UNIDEX® 21
MOTION CONTROLLER
HARDWARE MANUAL

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AEROTECH, INC., 101 Zeta Drive, Pittsburgh, PA 15238
(412) 963-7470 • TWX 710-795-3125 • FAX(412)963-7459

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TABLE OF CONTENTS

TABLE OF CONTENTS(CON'T)

LIST OF FIGURES

LIST OF FIGURES (CON'T)

CHAPTER 1: INTRODUCTION

This manual contains both electrical and mechanical hardware information for the Unidex 21 Motion Controller, Models U21B and U21R. For a thorough understanding of the complete Unidex 21 Control System it is also necessary to be familiar with the following manuals:

Unidex 21 User's Manual

Unidex 21 Programming Manual

Unidex 21 Options Manual

SECTION 1-1: USING THIS MANUAL

The focus of this manual is to provide the User with general information concerning the internal structure of the Unidex 21 as well as providing details necessary to interface peripheral equipment. Following is a brief description of the contents of each of the Chapters:

Chapter 1:	Introduction
Chapter 2:	Illustrations and descriptions of the external characteristics of the Unidex 21, Models U21B and U21R. A block diagram and description of internal system interaction, and simplified system wiring diagram are included for reference.
Chapter 3:	Illustrations and descriptions of Jumpers and Switches on the various Printed Circuit Boards of the Unidex 21.
Chapter 4:	Power requirements and information.
Chapter 5:	Detailed description and illustration of the Motor Interface Connectors.

Chapter 6:	General description of the Limit and Home Switch functions.
Chapter 7:	Detailed descriptions and illustrations of the interface for the various transducer types that may be used in conjunction with the Unidex 21.
Chapter 8:	Detailed description and illustration of the MST and Indexer Board Interface Connector.
Chapter 9:	Detailed description and illustration of the IEEE-488 Interface Connector.
Chapter 10:	Detailed descriptions and illustrations of the RS-232 Ports A and B and the Terminal Port.
Chapter 11:	Detailed description and illustration of the Synchronous Serial Interface Connector.
Chapter 12:	Detailed description and illustration of the interface connector used for a supplementary EGA Monitor.
Chapter 13:	Detailed description and illustration of the Opto 22, PAMUX Bus 24/I/O Channel, I/O Power and Miscellaneous I/O Interface Connectors.
Chapter 14:	Detailed description of the interface connectors used for Joystick Mouse operation of the Unidex 21.
Chapter 15:	Detailed description and illustration of the Trackball Interface Connector.
Chapter 16:	Detailed description and illustration of the PC/AT Keyboard Interface Connector.
Chapter 17:	Basic troubleshooting procedures to identify and correct possible malfunctions that may occuras a result of improper hardware configurations.

CHAPTER 2: SYSTEM OVERVIEW

SECTION 2-1: PACKAGING

The Unidex 21 is available in three major package configurations:

Desktop - Models U21B and U21R

Free Standing Enclosure - Model U21C

Panel or Rack Mounted - Models U21P or U21K

The operating parameters for all models are similar and are detailed in the *Unidex 21 Users Manual* and the *Unidex 21 Programming Manual*. Extensive hardware variations exist between Models however, warranting a separate Hardware Manual for each of the three package configurations.

This manual is intended for use with Unidex 21, Models U21B or U21R. Before proceeding, make certain that this manual is the appropriate manual for the Unidex 21 Model being used.

SECTION 2-2: UNIDEX 21 MODEL U21B/U21R DESCRIPTION

Models U21B and U21R are the most compact and self contained of the available Unidex 21 package configurations. (See Figures 2-1, 2-2 and 2-3.)

Each is capable of serving up to four integral DC Servo or AC Brushless Drivers.

Model U21B is full-featured except for the Operator's Front Panel. Communication with the U21B is accomplished through it's RS-232 terminal port to a remote data terminal. The U21B may be equipped with an optional CRT Driver Card and Front Panel Card permitting the addition of an EGA compatible monitor and AT-style keyboard providing full stand-alone operation.

Model U21R builds upon the U21B with the addition of a sealed- membrane front panel and electroluminescent display.

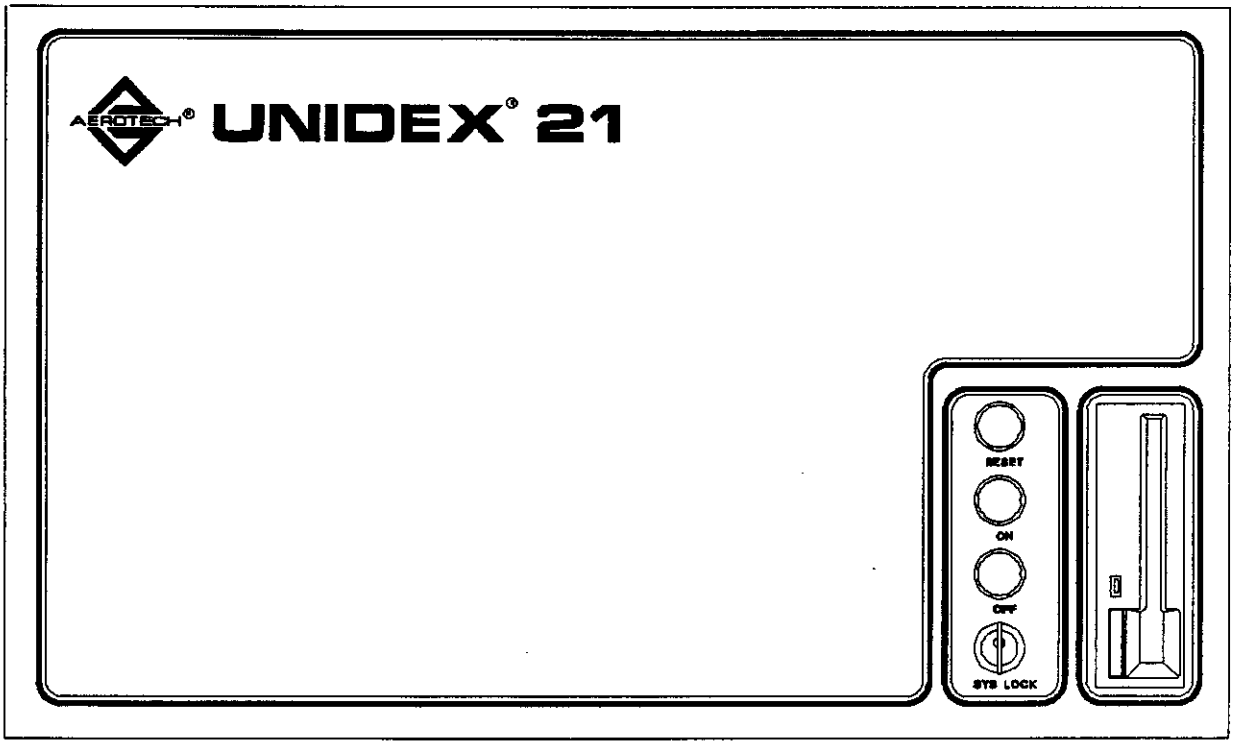

Figure 2-1: Unidex 21, Model U21B (Shown with Optional Disk Drive)

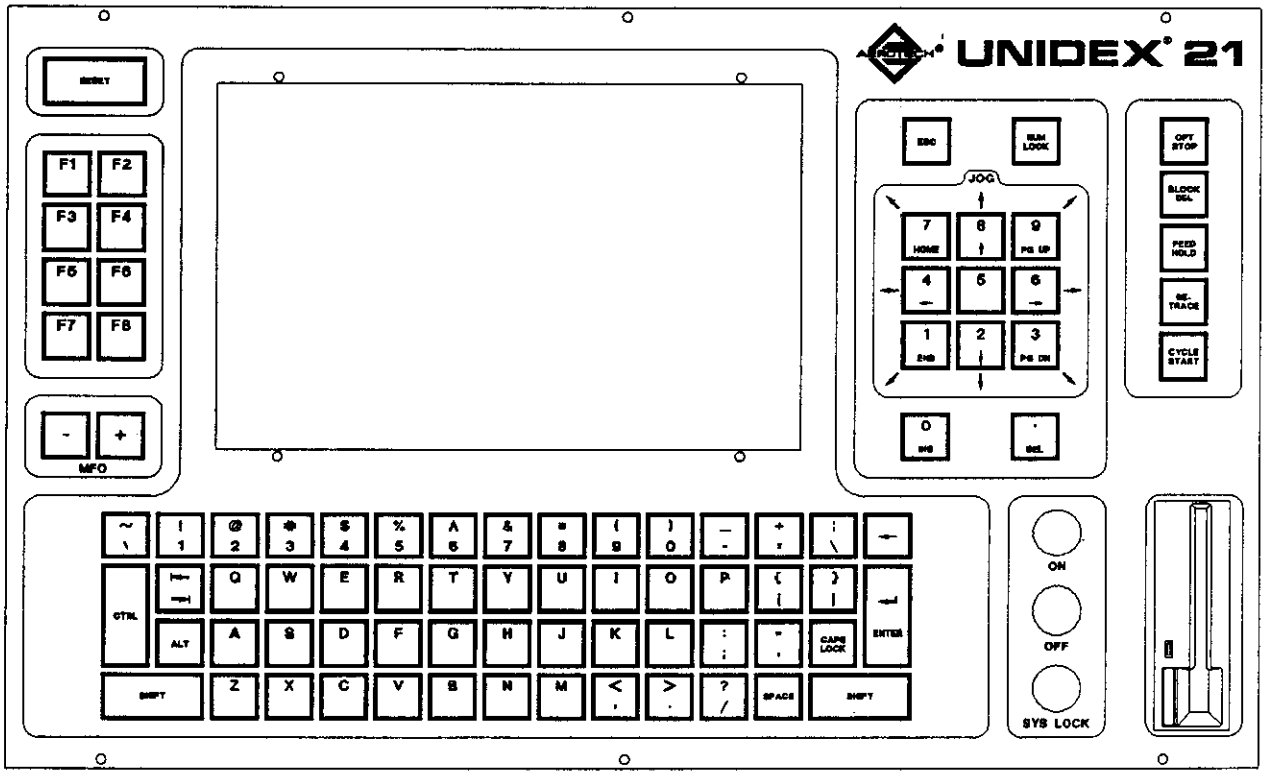

Figure 2-2: Unidex 21, Model U21R (Shown with Optional Disk Drive)

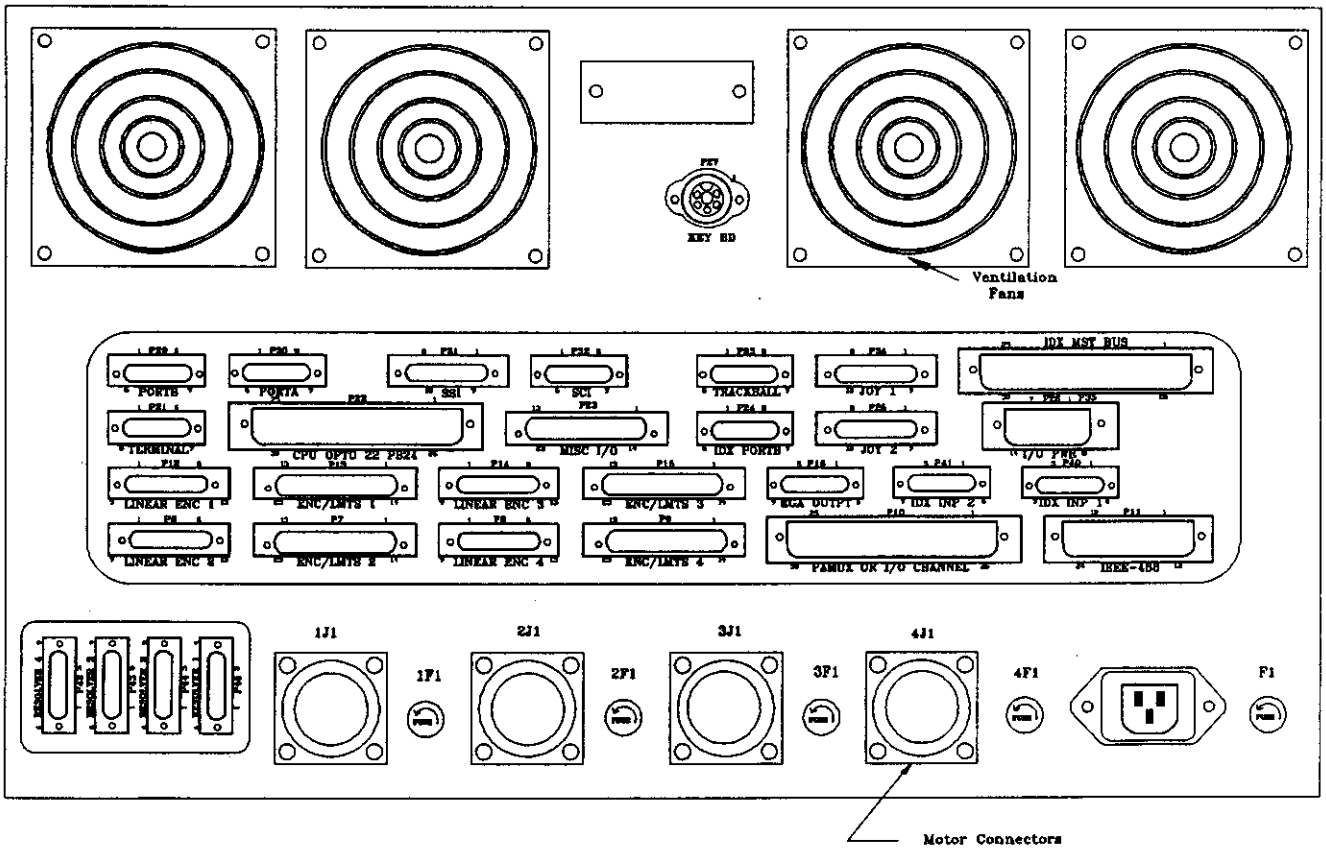

Figure 2-3: Unidex 21 Rear Panel, Models U21R and U21B

SECTION 2-3: INTERNAL STRUCTURE

The Unidex 21 is a microprocessor based multiple axis Motion Controller. A basic Unidex 21 consists of a CPU Board, an Indexer Board, a DSP Board, an optional graphics (CRT) Board and Front Panel Board and the Axis Amplifiers. (See Figures 2-4, 2-5, and 2-6.) A system wiring diagram is provided in Figure 2-7.

2-3-1: CPU BOARD

The CPU Board is the front end processor of the Unidex 21 system. It contains a Motorola 68000 microprocessor to handle File editing, File management, System Parameters, Machine Modes (Mdi, Jog, Debug) and peripheral communications via RS-232. It also contains eight (8) Opto-Isolated Outputs and sixteen (16) Opto-Isolated Inputs.

The CPU Board communicates with the Indexing Board through the VME Bus. The VME Bus allows communication between multiple boards within a system. In the Unidex 21 system the CPU Board is the Bus master with the CRT and the Indexer Boards as slaves.

The Beeper, Keyboard, and Reset signals from the CRT Board are interfaced to the CPU Board through one half of the Extension Bus Board. The Extension Board also provides the link for the CPU's I/O and RS-232 to the Rear Panel Interface Board.

CPU Board communication consists of three RS-232 Ports. Two of these Ports (Port A and Port B) are multi-purpose ports which can be used to interface various peripheral equipment. The third RS-232 Port is dedicated to an external terminal (TeleVideo 905 Display Terminal or equivalent). When a terminal is connected to this port the Unidex 21 is fully operational from the terminal. (Certain functions such as the Function Key assignment, display of Graphics etc. are not available to the Terminal user.)

The I/O interface of the CPU Board is arranged such that an Opto- 22 PB24 board may be directly connected. The PB24 may then be equipped with various Opto 22 I/O modules. The Unidex 21 hardware defines Modules 0-7 as outputs and Modules 8-23 as inputs.

The CPU Board also provides three Interrupt Inputs accessable to the User. Two of these Interrupts are considered "User Interrupts" as they can be defined within a program to perform a User specified function. The third interrupt is the High Speed Interrupt and is dedicated to the purpose of data collection (e.g. PB24 Input Status).

2-3-2 INDEXER BOARD

The Indexing Board passes information to the CPU such as errors and messages to indicate when indexing is complete. The Indexing Board receives motion commands from the CPU and breaks them into data strings that digitally represent the trajectories necessary to make the requested move(s). The Indexer Board then transfers these trajectory commands through the Extension Bus Board to the DSP Board at 1 millisecond intervals.

The Indexer Board also contains the Input connections for a Trackball, two Joysticks and two Handwheels.

The MST Bus of the Indexer Board is a 16 bit output bus which is totally opto-coupled. The data that is output on this bus is written with M (Miscellaneous), S (Spindle), or T (Toolchanger) commands which may be toggled while axes are in motion. Strobe signal outputs exist for the M, S, and T functions to latch the data into the receiving devices. There is also an Acknowledge (ACK-N) signal used for handshaking between the Indexer Board and the receiving device(s).

2-3-3 DSP BOARD

The DSP Board contains a Motorola 56001 Digital Signal Processor which controls the servo loops of the axes by the use of software alogrithms (PID loops). The alogrithms read the Encoder Feedback and generate current commands via D/A converters. By the use of an extension bus, the DSP receives operating parameters such as gain settings. Trajectory information is processed to set the commanded axes in motion. When trajectory commands end, the 56001 reverts to the role of maintaining axis position.

The DSP Board accepts Encoder and Limit data input from four axes through DSP connector P3. The Encoder inputs accept differential line driven, square wave Encoders. The DSP Board is configured for a standard quadrature Encoder. Clock and direction Encoders as well as CW and CCW Train Encoders may be used with appropriate jumper configurations.

The Limit inputs consist of a CW, CCW, and Home Limit line for each axis. The Limit inputs may be active high or active low. Polarity is established within the Unidex 21 parameters.

A variety of functions are interfaced to the DSP Board through the P2 connector. Of most significance are the Current Command output signals used to command the Axis Amplifiers. A shutdown signal that may be used for disabling the drives is also included in this signal group.

The P2 connector also contains the SCI (Serial Communication Interface) and SSI (Synchronous Serial Interface) ports for the DSP56001. To date these functions have not been implemented in the Unidex 21 System.

The DSP Board contains two opto-coupled interrupt sources that are interfaced through the P2 connector. One is a Fast Feedhold Input which is capable of stopping a current axis move in 1 milli-second as opposed to the implementation of a Feedhold command through the CPU Board, which may take up to 300 milli-seconds. The second interrupt to the DSP Board is the "Position-Grabbing" interrupt which, when activated, stores the current axis position and reports it to the CPU Board.

When a Brushless Motor System is used, the DSP Board's P2 connector contains the Hall Effect Switch Inputs. These switches (three (3) per axis) are located on the motors and output a six (6) step pattern which is read by the DSP56001 upon power-up to initialize motor position, thereafter the pattern is read on a 0.25 milli-second basis to provide accurate motor commutation.

Finally, the P2 connector provides the Vertical Axis Brake interface. Two lines are provided for this function. The first is a Brake Output line which activates a Brake whenever a fault is encountered that causes the vertical axis motor to lose torque. The second Brake line is an input to the DSP Board that signals the DSP56001 Brake/Axis integrity.

2-3-4 CRT AND FRONT PANEL BOARD S (OPTIONAL)

Both the CRT and Front Panel Boards are necessary if the User desires to operate the Unidex 21 from something other than a TeleVideo 905 Display Terminal. The CRT Board is capable of driving four types of displays; an Electo-Luminescent display, an IBM EGA 640x400 display, a monochrome display and an IBM EGA 640x350 display. The CRT Board provides either an EIA character set or an IBM character set.

The output lines of the CRT Board's P3 connector are the outputs of differential line drivers to provide noise immunity. The J3 connector of the Front Panel Board provides line receivers to return these signals to single ended TTL levels. It also provides a 16 pin locking header for interfacing to the EL Display, a 9 pin D style connector for interfacing directly to an EGA Monitor, and a 10 pin locking header which provides a connection to the Rear Panel Interface Board for connecting a EGA Monitor to the Unidex 21 as an external display.

The P4 connector of the CRT Board provides a line driver/line receiver interface to the Disk Drive via the Front Panel Board. The signals present on this connector are differential versions of the signals on the CPU P3/CRT P5 connection. This connector also provides the Front Panel System Reset and Keyboard Clock Lines in differential format that run through line receivers and return to the CPU Board.

The Front Panel Board provides connections for an IBM PC/AT keyboard and connections and decoding circuitry for the Front Panel Membrane Keyboard. Also contained on the Front Panel Board is the Disk Drive Interface complete with Disk Drive power connections. The Beeper and Reset Switch are routed through the Front Panel Board along with the switch and lamp signals for Power On/Off.

2-3-5 AXIS AMPLIFIERS

The type of Axis Amplifier included in the Unidex 21, corresponds to the type of Servo Motor used for each axis. The Unidex 21 is capable of controlling both DC Brush and AC Brushless motor types.

The DC Brush type motor uses a PWM DC Servo Amplifier. The DC Amplifier may be wired for up to 160 Volts PWM. A 20 Amp Peak, 10 Amp continuous version is available (DS16020) as well as a 30 Amp Peak, 15 Amp continuous version (DS16030). Future plans include a Linear DC Servo Amplifier rated at 30 Volts with 15 Amps Peak , 5 Amp continuous.

The AC Brushless type drive is not presently available.

