UNIDEX™16 INSTALLATION MANUAL

REV. 0

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AEROTECH, INC., 101 Zeta Drive, Pittsburgh, PA 15238

(412) 963-7470 TWX 710-795-3125

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DISCLAIMER

The information contained in this manual is subject to change due to improvements in design.

Though this document has been checked for inaccuracies, Aerotech does not assume responsibility for any errors contained herein.

CHAPTER 1: INTRODUCTION

This manual is intended to be an aid in the installation of Unidex 16 systems. Unidex 16 systems are available in many standard forms. They are:

Unidex 16 EQE4 Model
Unidex 16 FSE Model
Unidex 16 UP Model
Unidex 16 MPE-B Model

The Unidex 16 system may be ordered with a variety of options. For example: motors, encoders, output wiring, linear or rotary translation stages, etc.

Since Unidex 16 may be purchased as a Turn Key system or as OEM components, and there are many variations of the above mentioned standard models, this manual contains general information, as well as specific information whenever possible. For more information particular to your system, refer to your system drawings.

NOTE

When calling Aerotech concerning your system, please **have your SYSTEM SERIAL NUMBER on hand.** All information concerning your system is referenced through this number.

CHAPTER TWO: UNPACKING THE UNIDEX 16 SYSTEM

If there is any evidence of damage to the shipping container, request that the carrier's agent be present while the system is being unpacked and inspected.

If any damage is found, contact Aerotech's Customer Service Department.

Check the sales order slip accompanying your system to verify that all of the features, options and parts ordered are included.

CAUTION

IMPROPER HANDLING OF ELECTRICAL OR MECHANICAL DEVICES COULD ADVERSELY EFFECT THEIR PERFORMANCE.

CHAPTER 3: POWER WIRING

SECTION 3-1 POWER REQUIREMENTS

When Unidex 16 is powered by an Aerotech power transformer, the input power can be 104/115VAC, single-phase, 50/60 Hz, 30 amps, or 208/230VAC, single phase, 50/60 Hz, 15 amps.

The transformer size and input voltage will depend on the amplifiers and motors selected. It is not recommended to run equipment that has a high current requirement from a 115V circuit. Although 115V, 30A circuits are available, this does not make for a very good installation, due to the line drop when peak current is required during acceleration.

CAUTION

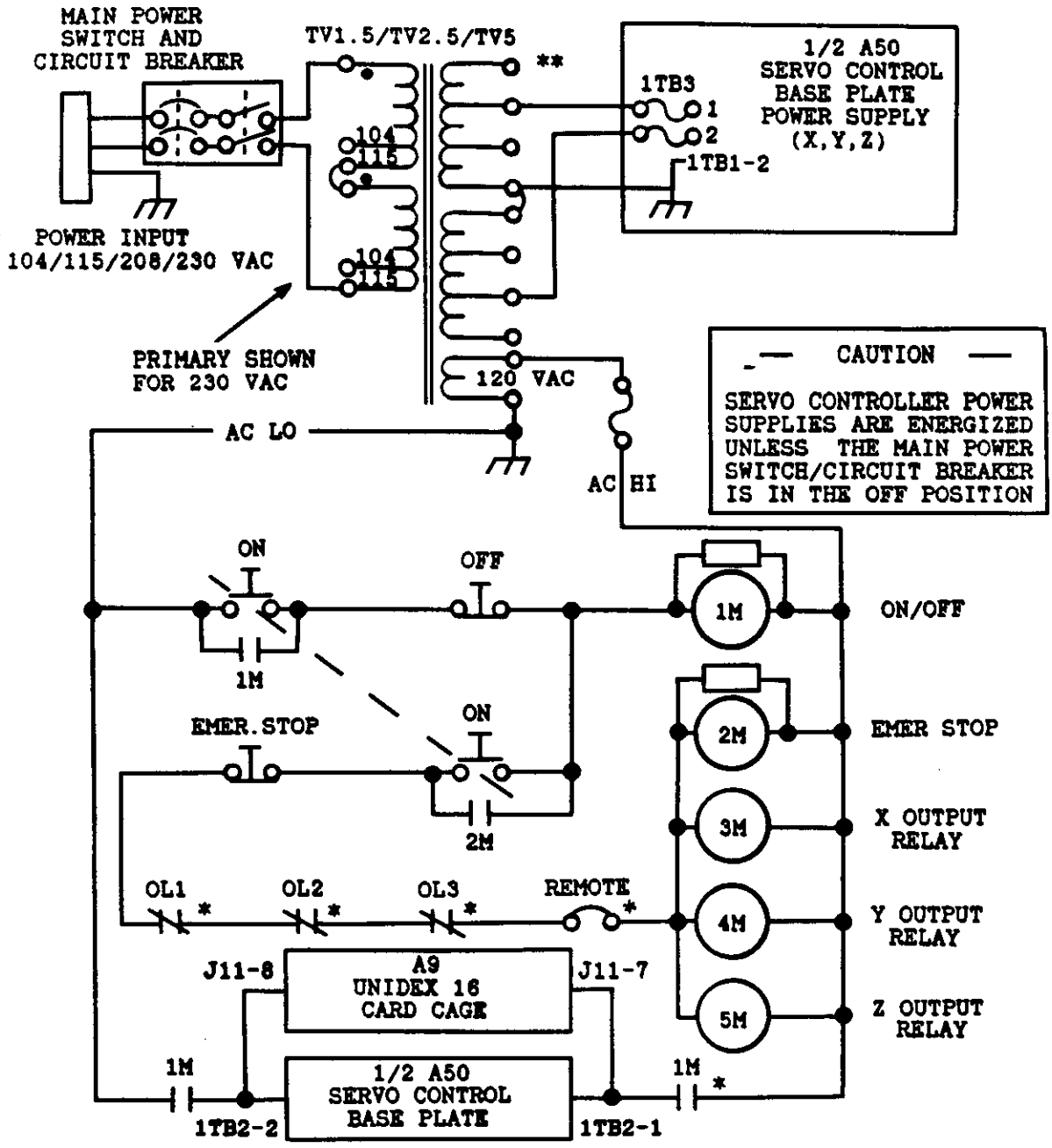
ON THE REAR OR SIDE PANEL OF EACH MODEL IS A POWER REQUIREMENT LABEL. PLEASE NOTE THIS RATING BEFORE MAKING ANY CONNECTIONS. THIS LABEL LISTS VOLTS, AMPS AND FREQUENCY.

The input power requirement label indicates the power required to operate the equipment properly. The AC current value is normally the rating of the input circuit protection device and is generally 150% of full load capability.

SECTION 3-2 FUNCTIONAL BLOCK DIAGRAM OF INPUT POWER

To make AC wiring easier to understand, figure 3-1, "Functional AC Power Wiring For Unidex 16" offers a functional block diagram of Input Power and Emergency Stop Wiring. For more details, please consult your system drawings.

Please note that although figure 3-1 illustrates input power wiring using three axes, up to six axes may be used.



* MOTOR OVERLOAD RELAYS ARE OPTIONAL AND NOT AVAILABLE ON ALL MODELS

** SECONDARY TRANSFORMER TAPS FOR 28, 43, 56, 70 AND 115 VRMS

FIGURE 3-1: FUNCTIONAL AC POWER WIRING FOR UNIDEX 16 SYSTEMS

SECTION 3-3 GROUNDING

Proper grounding is very important. It insures the safe and proper operation of the equipment. All systems require a safety ground.

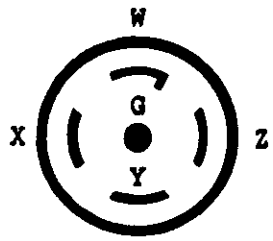
SECTION 3-4 INPUT POWER CONNECTIONS

The Unidex 16 power wiring is accomplished via one of two connectors. They are:

1. Hubbell Flanged Power Inlet Connector (#2815)
2. TRW Terminal Strip (#6-150)

A. HUBBELL FLANGED POWER INLET CONNECTOR

Following is an illustration of the Hubbell Connector. There are three types of connections which can be made for Unidex 16 input power via this connector.



2815
HUBBELL
FLANGED POWER
INLET CONNECTOR

G	SAFETY GROUND
X	LINE
Y	LINE
Z	LINE
W	NEUTRAL

TYPE ONE
104/115 VAC INPUT DOMESTIC

For 104/115, single-phase AC, 50/60 Hz, 30 amp input power, connect:

SAFETY GROUND	TO	G
AC LINE HIGH	TO	X
AC LINE LOW (NEUTRAL)	TO	W

TYPE TWO
208/230 VAC INPUT DOMESTIC

For 208/230, single-phase AC, 50/60 Hz, 15 amp input power, connect:

SAFETY GROUND	TO	G
AC LINE	TO	X
AC LINE	TO	Y
NO CONNECTION	TO	W

TYPE THREE
230 VAC INPUT EUROPEAN

SAFETY GROUND	TO	G
AC LINE HIGH	TO	X
AC LINE LOW (NEUTRAL)	TO	W

B. TRW TERMINAL STRIP TB6

The connections required are as follows:

SAFETY GROUND	TO FRAME
AC LINE	TO TB6-1
AC LINE (OR NEUTRAL)	TO TB6-2

Input voltage depends on the transformer wiring.

For more detailed information, please refer to the system drawings or consult the factory.

CHAPTER 4: LIMIT AND HOME SWITCH INTERFACING

If you have been supplied with a complete Unidex 16 system, i.e., controller, cables, motors, encoders, tables, etc., all you must do is plug the correct cables into the appropriate axes.

NOTE

Though similar tables may be interchanged, it is <u>not</u> recommended, since each table is calibrated to its own axis.

CAUTION

NEVER CONNECT OR DISCONNECT ANY CABLE WHILE POWER IS APPLIED.

The information contained in this chapter defines the Aerotech standard for limit switches and is intended for those customers who are supplying their own stages and/or limit switches.

SECTION 4-1 LIMIT SWITCH DIRECTION

The terms Clockwise (CW) and Counterclockwise (CCW) refer to motor rotation when viewed from the mounting flange of the motor. This has been adopted as an Aerotech standard to clarify the limits when one controller is interfaced to many different mechanical configurations. Therefore, the CW limit will stop CW rotation and the CCW limit will stop CCW rotation, as illustrated in figure 4-1.

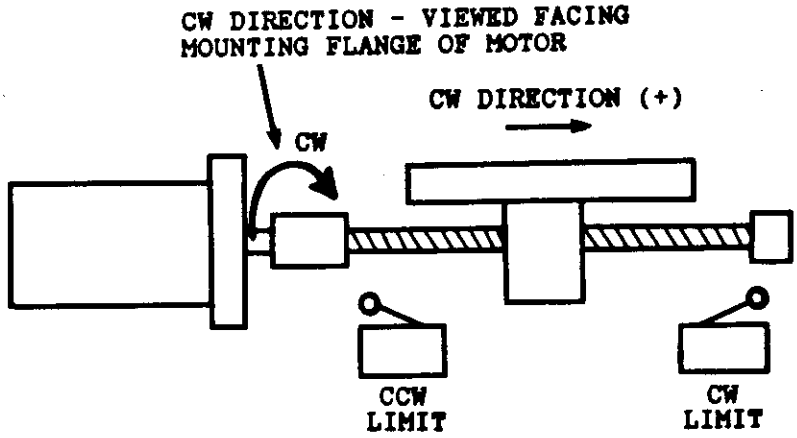


FIGURE 4-1: LIMIT SWITCH DIRECTION

On Aerotech tables the electrical limit switches precede the rubber mechanical stops by approximately one revolution of the ballscrew. **Although the rubber mechanical stop will help lighten the blow, it is not recommended that you run the table into it. To do so will result in damage.**

SECTION 4-2 HOME SWITCH POSITION

Most Aerotech controls come equipped with a cold-starting reference point, which Aerotech calls the Home Position. This is the machine home and is a fixed position, dependent solely on the once-per-revolution marker generated by the rotaty encoders or by the marker that occurs every two inches on the linear encoder.

The purpose of the home switch is to establish which marker will be used as the home reference point. Again, if you have purchased a complete Aerotech system, the home position has already been set up at the factory.

This home reference can be at either end of travel, and if that is the case, you may use the limit switch as your home switch. If, however, some point in between is to be the home reference point, then a separate home switch and a cam are necessary.

NOTE

In addition to the hardware considerations, Home CW or Home CCW must be set up in the Unidex 16 EEPROM (parameter #320), where CW is positive (1) and CCW is negative (0). See "Unidex 16 User's Manual", chapter 6, for details.

Regardless of whether the home reference point is a CW limit, CCW limit or home switch, its optimum position should be 1/2 revolution ($\pm$ 1/4 rev) from where the switch opens (for Normally Open type switch) to the leading edge of the marker pulse.

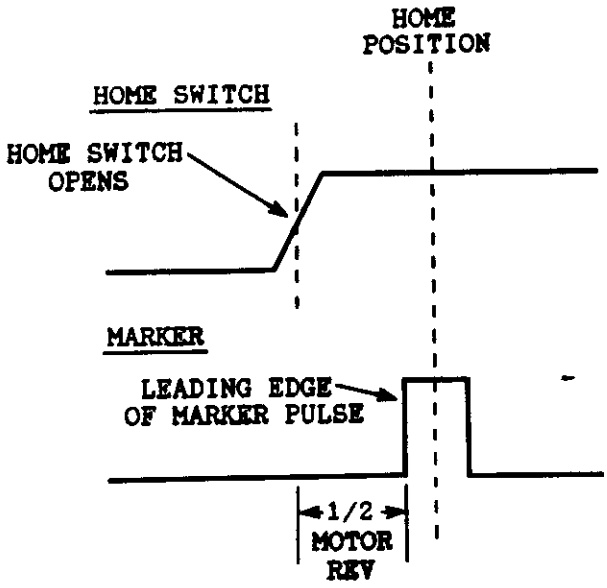


FIGURE 4-2: HOME SWITCH POSITION

SECTION 4-3 LIMIT OR HOME INPUTS

A typical home or limit switch input is shown in figure 4-3.

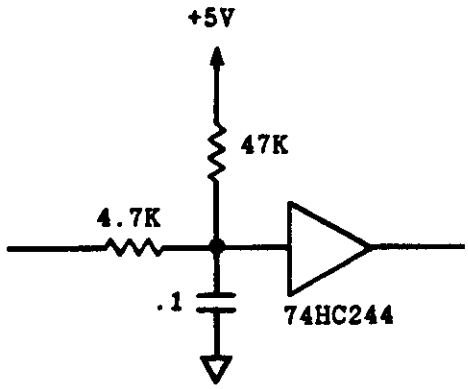


FIGURE 4-3: HOME OR LIMIT SWITCH INPUT

Figure 4-3 illustrates a 5V CMOS logic input and filter for high noise immunity.

If choosing a mechanical limit switch, it should have a dry circuit contact rating (24V signal or less). The input is normally active when low (logic 0). However, by changing the appropriate jumper on the Unidex 16 Indexing Board, it can be set up to be active high (logic 1). (Refer to chapter 7 for details on jumper selections.)

SECTION 4-4 CONNECTIONS FOR LIMIT AND HOME SWITCHES

Connections for the limit and/or home switches is made in one of two places: the terminal board located inside the motor cover or at the J1 circular output connector. These connections are illustrated in figure 4-4 and figure 4-5.

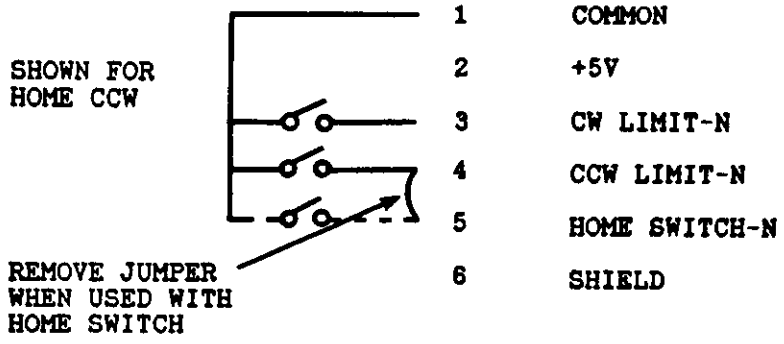


FIGURE 4-4: TERMINAL BOARD CONNECTIONS

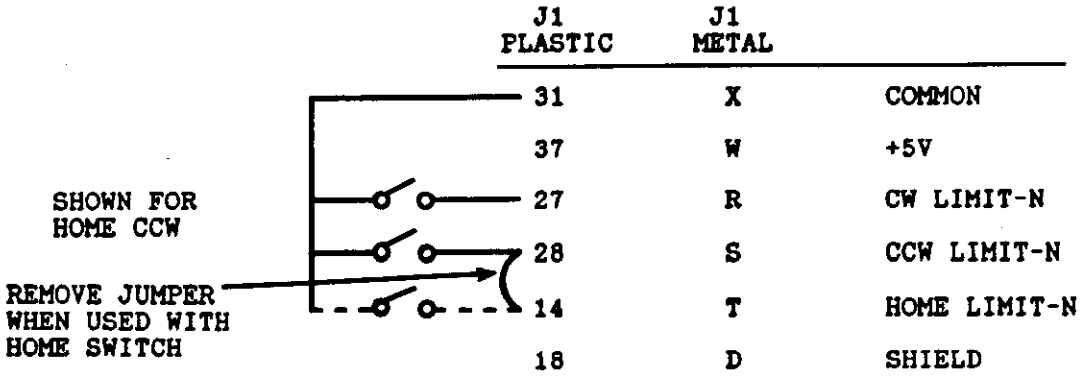


FIGURE 4-5: J1 (METAL AND PLASTIC TYPES) CONNECTIONS

CHAPTER 5: MOTOR/TACH INTERFACING

If you have been supplied with a complete Unidex 16 system, i.e., controller, cables, motors, encoders, tables, etc., all you must do is plug the correct cables into the appropriate axes.

The information contained in this chapter is intended for those customers who are supplying their own motor and tachometer. It may also be helpful when servicing the equipment.

SECTION 5-1 MOTOR/TACH PHASING

The servo drive system can be broken into two parts: the position loop (discussed in chapter 6) and the rate loop (discussed here). The rate loop is made up of the amplifier, the motor and the tachometer.

The amplifier's output commands the motor to turn. The turning of the motor causes the tach to turn and therefore generate a feedback voltage. This feedback voltage has an amplitude which is proportional to speed and a polarity which represents direction. It is important to be certain that the motor and tach polarities are correctly connected to the Aerotech equipment.

If not connected properly, instability of the servo drive system and possibly even a runaway condition may result.

The polarity of the motor and tach is in reference to clockwise (CW) rotation of the motor. This can easily be determined by:

1. Placing a voltmeter's leads on the motor terminals (or leads) and rotating the motor CW. If the leads are connected properly, you should see positive deflection. (CW rotation is always as viewed from the mounting flange of the motor.)

2. Placing the voltmeter leads on the tachometer terminals (or leads) and following the same procedure.

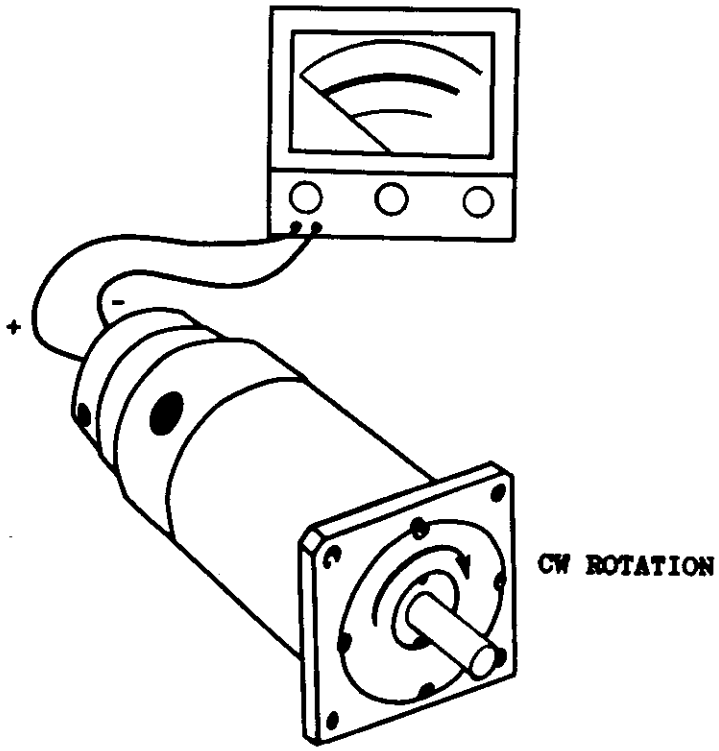


FIGURE 5-1: MOTOR AND TACH PHASING

SECTION 5-2 CONNECTIONS

Once the polarity of the motor and tach is determined, they should be connected to your Aerotech equipment as shown below. (For other configurations, see your system drawings.)

