



REFERENCE  
ONLY

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

AEROTECH  
MODEL 10D  
INCREMENTAL INDEXER  
D 690-1065

## TABLE OF CONTENTS

<u>Section</u>	<u>Contents</u>	<u>Page</u>
1.0	GENERAL DESCRIPTION	1-1
2.0	OPERATION	2-1
.1	Circuit Description	2-1
.1.1	Index	2-1
.1.2	Slew	2-1
.1.3	Direction Selection	2-2
.2	Front Panel Controls	2-2
.3	Remote (Computer) Control	2-3
.4	SL System Interface	2-4
.5	Block Diagram	2-5
3.0	INSTALLATION	3-1
.1	Power Source, 5v/12v Operation	3-1
.2	Thumbwheel and Computer Inputs	3-1
.3	Front Panel Switch Assembly or other control	3-1
.4	Drive Interface	3-2
4.0	ADJUSTMENTS	4-1
.1	Internal or external clock source	4-1
.2	Clock frequency	4-1
.3	Disabling Slew and front panel execute in Remote	4-1

## 1.0 GENERAL DESCRIPTION

The Model 10D is a dual input, 5 digit, incremental indexer. It is an improved version of the earlier Model 10 and has an internal oscillator on the card, latches data and direction when executed, can be driven from an external precision clock source, has Serial Load input capability and latched IN PSN, has manual control (SLEW) capability, and interfaces easily to the drive (J1) and front panel switch assembly (J2).

The indexer will accept 5 digit data from J3 (TW coded) or J4 (Remote coded) upon command from J2. Once selected the data will be latched by the execute command and converted to the serial data required by serial load systems. The output serial data is not ramped and can be input to encoded DC motor drives (CW clock and CCW clock) or stepping motor drives (clock and direction) by jumper selection on the card.

The internal oscillator is adjustable by pot on the card or can be remotely controlled. A capacitor on stand-offs can be changed to achieve various speed ranges for different Aerotech drives.

If the indexer is part of an Aerotech system including drives and stage, all adjustments have been made at the factory.

## 2.0 OPERATION

### 2.1 Circuit Description

#### 2.1.1 Index

An index is initiated by an execute command at J2-4 & 12 (FP EX, Form C switch), J3 or J4 ( $\overline{EX}$ , negative pulse, 2 to 20us). J2-12 going hi or the negative transition of  $\overline{EX}$  presets the data into down counters M6 thru M10; the data from J3 or J4 is selected by M1 thru M5 in response to the LCL/REM switch on J2-16. Any number other than zero entered into the counters causes M6-7 to go hi, enabling M13-13. When M13-7 goes hi ( $\sim 7\mu s$  later) M13-9 will go lo, setting the index latch M17-4 lo. This causes M17-11 to go hi and 1). latch the command direction, 2). enable the internal or external oscillator, 3. cause IN PSN to go lo.

The clock will start counting the counters down and outputting pulses at J1. When the counters reach zero, (CZ) M6-7 will go lo, resetting the index latch M17. M17-4 will go hi, M17-11 lo, the clock will turn off, and after a small delay M19-2 will be enabled. When the counters in the SL system reach their count zero. M19-1 will go hi after a short delay and M19-3 will go lo, resetting M18-1 and causing IN PSN to go hi.

#### 2.1.2 SLEW

A lo on J2-5 will cause the direction command to be latched, enable the clock source, and cause IN PSN to go lo just as an index command did in 2.1.1.

### 2.1.3 Direction Selection

Direction inputs at J3-4 and J2-11 are selected in LCL (J2-16 hi). In REM, the DIR input at J4-22 is selected and latched by M18-13. When operation from a joystick (J2-15 lo) the DIR at J4-22 is fed directly thru to the SL drive.

### 2.2 Front Panel Controls

The 16 pin connector J2 determines the mode of the indexer and plugs directly into the front panel switch assembly which allows complete control of a 2 axis system. If the front panel switch assembly is not used, switches may be connected as shown on sheet 1 of D 690-1065.

The controls are:

J2 Front Panel Interface

J2-1 SPARE.

J2-2  $\overline{\text{RESET}}$ . A LO signal resets the indexer counters to zero and outputs a LO on J1-5.

J2-3 SPARE.

J2-4 & 12 EXC. Loads data and direction and outputs clock and direction signals required by SL systems. Data and direction can be removed 10us after NC (normally closed contact) goes HI and NO goes LO. Accepts Form C switch and provides debouncing. A LO on J2-12 disables EXC inputs at J3-2 and J4-21.

