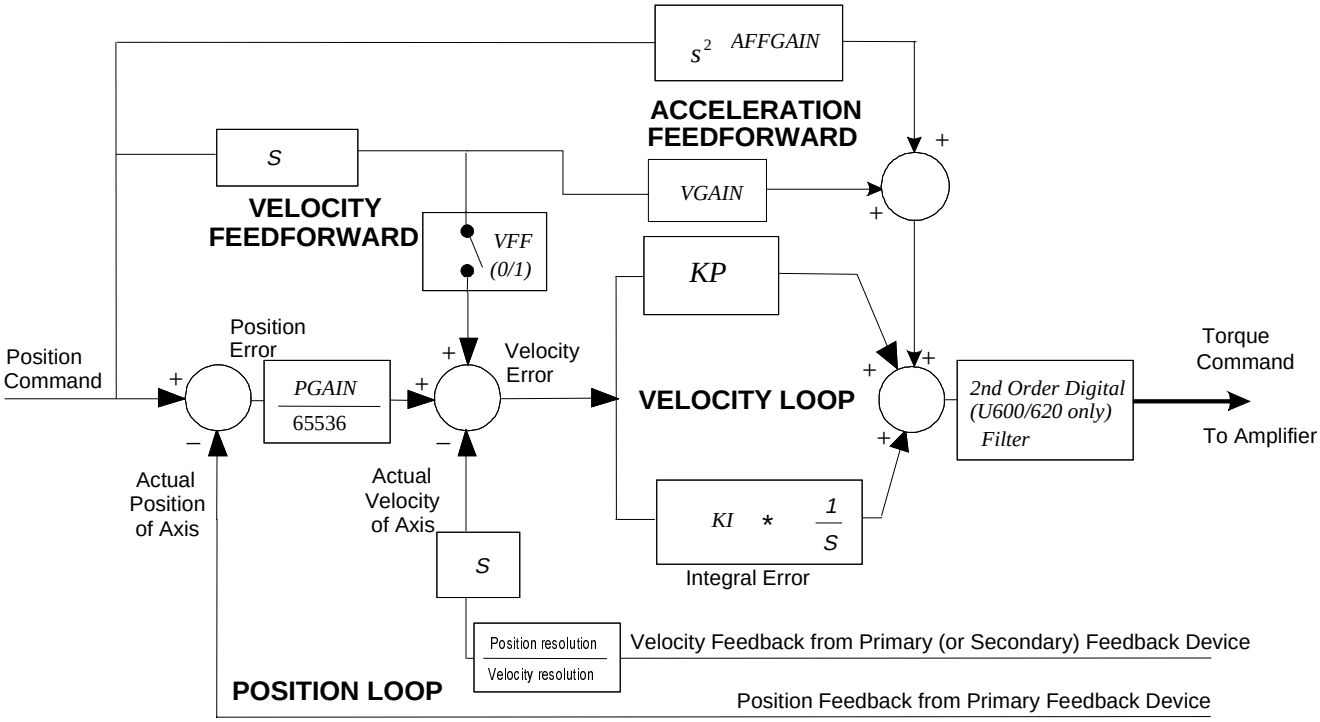



**Figure 4-19. UNIDEX 600 Series Servo Loop (Torque Mode)**

### 4.25.1. 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.