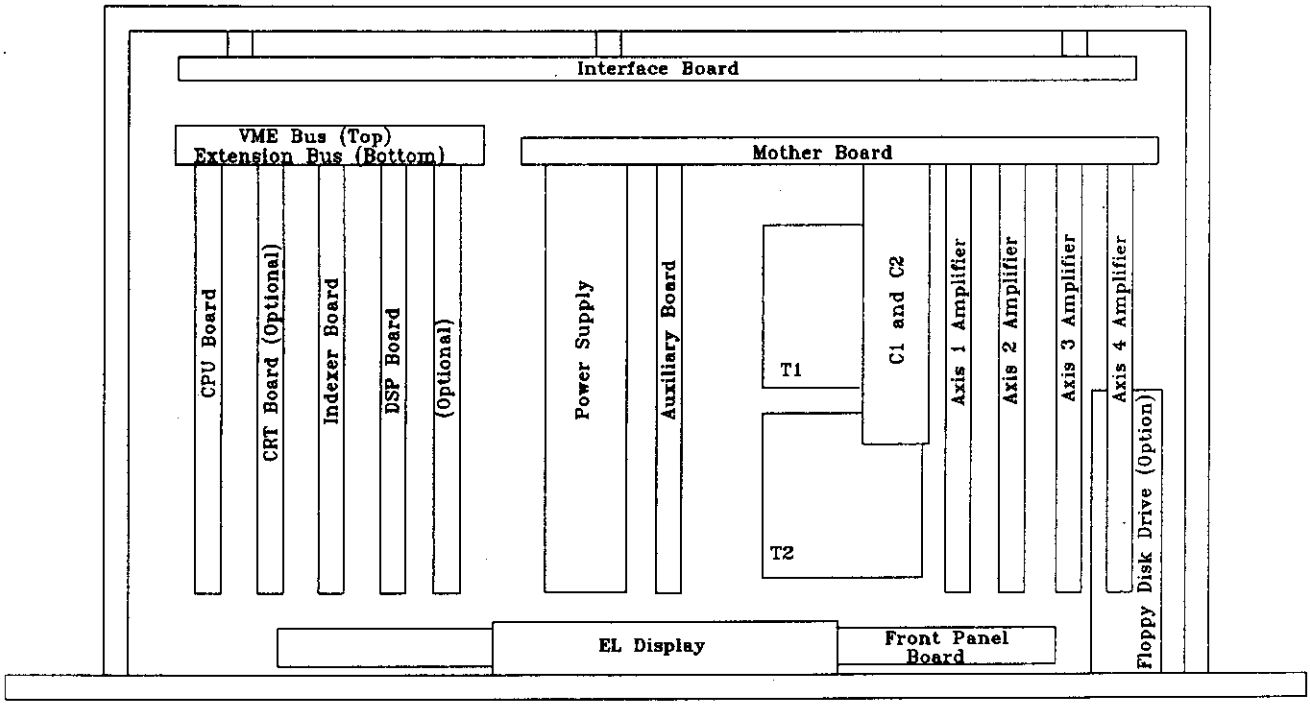

Figure 2-4: Unidex 21 Models U21R and U21B (Top View-Cover Removed)

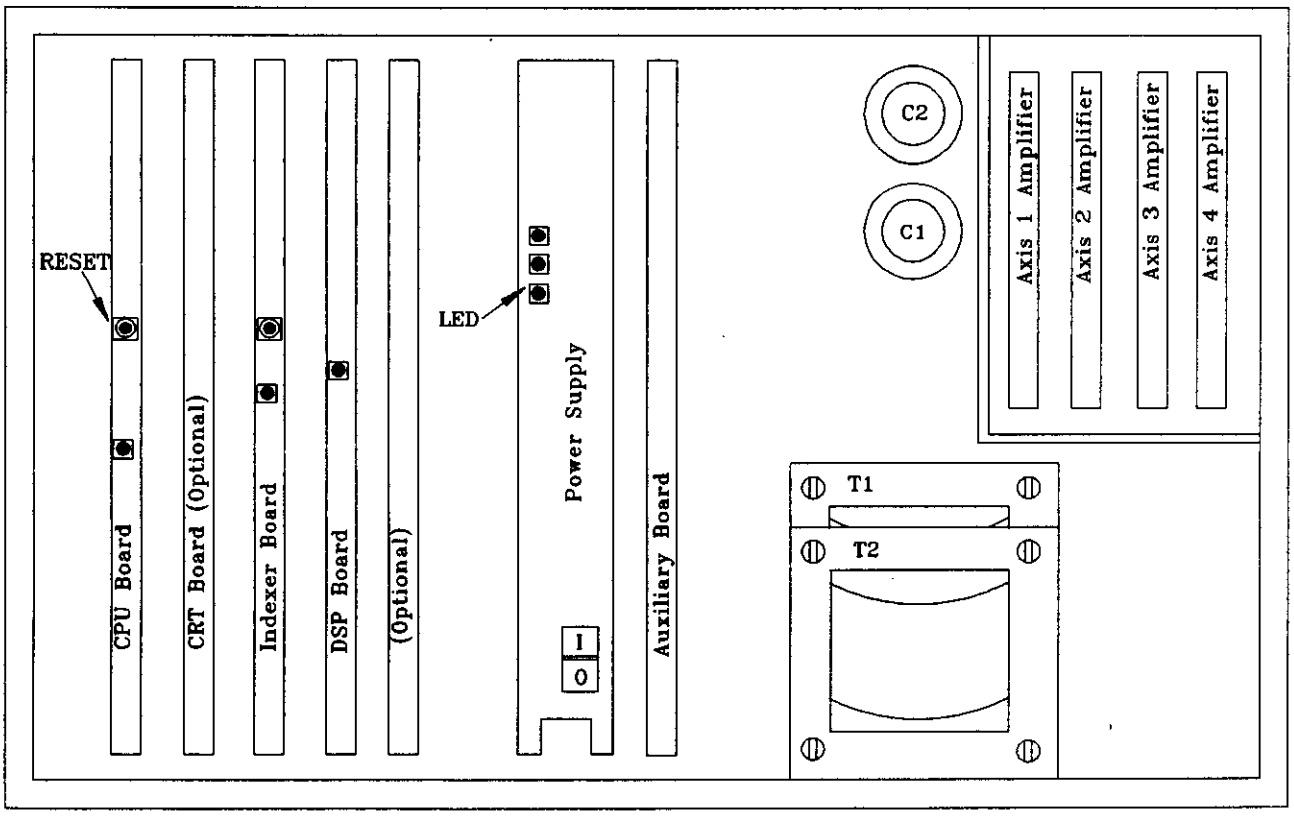

Figure 2-5: Unidex 21 Models U21R and U21B (Front View-Front Panel Removed)

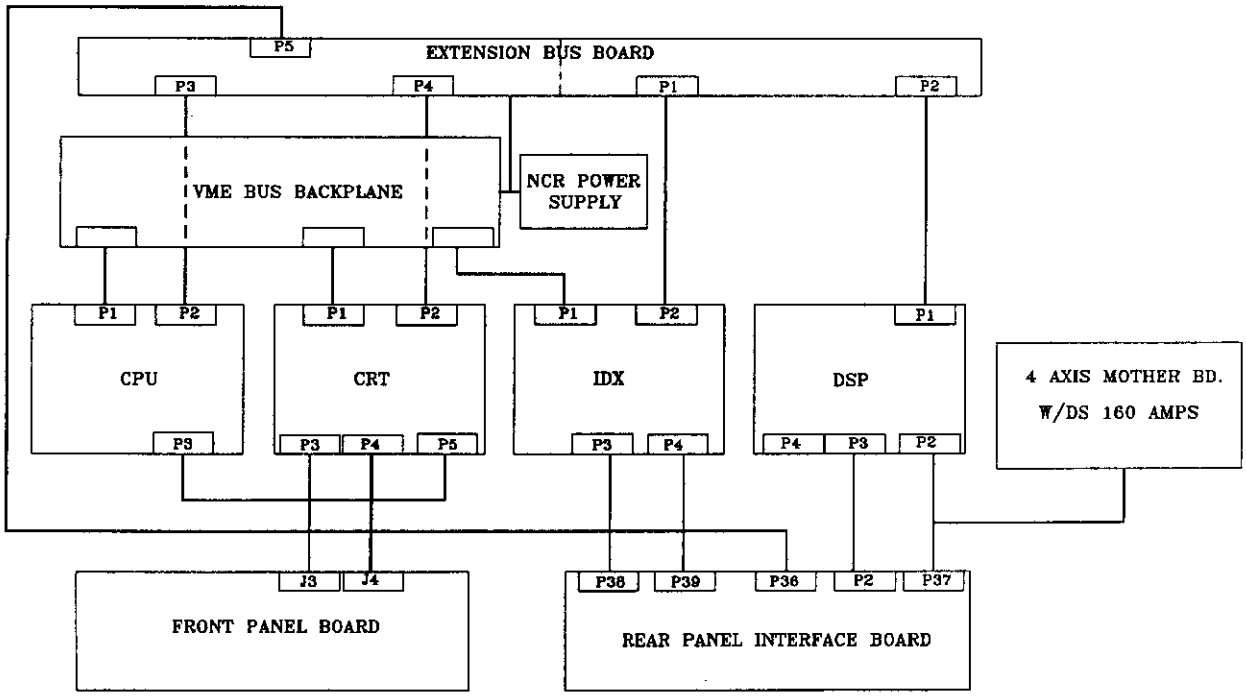

Figure 2-6: Unidex 21 System Block Diagram

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CHAPTER 3: JUMPERS AND SWITCHES

Many of the circuit boards that make up the Unidex 21 contain Jumpers and/or Switches. The following sections provide a board by board listing of the Jumpers and/or Switches, possible configurations and a brief explanation as to their function. Refer to Chapter 2, Figures 2-4 and 2-5 for relative board locations.

3-1: FRONT PANEL BOARD JUMPERS AND SWITCHES

The optional Front Panel Board (Figure 3-1) contains the Line Driver Receivers that provide interface between the CRT Line Drive Differential outputs and the following devices: EL or EGA Display, the Disk Drive, the Front Panel RESET, the Beeper, the Keyboard Clock, and the Keyboard Data signals.

The following Jumpers are located on the Front Panel Board:

JUMPER	CONDITIONS	FUNCTION
JP1	1-2, 3-4	EL Display Internal Clock Synchronization polarity set Negative
	1-4, 2-3	EL Display Internal Clock Synchronization polarity set Positive (Default)
JP2	1-2	Secondary EGA Display color signal not used. Connector J2, Pin1 is Shield Ground.
	2-3	Secondary EGA Display color signal used. Connector J2, Pin1 is Signal Ground. (Configured in conjunction with JP3 being 2-3) (Default)

JUMPER	CONDITIONS	FUNCTION
JP3	1-2	Disables secondary EGA Display color signal. Connector J2, Pin 2 is Signal Ground. (Configured in conjunction with JP2 being 1-2)
	2-3	Enables secondary EGA Display color signal. Connector J2, Pin 2 is Secondary Red.(Configured in conjunction with JP2 being 2-3) (Default)
JP4	1-2, 3-4	EL Display Vertical Sink Polarity set Negative (Default)
	1-4, 2-3	EL Display Vertical Sink Polarity set Positive (Default)

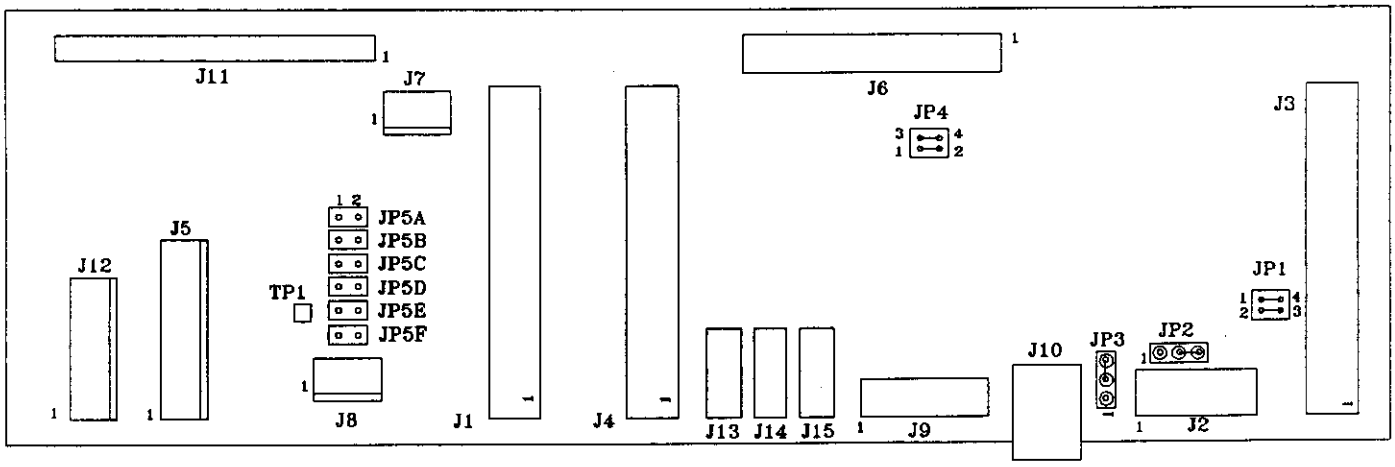

Figure 3-1: Unidex 21 Front Panel Board Jumpers and Switches

SECTION 3-2: CPU BOARD JUMPERS AND SWITCHES

The CPU Board is the Front End of the Unidex 21 System. It is directed by a Motorola 68000 Microprocessor. The CPU provides file editing, file management, floppy disk functions and RS-232 communications, as well as being the System's Bus Master. The CPU Board also contains eight (8) Opto-Isolated Outputs, sixteen (16) Opto-Isolated Inputs, and three (3) User Interrupts.

The following Jumpers are located on the CPU Board.

JUMPER	CONDITIONS	FUNCTION
JP1	1-2	External Battery operation. Configured in conjunction with JP2 being OUT. (An external Battery may be used to provide backup for the CPU and/or the Indexer Boards)
	2-3	Battery #1 is active (Configured in conjunction with JP2 being IN) (Default)
JP2	IN	Battery #1 is active (Configured in conjunction with JP1 being 2-3) (Default)
	OUT	External Battery operation. Configured in conjunction with JP1 being 1-2. (An external Battery may be used to provide backup for the CPU and/or the Indexer Boards)
JP3	1-2	Watchdog Input is active (Default)
	2-3	Watchdog Input not active (Factory Software Development Use Only)
JP4	1-2	High Write Current for Disk Drive
	2-3	Reduced Write Current for Disk Drive (Default)

JUMPER	CONDITIONS	FUNCTION
JP5	IN	All VME Bus Boards are affected by Reset (Default)
	OUT	Only CPU Board is affected by Reset
JP6	1-2	Pre-compensation value of 125 Nano-Seconds for Disk Drive
	2-3	Pre-compensation value of 187 Nano-Seconds for Disk Drive (Default)
JP7	1-2	High Speed Interrupt Disabled
	2-3	High Speed Interrupt Enabled (Default)
JP8	IN	RS-232 Clear to Send Termination to Ground, enables PC/AT Keyboard and Membrane input (Default)
	OUT	Disables PC/AT Keyboard and Membrane input (JP8 must always be installed)
JP9	IN	16 mHz Clock Signal sent out to System (Default)
	OUT	System will not operate (JP9 must be installed unless the unit is one of a multi-unit system and another board is configured to be the Master)
JP10	IN	Enables the Bus Busy Signal (Default)
	OUT	Disables the Bus Busy Signal

JUMPER	CONDITIONS	FUNCTION
JP11	1-2	CPU Board passes Interrupt Acknowledge Signal "In" to Interrupt Ackowledge "Out" (Default)
	2-3	CPU Generates Interrupt Acknowlege Signal "Out" that other VME Bus Boards receive as Interrupt Acknowledge "In"
JP12	1-2	Provides Bus arbitration, activating Bus Request (2) Signal
	2-3	Provides Bus arbitration, activating Bus Request (3) Signal (Default)
JP13	None Installed (Default)	Available to provide Bus arbitration to activate Bus Request (0) or Bus Request (1) Signals
JP14	IN	Enables Bus Grant In Signal (Default)
	OUT	Disables Bus Grant In Signal
JP15	None Installed (Default)	Available to provide Bus arbitration to activate Bus Grant "In" (0) or Bus Grant "In" (1) Signals
JP16	1-2	Provides Bus arbitration, activating Bus Grant "In" (3) Signal (Default)
	2-3	Provides Bus arbitration, activating Bus Gain "In" (2) Signal
JP17	None Installed (Default)	Available to provide Bus arbitration to activate Bus Grant "Out" (0) and Bus Grant "Out" (1) Signals

JUMPER	CONDITIONS	FUNCTION
JP18	1-2	Provides Bus arbitration, activating Bus Grant "Out" (3) Signal (Default)
	2-3	Provides Bus arbitration, activating Bus Grant "Out" (2) Signal
JP19	IN	Enables Bus Interrupt Request (6) Signal (Default)
	OUT	Disables Bus Interrupt Request (6) Signal
JP20	IN	Enables Bus Interrupt Request (5) Signal (Default)
	OUT	Disables Bus Interrupt Request (5) Signal
JP21	IN	Enables Bus Interrupt Request (4) Signal (Default)
	OUT	Disables Bus Interrupt Request (4) Signal
JP22	IN	Enables Bus Interrupt Request (3) Signal (Default)
	OUT	Disables Bus Interrupt Request (3) Signal
JP23	IN	Enables Bus Interrupt Request (2) Signal (Default)
	OUT	Disables Bus Interrupt Request (2) Signal
JP24	IN	Enables Bus Interrupt Request (1) Signal (Default)
	OUT	Disables Bus Interrupt Request (1) Signal

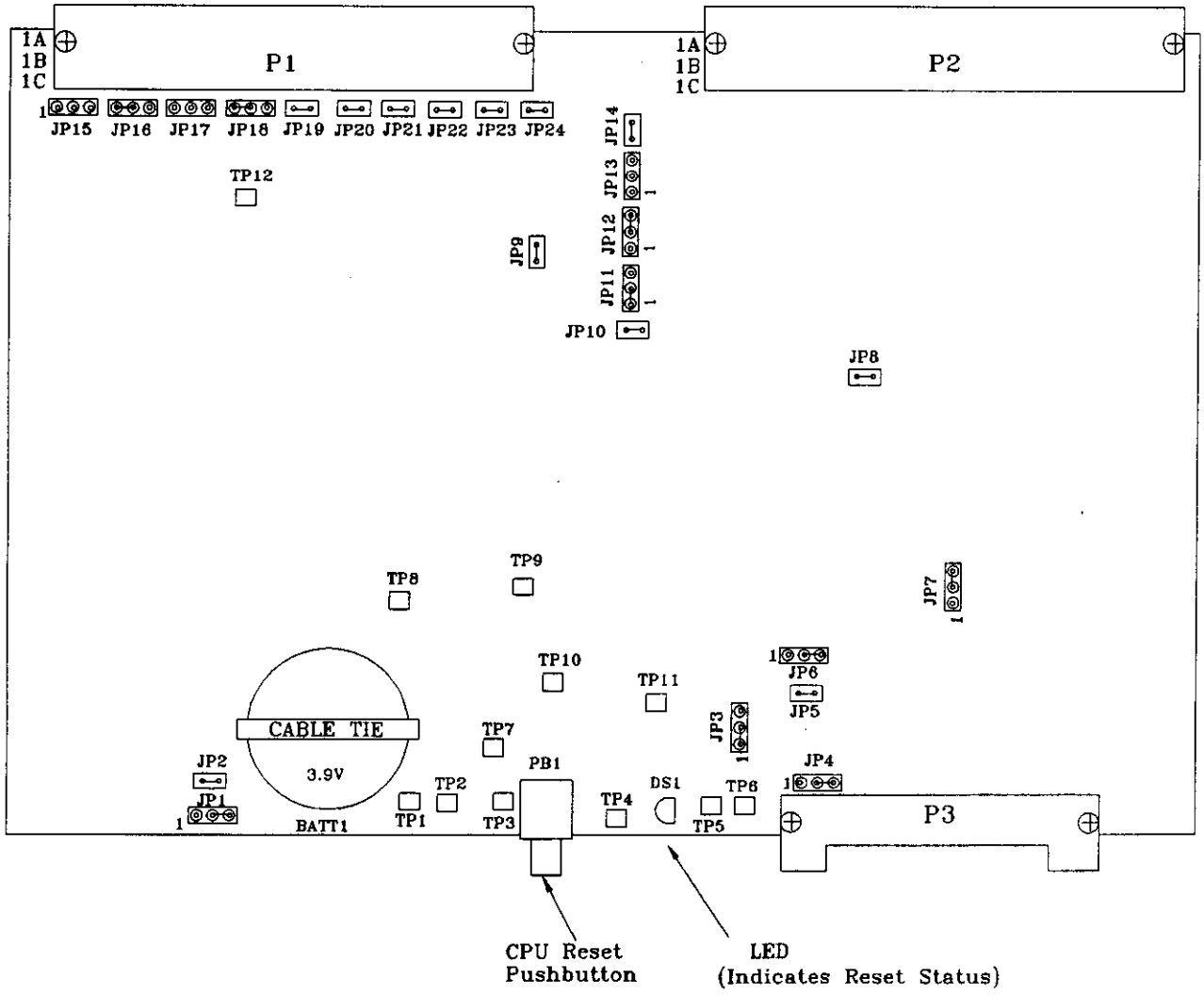

Figure 3-2 : Unidex 21 CPU Board - Jumpers and Switches

SECTION 3-3: INDEXER BOARD JUMPERS AND SWITCHES

The Indexer Board functions as the translator between the CPU and the DSP boards. It accepts motion commands from the CPU Board and converts them to trajectory commands which are a digital representation of the commanded move(s). The data is then transferred to the DSP Board which in turn outputs current commands that correspond to the trajectory commands.

The Indexer Board also provides auxilliary functions such as Joystick, Handwheel, and Trackball Inputs. The MST Bus for Output functions also is contained on the Indexer Board.