J2-5  $\overline{\text{SLEW}}$ . A LO signal generates a constant frequency clock command to run the motor continuously.

J2-6 SPARE.

J2-7 DSC. Digital speed clock input when not using internal clock.

J2-8 SPARE

J2-9 IN PSN. In position. Latched index complete AND count zero.

- J2-10  $\overline{\text{OSC}}$ . LO output commands external clock source to turn on. Used only for external clock control of speed such as with digital speed control option.
- J2-11 DIR. Direction input, also connected to J3-4. These direction command inputs enabled when J2-16 HI.
- J2-13 COM. Signal common.
- J2-14 +V. Logic supply out to power front panel interface card.
- J2-15  $\overline{\text{EXT CL}}$  & DIR. LO input disables internal clock and DSC and enables external clock and direction inputs on J4-22 and 25.
- J2-16 LCL/REM. A HI (LO) selects data and direction inputs from J3 (J4).

### 2.3 Remote Controls

J3 & J4 are 26 line I/O used for remote inputs. J3 is typically used for the Aerotech Thumbwheel Assembly and is coded to plug directly into the TW assembly cable. J4 is typically used for computer control. The pin numbers and functions of these connectors are shown below.

#### I/O FUNCTION

1	J4-4	J3-6
2	3	8
4	2	5
8	1	7
10	8	10
20	7	12
40	6	9
80	5	11
100	12	14
200	11	16
400	10	13
800	9	15
1K	16	18
2K	15	20
4K	14	17
8K	13	19
10K	20	23
20K	19	21
40K	18	22
80K	17	24

I/O  
FUNCTION (cont'd)

DIRECTION	22	4
$\overline{\text{EX}}$	21	2
IN PSN	23	26
EXT.CL.	25	NOT USED
+V	24	25
COM	26	1

REMOTE INTERFACE DESCRIPTION

1 thru 80K--Data inputs, 5-digit BCD, positive true (5V on data input 10 commands the drive to take 10 steps upon "executing").

DIR-DIRECTION. Input commanding the direction of travel: +(5V) commands CW and -(0V) commands CCW motor rotation. For SI and SA systems only, this is also the direction input used with the external clock input to enable controlling the SL system via clock and direction commands.

$\overline{\text{EX}}$ -EXECUTE. A negative pulse on this input loads and executes the above data commands. Pulse width is 10us minimum (must remain LO for this amount of time). Data and direction must be on the line and settled before EX goes LO, and can be removed 10us after EX goes HI.

IN PSN-IN POSITION. This output goes HI when the drive has completed the command. Lo when the motor is positioning.

EXT. CL-EXTERNAL CLOCK. Clock command passed directly through the indexer to the SL system. Converted to CW and CCW CL by the indexer for encoded DC motor drive Serial Load systems. Active when in remote, external clock mode. Each transition from 0 to 5V causes the drive to take a single step.

+V-LOGIC SUPPLY. This output indicates the logic voltage used by the indexer and that the Aerotech chassis has power applied.

COM-LOGIC COMMON. All I/O is referenced to this output common.

$\overline{\text{RESET}}$ -RESET. Zero volts on this input resets the system.

Interface Notes:

1. Inputs to Aerotech should not have a drive capability greater than 10 mA for protection of C/MOS gates, in case of power failure to the Aerotech drive.
2. When driving Aerotech inputs from TTL/DTL circuitry, a 2K ohm to 3K ohm pull-up resistor is recommended to in-

sure adequate positive driving levels to the Aerotech C/MOS inputs.

3. Aerotech outputs are capable of driving at least two TTL/DTL loads.
4. With Aerotech equipment operating at the standard 5V logic level, inputs at 1.5V to zero are recognized as LO or zero; inputs 3.5V to 5V are recognized as HI or +5.

#### 2.4 SL System Interface

The 6 pin connector provides the interface to any Aerotech SL system. The connection to J1 are:

##### J1 SL System Interface

J1-1 +V. Power input to indexer. Unregulated V<sub>12V</sub> or regulated +5VDC.

J1-2 COM. Power common input.

J1-3 CL or CW CL. Jumper selectable output command to Serial Load system.