### 4.25.2. 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 4-20 for additional information.

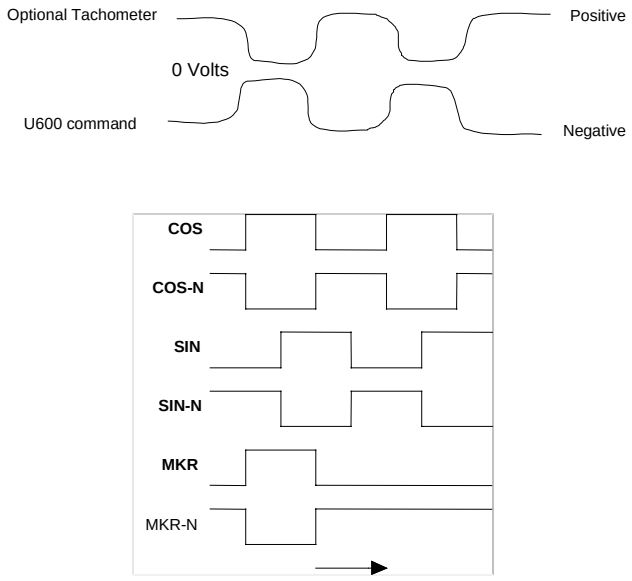
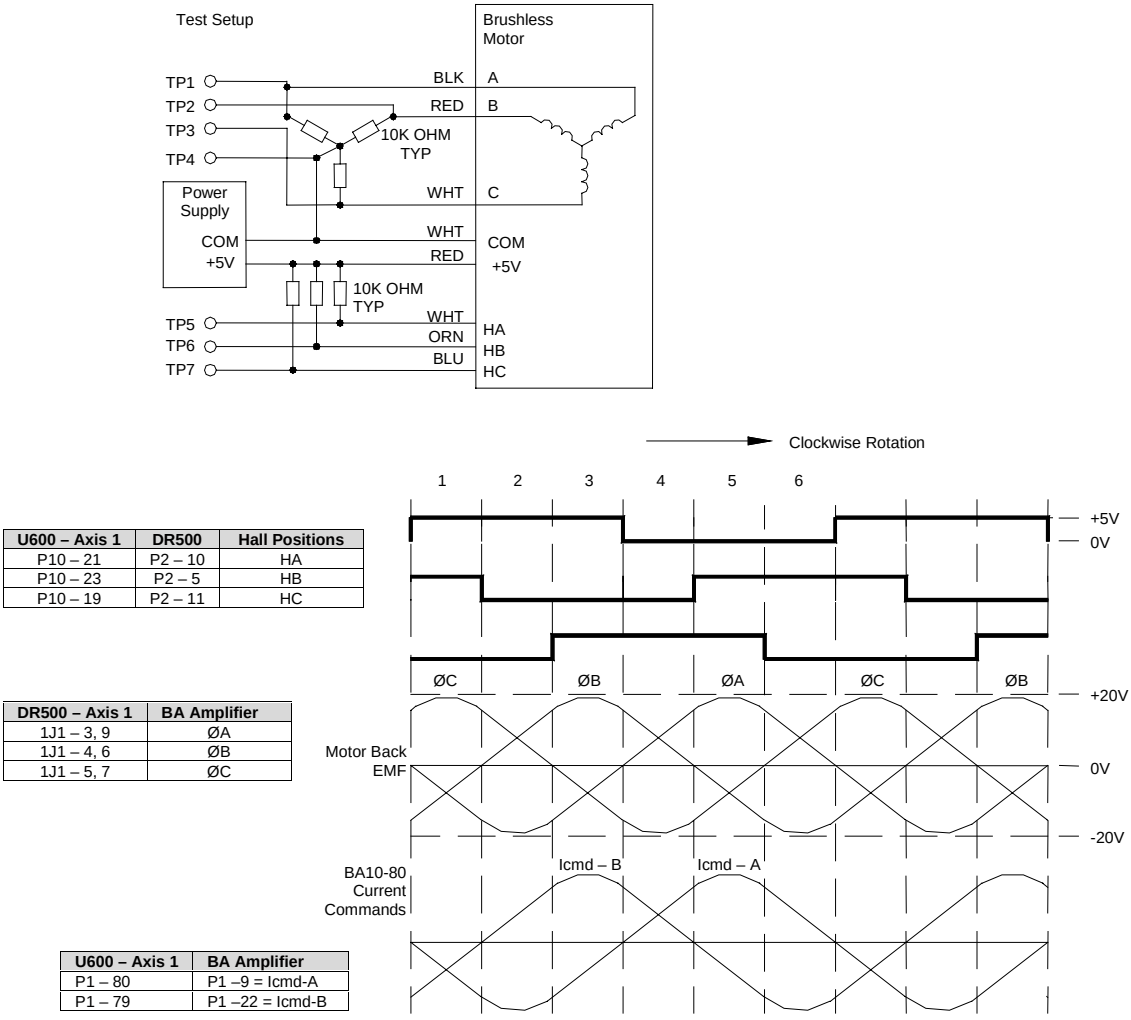