AEROTECH MOTOR COLOR CODE	J1 PLASTIC	J1 METAL	FUNCTION
BLUE	29	Y	TACH +
WHITE	34	Z	TACH -
RED *	16	J	MOTOR +
RED *	6	P	"
BLACK *	10	V	MOTOR -
BLACK *	17	Q	"

* Multiple output pins are available for higher current applications.

NOTE: J1 (MO) is the plastic connector. J1 (MSO) is the metal (military specification) connector.

SECTION 5-3 FUSING AND CURRENT LIMIT

The fusing and the current limit are provided to protect the motor from overheating and the damage that may be caused by excessive peak current conditions.

The motor fuse (located on the servo controller) will protect the motor from overheating. Its rating is determined by the continuous current rating or 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 motor. In addition, some of the Aerotech servo controllers have a dynamic current limit adjustment which will limit current with respect to speed for added performance. The following is a list of some of the Aerotech standard motors and windings.

MOTOR	FUSING	CURRENT LIMIT	DYNAMIC CURRENT LIMIT
1017-01	4ASB	16A	NOT APPLICABLE
1035-01	4ASB	16A	NOT APPLICABLE
1050-01	5ASB	20A	NOT APPLICABLE
1075-01	5ASB	20A	17A @ 4KRPM
1135-01	5ASB	20A	16A @ 3.5KRPM
1210-01	5ASB	20A	18A @ 2.5KRPM
1410-03	8ASB	30A	22A @ 2KRPM
1410-04	10ASB	30A	NA (45A @ 2KRPM)
1580-02	8ASB	30A	26A @ 2KRPM
1960-02	12ASB	30A	NA (35A @ 2KRPM)

NOTE1: This information applies only to the standard windings and may vary on some applications.

NOTE2: The above information may also vary with servo amplfier limitations.

NOTE3: When a remote motor fuse is provided, the amplifier motor fuse will be $\geq$ 150% of the remote motor fuse.

On some models, motor overload relays, rather than fusing, are supplied:

MOTOR	OL HEATER	OL SETTING	CURRENT LIMIT	DYNAMIC CURRENT LIMIT
1017-01	A17	90%	16A	NA
1035-01	A17	90%	16A	NA
1050-01	B2	85%	20A	NA
1075-01	B2	85%	20A	17A @ 4KRPM
1135-01	B2	85%	20A	16A @ 3.5KRMP
1210-01	B2	90%	20A	18A @ 2.5KRMP
1410-03	B5	100%	30A	22A @ 2KRPM
1410-04	B11	85%	30A	NA (45A @ 2KRPM)
1580-02	B5	95%	30A	26A @ 2KRPM
1960-02	B11	90%	30A	NA (35A @ 2KRPM)

NOTE: When a motor overload relay is provided, the amplifier motor fuse will be $\geq$ 150% of the motor overload relay.

CHAPTER 6: ENCODER INTERFACING

If you have been supplied with a complete Unidex 16 system, i.e., controller, cables, motors, encoders, tables, etc., all you must do is plug the correct cables into the appropriate axes.

The information contained in this chapter is intended not only for those customers who are supplying their own encoders, but for those who want a better understanding of the encoder interface as well.

SECTION 6-1 POSITION LOOP

As mentioned in chapter 5, the servo drive system can be broken into two parts: the rate loop (discussed in chapter 5) and the position loop which will be covered in this chapter.

The position loop consists of the Unidex 16 indexing board, power amplifier, motor, tachometer and incremental optical encoder.

The position loop is closed around and is phased with respect to the rate loop. Therefore, it is important to have a stable rate loop prior to closing the position loop.

The encoder inputs are designed to accept sine, cosine and marker, as well as their complementary signals.

As their names imply, sine and cosine are two signals in quadrature, i.e., when the motor is turning in a clockwise (CW) direction, the cosine signal will lead the sine signal by 90 electrical degrees.

The phase relationship between sine and cosine indicates the direction that the encoder is rotating, and the number of cycles indicates how far the axis has moved. In addition, the resolution can be multiplied by 1, 2, or 4 by selecting the appropriate jumper (see chapter 7) on the Unidex 16 indexing board.

SECTION 6-2 INPUT CIRCUITRY

The input circuitry is compatible with most sine wave and square wave encoders. A typical input is shown in figure 6-1.

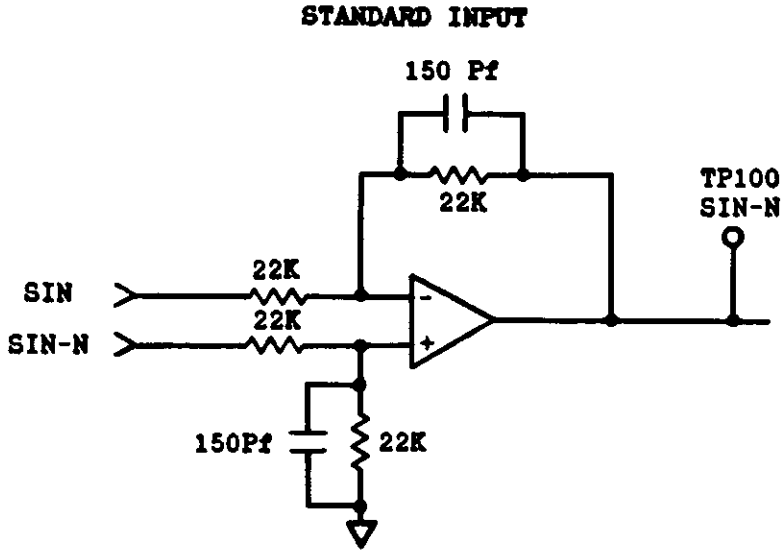


FIGURE 6-1: TYPICAL INPUT

As shown in the following illustration (figure 6-2), the input signals for the sine wave encoder are both 2 V peak to peak, riding a 2V bias.

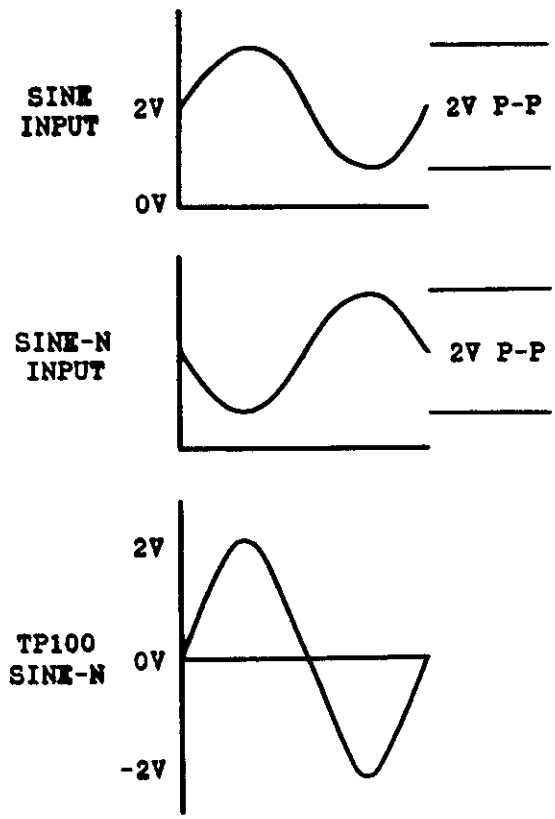


FIGURE 6-2: INPUT SIGNALS FOR THE SINE WAVE ENCODER

Figure 6-3 shows an example of square wave encoder signals.

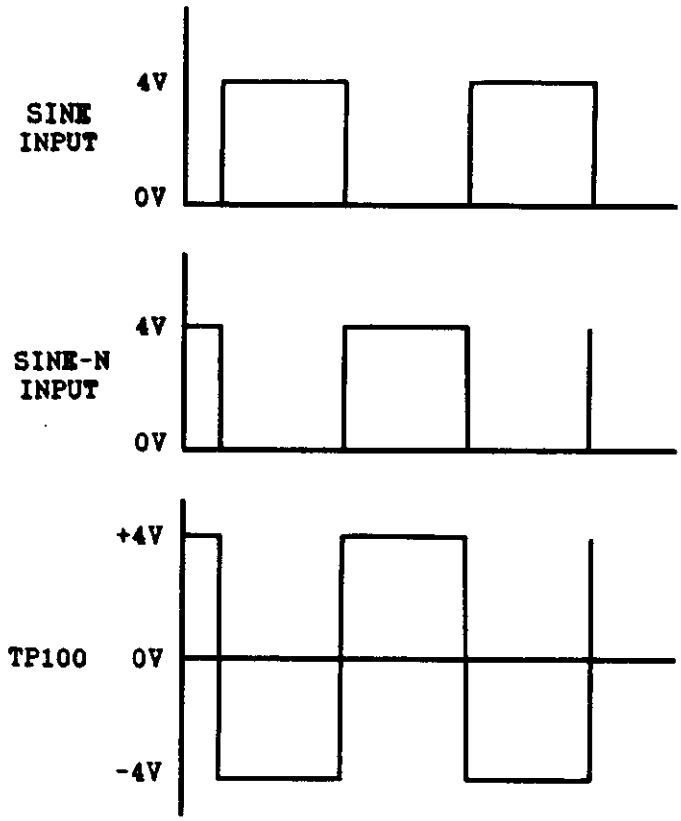


FIGURE 6-3: INPUT SIGNALS FOR THE SQUARE WAVE ENCODER

Maximum input frequency, in either case, should not exceed 40KHz. (For higher data rates, please consult the factory.)

Whenever single-ended encoders are used, the unused input should be biased at the appropriate voltage (normally 2 volts). For high noise immunity, we advise the use of an encoder with complementary outputs with totem pole drivers. Encoder wires should use shielded cable as well.

A. LINE RECEIVER INPUT OPTION

The Line Receiver Input Option is available if you should utilize either of the following:

Encoders with line drivers

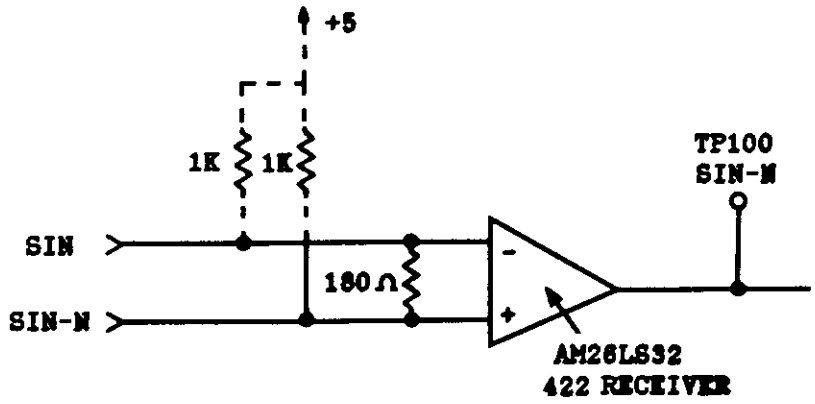
Encoders with TTL outputs that are required to run at high data rates.

When either of the above is the case, the maximum input frequency is 125 KHz.

Line drivers are used in noisy environments and/or when driving long cables.

The TTL output is used when higher data rates are required.

LINE RECEIVER INPUT (OPTIONAL)



NOTE: A configuration of a line driver is illustrated above. For TTL output, remove the 180 ohm resistor and connect the two 1K pull-up resistors.

SECTION 6-3 ENCODER PHASING

On Aerotech motor/encoder assemblies, the rotary encoder is mounted on the rear of the motor.

For both rotary and linear encoders, the phasing 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 signal coincides with the positive cosine signal. (CW rotation is as viewed from the mounting flange of the motor.)

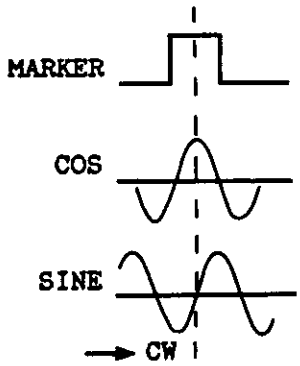
It should be noted that if a standard Aerotech encoder is mounted at the opposite end of the ballscrew, the shaft rotation will now be reversed and the sine and sine-n signals must be exchanged in order to have proper phasing.

CAUTION

IMPROPER POSITION LOOP PHASING WILL CAUSE A RUNAWAY CONDITION

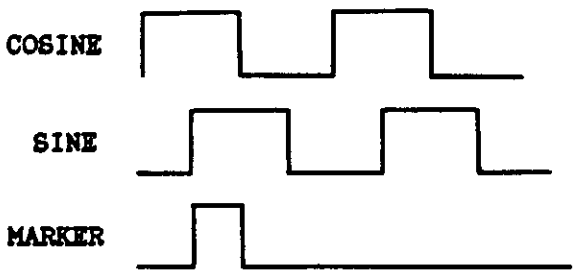
ENCODER PHASING

SINE WAVE ENCODER



ENCODER PHASING

SQUARE WAVE ENCODER



NOTE: SIN-N AND COS-N SIGNALS ARE NOT SHOWN

FIGURE 6-4: SINE AND SQUARE WAVE ENCODER PHASING

SECTION 6-4 PHASING TEST

In figure 6-5, a typical block diagram of the position loop and rate loop is shown.

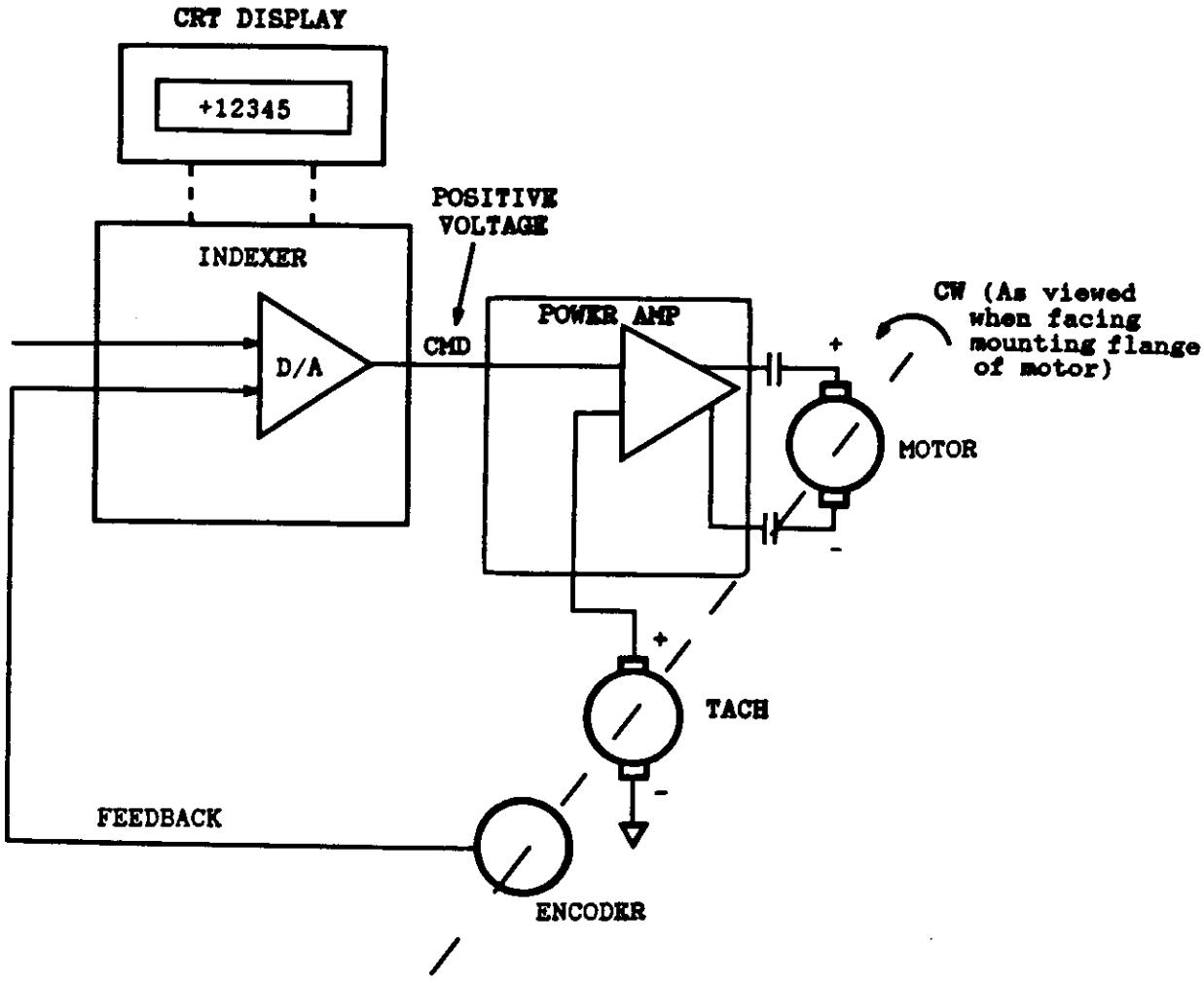


FIGURE 6-5: BLOCK DIAGRAM OF POSITION LOOP AND RATE LOOP

A convenient test for proper system phasing can be accomplished with the following steps:

1. Press the Emergency Stop on Unidex 16 in order to disable the drives.

2. Manually rotate the motor shaft CW.

3. Observe tracking displays for positive count for standard system direction. (See chapter 7 of this manual for jumper selections and chapter 6 of the "Unidex 16 User's Manual" for parameter selections, both pertaining to system direction.)

4. With a voltmeter, measure the following:

   a. A positive voltage should be measured from signal common to the tach input.

   b. A positive voltage should be measured from signal common to the command input.

5. Motor phasing can be checked across the motor or at the motor input to Unidex 16 (see chapter 5, Rate Loop Phasing).

SECTION 6-5 CONNECTIONS

The encoder connections to be discussed in this section pertain to most Unidex 16 systems. However, if you have any questions concerning your system, refer to your system drawings.

There are three sites where the standard encoder connections can be made:

1. Encoder terminal board

2. J1 plastic (AMP #206151-1) connector

3. J1 metal (MS #3106A-24-28P) connector

Table 6-1 lists the standard encoder interface connections.

FUNCTIONS	J1 METAL CONNECTOR	J1 PLASTIC CONNECTOR	TERMINAL BOARD
SINE	F	26	7
SINE-N	L	20	8
COSINE	E	25	5
COSINE-N	K	19	6
MARKER	G	21	4
MARKER-N	M	22	3
+ 5V	A	35	2
COMMON	B	32	1
SHIELD	C	30	N.C.

TABLE 6-1: ENCODER INTERFACE

CHAPTER 7: UNIDEX 16 MODULES' JUMPERS AND CONNECTORS

SECTION 7-1 CARD CAGE JUMPERS AND SWITCHES

A. COMMON/FRAME GROUND JUMPERS

STANDARD CONFIGURATION

R1 = 100 Ohms, 1/2 Watt resistor
R2 = 0 Ohm jumper

R1 and R2 connect Unidex 16 DC Power Supply Common to the Card Cage Frame. To isolate the power supply common from the card cage frame, remove R1 and R2 as required.

