



REFERENCE
ONLY

AEROTECH
MODEL 20D
ABSOLUTE/INCREMENTAL INDEXER
D690-1075

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1.0 GENERAL DESCRIPTION

The Model 20D is a dual input, 5 digit, absolute/incremental indexer. It 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).

Single step capability can be added without requiring a TW for special applications, but the front panel switch assembly does not provide this switch.

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 Incremental Index

An index is initiated by an execute command at J2-4 & 12 (FP EX, Form C switch) or J3-2 ($\overline{\text{EX}}$, negative pulse, 2 to 20us) in the Local Mode or from J4-21 in the Remote Mode (J2-16 lo). J2-12 going hi or the negative transition of $\overline{\text{EX}}$ presets the data into down counters M12 thru M16; the data from J3 or J4 is selected by M4 thru M8 in response to the LCL/REM switch on J2-16. Any number other than zero entered into the counters causes M12-7 to go hi, enabling M35-8, causing IN-PSN to go lo and removing the resets from M13. When the $\overline{\text{EX}}$ goes hi M13-13 goes hi enabling M35-12. The clock is on M35-13 so when it goes hi and then lo, M34-3 goes hi, setting M35-5 hi and enabling clock pulses out of M35-4. Clock pulses out of M35-3 are one shot (OS) by M37-7 and delayed by M37-9. When M37-9 goes hi, M36-7 outputs a 2u.s. negative clock pulse which goes out to the SL drive on J1. The negative pulses out of M37-9 also trigger M36-10 which counts down the counters M12 thru M16. When these counters reach zero (the indexer has output the proper number of steps) M12-7 goes lo, causing M35-10 to go hi, M34 D flip flops and stopping clock signals out of M35-3. M34-12 resetting also causes IN-PSN to go hi.

2.1.2 Absolute Index

Counters M28 thru M32 keep track of all data passed to the SL system. Counters M12 thru M16 act only as latches for the input command: they will contain the position that the system is to go to. M20 thru M24 are comparators comparing the actual position in counters M28 with the desired position in counters M12 thru M16. When the two counters agree M20-3 goes hi, enabling M11-1: the magnitude of the two counters are equal.

The actual sign of the SL system is contained in M26-10 latch. This sign only changes when counting through zero. When the actual position counters are at zero M28-7 is lo, causing a lo on M38-9. The next $\overline{\text{clock}}$ pulse out of M37-9 causes a pulse from M38-10. This pulse is passed to M26-5 or M26-9, depending on the output $\overline{\text{Direction}}$ command on M27-12.

The command direction is latched in M12-2 and compared against the actual sign from M26-10. M27-4 is hi when the command and actual sign agree, providing the other requirement for an absolute index (magnitude and sign agree). When M11-1 and 2 both go hi, M11-3 goes lo and ends the absolute index.

M19 computed the direction of travel by comparing the actual sign, latched direction command, and M20-13 (actual command). The computed $\overline{\text{direction}}$ is then latched in M12-13.

In the absolute mode M36-10 is disabled so that the latched command position is not changed during travel.

2.1.3 SLEW

A lo on J2-5 will enable the clock source causing manual clock signals at M35-1 and cause IN PSN to go lo just as an index command did. These clocks will be kept track of by M28 thru M32 as long as the 5 digit capability is not exceeded (99999 counts).

2.1.4 Direction Selection

The M11-4/10 Index/MAN latch selects whether the latched $\overline{\text{DIR}}$ command from M2-13 or the unlatched command from M9-6 is chosen. Manual or joystick control requires the ability to change direction at any time while indexing does not permit direction changes while moving.

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 to the J2 inputs as shown on sheet 1 of D 690-1075.

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 ABS/INC. A LO signal places the indexer in the incremental mode.
- J2-7 DSC. Digital speed clock input when not using internal clock.
- J2-8 Step NC (remove jumper 10-11)
- J2-9 IN PSN. In position. Latched index complete AND count zero
- J2-10 Step. NO.
- 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

I/O
FUNCTION

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
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.

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 insure 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 12V or regulated +5VDC.