**Figure 4-20. CW Motor Rotation Viewed from Mounting Flange End**

In addition, motor phasing must be considered when using brushless motors with Hall effect sensors. Figure 4-21 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 – Axis 1 | DR500 | Hall Positions |
|---|---|---|
| P10 – 21 | P2 – 10 | HA |
| P10 – 23 | P2 – 5 | HB |
| P10 – 19 | P2 – 11 | HC |

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

| U600 – Axis 1 | 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 the front of the motor shaft.

**Figure 4-21. Brushless Motor Phasing**

## 4.26. Handwheel Interface

This dedicated quadrature encoder input channel may be used for an operator handwheel interface. Refer to Figure 4-22 for pinouts.

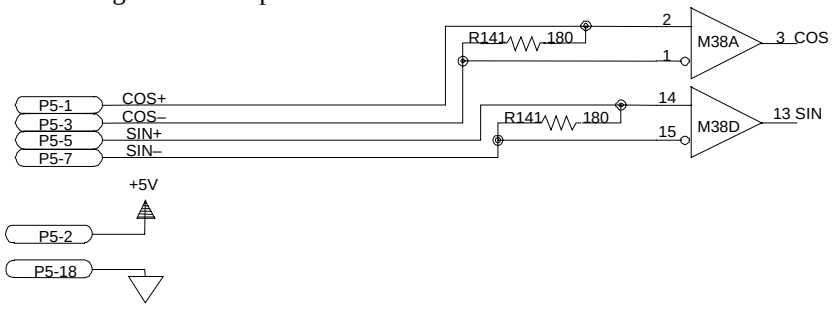



**Figure 4-22. Handwheel Interface**

## 4.27. Teach Pendant Interface

The inputs from P5 of the U600 board are used to interface to the teach pendant switches and I/O. Refer to Figure 4-23 for pinouts and Table 4-20 for teach pendant labeling.