B. FAULT SWITCH

The fault circuit is a series circuit that is daisy chained from module to module (A1 - A8). The circuit is fail safe, in that a fault will be reported if the circuit is open or if a module is not plugged into the mother board card slot. A fault is reported to Unidex 16 and the shutdown line will be asserted. Therefore, whenever a position (A1 - A8) is not used, the appropriate bypass switch must be closed to transfer the fault signal to the next module. The following lists the modules and corresponding switches:

ASSEMBLY#	SLOT	MODULE	SWITCH	ACTIVE	PASSIVE
A1	S0	PWR.SUPPLY 690E1254	NO SWITCH	N/A	N/A
A2	S1	CPU BD. 690D1255	NO SWITCH	N/A	N/A
A3	S2	CRT BD. 690D1256	SW7-1	OFF	ON
A4*	S3	FDC BD. 690D1258	SW7-2	OFF	ON
A5*	S4	MEM BD. 690D1257	SW8-1	OFF	ON
A6*	S5	MEM BD. 690D1257	SW8-2	OFF	ON
A7*	S6	IDX BD. 690D1261	SW9-2	OFF	ON
A8	S7	IDX BD. 690D1261	NO SWITCH	N/A	N/A

* Indicates optional module

EXAMPLE:

If the optional Indexing Board A7 is not used, switch SW9-2 must be in the "ON" position and if it is used, it must be in the "OFF" position.

C. ACKNOWLEDGE SWITCH

The acknowledge signal is an interlocking type signal that is daisy chained from one module (A1 - A8) to the next. If a module is absent, the appropriate bypass switch (SW1 - SW5) must be closed to transfer the signal to the next module. Failure to do so will cause a bus error. The following is a list of Unidex 16 assemblies, their normal positions on the bus, and their appropriate bypass switch.

ASSEMBLY#	SLOT	MODULE	SWITCH	ACTIVE	PASSIVE
A1	S0	PWR.SUPPLY 690E1254	NO SWITCH	N/A	N/A
A2	S1	CPU BD. 690D1255	NO SWITCH	N/A	N/A
A3	S2	CRT BD. 690D1256	SW1-1	OFF	ON
A4*	S3	FDC BD. 690D1258	SW2-1	OFF	ON
A5*	S4	MEM BD. 690D1257	SW3-1	OFF	ON
A6*	S5	MEM BD. 690D1257	SW4-1	OFF	ON
A7*	S6	IDX BD. 690D1261	SW5-1	OFF	ON
A8	S7	IDX BD. 690D1261	NO SWITCH	N/A	N/A

* Indicates optional module

EXAMPLE:

When Unidex 16 is used without the floppy disk control option (FDC A4), the bypass switch (SW2-1) must be in the "ON" position and if used with the FDC option, the bypass switch (SW2-1) must be in the "OFF" position.

D. REMAINING SWITCHES

The remaining switches are reserved for future use and although they have no effect on Unidex 16 at this time, they should be in the "OFF" position unless otherwise specified.

E. FAULT INPUT J9-8

The fault input must be pulled low or a fault condition will exist that will inhibit normal system operation. If this input is not used, it can be jumpered to J9-1 (common).

F. FAULT OUTPUT J9-7

The fault output is normally low (open collector output) and is pulled high when a fault occurs. This output is usually tied to the shutdown input J9-6.

G. SHUTDOWN INPUT J9-6

The shutdown input J9-6 must be pulled low or a shutdown will occur. This input is normally tied to the fault output J9-7.

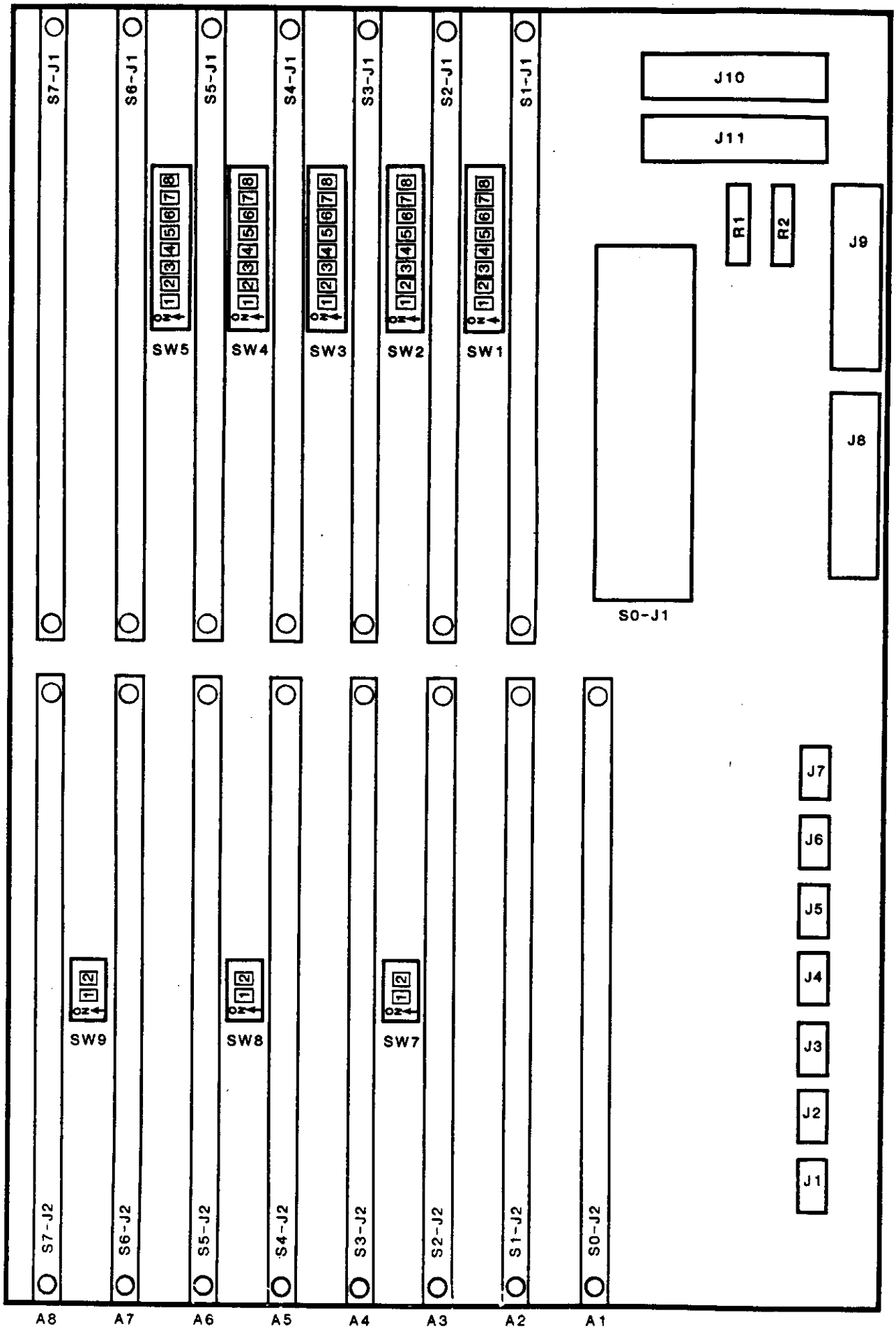


FIGURE 7-1: CARD CAGE JUMPER AND SWITCH LOCATIONS

SECTION 7-2 CPU BOARD JUMPER SELECTIONS

The Aerotech standards for jumper selections will be indicated with an asterisk (*).

A. CPU BOARD JUMPERS

1. BATTERY BACK-UP JUMPER

JUMPER 1-2	
IN	* Active
OUT	Storage

In order to back-up the user's memory when control power is turned off, the CPU board is supplied with battery #2 installed (jumper 1-2 IN).

When battery #2 runs low (indicated by an error message) and needs to be replaced by battery #1, follow these steps:

1. Insert battery #1
2. Secure with tie wrap
3. Remove battery #2

2. EXTERNAL BACK-UP JUMPER

(NOT AVAILABLE AT THIS TIME)

JUMPER 3-4	
IN	External battery back-up
OUT	* Internal battery back-up

3. RS-232/422 JUMPERS

JUMPER 33-34	
IN	Port-A is configured for RS-422
OUT	* Port-A is configured for RS-232

JUMPER 31-32	
IN	Port-B is configured for RS-422
OUT	* Port-B is configured for RS-232

4. MODEM/TERMINAL JUMPERS

In order to communicate with different types of RS-232/422 devices, there are jumpers provided on the CPU board.

IF A PORT IS CONFIGURED FOR RS-422, **ALL OF THE FOLLOWING JUMPERS PERTAINING TO THAT PORT MUST BE REMOVED.**

Following is a list of your possible selections if using RS-232.

PORT-A		PORT-B	
UNIDEX 16 AS TERMINAL	**UNIDEX 16 AS MODEM**	**UNIDEX 16 AS TERMINAL**	**UNIDEX 16 AS MODEM**
7-8	* 8-9	35-36	* 36-37
10-11	* 11-12	38-39	* 39-40
13-14	* 14-15	41-42	* 42-43
16-17	* 17-18	44-45	* 45-46
19-20	* 20-21	47-48	* 48-49
22-23	* 23-24	50-51	* 51-52
25-26	* 26-27	53-54	* 54-55
28-29	* 29-30	56-57	* 57-58

NOTE: In order to achieve the correct results, all selections in any of the above columns must be jumpered.

5. BUS ERROR JUMPER (FOR PURPOSE OF SERVICING THE SYSTEM ONLY)

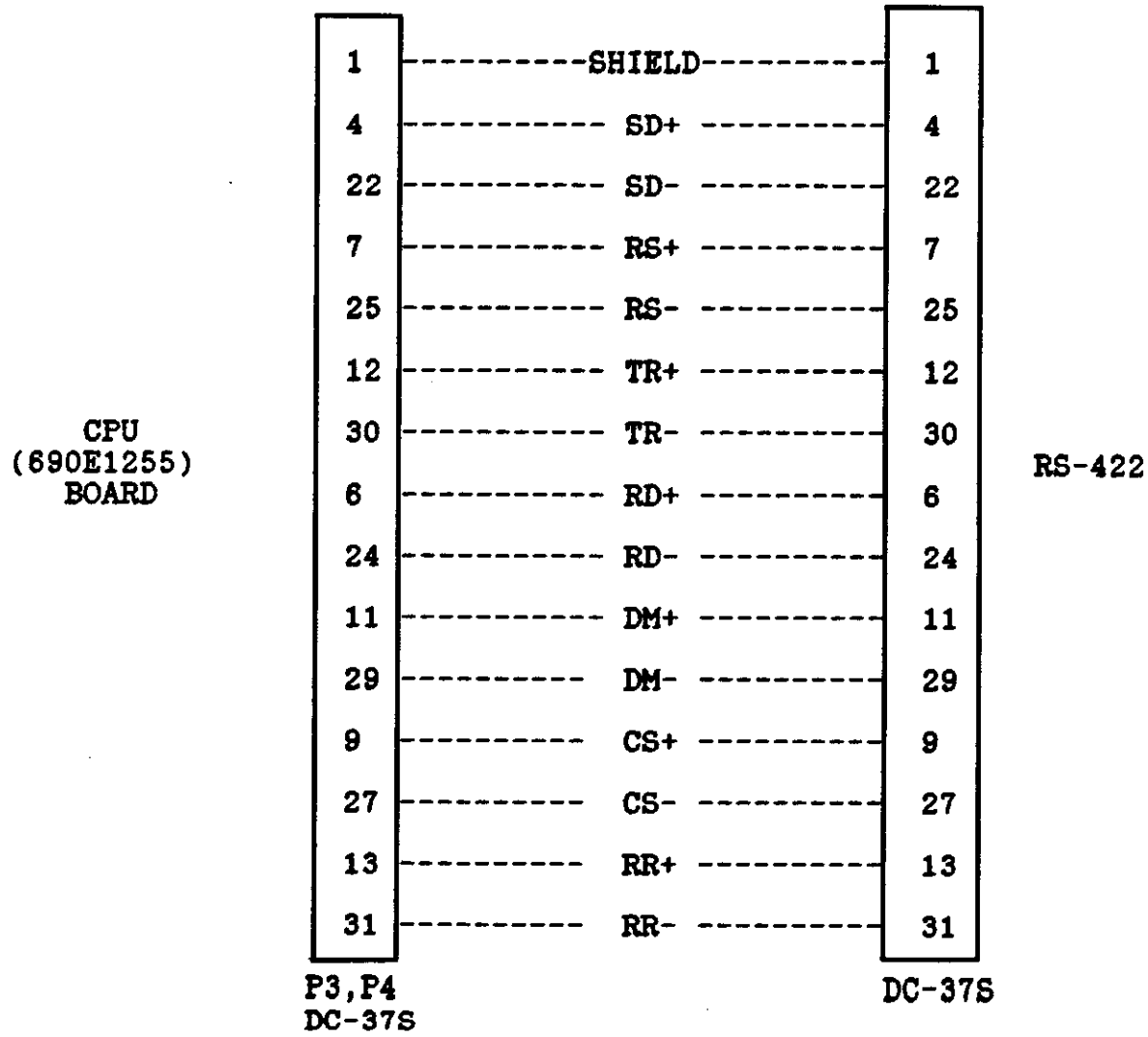
JUMPER 5-6	
IN	* Normal system operation
OUT	Servicing system only

Under normal circumstances, jumper 5-6 is IN and when a bus error is detected the microprocessor services the bus error circuit, displaying the bus error on the CRT.

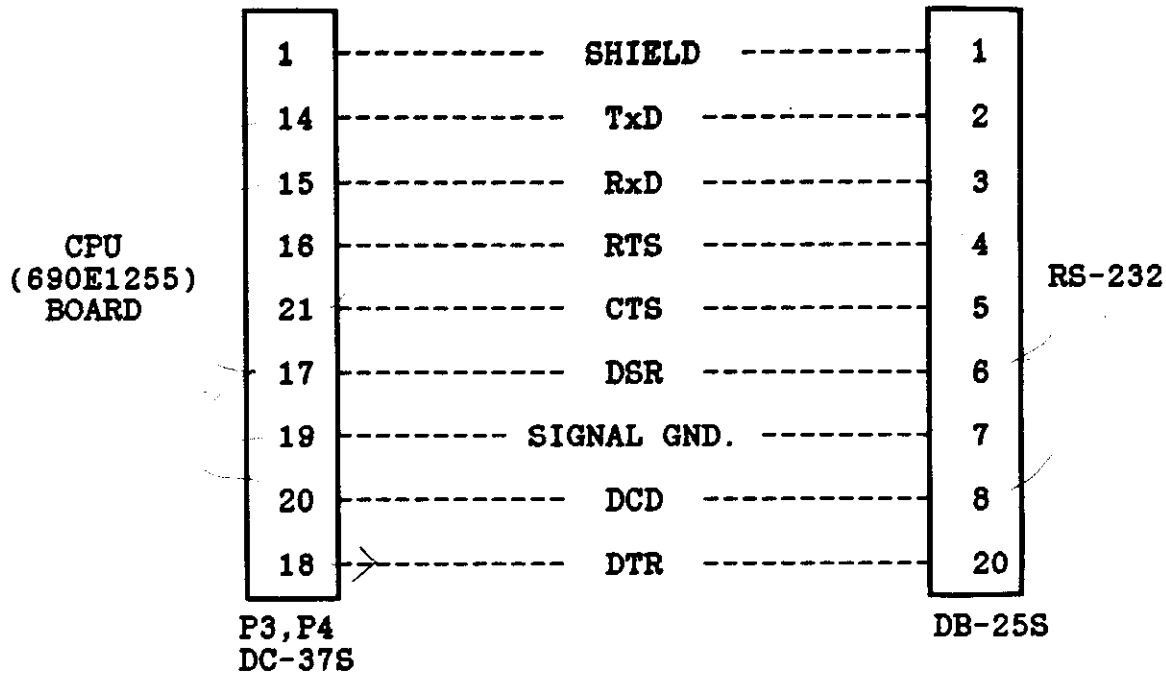
When the system is to be serviced, the above routine is omitted by removing jumper 5-6. In this case, when a bus error occurs, the microprocessor will halt the bus, waiting for a DTACK-N signal.

B. RS-232/422 COMMUNICATION FOR UNPACKAGED SYSTEM

Though cables for RS-232/422 communications are not supplied, the following diagrams illustrate the necessary connections.



CPU RS-422 PORT CABLE DIAGRAM



CPU RS-232 PORT CABLE DIAGRAM

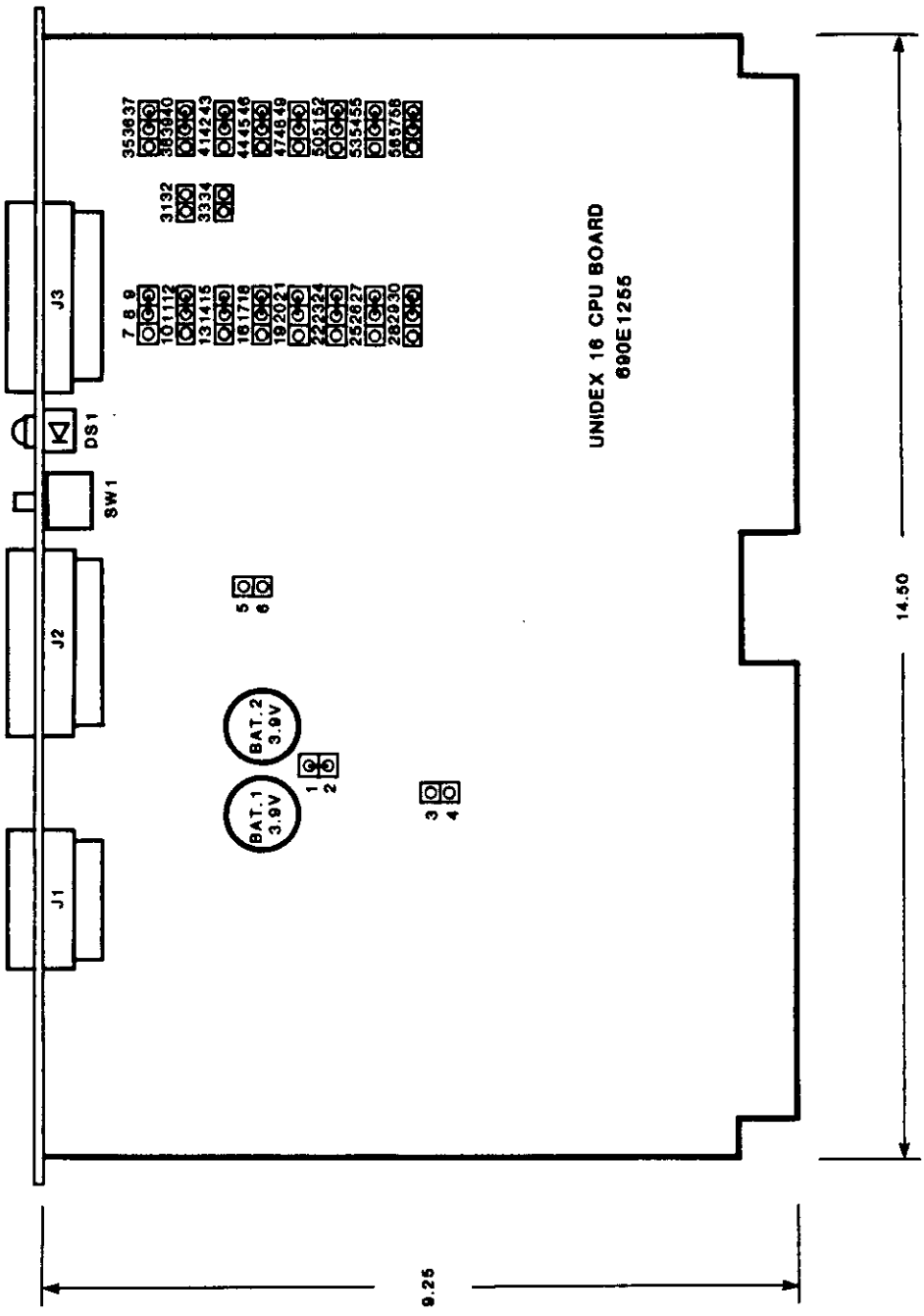


FIGURE 7-2: CPU BOARD

SECTION 7-3 CRT BOARD JUMPERS

Aerotech standards for jumper selections will be indicated with an asterisk (*).