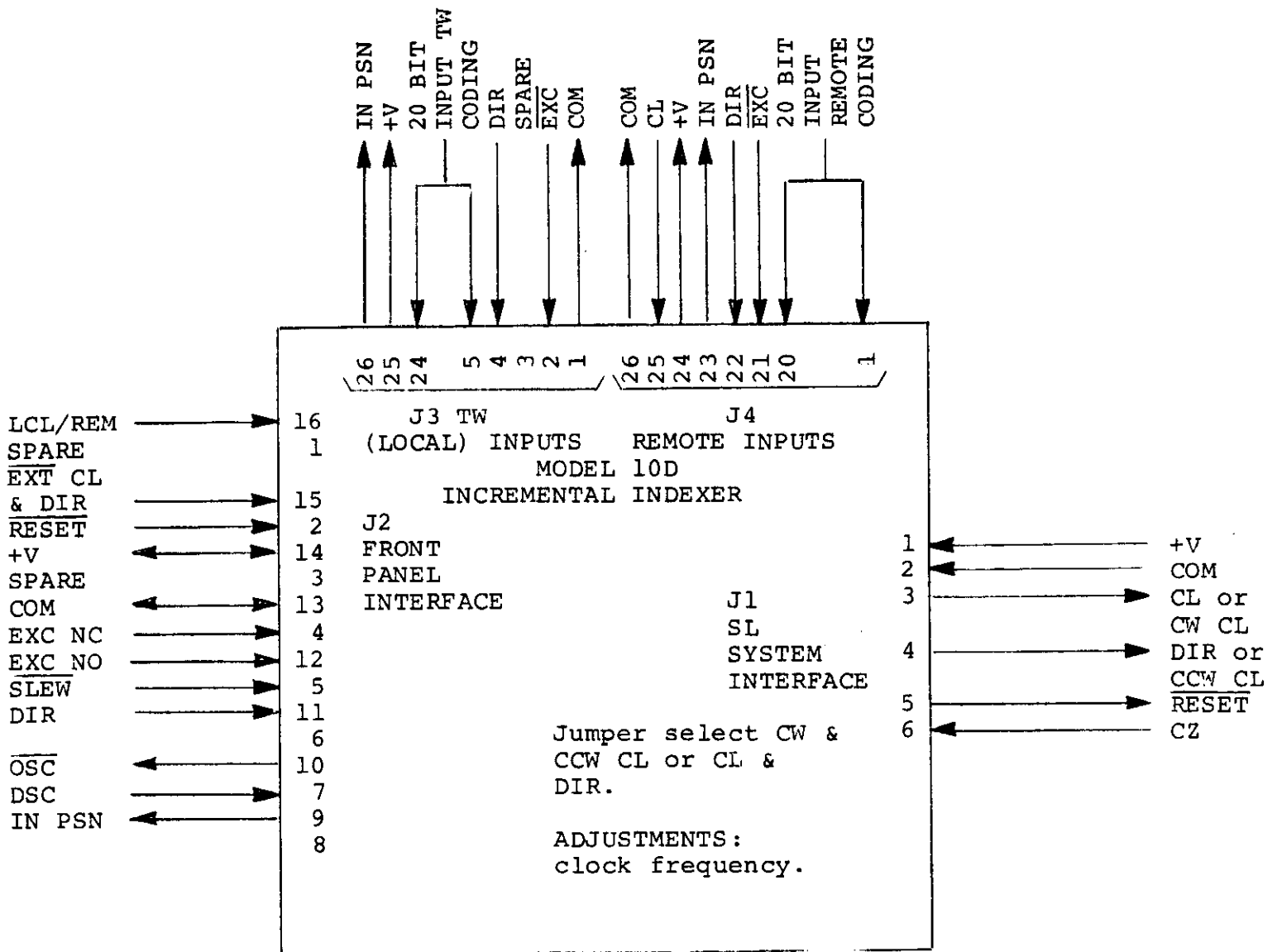
J1-4 DIR. or CCW CL. Jumper selectable output.

J1-5 RESET. Reset out to SL system.

J1-6 CZ. Count zero input from SL systems.



## 2.5 Block Diagram



## 3.0 INSTALLATION

### 3.1 Power Source

The indexer is capable of operating from unregulated supplies  $\geq$  12VDC or regulated 5V. Input power typically comes into J1-1 & 2. Unregulated voltages can be zenered to +12 or +5VDC via jumpers on the card. The card must operate at the same voltage as the drive unless level shifters are used on J1-3, 4, 5 & 6. If it is desired to operate at 5v from unregulated DC, jumper 27 to 28. If operating from regulated 5V, short R23; do not jumper 27 to 28 when operating from regulated +5VDC.

If the Front Panel Switch Assembly is connected to J2, the indexer must operate at 5V logic - or the LED must be removed on the FPSA.

Inputs and outputs connected to the indexer must operate at the same logic level as the indexer since there is no level conversion on the card.