JUMPER	CONDITIONS	FUNCTION
JP1	1-2	Enables Watchdog Input Signal (Default)
	2-3	Disables Watchdog Input Signal (Factory Software Development Use Only)
JP2	1-2	Enables MST Bus RESET function (Default)
	2-3	Disables MST Bus RESET function
JP3	1-2	Determines the address range used by the CPU for one Indexer Board. (Configured in conjunction with JP5 being 1-2) (Default)
	2-3	(Not available for Unidex 21 Models U21B or U21R)
JP4	1-2	System RESET resets Indexing Board
	2-3	System RESET does not reset Indexing Board

JUMPER	CONDITIONS	FUNCTION
JP5	1-2	Determines the address range used by the CPU for one Indexer Board. (Configured in conjunction with JP3 being 1-2) (Default)
	2-3	(Not available for Unidex 21 Models U21B or U21R)
JP6	1-2	Battery #1 active (Configured in conjunction with JP7 being 1-2) (Default)
	2-3	Battery #1 is disabled. Configured in conjunction with JP7 being 2-3. (An external Battery may be used to provide backup for the Indexer and/or the CPU Boards)
JP7	1-2	Battery #1 is active (Configured in conjunction with JP6 being 1-2) (Default)
	2-3	Battery #1 is disabled. Configured in conjunction with JP6 being 2-3. (An external Battery may be used to provide backup for the Indexer and/or the CPU Boards)
JP8	1-10	Interrupt Request Signal (5) active (Default)
	2-9	Interrupt Request Signal (4) active (Not available at this time)
	3-8	Interrupt Request Signal (3) active (Not available at this time)
	4-7	Interrupt Request Signal (2) active (Not available at this time)
	5-6	Interrupt Request Signal (1) active (Not available at this time)

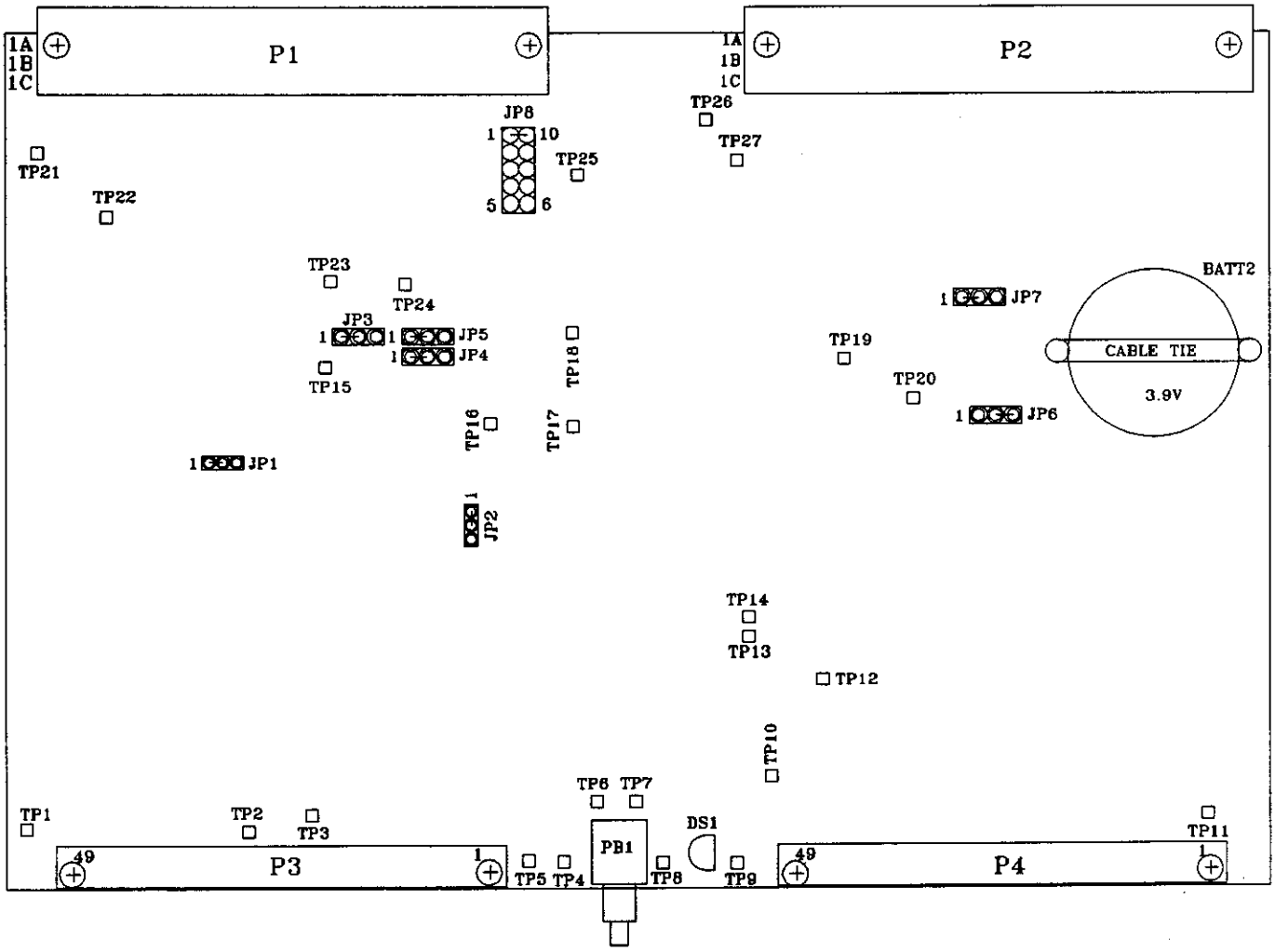

Figure 3-3: Unidex 21 Indexer Board - Jumpers and Switches

SECTION 3-4: DSP BOARD JUMPERS AND SWITCHES

The Unidex 21's DSP Board receives all motion information from the Indexer Board and converts this digital data to analog current commands which interface directly to the Power Amplifiers. The core of the DSP Board is the DSP56001 Digital Signal Processor. The exceptionally fast speed of this processor is due to it's single cycle instruction and parrallel processing abilities which are enhanced by being run on a 20MHz clock.

As well as generating current commands for eight axes of motors the DSP Board accepts Transducer signals for tracking the axes motion and monitors the Limit signals for each axis.

The following jumpers are located on the DSP Board:

JUMPER	CONDITIONS	FUNCTION
JP1	1-2	Enables Strobe Input Signal (Default)
	2-3	Disables Strobe Input Signal (Factory Software Development Use Only)
JP2	1-2	If Opto Isolator M15 is a HCPL2601, Pin 7 is enabled for output
	2-3	If Opto Isolator M15 is a 6N136, Pin 7 requires no connection (Default)
JP3	1-2	If Opto Isolator M13 is a HCPL2601, Pin 7 is enabled for output
	2-3	If Opto Isolator M13 is a 6N136, Pin 7 requires no connection (Default)
JP4 through JP19		Three Encoder types may be used. JP4 through JP19 must be configured in accordance with Figure 3-4

JUMPER	CONDITIONS	FUNCTION
JP21	1-2	If JP21, JP22 and JP23 are "1-2" the 24 bit word Static RAM capacity is 8Kx24
	2-3	If JP21, JP22 and JP23 are "2-3" the 24 bit word Static RAM capacity is either 32Kx24 or 128Kx24 (Default)
JP22	1-2	If JP21, JP22 and JP23 are "1-2" the 24 bit word Static RAM capacity is 8Kx24
	2-3	If JP21, JP22 and JP23 are "2-3" the 24 bit word Static RAM capacity is either 32Kx24 or 128Kx24 (Default)
JP23	1-2	If JP21, JP22 and JP23 are "1-2" the 24 bit word Static RAM capacity is 8Kx24
	2-3	If JP21, JP22 and JP23 are "2-3" the 24 bit word Static RAM capacity is either 32Kx24 or 128Kx24 (Default)
JP24 through JP26		Up to eight (8) DSP Boards may be used. JP24 through JP26 of each Board must be configured in accordance with Figure 3-5.

		ENCODER TYPE/JUMPER CONFIGURATION			
AXIS	JUMPERS	NONE	QUADRATURE SQUARE WAVE	CLOCK & DIRECTION	CW/CCW CLOCK
1	JP14 JP15	1-2 1-2	2-3 1-2	1-2 2-3	2-3 2-3
2	JP10 JP11	1-2 1-2	2-3 1-2	1-2 2-3	2-3 2-3
3	JP18 JP19	1-2 1-2	2-3 1-2	1-2 2-3	2-3 2-3
4	JP6 JP7	1-2 1-2	2-3 1-2	1-2 2-3	2-3 2-3
5	JP12 JP13	1-2 1-2	2-3 1-2	1-2 2-3	2-3 2-3
6	JP8 JP9	1-2 1-2	2-3 1-2	1-2 2-3	2-3 2-3
7	JP16 JP17	1-2 1-2	2-3 1-2	1-2 2-3	2-3 2-3
8	JP4 JP5	1-2 1-2	2-3 1-2	1-2 2-3	2-3 2-3

Figure 3-4: Configuration of DSP Board Jumpers JP4 through JP19

	JUMPER CONFIGURATIONS		
DSP BOARD ADDRESS	JP24 (LEAST SIGNIFICANT BIT)	JP25	JP26 (MOST SIGNIFICANT BIT)
0	1-2	1-2	1-2
1	1-2	1-2	2-3
2	1-2	2-3	1-2
3	1-2	2-3	2-3
4	2-3	1-2	1-2
5	2-3	1-2	2-3
6	2-3	2-3	1-2
7	2-3	2-3	2-3

Figure 3-5: Configuration of DSP Board Jumpers JP24 through JP26

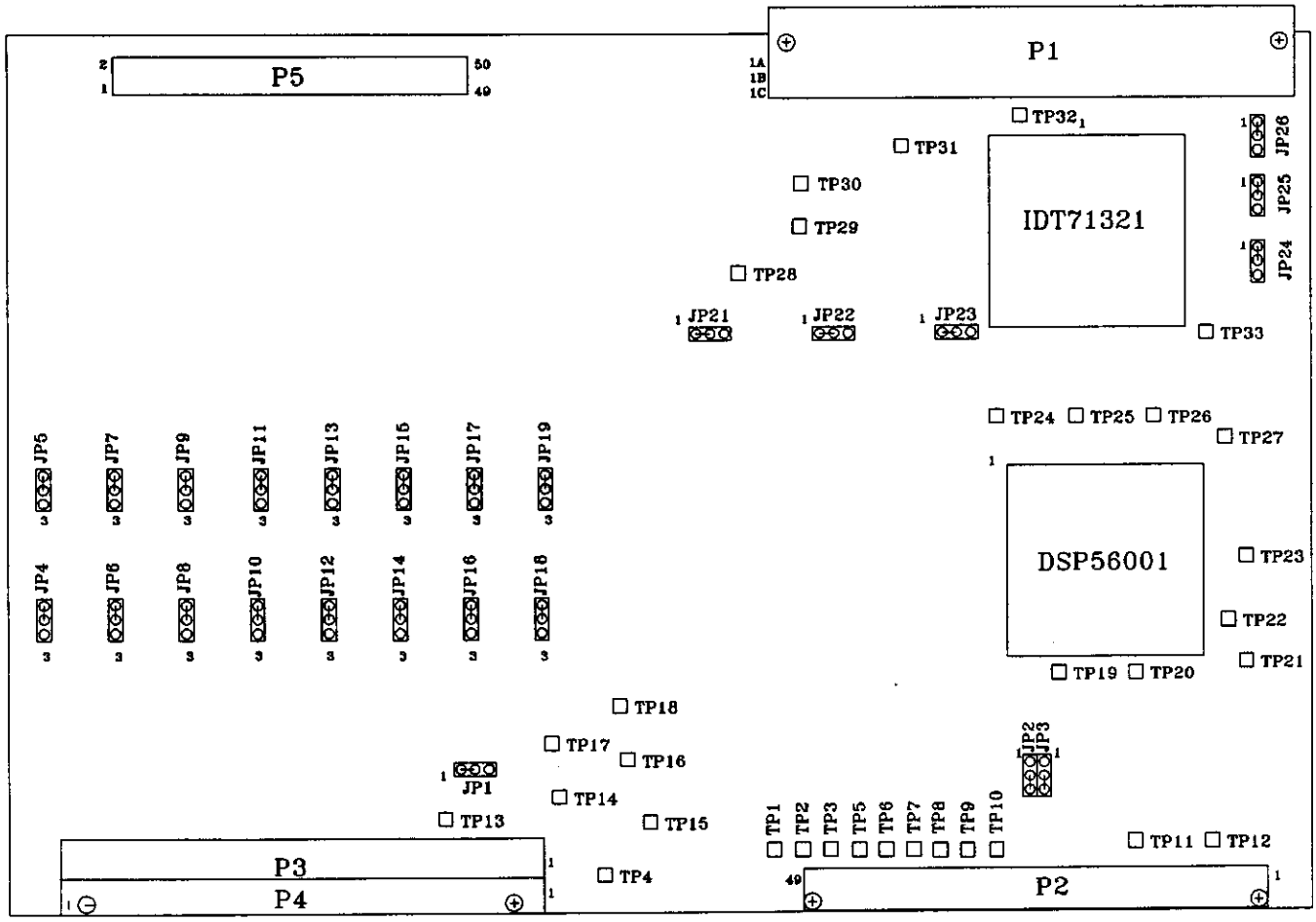

Figure 3-6: Unidex 21 DSP Board - Jumpers and Switches

SECTION 3-5: CRT BOARD JUMPERS AND SWITCHES

The Unidex 21's optional CRT Board provides several display functions. If the Unidex 21 is not equipped with the CRT Board, it is operable only by the use of a Televideo 905 Terminal. Equipped with the CRT Board, the Unidex 21 is capable of outputting a display to an Electro-Luminescent Panel or one of three monitor types: an IBM EGA 640x400, an IBM 640x350, or Monochrome.

The CRT Board also contains Line Drivers and Line Receivers for the optional Floppy Disk Drive and the Front Panel Keyboard lines.

The CRT Board contains a ten (10) position DIP Switch (SWN1) used for selecting the Character set, the Display type and for enabling the Front Panel Reset.

Switch configurations are as follows:

SWITCH NUMBER AND POSITION										MODE
1	2	3	4	5	6	7	8	9	10	
1	X	X	X	X	X	X	X	X	X	EIA CHARACTER SET
0	X	X	X	X	X	X	X	X	X	IBM CHARACTER SET
X	0	0	X	X	X	X	X	X	X	IBM EGA 640x350
X	0	1	X	X	X	X	X	X	X	IBM EGA 640x400
X	1	0	X	X	X	X	X	X	X	MONOCHROME
X	1	1	X	X	X	X	X	X	X	EL DISPLAY
X	X	X	X	X	X	X	X	1	X	FRONT PANEL RESET ENABLED
X	X	X	X	X	X	X	X	0	X	FRONT PANEL RESET DISABLED

1 = ON 0 = OFF X = NOT APPLICABLE

EXAMPLE:

1	2	3	4	5	6	7	8	9	10
1	0	1	X	X	X	X	X	1	X

EIA CHARACTER SET SELECTED
IBM EGA 640x400 MONITOR SELECTED
FRONT PANEL RESET ENABLED

SECTION 3-6: AUXILIARY BOARD JUMPERS AND SWITCHES

The Unidex 21's Auxiliary Board provides several functions. It contains a 24 VDC unregulated Power Supply to provide continuous power which is used to produce the logic for the Unidex 21's Power On/Off.

The Auxiliary Board also contains a Shunt Regulator to protect the Amplifier from damage due to increases in Bus voltage. The Shunt Regulator has been factory set for the appropriate voltage and must not be re-adjusted by the User.

Lastly, the Auxiliary Board monitors the Motor Contactors and the AC line current initiating the AC Fail error message when appropriate.

The following Jumpers are located on the Auxiliary Board:

JUMPER	CONDITIONS	FUNCTION
JP1	IN	If JP1 is "In", JP2 is "Out" and JP3 is "In", the System is configured for 115 VAC operation. (Default)
	OUT	* If JP1 is "Out", JP2 is "In" and JP3 is "Out", the System is configured for 230 VAC operation.
JP2	IN	* If JP2 is "In", JP1 is "Out" and JP3 is "Out", the System is configured for 230 VAC operation.
	OUT	If JP2 is "Out", JP1 is "In" and JP3 is "In", the System is configured for 115 VAC operation. (Default)

JUMPER	CONDITIONS	FUNCTION
JP3	IN	If JP1 is "In", JP2 is "Out" and JP3 is "In", the System is configured for 115 VAC operation. (Default)
	OUT	*If JP1 is "Out", JP2 is "In" and JP3 is "Out", the System is configured for 230 VAC operation.
JP4	1-2	Loss of Power to Motor Contactors will NOT Shut System Off. If JP4 is "1-2" and JP5 is "2-3", loss of Motor Contactor Power will cause an AC FAIL Message to be displayed. (Default)
	2-3	If JP4 is "2-3" and JP5 is "2-3" Motor Contactor Status is monitored. System will Shut Off if Motor Contactors Lose Power.
JP5	1-2	Motor Contactor Status is not monitored (Default)
	2-3	If JP4 is "2-3" and JP5 is "2-3" or if If JP4 is "1-2" and JP5 is "2-3", Motor Contactor Status is monitored and an AC Fail Fault message is reported to the CPU Board which in turn Displays an AC FAIL message on the Screen.

***NOTE: If the Unidex 21 is changed from115 Volt operation to 230 Volt operation the DPC-20-220 Transformer must be changed to a DPC-24-180.**

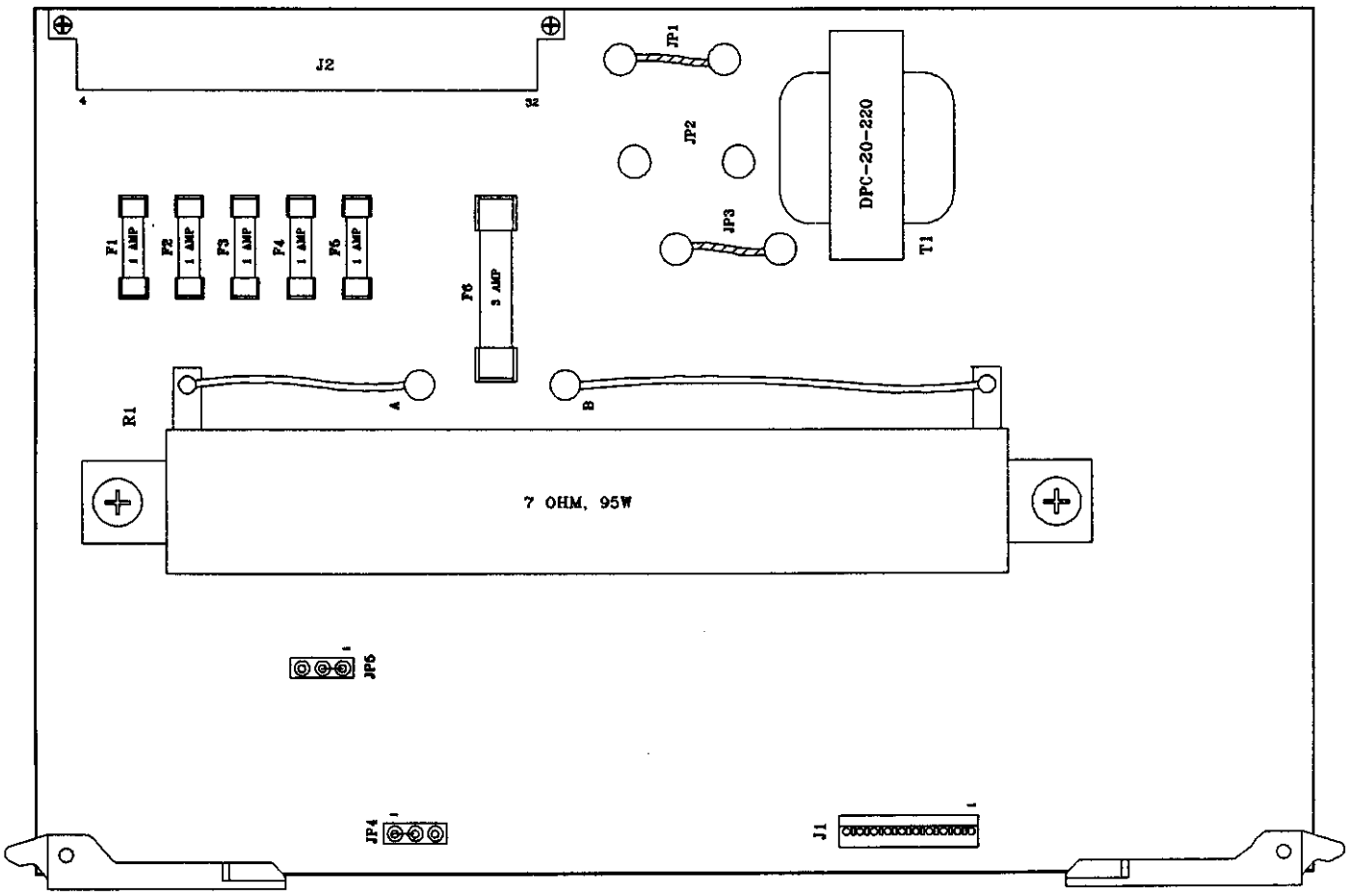

Figure 3-7 : Unidex 21 Auxiliary Board - Jumpers and Switches

CHAPTER 4: POWER INTERFACE

SECTION 4-1: POWER REQUIREMENTS

The Unidex 21, Models U21B or U21R may be factory wired for an input power of either 115 VAC, single phase, 50/60 Hz, 30 amps, 230 VAC, single phase, 50/60 Hz, 15 amps.

WARNING: **Located on the side panel of each Unidex 21 is a Power Requirement label. Deviation from the power specifications on the label could result in extensive damage to the equipment. Consult your Aerotech representative for further information.**

Prior to making any power connections refer to the Power Requirement label for input power specifications.

SECTION 4-2: INPUT POWER CONNECTION

Figure 4-1 shows an outline of the INPUT POWER receptacle. The Input Power cable is supplied with the Unidex 21.

WARNING: **Prior to making any electrical connections, make certain all POWER switches are in the OFF position.**

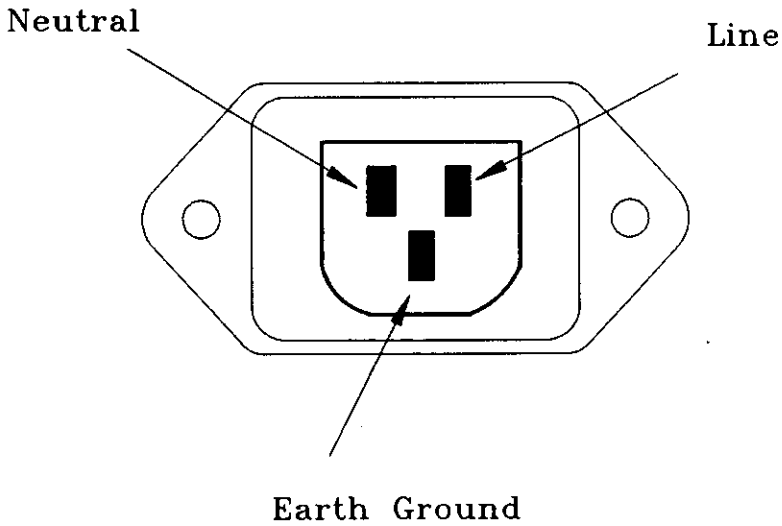

Figure 4-1: AC Input Power Connector

SECTION 4-3: POWER SYSTEM FUSES AND BATTERIES

The following is a list of all of the fuses incorporated in the Unidex 21 power system.