A. AC CLOCK JUMPER

(NOT AVAILABLE AT THIS TIME)

JP1	
IN	Synchronizes monitor with AC line
OUT	* Not synchronized

The AC clock jumper is designated to eliminate the effect of the AC line on the monitor of the CRT board.

B. COLOR GRAPHICS

(NOT AVAILABLE AT THIS TIME)

JP2	
IN	* No color graphics

JP3	
IN	* No color graphics

JP4	
IN	* No color graphics

JP5	
1-2	*
2-3	

These jumpers represent hardware provisions for future use of color graphics. Though not used at this time, all of these jumpers must be installed.

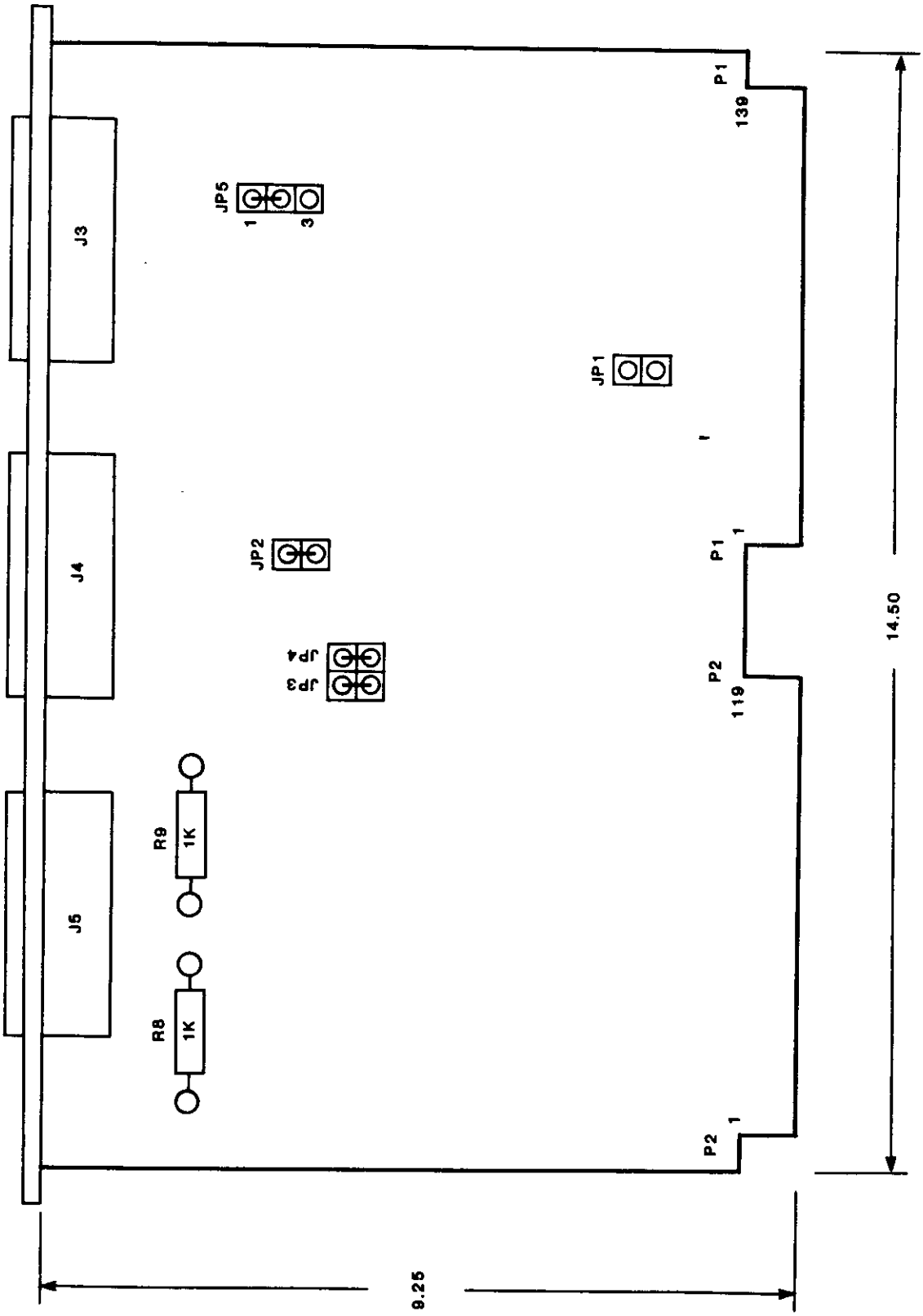


FIGURE 7-3: CRT BOARD

SECTION 7-4 MEMORY BOARD JUMPERS

Aerotech standards for jumper selections will be indicated with an asterisk (*).

Up to two memory boards may be added to your basic Unidex 16 system. The memory board fits into the card cage, slot A5 (and A6 if a second memory board is added).

The memory board can contain from 32K to 256K bytes of memory. The standard board will be supplied with 32K of memory. Additional memory can be added to the board in increments of 32K.

The end address of user's memory, or RAM, is set in parameter 100. It is set at 65535 for the 16K of memory that comes with the basic Unidex 16 system. For each additional 32K of memory added to the system's RAM, add the number 32768 to the number residing in parameter 100.

A. MEMORY BOARD OPTION

Depending on the amount of memory purchased, the following RAM chips and switch settings will be required.

NOTE: Of course, as you add another increment of memory, the previous RAM chips remain and the previous switch settings stay ON. With each new memory bank added, you are adding the new chips and switch settings to the previous ones.

(ALL switches must be OFF, except those indicated as ON for the appropriate amount of memory in your system.)

	RAM	RAM CHIPS	SWITCH TO ON POSITION A5 (1ST CARD)	A6 (2ND CARD)
1.	32K	M1, 2, 15 & 16	SW4-1 & 9	SW4-1, 3 & 9
	64K	M3, 4, 17 & 18		
2.	96K	M5, 6, 19 & 20	SW3-2 & 9	SW3-2, 3 & 9
	128K	M7, 8, 21 & 22		
3.	160K	M34, 35, 48 & 49	SW2-1, 2 & 9	SW2-1, 2, 3 & 9
	192K	M36, 37, 50 & 51		
4.	224K	M38, 39, 52 & 53	SW1-3 & 9	SW1-4 & 9
	256K	M40, 41, 54 & 55		

B. BATTERY JUMPERS

If the memory board contains less that 128K, it comes with one battery.

If there is 128K or more, the board comes supplied with a second battery.

If your memory board has one battery, insert the new battery and connect its associated jumper before removing the old battery and jumper.

If your memory board has two batteries, change them both, one at a time, when the "Battery Low" message appears on the screen at power-up.

JMP 1	
IN	* Battery #1 active
OUT	Battery #1 inactive

JMP 2	
IN	Battery #2 active
OUT	* Battery #2 inactive

JMP 3	
IN	External battery active
OUT	* Internal battery active

1. REPLACING BATTERY #1

Insert and solder battery #2 and insert jumper #2. Disconnect jumper #1 and remove battery #1.

2. REPLACING BATTERY #2

Insert and solder battery #1 and insert jumper #1. Disconnect jumper #2 and remove battery #2.

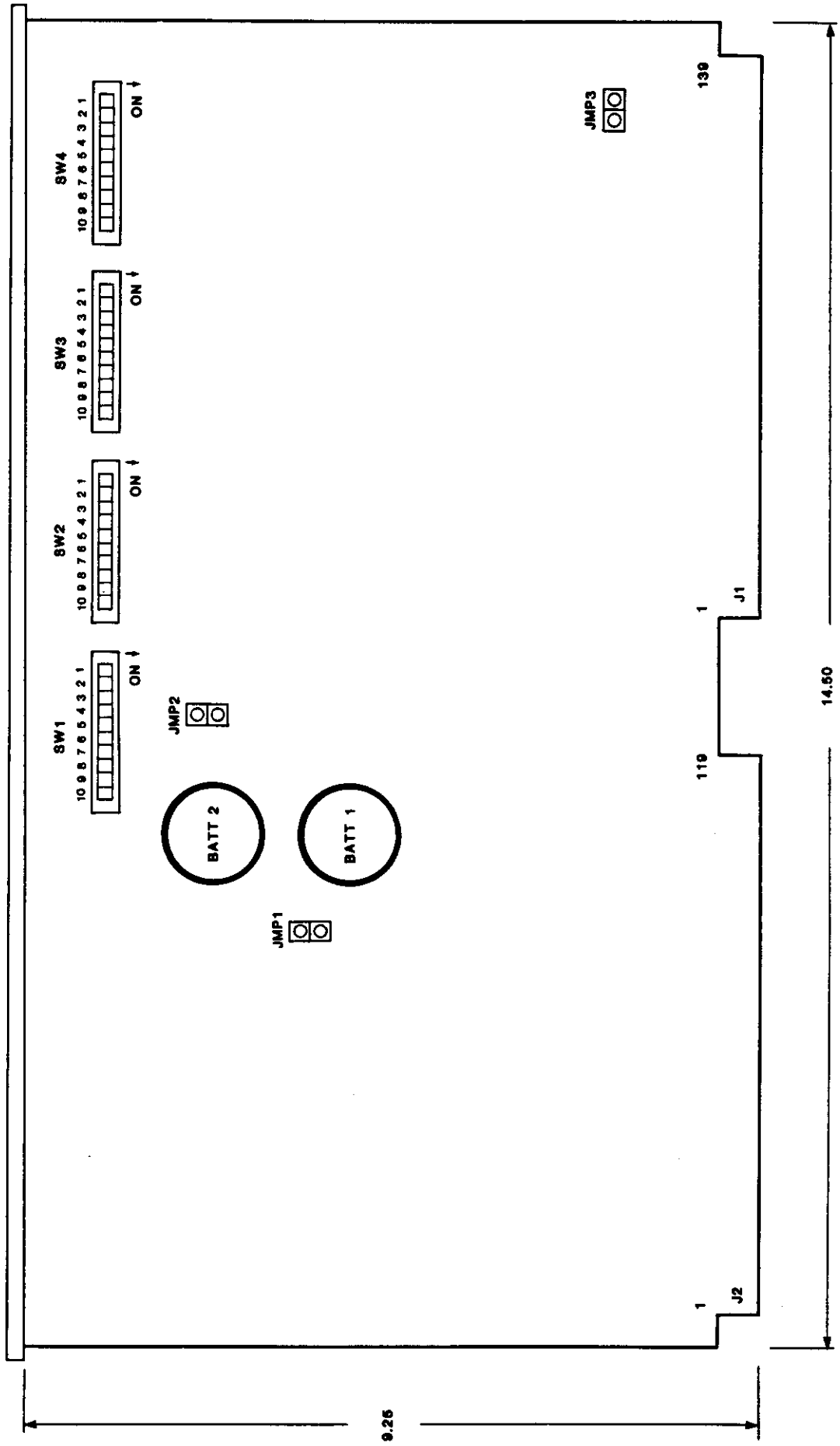


FIGURE 7-4: MEMORY BOARD

SECTION 7-5 INDEXING BOARD JUMPERS AND CONNECTORS

Aerotech standards for jumper selections will be indicated with an asterisk (*).

The silk screen on the indexing board is for the XYZ axes group. Therefore, if the indexing board is addressed for UVW operation, a silkscreened X indicates the U axis, a Y indicates the V axis, and a Z indicates the W axis.

A. AXIS ADDRESS JUMPERS

		JP4	JP5
* A8	X,Y,Z	1-2	IN
* A7	U,V,W	2-3	OUT

To address the indexing board for X, Y, Z operation (A8), jumper JP4 1-2, JP5 IN.

To address the indexing board for U, V, W operation (A7), jumper JP4 2-3, JP5 OUT.

B. LIMIT JUMPERS

	XJP1	YJP1	ZJP1
* Normally Open (LMT-N)	OUT	OUT	OUT
Normally Closed (LMT)	IN	IN	IN

SPARE	XJP2	YJP2	ZJP2
*	IN	IN	IN

For LMT-N, a low signal indicates a limit.
For LMT, a high signal indicates a limit.

NOTE: CW/CCW rotation refers to motor shaft rotation viewed from mounting flange end of motor.

C. RESOLUTION JUMPERS

Position feedback can be multiplied by a factor of 1, 2 or 4. For example: a 1000 line encoder multiplied by a factor of 4 gives 4000 line/revolution (X4 resolution).

1.

X-AXIS (Sine wave or square wave encoder)	Y-AXIS	Z-AXIS	RESOLUTION X1
XJP4	YJP4	ZJP4	1-2
XJP5	YJP5	ZJP5	1-2
XJP6	YJP6	ZJP6	OUT
XJP7	YJP7	ZJP7	OUT
XJP12	YJP12	ZJP12	2-3
R104	R204	R304	IN
R106	R206	R306	OUT
R117	R217	R317	OUT
R118	R218	R318	IN

2. *

X-AXIS (Sine wave or square wave encoder)	Y-AXIS	Z-AXIS	RESOLUTION X2
XJP4	YJP4	ZJP4	1-2
XJP5	YJP5	ZJP5	1-2
XJP6	YJP6	ZJP6	OUT
XJP7	YJP7	ZJP7	IN
XJP12	YJP12	ZJP12	2-3
R104	R204	R304 43K	IN
R106	R206	R306 43K	OUT
R117	R217	R317 22K	OUT
R118	R218	R318 22K	IN

3.

X-AXIS	Y-AXIS	Z-AXIS	RESOLUTION X4 (Sine wave encoder)	RESOLUTION X4 (Square wave encoder)
XJP4	YJP4	ZJP4	1-2	1-2
XJP5	YJP5	ZJP5	OUT	OUT
XJP6	YJP6	ZJP6	IN	IN
XJP7	YJP7	ZJP7	OUT	OUT
XJP12	YJP12	ZJP12	1-2	1-2
R104	R204	R304	OUT	IN
R106	R206	R306	IN	OUT
R117	R217	R317	IN	OUT
R118	R218	R318	OUT	IN

INSERT DS1316 (QD5303)
ADD ECN 05443

4 AB JUMPERS

XYZ	X J1
N.O. LMT SW	OUT *
N.C.	IN

XYZ	X J2
SPARE	IN *

PROVIDE MATES
DB25P (PLUG)
3824659 (BACKSHELL)
D-20919-16 (SPECIALTY)

XYZ	X J4	X J5	X J6	X J7	X J12	304 204 R 104	306 206 R 106	318 218 R 118	317 217 R 117
X1	1-2	1-2	OUT	OUT	2-3	IN	OUT	IN	OUT
X2	1-2	1-2	OUT	IN	2-3	IN	OUT	IN	OUT *
X4	1-2	OUT	IN	OUT	1-2	OUT	IN	OUT	IN

43K 43K 22K 22K

XYZ	X J8	X J9	XYZ	X J10	XYZ	X J11
FEED BACK	1-2	1-2	3 BIT C2	IN *	2048 P/R	1-2 *
GROUND			C BIT C2	OUT	1024 P/R	2-3

	J1
X+ → CW	OUT *

	J2
Y+ → CW	OUT *

	J3
Z+ → CW	OUT *

	J4	J5
X, Y, Z	1-2	IN *
U, V, W	2-3	OUT

J6 DOES NOT EXIST

	J7	J8	J9	J10	J11
STOP FREE	IN	IN	IN	IN	IN *
AC-DC	Remove complete Assy				

3 AT JUMPERS

XYZ	X J1
N.O. LMT SW	OUT *
N.C.	IN

XYZ	X J2
SPARE	IN *

XYZ	X J4	X J5	X J6	X J7	X J12	304 204 R 104	306 206 R 106	318 218 R 118	317 217 R 117
X1	1-2	1-2	OUT	OUT	2-3	IN	OUT	IN	OUT
X2	1-2	1-2	OUT	IN	2-3	IN	OUT	IN	OUT *
X4	1-2	OUT	IN	OUT	1-2	OUT	IN	OUT	IN

43K 43K 22K 22K

XYZ	X J8	X J9	XYZ	X J10	XYZ	X J11
FEED BACK	1-2	1-2	3 BIT C2	IN *	2048 P/R	1-2 *
GROUND			C BIT C2	OUT	1024 P/R	2-3

	J1
X+ → CW	OUT *

	J2
Y+ → CW	OUT *

	J3
Z+ → CW	OUT *

	J4	J5
X, Y, Z	1-2	IN *
U, V, W	2-3	OUT

J6 DOES NOT EXIST

	J7	J8	J9	J10	J11
STOP FREE	IN	IN	IN	IN	IN *
AC-DC	Remove complete Assy				

5 CARD CAGE JUMPERS

POSITION	1		2		3		4		5		6		7		8	
	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
SWITCH 1		✓		✓		✓		✓		✓		✓		✓		✓
SWITCH 2	✓			✓		✓		✓		✓		✓		✓		✓
SWITCH 3	✓			✓		✓		✓		✓		✓		✓		✓
SWITCH 4	✓			✓		✓		✓		✓		✓		✓		✓
SWITCH 5		✓		✓		✓		✓		✓		✓		✓		✓
			Due to no LMI													
SWITCH 7	✓		✓													
SWITCH 8	✓		✓													
SWITCH 9		✓		✓												

RR = OR

REF SYSTEM DWG 620D1188

ITEM NO	PART OR IDENTIFYING NO	DESCRIPTION	SPEC	MATERIAL	QTY

2 JUL 96

R117, R217, R317 are 22K
R118, R218, R318 are 22K

R104, R204, R304 are 43K
R106, R206, R306 are 43K

D. DIRECTION JUMPERS

	JP1
* +X=CW	OUT
+X=CCW	IN

	JP2
* +Y=CW	OUT
+Y=CCW	IN

	JP3
* +Z=CW	OUT
+Z=CCW	IN

CW/CCW rotation refers to motor shaft rotation when viewed from mounting flange end of motor.

When direction becomes inverted, all travel relating to an axis gets inverted as well. (Refer to Home Direction Parameter #320.)

E. FEEDBACK CL/COMMAND CL OUTPUT SELECT JUMPER

Select jumper according to whether feedback clock or command clock is to be output to 10-pin connector interface A9J1-A9J6.

	XJP8	XJP9	YJP8	YJP9	ZJP8	ZJP9
* Feedback Cl	1-2	1-2	1-2	1-2	1-2	1-2
Command Cl	2-3	2-3	2-3	2-3	2-3	2-3

NOTE: FOR REV-A BOARD ONLY, THE FOLLOWING JUMPER SELECTIONS APPLY:

	XJP8	XJP9	YJP8	YJP9	ZJP8	ZJP9
* Feedback Cl	1-2	2-3	2-3	1-2	1-2	1-2
Command Cl	2-3	1-2	1-2	2-3	2-3	2-3

F. COUNT ZERO DEAD BAND JUMPER

	XJP10	YJP10	ZJP10
* 3 BIT	IN	IN	IN
5 BIT	OUT	OUT	OUT

Designates if dead band range is 3 bits or 5 bits.

G. D/A RESOLUTION JUMPER

	XJP11	YJP11	ZJP11
* 2048 BITS	1-2	1-2	1-2
1024 BITS	2-3	2-3	2-3

2048 Bits give ±2048 range on D/A, or 4.9mV per bit resolution.

1024 Bits give ±1024 range on D/A, or 9.8mV per bit resolution.

H. ACCEL/DECEL RATE OFFSET JUMPERS

	JP7	JP8	JP9	JP10	JP11
* MIN. RATE OFFSET	IN	IN	IN	IN	IN
	IN	IN	IN	IN	OUT
	IN	IN	IN	OUT	IN
	IN	IN	IN	OUT	OUT
	.	.	etc	.	.
MAX. RATE OFFSET	OUT	OUT	OUT	OUT	OUT
	MSB				LSB

I. JP6

JP6 does not exist.

J. ENCODER FAULT JUMPER

Add jumpers as required to disable the fail-safe encoder fault circuit on any axis not in use.