### 3.2 Thumbwheel and Computer Inputs

J3 and J4 connect directly to 3M card-edge connectors type 3462-0001. Care must be taken to orient the connector properly. The connector and card are numbered.

### 3.3 Front Panel Switch Assembly or other control

The FPSA plugs directly into J2 via a 16 pin dip connector 3M type 3416. The FPSA is capable of controlling two indexers.

### 3.4 Drive Interface

The indexer is interfaced to the drive via a 6 pin Molex type 22-05-2061. J1-3&4 can be configured for Clock/Direction or CW Clock/CCW Clock outputs by jumpers. For stepper drives Clock and Direction are obtained by removing jumper 13-14 and adding 15-16. For DC drives CW clock and CCW clock can be obtained by connecting 13-14 and 16-17.

## 4.0 ADJUSTMENTS

### 4.1 Internal or External Clock Source

To use the internal clock, jumper 19 to 18, to connect an external source jumper 19 to 20. The external clock should be connected to J2-7.

### 4.2 Clock Frequency

R17 allows a factor of ten adjustment of the internal oscillator. C4 on standoffs (23 and 24) can be changed to yield a maximum (nominal) frequency of 50KC - .001uf, 15KC - .0022, 5KC - .01, 500Hz - .1 uf. If external adjustment of frequency is desired, remove R26 on standoffs (21 and 22) and connect a 200K  $\Omega$  external potentiometer. Turn R17 full CCW or to the desired upper frequency limit.

### 4.3 Disabling Slew and FP Execute in Remote

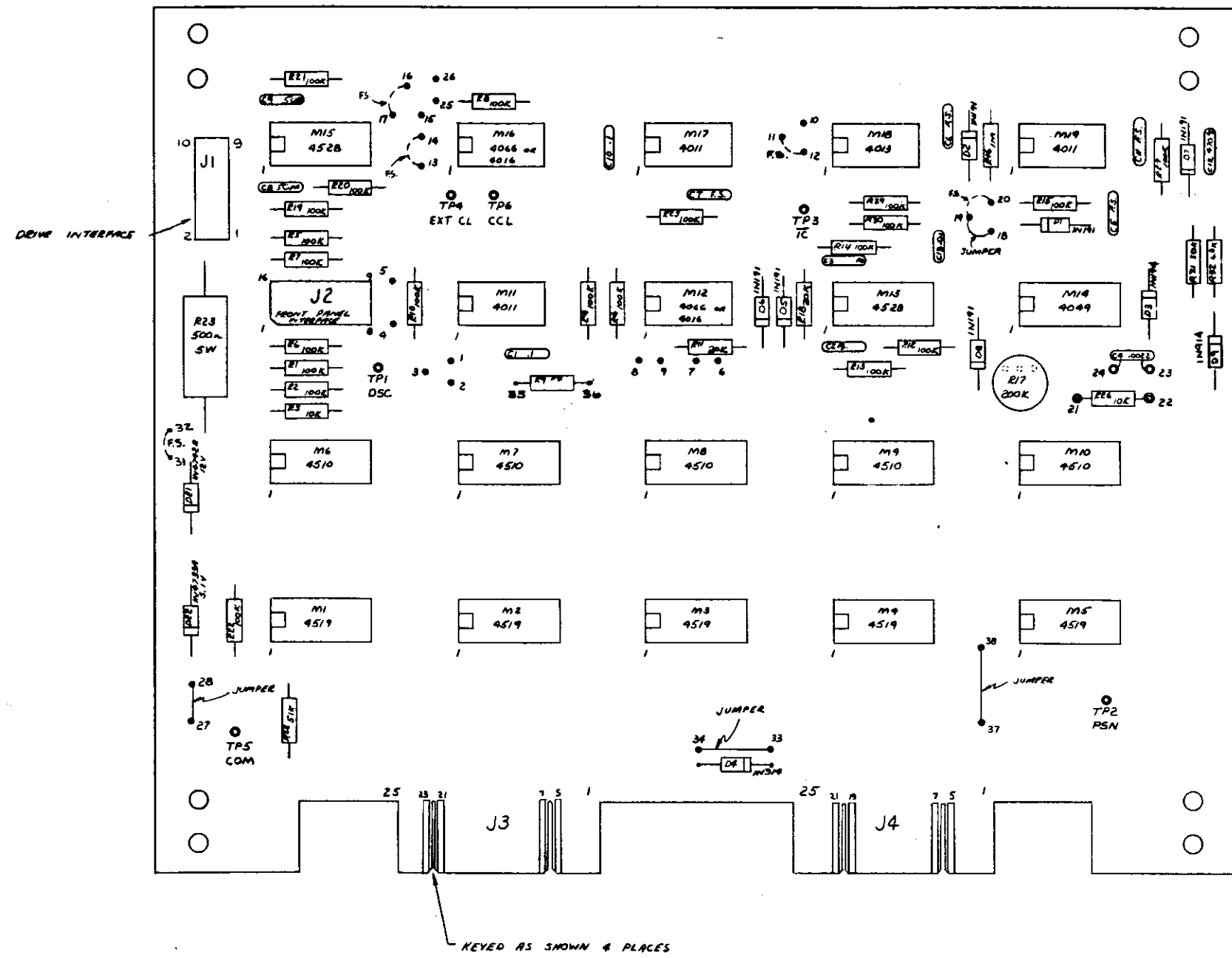
Cut trace between 8 and 9 to disable SLEW in Remote. Cut trace between 6 and 7 to disable FP execute when in Remote.