LABEL	PART NUMBER	RATING	LOCATION
F1	313005	10ASB	AC Input/Rear Panel (110V)
	XXXXXX	5ASB	AC Input/Rear Panel (230V)
1F1	Fuse rating determined by Motor type		Axis 1 Rear Panel Motor Connection
2F1	Fuse rating determined by Motor type		Axis 2 Rear Panel Motor Connection
3F1	Fuse rating determined by Motor type		Axis 3 Rear Panel Motor Connection
4F1	Fuse rating determined by Motor type		Axis 4 Rear Panel Motor Connection
F1-F5	218001	1ASB	Auxilliary Board AC Input
F6	313003	3AS 3ASB	Auxilliary Board Shunt
F1	XXXXXX	XXASB	In-Line T1
F2	XXXXXX	XXASB	In-Line T2
F1	XXXXXX	XXASB	NCR Power Supply
F1	XXXXXX	12ASB	Axis 1 Amplifier (DS16020)
		20ASB	Axis 1 Amplifier (DS16030)
F1	XXXXXX	12ASB	Axis 2 Amplifier (DS16020)
		20ASB	Axis 2 Amplifier (DS16030)
F1	XXXXXX	12ASB	Axis 3 Amplifier (DS16020)
		20ASB	Axis 3 Amplifier (DS16030)
F1	XXXXXX	12ASB	Axis 4 Amplifier (DS16020)
		20ASB	Axis 4 Amplifier (DS16030)
BATT1	BCX72 3850	3.9V	CPU Memory Backup
BATT2	BCX723850	3.9V	Indexer Memory Backup

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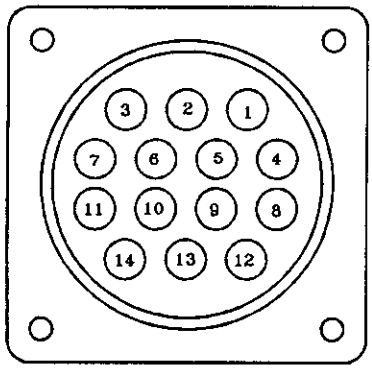
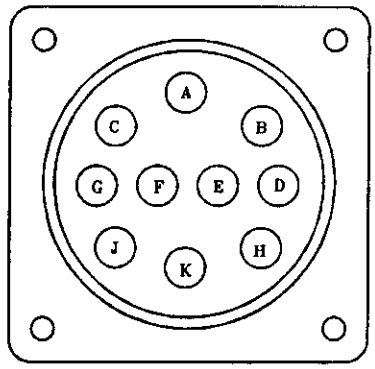
CHAPTER 5: MOTOR INTERFACE

The Rear Connector Panel of the Unidex 21, Models U21B and U21R contains the Motor Connectors for four axes. Details of the connectors are shown in Figures 5-1, 5-2 and 5-3.



14 Pin Plastic Style



10 Pin Metal Style

Figure 5-1: Unidex 21 Motor Output Receptacles

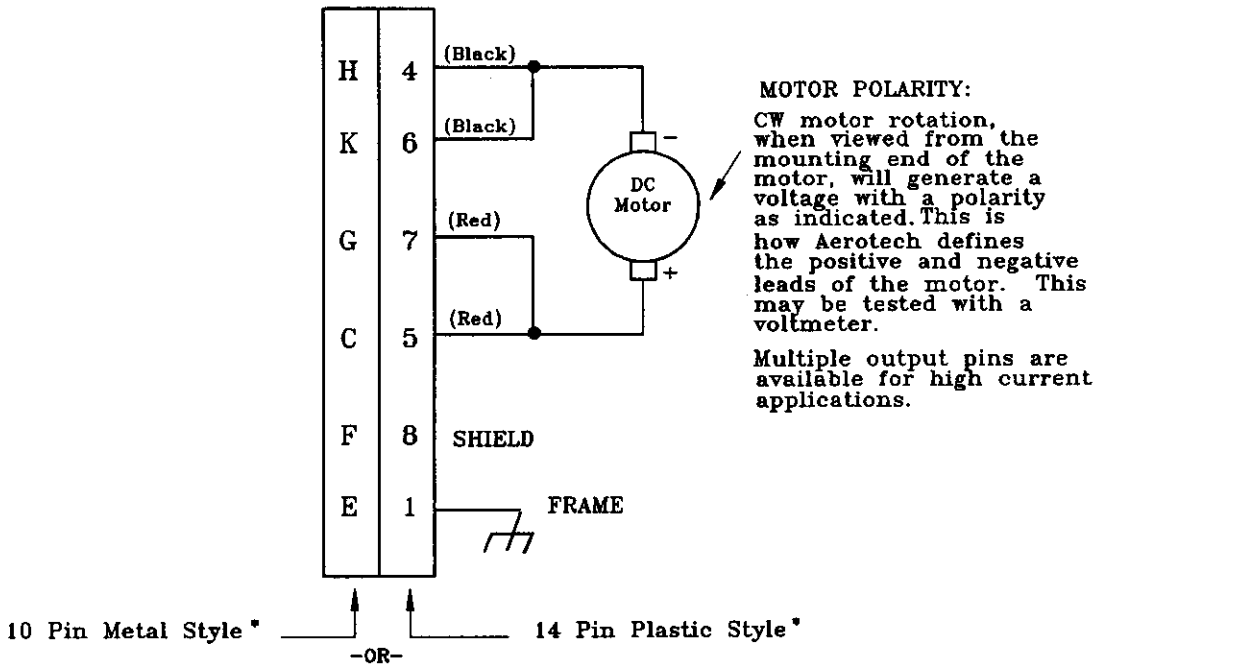
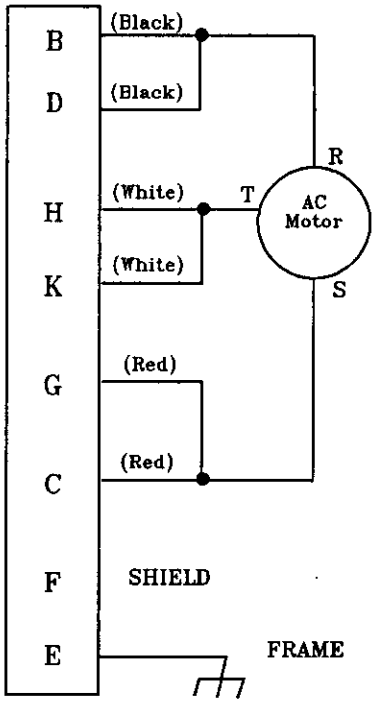


Figure 5-2: Outline of Connections for "Brush" Type DC Servo Motor



MOTOR POLARITY

CW Motor rotation (as viewed from the Motors mounting end) generates a specific Sine Wave pattern. Identification of this pattern defines the Motor's leads. This may be tested with the use of an Oscilloscope. See Figures 5-4 and 5-5.

Pins A and J not used

10 Pin Metal Style
(Standard for AC Brushless Motors)
See also Figure 5-1

Figure 5-3: Outline of Connections for "Brushless" Type AC Motor

SECTION 5-1: MOTOR PHASING

5-1-1 BRUSH TYPE DC SERVO MOTORS

The Motor is commanded to turn by the Servo Amplifier. The turning of the Motor generates a feedback voltage having an amplitude proportional to speed and a polarity representing direction. It is important that correct polarity is observed when the motor is connected to Aerotech equipment.

WARNING: **If the Motor is not properly connected, instability of the Servo Drive system may result in a runaway condition.**

The polarity of the Motor is in reference to Clockwise (CW) rotation of the Motor. This may be determined as follows:

Connect a Voltmeter to the Motor's terminals (or leads). Turn the Motor Shaft in a Clockwise (CW) direction. A positive indication will occur while the Motor Shaft is being turned if the correct polarity has been identified. If no indication or a negative indication is noted, the polarity of the Motor leads has not been identified correctly and the Motor connections must be reversed. Refer to Figure 5-4.

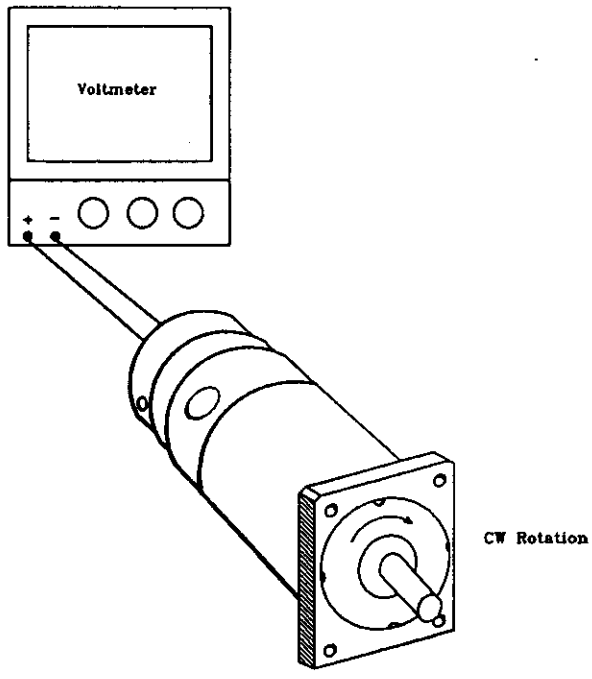


Figure 5-4: DC "Brush" Type Motor Phasing

5-1-1 AC BRUSHLESS TYPE SERVO MOTORS

Motor polarity must also be determined for Brushless type Motors. It is important that correct polarity is observed when the Motor is connected to Aerotech equipment.

WARNING: **If the Motor is not properly connected, instability of the Servo Drive system may result in a runaway condition.**

The polarity of the Motor is in reference to Clockwise (CW) rotation of the Motor. This may be determined as follows:

Connect an Oscilloscope to two of the Motor's leads. Turn the Motor Shaft in a Clockwise (CW) direction. The Oscilloscope indication should be as illustrated in Figure 5-5 (for Motors equipped with Hall Sensors) or Figure 5-6 (for Motors equipped with Resolvers or Encoders). If the Oscilloscope indication is not in accordance with Figures 5-5 or 5-6 or no indication is noted, the polarity of the Motor leads has not been identified correctly and the Motor connections must be changed.

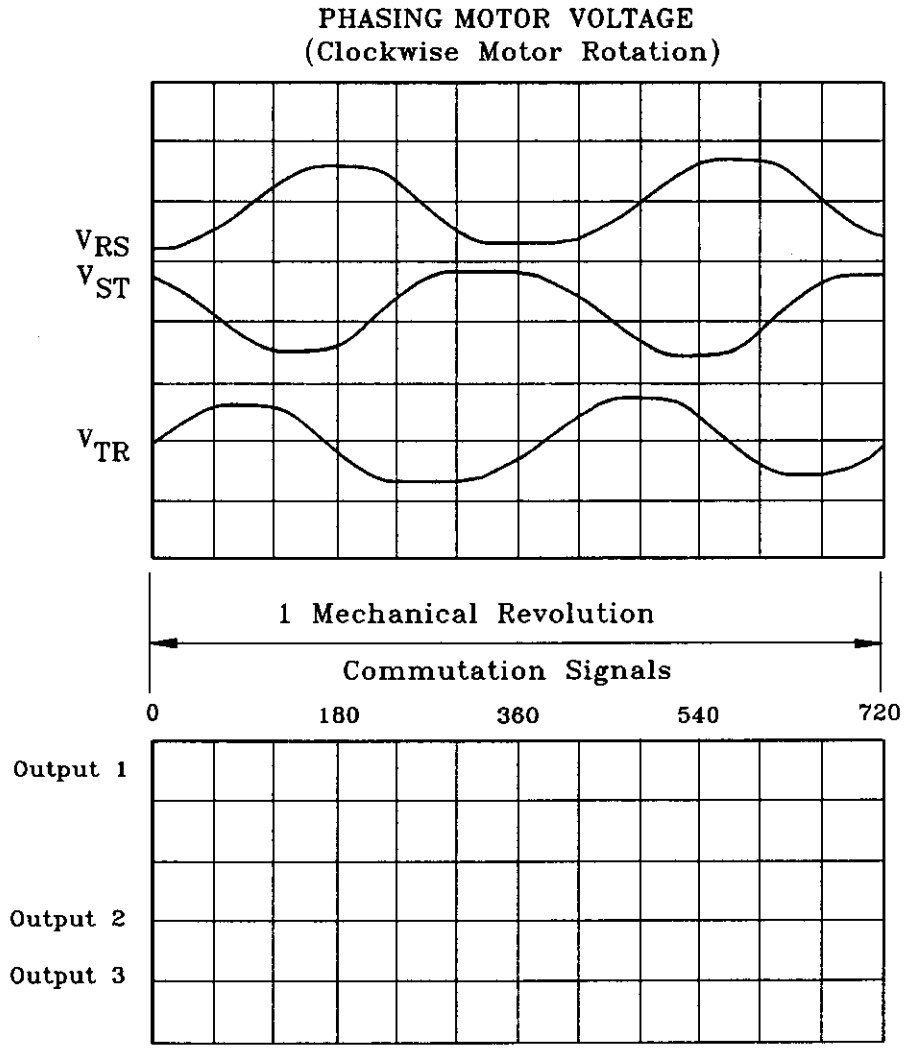


Figure 5-5: "Brushless" Motor Equipped With Hall Sensors

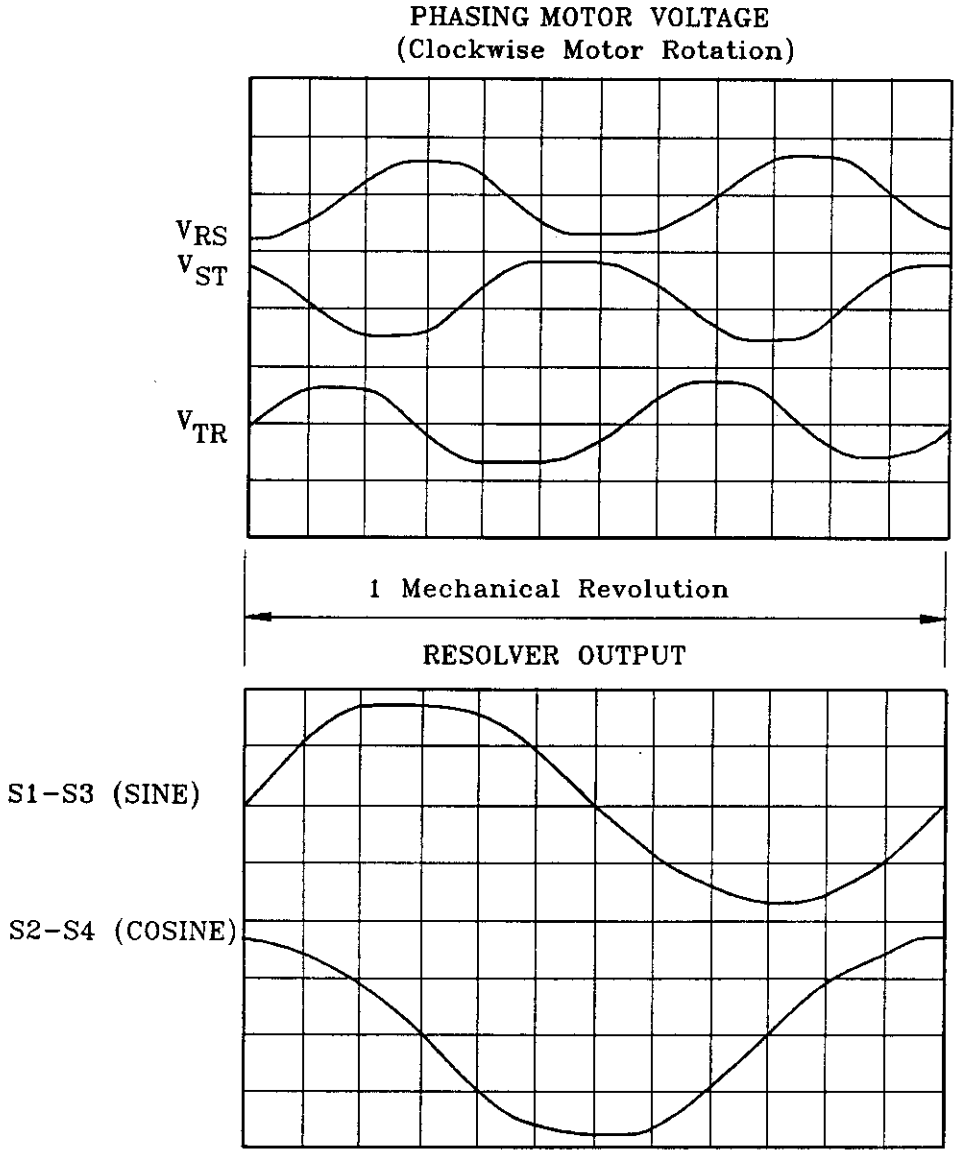


Figure 5-6: "Brushless" Motor Equipped With Resolver or Encoder

SECTION 5-2:MOTOR FUSING AND CURRENT LIMIT

Motor fusing and current limit are provided to protect the Motor from damage due to overheating caused by excessive peak current conditions.

The Motor Fuse (located on the Servo Controller) protects the Motor from overheating. Fuse rating is determined by the continuous current rating or the torque rating of the Motor.

The current limit adjustment on the Servo Controller is determined by the peak torque or peak current rating of the Servo Motor.

5-2-1 "BRUSH" TYPE DC SERVO MOTORS

The following is a list of some standard Aerotech DC Servo Motors and suggested Fuse and Current Limit ratings.

MOTOR	FUSING	CURRENT LIMIT
1017-01	4ASB	16A
1035-01	4ASB	16A
1050-01	5ASB	20A
1075-01	5ASB	20A
1135-01	5ASB	20A
1210-01	5ASB	20A
1410-03	8ASB	30A
1580-02	8ASB	30A
1960-02	12ASB	30A

5-2-2: "BRUSHLESS" TYPE AC SERVO MOTORS

The following is a list of some standard Brushless AC Servo Motors and suggested Fuse and Current Limit ratings.

MOTOR	FUSING	CURRENT LIMIT

(Not currently available)

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CHAPTER 6: LIMIT AND HOME SWITCH INTERFACE

The optically isolated Limit and Home Switch Inputs are interfaced to the Unidex 21 through the ENC/LMT Connectors (P7, P9, P13, and P15).

An ENC/LMT Connector is provided for each of the four axes. Details of a typical connector are shown in Figure 6-1. Electrical characteristics of a typical Limit or Home Switch Input are shown in Figure 6-2.

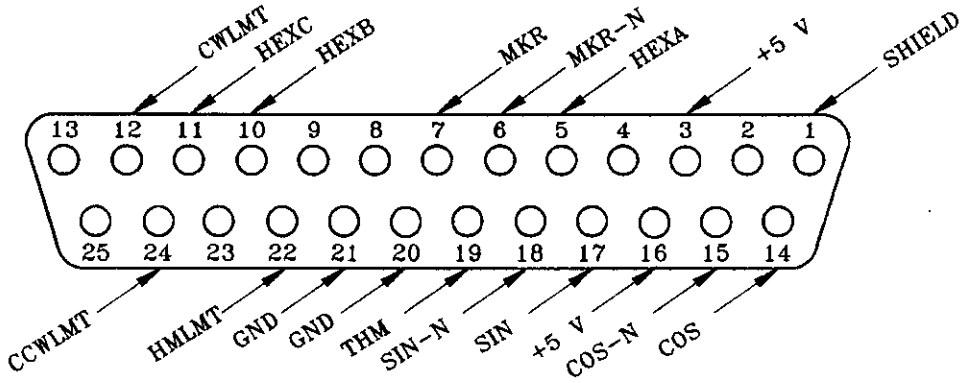


Figure 6-1: ENC/LMTS Connector (P7, P9, P13, P15)

PIN	DESCRIPTION
1	Encoder Shield connection. Sent to Chassis Ground unless otherwise specified.
2,4,8,9,13,23,25	(Not Used)
3	+5 V Input Common
5	Hall Effect Switch signal feedback to the DSP Board for Motor commutation (Active only when using a Brushless type Motor)
6	Inverse Marker pulse feedback from the Encoder to the DSP Board
7	Positive Marker pulse feedback from the Encoder to the DSP Board
10	Hall Effect Switch signal feedback to the DSP Board for Motor commutation (Active only when using a Brushless type Motor)
11	Hall Effect Switch signal feedback to the DSP Board for Motor commutation (Active only when using a Brushless type Motor)
12	CW * Limit Switch Input Signal to the DSP Board
14	Positive Cosine feedback from the Encoder to the DSP Board
15	Inverse Cosine feedback from the Encoder to the DSP Board.
16	+5 V Input Common
17	Positive Sine feedback from the Encoder to the DSP Board
18	Inverse Sine feedback from the Encoder to the DSP Board
19	Motor Thermistor feedback providing motor temperature data to the R/D Board (Active only when using a Brushless type Motor)
20,21	Ground, common to all Encoder connectors
22	Home Limit Switch Input signal to the DSP Board
24	CCW * Limit Switch Input Signal to the DSP Board

* See Section 6-3 for Limit Switch/Direction relationship

SECTION 6-1: LIMIT OR HOME SWITCH INPUTS

Aerotech supplied Limit and Home Switches are of the Normally Open, Logic 0 type (Refers to Contact positions when not in Limit) (see Figure 6-2).

If Normally Closed, Logic 1, Limit and/or Home Switches are used , the Axis Parameter "28: Home Switch is Normal Open?" and /or "30: Limit Switch is Normal Open", must be reconfigured. (See Chapter 6 of the *Unidex 21 User's Manual*)

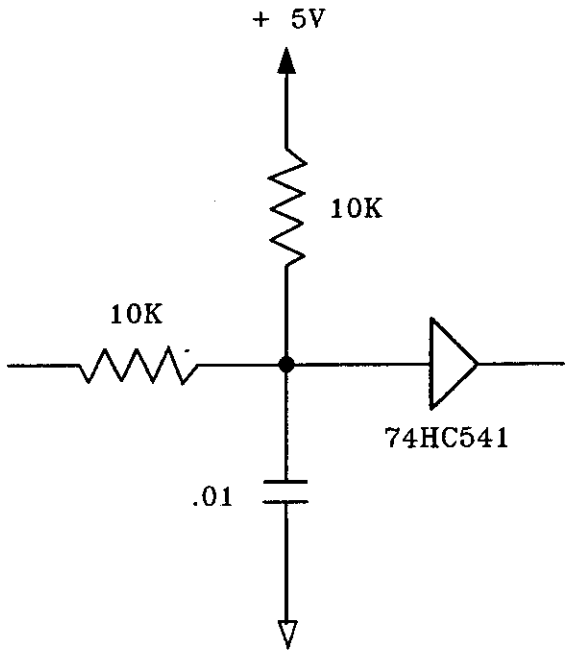


Figure 6-2: Electrical Characteristics of a Typical Limit Switch or Home Input

SECTION 6-2: LIMIT SWITCH DIRECTION

The CW and CCW Limit Switches provide travel limit protection for the Unidex 21 Drive System. Clockwise (CW) and Counterclockwise (CCW) motor rotation are referenced as viewed from the mounting flange of the motor. Aerotech has established this standard to clarify the Limit direction when one controller is interfaced to several mechanical configurations. The CW Limit stops CW motor rotation and the CCW Limit stops CCW rotation. (See Figure 7-6.)