A8	A7	JUMPER
X	U	FROM M109-7 - TO M109-10
Y	V	FROM M209-7 - TO M209-10
Z	W	FROM M309-7 - TO M309-10

EXAMPLE:

When using a 3-axis indexing board (IDX-3) for a 2-axis system in the XY configuration, the jumper from M309-7 to M309-10 must be installed or a drive fault condition will inhibit system operation.

K. INDEXING BOARD CONNECTORS

1. CONNECTORS J1 AND J2

Unidex 16 Versabus card edge connectors require no customer interfacing.

2. CONNECTORS J3, J4, J5 (XYZ/UVW)

ENCODER, LIMIT AND TACH INTERFACE

PIN #	FUNCTION	COMMENT
1	SIGNAL SHIELD	For more information on encoder inputs, see chapter 6 of this manual.
11	SIN	
4	SIN-N	
10	COS	
3	COS-N	
12	MARKER	
5	MARKER-N	
14	+5V OUTPUT	250 mA per axis, maximum
2	COMMON	
8	CW/CW-N LIMIT	For more information on limit inputs, see chapter 4.
7	CCW/CCW-N LIMIT	
9	HOME/HOME-N LIMIT	
13	RESERVED	
6	RESERVED	

MATING CONNECTOR

	AEROTECH NUMBER
3M CONNECTOR 3572-1001	(ECK 354)
or	
AMP CONNECTOR 552316-1	(ECK 357)
BACKSHELL 2-552412-1	(ECK 366)

3. CONNECTOR J6, SERVO AMPLIFIER INTERFACE (XYZ/UVW)

PIN #	FUNCTION	COMMENT
1	SIGNAL SHIELD	
28	X/U OUTPUT	± 10V ANALOG OUTPUT
34	Y/V OUTPUT	
40	Z/W OUTPUT	
3	X/U COMMON	
2	X/U COMMON	
9	Y/V COMMON	ANALOG COMMON
8	Y/V COMMON	
15	Z/W COMMON	
14	Z/W COMMON	
4	X/U SHUT DOWN	
10	Y/V SHUT DOWN	OPEN COLLECTOR TTL
16	Z/W SHUT DOWN	OUTPUT ACTIVE HIGH
27	RESERVED	
33	RESERVED	
39	RESERVED	
26	FAULT INPUT –	LOGIC INPUT, 74LS27 WITH 1K PULL UP. ACTIVE HIGH MUST BE PULLED LOW IF NOT USED

MATING CONNECTOR

	AEROTECH NUMBER
3M CONNECTOR 3564-1001	(ECK 353)
OR	
AMP CONNECTOR 552032-1	(ECK 320)
90 BACKSHELL 552731-1 OR 180 BACKSHELL 552008-1	(EIK 264)
ALPHA CABLE 5100/50	

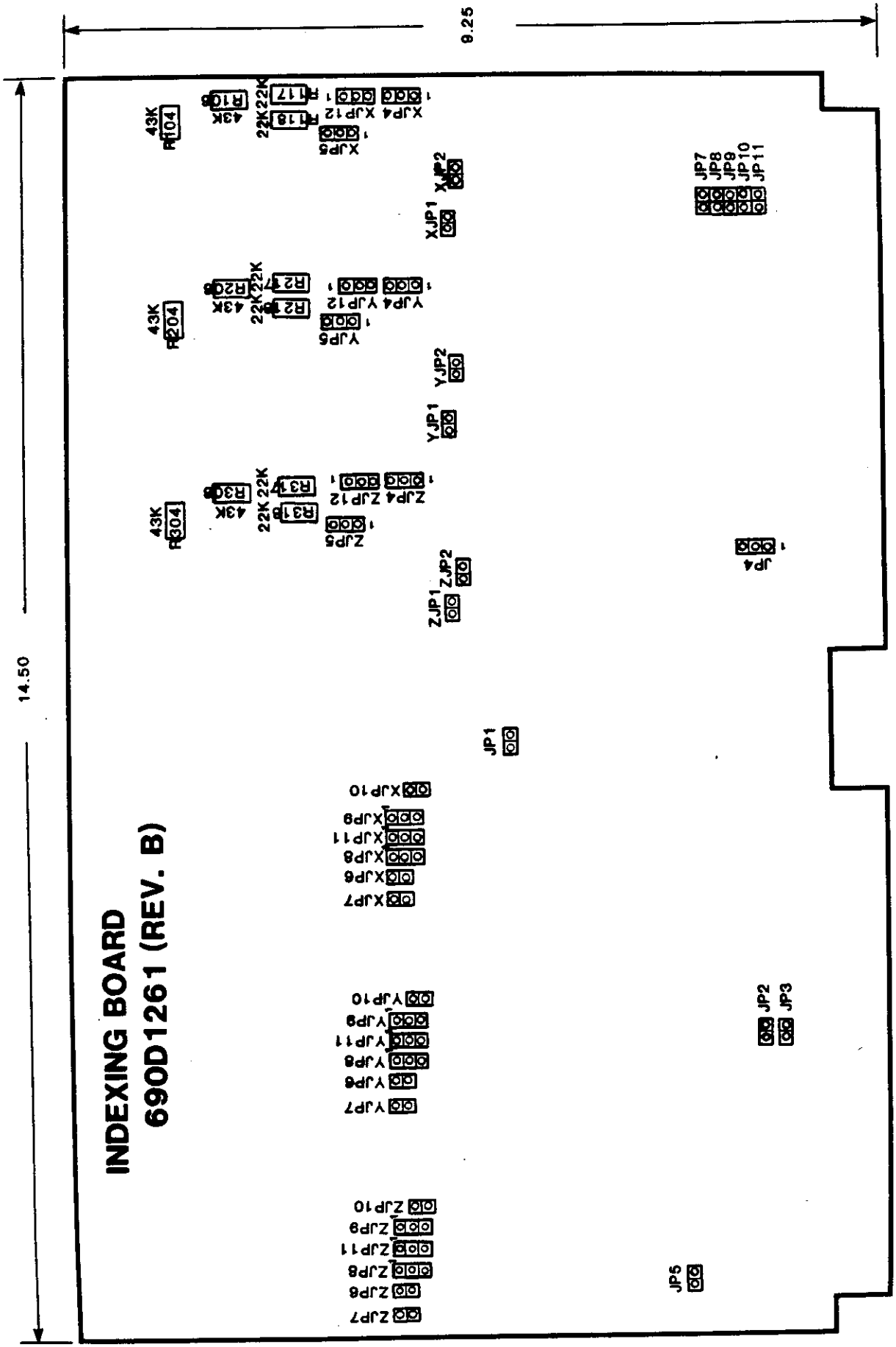


FIGURE 7-5: INDEXING BOARD

SECTION 7-6 LMI CARD

NOTE: Aerotech standards will be indicated by an asterisk (*).

A. ADDRESS JUMPERS

Although no address lines exist on the MST bus, each LMI-16 card can be jumpered to respond to two decades of M-function data (M00 - M99). As an example, the first LMI-16 card (A30) will set one of 10 latched relay outputs with M-function commands M90 through M99 and reset (clear) one of 10 latched relay outputs with M-function commands M80 through M89.

NOTE: A logic input followed by "-N" indicates an active low signal.

LMI CARD	SET JUMPER	CLEAR JUMPER
A30 (1ST LMI)	M90*	M80*
A31 (2ND LMI)	M70*	M60*
A32 (3RD LMI)	M50*	M20*
(4TH LMI)	AS REQUIRED	AS REQUIRED
(5TH LMI)	AS REQUIRED	AS REQUIRED

Notice the LMI card at A32 has its clear jumpers configured as M20-M29. The reason the M40 decade is not used is because M47 is usually a software command (repeat program). As mentioned

previously, the MST bus can accommodate up to 5 LMI-16 cards. When a fourth and fifth card is used, however, the M codes needed to address these cards will conflict with some software M-functions, since M0, M1, M2, M30 and M47 are generally designated for specific software functions. This may be changed in the parameters (see the "Unidex 16 User's Manual", chapter 6) and a software M-function can be configured as a output or user M-function instead.

B. RESET-N JUMPER

JP 3-4	
IN	* MST RESET-N will clear latched outputs
OUT	MST RESET-N disabled

When foil jumper 3-4 is IN, MST reset (front panel reset) will clear all M-functions.

C. M STROBE-N

JP 13-14	
IN	* M STROBE-N active
OUT	M STROBE-N not required

Jumper 13-14 must be in when used with Unidex 16. Jumper 13-14 is provided for other applications.

D. LMI INPUTS AND ASSOCIATED JUMPERS

1. ACKNOWLEDGE INPUT (INPUT #1)

TB1-34 is ACK-HI
TB1-35 is ACK-LO

Each device on the MST bus normally generates an acknowledge signal when communicating with Unidex 16. The acknowledge input is used by Unidex 16 for handshaking with external devices. An acknowledge can originate from the LMI card itself or from an external device via the LMI-16 acknowledge inputs.

The acknowledge may be one of three types, explained fully in chapter 11 of the "Unidex 16 User's Manual". They are:

TYPE A: Output code to bus, wait forever for acknowledge.

TYPE B: Output code to bus, no acknowledge.

TYPE C: Output code to bus, wait for timed acknowledge.

The jumper settings decide which acknowledge (local or external) will be required. This is shown in the following table:

		SELECT	
		LOCAL	EXTERNAL
(SET)	S0	IN *	OUT
(CLEAR)	C0	IN *	OUT
	S1	IN *	OUT
	C1	IN *	OUT
	S2	IN *	OUT
	C2	IN *	OUT
	S3	IN *	OUT
	C3	IN *	OUT
	S4	IN *	OUT
	C4	IN *	OUT
	S5	IN *	OUT
	C5	IN *	OUT
	S6	IN *	OUT
	C6	IN *	OUT
	S7	IN *	OUT
	C7	IN *	OUT
	S8	IN *	OUT
	C8	IN *	OUT
	S9	IN *	OUT
	C9	IN *	OUT

The S0 to S9 selections apply to M90 to M99, M70 to M79 or M50 to M59, depending on the LMI card address (A30, A31 or A32). Of course, C0 to C9 selections apply to M80 to M89, M60 to M69 or M20 to M29. For example: if S0 is removed on A30 LMI-16 card, then when M90 is programmed, an external acknowledge is required.

If jumper 1-2 is removed (jumper out is the Aerotech standard) and R23 is a 2W 20K resistor, then the acknowledge input is configured for an opto-isolated 115V AC/DC input. (The value of R23 may vary according to input voltage requirements.)

If jumper 1-2 is in and R23 is removed, then the acknowledge is configured for 5V logic input, as illustrated in the diagram below:

INPUT	JUMPER 1-2	R23
LOGIC	IN	OUT
OPTO	OUT *	IN *

2. FAULT INPUT (INPUT #2)

When jumper 7-8 is inserted (standard), input #2 will be configured as a fault input.

The fault input must be activated (opto input) or pulled low (logic input) or a fault condition will exist that will inhibit the drives and signal Unidex 16 that a fault has occurred.

TB1-2 IS FAULT HI
TB1-3 IS FAULT LO

If jumper 5-6 is removed (jumper out is the Aerotech standard) and R26 is a 2W 20K resistor, then the fault input is configured for an opto-isolated 115V AC/DC input. (The value of R26 may vary according to input voltage requirements.)

If jumper 5-6 is in and R26 is removed, then the fault is configured for 5V logic input, as illustrated in the diagram below:

INPUT	JUMPER 5-6	R26
LOGIC	IN	OUT
OPTO	OUT *	IN *

CAUTION

ON MOST SYSTEMS, INPUT #2 IS SET UP FOR +12V OPTO INPUT (JUMPER 5-6 IS OUT AND R26 IS A 1K 1/4 WATT RESISTOR). THIS CAN BE VERIFIED BY CHECKING CARD OR SYSTEM DOCUMENTATION.

3. HALT INPUT OR CIRQ INPUT (INPUT #2)

HALT

To configure this input as a HALT-N (Halt is a feedhold), remove 7-8 and jumper 9-10 (make sure 11-12 is removed as well). TB1-2 becomes HALT-HI and TB1-3 becomes HALT-LO. If the input is configured as 5V logic, however, then TB1-2 becomes HALT-N and TB1-3 is not used.

CIRQ

CIRQ is an interrupt input (jumper 11- 12, remove 7-8 and 9-10). TB1-2 becomes CIRQ-HI and TB1-3 becomes CIRQ-LO. If the input is configured as 5V logic, TB1-2 becomes CIRQ-N and TB1-3 is not used.

E. POWER REQUIREMENTS

NOMINAL VALUES:

+5 V at 50 mA
+12 V at 300 mA

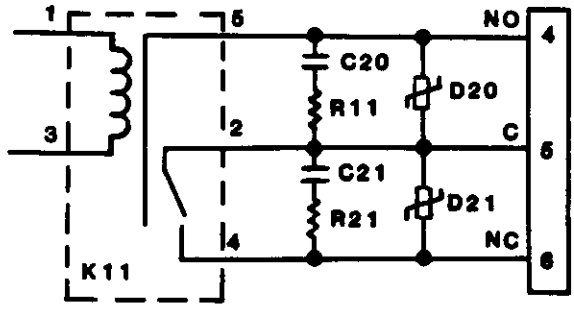
NOTE: For timing and MST pin-outs, see the "Unidex 16 User's Manual", chapter 11.

F. OUTPUTS

1. LATCHED OUTPUTS

There are 10 latched form "C" relay outputs on the LMI card. See the illustration below for a typical output:

TYPICAL OUTPUT

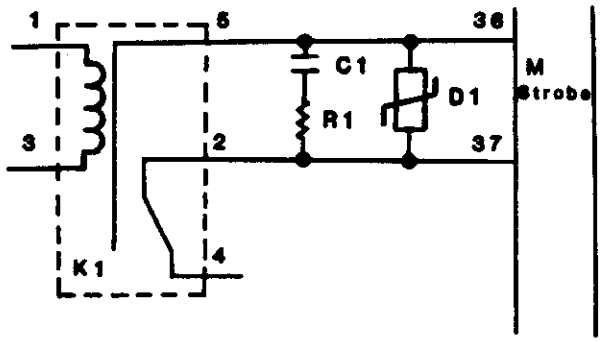


CONTACT RATING 5A AT 120VAC/28VDC
(RESISTIVE LOAD)

ALL VARISTORS AC 130V (V130LA20A) UNLESS OTHERWISE SPECIFIED.

2. M-STROBE OUTPUT

The M-strobe output is unique in that its not latched and provides only the normally open function. The duration of the strobe output will be determined by the M-function parameters (see the "Unidex 16 User's Manual", chapter 6).



(ALL RESISTORS 1/2 WATT 220 OHMS)
(ALL CAPACITORS .1 uF 400 V)

G. USER INTERFACE TB1

LMI-16 CARD RELAY OUTPUTS

10 LATCHED FOR "C" AND "M" STROBE

* SET/CLEAR	NORMALLY OPEN	WIPER	NORMALLY CLOSED
M90/M80	TB1-4	TB1-5	TB1-6
M91/M81	TB1-7	TB1-8	TB1-9
M92/M82	TB1-10	TB1-11	TB1-12
M93/M83	TB1-13	TB1-14	TB1-15
M94/M84	TB1-16	TB1-17	TB1-18
M95/M85	TB1-19	TB1-20	TB1-21
M96/M86	TB1-22	TB1-23	TB1-24
M97/M87	TB1-25	TB1-26	TB1-27
M98/M88	TB1-28	TB1-29	TB1-30
M99/M89	TB1-31	TB1-32	TB1-33
"M" STROBE	TB1-36	TB1-38	NOT USED

(AEROTECH STANDARD JUMPER SELECTION)

POWER OUTPUT

TB1-38	+12V (MAX 50 mA)
TB1-1	LOGIC COMMON

INPUTS

	INPUTS	OPTO-ISOLATED	5V LOGIC	
INPUT #1	TB1-34	ACK HI	ACK-N	
	TB1-35	ACK LO	NOT USED	
INPUT #2	TB1-2	FAULT HI	FAULT	JUMPER
	TB1-3	FAULT LO	NOT USED	7-8*
	TB1-2	HALT HI	HALT-N	
	TB1-3	HALT LO	NOT USED	9-10
	TB1-2	CLT HI	HALT-N	
	TB1-3	HALT LO	NOT USED	9-10
	TB1-2	CIRQ HI	CIRQ-N	
	TB1-3	CIRQ LO	NOT USED	11-12

CAUTION

ON MOST SYSTEMS, INPUT #2 IS SET UP FOR +12V OPTO INPUT (JUMPER 5-6 IS OUT AND R26 IS A 1K 1/4 WATT RESISTOR). THIS CAN BE VERIFIED BY CHECKING CARD OR SYSTEM DOCUMENTATION.

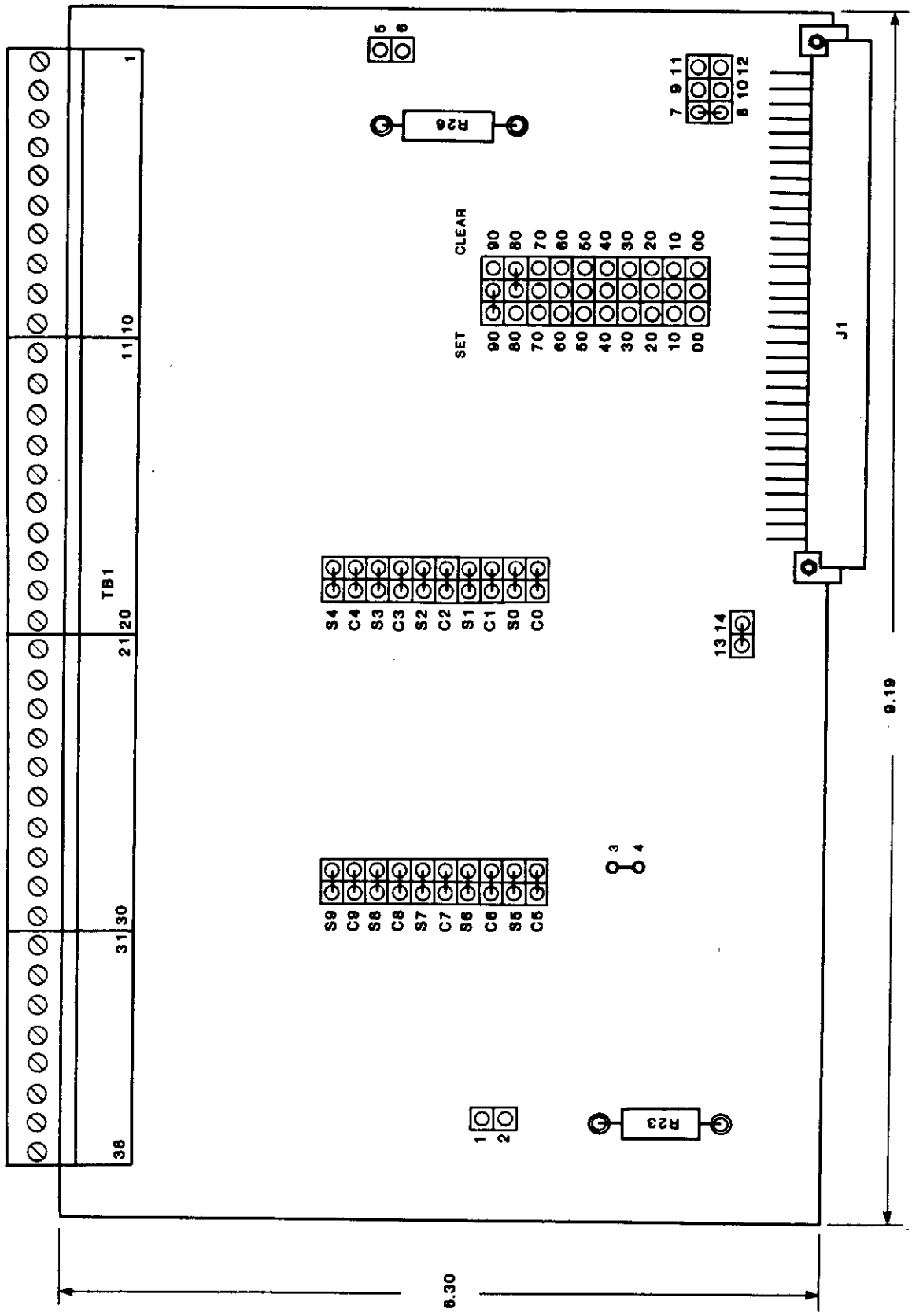


FIGURE 7-6: LMI CARD

SECTION 7-7 TCIO BOARD

Aerotech standards for jumper selections are indicated by an asterisk (*).