J1-2 COM. Power common input

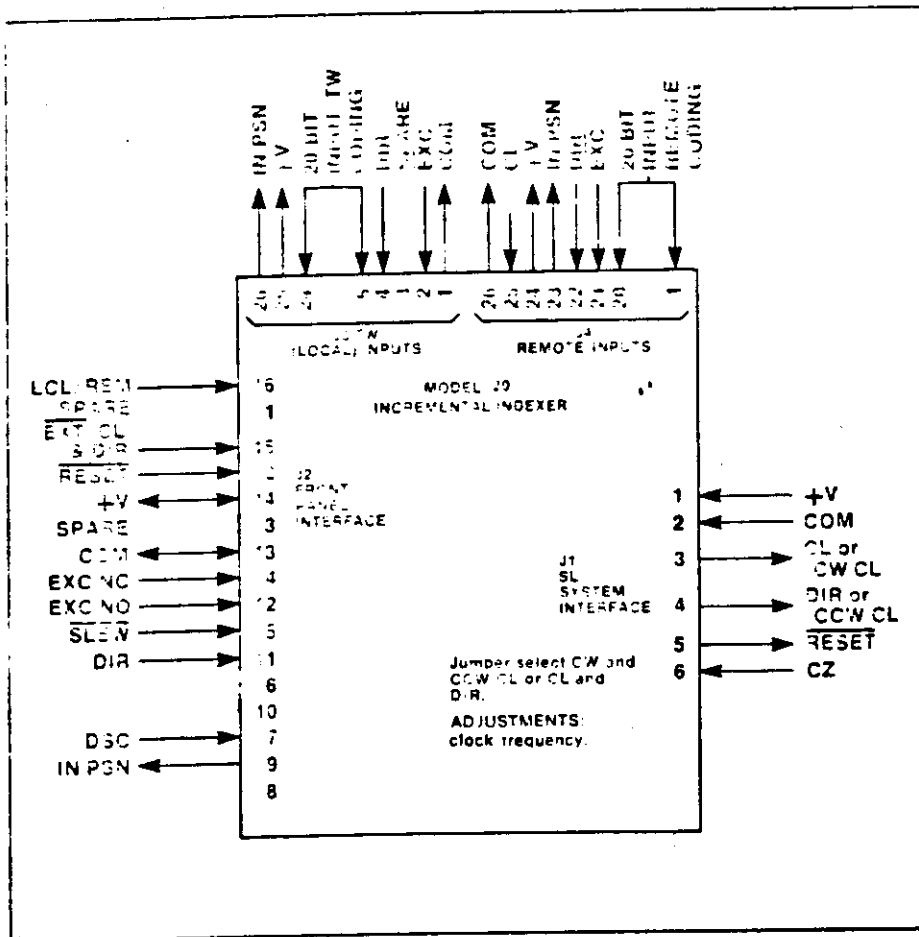
J1-3 CL or CW CL. Jumper selectable output command to Serial Load system.

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 adding jumpers 7-9 and 15-17. For DC drives CW clock and CCW clock can be obtained by connecting 7-8 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 200 K external potentiometer. Turn R17 full CCW or to the desired upper frequency limit.



WARRANTY

ALL SYSTEMS ARE WARRANTED FOR 12 CONSECUTIVE MONTHS FROM THE ORIGINAL SHIPMENT DATE. THIS WARRANTY COVERS DEFECTS IN WORKMANSHIP AND MATERIALS. A VOIDED WARRANTY IS DEFINED BY PHYSICAL ABUSE, REMOVAL OF FACTORY APPLIED SERIAL NUMBERS, IMPROPER APPLICATION, OVER-STRESSING EQUIPMENT BEYOND ITS PUBLISHED SPECIFICATIONS, FAILURE TO COMPLY WITH RETURN PROCEDURES DESCRIBED IN THE WARRANTY, ANY CHANGE OF OWNERSHIP FROM ORIGINAL PURCHASER.

IN THE EVENT A DEFECT OR A MALFUNCTION OCCURS IN YOUR EQUIPMENT, TWO CHOICES ARE AVAILABLE TO THE CUSTOMER. THESE TWO CHOICES ARE:

- A) NOTIFY FACTORY PRIOR TO YOUR PREPAID SHIPMENT TO AEROTECH. ALSO, ENCLOSE A FULLY-DETAILED WRITTEN EXPLANATION OF YOUR DISCREPANCY. THE CUSTOMER WILL BE NOTIFIED UPON RECEIPT OF SHIPMENT IF THE UNIT IS NOT COVERED BY OUR WARRANTY. AT THIS POINT, IF UNIT IS DETERMINED OUT OF WARRANTY, A PURCHASE ORDER MUST BE RECEIVED BEFORE AEROTECH WILL PROCEED WITH THE REPAIR.
- B) IF SENDING THE SYSTEM BACK TO THE FACTORY FOR REPAIR IS IMPOSSIBLE. NOTIFY THE FACTORY, WITH A PURCHASE ORDER, THAT YOU DESIRE ON-CALL MAINTENANCE. AT THIS TIME THE PREVAILING TRAVEL RATES WILL BE EXPLAINED ALONG WITH A TIME AND PLACE. IN THE EVENT THE SYSTEM HAD A WARRANTY PROBLEM, PARTS WILL BE FREE OF CHARGE.

THIS IS THE FULL EXTENT OF AEROTECH, INC., LIABILITY. AEROTECH IS NOT RESPONSIBLE FOR ANY PHYSICAL OR PROPERTY DAMAGE DUE TO PRODUCT USE OR FAILURE.