Aerotech tables are manufactured such that the CW and CCW Limit Switches precede the rubber mechanical stops by approximately one revolution of the ballscrew. It is not recommended that the table be allowed to come into contact with the mechanical stops.

WARNING: **Damage to the equipment may occur if the table is allowed to come into contact with the mechanical stops.**

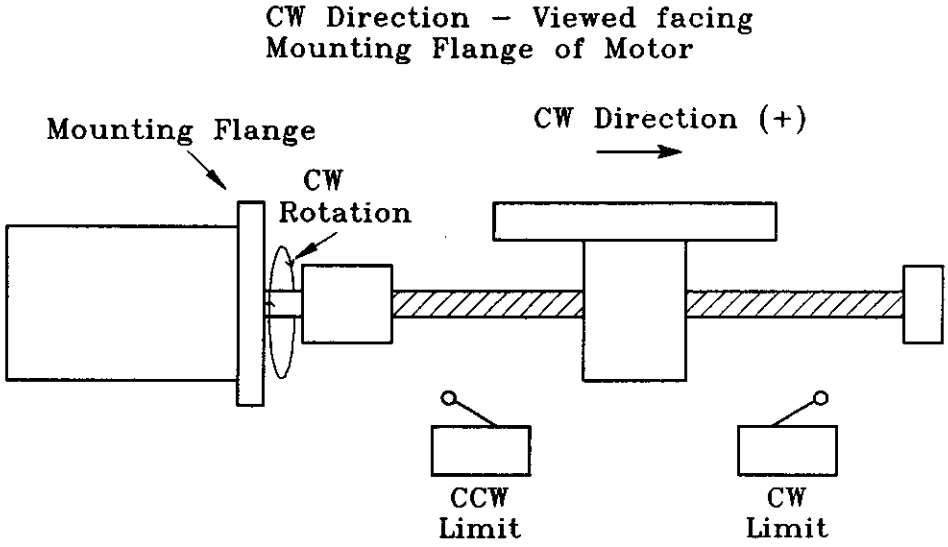


Figure 6-3: Limit Switch Direction

SECTION 6-3: HOME SWITCH POSITION

Most Aerotech Control systems are equipped with a cold-start reference point, which Aerotech refers to as the Home Position. This is the Machine Home and is a constant position depending on the marker location of a rotary or linear encoder.

When a Home command is issued, the motor will turn CCW (default) or CW (optional) until Home Limit Switch activation occurs, establishing the Home reference point. (Refer to the *Unidex 21 Programming Manual* for an explanation of the Home command and the *Unidex 21 User's Manual* for an explanation of Axis Parameters that affect motion to the Home Limit Switch position.) Upon Home Limit switch activation, the motor will reverse and rotate in the opposite direction until the Marker is encountered . (See the *Unidex 21 User's Manual* for an explanation of the Axis Parameters affecting the Home Limit Switch/Marker relationship.)

For most Rotary motion stages the Home Limit Switch is an independent switch and cam, incorporated into the system specifically for the Home cycle. When using a Linear motion stage, the CW or CCW Limit Switches may double as the Home Limit Switch. (See Section 6-4 of this Manual for Motor wiring details.)

Regardless of whether the Home reference point is established by a CW, CCW or Home Limit Switch, it's optimum position should be 1/2 revolution (± 1/4 revolution) from the location that the Switch opens (for a Normally Open type switch) to the leading edge of the marker pulse. (See Figure 6-3.)

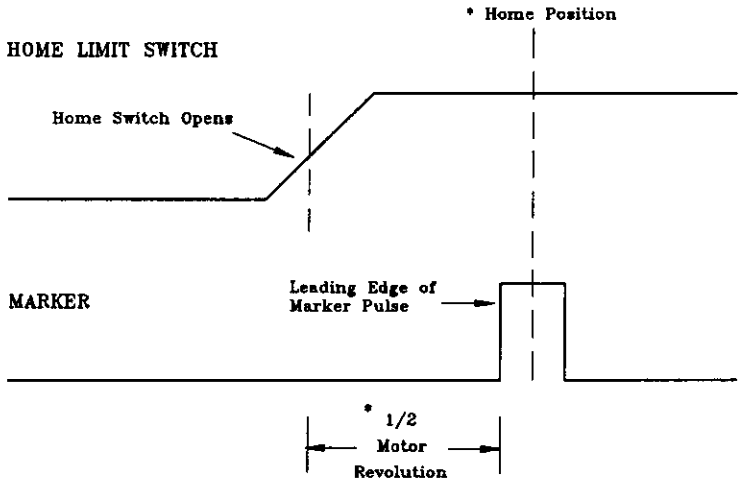


Figure 6-4: Home Switch Position

SECTION 6-4: MOTOR CONNECTIONS FOR HOME AND LIMIT SWITCHES

6-4-1: "BRUSH" TYPE DC SERVO MOTORS

6-4-2: "BRUSHLESS" TYPE AC SERVO MOTORS

CHAPTER 7: TRANSDUCER INTERFACE

Linear Encoders, Rotary Encoders, Resolvers, or Inductosyn ® type transducers may be used with the Unidex 21 Motion Controller to provide position feedback. The following Sections provide interface details for each transducer type.

SECTION 7-1: ENCODER INTERFACE

Linear and Rotary Encoders are interfaced to the Unidex 21 through the LINEAR ENC and the ENC/LMTS connectors. Phasing for the two types of Encoders is the same and is discussed in Section 7-1-1. Details concerning each of these connectors are provided in Sections 7-1-2 and 7-1-3.

7-1-1: ENCODER PHASING

Phasing for Encoders is as follows: as the Motor turns CW, the leading signal is the Cosine signal, the trailing signal is the Sine signal, and the Marker coincides with a positive Cosine signal (see Figure 7-1).

WARNING: **Improper phasing may cause a runaway condition which could result in personal injury or damage to the equipment.**

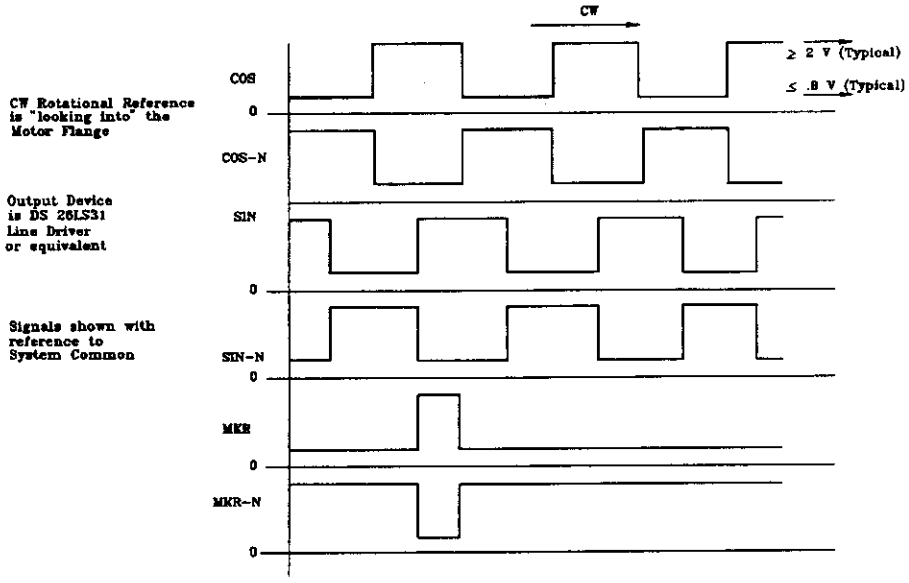
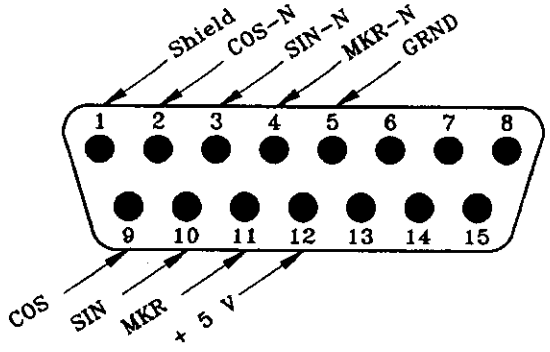


Figure 7-1: Encoder Signal Definition

7-1-2: LINEAR ENCODER INTERFACE (CONNECTORS P6, P8, P12 and P14)

The Linear Encoder Interface connectors provide for termination of basic control signals between the Unidex 21 and a Linear type Encoder. The Linear Encoder inputs are designed to accept complementary line driven Sine, Cosine and Marker signals.

A Linear Encoder connector is provided for each of the four axes. Details of a connector are shown in Figure 7-2. The Electrical Characteristics of a typical Linear Encoder input are shown in Figure 7-3. The four Encoder connectors are electrically the same.



PIN	DESCRIPTION
1	Linear Encoder Shield connection. Sent to Chassis Ground unless otherwise specified.
2	Inverse Cosine feedback from the Encoder to the DSP Board.
3	Inverse Sine feedback from the Encoder to the DSP Board
4	Inverse Marker pulse feedback from the Encoder to the DSP Board
5	Ground, common to all Encoder connectors
6,7,8,13,14,15	(Not Used)
9	Positive Cosine feedback from the Encoder to the DSP Board
10	Positive Sine feedback from the Encoder to the DSP Board
11	Positive Marker pulse feedback from the Encoder to the DSP Board
12	+5 V Input Common

Figure 7-2: LINEAR ENC Connector (P6,P8,P12 and P14)

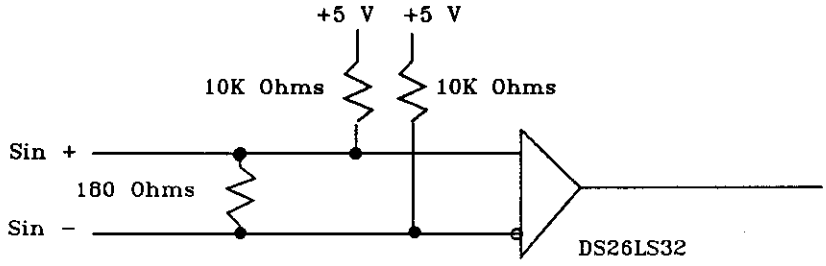


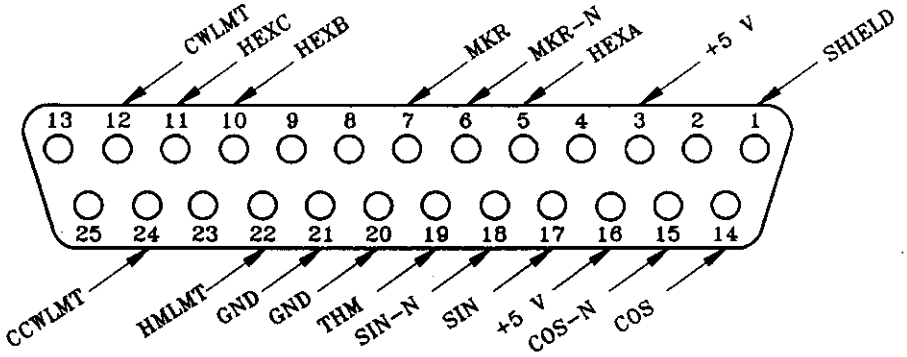
Figure 7-3: Electrical Characteristics of a Typical Linear Encoder Input

7-1-3: ENCODER/LIMIT INTERFACE (CONNECTORS P7, P9, P13 and P15)

The Encoder/Limit Interface connectors provide for termination of basic line driven control signals, optically isolated Motor travel limits, Motor commutation signals and Thermistor feedback.

An Encoder/Limit connector is provided for each of the four axes. Details of a connector are shown in Figure 7-4.

The Electrical Characteristics of a typical Limit Switch Input are shown in Figure 7-5. The four Encoder/Limit connectors are electrically the same.



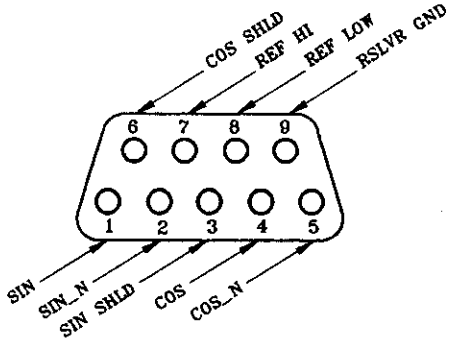
NOTE: **Refer to Chapter 6 of this manual for additional information concerning these inputs.**

Figure 7-4: ENC/LMTS Connector (P7,P9,P13,P15)

SECTION 7-2: RESOLVER INTERFACE

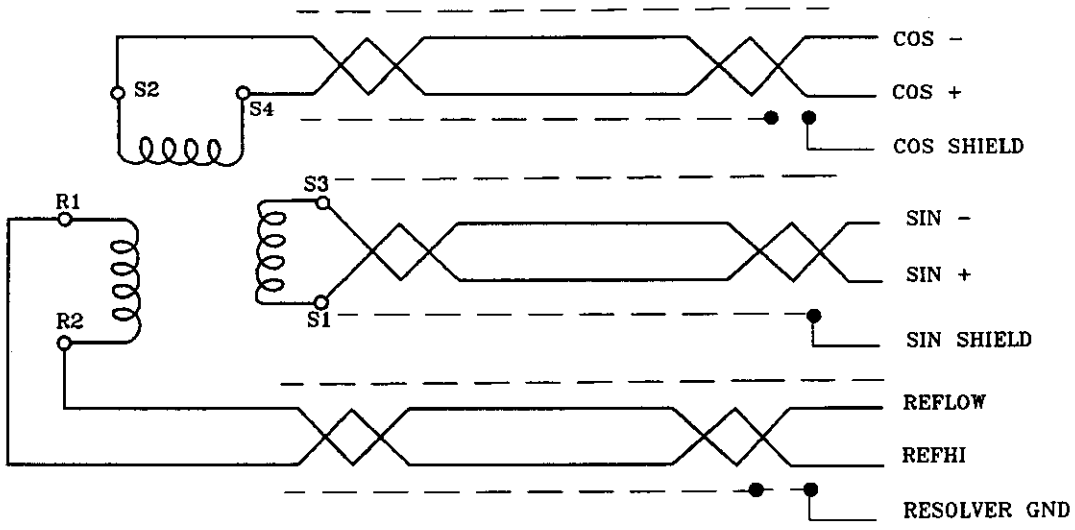
The Resolver Connectors (P42,P43,P44,P45) provide termination of control signals between the Unidex 21 and a Resolver or Inductosyn.

A Resolver Connector is provided for each of the four axes. Details of the Resolver Interface connector are shown in Figure 7-5. Electrical characteristics of the connector are shown in Figure 7-6. The four Resolver Connectors are electrically the same.



PIN	DESCRIPTION
1	Positive Sine feedback from the Resolver to the R/D Board
2	Inverse Sine feedback from the Resolver to the R/D Board
3	Sent to Ground on the R/D Board unless otherwise specified
4	Positive Cosine feedback from the Resolver to the R/D Board
5	Inverse Cosine feedback from the Resolver to the R/D Board
6	Sent to Ground on the R/D Board unless otherwise specified
7	Output signal from R/D Board to Resolver or Inductosyn
8	Output signal from R/D Board to Resolver or Inductosyn (Currently tied to Ground)
9	Chassis Ground

Figure 7-5: RESOLVER Connector (P42,P43,P44,P45)



(Twisted pair cables are recommended.)

Figure 7-6: Electrical Characteristics of the RESOLVER Connector (P42,P43,P44,P45)

CHAPTER 8: INDEXING BOARD INTERFACE

The Indexer Board may be interfaced through two sets of connectors, the IDX MST Connector and the IDX INPUT 1 and the IDX INPUT 2 Connectors. A third connector IDX PORT B is currently reserved for future Indexer Board interface requirements.

SECTION 8-1: INDEXING MST BUS INTERFACE (P35)

Details of the IDX MST BUS (P35) connector are shown in Figure 8-1. Electrical characteristics of the connector are illustrated in Figure 8-2.

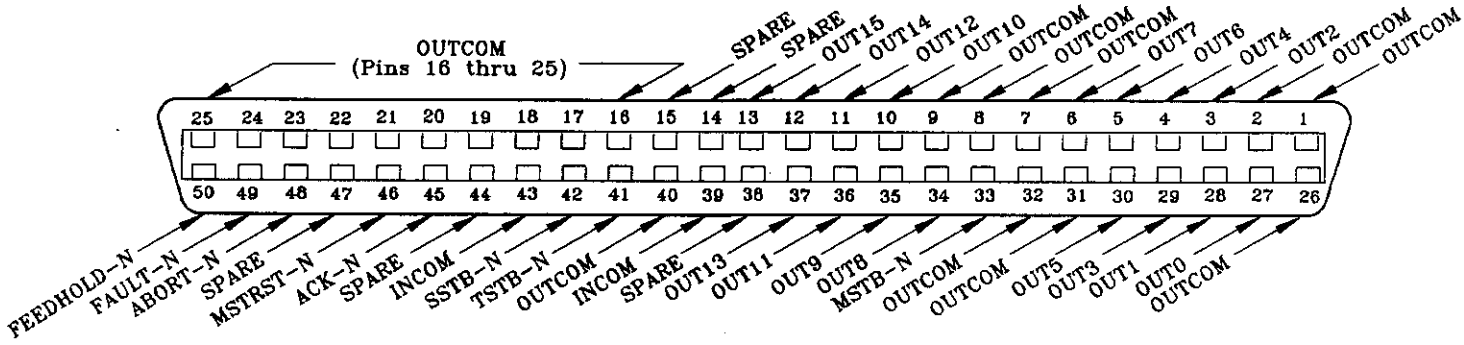


Figure 8-1: IDX MST BUS Connector (P35)

PIN	DESCRIPTION
1	Output Common *
2	Output Common *
3	Data Bit 2 Out
4	Data Bit 4 Out
5	Data Bit 6 Out
6	Data Bit 7 Out
7	Output Common *
8	Output Common *
9	Output Common *
10	Data Bit 10 Out
11	Data Bit 12 Out
12	Data Bit 14 Out
13	Data Bit 15 Out, Most Significant Bit
14,15,38,44	(Not Used)
16-26	Output Common *
27	Data Bit 0 Out, Least Significant Bit
28	Data Bit 1 Out
29	Data Bit 3 Out
30	Data Bit 5 Out
31	Output Common *
32	Output Common *
33	Qualifying output line for the M Strobe command signal. (See Chapter 6 of the *Unidex 21 User's Manual* for setting signal delay time.)
34	Data Bit 8 Out
35	Data Bit 9 Out
36	Data Bit 11 Out
37	Data Bit 13 Out
39	Input Common **
40	Output Common *
41	Qualifying output line for the T Strobe command signal. (See Chapter 6 of the *Unidex 21 User's Manual* for setting signal delay time.)

PIN	DESCRIPTION
42	Qualifying output line for the S Strobe command signal. (See Chapter 6 of the *Unidex 21 User's Manual* for setting signal delay time.)
43	Input Common **
45	Input line for the M, S and T Acknowledge Signal. (See Chapter 6 of the *Unidex 21 User's Manual* for setting Acknowledge delay time.)
46	Output signal derived from a Power Up or Front Panel System Reset to clear peripheral devices to their initial state.
47	(Not used)
48	(Not determined)
49	(Not Determined)
50	(Not Determined)

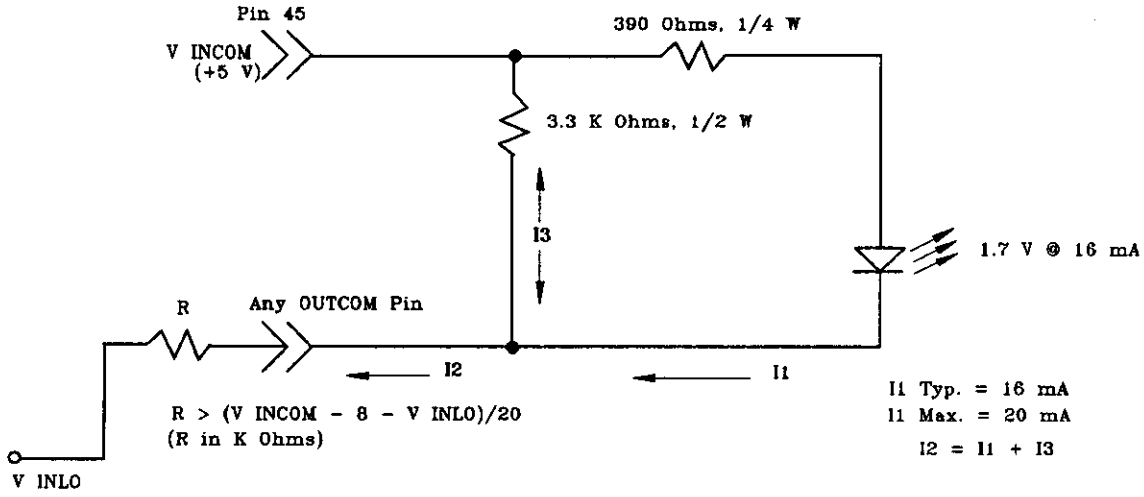
* Output Common is shared by all Indexing Board Outputs

** Input Common is shared by all Indexing Board Inputs.

ACK-N, ABORT-N, FAULT-N, FEEDHOLD-N (TLP621-4 Opto Coupler Input)

Example:

ACK-N (Typical for FAULT-N & FEEDHOLD-N)



EXAMPLE:

TTL Inputs

V INCOM = +5 V
I2 = 9 mA
R = 0

D0 THRU D15, MSTB-N, TSTB-N, SSTB-N & MSTRST-N OUTPUTS

Example:

D0 (Typical for D1 thru D15, MSTB-N, TSTB-N, SSTB-N & MSTRST-N)

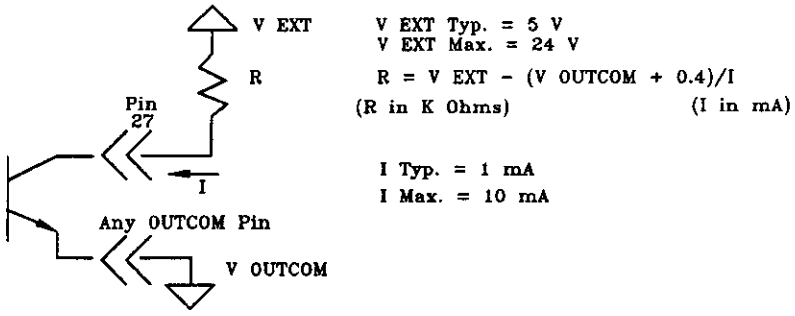
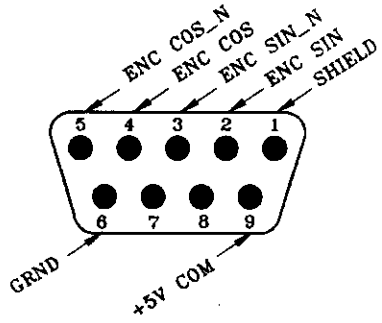


Figure 8-2: Electrical Characteristics of IDX MST Input Connector (P35)

SECTION 8-2: INDEXING INPUT 1 AND INDEXING INPUT 2 INTERFACE (P40,P41)

The IDX INP 1 and IDX INP 2 Connectors (P40 and P41) may be used to interface to Quadrature, CLK/DIR or CW/CCW type Transducers or to provide Handwheel or Auto-Focus Input. Refer to the *Unidex 21 User's Manual* for Parameter settings affecting the use of the IDX INP 1 and IDX INP 2 Connectors. The IDX INP 1 and IDX INP 2 Connectors are electrically identical.