The TCIO option is a universal module which provides the following features:

- Four (opto-isolated or logic) inputs to Unidex 16
- Four input-activated interrupts
- Interface for the Opto 22 Pamux 1 card
- Reset circuitry
- Termination for the I/O bus
- Power input to the I/O bus
- Single-high (3U) VME card form factor
- Jumper selection for interrupts
- Jumper selection for interrupt edge sensing

A. TCIO SPECIFICATIONS

CHARACTERISTICS	SPECIFICATIONS
OVERALL DIMENSIONS:	
LENGTH	6.95"
WIDTH	3.94"
THICKNESS	1.35"
SUGGESTED MATING CONNECTORS:	
J1 (I/O BUS)	3M: 3338-0001 (ECK 355)
J2 (POWER SUPPLY)	WEIDMULLER: 5528.6 (ECK 519)*
J3 (USER INPUTS)	3M: 3399-6026 (ECK 343)*
J4 (OPTO 22 INTERFACE)	3M: 3425-6050 (ECK 332)
* CONNECTOR SUPPLIED	
POWER REQUIREMENTS	5V @ 375 mA (TYPICAL)
INPUTS:	
OPTO ISOLATED	5V @ 20 mA
or	
5V LOGIC	CMOS INPUT WITH 4.7K PULL-UP
DEBOUNCE	TYPICAL 15 - 20 mS **
TEMPERATURE:	
OPERATING	0 TO 50 C
STORAGE	-40 TO 70 C

B. OPERATION OF THE TCIO CARD

1. INPUT JUMPERS JP4

The input can be configured as an opto isolated type (standard) or as a 5V logic type (jumper selectable).

JP4

INPUT #1

JUMPER 1-2	R1	
IN	OUT	Logic input
OUT	IN	* Opto isolated input

INPUT #2

JUMPER 3-4	R2	
IN	OUT	Logic input
OUT	IN	* Opto isolated input

INPUT #3

JUMPER 5-6	R3	
IN	OUT	Logic input
OUT	IN	* Opto isolated input

INPUT #4

JUMPER 7-8	R4	
IN	OUT	Logic input
OUT	IN	* Opto isolated input

The value of R1 - R4 will vary according to input voltage requirements. (Standard is 5V opto isolated input. R is a 120 ohm, 1/4 watt resistor.)

If configured as an opto isolated input, the input will be activated and the LED will light when 20 mA of current is flowing through the opto coupler.

If configured as a 5V logic-N input, then the input will be activated when pulled low.

Because the TCIO board employs a debounce circuit, the input must remain actuated for at least 20mS or the input (and/or interrupt) cannot be read. If, however, interfacing with high speed logic is required, the value of C1 can be changed to allow for minimum debouncing.

In order to read the 4 inputs, Unidex 16 will read the first 4 bits of the Input/Interrupt Status Register. An input is indicated when the appropriate bit is set high. The Input/Interrupt Status Register is <u>always</u> located at address $780. The second 4 bits are designated as the interrupt flags.

INPUT/INTERRUPT STATUS REGISTER

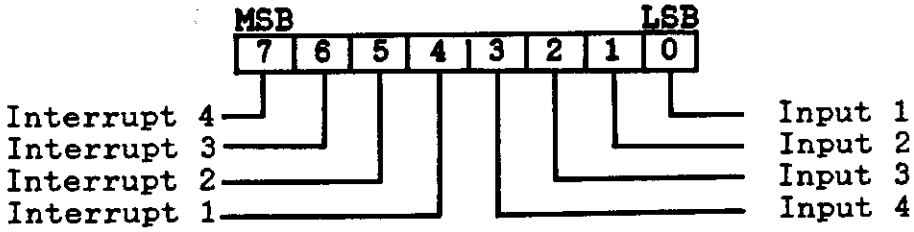


DIAGRAM 1

Following is an example of programming Unidex 16 to read the inputs:

```
VAR1=$780
(MSG,<2>,#H:VAR1)
```

In the above example, Unidex 16 will read the inputs and store the data in a users-variable (VAR1).

See the "Unidex 16 User's Manual" for more on the use of variables and the logic functions that help you to utilize your input information (see section 10-4 and 10-6C).

In the above example, the second block will cause the input information to be displayed on the CRT for 2 seconds in a hexadecimal format.

2. INTERRUPTS

The Unidex 16 I/O bus has 4 interrupts which are shared by all I/O modules. On the TCIO board, these 4 interrupts are accessed via the 4 inputs. Each interrupt line has a certain priority, INT4 having the highest priority, INT1 having the lowest.

The interrupt lines are used to interrupt Unidex 16 while it is performing another task. An interrupt is generated when a change in voltage level is detected (as opposed to an input, which detects a voltage level).

Please refer to the Unidex 16 User's Manual, section 10-2 O, for details on interrupt types and options.

INTERRUPT ACTIVE JUMPER JP2

Each of the inputs can be used to activate an interrupt when the appropriate jumper is installed in header JP2.

JP2

INPUT #1

JUMPER 1-2	
IN *	Interrupt #1 active
OUT	Input only

INPUT #2

JUMPER 3-4	
IN *	Interrupt #2 active
OUT	Input only

INPUT #3

JUMPER 5-6	
IN *	Interrupt #3 active
OUT	Input only

INPUT #4

JUMPER 7-8	
IN *	Interrupt #4 active
OUT	Input only

When an input is activated, the corresponding interrupt flag will be set and the interrupt line will be held low by the TCIO board. It will be held low until that flag is cleared by Unidex 16 by reading or writing to the appropriate TCIO address (see table below).

TCIO ADDRESS	INTERRUPT FLAG
$790	Interrupt flag 1
$7A0	Interrupt flag 2
$7B0	Interrupt flag 3
$7C0	Interrupt flag 4

Because the interrupt lines are shared by all I/O modules, one of the first tasks performed by Unidex 16 upon receiving an interrupt will be to determine which module generated the interrupt. By reading the Input/Interrupt Status Register, Unidex 16

can determine if the TCIO board generated the interrupt by checking to see if any of the bits are set (see diagram 1).

The Status Register check and the clearing of the interrupt flags must be generated by the user's program.

INTERRUPT EDGE JUMPERS JP3

Interrupts can be generated when inputs are activated (+ edge) or deactivated (- edge). This will be determined by header JP3 as shown next:

JP3

INPUT #1 - INTERRUPT #1

JUMPER 1-2	
IN *	+ Edge
OUT	- Edge

INPUT #2 - INTERRUPT #2

JUMPER 3-4	
IN *	+ Edge
OUT	- Edge

INPUT #3 - INTERRUPT #3

JUMPER 5-6	
IN *	+ Edge
OUT	- Edge

INPUT #4 - INTERRUPT #4

JUMPER 7-8	
IN *	+ Edge
OUT	- Edge

INTERRUPT FLAG OUTPUT

In addition to the internal functions of the interrupt flags, each flag provides an output and LED indicator as well. The output allows the user to see when an interrupt flag has been set as well as when its been cleared.

The output is available through an optical isolator (Motorola 4N33).

A typical example of an interrupt is as follows:

```
N1 (INT1,4,SUB1) ; Enable interrupt.  Upon
                 ; INT1, go to subroutine SUB1
        .
        .
        .
N10 (DFS,SUB1    ; Define subroutine SUB1
N11 VAR1=$780    ; Read Input/Interrupt Status
                 ; Register
        .
        .
        .
N20 $790=H,00    ; Clear interrupt flag #1
                 ; to zero
N21 (MSG,<2>,INT1 - VAR1=#H:VAR1); Display
                 ; message showing INT 1 as
                 ; well as the hex value of
                 ; of VAR1
N22 )            ; End of subroutine
```

In the above program, N1 will arm Unidex 16 to act on a level 1 interrupt, utilizing the #4 option. The #4 option tells Unidex 16 to finish all functions in the present program block before servicing the subroutine and when the subroutine is complete to go back to the next block of the main program.

3. OPTO 22 PAMUX 1 INTERFACE

The interface between the TCIO card and one or more Opto 22 cards is provided through J4. J4 is a 50 pin ribbon cable connector that is pin for pin compatible with Opto 22 Pamux 1 (PB16P1).

The Opto 22 Pamux 1 is a flexible I/O system which can accommodate up to 16 plug-in I/O modules of AC inputs, DC inputs, AC outputs, DC outputs or any combination of the above.

Each Opto 22 Pamux 1 board has 2 (8-bit) bytes of data, each bit corresponding to one I/O module, and is provided with an address switch. An address ranging from $700 to $77F may be selected. When the address switch for one Opto 22 board is set to a certain address, for example $700, the first 8 modules are assigned to this address. Automatically, the second 8 modules are assigned to the next address (in this case $701).

To select addresses, see the following diagram.

OPTO 22 PAMUX 1

OPTO 22 PAMUX 1	ADDRESS SWITCHES	ADDRESS	MODULES	ADDRESS	MODULES
	654321				
A47(A)	CCCCCC	$700	0-7	$701	8-15
A47(B)	CCCCCO	$702	0-7	$703	8-15
.	.	.	.	.	.
.	.	.	.	.	.
	OOOOOO	$77E	0-7	$77F	8-15

C = CLOSED
O = OPEN

NOTE: TERMINATING RESISTORS ON THE LAST PAMUX 1 BOARD ONLY. REMOVE ALL OTHERS.

4. RESET JUMPER JP1

The TCIO card is provided with reset option circuitry. Within this circuitry, there is a jumper provided for the interrupt flags and one for the Opto 22 interface.

If the Unidex 16 <RESET> is to have no effect on the interrupt flags or on the Opto 22 Pamux 1 board, the jumper (JP1) applicable to either or both may be removed.

JP1

JUMPER 1-2

IN *	Unidex 16 <RESET> active: will reset interrupt flags
OUT	Unidex 16 <RESET> inactive: will not reset interrupt flags

JUMPER 3-4

IN *	Unidex 16 <RESET> active: will reset Opto 22 Pamux 1 board
OUT	Unidex 16 <RESET> inactive: will not reset Opto 22 Pamux 1 board

5. BUS TERMINATION

The TCIO board provides adequate termination for the I/O bus. All of the address lines, data lines and clock lines are terminated with a 330 ohm pull-up resistor and a 470 ohm pull-down resistor.

6. POWER INPUTS J2

The J2 connector on the TCIO card provides the DC power connections to run not only the TCIO card but also provides power for the rest of the modules on the I/O bus, as well.

When no auxiliary power supply is required, the TCIO board will be powered through the ribbon cable wiring of the I/O bus. When an auxiliary power supply is required for more I/O capacity, then the I/O bus will be powered via the J2 connector.

7. USER INTERFACE

J1 - I/O BUS INTERFACE

PIN#	FUNCTION	PIN#	FUNCTION
C1	INT4-N	A1	COMMON
C2	INT3-N	A2	COMMON
C3	INT2-N	A3	COMMON
C4	INT1-N	A4	COMMON
C5	IORES-N	A5	COMMON
C6	XACK-N	A6	COMMON
C7	CLOCK	A7	COMMON
C8	RESERVED	A8	COMMON
C9	RESERVED	A9	COMMON
C10	RESERVED	A10	COMMON
C11	COMMON	A11	A11
C12	A9	A12	A10
C13	A7	A13	A8
C14	A5	A14	A6
C15	A3	A15	A4
C16	A1	A16	A2
C17	A0	A17	COMMON
C18	STB-N	A18	COMMON
C19	R/W	A19	COMMON
C20	COMMON	A20	D7

PIN#	FUNCTION	PIN#	FUNCTION
C21	D5	A21	D6
C22	D3	A22	D4
C23	D1	A23	D2
C24	D0	A24	COMMON
C25	COMMON	A25	COMMON
C26	-12V	A26	-12V
C27	RESERVED	A27	RESERVED
C28	+12V	A28	+12V
C29	+5V	A29	+5V
C30	+5V	A30	+5V
C31	COMMON	A31	COMMON
C32	COMMON	A32	COMMON

J2 - POWER SUPPLY

PIN#	FUNCTION
1	+12V
2	+5V
3	SIG COM
4	-12V

J3 - INPUTS/INTERRUPT FLAG OUTPUTS

PIN#	FUNCTION
1	COMMON
2	IP1+ (Input #1)
3	IP1-
4	COM
5	IP2+
6	IP2-
7	COMMON
8	IP3+
9	IP3-
10	COMMON

PIN#	FUNCTION	
11	IP4+	
12	IP4-	
13	COMMON	
14	INT1+	(Interrupt flag output)
15	INT1-	
16	COMMON	
17	INT2+	
18	INT2-	
19	COMMON	
20	INT3+	
21	INT3-	
22	COMMON	
23	INT4+	
24	INT4-	
25	COMMON	
26	+5V	(50 mA)

J4 - OPTO 22 PAMUX 1 INTERFACE

PIN#	FUNCTION
1	A7-N
2	SIG COM
3	A6-N
4	SIG COM
5	A5-N
6	SIG COM
7	A4-N
8	SIG COM
9	A3-N
10	SIG COM
11	A2-N
12	SIG COM
13	A1-N
14	SIG COM
15	A0-N
16	SIG COM
17	RESERVED
18	SIG COM
19	RESERVED

PIN #	FUNCTION
20	SIG COM
21	W-N
22	SIG COM
23	R-N
24	SIG COM
25	RESERVED
26	SIG COM
27	RESERVED
28	SIG COM
29	RESERVED
30	SIG COM
31	RST-N
32	SIG COM
33	D7-N
34	SIG COM
35	D6-N
36	SIG COM
37	D5-N
38	SIG COM
39	D4-N
40	SIG COM
41	D3-N
42	SIG COM
43	D2-N
44	SIG COM
45	D1-N
46	SIG COM
47	D0-N
48	SIG COM
49	RESERVED
50	SIG COM

INDEX

Warranty and Field Service Policy

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a period of one year from date of shipment from Aerotech. Seller'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 one-year period. Seller 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 seller in specifications or drawings previously or subsequently provided seller, and whether or not seller's products are specifically designed and/or manufactured by seller for buyer's use or purpose. Aerotech's liability on 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.

Returning Goods Procedure
Claims for incorrect or defective materials must be filed within thirty (30) days from delivery at buyer's place of business. No units or systems may be returned, in or out of warranty, without first obtaining approval from the seller, and no claim will be allowed nor credit given for units or systems returned without such approval.

Returned Goods Warranty Determination
If possible, after approval from Aerotech, the defective unit or system is to be returned to the factory with statement of problem and transportation prepaid (no c.o.d. or collect freight shipments will be accepted). After Aerotech's in-plant examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination of such unit or system, warrantied defects exist, then the unit or system will be repaired at no charge and shipped, prepaid, back to the buyer. If an out-of-warranty situation exists, the buyer shall be notified of the repair cost immediately. At such time, the buyer must issue a purchase order to cover the cost of the repair or authorize the unit or system to be shipped back as is, at the buyer's expense.

On-Site Warranty Repair
If the system or unit cannot be made functional by telephone assistance or by sending and having customer install replacement parts, and cannot be returned to the Aerotech factory for repair, and if it is determined that 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 bona-fide purchase order to Aerotech covering all transportation and subsistence costs. For warranty repairs, customer will not be charged for cost of labor and material.

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 system or unit cannot be made functional by no-charge telephone assistance or purchased replacement parts cannot be returned to the Aerotech factory 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 bona-fide purchase order to Aerotech covering all transportation and subsistence costs and the prevailing cost per hour including travel time necessary to complete the repair.

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

Bulletin No. 130-1286

ADDENDUM ONE

REVISION OF SECTION 7-5 (INDEXING BOARD JUMPERS AND CONNECTORS). PERTAINS TO REV.C AND AFTER

SECTION 7-5 INDEXING BOARD JUMPERS AND CONNECTORS

Aerotech standards for jumper selections will be indicated with an asterisk (*).

The silk screen on the indexing board is for the XYZ axes group. Therefore, if the indexing board is addressed for UVW operation, a silkscreened X indicates the U axis, a Y indicates the V axis, and a Z indicates the W axis.

A. AXIS ADDRESS JUMPERS

			JP4	JP5
*	A8	X,Y,Z	1-2	IN
	A7	U,V,W	2-3	OUT

To address the indexing board for X, Y, Z operation (A8), jumper JP4 1-2, JP5 IN.

To address the indexing board for U, V, W operation (A7), jumper JP4 2-3, JP5 OUT.

B. LIMIT JUMPERS

		XJP1	YJP1	ZJP1
*	Normally Open (LMT-N)	OUT	OUT	OUT
	Normally Closed (LMT)	IN	IN	IN

SPARE	XJP2	YJP2	ZJP2
*	IN	IN	IN

For LMT-N, a low signal indicates a limit.
For LMT, a high signal indicates a limit.

NOTE: CW/CCW rotation refers to motor shaft rotation viewed from mounting flange end of motor.

C. RESOLUTION JUMPERS

Position feedback can be multiplied by a factor of 1, 2 or 4. For example: a 1000 line encoder multiplied by a factor of 4 gives 4000 line/revolution (X4 resolution).

1. XI RESOLUTION

MAIN INDEXING BOARD 690D1261 (FOR SINE WAVE AND SQUARE WAVE ENCODERS)

XJP4	YJP4	ZJP4	1-2
XJP5	YJP5	ZJP5	1-2
XJP6	YJP6	ZJP6	OUT
XJP7	YJP7	ZJP7	OUT

X/Y/Z SINE WAVE ENCODER BOARD 690C1333 (FOR SINE WAVE ENCODER ONLY)

R5	22K
R6	OUT
R7	OUT
R8	43K

JUMPER 2-3 (REMOVE 1-2)

2. X2 RESOLUTION

MAIN INDEXING BOARD 690D1261 (FOR SINE WAVE AND SQUARE WAVE ENCODERS).

XJP4	YJP4	ZJP4	1-2
XJP5	YJP5	ZJP5	1-2
XJP6	YJP6	ZJP6	OUT
XJP7	YJP7	ZJP7	IN

X/Y/Z SINE WAVE ENCODER BOARD 690C1333
(FOR SINE WAVE ENCODER ONLY)

R5	22K
R6	OUT
R7	OUT
R8	43K

JUMPER 2-3 (REMOVE 1-2)

* 3. **X4 RESOLUTION**

MAIN INDEXING BOARD 690D1261 (FOR SINE WAVE AND SQUARE WAVE ENCODERS)

XJP4	YJP4	ZJP4	1-2
XJP5	YJP5	ZJP5	OUT
XJP6	YJP6	ZJP6	IN
XJP7	YJP7	ZJP7	OUT

* X/Y/Z SINE WAVE ENCODER BOARD 690C1333
(FOR SINE WAVE ENCODER ONLY)

R5	OUT
R6	43K
R7	22K
R8	OUT

JUMPER 1-2 (REMOVE 2-3)

Unless otherwise specified, the X4 resolution mode is the Unidex 16 Indexing Board standard. This standard configuration includes three Sine Wave Encoder Interface Boards (690C1333), which are plugged into the main Indexing Board. If a square wave encoder is required, the sine wave interface must be removed and replaced with a Square Wave Encoder Interface Board (690C1334). These Encoder Interface Modules can be mixed and matched.

D. DIRECTION JUMPERS

	JP1
* +X=CW	OUT
+X=CCW	IN

	JP2
* +Y=CW	OUT
+Y=CCW	IN

	JP3
* +Z=CW	OUT
+Z=CCW	IN

CW/CCW rotation refers to motor shaft rotation when viewed from mounting flange end of motor.