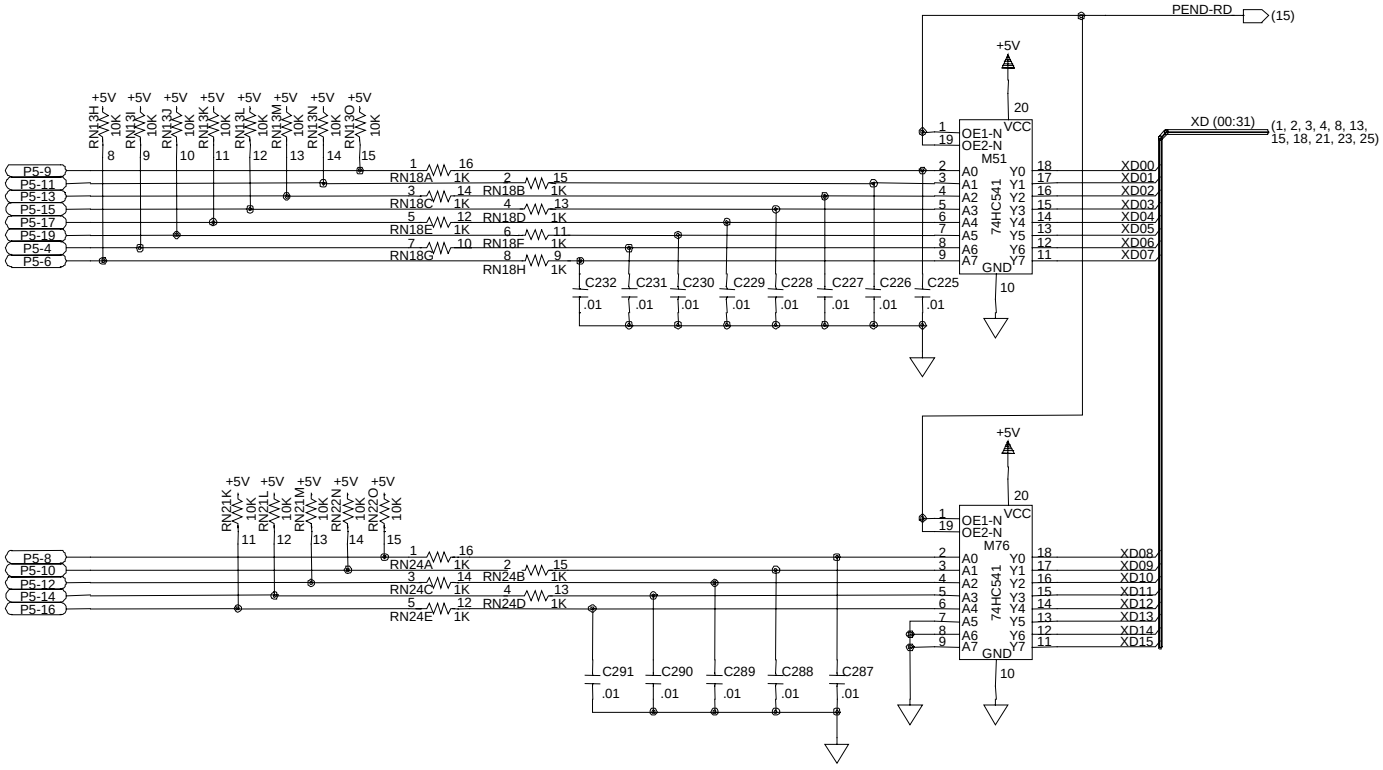



**Figure 4-23. Teach Pendant Inputs**

**Table 4-20. Teach Pendant Labels and Associated Pin Number (Inputs)**

| Label | P5 Pin Number | Label | P5 Pin Number |
|---|---|---|---|
| TPBI0 | 9 | TPBI8 | 8 |
| TPBI1 | 11 | TPBI9 | 10 |
| TPBI2 | 13 | TPBI10 | 12 |
| TPBI3 | 15 | TPBI11 | 14 |
| TPBI4 | 17 | TPBI12 | 16 |
| TPBI5 | 19 | +5V | 2 |
| TPBI6 | 4 | COM | 18 |
| TPBI7 | 6 | | |

## 4.27.1. Teach Pendant Outputs

The outputs from P5 of the U600 board are used to interface to the lamp indicators on the teach pendant. Refer to Figure 4-24 for pinouts and Table 4-21 for teach pendant labeling.