Details of the IDX INP 1 and IDX INP 2 Connectors are shown in Figure 8-3. Electrical characteristics of the connectors are shown in Figure 8-4.



PIN	DESCRIPTION
1	Shield Connection (Sent to Chassis Ground unless otherwise specified.)
2	Encoder Sine Phase Input
3	Inverse Encoder Sine Phase Input
4	Encoder Cosine Phase Input
5	Inverse Encoder Cosine Input
6	Ground
7,8	(Not Used)
9	+5 V Input Common

Figure 8-3: IDX INP 1 and IDX INP 2 Connector (P40 and P41)

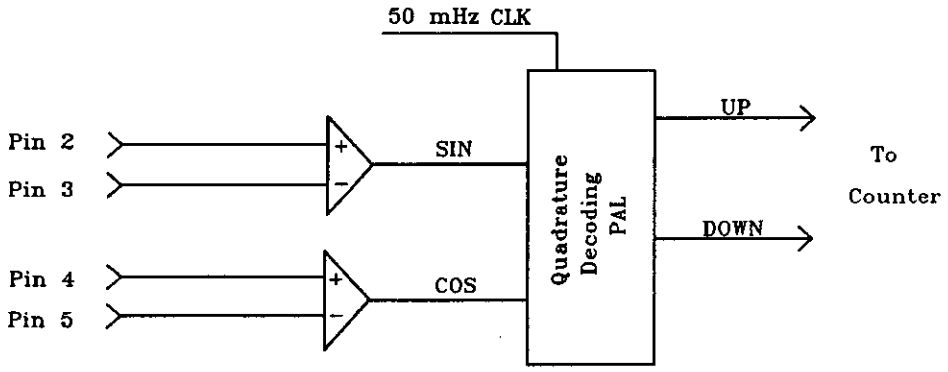


Figure 8-4: Electrical Characteristics of the IDX INP 1 and IDX INP 2 Connectors (P40 and P41)

CHAPTER 9: IEEE-488 INTERFACE

The Unidex 21's IEEE-488 interface connector (P11) permits a host computer to interactively control a Unidex 21. (Refer to the *Unidex 21 User's Manual*, Chapter 6 for Parameter settings affecting the use of the IEEE-488 Interface.)

IEEE-488 contains 8 data lines and 8 control lines. It can accomodate up to 14 devices and provides a Service Request line from all devices to the Bus Controller.

Details of the IEEE-488 connector are shown in Figure 9-1. Configurations for multiple device connections to the IEEE-488 Interface are illustrated in Figure 9-2.

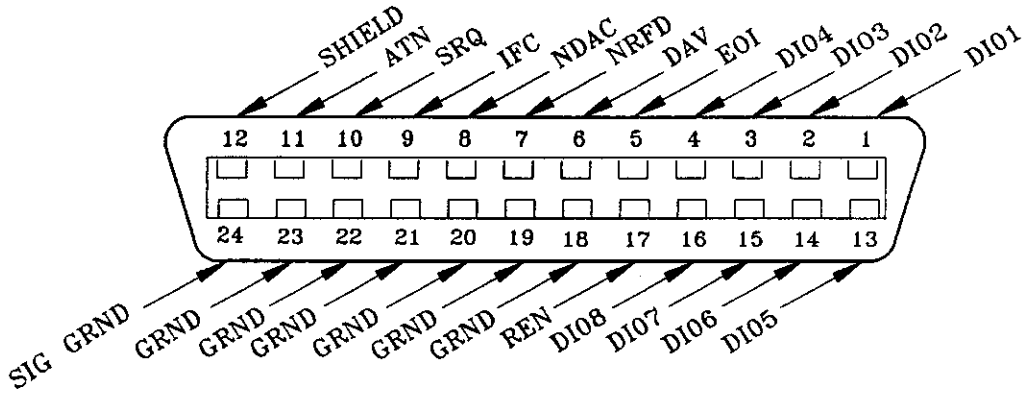


Figure 9-1: IEEE-488 Connector (P11)

PIN	DESCRIPTION
1,2,3,4 13,14,15,16	Used for sending data (ATN lines false) or bus interface messages (ATN line true)
5	End or Identify, once asserted indicates the termination of data flow. Asserted when the last data byte is placed on the Bus.
6	Data Valid, asserted by the Talker to indicate to all Listeners that data on the Bus is valid.
7	Not Ready For Data, when true, indicates to Talker that all Listeners are not ready for data.
8	Not Data Accepted, when true indicates to the Talker that all Listeners have not accepted the data placed on the Bus
9	Interface Clear, asserted only by the System Controller to place all devices in the unaddressed state. Devices go into the Talker idle, Listener state. If control has been passed to another device, the System Controller again becomes active by asserting IFC.
10	Service Request, asserted by a device to indicate a need for interaction with the Controller.
11	Attention, asserted true by active Controller to send Bus interface messages. When ATN is asserted, signals on the data lines are interpreted as messages. ATN asserted with EOI does a Parallel Poll. When ATN is false, data may be sent over the Bus by a designated Talker.

PIN	DESCRIPTION
12	Shield
17	Remote Enable, remotely asserted to program devices on the Bus. Any device addressed to listen while REN is true, is placed in the Remote Mode of operation.
18	Ground (Twisted Pair with DAV)
19	Ground (Twisted Pair with NRFD)
20	Ground (Twisted Pair with NDAC)
21	Ground (Twisted Pair with IFC)
22	Ground (Twisted Pair with SRQ)
23	Ground (Twisted Pair with ATN)
24	Signal Ground

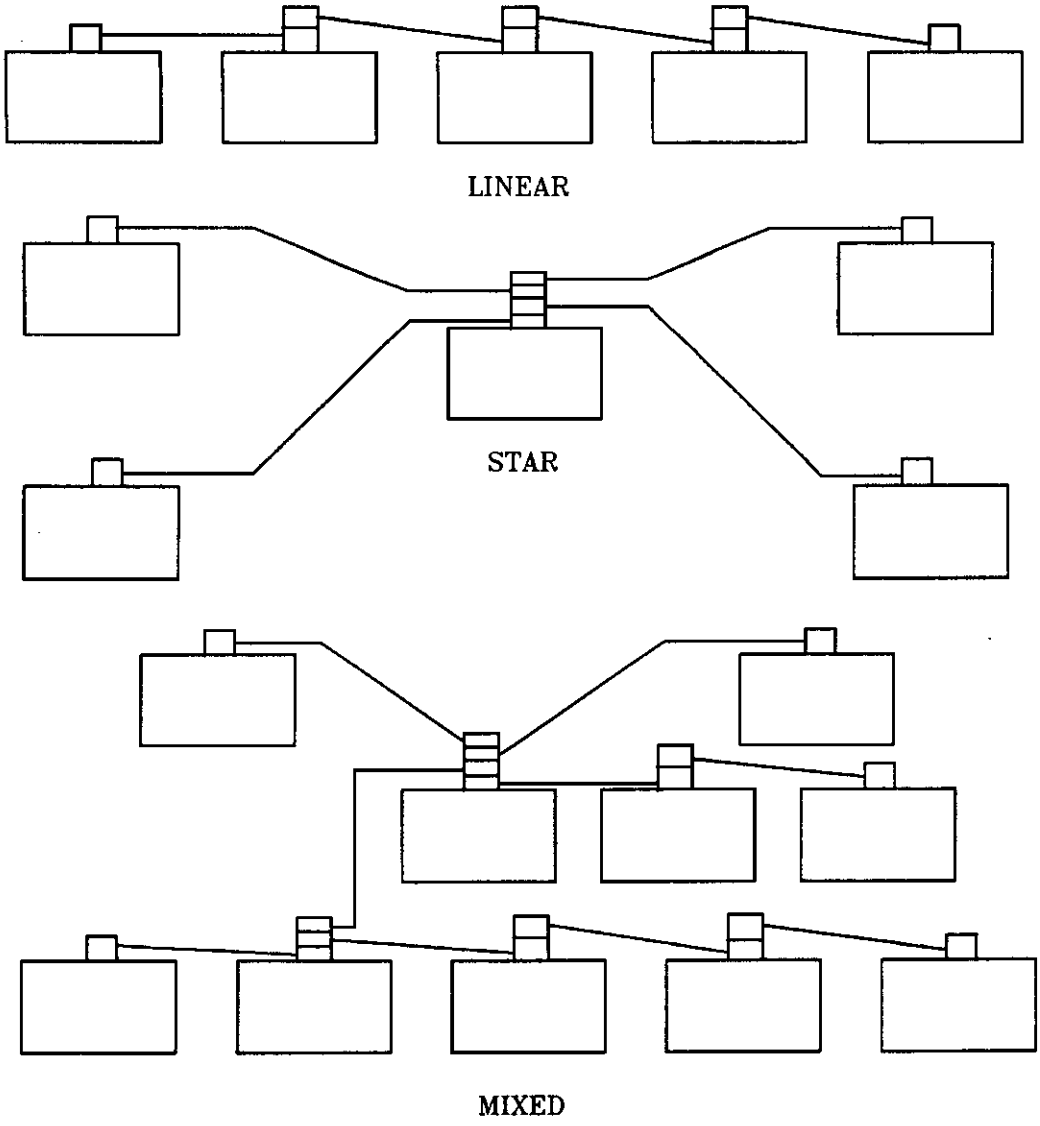


Figure 9-2: IEEE-488 Cabling Configurations

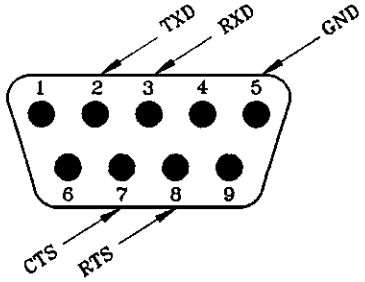
CHAPTER 10: SERIAL ASYNCHRONOUS COMMUNICATION

SECTION 10-1: PORT A, PORT B AND TERMINAL INTERFACE

PORT A and PORT B (P30 and P29) provide a RS-232 interface to accommodate communication between the Unidex 21 and peripheral devices such as a Host Computer, Printer, Slave Controller, etc. (Refer to the *Unidex 21 User's Manual*, Chapter 6, for Parameter settings affecting Port A and Port B communication.)

The TERMINAL Connector (P21) is also an RS-232 interface, however, it is dedicated solely to provide interface to a TeleVideo 905 Video Display Terminal. (Refer to the *Unidex 21 User's Manual* for Parameter settings affecting Terminal use.)

Details of the PORT A, PORT B and TERMINAL Connectors are shown in Figure 10-1. Electrical characteristics of the connectors are illustrated in Figure 10-2.



PIN	DESCRIPTION
1,4,6,9	(Not Used)
2	Transmit Data, Unidex 21 Output, transfers data to an RS-232 device
3	Receive Data, Unidex 21 Input, accepts input data from an RS-232 device
5	Ground
7	Clear to Send, Unidex 21 Input, goes high when RS-232 device is ready to receive data
8	Request to Send Data, Unidex 21 Output, sends a request signal to the RS-232 device to initiate sending

Figure 10-1: PORT A, PORT B and TERMINAL Connector (P30, P29, and P21)

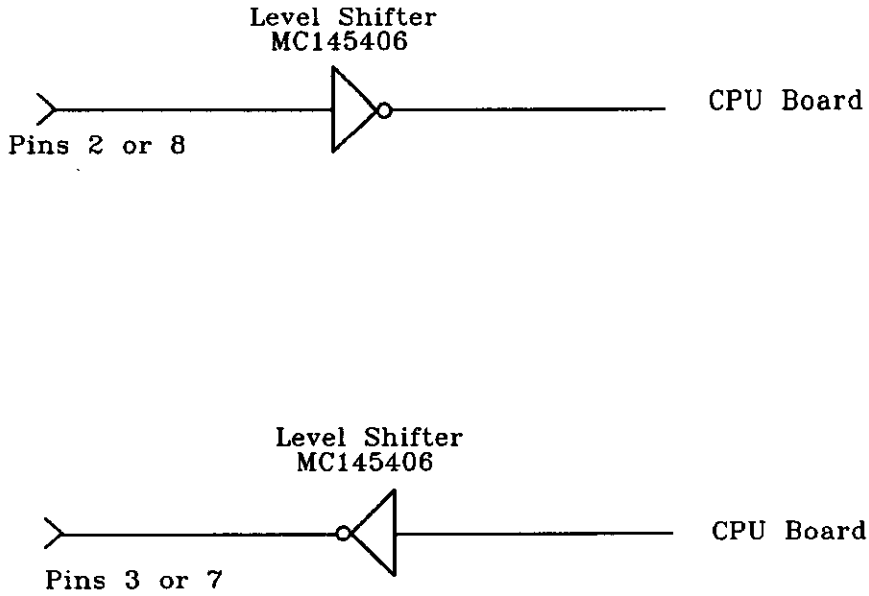
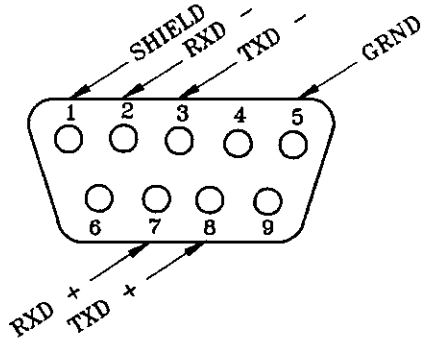


Figure 10-2: Electrical Characteristics of the PORT A, PORT B and TERMINAL Connectors (P30, P29 and P21)

SECTION 10-2: SERIAL COMMUNICATION INTERFACE

The SCI Connector (P32) provides for full Asynchronous Serial capability from the Unidex 21's DSP Boards to other DSP Boards, Microproccessors or periperals. These ports support standard bit rates (9600, 4800, 1200, and 300 bits/second), and protocols (1 start, 8 data, even/odd parity, 1 stop).

Details of the SCI Connector are shown in Figure 10-3. Electrical characteristics of the connector are illustrated in Figure 10-4.



PIN	DESCRIPTION
1	Shield
2	Receive Data (Inverse), accepts input data from a RS-232 device
3	Transmit Data (Inverse), transfers data to a RS-232 device
4,6,9	(Not Used)
5	Ground
7	Receive Data (Positive), accepts input data from a RS-232 device
8	Transmit Data (Positive), transfers data to a RS-232 device

Figure 10-3: SCI Connector (P32)

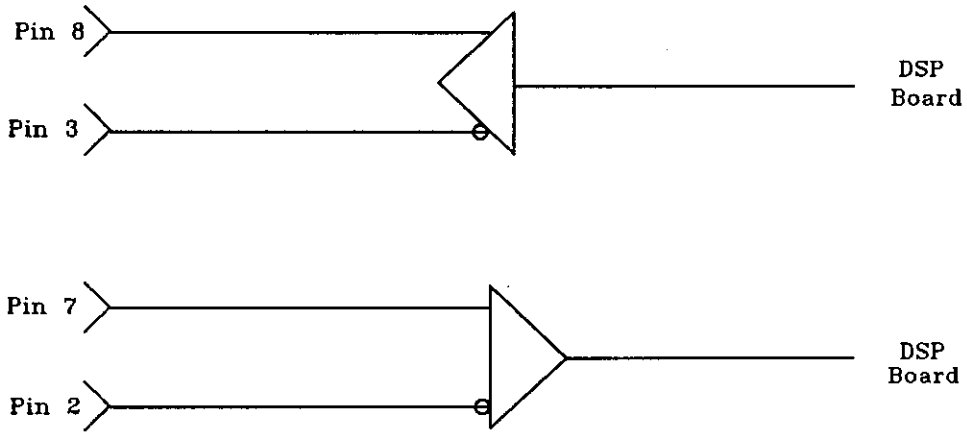


Figure 10-4: Electrical Characteristics of the SCI Connector (P32)

CHAPTER 11: SYNCHRONOUS SERIAL INTERFACE

The SSI Connector (P31) provides for communication with a variety of Synchronous Serial devices including industry-standard Codecs, Serial Peripherals (A/D, D/A) and Shift Registers. Data can be transmitted at a maximum of 5 million bits/second with word lengths of 8, 12, 16, or 24 bits.

NOTE: The SSI Connector does not currently support Customer interface.

Details of the SSI Connector are shown in Figure 11-1. Electrical characteristics are illustrated in Figure 11-2.

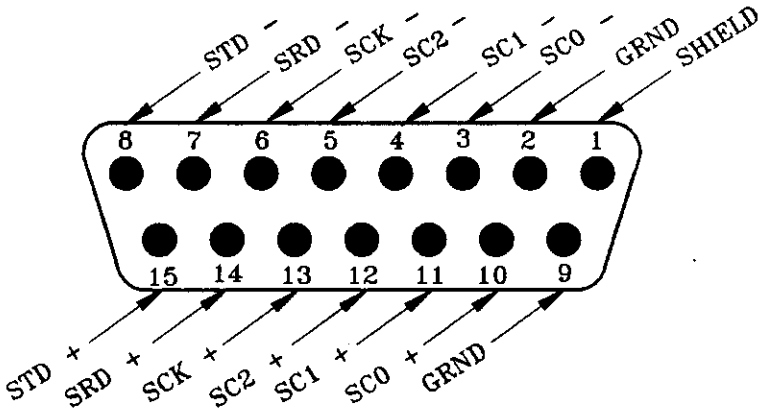


Figure 11-1: SSI Connector (P31)

PIN	DESCRIPTION
1	Shield
2	Ground
3	Serial Control Zero (Inverse), used for Serial Flag I/O such as is required in multiple device addressing
4	Serial Control One (Inverse), used for Serial Flag I/O such as is required in multiple device addressing
5	Serial Control Two (Inverse), generates the Frame Sync I/O Signal
6	Serial Clock (Inverse), clock output to the Receiver
7	Serial Receive Data (Inverse), receives Serial data and transfers data to Serial Shift Register
8	Serial Transmit Data (Inverse), transmits data from the Serial Transmit Shift Register
9	Ground
10	Serial Control Zero (Positive), used for Serial Flag I/O such as is required in multiple device addressing
11	Serial Control One (Positive), used for Serial Flag I/O such as is required in multiple device addressing
12	Serial Control Two (Positive), generates the Frame Sync I/O Signal
13	Serial Clock (Positive), clock output to the Receiver
14	Serial Receive Data (Positive), receives Serial data and transfers data to Serial Shift Register
15	Serial Transmit Data (Positive), transmits data from the Serial Transmit Shift Register
16 through 25	(Not Used)

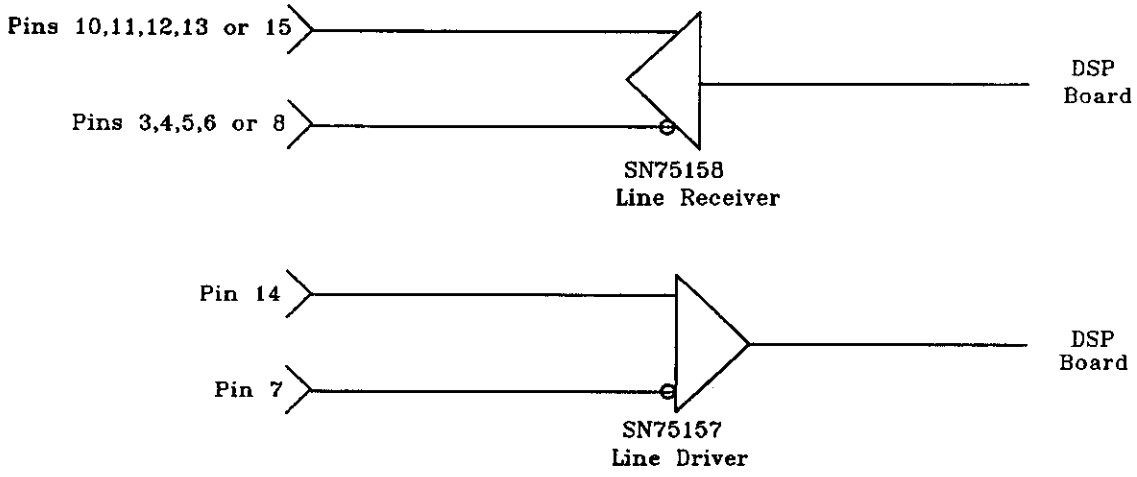


Figure 11-2: Electrical Characteristics of the SSI Connector (P31)

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CHAPTER 12: EGA MONITOR INTERFACE

An EGA Monitor may be interfaced to a Unidex 21 (equipped with an optional CRT Board) through the EGA OUT Connector (P16).

Details of the EGA OUT Connector are shown in Figure 12-1. Electrical characteristics are shown in Figure 12-2.