When direction becomes inverted, all travel relating to an axis gets inverted as well. (Refer to Home Direction Parameter #320 and Jog Arrows Parameter #160.)

E. FEEDBACK CL/COMMAND CL OUTPUT SELECT JUMPER

Select jumper according to whether feedback clock or command clock is to be output to 10-pin connector interface A9J1-A9J6.

	XJP8	XJP9	YJP8	YJP9	ZJP8	ZJP9
* Feedback Cl	1-2	1-2	1-2	1-2	1-2	1-2
Command Cl	2-3	2-3	2-3	2-3	2-3	2-3

F. COUNT ZERO DEAD BAND JUMPER

	XJP10	YJP10	ZJP10
* 3 BIT	IN	IN	IN
5 BIT	OUT	OUT	OUT

Designates if dead band range is 3 bits or 5 bits.

G. D/A RESOLUTION JUMPER

	XJP11	YJP11	ZJP11
* 2048 BITS	1-2	1-2	1-2
1024 BITS	2-3	2-3	2-3

2048 Bits give ±2048 range on D/A, or 4.9mV per bit resolution.

1024 Bits give ±1024 range on D/A, or 9.8mV per bit resolution.

H. ACCEL/DECEL RATE OFFSET JUMPERS

	JP7	JP8	JP9	JP10	JP11
* MIN. RATE OFFSET	IN	IN	IN	IN	IN
	IN	IN	IN	IN	OUT
	IN	IN	IN	OUT	IN
	IN	IN	IN	OUT	OUT
	.	.	etc	.	.
MAX. RATE OFFSET	OUT	OUT	OUT	OUT	OUT
	MSB				LSB

I. ENCODER FAULT JUMPER

Add jumpers as required to disable the fail-safe encoder fault circuit on any axis not in use.

	JUMPER	XJP3	YJP3	ZJP3
*	Enable	2-3	2-3	2-3
	Disable	1-2	1-2	1-2

EXAMPLE:

When using a 3-axis indexing board (IDX-3) for a 2-axis system in the XY configuration, the jumper from 1-2 on ZJP3 must be installed in order to disable the drive fault condition. If not, system operation will be inhibited.

J. USER FREE-RUN (SFR) OPTION

With this option you can select the speed of the free-run axis via "S" commands and run/stop via "M" commands. Only one of the axes in your system can be configured for axis free-run. In addition to adding the User Free-Run Board (690D1303) to the Unidex 16 card cage, the following hardware changes must be made to the indexing board. (See User Free-Run Addendum in the Unidex 16 User's Manual for more information.)

FREE RUN AXIS

JUMPER	X	Y	Z	* NO FREE-RUN
XJP13	OUT	1-2	1-2	1-2
XJP14	OUT	1-2	1-2	1-2
YJP13	1-2	OUT	1-2	1-2
YJP14	1-2	OUT	1-2	1-2
ZJP13	1-2	1-2	OUT	1-2
ZJP14	1-2	1-2	OUT	1-2
XJP16	1-2	2-3	2-3	2-3
XJP17	1-2	2-3	2-3	2-3
XJP18	1-2	2-3	2-3	2-3
YJP16	2-3	1-2	2-3	2-3
YJP17	2-3	1-2	2-3	2-3
YJP18	2-3	1-2	2-3	2-3
ZJP16	2-3	2-3	1-2	2-3
ZJP17	2-3	2-3	1-2	2-3
ZJP18	2-3	2-3	1-2	2-3
JP18	1-4	1-3	1-2	1-5
JP19	1-4	1-3	1-2	1-5
JP20	1-2	1-3	1-4	1-5

K. ENCODER SYNCHRONIZATION (E SYNC) OPTION

The Encoder Synchronization Option is used to synchronize Unidex 16 with other equipment (such as a conveyor belt) for the purpose of positioning or contouring on the fly. Only one of the axes within your system can be configured for E Sync. In addition to adding an Encoder Synchronization Board to your system, the following jumper changes must be made to the proper axis. For more information, see the Encoder Synchronization Addendum in the Unidex 16 User's Manual.

E SYNC AXIS

JUMPER	X	Y	Z	NO E SYNC *
XJP13	1-3,2-4	1-2	1-2	1-2
XJP14	1-3,2-4	1-2	1-2	1-2
XJP15	1-3,2-4	1-2	1-2	1-2
YJP13	1-2	1-3,2-4	1-2	1-2
YJP14	1-2	1-3,2-4	1-2	1-2
YJP15	1-2	1-3,2-4	1-2	1-2
ZJP13	1-2	1-2	1-3,2-4	1-2
ZJP14	1-2	1-2	1-3,2-4	1-2
ZJP15	1-2	1-2	1-3,2-4	1-2

L. INDEXING BOARD CONNECTORS

1. CONNECTORS J1 AND J2

Unidex 16 Versabus card edge connectors require no customer interfacing.

2. CONNECTORS J3, J4, J5 (XYZ/UVW)

ENCODER, LIMIT AND TACH INTERFACE

PIN #	FUNCTION	COMMENT
1	SIGNAL SHIELD	
11	SIN	For more information on encoder inputs, see chapter 6 of this manual.
4	SIN-N	
10	COS	
3	COS-N	
12	MARKER	
5	MARKER-N	
14	+5V OUTPUT	250 mA per axis, maximum
2	COMMON	
8	CW/CW-N LIMIT	For more information on limit inputs, see chapter 4.
7	CCW/CCW-N LIMIT	
9	HOME/HOME-N LIMIT	
13	RESERVED	
6	RESERVED	

MATING CONNECTOR

	AEROTECH NUMBER
3M CONNECTOR 3572-1001	(ECK 354)
or	
AMP CONNECTOR 552316-1	(ECK 357)
BACKSHELL 2-552412-1	(ECK 366)

3. CONNECTOR J6, SERVO AMPLIFIER INTERFACE (XYZ/UVW)

PIN #	FUNCTION	COMMENT
1	SIGNAL SHIELD	
28	X/U OUTPUT	± 10V ANALOG OUTPUT
34	Y/V OUTPUT	
40	Z/W OUTPUT	
3	X/U COMMON	
2	X/U COMMON	
9	Y/V COMMON	ANALOG COMMON
8	Y/V COMMON	
15	Z/W COMMON	
14	Z/W COMMON	
4	X/U SHUT DOWN	
10	Y/V SHUT DOWN	OPEN COLLECTOR TTL OUTPUT ACTIVE HIGH
16	Z/W SHUT DOWN	
27	RESERVED	
33	RESERVED	
39	RESERVED	
26	FAULT INPUT	LOGIC INPUT, 74LS27 WITH 1K PULL UP. ACTIVE HIGH MUST BE PULLED LOW IF NOT USED

MATING CONNECTOR

	AEROTECH NUMBER
3M CONNECTOR 3564-1001	(ECK 353)
OR	
AMP CONNECTOR 552032-1	(ECK 320)
90 BACKSHELL 552731-1	
OR	(EIK 264)
180 BACKSHELL 552008-1	
ALPHA CABLE 5100/50	

ADDENDUM 2

PROGRAMMABLE S-FUNCTION D/A BOARD (S D-A 690D1332, REV. 0)

The purpose of the Programmable S-Function D/A Converter Card is to enable a digital S-function output from Unidex 16 to be converted to an analog signal. The analog signal is used to control either a unipolar or bipolar spindle controller.

The S-Function D/A Card provides the following features:

* Precision 12 bit DAC
* CMOS/TTL compatible
* Data/Data-N inputs
* Strobe/Strobe-N control input
* Reset/Reset-N control input
* Acknowledge-N output
* One-half second power-on Reset
* Bipolar binary input (±10V, ±5V, ±2.5V)
* Unipolar binary input (0 - +10V, 0 - +5V)
* Unipolar BCD (0 - +10V)
* 3U or 6U Eurocard form
* Convenient screw-terminal user interface

A. S-FUNCTION D/A BOARD SPECIFICATIONS

BOARD SIZE	3U or 6U (See Figure A2-1 for overall dimensions)
SUGGESTED MATING CONNECTORS:	
J1 (MST Bus)	3M 3338-0001 (ECK355)
P2 (User Interface)	Weidmuller 5131.6 (EIK 512)

NOTE: P2 is supplied with S-Function D/A Card

POWER REQUIREMENTS:

+12V	+11.4 to +16V at 40mA
+ 5V	+ 4.75 to 5.25V at 120mA
-12V	-11.4 to -16V at 40mA

INPUTS

Data Inputs D0 - D11	LS TTL with 10K Pull-up (74LS244 / 74LS240

CONTROL INPUTS

Strobe-N, Reset-N	CMOS Input with 10K Pull-up
Debounce Active	Min. Pulse Input 250uS
Debounce Bypass	Min. PUlse input 2uS

ACKNOWLEDGE OUTPUT Open Collector TTL 7406

ANALOG OUTPUT

Max. Voltage	±10V
Max. Current	±5mA (2Kohm load)
Overall Accuracy	±1 LSB Typical
Worst Case Accuracy	±.1 % of full scale
Monotonicity Temp. Range	0 to 50 C

Accuracy Spec is based on ±10V Binary Output at 10 to 50 C

TEMPERATURE

Operating	10 to 50 C
Storage	-40 to 70 C

B. OPERATION

1. DATA AND CONTROL INPUTS

The programmable S-Function D/A Card is pin for pin compatible with the Unidex 16 MST bus. Data and control inputs are accomplished via the 64 pin DIN connector, P1. The S-function D/A board is standardly supplied to accept Data-N, Strobe-N and Reset-N (active low) inputs. However, input devices and jumpers can be changed to accept data, strobe and reset. All inputs are pulled up with a 10K resistor.

M2 and M3

*	Data	74LS244
	Data-N	74LS240

JP2

	Strobe	1-2
*	Strobe-N	2-3

JP1

	Reset	1-2
*	Reset-N	2-3

NOTE: A .5 second Power-on Reset is provided internally by M9 (MC 1455 Timing Circuit).

2. MSB/SIGN INPUT

This jumper is for use with Unidex 16 and will always be in position 1-2. This jumper was provided for special applications where the sign bit may only be available on signal D15 (P1-A13).

MSB/SIGN JUMPER JP3

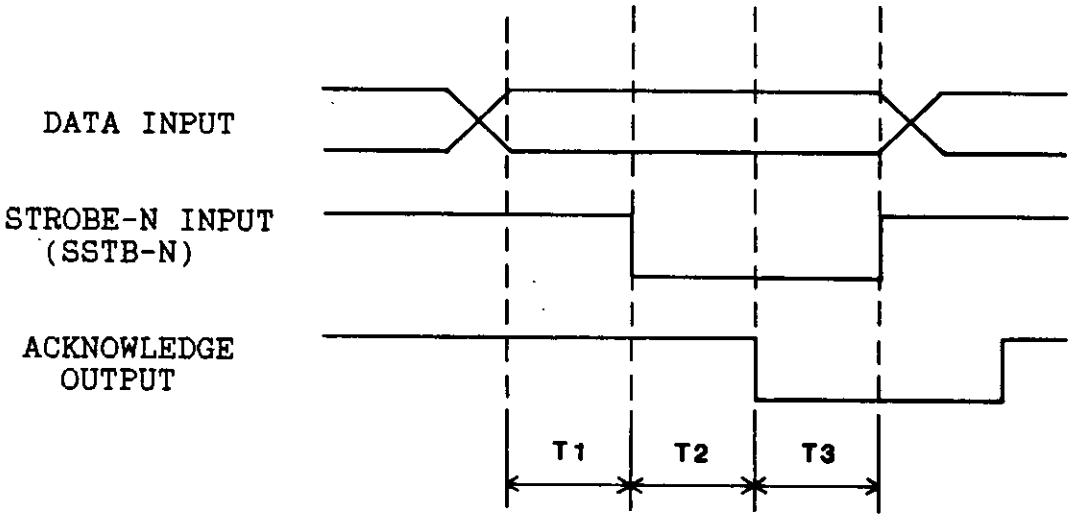
*	D11	1-2
	D12	2-3

3. ACKNOWLEDGE OUTPUT

The ACK-N out signal is an active low, open-collector, handshaking signal which is used by Unidex 16 for synchronous communication.

4. TIMING

The timing diagram below illustrates the timing cycle utilized by Unidex 16 when sending data to the S-function D/A Card.



T1	Data to SSTB-N Low	1 mS typical, determined by Unidex 16 parameter #402 0 0 0 0 1
T2	SSTB-N Low to ACK-N Low	250 uS typical, determined by "S" D/A board debounce circuit M1 and C17
T3	ACK-N Low to Strobe-N Hi	1 mS typical, determined by Unidex 16 parameter #410 0 0 0 0 1

NOTE: Standard Unidex 16 default value for parameters 402 and 410 is 00010 for 10mS. Although 10mS for T1 and T2 will operate properly with the "S" D/A board, it is not optimum timing.

5. DAC CONFIGURATION

The programmable S-function D/A Card is normally supplied in the ±10 Binary configuration. This, as well as the other configurations listed, are achieved by changing the following board jumpers and components. These changes ensure compatibility with the various digital input coding.

JP4 (16 PIN DIP HEADER)

	CONFIGURATION	1-16	2-15	3-14	4-13	5-12	6-11	7-10	8-9	M10 DAC
*	±10V BINARY	OUT	IN	OUT	IN	OUT	IN	OUT	OUT	DAC80Z CBIV
	± 5V BINARY	OUT	IN	OUT	OUT	IN	IN	OUT	OUT	"
	±2.5V BINARY	OUT	IN	IN	OUT	IN	IN	OUT	OUT	"
	0 TO 10V BINARY	IN	OUT	OUT	OUT	IN	OUT	IN	OUT	"
	0 TO 5V BINARY	IN	OUT	IN	OUT	IN	OUT	IN	OUT	"
	0 TO 10V BCD	OUT	OUT	OUT	IN	OUT	OUT	IN	OUT	DAC80Z CCDV

C. PROGRAMMING UNIDEX 16

1. PARAMETERS

There are eight Unidex 16 parameters associated with the S-function D/A Card. The following list identifies these parameters, their functions, normal default values, standard configuration (Bipolar Binary) and two additional configurations (Unipolar Binary and Unipolar BCD).

NOTE: Remember that the parameters must be changed to the appropriate configurations if a S-function D/A Card is being added to a system already in the field.

PARAMETER	DESCRIPTION	DEFAULT	* BIPOLAR BINARY	UNIPOLAR BINARY	UNIPOLAR BCD
402	TIMING DATA TO STROBE-N	00010	00001	00001	00001
410	TIMING STROBE LENGTH	00010	00001	00001	00001
420	SPINDLE TYPE	007	002	003	007
421	JOG OR MDI SPEED INCREMT	020	020	020	020
422	+ HIGH LIMIT	09999	02047	04096	00999
430	+ LOW LIMIT	00001	00000	00000	00000
431	- HIGH LIMIT	09999	02047	N/A	N/A
432	- LOW LIMIT	00001	00000	N/A	N/A

2. "S" FUNCTION COMMANDS

Sending an "S" command outputs a digital signal to the MST bus which is converted at the S-function D/A board to the appropriate analog signal. Several of the following examples list "S" commands and the corresponding digital and analog outputs.

BIPOLAR BINARY

S-CMD	MST BUS DIGITAL OUTPUT	S-FUNCTION D/A CARD ANALOG OUTPUT
S 2047	0000 0111 1111 1111	+10.000V
S 1	0000 0000 0000 0001	+ .005V
S 0	0000 0000 0000 0000	0.000V
S-1	1111 1111 1111 1111	- .005V
S-2047	1111 1000 0000 0000	-10.000V

Not Used by S-Function D/A Card

UNIPOLAR BINARY

S-CMD	MST BUS DIGITAL OUTPUT	S-FUNCTION D/A CARD ANALOG OUTPUT *
S 0	0000 0000 0000 0000	0.000V
S 1	0000 0000 0000 0001	+ 0.0024V
S 4095	0000 1111 1111 1111	+10.000V

Not used by S-function D/A Card

UNIPOLAR BCD

S-CMD	MST BUS DIGITAL OUTPUT	S-FUNCTION D/A CARD ANALOG OUTPUT *
S 0	0000 0000 0000 0000	0.00V
S 1	0000 0000 0000 0001	+ 0.01V
S 999	0000 1001 1001 1001	+ 9.99V

Not used by S-function D/A Card

* **NOTE:** Analog output voltage range will depend on the D/A Configuration. (Refer to section B5 of this addendum.)

D. ADJUSTMENTS

The following list of adjustments are completed at Aerotech. However, if the DAC is replaced in the field, the user is responible for these adjustments.

1. UNIPOLAR

a. For S0, adjust Balance Pot, R1, for 0.000V, ±.002V.

b. For S Max, adjust for full scale output voltage, ±.002V.

2. **BIPOLAR**

a. For S -Max, adjust R1 for -full scale output voltage, ±.002V.

b. For S +Max, adjust R2 for +full scale output voltage, ±.002V.

c. For S0, adjust R1 for 0.000V, ±.002V.

E. INTERFACE

This section lists the pinouts for both J2 and P1.