Addendum Notice for Rev D and above  
690D1065 Bds.

- 1). J1 was A6 Pin Connector and is now a 10 Pin.
- 2). J4 was Remote Coded and is now TW (same as J3) coded.

For Pin out information see system print, or Board drawing  
690D1065 Rev D and above.

REVISIONS				
REV	DATE	DESCRIPTION	BY	APPROVAL
A		NO CHANGE THIS SHEET	4/1/76	TPM
B		ADDED C11, C12 CHANGED J1-3, 9 AROUND	4/6/76	TPM
C		C6, C9 WAS OK, C12 WAS INC, ADDED WIRE JUMPS 18-19, 13-14, 16-17	4/6/76	TPM
D		ADDED R18-22 & D-18 & C12'S REMOVED D3, D23 CHANGED 21-24	7/12/76	JSD
E		R18 WAS 2.0K AND R19 WAS 1.0K (E1) ADDED JUMPS BETWEEN PADS 27-28, 33-34 AND 37-38. PADS 37 & 38 WERE ADDED ECH O/S.	2/6/76	DJS
F		ADDED D9, R11 & R31 WERE 100K, D3 WAS IN 191 ECN0182 & ECN0306	4/1/76	HS



1. STANDARD JUMPS: 16-19, 27-28, 33-34, 37-38

NOTES:

ITEM NO	PART OR IDENTIFYING NO	DESCRIPTION	SPEC	MATERIAL OR NOTE	QTY REQD												
LIST OF MATERIAL																	
MACHINING TOLERANCE MANUAL, 989-1000 APPLIES UNLESS OTHERWISE SPECIFIED																	
TOLERANCES ON FRACTIONS DECIMALS ANGLES																	
D TO 3/16 ± 1/32 3/16 TO 1/2 ± 1/64 1/2 TO 1 ± 1/16 1 TO 2 ± 1/32 2 TO 5 ± 1/64 5 AND UP ± 1/16 SEE 2-9006																	
MATERIAL																	
<input type="checkbox"/> STEEL <input type="checkbox"/> CASTING <input type="checkbox"/> ALUM <input type="checkbox"/> TUBING <input type="checkbox"/> CRES <input type="checkbox"/> STRUCT <input type="checkbox"/> SEE LM OR P/L <input type="checkbox"/> SEE NOTE																	
FINISH																	
<input type="checkbox"/> BLACK OXIDE <input type="checkbox"/> CLEAR ANODIZE <input type="checkbox"/> BLACK ANODIZE <input type="checkbox"/> SEE NOTE <input type="checkbox"/> ALODINE <input type="checkbox"/> SEE NOTE																	
DO NOT PAINT SURFACES MARKED PER AEROTECH SPEC. OR PER.																	
<table border="1"> <tr> <td>DATE</td> <td>BY</td> <td>CHKD BY</td> <td>APPD BY</td> <td>DATE</td> <td>BY</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						DATE	BY	CHKD BY	APPD BY	DATE	BY						
DATE	BY	CHKD BY	APPD BY	DATE	BY												

**AEROTECH, INC.**  
 101 Zeno Drive  
 Pittsburgh, Pa 15220 412 963 7470

MODEL 100, 5 DIGIT, DUAL INPUT  
 INCREMENTAL INDEXER  
 (ASSEMBLY) REV D AND ABOVE

CODE IDENT. NO. **PC** SIZE **D**  
 690D1065

SCALE: 2:1 WT 5" x 5"