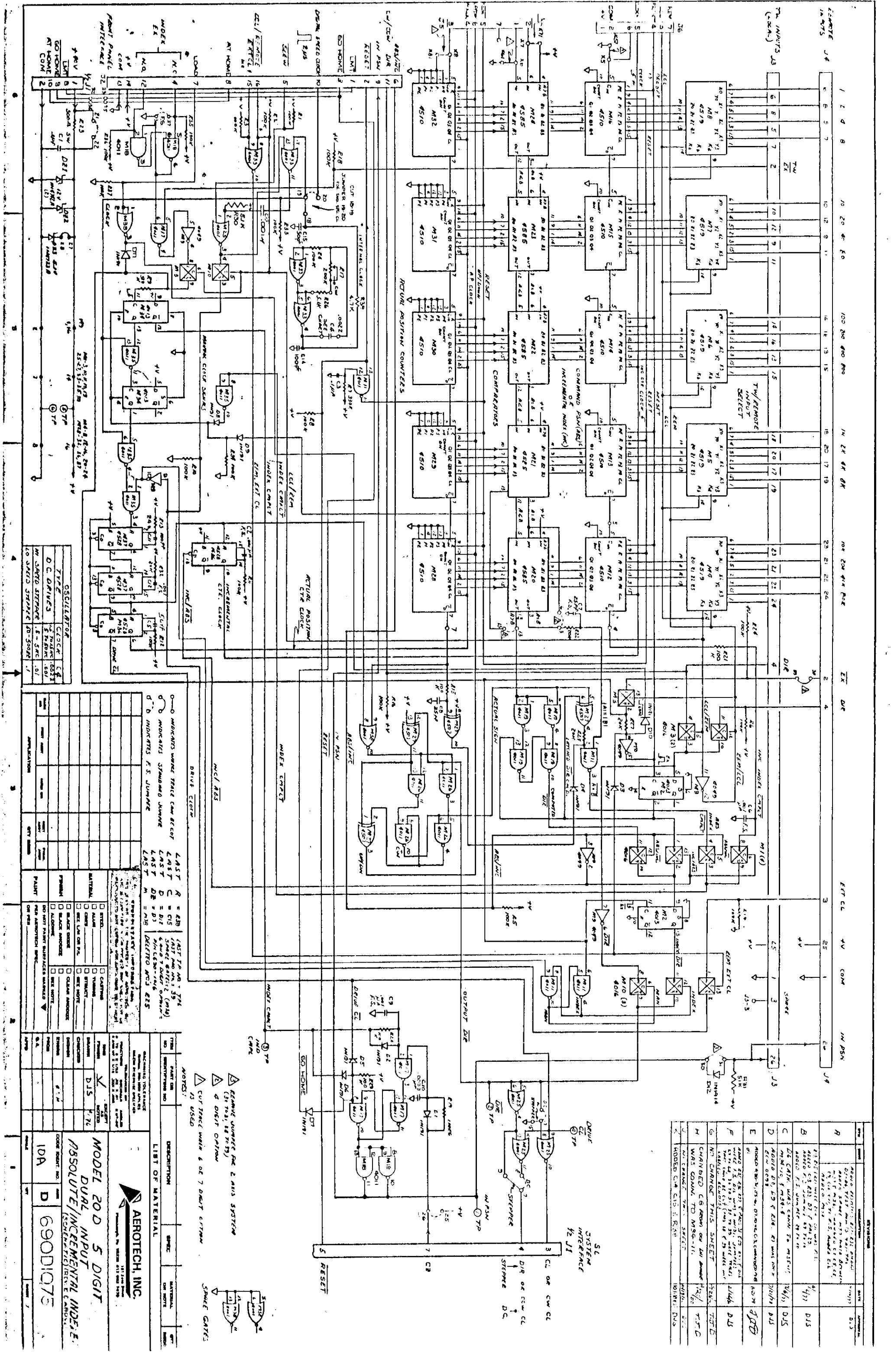
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Addendum Notice for Rev E and above
690D1075 Bds.

- 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
690D1075 Rev E and above.



TYPE	CLOCK	RES	RES
D.C. DRIVES	10-30K	10-30K	10-30K
W. SPEED STOPPER	10-30K	10-30K	10-30K
TO SPEED STOPPER	10-30K	10-30K	10-30K

APPLICATION	QTY	REMARKS

PROBLEM	CAUSE	SOLUTION

AEROTECH, INC.
 MODEL 20D 5 DIGIT
 DUAL INPUT
 ABSOLUTE/INCREMENTAL INDEFINITE
 COUNTER

DESCRIPTION	QTY	REMARKS
RESISTOR		
CAPACITOR		
IC		
WIRE		

NOTES:
 1. IS USED
 2. CUT TRACES WITH 6 OR 7 DRAIT CUTTER
 3. RESISTOR VALUES ARE 2 AND 5 SYSTEM
 4. DRAIT CUTTER
 5. SPARK GATES

REV.	DATE	DESCRIPTION
A	1/17/73	REVISED DRAWING TO SHOW...
B	1/17/73	REVISED DRAWING TO SHOW...
C	1/17/73	REVISED DRAWING TO SHOW...
D	1/17/73	REVISED DRAWING TO SHOW...
E	1/17/73	REVISED DRAWING TO SHOW...
F	1/17/73	REVISED DRAWING TO SHOW...
G	1/17/73	REVISED DRAWING TO SHOW...
H	1/17/73	REVISED DRAWING TO SHOW...
I	1/17/73	REVISED DRAWING TO SHOW...