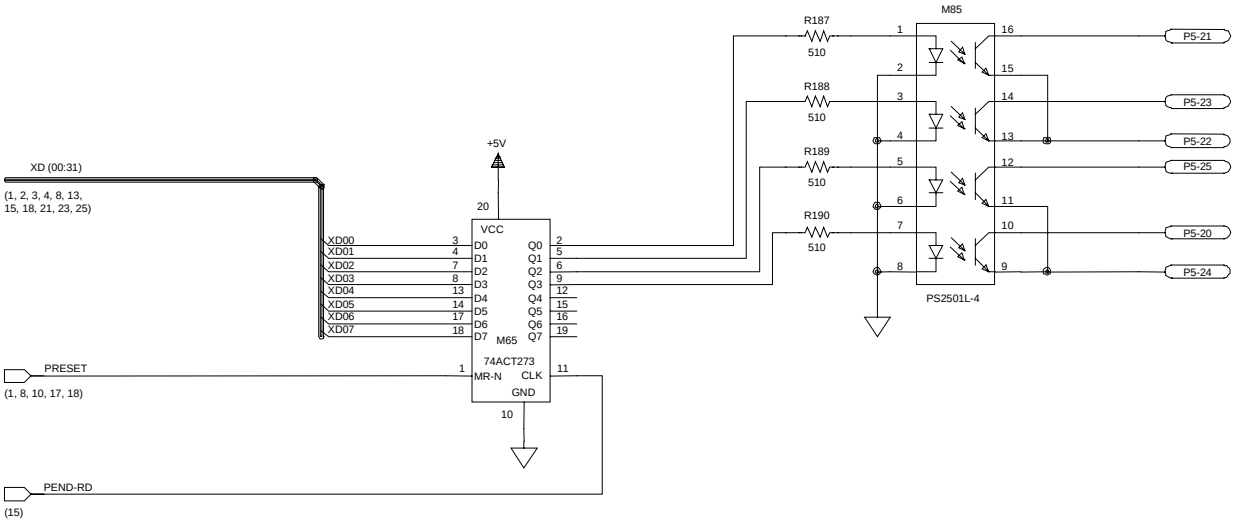



**Figure 4-24. Teach Pendant Outputs**

**Table 4-21. Teach Pendant Labels and Associated Pin Number (outputs)**

| Label | P5 Pin Number | P5 Con Pin Number |
|---|---|---|
| TPBO0 | 21 | 22 |
| TPBO1 | 23 | 22 |
| TPBO2 | 25 | 24 |
| TPBO3 | 20 | 24 |

## 4.28. Stepper Drive Interface

All clock and direction output signals (U600ULTRA-xxMB only) are 26LS31 line driven outputs from the P7 connector. Refer to Figure 4-25 for an example diagram and Table 4-22 for pinouts.

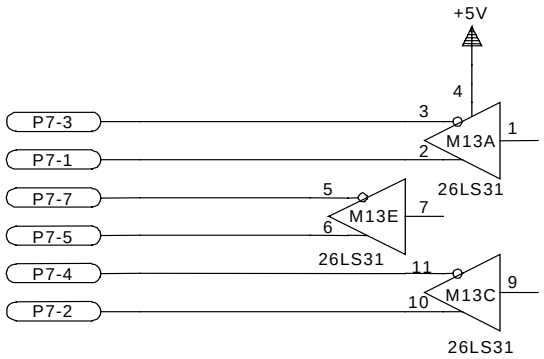



**Figure 4-25. Stepper Clock and Direction Interface**

**Table 4-22. P7 Stepper Drive Interface Clock and Direction Pinouts**

| Label | Pin Number | Label | Pin Number |
|---|---|---|---|
| Axis 1 Clock + | 1 | Axis 3 Direct - | 14 |
| Axis 1 Clock - | 3 | Axis 4 Clock + | 15 |
| Axis 1 Direct + | 2 | Axis 4 Clock - | 17 |
| Axis 1 Direct - | 4 | Axis 4 Direct + | 16 |
| Axis 2 Clock + | 5 | Axis 4 Direct - | 18 |
| Axis 2 Clock - | 7 | Common | 9 |
| Axis 2 Direct + | 6 | Common | 10 |
| Axis 2 Direct - | 8 | Common | 19 |
| Axis 3 Clock + | 11 | Common | 20 |
| Axis 3 Clock - | 13 | | |
| Axis 3 Direct + | 12 | | |

You may have purchased Aerotech's optional SR-20DRH-25DS cable instead. This cable extends the connector from the P.C. The cable is terminated with a 25 pin "D" style connector, producing the pinout shown in Figure 4-26.