J2

PIN #	SIGNAL NAME
1	Analog Output
2	Analog GND
3	+12V
4	+ 5V
5	Common
6	-12V

P1

PIN #	SIGNAL NAME	PIN #	SIGNAL NAME
C1	CIRQ-N (Reserved)	A1	COMMON
C2	FAULT (Reserved)	A2	COMMON
C3	HALT-N (Reserved)	A3	COMMON
C4	SPARE	A4	COMMON
C5	MSTRST-N	A5	COMMON
C6	ACK-N	A6	COMMON
C7	ACCL (Reserved)	A7	COMMON
C8	SPARE	A8	COMMON
C9	SSTB-N	A9	COMMON
C10	TSTB-N (Reserved)	A10	COMMON
C11	COMMON	A11	SPARE
C12	SPARE	A12	RESERVED
C13	SPARE	A13	D15
C14	D13 (Reserved)	A14	D14 (Reserved)
C15	D11	A15	D12 (Reserved)
C16	D09	A16	D10
C17	D08	A17	COMMON
C18	MSTB-N (Reserved)	A18	COMMON
C19	RESERVED	A19	COMMON
C20	COMMON	A20	D07
C21	D05	A21	D06
C22	D03	A22	D04
C23	D01	A23	D02
C24	D00	A24	COMMON
C25	COMMON	A25	COMMON
C26	-12V	A26	-12V
C27	RESERVED	A27	RESERVED
C28	+12V	A28	+12V
C29	+ 5V	A29	+ 5V
C30	+ 5V	A30	+ 5V
C31	COMMON	A31	COMMON
C32	COMMON	A32	COMMON

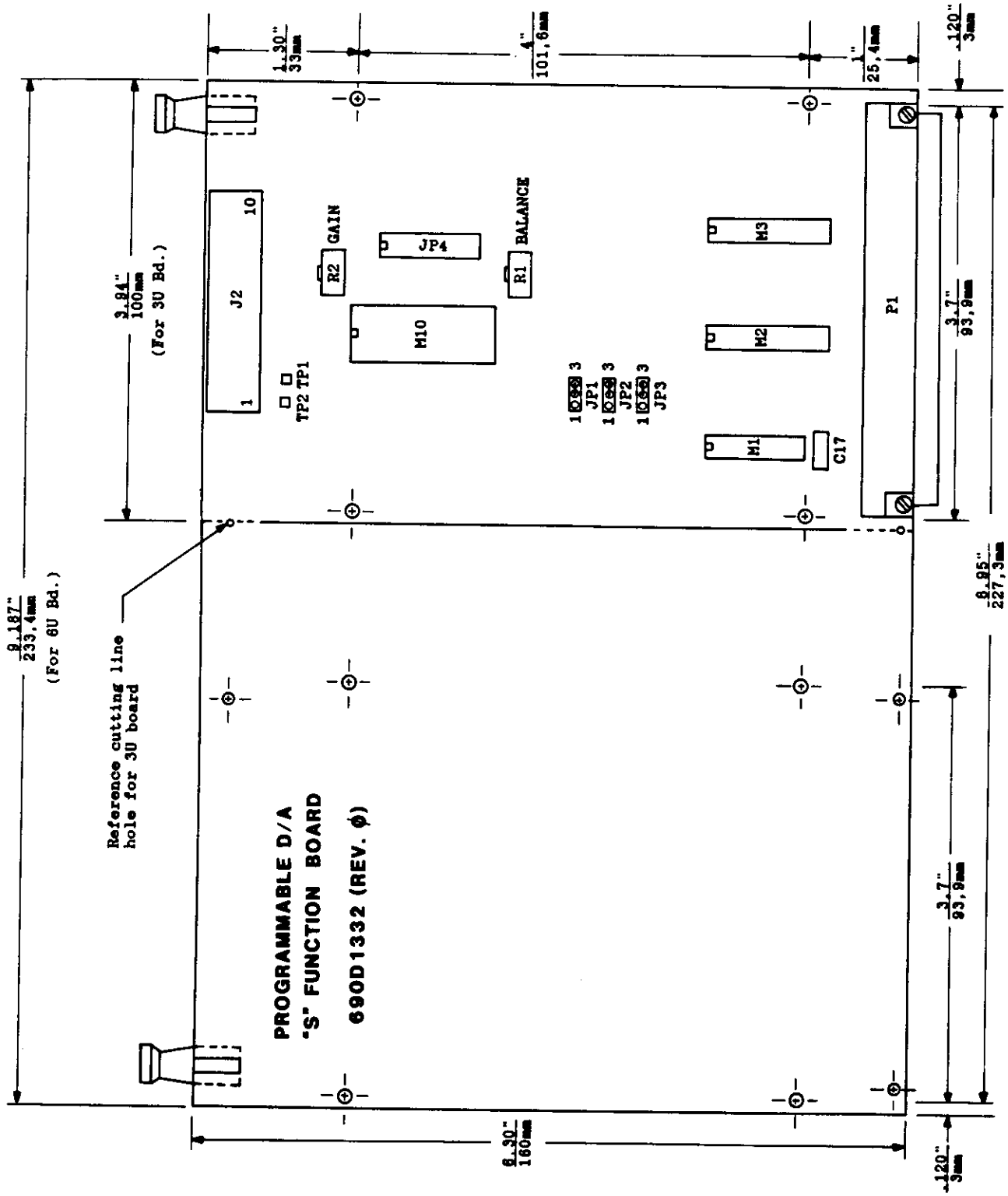


FIGURE A2-1: PROGRAMMABLE D/A S-FUNCTION BOARD

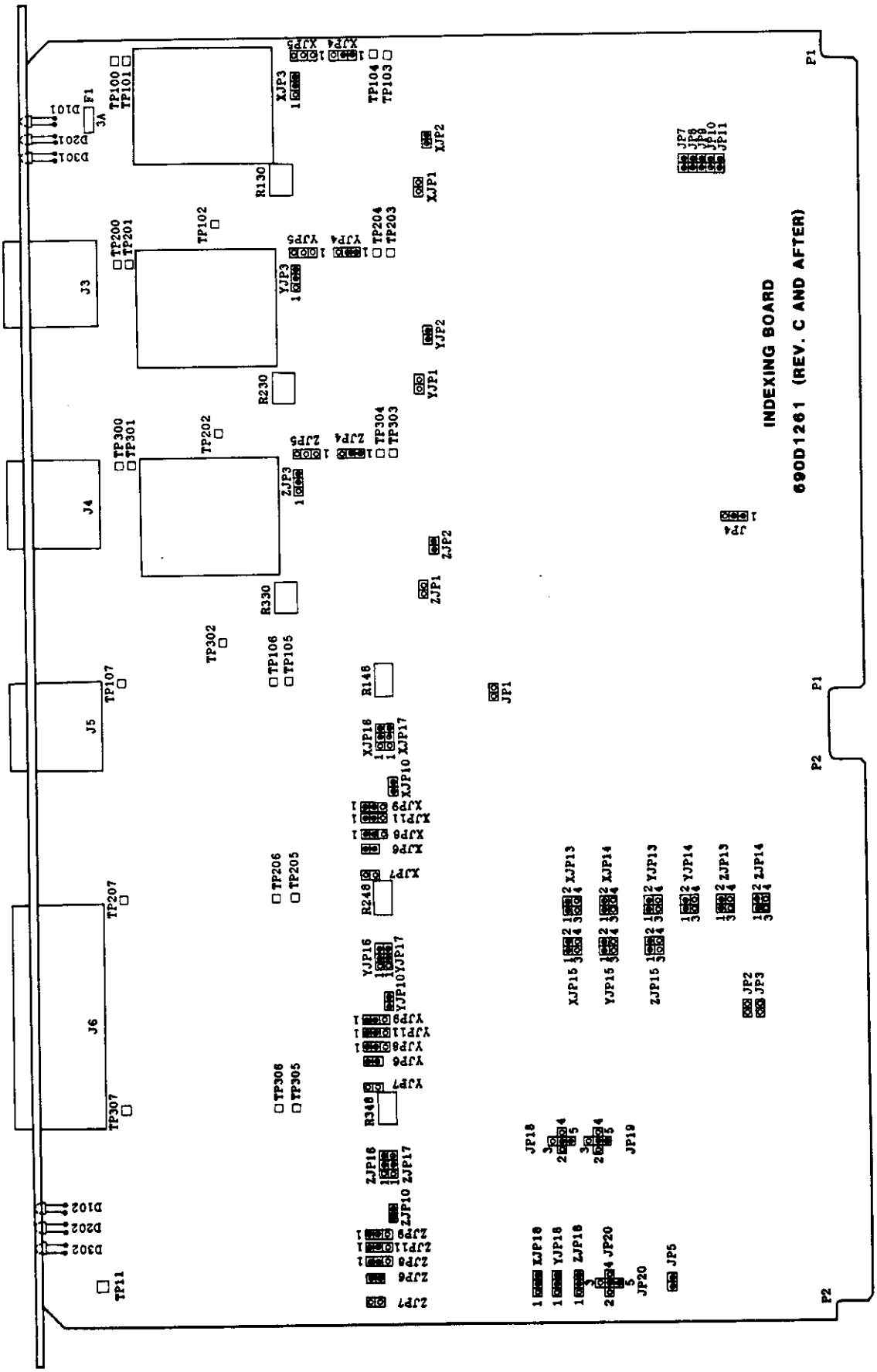


FIGURE 7-5 A: INDEXING BOARD

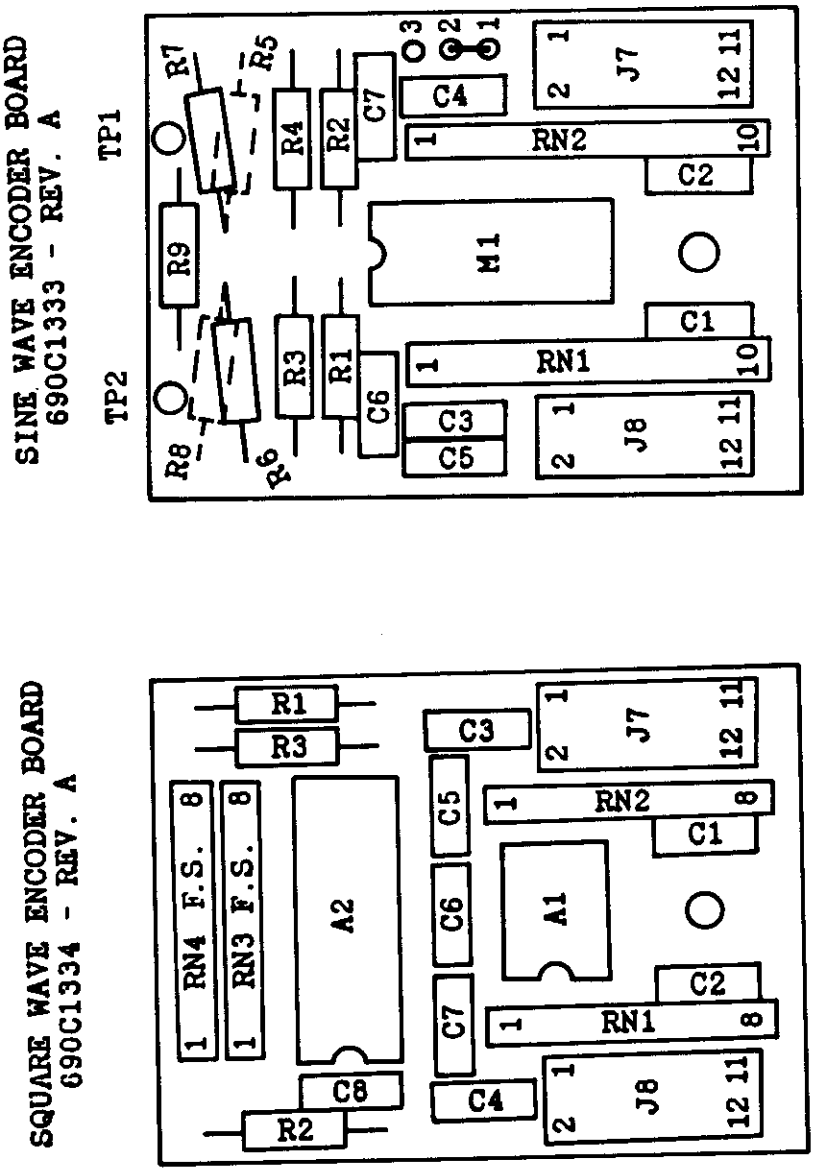


FIGURE 7-5 B: SQUARE WAVE AND SINE WAVE ENCODER INTERFACE BOARDS

WHT	4
BRN	3
BLK	2
BLU	1

BOARD 690C1311

WIRE WRAP

JUMPER 1-2, 5-6

SET UP BOTH OUTPUTS [illegible]

JUMPER 29-30, 24-[illegible] 19-9, 54-55 [illegible] 39-40, 36-37

REMOVE 31-32, 33-34 [illegible] 16-17, 18-19, 20-21 [illegible] 47-48, 44-45, 41-42 [illegible]

INSERT DS1216 (ECS800) [illegible]

ADD ECN 0543

4 A8 JUMPERS

XYZ	J1 (x)
N.O. LMT SW	OUT *

XYZ	J2 (x)
SPARE	IN *

Provide mates DB25P (plug), DB24659 (backshell), D-20419-16 (screwlocks)

XYZ	J4	J5	J6	J7	J12	104	106	118	117
	x	x	x	x	x	R 204 304	R 206 306	R 218 318	R 217 317
XZ	1-2	1-2	OUT	IN	2-3	IN	OUT	IN	OUT *
						43K	43K	22K	22K

XYZ	J8 (x)	J9 (x)
FEED BACK	1-2	1-2 *

XYZ	J10 (x)
5 BIT CZ	IN *

XYZ	J11 (x)
2048 $^D/_A$	1-2 *

	J1
X+ → CW	OUT *

	J2
Y+ → CW	OUT *

	J3
Z+ → CW	OUT *

	J4	J5
X,Y,Z	1-2	IN *

J6 DOES NOT EXIST

	J7	J8	J9	J10	J11
STOP FREE	IN	IN	IN	IN	IN *

3 A7 JUMPERS

XYZ	J1 (x)
N.O. LMT SW	OUT *

XYZ	J2 (x)
SPARE	IN *

XYZ	J4	J5	J6	J7	J12	104	106	118	117
	x	x	x	x	x	R 204 304	R 206 306	R 218 318	R 217 317
XZ	1-2	1-2	OUT	IN	2-3	IN	OUT	IN	OUT *
						43K	43K	22K	22K

XYZ	J8 (x)	J9 (x)
FEED BACK	1-2	1-2 *

XYZ	J10 (x)
5 BIT CZ	IN *

XYZ	J11 (x)
2048 $^D/_A$	1-2 *

	J1
X+ → CW	OUT *

	J2
Y+ → CW	OUT *

	J3
Z+ → CW	OUT *

	J4	J5
U,V,W	2-3	OUT *

J6 DOES NOT EXIST

	J7	J8	J9	J10	J11
STOP FREE	IN	IN	IN	IN	IN *

5 CARD CAGE JUMPERS

POSITION	1 ON	1 OFF	2 ON	2 OFF	3 ON	3 OFF	4 ON	4 OFF	5 ON	5 OFF	6 ON	6 OFF	7 ON	7 OFF	8 ON	8 OFF
SWITCH 1		✓		✓		✓		✓		✓		✓		✓		✓
SWITCH 2	✓			✓		✓		✓		✓		✓		✓		✓
SWITCH 3	✓			✓		✓		✓		✓		✓		✓		✓
SWITCH 4	✓			✓		✓		✓		✓		✓		✓		✓
SWITCH 5		✓		✓		✓		✓		✓		✓		✓		✓
	← DUE TO NO LNI															
SWITCH 7	✓		✓													
SWITCH 8	✓		✓													
SWITCH 9		✓		✓												

REF SYSTEM DWG 620D1188(?)

ITEM NO | PART OR IDENTIFYING NO | DESCRIPTION | SPEC

LIST OF MATERIAL

MACHINING TOLERANCE MANUAL AMA-1000 APPLIES UNLESS OTHERWISE SPECIFIED

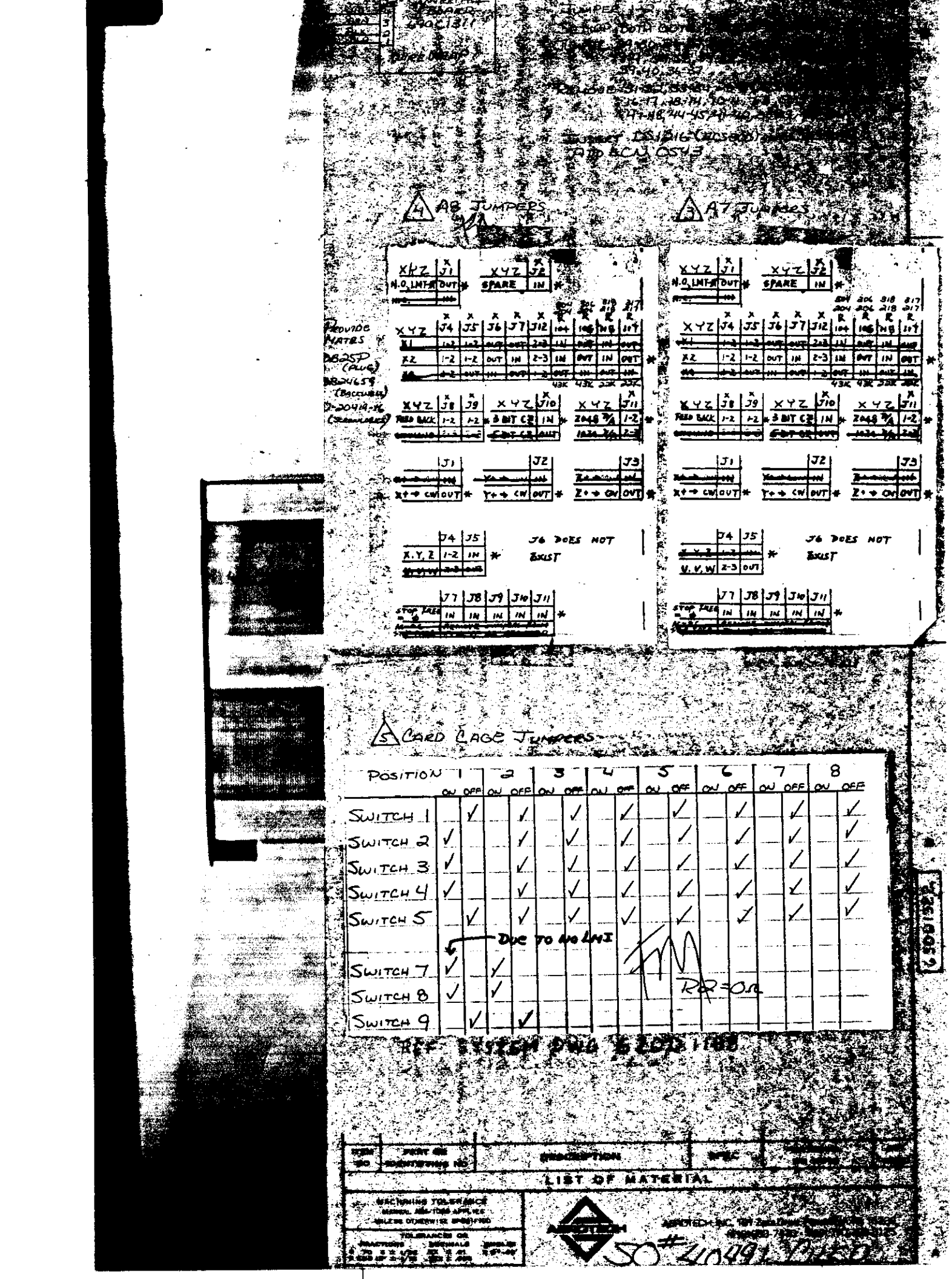
TOLERANCES ON FRACTIONS DECIMALS ANGLES

AEROTECH

AEROTECH, INC. [illegible]

SO# 40491 [illegible]

6 3061822



4 AB JUMPERS

XYZ	J1	XYZ	J2
N.O. LMT-SW	OUT	SPARE	IN

XYZ	J4	J5	J6	J7	J12	10K	10K	43K	22K
XI	1-2	1-2	OUT	OUT	2-3	IN	OUT	IN	OUT
XZ	1-2	1-2	OUT	IN	2-3	IN	OUT	IN	OUT
YI	1-2	OUT	IN	OUT	2-3	OUT	IN	OUT	IN

XYZ	J8	J9	XYZ	J10	XYZ	J11
FEED BACK	1-2	1-2	3 BIT CB	IN	2048 P/R	1-2

	J1	J2	J3
	X+ → CW OUT	Y+ → CW OUT	Z+ → CW OUT

	J4	J5
X, Y, Z	1-2	IN
U, V, W	2-3	OUT

J6 DOES NOT EXIST

	J7	J8	J9	J10	J11
STOP FREE	IN	IN	IN	IN	IN

3 A7 JUMPERS

XYZ	J1	XYZ	J2
N.O. LMT-SW	OUT	SPARE	IN

XYZ	J4	J5	J6	J7	J12	10K	10K	43K	22K
XI	1-2	1-2	OUT	OUT	2-3	IN	OUT	IN	OUT
XZ	1-2	1-2	OUT	IN	2-3	IN	OUT	IN	OUT
YI	1-2	OUT	IN	OUT	2-3	OUT	IN	OUT	IN

XYZ	J8	J9	XYZ	J10	XYZ	J11
FEED BACK	1-2	1-2	3 BIT CB	IN	2048 P/R	1-2

	J1	J2	J3
	X+ → CW OUT	Y+ → CW OUT	Z+ → CW OUT

	J4	J5
X, Y, Z	1-2	IN
U, V, W	2-3	OUT

J6 DOES NOT EXIST

	J7	J8	J9	J10	J11
STOP FREE	IN	IN	IN	IN	IN

5 CARD CAGE JUMPERS

POSITION	1		2		3		4		5		6		7		8	
	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
SWITCH 1		✓		✓		✓		✓		✓		✓		✓		✓
SWITCH 2	✓			✓		✓		✓		✓		✓		✓		✓
SWITCH 3	✓			✓		✓		✓		✓		✓		✓		✓
SWITCH 4	✓			✓		✓		✓		✓		✓		✓		✓
SWITCH 5		✓		✓		✓		✓		✓		✓		✓		✓
SWITCH 7	✓		✓													
SWITCH 8	✓		✓													
SWITCH 9		✓		✓												

Due to 440 LMI

RR=OR

REF SYSTEM DWG 2001188

LIST OF MATERIAL

MACHINING TOLERANCE
UNLESS OTHERWISE SPECIFIED

TOLERANCES ON
FRACTIONS DECIMALS ANGLES

ANORAD

SO# 40491 1250