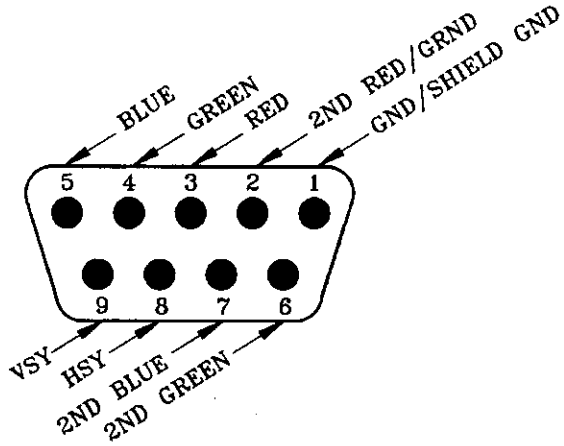

Figure 12-1: EGA OUTPT Connector (P16)

PIN	DESCRIPTION
1	Provides Shield Ground for EGA Monitors with only Red, Green, and Blue Signals or Signal Ground for EGA Monitors also having secondary Red, Green and Blue Signals (Selectable by Jumper JP2 of the Front Panel Board - See Chapter 3 of this Manual)
2	Provides Signal Ground for EGA Monitors with only Red, Green and Blue Signals or carries the Secondary Red line of an EGA Monitor equipped with secondary Red, Green and Blue Signals. (Selectable by Jumper JP3 of the Front Panel Board - See Chapter 3 of this Manual)
3	Primary Red Signal
4	Primary Green Signal
5	Primary Blue Signal
6	Secondary Green Signal
7	Secondary Blue Signal
8	Horizontal Signal Adjustment
9	Vertical Signal Adjustment

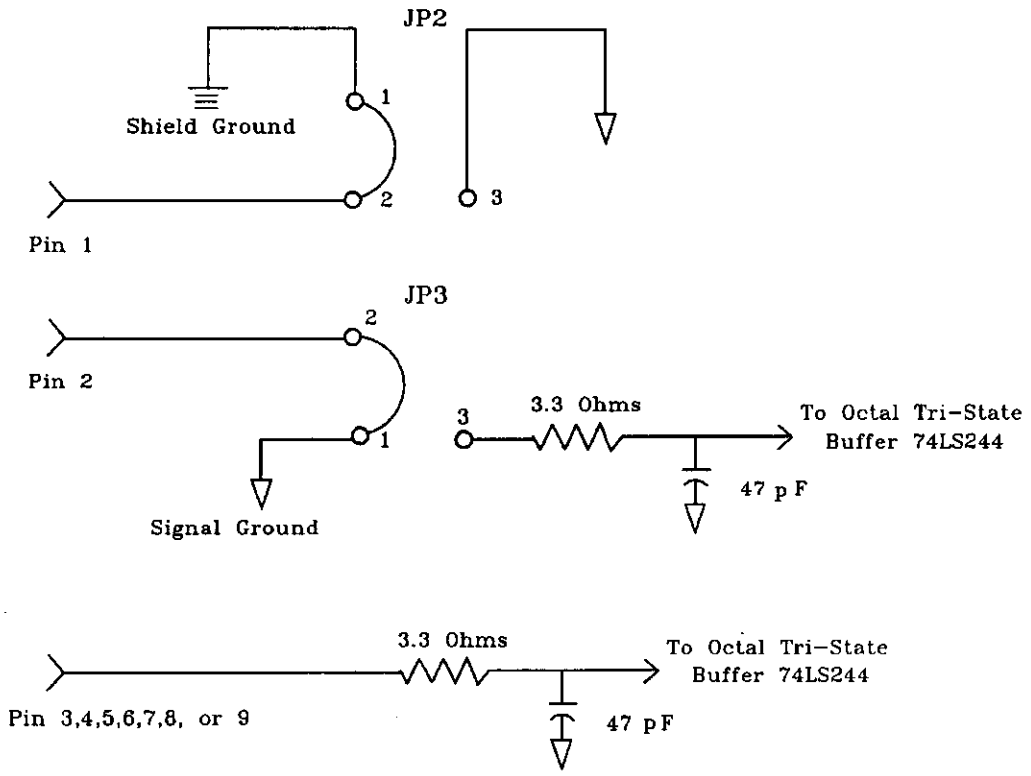

Figure 12-2: Electrical Characteristics of the EGA OUTPT Connector (P16)

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CHAPTER 13: I/O INTERFACE

SECTION 13-1: CPU I/O CONNECTOR(P22)

Details of the general purpose CPU I/O connector are shown in Figure 13-1. This connector provides up to 8 outputs and 16 inputs, all of which are opto-coupled. When used with the OPTO 22 I/O mounting rack assemblies (or equivalent) the Model OPC interconnection cable (standard 5 ft. length) provides a direct mating between the 50-pin Champ style connector and the edge connector on the OPTO board. Opto 22 Models PB8, PB16 and PB24 (or equivalent) may be utilized to provide either 8 outputs, 8 outputs/8 inputs, or 8 outputs/16 inputs with OPC interconnection. Other combinations are available with special cabling.

Electrical characteristics of the connector are illustrated in Figure 13-2. In order to provide optimum noise immunity, a seperate Power Supply must be used.

Table 13-1 lists the standard I/O interconnection between the Unidex 21 and the I/O mounting rack assemblies. Figure 13-3 illustrates OPTO 22 I/O mounting rack assembly wiring and jumper placement. These jumpers are essential so that an external +5V may be routed back to the Unidex 21's opto couplers.

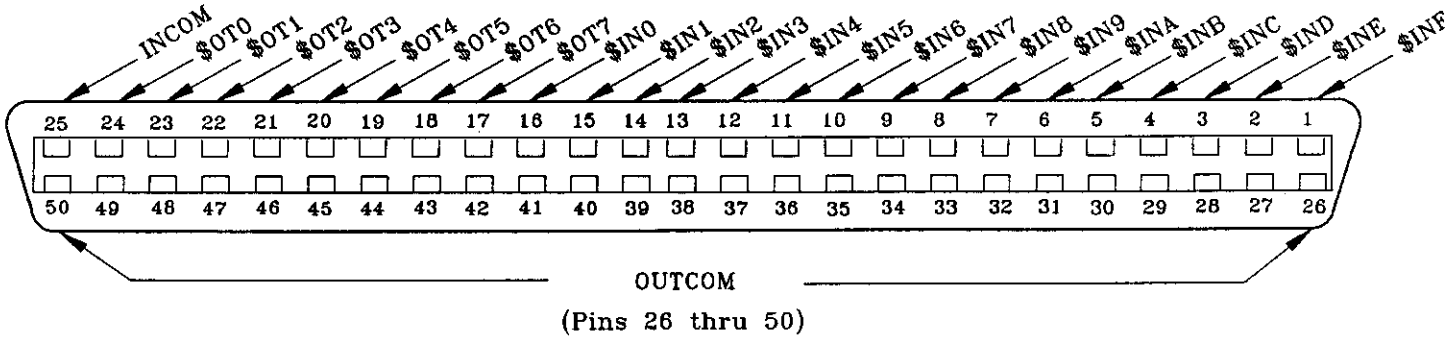
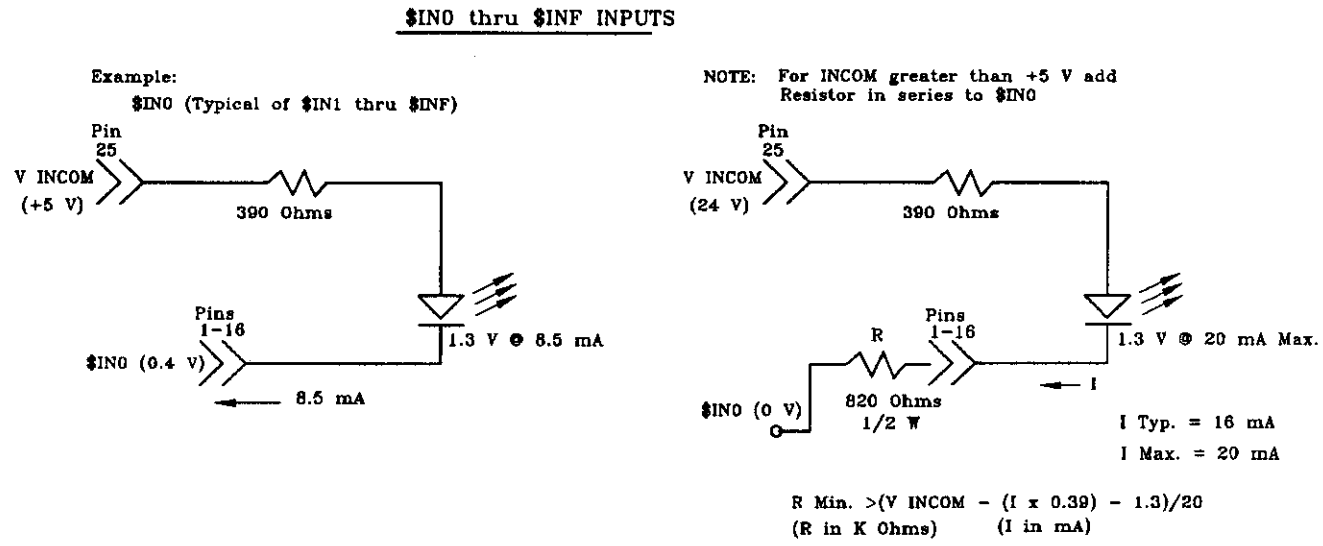


Figure 13-1: General Purpose CPU I/O Connector (P22)

PIN	DESCRIPTION
1	Data Input Bit 15, Address $INF
2	Data Input Bit 14, Address $INE
3	Data Input Bit 13, Address $IND
4	Data Input Bit 12, Address $INC
5	Data Input Bit 11, Address $INB
6	Data Input Bit 10, Address $INA
7	Data Input Bit 9, Address $IN9
8	Data Input Bit 8, Address $IN8
9	Data Input Bit 7, Address $IN7
10	Data Input Bit 6, Address $IN6
11	Data Input Bit 5, Address $IN5
12	Data Input Bit 4, Address $IN4
13	Data Input Bit 3, Address $IN3
14	Data Input Bit 2, Address $IN2
15	Data Input Bit 1, Address $IN1
16	Data Input Bit 0, Address $IN0
17	Data Output Bit 7, Address $OT7
18	Data Output Bit 6, Address $OT6
19	Data Output Bit 5, Address $OT5
20	Data Output Bit 4, Address $OT4
21	Data Output Bit 3, Address $OT3
22	Data Output Bit 2, Address $OT2
23	Data Output Bit 1, Address $OT1
24	Data Output Bit 0, Address $OT0
25	Input Common (5V Typical)
26 thru 50	Output Common (Grnd. Typical)

Sample Output Command: $OT0 = H,01 or $OT0 = H,00

Sample Input Command: (JUMP, ENT1, $IN0.EQ.H, 01)



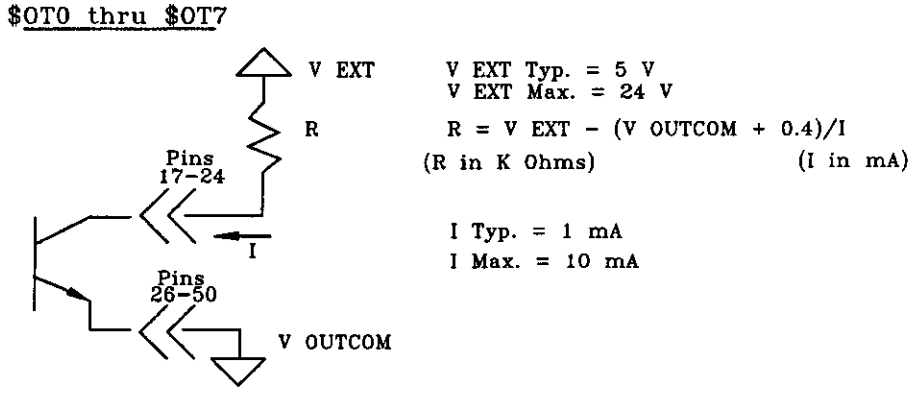
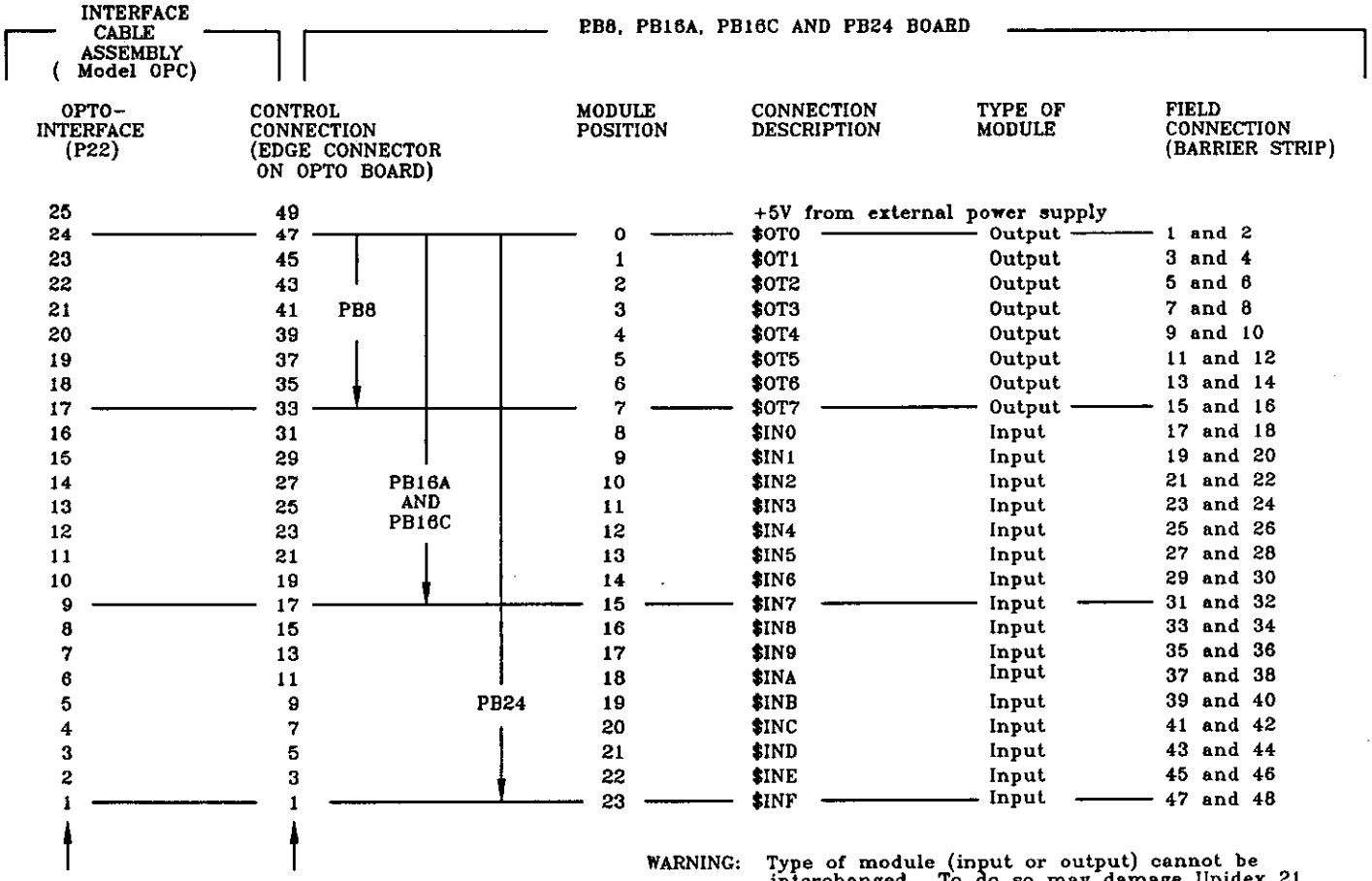


Figure 13-2: Electrical Characteristics of CPU I/O (P22)



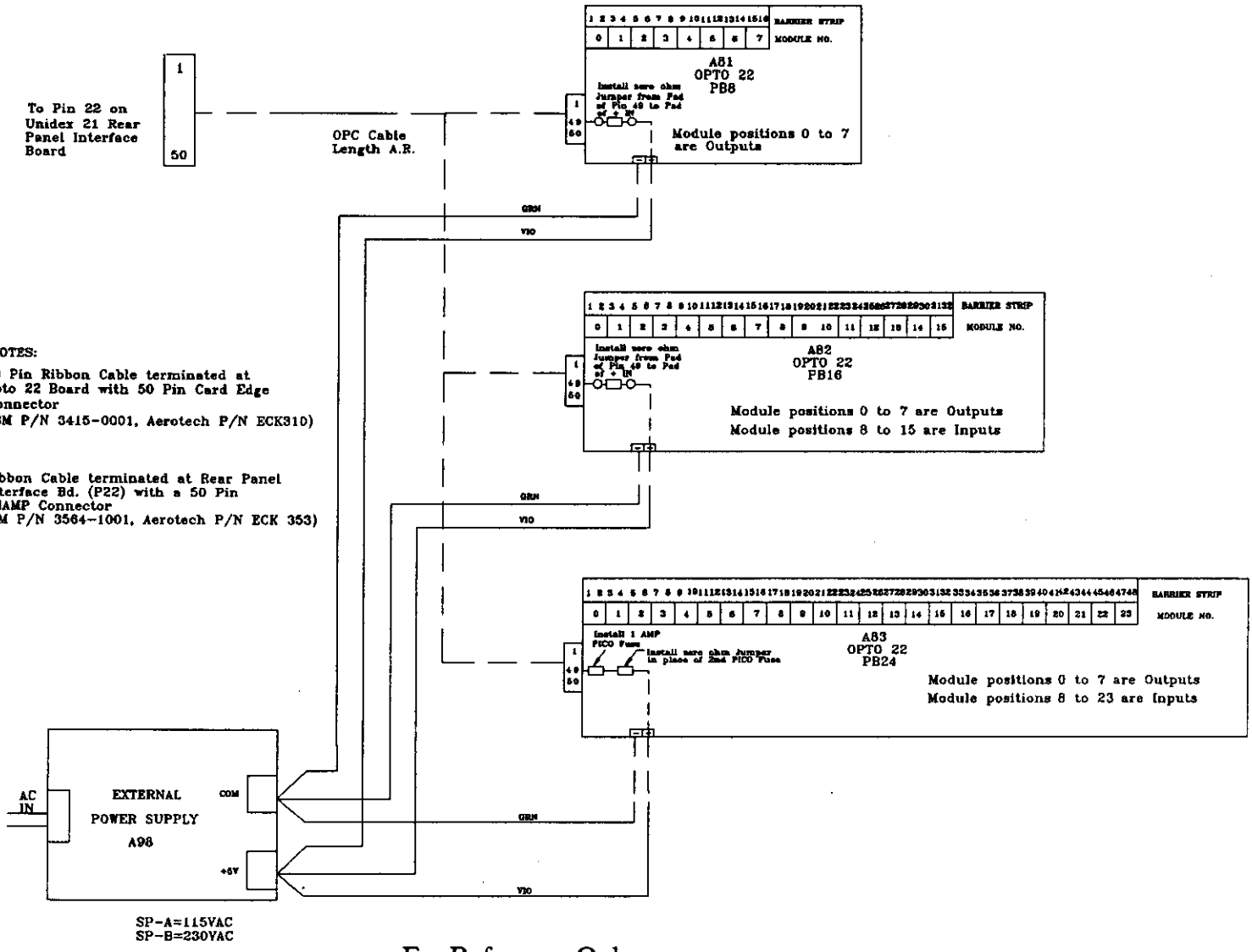
Typical Modules: IDC5, IDC5B, IAC5, IAC5A
ODC5, ODC5A, OAC5, OAC5A

WARNING: Type of module (input or output) cannot be interchanged. To do so may damage Unidex 21.

NOTE: +5 volt connection on Pin 25 (P22) or Pin 49 of edge connector is required when using PB8, PB16 and PB24.

This should be supplied from an external power supply and requires Opto rack jumper insertion as per Figure 13-3.

Table 13-1: Interconnection Diagram of PB8, PB16A or C, or PB24 I/O Board



For Reference Only

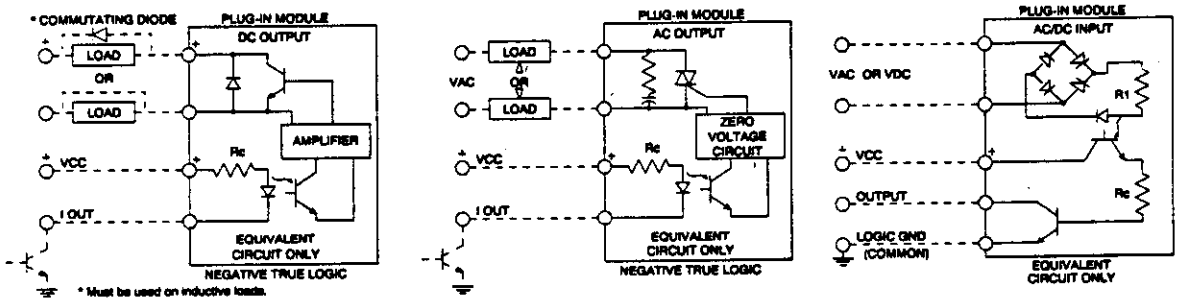


Figure 13-3: Unidex 21 CPU OPTO 22 I/O

SECTION 13-2: MISCELLANEOUS I/O

Details of the MISC I/O connector are shown in Figure 13-4. Electrical characteristics of the connector are shown in Figure 13-5.