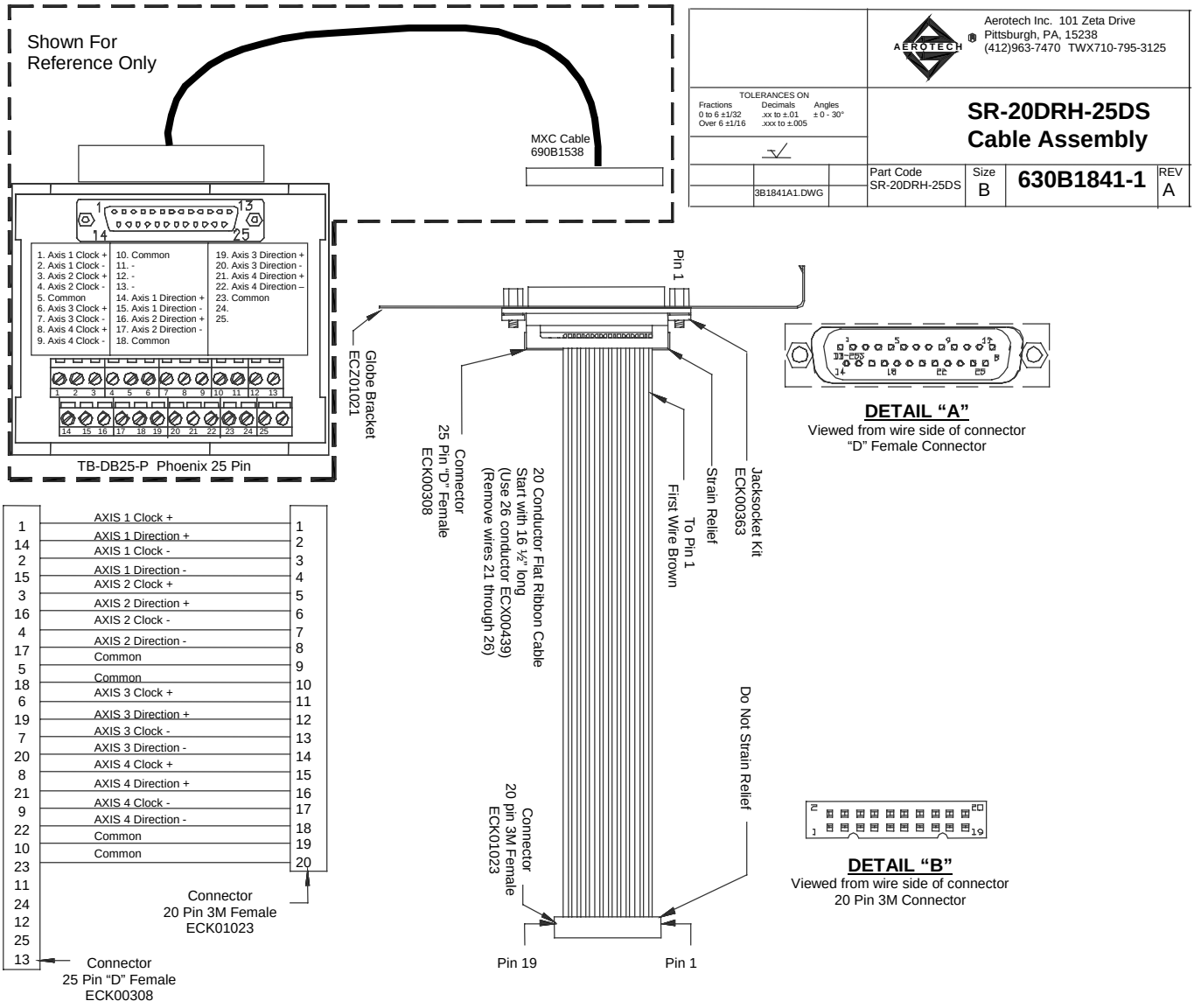



**Figure 4-26. SR-20DRH-25DS Cable Drawing and Pinouts**

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# 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 or the title bar of the UNIDEX 600 MMI.
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.
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 hard disk space available. | |
| Initialization failure, communication failure or "Error Downloading Firmware !" error occurs... | The UNIDEX 600 board is not installed.<br>The UNIDEX 600 board is not seated properly.<br>The software address does not match the hardware address.<br>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.<br>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.<br>Another device in the PC is set to the same base address as the U600 board. Select a unique base address.<br>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<br>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.<br>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.<br>External wiring problems exist. Remove the main interface cable and recheck.<br>The UNIDEX 600 board is faulty. | 4.11, PC Manual |

## 5.2. Servo Related Problems

Some common problems that relate to the use of servomotors 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.<br>The motor wiring is faulty.<br>The amplifier fuse is blown.<br>The amplifier is faulty. | Refer to U600MMI Online Help File |
| The motor buzzes or makes an unusual noise ... | The PID servo loop gains are not adjusted properly. | Refer to U600MMI Online Help File |
| The motor runs away when it is enabled ... | The feedback device is not connected.<br>The wrong feedback channel has been specified. Verify feedback.<br>The wrong feedback device has been specified. Verify feedback. | Refer to U600MMI Online Help File |
| A position or integral trap error occurs when the motor is enabled ... | The feedback device is not connected.<br>The wrong feedback channel has been specified. Verify feedback.<br>The motor has no torque. (See above) | Refer to U600MMI Online Help File |
| A position or integral trap error occurs when motion is commanded ... | The feedback device is not connected.<br>The wrong feedback channel has been specified. Verify feedback.<br>The wrong feedback device has been specified. Verify feedback.<br>The motor has no torque. (See above) | Refer to U600MMI Online Help File |
| The amplifier does not enable ... | An amplifier fault has occurred. This could be due to an improperly wired or shorted motor.<br>The amplifier is faulty. | Refer to U600MMI Online Help File |

## 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.<br>The wrong feedback channel has been specified. Verify the feedback.<br>The wrong feedback device has been specified. Verify the feedback.<br>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 U600MMI Online Help File |
| A position or integral trap error occurs when motion is commanded ... | The feedback device is not connected.<br>The wrong feedback channel has been specified. Verify the feedback.<br>The wrong feedback device has been specified. Verify the feedback.<br>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 U600MMI Online Help File |
| A velocity trap occurs ... | The feedback device is faulty. | Refer to U600MMI Online Help File |
| 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 U600MMI Online Help File |
| A clockwise (CW) or counter-clockwise (CCW) limit condition always exists ... | Limits are not connected to the UNIDEX 600.<br>The active polarity IO Level parameter for the limits is set wrong. | Refer to U600MMI Online Help File |
| 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.<br>The system has been powered up in a limit condition. Acknowledge the fault and move out of the limit.<br>The active limit polarity parameter IO Level is set incorrectly.<br>Software limits are improperly set. | Refer to U600MMI Online Help File |

**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.<br>The RMS current trap parameter is set too low.<br>The RMS current trap time is set too short.<br>The amplifier gain parameter is set too low.<br>The mechanical system is damaged or jammed.<br>The motor/amplifier may be undersized for the load. | Refer to U600MMI Online Help File |
| A feedback trap has occurred ... | The incorrect feedback channel has been specified.<br>The incorrect feedback device has been specified.<br>The feedback device is not connected. Verify feedback is present<br>Single ended encoders are connected. Set the fault mask to ignore encoder faults.<br>A sinusoidal encoder is connected. The UNIDEX 600 accepts square wave encoders only.<br>One or more encoder connections are broken.<br>The encoder is faulty.<br>A resolver-to-digital tracking loop error has occurred.<br>One or more resolver connections are broken.<br>The resolver reference has not been adjusted properly. | Refer to U600MMI Online Help File |
| A feedrate trap has occurred ... | The commanded feedrate may have exceeded the rapid feedrate parameter (machine parameters). | Refer to U600MMI Online Help File |

## 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.<br>The maximum acceleration/deceleration parameter (axis parameters) is set too low. | Refer to U600MMI Online Help File |
| The axis runs into a limit during the home cycle ... | The homing direction/type parameter is wrong. (machine parameters)<br>The home switch is not connected. | Refer to U600MMI Online Help File |
| Software limits are not working ... | The home cycle may not have completed yet. | Refer to U600MMI Online Help File |

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# 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 servomotors 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 servomotor, 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.

**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.

**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. 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.

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# APPENDIX B: WARRANTY AND FIELD SERVICE

**In This Section:**



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

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## NUMBERS



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**READER'S COMMENTS**

**UNIDEX 600 Hardware Manual**
**P/N EDU 154, March, 2001**

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