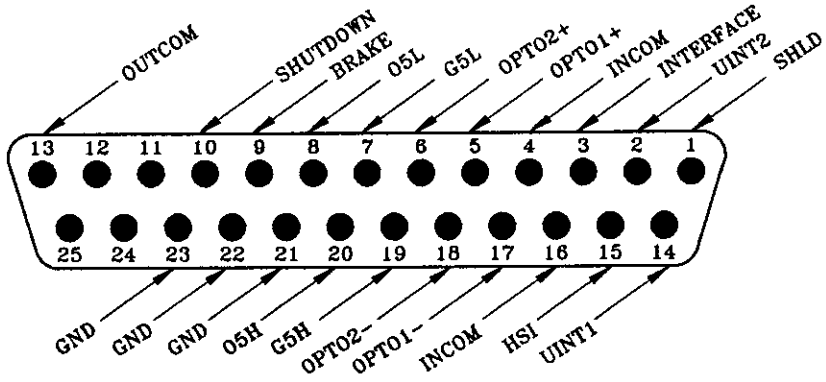
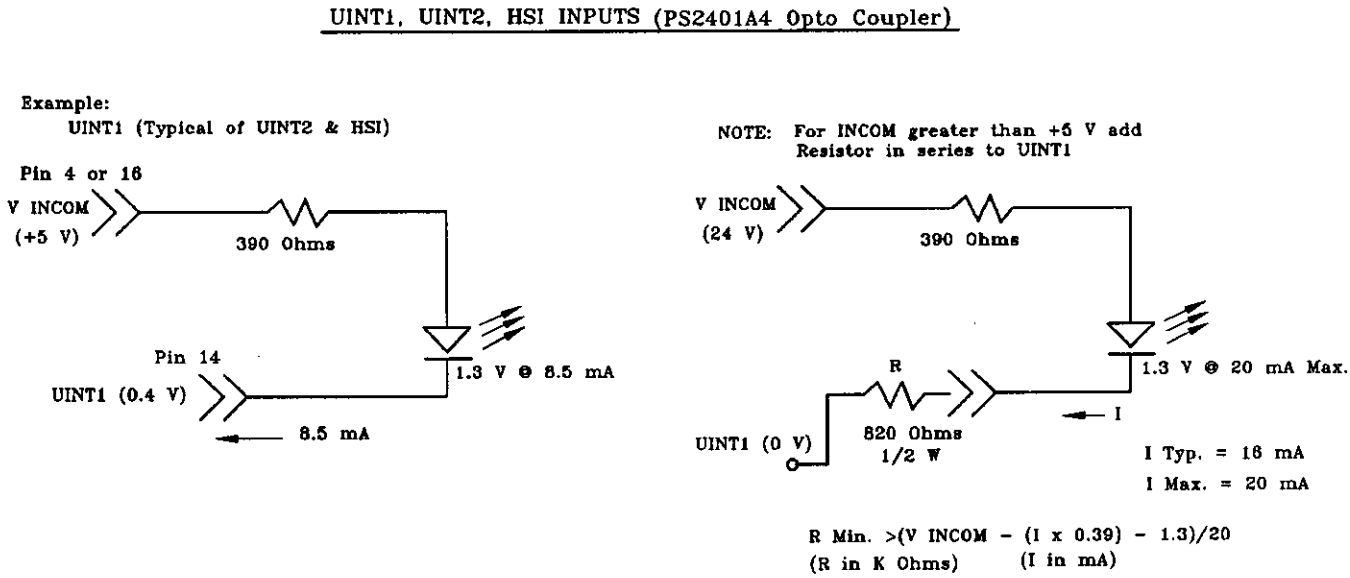


Figure 13-4: MISC I/O Connector (P23)

PIN	DESCRIPTION
1	Shield
2	User Interrupt 2 Input to CPU Board. Activates an established Interrupt routine.
3	Interface, used in conjunction with High Speed Interrupt Memory allocation.
4	Input Common, used in conjunction with High Speed Interrupt and User Interrupts 1 and 2*.
5	Fast Feedhold Positive Opto 1 Interrupt Input to DSP
6	Position Grabbing, Positive Opto 2 Interrupt Input to DSP
7	Not Determined
8	Not Determined
9	DSP Output activates Brake In Fault condition.
10	Monitors Brake Interlock, provides DSP Input to activate shutdown if Brake not connected.
11,12,24,25	(Not Used)
13	Output Common, used in conjunction with "Interface" (Pin3) * *
14	User Interrupt 2 Input to CPU Board. Activates an established Interrupt routine.
15	High Speed Interrupt for data collection
16	Input Common, used in conjunction with High Speed Interrupt and User Interrupts 1 and 2 *.
17	Fast Feedhold Negative Opto 1 Interrupt Input to DSP
18	Position Grabbing, Negative Opto 2 Interrupt Input to DSP
19	Not Determined
20	Not Determined
21,22,23	Ground

* IN COM is shared by all CPU Inputs and Interrupts

** OUT COMM is shared by all CPU Outputs and Interfaces



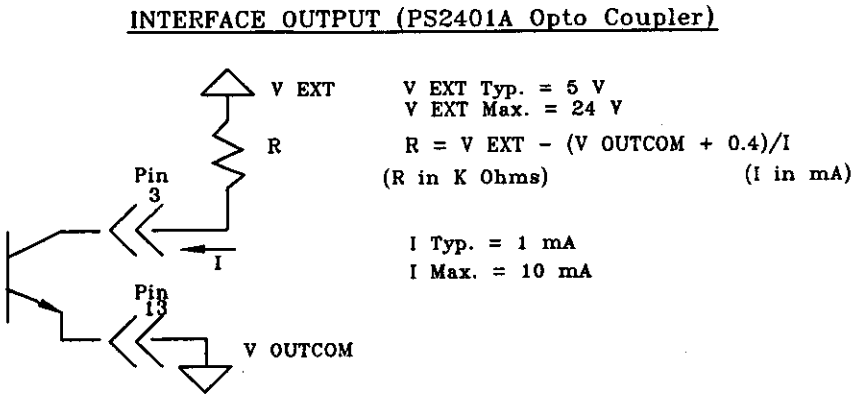


Figure 13-5: Electrical Characteristics of MISC I/O Connector (P35)

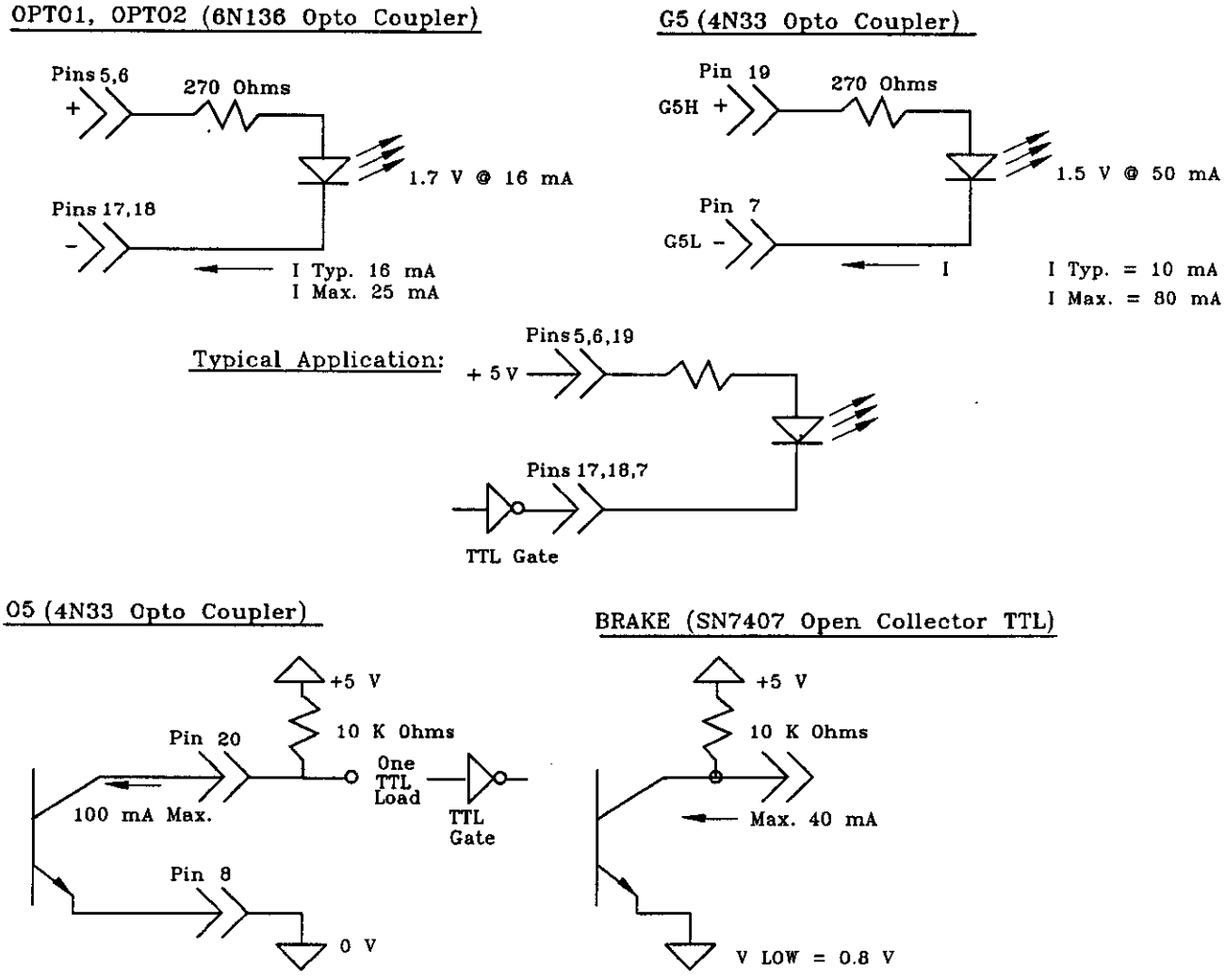
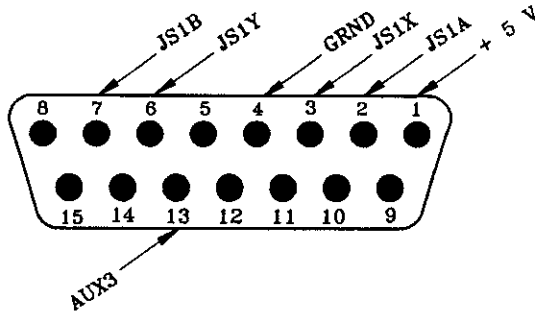


Figure 13-5Con't .: Electrical Characteristics of MISC I/O Connector (P35)

CHAPTER 14: JOYSTICK INTERFACE

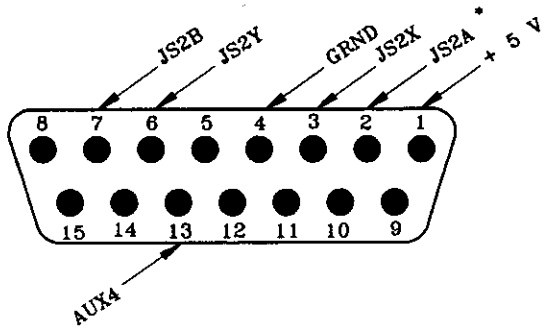
The Unidex 21 is configured to accommodate two optional JBV Joysticks.

Details of the Joystick 1 and Joystick 2 connectors (P34 and P25) are shown in Figure 14-1 and 14-2. Electrical characteristics of the connector are shown in Figure 14-3.



PIN	DESCRIPTION
1	+ 5V Input Common
2	Joystick Pushbutton "A" signal for axis grouping
3	Velocity control line for Axis 1 (as designated by Pushbutton "A")
4	Ground
5,8,9,10,11,12,14,15	(Not Used)
6	Velocity control line for Axis 2 (as designated by Pushbutton "A")
7	Joystick Pushbuton "B" signal for Joystic/Axis speed ratio
13	Receives signal upon Power Up from XY Potentiometers to provide Joystick "zero" position

Figure 14-1: JOYSTICK 1 Connector (P34)

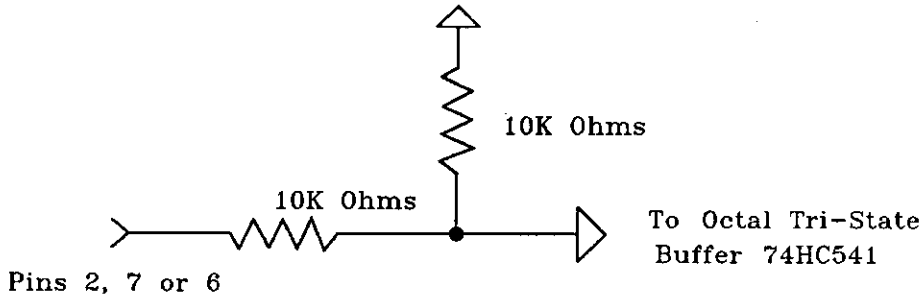


PIN	DESCRIPTION
1	+ 5V Input Common
2	Joystick Pushbutton "A" signal for axis grouping
3	Velocity control line for Axis 3 (as designated by Pushbutton "A")
4	Ground
5,8,9,10,11,12,14,15	(Not Used)
6	Velocity control line for Axis 4 (as designated by Pushbutton "A")
7	Joystick Pushbuton "B" signal for Joystic/Axis speed ratio
13	Receives signal upon Power Up from XY Potentiometers providing Joystick "zero" position

*** NOTE: When the Unidex 21 is used in the Teach Mode (Refer to the RECO command in the Unidex 21 Programming Manual) Pin 2 of the Joystick 2 Connector may be used to supply a hardware input signal from a triggering device to enable or disable position recording.**

Figure 14-2: JOYSTICK 2 Connector (P25)

Input Example:
JOYSTICK 1 Connector
(Typical of JOYSTICK 2 Connector)



Output Example:
JOYSTICK 1 Connector
(Typical of JOYSTICK 2 Connector)

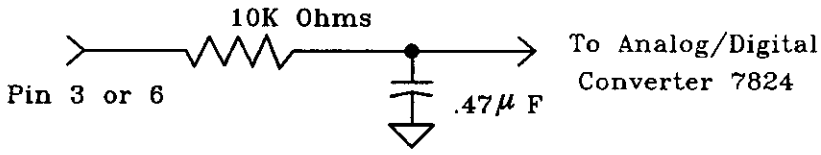


Figure 14-3: Electrical Characteristics of JOYSTICK 1 and 2 Connectors (P34 and P25)

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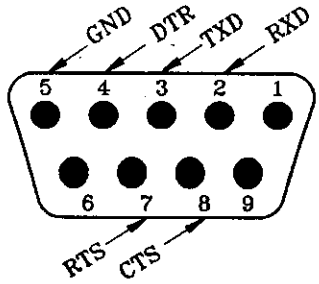
CHAPTER 15: TRACKBALL INTERFACE

A Trackball may be interfaced to the Unidex 21 to be used for manual positioning. The Trackball Connector (P33) is in RS-232 format.

Details of the Trackball Connector are shown in Figure 15-1. Electrical characteristics of the connector are shown in Figure 15-2.



PIN	DESCRIPTION
1,6,9	(Not Used)
2	Receive Data
3	Transmit Data
4	Data Terminal Ready
5	Ground
7	Request to Send
8	Clear to Send

Figure 15-1: TRACKBALL Connector (P33)

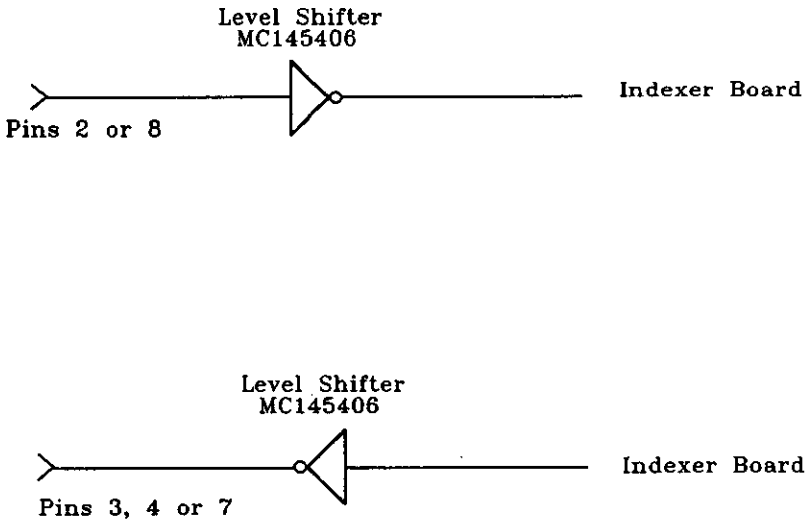
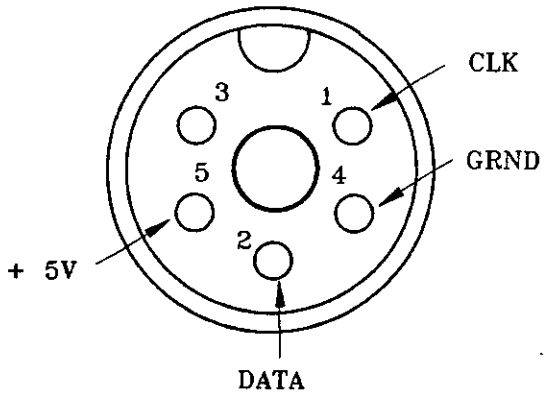


Figure 15-2: Electrical Characteristics of the TRACKBALL Connector (P33)

CHAPTER 16: KEYBOARD INTERFACE

The Keyboard Connector provides an interface between the Unidex 21 and an external Keyboard. The Keyboard must be a 101-key, "Qwerty" IBM PC/AT Keyboard operated by IBM Scan Code 2 (such as Model G81-1000 HBU/04 available from Cherry Electrical Products, 3600 Sunset Ave., Waukegan, Il. 60687).

Details of the KEY BD Connector (P27) are shown in Figure 16-1. Electrical characteristics of the connector are shown in Figure 16-2.



PIN	DESCRIPTION
1	Clock
2	Data Output
3	(Not Used)
4	Ground
5	+5V Input Common

Figure 16-1: KEY BD Connector (P27)

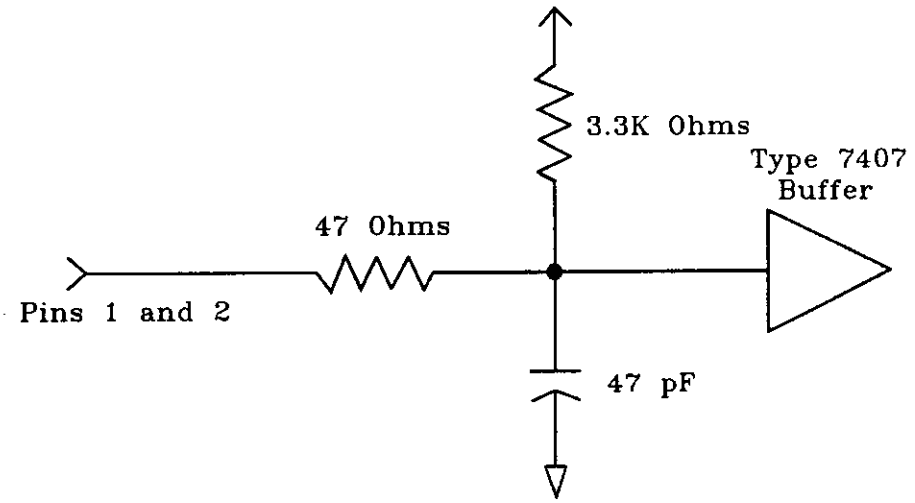


Figure 16-2: Electrical Characteristics of the KEY BD Connector (P27)

CHAPTER 17: TROUBLESHOOTING

This Chapter is provided to be used as an aid in the diagnosis and solution of problems due to improper hardware configurations.

SYMPTOM	POSSIBLE CAUSE
Power Up - Unidex 21 does not respond. (Cooling Fans do NOT Come On.)	Power Source Not Active
	Power input cable damaged or improperly connected (See Chapter 4 of this manual)
	Power Input Fuse Blown
Power Up - Fans Come On - No Display	Internal AC Power Cord to Power Supply damaged or incorrectly connected
	Power Supply's ON/OFF Switch in the OFF position
	Power Supply Fuse Blown
	Front Panel and/or CRT Board not included in system configuration
Power Up - Fans Come On - No Display	Front Panel and the CRT Board are not properly seated

SYMPTOM	POSSIBLE CAUSE
Power Up - Fans Come On - No Display - Con't	Cables to the Front Panel and CRT Boards are loose or improperly connected
Unidex 21 active but does not respond to Keyboard entry	System Key Switch is OFF
	Error condition exists, locking up system
	Keyboard Connection Cable is damaged or incorrectly connected
	Keyboard not functional
Unidex 21 does not respond appropriately to keyboard entries	Parameter Settings do not correspond to system configuration. (See Unidex 21's User Manual, Chapter 6.)
	A circuit board is not properly seated.
	Poor Ground and/or Shield connection.
Unidex 21 does not respond appropriately to keyboard entries	Parameter Settings do not correspond to system configuration. (See Unidex 21's User Manual, Chapter 6.)
	A circuit board is not properly seated.
	Poor Ground and/or Shield connection.

SYMPTOM	POSSIBLE CAUSE
Unidex 21 does not respond appropriately to keyboard entries - Con't	Motor and/or Encoder cables not properly routed or connected.
Unidex 21 responds to Keyboard entry but improper communication takes place between Unidex 21 and Transducer.	Blown Rear Panel Motor Fuse
	Motor and/or Transducer cables not properly routed or connected.
	Power Supply's 5V output not functioning (Any Power Suppy LED Off)
Axis Movement Unstable	System needs tuned. (See Auto-Tune procedure as described in the Unidex 21 User's Manual, Chapter 6)
Axis Movement Unstable	Motor and/or Transducer cables not properly routed or connected.
	Amplifier and/or Motor sized improperly
	Line Noise from improper Ground or Shield connections.
Motor does not move when requested	Parameter Settings do not correspond to system configuration (See Unidex 21's User Manual, Chapter 6.)
	Wrong Axis designation
	Motor and/or Transducer cables not properly routed or connected.

SYMPTOM	POSSIBLE CAUSE
Motor does not move when requested-Con't	Blown Rear Panel Motor Fuse
	System needs tuned. (See Auto-Tune procedure as described in the Unidex 21 User's Manual, Chapter 6)
	Faulty Motor
Motor does not move when requested	Line Noise from improper Ground or Shield connections.
Motor does not stop when requested	Wrong Axis designation
	Incorrect Amplifier Offset
	Line Noise from improper Ground or Shield connections.
Motor moves in the opposite direction from what is requested	Reversed Motor Polarity (DC Servo Brush Type only) (See Chapter 5 of this Manual)
Eratic Motor movement	Inproper Motor Phasing (AC Servo Brushless Type only) (See Chapter 5 of this Manual)
Motor Speed does not correspond to requested speed	Amplifier and/or Motor sized improperly
	Parameter Settings do not correspond to system configuration (See Unidex 21's User Manual, Chapter 6.)

SYMPTOM	POSSIBLE CAUSE
System does not respond to Limit Switch	Limit Switch wiring faulty
System does not respond to Limit Switch	Parameter Settings do not correspond to system configuration (See Unidex 21's User Manual, Chapter 6.)
	Line Noise from improper Ground or Shield connections.